

[72] Inventor **George E. Stanton**
7945 Hoover Road, Orient, Ohio 43146
[21] Appl. No. **849,784**
[22] Filed **Aug. 13, 1969**
[45] Patented **Aug. 17, 1971**

3,409,158 11/1968 Lull 214/730 X

FOREIGN PATENTS

1,026,688 3/1958 Germany 214/730
60,843 3/1912 Switzerland 214/730
793,972 4/1958 Great Britain 214/670

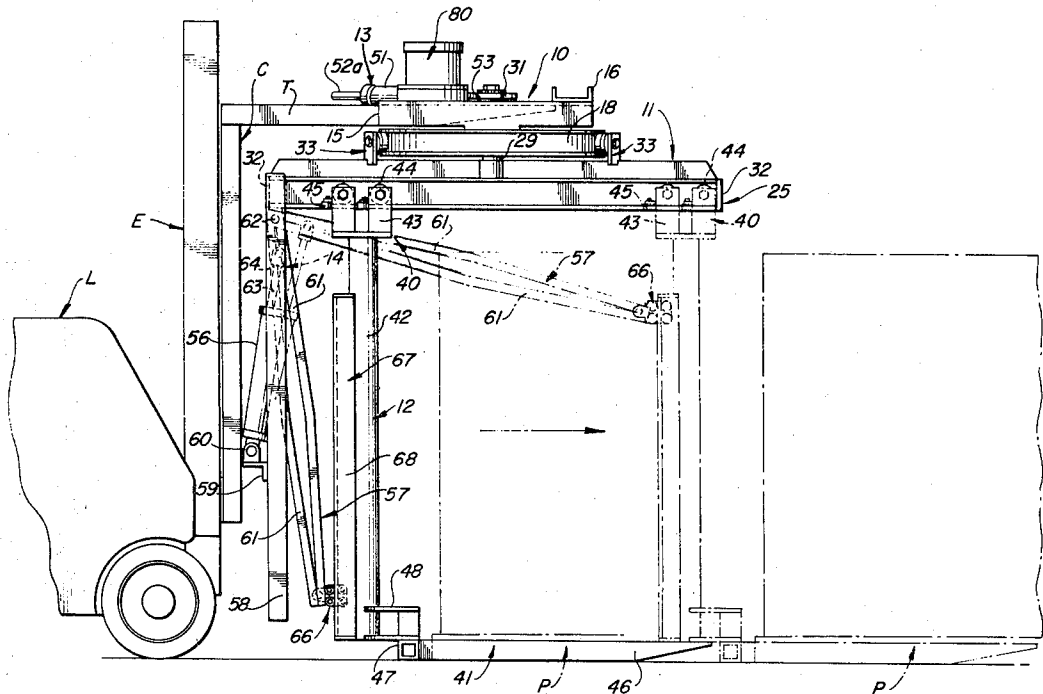
Primary Examiner—Gerald M. Forlenza
Assistant Examiner—Raymond B. Johnson
Attorney—Mahoney, Miller & Stebens

[54] **LOAD SUPPORT ATTACHMENT FOR VERTICAL LIFT TRUCKS PROVIDING HORIZONTAL AND ROTATIONAL DISPLACEMENT OF A LOAD**
5 Claims, 7 Drawing Figs.

[52] U.S. Cl. **214/620,**
214/730
[51] Int. Cl. **B66f 9/14**
[50] Field of Search 214/730,
660, 670—674, 620; 74/104

[56] **References Cited**
UNITED STATES PATENTS
2,828,880 4/1958 Perry 214/730
3,202,242 8/1965 Dolphin 214/730 X
3,323,664 6/1967 Loeft et al. 214/730 X
3,390,798 7/1968 Dixon 214/730

ABSTRACT: An attachment is provided for lift trucks permitting narrow-aisle stacking operations. The attachment includes a load carrier adapted to be mounted on the vertically elevatable carriage of a lift truck and capable of selective rotational displacement and horizontal displacement of a load relative to the lift truck in accomplishing stacking of loads in laterally offset relationship to the lift truck and its line of travel. The load carrier is mounted on a support structure for horizontal displacement which is effected by a selectively operable lever arm mechanism and the support structure is mounted on a support frame for rotational movement about a vertical axis by selectively operable motive means.



PATENTED AUG 17 1971

3,599,818

SHEET 1 OF 4

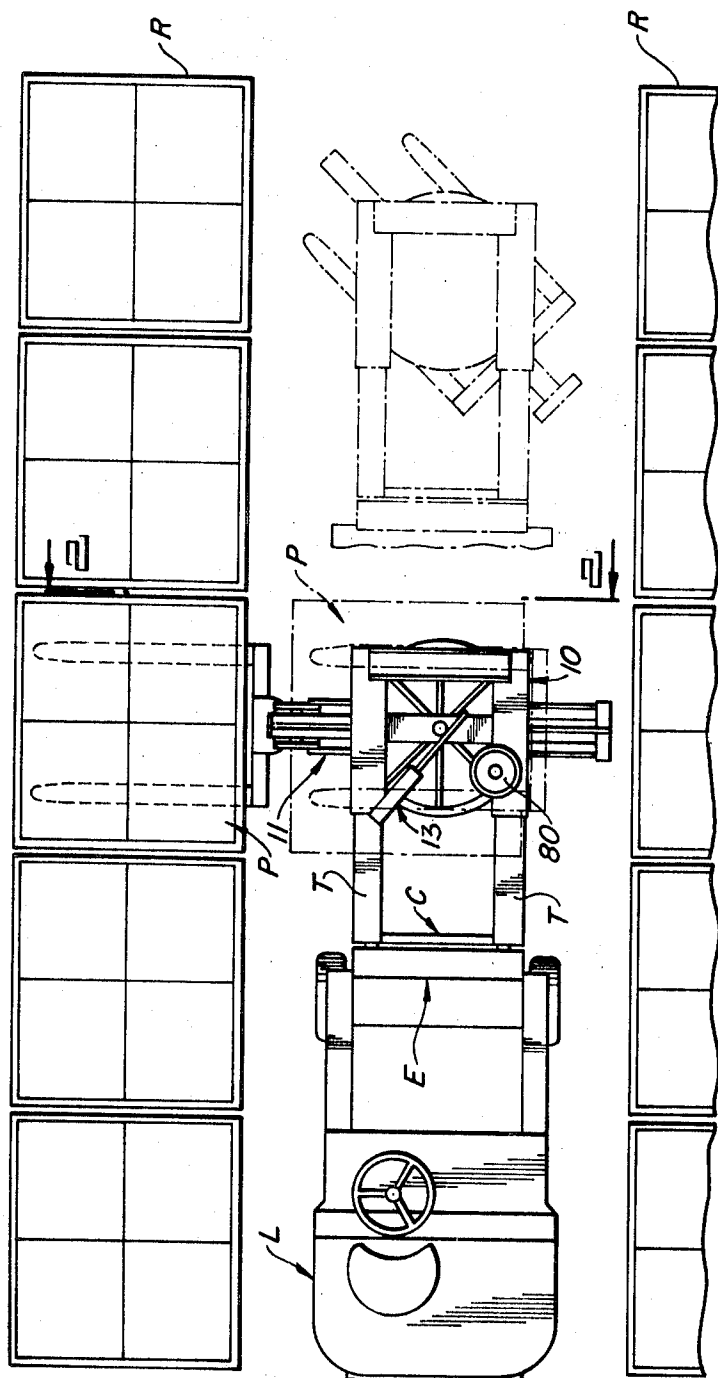
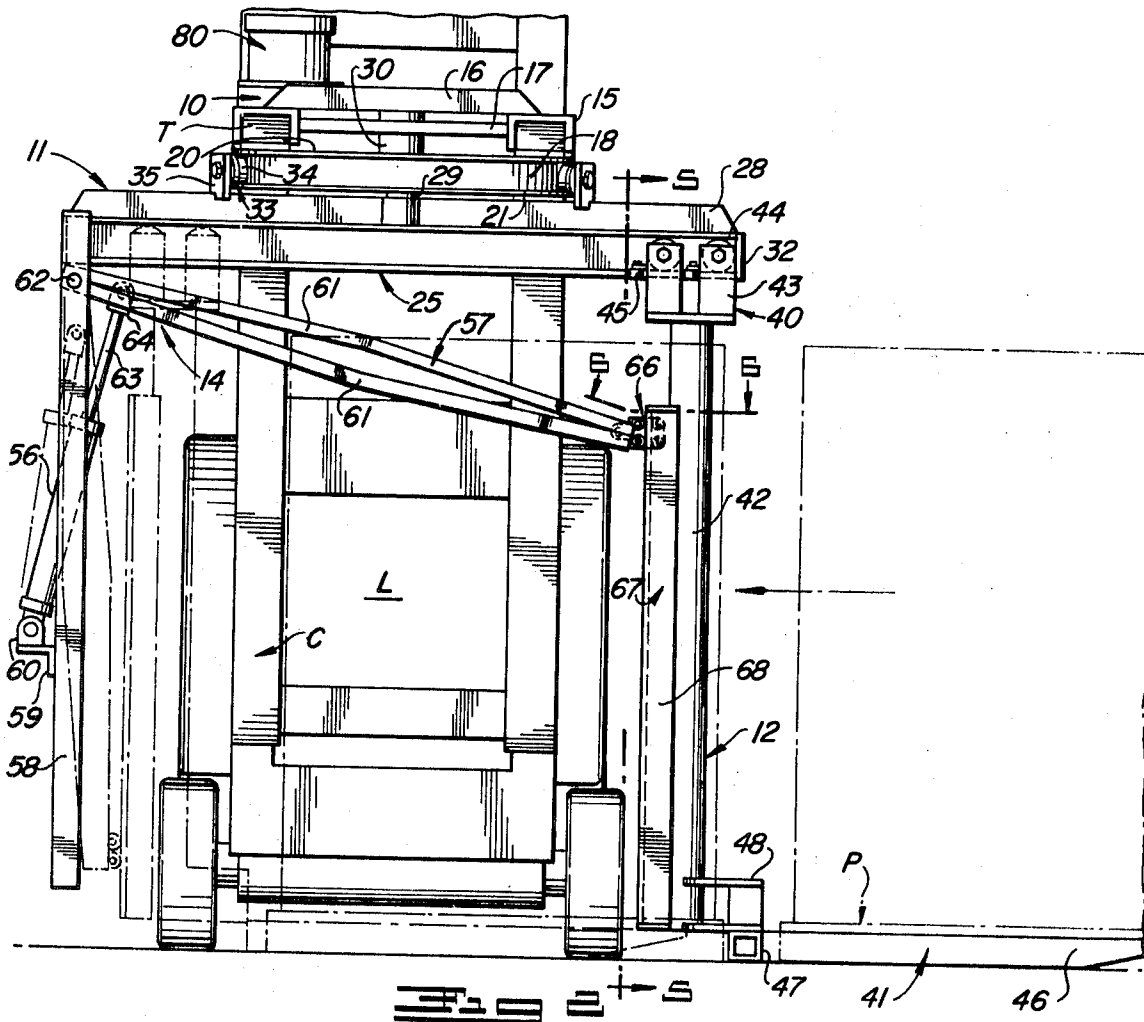
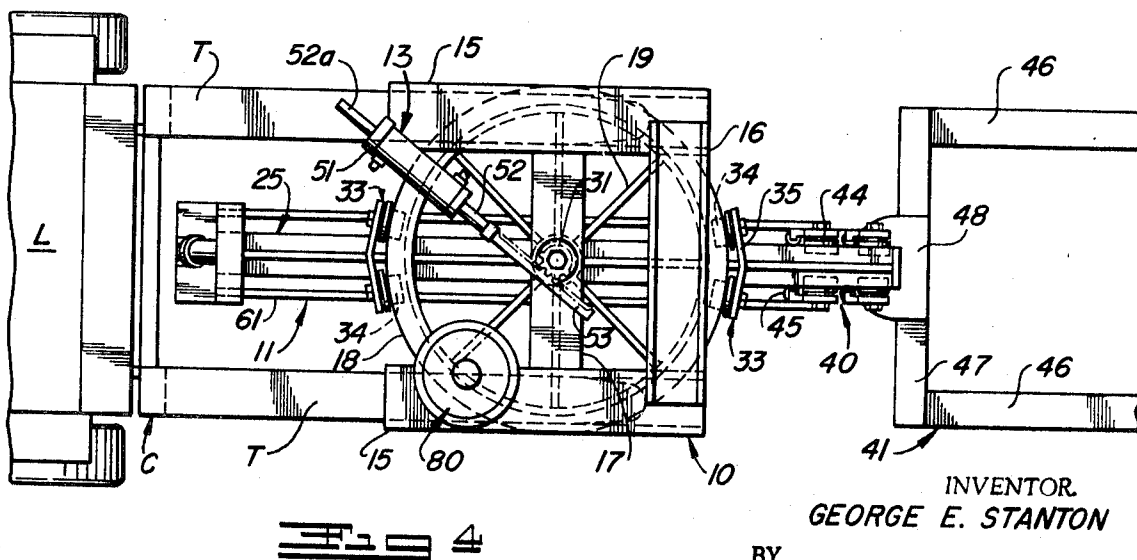


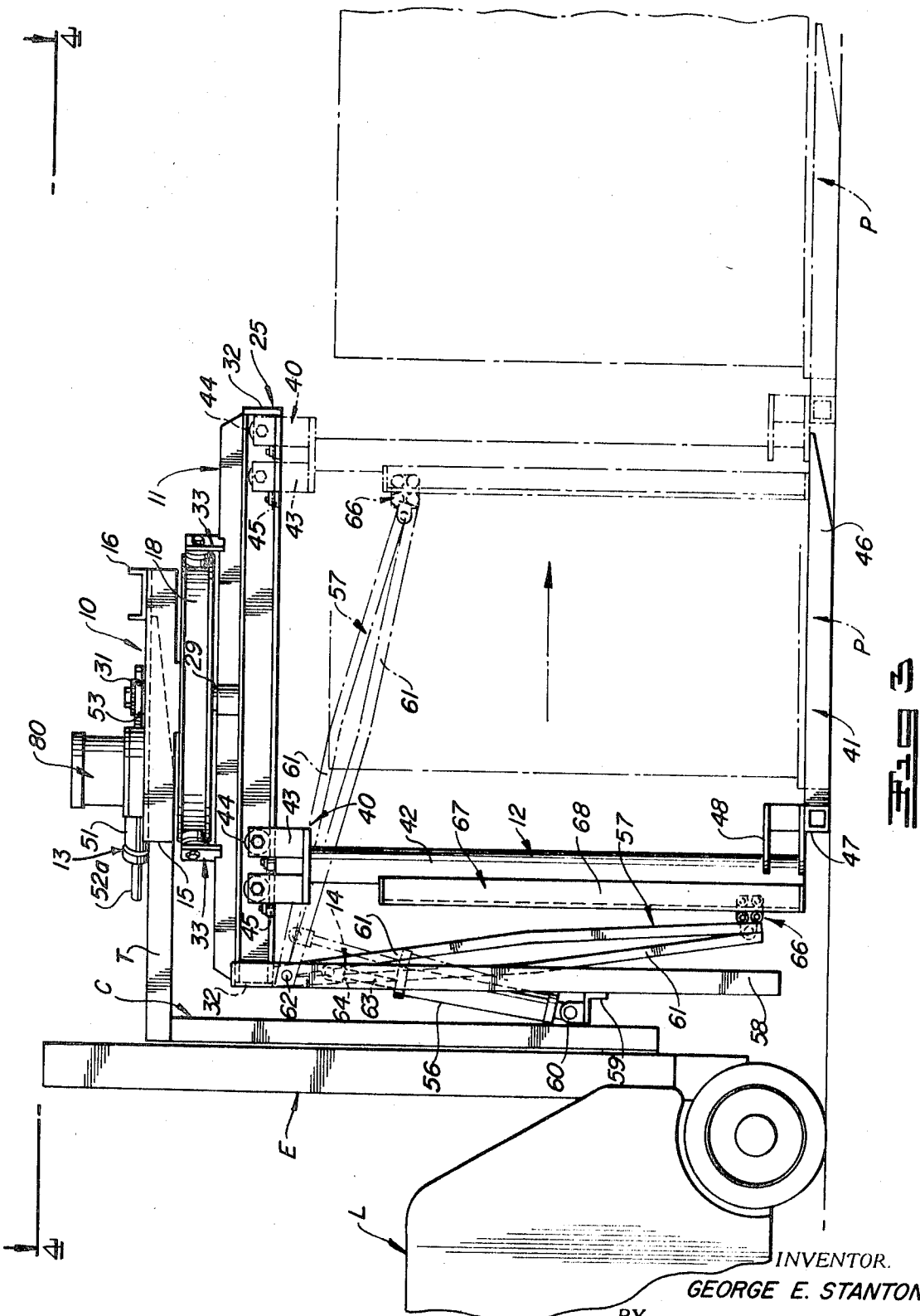
Fig. 1

INVENTOR
GEORGE E. STANTON
BY MAHONEY, MILLER & RAMBO
BY *Wm. V. Miller*
ATTORNEYS



INVENTOR.
GEORGE E. STANTON

BY
MAHONEY, MILLER & RAMBO
BY *Wm. V. Moller*
ATTORNEYS



INVENTOR.
GEORGE E. STANTON
BY
MAHONEY, MILLER & RAMBO
BY *Wm. V. Miller*
ATTORNEYS

LOAD SUPPORT ATTACHMENT FOR VERTICAL LIFT TRUCKS PROVIDING HORIZONTAL AND ROTATIONAL DISPLACEMENT OF A LOAD

GENERAL DESCRIPTION OF THE INVENTION

Economical warehousing practices emphasize the conservation of warehouse floorspace and this can only be accomplished through multiple-tiered stacking of generally palletized containers or articles with minimal allocation of floor space for aisles through which transporting and stacking equipment may traverse the warehouse area. This problem is particularly important in the case of warehouses or storage areas where selective placement or removal of certain pallets throughout any one aisle must be readily accomplished in that each aisle normally would contain more than one type of article or product. While industrial lift forks have been highly developed for use in warehouses for the purpose of stacking and unstacking palletized articles, these forklifts normally require considerable aisle space in which to maneuver to place the pallets in a position which is normally perpendicular to the line of travel through the aisle. Consequently, industrial lift forks have been further modified or have been provided with attachments which enable the pallet or load to be revolved and transversely displaced relative to the longitudinal axis of the industrial lift forks have been further modified or have been provided with attachments which enable the pallet or load to the revolved and transversely displaced relative to the longitudinal axis of the industrial lift truck which axis is the normal direction of movement of the truck. When capable of accommodation of such transverse movement, an industrial lift truck may longitudinally traverse the aisle space and, at the desired point, operated to either displace a pallet laterally of the aisle or to remove a pallet from a previously stacked position to the central aisle space for subsequent removal along the aisle without necessity of turning the lift truck.

The load support attachment of this invention is capable of effecting the necessary rotational movement at a central axis of the lift truck and then to subsequently effect a transverse displacement of the load relative to the longitudinal axis of the truck and thus eliminate any requirement for manipulation of the lift truck relative to the space in which a pallet is to be placed or from which a pallet will be removed. In general, the disclosed apparatus includes a base frame which is removably attachable to a vertically elevatable carriage of a lift truck and supports mechanism for effecting the revolving movement and transverse displacement of a pallet. This mechanism includes a rotatable support structure mounted in depending relationship on the base support frame and which supports the load carrier. The load carrier is mounted on the rotatable support structure for reciprocating movement in a horizontal plane and thus effects the transverse displacement of the pallet while the rotatable support structure effects the desired rotational movement to permit transverse movement of the pallet relative to a longitudinal axis of the lift truck. In accordance with this invention, the load carrier is mounted on the rotatable support structure and mechanism and means for effecting reciprocating movement thereof is interconnected between the load carrier and the rotatable support structure and selectively operable as required to effect extension or retraction of the load relative to the apparatus. A novel and simple actuating mechanism is provided which is capable of effecting the desired reciprocating movement of the load carrier but which is of a relatively lightweight construction as the load is directly carried and transferred from the load carrier to the rotatable support structure without dependence on the actuating mechanism. A simplified structure is also employed in the construction and fabrication of the load carrier and rotatable support structure which further simplifies the apparatus and results in an efficient and effective, but relatively lightweight structure.

These and other objects and advantages of this invention will be readily apparent from the following detailed descrip-

tion and the accompanying drawings of a preferred embodiment of the load support attachment.

In the drawings:

FIG. 1 is a diagrammatic plan view of a portion of a warehouse or storage space and a top plan view of a lift truck provided with a load support attachment of this invention illustrating the utilization and application thereof.

FIG. 2 is a front elevational view taken along line 2-2 of FIG. 1 and on an enlarged scale showing structural details of the load-support attachment with the load carrier extended.

FIG. 3 is a side elevational view of the load support attachment showing the load carrier retracted, but with the rotatable support structure rotated 90° from that position shown in FIG. 2 and being aligned with the normal direction of travel.

FIG. 4 is a top plan view taken along line 4-4 of FIG. 3 showing the load support attachment mounted on an industrial lift truck but with the load carrier retracted.

FIG. 5 is a vertical sectional view taken along line 5-5 of FIG. 2 and further enlarged.

FIG. 6 is a horizontal sectional view taken along line 6-6 of FIG. 2.

FIG. 7 is a schematic diagram of the fluid-actuating system and control for selective rotation and transverse displacement of the load carrier.

Having reference to the several figures of the drawings, a load-supporting attachment embodying this invention is shown mounted or attached onto an industrial lift truck of typical and well-known form and identified by the letter L. A typical lift truck L of this general configuration normally comprises a wheeled vehicular structure provided at one end with an elevator structure E. Mounted on the elevator E and selectively movable in a vertical direction at the option of the truck operator is a vertically elevatable carriage designated generally by the letter C. Forming a part of the carriage C are a pair of forwardly projecting, horizontally disposed tines T which could be of a configuration designed to normally effect lifting and support of a load. The load support attachment of this invention is designed in its basic form to be simply and readily attached to the normally provided lifting tines T which are carried by a typical lift truck in order to obtain the desired height and elevation capability. These tines and their associated mounting brackets are inverted on the elevator carriage E as can be most clearly seen in FIG. 3. Controls for operation of the carriage C and for normal operation of the lift truck are not shown or otherwise described as these are well known and understood. It will also be understood that in connection with this invention the carriage C will be subject to selective operation by the operator of the truck as is required for the specific stacking or unstacking operations. Operation of the vertically elevatable carriage C is independent of operation of the load support attachment.

The load support attachment comprises three basic structural elements which may be designated and identified as a base support frame 10, rotatable support structure 11 and load carrier 12. The base support frame 10 is adapted to be detachably secured or mounted on a horizontally disposed and forwardly projecting lifting tines T. Secured in depending relationship to the base support frame is the rotatable support structure 11 which may be selectively revolved in either direction to the extent of substantially a complete revolution. Actual physical engagement with a specific load such as the well-known pallets is effected by the load carrier 12 which is mounted on the rotatable support structure for reciprocal movement in a horizontal plane. Revolution of the rotatable support structure 11 in the desired direction and to the required extent is effected by first selectively operable motive means 13. Reciprocal movement of the load carrier 12 throughout the specified length of travel is effected by second selectively operable motive means 14. Both motive means 13 and 14 are interconnected in a suitable control and actuating system which is subject to the selective manipulation and operation by the lift truck operator.

Mounting of the attachment on a lift truck and support of any load to be carried by the attachment is effected by the base support frame 10. This frame comprises two elongated sidebeams forming tubes having openings which are adapted to receive respective ones of the tines T and a transverse cross brace 16 interconnecting the two tubes. Each side beam 15 is of a generally rectangular cross-sectional configuration and the beams are disposed in parallel spaced relationship with the spacing being determined by the lateral spacing of the lifting tines T of a lift truck with which the apparatus or attachment is to be utilized. Also forming a part of the base support frame 10 is a bearing bracket 17 on which the rotatable support structure 11 is mounted. Both the cross brace 16 and the bearing bracket 17 are rigidly secured to the two side beams 15 by suitable fastening means, welding, for example; thus forming a rigid structure capable of supporting any load for which the attachment is designed.

Secured to the lower side of the side beams 15 is a circular stabilizing track 18 disposed in a horizontal plane and having a center which is substantially coincident with the geometric center of the side beams and interconnecting cross brace 16 positioned at one end thereof. The bearing bracket 17 also intersects the center of the stabilizing track 18. Peripheral portions of the track are secured by welding to the side beams 15 and bearing bracket 17. A plurality of diametrically disposed ribs 19 are welded across the central portion of the track 18 to enhance the rigidity of the structure. The track is of channel form and includes a central circular web with radially outwardly projecting, upper and lower flanges 20 and 21.

Disposed beneath the base support frame 10 is the rotatable support structure 11. This structure comprises a horizontally disposed track 25 which is pivotally suspended from the bearing bracket 17. The track 25 may be fabricated from a structural member such as an I-beam as can be best seen in FIG. 5 and which includes a vertically disposed web portion with horizontal flanges that are vertically spaced and extend outwardly at either end of the web. These flanges are designated as upper and lower flanges identified by the respective numerals 26 and 27. In the illustrated embodiment, an upstanding rib 28 is secured to the upper flange 26 and extends substantially the length of the track providing attachment means and strength. Also secured to the track 25 at substantially the central point along the longitudinal axis thereof is a stub shaft 29 which extends vertically upward from the track and is journaled in a bearing assembly 30 mounted on and carried by the bearing bracket 17. This bearing assembly 30 is of the type designed specifically to accommodate thrust loads. A gear member 31 is secured to the upper end of the shaft 29. Attached to each end of the track 25 is an end or stop plate 32 which extends across the channel form space defined by the flanges 26 and 27 and the interconnecting web.

Two stabilizing roller assemblies 33 are mounted on the track 25 for interengagement with the stabilizing track 18 of the base support frame. Each stabilizing roller assembly 33 comprises a pair of rollers 34 rotatably mounted on the track by means of a bracket 35. This mounting bracket 35, which may be secured to the track and upstanding rib 28 as by welding, supports the rollers for rotation about a substantially horizontal axis with this axis of rotation being a radial to the vertical axis of revolution of the rotatable support structure 11. All rollers 34 are thus equidistantly spaced from the vertical axis and engage the stabilizing track 18. Thus, the rollers 34 resist twisting movement due to eccentric loading applied to the track 25 by interaction with the upper and lower flanges 20 and 21.

Mounted on the rotatable support structure 11 is the load carrier 12 which is adapted to be reciprocated along a horizontal path. Forming the load carrier 12 is a wheeled carriage 40 and a load-receiving platform 41 with these two elements being interconnected by a vertically disposed strut 42. The carriage 40 comprises a rigid frame 43 including vertically disposed sideplates interconnected by a bottom plate. Secured to the upper marginal edge portions of the rigid frame

43 are pairs of rollers 44 which project inwardly of the vertical sideplates in opposed relationship. These pairs of rollers 44 are positioned to interengage with the channel form tracks formed by the flanges 26 and 27 of the horizontal track 25 with the diameter of the rollers such that there is only a small clearance between the surfaces of the rollers and the opposed surfaces of the flanges 26 and 27 as can be best seen in FIG. 5. It will be noted that the rollers not only function in a primary aspect of supporting a load on the track 25, but through the cooperation of the longitudinal spacing of the pairs of rollers at each side, resist any tendency of the load carrier to swing in a vertical plane aligned with the longitudinal axis of the track. Resistance to such swinging movement is necessary as will be observed from the several figures of the drawings which indicate that a load supported by this carrier will be eccentric to the point of support and will thus result in an eccentric or rotative force. The rigid frame 43 is also provided with a second set of four rollers 45 which are of a substantially smaller diameter. The smaller rollers 45 are mounted on the sideplates of the frame 43 by suitable brackets to rotate about a vertical axis. These rollers are also positioned on the rigid frame 43 to engage the side edges of the lower flange 20. Accordingly, since these rollers are in spaced pairs at each side of the track 25 and are in engagement with the flange 27, they will resist any tendency of the load carrier to twist about a vertical axis.

The vertical strut 42 in the present embodiment is an elongated, cylindrical tube which is fastened at its upper end to the carriage 40 by suitable means such as welding to the horizontal plate of the rigid frame 43. The load receiving platform 41 would be designed to accommodate the specific load and in this instance, comprises two forklift tines, 46 interconnected by a crossbeam 47. The crossbeam 47, in turn, is secured to the vertical strut at its lower end by a bracket assembly 48 welded to the lower end of the strut 42.

Selective revolution of the rotatable support structure 11 about the vertical axis is effected by the first motive means 13 which includes an actuator 51 mechanically coupled with the pinion gear 31. In the illustrated embodiment, the actuator 51 is a double-acting hydraulic cylinder and piston unit having an axially extendable piston rod 52. The cylinder portion of the actuator 51 is rigidly mounted on the base support frame 10 and the free end of the piston rod 52 is provided or formed with a rack gear 53 with the actuator relatively oriented on the support frame 10 to cause the gear rod 53 to drivingly engage the pinion gear 31. Consequently, extension or retraction of the piston rod 52 will result in imparting rotation to the stub shaft 29 that carries the rotatable support structure 11. This gear rack 53 is of a length such that the actuator 51 will be capable of revolving the rotatable support structure 11 through the desired angular arc. For the purpose of stacking palletized cargo or articles at either side of the longitudinal axis of travel, it will be seen that this mechanism need only be capable of effecting substantially 180° of revolution. However, if desired, the rack and gear may be designed to effect a greater degree of revolution as may be required in specific instances. A suitable source of pressurized hydraulic fluid would be supplied and connected to the cylinder of the actuator. Such a system and fluid circuit is diagrammatically illustrated in FIG. 7 and will be subsequently explained in detail. Preferably, the actuator 51 is of a type having a piston with a double-end rod having the second portion 52a projecting outwardly from the opposite end of the cylinder. The double piston rod arrangement enhances the rigidity of the piston rod in effecting the transmission of a rotational driving force to the shaft 29 through the gear 31.

Horizontal displacement of the load carrier 12 and any load carried thereon is effected by the second motive means 14. This second motive means 14 also includes an actuator 56 of the cylinder and piston type and includes a lever arm 57 which is mechanically interconnected between the rotatable support structure 11 and the load carrier 12 to effect horizontal reciprocation of the load carrier in response to operation of the actuator 56. Secured to one end of the horizontally

disposed track 25 as by welding are a pair of parallel spaced downwardly extending struts 58. These struts are preferably of a length substantially equal to a length of the load carrier strut 42 and thus form a guard as well as guide for swinging movement or rotational movement of the load support attachment. A horizontally disposed mounting bracket 59 is secured to the strut 58 at a point substantially below the track 25 and one end of the actuator 56 is pivotally secured to the bracket by bearing blocks 60.

The lever arm 57 includes two spaced parallel elements of similar configuration as can be best seen in FIGS. 2 and 3 and including two elongated bars 61 that are welded together to form a lightweight but rigid truss structure. One end of each of the two elements forming the lever arm 57 is pivotally connected to the respective strut 58 by means of horizontally disposed pivot bolts 62 extending through the upper ends of the strut at a point adjacent to horizontal track 25. This mounting of the lever arm 57 permits swinging movement of the arm in a vertical plane.

The actuator 56 which is of the double-acting cylinder and piston type includes a piston rod 63 that is axially extendable from the cylinder and has a free end pivotally connected to the lever arms 57. Pivotal connection of this piston rod 63 to the lever arm 57 is effected by a pivot bracket 64 with the point of connection being relatively close to the pivot bolt 62 and thus requires a relatively short stroke of the actuator 56 to accomplish a large angular displacement of the lever arm 57. The extent of angular displacement is between the position with the lever arm 57 substantially vertically disposed and a position where the arm is substantially horizontally disposed as shown in FIGS. 2 and 3.

The opposite end of the lever arm 57 is provided with a roller guide assembly 66 which is engageable with a vertically extending guide track 67 secured to one side of the vertical strut 42. Forming the guide track 67, as can be best seen in FIG. 6, are two elongated L-shaped members 68. These two members 68 are mounted on the strut 42 as by welding to form a generally channel-shaped structure with the opposed longitudinal edges 69 of two flanges relatively spaced apart to form an elongated slot extending the length of the two members 68. Forming the roller guide assembly 66 is a guide plate 70 which projects a distance into the channel form structure formed by the members 68 and between the longitudinal edges 69. Mounted on the guide plate 70 are four pairs of guide rollers 71 which are positioned on the plate to engage the opposite surfaces of the flanges adjacent the longitudinal edges 69 in opposed pairs to prevent swinging movement of the guide plate in a vertical plane and relative to the guide track 67. Lateral displacement of the guide assembly 66 relative to the track 67 is prevented by the longitudinal edges 69 which are capable of bearing against the plate 70. Secured to a lateral projection of the guide plate 70 is a horizontally disposed bearing sleeve 72 which is in engagement with a bearing shaft 73. This bearing shaft 73 extends between and is secured to the bars 61 forming the two side elements of the lever arm 57. This roller guide assembly 66 and guide track 67 form a mechanism which maintains the end of the lever arm 57 in engagement with the load carrier 12. Consequently, swinging movement of the lever arm 57 in a vertical plane in response to operation of the actuator 56 will cause the load carrier to be reciprocated in a horizontal direction along track 25 between the end plates 32. The extent of this horizontal displacement is shown in FIGS. 2 and 3 as between the solid line illustrations of the load carrier.

A fluid control circuit for effecting operation and control of the two actuators 51 and 56 is schematically illustrated in FIG. 7. This apparatus may be embodied in a self-contained unit providing a suitable pressurized hydraulic fluid to the actuators under selective control of the operator. This source of pressurized hydraulic fluid may comprise a fluid pump 76 driven by electric motor 77. Both the motor and pump may be contained within a single housing and combined with a hydraulic fluid reservoir 78 along with a relief valve 79 in a

single-unit component indicated generally at 80 in the several figures. Control of hydraulic fluid flow to or from the respective independently operable four-way valves 81 and 82. These valves may be of the indicated spring-centered type having a manual actuator for the lift operator and would be conveniently located adjacent to the operator's driving station on the lift truck. The necessary flexible fluid conduits interconnecting the pump unit 80 and the valves 81 and 82 with the actuators 51, 56 are not otherwise shown in the drawings in FIG. 7 as their arrangement and construction or connection is well known.

Utilization of the load support attachment of this invention can be best understood with reference to an illustrative example as is shown in FIG. 1. In FIG. 1, a relatively narrow aisle warehouse area is diagrammatically shown as comprising two opposed rows R which may include a number of linearly spaced pallet-stacking areas and each area is assumed to be of a multiple-tier type. Vertical stacking may be either directly pallet on pallet or the pallets may be positioned on racks or shelving. For purposes of this illustration, it will be assumed that it is desired to place the palletized load P at a particular point in the illustrative warehouse area. In this instance, the load support attachment would be configured substantially as shown in FIG. 3 with the rotatable support structure 11 oriented with the horizontal track 25 extending parallel to the longitudinal axis of normal travel of the lift truck and the load carrier 12 retracted to the indicated full-line position. With the vertically elevatable carriage C of the normal lift truck vertically positioned at an appropriate height, the tines T may be directed to an engagement with the pallet to forward movement of the lift truck. Subsequent to engagement of the fork tines 46 with the pallet P, the vertically elevatable carriage C may be operated by the forklift operator to vertically raise the tines T and therewith the palletized load P. Elevation of the load in this instance would only be nominal and to an extent adequate to assure clearance of obstacles during the course of travel of the forklift with the load thus elevated and carried by the forklift.

The operator would direct the forklift between the two opposed aisles or rows R of the warehouse aisle area. At the selected point along the rows R where it is desired to place the palletized load P, the forklift would be stopped with the center of the load support attachment, that is the stub shaft 29, aligned with this specific space. The lift operator would then actuate the valve 81 in the desired direction to cause rotation of the rotatable support structure 11 in the desired direction, in this case, to the left, to an extent of 90° displacement. Operation of the normal forklift controls to effect elevation of the vertically elevatable carriage C will then appropriately position the palletized load P at an elevation for stacking if the stacking is to be other than ground level. After obtaining the desired vertical elevation, the operator actuates valve 82, which in turn, actuates the cylinder 56 to effect swinging movement of the lever arm 57 and consequent horizontal displacement of the load carrier 12 with the palletized load P. This results in lateral displacement of the load P relative to the longitudinal line of travel of the forklift and into the desired storage space. When fully extended, the load will be positioned as shown in FIG. 1. Slight lowering of the carriage C will permit a reverse of the operation and retract the load carrier 12 to the broken line position shown in FIG. 2 and thus, engagement of the forklift tines 46 from the pallet. This completes the stacking operation and the forklift may be removed from the warehouse aisle space in either a forward or reverse direction. If desired, the rotatable support structure 11 may be revolved to the normal longitudinally aligned position before further movement of the forklift; however, this is not necessary.

Having thus described this invention, what I claim is:

1. A load support attachment for lift trucks having a vertically elevatable carriage provided with horizontally projecting load-lifting tines comprising:

- A. a base support frame having openings to receive the tines for detachable mounting the attachment on the elevatable carriage for vertical displacement therewith and including in depending relationship thereto a circular stabilizing track disposed in a horizontal plane and having a vertical axis,
- B. a rotatable support structure mounted on said base support frame in depending relationship for revolution about said vertical axis and including an elongated, horizontally disposed track, said rotatably support structure having roller means engaging with said stabilizing track for resisting twisting forces imposed by eccentric loads,
- C. first selectively operable motive means interconnected with said base support frame and said rotatable support structure for effecting relative rotation thereof,
- D. a load carrier mounted on said rotatable support structure for reciprocable movement longitudinally of said track, said load carrier including a carriage mounted on said track for movement longitudinally thereof, a vertically disposed strut secured to and depending from said carriage and having a vertically extending guide track, and a load-receiving platform secured to said strut in laterally projecting relationship for supporting a load thereon beneath said track, and
- E. second selectively operable motive means interconnected with said rotatable support structure and said load carrier for effecting displacement of said load carrier for effecting displacement of said load carrier relative to said track between a position coaxial with said vertical axis and a position laterally offset therefrom, said second motive means including a lever arm pivotally mounted on said rotatable support structure eccentric to said vertical axis for swinging movement in a vertical plane aligned with said track between a nearly vertical position and a substantially horizontal position and having a roller guide engaged with said guide track and movable longitudinally

thereof to displace said load carrier in response to swinging movement of said lever arm, and actuator means interconnected with said rotatable support structure and said lever arm to effect swinging movement of said lever arm.

2. A load support attachment according to claim 1 wherein said guide track includes a pair of elongated plates disposed in coplanar relationship with spaced parallel, longitudinally extending edges, and said roller guide includes a guide plate projecting between said elongated plates and pivotally secured to said lever arm for relative swinging movement in a vertical plane and a plurality of rollers mounted on said guide plate and engaging said elongated plates preventing rotational movement of said guide plate relative to said elongated plates.

3. A load support attachment according to claim 1 wherein said load carrier carriage includes roller means engaging said rotatable support structure track for movement of said carriage longitudinally of said track and for resisting rotational movement of said carriage relative to said track about either a vertical or a horizontal axis.

4. A load support attachment according to claim 1 wherein said first motive means includes actuator means carried by said base support frame, and an axially extendible member having gear teeth formed thereon, and said rotatable support structure includes a gear drivingly engaged with said axially extendible member whereby axial movement of said member imparts a rotational movement to said rotatable support structure.

5. A load support attachment according to claim 1 wherein said first motive means comprises a fluid actuator having a double acting cylinder and an axially extendible piston rod, said cylinder connectable with a selectively controllable source of pressurized fluid to effect revolving movement of said rotatable support structure in either selected direction.

40

45

50

55

60

65

70

75