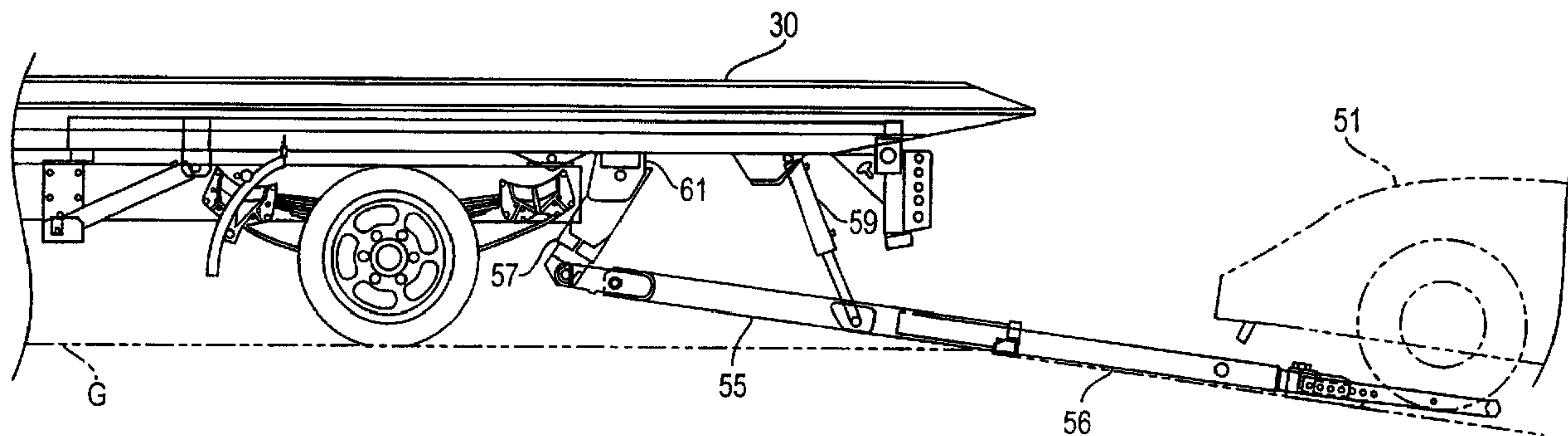




(86) Date de dépôt PCT/PCT Filing Date: 1997/08/07
 (87) Date publication PCT/PCT Publication Date: 1998/02/12
 (45) Date de délivrance/Issue Date: 2007/07/03
 (85) Entrée phase nationale/National Entry: 1999/02/02
 (86) N° demande PCT/PCT Application No.: US 1997/013765
 (87) N° publication PCT/PCT Publication No.: 1998/005524
 (30) Priorités/Priorities: 1996/08/08 (US60/023,734);
 1997/04/08 (US08/827,701)

(51) Cl.Int./Int.Cl. *B60P 3/12* (2006.01),
A61G 3/06 (2006.01)
 (72) Inventeurs/Inventors:
 YOUNG, CHARLES E., US;
 HEDSTROM, DAVID D., US
 (73) Propriétaire/Owner:
 JERR-DAN CORPORATION, US
 (74) Agent: ROBIC

(54) Titre : CADRE DE LEVAGE DE ROUES BASCULANT AMELIORE
 (54) Title: ADVANCED ROLLBACK WHEEL-LIFT



(57) Abrégé/Abstract:

An improved wheel-lift apparatus (63) attachable to various types of transport trucks (22), including rollback trucks for loading and carrying disabled vehicles (51). The improved wheel-lift apparatus provides a horizontal extendable boom mechanism (55) long enough for receiving disabled vehicles. As a result of the wheel-lift's "low angle" or horizontal approach, the risk of damage occurring to the chassis or body of the disabled vehicle while in the loading and carrying modes is greatly diminished.



PCT

WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification⁶ :
B60J 9/00

A1

(11) International Publication Number: WO 98/05524

(43) International Publication Date: 12 February 1998 (12.02.98)

(21) International Application Number: PCT/US97/13765

(22) International Filing Date: 7 August 1997 (07.08.97)

(30) Priority Data:

60/023,734	8 August 1996 (08.08.96)	US
08/827,701	8 April 1997 (08.04.97)	US

(71) Applicant (for all designated States except US): JERR-DAN CORPORATION [US/US]; 1080 Hykes Road, Greencastle, PA 17225 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): YOUNG, Charles, E. [US/US]; Route 1, Box 169J, Falling Waters, WV 25419 (US). HEDSTROM, David, D. [US/US]; 7121 Valley Camp Road, St. Thomas, PA 17252 (US).

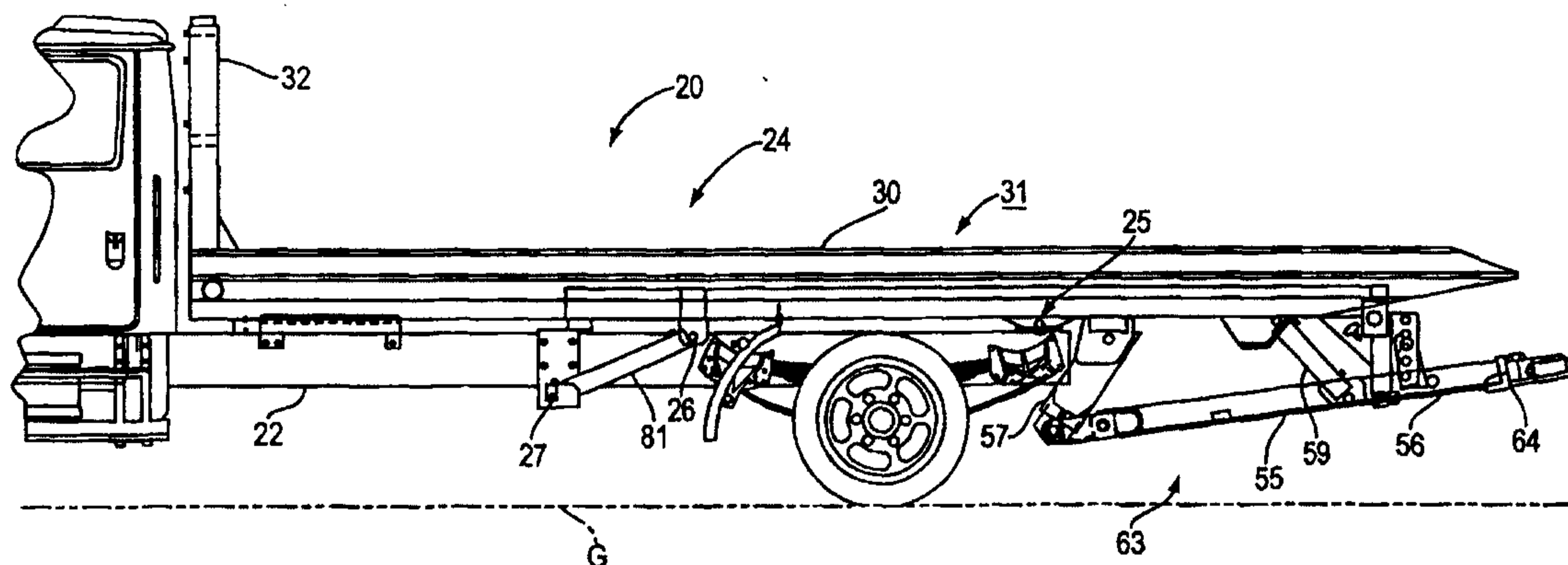
(74) Agents: CAGE, Kenneth, L. et al.; McDermott, Will & Emery, 600 13th Street N.W., Washington, DC 20005-3096 (US).

(81) Designated States: BR, CA, CN, JP, US, European patent (AT, BE, CH, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published

With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: ADVANCED ROLLBACK WHEEL-LIFT



(57) Abstract

An improved wheel-lift apparatus (63) attachable to various types of transport trucks (22), including rollback trucks for loading and carrying disabled vehicles (51). The improved wheel-lift apparatus provides a horizontal extendable boom mechanism (55) long enough for receiving disabled vehicles. As a result of the wheel-lift's "low angle" or horizontal approach, the risk of damage occurring to the chassis or body of the disabled vehicle while in the loading and carrying modes is greatly diminished.

ADVANCED ROLLBACK WHEEL-LIFT**BACKGROUND OF THE INVENTION**

This application is based, in part, on Provisional Application No. 60/023,734, having a filing date of 8/8/96. A corresponding United States application was filed on April 8, 1997 under serial no. 08/827,701.

Transporting and towing vehicles such as damaged automobiles and the like, show cars, antique vehicles of various types and other similar transportation type of vehicles has become quite popular in recent years and the development of transport trucks to convey such vehicles has been undertaken.

Transport vehicles having rollback decks are well known as a means for transporting vehicles. U.S. Patent No. 5,133,633, issued to "Grata" on 7/28/92, entitled "Low-Angle Slidably Supported Roll-Back Vehicle Transport Apparatus", which is incorporated herein by reference, illustrates one type of transport vehicle having a rollback deck. As detailed therein, such transport vehicles include a vehicle support surface or the rollback deck movably mounted on a truck bed frame. Specifically, the vehicle support surface is pivotable relative to the truck bed frame between a transport position and a loading position. In the transport position, the support surface is parallel to the bed frame. In the loading position, the support surface is at an angle relative to the bed frame such that it contacts the ground so as allow a disabled vehicle to be rolled thereon.

Another method of towing and transporting vehicles is the wheel-lift apparatus. Typical wheel-lift apparatuses carry disabled vehicles by lifting either the front or rear wheels off the ground, and towing the partially-lifted disabled vehicle on its remaining two wheels. U.S. Patent Application No. 08/555,211, filed on 11/8/95, entitled "Tilt Cylinder For

2

an Underreach Assembly", which is incorporated herein by reference, illustrates one type of wheel-lift apparatus.

Other early versions of the lifting or towing vehicles have a wheel-lift apparatus in which the boom and related lifting mechanism are located beneath the deck of the lifting and towing vehicle; see U.S. Patent No. 5,269,553, issued to "Alonso" on 12/14/93, entitled "Towing Apparatus and Thrust Reversal Mechanism Therefor". As shown in Alonso, the wheel-lift apparatus boom has an inner end pivotally mounted adjacent the rear axle and a wheel supporting cradle at an outer end. Similarly, U.S. Patent No. 5,061,147, issued to "Nespor" on 10/29/93 (Reexamination Certificate No. B1 5,061,147, issued on 2/25/97), entitled "Vehicle Carrier with Wheel Lift", discloses a wheel-lift apparatus boom having an inner end pivotally mounted to struts and a bracket adjacent the rear axle and a wheel supporting cradle at an outer end. Each of the Alonso and Nespor booms are outwardly extended by hydraulic cylinders at an angle raised substantially from horizontal to the ground. Such devices suffer from a number of deficiencies, as explained below.

For example, referring to Alonso and Nespor, by utilizing a boom raised at a substantial slope to connect the wheel supporting cradle to the lifting or towing vehicle, there is a possibility of the supporting cradle or the boom hitting the disabled vehicle, often resulting in significant damage to the disabled vehicle. In some types of vehicles, such as vans and jeeps, the danger is minimal since there is a very short distance between the bumper and the adjacent wheel axle. However, on vehicles where there is substantial overhang of the body or chassis, beyond the rear and/or front axle the likelihood of damage to the disabled vehicle by the lifting wheel-lift apparatus is significant. A 1996 "CHEVROLET CAMARRO" is an example of a car which is likely to be damaged by many known wheel-lift apparatuses.

FIGS. 10 and 12 illustrate typical prior art wheel-lift apparatuses of a rollback transport vehicle. Referring to FIGS. 10 and 12, the conventional boom extends in the loading position with an angle substantially greater than horizontally parallel to the ground. The conventional boom hits the

disabled vehicle because the slope and height of the boom is too great while it approaches the car in the loading position and/or lifts the car in the carrying position.

None of the patents described above provides the important advantages associated with towing vehicles comprising a boom capable of a substantial reach while maintaining a horizontally aligned or "low angle" approach and lift, between about -15 and 15 degrees during loading and carrying, respectively. In this manner an approach and lift is provided in which the boom operates horizontally to the ground.

BRIEF SUMMARY OF THE INVENTION

According to this invention, wheel-lift apparatuses are mounted on various types of lifting or towing vehicles (recovery vehicles), such as rollback or tow trucks. The wheel-lift apparatus is provided with means for carrying a disabled vehicle by elevating or lifting and supporting one end of the disabled vehicle while the opposite end of the disabled vehicle is supported by its own wheels rotating along the ground.

As pointed out in greater detail below, the important advantage of the present invention is that the wheel-lift apparatus incorporates a horizontal approach boom. In this manner, a boom capable of a "low angle" approach is provided which is horizontal to the ground for loading the disabled vehicle, as well as for lifting and carrying the disabled vehicle.

The "low angle" approach allows the boom to remain horizontal to the slope of the ground surfaces where the recovery and disabled vehicles are located. The range of the "low angle" approach is between about -15 and 15 degrees. Indifferent to whether the particular ground surfaces are inclined, declined or level, the "low angle" approach enables the boom(s) to be horizontal with the slope of the ground surfaces. As a result, this enables the disabled vehicle to be lifted and carried with minimal risk of damage to the chassis or frame of the disabled vehicle.

According to a first aspect of the invention, there is provided a wheel-lift apparatus for use with a transport vehicle having a frame, the wheel-lift apparatus comprising:

a base boom having a fly boom extendable from a rear end of the base boom;

a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end suitable for attachment to the frame;

a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end suitable for attachment to the frame; and

10 a wheel supporting cradle attached at a rear end of the fly boom,
wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and wherein a single pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

In accordance with another aspect of the invention, there is provided a transport vehicle comprising:

a rollback deck slidably mounted on a subframe; and

a wheel-lift apparatus comprising:

20 a base boom having a fly boom extendable from a rear end of the base boom;

a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end attached to the subframe; and

a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end attached to the subframe,

wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and wherein a single pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

30 Yet another aspect of the invention concerns a boom assembly for use on a transport vehicle having a frame, the boom assembly comprising:

a base boom having a fly boom extendable from a rear end of the base boom;

a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end suitable for attachment to the frame; and

a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end suitable for attachment to the frame,

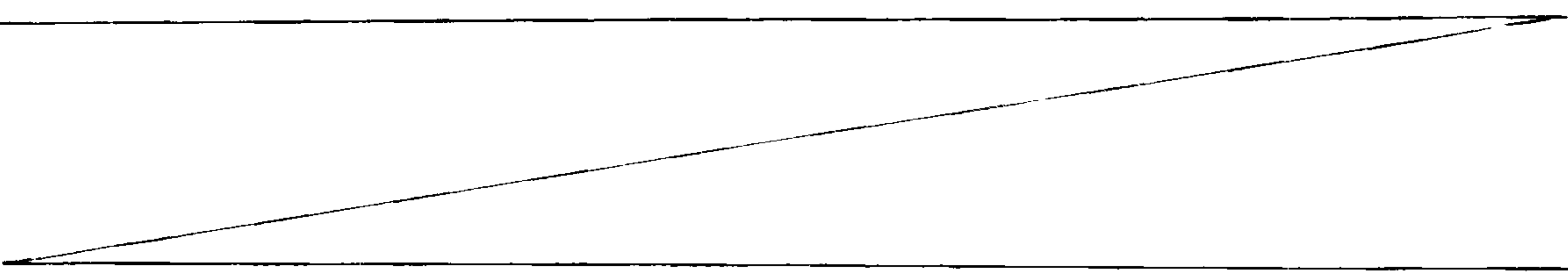
wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and wherein a single pivot point is provided between the first end of the lift cylinder
10 and substantially the rear end of the base boom.

The advantage of the present invention is that the wheel-lift apparatus operates a boom in the horizontal loading or carrying positions having a significant extension length whereby the risk of damage to the chassis or frame of the disabled vehicle due to contact between the boom or wheel supporting cradle and the frame/chassis is greatly diminished compared with the prior art cited above.

As can be seen from above, the present invention provides numerous other advantages. The horizontal, "low angle", wheel-lift apparatus enables superior clearance under disabled vehicles which are especially low to the ground.
20

Another advantage of the present invention is to provide a transport or tow truck having a wheel-lift apparatus which is relatively easy to engage with a disabled vehicle loading and carrying which provides for such engagement without undue maneuvering of the truck.

Still another advantage of the present invention is the provision of a transport truck or tow-truck (recovery vehicle) having a wheel-lift apparatus which will be able to load and carry a disabled vehicle without the substantial danger of



tipping of the transport truck and subjecting the disabled vehicle to additional damage.

Further advantages include the provision of a transport truck or tow truck (recovery vehicle) with a wheel-lift apparatus having a very large range of reach between retracted and extended boom positions, to provide such a range of reach using the multiple booms, and to provide an economical and strong truck which does not require positioning immediately adjacent to the disabled vehicle.

The invention itself, together with further objects and attendant advantages, will best be understood by reference to the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side view showing a rollback truck with a wheel-lift apparatus attached below the rollback truck subframe, wherein the rollback deck is in a rollback position and the wheel-lift is in a stored position.

FIG. 2 is a side view showing a rollback truck with a wheel-lift apparatus attached below the rollback truck subframe, wherein the rollback deck is in an intermediate position and the wheel-lift is in a stored (stowed) position.

FIG. 3 is a side view of a rollback truck with a wheel-lift apparatus attached below the rollback truck subframe, wherein the rollback is in a loading position.

FIG. 4 is a side view of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 5 is a plan view of the wheel-lift apparatus wheel supporting cradle.

FIG. 6 is a side view of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is aligned at an angle below the horizontal and in contact with the ground surface, having a negative incline.

FIG. 7 is a side view of the wheel-lift apparatus attached below the rollback truck subframe and the wheel-lift

is elevated first, from loading position, to clear the disabled vehicle understructure, so as to prepare for a carry position.

FIG. 8 is a side view of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a carry position such that it is exactly horizontal.

FIG. 9 is a side view of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a carry position such that it is aligned at an angle substantially above the horizontal.

FIG. 10 is a side view comparing a conventional design with the present invention design of a wheel-lift apparatus attached below a rollback truck subframe. The wheel-lift load position of the conventional design is at an angle above the horizontal while the present invention design is horizontal.

FIG. 11 is a side view of the second embodiment of the wheel-lift apparatus attached below the rollback truck subframe having a pair of struts mounting the wheel-lift to the subframe. The wheel-lift is in a carry position such that it is horizontal with the ground surface.

FIG. 12 is a side view comparing a conventional design with the second embodiment of the present invention design of the wheel-lift apparatus attached below a rollback truck subframe. The wheel-lift load position of the conventional design is at an angle above the horizontal while the present invention design is horizontal.

FIG. 13 is a side view of the third embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 14 is a side view of the fourth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 15 is a side view of the fifth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

8

FIG. 16 is a side view of the sixth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 17 is a side view of the seventh embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 18 is a side view of the eighth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 19 is a side view of the ninth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

FIG. 20 is a side view of the twentieth embodiment of the wheel-lift apparatus attached below the rollback truck subframe, wherein the wheel-lift is in a loading position such that it is horizontal and in contact with the ground surface.

DETAILED DESCRIPTION OF A PREFERRED EMBODIMENT

Turning now to the drawings, wherein like or corresponding reference numerals are used for like or corresponding parts throughout the figures, as best shown in FIGS. 1-3, a rollback assembly 20 includes a truck bed frame (or "bed frame") 22 which mounts to a deck support surface assembly 24 at a pivot point 25. A cylinder 81 is connected between a pair of points 26 and 27 for driving the deck support surface assembly 24 to pivot relative to the bed frame 22 and move the deck from the transport position, illustrated in FIG. 1, to a loading position, illustrated in FIG. 3. The deck support surface assembly 24 includes a subframe 28 pivotally connected at the pivot point 25 of the truck bed frame 22, and a deck portion 30 which is slidable relative to the subframe 28.

Further, merely by way of example, there are shown a deck portion 30 which defines a surface 31 which supports a vehicle to be transported. A forward end 32 of the deck portion 30 is

defined at one longitudinal end of the rollback assembly 20. The movement of the rollback assembly 20 from the transport(rollback) position illustrated in FIG. 1 to a loading position will be explained with reference to FIGS. 2 and 3. When it is desired to move the rollback assembly 20 to the loading position, the deck portion 30 is first driven rearwardly relative to the subframe 28 through some conventional means, typically hydraulic cylinders or screw actuators driven by a screw motor are utilized. The rollback assembly 20 is illustrated in FIG. 2 with the deck portion 30 having been moved rearwardly relative to the subframe 28. As the deck portion 30 initially begins to move rearwardly from the transport(rollback) position, this rearward movement continues until the members arrive at the intermediate position illustrated in FIG. 2.

FIG. 3 illustrates the rollback assembly 20 in the loading position. A bottom face 35 contacts the ground over an area extending from point 52 to point 53.

Once in the loading position, a disabled vehicle 51 can be moved onto the surface 31, by wrench or some other means, and the rollback assembly 20 may then move back to the transport(rollback) position. Initially, the subframe 28 is pivoted relative to the bed frame 22 to return to the intermediate position illustrated in FIG. 2. The deck portion 30 is then moved forwardly relative to the subframe 28 to return the deck to the transport(rollback) position, illustrated in FIG. 1.

As the deck portion 30 initially begins to move forwardly from the intermediate position, this forward movement of the deck portion 30 relative to the subframe 28 or frame 22 continues until the deck portion 30 has returned to the transport(rollback) position illustrated in FIG. 1.

Regardless of whether the rollback assembly 20 has loaded a disabled vehicle 51 onto the deck portion 30 to be transported, the wheel-lift apparatus 63 will accommodate another disabled vehicle to be loaded and carried. As best shown in FIG. 4, a wheel-lift apparatus 63 mounted below the subframe 28 or frame 22 having an inner tilt boom 57 extending downward from the tilt housing 61 attached on the underside of

10

the subframe 28 or frame 22 and a lift cylinder 59 extending downward and pivotally attached to the subframe 28 whereby a base boom 55, which may be positioned to be horizontal to or in contact with the ground G, pivotally links the lower ends of the inner tilt boom 57 and lift cylinder 59. A tilt cylinder 58 located within the inner tilt boom 57 is operated either in conjunction with or independently with the lift cylinder 59 for lowering and raising the base boom 55. A fly boom 56 which is telescopically extendable from the outer end of the base boom 55 which may be positioned to be horizontal to or in contact with the ground G has a "low profile" pivot 64 at its outer end so as to telescopically connect the wheel supporting cradle 70 for engaging the wheel W of the disabled vehicle which is to be loaded.

As a variation to the tilt cylinder, the tilt cylinder is installed without the accompaniment of an inner tilt boom. Rather, a heavy duty tilt cylinder has one end attached to the truck frame or subframe and the other end to the inner end of the base boom (without the being disposed inside an inner tilt boom).

Merely by way of example, the disabled vehicle will then be lifted and then towed in its carry position, as illustrated in FIGS. 8 and 9. The horizontal boom approach upon the disabled vehicle presents a significant advantage over the prior art whereby risk to chassis or body is greatly diminished. This is because the horizontal, low angle, loading or carrying positions of the boom, having significant extension length capabilities, reduces the risk of the chassis or frame of the disabled vehicle from coming into contact with the fly or base booms 56, 55 or wheel supporting cradle 70.

Returning to FIG. 4, the wheel-lift apparatus 63 is positioned to engage either the forward or rearward wheels W of the disabled vehicle. The tilt cylinder 58 and the lift cylinder 59 are raised and lowered in conjunction with each other through some conventional means, typically an hydraulic actuator, a screw actuator driven by a screw motor, a pneumatic actuator, or various other mechanical devices (not shown), causing the base boom 55 to be raised or lowered in a horizontal position. The hydraulic circuit is controlled by

at least one control lever (not shown) such that up to about 40 percent of the hydraulic fluid is delivered to the tilt cylinder 58 and up to about 60 percent to the lift cylinder 59 thus causing the lift cylinder 59 and tilt cylinder 58 to rise or lower at different speeds relative to one another, thereby providing the horizontal approach. Distributing the power as mentioned above between the tilt cylinder 58 and the lift cylinder 59, rather than designating all the power to the lift cylinder 59 in absence of the existence of a tilt cylinder 58 as in prior art apparatuses, allows the base boom 55 to operate at less of a slope and therefore more horizontal to the ground G. As a result, one of the advantages of the present invention is achieved by having the various booms and wheel supporting cradle 70 approach the disabled vehicles at a horizontal or "low angle" loading position.

The "low angle" approach allows the boom to remain horizontal to the slope of the ground surfaces where the recovery and disabled vehicles are located. The range of the "low angle" approach is between about -15 and 15 degrees. Indifferent to whether the particular ground surfaces are inclined, declined or level, the "low angle" approach enables the boom(s) to be horizontal with the slope of the ground surfaces. As a result, this enables the disabled vehicle to be lifted and carried with minimal risk of damage to the chassis or frame of the disabled vehicle.

Referring to FIGS. 4-9 and 11, the fly boom 56 is telescopically extendable, for example via hydraulic cylinders, from the base boom 55, while the wheel supporting boom 71 is also telescopically extendable, for example via hydraulic cylinders, at a low profile pivot 64 from the fly boom 56 and supports the wheel supporting cradle 70. The wheel supporting cradle 70 comprises the wheel supporting boom 71 extending rearwardly having a cross bar 72 and at each end of the cross bar 72, and generally perpendicular thereto, an arm 73,74 is connected by a conventional type housing 77,78. Attached to each arm 73,74 is a rear support 75,76 extending inwardly thereby forming an L-shaped support for each respective wheel W where the lower portion of the wheel W will be engaged for loading and carrying.

Various operating modes for the embodiments are possible. For example, as best shown in FIG. 6, base boom 55 can be raised or lowered in a substantially horizontal position with an angle below the horizontal so as to prepare for a low angle approach for a disabled vehicle located on a surface having a negative incline, i.e., a declining surface.

Finally, as additional examples, first shown in FIG. 8, the base boom 55 can be raised or lowered to precisely a horizontal position so as to tow the disabled vehicle in its carry position. After the wheels W of the disabled vehicle has been engaged by the wheel supporting cradle and the disabled vehicle is loaded and lifted then the vehicle is said to be in the carry position for transport. Next, as best shown in FIG. 9, the base boom 55 can be raised upwardly at a slope having an angle substantially above the horizontal for its carrying position.

The second embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 11, wherein base boom 55 can be raised or lowered in a "low angle" horizontal position so as to tow the disabled vehicle in its carry position. This second embodiment, comprises a pair of struts having one of their ends fixably attached to the truck subframe or frame and the other end pivotably attached to the inner end of the base boom, the same point as where a pair of tilt cylinders are also pivotably attached to the base boom.

The third embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 13, wherein a support 101 is attached to the truck frame and a pair of links 100 are connected between the support 101 and the front end of the base boom.

The fourth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 14, wherein an outer boom section 102 is attached to the truck frame and an inner boom section 103 is configured to be attached within the outer boom section 102 and connected to the front end of the base boom. A brace 104 is disposed to connect the outer boom section 102 to the truck frame proximate to where the lift cylinder(s) connects with the truck frame.

The fifth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 15, wherein a support 101 coupled with a triangle link 105 connects the front end of the base boom with the truck frame. A brace 104 is disposed to connect the support 101 to the truck frame proximate to where the lift cylinders connect with the truck frame.

The sixth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 16, wherein a link arm 106 attaches to the truck frame at the portion of the base boom located between where the tilt cylinder and lift cylinder connects to the base boom. The link arm 106 has an elbow-like configuration.

The seventh embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 17, wherein a link arm 106 connects the rear end of the base boom with the truck frame, proximate to where the tilt cylinder attaches with the truck frame.

The eighth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 18, wherein a support 101 coupled with a triangle link 105 connects the middle portion of the base boom with the truck frame. The tilt cylinder is connected to the truck frame by way of the support 101.

The ninth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 19, wherein a support 101 coupled with a pair of links 100 connects the middle portion of the base boom with the truck frame. The tilt cylinder is connected to the truck frame by way of the support 101.

The tenth embodiment of the advanced rollback wheel-lift in accord with the present invention is shown in FIG. 20, wherein a support 101 and a pair of triangle arms 107 is attached to the truck frame. In turn, a tilt cylinder and the link arms 106, 108 connect the support 101 and pair of triangle arms 107 to the front end of the base boom.

The embodiments described above provide a number of significant advantages. For example, the wheel-lift apparatus operates a boom in the horizontal or "low angle" loading

position having a significant extension length whereby the risk of damage to the chassis or frame of the disabled vehicle due to contact between the boom or wheel supporting cradle and the frame/chassis is greatly diminished compared with the prior art cited above.

The advantages of the present inventions is accomplished by the providing the additional cylinder(s), i.e., the tilt cylinder(s) 58, in the wheel-lift apparatus boom design. The benefit of the additional cylinder(s) provides the capability of the base boom 55 to have both its outer and inner ends to move either in relative uniformity with or independently from each other such that the base boom 55 remains horizontal to the ground G. In absence of the existence of the tilt cylinder 58, as such the case with the prior art, the inner end of the base boom 55 is fixed to move only pivotally while only allowing the outer end of the base boom 55 to move vertically via the lift cylinder 59. The end result is that the prior art base boom operates having a greater slope. The present invention provides a tremendous advantage over the prior art as a result of having its various booms and wheel supporting cradle 70 capable of approaching the disabled vehicles at a horizontal, low angle, loading and carrying positions.

Of course, it should be understood, that a wide range of changes and modifications can be made to the preferred embodiments described above. It is therefore intended that the foregoing detailed description be regarded as illustrative rather than limiting and that it is to be understood that it is the following claims, including all equivalents, which are intended to define the scope of the invention.

WHAT IS CLAIMED IS:

1. A wheel-lift apparatus for use with a transport vehicle having a frame, the wheel-lift apparatus comprising:

a base boom having a fly boom extendable from a rear end of the base boom;

a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end suitable for attachment to the frame;

a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end suitable for attachment to the frame; and

10 a wheel supporting cradle attached at a rear end of the fly boom,

wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and wherein a single pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

2. The wheel-lift apparatus of claim 1, wherein the wheel-lift apparatus is suitable for use with a transport vehicle having a rollback deck slidably mounted on the frame for loading and towing a vehicle.

3. The wheel-lift apparatus of claim 1, wherein a single pivot point is provided between the first end of the tilt cylinder and substantially the front end
20 of the base boom.

4. The wheel-lift apparatus of claim 1, wherein the second end of the lift cylinder is suitable for attachment to the frame at a position spaced apart in a fore and aft direction from the second end of the tilt cylinder.

5. The wheel-lift apparatus of claim 1, further comprising a telescoping tilt boom with a top end suitable for attachment to the frame and a bottom end attached at substantially the front end of the base boom, wherein the tilt boom contains the tilt cylinder.

6. The wheel-lift apparatus of claim 1, wherein the low angle loading position is at an angle below horizontal of about 0.0 degrees to about 15.0 degrees.

7. The wheel-lift apparatus of claim 1, wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle towing position that is at an angle above horizontal of about 0.0 degrees to about 15.0 degrees.

8. The wheel-lift apparatus of claim 1, wherein the first end of the lift cylinder is attached to a first side of substantially the rear end of the base boom, and the wheel-lift apparatus further comprises a second lift cylinder with a first end attached to a second side of substantially the rear end of the base boom and a second end suitable for attachment to the frame.

9. The wheel-lift apparatus of claim 1, further comprising:

a support having an upper end that is suitable for attachment to the frame; and

a link having an upper end attached to the lower end of the support and a lower end attached to substantially the front end of the base boom.

10. The wheel-lift apparatus of claim 9, wherein the first end of the tilt cylinder is directly attached to the link.

11. The wheel-lift apparatus of claim 9, wherein the link comprises a pair of links with a first link having an upper end attached to a first side of the lower end of the support and a lower end attached to a first side of substantially the front end of the base boom, and a second link having an upper end attached to a second side of the lower end of the support and a lower end attached to a second side of substantially the front end of the base boom.

12. The wheel-lift apparatus of claim 1, further comprising a link arm having an upper end suitable for attachment to the frame and a lower end attached to the base boom.

13. The wheel-lift apparatus of claim 1, further comprising:

a first support strut with a first end attached to a first side of substantially the front end of the base boom and a second end suitable for attachment to the frame; and

10 a second support strut with a first end attached to a second side of substantially the front end of the base boom and second end suitable for attachment to the frame.

14. A transport vehicle comprising:

a rollback deck slidably mounted on a subframe; and

a wheel-lift apparatus comprising:

a base boom having a fly boom extendable from a rear end of the base boom;

a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end attached to the subframe; and

a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end attached to the subframe,

20 wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

15. The transport vehicle of claim 14, wherein the wheel-lift apparatus further comprises a wheel supporting cradle attached at a rear end of the fly boom, the wheel supporting cradle being configured to receive and secure at least one wheel of a vehicle to be transported.

16. The transport vehicle of claim 15, wherein a single pivot point is provided between the first end of the tilt cylinder and substantially the front end of the base boom.

17. The transport vehicle of claim 14, wherein the second end of the lift cylinder is attached to the subframe at a position spaced apart in a fore and aft direction from the second end of the tilt cylinder.

18. The transport vehicle of claim 14, wherein the low angle loading position is at an angle below horizontal of about 0.0 degrees to about 15.0 degrees.

10 19. The transport vehicle of claim 14, wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle towing position that is at an angle above horizontal of about 0.0 degrees to about 15.0 degrees.

20. A boom assembly for use on a transport vehicle having a frame, the boom assembly comprising:

 a base boom having a fly boom extendable from a rear end of the base boom;

 a tilt cylinder having a first end attached at substantially a front end of the base boom and a second end suitable for attachment to the frame; and

20 a lift cylinder having a first end attached at substantially a rear end of the base boom and a second end suitable for attachment to the frame,

 wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle loading position, and wherein a single pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

21. The wheel-lift apparatus of claim 20, wherein the wheel-lift apparatus is suitable for use with a transport vehicle having a rollback deck slidably mounted on the frame for loading and towing a vehicle.

22. The wheel-lift apparatus of claim 20, wherein a single pivot point is provided between the first end of the lift cylinder and substantially the rear end of the base boom.

23. The wheel-lift apparatus of claim 20, wherein the second end of the lift cylinder is suitable for attachment to the frame at a position spaced apart in a fore and aft direction from the second end of the tilt cylinder.

10 24. The wheel-lift apparatus of claim 20, wherein the low angle loading position is at an angle below horizontal of about 0.0 degrees to about 15.0 degrees.

25. The wheel-lift apparatus of claim 20, wherein the combination of the tilt cylinder and the lift cylinder enables the base boom and the fly boom to achieve a low angle towing position that is at an angle above horizontal of about 0.0 degrees to about 15.0 degrees.

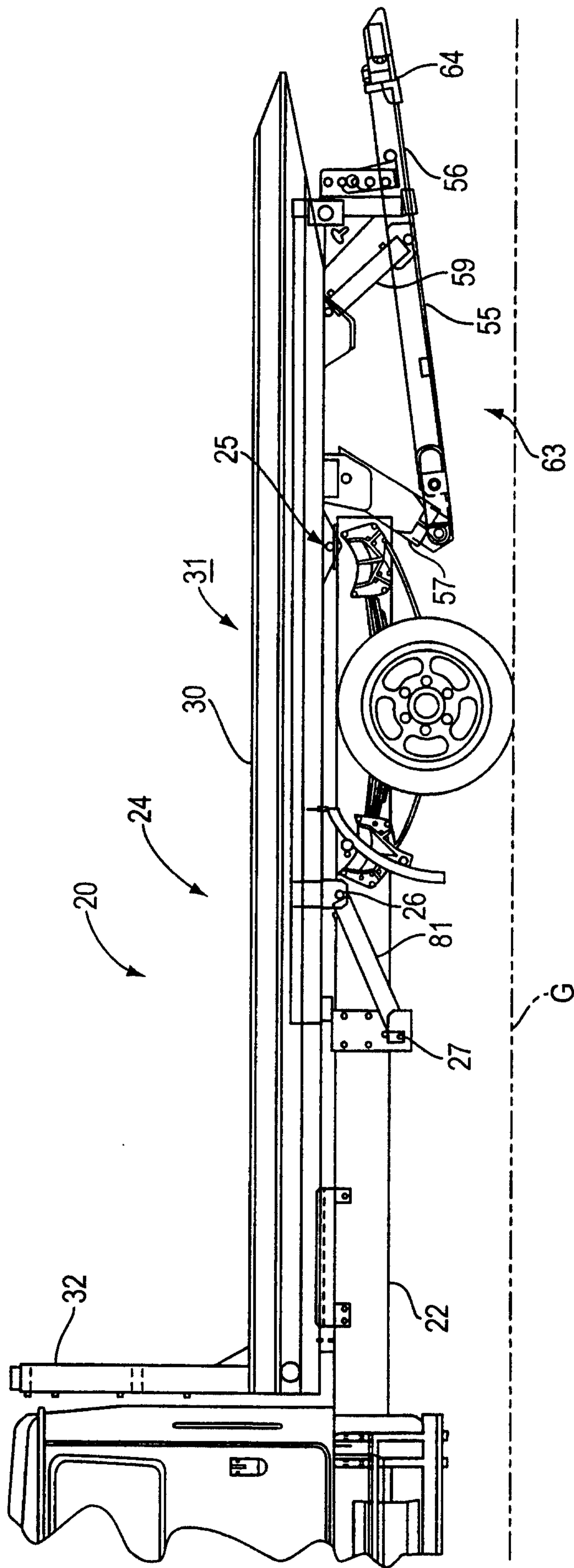


FIG. 1

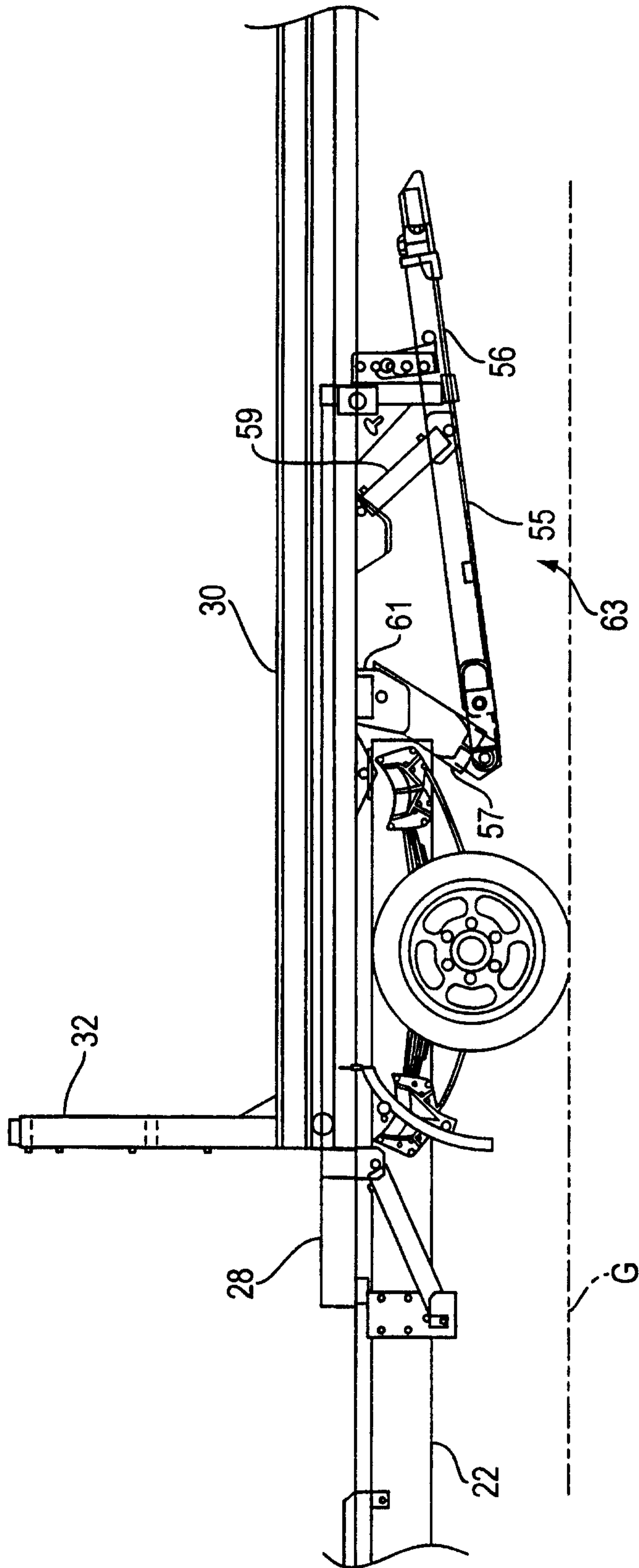


FIG. 2

3 / 20

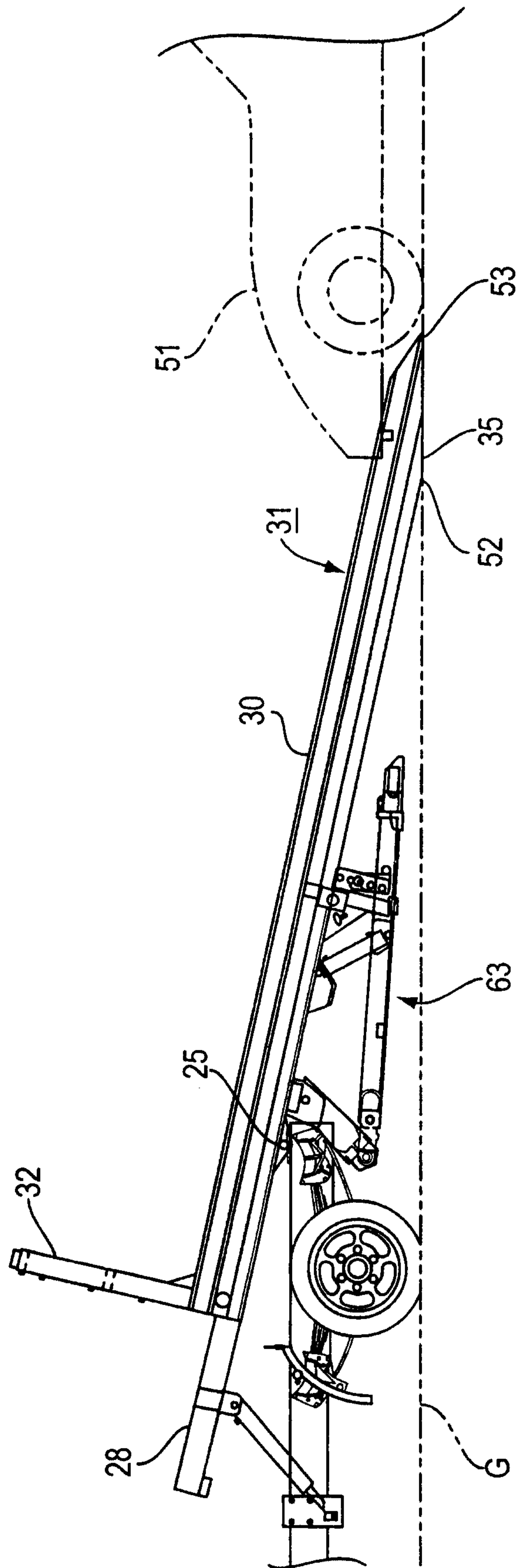


FIG. 3

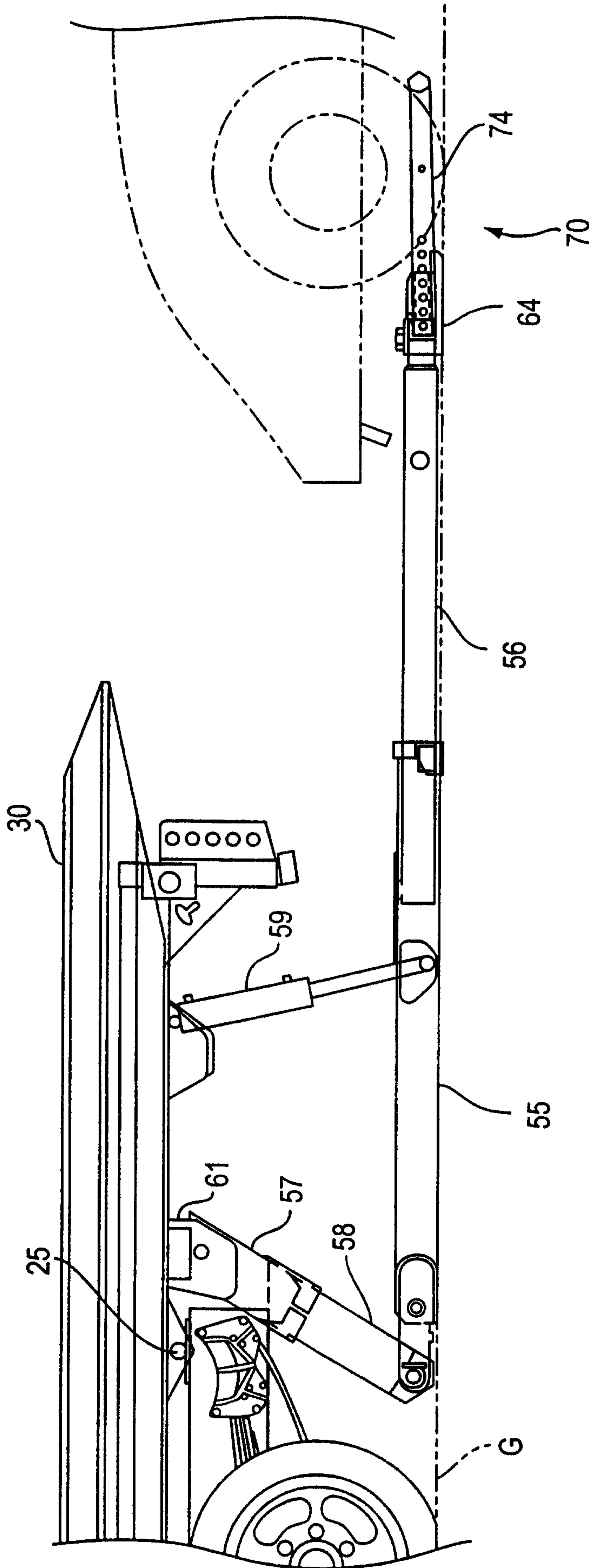


FIG. 4

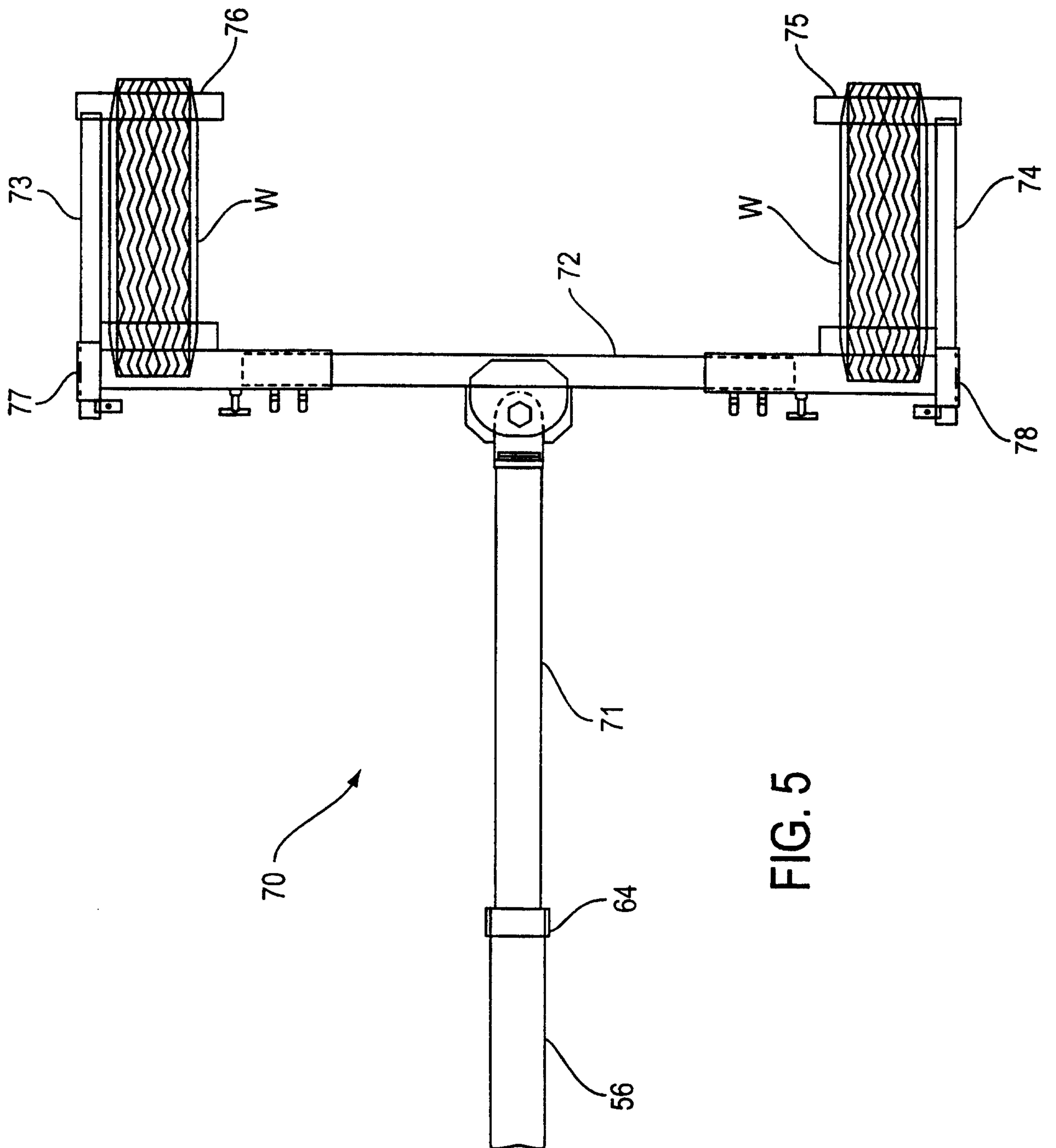


FIG. 5

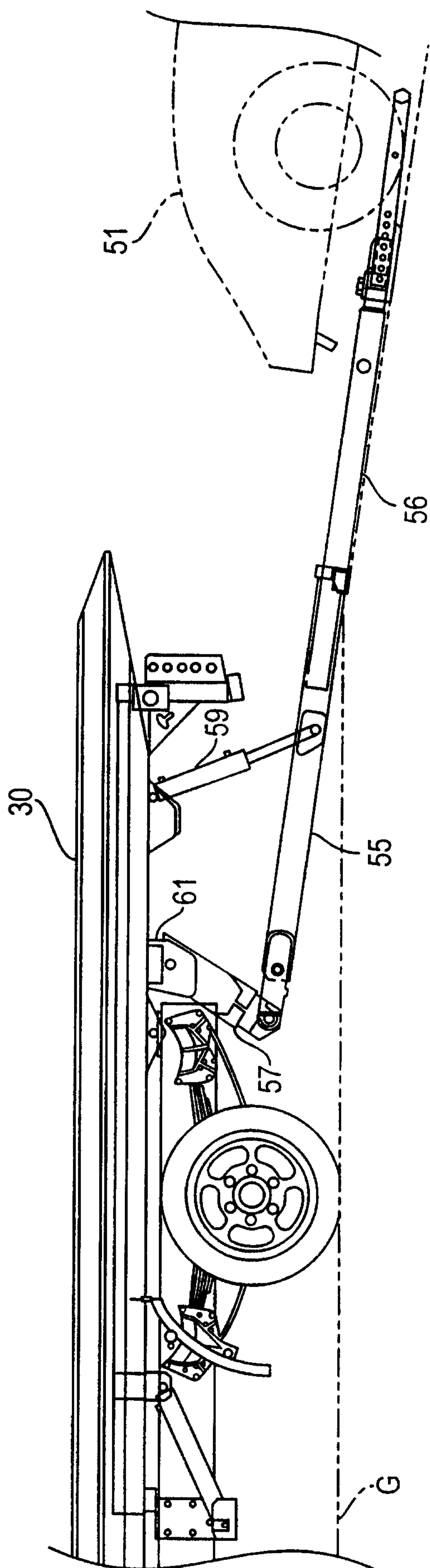


FIG. 6

7 / 20

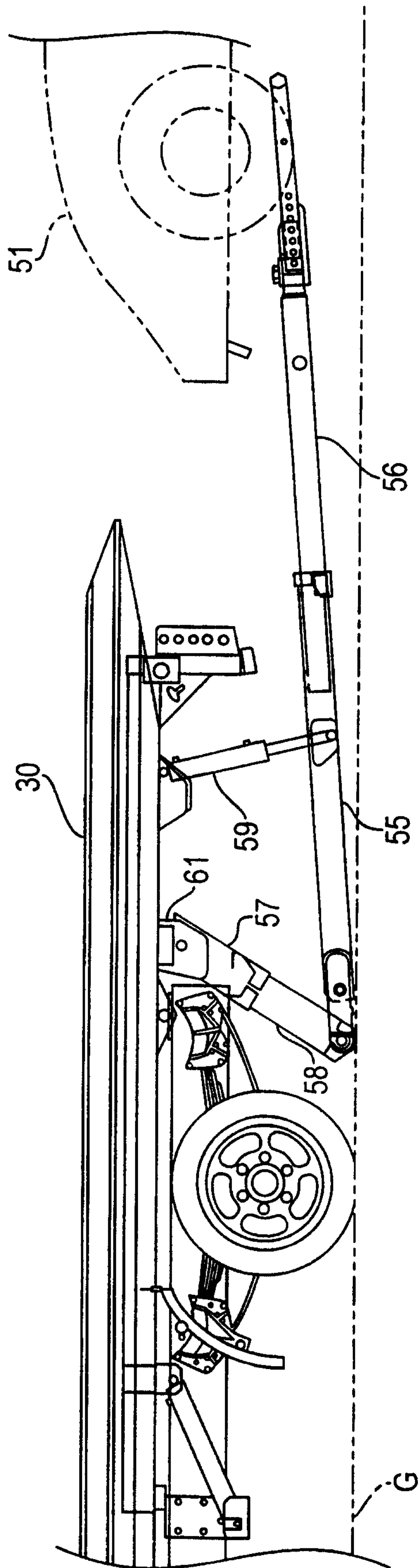


FIG. 7

8 / 20

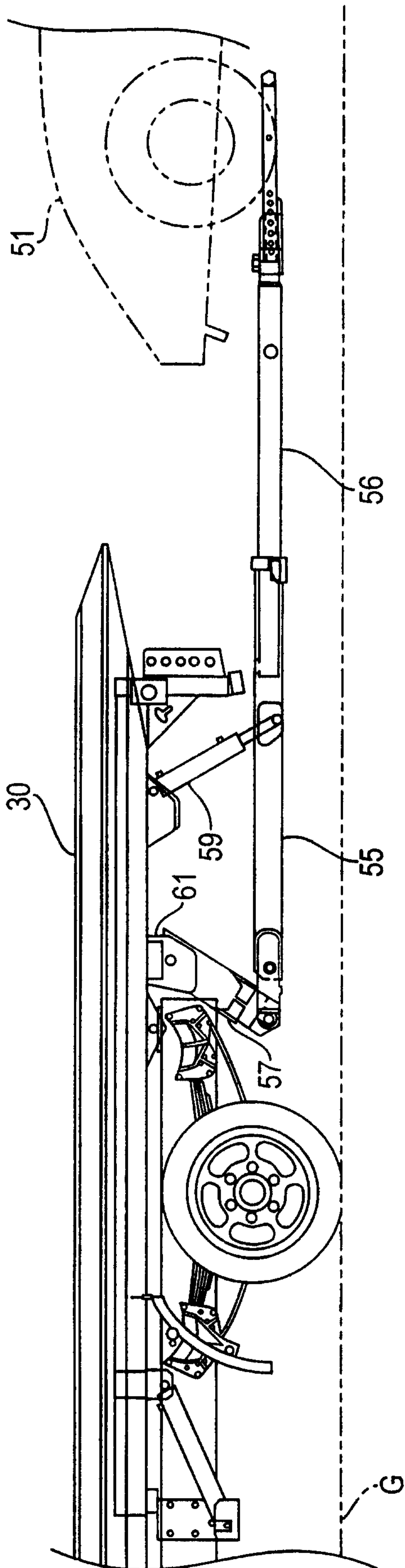


FIG. 8

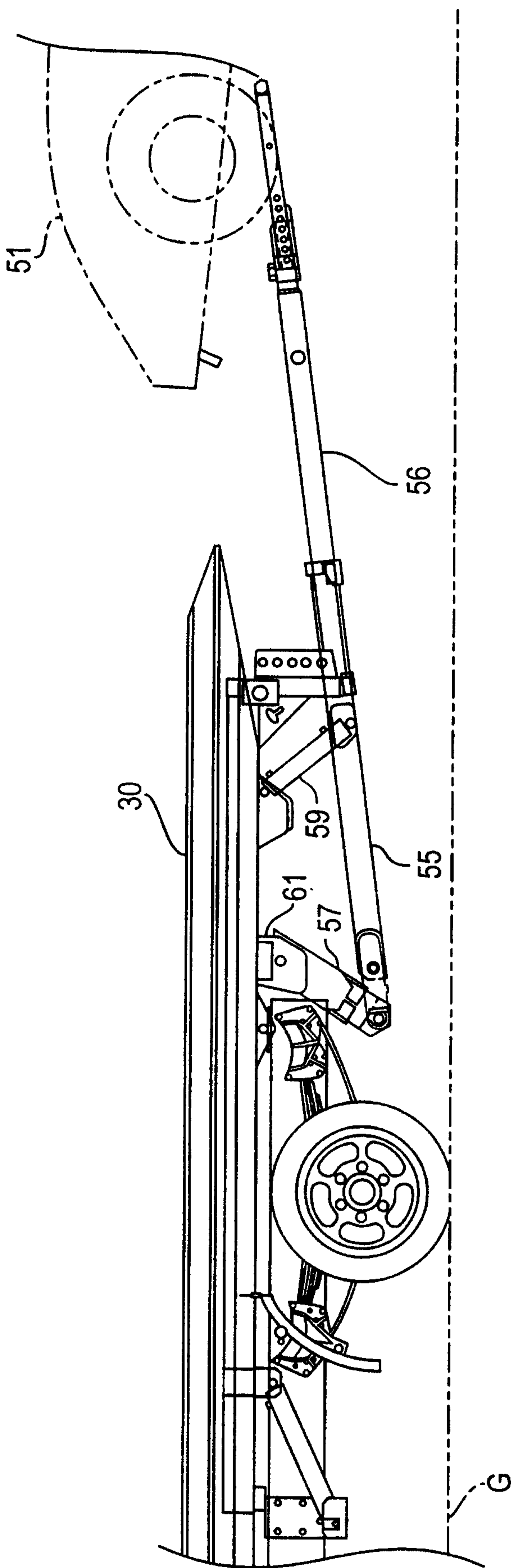


FIG. 9

10 / 20

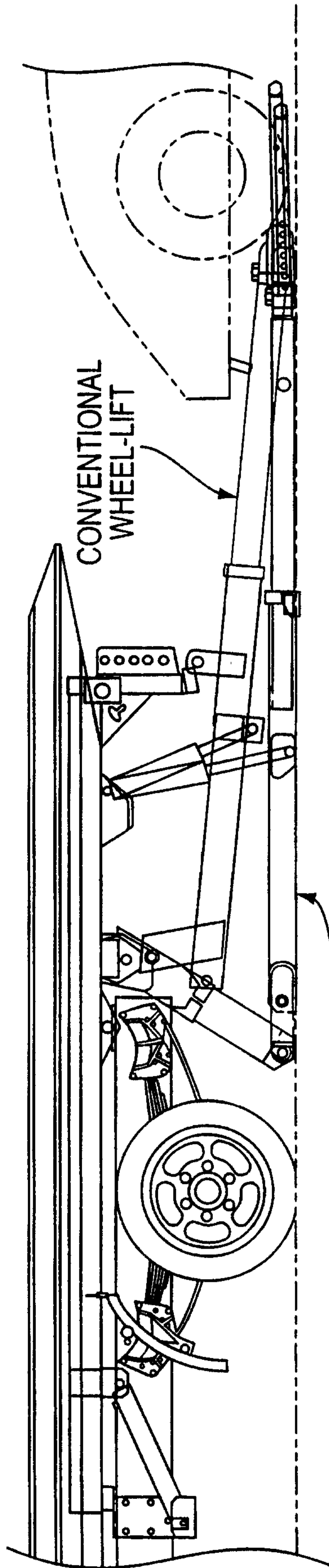


FIG. 10
PRIOR ART

11 / 20

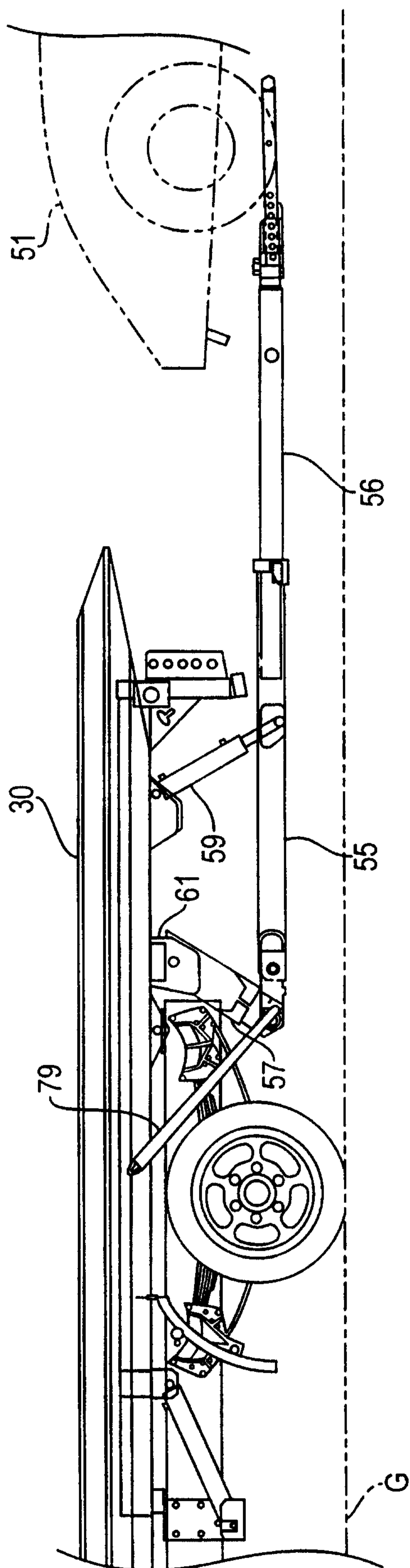


FIG. 11

12 / 20

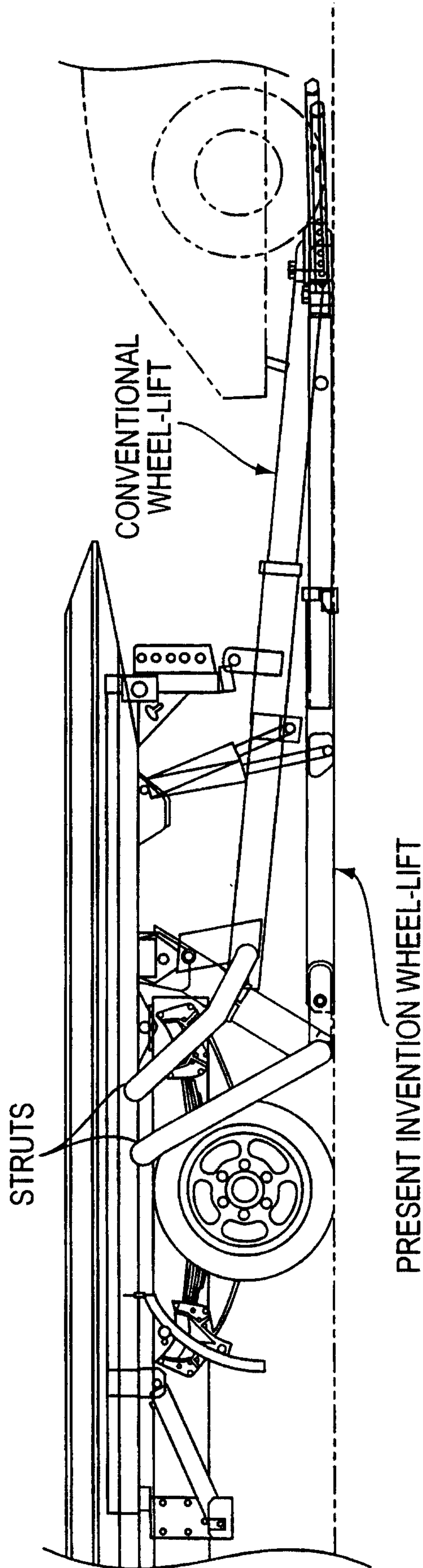


FIG. 12
PRIOR ART

13 / 20

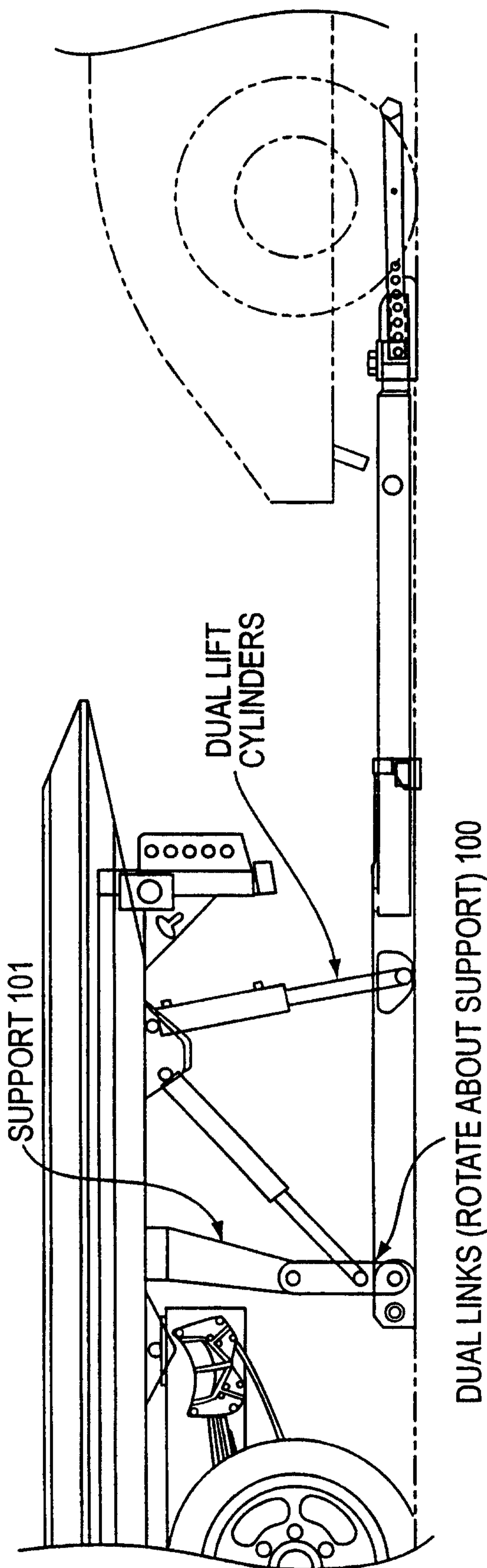


FIG. 13

14 / 20

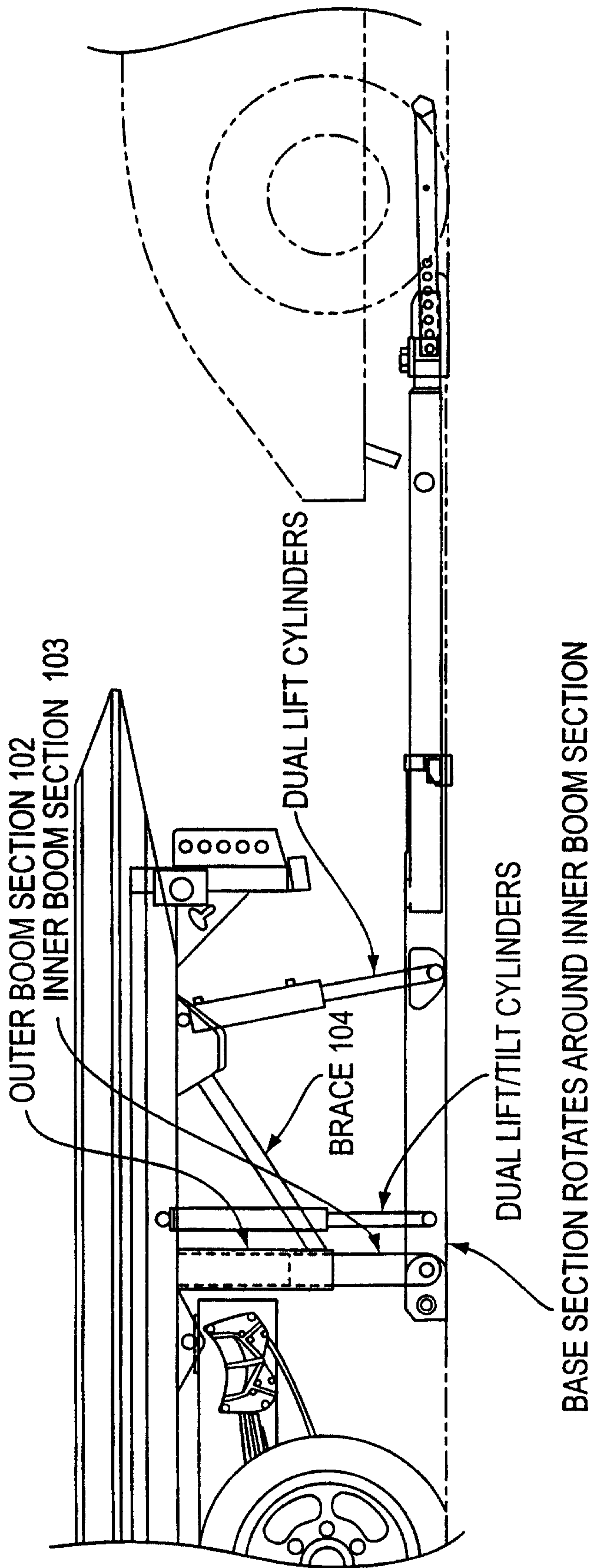


FIG. 14

15 / 20

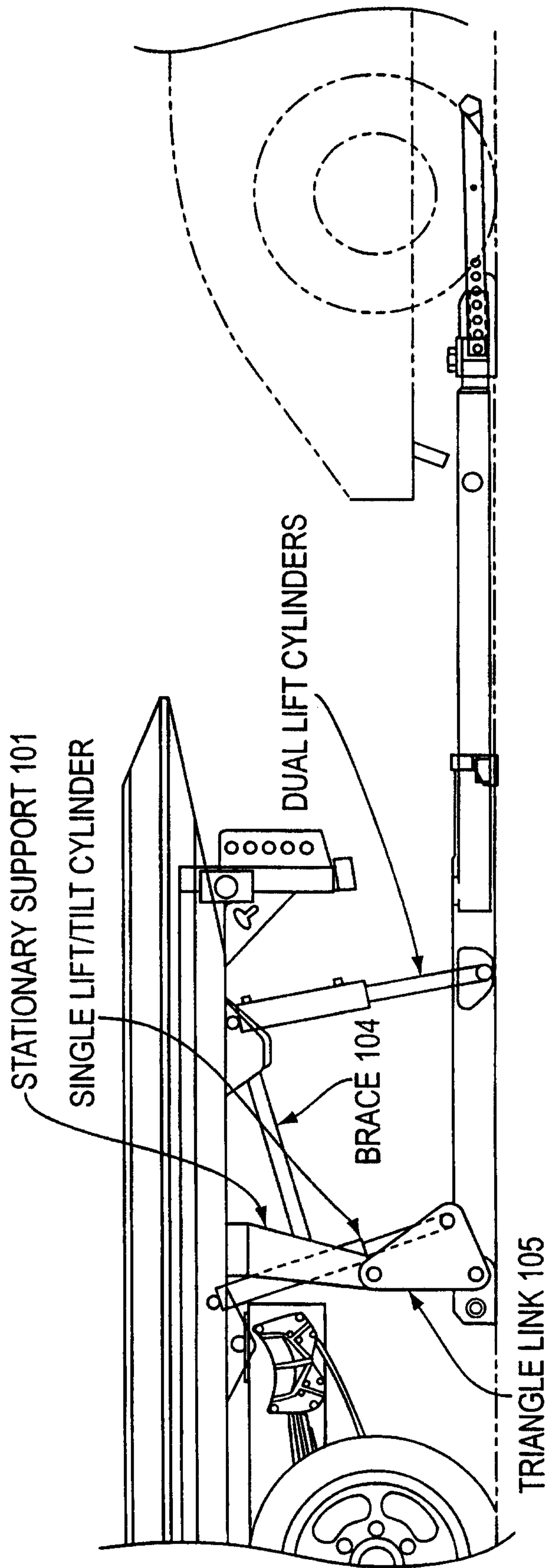
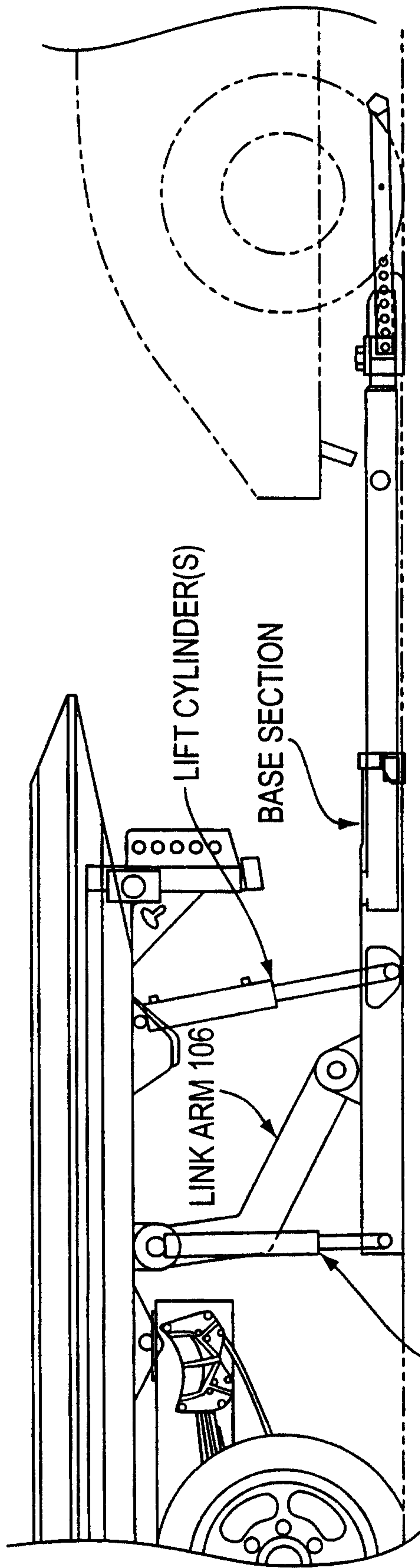


FIG. 15



TILT CYLINDER(S) (CONTROLS ANGLE BETWEEN LINK AND BASE SECTION)

FIG. 16

17 / 20

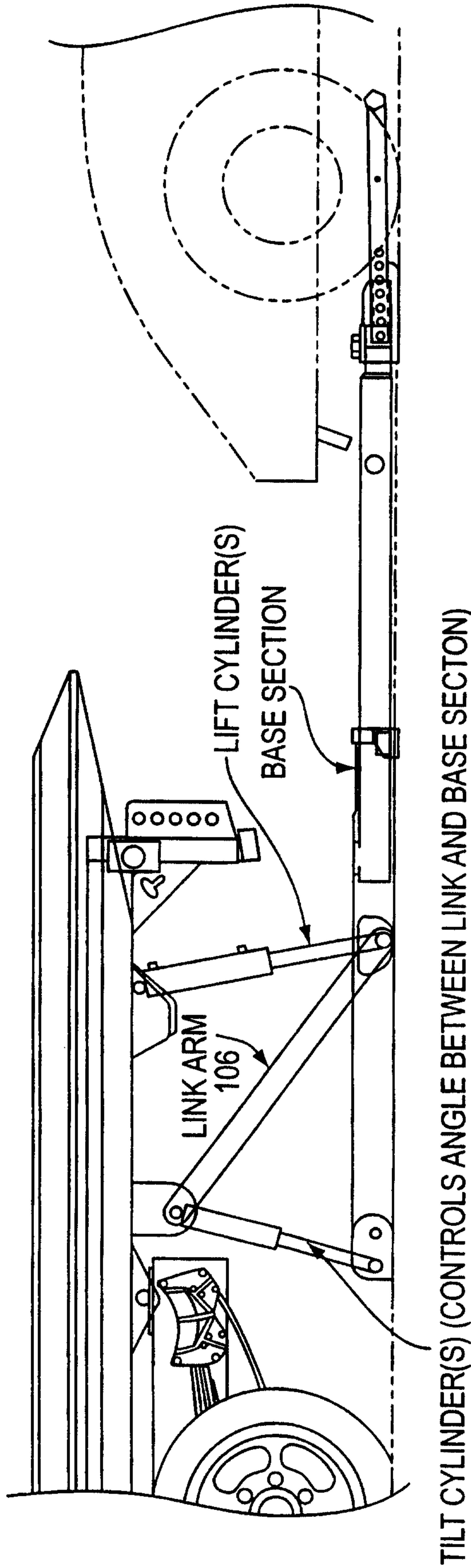


FIG. 17

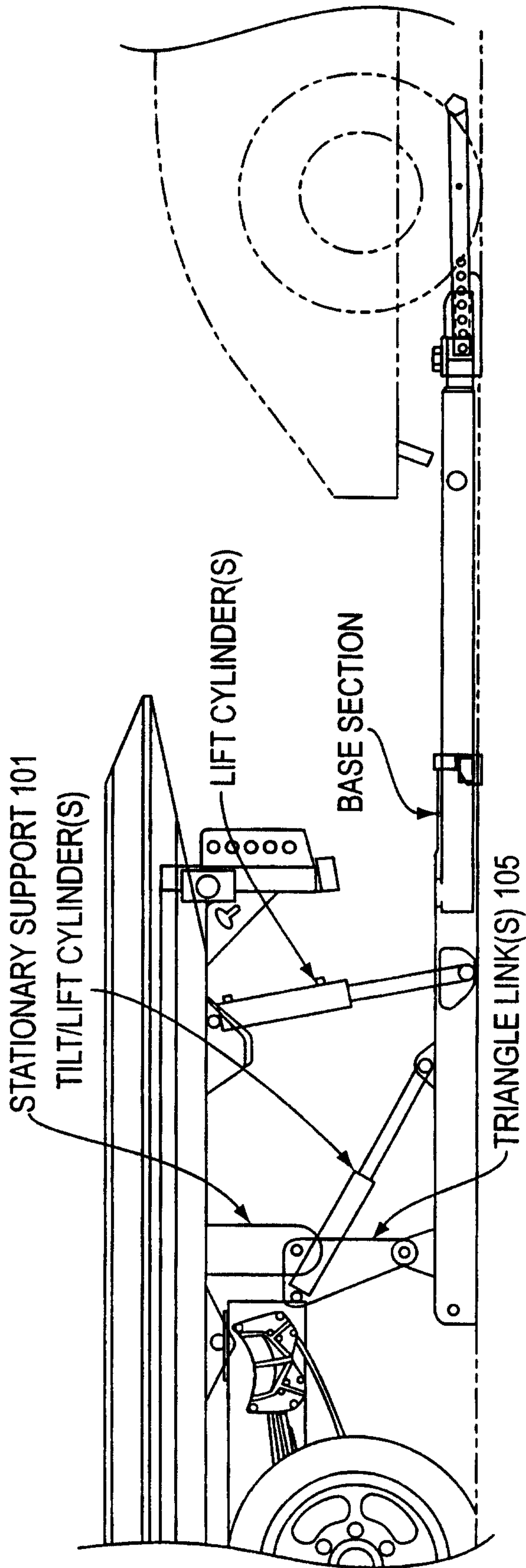


FIG. 18

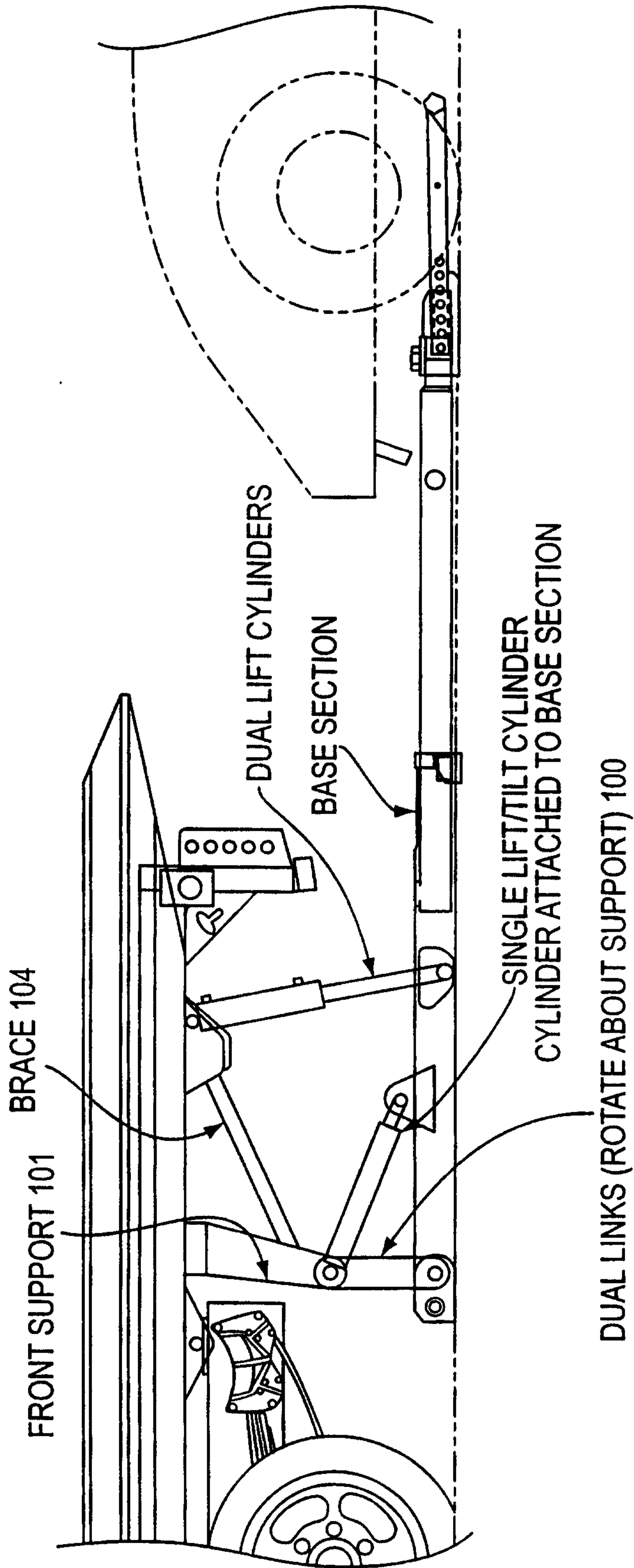


FIG. 19

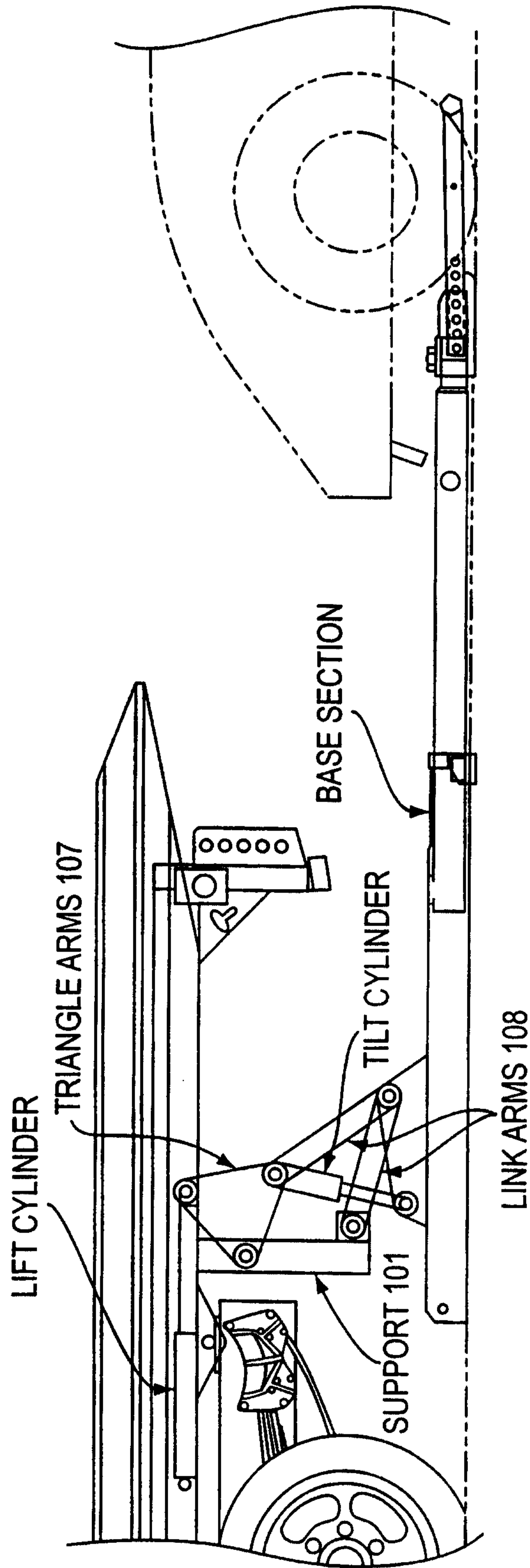


FIG. 20

