

[54] **FRONT AND SIDE LOADING
ATTACHMENT FOR LIFTING TRUCKS**
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[73] Assignee: **Clark Equipment Company**
[22] Filed: **Aug. 6, 1970**
[21] Appl. No.: **61,672**

[52] U.S. Cl.214/730, 187/95
[51] Int. Cl.B66f 9/14
[58] Field of Search214/660, 730, 731, 83.24;
187/19

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Attorney—Hobbs & Green and Kemon, Palmer & Estabrook

[57] **ABSTRACT**

A front and side loader attachment for lift trucks with an upright in which the fork section is connected to the upright by a member movable angularly in a horizontal plane from one side of the carriage to the other side. The member is pivoted at one end on a line substantially in the longitudinal center of the carriage, and the fork section is movable to and from lateral positions on a line perpendicular to the longitudinal center line and is adapted to be skewed to various angles between the two lateral positions. A load distributing system is preferably incorporated in the carriage consisting generally of spaced racks mounted on the upright and one or more shafts with pinions meshing with the racks.

19 Claims, 8 Drawing Figures

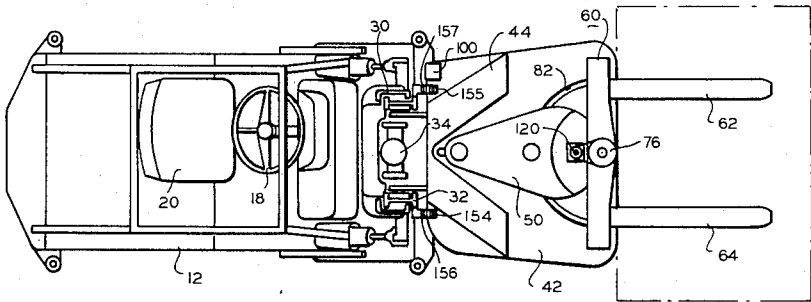


FIG. 2

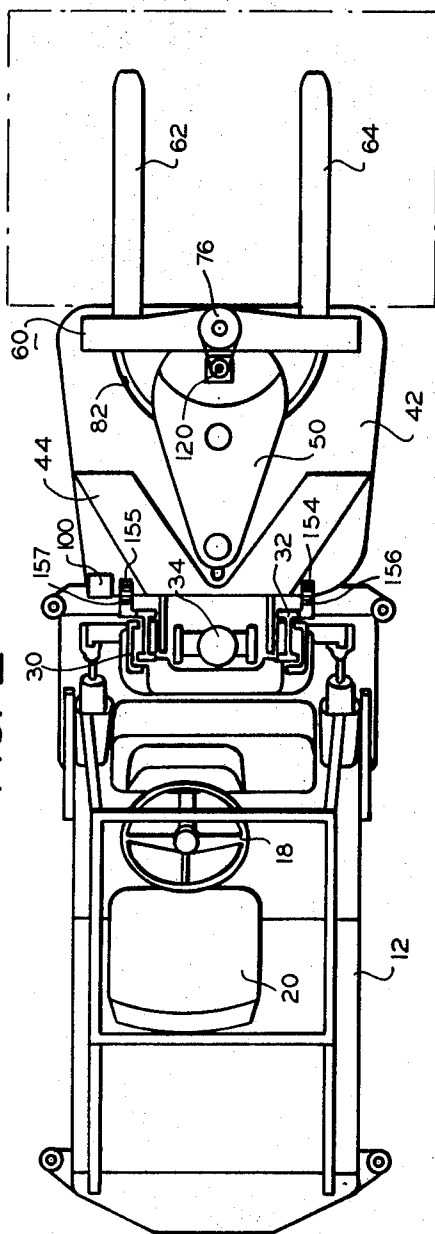
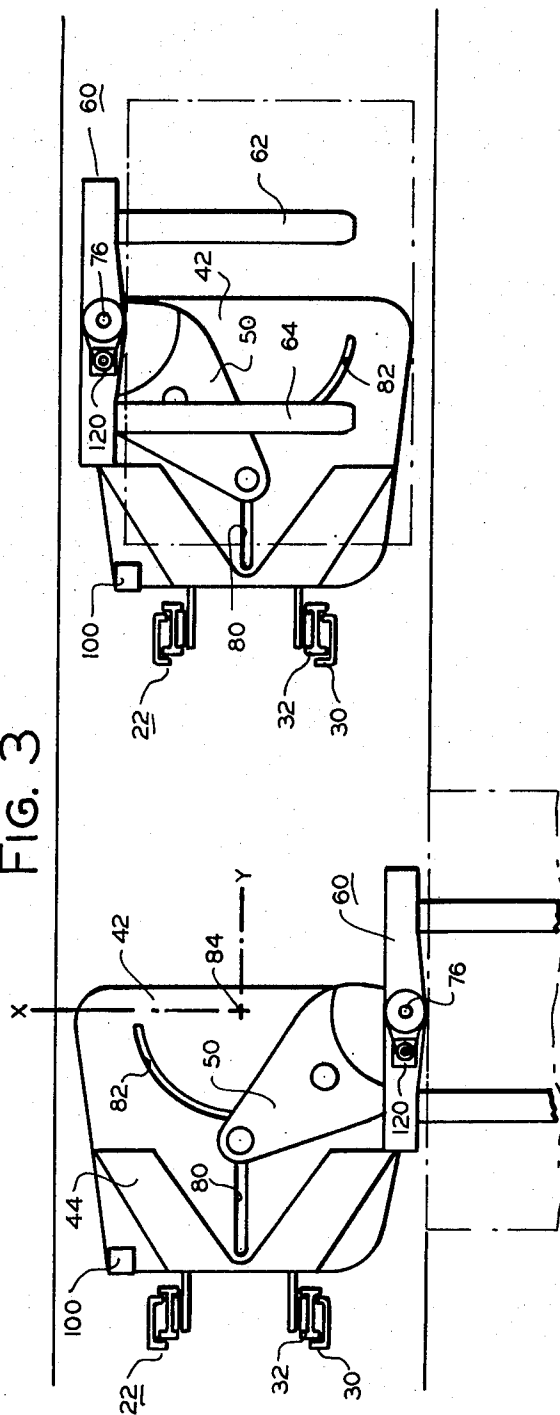


FIG. 3



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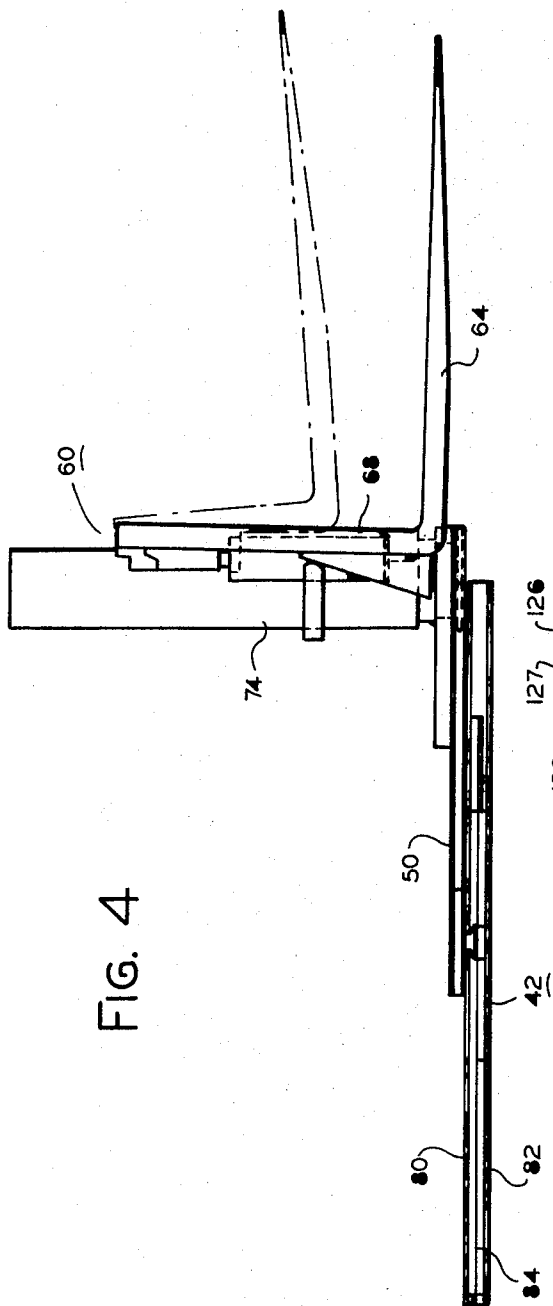


FIG. 4

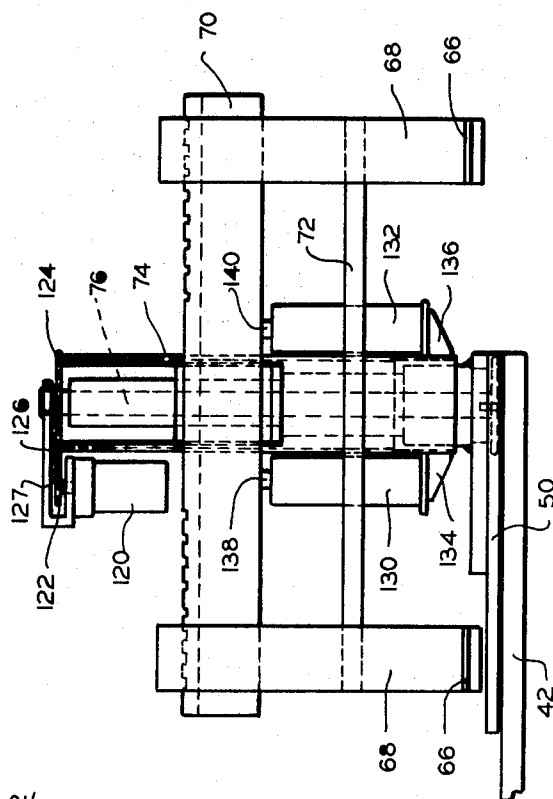


FIG. 5

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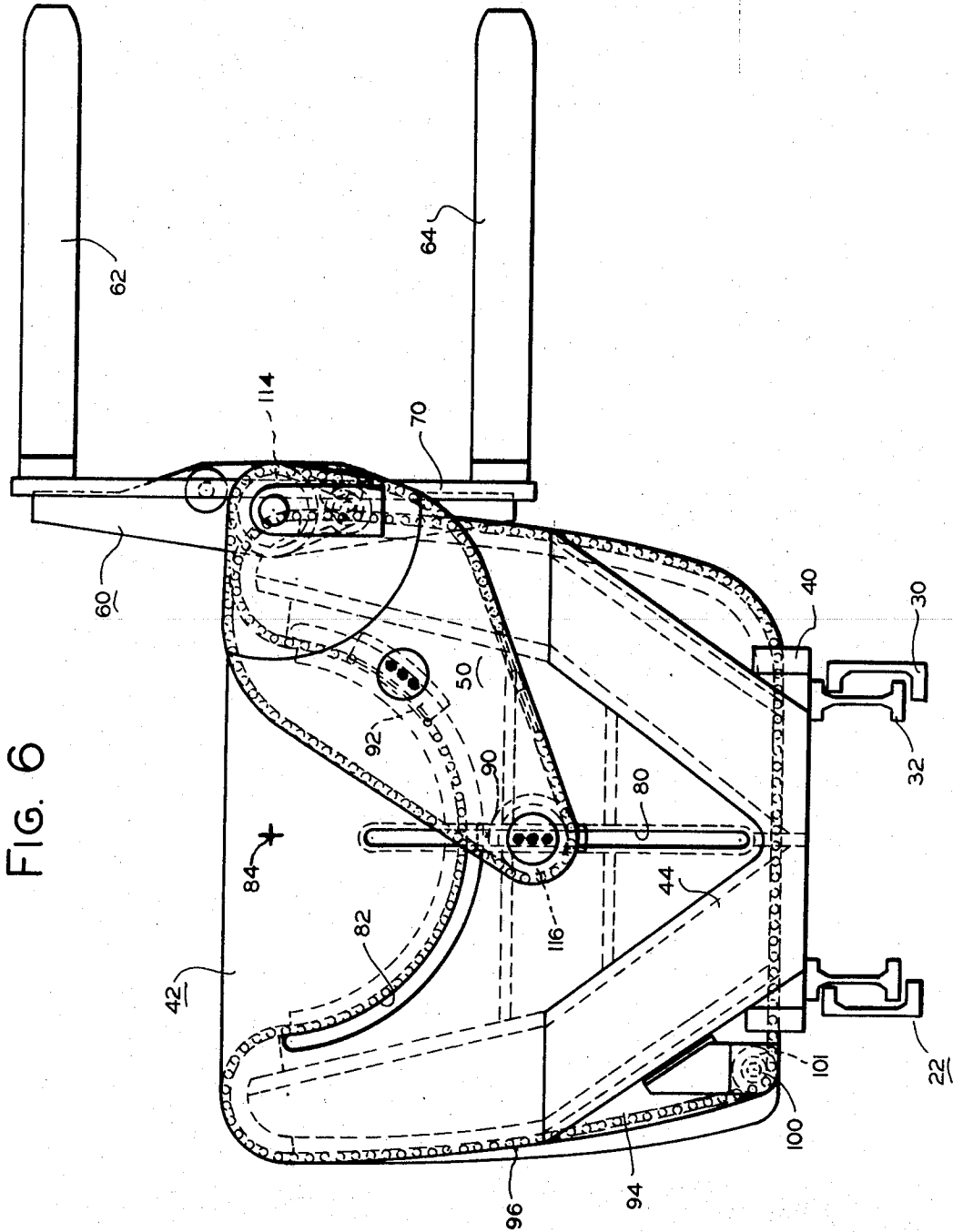


FIG. 6

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FIG. 8

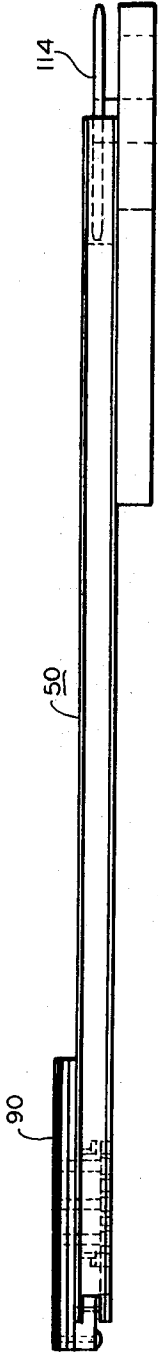
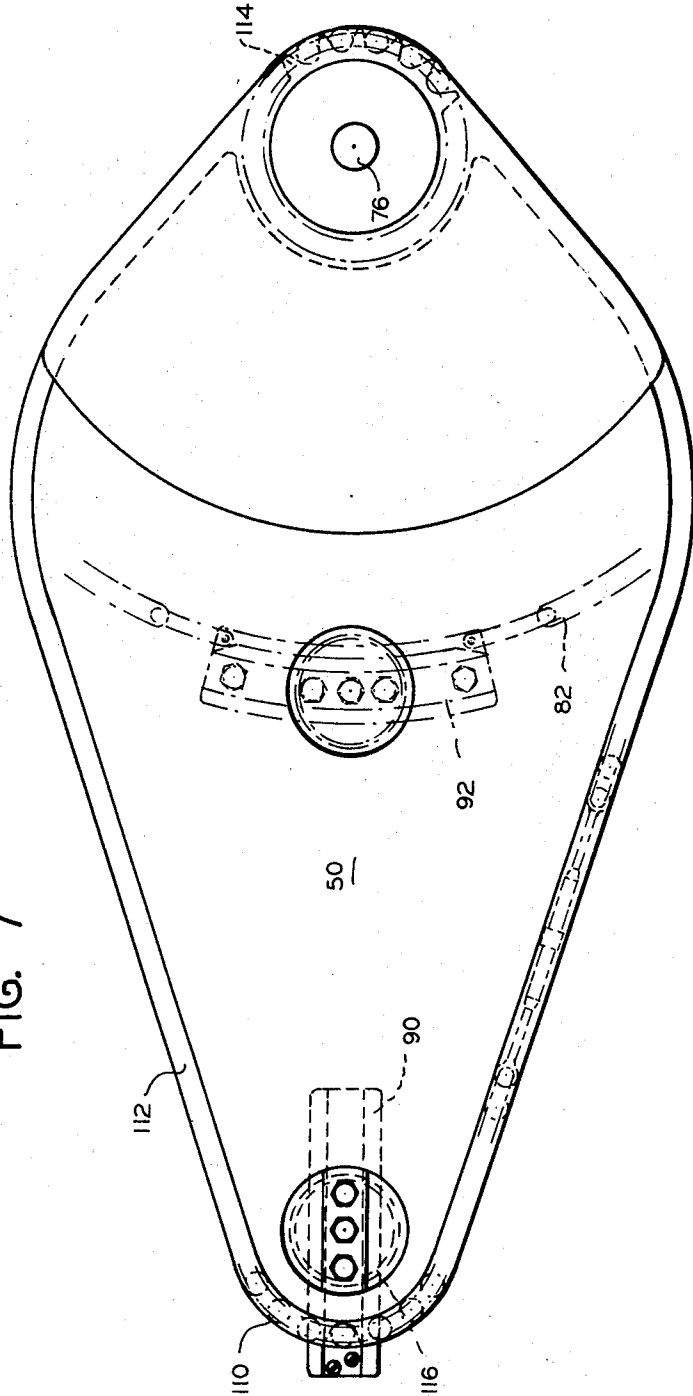


FIG. 7



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FRONT AND SIDE LOADING ATTACHMENT FOR LIFTING TRUCKS

Materials and products are often stored in warehouses, manufacturing plants, and shipping terminals in large storage rack structures spaced from one another by aisles used for transporting, depositing and retrieving loads of material or products in the rack structures on either side of the aisle. The loading and unloading of the racks involve the operations of moving the loads longitudinally in either direction along the aisle and moving the loads laterally into and from the racks on either side of the aisle. Sideloading devices require a reach mechanism capable of moving the load from a central carry position to a laterally extended position beyond the side of the vehicle. The minimum travel distance or stroke requirement of the mechanism is equal to the lateral dimension of the pallet and/or load, plus an additional several inches of aisle clearance required within the aisle between the traveling truck and the storage rack structure. Most mechanisms used in transporting loads do not lend themselves conveniently to this requirement. For instance, if a conventional pantograph mechanism is used for such long strokes, its collapsed height is so great as to severely limit the ability of the device to place loads in a top storage rack shelf near the ceiling. If a single stage telescoping arrangement is used for the large stroke required, the collapsed dimension of the telescope is much greater than the width of the truck, and a two-stage telescoping arrangement becomes excessively complex and costly. One known device employs a combination of two basic mechanisms, consisting of a single-stage telescope device and a pantograph mechanism, the first device achieving a portion of the stroke requirement and the pantograph mechanism extending to achieve the balance of the stroke. Such arrangements have been inherently unsatisfactory.

Further, in order to perform the two longitudinal and lateral operations with lift trucks, the aisles between the rack structures have been relatively wide to permit some lateral maneuvering of the trucks when a load is being deposited in or removed from the racks, thus limiting the amount of storage space available for any given area. The prior lift trucks also have not had the ability to handle loads on more than one side or to transfer a load from one side to the other in addition to picking up and depositing a load straight ahead and directly on the floor, and have often been of limited capacity and required precise positioning of the truck and the use of special rack structures rather than conventional shelf type storage racks.

It is, therefore, one of the principal objects of the present invention to provide a side loading attachment for fork lift trucks, which will enable the truck to handle full size pallet loads in relatively narrow aisles and perform the operations of loading and unloading directly ahead and on either side of the truck, and which will pick up and deposit loads and transfer them from one side to the other near floor level or in any elevated position.

Another object of the invention is to provide a fork lift truck attachment which can be mounted on a conventional lift truck with little or no substantial change in the structure or operating mechanism of the truck, and which is relatively simple in construction and design and capable of effectively utilizing standard, shelf-type rack structures.

Still another object of the invention is to provide a lift truck which is capable of handling loads to either side and in front without any lateral supporting means apart from the truck itself, and which will pick up a pallet load squarely and accurately without precise positioning of the truck and will move the load into and from the rack on a straight line at right angles to the longitudinal center line of the truck.

A further object is to provide a lift truck or the like with a mechanism which will skew pallet loads to either side of the truck and move the loads laterally to and from storage spaces, and which will retract laterally sufficiently to permit the truck to be moved in narrow aisles while the loads are held in their skewed positions and also to skew the loads while the truck is in the aisle.

Additional objects and advantages of the invention will become apparent from the following description and accompanying drawings, wherein:

FIG. 1 is a side elevational view of a lift truck having the present attachment or carriage assembly mounted thereon;

FIG. 2 is a top plan view of the lift truck shown in FIG. 1 including the present attachment;

FIG. 3 is a fragmentary top plan view of the present attachment, showing the attachment in two different positions in an aisle between two shelf racks;

FIG. 4 is a side elevational view of the present attachment removed from the truck upright;

FIG. 5 is a front elevational view of the attachment shown in the preceding figures;

FIG. 6 is an enlarged top plan view of the present attachment, showing it mounted on an upright of the lift truck;

FIG. 7 is a top plan view of a portion of the attachment operating mechanism, showing the construction thereof in greater detail; and

FIG. 8 is a side elevational view of the mechanism illustrated in FIG. 7.

Referring more specifically to the drawings and to FIG. 1 in particular, numeral 10 designates generally a lift truck having a body 12, front and rear wheels 14 and 16, steering wheel 18, seat 20, and an upright 22 on the front of the truck having mounted thereon a carriage 24 and the present attachment indicated generally by numeral 26. The lift truck shown in the drawings on which the present attachment may be used is considered conventional, for the purpose of the present description, and may be of any one of a number of well known types including those powered by a battery driven electric motor or by a gasoline engine. Hence the details of the lift truck will not be described in detail herein.

The upright 22 and the carriage 24 mounted on the front of the truck likewise may be considered conventional for the purpose of the present description, the one shown briefly consisting of an outer mast section 30 and inner mast section 32, telescopically arranged with respect to one another, and a hydraulic cylinder 34 for operating the inner mast section and the carriage mounted on the front of the upright. The inner and outer sections are each constructed of lateral channel members and the upright shown in the drawing embodies a two stage lift system, although the present attachment could be used with other types of systems. The carriage 24 is mounted for vertical travel with respect to the rails of the inner section by conventional carriage rollers. Hydraulic fluid is transmitted to and from the upright and carriage and to and from the hydraulic actuating mechanisms on the attachment by a plurality of hydraulic hose (not shown) connected to the hydraulic system of the truck. The operating mechanisms of the upright and of the attachment are controlled from the operator's compartment by control valves in the hydraulic system.

Carriage 24 includes a vertical rear section 40 and a forwardly projecting horizontal section 42 attached integrally and forming a rigid structure with vertical section 40, the structure being reinforced by angularly projecting reinforcing members 44 joined at their inner end to vertical section 40 and to the upper surface of horizontal section 42. The carriage is elevated to various loading and unloading levels by the upright operating mechanism and is so designed and constructed that it will seat on and operate from the floor as illustrated in FIG. 1. The attachment which is mounted on and operated from horizontal section 42 has a link 50 movable over the upper surface of section 42 and supporting section 60 on which the two lift forks 62 and 64 are mounted. The forks have a horizontal pick-up portion 66 and a vertical portion 68 connected to upper and lower fork bars 70 and 72 and are preferably adjustable laterally in order to accommodate a wide range of load sizes. The two fork bars are rigidly connected to a cylinder 74 which in turn is mounted on a post 76 the lower end of which is rotatably connected to the forward end of link 50.

The link is mounted on the upper surface of horizontal carriage section 40 in sliding contact therewith, and operates in a manner to move fork section 60 from a forward position such as that shown in FIG. 2 into a lateral position shown in FIG. 3 with the forks projecting to the right side of the truck, and to a lateral position with the forks projecting to the left side of the truck. The link also moves the fork section outwardly to the position shown in the left hand view of FIG. 3, and to an extended position or to a withdrawn position illustrated in the right hand view of FIG. 3. The movement of link 50 is controlled by a guide or track system consisting of a straight slot 80 forming a track means on the Y axis and an arcuate slot 82 forming a track means with a radius having its center at the point of intersection 84 of the Y axis and the X axis, as seen in FIG. 3. The inner end of link 50 is rotatably connected to a crosshead 90 retained in slot 80 and adapted to reciprocate therein, and the center of the link is rotatably connected to crosshead 92 retained in arcuate slot 82 and adapted to reciprocate therein. The crosshead 92 is driven throughout the length of the arcuate slot by a chain 94 disposed in the slot and in a peripheral slot 96 extending along the two lateral and rear sides of horizontal section 40. The chain is a roller link type chain and the inner sides of the peripheral and arcuate slots form a track for the chain rollers. The chain is driven in either direction by a hydraulic motor 100 mounted on the inner left hand edge of horizontal section 40, the motor rotating a motor sprocket 101 which in turn drives the chain. Crosshead 92, which is connected to the chain, moves along slot 82, and crosshead 90 is moved by means of link 50 along slot 80, i.e. on the Y axis. As the two crossheads move in their respective slots, the forward end of link 50 on which post 76 is rotatably mounted moves on the X axis from right to left. Thus, as the rear end of link 50 is moved forwardly and rearwardly in slot 80 and the center of the link is moved on the arcuate path determined by slot 82, the fork section 60 is extended to and withdrawn on a straight line perpendicular to the longitudinal center line of the truck, from one side or the other depending upon the initial position of the fork section with respect to the link.

As previously mentioned, the center for the radius of slot 82 is the point of intersection 102 of the X and Y axes which intersect one another at right angles near the forward end of horizontal section 40. In order for this system to operate in the manner described, the pivot connection between crosshead 92 and the link must be equally spaced from between post 76 and the pivoted connection of the link to crosshead 90. While a crosshead could be used at the base of post 76 in addition to, or as a substitution for, crosshead 90, only one crosshead in combination with crosshead 92 is required in order to perform the extending and withdrawing operation of the fork carriage along the X axis. In either arrangement, the link would be driven by the chain connected to crosshead 92 in slot 82.

A chain 110 similar to chain 94 is seated in a groove in the periphery of link 50 and is trained on a sprocket 114 at the forward end of the link connected to the bottom of post 76 and at the rear of the link on a sprocket 116 connected to crosshead 90. Thus when the forward end of the link moves from one side of horizontal section 40 to the other side, the post maintains a fixed radial position relative to the X axis, for reasons which will hereinafter be more fully explained.

Fork section 60 is slewed to various angular positions with respect to carriage section 40 by a hydraulic motor 120 which rotates cylinder 74 through sprockets 122 on the motor and 124 on the cylinder, and by a chain 126 trained on the two sprockets. The motor 120 is rigidly connected to post 76 and supported thereon by bracket 127 at the upper end thereof. The lower section 128 of cylinder 74 is also moved telescopically with respect to the upper section 129 by two cylinders 130 and 132 mounted on the lower section of the cylinder by brackets 134 and 136, respectively, and connected to cross bar 70 by piston rods 138 and 140. This auxiliary lift is essential, in that, in lifting a pallet from the floor, the bottom board of the pallet must be raised above the upper surface of the link

before the fork section is slewed or moved to any position above horizontal section 40 of the carriage. The movement of the lift forks upwardly as the lower section of cylinder 74 is elevated by hydraulic cylinders 130 and 132, tilts the forks upwardly as illustrated by the broken lines, as a result of one or more wedge shaped cams 142 engaging a lug 144 on the side of the cylinders. The tilted position of the lift forks restrains the load as the load is being further elevated by the carriage 26 and is being transported by the truck. Since shaft 76 is constrained by chain 110 in any fixed position of link 50, energization of motor 120 causes cylinder 74 to rotate in the right or left hand direction about post 76, which in turn causes the forks to slew right or left in orientation. The arrangement is such that forks 62 and 64 may be slewed 100° to the left and 100° to the right from straight forward orientation with respect to the truck.

Carriage 24 is mounted for vertical movement on upright 22 by a plurality of conventional carriage rollers and the upright lift cylinder furnishing the upward force for lifting the load; however, a torque force of substantial magnitude exists when fork section 60 is in one of its lateral positions, such as that illustrated in FIG. 3. In order to obtain satisfactory performance of carriage 24 on upright 22, the torque force must be distributed or counteracted to prevent an excessive strain on the upright and to facilitate easy movement of the carriage on the upright. In the embodiment of the invention illustrated in the drawings, the torque forces are transmitted equally to both sides of the outer section of the upright by a system of squaring shafts and gears, indicated generally by numeral 150. Each squaring shaft includes a shaft 152, gears 154 and 155 mounted on opposite ends thereof, and racks 156 and 157 secured to and running the full length of the vertical members forming the outer section of the upright. The gears 154 and 155 are keyed to the ends of the shaft so that the two gears and shaft rotate in unison, and the shaft is journaled in vertical section 40 of carriage 24. The gears of each respective shaft travel on the two racks 156 and 157 as the carriage is moved upwardly and downwardly on the upright and carrying a lateral load, thus distributing the torque uniformly between the two sides of the upright. The use of the squaring shaft system, in combination with the fork lift upright frame, serves to rotate the opposing forces so that the forces are aligned and parallel to the upright members which can then readily withstand additional in line forces, but which they might otherwise not be capable of supporting as torque resulting from a laterally offset load. While only three sets of shafts and gears are shown in the drawings, a greater or smaller number of shafts and gears may be used as required.

In the operation of the present side loader attachment for lift trucks, starting with the truck and attachment in the position illustrated in FIG. 1, and with a load on pallet P, the truck moves forwardly, inserting forks 62 and 64 into the pallet slots. Cylinders 130 and 132 are then actuated to lift the load until the forks are in the position shown in broken lines. In this position the load can be moved to any angular position without interference from link 50 or from horizontal section 42 of the carriage. The upright power cylinder is then operated to lift carriage 24 from the floor. With the carriage in the foregoing position, the truck is maneuvered along an aisle between two sections of shelf racks, for example, until it reaches the location where the load is to be deposited. Assuming the load is to be deposited on one of the upper shelves, the carriage is elevated by the upright to approximately the level of the shelf and motor 100 is operated to move fork section 60 laterally, for example, to the right, and simultaneously motor 120 is operated to slew the fork section to the left, thus placing the load in position to insert it into the shelf section. With the forks at the right angle position to the forward direction of the truck and with the link in its fully right hand position, for example, the motor 100 is again actuated to move the forward end of the link along the X axis, thereby moving fork section 60 and the load directly laterally in a straight line into the shelf section. After the load has been inserted in the shelving, either

cylinders 130 and 132 are operated, or the carriage is lowered to lower the forks and disengage them from the pallet. The foregoing operation is then reversed to withdraw the forks from the pallet by moving link 50 to its right hand position. Thereafter the carriage can be again lowered and the truck withdrawn from the aisle between the shelf racks.

As an alternative to the foregoing operational procedure, the lateral positioning of the load may be performed before the truck enters the aisle so that the only operations to be performed in the aisle are the elevation of the load and the lateral movement of inserting or withdrawing the load. The same operation is performed to load and unload the shelving on the opposite side of the aisle, and the attachment can be operated in essentially the foregoing manner to shift the load from one extended side position to the other extended side position without withdrawing the truck from the aisle.

The foregoing operation can be performed in an area only slightly larger than the width of the truck and attachment, and without the need of any lateral supporting structure or outriggers to stabilize the truck and/or attachment thereon. The squaring shaft system 150 operates to distribute the load evenly on the upright so that no undue strain is placed on the upright.

While only one embodiment of the front and side loader attachment has been described in detail herein, various changes and modifications may be made without departing from the scope of the invention.

I claim:

1. A front and side loading attachment for a lift truck having an upright, comprising a carriage having a vertical section connected to the upright and a horizontal section connected to said vertical section and projecting forwardly therefrom, a means on said horizontal section having right angle intersecting X and Y axes with the Y axis positioned longitudinally with the truck, a straight track means on one of said axes, an arcuate track means having a radius the center of which is at the intersection of said axes, a crosshead on the straight track means of said one axis, a crosshead on said arcuate track means, an elongated link having a forward end and being connected at its rearward end to said first crosshead and connected at its longitudinal center to the second crosshead, means for moving said second crosshead along said arcuate track means and indirectly moving said first crosshead along said straight track means, a fork section pivotally connected on a vertical axis to the forward end of said link, and means for skewing the fork section on said vertical axis from one side of the carriage to the other side thereof.

2. A front and side loader attachment for a lift truck as defined in claim 1 in which said straight track means is on said Y axis.

3. A front and side loader attachment for a lift truck as defined in claim 1 in which a motor mounted on said horizontal section drives said second crosshead along said arcuate track to move the forward end of said link from one side of the carriage to the other.

4. A front and side loader attachment for a lift truck as defined in claim 3 in which said motor means and said second crosshead are interconnected by a chain to drive said crosshead in either direction in said arcuate track means.

5. A front and side loader attachment for a lift truck as defined in claim 4 in which the vertical axis on the link on which said fork section is pivotally connected is a vertical shaft and a chain is mounted on said link for retaining said shaft in a fixed position relative to the carriage.

6. A front and side loader attachment for a lift truck as defined in claim 1 in which said straight track means and said arcuate track means consist of slots in said horizontal section, and in which said crossheads are disposed in the respective slots, and a motor mounted on said horizontal section drives the crosshead in said arcuate track means, and in which a chain interconnects said motor and the crosshead in said arcuate track means and moves in said arcuate slot.

7. A front and side loader attachment for a lift truck as defined in claim 1 in which said carriage has a load distributing system including a pair of laterally spaced racks mounted on said upright and interconnecting shaft and pinions meshing with said racks.

8. A front and side loader attachment for a lift truck as defined in claim 6 in which said carriage includes a load distributing system having a pair of laterally spaced racks mounted on said upright and a plurality of interconnecting shafts and pinions meshing with said racks.

9. A front and side loader attachment for a lift truck as defined in claim 1 in which said fork section includes a fork frame and a motor means for raising and lowering said fork frame relative to said fork section and the horizontal section.

10. A front and side loading attachment for lift trucks having an upright, comprising a carriage having a vertical section connected to the upright and a forwardly extending, laterally movable horizontal section, a means connected to said vertical section and supporting said horizontal section and having a slidable pivot means retained substantially on the longitudinal center line of said carriage, a pivot means mounted on said forward end of said horizontal section, and a load supporting section journaled on said pivot means and being movable angularly to face to the front and to either side of the carriage.

11. A front and side loader attachment for lift trucks as defined in claim 10 in which the forward end of said horizontal section moves on a straight line perpendicular to the center line of the lift truck.

12. A front and side loader attachment for lift trucks as defined in claim 10 in which said pivot means consists of a shaft mounted on the forward end of said horizontal section, and a motor is connected to said shaft for skewing the fork section about said pivot means.

13. A front and side loader attachment for a lift truck as defined in claim 10 in which said carriage includes a load distributing system having a pair of laterally spaced racks mounted on said upright and interconnecting shaft and pinions meshing with said racks.

14. A front and side loader attachment for a lift truck as defined in claim 12 in which said carriage includes a load distributing system having a pair of laterally spaced racks mounted on said upright and including a plurality of interconnecting shafts and pinions meshing with said racks.

15. A front and side loading attachment for lift trucks, comprising a carriage, a member mounted on said carriage and having at one end a slidable pivot means movable on a line substantially on the longitudinal center of said carriage, the other end of said member being movable from side to side substantially the full width of said carriage and on a line perpendicular to said first mentioned line, a fork section pivoted to the member at said other end and being movable with said member on said perpendicular line and movable angularly in a horizontal plane from one side of the carriage to the other side.

16. A front and side loader attachment for lift trucks as defined in claim 15 in which a motor means is mounted on said carriage for moving said other end from one side of said carriage to the other side thereof and thereby moving said fork section from one side of the carriage to the other side thereof.

17. A front and side loader attachment for lift trucks as defined in claim 15 in which a motor means is connected to the pivot of said fork section for moving said fork section between forward position and to either lateral side position.

18. A front and side loader attachment for a lift truck as defined in claim 15 in which said carriage includes a load distributing system having a pair of laterally spaced racks mounted on said upright and interconnecting shaft and pinions meshing with said racks.

19. A front and side loader attachment for a lift truck as defined in claim 17 in which said carriage includes a load distributing system having a pair of laterally spaced racks mounted on said upright and including a plurality of interconnecting shaft and pinions meshing with said racks.

* * * * *

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,672,526

Dated June 27, 1972

Inventor(s) Howard C. Hansen

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

On the cover sheet item [54] and column 1, lines 1 and 2, change the title from "FRONT AND SIDE LOADING ATTACHMENT FOR LIFTING TRUCKS" to -- FRONT AND SIDE LOADING ATTACHMENT FOR LIFT TRUCKS --.

Column 1, line 33, "acheive" should read -- achieve --.

Column 3, line 2, "40" should read -- 42 --;

line 22, "40" should read -- 42 --;

line 26, "40" should read -- 42 --;

line 41, "102" should read -- 84 --;

line 43, "40" should read -- 42 --;

line 58, "40" should read -- 42 --;

line 62, "40" should read -- 42 --.

Column 4, line 2, "40" should read -- 42 --.

Column 6, claim 18, line 2, after "which" insert -- said
truck has an upright and --.

claim 19, line 2, after "which" insert -- said
truck has an upright and --.

Signed and sealed this 14th day of May 1974.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents