

Dec. 20, 1966

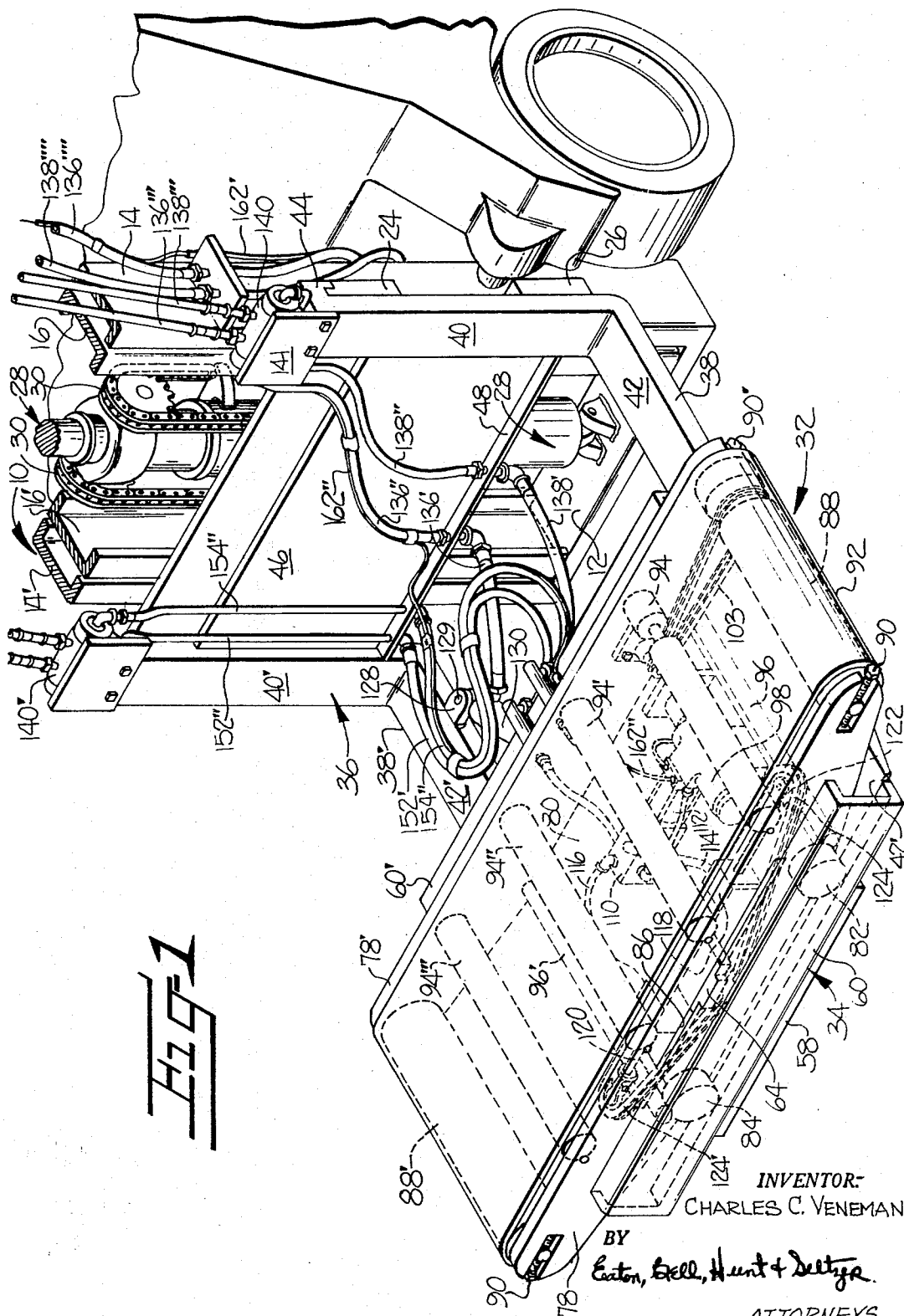
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3,292,804

PIVOTAL AND LONGITUDINALLY MOVABLE ATTACHMENT FOR A LIFT TRUCK

Filed Oct. 29, 1963

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

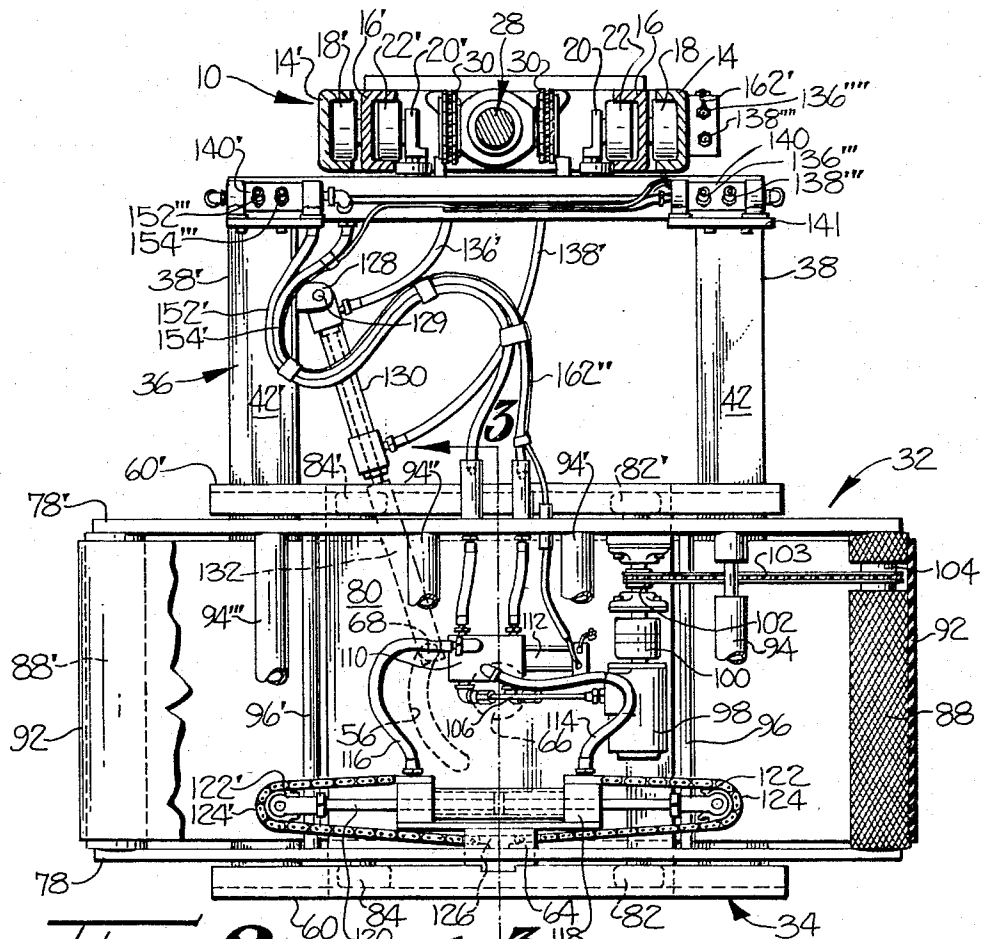


Fig. 2

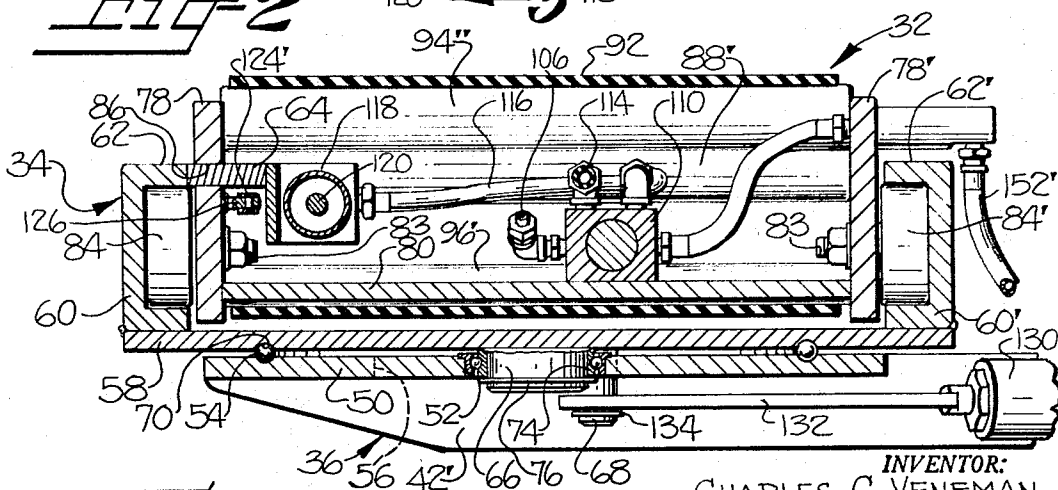


Fig. 3

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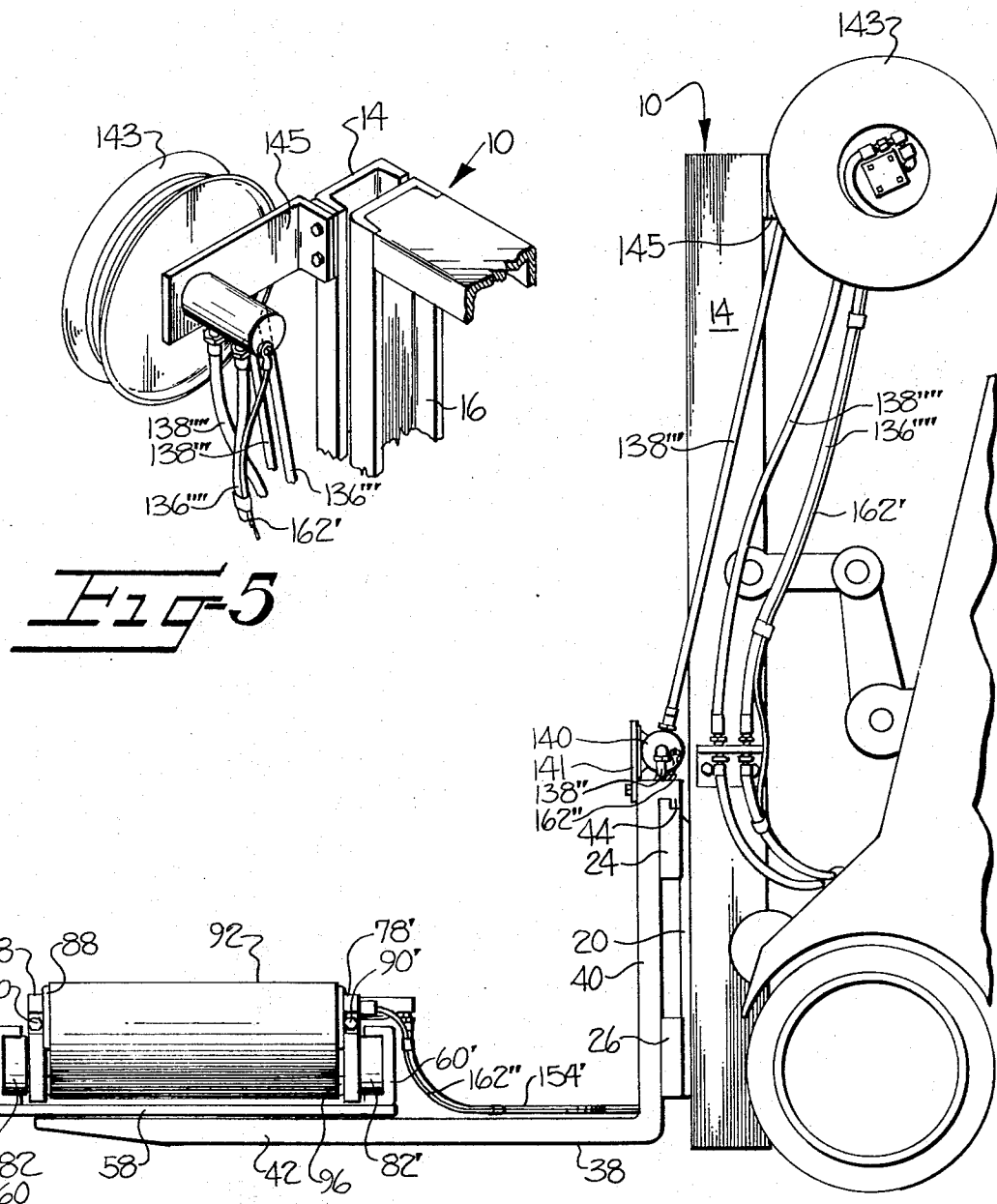


Fig. 4

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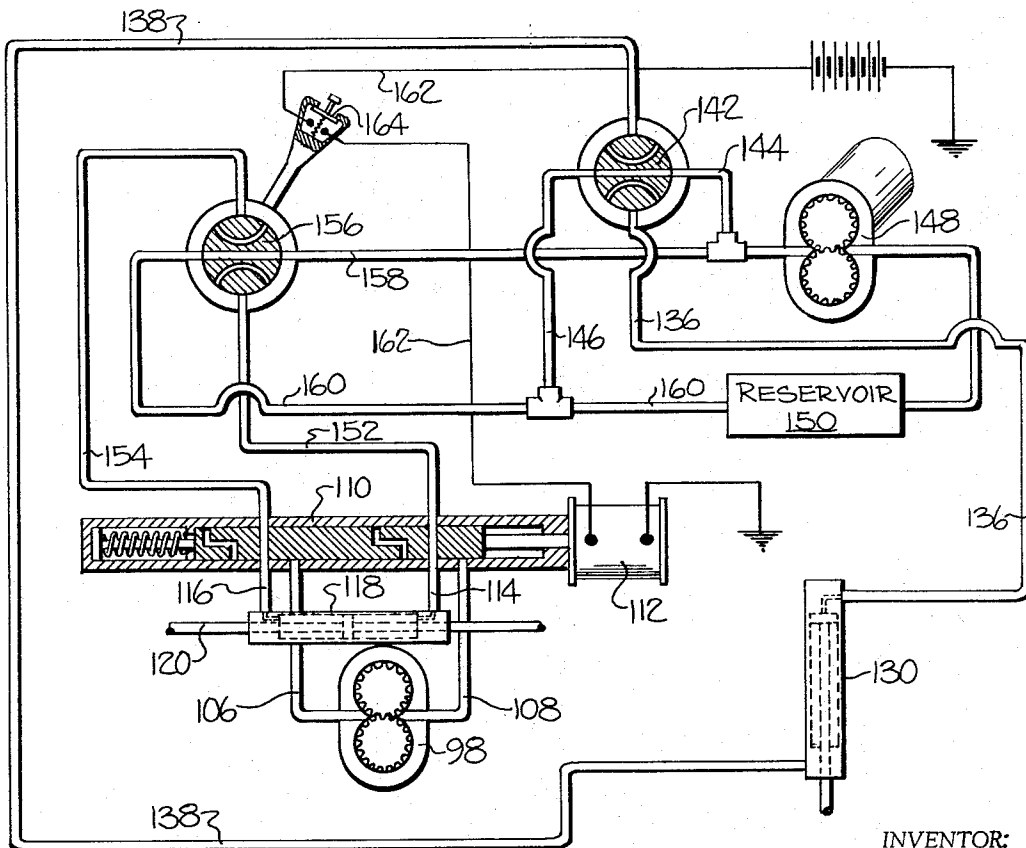
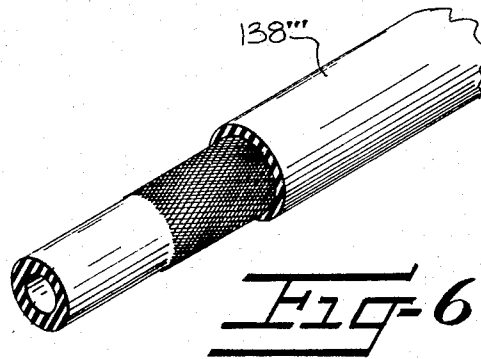
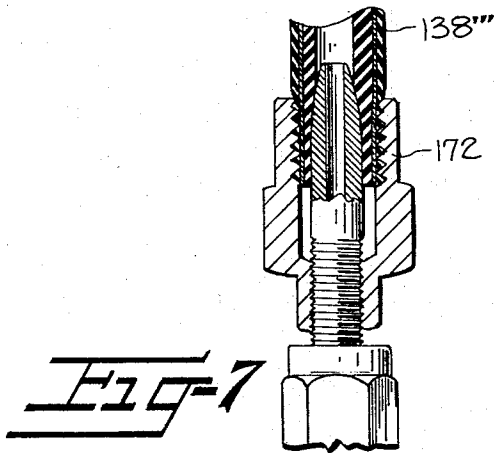
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4 Sheets-Sheet 4



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PIVOTAL AND LONGITUDINALLY MOVABLE ATTACHMENT FOR A LIFT TRUCK

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11 Claims. (Cl. 214—512)

This invention relates to an attachment for a load-handling vehicle of the fork-lift truck type and, more particularly, to an attachment enabling a truck operator to quickly and easily effect the transfer of loads of many different kinds to and from storage racks or the like without manual handling of the loads by either the operator or any other person, irrespective of whether the storage racks are located to one side or the other side or the front of the truck.

It is customary to store heavy loads of supplies, products to be sold, etc. in storage racks located in warehouses and other similar areas to await subsequent use or shipment. Materials-handling vehicles of the well-known fork-lift type have greatly speeded up the transfer of such loads from one area to another, while substantially reducing the physical effort required to accomplish such transfers. Originally, however, some time consuming and physically tiring manual handling of each load by the truck operator and/or another person was required to place the load upon the truck and remove it therefrom at the commencement and completion of the transfer. Even in the case of loads supported by pallets, such manual handling was still frequently necessary where the transfer was either to or from storage racks or other sites located in confined areas where turning and maneuvering of the lift truck was difficult or impossible to accomplish.

Various attachments have heretofore been proposed for enabling the operator of a lift truck to transfer loads to and from storage racks or the like without manual assistance. Such attachments have commonly consisted of an elongate transversely extending, load-supporting frame which is transversely shiftable with respect to the lift truck and which has a positively driven roller at one end thereof for engagement with a marginal edge portion of the lower surface of a load projecting outwardly from a storage rack. While in theory, rotation of this roller in the appropriate direction is supposed to cause the load to be removed from the storage rack and transferred to the load-supporting frame of the attachment, in actual practice slippage between the roller and the lower surface of the load engaged thereby has been a frequently encountered problem restricting the efficiency of such attachments. When slippage occurs, of course, it is necessary for the truck operator and/or another person to provide time-consuming and physically tiring manual assistance in transferring the load.

Apart from the foregoing, another deficiency frequently inherent in attachments including a side-shiftable, transversely-extending frame has been a lack of versatility obviating or severely diminishing the attachments' utility in all but one standard environment. Thus, such attachments have required that all areas in which they are used or taken be of a width not only greater than that of the trucks to which they are attached, but also greater than the length of their transversely-extending load-supporting frames, and have also required that the sites to and from which the loads are transferred be almost precisely at a right angle to one side or the other of the truck. The first of these requirements has necessitated either the provision of an excessive aisle area between and adjacent the load storage facilities and those sites to and from which the loads stored therein are transferred, or has necessitated time-consuming detours on the part of the truck operators.

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The second of these requirements has necessitated the provision of manual assistance in transferring loads to and from delivery vehicles and other similar, confined areas in which it would be either excessively time consuming or impossible to maneuver the truck into the precise location necessary for fully mechanical transfer.

With the foregoing in mind, one object of the present invention is to provide an improved attachment for a load-handling vehicle of the fork-lift truck type to facilitate the transfer of a load to and from a storage rack of the like, wherein the attachment includes a load-engaging conveyor belt carried by the load-supporting frame of the attachment, and providing improved frictional engagement with the lower surface of a load to more effectively transfer the load between a storage rack or the like and the load-supporting frame of the attachment, and wherein either end of the load-supporting frame can, if desired, be projected bodily to a considerable extent within a storage rack to facilitate a load's transfer to and storage within the rack.

Another object of this invention is the provision of an attachment for a load-handling vehicle of the fork-lift truck type which enhances the versatility of utilization of the lift truck and which permits its use in aisles of standard width and in confined areas where precise maneuvering of the truck is either quite difficult or impossible, by reason of the load-supporting frame of the attachment being mounted for both transverse shifting and horizontal pivotal movement relative to the truck. The dual movement of which the load-supporting frame of the attachment is capable renders unnecessary precise placement of the truck relative to the load to be transferred, and also obviates any need for travel aisles of a width equal to the length of the frame. For instance, by pivoting the load-supporting frame of the attachment into alignment with the longitudinal axis of the truck after receiving a load from a storage rack, the load can then be conducted over aisles of no greater width than the truck to the interior of a delivery vehicle of other area of such small size as to permit only longitudinal movement of the truck, and there deposited without the necessity for any manual handling of the load whatsoever.

Another object is the provision of an attachment of the type described which is so designed and constructed as to detract to the minimum possible extent from the stability of the truck to which it is attached. The components of the present attachment are, insofar as possible, spaced closely adjacent to and balanced on opposite sides of the longitudinal center line of the vehicle, and side-shifting movement is restricted to only certain essential components rather than to the entire attachment.

Still another object is the provision of an attachment of the type described which is fully operable in all respects from the lift truck to which it is attached, all of the attachment controls being disposed upon the truck adjacent the operator, but which is capable of being quickly and easily disconnected and removed from the truck when desired. In this same connection, a related and more specific object is the provision of improved means for transmitting electric power between a power source carried by a lift truck and a power consumer carried by an attachment which is movable relative to the truck.

Additional objects of a more specific nature are the provision in an attachment of the type described of improved mechanisms for imparting pivotal and side-shifting movement to a load-supporting frame, the mechanisms being of simple, inexpensive and durable construction but highly efficient and reliable in operation.

Still other objects and advantages will be in part evident and in part pointed out in the following description of an illustrative embodiment of the invention, which should be

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read in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of an attachment constructed in accordance with the present invention and attached to the front of a lift truck;

FIGURE 2 is a top plan view of the attachment and of the immediately adjacent components of the lift truck shown in FIGURE 1, some of the latter being shown in horizontal section and a portion of the conveyor belt of the former being broken away;

FIGURE 3 is an enlarged vertical section taken approximately along the line 3—3 of FIGURE 2 through a portion of the attachment;

FIGURE 4 is a side elevational view of the attachment and of the forwardmost portion of the lift truck to which it is attached;

FIGURE 5 is a fragmentary rear perspective view of the reel mechanism, with the cover therefor removed, shown in FIGURE 4 and of certain immediately adjacent components;

FIGURE 6 is an enlarged perspective fragmentary view of a portion of the conduit extending downwardly and forwardly from the reel mechanism shown in FIGURE 4, with the components of the conduit broken away to disclose details of construction;

FIGURE 7 is an enlarged sectional view of an end portion of the conduit shown in FIGURE 6 and the fitting secured thereto, illustrating the connection between the conduit and the fitting; and

FIGURE 8 is a diagrammatic view of the operating and control system and circuitry for the attachment.

Referring more particularly to the drawings, the load-handling vehicle to which the present attachment is connected is of the conventional lift type including a substantially vertical, telescopic mast structure 10 mounted for limited tilting movement on the forward part of the truck. As shown in FIGURE 1, mast structure 10 is of a well-known construction including a lowermost horizontal support member 12 from which channel-shaped support members 14, 14' extend upwardly in parallel, spaced relationship to each other. Mounted between and guided by support members 14, 14' for vertical movement relative thereto is a first vertically-movable assembly (see FIGURE 2) including channel members 16, 16' and rollers 18, 18', while mounted between and guided by the channel members 16, 16' is a second assembly movable vertically relative to the first assembly and including angle members 20, 20' and rollers 22, 22'. Plate means in the form of spaced, horizontally extending upper and lower plate members 24, 26 are secured to angle members 20, 20' for movement forwardly of and vertically along the mast structure, this vertical movement being conventionally imparted to the plate means by a hydraulic hoist motor and piston assembly, generally designated in its entirety by the numeral 28, mounted upon support member 12 of the mast structure and including chains 30 operatively connected to the plate means.

All of the foregoing structure being conventional, a more detailed description thereof is unnecessary. It will further be understood that the lift truck is provided with the conventional controls, mechanisms and motors necessary for an operator seated thereon to steer and operate the same in all customary respects, including causing tilting of the mast structure 10, vertical movement of the plate means including plate members 24, 26, etc.

Turning now to the attachment shown in the drawings, the same consists generally of elongate load-supporting frame means 32 movable or shiftable longitudinally in either direction in a substantially horizontal plane, carriage means 34 supporting frame means 32 and pivotally movable in a substantially horizontal plane about a substantially vertical axis, and bed means 36 supporting carriage means 34 and connected to the vertically movable plate means including members 24, 26 for movement therewith along mast structure 10 of the truck.

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Referring now to FIGURES 1-4, bed means 36 includes a pair of spaced, rigidly interconnected, L-shaped members 38, 38' consisting of substantially vertical portions 40, 40' from the lower ends of which extend substantially horizontal portions 42, 42', respectively. Hook means in the form of rearwardly extending hook members 44, 44' are integral with the upper ends of vertical portions 40, 40', respectively, for detachably connecting bed means 36 to the plate means movable vertically along mast structure 10 of the truck. As is best shown in FIGURES 1 and 4, members 44, 44' hook over the upper edge of plate member 24 of the vertically movable plate means, which upper edge may be suitably notched as shown to facilitate reception of the hook members, and the rear surfaces of vertical portions 40, 40' of L-shaped members 38, 38' engage and rest against the forward surfaces of plate members 24, 26 of the vertically movable plate means. When thus supported by hook members 44, 44', L-shaped members 38, 38' are spaced equidistant from and on opposite sides of the longitudinal center line of the truck, and horizontal portions 42, 42' thereof extend forwardly of the truck to a considerable extent. Three plate members rigidly interconnect L-shaped members 38, 38'. Plate member 46 extends in a substantially vertical plane between, and is rigidly connected to, medial sections of vertical portions 40, 40' of members 38, 38'. A second plate member, identified in FIGURE 1 by the numeral 48, also interconnects vertical portions 40, 40' of L-shaped members 38, 38', but is considerably smaller in size than member 46 and has its major surfaces horizontally disposed. The third plate member interconnecting L-shaped members 38, 38', identified in FIGURE 3 by the numeral 50, extends horizontally between and is rigidly connected to horizontal portions 42, 42' of members 38, 38' adjacent the forward ends of these portions and has its upper surface substantially co-planar with their upper surfaces. For reasons subsequently made apparent, plate member 50 is provided with a centrally-located, vertical bore 52 there-through and with a groove 54 of generally semicircular cross-sectional shape formed in its upper surface so as to define a circle concentric with bore 52. Further, a slot 56 (see FIGURE 2) extends through plate 50 and is arcuately formed so as to also be concentric with bore 52 and so as to span between its opposite ends an angle of slightly more than ninety degrees.

The carriage means 34 carried by bed 36 includes a substantially flat plate member 58 of generally rectangular shape. A pair of elongate channel members 60, 60' are affixed to the upper surface of plate 58, as by welding, in such a manner as to extend along opposite longitudinal edges of plate member 58 in spaced parallel relation to each other with their flanges 62, 62' directed horizontally inwardly. Midway of the length of channel member 60 is an L-shaped bracket 64 (see FIGURE 3), one leg of which is rigidly connected to upper flange 62 of channel member 60 and extends horizontally inwardly therefrom, and the other leg of which depends vertically downwardly a short distance from the innermost end of the horizontal leg of the bracket.

The means mounting carriage 34 upon bed 36 for pivotal movement in a substantially horizontal plane includes a relatively large-diameter shaft 66 fixed to and projecting vertically downwardly from the center of the lower surface of plate 58 of the carriage for reception within bore 52 of plate 50 of the bed, a second shaft 68 also fixed to and projecting vertically downwardly from the lower surface of plate 58 as to be received within and project through arcuate slot 56 of plate 50, and a circular groove 70 formed in the lower surface of plate 58 so as to complement the similar groove 54 in plate 50 of the bed and form therewith a raceway suitable for reception of a plurality of ball-bearings 72 (see FIGURE 3). The supporting means further includes a conventional bearing 74 encircling that portion of shaft 66 within bore

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52, and maintained within bore 52 by means of a snap ring 76. When carriage means 34 is mounted upon bed means 36 by the foregoing components in the manner shown in FIGURE 3, it will be apparent that the carriage is movable vertically in unison with the bed and is also independently pivotally movable in a substantially horizontal plane about the vertical axes of bore 52 and shaft 66. The pivotal movement of which carriage means 34 is thus capable is through an arc of ninety degrees, being limited by abutment of shaft 68 with the opposite ends of arcuate slot 56, such that carriage means 34 can be pivoted in a counterclockwise direction to any desired position between that shown in FIGURE 2, in which position it extends normal to the longitudinal axis of the truck, and a position in which it is aligned with the longitudinal axis of the truck.

The load-supporting frame means 32 carried, in a manner to be described more fully hereinafter, by carriage means 34 includes a pair of elongated frame members 78, 78' secured together centrally of their lengths and intermediate their heights in parallel spaced relationship by a flat bottom panel 80. The bottom panel 80 is relatively short as compared to frame members 78, 78', such that the opposite ends of the latter project considerably beyond the former. The width of frame means 32 is slightly less than the distance between channel members 60, 60' of carriage 34, and means are provided to mount frame means 32 between channel members 60, 60' and above plate 58 for longitudinal movement in both directions in a substantially horizontal plane. As best shown in FIGURES 1-3, such means comprises a first pair of spaced rollers 82, 84 mounted adjacent the outer side of frame member 78 by stub shafts 83 projecting through and bolted to the latter, these rollers 82, 84 being received between the flanges of channel member 60; and a second pair of rollers 82', 84' similarly positioned and connected to frame member 78' for reception between the flanges of channel member 60'. Rollers 82, 84, and 82', 84' are of such a size relative to the height and depth of channel members 60, 60' as to prohibit vertical and lateral movement of the rollers and of frame means 32 relative to channels 60, 60', but permit rolling movement of the rollers and therefore longitudinal movement of frame means 32 relative to carriage means 34. Frame means 32 is, as will be noted from FIGURE 3, freely capable of such longitudinal movement by reason of rollers 82, 84, 82', 84' suspending it in spaced relation to the various components of carriage 34. Nor does the L-shaped bracket 64 carried by channel member 60 impede the aforesaid mounting or longitudinal movement of frame means 32, since an elongate slot 86, best shown in FIGURE 1, is provided in frame member 78 for reception and passage of the horizontal leg of this bracket. And, as will be noted from FIGURE 3, with the horizontal leg of bracket 64 thus received within slot 86, the vertical leg of the bracket is disposed adjacent to but spaced from the upper surface of panel 80 of frame means 32.

Frame means 32 supports a conveyor assembly of improved form for moving loads longitudinally of its length and onto and off of its opposite ends. This conveyor assembly includes a pair of rotatable elements, in the form of relatively large-diameter rollers 88, 88', mounted by adjusting mechanisms 90, 90' between the opposite ends and normal to the lengths of frame members 78, 78' of frame means 32. The size and location of rollers 88, 88' relative to the frame members 78, 78' of frame means 32 are such that segments of the cylindrical surfaces of the rollers project both above and outwardly from the opposite ends of frame members 78, 78'. Entrained about rollers 88, 88' is an endless conveyor belt 92, the width of which is only slightly less than the distance between frame members 78, 78' of frame means 32. Intermediate rollers 88, 88', the upper flight of belt 92 is maintained at an elevation slightly above that of the uppermost edges of frame members 78, 78' by spaced, auxiliary rollers 94, 94' and 94'' mounted between and normal to frame members 78, 78' adjacent their upper edges. The lower flight of belt 92 is guided beneath bottom panel 80 of frame means 32 by auxiliary rollers 96, 96', which are mounted for rotative movement between frame members 78, 78' adjacent opposite end edges of panel 80, it being noted from FIGURE 3 that sufficient clearance is provided between bottom panel 80 of frame means 32 and plate member 58 of carriage 34 to permit free passage of the lower flight of belt 92 therebetween. It will be apparent that belt 92, when maintained in a sufficiently taut condition by the adjusting mechanisms 90, 90' provided for this purpose, is capable of being driven in either direction upon appropriate rotation of either roller 88 or 88' so as to convey a load in engagement with the upper surface of its upper flight longitudinally of frame means 32 and, if desired, onto or off of either end of the frame means. To insure good engagement between the inner surface of belt 92 and the cylindrical surface of the roller employed to drive the same, the latter is provided with a knurled or otherwise roughened finish such as is shown in FIGURE 3 on roller 88.

Suitable means operable from the lift truck impart the aforementioned movement to belt 92, and impart to frame means 32 and carriage means 34 the respective longitudinal and pivotal movements of which each of these components is capable. In the case of the conveyor belt 92, such means includes a reversible hydraulic motor 98 and its associated coupling 100 and driven sprocket 102, all of which are mounted upon bottom panel 80 of frame means 32 in spaced relation to end roller 88 of the conveyor assembly (see FIGURE 2). A driven chain 103 extends between sprocket 102 and a similar sprocket 104 fixedly connected to roller 88 within a cut-away portion adjacent one end thereof. A cut-away portion is also provided adjacent one end of auxiliary roller 94 to permit free passage of chain 103 between sprockets 102, 104. Hydraulic fluid is supplied to and from motor 98, to thus cause chain 103 to rotate roller 88 and in turn drive conveyor belt 92, through conduits 106, 108 (see FIGURES 2 and 8) which lead from a spool-type valve 110 actuated by a solenoid 112, both the valve 110 and solenoid 112 being also mounted upon bottom panel 80 of frame means 32 between the upper and lower flights of belt 82. Energization of solenoid 112 causes the spool of valve 110 to be shifted so as to direct hydraulic fluid supplied thereto through conduit 106 or 108 and to motor 98. When solenoid 112 is de-energized, however, the spool of valve 110 is biased to the position shown in FIGURE 8, in which position hydraulic fluid supplied thereto is directed through either of another pair of conduits, 114, 116, that also lead from valve 110 and to opposite ends of a double-acting hydraulic cylinder 118. Cylinder 118 is mounted by a suitable support upon the vertical leg of L-shaped bracket 64 so as to extend horizontally parallel and adjacent to the inner surface of frame member 78 of frame means 32. A piston rod 120 extending through cylinder 118 and projecting beyond the opposite ends thereof is provided with rotatable sprockets 122, 122' upon its extremities. Flexible chains 124, 124' are entrained about sprockets 122, 122', respectively, and the innermost ends of the chains are anchored to opposite ends of cylinder 118 or the support therefor, on that side of the cylinder distal from frame member 78 of frame means 32. The opposite ends of chains 124, 124' are each secured to a generally T-shaped lug 126 mounted centrally of and extending inwardly from the inner side of frame member 78 beneath the horizontal leg of the L-shaped bracket 64 upon which cylinder 118 is mounted. With the foregoing arrangement in mind, it will be apparent that upon hydraulic fluid being supplied from valve 110 to that end of cylinder 118 serviced by conduit 114, piston rod 120 will be shifted to the left as viewed in FIGURE 2. This leftward displacement of piston rod 120 in turn causes chain 124' and lug 126 to move frame means 32 longitudinally.

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nally of carriage 34, such movement being transversely of longitudinal axis of the truck and to the left when carriage 34 is disposed in the position illustrated in FIGURE 2. Similarly, the supplying of hydraulic fluid from valve 110 through conduit 116 to the opposite end of cylinder 118 causes piston rod 120, chain 124 and lug 126 to move frame 32 back to its centered position illustrated in FIGURE 2 and, if desired, therebeyond in a rightward direction. The length of chains 124, 124' and the stroke of piston rod 120 are such that in the extreme side-shifted positions of frame 32, rollers 82, 82' and 84, 84' thereof are disposed just inwardly of the respective ends of channel members 60, 60' adjacent thereto, so that at all times the rollers are guided by and supported within channels 60, 60' yet maximum longitudinal movement of frame means 32 is obtained. In this latter connection, it will also be apparent that the utilization of chains 124, 124' in the manner described, in lieu of a rigid connection between piston rod 120 and frame means 32, produces significantly greater longitudinal movement of frame means 32 than would otherwise be realized.

Turning now to the means for imparting pivotal movement to carriage 34, a lug 128 (see FIGURES 1 and 2) is secured to and extends normally from the inner side of horizontal portion 42' of L-shaped member 38' of bed 36 adjacent the rearmost end of portion 42'. An elongate hydraulic cylinder 130 is secured at one end to lug 128, by means of a suitable pivot pin 129, for limited pivotal movement in a substantially horizontal plane. The piston rod projecting from the opposite, forwardmost end of cylinder 130 carries an arm 132 having a vertical bore in its outer end portion adapted to receive the shaft 68 depending from plate 58 of carriage 34. As is shown in FIGURE 3, a snap ring 134 may be provided upon the outer end of shaft 68 to insure that the latter will be maintained within the bore of arm 132. When hydraulic fluid is supplied to that end of cylinder 130 adjacent lug 128, the resulting movement of arm 132 and its connection with shaft 68 pivots frame 32 in a substantially horizontal plane about the axis of shaft 66 to any desired position between that shown in FIGURE 2 and one disposed ninety degrees in a counterclockwise direction therefrom, i.e., a position in which carriage 34 and the frame 32 pivotable therewith are disposed in alinement with the longitudinal axis of the truck. The supplying of hydraulic fluid to the opposite end of cylinder 130 similarly causes return pivotal movement of carriage means 34 in a clockwise direction to any desired position up to and including that shown in FIGURE 2. The limited movement of which cylinder 130 is capable and the placement of cylinder below the plane of the lower surface of plate member 58 of carriage 34 insures that this pivotal movement of the carriage is in no way impeded or obstructed, and of course the length of horizontal portions 42, 42' of bed 36 in relation to the length of frame means 32 is also such as to freely allow this pivotal movement.

Hydraulic fluid is conducted to and from cylinder 130 through conduits 136, 138, which include flexible portions 136', 138' extending between the cylinder and suitable fittings carried by plate member 48 of bed means 36, portions 136'', 138'' connected to and extending upward from these fittings to the opposite fixed ends of a swivel fitting 140 mounted by a bracket 141 atop the substantially vertical portion 40 of L-shaped member 38, and flexible portions 136''', 138''' connected by quick-connect and disconnect couplings to the swivelable center section of swivel fitting 140 and extending therefrom to an automatic take-up reel mechanism 143 permanently mounted by a bracket 145 atop and to the rear of support member 14 of mast structure 10 of the truck. Final portions 136''', 138''' of conduits 136, 138 lead from reel mechanism 143 to a manually operable valve 142 (see FIGURE 6) mounted upon the lift truck in convenient access to the operator thereof and having inlet and outlet ports respectively connected by conduits 144, 146

to the hydraulic motor 148 and reservoir 150 customarily carried by the truck. For reasons subsequently made apparent, the brackets 141, 145 which support fitting 140 and reel 143, respectively, are each formed of a material which is a non-conductor of electricity.

Hydraulic fluid for operating conveyor motor 98 and cylinder 118 is supplied to and from spool valve 110 by similar conduits 152, 154 which include flexible portions 152', 154' extending through suitable fittings carried by frame member 78' of frame 32 and between spool valve 110 and fittings carried by plate member 48 of bed means 36, portions 152'', 154'' extending between these latter fittings and a swivel fitting 140' mounted atop L-shaped member 38' of bed means 36, and flexible portions 152''', 154''' connected by quick-connect and disconnect couplings to swivel fitting 140' and extending therefrom to a reel mechanism (not shown) comparable to the reel mechanism 143 hereinbefore mentioned but mounted atop support member 14' of mast structure 10 of the truck. Final portions of conduits 152, 154 lead from this reel mechanism to a manually operable valve 156 (see FIGURE 8) similar to valve 142 in its accessibility to the operator of the truck and also having its inlet and outlet ports connected to the truck's hydraulic pump motor 148 and reservoir 150, such connection being by conduits 158, 160 respectively.

As noted previously, spool valve 110 directs hydraulic fluid to and from cylinder 118 when solenoid 112 is de-energized, and to and from conveyor motor 98 when solenoid 112 is energized. As shown in FIGURE 8, the circuit for energizing solenoid 112 includes a conductor 162 leading from the battery conventionally carried by the truck to one terminal of a normally-open manually-closable switch 164 preferably mounted, as diagrammatically shown, upon the operating lever for valve 156, and from the other terminal of switch 164 to one end of the coil of solenoid 112. The opposite end of the coil of solenoid 112 and the other terminal of the truck battery are each suitably grounded, so as to complete a circuit through the coil of solenoid 112 upon closure of switch 164.

Although not apparent from FIGURE 8, the conductor 162 interconnecting the battery of the lift truck and the solenoid 112 of the attachment is unusually and advantageously constituted. Referring now to FIGURES 4 and 5, an insulated line 162' constituting the first part of the section of conductor 162 leading from switch 164 is electrically connected to reel mechanism 143, as by a conventional contact member 170 secured at any convenient point upon the latter. Reel 143 is, in turn, electrically connected to the swivel fitting 140 of the attachment by conduit 138''' of the heretofore described hydraulic circuitry extending between reel 143 and swivel fitting 140. More specifically in this connection, conduit 138''' is of a conventional three-core construction including, as shown in FIGURE 6, inner and outer rubberous or plastic cores, and an intermediate reinforcing core woven from metallic wire. This latter, metallic core conducts electricity satisfactorily and, moreover, requires no contact members for transmitting electricity to or from it other than the standard hydraulic couplings already connected to the opposite ends of conduit 138''' for the purpose of coupling the same to swivel 140 and reel 143. FIGURE 7 shows a portion of one of these couplings and the manner in which the toothed female segment 172 thereof pierces the outer core of conduit 138''' and engages the intermediate wire core thereof, thereby establishing electric contact between the wire core and the fitting. Electricity conducted from reel 143 to swivel fitting 140 through the wire core of conduit 138''' and the fittings connected to this conduit is transmitted from fitting 140 to solenoid 112 by a conventional insulated line 162'', which is electrically connected at one end by a suitable contact (not shown) secured at any convenient location to fitting 140 and at its opposite end to a terminal of solenoid 112. As is shown in FIGURES 1 and 2, the inter-

mediate length of line 162" may be taped or otherwise secured to the exterior of various of the hydraulic conduits extending to frame 32, so as to prevent its entanglement during pivotal movement of carriage 34.

From the foregoing explanation, it will be apparent that the section of conductor 162 shown in FIGURE 8 as leading from switch 164 to solenoid 112 is actually comprised of (see FIGURES 1-7) line 162', reel mechanism 143, the intermediate metallic core of conduit 138''' and the couplings (see FIGURE 7) secured to opposite ends of conduit 138''', swivel fitting 140, and line 162''. The components of the truck and of the attachment which support reel 143 and swivel fitting 140 are excluded from this circuit. This is accomplished, first, by the brackets 145 and 141 supporting reel 143 and swivel fitting 140, respectively, each being formed of non-conducting material, as hereinbefore noted; and, secondly, by utilizing conduit material lacking the metallic wire reinforcing core of conduit 138'''—and instead formed entirely of non-conducting substances—for the conduits 136''' and 138''' leading to reel 143 and for the conduits 136'' and 138'' leading from fitting 140. Such conduit material formed entirely of substances, such as rubber and/or nylon, which do not conduct electricity is available commercially and is well known. The conduit 136''' (extending parallel to conduit 138''' between swivel 140 and reel 143) may be formed either of the non-conductive material of conduits 136'', 136''', 138'' and 138''', or of the same metallic-core conduit material of conduit 138'''; if formed of the latter, then conduit 136''' would also form a part of conductor 162, paralleling and performing the same function in the conductor 162 as the conduit 138'''. Apart from the cost reduction realized by the use of conduit 138''' (and conduit 136'', if also employed) for both hydraulic and electric conduction, the utilization of conduit 138''' at the point noted in conductor 162 obviates the problem, which would be encountered were conductor 162 comprised entirely of conventional insulated line such as the line 162', of breakage of the conductor at this point of relatively great stress.

Complete freedom of movement of the various main components of the present attachment relative to each other and to the truck is afforded by the above described hydraulic and electrical connections. Thus, as the attachment is raised and lowered by and along mast structure 10 of the truck, reel mechanism 143 and its counterpart on the opposite side of the mast structure automatically reel in or out, as necessary, the conduits extending therefrom to swivel fittings 140, 140', and the latter automatically swivel to compensate for the change in the angular position of these conduits relative to the reel mechanisms. Similarly, the provision of ample slack, as shown in FIGURES 1 and 2, in the conduits 152', 154' and line 162'' extending from plate 48 of bed 36 to frame 32 insures that neither the movement of frame 32 and carriage 34 relative to bed 36 nor the movement of the frame relative to the carriage are in any way impeded by these conduits or the line 162''.

A previously noted object of the present invention was the provision of an attachment which detracted to the minimum possible extent from the stability of the truck to which it was attached. Contributing significantly to the realization of this object is the fact that of the three basic components of the present attachment only one, frame means 32, is ever unequally displaced to one side or the other of the longitudinal center line of the truck. Carriage means 34 and bed means 36 are at all times centered and are never thus displaced. Also contributing significantly to stability is the fact that the weight of frame means 32 and the components supported thereby is distributed as equally as possible on opposite sides of the longitudinal center line of the truck in all of the various positions of the frame and of carriage 34. Referring to FIGURE 2, it will be noted in this connection that motor 98 and its associated components are disposed dis-

tal from the ends of frame means 32, as closely adjacent the center of the frame as is feasible, and with the weight of the motor, on the one hand, and its associated driven shafts and sprockets, on the other hand, approximately counterbalanced on opposite sides on the longitudinal center line of frame means 32. Cylinder 118 extends equal distances on opposite sides of the center line of the truck. Spool valve 110, as viewed in FIGURE 2, is disposed rearwardly and to the left of the center of frame 32, so as to counterbalance the forward placement of cylinder 118 and, at least to some extent, the weight of motor 98. Cylinder 130 tends to further counterbalance the weight of motor 98 when carriage means 34 is in the position shown in FIGURE 2, and the weight of cylinder 118 when the carriage is in a position displaced ninety degrees in a counterclockwise direction from its position shown in FIGURE 2.

In addition to that relative to stability, another accomplished object of the present invention is the provision of an attachment capable of being quickly and easily connected to and disconnected from a truck, as desired. In order to disconnect the present attachment from the truck, the operator need but lower the same by mast structure 10 until horizontal portions 42, 42' of L-shaped members 38, 38' rest upon any suitable, slightly elevated support, and then continue lowering of the vertically movable plate means of mast structure 10 until plate 24 thereof passes below and out of engagement with hooks 44, 44' of members 38, 38'. The conduits extending between the swivel fittings 140, 140' and the reel mechanisms upon the truck are then disconnected from the former and plugged by any suitable means, following which the truck is free to be driven elsewhere and used as desired, leaving the attachment upon its support. Re-connection of the attachment to the truck can be accomplished when desired with equal facility and speed simply by performing the foregoing steps in reverse order.

In actual operation, the present attachment enjoys a wide versatility of utilization and eliminates the need for manual handling of loads. To briefly summarize such operation, the operator of the truck to which the present attachment is secured first drives the truck in conventional fashion to the site of the load to be transferred. Assuming such site to be a confined one, offering limited room for maneuvering of the truck, such as the interior of a delivery vehicle or railroad boxcar, the operator pivots carriage 34 and shifts frame 32 to whatever extent might be necessary in order to position either end of the frame beneath a part of the lower surface of the load. Pivoting of carriage 34 is achieved by the operator rotating valve 142 ninety degrees from its position shown in FIGURE 8, rotation of the valve in a counterclockwise direction causing counterclockwise pivotal movement of the carriage and rotation of the valve in a clockwise direction causing return movement of the carriage in a clockwise direction. Shifting movement of frame 32 is similarly achieved by rotation of valve 156 in the desired direction by the truck operator, rotation of this valve ninety degrees in a clockwise direction from its position shown in FIGURE 6 causing movement of frame 32 to the right (as viewed in FIGURE 2) and counterclockwise rotation of the valve causing movement of the frame means to the left. Once either end of frame means 32 is thus positioned beneath the lower surface of the load, the attachment is raised by mast structure 10 of the truck until that portion of the upper flight of conveyor belt 92 adjacent such end engages the lower surface of the load. The operator of the truck then actuates the conveyor drive mechanism so as to cause the upper flight of belt 92 to move the load onto and to the center of frame means 32. Assuming the load to be adjacent the right-hand end of frame 32 as viewed in FIGURE 1, such movement of belt 92 would be achieved by the operator maintaining switch 164 depressed and rotating valve 156 ninety degrees in a clockwise direction, thus causing roller 88 and belt 92 to

be rotated by motor 98 in a counterclockwise direction. The provision of the continuous belt 92, in lieu of a mere roller arrangement, insures that the necessary frictional engagement will be initially made with the load and maintained along the entire length of frame 32, even if the load be of such an exceedingly small or unusual size and/or shape. Once the load is thus centrally positioned, the operator of the truck re-orient's frame 32 and carriage 34, if desired, for travel to the load's destination. By pivoting carriage 34 ninety degrees in a counterclockwise direction from its position shown in FIGURE 2, it will be apparent that such travel can be over aisles of no greater width than that of the truck itself. Also, by shifting frame 32 so as to place roller 88 thereof as close as possible to plate member 46 of bed 36 and by utilizing belt 92 to carry the load thereon toward the roller 88 end of frame means 32, it will be apparent that the stability of the truck during its travel can be enhanced. When the truck arrives at the load's destination, say, a storage rack, it is maneuvered so that the rack is located generally forwardly and to one side or the other of the truck. Precise positioning of the truck relative to the storage rack is unnecessary, since once the truck is generally located as described, carriage means 34 is pivoted in a clockwise direction to whatever extent might be necessary to generally align frame means 32 with the rack. The attachment is then elevated by mast structure 10 of the truck to place the upper flight of conveyor belt 92 at an elevation slightly above the floor of the rack. The operator then actuates the proper controls to shift frame 32 so as to place one of its ends closely adjacent the rack opening and to thereafter drive belt 92 in the proper direction to convey the load thereon toward and off of said one end of frame 32 and into the storage rack. A significant feature of the present attachment is that the load thus deposited in the storage rack need not be left with one edge portion thereof projecting from the rack opening, but may if desired be positioned completely within the rack to a considerable extent. This is made possible by frame means 32 of the present attachment being the only component thereof which undergoes side-shifting movement, thereby allowing the ends of frame 32 to not only be positioned adjacent a rack opening, but to actually be inserted for a considerable distance within the rack.

It will thus be seen that there has been provided a lift truck attachment realizing the objects and possessing the benefits heretofore noted, together with many practical advantages. While a preferred embodiment of the invention has been shown and described with specificity, it will be realized this was for purposes of illustration only, and not for purposes of limitation, the scope of the invention being defined in accordance with the claims.

I claim:

1. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, means guided by and movable vertically along said mast, and mechanical means operable from said vehicle for imparting said movement to said vertically movable means, said attachment comprising:

- (a) bed means extending forwardly of said vehicle and connected to said vertically movable means for movement therewith;
- (b) carriage means mounted upon said bed means in spaced relationship to said vehicle for pivotal movement in a substantially horizontal plane;
- (c) elongate frame means mounted upon said carriage means for pivotal movement therewith and for longitudinal movement in a substantially horizontal plane relative to and outwardly beyond said carriage means;
- (d) an endless conveyor belt extending longitudinally the entire length of and carried by said elongated frame for movement therewith and for rotative movement relative thereto, said belt being adapted to en-

gage a load and upon rotation to move the load longitudinally of said elongate frame means;

- (e) power means operable from said vehicle for imparting said pivotal movement to said carriage means and said longitudinal movement to said elongate frame means and said rotary movement to said conveyor belt, said power means including chain means interconnecting said carriage means and said frame means, sprocket means engaging said chain means intermediate opposite ends thereof, and fluid-actuated piston and cylinder means carried by said carriage means and operatively connected to said sprocket means for imparting when actuated said longitudinal movement to said frame means through said sprocket means and said chain means.

2. An attachment as in claim 1, wherein said vertically movable means includes a substantially horizontal plate member guided by and movable vertically along said mast, and further including hook means carried by said bed means, said hook means being engageable with said plate member for detachably connecting said bed means to said vertically movable means.

3. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, means guided by and movable vertically along said mast, and mechanical means operable from said vehicle for imparting said movement to said vertically movable means, said attachment comprising:

- (a) bed means extending forwardly of said vehicle and connected to said vertically movable means for movement therewith;
- (b) carriage means mounted upon said bed means in spaced relationship to said vehicle for pivotal movement in a substantially horizontal plane, said carriage means comprising a substantially flat plate member of generally rectangular shape, and a pair of elongate channel members mounted upon said plate member adjacent opposite side edges thereof, said channel members extending in spaced parallel relationship to each other and having their flange portions inwardly directed;
- (c) elongate frame means carried by said carriage means, said frame means comprising a pair of elongate frame members of a length greater than the length of said channel members of said carriage means, and a substantially flat bottom panel connecting said frame members intermediate their length and maintaining said frame members in spaced parallel relationship to each other;
- (d) a plurality of rollers carried by and exteriorly of said frame members of said frame means, said rollers being closely received by said channel members of said carriage means and mounting said frame means for pivotal movement with said carriage means and for longitudinal movement in a substantially horizontal plane relative to and outwardly beyond said carriage means;

(e) an endless conveyor belt extending longitudinally the entire length of and carried by said elongate frame for movement therewith and for rotative movement relative thereto, said belt being adapted to engage a load and upon rotation to move the load longitudinally of said elongate frame means; and

(f) power means operable from said vehicle for imparting said pivotal movement to said carriage means and said longitudinal movement to said elongate frame means and said rotary movement to said conveyor belt.

4. An attachment as in claim 3, wherein said power means includes sources of fluid and electric power upon said vehicle, consumers of fluid and electric power upon said attachment, and means extending between said vehicle and said attachment for conducting fluid and electric power from said sources to said consumers, said last-mentioned means including a conduit having a reinforcing

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ing core formed of electrically conductive material, the interior of said conduit conducting fluid and said core of said conduit conducting electricity between said sources and said consumers.

5. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, means guided by and movable vertically along said mast, and mechanical means operable from said vehicle for imparting said movement to said vertically movable means, said attachment comprising:

- (a) bed means detachably connected to said vertically movable means for movement therewith, said bed means extending forwardly of said vehicle and being at all times approximately centered relatively to the longitudinal center line of said vehicle;
- (b) carriage means mounted upon said bed means in spaced relationship to said vehicle for pivotal movement in a substantially horizontal plane about a vertical axis extending adjacent the longitudinal center line of said vehicle;
- (c) elongate frame means mounted in a normal central position upon said carriage means for movement therewith and for longitudinal movement relative thereto in a substantially horizontal plane in both directions from its normal central position to offset positions in which said frame means projects outwardly beyond said carriage means;
- (d) an endless conveyor belt carried by said elongate frame for movement therewith and for rotative movement in both directions relative thereto, said belt extending over the entire length and over substantially the entire width of said elongate frame, and one flight of said belt being adapted to engage a load and upon rotation of said belt to move the load longitudinally of said elongate frame means;
- (e) power means operable from said vehicle for imparting said pivotal movement to said carriage means and said longitudinal movement to said elongate frame means and said rotary movement to said conveyor belt, said power means including a vertical shaft carried by said carriage means in spaced relationship to said vertical axis about which said carriage means is pivotal, and fluid-actuated cylinder and piston means pivotally connected to said bed means and operatively connected to said shaft of said carriage means for imparting when actuated said pivotal movement to said carriage means through said vertical shaft.

6. An attachment as in claim 5, and further including means limiting pivotal movement of said carriage means to an arc of approximately ninety degrees and between a first carriage means position normal to the longitudinal center line of said vehicle and a second carriage means position parallel to the longitudinal center line of said vehicle.

7. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, means guided by and movable vertically along said mast, and mechanical means operable from said vehicle for imparting said movement to said vertically movable means, said attachment comprising:

- (a) bed means extending forwardly of said vehicle and connected to said vertically movable means for movement therewith;
- (b) carriage means mounted upon said bed means in spaced relationship to said vehicle for pivotal movement in a substantially horizontal plane, said carriage means comprising a substantially flat plate member of generally rectangular shape, and a pair of elongate channel members mounted upon said plate member adjacent opposite side edges thereof, said channel members extending in spaced substantially parallel relation to each other and having their flange portions inwardly directed;

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- (c) elongate frame means;
- (d) roller means carried by said frame means and received between said flange portions of said channel members of said carriage means, said roller means mounting said frame means upon said carriage means between said channel members thereof for longitudinal movement of said frame means in a substantially horizontal plane relative to and outwardly beyond said carriage means;
- (e) rotatable elements mounted at opposite extreme ends of said elongate frame means;
- (f) an endless conveyor belt entrained about and having upper and lower flights extending between said rotatable elements at opposite ends of said elongate frame means, the upper flight of said belt being adapted to engage a load and to convey the load longitudinally of said elongate frame means upon rotation of one of said rotatable elements; and
- (g) power means operable from said vehicle for imparting said pivotal movement to said carriage means and said longitudinal movement to said elongate frame means and said rotary movement to said one of said rotatable elements.

8. An attachment as in claim 7, wherein said bed means comprises a pair of interconnected generally L-shaped members spaced equidistant from and on opposite sides of the longitudinal center line of said vehicle, said L-shaped members having substantially vertical portions adjacent said vehicle and substantially horizontal portions extending forwardly of said vehicle from the lower ends of said vertical portions, and hook means integral with the upper ends of said vertical portions of said L-shaped members for detachably connecting said bed means to said vertically movable means.

9. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, plate means guided by and movable vertically along the front of said mast, and mechanical means operable from said vehicle for imparting said movement to said plate means, said attachment comprising:

- (a) a pair of interconnected generally L-shaped members having substantially vertical portions adjacent the front of said vehicle and substantially horizontal portions extending forwardly of said vehicle;
- (b) hook means integral with said vertical portions of said L-shaped members for detachably connecting said L-shaped members to said vertically movable plate means for movement therewith, said L-shaped members being suspended by said hook means on opposite sides of and equidistant from the longitudinal center line of said vehicle;
- (c) a first flat plate member carried by and between said horizontal portions of L-shaped members adjacent the forwardmost ends thereof, said plate member having a circular groove in its upper surface and having a vertical bore and an arcuate slot extending therethrough, the axis of said bore intersecting the longitudinal center line of said vehicle and said slot being concentric with said bore and said groove and spanning an angle of at least ninety degrees;
- (d) a second flat plate member, said second flat plate member being of generally rectangular shape and having a circular groove in its lower surface complementing said groove within said first plate member and forming therewith a bearing raceway;
- (e) first and second vertical shafts depending from the lower surface of said second plate member for reception within said bore and said slot, respectively, of said first plate member;
- (f) a plurality of ball bearings within said raceway formed by said grooves, said ball bearings mounting said second plate member upon and in spaced parallel relationship to said first plate member for pivotal movement in a substantially horizontal plane relative to said first plate member, said shafts of

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said second plate member being received by said bore and said slot of said first plate member and pivotal movement of said second plate member being limited by abutment of said second shaft with opposite ends of said slot;

- (g) elongate frame means centrally mounted on said second plate means for pivotal movement therewith and for longitudinal movement relative thereto in a substantially horizontal plane in both directions from its normal central position to alternative positions on opposite sides of said central position in which the said frame means project outwardly beyond said carriage means;
- (h) rotatable means carried by said frame means, said rotatable means being adapted to engage a load and upon rotation to move the load longitudinally of said frame means; and
- (i) power means operable from said vehicle for imparting said pivotal movement to said second plate means and said longitudinal movement to said frame means and said rotary movement to said rotatable means, said power means including fluid-actuated cylinder and piston means pivotally connected to said horizontal portion of one of said L-shaped members and operatively connected to said second shaft of said second plate member for imparting when actuated said pivotal movement to said second plate means through said second shaft thereof.

10. An attachment as in claim 9, wherein said power means further includes a conduit extending between said vehicle and said bed means for conducting hydraulic fluid and electricity therebetween, said conduit having a reinforcing core of electrically conductive material intermediate inner and other cores of non-electrically conductive material, the interior of said conduit conducting fluid and said reinforcing core conducting electricity between said vehicle and said bed means.

11. An attachment for a load-handling vehicle of the lift-truck type having a substantially vertical mast, means guided by and movable vertically along said mast, and mechanical means operable from said vehicle for imparting said movement to said vertically movable means, said attachment comprising:

- (a) bed means detachably connected to said vertically movable means for movement therewith, said bed means extending forwardly of said vehicle and being at all times approximately centered relative to the longitudinal center line of said vehicle;
- (b) carriage means mounted upon said bed means in spaced relationship to said vehicle for pivotal move-

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ment in a substantially horizontal plane through an arc of at least 90° about a substantially vertical axis extending at all times through approximately the longitudinal center line of said vehicle;

- (c) elongate frame means mounted upon said carriage means in a normal central position relative thereto for pivotal movement therewith and for longitudinal movement relative to said carriage means in both alternative directions from said normal central position thereof and to offset positions wherein said frame means projects outwardly beyond said carriage means;
- (d) an endless conveyor belt carried by said elongate frame means for movement therewith and for rotative movement in both directions relative thereto, said belt having upper and lower flights extending over the entire length and over substantially the entire width of said elongate frame means, the upper flight of said belt extending substantially horizontally adjacent the uppermost surface of said frame means and being adapted to engage a load and upon rotation of said belt to move the load longitudinally of said elongate frame means; and
- (e) power means operable from said vehicle for imparting said pivotal movement to said carriage means and said longitudinal movement to said elongate frame means and said rotary movement to said conveyor belt.

References Cited by the Examiner

UNITED STATES PATENTS

2,559,319	7/1951	Robson	214—730
2,699,878	1/1955	Avery	214—620 X
2,744,644	5/1956	Hackney et al.	214—730 X
2,931,531	4/1960	Brudi	214—750
2,932,419	4/1960	Harris	214—652
2,978,129	4/1961	Becker	214—653
3,010,594	11/1961	Farmer et al.	214—653
3,075,659	1/1963	Sylvester et al.	214—730 X
3,092,268	6/1963	Powers	214—730 X

FOREIGN PATENTS

80,018	9/1963	Denmark.
152,416	3/1962	Russia.

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