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(54) Title: TOW TRUCK ROTATOR WITH KNUCKLE BOOM CRANE CAPABLE OF TURNING THE VEHICLE IN AIR, MOUNTED ON THE REAR AXIS

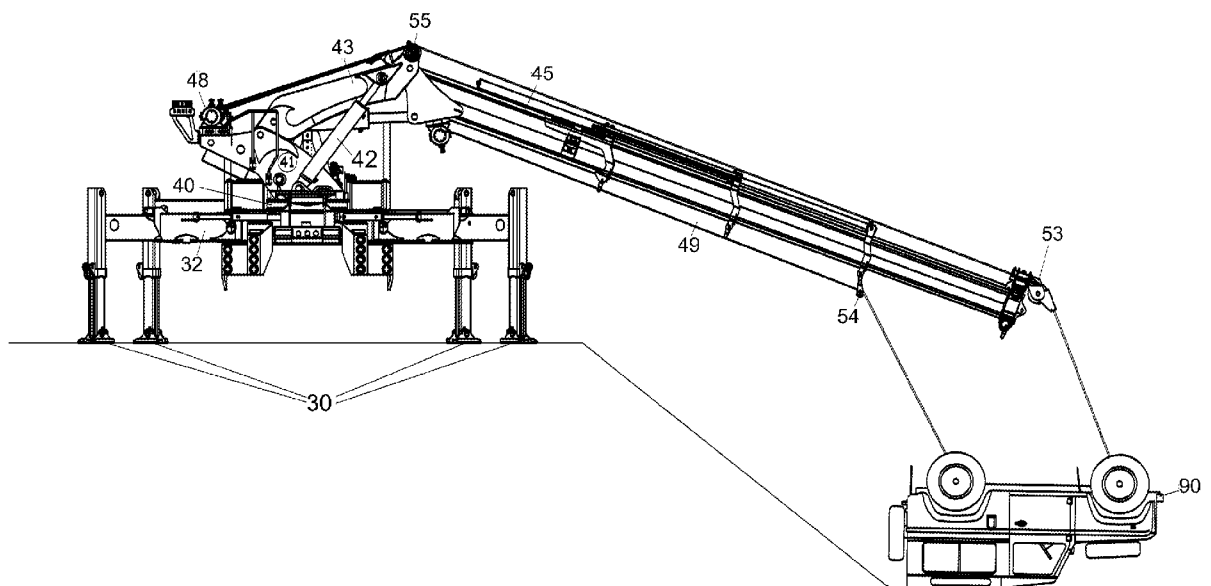


Figure . 3

(57) Abstract: Containing a main arm (43) capable to move up and down by help of erecting cylinder (42), and connected to lower chassis (11) via rotating system (40) and connected to a main body (41) capable to rotate around vertical axis (x); allowing lifting and rotating in air the vehicles (90) by help of independent movement two upper towing ropes (47) and lower towing rope (49), connected to the main arm (43) via the knuckle (52), capable to move up and down by help of cylinder for knuckling (44) and telescopic structure allowing length adjustment of the cylinders for extension (46) and located in the lower parts (45b), and capable to approach to related site as much as possible despite all obstacles by means of movement of vertical outrigger (30) in vertical axis (x).



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TOW TRUCK ROTATOR WITH KNUCKLE BOOM CRANE CAPABLE OF TURNING THE VEHICLE IN AIR, MOUNTED ON THE REAR AXIS

5 The Related Art

This invention relates to towing cranes capable to lift and rotate in the air the vehicles involved in accidents, tug, tow and lift high capacity weights by means of rope towing levers structured on extension arm.

10 Background of the Invention

The vehicles becoming unusable because of an accident or moving mechanism not working for any other reasons are towed by a tow truck having different designs in the related art. However, tow cranes already in
15 use fail to display the desired success for towing and rotating the rollover vehicles under various field conditions.

The patent application numbered US7683564 discloses a telescopic crane system comprising a towing hook on the end and an embodiment that can be
20 opened to enable the towing hook to reach a structure or a vehicle at a far distance. It is structured in a manner that it makes a joint motion to main body by telescopic body by means of a hydraulic piston. However, the patent numbered US7683564 does not have capability and technical characteristic to provide access to a vehicle falling in a hole or wild field at a far distance.

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The system disclosed under patent application numbered US6092975 comprising a fixed body fixed onto bottom having foot structure and carrying arm system conducting rotary movement on the main body. Rotary moving carrying arm system is supported by rope and tying to vehicle by a single
30 rope and taking the vehicle from the field where it has fallen, by means single rope is provided. However, the invention numbered US6092975 is not

capable to rotate the vehicle having accident and tow it remotely. It can perform short distance towing and lifting.

The application numbered US 4790710 discloses an embodiment
5 comprising a carrying extending arm having hook at the end and an embodiment moving the arm by means of a piston.

In addition, outriggers are used in order to prevent tip over of cranes of which weight centre changes during load carrying task. Outriggers are extended
10 from the body and meet the changing weight centre of the crane.

As a result, existence of need for cranes capable to lift up and rotate towed vehicles and inadequacy of existing solutions have necessitated improvement in the related art
15

Description of the Invention

The present invention relates to tow truck rotator with knuckle boom cranes meeting the needs mentioned above, eliminating some disadvantages and
20 providing some additional advantages.

The purpose of the tow truck rotator with knuckle boom cranes disclosed under the invention is to rotate the vehicle in the air after lifting up by means of independent motions of rope-like towing members located, two on upper and one on lower parts of extension arm and thus transfer the vehicle to the
25 desired place in the desired position. Any incidents can be addressed by means of such one crane. Operation period is short and needed workforce is low.

Another purpose of the invention is to provide bending of the extension arm
30 up to 40 degrees angles in respect to the plane where crane is by help of hydraulic piston controlled joint where extension arm is connected, and thus

enable it to access places on lower levels. Thus, scope of range is increased significantly without need for higher capacity cranes.

In order to achieve the above purposes in the broadest way, a tow truck
5 rotator with knuckle boom crane capable to lift up and rotate towed vehicles
has been developed. The towing crane comprising a body, main carrier fixed
onto the body with rotating system and capable to rotate around vertical axis,
main arm connected to the main carrier and capable to move up and down
by help of lifting piston, extension arm connected to main arm with joint,
10 having telescopic structure with length adjustable by help of extension piston
and capable to move up and down by help of straightening piston, two
upper towing members located on upper part of extension arm, driven
independently by upper driving components and providing lifting and lowering
the vehicles via extension arm, a lower towing member located on upper
15 part of extension arm, driven independently by lower driving components and
providing lifting and lowering the vehicles on extension arm, an opening arm
capable to rotate around vertical axis by help of vertical joint providing
connection to the body, and a vertical outrigger.

20 **Brief Description of the Drawings**

In order to make the embodiment and additional members being subject of
the present invention as well as the advantages clearer for better
understanding, it should be assessed with reference to the following
25 described figures.

Figure 1 is general view indicating status of towing crane when folded.

Figure 2 is general view indicating the position when the crane of the
invention located on the vehicle and lifts up a vehicle at low level.

30 Figure 3 is general view indicating the position when the crane of the
invention located on the vehicle and rotates in the air the vehicle at low level.

Figure 4 is general view indicating the position when the crane of the invention located on the vehicle and tows another vehicle.

Figure 5 is general view indicating the position when the crane of the invention located on the vehicle and pulls and rescues another vehicle from where it is.

Figure 6 is a detailed view of underreach system of the crane of the invention to transport vehicle.

Part References

10	10	Tow Truck Rotator With		
		Knuckle Boom Crane	47	Upper Towing Ropes
	11	Lower chassis	48	Upper Towing Hoists
	11a	Lower Chassis Side Part	49	Lower Towing Ropes
	30	Vertical outriggers	50	Lower Towing Hoists
15	32	Opening Arm	51	Load axis alignment
	33	Vertical Joint	52	Knuckle
	34	Cross Type Stabilizer	53	Load axis alignment roller
	35	Upper Chassis	54	Lower distance adjustment rollers
	40	Rotating System	55	Direction roller
20	41	Main Body	60	Extendable Underreach System
	42	Erecting Cylinder	61	Main Boom For
	43	Main Arm		Extendable Underreach
	44	Cylinder for knuckling	62	First knuckle Main Boom
	45	Extension Arms		for Extendable Underreach
25	45a	Upper Part	63	Extendable Booms for Underreach
	45b	Lower Part	64	Erecting Cylinder for Underreach
	46	Cylinder for Extension	65	Cylinder for Main Boom with
	x	Vertical Axis		Extendable Underreach
	y	Horizontal Axis	66	Cylinder for First knuckle Main Boom
30	90	Vehicle		with Extendable Underreach
	A	Turning Movement in Air	67	Cylinder for Extending with
				Underreach

5 Detailed Description of the Invention

The invention comprising at least a main body (41) containing a lower chassis (11) and connected to lower chassis (11) with a rotating system (40) and capable to rotate around vertical axis (x), an upper chassis (35), at least
10 a main arm (43) connected to main body (41) and capable to move up and down by means of erecting cylinder (42). However, it discloses a tow truck rotator with knuckle boom crane (10) comprising at least an extension arm (45) connected to main arm (43) with a knuckle (52), capable to move up and down by help of a cylinder for knuckling (44) and telescopic structure allowing
15 length adjustment by help of cylinders for extension (46).

The invention relating to tow truck rotator with knuckle boom crane (10), differently from existing embodiments, in respect to novelty, comprising two upper towing ropes (47) located on upper part (45a) of extension arm (45),
20 driven independently by means of upper towing hoists (48) and providing lifting and lowering the vehicles (90) by means of extension arm (45). Upper towing ropes (47) are directed with the load axis alignment rollers (53). It also comprising one lower towing rope (49) located on upper part (45b) of extension arm (45), driven independent of lower towing hoist (50) and
25 providing lifting and lowering of the vehicles (90) on the extension arm (45).

The extension arm (45) of the developed tow truck rotator with knuckle boom crane (10) can bend up to 40 degrees as shown in Figure -2 thanks to its knuckled (52) structure and can even tow the vehicles (90) from lower levels.
30 Upper towing ropes (47) and lower towing rope (49) are connected to the vehicle (90) from different points and are moved independent of each other by means of upper towing hoists (48) and lower towing hoist (50) respectively

and turning movement in air (A) of the vehicle (90) is provided. Said motion can be seen in Figure -3. Direction rollers (55) are housed in said knuckle (52) area.

- 5 Upper towing rope (47) and lower towing rope (49) preferably comprising steel rope material and providing pulling and turning movement in air (A) of vehicle (90) are supported by load axis alignments (51). Load axis alignments (51) also provide shifting direction of upper towing ropes (47) and lower towing rope (49). Thus, their movement in different directions is possible.
- 10

Erecting cylinder (42), cylinder for knuckling (44) and cylinder for extension (46) driving all axis motions of extension arm (45) which is main functional factor of the tow truck rotator with knuckle boom crane (10) are hydraulic based operated.

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Tow truck rotator with knuckle boom crane (10) also comprising at least an extendable boom for underreach (63) providing connection of vehicles (90) to lower chassis (11) and towing of them and at least a main boom for extendable underreach (61) having an erecting cylinder for underreach (64) providing up and down movements of the extendable booms for underreach (63). Main boom for extendable underreach (61) also contains a cylinder for main boom with extendable underreach (65). Figure -4 shows a general view of the Tow truck rotator with knuckle boom crane (10) in the position when it

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tows a vehicle (90). The Tow truck rotator with knuckle boom crane (10) not only rescues the vehicles (90) from accident site but also tows and transports them.

With knuckle (52) structure, the Tow truck rotator with knuckle boom crane (10) capable to tow vehicles (90) from lower levels, to make indefinite rotations by help of rotating system (40) and having capacity to lift 32 tons at 3 meters has been developed. It comprising total 3 lifting hoists namely, two

30

upper towing hoists and one lower towing hoists (50) and lifting capacity is 15 tons and tugging capacity is 40 tons. By help of them the vehicle (90) involved in accident or tilted over to one side can be hoisted and rotated or towed directly as shown in Figure -5.

5

During towing and rotating operations, firstly together with opening arms (32) vertical outriggers (30) and cross type stabilizer (34) are opened and the Tow truck rotator with knuckle boom crane (10) is put in balance. Then the rotating system (40), erecting cylinder (42), cylinder for knuckling (44) and
10 cylinders for extension (46) are moved and facing the extension arm (45) in correct position and distance to the vehicle (90) to be towed is provided. Then depending on the operation to be performed, the related ones of the upper towing hoists (48) and lower towing hoist (50) are started and upper towing ropes (48) and lower towing rope (49) are moved and towing and
15 straightening the vehicle (90) is provided. After this stage, the vehicle (90) is lowered onto ground or extendable booms for underreach (63) is connected. Folded extension arm (45) upon operation takes its place on the lower chassis (11) of the Tow truck rotator with knuckle boom crane (10) and balanced distribution of weight is provided. Lower towing rope (49) is
20 associated with Lower distance adjustment roller (54) and distanced by use of these reels.

Another feature of the Tow truck rotator with knuckle boom crane (10) is the extendable underreach system (60) with independent angular movements
25 and extending features. Underreach system is enabled to come to any desired position around 3 rotation centres by help of hydraulic pistons capable to move independent of each other. Approach to lower part of vehicle (90) at a right distance is allowed by help of extension arms and hydraulic equipment provided in the underreach system brought into desired
30 position. Another characteristic of the underreach system having extension arms is that it enables rescue of vehicle (90) from where it is even in cases

when the vehicle (90) is below road level, since it is enabled to conduct a negative angle of 20 degrees with horizontal.

The underreach system employs total 4 hydraulic pistons systems capable to move independent of each other, and the hydraulic pistons are 1 erecting cylinder for underreach (64), cylinder for extending with underreach (67) and 1 cylinder for main boom with extendable underreach (65) and 1 cylinder for first knuckle main boom for extendable underreach (66). Erecting cylinder for underreach (64) enables the rescue to make angular shifting between lower chassis (11) and main boom for extendable underreach (61), and thus is the carrying piston providing removal of the vehicle (90) involved in accident from the accident site. Cylinder for main boom for extendable underreach (65) enables first knuckle main boom for extendable underreach (62) to rotate around main boom for extendable underreach (61). Cylinder for first knuckle main boom with extendable underreach (66) enables the extendable booms for underreach (63) to conduct rotation around and enables first knuckle main boom for extendable underreach (62). Cylinder for extending for underreach (67) enables the extension arms to approach the vehicle (90) involved in accident, at the desired distance.

20

Underreach lifting piston provides transportation of entire weight of the vehicle (90) in a safe manner. Extension arms piston enables the extension arms to move. Other two hydraulic pistons enable the underreach system to come into desired position and rescue the vehicle (90) in a safe and fast manner.

25

CLAIMS

1. A Tow truck rotator with knuckle boom crane (10) comprising
- 5 - a main lower chassis (11),
- at least a main body (41) connected to said lower chassis (11) with a rotating system (40) and rotating around vertical axis (x),
- at least a main arm (43) connected to said main body (41) and capable to move up and down by help of erecting cylinder (42),
- 10 - at least an extension arm (45) connected to the main arm (43) with a knuckle (52), capable to move up and down by help of a cylinder for knuckling (44) and allowing length adjustment by help of cylinders for extension (46),
- 15 **characterized** in comprising;
- upper towing ropes (47) located on the extension arm (45), driven independent of each other by help of upper towing hoists (48) and connected to the vehicles (90),
- 20 - lower towing rope (49) located on the extension arm (45) and connected to vehicles (90) by means of lower towing hoist (50).
- an extendable underreach system (60) connected to the lower chassis (11) and having independent angular movements and extension features.
- 25 **2.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; at least a Load axis alignment (51) providing change of direction and supporting said upper towing ropes (47) and/or lower towing rope (49).
- 30 **3.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; at least two upper towing ropes (47) located on upper part (45a) of said extension arm (45).

4. A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; a lower towing rope (49) located on upper part (45a) of the extension arm (45).
- 5
5. A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in that upper towing ropes (47) and/or lower towing rope (49) are ropes.
- 10
6. A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in the erecting cylinder (42) and/or cylinder for knuckling (44) and/or cylinders for extension (46) are of hydraulic nature.
- 15
7. A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; at least an opening arm (32) capable to rotate around vertical axis (x) by means of vertical joint (33) providing connection to said lower chassis (11),
at least a vertical outrigger (30) to said opening arm (32).
- 20
8. A Tow truck rotator with knuckle boom crane (10) according to claim 7, characterized in that at least one said opening arm (11) is provided on each lower chassis side parts (11a) of lower chassis (11).
- 25
9. A Tow truck rotator with knuckle boom crane (10) according to claim 7, characterized in comprising; at least a cross type stabilizer (34) connected to the lower chassis (11) and extending to ground at a certain angle.
- 30
10. A Tow truck rotator with knuckle boom crane (10) according to claim 7, characterized in that at least one type of cross type stabilizer (34) is provided on each lower chassis (11) side parts of lower chassis (11).

- 11.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising;
at least an extendable boom for underreach (63) providing connection to lower chassis (11) and towing of vehicles (90),
5 -at least a main boom for extendable underreach (61) having erecting cylinder for underreach (64) lifting extension arm providing motion of the extendable booms for underreach (63) are in up and down directions,
-and cylinder for main boom for extendable underreach (65).
- 10 **12.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; Lower distance adjustment roller (54) associated to lower towing rope (49).
- 15 **13.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in comprising; Direction rollers (55) housed in said knuckle (52) area.
- 14.** A Tow truck rotator with knuckle boom crane (10) according to claim 1, characterized in that are extendable underreach system (60) comprising four
20 pistons allowing independent angular motions and extension.

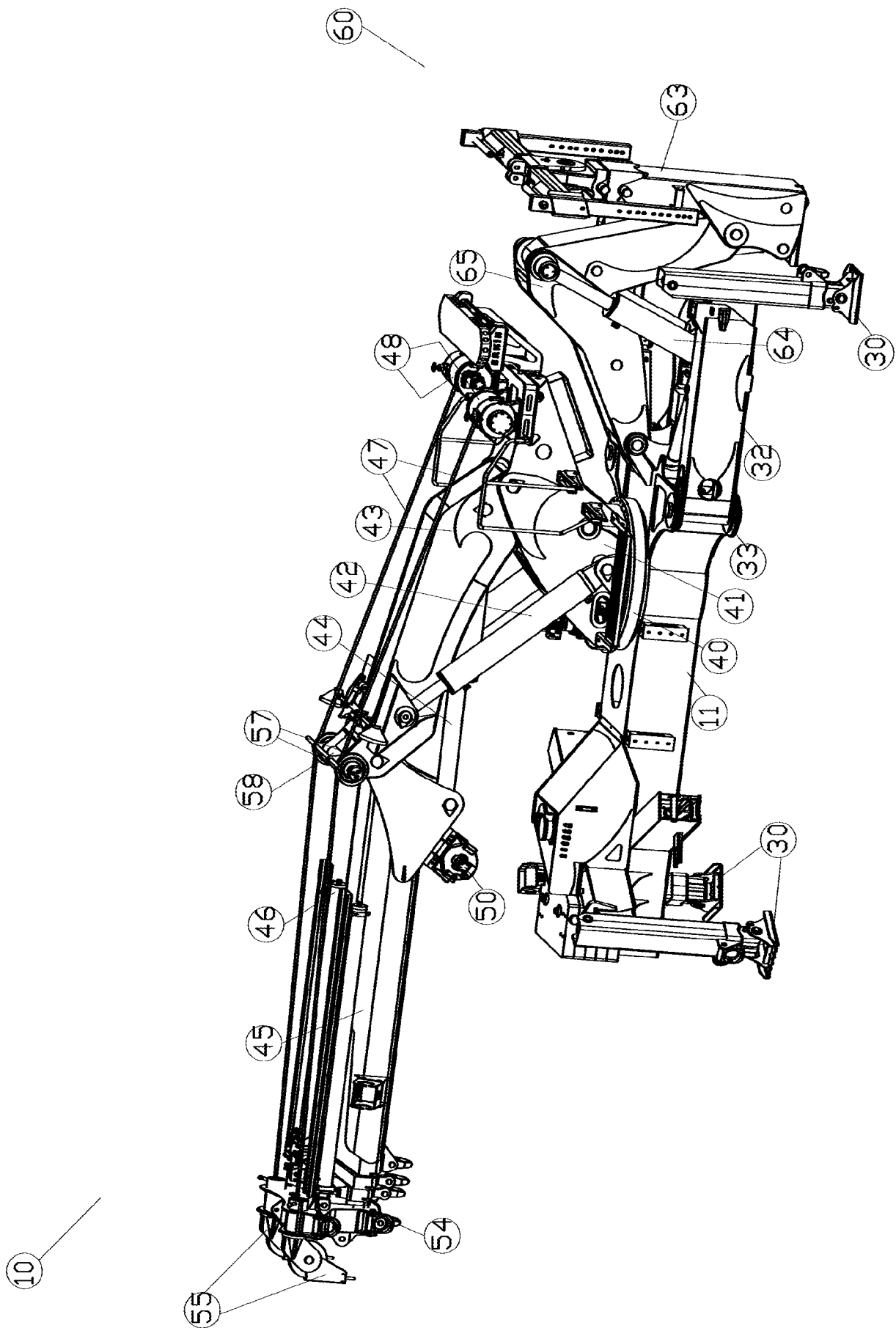


Figure . 1

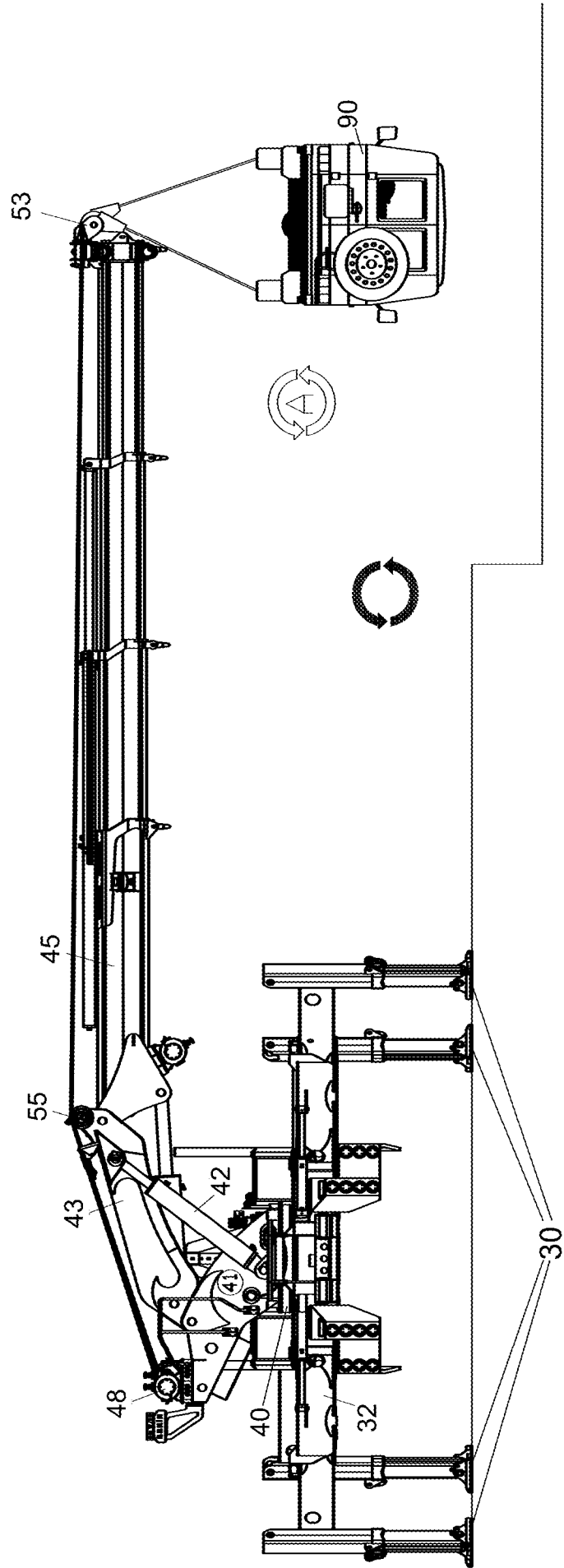


Figure . 2

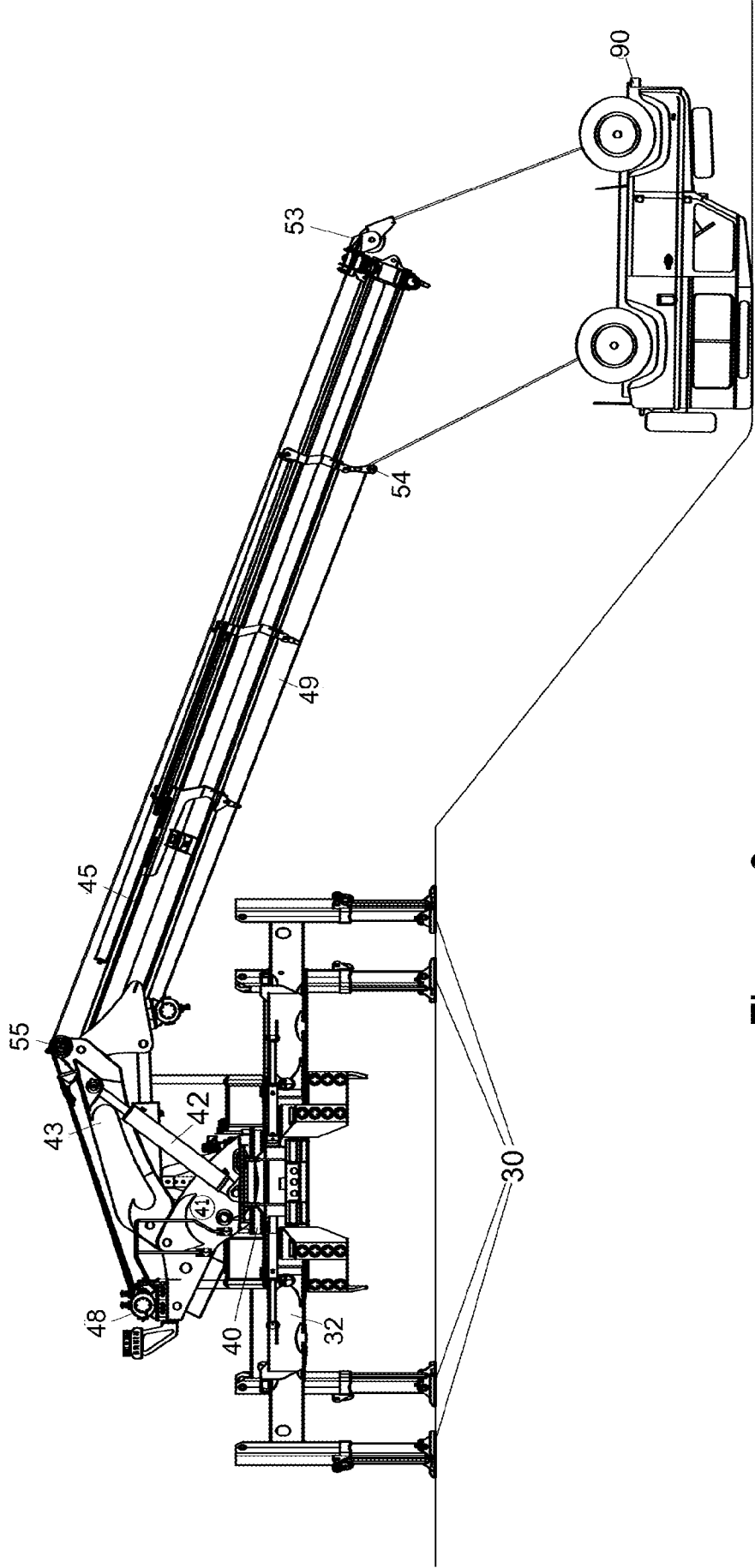


Figure . 3

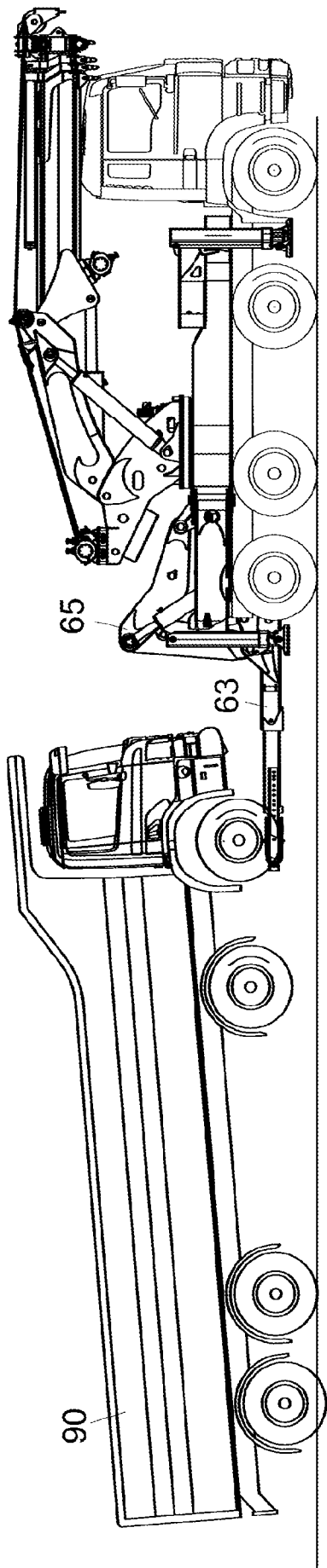


Figure . 4

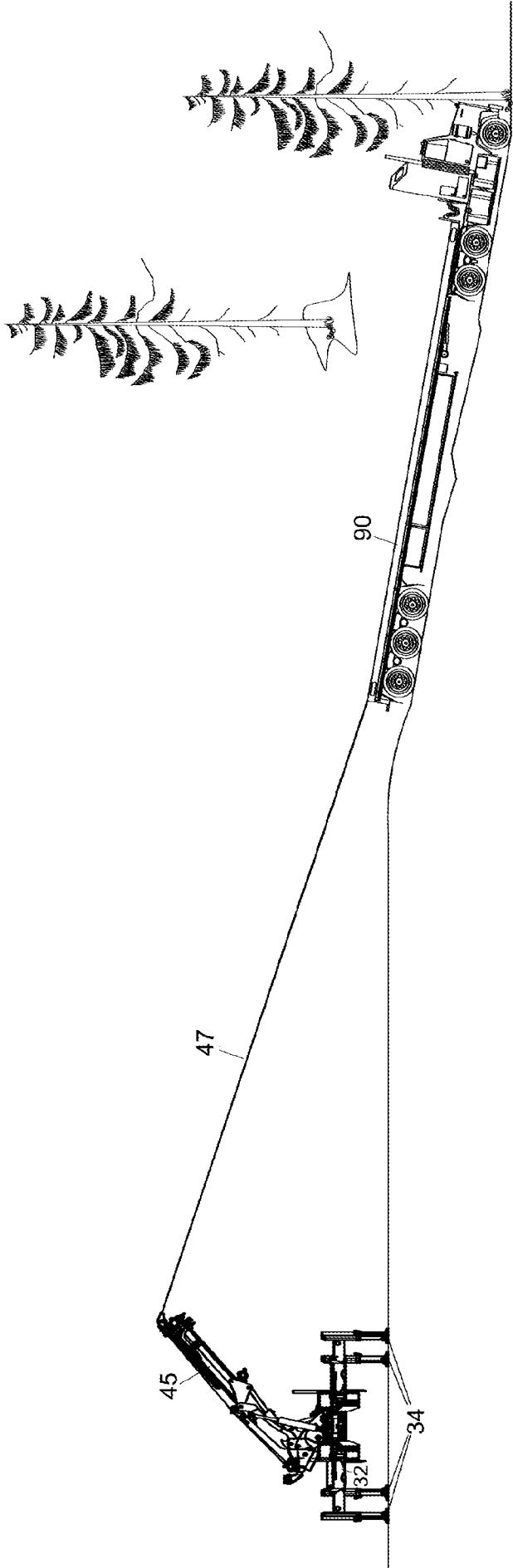


Figure . 5

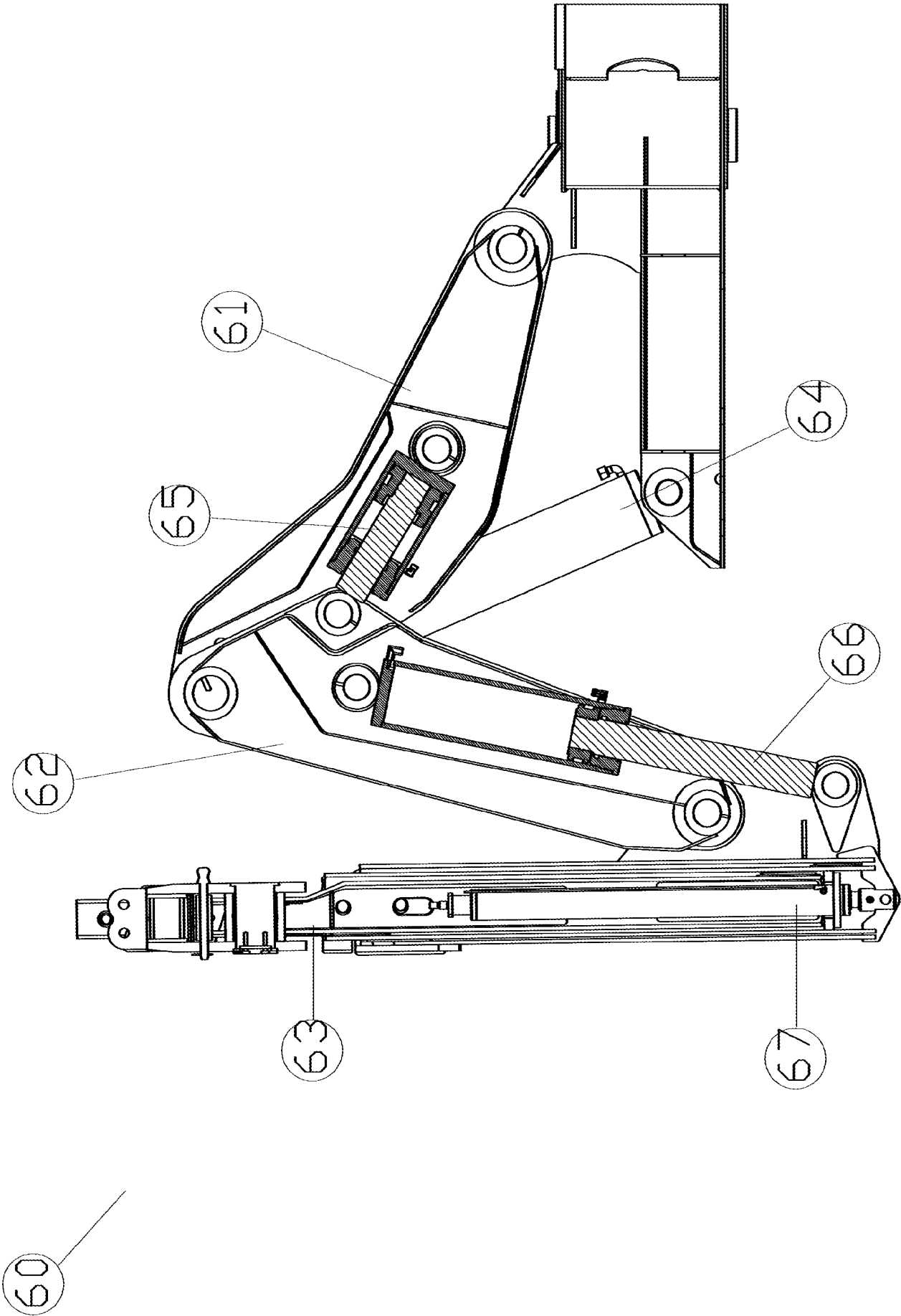


Figure . 6

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER

INV. B66C23/84 B66C23/70 B66C23/00 B66C23/66 B66C23/82
B66C13/08 B60P3/12 B60S9/12

ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

B66C B60P B60S

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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Y	CN 105 691 277 A (GUANGDONG YUEHAI MOTOR VEHICLE CO LTD) 22 June 2016 (2016-06-22) abstract; figures -----	1-14
A	US 2011/150613 A1 (HWANG DAVID HOW-HWA [US]) 23 June 2011 (2011-06-23) paragraph [0026] - paragraph [0029] figures -----	1-14
A	CN 105 480 140 A (UNIV SOUTHEAST) 13 April 2016 (2016-04-13) abstract; figures -----	1-14



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Date of the actual completion of the international search

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07/06/2019

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/TR2018/050351

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