(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 1 873 112 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
02.01.2008 Bulletin 2008/01

(51) Int Cl.:
B66C 5/00 *(2006.01)* ***B66C 19/00*** *(2006.01)*

(21) Application number: **07107247.4**

(22) Date of filing: **30.04.2007**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HU IE IS IT LI LT LU LV MC MT NL PL PT RO SE SI SK TR
Designated Extension States:
AL BA HR MK YU

(30) Priority: **29.06.2006 CN 200610028352**

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(54) **Jacking-up and turning device for rubber-tyred container gantry crane**

(57) The present invention provides a jacking-up and turning device for a rubber-tyred container gantry crane, comprising two identical sets of hydraulic systems and two sets of control systems, each of the said hydraulic system comprises two identical sets of turning and positioning assemblies (10), each turning and positioning assembly comprising a jacking-up hydrocylinder (17), a positioning hydrocylinder (18), a turning hydrocylinder (15) and a lockpin hydrocylinder (16), wherein the jacking-up hydrocylinder is disposed between the pair of wheels (1112,1113) under the balance beam (111), the positioning hydrocylinder, the turning hydrocylinder and the lockpin hydrocylinder are disposed under the balance beam, and each control system is provided with a manual electric cabinet, on the panel of which manual switch buttons are provided for each sub-action of the turning of the gantry, to control the operation, stop and reset of each hydrocylinder. In turning, the entire rubber-tyred container gantry crane is lifted up by the jacking-up hydrocylinders, thus the tyre of the gantry can be turned undampedly, thereby greatly extending the useful life of the tyre and reducing the operational cost of the terminals.

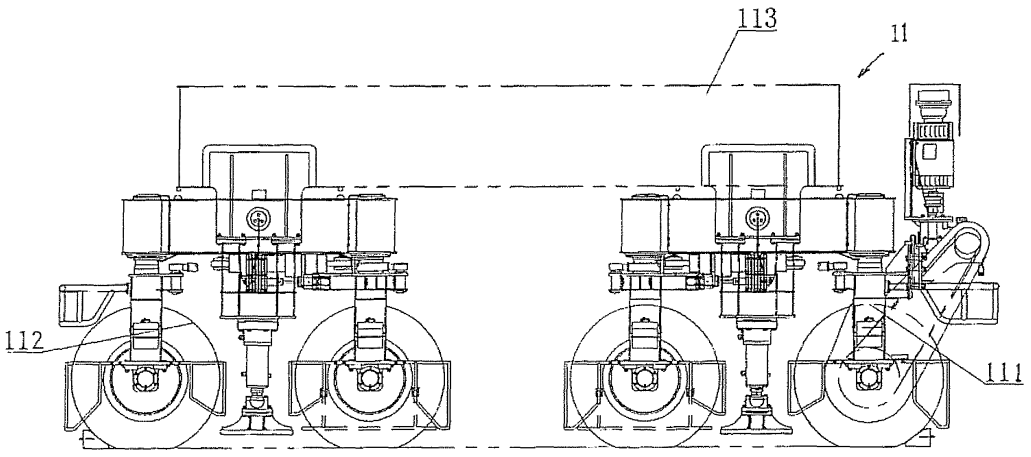


FIG 2

EP 1 873 112 A1

Description

Field of the Invention

[0001] The present invention relates to a jacking-up and turning device for a rubber-tyred container gantry crane.

Background

[0002] Rubber-tyred container gantry crane is a specialized equipment used in container terminal yards A container terminal yard generally has a plurality of lanes. In order to perform turning, the crane is provided with a 90° right-angle turning system and a 360° in-place turning system. In general cases, the terminal yard has a fixed location for the turning When the crane needs to turn, the crane moves to the fixed location, makes the tyres contact with steel plates (or the cement ground), and then turns, which increases the wearing amount of the tyre (because the wearing amount of the type resulted from turning is larger than that resulted from normal traveling) and the occurrences of the tearing phenomenon of the tread of the tyre, thus shortening the useful life of the tyre. Since tyre is used as the road wheel of the crane and the crane needs to turn, the tyre is always a wearing part of the rubber-tyred container gantry crane, which needs to be replaced at 1-2 years interval.

[0003] Rubber-tyred container gantry crane is a specialized equipment used in container terminal yards. A container terminal yard generally has a plurality of lanes. In order to perform turning, the crane is provided with a 90° right-angle turning system and a 360° in-place turning system In general cases, a steel plate for turning is laid down at a fixed location in the terminal yard. When the crane needs to turn, the crane moves to the fixed location, makes the tyres contact with the steel plate, and then turns. Thus, the drag force of the tyre in turning is appropriately reduced, the wearing of the tyre is alleviated, and thus the useful lifetime of the tyre is extended.

[0004] However, the above operations are extremely troublesome and inconvenient.

Summary

[0005] The present invention provides a jacking-up and turning device for a rubber-tyred container gantry crane, in order to overcome the above deficiencies in the prior art rubber-tyred container gantry crane. The jacking-up and turning device for the rubber-tyred container gantry crane provides two identical sets of hydraulic systems on both sides of the direction in which the gantry travels. Jacking-up hydrocylinder reversing valves disposed on both sides are electrically controlled to be linked, in order to ensure substantial synchronization of the reversing and telescopic motion of the fourth hydrocylinders. In use, the jacking-up device jacks up the entire gantry by means of hydraulic pressure. After lifting the tyres off the ground, turning of the gantry is performed. Thus, the tyre will not be worn out, reducing the replacement rate of the tyre and reducing the operational cost of the terminals.

[0006] The jacking-up and turning device for a rubber-tyred container gantry crane according to the present invention, wherein the rubber-tyred container gantry crane comprises a gantry crane body, and two gantry traveling mechanisms on two sides of the gantry crane body, each gantry traveling mechanism comprising two traveling parts, which are connected with each other by a gird, each of the traveling part comprising a balance beam and a pair of wheels disposed under the balance beam, wherein the rubber-tyred container gantry crane further comprises two identical sets of hydraulic systems and two sets of control systems, each control system controlling synchronous operation of each set of hydraulic system, the hydraulic systems and the control systems being disposed on two sides of the gantry crane body, respectively,

wherein each of the said hydraulic system comprises two identical sets of turning and positioning assemblies, each turning and positioning assembly comprising a jacking-up hydrocylinder, a positioning hydrocylinder, a turning hydrocylinder and a lockpin hydrocylinder, wherein the jacking-up hydrocylinder is disposed between the pair of wheels under the balance beam, the positioning hydrocylinder, the turning hydrocylinder and the lockpin hydrocylinder are disposed under the balance beam, wherein the turning hydrocylinder is disposed near inside of the balance beam, the positioning hydrocylinder is disposed near outside of the balance beam, and the lockpin hydrocylinder is disposed between the turning hydrocylinder and the positioning hydrocylinder, and

wherein each hydraulic system is controlled by a hydraulic power station, each hydraulic power station is provided with a manual electric cabinet, on the panel of which manual switch buttons are provided for each sub-action of the turning of the gantry, to control the operation, stop and reset of each hydrocylinder.

[0007] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein each jacking-up hydrocylinder comprises a body, a piston disposed in the body, an inlet disposed on an upper portion of the body, an outlet disposed on an lower portion of the body, and an omnidirectional adjustment mechanism disposed on the bottom of the body; the bottom of the omnidirectional adjustment mechanism is sustained on the ground; and the top of the body is connected with the bottom of the balance beam of the crane.

[0008] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein a lockpin fixing slot is disposed on the gantry frame, the lockpin hydrocylinder is horizontally disposed, the body of which is connected with the balance beam, an output shaft thereof is connected with a lockpin plunger, and the lockpin plunger is controlled by a lockpin limit switch to be locked in the lockpin fixing slot disposed on

the gantry frame

[0009] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein a position fixing slot is also disposed on the gantry frame, the positioning hydrocylinder is horizontally disposed, the body of which is connected with the balance beam via a stanchion, an output shaft thereof is connected with a positioning plunger, which is controlled by a positioning limit switch to be positioned in the position fixing slot disposed on the gantry frame.

[0010] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein a gantry frame locating piece is disposed near the outside of the position fixing slot on the gantry frame.

[0011] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein the body of the turning hydrocylinder is connected with the balance beam via a footstep, and the output shaft of the turning hydrocylinder is connected with the gantry frame via another footstep.

[0012] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, further comprising an inductive limit switch, disposed between the lockpin limit switch and the positioning limit switch.

[0013] The jacking-up and turning device for the rubber-tyred container gantry crane according to the above, wherein the manual switch buttons provided on the panel of the manual electric cabinet of each hydraulic power station for each sub-action of the turning of the gantry, comprises: an oil pump switch, a jacking-up/stop/reset switch, a pin back/forward switch; a positioning hydrocylinde switch, a button for 1# wheel 0°, a button for 1# wheel 90°, a button for 2# wheel 0° and a button for 2# wheel 90°.

[0014] By using the above technical solution, four jacking-up hydrocylinders are disposed on the fourth corners of the rubber-tyred container gantry crane, with each one having a jacking-up force of 50 tons The complete set of actions is controlled by the hydraulic system in connection with electric control. Each turning apparatus comprises a turning hydrocylinder, a lockpin hydrocylinder, a positioning hydrocylinder and a jacking-up hydrocylinder. In turning, one jacking-up hydrocylinder is provided under each of four balance beams, respectively, the entire rubber-tyred container gantry crane is lifted up to make the tyres off the ground, thus the tyre of the gantry can be turned undampedly, thereby greatly extending the useful life of the tyre and reducing the operational cost of the terminals.

Brief Description of the Drawings

[0015]

The concrete features and characteristics of the present invention will be described in the following embodiments and the figures.

Figure 1 is a simplified schematic diagram of the overall structure of the rubber-tyred container gantry crane.

Figure 2 is a schematic diagram of a gantry traveling mechanism on one side of the rubber-tyred container gantry crane according to the present invention.

Figure 3 is a structural schematic diagram of a traveling part of the rubber-tyred container gantry crane according to the present invention

Figure 4 is a structural schematic diagram of an assembly of a turning and positioning hydrocylinder in a jacking-up and turning device for the rubber-tyred container gantry crane according to the present invention (side view).

Figure 5 is a top view of Figure 4.

Figure 6 is a left view of Figure 4.

Figure 7 is a structural schematic diagram of a jacking-up hydrocylinder in the jacking-up and turning device for the rubber-tyred container gantry crane according to the present invention.

Figure 8 is a hydraulic pressure schematic diagram of the gantry turning (jacking-up) in the jacking-up and turning device for the rubber-tyred container gantry crane according to the present invention.

[0016] Essential elements in the drawings are as follows:

gantry crane body 1;
gantry traveling mechanisms 11, 12;
traveling parts 111, 112;
gird 113,
balance beam 1111;
wheels 1112, 1113;
control system 1114;
turning and positioning assembly 10;
jacking-up hydrocylinder 17;
positioning hydrocylinder 18; t
urning hydrocylinder 15;
lockpin hydrocylinder 16;
motor M,
electromagnets S1, S2, S3, S4, S5, S6, S7, S8, S9;

wherein:

S1→1# wheel 90° valve,	S2→1# wheel 0° valve,
S3→2# wheel 90° valve,	S4→4# wheel 0° valve,
S5→pin-back valve,	S6→locating pin valve,
S7→jacktng-up valve,	S8→reset valve,
S9→fast valve;	

jacking-up hydrocylinder limit switch T1, T2, T1', T2',
lockpin hydrocylinder limit switch T5, T6, T5', T6',
positioning hydrocylinder limit switch T3, T4, T3', T4',
turning hydrocylinder limit switch T7, T8, T7', T8'.

Detailed Description of Preferred Embodiments

[0017] Refer now to Figures 1 and 2. In the jacking-up and turning device for the rubber-tyred container gantry crane according to the present invention, the rubber-tyred container gantry crane comprises a gantry crane body 1, and two gantry traveling mechanisms 11 on two sides of the gantry crane body. Each gantry traveling mechanism comprises two traveling parts 111, 112, which are connected with each other by a gird 113.

[0018] Refer now to Figure 3. Each of the traveling part (for simplicity, only the traveling part 111 is described as an example) comprises a balance beam 1111 and a pair of wheels 1112, 1113 disposed under the balance beam 1111; and further comprise two identical sets of hydraulic systems and two sets of control systems. Each control system 1114 (Refer to Figure B) consists of a hydraulic power station for controlling synchronous operation of each set of hydraulic system The hydraulic systems and the control systems are disposed on two sides of the gantry crane body, respectively.

[0019] Refer now to Figures 4, 5 and 6. Each of the said hydraulic system comprises two identical sets of turning and positioning assemblies 10. Each turning and positioning assembly 10 comprises a jacking-up hydrocylinder 17, a positioning hydrocylinder 18, a turning hydrocylinder 15 and a lockpin hydrocylinder 16. The jacking-up hydrocylinder 17 is disposed between the pair of wheels under the balance beam 1111, the positioning hydrocylinder 18, the turning hydrocylinder 15 and the lockpin hydrocylinder 16 are disposed under the balance beam 1111, wherein the turning hydrocylinder 15 is disposed near inside of the balance beam 1111, the positioning hydracylinder 18 is disposed near outside of the balance beam 1111, and the lockpin hydrocylinder 16 is disposed between the turning hydrocylinder 15 and the positioning hydrocylinder 18 Each hydraulic system is controlled by a hydraulic power station.

[0020] A lockpin fixing slot 3 is disposed on the gantry frame 1115. The lockpin hydrocylinder 16 is horizontally disposed, the body of which is connected with the balance beam 1111. An output shaft thereof is connected with a lockpin plunger, and the lockpin plunger is controlled by a lockpin limit switch to be locked in the lockpin fixing slot 3 disposed on the gantry frame

[0021] A position fixing slot 4 is also disposed on the gantry frame. The positioning hydrocylinder 18 is horizontally disposed, the body of which is connected with the balance beam 1111 via a stanchion 221. An output shaft thereof is connected with a positioning plunger, which is controlled by a positioning limit switch to be positioned in the position fixing slot 4 disposed on the gantry frame

[0022] A gantry frame locating piece 5 is disposed near the outside of the position fixing slot on the gantry frame.

[0023] The body of the turning hydrocylinder 15 is connected with the balance beam 1111 via a footstep, and the output shaft of the turning hydrocylinder is connected with the gantry frame via another footstep.

[0024] The present invention also comprises a 360° inductive limit switch 19, disposed between the lockpin limit switch and the positioning limit switch.

[0025] Refer to Figure 7. In the jacking-up and turning device for the rubber-tyred container gantry crane according to the present invention, each jacking-up hydrocylinder 17 comprises a body 171, a piston 172 disposed in the body, an inlet 173 disposed on an upper portion of the body, an outlet 174 disposed on an lower portion of the body, and an omnidirectional adjustment mechanism 175 disposed on the bottom of the body; the bottom of the omnidirectional adjustment mechanism is sustained on the ground, and the top of the body is connected with the bottom of the balance beam 1111 of the crane.

[0026] Refer to Figure 8. The control system 1114 for controlling synchronous operation of the hydraulic system as described in the present invention comprise: a motor M, the parameters of which are, for example, 460V/60Hz, 11kw, and 1750rpm; electromagnet valves S1 and S2 connected with a turning hydrocylinder 15A respectively, the electromagnet S1→(corresponding to) 1# wheel 90° valve, and the electromagnet S2→(corresponding to) 1# wheel 0° valve; electromagnet valves S3 and S4 connected with another turning hydrocylinder 15B respectively, the electromagnet S3→(corresponding to) 2# wheel 90° valve, and the electromagnet S4→(corresponding to) 4# wheel 0° valve, an electromagnet valve S5 connected in parallel to the lockpin hydrocylinders 16A and 16B, the electromagnet S5→(corresponding to) a pin-back valve; an electromagnet valve S6 connected in parallel to the positioning hydrocylinders 18A and 18B, the electromagnet S6→(corresponding to) a locating pin valve, and electromagnet valves S7, S8 and S9 connected with a jacking-up hydrocylinder 17A and another jacking-up hydrocylinder 17B, respectively, wherein the electromagnet S7 → (corresponding to) a jacking-up valve, the electromagnet S8→(corresponding to) a reset valve, and the electromagnet S9→(corresponding to) a fast valve. The control system further comprises limit switches, each being connected with a respective hydrocylinder, the limit switches comprising jacking-up hydrocylinder limit switches T1, T2, T1', T2'; lockpin hydrocylinder limit switches T5, T6, T5', T6'; positioning hydrocylinder limit switches T3, T4, T3', T4'; and turning hydrocylinder limit switches T7, T8, T7', T8'.

[0027] Jacking-up hydrocylinder reversing valves disposed on both sides of the direction in which the gantry travels are electrically controlled to be linked, in order to ensure substantial synchronization of the reversing and telescopic motion of the fourth hydrocylinders Each hydraulic power station is provided with a manual electric cabinet, on the panel of which manual switch buttons are provided for each sub-action of the turning of the gantry, comprising: an oil pump switch, a jacking-up/stop/reset switch, a pin back/forward switch; a positioning hydrocylinde switch 18, a button for 1# wheel 0°, a button for 1# wheel 90°, a button for 2# wheel 0° and a button for

2# wheel 90°.

[0028] When resetting manually, both of the electromagnet valves S8 and S9 are powered, and the electromagnet valve S9 is delayedly powered-off by the electromagnet S8 controlling a time relay.

[0029] If no action is performed in 3 minutes after the motor is initiated, the motor is automatically turned off.

[0030] In the driver's cab, there are provided one "automation/on-site"switch, one button for 0° → 90°, one button for 90° → 0°, and one button for 360° turning.

[0031] The principles and operating conditions of the hydraulic turning system of the present invention (taking a single side as an example) are described in detail as follows:

1. 0°→90° turning of the gantry

With pressing the button for 0°→90° turning of the gantry, the motor M is powered on, the electromagnet valve S7 is powered on 0.5 second later, the jacking-up hydrocylinders 17A and 17B jack up quickly, and jack up slowly when reaching the ground position. When a limit position is reached to make the tyres absolutely off the ground, the jacking-up hydrocylinder limit switches T1 and T1' signal to permit turning. The electromagnet valve S7 is powered off. The electromagnet valve S5 is powered on, the lockpin hydrocylinders 16A and 16B make the lock pin back and off the gantry frame fixing slot to permit the turning of the gantry. Then the lockpin hydrocylinder limit switches T6 and T6' signal.

The electromagnet valves S1 and S3 are powered on. The turning hydrocylinders 15A and 15B start to make the gantry frame and the wheels turn. After the wheel is turned 90°, the turning hydrocyliner limit switches T8 and T8' signal. The electromagnet valve S5 is powered off, the lockpin hydrocylinders 16A and 16B make the pin forward and into the gantry frame fixing slot to fix the gantry frame. Then, the lockpin hydrocylinder limit switches T5 and T5' signal. The electromagnet valves S1 and S3 are powered off. The electromagnet valves S8 and S9 are powered on, and the jacking-up hydrocylinders 17A and 17B begins to reset Delaying (set on-site) until the tyre reaches the ground position, the electromagnet valve S9 is powered off, and the jacking hydrocylinders 17A and 17B speed up the reset.

When the jacking-up hydrocylinders 17A and 17B are completely reset, the jacking-up hydrocynlinder limit switches T2 and T2' signal to make the electromagnet valve S8 and the motor M powered off.

The 90° turning of the gantry is complete, and then the gantry travels along a straight line.

3. 90° → 0° turning of the gantry

With pressing the button for 90°→0° turning of the gantry, the motor M is powered on, the electromagnet valve S7 is powered on 0 5 second later, the jacking-up hydrocylinders 17A and 17B jack up quickly, and jack up slowly when reaching the ground position. When a limit position is reached to make the tyres absolutely off the ground, the jacking-up hydrocylinder limit switches T1 and T1' signal to permit turning. The electromagnet valve S7 is powered off. The electromagnet valve S5 is powered on, the lockpin hydrocylinders 16A and 16B make the lock pin back and off the gantry frame fixing slot to permit the turning of the gantry Then the lockpin hydrocylinder limit switches T6 and T6' signal.

The electromagnet valves S2 and S4 are powered on. The turning hydrocylinders 15A and 15B start to make the gantry frame and the wheels turn. After the wheel is turned to 0° position, the turning hydrocyliner limit switches T7 and T7' signal The electromagnet valve S5 is powered off, the lockpin hydrocylinders 16A and 16B make the pin forward and into the gantry frame fixing slot to fix the gantry frame. Then, the lockpin hydrocylinder limit switches T5 and T5' signal The electromagnet valves S2 and S4 are powered off The electromagnet valves S8 and S9 are powered on, and the jacking-up hydrocylinders 17A and 17B begins to reset. Delaying (set on-site) until the tyre reaches the ground position, the electromagnet valve S9 is powered off, and the jacking hydrocylinders 17A and 17B speed up the reset.

When the jacking-up hydrocylinders 17A and 17B are completely reset, the jacking-up hydrocynlinder limit switches T2 and T2' signal to make the electromagnet valve S8 and the motor M powered off

The 0° turning of the gantry is complete, and then the gantry travels along a straight line.

4 360° turning of the gantry (turning from 0° to predetermined degrees)

With pressing the button for 360° turning of the gantry, the motor M is powered on, the electromagnet valve S7 is powered on 0.5 second later, the jacking-up hydrocylinders 17A and 17B jack up quickly, and jack up slowly when reaching the ground position. When a limit position is reached to make the tyres absolutely off the ground, the jacking-up hydrocylinder limit switches T1 and T1' signal to permit turning. The electromagnet valve S7 is powered off. The electromagnet valve S5 is powered on, the lockpin hydrocylinders 16A and 16B make the lock pin back and off the gantry frame fixing slot to permit the turning of the gantry. Then the lockpin hydrocylinder limit switches T6 and T6' signal. Meanwhile, the electromagnet valve S6 is powered off, and the positioning hydrocylinders 18A and 18B protrude, and then the positioning hydrocylinder limit switches T4 and T4' signal.

The electromagnet valves S1 and S3 are powered on. The turning hydrocylinders 15A and 15B start to make the gantry frame and the wheels turn. After the wheel is turned predetermined degrees, it comes into contact with the positioning plunger of the positioning hydrocylinder 18 The 360° inductive limit switch signals. The electromagnet valve S5 is powered off, the

lockpin hydrocylinders 16A and 16B make the pin forward and into the gantry frame fixing slot to fix the wheel and the gantry frame. Then, the lockpin hydrocylinder limit switches T5 and T5' signal. The electromagnet valves S1 and S3 are powered off The electromagnet valves S8 and S9 are powered on, and the jacking-up hydrocylinders 17A and 17B begins to reset. Delaying (set on-site) until the tyre reaches the ground position, the electromagnet valve S9 is powered off, and the jacking hydrocylinders 17A and 17B speed up the reset

When the jacking-up hydrocylinders 17A and 17B are completely reset, the jacking-up hydrocynlinder limit switches T2 and T2' signal to make the electromagnet valve S8 and the motor M powered off. The 360° turning of the gantry is complete. It is permitted that the gantry turns in-place around its center

5. reset of 360° turning of the gantry

[0032] With pressing the button for reset of 360° turning of the gantry, the motor M is powered on, the electromagnet valve S7 is powered on 0.5 second later, the jacking-up hydrocylinders 17A and 17B jack up quickly, and jack up slowly when reaching the ground position. When a limit position is reached to make the tyres absolutely off the ground, the jacking-up hydrocylinder limit switches T1 and T1' signal to permit turning. The electromagnet valve S7 is powered off. The electromagnet valve S5 is powered on, the lockpin hydrocylinders 16A and 16B make the lock pin back and off the gantry frame fixing slot to permit the turning of the gantry. Then the lockpin hydrocylinder limit switches T6 and T6' signal

[0033] The electromagnet valves S2 and S4 are powered on. The turning hydrocylinders 15A and 15B start to make the gantry frame and the wheels turn. After the wheel is turned to the 0° position, the limit switches T7 and t7' signal. The electromagnet valve S5 is powered off, the lockpin hydrocylinders 16A and 16B make the pin forward and into the gantry frame fixing slot to fix the wheel and the gantry frame. Then, the lockpin hydrocylinder limit switches T5 and T5' signal. The electromagnet valves S1 and S3 are powered off and the electromagnet valve S6 is also powered off. The positioning hydrocylinders 18A and 18B draw back, and then the positioning hydrocylinder limit switches T3 and T3' signal. The electromagnet valves S2 and S4 are powered off. The electromagnet valves S8 and S9 are powered on, and the jacking-up hydrocylinders 17A and 17B begins to reset. Delaying (set on-site) until the tyre reaches the ground position, the electromagnet valve S9 is powered off, and the jacking hydrocylinders 17A and 17B speed up the reset.

[0034] When the jacking-up hydrocylinders 17A and 17B are completely reset, the jacking-up hydrocynlinder limit switches T2 and T2' signal to make the electromagnet valve S8 and the motor M powered off The reset of 360° turning of the gantry is complete. It is permitted that the gantry turns in-place around its center.

[0035] The present invention also comprises fault alarm:

1. If the initial position signal of any one of the jacking-up hydrocylinder limit switches T1, T2, or T1', T2'still exists 5 seconds after the button for turning the gantry is pressed, it is regarded as a fault. The motor is powered off, and check-out shall be performed.
2. When in the operation mode of suspension, the jacking-up hydrocylinders 17A and 17B are reset, the limit switches T2, T2' lose the signal, i.e., the motor is started, and the electromagnet valve S8 is powered on. When the limit switches T2, T2' re-signal, the electromagnet valve S8 is powered off, and the motor is powered off
3. When the oil temperature reaches a predetermined temperature (65°C), a high-temperature alarm gives an alarm, showing a high-temperature fault, and the motor is powered off.

[0036] The circuit could be implemented by the PLC in a computer. As it is a proven technique, detail description is omitted.

[0037] Summing up the above, the technical effects of the present invention are prominent:

The entire weight of the rubber-tyred container gantry crane generally is about 150 ~ 180 tons, and four jacking-up hydrocylinders 17 are disposed on the fourth corners of the rubber-tyred container gantry crane, with each one having a jacking-up force of 50 tons. The complete set of actions is controlled by the hydraulic system in connection with electric control. Each turning apparatus comprises a turning hydrocylinder 15, a lockpin hydrocylinder 16, a positioning hydrocylinder 18 and a jacking-up hydrocylinder 17. In turning, one jacking-up hydrocylinder 17 is provided under each of four balance beams 1111, respectively, the entire rubber-tyred container gantry crane is lifted up to make the tyres off the ground, thus the tyre of the gantry can be turned undampedly, thereby greatly extending the useful life of the tyre and reducing the operational cost of the terminals.

Claims

1. A jacking-up and turning device for a rubber-tyred container gantry crane, wherein the rubber-tyred container gantry crane comprises a gantry crane body, and two gantry traveling mechanisms on two sides of the gantry crane body, each gantry traveling mechanism comprising two traveling parts, which are connected with each other by a gird, each of the traveling part comprising a balance beam and a pair of wheels disposed under the balance beam, wherein the rubber-tyred container gantry crane further comprises two identical sets of hydraulic systems

and two sets of control systems, each control system controlling synchronous operation of each set of hydraulic system, the hydraulic systems and the control systems being disposed on two sides of the gantry crane body, respectively,
wherein each of the said hydraulic system comprises two identical sets of turning and positioning assemblies, each turning and positioning assembly comprising a jacking-up hydrocylinder, a positioning hydrocylinder, a turning hydrocylinder and a lockpin hydrocylinder, wherein the jacking-up hydrocylinder is disposed between the pair of wheels under the balance beam, the positioning hydrocylinder, the turning hydrocylinder and the lockpin hydrocylinder are disposed under the balance beam, wherein the turning hydrocylinder is disposed near inside of the balance beam, the positioning hydrocylinder is disposed near outside of the balance beam, and the lockpin hydrocylinder is disposed between the turning hydrocylinder and the positioning hydrocylinder, and
wherein each hydraulic system is controlled by a hydraulic power station, each hydraulic power station is provided with a manual electric cabinet, on the panel of which manual switch buttons are provided for each sub-action of the turning of the gantry, to control the operation, stop and reset of each hydrocylinder.

2. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein each jacking-up hydrocylinder comprises a body, a piston disposed in the body, an inlet disposed on an upper portion of the body, an outlet disposed on an lower portion of the body, and an omnidirectional adjustment mechanism disposed on the bottom of the body; the bottom of the omnidirectional adjustment mechanism is sustained on the ground; and the top of the body is connected with the bottom of the balance beam of the crane.

3. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein a lockpin fixing slot is disposed on the gantry frame, the lockpin hydrocylinder is horizontally disposed, the body of which is connected with the balance beam, an output shaft thereof is connected with a lockpin plunger, and the lockpin plunger is controlled by a lockpin limit switch to be locked in the lockpin fixing slot disposed on the gantry frame.

4. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein a position fixing slot is also disposed on the gantry frame, the positioning hydrocylinder is horizontally disposed, the body of which is connected with the balance beam via a stanchion, an output shaft thereof is connected with a positioning plunger, which is controlled by a positioning limit switch to be positioned in the position fixing slot disposed on the gantry frame

5. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein a gantry frame locating piece is disposed near the outside of the position fixing slot on the gantry frame.

6. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein the body of the turning hydrocylinder is connected with the balance beam via a footstep, and the output shaft of the turning hydrocylinder is connected with the gantry frame via another footstep.

7. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, further comprising an inductive limit switch, disposed between the lockpin limit switch and the positioning limit switch.

8. The jacking-up and turning device for the rubber-tyred container gantry crane according to claim 1, wherein the manual switch buttons provided on the panel of the manual electric cabinet of each hydraulic power station for each sub-action of the turning of the gantry, comprises: an oil pump switch, a jacking-up/stop/reset switch, a pin back/forward switch; a positioning hydrocylinde switch, a button for 1# wheel 0°, a button for 1# wheel 90°, a button for 2# wheel 0° and a button for 2# wheel 90°.

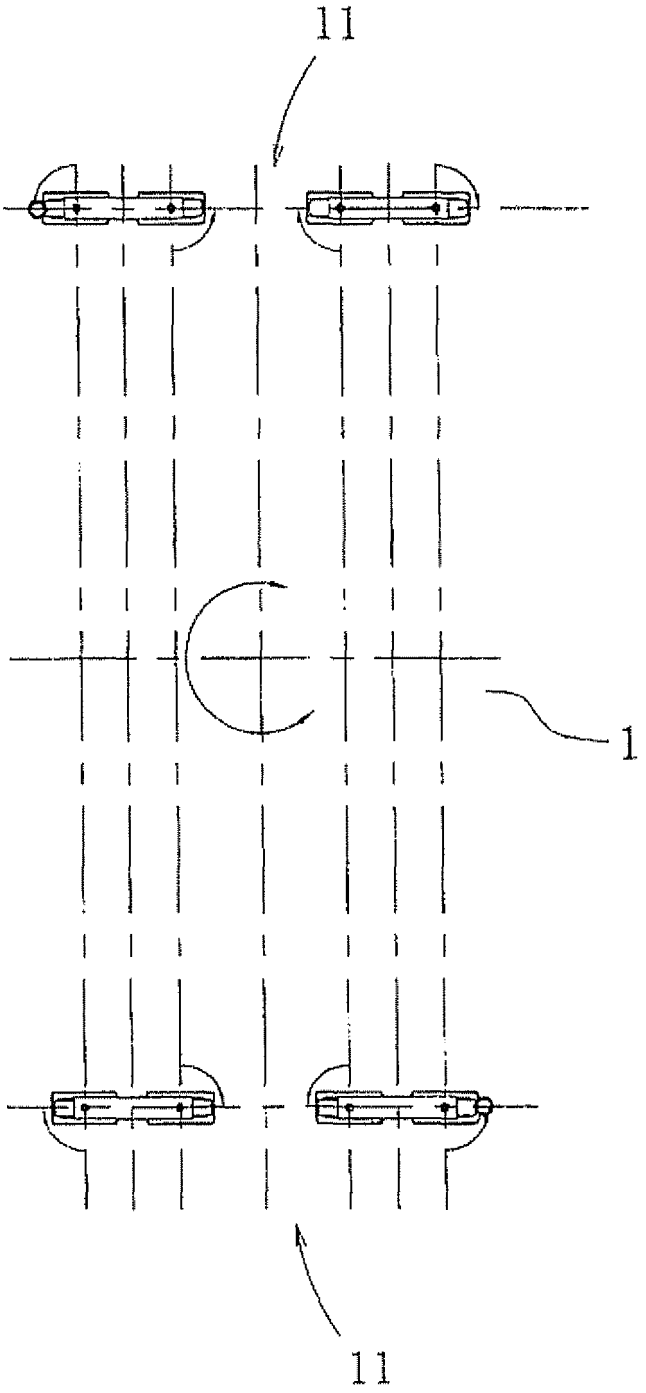


FIG 1

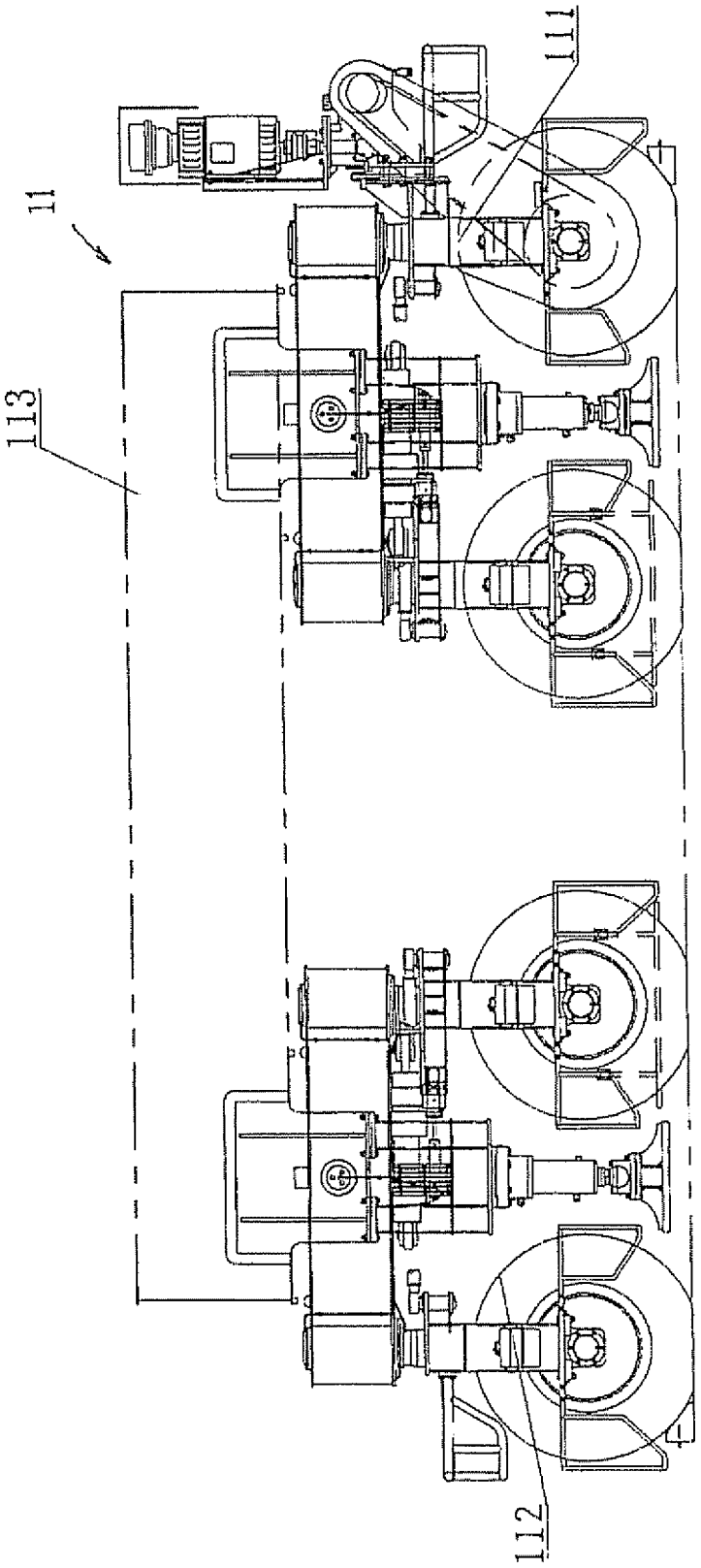


FIG 2

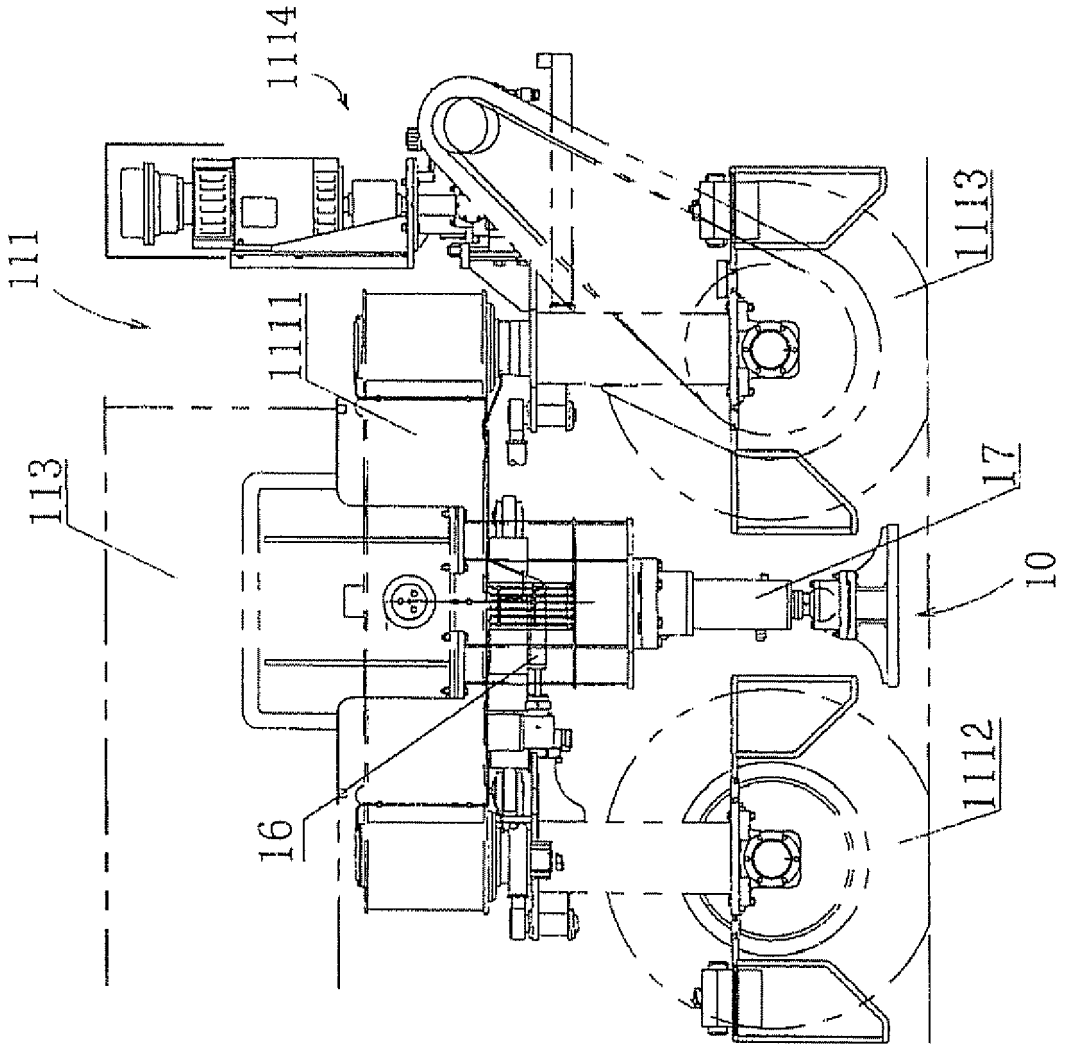


FIG 3

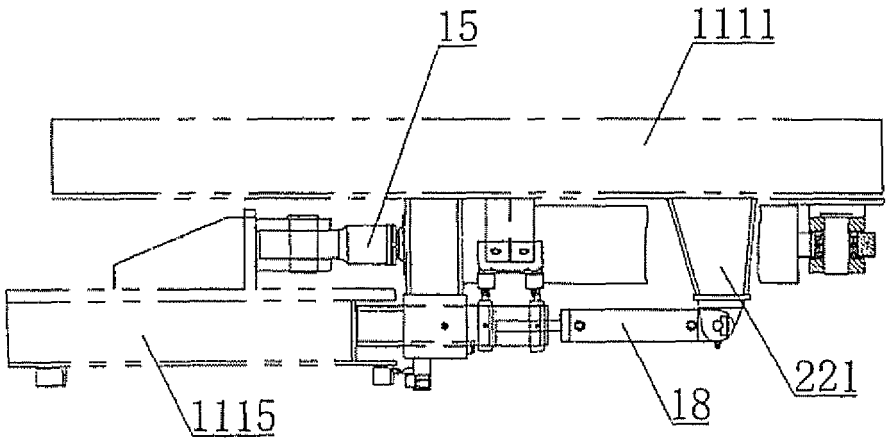


FIG 4

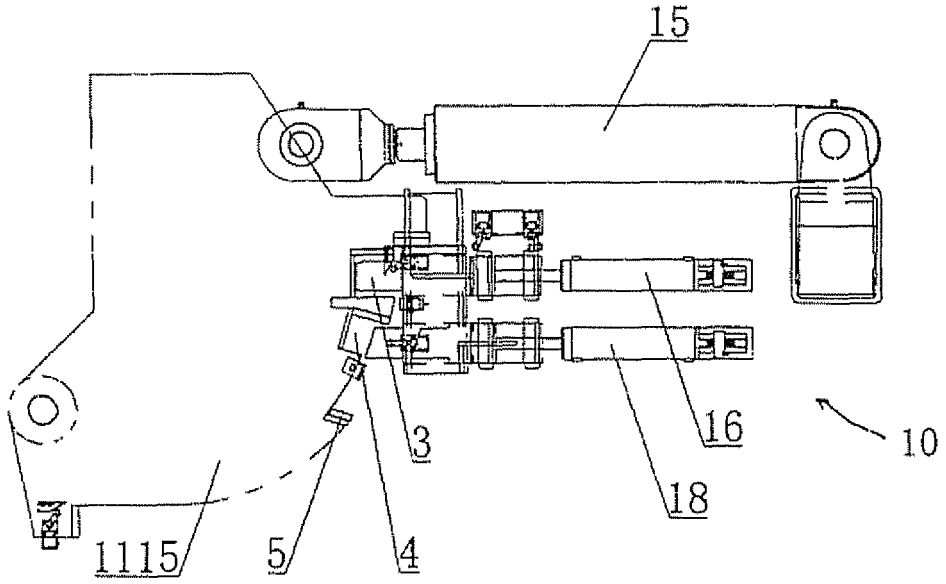


FIG 5

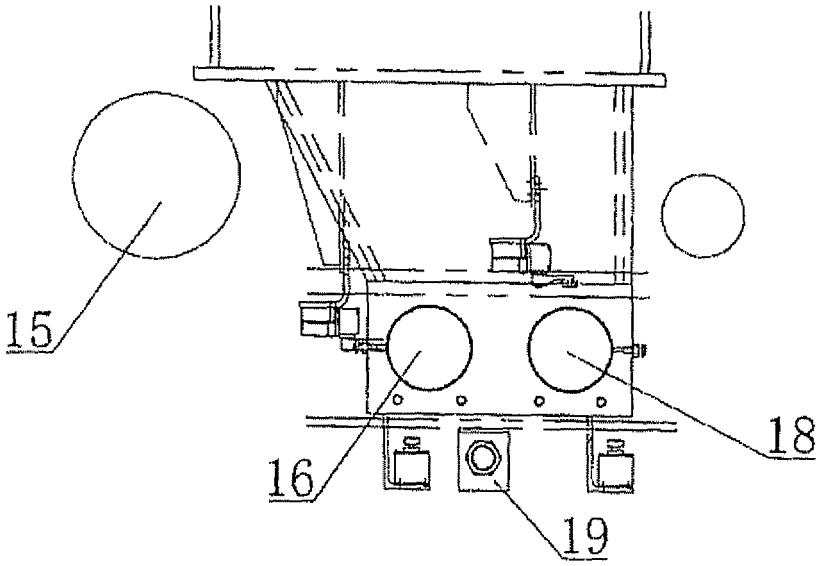


FIG 6

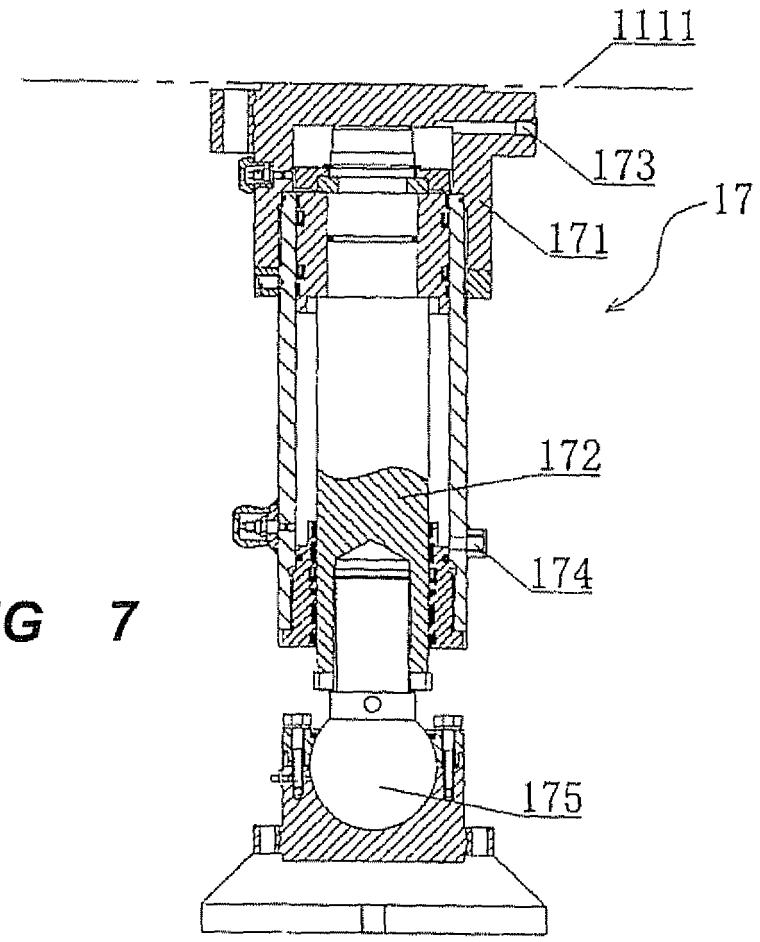
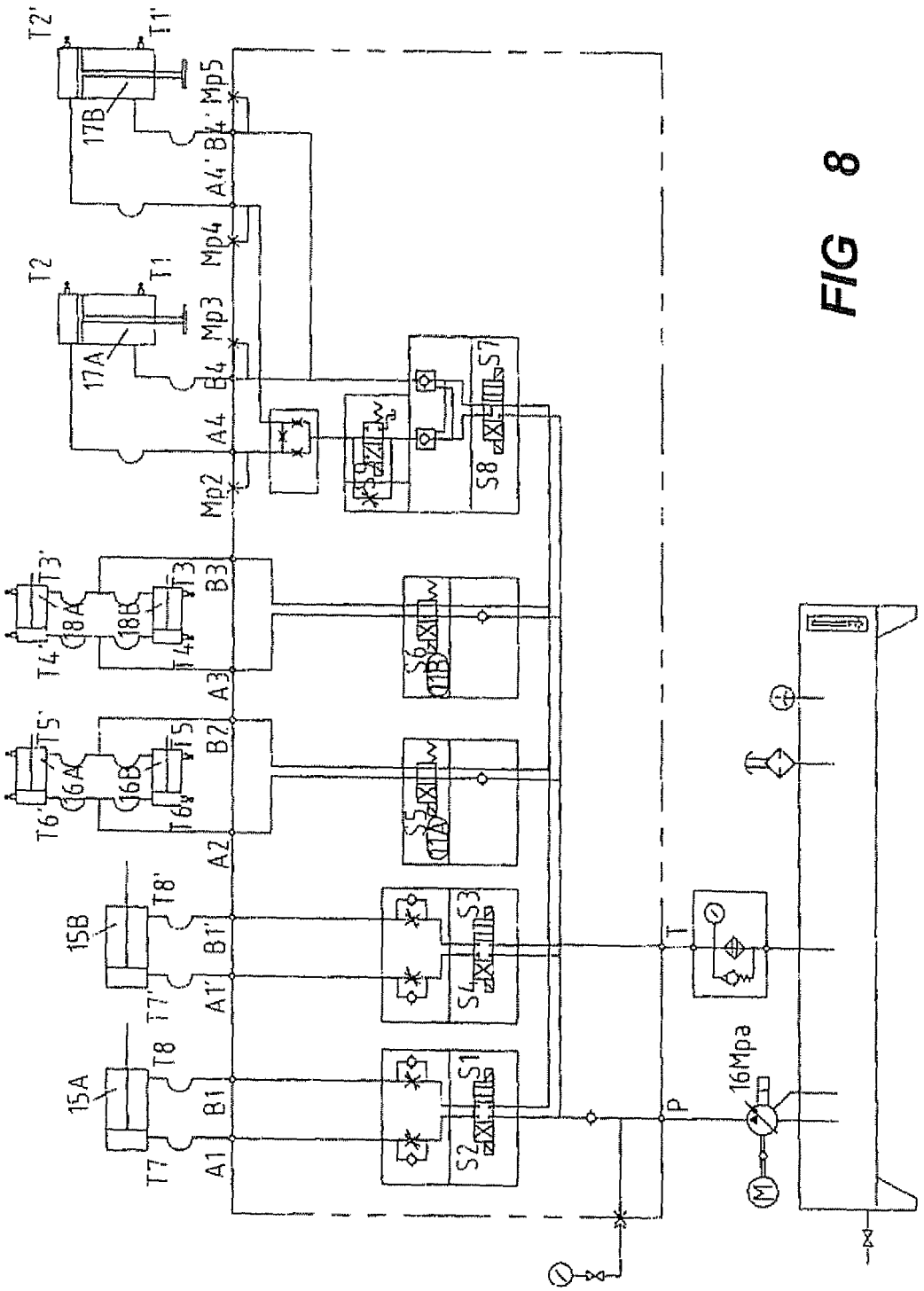


FIG 7


T2'
T1'
17B
Mp5
B4'
A4'
Mp4
T2
T1
17A
Mp3
B4
A4
Mp2
S7
S8
T3'
T4'
18A
18B
T3
T4
B3
A3
S6
T5'
T6'
16A
16B
T5
T6
B2
A2
S5
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T8'
T7'
B1'
A1'
S3
S4
15A
T8
T7
B1
A1
S1
S2
T
P
16Mpa
M

FIG 8

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7247

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	CN 1 141 245 C (SHANGHAI ZHENHUA HARBOUR MACHI [CN] INT EPODOC Caesar accession number) 10 March 2004 (2004-03-10) * abstract * * figures * -----	1-8	INV. B66C5/00 B66C19/00
			TECHNICAL FIELDS SEARCHED (IPC) B66C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 October 2007	Sheppard, Bruce

CATEGORY OF CITED DOCUMENTS

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 07 10 7247

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09-10-2007

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