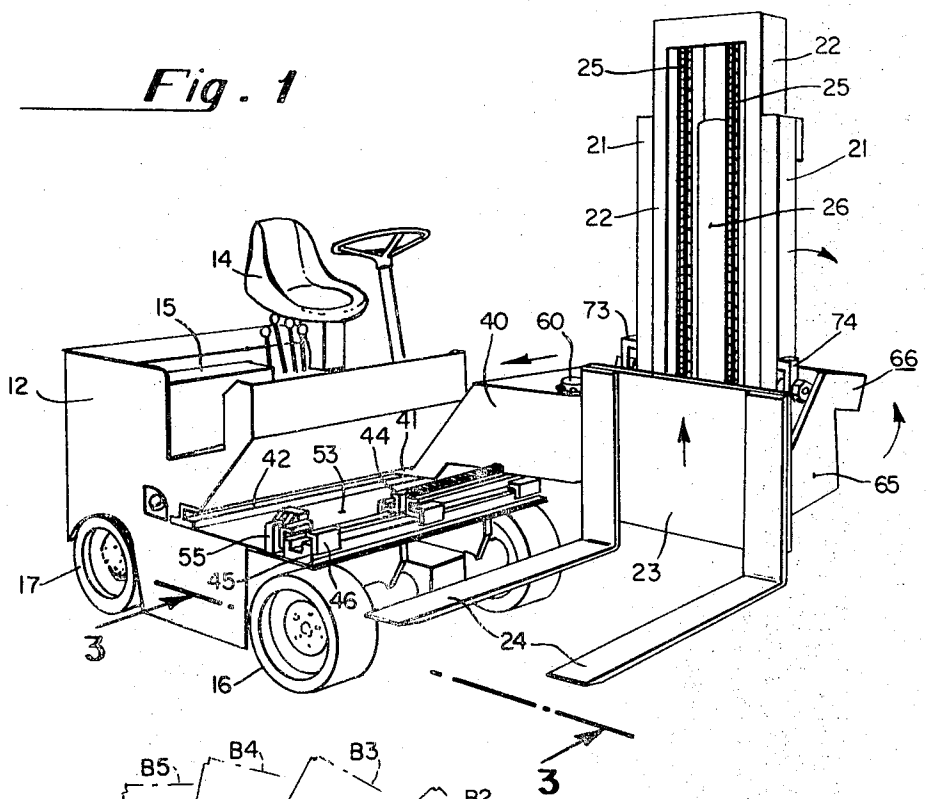
Oct. 6, 1970 H. C. McMILLAN 3,532,238

SWING SHIFT LIFT TRUCK

Filed Dec. 4, 1968 4 Sheets-Sheet 1

Fig. 1



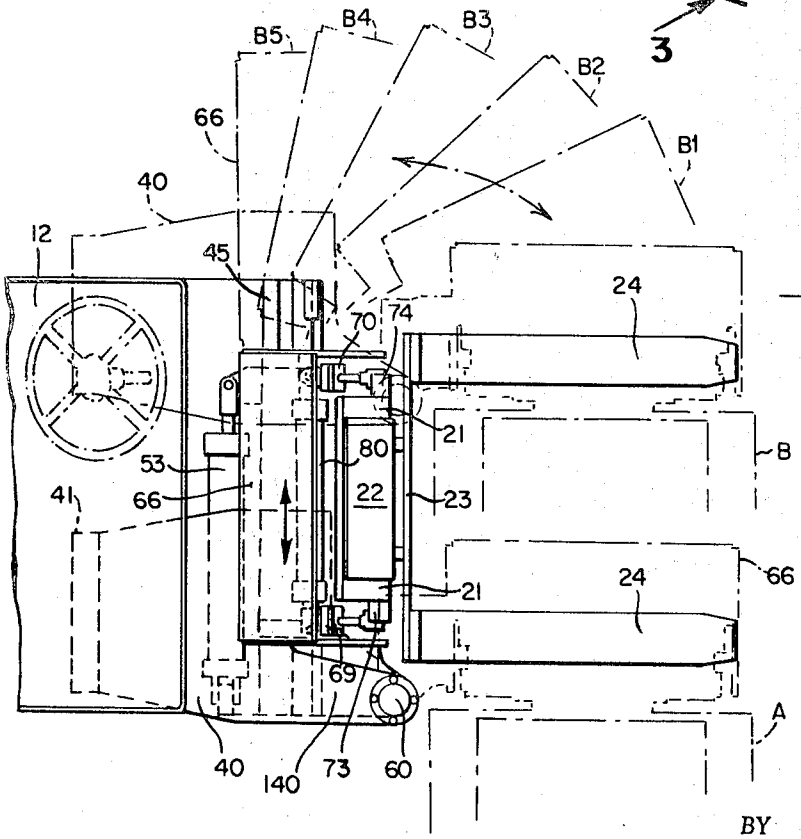


Fig. 2

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SWING SHIFT LIFT TRUCK

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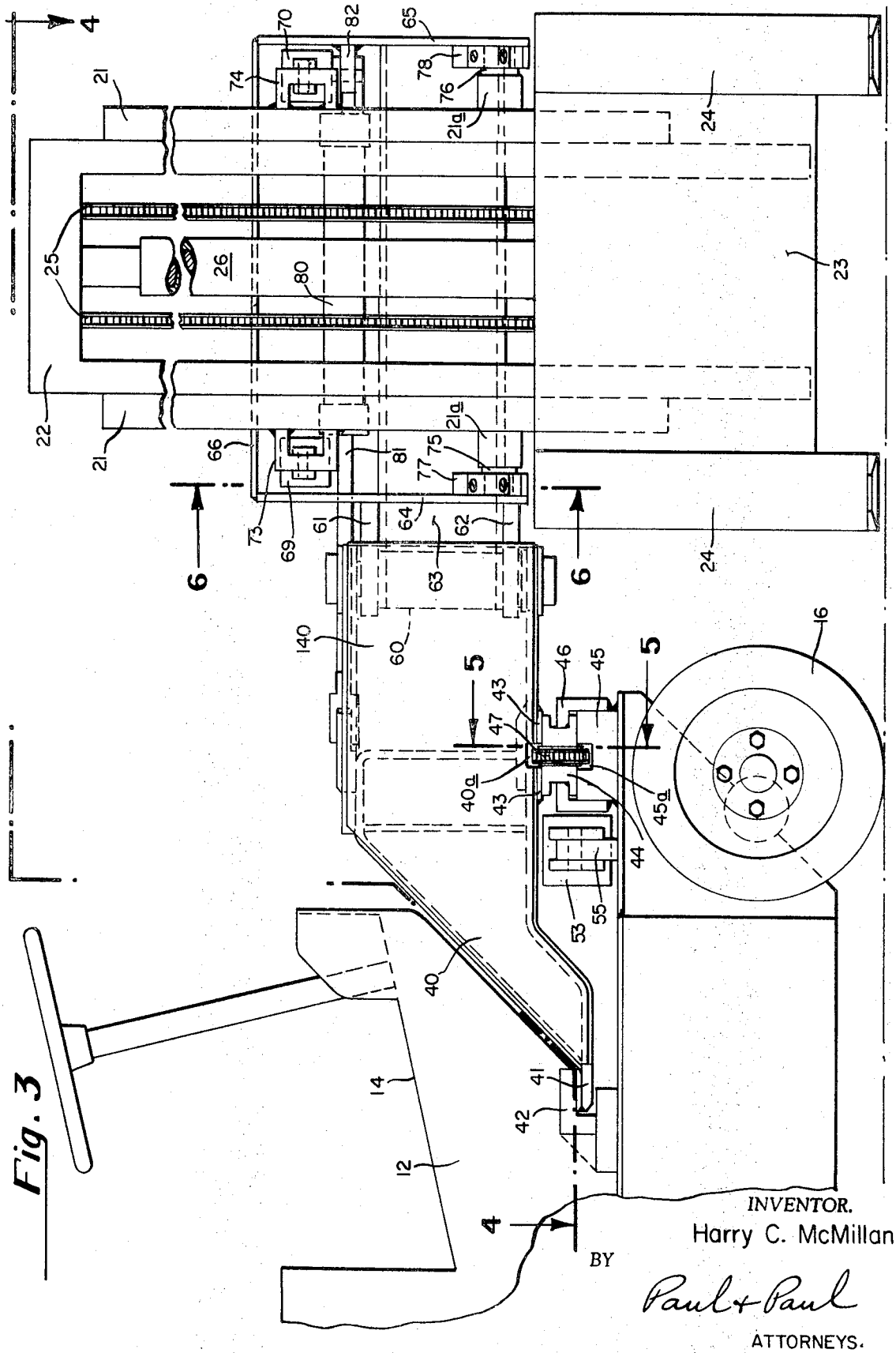


Fig. 3

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SWING SHIFT LIFT TRUCK

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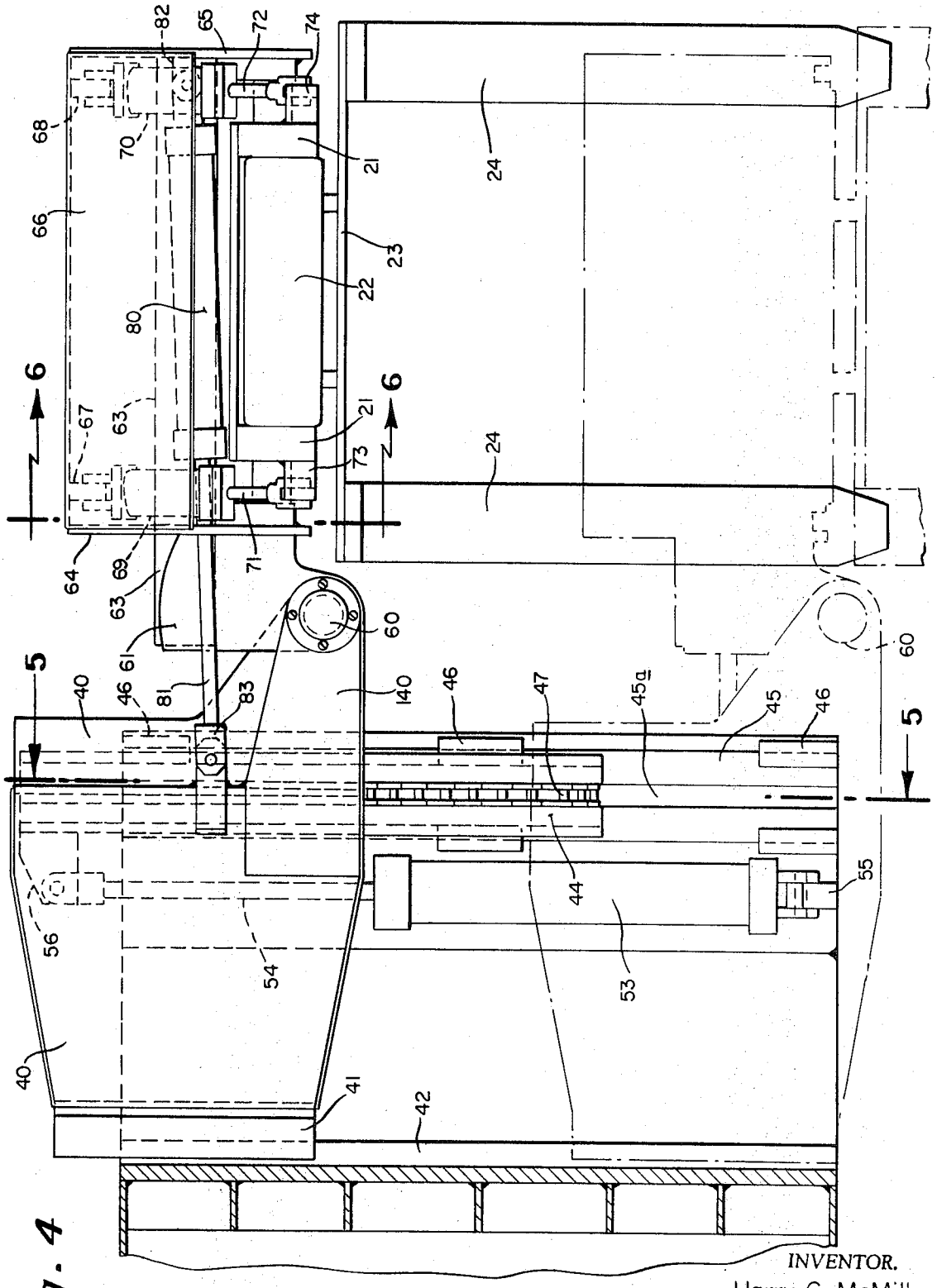


Fig. 4

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SWING SHIFT LIFT TRUCK

Filed Dec. 4, 1968 4 Sheets-Sheet 4

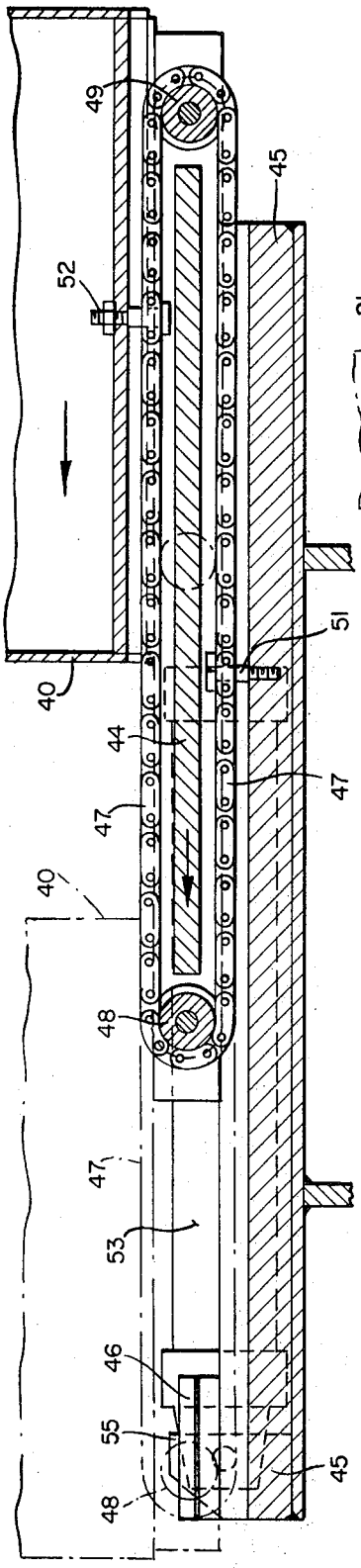


Fig. 5

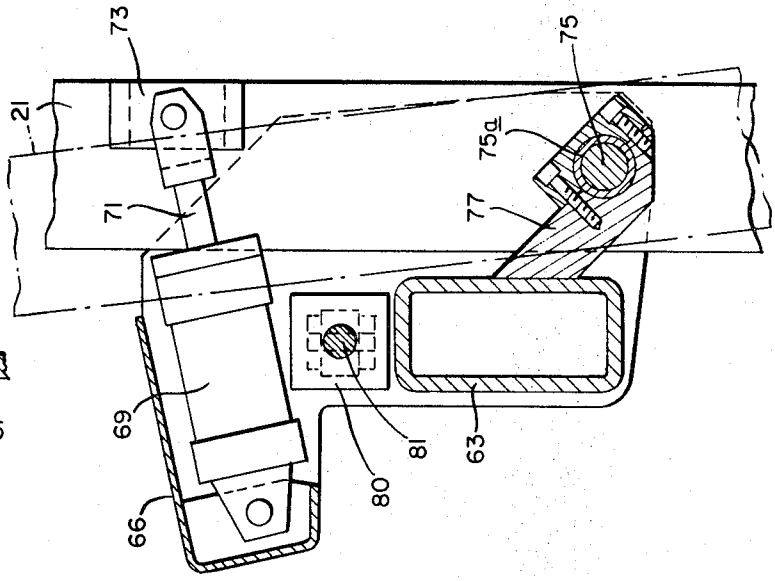


Fig. 6

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United States Patent Office

3,532,238

Patented Oct. 6, 1970

3,532,238

SWING SHIFT LIFT TRUCK

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Int. Cl. B66f 9/10
U.S. Cl. 214—672 2 Claims

ABSTRACT OF THE DISCLOSURE

A swing shift fork lift truck is disclosed having a lift assembly attached to the side of a single swing arm. One end of the single swing arm is pivotally mounted on the vehicle chassis on a side shift mechanism having a transverse travel across the front of the vehicle. The vehicle is capable of operating either as a front loader by positioning the lift assembly immediately in front of the drive axle, or as a side loader by rotating the swing arm to move the lift assembly to a position parallel to the direction of the vehicle travel. The side shift mechanism is then used to move the lift assembly transversely to enter or remove the forks from the load. The operator is seated on one side of the chassis in a fixed position facing forward. All operator controls are located in the operator's compartment.

BACKGROUND OF THE INVENTION

Fork lift trucks have been designed and constructed in a wide variety of forms for a wide variety of purposes.

A principal object of the present invention is to design and construct a vehicle of relatively simple design and construction which nevertheless provides a high degree of maneuverability and which is capable, for example, of picking up pallets in narrow aisles, or going deep for a pallet load, or picking up a long load in a narrow aisle, or making a right angle turn at a relatively narrow intersection, and so forth.

In the prior art, fork lift vehicles having some degree of similarity to the fork lift vehicle of the present application are shown in U.S. Pats. 2,799,418 and 3,313,436.

In U.S. Pat. 2,799,418, the vehicle has a transversely movable carriage on which a mast is supported. However, the mast is fixed vertically relative to the cross carriage. Hence, to raise and lower the forks, the entire transverse carriage is moved up and down on the vehicle. In contrast to Pat. 2,799,418, in the vehicle of the present application, the transversely movable carriage is vertically stationary and the load-carrying forks are moved up and down on the mast.

In U.S. Pat. 3,313,436, the vehicle has a mast assembly which is pivotally mounted, at its center point, on a king post carried on a transverse carriage. The carrier frame of the mast assembly is cutaway at the forward side to permit the carrier frame to be lowered to the gound level while straddling the carriage guide, front axle and front wheel, and the frame of the lift truck is shaped to have a recess to the rear of the front axle to admit the carrier frame. In contrast to the construction shown in U.S. Pat. 3,313,436, in the vehicle of the present application, the carrier frame which supports the lift forks is not cutaway, and there is no recess to the rear of the front axle for the carrier frame.

SUMMARY OF THE INVENTION

In the vehicle of the present invention, the mast or lift assembly is mounted on a single swing arm and one end of the swing arm is pivotally mounted on a king post which is carried on a slide carriage transversely movable across the front of the vehicle.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a perspective view showing a fork lift truck according to the present invention;

FIG. 2 is a plan view, partly cutaway, of the fork lift truck of FIG. 1;

FIG. 3 is an enlarged side elevational view of the lift truck of FIG. 1, looking along the line 3—3 of FIG. 1;

FIG. 4 is a detailed plan view looking down along the line 4—4 of FIG. 3;

FIG. 5 is an elevational view, in section, of the transverse carriage drive mechanism looking along the line 5—5 of FIG. 4;

FIG. 6 is an elevational view looking along the line 6—6 of FIG. 4, showing the swing arm and the mast tilt mechanism.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring first to FIG. 1, there is shown a fork lift vehicle embodying the present invention and comprising a vehicle frame **12** having an operator's control station **14**, and a compartment **15** for the batteries which power the vehicle, and having a pair of front drive wheels **16**, and a pair of steerable rear wheels **17**.

Supported on the vehicle chassis or frame **12** at the forward end thereof is a mast or lift assembly including, among other things, fixed guide rails **21**, a movable guide **22** slidable up and down in the fixed guide channels **21**, and a carrier frame **23** which is movable vertically relative to both the fixed guide **21** and the movable guide **22** and which carries the lift fork **24**. A pair of chains **25** are trained over pulleys (not shown) carried at the upper end of the piston of a hydraulic lift cylinder **26**. One end of the chains **25** is fixed to the carrier frame **23**. The other end is fixed to the fixed guide **21**. Thus, when the lift cylinder **26** is extended, the carrier frame **23** is lifted through a distance twice that of the distance through which the piston is moved. The mast or lift assembly used in the vehicle of the present invention is a known form of mast and need not be further described.

In accordance with the present invention, mounted for transverse movement across the forward end of the vehicle chassis is a crosshead **40** having at its rearward end a tongue **41** which is received within the channel of a fixed rear guideway **42** formed in the chassis **12**. Since guideway **42** takes the upward thrust imposed by the weight of the load on the fork **24**, the guideway **42** also functions as a load bearing surface for the crosshead.

As shown in FIG. 3, the undersurface of the crosshead **40**, at a location just above the front wheels **16**, is provided with bearing plates **43** which rest on a slide **44** which supports the crosshead during its transverse travel. Slide **44** is supported on a bearing block **45** and is guided in its travel by a series of guide brackets **46** secured, as by welding, to the bearing block **45**.

The bearing block **45** is provided with a center groove **45***a* which runs the length of the block **45** and which receives the lower leg of an endless chain **47** which is trained over a pair of rollers **48** and **49** supported on shafts carried by the slide **44**, as best seen in FIG. 5. A groove **40***a* in the underside of the crosshead **40** receives the upper leg of the endless chain **47**. The bearing plates **43** are on either side of the groove **40***a*.

A first pin **51** fixes the lower leg of endless chain **47** to the bearing block **45**, and a second pin **52** fixes the upper leg of the chain **47** to the crosshead **40**. It will be apparent that two separate chains may replace the endless chain **47**, with one end of each chain secured to the bearing block **45** and the other end of each chain secured to the crosshead **40** with one of the chains trained around

one of the rollers 48 and the other chain trained around the other roller 49.

Slide 44 is moved by a hydraulic jack comprising a cylinder 53 and piston rod 54, best seen in FIG. 4. One end of the cylinder 53 is pivotally secured to a bracket 55 fixed to the chassis 12. The end of the piston rod 54 is pivotally secured to a connecting arm 56 which is secured, as by welding, to the slide 44. Thus, when the piston rod 54 is extended or retracted to move the slide 44, the crosshead 40 is moved transversely through a distance equal to twice that of the distance through which the slide 44 is moved.

Crosshead 40 has a forwardly projecting portion 140 which carries a vertically-disposed king post 60 supported for rotation in bearings at its upper and lower ends. Secured to king post 60 for rotation therewith is a swing arm assembly comprising upper and lower arms 61 and 62 having welded thereto the upper and lower faces of a tubular member 63. Tubular member 63 extends outwardly transversely across the rear of the mast assembly, but the arms 61 and 62 terminate at, and are welded to, a side plate 64 having therein an opening through which the tubular member 63 passes. At the outward end of the tubular member 63 is an outer side plate 65. Both side plates 64 and 65 are welded to the tubular member 63.

Secured, as by welding, to the outer faces of the side rails of the vertically-fixed mast guide 21 are bearing blocks 21*a*, and secured, as by welding, to the inside surfaces of the plates 64 and 65 and to the tubular member 63 are bearing blocks 77 and 78. Trunnions 75 and 76 are received within the bearing blocks and in this manner the mast tilt assembly is supported on the swing arm. A bronze bushing, such as 75*a* of FIG. 6, may be interposed between the trunnions and the bearing blocks 77 and 78.

Side plates 64 and 65 each have a rearwardly extending portion, and extending transversely between these rearward portions is a plate 66 having brackets 67 and 68 (FIG. 4) for supporting the rearward end of a pair of tilt cylinders 69 and 70. The piston rods 71 and 72 of the tilt cylinders are pivotally connected at their forward ends to a pair of ears 73 and 74 which are welded to the sides of the vertically-fixed mast guide 21.

The swing arm, including arms 61 and 62, tubular member 63, side plates 64 and 65, and rear plate 66, is supported as a unit on the king post 60. This swing arm unit is not tiltable. Thus, when tilt cylinders 69 and 70 are actuated to extend or retract the piston rods 71 and 72, the vertically-fixed mast guide 21 is pivotally moved about the trunnions 75 and 76.

When the vertically fixed guide 21 is tilted, the vertically movable guide 22 also tilts since the channels of the guides are intermeshed. And, of course, the vertically-movable carrier frame 23 and forks 24 also tilt.

It has just been described how the mast assembly (21, 22, 23, 24, 25, 26) is supported on the swing or pivot arm assembly (61, 62, 63, 64, 65, 66, etc.) which in turn is supported in cantilever fashion on the king post 60 carried in the crosshead 40. The pivot arm assembly is moved pivotally about the axis of the king post 60 by a hydraulic jack comprising the cylinder 80 and piston rod 81. One end of the pivot cylinder 80 is pivotally secured to a bracket 82 secured, as by welding, to the outward side plate 65. The opposite end of the piston rod 81 is pivotally secured to a bracket 83 carried by the crosshead 40. Thus, when the pivot piston rod 81 is extended or retracted, the pivot arm assembly is pivoted about the king post 60 in the manner indicated in FIG. 2.

In FIG. 2, the vehicle is illustrated in solid line with the fork 24 extended forwardly. In this position of the fork 24, the crosshead 40 and king post 60 are at the right side of the vehicle as indicated by the solid line showing of the king post. If the pivot arm is pivoted 90° clockwise when the crosshead or carriage 40 and king post 60 are at the right side of the vehicle, the mast assembly and fork 24 will move from the solid line position shown in FIG. 2 to the dot-and-dash position indicated by the letter A. If the carriage 40 is then moved transversely across the front of the vehicle from the right limit position to the left limit position, the mast assembly and forks 24 will move to the dot-and-dash lines identified by letters B1 through B5 indicates the positions the mast assembly would assume if the pivot or swing arm unit were to be moved counter-clockwise through 90° when the carriage 40 is at the left side of the vehicle.

It will be seen that the present invention provides a mobile load-carrying lift vehicle characterized by a carriage mounted for transverse movement across a forward end of said chassis, a king or pivot post carried by said carriage at a forward portion thereof and mounted for pivotal movement about a vertical axis, a swing arm unit mounted in cantilever fashion on said pivot post entirely to one side thereof for pivotal movement in a generally horizontal plane about the axis of said pivot post, and a tiltable mast lift assembly mounted on said swing arm and having vertically movable load-carrying forks or other platform. The vehicle is further characterized by means at the rearward end of the transverse carriage for taking the upward thrust imposed thereat by the downward load on the swing arm unit. The means just referred to, in the illustrated form, consists of the carriage or crosshead being given a tapered configuration toward the rear, terminating in a tongue which is received for sliding transverse movement within a cross channel in the chassis. This cross channel takes the upward thrust generated by the downward thrust of the load on the swing arm.

In the vehicle of the present invention, in preferred form, the carriage is mounted on a transversely movable slide, and the slide is mounted on a transverse bearing block fixed to the chassis. A belt or chain is provided having one point fixed to the chassis and another to the carriage, and trained over rollers carried by said slide. A first hydraulic jack is connected between the chassis and the slide for moving the slide, thereby to move the carriage. A second hydraulic jack is connected between the carriage and the swing arm for pivoting the swing arm about the king post. Hydraulic jacks are also provided for moving the forks vertically, and for tilting the mast.

While the preferred embodiment of this invention has been described in some detail, it will be obvious to one skilled in the art that various modifications may be made without departing from the invention as hereinafter claimed.

What is claimed is:

1. A lift vehicle comprising:

(a) a mobile chassis;

(b) a carriage mounted for transverse movement across a forward end portion of said chassis;

(c) a pivot post carried by said carriage at a forward portion thereof and mounted for pivotal movement about a vertical axis;

(d) a swing arm mounted in cantilever fashion on said pivot post and to one side thereof for pivotal movement in a generally horizontal plane about the post axis of said pivot post;

(e) a mast lift assembly mounted on said swing arm and having load-carrying members;

(f) means at the rearward end of the transverse carriage for taking the upward thrust imposed thereat by the downward load on the swing arm, the rearward portion of said carriage being tapered to form a tongue, said means for taking the upward thrust comprises a cross load-bearing channel in said chassis receiving said tongue;

(g) means for moving the carriage transversely across the chassis;

(h) means for pivoting the swing arm;

(i) means for raising and lowering the load-carrying members of the mast lift assembly;

(j) means mounting said carriage on a transversely movable slide;

(k) said slide being mounted on a transverse bearing block fixed to said chassis;

(l) flexible link means fixed to said chassis and to said carriage and carried by said slide;

(m) means connected between said chassis and said slide for moving said slide;

(n) said swing arm includes an upper and lower plate fixed to said king post;

(o) an elongated tubular member secured to said upper and lower plates and extending outwardly from the king post;

(p) a pair of side plates, one secured to the outward end of said tubular member and the other substantially inward thereof secured to said upper and lower plates and having an opening through which said tubular member passes;

(q) means, including trunnions, for pivotally mounting said mast lift assembly on said inward and outward side plates.

2. A lift vehicle according to claim **1** characterized in

that a pair of hydraulic jacks are connected between said swing arm and said mast lift assembly for tilting said mast lift assembly.

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U.S. Cl. X.R.

214—671