Feb. 7, 1967 F. C. HEIDRICK 3,302,810

SELF-LOADING FORK LIFT TRUCK

Filed Aug. 13, 1964 4 Sheets-Sheet 1

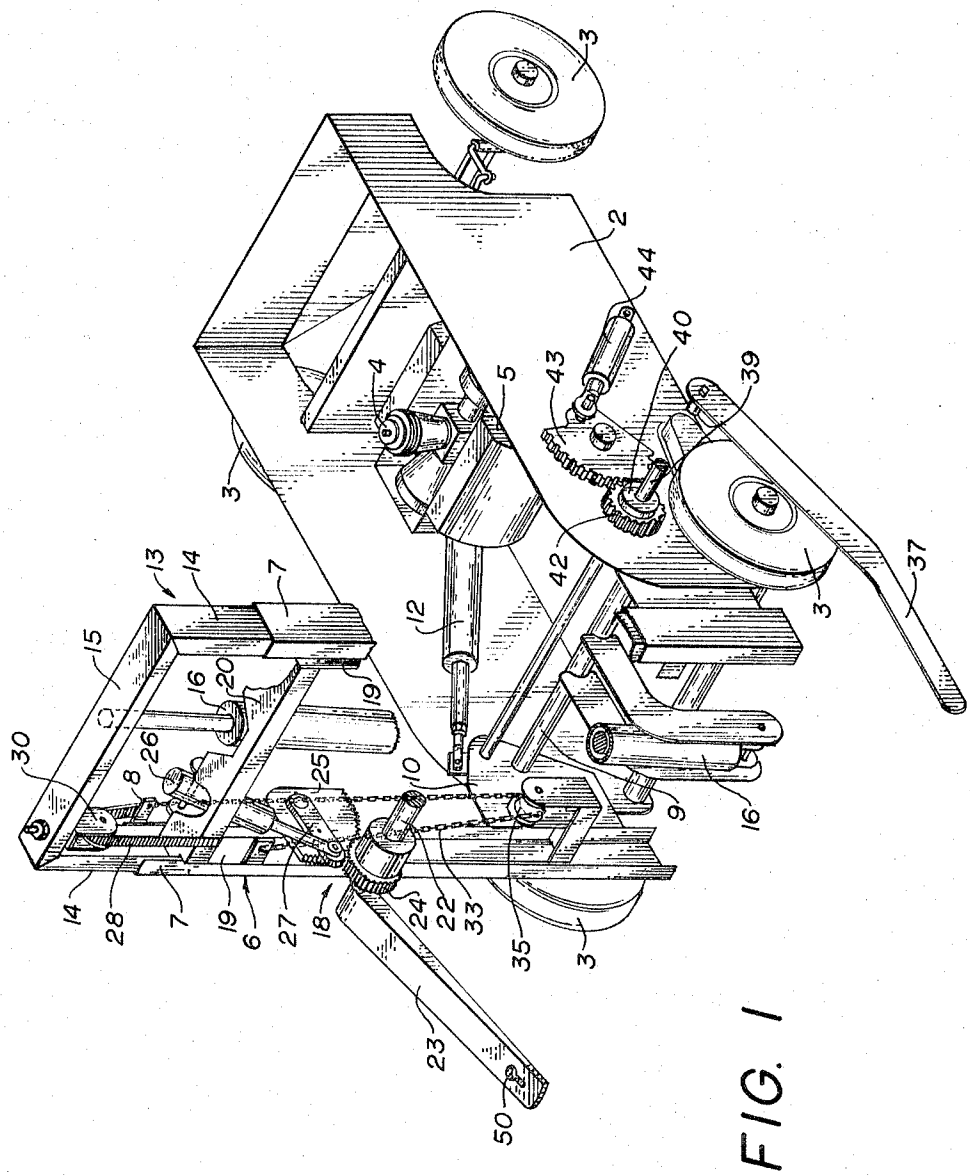


FIG. 1

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Filed Aug. 13, 1964 4 Sheets-Sheet 2

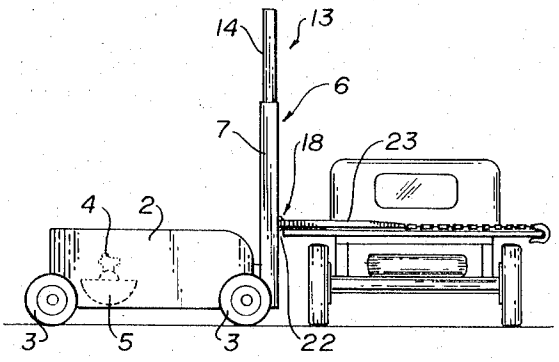


FIG. 2

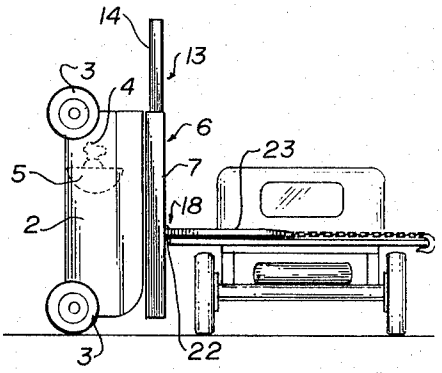


FIG. 3

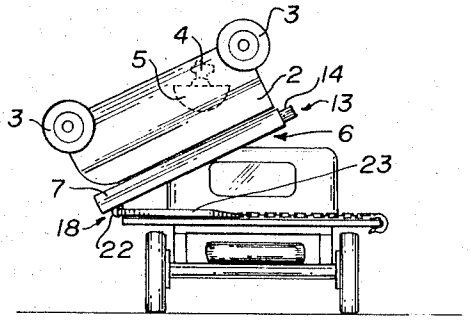


FIG. 5

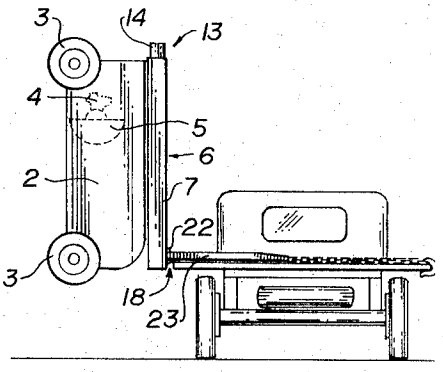


FIG. 4

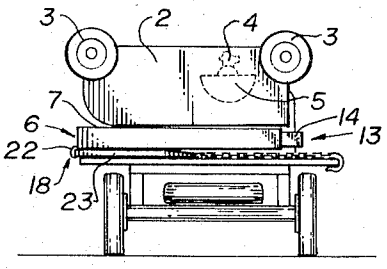


FIG. 6

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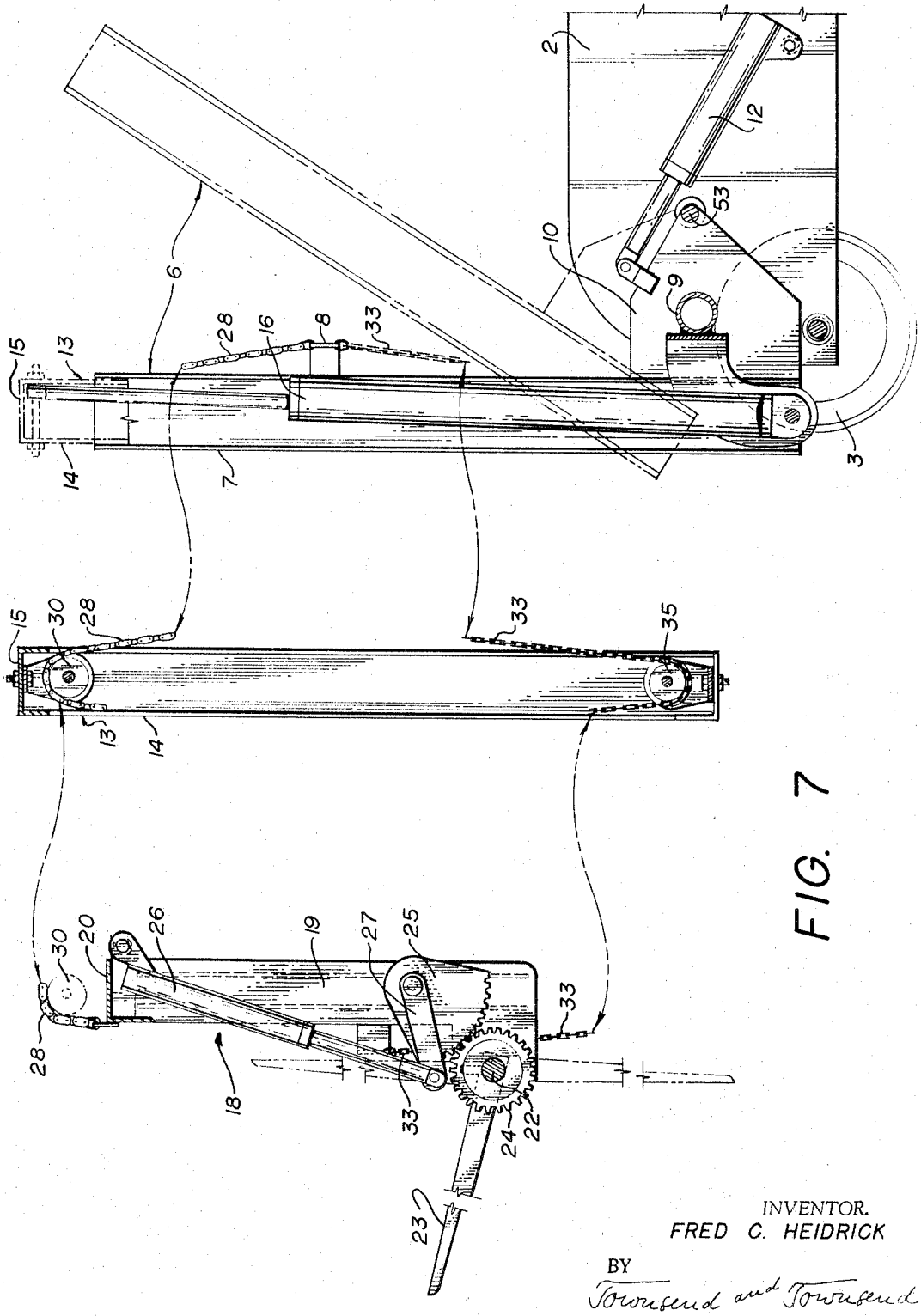


FIG. 7

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SELF-LOADING FORK LIFT TRUCK

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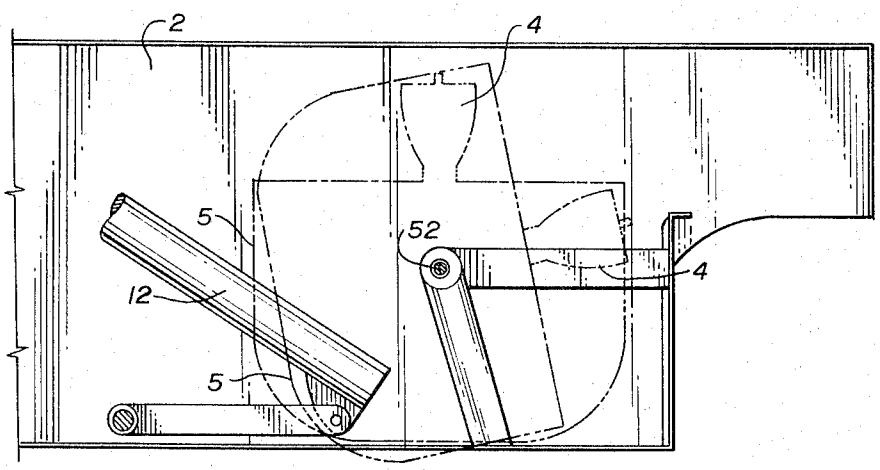


FIG. 8

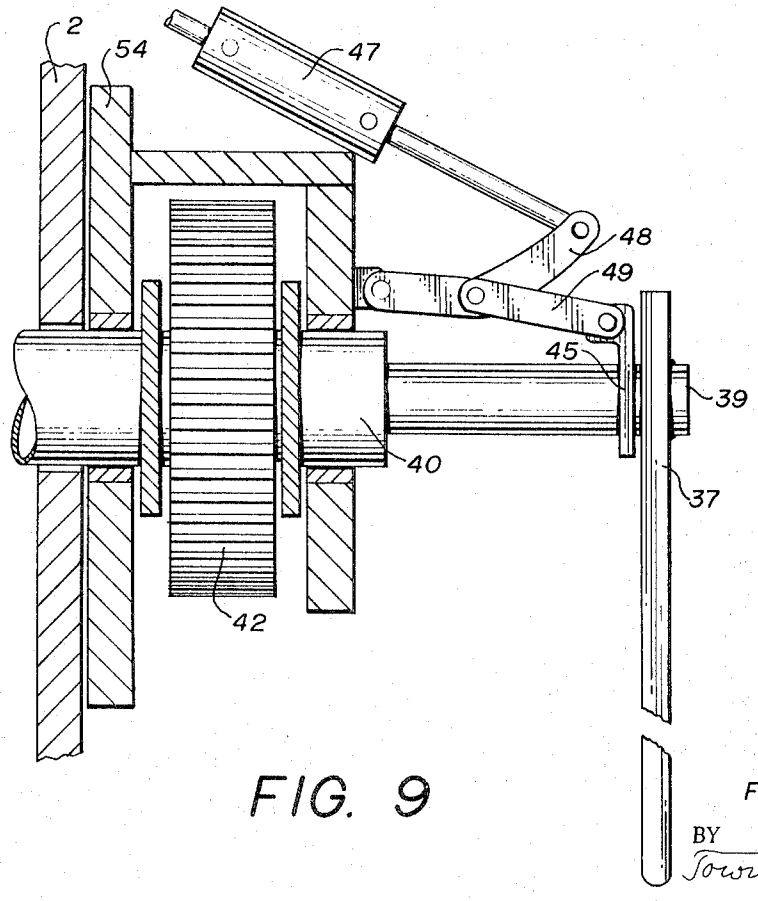


FIG. 9

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3,302,810

Patented Feb. 7, 1967

3,302,810

SELF-LOADING FORK LIFT TRUCK

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Filed Aug. 13, 1964, Ser. No. 389,267
9 Claims. (Cl. 214—660)

This invention relates to fork lift trucks and more particularly to a fork lift truck which is capable of lifting itself from the ground onto and off of the bed of a carrier or other elevated surface.

It is usually economically feasible to keep a fork lift truck only at a site where it will be often used. At job sites where only one or a few loads will require the use of a fork lift truck, it is usually necessary to bring a fork lift truck especially for the purpose of handling only these loads. At the present time, however, there is no inexpensive method by which fork lift trucks may be transported from site to site to perform lifting jobs. Particularly there is now no way in which a single operator can load and unload a fork lift truck onto and off of the bed of the same carrier which is used to carry the load requiring the services of the fork lift truck.

It is an object of the present invention to provide a fork lift truck which has the capability of using its own power to lift itself onto and off of the bed of a truck or other carrier. This is basically accomplished by providing a fork lift truck with the ability to lift itself by its fork lift arms when the fork lift arms are secured to a position on the bed of a carrier and to rotate itself from a customary upright position to a substantially upside-down position. To achieve this rotation, there are provided a mast which will pivot from its customary substantially vertical position to a substantially horizontal position over the top of the fork lift truck, and fork lift arms which will rotate from their customary substantially horizontal position to a substantially vertical position against the mast. The lifting power is achieved by providing means for pulling the fork lift arms downwardly on the mast instead of, as is customary, allowing the fork lift arms to descend by force of gravity. When, therefore, the fork lift arms are held at a given level, such as when they are secured to the bed of a truck, the opposite reaction may be induced, that is, the force that exerts downward pull on the fork lift arms exerts upward pull on the mast, thereby lifting the fork lift truck relative to the fork lift arms.

Since it is contemplated that an internal combustion engine wil be used to provide the fork lift truck with power and since the engine must be kept operating through the rotation of the fork lift truck, means are provided to insure that the engine will remain upright while the fork lift truck rotates about it.

Because it is desirable that the fork lift truck be relatively light in weight so that it may be self-lifting and so that it will ride easily on the top of loads as well as directly on the bed of a carrier, it is contemplated that the fork lift truck wil be made of light weight materials such as aluminum.

Other advantages and purposes of the present invention will become apparent upon reading the following specification and referring to the accompanying drawings.

In the drawings:

FIG. 1 is a perspective view of the present invention with various parts cut away.

FIG. 2 is a simplified side elevation of the fork lift truck as it is parked adjacent a carrier and secured to the bed of the carrier.

FIG. 3 is a simplified side elevation of the fork lift truck as it appears after being rotated to a vertical position.

FIG. 4 is a simplified side elevation of the fork lift truck as it appears after being elevated while in vertical position.

FIG. 5 is a simplified side elevation of the fork lift truck as it appears while being rotated from a vertical position to a resting position on the bed of a carrier.

FIG. 6 is a simplified side elevation of the fork lift truck as it appears while in a resting position on the bed of the carrier.

FIG. 7 is an exploded side view of the mast and associated lifting structure of the fork lift truck of the present invention.

FIG. 8 is a side elevation of the engine and hydraulic tank of the fork lift truck as mounted for rotation in the frame.

FIG. 9 is an end elevation of the support arm structure of the fork lift truck showing the frame and supporting housing in cross section.

Referring now to the drawings, the fork lift truck of the present invention, as best shown in FIG. 1, is constructed on frame 2 which is preferably made of a light weight metal such as aluminum. Attached to frame 2 are wheels 3 which give the fork lift truck a self-driving capability. Wheels 3 are driven by hydraulic pressure which is provided by an engine-pump 4 pumping hydraulic fluid contained in tank 5 through any standard hydraulic system for driving wheels, a number of which are well known in the art.

Engine 4 and tank 5 are pivotally mounted on frame 2 so as to allow engine 4 and tank 5 to pivot freely through a substantially vertical arc. Any standard type pivot mountings 52, such as shown in FIG. 8, may be used, the only requirement being that engine 4 and tank 5 must be free to rotate as illustrated in FIG. 8. The reason for the necessity of providing such a rotation capability for engine 4 and tank 5 will be explained hereinafter.

Mounted on frame 2 is mast 6 which preferably consists of two longitudinal members 7 and at least one cross member 9. Mast 6 is mounted on frame 2 in such a manner that it is free to pivot from a position where longitudinal members 7 lie in a substantially horizontal plane directly over frame 2 to a position where longitudinal members 7 stand in a substantially vertical position. Any standard pivoting device may be used. However it is preferable that there be two standard pivot mountings 53, one at each side of frame 2, each pivot mounting being connected by a member 10 to a longitudinal member 7 of mast 6.

Pivoting mast 6 between a substantially vertical position and a substantially horizontal position is preferably accomplished by a pair of hydraulic rams 12, one end of each of which is pivotally attached to frame 2, the second end of each of which is pivotally attached to mast 6, preferably at member 10 of mast 6. Hydraulic rams 12 are double acting; that is, the cylinders of hydraulic rams 12 have a hydraulic fluid connection at each end. These fluid connections connect at their other end to tank 5. Thus the pistons of hydraulic rams 12 may be forced toward either end of the cylinders in response to the

hydraulic pressure induced in the fluid in tank 5 by engine 4. In turn, mast 6 will be pivoted through its arc.

Bridge 13 consisting preferably of longitudinal members 14 and cross member 15 is mounted within mast 6. Longitudinal members 14 of bridge 13 fit into and are slidably engaged with the longitudinal members 7 of mast 6. Bridge 13 is extended outwardly or inwardly in relation to mast 6 by means of hydraulic ram 16. Hydraulic ram 16 is mounted at one end to a relatively fixed point of the fork lift truck, preferably to cross member 9 of mast 6 or to another point near the bottom of mast 6 when mast 6 is standing in a vertical position. The second end of hydraulic ram 16 is connected to bridge 13, preferably to cross member 15 of bridge 13. Hydraulic ram 16 is also a double acting ram; that is, it is able to receive hydraulic fluid at each end. By pumping hydraulic fluid into the one end of the cylinder the connecting rod of ram 16 is forced outwardly of the cylinder, thus also forcing bridge 13 outwardly of mast 6. By reversing this process, that is by pumping hydraulic fluid into the second end of the cylinder, the connecting rod is forced inwardly to the cylinder, thereby also telescoping bridge 13 into mast 6. Hydraulic ram 16 receives hydraulic fluid through connections with tank 5 and is thus responsive to the pumping pressures generated by engine 4.

Slidably engaged within bridge 13 is a fork lift unit generally depicted at 18. Fork lift unit 18 preferably comprises two longitudinal members 19 and at least one cross member 20. Longitudinal members 19 are slidably engaged within longitudinal members 14 of bridge 13. Attached to fork lift unit 18 is shaft 22 which extends across the front of fork lift unit 18 in a substantially horizontal plane. Fixed to shaft 22 and extending outwardly at substantially right angles from the axis of shaft 22 are fork arms 23. Also attached to fork lift unit 18 are means for rotating shaft 22, which means preferably comprise spur gears 24 mounted substantially near each end of shaft 22. Gear sections 25 are rotatably mounted one on each longitudinal member 19 of fork lift unit 18 in a position such that the teeth of each gear section 25 engage the teeth of a spur gear 24. Hydraulic rams 26, one end of each of which is attached to one of longitudinal members 19 of fork lift unit 18 and the other end of each of which is attached to a point near the periphery of one of gear sections 25 and, preferably, in order to increase the leverage of hydraulic rams 26 on gear sections 25, to rod member 27 which is fixed to the face of each gear section 25 and which extends beyond the periphery of a gear section 25, are used to rotate shaft 22. Hydraulic rams 26 are double acting and have fluid connections to tank 5 and are thus responsive to the pumping pressure generated by engine 4. When fluid is introduced into hydraulic rams 26 the fluid pressure forces the connecting rod outwardly or inwardly from the cylinder, thus imparting rotation to gear sections 25 which in turn rotate spur gears 24 and thus also shaft 22 and fork arms 23.

Fork lift unit 18 is held in position relative to bridge 13 by means of a pair of chains 28 from which fork lift unit 18 is suspended. One such chain 28 is shown in FIG. 1, the second chain 28, which is cut away in FIG. 1, being mounted opposite chain 28 as shown. Chains 28 pass upwardly from their positions of attachment to fork lift unit 18 and then around a pair of pulleys 30 which pulleys are rotatably mounted substantially near the top of bridge 13, preferably on cross member 15. One such pulley 30 is shown in FIG. 1, the second pulley 30, which is cut away in FIG. 1 being mounted in a position opposite pulley 30 as shown. Chains 28 after passing over pulleys 30, are secured at their second ends to a relatively fixed position on the fork lift truck, preferably to fixed points 8 on mast 6.

Fork lift unit 18 is lifted in relation to mast 6 and bridge 13 by means of hydraulic ram 16 being extended. When hydraulic ram 16 is extended bridge 13 is telescoped outwardly of mast 6. When this happens upward force is exerted against chains 28 by pulleys 30. Since chains 28 are secured at their second ends to fixed points 8, the first ends are pulled upwardly as chains 28 pass over pulleys 30. The first ends of chains 28 thus pull fork lift unit 18 upwardly. Because of the pulley effect, the rate of ascent of fork lift unit 18 is substantially twice that of the rate of movement of bridge 13.

Also secured each at one end to fork lift unit 18 are chains 33. From fork lift unit 18 chains 33 pass downwardly around pulley 35 which pulleys are rotatably mounted on bridge 13 substantially near the bottom of bridge 13 and preferably one on each of longitudinal members 14. After passing over pulleys 35 chains 33 are attached at their second ends to relatively fixed points on the fork lift truck, again preferably to fixed points 8. The lowering of fork lift unit 18 in relation to mast 6 and bridge 13 is achieved, not by gravity, but by forcing hydraulic fluid into the upper end of the cylinder of hydraulic ram 16 thus forcing the piston of hydraulic ram 16 downwardly. This downward motion of the piston telescopes bridge 13 into mast 6 and thus lowers fork lift unit 18 which is suspended from bridge 13 on chains 28. Chains 33 act to pull fork lift unit 18 downwardly because pulleys 35 attached to bridge 13 are necessarily lowered with bridge 13 thus imparting downward movement to the first ends of chains 33 which are attached to fork lift unit 18. The pulley effect of chains 33 on pulleys 35 is to substantially double the rate of descent of fork lift unit 18 as compared to the rate of descent of bridge 13.

Because the apparatus of the present invention is preferably of light weight construction and because, when the mast is in vertical position fork arms 23 will be extended outwardly from frame 2, heavy loads will tend to tip the fork lift truck toward the weight of the load. To prevent this tipping when the fork lift truck is in a stationary position, support arms 37 are provided. Support arms 37 are rotatably mounted on frame 2, and in housing 54 which is attached to frame 2, and extend outwardly from frame 2 in the same direction as fork arms 23. Support arms 37, when used in a supporting position, extend from frame 2 outwardly and downwardly to the ground and are held in that position, thus preventing the fork lift truck from tipping. Support arms 37 are rotatable by virtue of being connected to a hydraulic gear arrangement as best shown in FIG. 1. Each support arm 37 is secured to a shaft 39 which in turn is secured for rotation in a rotatable hub 40 mounted in frame 2 and in housing 54 as shown in FIG. 9. Secured to rotatable hub 40 is spur gear 42. Rotatably mounted on frame 2 is gear section 43 whose teeth engage the teeth of spur gear 42. A hydraulic ram 44 is pivotally mounted at one end to frame 2 and pivotally mounted at its other end to a point near the periphery of gear section 43. Hydraulic ram 44 has fluid connection to tank 5 and is thus responsive to hydraulic pressure generated by engine 4. Hydraulic pressure applied to hydraulic ram 44 extends the connecting rod of hydraulic ram 44 thus rotating gear sector 43. This rotation imparts a counter rotation to spur gear 42 which, in turn, imparts rotation to hub 40 and thus rotation to support arm 37 through shaft 39.

It further may be required that support arms 37 be adjustable along their respective axes of rotation; that is, toward or away from frame 2, in order that support arm 37 may be flexible in being positioned. This may be necessary, for example, to avoid the wheels of the carrier when the fork lift is being made ready to lift itself aboard the carrier. In the present invention provision is made to adjust the spacing between frame 2 and the planes of rotation of support arms 37. As aforementioned shaft 39 is secured for rotation only in hub 40. Shaft 39, is however, slidably engaged with hub 40 in such a manner as to allow shaft 39 to telescope outwardly from or inwardly toward hub 40 in the direction of its axis. This

type of relationship is preferably achieved by shaft 39 being square or rectangular in shape and being fitted into hub 40 in an opening of the same size and shape. The adjustment of each of support arms 37 away from or toward frame 2 may be achieved, as shown in FIG. 9, by hydraulic ram 47, which is pivotally attached at one end to frame 2 and at its second end to one end of a bell crank 48, the other end of bell crank 48 being pivotally attached, preferably, to housing 54 on frame 2. Rod member 49 is connected at one end to a collar 45 mounted on shaft 39 and its second end to bell crank 48. When the connecting rod of hydraulic ram 47, which has fluid connection to tank 5, is extended outwardly under hydraulic pressure imparted by engine 4, the bell crank 48 pivots away from frame 2 thus forcing rod member 49 and collar 45 away from frame 2. Collar 45, being secured to shaft 39, thus extends shaft 39 to a point farther distant from frame 2. In an opposite manner shaft 39 may be telescoped into hub 40 by virtue of the rod of hydraulic ram 47 being contracted into the cylinder of hydraulic ram 47. Using this type of adjustment mechanism, hydraulic ram 47 must be a double acting ram.

In order for the fork lift truck of the present invention to lift itself onto the bed of a carrier, it must be first properly positioned with respect to the carrier. The lifting operation is best shown in FIGS. 2 through 6. The apparatus is driven to a point adjacent the carrier and fork arms 23 are placed along substantially their entire length on the bed of the carrier. This is done with mast 6 in a substantially vertical position. Fork arms 23 are secured in position on the bed of the truck, preferably by removable chains which are attached at one end to fork arms 23 through link engaging openings 50 defined therein, and, which are attached at their second end to the bed of the carrier at a point opposite the side of the bed where the fork lift truck is being readied. Support arms 37 meanwhile are used to brace the fork lift truck in position against the side of the truck. This is done by rotating support arms 37 to position where they rest upon and are held under hydraulic pressure against the sides of the bed of the carrier. This support will prevent the fork lift truck from moving under the carrier during the lifting operation.

Hydraulic rams 12 are then subjected to hydraulic pressure in the direction which would normally rotate mast 6 from a vertical position to a horizontal position above frame 2. However, since mast 6 is held in a vertical position against the bed of the truck by virtue of fork arms 23 being chained down, the effect of this hydraulic pressure instead is to rotate frame 2 upwardly to a vertical position adjacent mast 6, as shown in FIG. 3. Hydraulic ram 16 is then activated in the direction that would normally telescope bridge 13 downward into mast 6, thus also lowering fork lift unit 18. Again, however, since fork arms 23 are chained in position against the bed of the truck the opposite effect is produced; that is, mast 6 is telescoped upwardly over bridge 13 raising frame 2 along with it. It is here that the importance of chains 33 become apparent in that by chains 33 exerting downward pull on fork lift unit 18, frame 2 is lifted upwardly.

When frame 2 is suspended from the side of the bed of the carrier in a position as shown in FIG. 4, which will allow the fork lift truck to be tilted over onto the bed of the carrier, hydraulic rams 26 are activated to rotate fork arms 23 upwardly. Once again, however, since fork arms 23 are secured to the bed of the carrier the opposite reaction occurs, that is, frame 2 along with mast 6 and bridge 13 are rotated about shaft 22 downwardly toward the bed of the carrier, as shown in FIG. 5, until the entire apparatus is resting upside down on the bed of the carrier, as shown in FIG. 6. The operator, at this point, may further secure the fork lift truck in any manner deemed desirable and he is ready to drive off to meet the remainder of his schedule. It is to be noted that the present invention may also be loaded in the above described manner on top of a load that is already in the bed of the carrier merely be securing fork arms 23 on top of the load instead of on the bed of the carrier. To lift the fork lift truck of the present invention off of the bed of the carrier, the opposite actions of the above described steps are taken.

It is at this point apparent why engine-pump 4 and tank 5 are pivotally mounted for free rotation through a substantially vertical arc. Engine-pump 4 supplies the pumping power which is necessary to accomplish the above described steps and, since an internal combustion engine is contemplated, must remain in an upright position in order to operate while frame 2 is first pivoted upwardly to a vertical position, and then, secondly, rotated onto the bed of a carrier in an upside down position. Engine-pump 4, because it is rotatably mounted on frame 2, remains in an upright position as shown in FIGS. 2 through 6. Tank 5 is thus also rotatably mounted so as to remain in an upright position to prevent leakage and to maintain a fixed relationship to engine-pump 4. This fixed relationship permits simplicity in maintaining a pumping connection between engine-pump 4 and tank 5.

Preferably, tank 5 is mounted directly on and beneath engine-pump 4. This arrangement offers the advantage of providing a lower center of gravity to engine-pump 4 than it itself would have and thus more likely insures free rotation of engine-pump 4 so that it will remain upright.

When the present invention is on the ground and is being used in its capacity as a fork lift truck, it is contemplated that the normal carrying position of a load will be over frame 2. This is because the light weight construction of the apparatus, which preferably is constructed of aluminum, will not permit substantial loads to be carried on fork arms 23 when mast 6 is in a vertical position without causing forward tipping of the fork lift truck. Support arms 37 are used to prevent this tipping when the fork lift truck remains stationary, but they cannot be used when the fork lift truck is moving. To center the weight of the load on fork arms 23 over frame 2, mast 6 is tilted back toward frame 2 by properly controlling hydraulic rams 12. By also controlling hydraulic rams 26 fork arms 23 are meanwhile maintained in a horizontal position to keep the load balanced thereon. Mast 6 may be rotated downward as far as the weight of the load requires, even to a horizontal position so that the load is riding directly on top of frame 2. By carrying a load in this fashion, the fork lift truck of the present invention can carry considerable weight despite being itself of light construction.

As is apparent from the foregoing description, six sets of hydraulic controls may be desired. This is because the present invention is provided with hydraulic rams 12, 16, 26, 44 and 47 in addition to the standard hydraulic drive system connecting engine-pump 4 to wheels 3. Suitable valves as are generally known in the art may be used to control the flow of hydraulic fluid between tank 5 and the foregoing hydraulic rams. A standard control panel is provided at a convenient position on frame 2 so that the operator of the fork lift truck can control all hydraulic rams from a single position.

It is contemplated that the present invention will not provide a seat on which an operator may sit. Instead it is contemplated that the operator will walk beside the fork lift truck and maintain control of the operations of the apparatus through the control panel position. However, a seat and different control arrangement might be provided without departing from the present invention.

A number of modifications may be made without departing from the spirit of the invention and I do not intend to limit myself except as set forth in the claims which follow.

What is claimed is:

1. In a fork lift truck, capable of self-loading onto and off of the bed of a carrier, having a frame, an engine-pump mounted on the frame, a tank for containing hydraulic fluid mounted on the frame and connected to the engine-pump, a mast mounted on the frame, and a fork lift unit having fork lift arms attached to the mast, the improvement comprising attaching means for securing said fork lift arms in a fixed position relative to the carrier; lifting means actuated by fluid from the tank for causing the frame to be moved relative to the fork lift unit when the fork lift arms of the fork lift unit are fixed to the bed of a carrier; rotation means including linkages between the fork lift arms and the mast and between the mast and the frame actuated by fluid from the tank for rotating the frame and mast from a suspended position adjacent the carrier to a resting position on the carrier; and mounting means for maintaining the engine-pump operating independently of the position of the frame.

2. Apparatus according to claim 1 wherein said mounting means comprises pivot mountings attached to said frame, said pivot mountings being adapted to receive said engine-pump in rotational relationship thereto, said pivot mountings being adapted to permit said engine-pump to remain in an upright position while said frame is rotated between a horizontal and a vertical position.

3. Apparatus according to claim 1 wherein the linkage between the mast and the frame comprises pivot mountings attached to said frame, said pivot mountings being adapted to receive said mast in pivotal relationship thereto and to permit said mast to pivot through an arc between a substantially horizontal position parallel with and adjacent a plane across the top of said frame and a substantially vertical position.

4. Apparatus according to claim 1, wherein said lifting means comprises a bridge slidably engaged with said mast and said fork lift unit; a double acting hydraulic ram activated by fluid from said tank connected at one end to said mast and connected at the other end to said bridge to telescope said bridge relative to said mast; at least one pulley attached to said bridge below said fork lift unit; a chain positioned around each of said pulleys and connected at one end to said fork lift unit and connected at the other end to said mast at a point above said pulley.

5. Apparatus according to claim 1 wherein the linkages between the fork lift arms and the mast comprise means for pivotally mounting the fork lift arms on the fork lift unit so that the fork lift arms of the fork lift unit are movable through a substantially 180 degree arc, and means for pivoting the fork lift arms under positive control.

6. Apparatus according to claim 1, wherein said linkage between the fork lift arms of the fork lift unit and the mast comprises a substantially horizontal shaft rotatably mounted on said fork lift unit, the fork lift arms being mounted on said shaft; at least one gear sector rotatably mounted on said fork lift unit; a spur gear associated with each of said gear sectors attached to said shaft so as to mesh with the teeth of its associated gear sector; at least one double acting hydraulic ram actuated by fluid from the tank for each cooperating gear sector and spur gear, pivotally connected at its first end to said fork lift unit and pivotally connected at its second end to a point near the periphery of the gear sector whereby said hydraulic ram will rotate the fork lift arms of the fork lift unit relative to the mast.

7. Apparatus according to claim 6 and further including a rod member fixed to the face of said gear sector and extending outwardly of the periphery of said gear sector; attaching means on said rod member for pivotally connecting the second end of said hydraulic ram to the outward end of said rod member, whereby said hydraulic ram may exert greater leverage for rotation on said gear sector.

8. Apparatus for fork lifting and carrying articles which has self loading and self un-loading capabilities comprising a frame; a first pair of pivot mountings attached to said frame, an engine-pump rotatably mounted in said first pair of pivot mountings on a substantially horizontal axis, said first pair of pivot mountings permitting said engine-pump to remain in an upright position when said frame is rotated; a tank for containing hydraulic fluid mounted to surround the underside of said engine-pump and in fluid connection with said engine-pump; a second pair of pivot mountings attached to said frame; a mast pivotally mounted on said second pair of pivot mountings on a substantially horizontal axis, said second pair of pivot mountings permitting said mast to be pivoted through an arc between a substantially vertical position and a substantially horizontal position, comprising two parallel longitudinal members and at least one cross-member connecting said longitudinal members; a first pair of double acting hydraulic rams having fluid connection to said tank and being pivotally connected at one end to said frame and being pivotally connected at their other end one to each longitudinal member of said mast; a bridge having two parallel longitudinal members and at least one cross-member connecting said parallel longitudinal members, each of said two parallel longitudinal members being slidably engaged with one of the two parallel longitudinal members of said mast, the cross-member of said bridge connecting the parallel longitudinal members of said bridge near the ends of the longitudinal members farthest removed from the pivot point of said mast; a double acting hydraulic ram having fluid connection to said tank connected at one end to the cross-member of said bridge and connected at the other end to the cross-member of said mast; a fork lift unit having two parallel longitudinal members slidably engaged with the longitudinal members of said bridge, at least one cross-member connecting said longitudinal members, a shaft rotatably mounted between the longitudinal members, a pair of lifting forks fixed on the shaft, a pair of spur gears fixed on the shaft, a pair of gear sectors each rotatably mounted on one of the longitudinal members with the teeth of each of the gear sectors engaging the teeth of one of the pair of spur gears, a pair of double acting hydraulic rams each having fluid connection to said tank with one end of each of the hydraulic rams being pivotally connected to one of the longitudinal members, the second end of each of the hydraulic rams being pivotally connected to one of said pair of gear sectors; a first pair of pulleys mounted on the cross-member of said bridge; a second pair of pulleys mounted one on each of the longitudinal members of said bridge; a first pair of chains each secured at one end to one of the longitudinal members of said mast and passing upwardly and around one of said first pair of pulleys and each secured at their second end to said fork lift unit thereby supporting said fork lift unit in slidable engagement with said bridge; a second pair of chains each secured at one end to one of the longitudinal members of said mast and passing downwardly and around one of said second pair of pulleys and each secured at their second end to said fork lift unit; a pair of support arm units each mounted on opposite sides of said frame and each comprising a hub rotatably mounted on said frame and extending outwardly from said frame, a shaft axially slidably engaged in the hub extending outwardly from the hub and fixed to rotate with the hub, a support arm fixedly mounted to the shaft near the outer end of the shaft, means for sliding the shaft in and out of the hub.

9. In a fork lift truck, capable of self-loading onto and off of the bed of a carrier, having a frame, power means mounted on the frame, mounting means permitting operation of said power means independently of the position of the frame, a mast mounted on the frame, and a fork lift unit having fork lift arms attached to the mast, the improvement comprising attaching means for securing said fork lift arms in a fixed position relative to the carrier; lifting means actuated by said power means for

causing the frame to be moved relative to the fork lift unit when the fork lift arms of the fork lift unit are fixed to the bed of a carrier; and rotation means including linkages between the fork lift arms and the mast and between the mast and the frame actuated by said power means for rotating the frame and mast relative to the lift arms and carrier from a suspended position adjacent the carrier to a resting position on the carrier.

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