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(54) **HYBRID CARRIER SYSTEM FOR CRANES**

(57) Self-propelled hybrid carrier for cranes, comprising a crawler mechanism as well as wheels on telescoping arms.

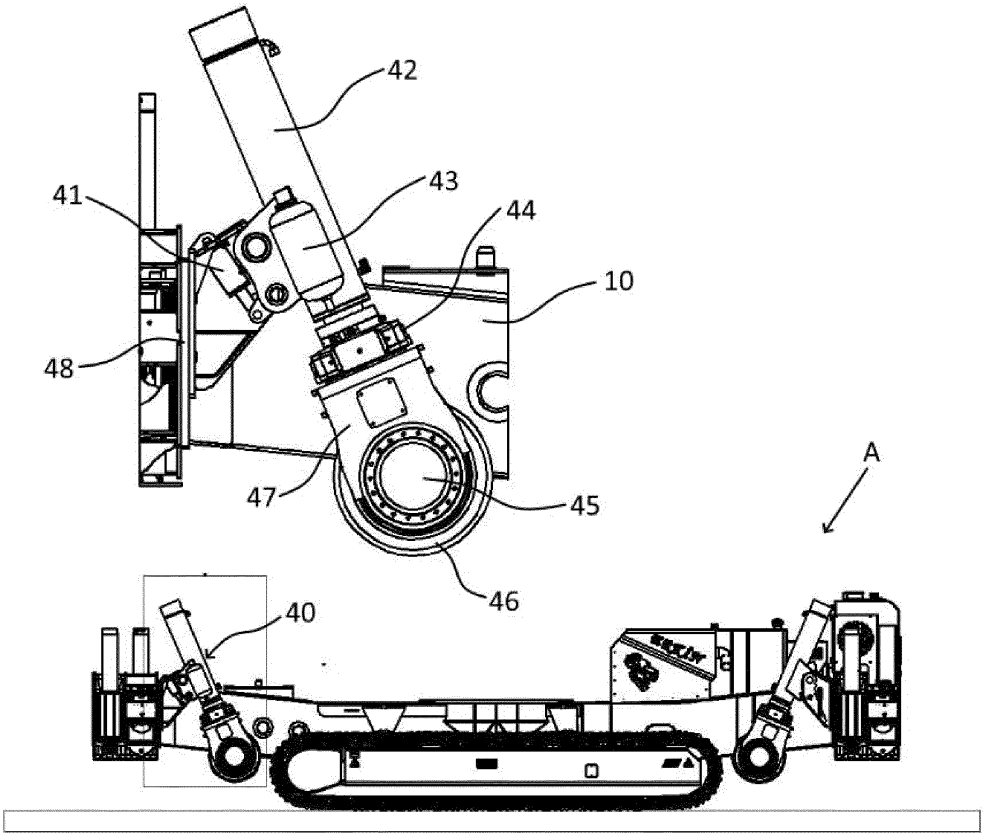

Figure-2

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Description

Technical Field

[0001] The invention relates to a hybrid carrier system for cranes.

[0002] The invention particularly relates to a self-propelled hybrid carrier system for knuckle boom cranes and telescopic cranes.

State of The Art

[0003] The self-propelled carrier systems for knuckle boom and telescopic boom cranes are the systems that are controlled by a remote control and do not have a compartment for the operator. The self-propelled carrier systems for knuckle boom cranes and telescopic cranes are the equipment that are used for increasing portability and mobility characteristics of cranes. These systems enable cranes to move on their own wheels and provide easy portability and flexibility. The self-propelled carrier systems are generally equipped with wheels and motorized drive mechanisms mounted on the crane chassis. Thus, the cranes can move with their own power and easily change their position at the work area. Some self-propelled carrier systems have various wheels and axles that can move independently on the crane chassis. In this way, the crane enables movements such as rotation, back and forth and drifting sideways.

[0004] The carrier systems used in the state of the art are designed in two different ways; only crawler or only rubber-wheeled. The power unit of the carrier systems generally comprises a diesel engine and the diesel engine energizes the propulsion system. The diesel engine is mounted on the carrier substructure. Therefore, it causes the center of gravity of the carrier substructure to be higher than the normal and negatively affects the climbing performance of the carrier system.

[0005] If the carrier systems used in the state of the art are designed to operate on rough lands, the crawler system is generally chosen. Steel crawler systems are used for crawler systems to comfortably operate on rough lands. Even though the steel crawler system provides high climbing ability and durability in difficult rough lands, it is not suitable for using in areas where the land conditions are smoother (such as asphalt road, factory area) due to the damage to the ground by the steel crawler system. It is possible for the steel pallets to be covered with rubber type soft materials in order to prevent them to damage the ground, however, the pallets covered by a soft material has low climbing capacity on highlands. Moreover, the crawler systems move very slowly, and their manoeuvrability is very limited for narrow areas.

[0006] The crawler carrier systems generally have the following features:

- Pallets are durable belts or chains that are generally made of metal or rubber and comprise many small wheels.
- The crawler carriers are capable of carrying heavy loads and providing better stability on the surface.
- They are used in difficult land conditions such as construction, mining, agriculture and military applications.

[0007] Rubber-wheeled propulsion systems are generally designed to operate in areas where the land conditions are smooth (such as asphalt road, parquet areas) and are not suitable for using on rough lands. In the rubber-wheeled propulsion systems, manoeuvrability is generally provided by steering the front tires. This limits manoeuvrability in very narrow areas.

[0008] The rubber-wheeled carrier systems generally have the following features:

- The rubber-wheeled carriers are generally used for carrying light loads or people.
- Each wheel has a metal rim having an outer base made of rubber or rubber material.
- The rubber wheels provide good traction and mobility on flat surfaces.
- They are used in many fields such as industrial storage, distribution, construction and airport.

[0009] In the state of art, diesel engines that provide power to the carrier systems are generally located on the upper part of the chassis. This causes the center of gravity of the total system to be on the higher and negatively affects the climbing ability of the carrier systems.

[0010] As a result of the research related to the subject, the application titled "Wheeled carrying platform" with application number TR2007/07833 has been found. In the related application, a carrier system with only wheels is described.

[0011] In conclusion, it has been required to make an improvement in the related technical field due to the above-mentioned negativities and the inadequacy of the present solutions about the subject.

Object of the Invention

[0012] The invention is inspired by the present conditions and aims to solve the above-mentioned disadvantages.

[0013] The main object of the invention is to introduce a carrier system comprises a combination of a steel crawler system and a trackless rubber wheeled propulsion system. Thus, the trackless rubber wheeled propulsion system is activated in places where the land conditions are smoother, while the steel crawler system is used on rough lands.

[0014] Another object of the invention is to provide a carrier system with increased climbing ability with a design that enables the center of gravity to be closer to the ground.

[0015] Another object of the invention is to provide a

carrier system with maximum mobility, particularly on rough lands.

[0016] Another object of the invention is to increase the climbing angle of the carrier system on rough lands.

[0017] Another object of the invention is to enable the steel crawler system to be separated by the right and left side of the carrier system, to increase the logistics capability of the system, and to ensure that the weight of the system can be reduced when necessary. The weight reduction mentioned above also provides an opportunity to create an ecofriendly system by reducing the fuel consumption during use.

[0018] In order to achieve the objects described above, a self-propelled hybrid carrier system for cranes comprising a body acting as a chassis and a substructure on which the cranes are carried, a crawler system located on the sides of the body to enable the carrier system to move in rough land conditions and climb the inclined surfaces, comprises following:

a four-wheel propulsion system positioned opposing on the sides of the body, enabling the carrier system to move on the wheels by cutting off the contact of the crawler system with the ground when activated,
a movement cylinder to provide adjustment of the height,
an inner arm moving linearly in the movement cylinder,
a wheel body connected with the inner arm,
a wheel positioned in the wheel body,
a hydraulic motor connected with the wheel by its center point on the wheel body to provide rotation for the wheel,
a slewing ring located between the wheel body and the inner arm to enable the body and the wheel to be steered to the right and left,
a folding cylinder connected with the movement cylinder to ensure that the wheel propulsion system is folded upwards with an angle on the body so as not to contact with the ground and not to prevent the movement of the crawler system when not in use.

[0019] The structural and characteristic features of the invention and all of its advantages will be understood more clearly by means of the figures given below and the detailed description written with reference to these figures, and therefore, the evaluation needs to be carried out by taking these figures and detailed description into consideration.

Drawings For Better Understanding of The Invention

[0020]

Figure 1 is a general perspective view of the carrier system.
Figure 2 is a side view of the carrier system and the wheel propulsion system.
Figure 3 is a perspective view of the wheel propulsion system.
Figure 4 is a general perspective view of the carrier system with separated pallets.
Figure 5 is a side view of the carrier system in the condition that the wheel propulsion system is folded with an angle.
Figure 6 is a side view of the carrier system in the condition that the wheel propulsion system is above.
Figure 7 is a side view of the carrier system in the condition that the wheel propulsion system is active.
Figure 8 is a general perspective view of the carrier system in the condition that a crane is mounted.
Figure 9 is a general perspective view of the carrier system with opened stabilizers.
Figure 10 is a detailed view of the carrier system with a sensor.
Figure 11 is a detailed view of the upper part of the wheel propulsion system.
Figure 12 is a perspective view of the wheel propulsion system.

Description of the References

[0021]

10	Body
11	Engine bearing
12	Pin
20	Stabilizers
30	Crawler system
31	Pin housing
40	Wheeled propulsion system
41	Folding cylinder
42	Movement cylinder
421	Port
422	Load check valve
423	Inner arm
43	Air tube
44	Slewing ring
441	Sensor
45	Hydraulic motor
46	Wheel
47	Wheel body
48	Connecting plate
A	Carrier system

Detailed Description of the Invention

[0022] In this detailed description, the preferred embodiments of hybrid carrier system (A) of the invention are described only for a better understanding of the subject.

[0023] The carrier system (A) comprises pieces positioned on a body (10) acting as a chassis. The body (10) is also a substructure on which the cranes are carried besides enabling the other elements to be together. The cranes are preferably knuckle boom cranes or telescopic

boom cranes. Lower part of the body (10) is in the form of an arc with its ends tapering upwards, while middle parts are parallel to the ground. Therefore, the body (10) has the shape of a boat and ensures that the body (10) can easily climb particularly on rough lands when in motion, and it ensures that it can climb on the lands with higher angle values, and that the lower part of the body (10) does not hit ground during climbing. Inner part of the body (10) is produced with a latticed model. Therefore, the crane mounted on the body (10) prevents the body (10) from flexing during the load lifting process and increases the stability of the carrier system (A).

[0024] There is an engine bearing (11) in the front part of the body (10). The engine bearing (11) is hollow in the shape of V, and a diesel engine is placed inside it to provide power to the carrier system (A). The position of the engine bearing (11) is specially chosen and the diesel engine is not on the body (10), but the inner part the body (10). In this way, the center of gravity of the carrier system (A) is lowered so that it enables the carrier system (A) to climb steeper angles.

[0025] There is an stabilizer (20) on the front and back sides, on the right and on the left, of the body (10). The stabilizers (20) are in a position higher than the body (10) and provide the stability of the crane mounted on the body (10) during operation. The stabilizers (20) are mounted on the body (10) preferably with the welding method or any fixing element. The stabilizers (20) can be used by opening them to the sides as seen in Figure 9.

[0026] There is a crawler system (30) on both sides of the body (10). The crawler system (30) preferably has pallets made of steel material product and provides that the carrier system (A) can move in rough land conditions and climb right surfaces between 15-20 degrees. The crawler system (30) can be chosen as any crawler system used in the state of art. The crawler system (30) generally comprises pallets made of steel or special alloys, and each pallet having a set of wheels or rollers. These wheels or rollers move on the propulsion rails on the mechanism. The pallets are moved by the drive that it receives from a diesel engine located in the engine bearing (11). An electric engine can also preferably be used in the engine bearing (11).

[0027] The carrier system (A) comprises four-wheel propulsion systems (40) to be positioned on the sides of the body (10) and on the sides of the stabilizers (20). The wheel propulsion system (40) basically comprises folding cylinder (41), movement cylinder (42), port (421), load check valve (422), inner arm (423), air tube (43), slewing ring (44), sensor (441), hydraulic motor (45), wheel (46), wheel body (47) and connecting plate (48).

[0028] The carrier system (A), which is subject of the invention, can optionally move with the crawler system (30) or the wheel propulsion system (40). Through using the propulsion systems together, the carrier system (A), which is subject of the invention, has a hybrid feature.

[0029] In the wheel propulsion system (40), the height is adjusted by the movement cylinder (42). There is a wheel body (47) connected with the inner arm (423) of the movement cylinder (42). The wheel body (47) can move linearly with the movement of the movement cylinder (42) and the height of the wheel body (47) can be adjusted according to the usage requirement. There is a wheel (46) placed in the wheel body (47). The wheel (46) contacts with the ground when the wheel propulsion system (40) is activated and enables the carrier system (A) to move with the rotational movement. There is a hydraulic motor (45) connected with the wheel (46) by its center point on the wheel body (47). The hydraulic motor (45) provides the rotational movement to the wheel (46). The hydraulic motor (45) is preferably hydraulic-powered, and it is an engine operating with hydraulic fluid pressure and has different speed modes.

[0030] There is a slewing ring (44) between the wheel body (47) and the inner arm (423). The slewing ring (44) enables the wheel body (47) and the wheel (46) to be steered to the right or left. Each wheel (46) in the carrier system (A) can be steered independently from each other. There is an integrally mounted sensor (441) on the slewing ring (44). The sensor (441) continuously controls the steering angles of the wheels (46) and enables the wrong rotations to be prevented. Therefore, it is provided that the four wheels (46) in the carrier system (A) operate synchronously. The sensor (441) is integrated on the slewing ring (44). It reports the position of a wheel (46) to the main processor (computer) on the carrier system (A). The main processor calculates how many degrees the other three wheels (46) should turn to the right or left by using this information and transmits the rotation angle to the wheels (46) as a command. The wheels (46) are stopped electronically when they reach the desired angle. Therefore, it is prevented from going out of the desired rotation angle.

[0031] The wheels (46), which are preferably made of trackless material are used in the wheel propulsion system (40). Therefore, the wheels (46) do not leave a tire track on the ground while driving. This provides that the ground is not damaged, especially when working inside the factory.

[0032] Since the carrier system (A), which is subject of the invention, has four aforementioned wheel propulsion systems (40) and each is independent of each other, manoeuvrability is maximized. For example, while the two back wheels (46) are stable, steering can be performed by the two front wheels (46) or, on the contrary, while the front wheels (46) are stable, steering can be performed by the back wheels (46). In addition, each four wheels (46) has the ability of steering at the same time. Thus, the carrier system (A) can move forward or backward diagonally and also rotate 360 degrees around a fixed point or slide right or left.

[0033] In the wheel propulsion system (40), there is an air tube (43) on the movement cylinder (42). The air tube (43) adds suspension ability to the movement cylinder (42). In the wheel propulsion system (40), the vibrations that occur as a result of the action and reaction forces

between the wheels (46) and the ground during driving will be absorbed by the air tube (43). Therefore, the damage that will occur especially at the connection points will be prevented. The air tube (43) draws the hydraulic fluid squeezed into it during driving in the movement cylinder (42) and it enables the inner arm (423) part of the movement cylinder (42) to get in a little. This movement provides the opportunity to act as a suspension to the movement cylinder (42) so that the vibration is absorbed.

[0034] There are two ports (421) on the movement cylinder (42), wherein this movement cylinder (42) is preferably a double-acting hydraulic cylinder. One of the ports (421) is on the side of the movement cylinder (42) (sleeve), and the other is on the side of the inner arm (423) (rod). Forward and backward movements of the movement cylinder (42) are possible by directing the hydraulic fluid from the right port (421) of the movement cylinder (42). Load check valves (422) are used in order to prevent the fluid directed into the movement cylinder (42) from staying in that position and to prevent the inner arm (423) part of the movement cylinder (42) from reaching to equilibrium position after the movement cylinder (42) is brought to the desired position. When the wheel propulsion system (40) is brought to the driving position, the load check valves (422) block the hydraulic fluid inside the movement cylinder (42) and the movement enables the movement cylinder (42) to stay in the determined position.

[0035] In the carrier system (A), which is the subject of the invention, when the wheel propulsion system (40) is not used, it is folded upwardly with an angle on the body (10) so as not to contact with the folding cylinder (41) to the ground and not to prevent the movement of the crawler system (30). This fold also forms a sufficient amount of gap for the crawler system (30) to operate. The gap also enables the crawler system (30) to be able to climb comfortably. The folding cylinder (41) is connected with the movement cylinder (42).

[0036] In the carrier system (A), which is the subject of the invention, the wheel propulsion system (40) is mounted on the body (10) with the connecting plate (48). The folding cylinder (41) is located on the connecting plate (48).

[0037] There is at least one pin housing (31) on the crawler system (30); and there is at least one pin (12) on the body (10), which can be placed in the pin housing (31). The pin (12) is a hydraulic pin, and when it is separated from the pin housing (31), it enables the crawler system (30) to be separated from the body (10) if necessary. The crawler system (30) can be removed from the body (10) so that the weight of the system is reduced, and the cost of transportation is lowered. In addition, if there is a maximum pressure restriction to be applied to the ground while the wheel propulsion system (40) is being used, when the crawler system (30) is removed, the total pressure exerted by the wheel propulsion system (40) on the ground can be reduced by lowering the weight of the carrier system (A) by approximately 8 tons. Considering that the factory grounds are not designed for the driving of very heavy vehicles and the installation of equipment used in present technology, cranes with high lifting capacity are needed, the damages that these cranes will bring to the factory ground due to their own weights can also be eliminated when the wheel propulsion system (40) is activated in the carrier system (A), which is subject of the invention.

Claims

1. A self-propelled hybrid carrier system (A) for cranes, comprising:

- a body (10) acting as a chassis and a substructure on which the cranes are carried,
- a crawler system (30) on the side parts of the body (10) in order to enable the carrier system (A) to be able to move in rough field conditions and to climb the inclined surfaces,

and **characterized by comprising:**

- a four-wheel propulsion system (40) positioned opposing on the sides of the body (10), enabling the carrier system (A) to move on the wheels by cutting off the contact of the crawler system (30) with the ground when activated, and

the wheel propulsion system (40) further comprising:

- a movement cylinder (42) to provide adjustment of the height,
- an inner arm (423) moving linearly in the movement cylinder (42),
- a wheel body (47) connected with the inner arm (423),
- a wheel (46) placed in the wheel body (47),
- a hydraulic motor (45) connected with the wheel (46) by center point on the wheel body (47) in order to provide rotational movement to the wheel (46),
- a slewing ring (44) located between the wheel body (47) and the inner arm (423) to enable the wheel body (47) and the wheel (46) to be steered to the right or left,
- a folding cylinder (41) connected with the movement cylinder (42) to enable the wheel propulsion system (40) to be folded upwards with an angle on the body (10) so as not to contact with the ground when not in use and not to prevent the movement of the wheel propulsion system (30).

2. The carrier system (A) according to claim 1, **characterized by comprising** an engine bearing (11),

that is a hollow in the shape of V enabling the carrier system (A) to climb right angles by lowering the center of gravity and providing a power to the carrier system (A) and in which a diesel engine is placed.

3. The carrier system (A) according to claim 1 or 2, **characterized by comprising** stabilizers (20) that are in a position higher than the body (10) and that are in the front and back sides, on the right and on the left, of the body (10) in order to provide stability of the crane mounted on the body (10) during operation.

4. The carrier system (A) according to any of the preceding claims, **characterized in that** the hydraulic motor (45) is hydraulic-powered, and chosen as an engine operating with hydraulic fluid pressure.

5. The carrier system (A) according to any of the preceding claims, **characterized by comprising** a sensor (441) integrally mounted on the slewing ring (44) in order to control the steering angles of the wheels (46) continuously and to prevent the wrong rotations and to enable the four wheels (46) located in the carrier system (A) to operate synchronously.

6. The carrier system (A) according to any of the preceding claims, **characterized in that** the wheels (46) are made of trackless material to ensure that the wheels (46) do not leave a tire track on the ground while driving and that the ground is not damaged.

7. The carrier system (A) according to any of the preceding claims, **characterized in that** each of the wheel propulsion systems (40) of the carrier system (A) can operate independently of each other.

8. The carrier system (A) according to any of the preceding claims, **characterized by comprising** an air tube (43) on the movement cylinder (42) in order to provide suspension to the movement cylinder (42) by drawing the hydraulic fluid squeezed in the movement cylinder (42) into during driving and enabling the inner arm (423) part of the movement cylinder (42) to get in an amount.

9. The carrier system (A) according to any of the preceding claims, **characterized in that** the movement cylinder (42) is double-acting hydraulic cylinder and the movement cylinder (42) comprises two ports (421), one in the side of the movement cylinder (42) and the other in the side of the inner arm (423).

10. The carrier system (A) according to any of the preceding claims, **characterized by comprising** a port (421) enabling the hydraulic fluid to be directed in order to provide forward and backward movement of the movement cylinder (42).

11. The carrier system (A) according to any of the preceding claims, **characterized by comprising** a connecting plate (48) located on the folding cylinder (41) in order to enable the wheel propulsion system (40) to be mounted on the body (10).

12. The carrier system (A) according to any of the preceding claims, **characterized by comprising** at least one pin housing (31) on the crawler system (30).

13. The carrier system (A) according to claim 10, **characterized by comprising** load check valves (422) in order to enable the hydraulic fluid to stay in the position directed to the inside of the movement cylinder (42) and to prevent the inner arm (423) part of the movement cylinder (42) from reaching the equilibrium position after the movement cylinder (42) is brought to the desired position.

14. The carrier system (A) according to claim 12, **characterized by comprising** at least one pin (12) to be placed in the pin housing (31) on the body (10) in order to enable the crawler system (30) to be separated from the body (10).

15. The carrier system (A) according to claim 12 or 14, **characterized by comprising** the pin (12) is a hydraulic pin.

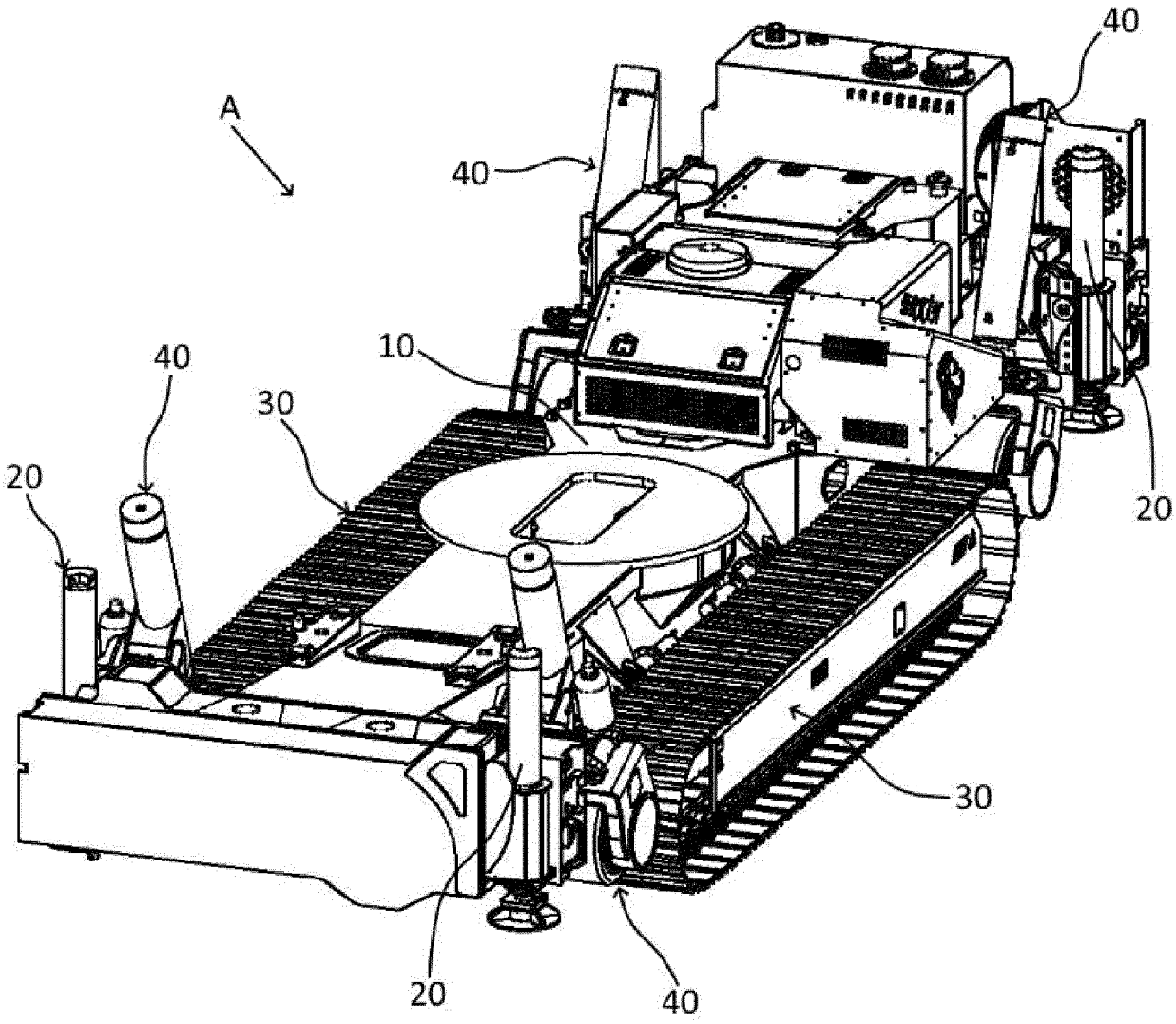


Figure-1

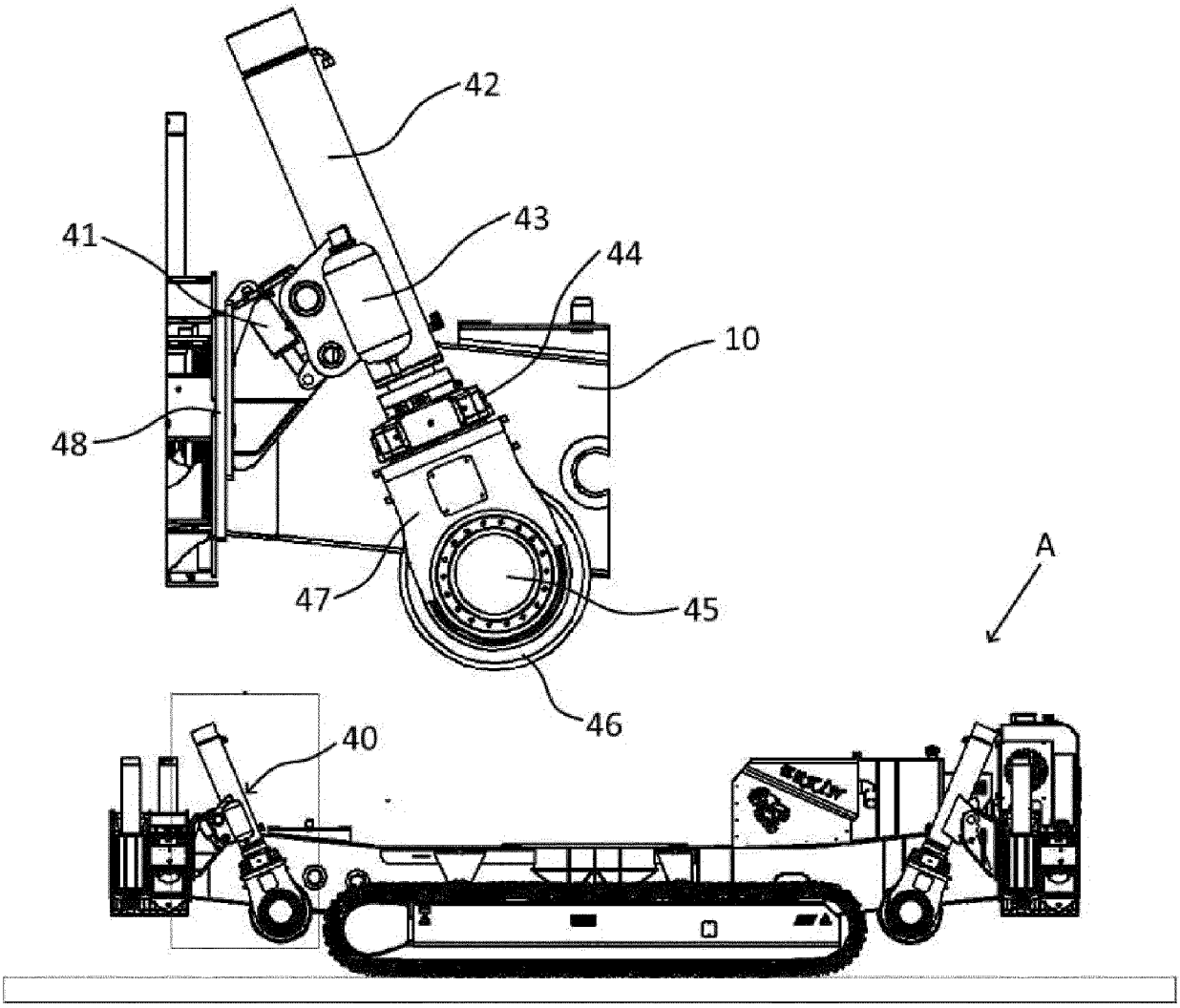


Figure-2

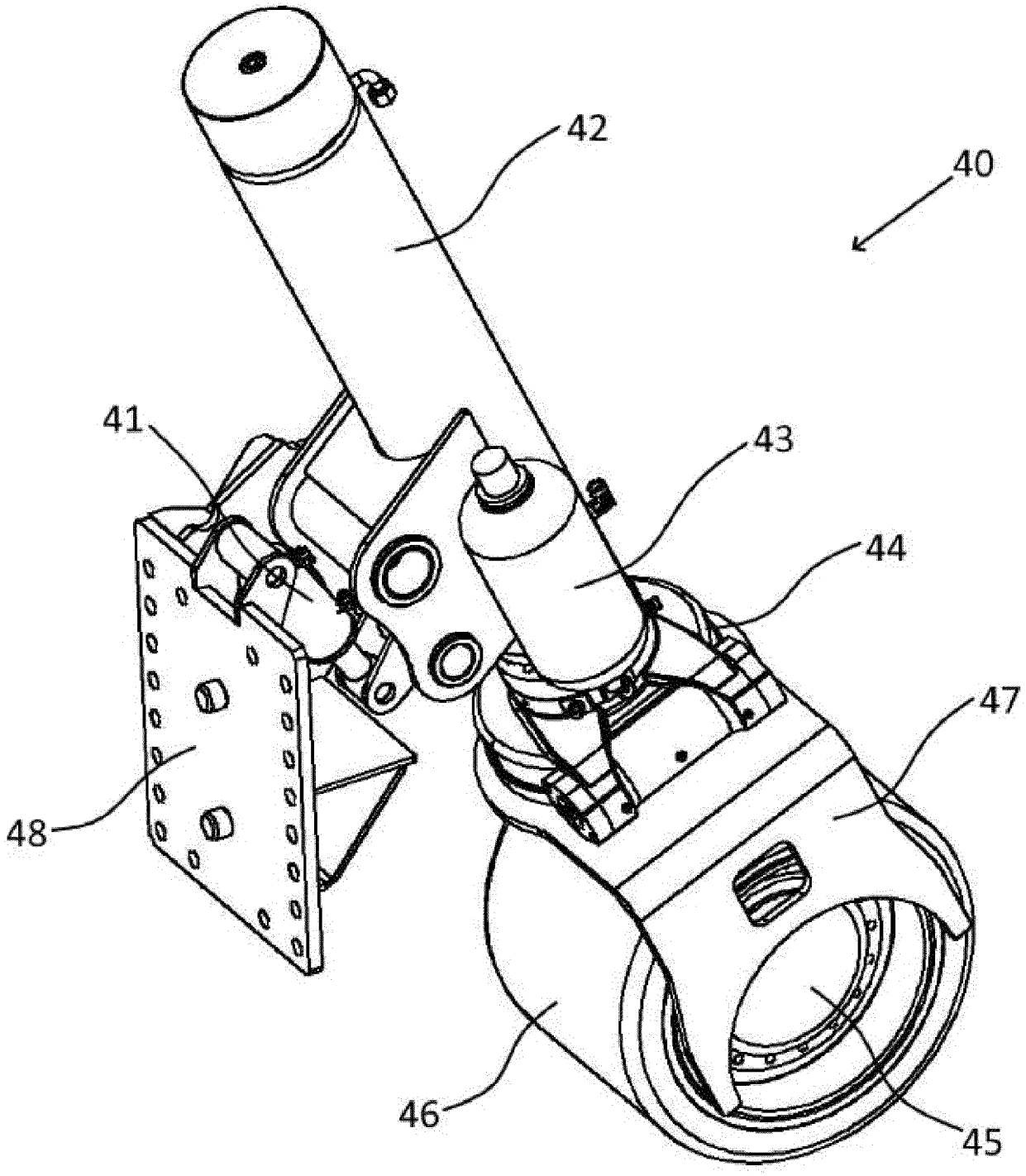


Figure-3

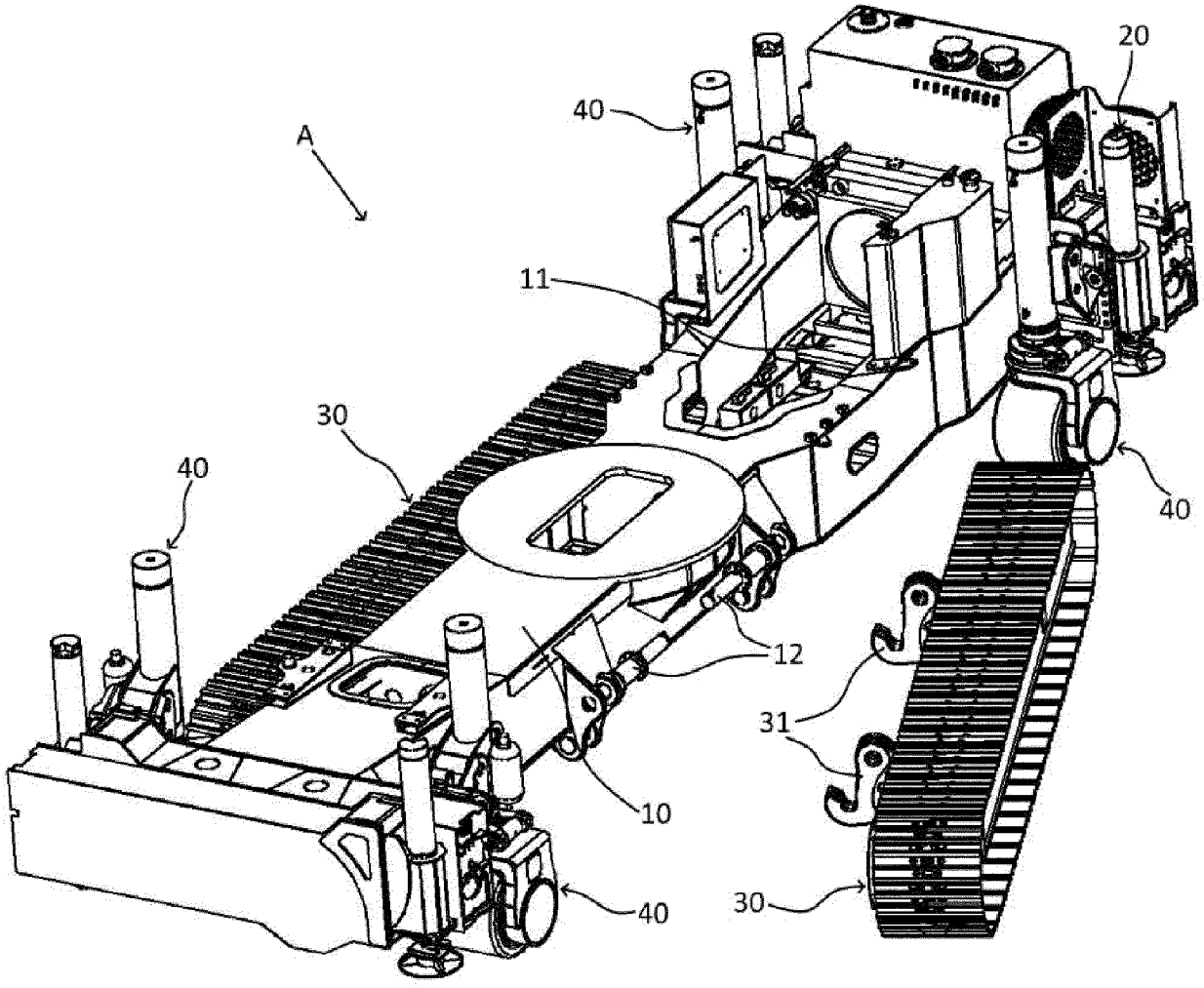
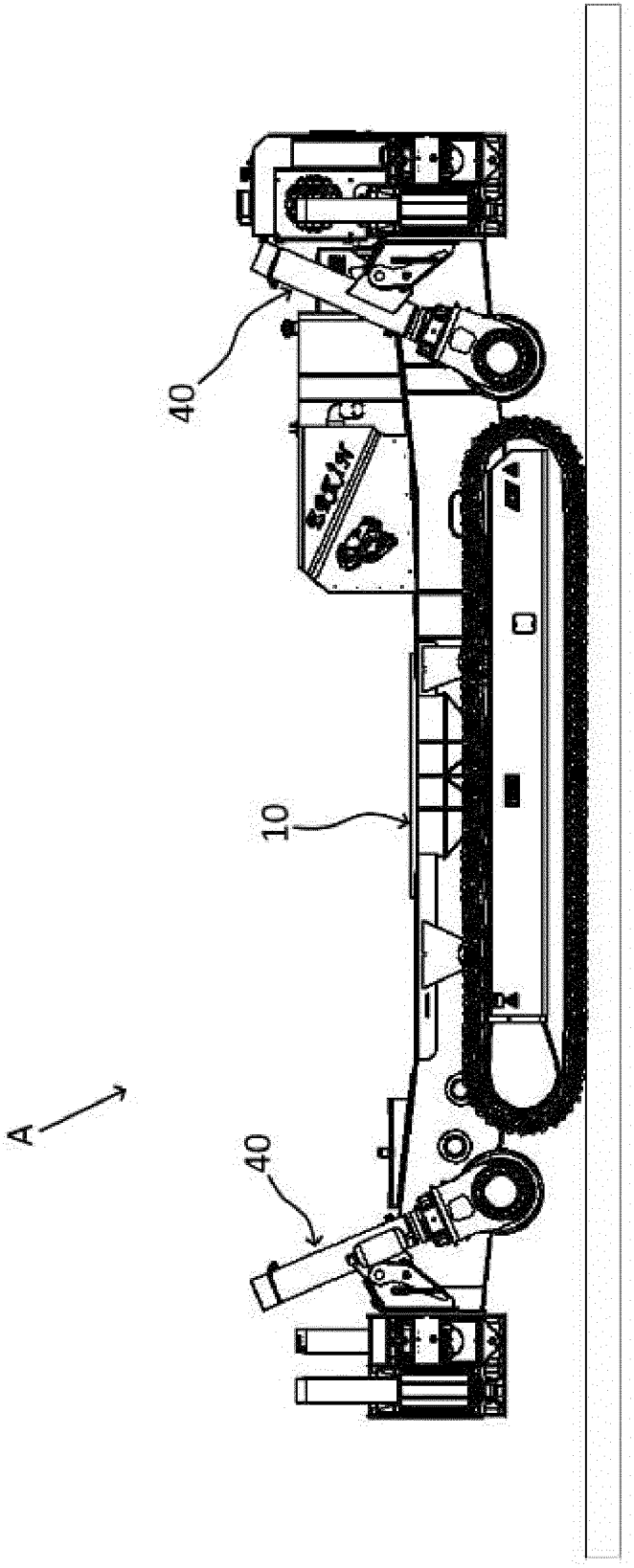


Figure-4



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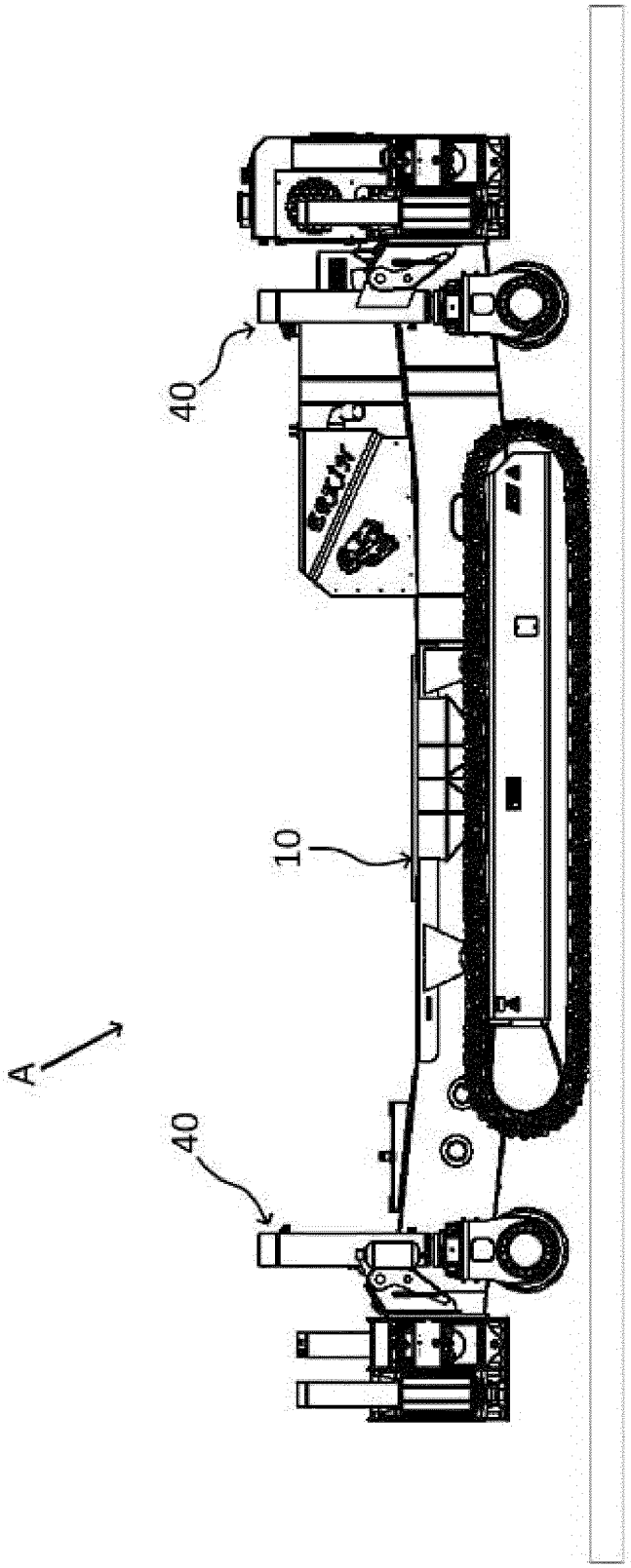

Figure-6

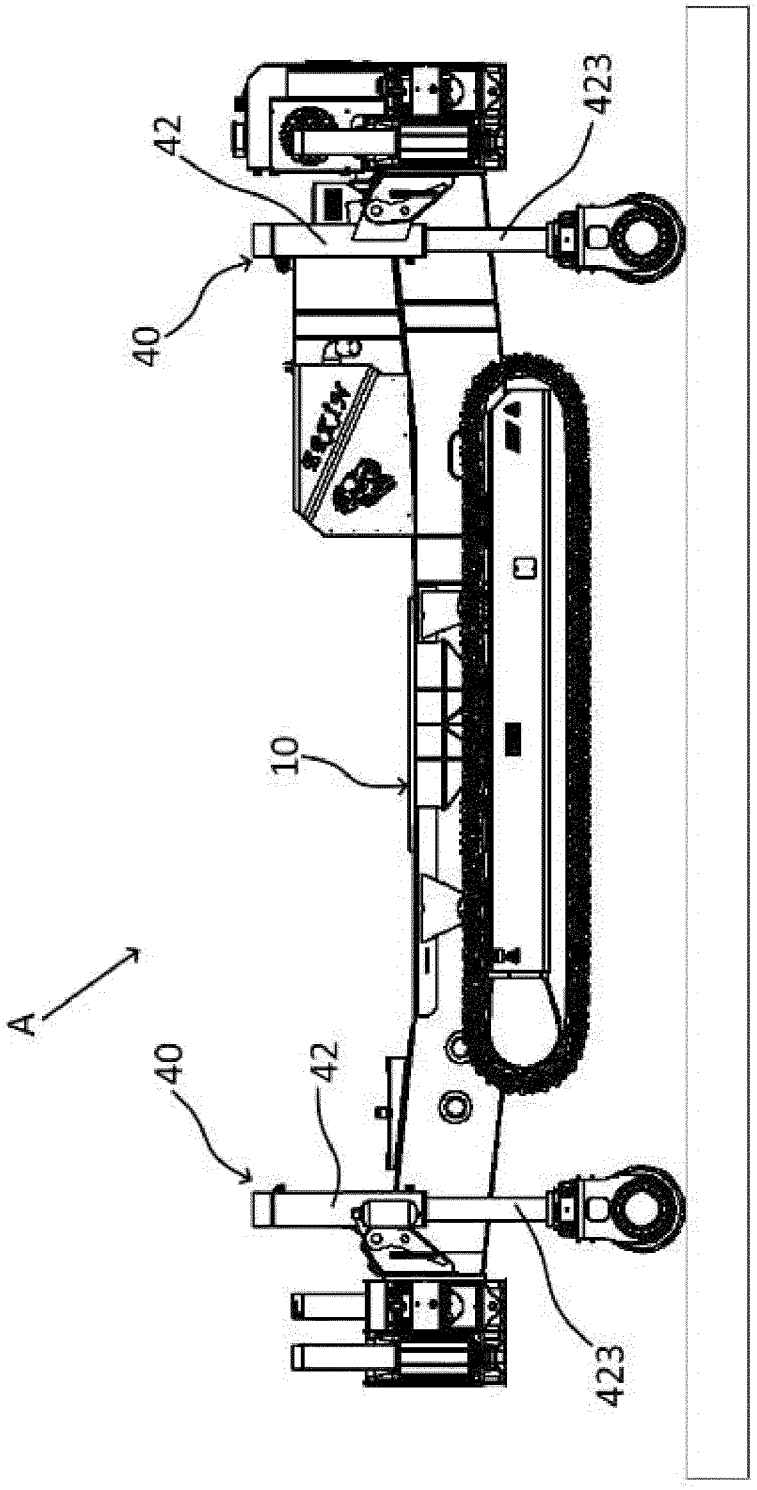

Figure-7

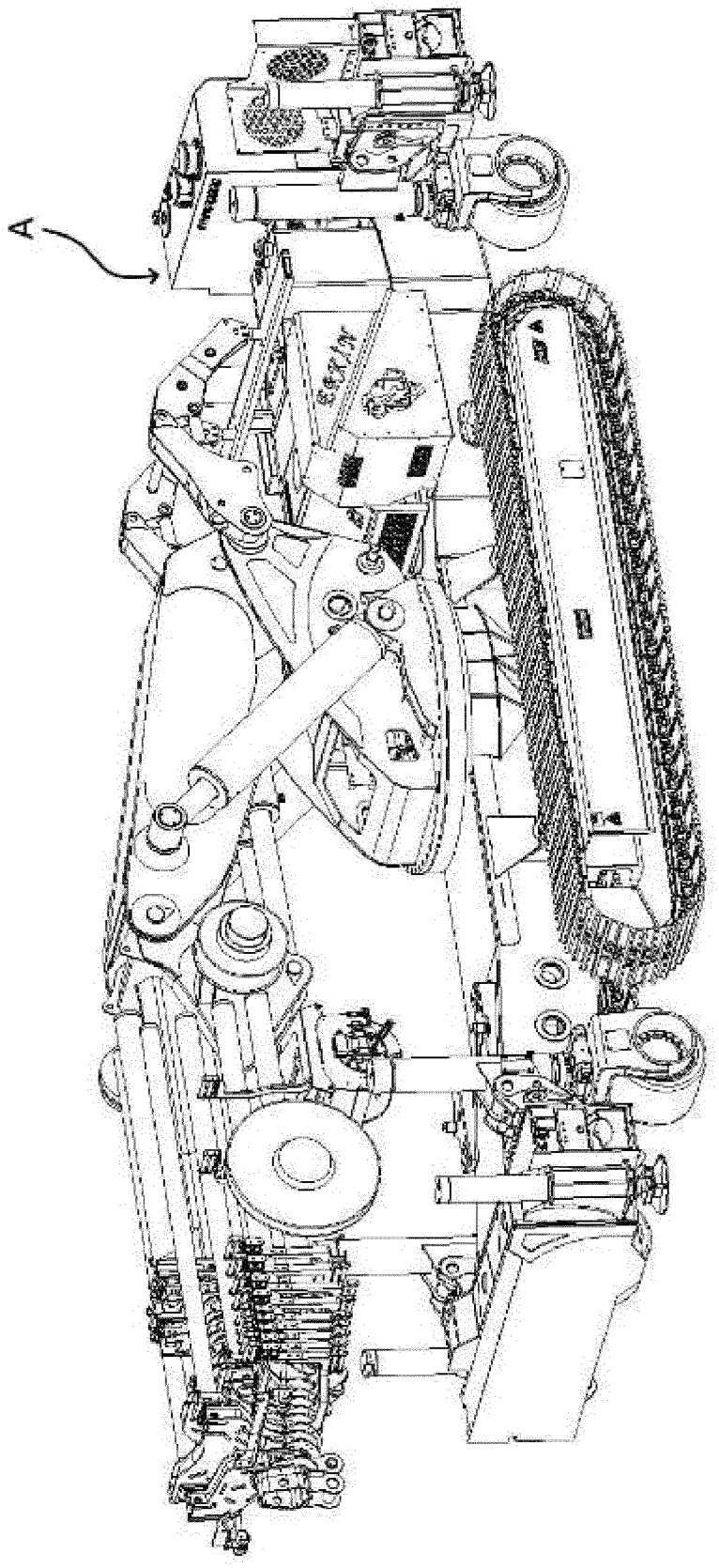

Figure-8

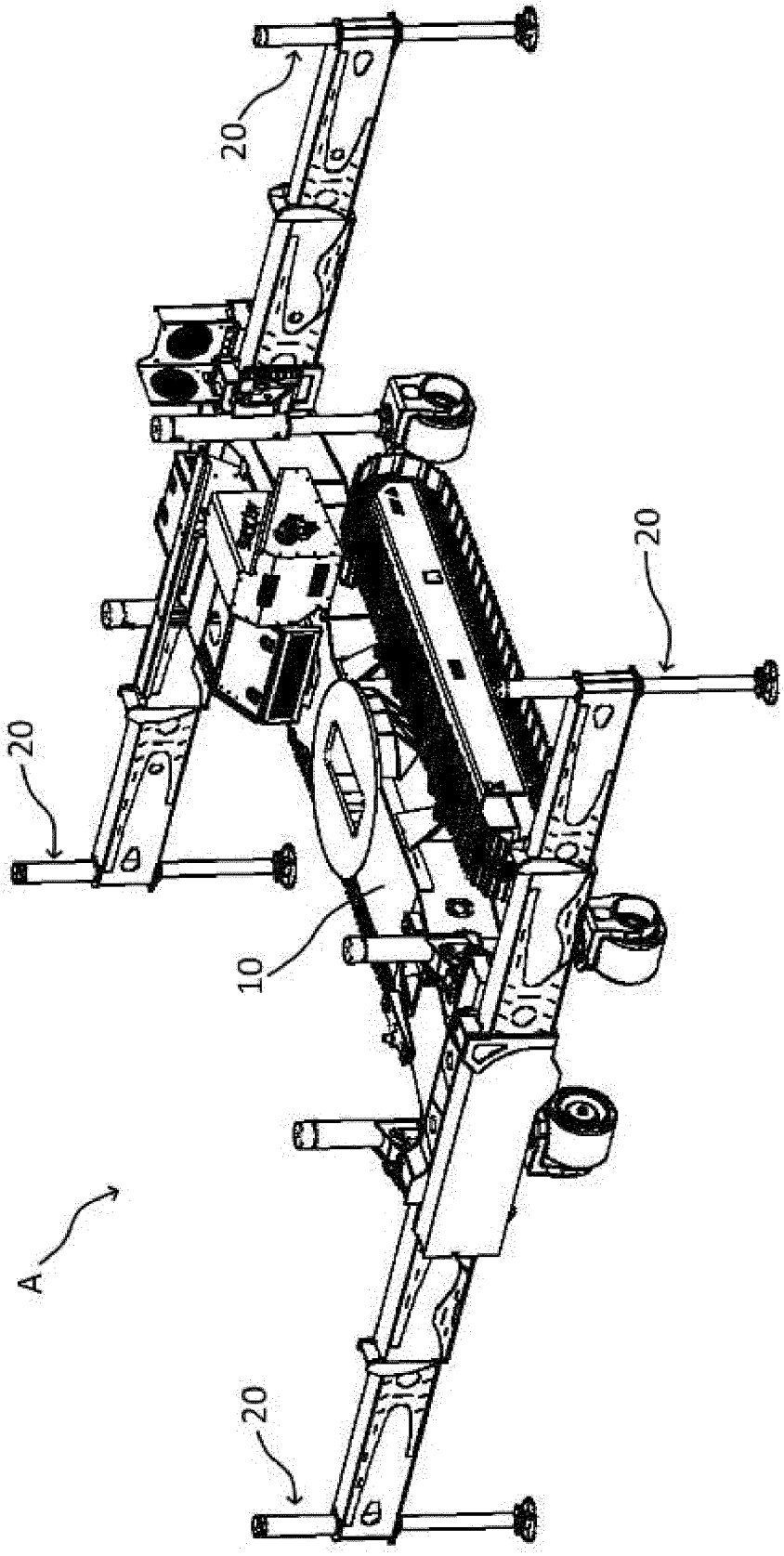

Figure-9

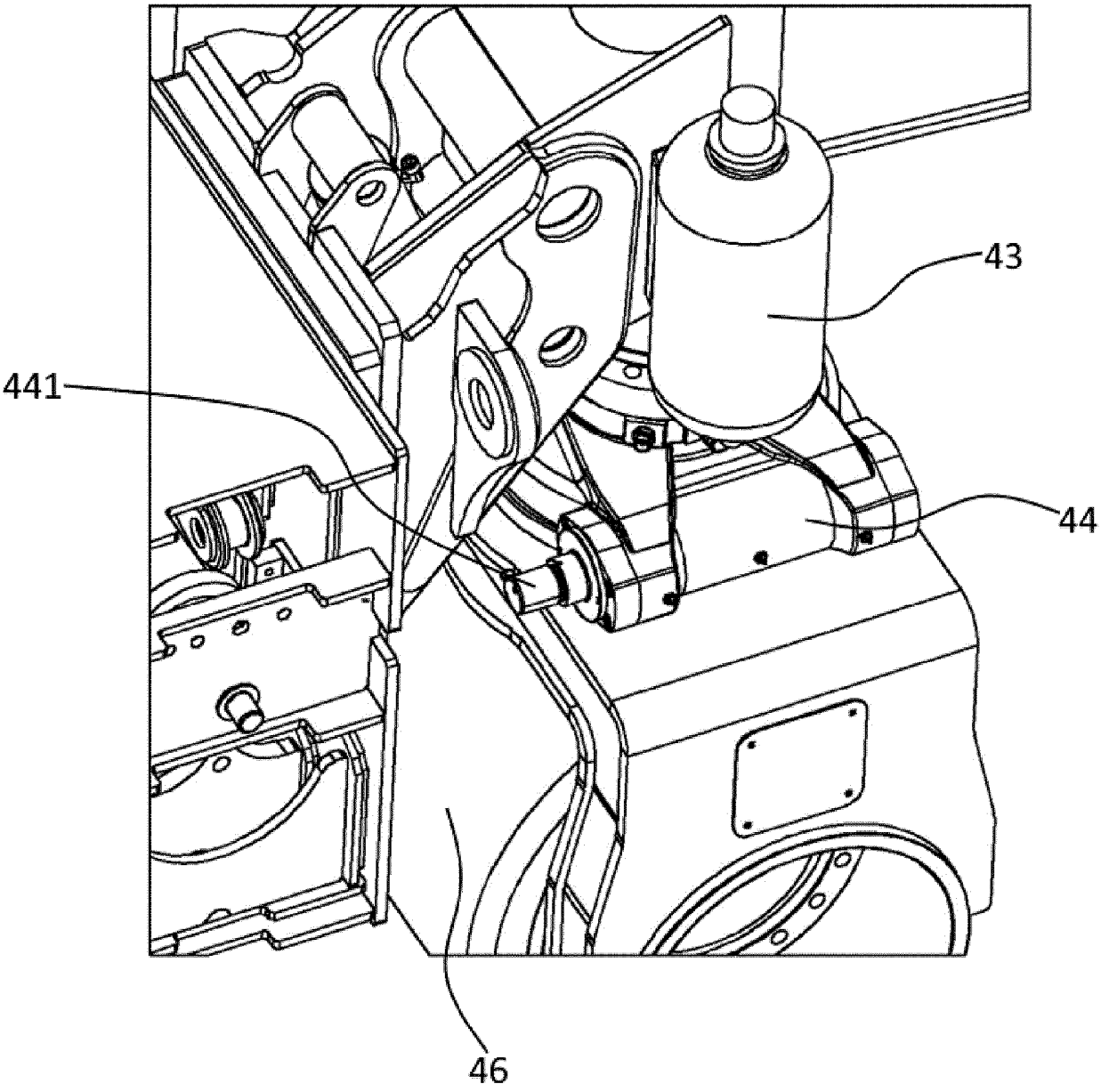

Figure-10

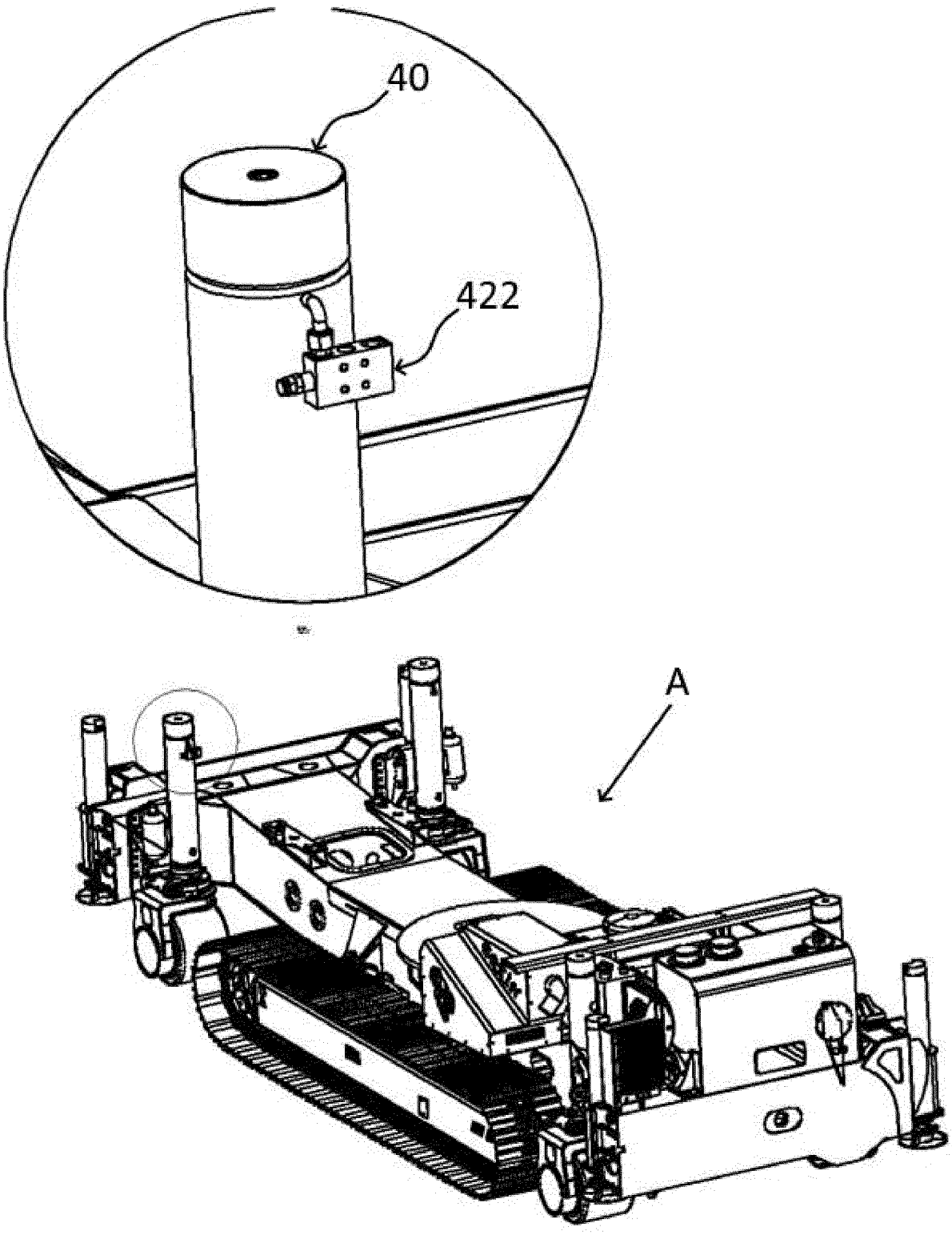

Figure-11

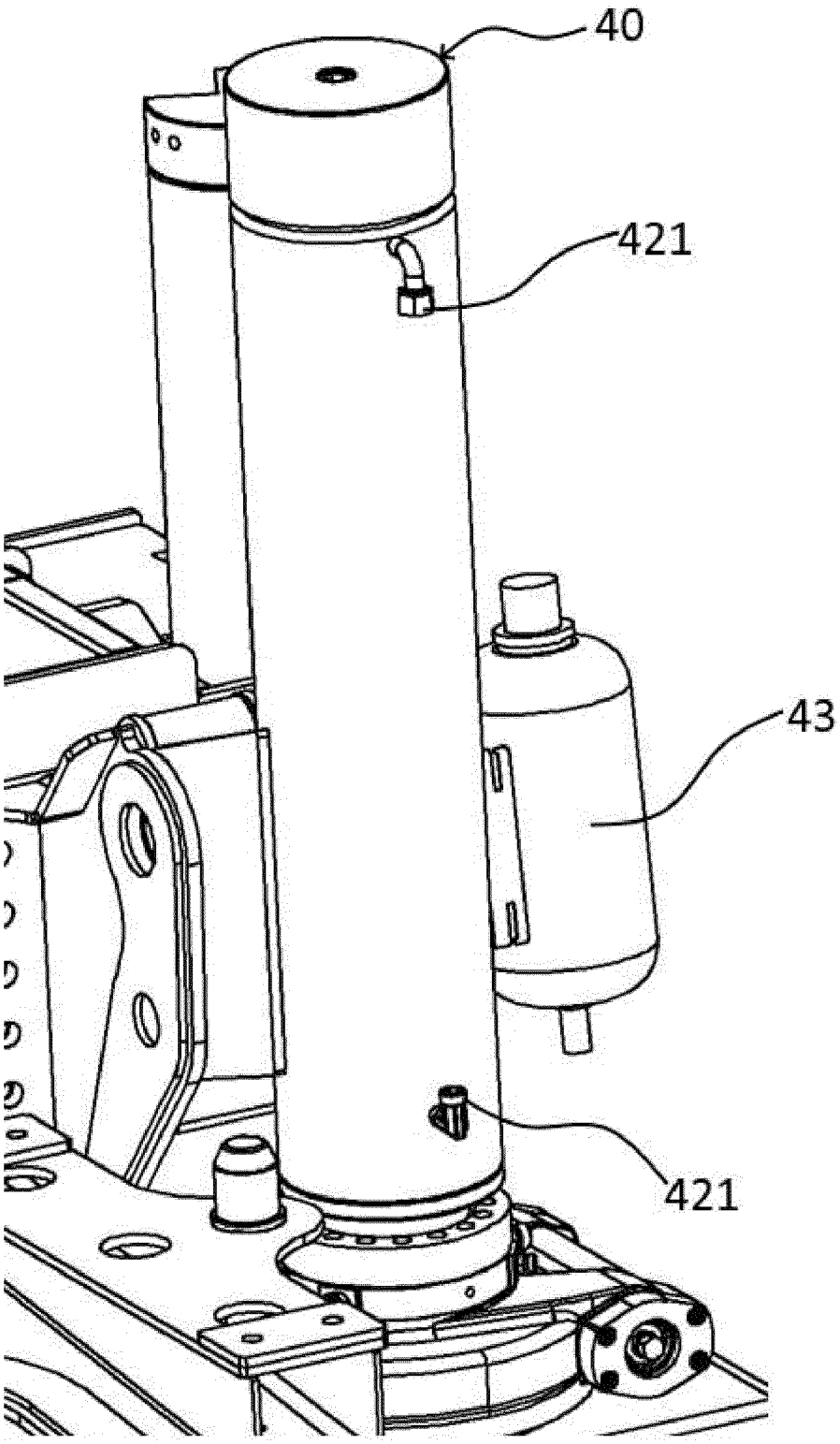

Figure-12

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 23 18 4032

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	JP 2000 211560 A (TCM CORP) 2 August 2000 (2000-08-02) * abstract; figures 1,4 *	1-15	INV. B66C23/36
A	JP H11 222151 A (KOMATSU MFG CO LTD) 17 August 1999 (1999-08-17) * abstract; figure 10 *	1-15	

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	27 November 2023	Serôdio, Renato

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
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 23 18 4032

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27-11-2023

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REFERENCES CITED IN THE DESCRIPTION

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