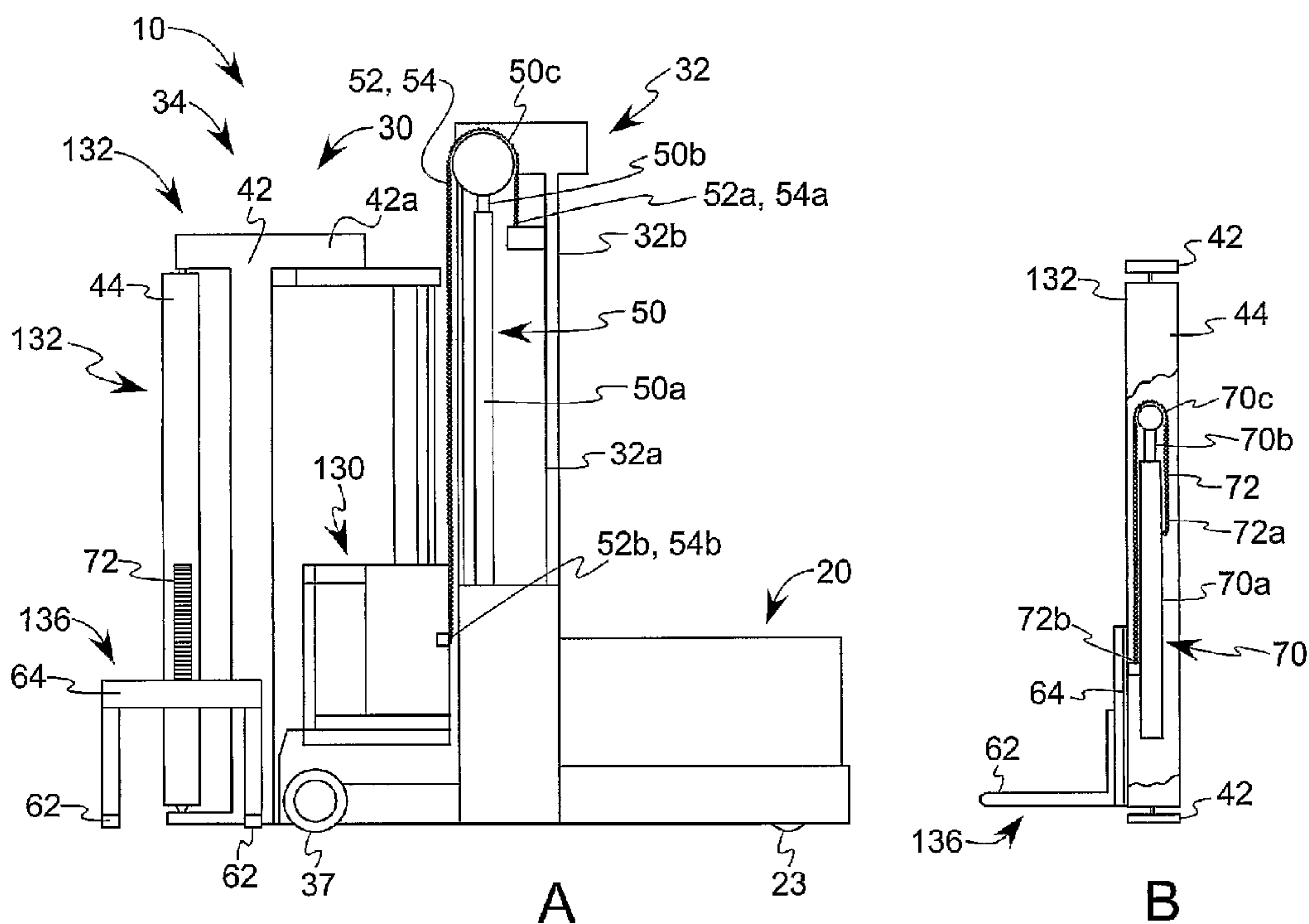




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 SENSIBLEMENT TOUS MONTES SUR UN ENSEMBLE CHASSIS PRINCIPAL
 (54) Title: MATERIALS HANDLING VEHICLE HAVING SUBSTANTIALLY ALL HYDRAULIC COMPONENTS MOUNTED
 ON A MAIN FRAME ASSEMBLY



(57) **Abrégé/Abstract:**

A lift truck (10) is provided comprising: a power unit assembly (20) comprising a power unit base (21), a wheel (23) coupled to the base, and a system for driving the wheel; and a main frame assembly (30) detachably connected to the power unit assembly. The main frame assembly comprises a main frame base (31), a mast assembly (32) coupled to the main frame base, a carriage assembly (34) coupled to the mast assembly, and hydraulic drive apparatus (80) coupled to the mast assembly. Preferably, substantially the entirety of the hydraulic drive apparatus is provided on the main frame assembly such that the main frame assembly is detachable from the power unit assembly without requiring disconnecting hydraulic connections to the power unit assembly.

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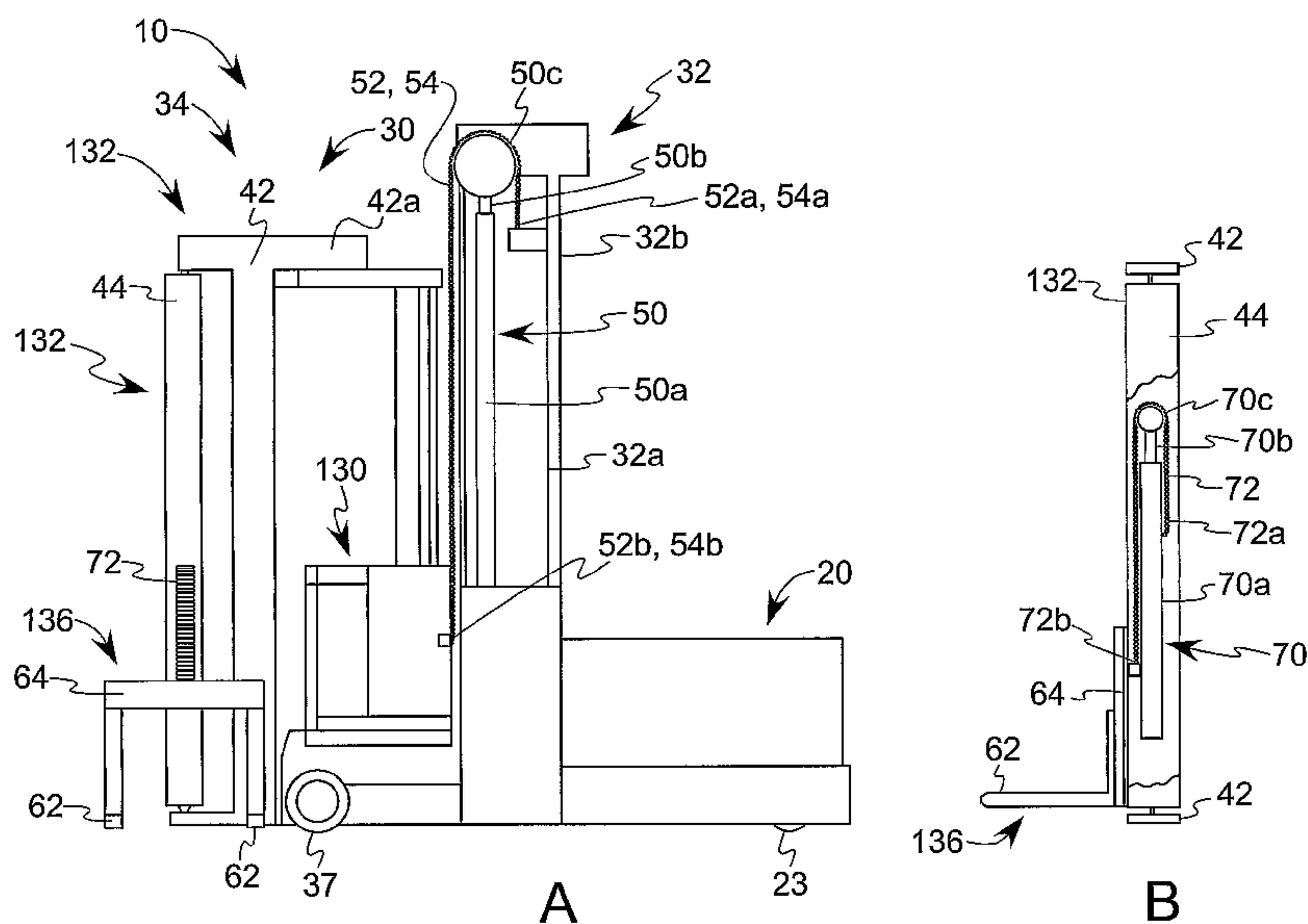
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(54) Title: MATERIALS HANDLING VEHICLE HAVING SUBSTANTIALLY ALL HYDRAULIC COMPONENTS MOUNTED ON A MAIN FRAME ASSEMBLY



(57) Abstract: A lift truck (10) is provided comprising: a power unit assembly (20) comprising a power unit base (21), a wheel (23) coupled to the base, and a system for driving the wheel; and a main frame assembly (30) detachably connected to the power unit assembly. The main frame assembly comprises a main frame base (31), a mast assembly (32) coupled to the main frame base, a carriage assembly (34) coupled to the mast assembly, and hydraulic drive apparatus (80) coupled to the mast assembly. Preferably, substantially the entirety of the hydraulic drive apparatus is provided on the main frame assembly such that the main frame assembly is detachable from the power unit assembly without requiring disconnecting hydraulic connections to the power unit assembly.

WO 2006/034376 A3

MATERIALS HANDLING VEHICLE HAVING SUBSTANTIALLY ALL
HYDRAULIC COMPONENTS MOUNTED ON A MAIN FRAME ASSEMBLY

TECHNICAL FIELD

5 The present invention relates to a fork lift truck comprising a power unit assembly detachably connected to a main frame assembly, wherein substantially all hydraulic components are mounted on the main frame assembly.

BACKGROUND ART

10 Fork lift trucks, such as turret stockpicker trucks, comprising a power unit assembly detachably connected to a main frame assembly are known in the prior art. In such a truck, the power unit assembly comprises a power unit base, at least one wheel coupled to the base and being driven by one or more traction motors, a battery for providing power to the traction motor(s), and a traction motor control module(s) for controlling the operation of the traction
15 motor(s). A first hydraulic motor/pump assembly and at least one manifold valve block are also mounted on the power unit base. The main frame assembly comprises a main frame base, a mast assembly comprising a fixed first mast and a second mast movable relative to the first mast, a piston/cylinder unit for effecting movement of the second mast relative to the first mast, a second hydraulic motor/pump assembly for providing pressurized fluid to the
20 piston/cylinder unit for effecting movement of the second mast, and a carriage assembly coupled to said second mast for movement with the second mast. Further provided on the main frame base is a hydraulic fluid reservoir and at least one manifold valve block.

Because the first hydraulic motor/pump assembly and at least one manifold valve block are mounted on the power unit base and the fluid reservoir is mounted on the main
25 frame assembly, hydraulic tubes/lines extend between the power unit and main frame assemblies. Hence, in order to separate those assemblies, such as for shipping the truck, one or more of the hydraulic tubes/lines extending between the power unit assembly and the main frame assembly must be disconnected. Such a disassembly operation is disadvantageous due to its complexity. Also, disconnecting one or more hydraulic lines/tubes increases the risk
30 that those lines/tubes may become contaminated with moisture, dirt, air, etc. A further disadvantage to having the first hydraulic motor/pump assembly mounted on the power unit is that it is located in close proximity to many of the electronic and electrical components. As a result, there is an increased risk that those electronic and electrical components may be contaminated with hydraulic fluid or dirt accumulated on the first hydraulic motor/pump

assembly mounted to the power unit base.

DISCLOSURE OF INVENTION

In accordance with the present invention, a fork lift truck, such as a turret stockpicker
5 truck, is provided comprising a power unit assembly detachably connected to a main frame
assembly, wherein substantially all hydraulic components are mounted on the main frame
assembly. Consequently, when the truck is separated, such as for shipping, no hydraulic
tubes/lines extending between the power unit and main frame assemblies need be
10 disconnected. Hence, the disassembly operation is simplified. Further, risk of moisture, dirt, air,
etc. contaminating open hydraulic tubes/lines is reduced. Also, the length of hydraulic tubes/lines
required on the truck is reduced since tubes/lines extending between the power unit and main
frame assemblies are not required. This reduces costs as well as pressure drops within the
hydraulic system.

In accordance with a first aspect of the present disclosure there is provided a lift truck
15 comprising: a power unit assembly comprising a power unit base, at least one wheel coupled to
said base, and a system for driving said at least one wheel; a main frame assembly detachably
connected to said power unit assembly, said main frame assembly comprising a main frame base,
a mast assembly coupled to said main frame base, a carriage assembly coupled to said mast
assembly, and a hydraulic drive apparatus comprising a hydraulic motor/pump assembly
20 receiving power from a battery of said power unit assembly, wherein said hydraulic drive
apparatus including said hydraulic motor/pump assembly is provided on said main frame
assembly such that said main frame assembly is detachable from said power unit assembly
without requiring disconnecting hydraulic connections to said power unit assembly; and a control
module controlling the operation of said hydraulic motor/pump assembly of said hydraulic drive
25 apparatus, wherein said control module is mounted on said power unit base.

The hydraulic drive apparatus may comprises a hydraulic fluid reservoir, a hydraulic
motor/pump assembly, and a manifold system. Preferably, the reservoir is spaced from the
motor/pump assembly and the manifold system.

The main frame base may comprise front and rear portions. The mast assembly, the
30 hydraulic fluid reservoir and the hydraulic motor/pump assembly are preferably located at the

rear portion of the main frame base, with the reservoir being positioned on a first side of the mast assembly and the motor/pump assembly being positioned on a second side of the mast assembly.

5 The power unit system for driving the at least one wheel may comprise at least one traction motor, a battery for providing power to the motor, and a control module for controlling the operation of the traction motor.

As noted above, the main frame base may comprise front and rear portions. Similarly, the power unit base may comprise front and rear portions. The rear portion of the main frame base may be positioned adjacent to the front portion of the power unit base, and the traction motor and the traction motor control module may be located in the rear portion of the power unit base.

10 The power unit assembly may further comprise a steer motor for effecting steering movement of the wheel and a steer motor control module for controlling the operation of the steer motor. The steer motor and the steer motor control module are preferably located in the rear portion of the power unit base.

15 The mast assembly may comprise a fixed first mast, a second mast movable relative to the first mast and a mast piston/cylinder unit for effecting movement of the second mast relative to the first mast. The carriage assembly may comprise a platform assembly coupled to the second mast so as to move with the second mast. The platform assembly may be movably coupled to the second mast so as to move relative to the second mast as well as with the second mast.

20 The carriage assembly may further comprise a load handler assembly movably coupled to the platform assembly and a fork carriage assembly movably coupled to the load handler assembly.

25 In accordance with a second aspect of the present disclosure there is provided a lift truck comprising: a power unit assembly comprising a power unit base, at least one wheel coupled to said base, and a system for driving said at least one wheel; a main frame assembly detachably connected to said power unit assembly, said main frame assembly comprising a main frame base, a mast assembly coupled to said main frame base, a carriage assembly coupled to said mast assembly, and a hydraulic drive apparatus, wherein said hydraulic drive apparatus is provided on said main frame assembly such that said main frame assembly is detachable from said power unit assembly without requiring disconnecting hydraulic connections to said power unit assembly,
30 said hydraulic drive apparatus comprising a hydraulic motor/pump assembly receiving power from a battery of said power unit assembly, said hydraulic drive apparatus is coupled to at least

said mast assembly; and a control module controlling the operation of said hydraulic motor/pump assembly of said hydraulic drive apparatus, wherein said control module is mounted on said power unit base.

5 The hydraulic drive apparatus may comprise a hydraulic fluid reservoir, a hydraulic motor/pump assembly and a manifold system. The reservoir is preferably spaced from the motor/pump assembly and the manifold system.

10 The mast assembly, the hydraulic fluid reservoir and the hydraulic motor/pump assembly are preferably located at the rear portion of the main frame base, with the reservoir being positioned on a first side of the mast assembly and the motor/pump assembly being positioned on a second side of the mast assembly.

15 The power unit assembly may further comprise at least one steer motor for effecting steering movement of the at least one wheel and a steer motor control module for controlling the operation of the steer motor. The steer motor and the steer motor control module are located in the rear of the power unit base.

20 In accordance with a third aspect of the present disclosure there is provided a fork lift truck comprising a power unit assembly detachably connected to a main frame assembly, wherein substantially all truck hydraulic components including a hydraulic motor/pump assembly are mounted on the main frame assembly while all truck electronic control modules including a module for controlling said hydraulic motor/pump assembly are mounted on the power unit assembly, and wherein said hydraulic motor/pump assembly receives power from a battery of said power unit assembly, and said main frame assembly is detachable from said power unit assembly without requiring disconnecting hydraulic connections to said power unit assembly.

25 BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1 and 2 are perspective views, from opposite sides, of a materials handling vehicle constructed in accordance with the present invention with outer covers on the power unit and main frame assemblies removed;

30 Fig. IA is a schematic view illustrating the first and second masts, and a piston/cylinder unit of the main mast assembly of the vehicle illustrated in Fig. 1;

Fig. 1B is a schematic view illustrating a piston/cylinder unit of the auxiliary mast of the vehicle illustrated in Fig. 1;

Fig. 3 is a perspective view of the hydraulic motor/pump assembly and first manifold of the vehicle illustrated in Fig. 1;

5 Fig. 4 is a perspective view of the power unit assembly with outer covers removed and shown disconnected from the main frame assembly;

Fig. 5 is a perspective view of the main frame assembly with outer covers removed and shown disconnected from the power unit assembly; and

10 Fig. 6 is a perspective view of a portion of the main frame assembly and illustrating a rear portion of the main frame base.

BEST MODE FOR CARRYING OUT THE INVENTION

Referring now to the drawings, and particularly to Figs. 1 and 2, which illustrate a materials handling truck or vehicle 10 constructed in accordance with the present invention. In the illustrated embodiment, the vehicle 10 comprises a turret stockpicker. The vehicle 10 includes a power unit assembly 20 and a main frame assembly 30, which assemblies 20 and 30 are releasably coupled together, as will be discussed more explicitly below. The power unit assembly 20 includes a power unit base 21 having front and rear portions 21a and 21b, respectively, a power source, such as a battery unit 22, positioned on the base 21, a steered wheel 23 rotatably coupled to the base rear portion 21b, a traction motor 23a for driving the wheel 23 and a traction motor control module 25 for controlling the operation of the traction motor 23a, i.e., its speed and direction, in response to operator generated commands, see Figs. 1, 2 and 4. The main frame assembly 30 comprises a main frame base 31 having front and rear portions 31a and 31b, respectively, a mast assembly 32 coupled to the base 31, a carriage assembly 34 coupled to the mast assembly 32, a hydraulic drive apparatus 80 coupled to the base 31, the mast assembly 32 and the carriage assembly 34, and a pair of load wheels 37 coupled to the main frame base 31. The carriage assembly 34 comprises, in the illustrated embodiment, a platform assembly 130 adapted to carry an operator and coupled to the mast assembly 32, a load handling assembly 132 coupled to the platform assembly 130, and a fork carriage assembly 136 coupled to the load handling assembly 132.

The mast assembly 32 comprises a first mast 32a fixedly coupled to the main frame base 31, a second mast 32b movable coupled to the first mast 32a, and a main mast piston/cylinder unit 50, see Fig. 1A. In the illustrated embodiment, the platform assembly 130 is movably coupled to the second mast 32b so as to move relative to the second mast 32b and with the second mast 32b. The load handling assembly 132 is coupled to the platform assembly 130 and, hence, moves vertically with the platform assembly 130.

The mast piston/cylinder unit 50 is provided in the first mast 32a for effecting movement of the second mast 32b relative to the first mast 32a and the base 31, see Fig. 1A. The cylinder 50a forming part of the piston/cylinder unit 50 is fixedly coupled to the base 31. The piston 50b forming part of the unit 50 is fixedly coupled to the second mast 32b such that movement of the piston 50b effects movement of the second mast 32b relative to the first mast 32a. The piston 50b comprises a roller 50c on its distal end which engages a pair of chains 52 and 54. Each chain 52, 54 is fixedly coupled at a first end 52a, 54a to the first mast 32a and coupled at a second end 52b, 54b to the platform assembly 130. Hence, movement

of the piston 50b relative to the cylinder 50a effects movement of the platform assembly 130 relative to the base 31 via the roller 50c acting against the chains 52, 54 and the piston 50b acting against the second mast 32b. One unit of vertical movement of the piston 50b results in two units of vertical movement of the platform assembly 130. Hence, in the illustrated
5 embodiment, the platform assembly 130 moves with the second mast 32b as the second mast 32b moves relative to the base 31 and further moves relative to the second mast 32b.

The load handling assembly 132 comprises a first structure 42 which is movable back and forth transversely relative to the platform assembly 130, as designated by an arrow 200 in Fig. 2, via a hydraulic motor (not shown). The load handling assembly 132 further comprises
10 a second structure 44 (also referred to as an auxiliary mast) which moves transversely with the first structure 42 and is also capable of rotating relative to the first structure 42. In the illustrated embodiment, the second structure 44 is rotated back and forth relative to the first structure 42 through an angle of about 180° via first and second piston/cylinder units (not shown) provided in an upper portion 42a of the first structure 42. A similar arrangement for
15 pivoting a second structure is disclosed in U.S. Patent No. 5,011,363, the disclosure of which is incorporated herein by reference.

Coupled to the second structure 44 is the fork carriage assembly 136 comprising a pair of forks 62 and a fork support 64. The fork carriage assembly 136 is capable of moving vertically relative to the second structure 44, as designated by an arrow 201 in Fig. 1. While
20 not shown in the figures, a piston/cylinder unit may be provided in each fork 62 for causing a corresponding sliding fork member (not shown), comprising part of the fork 62, to extend and retract relative to a corresponding fixed fork member (not shown), see again U.S. Patent No. 5,011,363. Rotation of the second structure 44 relative to the first structure 42 permits an operator to position the forks 62 in one of at least a first position and a second position,
25 wherein the second position may be located about 180° from the first position.

A second structure or auxiliary mast piston/cylinder unit 70 is provided in the second structure 44 for effecting vertical movement of the fork carriage assembly 136 relative to the second structure 44, see Fig. 1B. The cylinder 70a forming part of the piston/cylinder unit 70 is fixedly coupled to the second structure 44. The piston 70b forming part of the unit 70
30 comprises a roller 70c on its distal end which engages a chain 72. One unit of vertical movement of the piston 70b results in two units of vertical movement of the fork carriage assembly 136. The chain 72 is fixedly coupled at a first end 72a to the cylinder 70a and fixedly coupled at a second end 72b to the fork support 64. The chain 72 extends from the

cylinder 70a, over the roller 70c and down to the fork support 64. Upward movement of the piston 70b effects upward movement of the fork carriage assembly 136 relative to the second structure 44, while downward movement of the piston 70b effects downward movement of the fork carriage assembly 136 relative to the second structure 44.

5 The hydraulic drive apparatus 80 supplies pressurized fluid to the mast piston/cylinder unit 50 and the second structure piston/cylinder unit 70. The hydraulic apparatus 80 may also provide pressurized fluid to the hydraulic motor for effecting transverse movement of the first structure 42, the first and second piston/cylinder units for effecting rotation of the second structure 44 and the first and second piston/cylinder units for causing the sliding fork members to extend and retract. The apparatus 80 comprises, in the illustrated embodiment, a hydraulic motor/pump assembly 82, a first manifold 90, and a hydraulic fluid reservoir 84, all of which are mounted on the main frame base 31, see Figs. 1-3, 5 and 6. The hydraulic apparatus 80 further comprises a second manifold 190, shown in phantom only in Fig. 1, mounted in the upper portion 42a of the first structure 42, see Fig. 1. The motor/pump assembly 82 supplies hydraulic fluid from the reservoir 84 under pressure to the manifolds 90 and 190. In response to appropriate operator-generated commands, a hydraulic drive apparatus control module 400, see Figs. 2 and 4, causes the first manifold 90 to provide pressurized fluid to the piston/cylinder unit 50 and further causes the first and second manifolds 90 and 190 to provide pressurized fluid to the piston/cylinder unit 70, the hydraulic motor for effecting transverse movement of the first structure 42, the first and second piston/cylinder units for effecting rotation of the second structure 44, and the first and second piston/cylinder units for causing the sliding fork members to extend and retract. Example first and second manifolds 90 and 190 are disclosed in U.S. Patent No. 7,344,000, entitled "ELECTRONICALLY CONTROLLED VALVE FOR A MATERIALS HANDLING VEHICLE," by Dammeyer et al.

25 As noted above, the power unit assembly 20 and the main frame assembly 30 are releasably coupled to one another. The power unit base 21 comprises a front plate member 210 provided with three openings in a first lower corner 210a, three openings in a second lower corner 210b and a pair of openings along an upper edge 210c, see Fig. 4. Bolts 300 extend through those openings such that head portions (not shown) of the bolts 300 engage a first side 210d of the front plate member 210 while threaded portions 300a of the bolts 300 extend through the openings in the plate member 210. A first horizontal member 310 and

first and second vertical members 312 and 314, respectively, of the main frame base 31 are provided with openings 310a, 312a, and 314b, see Figs. 5 and 6. The bolt threaded portions 300a extend through the openings 310a, 312a and 314b and nuts 315 are secured to the bolts 300 so as to releasably couple the power unit base 21 and the main frame base 31 to one another, see Fig. 3.

All hydraulic fluid lines extending from the reservoir 84 to the motor/pump assembly 82, from the motor/pump assembly 82 to the first and second manifolds 90 and 190 and from the first and second manifolds 90 and 190 to the mast piston/cylinder unit 50, the second structure piston/cylinder unit 70, the hydraulic motor for effecting transverse movement of the first structure 42, the first and second piston/cylinder units for effecting rotation of the second structure 44, and the first and second piston/cylinder units for causing the sliding fork members to extend and retract are contained within the main frame assembly 30. Hence, all vehicle hydraulic components including the hydraulic apparatus 80, the mast piston/cylinder unit 50 and the second structure piston/cylinder unit 70 are contained within the main frame assembly 30. This is advantageous as there is no need to disconnect any hydraulic tubes/lines extending between the power unit and main frame assemblies 20 and 30 when the vehicle 10 is to be separated. Hence, the vehicle disassembly operation is simplified. Further, risk of moisture, dirt, air, etc. contaminating open hydraulic tubes/lines is reduced. Also, the length of hydraulic tubes/lines required on the vehicle 10 is reduced since tubes/lines extending between the power unit and main frame assemblies 20 and 30 are not required. This reduces costs as well as pressure drops within the hydraulic apparatus 80.

The vehicle 10 comprises three substantial heat sources, which are: 1) the hydraulic fluid reservoir 84; 2) the motor/pump assembly 82 and the first manifold 90; and 3) the traction motor 23a, a gear box (not shown) coupled to and mounted below the motor 23a and the control modules 25, 27, 130 and 400. So as to allow the heat generated by those sources to be efficiently transferred from the vehicle 10, those elements are spaced apart from one another on the vehicle 10. In particular, the hydraulic fluid reservoir 84 is positioned to a first side 32c of the mast assembly 32 so as to be spaced from the motor/pump assembly 82 and the first manifold 90, which are positioned to a second side 38d of the mast assembly 38, see Figs. 1 and 2. The control modules 25, 27, 130 and 400, the traction motor 23a, and the traction motor gear box (not shown) are mounted in a rear section 26 of the power unit assembly 20.

The power unit base 21 comprises first, second and third compartments 100, 110 and

120 located in the rear section 26 of the power unit assembly 20, see Figs. 1 and 2. The traction motor 23a for driving the wheel 23 and a steer motor 24 for effecting steering movement of the wheel 23 are mounted in the second compartment 110, see Fig. 1. Mounted in the first compartment 100 is the traction motor control module 25 for controlling the operation of the traction motor 23a, i.e., its speed and direction of rotation, in response to operator generated commands. Also mounted in the first compartment 100 is a steer motor control module 27 for controlling the operation of the steer motor 24 in response to operator generated commands. Mounted in the third compartment 120 is the control module 400 for controlling the operation of the motor/pump assembly 82 and the first and second manifolds 90 and 190 in response to operator generated commands. Also mounted in the third compartment 120 is a guidance control module 130. The vehicle 10 may be provided with front and back sensors (not shown) for sensing a guide wire provided in the floor on which the vehicle 10 is operated. The control module 130 receives signals generated by those sensors and generates appropriate control commands to the steer motor control module 27 to ensure that the vehicle 10 is positioned correctly relative to the guide wire. The control module 130 may also include an end-of-aisle feature such that the vehicle 10 is slowed to a stop before leaving an aisle, i.e., a predefined area, in response to the control module 130 receiving signals from end-of-aisle sensors on the vehicle which sense end-of-aisle markers in or on the floor.

Each of the traction motor 23a, the steer motor 24 and the control modules 25, 27, 130 and 400 generate significant amounts of heat energy, which energy must be efficiently transferred from the vehicle. By placing the traction motor 23a and the steer motor 24 a spaced distance away from the control modules 25, 27, 130 and 400, efficient transfer of the heat generated by those elements from the vehicle 10 occurs. Furthermore, by locating the traction motor 23a, the steer motor 24 and the control modules 25, 27, 130 and 400 in the rear section 26 of the power unit assembly 20, those elements are spaced a substantial distance from the hydraulic fluid reservoir 84, the motor/pump assembly 82 and the first manifold 90, so as to improve thermal balance on the vehicle 10 and to facilitate dissipation of heat from those elements.

The power unit assembly 20 can be detached from the main frame assembly 30 by removing the nuts 315 from the bolts 300. Prior to separating the assemblies 20 and 30, power supply cables 405 extending from the power unit assembly 20 to the hydraulic motor/pump assembly 82 and wiring harnesses 410, three in the illustrated embodiment,

extending from the power unit assembly 20 to the main frame assembly 30 need to be disconnected.

Having described the invention in detail and by reference to preferred embodiments thereof, it will be apparent that modifications and variations are possible without departing
5 from the scope of the invention defined in the appended claims.

What is claimed is:

CLAIMS

1. A lift truck comprising:
a power unit assembly comprising a power unit base, at least one wheel coupled to said
5 base, and a system for driving said at least one wheel;
a main frame assembly detachably connected to said power unit assembly, said main
frame assembly comprising a main frame base, a mast assembly coupled to said main frame
base, a carriage assembly coupled to said mast assembly, and a hydraulic drive apparatus
10 comprising a hydraulic motor/pump assembly receiving power from a battery of said power unit
assembly, wherein said hydraulic drive apparatus including said hydraulic motor/pump assembly
is provided on said main frame assembly such that said main frame assembly is detachable from
said power unit assembly without requiring disconnecting hydraulic connections to said power
unit assembly; and
a control module controlling the operation of said hydraulic motor/pump assembly of said
15 hydraulic drive apparatus, wherein said control module is mounted on said power unit base.
2. The lift truck as set forth in claim 1, wherein said hydraulic drive apparatus comprises a
hydraulic fluid reservoir, and a manifold system.
- 20 3. The lift truck as set forth in claim 2, wherein main frame base comprises front and rear
portions, said mast assembly, said hydraulic fluid reservoir and said hydraulic motor/pump
assembly being located at said rear portion of said main frame base, and said reservoir being
positioned on a first side of said mast assembly and said motor/pump assembly being positioned
on a second side of said mast assembly.
- 25 4. The lift truck as set forth in claim 1, wherein said system for driving said at least one
wheel comprises at least one traction motor, said battery providing power to said at least one
motor, and a traction motor control module for controlling the operation of said at least one
traction motor.
- 30 5. The lift truck as set forth in claim 4, wherein said main frame base comprises front and
rear portions and said power unit base comprises front and rear portions, said rear portion of said

main frame base being positioned adjacent to said front portion of said power unit base, and said at least one traction motor and said traction motor control module being located in said rear portion of said power unit base.

5 6. The lift truck as set forth in claim 5, wherein said power unit assembly further comprises a steer motor for effecting steering movement of said wheel and a steer motor control module for controlling the operation of said steer motor, said steer motor and said steer motor control module being located in said rear portion of said power unit base.

10 7. The lift truck as set forth in claim 1, wherein said mast assembly comprises a fixed first mast, a second mast movable relative to said first mast and a mast piston/cylinder unit for effecting movement of said second mast relative to said first mast.

15 8. The lift truck as set forth in claim 7, wherein said carriage assembly comprises a platform assembly coupled to said second mast so as to move with said second mast.

9. The lift truck as set forth in claim 8, wherein said platform assembly is capable of moving relative to said second mast.

20 10. The lift truck as set forth in claim 8, wherein said carriage assembly further comprises a load handler assembly movably coupled to said platform assembly and a fork carriage assembly movably coupled to said load handler assembly.

11. A lift truck comprising:

25 a power unit assembly comprising a power unit base, at least one wheel coupled to said base, and a system for driving said at least one wheel;

a main frame assembly detachably connected to said power unit assembly, said main frame assembly comprising a main frame base, a mast assembly coupled to said main frame base, a carriage assembly coupled to said mast assembly, and a hydraulic drive apparatus, 30 wherein said hydraulic drive apparatus is provided on said main frame assembly such that said main frame assembly is detachable from said power unit assembly without requiring

disconnecting hydraulic connections to said power unit assembly, said hydraulic drive apparatus comprising a hydraulic motor/pump assembly receiving power from a battery of said power unit assembly, said hydraulic drive apparatus is coupled to at least said mast assembly; and

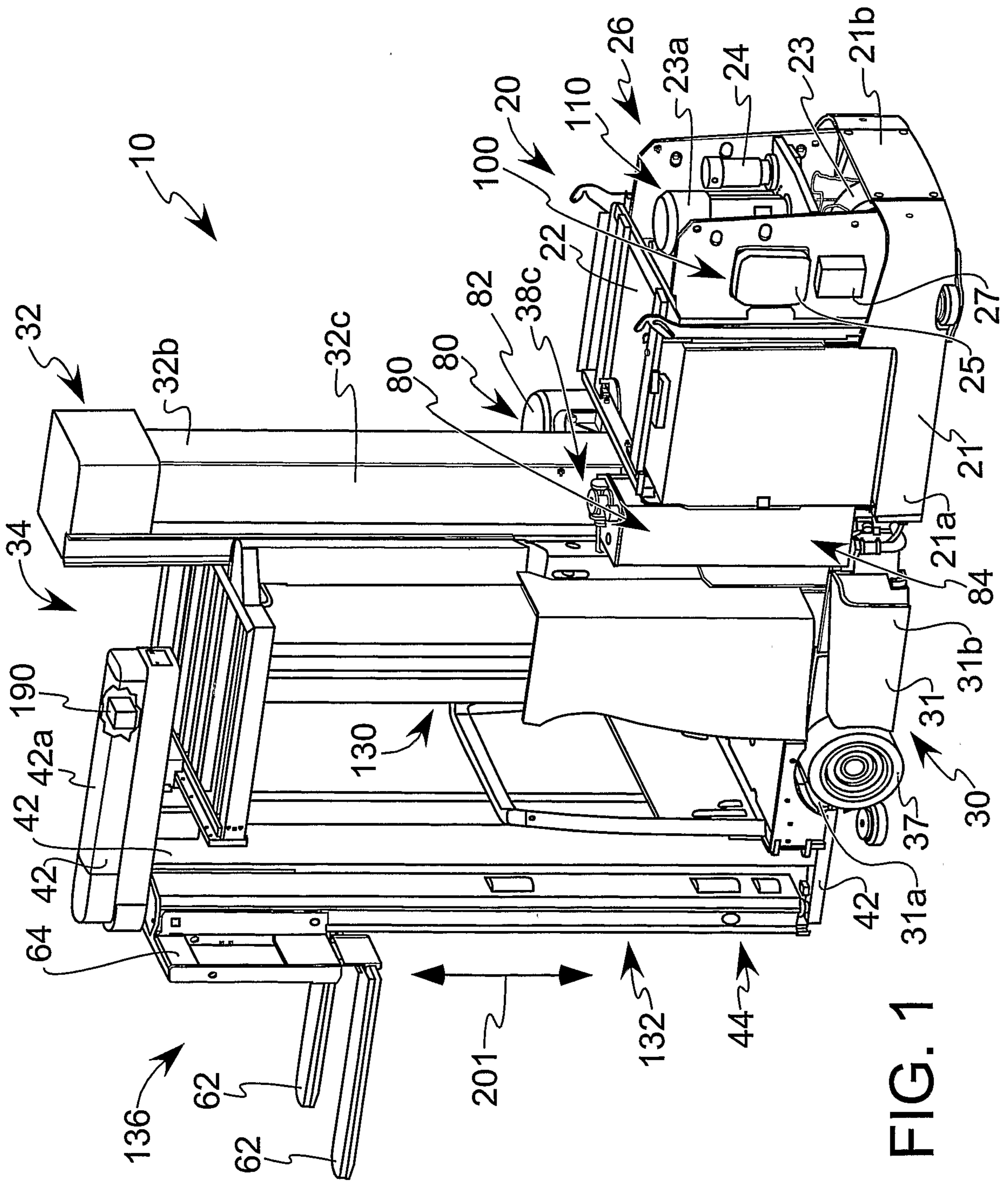
5 a control module controlling the operation of said hydraulic motor/pump assembly of said hydraulic drive apparatus, wherein said control module is mounted on said power unit base.

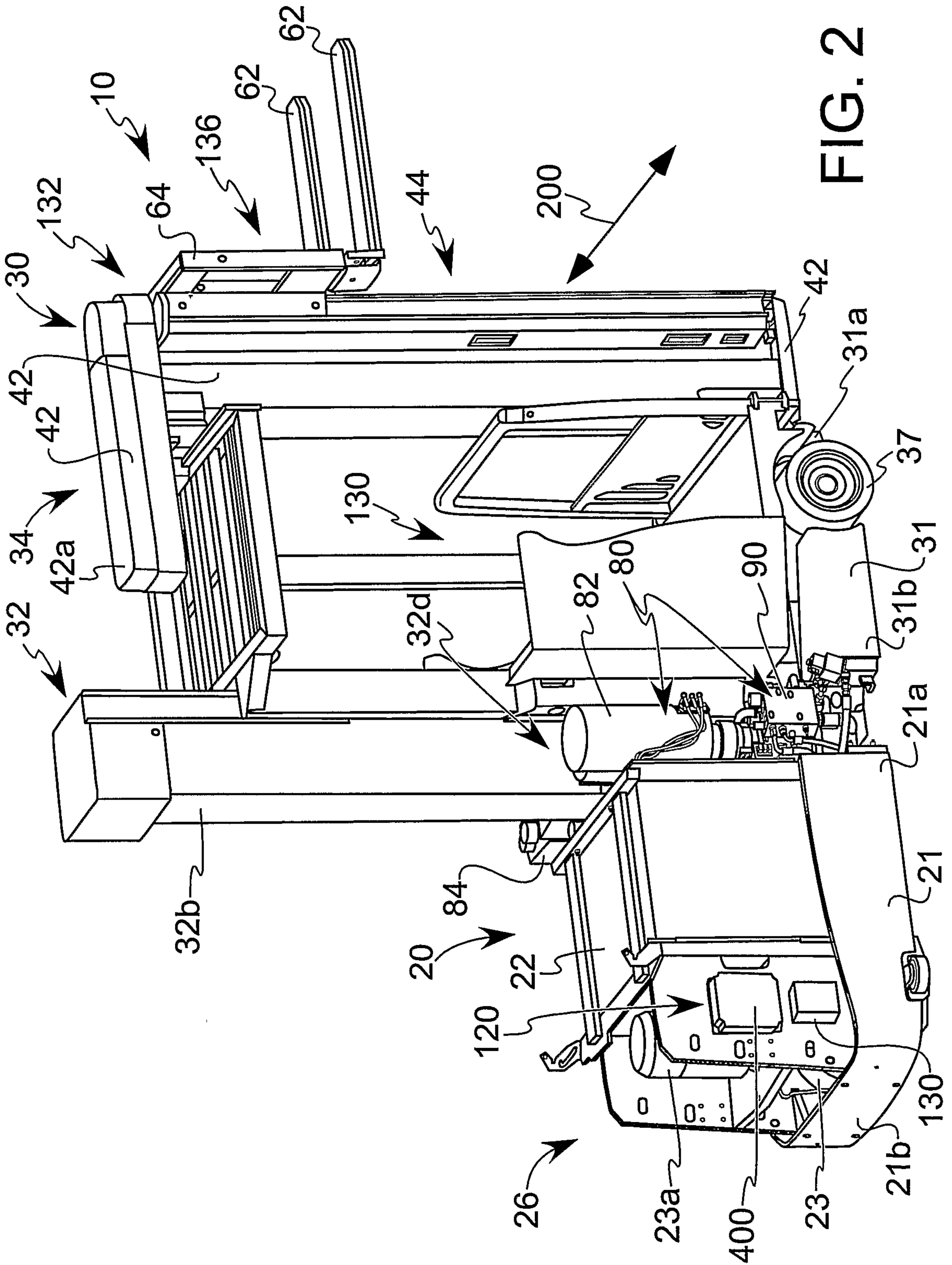
12. The lift truck as set forth in claim 11, wherein said hydraulic drive apparatus further comprises a hydraulic fluid reservoir, and a manifold system.

10 13. The lift truck as set forth in claim 12, wherein main frame base comprises front and rear portions, said mast assembly, said hydraulic fluid reservoir and said hydraulic motor/pump assembly being located at said rear portion of said main frame base, and said reservoir being positioned on a first side of said mast assembly and said motor/pump assembly being positioned on a second side of said mast assembly.

15 14. The lift truck as set forth in claim 11, wherein said system for driving said at least one wheel comprises at least one traction motor, said battery providing power to said at least one traction motor, and at least one control module for controlling the operation of said at least one traction motor.

20 15. A fork lift truck comprising a power unit assembly detachably connected to a main frame assembly, wherein substantially all truck hydraulic components including a hydraulic motor/pump assembly are mounted on the main frame assembly while all truck electronic control
25 modules including a module for controlling said hydraulic motor/pump assembly are mounted on the power unit assembly, and wherein said hydraulic motor/pump assembly receives power from a battery of said power unit assembly, and said main frame assembly is detachable from said power unit assembly without requiring disconnecting hydraulic connections to said power unit assembly.





4 / 7

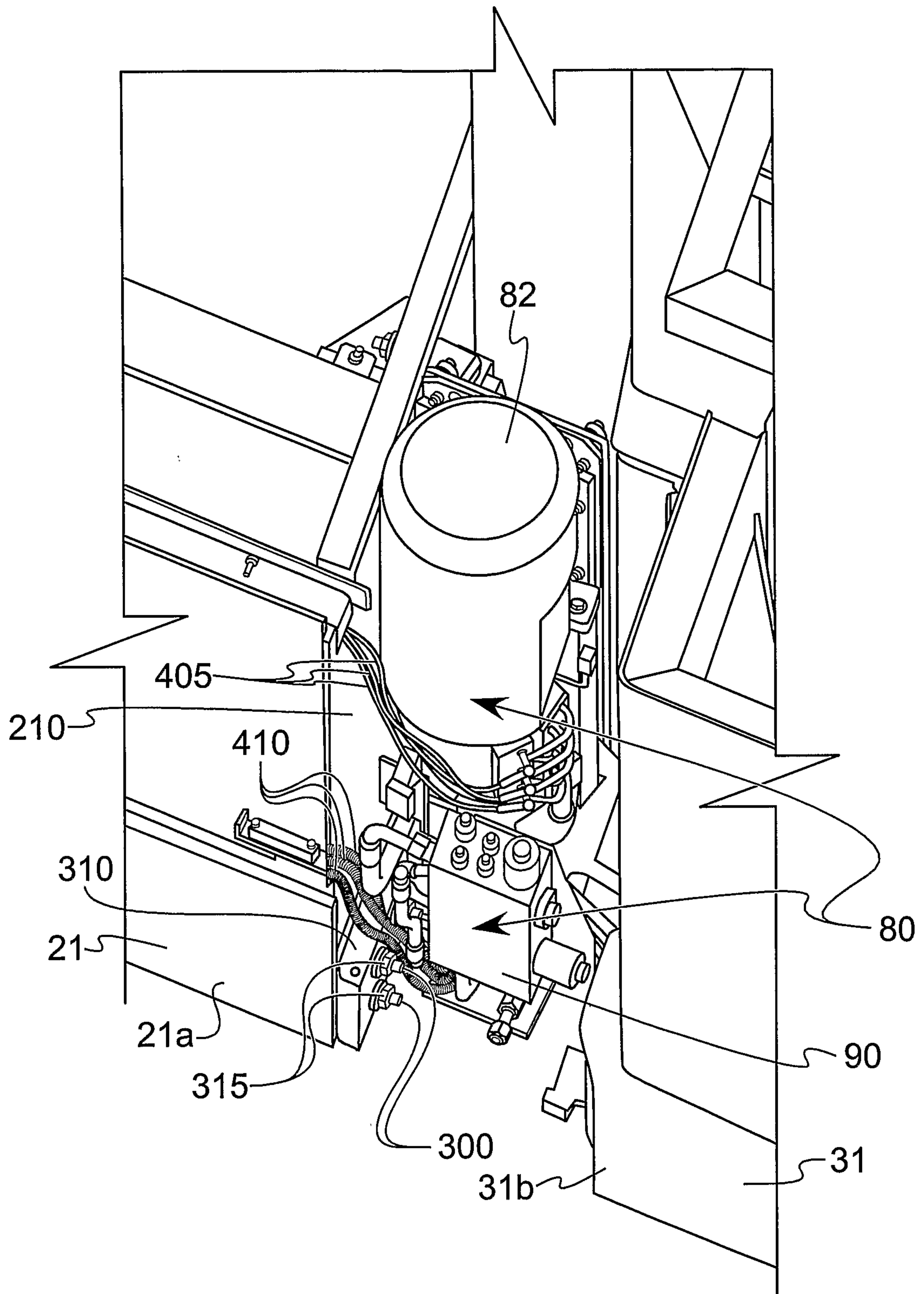


FIG. 3

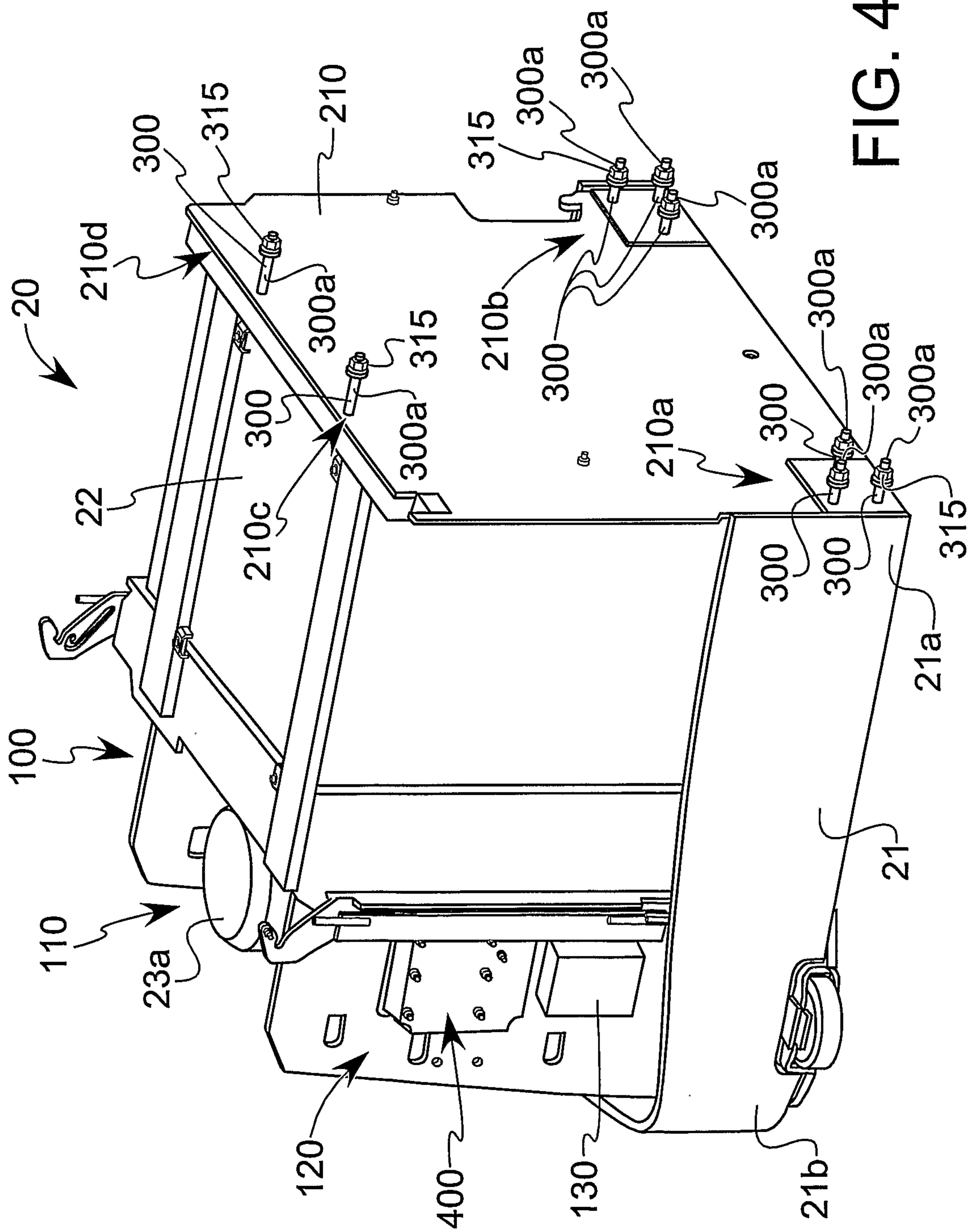


FIG. 4

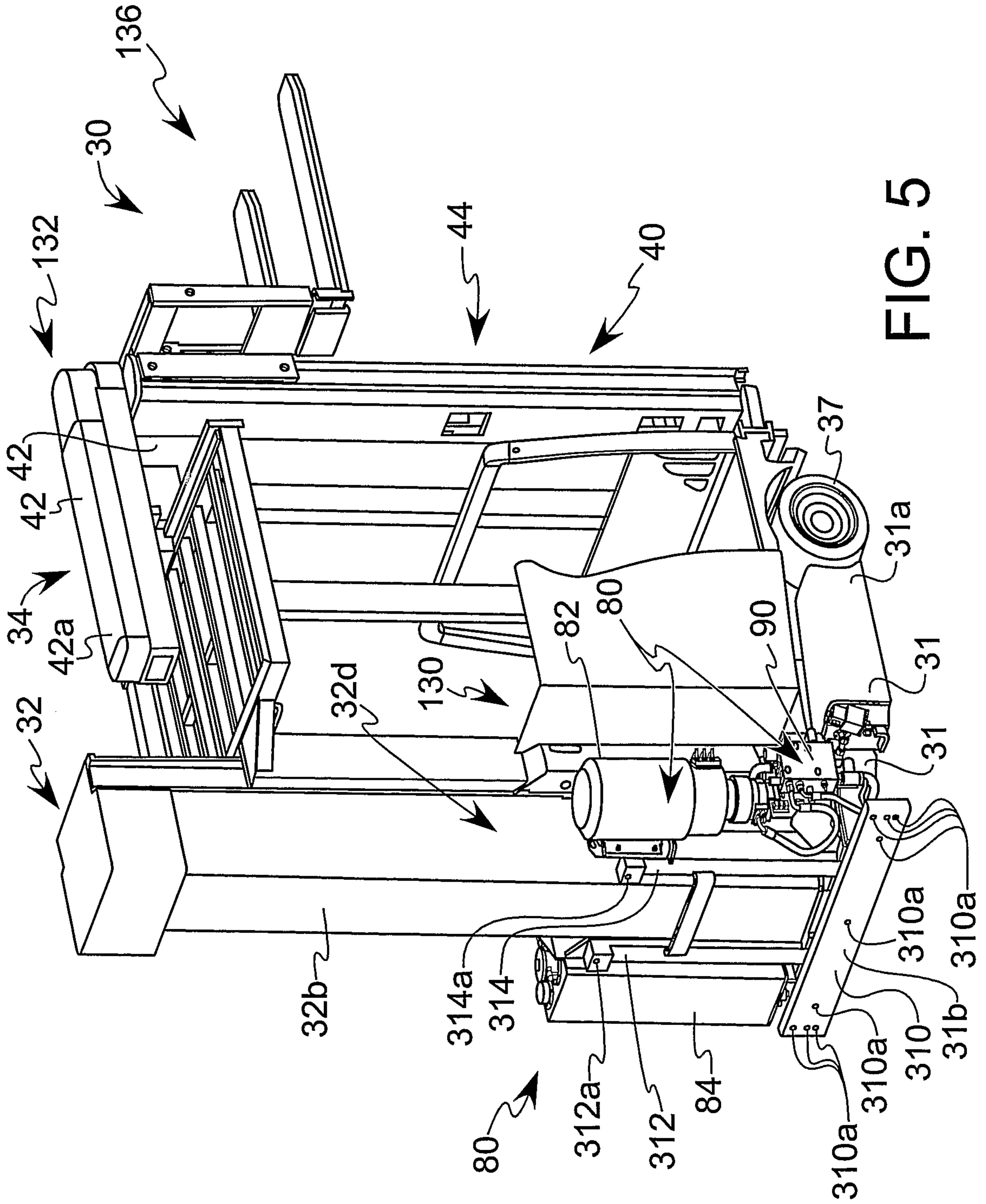


FIG. 5

7 / 7

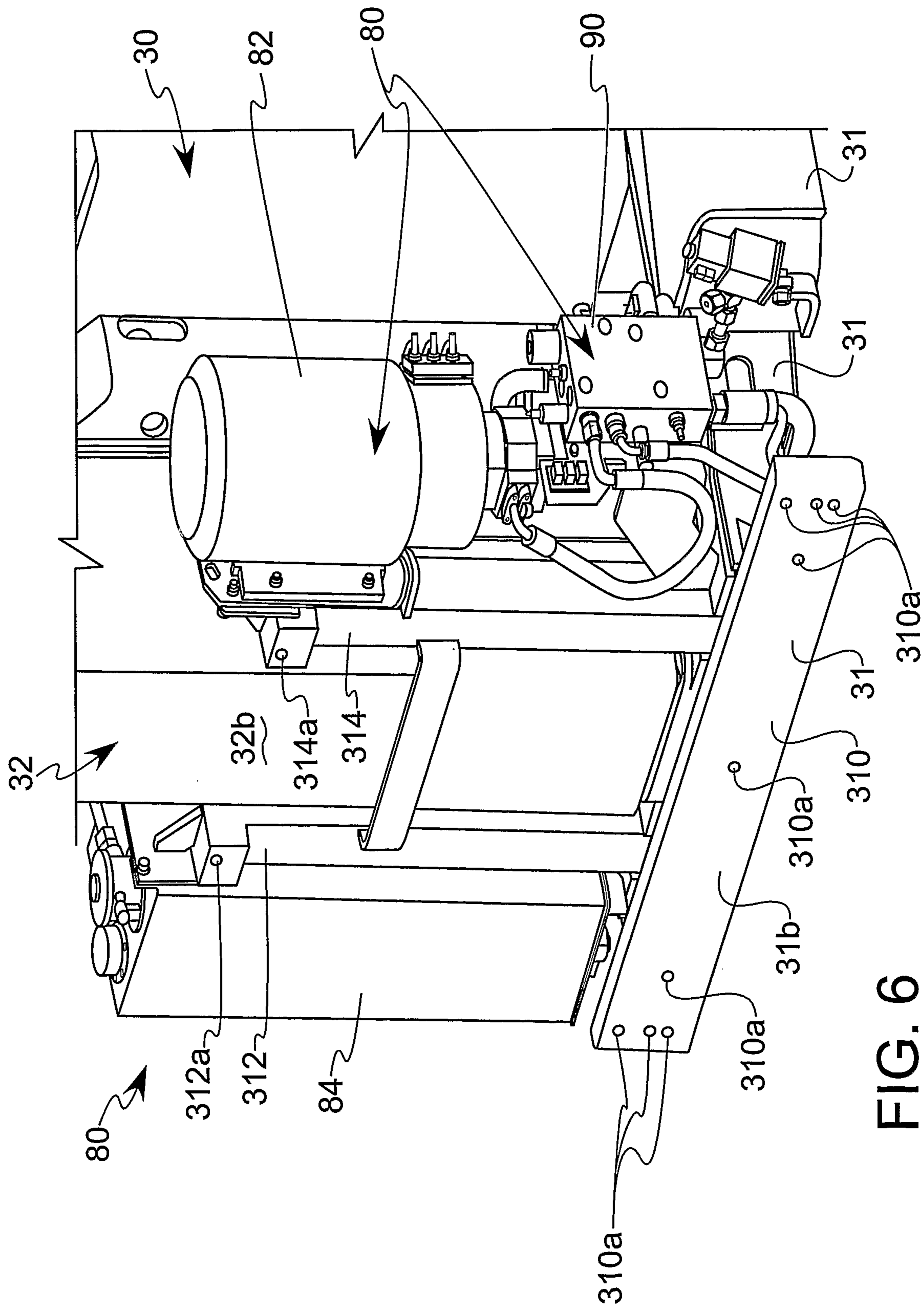


FIG. 6

