Feb. 13, 1951 H. E. MILZ 2,541,268

ROTATING FORK CARRIAGE

Filed April 13, 1949 5 Sheets-Sheet 1

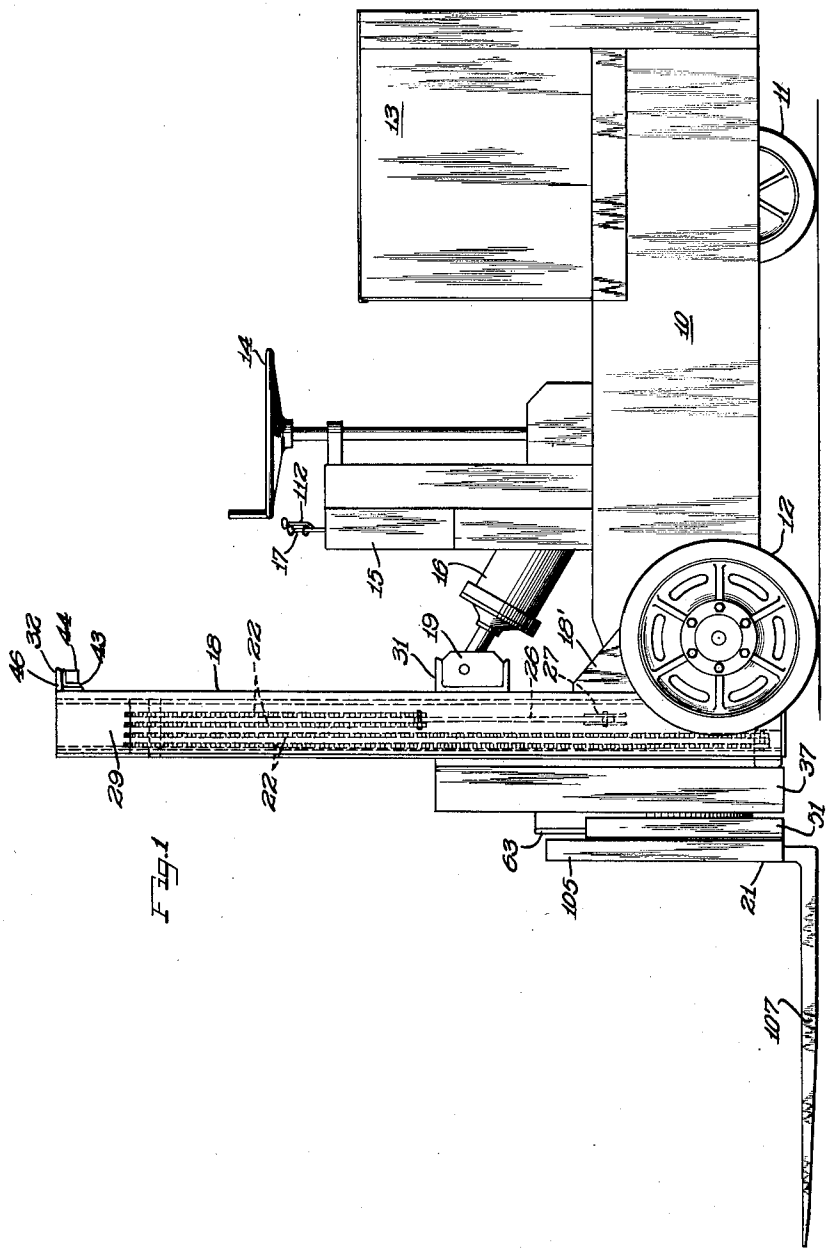


Fig. 1

Inventor
Harold E. Milz

By The firm of Charles Hall Attys

Feb. 13, 1951 H. E. MILZ 2,541,268

ROTATING FORK CARRIAGE

Filed April 13, 1949 5 Sheets-Sheet 2

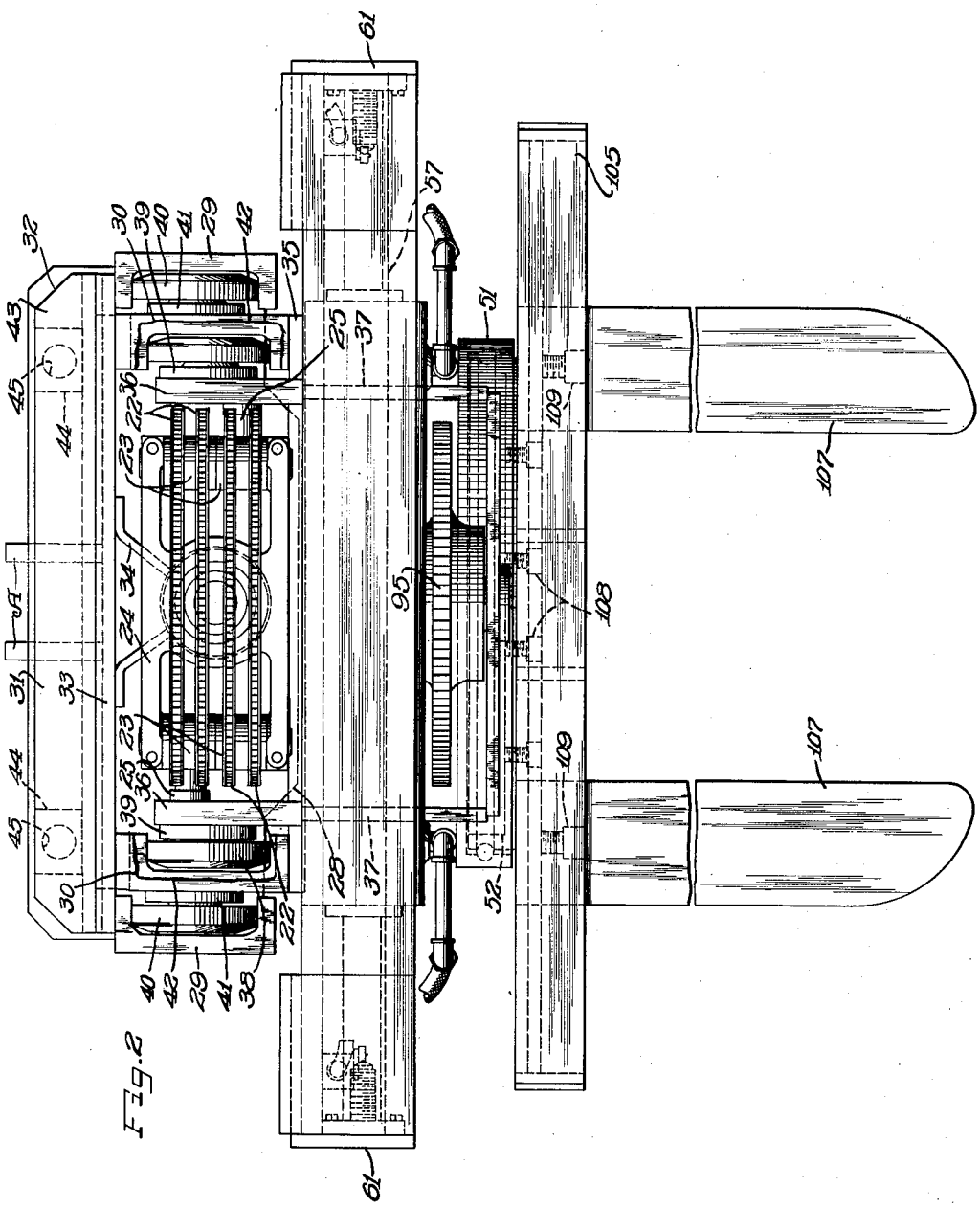


Fig. 2

Inventor
Harold E. Milz

By The Firm of Charles Hollick Attys

Feb. 13, 1951 H. E. MILZ 2,541,268

ROTATING FORK CARRIAGE

Filed April 13, 1949 5 Sheets-Sheet 3

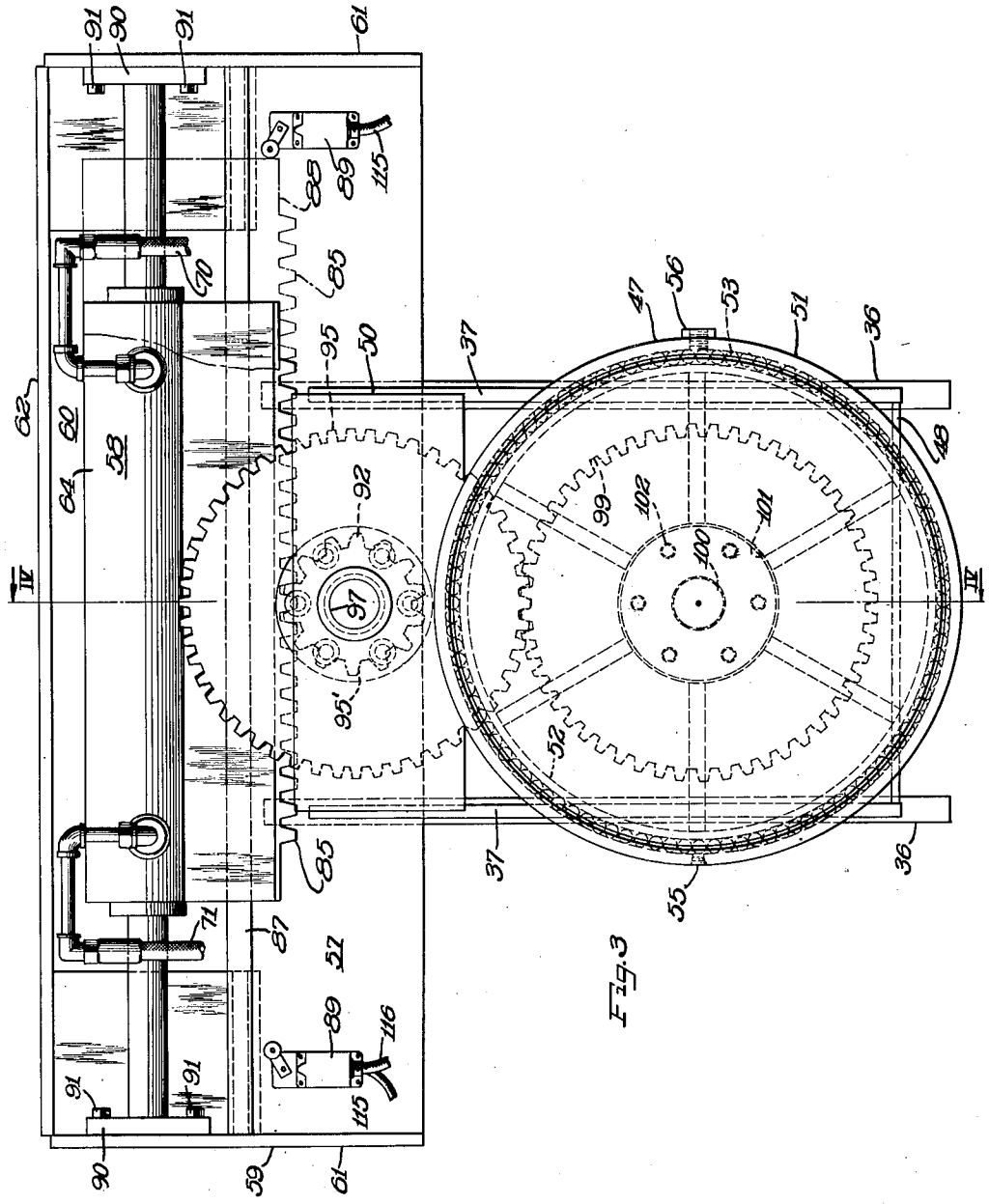


Fig. 3

Inventor
Harold E. Milz

By The Firm of Charles A. Hill Attys

Feb. 13, 1951 H. E. MILZ 2,541,268

ROTATING FORK CARRIAGE

Filed April 13, 1949 5 Sheets-Sheet 4

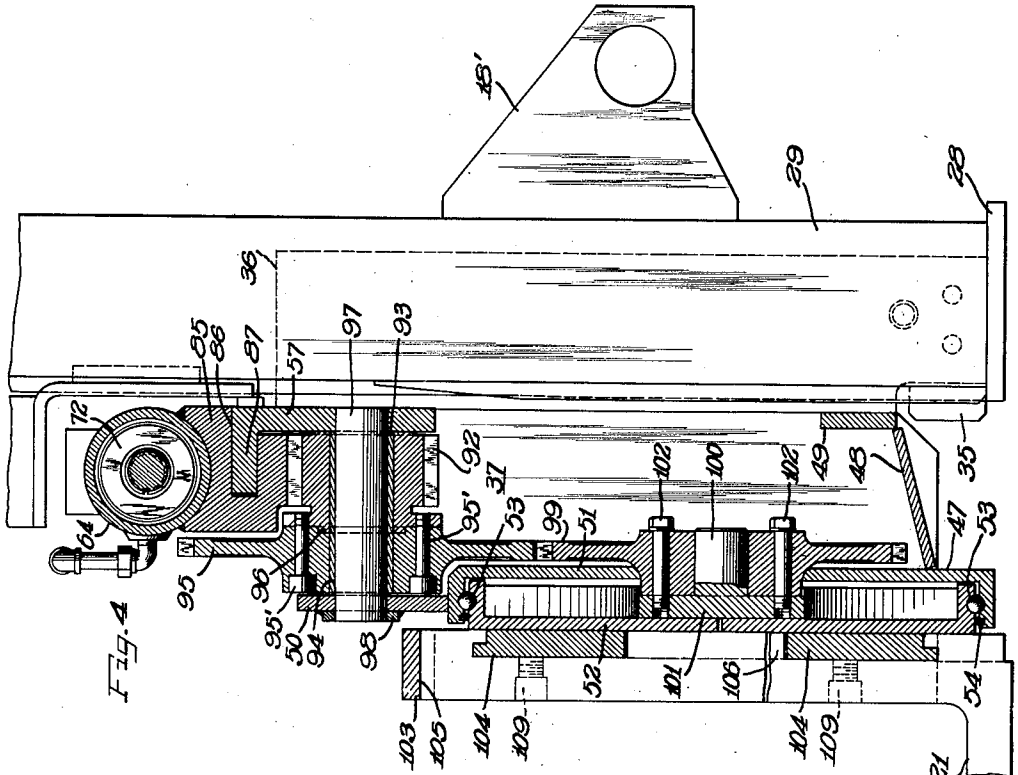


Fig. 4

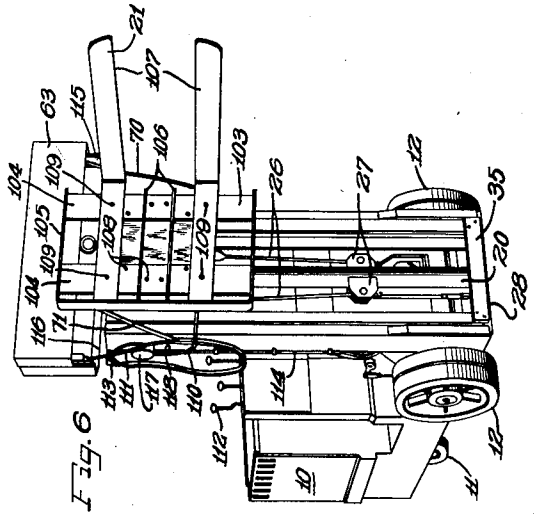


Fig. 6

Inventor
Harold E. Milz

By Thos. Ewing of Arnold & Kelly Attys

Feb. 13, 1951 H. E. MILZ 2,541,268

ROTATING FORK CARRIAGE

Filed April 13, 1949 5 Sheets-Sheet 5

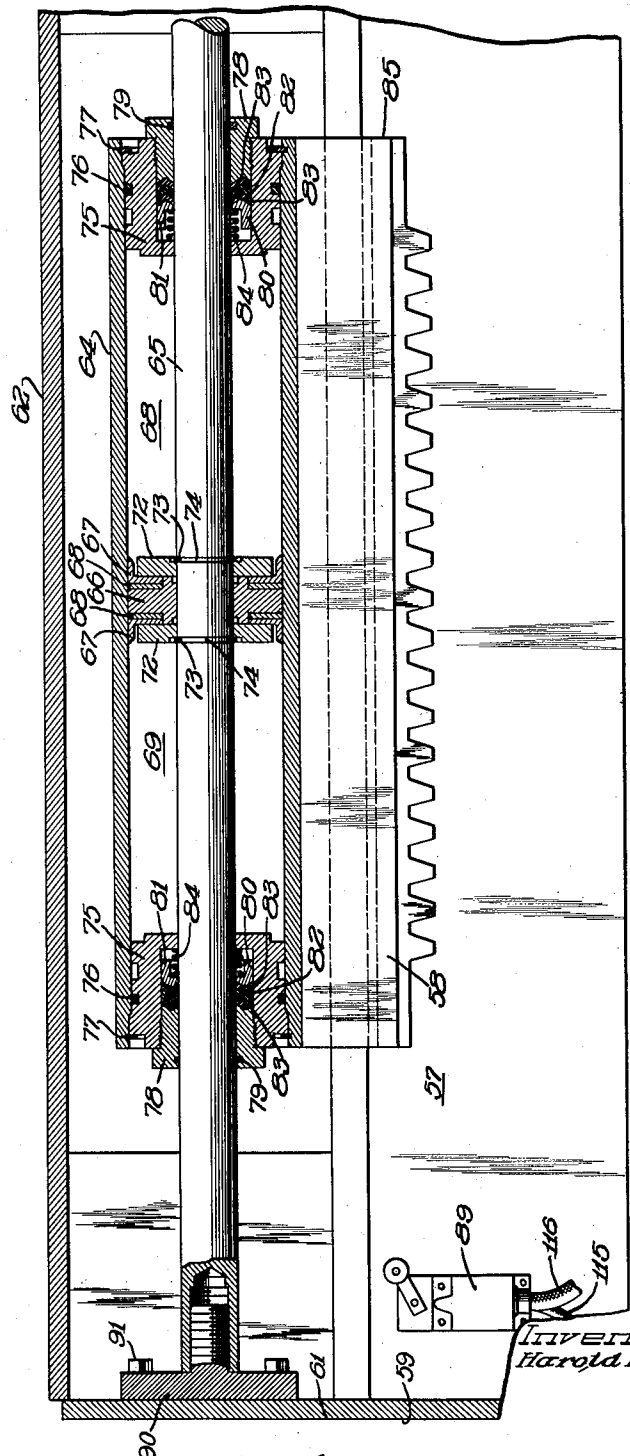


Fig. 5

By The Firm of Charles A. Wilkie Attys

Patented Feb. 13, 1951 2,541,268

UNITED STATES PATENT OFFICE

2,541,268

ROTATING FORK CARRIAGE

Harold E. Milz, Chicago, Ill., assignor to The Mercury Manufacturing Company, Chicago, Ill., a corporation of Illinois

Application April 13, 1949, Serial No. 91,059

4 Claims. (Cl. 214—113)

1

This invention relates to industrial lift trucks, and more particularly to lifting means carried by said trucks for receiving and raising a load and for changing the position of the load for dumping or depositing the load.

Industrial lift trucks for handling and transporting loads from place to place in manufacturing establishments are well known at present. Lift trucks generally comprise a relatively short frame supporting a power unit at the forward end or the rear end and supporting at one end thereof a load-engaging member, such as lifting forks and the like adapted to engage a load resting comparatively close to the truck supporting surface. Many of these industrial trucks employ a load-engaging member which is telescopically arranged to be raised and lowered in a substantially vertical plane. Also, this load-engaging member is usually pivotally mounted on the truck frame to enable a load to be tilted rearwardly into a position overlying the truck frame, thus positioning the weight of the load to maintain a more nearly balanced weight distribution on the truck carriage.

Specifically, the invention relates to a hoist and tilt assembly for industrial lift trucks provided with a fork support assembly, and in which the fork assembly is adapted to be rotated from a position with the forks in a substantially horizontal plane to a position in which the forks are rotated substantially through 180° in order that a tote box mounted on the lifting fork may be readily dumped. More specifically, this invention relates to a hydraulic actuating mechanism for revolving or rotating a fork carriage in any vertically adjusted position of the fork carriage on the hoist and tilt assembly of the lift truck.

A feature of this invention includes the provision of a revolving fork carriage assembly which may be interchangeably mounted with a conventional fork carriage assembly which is solely adapted for vertical movement upon the telescopic hoist assembly.

Another feature of this invention includes the provision of a simple hydraulic mechanism for accomplishing the rotary movement through a simple rack and spur gear drive to a rotatable turn-table upon which the hoisting fork assembly is mounted for rotary movement.

It is a principal object of my invention to provide a simple and effective power mechanism for raising a load carrier upon a telescopic lifting element for tilting the telescopic lifting element to facilitate the transportation of the load and

2

for changing or rotating the position of the load carrier prior to depositing the load.

A further object of the invention is to permit all these operations to be readily and effectively controlled by the operator.

Another object of the invention is to provide fluid or hydraulically actuated means for effecting the lifting of the load carrier, the tilting of the telescopic construction, and for providing a rotary movement through the fork carriage to facilitate depositing the load carried thereby in a predetermined position or location.

Another object of the invention is to provide a unitary rotating fork carriage assembly including the fluid actuating mechanism for rotating the fork carriage in any position of the rotating fork carriage assembly upon the telescopic hoist assembly.

Another object of the invention is to provide a unitary rotary fork carriage assembly which may be interchangeably mounted with a conventional fork carrige on the telescopic hoist assembly of a conventional lift truck.

The novel features which I believe to be characteristic of my invention are set forth with particularity in the appended claims. My invention itself, however, both as to organization and method of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings.

On the drawings:

Figure 1 is a view in elevation of an industrial lift truck having the rotary fork carriage of my invention applied thereto;

Figure 2 is a plan view of the rotary fork carriage assembly mounted on the telescopic hoist assembly of the lift truck;

Figure 3 is a front elevational view of the rotary fork carriage assembly illustrating the drive mechanism thereof;

Figure 4 is a vertical sectional view taken along the line IV—IV of Figure 3, illustrating the turntable construction and drive construction therefor of the fork carriage assembly;

Figure 5 is a vertical sectional view illustrating the construction of the piston and cylinder for the drive mechanism of the rotary fork carriage assembly; and

Figure 6 is a perspective view of the hoist and rotary carriage assembly mounted on a lift truck illustrating the rotary fork carriage rotated 90° from the position of Figure 1.

Referring to the drawings, a motor propelled industrial lift truck 10 having rear steering wheels

11 and front drive wheels 12 is driven by suitable connections from either an electric motor or internal combustion motor within a hood 13. The truck is steered by a steering wheel 14. A control panel 15 provides a conventional snap action mechanical contactor controller for the conventional four speeds forward and reverse. A hoist and tilt control is actuated through lever operated switches which actuate a magnetic contactor in a pump motor circuit (not shown). A conventional unidirectional motor pump has variable speed control (not shown) used for lowering or hoisting. Pressure supplied by the hoist pump to a pivotally mounted double-acting cylinder 16 and ram thereof effects tilt in any direction and to any degree desired. A battery of levers 17 mounted on the control panel 15 is within easy reach of the operator and serves to selectively control the truck as to speed and directional movement, the telescopic hoist and tilt assembly, and the rotation of the rotary fork carriage, the construction thereof being described in detail later.

A conventional telescopic channel assembly 18 is pivotally mounted on the chassis of the lift truck through a fulcrum plate 18'. The tilting cylinder pivot mounting 19 operatively connects the telescopic channel assembly to the double-acting cylinder 16 which, through pressure supplied by the hoist pump to the pivotally mounted double-acting cylinder and ram, effects tilt in that direction and to that degree desired when controlled by the operator. A hydraulic ram operatively mounted in a cylinder 20 elevates a fork assembly 21 by means of double chains 22 which pass over sprockets 23 on a ram head 24. One end of each chain is attached to the platform of the fork assembly at 25, the other end of each chain being connected through a rod 26 to clevis connections 27 mounted on the cylinder 20 (Figures 1 and 6).

The cylinder 20 is mounted on a cylinder supporting cross-member 28 forming part of the telescopic channel assembly 18. The telescopic channel assembly 18 preferably comprises outer main channels 29 secured to the bottom plate 28 and inner telescopic channels 30. A channel assembly 31 secured to the main channels 29 provides a mounting for the tilt cylinder pivot mounting 19 (Figures 1 and 2). A transverse member 32 connects the upper ends of the main channels 29. A cylinder supporting cross-member 33 of the channel assembly 31 is affixed to the main channels 29 and is connected to the cylinder 20 through a bracket 34. It will thus be seen that a rigid telescopic main frame construction is shown for operatively mounting the hoist cylinder thereon.

The inner telescoping frame assembly including the inner telescoping channels is provided with a transverse support member 35 at the bottom of the channels 30.

A lifting frame assembly 36 comprising spaced forwardly extending support members 37 is operatively connected to the lifting chains 22 through the connections 25. The lifting frame assembly is also operatively connected to the inner telescopic channels 30 by inner rollers 38 engaging the inner surfaces of the channels 30 (Figure 2) being mounted on rollers 39. Two sets of rollers 38 are mounted on each side of the lifting frame members 36. Likewise, two sets of outer rollers 40 engage the inner spaces of the legs of the channels 29 and are operatively mounted on roller studs 41 secured to the inner telescopic channels 30. When the lifting frame is in its uppermost position, the upper rollers 39 engage stops 42 secured to the upper ends of the channels 30.

Referring to Figure 1, the transverse construction 32 comprises a transverse angle 43 secured to the outer channels 29, as illustrated. This member is provided with spaced blocks 44 having tapered holes 45 therein to receive complementally formed tapered pins mounted on a transverse angle 46 which in turn is secured at each end to the inner telescopic channel 30. In the lower position of the inner telescopic channel, a tapered pin mounted thereon engages the complementally formed holes 45 to lock the two channels together.

In the raising of the telescopic assembly of the lifting frame or platform, the hydraulic ram operatively mounted in the cylinder 20 elevates the platform by means of the double chains 22 which pass over the sprockets 23, as previously described. The platform may be elevated substantially more than 25" before an overall increase in the height of the truck occurs. As pressure is applied to the lifting ram, the platform is raised until the rollers 38 engage the stops 42 whereupon as lifting pressure is applied, the platform and the inner telescopic frame are raised together to a height limited by the telescopic arrangement of the telescopic frame members.

A conventional hoist system (not shown) actuates the single acting cylinder 20 and ram thereof which elevates the platform. An electric motor-driven vane pump delivers oil under pressure from a reservoir to the ram and cylinder. A magnetic contactor in the pump circuit and a release valve control the operation of lifting and lowering.

The telescopic frame is tilted in a direction and to a degree desired by pressure applied by the hoist pump to the pivotally mounted double-acting cylinder and ram 16. The controls for the tilting and hoisting operation are conveniently mounted at the station 17.

Having thus disclosed a conventional industrial lift truck provided with telescopic hoist and tilting frame, a preferred construction of my rotating fork carriage adapted for mounting on a conventional tilting telescopic hoist assembly will now be described. The telescopic lifting frame 36 has suitably secured thereto, preferably by welding, the spaced forwardly extending members 37. The members 37 form a support for a turntable construction 47, the turntable frame being pre-fabricated from steel members 48 and 49 and 50 suitably welded together to provide a rigid turntable frame structure. The turntable assembly 47 includes a stationary member 51 and a complementary rotatable member 52, which is ribbed for strength, forming the turntable. The member 52 is rotatably mounted on ball bearings 53 and a dirt seal 54 is provided. The turntable may be suitably lubricated at 55. In assembling the ball bearings 53, a raceway is provided between the members 51 and 52 wherein the ball bearings are inserted through a hole closed by a bolt 56.

At the upper end of the members 37 and affixed to the frame members 36 is a transverse angular-shaped member 57 which slidably mounts for transverse movement a cylinder and rack assembly 58 (Figures 2, 3, 4 and 5). A housing 59 is affixed to the transverse angular-shaped member 57 forming a back wall 60, side wall 61, and a top panel 62. A cover 63 (Figure 6) is detach-

ably mounted on the housing 59 to enclose the operating mechanism therein.

Referring to Figures 3, 4 and 5, the hydraulic actuating mechanism comprising the cylinder and rack assembly 58 will now be described in detail. A cylinder 64 is mounted for transverse movement on a fixed piston rod 65. The piston rod has mounted thereon at the center a fixed piston head 66. A cup-shaped leather washer 67 and packing gland 68 provide an effective seal between right-hand and left-hand chambers 68 and 69 formed by the piston head 66 and the cylinder 64. Hydraulic fluid is supplied through a pair of flexible fluid conduits 70 and 71 and their respective fittings, as illustrated in Figure 3, connecting the flexible conduits to each of the chambers 68 and 69.

Annular ring members 72 mounted on the piston rod are fixed to the piston head 66 through snap rings 73 mounted in annular grooves 74 formed on the piston rod 65. With this construction the head 66 is firmly secured in position on the piston rod and the packing members secured in position.

Each end of the cylinder 64 is closed by a cylinder end 75 complementally formed to the cylinder ends, as illustrated on Figure 5, and sealed by a gasket 76. The cylinders are held in place by a snap ring 77 engaging a complementally formed groove of the cylinder.

A packing gland 78 provided with a felt seal 79 is in threaded engagement with the cylinder end 75 to compress a spring-biased packing construction 80 including a spring retainer washer 81. Alternate layers of rubber and leather packings 82 and 83, respectively complementally formed, as illustrated in Figure 5, to the packing gland and to the spring-biased retaining washer 81 are spring-biased in position by a spring 84.

It is thus obvious that with the packing construction of the cylinder head and for each end of the cylinder slidably mounted on the piston rod, suitable seals are provided to prevent escape of the fluid from each end of the cylinder under the high pressure necessary for the operation of the actuating mechanism for the rotary turntable mechanism.

A rack construction 85 having a surface complementary to the outer surface of the cylinder 64, as illustrated in Figure 4, and welded thereto is provided with a transversely extending groove 86 complementary to the leg 87 of the transverse angular shaped member 57. This construction provides a bearing surface for the movable cylinder 64 as it is moved from the center position, as shown in Figure 3, to a dotted line position 88 as the cylinder is actuated to be moved to the right or left while rotating the turntable. This construction also prevents rotation of the cylinder about the piston rod and avoids the transfer of the gear thrust loads to the cylinder.

Limit switches 89 normally biased closed, mounted as illustrated in Figure 3, will limit the travel of the cylinder and its associated rack construction 85 to its maximum movement to the right or left upon actuation of the hydraulic fluid control mechanism for operating the cylinder.

Piston rod 65 with the cylinder 64 and rack 85 assembled thereon is detachably mounted in the housing 59 by piston rod ends 90, constructed as illustrated in Figure 5, in threaded engagement with the ends of the piston rod 65. The assembled piston rod ends are detachably secured within the housing 59 by securing means 91. A

pinion 92 (Figures 3 and 4) is rotatably mounted on gear shaft bushings 93 and 94, together with a spur gear 95. The spur gear and pinion are assembled together with recessed stud bolts 95' with a gear spacer 96 therebetween and are journalled on the bushings previously described which in turn are journalled on a gear shaft 97 mounted at one end in the transverse shaped angular member 57 and at the other end mounted on the plate member 50. A boss 98 provides additional bearing surface and the shaft is prevented from rotation by suitably keying the gear shaft 97 with respect to the rest of the frame construction.

A spur gear 99 meshes with the spur gear 95 (Figure 4). The spur gear 99 is detachably mounted on a stub shaft 100 integrally formed with a plate portion 101 welded or otherwise secured to the rotary turntable member 52 and concentric with the axis thereof. Securing means 102 extending through the spur gear 99 affix it to the turntable whereby they rotate together.

From the construction of the fluid operating mechanism and its associated gear drive to the rack and pinion construction and the spur gears to the turntable, it is obvious that a simple mechanism has been provided for rotating the fork assembly 21, for example, from the position shown in Figure 1 to the position shown in Figure 6 and also to a completely inverted position 180° from that shown in Figure 1 in which the cylinder and the rack 88 assume the position shown in dotted outline in Figure 3. The fork assembly may be rotated 180° in either direction from the position shown in Figure 1 to the completely inverted position by movement of the cylinder to the left or right as indicated in the dotted position 88 of Figure 3 or in intermediate positions in either direction as desired.

Referring to Figures 4 and 6, the preferred form of fork assembly 21 is illustrated. A fork assembly frame 103 is provided by transverse members 104 secured to a U-shaped member 105 together with vertical members 106 to provide a rigid frame construction for a pair of lifting forks 107. The fork supporting assembly frame 103 is detachably secured to the turntable 52 by threaded countersunk lock pins 108. The lifting forks 107 are detachably secured to the transverse members 104 of the fork support assembly 103 by the threaded fork lock pins 109.

Although it is preferred to use a fork support assembly constructed as illustrated in Figures 4 and 6, it is within the scope of the invention to employ other forms of lifting fork assembly means which may be detachably mounted thereon, including also other forms of lifting forks than those illustrated.

Referring to Figure 6, a transverse U-shaped rod 110 mounted on the lifting frame assembly 36 engages the flexible conduits 70 and 71 and a cable 111 to prevent the cable and the flexible conduits from becoming tangled in the raised position of the fork assembly frame.

A control handle 112 controls a suitable two-way valve for controlling the fluid from a motor driven pump to the flexible conduits 70 and 71 operatively connected to the chambers 68 and 69 of the cylinder 64. The fluid conduits 70 and 71 are connected to a coupling 113 mounted on the upper end of the stationary telescoping channel and connected to a flexible conduit 114 independently connected to the valve operating the hydraulic cylinder.

Each of the limit switches 89 are connected together in series to a cable 115, and they in turn

are connected through a cable 116 to an outlet box 117. The circuit of the limit switches 89 is completed by connecting a cable 118 to the motor circuit of the pump supplying the hydraulic fluid for the control of the hydraulic cylinder 64.

While I have disclosed the preferred form of my rotary fork carriage mechanism and supporting frame thereof assembled from pre-fabricated shapes of steel welded together, it is also within the scope of the invention that the various members may be formed from other suitable materials to withstand the stresses intended.

The valve mechanism for controlling the flow of hydraulic fluid from a suitable reservoir to the cylinders 20 and 16 may be of any standard construction and, since its details do not form part of my invention herein disclosed, further detailed illustration of the same is unnecessary. The tilting telescopic hoist assembly is driven through a common motor-driven hoist pump which actuates the hydraulic ram which elevates the lifting elements and forks 107. The pressure supplied also by the hoist pump to the pivotally mounted double-acting cylinder 16 and ram effects tilt in direction and to degree desired.

With the parts constructed and arranged as described, it is believed that the operation will be readily understood. Assuming that my lift truck is to be used for the purpose of picking up a tote box and transporting it from one position to another, it may be raised and tilted, for example, to discharge the contents thereof. It is to be understood that it is within the scope of my invention that a tote box (not shown) shall be provided with suitable brackets engaged by the forks 107 so that in tilted position the tote box shall be retained on the lifting forks 107.

A tote box when engaged by the forks 107, for example, as illustrated in Figure 1, may be raised to transport position when the operator raises the fork assembly a sufficient distance off the floor by the control mounted on the control panel 15. Then the operator, through the control, may drive the lifting truck forward or reverse to the station at which it is required to discharge the contents from the tote box. It is preferred in transporting a skid box to tilt the telescoping assembly rearwardly through the tilt hoist cylinder 15. When the destination is reached, the operator through a suitable control holds the lifting ram which raises the fork assembly to a predetermined height at which it is desired to rotate the tote box for the discharge of contents thereof. Then upon actuation of the control lever 112 fluid, for example, may be admitted to the chamber 68 of the cylinder 64 rotating the forks 107 to the position shown in Figure 6 or 90° beyond this position so that the box is completely inverted. It is to be understood that the position of the forks, from a horizontal position to an inverted position, may be controlled to any position intermediate thereof.

If it is desired to rotate the forks 270° from the position shown in Figure 6, fluid is admitted by the control lever 112 to the chamber 69, causing the cylinder to move to the left, rotating the turntable through the rack, pinion and spur gear drive. After the rotary fork carriage has been rotated to either position, for example, that of Figure 6, the forks may be returned to the horizontal position by actuating the control mechanism in a reverse order.

The limit switches 89 prevent movement of the ram 85 beyond a predetermined range on the piston rod 65. Switches 89 are in the motor control circuit of the fluid circuit controlling the fluid to the cylinder 64. It is within the scope of the invention that a separate fluid pump motor drive may be used for controlling the operation of the cylinder 64, or the fluid system of the cylinder 64 may be connected to the motor actuated pump for the hoist and tilt cylinders. It is within the scope of the invention to use by-pass pressure relief valves in the fluid circuit to each end of the cylinder, so that any overflow from the pressure relief valve may return to a common reservoir for the pump.

It will also be apparent to those skilled in the art that I have described a simple tilting telescope hoist assembly in combination with a simple mechanism for rotating or revolving a fork carriage assembly for moving the fork from a substantially horizontal position to any position, either to the right or left, within a range of 180° with any predetermined range of movement desired. This rotary motion may be accomplished in any position of the telescopic assembly after the lifting fork assembly has been raised a predetermined distance off the ground to permit rotation of the fork and any tote box carried thereby and, also, the fork may be rotated in this manner in the tilted position of the telescoping assembly. All three movements may also be performed simultaneously, if so desired.

It is also apparent to one skilled in the art that a simple hydraulic and electrical control mechanism has been disclosed for accomplishing the various movements of tilting, raising and lowering and rotating of the tilting telescoping hoist assembly and rotating fork carriage mechanism in combination therewith. These movements are also simply controlled from an operator's station from which the lifting truck is steered and actuated forward and reverse so that all the movements are visibly observed.

While I have disclosed a particular form of telescopic device and tilting mechanism in combination with a rotary fork carriage mechanism, it is also to be understood that the preferred embodiment may be suitably modified without departing from the scope of my invention.

While I have resorted to detail in the description of my invention for the sake of clarity, it will, of course, be understood that many modifications with respect to various details will suggest themselves to those versed in the art which will not mark a departure from the true spirit of my invention. I desire to be limited, therefore, only by the scope of the appended claims and the prior art.

I claim as my invention:

1. The combination with an industrial lift truck including a telescopic hoist assembly, within a predetermined range of movement, of a revolving fork carriage assembly, said revolving fork carriage assembly comprising a supporting frame fixed to the telescopic hoist assembly whereby the revolving fork carriage assembly is adapted to be raised and lowered, a turntable operatively mounted for rotation on the supporting frame, a second supporting frame affixed to the first supporting frame, a piston rod assembly mounted on said second frame, and a cylinder operatively mounted on the piston rod assembly for a movement of translation within a predetermined range of movement, a rack operatively mounted on the cylinder, means for slidably mounting the rack on the second frame, a pinion operatively mounted on the first mentioned frame and operatively connected to the rack, and means operatively

connecting the pinion to the turntable, whereby, upon movement of translation of the cylinder upon the piston rod assembly in either direction, the turntable is rotated about its axis in a corresponding direction.

2. A turntable frame assembly for a telescopic hoist assembly comprising a turntable adapted to be rotated about a substantially horizontal axis, a complementally formed support for journalling the turntable thereon, a piston rod assembly including a piston head mounted on the frame assembly, a hydraulic cylinder mounted on the stationary piston rod assembly for movement of translation in either direction between predetermined limits, a rack mounted on the cylinder, means for slidably mounting the rack on the turntable frame assembly, said means including an angle member fixedly mounted on the frame assembly in a longitudinal direction with respect to said rack, said rack having a longitudinal slot slidably receiving one leg of said angle member in conforming relation, a gear shaft substantially parallel to the axis of the turntable, a pinion gear mounted on the shaft for rotary movement and operatively connected to the rack, said rack mounting means permitting only longitudinal sliding movement of said rack and absorbing transverse loads exerted on the rack by said pinion gear, and drive means operatively connected to the pinion gear and to the turntable whereby the turntable is adapted to be rotated through a predetermined range of movement upon movement of the hydraulic cylinder through a predetermined range of movement.

3. A turntable assembly for a telescopic hoist assembly of a lift truck comprising a supporting frame, a turntable rotatably mounted thereon, a stationary piston rod assembly including a piston head intermediate the ends thereof, the rod assembly having its end portions affixed to the aforesaid frame, a fluid cylinder adapted for a motion of translation mounted on the stationary piston rod assembly, packing means for sealing the chambers formed by the cylinder and piston head, a rack mounted on the cylinder, means for slidably mounting the rack on the turntable frame assembly, a gear shaft substantially parallel to the axis of the turntable, a pinion gear mounted on the shaft for rotary movement and operatively connected to the rack, whereby, as the turntable assembly is rotated upon actuation of the cylinder, the aforesaid means for slidably mounting the rack on the turntable assembly absorbs the gear tooth thrust loads of the rack and pinion relieving the cylinder of these loads and consequently reducing cylinder friction and wear of the packing means.

4. In a lift truck assembly having a telescopic hoist mechanism, a turntable frame mounted on said hoist mechanism and movable in a substantially vertical direction therewith, a turntable support fixedly mounted on said turntable frame, said turntable support having an annular portion, a turntable having an annular portion with its axially outward surface in substantially conforming relationship to the turntable support annular portion inner surface, anti-friction bearing means disposed between said annular portions rotatably supporting said turntable with respect to said support, an axial shaft fixedly connected to said turntable, a gear member fixedly attached coaxially of said shaft, a second gear member rotatably retained on said turntable frame and operatively meshing with said first gear member to drive the same and thereby to rotate said turntable, a pinion fixedly attached to and coaxial of said second gear member, a reciprocable rack operatively meshed with said pinion to drive the same, means slidably retaining said rack with respect to said turntable frame to transmit non-reciprocatory loads imposed on the rack to the frame, said means including an angle member fixedly mounted on the frame assembly in a longitudinal direction with respect to said rack, said rack having a longitudinal slot slidably receiving one leg of said angle member in conforming relation, a reciprocable hydraulic cylinder fixedly attached to said rack and movable therewith, a piston rod, a piston centrally fixed thereon, said piston rod being disposed axially through said cylinder and having its end portions fixedly attached to said turntable frame with the piston operatively disposed in said cylinder, means providing a fluid seal at the ends of said cylinder about said rod, and means for selectively supplying hydraulic fluid to said cylinder on either side of said piston to move the cylinder axially in a direction away from the supplied fluid to rotate said turntable through cooperation of said rack, said pinion and said gear members.

HAROLD E. MILZ.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,251,452	Hirst	Aug. 5, 1941
2,270,664	Weaver	Jan. 20, 1942
2,281,004	Lehmann et al.	Apr. 28, 1942
2,287,469	Cochran	June 23, 1942
2,335,572	Schroeder	Nov. 30, 1943
2,457,366	Guerin	Dec. 28, 1948
2,473,659	Musgrave	June 21, 1949
2,522,128	Lehmann	Sept. 12, 1950