

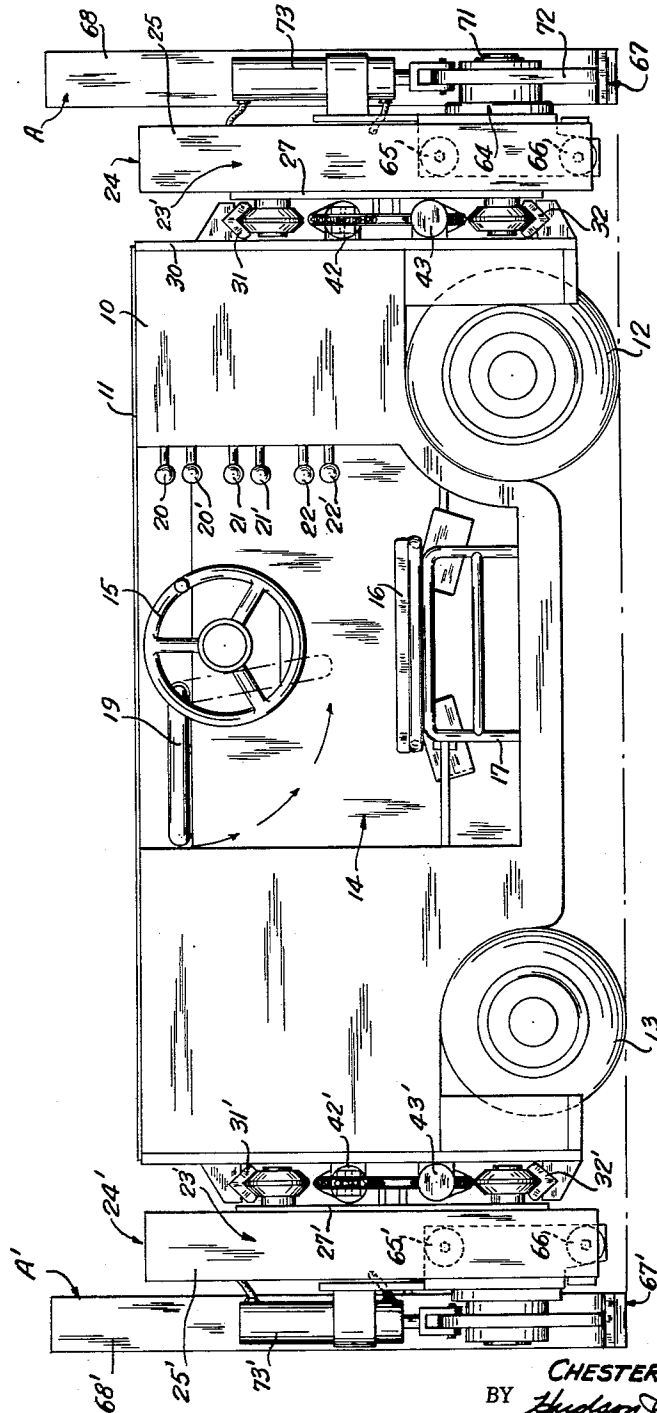
June 4, 1963

C. H. POWERS
INDUSTRIAL LIFT TRUCK

3,092,268

Filed Oct. 13, 1958

5 Sheets-Sheet 1



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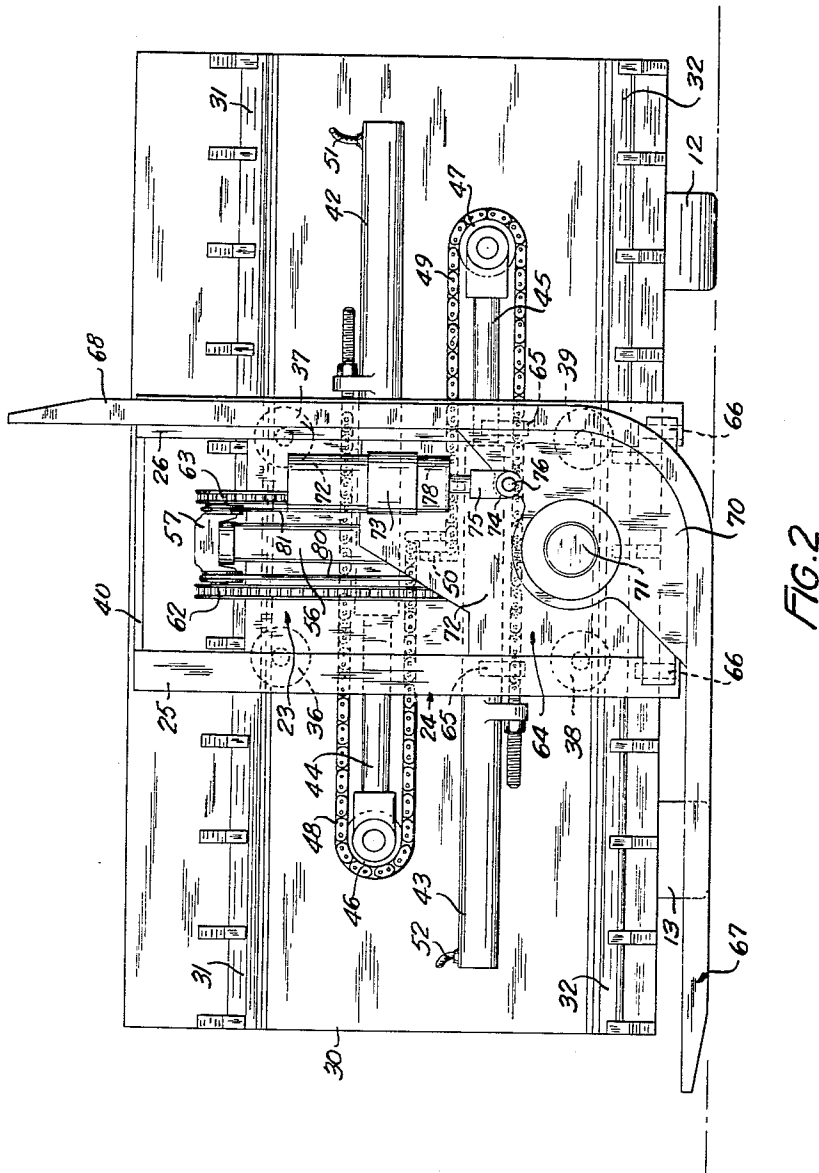
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5 Sheets-Sheet 2



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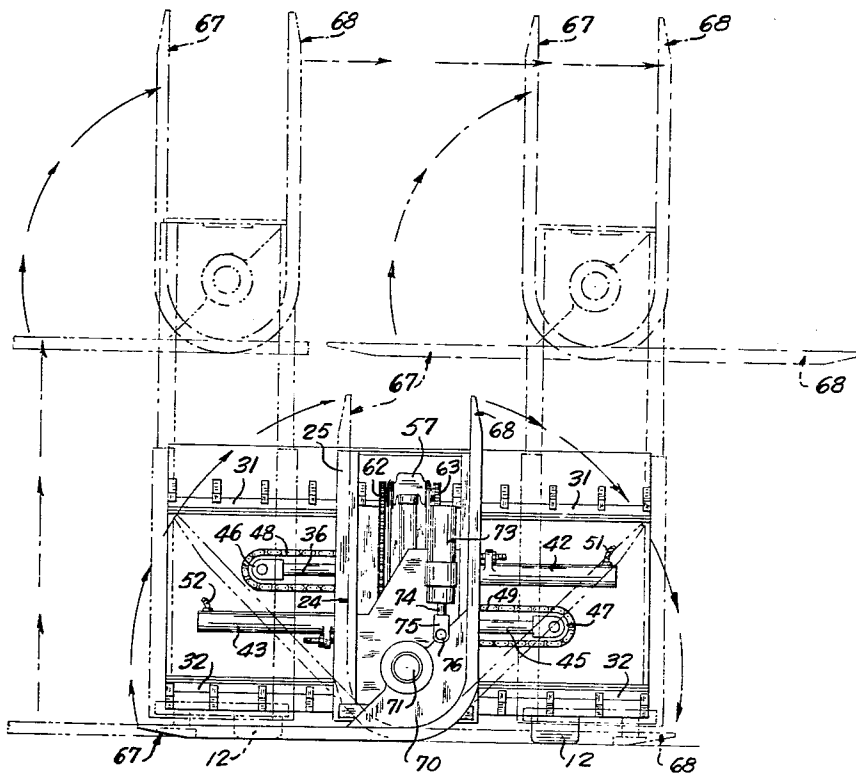


FIG. 3

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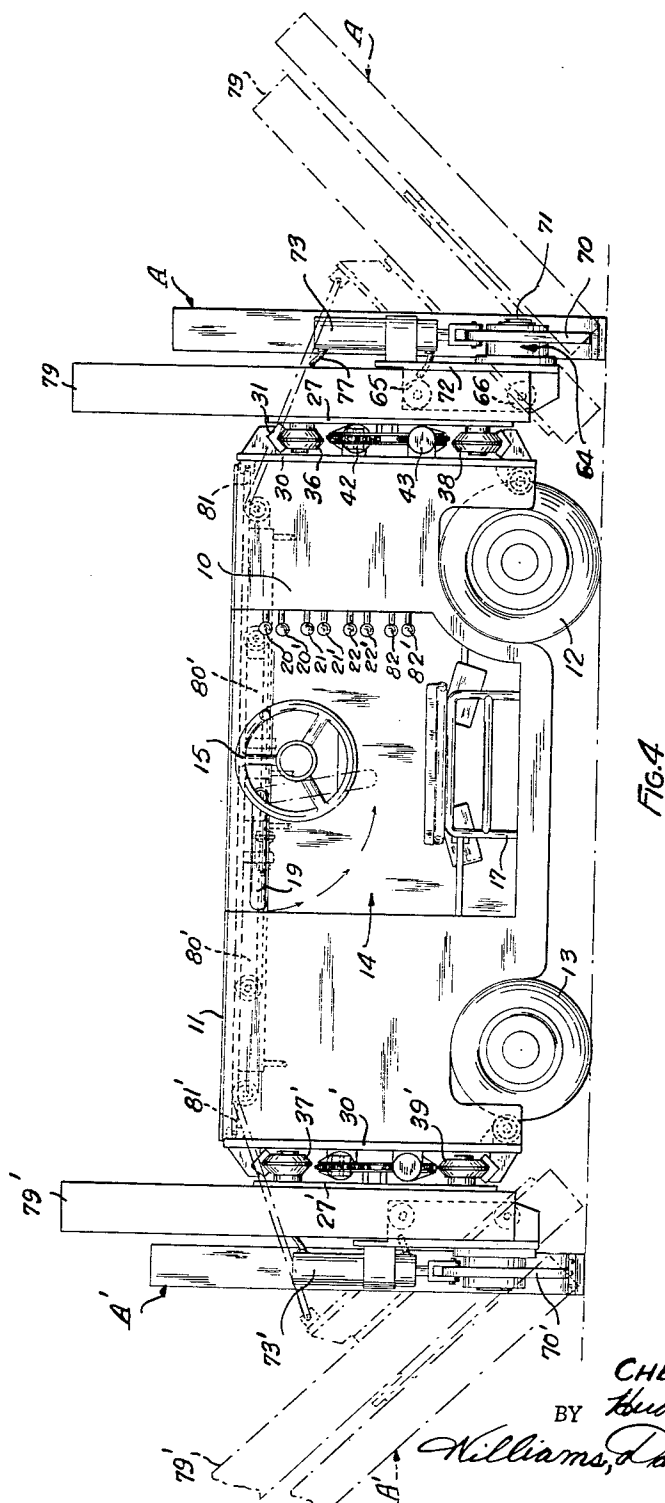
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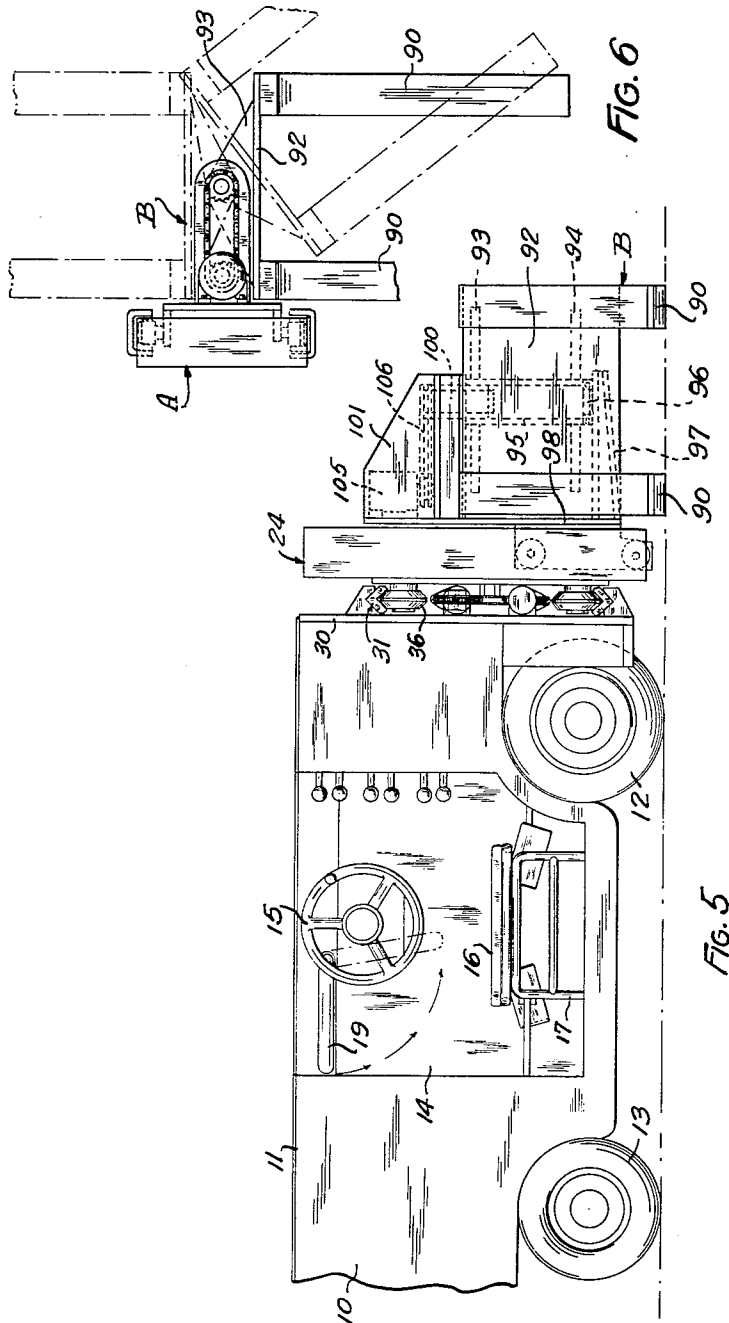
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5 Sheets-Sheet 5



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3,092,268

INDUSTRIAL LIFT TRUCK

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4 Claims. (Cl. 214—75)

The present invention relates to industrial lift trucks of the fork truck type and to handling of material by the use of such trucks and is a continuation-in-part of my copending application Serial No. 721,935, filed March 17, 1958, and now abandoned.

One of the principal objects of the invention is the provision of a new and novel industrial lift truck of the type mentioned capable of picking a load up on one side of the truck and depositing it on the other side thereof.

Another of the principal objects of the invention is the provision of a novel method of handling material utilizing an industrial lift truck of the character referred to.

Another object of the invention is to provide a new and novel industrial lift truck of the fork truck type provided with a plurality of discrete load handling members operable to pick up a long load at one side of the truck and deposit it at the other side of the truck, thus avoiding the necessity of turning the truck around to transfer a load from one side to the other or from one end to the other.

Another object of the invention is to provide a new and novel industrial lift truck of the type referred to, which truck is so constructed that it will be capable of reaching relatively high locations while maintaining a relatively low over-all height.

The invention further resides in certain novel features of construction, and combinations and arrangements of parts, and further objects and advantages thereof will be apparent to those skilled in the art to which it relates from the following description of the preferred embodiments described with reference to the accompanying drawings in which similar reference characters designate corresponding parts throughout the several views, and in which:

FIG. 1 is a side elevational view of a truck embodying the present invention;

FIG. 2 is an elevational view of the front end of the truck shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2, but on a reduced scale and showing the load handling members in various positions incident to picking up a load on the left side of the truck and depositing it on the right side of the truck;

FIG. 4 is a side elevational view of a truck of modified construction embodying the present invention;

FIG. 5 is a fragmentary side elevational view of a truck of still different construction embodying the invention; and

FIG. 6 is a fragmentary view of the truck shown in FIG. 5.

Before referring, in detail, to the preferred embodiments of the invention illustrated, it is to be understood that the invention is not limited to the constructions and arrangements of parts shown and described, but that it is capable of being otherwise embodied and of being practiced or carried out in various ways. It is to be understood also that the phraseology or terminology employed herein is for the purpose of description and that there is no intention to thereby limit the invention beyond the requirements of the prior art.

Referring to FIGS. 1 to 3 of the drawings, the industrial lift truck shown therein comprises a body 10 having a top side formed by a plate 11 adapted to support a load. The body 10 is supported by a pair of front steerable wheels 12 and a pair of rear drive wheels 13. A power

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unit, not shown, is mounted on the rear part of the chassis for driving the wheels 13 and certain auxiliary equipment such as one or more hydraulic pumps for supplying fluid pressure for operating hydraulically operated equipment hereinafter referred to. The truck is provided with dual or duplicate operator's compartments 14 at opposite sides thereof, which compartments are located intermediate the ends of the body and only one of which is shown in the drawings. It is to be understood, however, that only one operator's compartment may be provided, if desired, in lieu of the preferred two compartments.

Each of the operator's recesses or compartments 14 is provided with a steering wheel 15 operatively connected to the front steerable wheels 12. In like manner, each compartment has an operator's seat 16 supported on a tubular framework 17 connected to the body 10, a parking brake including a handle 19, and a plurality of control levers 20, 21, 22 and 20', 21', 22', located on the forward wall of each of the operator's compartments for respectively operating two load handling mechanisms, designated generally as A, A', located at opposite ends of the truck. It is to be understood that any suitable controls may be employed and that they may be located at any convenient location in or adjacent to the operator's compartment.

Since the load handling mechanisms at opposite ends of the truck are identical in construction and operated and moved in a similar manner, only the mechanism at the front or right hand end of the truck will be described in detail, and the corresponding parts of the other mechanism at the other end of the truck will be designated by the same reference characters with a prime mark applied thereto. It is to be understood, however, that the load handling mechanism at opposite ends of the truck need not be identical but may take on various shapes and forms.

The load handling mechanism at the front end of the truck comprises a mast assembly designated generally as 24 and includes a pair of vertically disposed parallel main guide members 25, 26 connected together by a plate-like carriage member 27. The interconnected main vertical guide members 25, 26 are each of channel-shaped cross section with the channels thereof opening towards each other. Telescoped or nested within the main vertical guides 25, 26 of the mast assembly 24 is a pair of parallel and vertically disposed channel-shaped extensible auxiliary guides or guide members, the upper ends of which are connected by a member 28. The member 27 is supported on the front side of a plate 30 at and fixed to the front end of the truck body for movement transversely across the front end of the truck by a pair of horizontal guide tracks or members 31, 32 secured to the plate 30 and extending at least the full width of the truck. The horizontal guide members 31, 32 are in the form of angle irons so connected to the plate 30 so as to provide parallel, facing V-shaped grooves within which the member 27 is supported by a pair of spaced rollers 36, 37, journaled on the member 27 near its upper edge and engaging in the downwardly facing V-shaped guide or track 31, and a second pair of laterally spaced rollers 38, 39 journaled on the member 27 near its lower edge and received within the upwardly facing V-shaped groove or track 32.

The member 27 and in turn the mast assembly 24 are adapted to be moved transversely across the front of the truck along the horizontal V-shaped guide members or rails 31, 32 by two oppositely facing single acting pressure fluid motors 42 and 43, rigidly secured to the plate 30 so that the axes thereof are parallel with the rails 31, 32 and offset horizontally with respect to one another. The fluid motors 42, 43 have reciprocable piston rods 44, 45, respectively, slidably mounted in their

cylinder housings, the projecting ends of which are provided with rotatable sprocket wheels 46, 47 about which sprocket chains 48, 49, respectively, are reeved. One end of each of the sprocket chains 48, 49 is secured to the fixed cylinder member of the respective fluid motor with which it is operatively associated. The other ends of the sprocket chains 48, 49 are secured to the member 27 by a bracket 50.

In order to move the member 27 and the mast assembly 24 to the left, as viewed in FIG. 2, pressure fluid is admitted into the motor 42 by way of the conduit 51, and for moving the member 23 to the right, pressure fluid is supplied to the motor 43 via the conduit 52. A pressure fluid pump, valves, etc., not shown, but of conventional construction, provide the necessary pressure fluid and controls to operate the pressure fluid motors 42, 43, and additional pressure fluid motors hereinafter referred to.

The mast assembly 24, as hereinbefore pointed out, includes a pair of extensible auxiliary vertical guides slidably mounted within the main vertical guides 25, 26. The extensible guides are raised and lowered by a suitable pressure fluid operated elevating mechanism 56 which may be similar to that described in United States Patent No. 2,536,068 to Lehmann, issued January 2, 1951. The elevating mechanism illustrated includes a yoke member 57 mounted upon the upper end of the cylinder assembly and provided with a pair of sprocket wheels having sprocket chains 62, 63 operatively disposed thereabout. One end of each of the sprocket chains 62, 63 is connected to the member 27 and the other ends thereof to an elevatable load grab carrier 64 supported for vertical reciprocation in the auxiliary or secondary guide members of the mast assembly by pairs of rollers 65, 66 journaled thereon and engaging within the auxiliary channel members. The cylinder assembly shown is of the multiple lift type but it will be understood that a single lift cylinder may be used, if desired.

The carrier or carrier member 64 is provided with a load handling means, member or grab in the form of two times or forks 67, 68 disposed perpendicularly to each other and pivoted to the carrier 64 for oscillation about an axis normal to the end of the truck. The adjoining ends of the forks are connected together by means including a flange or web 70 at the bight thereof, which web is provided with an opening for receiving the projecting end of a shaft 71 upon which the grab or forks are pivoted. The other or rear end of shaft 71 is fixed in a plate 72 forming a part of the carrier or member 64. A reciprocating type double acting pressure fluid motor 73 pivoted to the plate 72 and provided with a piston rod 74 pivotally connected at a bifurcated member 75 to pin 76 in the web 70 provides a means for oscillating the forks about the shaft 71 through slightly more than 90°, preferably from 100° to 115°. Upon supplying pressure fluid to motor 73 via a conduit 77, and appropriately exhausting fluid through a conduit 78, the connecting rod 74 is extended and acts to turn or pivot the forks clockwise about the shaft 71. Operation of the pressure fluid motor 73 in the opposite direction returns the fork to the position shown in FIG. 2.

The forks 67, 68 are preferably made as long as consistent with other requirements and as shown in FIG. 2 extend beyond the truck proper when in the position shown in FIG. 2, but can be such that when rotated in a clockwise direction 45° from the position shown they will be within the outline of the body 10, thus permitting the truck to be driven through narrow aisles, etc. If desired, one or more of the forks employed may be of the multiple parallel tine type, in which event discrete loads could be independently handled by each of the respective load handling mechanisms.

The carrier or member 64 and in turn the plate 72 and

the forks 67, 68 can be moved horizontally to the right or left by operation of the pressure fluid motors 42, 43, and vertically up and down by operation of the elevating pressure fluid motor 56, and the forks 67, 68 pivoted through at least 90° in a clockwise or counterclockwise direction by operation of the motor 73. These operations can be performed by the operator upon manipulation of the controls 20, 21, 22 and 20', 21', 22' at the operator's compartments.

The forks 67, 67' at opposite ends of the truck can be extended while in their lowermost position beyond the left side of the truck for picking up a load. It will be understood, of course, that the forks can be projected beneath the load by having the load placed upon a pallet or the like. The forks can be then elevated to a height sufficient for the load to clear the flat top or top side 11 of the truck, the forks shifted to the right and thereafter lowered to place the load upon the top side 11 of the truck. The forks can then be lowered and pivoted in a clockwise direction through a suitable angle, such as 45°, and with the carrier member 64 in its lower position, it can be shifted to the left hand side of the truck, the forks rotated through a second 45° and the load again engaged and lifted from the top of the truck, this time, however, by the forks 68, 68'. The carrier and forks can then be shifted to the right side of the truck and again lowered to deposit the load on a suitable support at the right side of the truck. It will be apparent that the load may be moved from the right to left side of the truck by a reverse operation of the load handling mechanisms. The manner in which the forks are manipulated to move them from one side of the load to the other while the load is resting upon the top side of the truck to the other will depend upon their construction. It is also to be understood that while a load is resting upon the forks they may be rotated slightly from the horizontal so as to reduce the possibility of the load rolling or otherwise falling off the free ends thereof.

The pump, control valves, etc. for supplying pressure and controlling the operation of the various pressure fluid motors described, are of conventional construction and are not herein shown and described in detail. Suffice to say that pressure fluid is supplied to an exhaust from the motor 73 on the grab carrier 64 by pairs of flexible conduits 80, 81 reeved about suitable pulley wheels supported coaxially with the sprocket wheels for the chains 62, 63 in a manner well known in the art. Pressure fluid is transmitted from the truck body 10 to the member 27 in a similar manner by flexible conduits reeved about pulley wheels mounted coaxially with the sprocket wheels 46, 47.

The truck shown in FIG. 4 is similar to the truck shown in FIGS. 1 to 3 with the exception of the fact that the plates 30 at opposite ends of the truck which carry the load handling mechanisms, are connected to the truck body proper in such a manner that the load handling mechanisms can be individually tilted forward or backward, as the case may be, to allow the upper ends of the mast assemblies or the forks connected thereto to be passed underneath a load resting upon the top side of the truck. It will be noted that the track or guide members 31, 32 and 31', 32' have been raised on the plates 30, 30' and the bottom ends of the body are cut away to allow the plates 30, 30' to pivot downwardly, and the mast assemblies shown in FIGS. 1 to 3, in their collapsed position, do not extend above the top side of the truck; whereas, in the embodiment shown in FIG. 4, the mast assemblies 79, 79', which are otherwise similar to the mast assemblies 24 shown in FIGS. 1 to 3, have their main and auxiliary guide members so constructed that they extend above the top side of the truck when collapsed. This construction provides a higher mast and allows the forks to be raised higher than possible with the truck shown in FIGS. 1 to 3. The mast assemblies, including the forks may, however, be readily moved under-

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neath a long load resting on the top side of the truck from one side of the load to the other.

As shown in FIG. 4, the plates 30, 30' are pivotally connected adjacent to their lower edges to opposite front and rear ends of the body 10 of the truck proper for pivotal movement about generally horizontal axis extending transversely of the truck and located forwardly of the front wheels 12. The plates 30, 30' are adapted to be moved about their pivotal axes adjacent to its lower end by a plurality of fluid pressure operated reciprocating type motors 80, 80' located underneath the top plate 11 of the truck body and connected by chains 81, 81' to the plates 30, 30' adjacent to their upper edges. The flow of fluid pressure to and from the motors 80, 80' is controlled by a pair of controls 82, 82' located in the operator's compartment.

From the foregoing description of the truck shown in FIG. 4, it is believed that its operation will be apparent.

Referring to FIGS. 5 and 6, the truck shown therein is similar in construction and operation to the truck shown in FIGS. 1 to 3 inclusive with the exception of the fact that the vertically and horizontally movable load grab carriers which correspond with the carriers 64, 64', instead of being provided with the grab or fork mechanisms designated generally by the reference characters A, A', shown in FIGS. 1 to 3 and the fluid pressure operating motors 73, 73', are in this instance, provided with fork or grab mechanisms designated generally by the reference characters B, B'. Each of these mechanisms is alike and only the right hand one is shown. They each comprise one or more forks 90 preferably detachably connected to a vertically extending plate 92 connected by a pair of webs 93, 94 welded or otherwise fixedly secured to the rear sides thereof, to a vertical tube 95, the lower end of which telescopes over and is rotatable about a stub shaft 96 carried by a bottom projecting plate 97 welded to the front side of the plate carrier plate or member 98 corresponding to the plate 72 of the carrier 64 of the embodiment shown in FIGS. 1 to 3. The upper end of the tube 95 has a short shaft 100 fixed in its upper end and which projects into and is rotatably supported by a top built up bracket 101 also welded to the plate 98 and rotatably supported on a vertical shaft 96 projecting forwardly thereof. The vertical shaft 100, and in turn the forks 90, 91 are adapted to be selectively rotated in opposite directions by a fluid pressure rotary type motor 105 supported in the structure 101 and connected to the upper end of the shaft 100 by a sprocket chain drive 106. Fluid pressure for operating the motor 105 is supplied by the fluid conduits employed for supplying pressure to the reciprocating motor 73 of the embodiment shown in FIGS. 1 to 3. The flow of fluid pressure to the rotary motor at the opposite end of the truck is controlled by the same valves 22, 22' utilized to control the flow of fluid pressure to the motors 73, 73'.

In the three trucks herein shown, the mast assemblies are connected to the plates 30, 30' at opposite ends of the truck body for movement transversely of the trucks for the purpose of permitting the forks to be shifted from one side of the truck to the other. Alternately, the mast assemblies could be fixedly secured to the plates 30, 30' and the load handling members or grabs connected to the vertically movable members by intermediate members or means in such a manner that they could be shifted transversely of the truck with respect to the carrier members proper. In other words, the side shifting mechanism interposed between the plate 30 and the member 27 in the embodiments shown could be interposed between the vertically movable carrier members and the grabs or load handling members.

While in the preferred embodiments shown the load handling mechanisms are discrete units, so to speak, located at opposite front and rear sides of the trucks, it will be apparent that they could be located at opposite lateral sides of the trucks, in which event they could be em-

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ployed to transfer loads from the front to the rear of the trucks or vice versa. It is believed that it will also be apparent that the load handling mechanisms need not be located "outboard" with respect to the bodies of the trucks proper, but could be located in or adjacent to wells intermediate the ends of the trucks somewhat similar to the manner in which load handling mechanism shown in U.S. patent to Lull 2,621,811 is located in or adjacent to a well or side opening in the truck. In this event, a well would be provided at each side of the truck and the operator's station would be moved to one end or the other of the truck. It is also to be understood that while in the preferred embodiment of the invention shown, both load handling mechanisms are operated separately, the corresponding motors at opposite sides of the truck could be operated simultaneously by single controls. In this event, however, it would be preferable to include balancing or equalizing mechanisms so that the respective motors at opposite sides would move in unison. Mechanisms of this character are well known in the art and are shown in many of the patents in Class 60—Sub-classes 52 and 97.

As previously suggested, the invention broadly contemplates the provision of a new and novel method of handling material and a new and novel fork type industrial lift truck having a plurality of discrete load handling means capable of picking up a load at one side of the truck and depositing it at the other side and is not limited to the particular constructions and arrangements of parts shown and described. It is the intention hereby to cover all adaptations, modifications and uses of the invention disclosed which come within the practice of those skilled in the art to which it relates and within the scope of the appended claims.

Having thus described my invention, I claim:

1. A method of transferring an object from one place to another by an industrial truck having a body with first and second generally parallel sides and third and fourth generally parallel sides substantially normal to said first and second sides and a top side forming an elevated load platform and lifting forks connected to the body adjacent the first and second sides thereof comprising the steps of, placing the object and truck in a relative position in which the object is adjacent the third side of the truck, inserting lifting forks which extend substantially perpendicular to the length of said third side under the object from one side thereof, raising the object to a height higher than the top side of the truck, moving the forks with the object supported thereon transversely of the truck to position the object above the top side of the truck, lowering the forks to position the object on the top side of the truck, moving the truck to transport the object while so supported on the top side of the truck, inserting underneath the object from the opposite side of the object lifting forks extending substantially perpendicular to the fourth side of the truck while the object is supported on the top side of the truck, raising the forks to support the object at a height higher than the top side of the truck, moving the forks with the object supported thereon transversely of the truck to position the object beyond the fourth side of the truck, lowering the forks to rest the object on a support adjacent to the truck, and laterally withdrawing said forks from underneath the object.

2. An industrial lift truck comprising: a body having first and second generally parallel sides and third and fourth generally parallel sides substantially normal to said first and second sides and a top side forming an elevated load platform; independent members supported adjacent to said first and second sides and movable vertically and horizontally relative to said body; independent fork lift means connected to each of said members for movement relative thereto between a first position wherein a fork thereof extends substantially perpendicular to the length of said third side of said body and a second position wherein a fork thereof extends substantially perpendicular to the

length of said fourth side of said body; power means for moving each of said fork lift means while in their first positions horizontally to position the forks thereof under an object located adjacent said third side of said body; power means for raising said fork lift means and said object above said load platform; power means for moving each of said fork lift means to position said object above said platform; means for lowering said object onto said platform; means for moving each of said fork lift means to their said second positions; power means for raising each of said fork lift means when in their second position to position said object on said fork lift means; and power means for moving said object horizontally beyond said fourth side of said body when said fork lift means are in their said second positions.

3. An industrial lift truck comprising: a body having first and second generally parallel sides and third and fourth generally parallel sides substantially normal to said first and second sides and a top side forming an elevated load platform; independent members supported adjacent to said first and second sides and movable vertically and horizontally relative to said body; independent fork lift means comprising a pair of tines disposed perpendicularly to one another pivotally connected to each of said members for pivotal movement relative thereto about a horizontal axis between a first position wherein one tine thereof extends substantially perpendicular to the length of said third side of said body and a second position wherein the other tine thereof extends substantially perpendicular to the length of said fourth side of said body; power means for moving each of said fork lift means horizontally to position said one tine thereof under an object located adjacent said third side of said body; power means for raising said fork lift means and said object above said load platform; power means for moving each of said fork lift means to position said object above said platform; means for lowering said object onto said platform; means for moving each of said fork lift means to their said second positions; power means for raising each of said fork lift means when in their second position to position said object on said other tine and power means for moving said

object horizontally beyond said fourth side of said body when said fork lift means are in their said second positions.

4. An industrial lift truck comprising: a body having first and second generally parallel sides and third and fourth generally parallel sides substantially normal to said first and second sides and a top side forming an elevated load platform; independent members supported adjacent to said first and second sides and movable vertically and horizontally relative to said body; independent fork lift means including at least one fork pivotally connected to each of said members for pivotal movement relative thereto about a vertical axis between a first position wherein said fork extends substantially perpendicular to the length of said third side of said body and a second position wherein said fork extends substantially perpendicular to the length of said fourth side of said body; power means for moving each of said fork lift means horizontally to position said fork thereof under an object located adjacent said third side of said body; power means for raising said fork lift means and said object above said load platform; power means for moving each of said fork lift means to position said object above said platform; means for lowering said object onto said platform; means for moving each of said fork lift means to their said second positions; power means for raising each of said fork lift means when in their second position to position said object on said fork; and power means for moving said object horizontally beyond said fourth side of said body when said fork lift means are in their said second positions.

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