United States Patent

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[54] LIFT TRUCK WITH ROTATABLE CARRIAGE

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[52] **U.S. Cl.** **214/78,** 214/768, 214/776

[51] **Int. Cl.** **B60p 1/48**

[58] **Field of Search**.....214/131, 147, 141, 768, 138, 214/80, 730, 671, 78, 776

[56] **References Cited**

UNITED STATES PATENTS

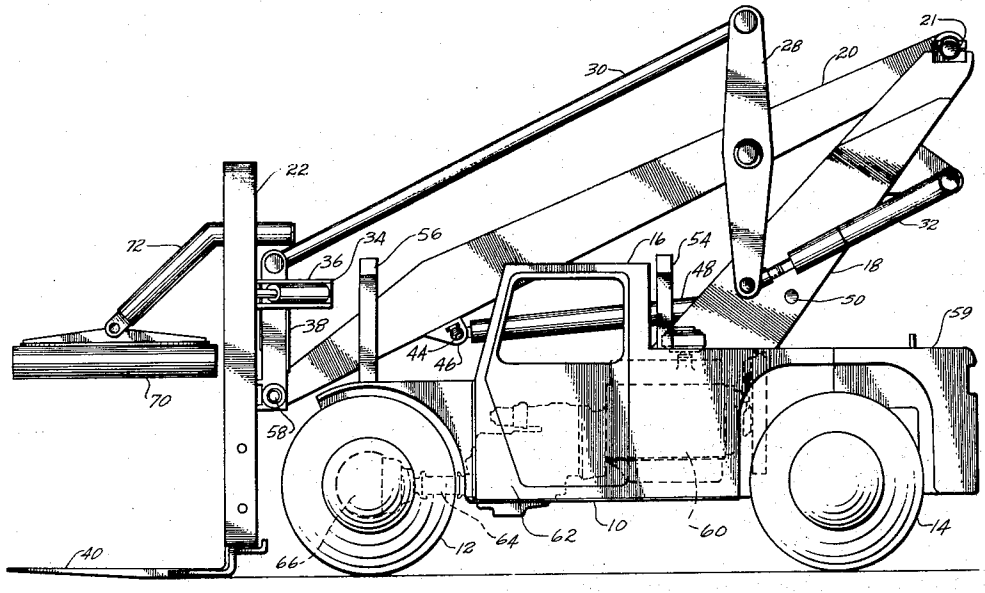
3,554,395	1/1971	Dunbar	214/138 R
2,995,261	8/1961	Soyland et al.	214/138
3,404,792	10/1968	Frieberg	214/80
3,155,251	11/1964	Williamson	214/768
3,454,176	7/1969	Landeborg et al	214/768
3,024,933	3/1962	Albert et al	214/768
3,106,305	10/1963	Gehring	214/730
3,335,879	8/1967	Shaffer	214/671
3,263,834	8/1966	LaTendresse	214/147 G

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[57] **ABSTRACT**

The lift truck described herein includes a front-mounted fork lift carriage supported by a pivot member positioned to one side of its center. To the pivot member is attached a large lift arm supported at its opposite end on a mast at the right rear of the truck chassis, which arm is moved upwardly by means of a hydraulic motor carried on the truck chassis. The operator's cab is located on the left side of the centerline of the truck, and the engine, transmission and differential are essentially centered in the chassis. A linkage carried on the lift arm permits the carriage to be kept level or tilted as needed during raising or lowering of the load. When elevated, the carriage and load may be rotated around the pivot member to place the load in a laterally facing position above the operator's cab. When so rotated, the center of gravity of the load is carried well within the maximum width of the vehicle, and no portion of the carriage or lift mechanism extends significantly beyond the maximum tread width as defined by the outside edges of the tires, although the load may extend beyond the tread width.

9 Claims, 6 Drawing Figures



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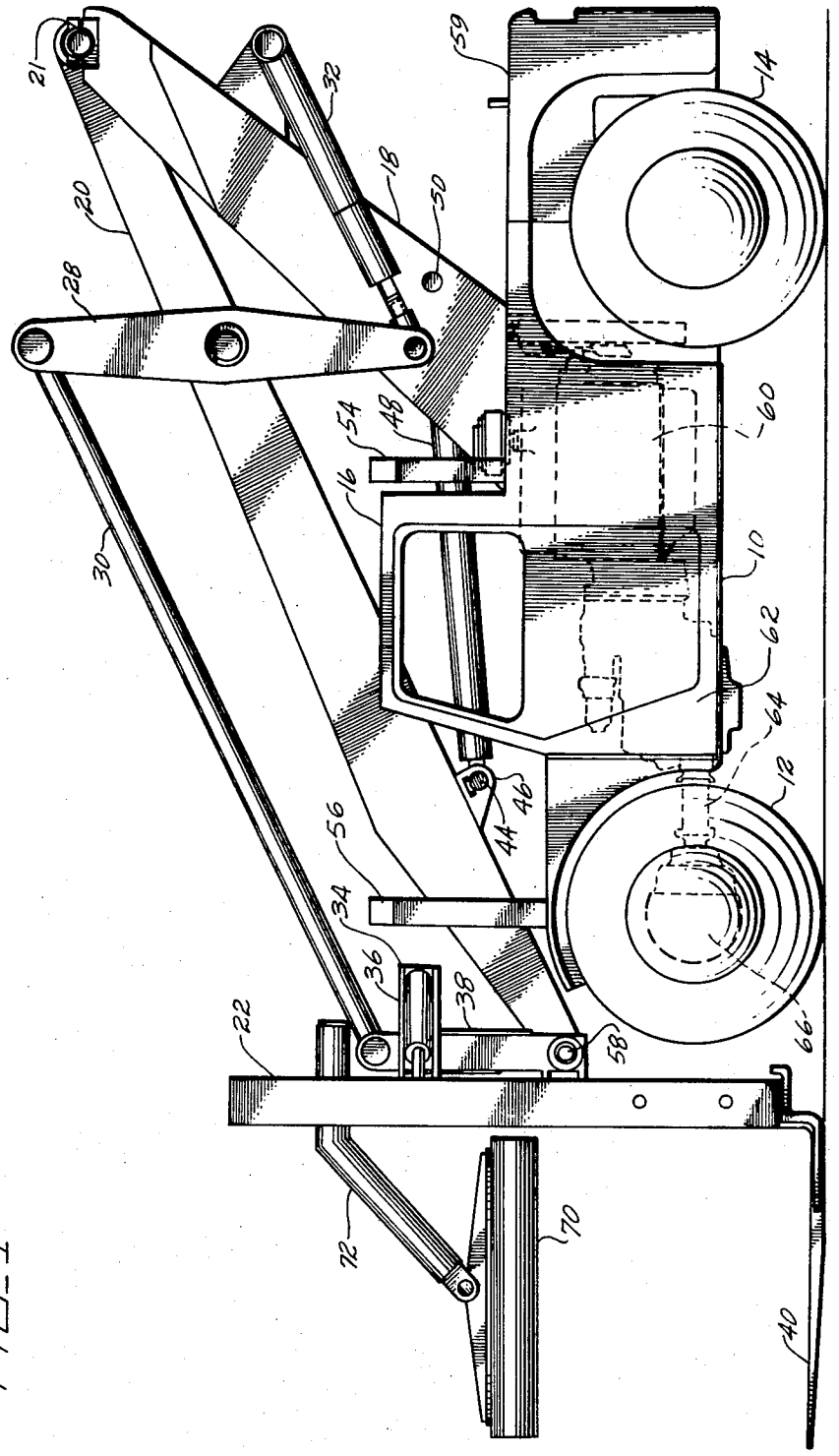


FIG. 1

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FIG. 2

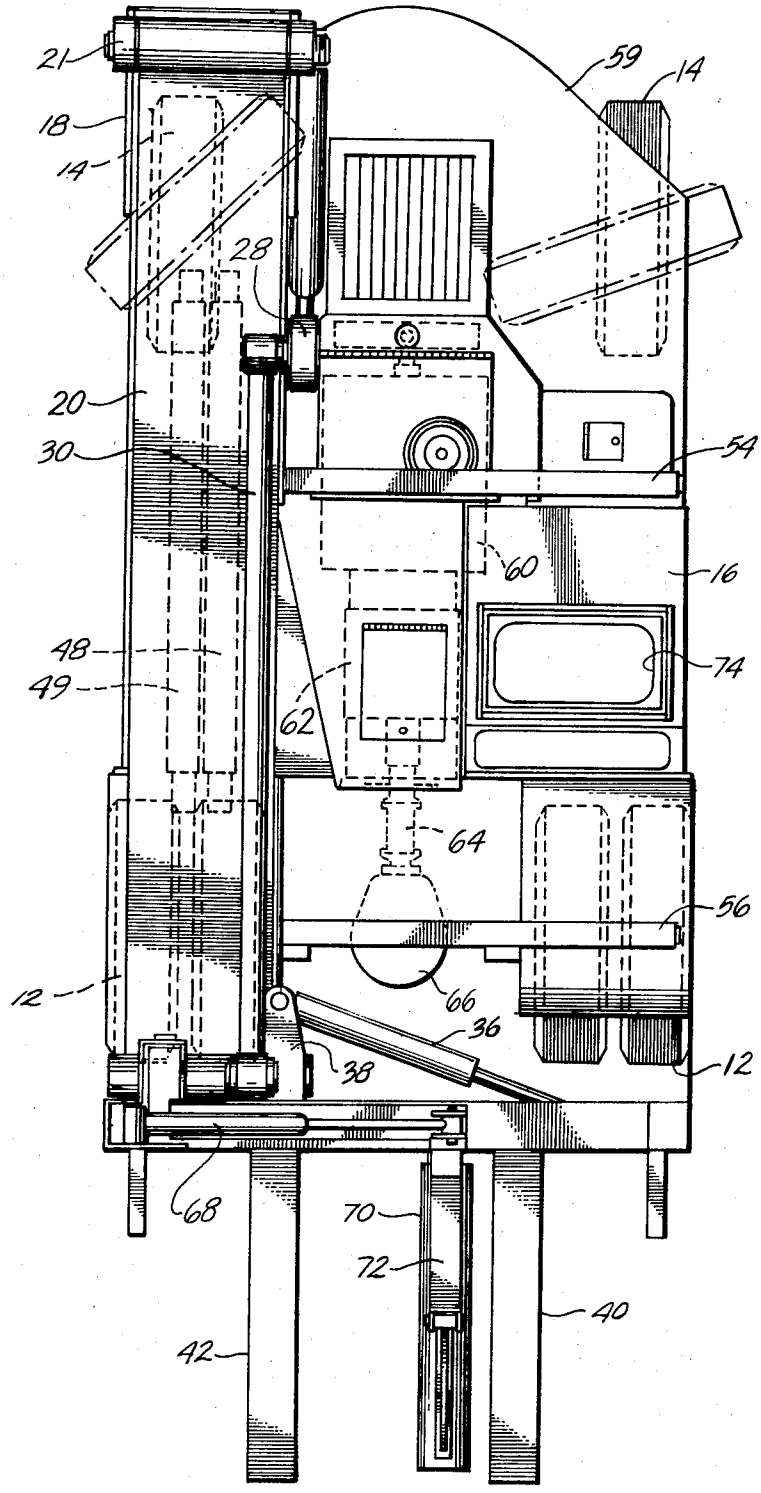

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FIG. 3

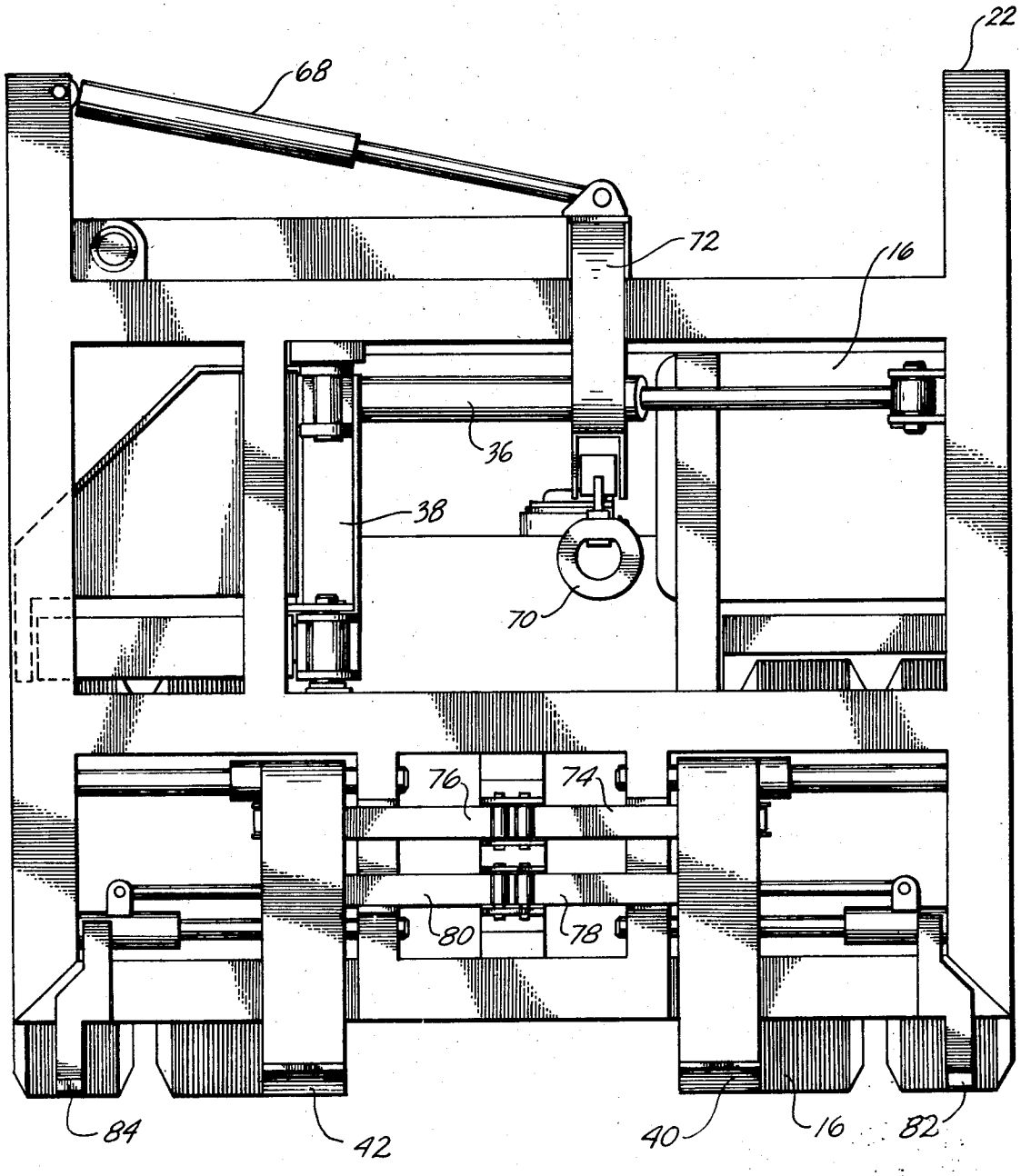


FIG. 4

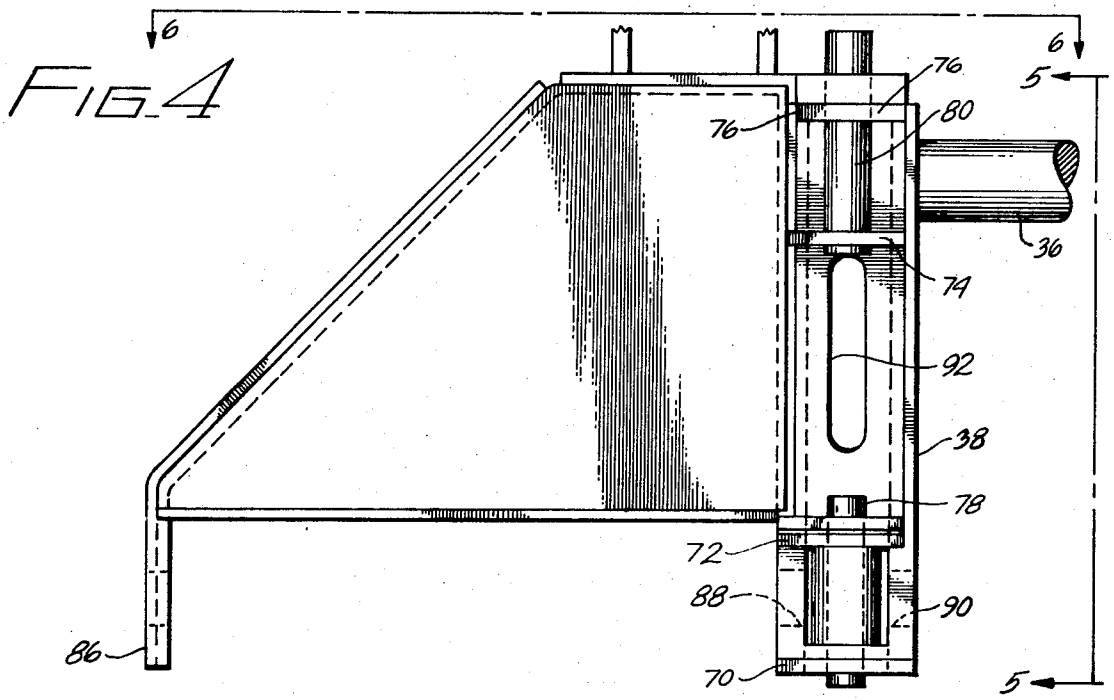


FIG. 5

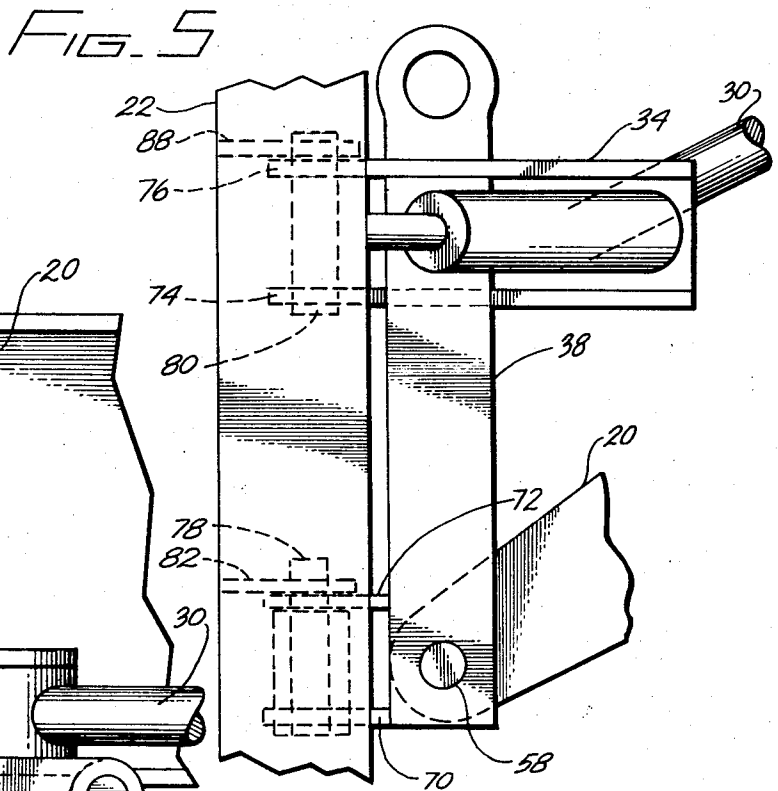
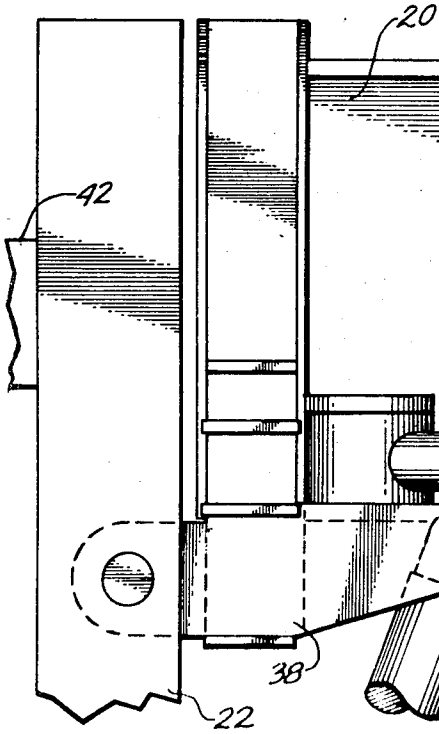


FIG. 6



LIFT TRUCK WITH ROTATABLE CARRIAGE

BACKGROUND OF THE INVENTION

Lift trucks have been designed for handling large, elongated loads wherein a load carrier, such as a fork lift carrier, can be positioned in a forward-facing position relative to the truck to pick up a load and, when the load has been raised to a given height, rotate the load to a laterally facing position to place it parallel to the truck or transport. These lift truck designs are intended to facilitate transport of elongated material along narrow aisles and yet permit front-end loading and unloading. In some instances, however, the load capacity of such lift trucks is limited to a maximum weight or width, or both, by a truck structure that cannot withstand the forces imposed by large loads or that tends to unbalance the truck when the carriage is rotated to a laterally facing position, or that blocks the operator's lateral line of sight when the carriage and load are rotated to a laterally facing position. Other designs have proved to be too large and massive for operation within the restricted aisles available or have made it necessary to provide wider aisles, thus reducing the effective area for storage of material. Also, in some applications a negative lift arrangement is required for getting the lifting mechanism, which is usually a lift fork, next to the ground. The overall height of the truck, unloaded, should be no more than that of conventional lift trucks capable of lifting a load to a comparable height. There is, therefore, a need for a lift truck capable of handling moderately heavy loads but which does not require excessive width of aisleway for transporting the load and which, when loaded, affords good vision for the operator. Such a truck should be well balanced at all stages of cargo handling and should be mechanically simple and straightforward.

SUMMARY OF THE INVENTION

The lift truck which is described herein avoids many of the above objections and meets the above requirements. On a chassis of adequate size and weight are provided an operator's cab located at one side of the chassis and a support mast located to the rear at the opposite side of the chassis which supports a large lift arm member extending forwardly to support the carriage which includes the fork members. A linkage means is connected to the carriage and to the support mast through a hydraulic motor device, which organization permits tilting of the carriage to assist in lifting and carrying the load. The carriage member is fastened to the forward part of the lift arm by means of a vertical pivot structure, and a hydraulic motor means serves to rotate the carriage around this vertical pivot such that the load which is lifted in front of the vehicle may be rotated 90° and carried in a laterally facing position. Additional hydraulic motor means is fastened between the lift arm member and the chassis or the base of the support member for raising and lowering of the lift arm to raise and lower the load. When the load is raised over the operator's cab and pivoted 90° as described, there is little or no obstruction to the operator's vision. The load itself may be completely carried within the maximum width of the truck. Additionally, the entire lifting mechanism, including the main support mast, the lift arm, the pivot structure, and the carriage including the forks, as rotated, remain essentially within the maximum tread width of the vehicle, as defined by the outside edges of the tires.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevation of a lift truck constituting an embodiment of my invention;

FIG. 2 is a top view of the lift truck shown in FIG. 1;

FIG. 3 is a front elevation of the load carrier shown in FIGS. 1 and 2;

FIG. 4 is a view, as seen from the front, of the main carriage pivot frame;

FIG. 5 is a side view of the structure of FIG. 4; and

FIG. 6 is a plan view of the structure shown in FIGS. 4 and 5.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIG. 1 a truck body is shown generally at numeral 10 having a forward set of wheels 12 and a rearward set of wheels 14. An operator's cab 16 is positioned on the left side of the body structure and immediately behind front wheels 12. Carried at the back of the body structure is a vertical support member or mast 18 having a large lift arm 20 attached to the mast by means of a pivot 21. Mounted at the forward end of lift arm 20 is a carriage 22 including lift fork members, only one of which 40, is shown in this view. The carriage 22 is pivotable around a pivot member 38, and the force for moving carriage 22 around pivot 38 is provided by means of a hydraulic motor 36 connected between carriage 22 and a lever 34 forming part of pivot structure 38. Also attached to the lift arm 20 through a pin 44 hold by a boss 46 forming part of arm 20 are actuator rods from the main lift hydraulic motors 48, 49. This motor is pivotally attached to mast 18 through a bearing structure. This arrangement permits the motors 48, 49 to rotate to a limited degree around the bearing 50 as the lift arm 20 is raised. Fastened to body 10 at the rear of the cab 16 is a support stanchion 54 which is designed to bear at least a portion of the weight of the load when it is lifted and rotated to its laterally facing position. A similar stanchion 56 is located at the forward part of the body directly over the front axle for the same purpose. Since the carriage is lifted from the forward part of lift arm 20 at the pivot 58, the entire carriage assembly will swing through an arc as the carriage is lifted. This, of course, causes the load to be moved forwardly somewhat as it is raised, and the weight of the counterweight 59 at the rear of the vehicle must be chosen to take this factor into consideration. As the carriage 22 is lifted, a hydraulic motor 32 acting through the lever 28 and the link 30 will tilt the carriage as required, keeping it level or angled as desired to prevent the load from sliding forwardly off the forks. The hydraulic motor 32 is effective to tilt the carriage 22 forwardly, as well, should it be desirable to lower the front end of the forks to assist in picking up the load. The engine 60, transmission 62, drive shaft 64, and differential gear housing 66 are shown mostly in dotted outline.

FIG. 2 is a top view of the load carrier shown in FIG. 1. In this view it is apparent that the operator's cab 16 is located at the extreme left edge of the vehicle and that the support mast 18 is positioned toward the right edge of the vehicle, as is the main lift arm 20. Other heavy

components shown in dotted outline in this view include engine **60**, transmission **62** and drive shaft **64**, all of which are positioned along the centerline of the vehicle and driving into the differential gear box **66** which is connected to the front wheels **12**. As previously described, when hydraulic motor **36** is retracted the carriage **22** will pivot approximately 90° around the pivot member **38** in such manner as to place the load over the cab **16** and across stanchions **54** and **56**.

Also visible in FIG. **2** is a hydraulic motor **68** which cooperates with a load clamp **70** fastened to an arm **72**. This load clamp is useful for holding stacks of cargo, such as lumber, but its use is optional, and it may not be required for many types of cargo. Also shown in this view is a window **74** located at the top of cab **16**. It is the purpose of this window to enable the driver to see the load when in elevated position so that it may be stacked at the maximum height that the carriage can be raised. FIG. **3** shows a front view of the vehicle depicted in FIGS. **1** and **2**. In this view front wheels **12** are shown as dual wheels for supporting the load concentrated at the front of the vehicle. The operator's cab **16** is positioned on the left side of the vehicle (as viewed from the cab). The main support mast **18** and the lift arm **20** and associated components at the rear of the vehicle have been omitted from this view, since they are clearly shown in FIGS. **1** and **2**. It will be observed from the position of pivot member **38** that the load will normally be carried well within the outer edges of the tires on front wheels **12**. Alternatively, it could extend somewhat beyond the edge of the vehicle if aisle conditions permit without danger of moving the center of gravity of the load so far outwardly as to involve danger of upsetting. With reference to FIG. **3**, the vehicle shown is almost exactly 8 feet wide, and a typical load positioned in the laterally facing position would normally be approximately 4 feet wide. If this load were as much as 6 feet wide, it would extend somewhat beyond the left edge of the vehicle, but its center of gravity would still be well within the maximum tread width of the vehicle.

Lift forks **40** and **42** are shown in this view, and these forks may be moved laterally by means of hydraulic cylinders **74** and **76**. Similar hydraulic cylinders **78** and **80** move small auxiliary forks **82** and **84** laterally with respect to forks **40** and **42**, respectively, thereby providing a means for clamping dunnage boards or members upon which a load may be stacked. This structure has been included for completeness only since it has been described in copending application Ser. No. 45,746 in the name of Robert L. Roller (common assignee).

FIG. **4** shows the pivot member **38** as seen looking into the front of the vehicle as in FIG. **3**. The lift carriage **22** is supported on a pair of lower bosses **70** and **72** and a pair of upper bosses **74** and **76** which act in conjunction with similar members formed on carriage **22** to enable the carriage structure to be rotated around a lower pin member **78** and an upper pin member **80**. These parts are also visible in the side view of member **38** shown in FIG. **5**. Also shown in FIG. **5** are the cooperating bosses **82** and **84** attached to carriage **22**. Member **38** is pinned to the front of the main lift member **20** by means of a boss **86** and drilled ports **88** and **90** which are aligned to receive a pivot pin supported in a journal such as that at pivot **58** (FIG. **1**). A pair of slots **92** provide a passageway through member **38** for hoses.

FIG. **5** shows the main lift arm member **20** attached, as by means of a journaled pivot **58**, to the pivot member **38**. Also attached to this member is link **30** of the parallelogram linkage which serves to keep the carriage structure level as the load is raised.

A plan or top view of the structure shown in FIGS. **4** and **5** appears in FIG. **6**. The carriage member **22** is shown, as is a portion of the fork **42**. Pivotally attached to carriage **22** is lever **34** which forms a part of the pivot member **38** and which is attached at its opposite end to one end of the hydraulic motor **36**. The link **30** forming part of the parallelogram linkage is also shown attached to a portion of the pivot member **38**.

It is necessary that the pivot member **38** be strong enough to support the entire load on carriage **22** and, since the load is carried off-center, to operate with a moment arm effectively acting on a lever extending from the center of gravity of the load to a line extending through pins **78** and **80**. From FIG. **2** and other structure described above, it will be recognized that as the rod **36***a* drawn into the interior of the hydraulic motor **36** the carriage structure **22** will pivot around the pivot member **38**, and more specifically around pins **78** and **80**. While these devices have been shown as rather simple hinge structures, those skilled in the art will recognize the necessity for proper bearings, etc., to carry the loads imposed.

From the foregoing it will be appreciated that the applicant herein has devised a load carrier vehicle which can lift and transport an elongated load in essentially the same manner as does a conventional fork lift truck but which has the capability of transporting the load in a laterally facing attitude such that the load and the lift mechanism are always within or substantially within the outer edges of the vehicle, and thus the vehicle and load can travel through aisles which are barely wide enough to accommodate the vehicle chassis alone. With the load so transported, the view from the operator's cab has very little obstruction either forward or to the sides, which adds considerably to the safety of operation. The maximum height of the vehicle is no greater than that which would normally be required for a conventional fork lift truck having the capability of lifting loads to the same height for stacking. While the single arm structure shown does require some accommodation of unbalanced forces, these forces are all operating with relatively short lever arms, and therefore the resulting moments are easily accommodated. And while hydraulic motor means are shown throughout for operating the lift, tilt and pivot mechanisms and would be preferable, other motor means such as electrically driven actuators would be quite operative.

I claim:

1. A lift truck comprising a chassis and rearwardly and forwardly mounted wheel assemblies fastened to said chassis, an operator's cab mounted on said chassis between said wheel assemblies and to one side of said chassis such that its lowest point is not substantially above the axis of rotation of said wheel assemblies,

a prime mover carried on said chassis and drivably connected to at least one of said wheel assemblies,

a vertically extending support mast mounted toward the rear of said chassis and at the opposite side from said cab,

a lift carriage for lifting and carrying a load to be picked up at the front of said truck and a pivot arm connecting said carriage to said support member, said connection including a pivot member permitting said carriage to rotate around a substantially vertical axis, and first motor means fastened between said pivot member and said carriage to effect said rotation such that said load is carried above said cab with its center of gravity well within the tread width of said truck; and

second motor means for raising and lowering said pivot arm to raise and lower said lift carriage.

2. A lift truck as set forth in claim **1** including a linkage connected between said lift carriage and said pivot member and third motor means connected in said linkage for tilting said lift carriage.

3. A lift truck as set forth in claim **2** wherein said linkage is a parallelogram linkage and said motor means is a hydraulic motor.

4. A lift truck as set forth in claim **1** wherein said prime mover is an engine connected between said wheel assemblies, forward of said support mast, and substantially centered relative to said wheel assemblies.

5. A lift truck as set forth in claim **1** wherein stanchion members are fastened to said chassis for supporting the rotated load.

6. A lift truck as set forth in claim **1** wherein said support member and pivot arm are located within the maximum tread width of said truck.

7. A lift truck as set forth in claim **1** wherein said second motor means is a hydraulic motor pivotally mounted with respect to said chassis.

8. A lift truck as set forth in claim **2** wherein said pivot member includes a pair of spaced, vertically aligned bearing structures and a lever attached at one end to said carriage and at its opposite end to said first motor means.

9. A lift truck as set forth in claim **8** wherein said pivot member includes a pair of spaced, horizontally aligned bearing structures, and pivotable support means is carried in said bearing structures connecting said lift arm to said pivot member.

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