

April 2, 1963

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3,083,853

LOAD ENGAGING APPARATUS FOR LIFT TRUCKS

Filed June 6, 1960

5 Sheets-Sheet 1

FIG. 1

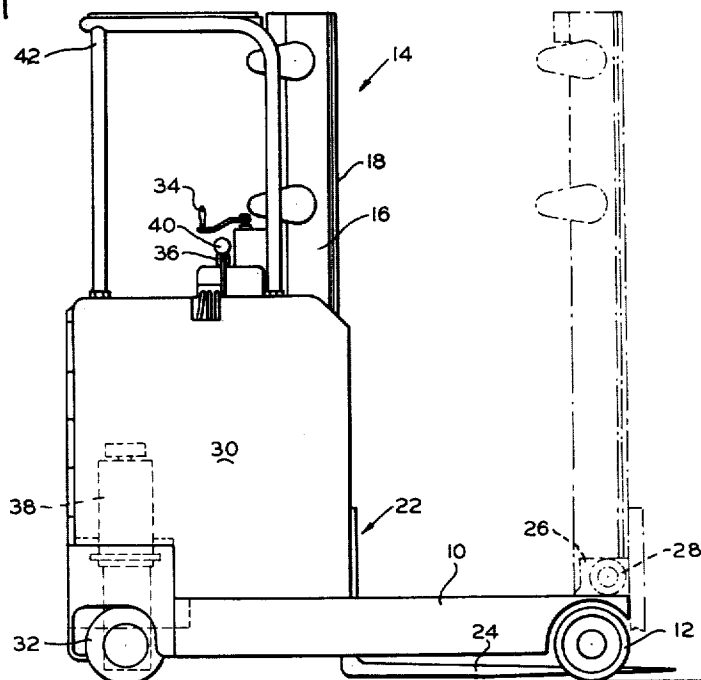
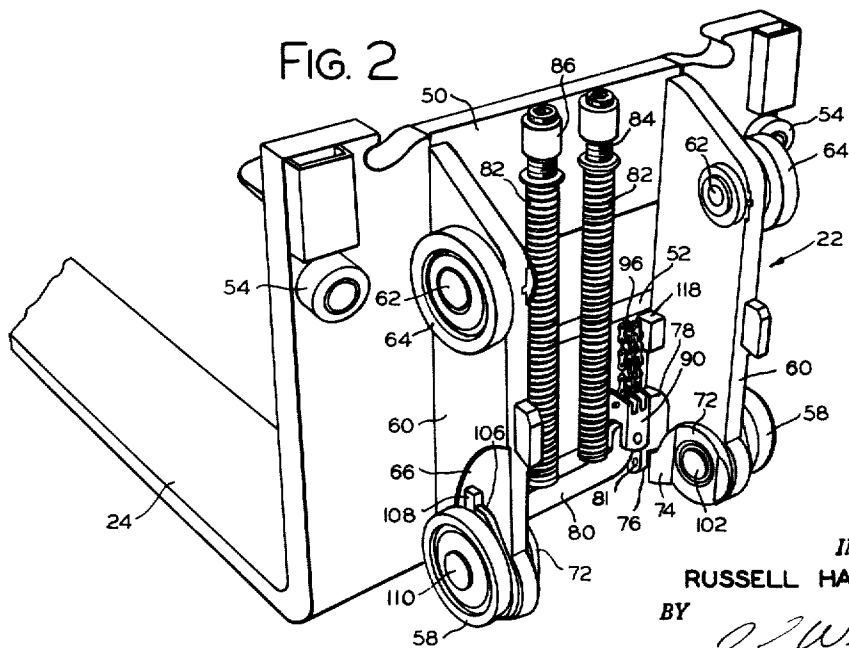


FIG. 2



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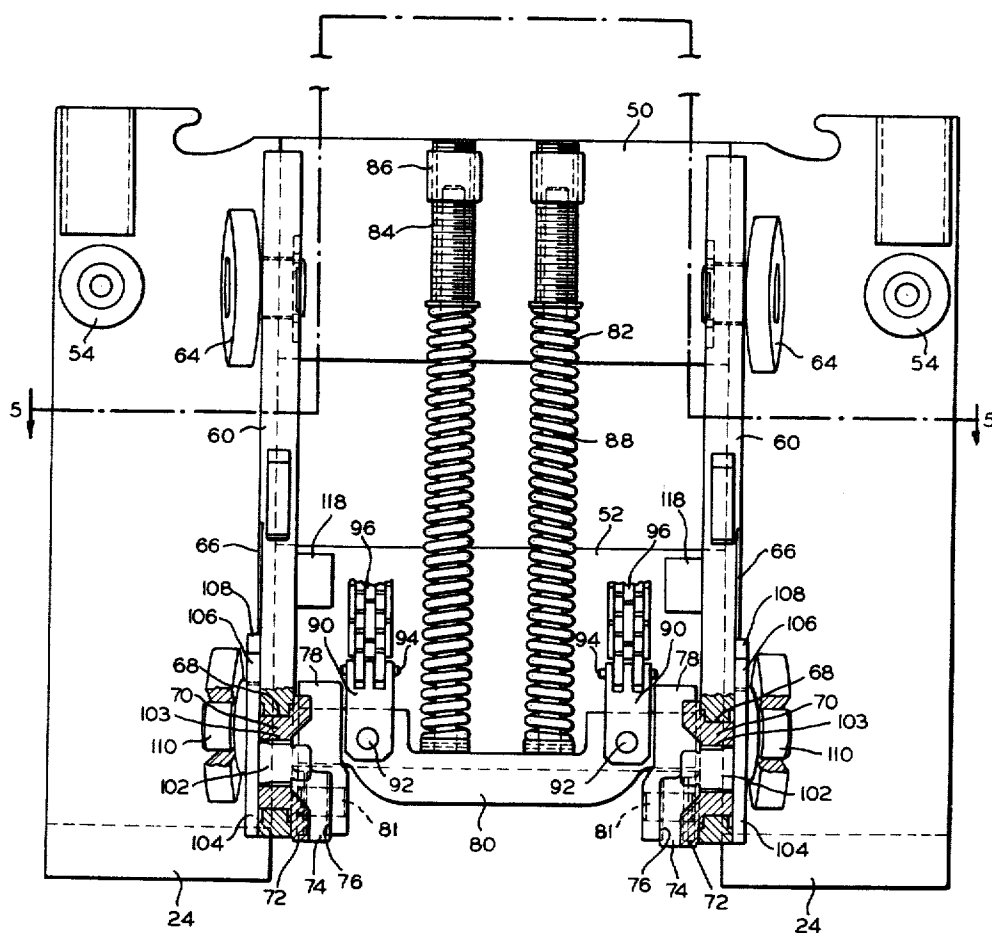
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FIG. 3



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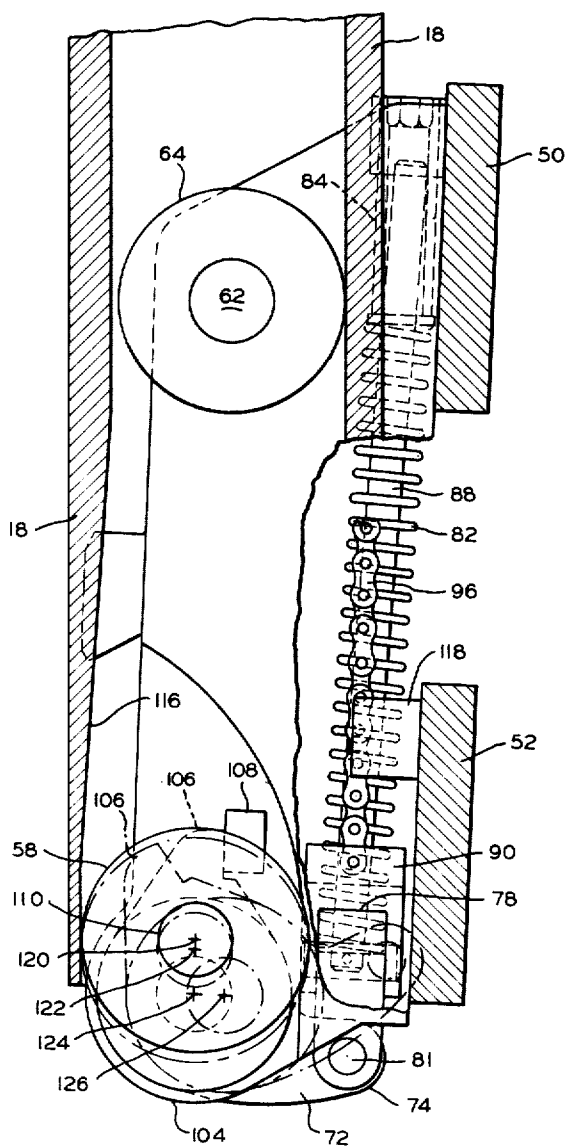
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FIG. 4



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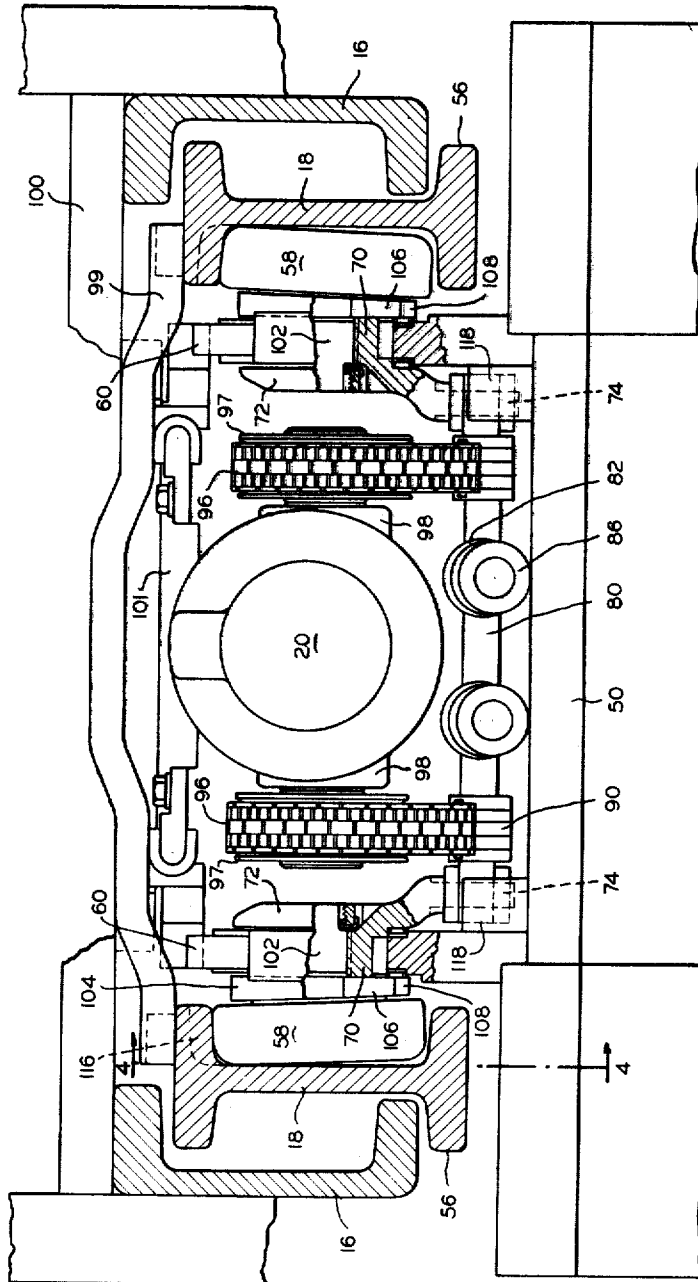
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LOAD ENGAGING APPARATUS FOR LIFT TRUCKS

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FIG. 5



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LOAD ENGAGING APPARATUS FOR LIFT TRUCKS

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FIG. 9

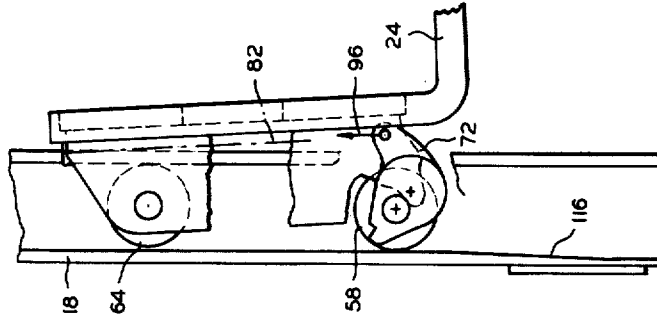


FIG. 8

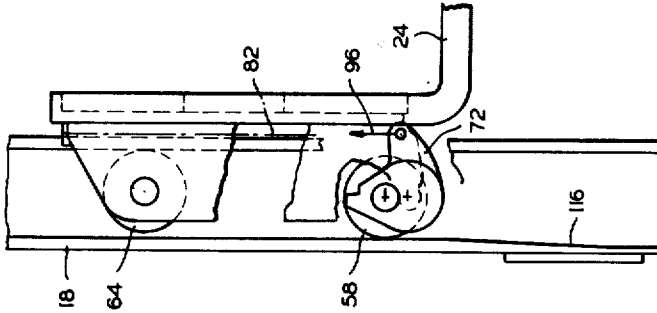


FIG. 7

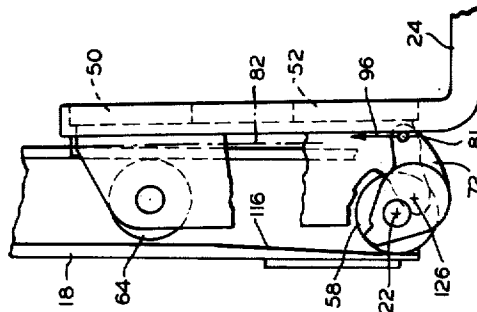
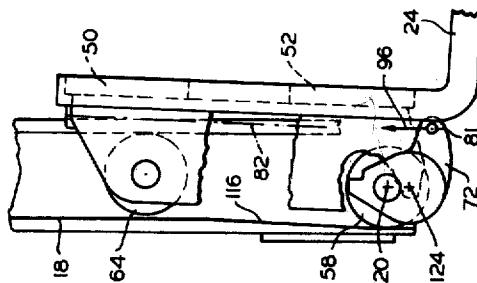


FIG. 6



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3,083,853

LOAD ENGAGING APPARATUS FOR LIFT TRUCKS

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18 Claims. (Cl. 214-660)

This invention relates to apparatus for tilting elevatable load engaging means, and more particularly to apparatus for tilting the load engaging means of a lift truck having an upright mast with which the load engaging means is associated for vertical movement.

In certain types of elevating mast apparatus, such as is normally associated with lift trucks and the like, a problem arises concerning how best to provide in an extremely limited space for tilting in a vertical plane of the lifting fork or other load engaging means when the fork is associated with a non-tilting mast structure. Also, although the mast structure may be tiltable, it may be found to be desirable to provide tilting movement of the fork additional to that provided by the mast structure.

My invention relates to improved apparatus for tilting in relatively limited space load engaging means in the aforementioned association. It has been found to be particularly useful in lift trucks of a type generally known as "narrow-aisle" trucks in which the mast is fixed in non-tilting relationship to the chassis, so that any tilting of the fork must be effected independently of tilting of the mast.

In carrying out the invention I provide in an elevatable load carriage for mounting in a lifting mast a cranking means which is associated in eccentric pivotal relation to a guide roller of the carriage so that rotation of the crank causes the carriage to be pivoted about a vertically spaced pivot means to a tilted position. Such tilting movement occurs upon the initiation of lifting movement of the carriage in the mast when a load engaging means of the carriage is in engagement with a load of predetermined mass which overcomes resilient means normally urging the carriage and load engaging means to a non-tilted position. When the load engaging means, hereinafter sometimes referred to as a fork or fork tines to simplify the expression, supports such as a load, the hoisting chain or cable normally associated with lift truck mast constructions functions to overcome the force of such resilient means to actuate the cranking means as aforesaid. In addition, an inclined plane arrangement is provided in the lifting mast which permits the carriage and fork to assume a reversely tilted position when it is lowered in the mast to a position near the bottom end thereof.

It is an important object of the invention to provide generally improved tilting apparatus which is operative in relatively limited space for the load engaging means of an elevator mechanism.

Another object of the invention is to provide apparatus for tilting rearwardly the load engaging means of a lift truck only in the event of a load being supported by the load engaging means.

It is a further object of the invention to provide fork tilt apparatus for lift trucks or other elevator mechanism wherein means urges the load engaging means toward a level position and is overcome upon initiation of lifting movement of the load engaging means under load to provide a rearward tilting movement of the load engaging means.

It is a further object of the invention to provide means in the upright mast of a lift truck which causes and elevatable load engaging means associated therewith to be tilted in a forward direction when it is located adjacent the lower end of the mast.

Other objects, features and advantages of the present

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invention will appear in the detailed description below when taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a side elevational view showing the general arrangement of one type of industrial lift truck in which the present invention finds particular utility;

FIGURE 2 is a perspective view of the fork carriage construction of the present invention;

FIGURE 3 is a rear view shown partially in section of the fork carriage of FIGURE 2;

FIGURE 4 is a side view in section taken along line 4-4 of FIGURE 5;

FIGURE 5 is a top view shown partly in section taken along a line such as 5-5 of FIGURE 3 but with the load carriage assembly mounted in the mast of the truck, the section being taken through opposite center side portions of the carriage assembly and through the upright channels of the mast, and then extending upwardly and above the central hoist motor and sheave portion of the mast so as to illustrate the latter in elevational view;

FIGURES 6, 7, 8 and 9 are schematic illustrations of a portion of the upright and carriage assembly with the latter being illustrated in various attitudes of operation in the respective figures.

Referring now in detail to the drawings and first to FIGURE 1, the main frame of a wheeled truck is generally in the form of a U-shape, the projecting legs of which are spaced transversely apart. Each outrigger leg, one of which is shown, comprises a longitudinally extending channel construction 10 upon which is mounted a ground engaging wheel 12. The opposite ends of the legs are secured together and the space therebetween is bridged by means of transverse frame members. A lifting mast or upright of generally known construction is illustrated at numeral 14 and comprises broadly a pair of laterally spaced outer fixed channel members 16, a pair of laterally spaced I-beams 18 suitably nested as shown within the channel members for vertical telescoping movement, a hydraulic hoist motor 20 (FIG. 5), and a carriage assembly 22, including fork tines 24, which is mounted in a manner to be described for vertical movement relative to members 18, the fork carriage being connected to hoist motor 20 in known manner by means of chain and sprocket mechanism.

The upright structure 14 is suitably connected by means of a pair of rearwardly extending L-shaped brackets 26, only a portion of one of which is illustrated, to the channel members 10 for longitudinal movement relative thereto. Each member 26 is secured to a lower side portion of one of channel members 16 and mounts the upright upon the adjacent channel member 10 by means of a pair of rollers located adjacent the opposite ends of each L-shaped bracket and in rolling abutment with inner and outer surfaces of the upper flange of each channel member 10. An upper one of such pairs of rollers is illustrated at numeral 28. The bracket members 26 may be associated with a worm gear mechanism, not shown, located within each channel member 10 so that as the worm gears are rotated in one or the other directions the mast 14 is actuated longitudinally outwardly or inwardly of the legs, as illustrated in FIGURE 1. Suitable motor means and driving mechanism, not shown, are mounted within a main body portion 30 for driving the worm gear mechanisms, and thereby the mast construction. A pair of driving-steering wheels 32, one of which is shown, are controlled by means of a steering tiller 34, and a master truck control handle 36 controls the operation of an electric drive motor 38 as well as controlling vertical movement of carriage assembly 22 in the mast 14. A control lever 40 controls the operation in extension and retraction of upright and carriage assembly 14 and 22. An opera-

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tor's overhead guard construction 42 is adapted to protect the drive from injury from falling objects.

The utility of the carriage assembly of the present invention is well exemplified in the illustrated association with a lift truck of the type shown in FIGURE 1, wherein the upright assembly 14 cannot be tilted out of a vertical position. However, it will be understood that the present invention is not intended to be restricted to use with any particular type of industrial truck or other industrial vehicle, but may be usable in various associations.

The fork carriage assembly 22, as best shown in FIGURES 2 and 3, comprises a pair of vertically spaced transverse plate members 50 and 52, to the opposite ends of which is secured, as by welding, a pair of laterally spaced L-shaped fork tines 24. A pair of rollers 54 is secured to the upper corner portions of tines 24 which, with the carriage mounted in upright 14, are adapted to abut the outer forward edge portions 56 of inner movable upright I-beams 18. Rollers 54 are adapted to cooperate during operation with a pair of transversely spaced cocked rollers 58 of the carriage assembly to prevent lateral twisting or rotational movement of the carriage assembly under the influence of an off-center load on the fork tines 24. A similar upright construction to that shown herein is fully disclosed in co-pending application Serial No. 111,070, filed May 18, 1961, in the names of Hastings and Backofen (common assignee).

A pair of laterally spaced and rearwardly extending carrier plates 60 are secured to the rear surfaces of plates 50 and 52 and provide openings in the upper ends thereof for the reception of a pair of shafts 62 upon which are mounted outwardly of carrier plates 60 a pair of upper carriage guide rollers 64. Adjacent the lower ends of the carrier plate 60, which include recessed portions 66, are openings 68 for the reception of a pair of shaft members 70 upon which are formed inwardly of carriage plates 60 a pair of crank members 72 having forwardly extending portions 74. Each portion 74 is received in a slot 76 of a bifurcated lower portion of each end portion 78 of a transverse spring support and chain anchor member 80. Pin members 81 pivotally connect crank end portions 74 with each bifurcated end portion of support and anchor member 80. Supported from the upper edge of support and anchor member 80 are the lower ends of a pair of compression springs 82 which are secured to plate member 50 by a pair of spring adjustment studs 84 and a pair of tubular members 86 which may be welded to plate 50. A rod 88 extends through each spring and is secured at the lower end to member 80, being slidably engaged with each stud 84 internally thereof. A pair of bifurcated chain anchors 90 are secured by pins 92 to the opposite end portions of support and anchor member 80 and provide anchor pins 94 for the reception of one end of each of a pair of lifting chain members 96 which extend from said anchors upwardly for reaving over a pair of laterally spaced sheaves or sprockets 97 and thence downwardly to connect with fixed chain anchor members, not shown, which may be secured either to a fixed portion of the upright 14 or which may be secured to the lower end portion of the fixed cylinder hoist motor 20. Sprockets 97 are secured in known manner to a cross-head 98 which extends laterally outwardly from opposite sides of the upper end of the piston rod of hoist motor 20. Inner and outer upright supports 99 and 100 are secured to the rear sides of pairs of upright members 18 and 16, respectively, and piston rod guide support means 101 functions to guide the piston rod during operation.

Each shaft member 70 includes a central internally splined opening 103 (FIG. 3) engaging an externally splined shaft 102 to the outer ends of which is securely mounted a rotatable and generally circular travel limit control member 104 having an upper projecting end 106, each of which abuts along a flat forward surface thereof

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a stop block 108 secured in predetermined position in each of recesses 66. A pair of stub shafts 110 is secured to the outer surfaces of movement limit members 104 in spaced relation to the pivot shafts 102 for receiving the pair of roller carriage guide rollers 58. Preferably the stub shafts 110 are formed to provide a slight forwardly cocked relation to a horizontal line transverse of the upright so that when rollers 58 are mounted thereon they assume a position relative to I-beams 18 as shown in FIG. 5. Upper stub shafts 62 are formed to provide a slight reverse cocked relation to a horizontal line transverse of the upright for receiving upper rollers 64, all as described in detail in the aforementioned co-pending application. The particular manner in which the carriage guide rollers 58 and 64 are cocked as aforesaid is not important to an understanding of the present invention, and straight or non-cocked rollers may be used with equal facility in the construction which embodies the invention.

Preferably, the axis of stub shafts 110 is located a predetermined distance vertically above the axis of shafts 70 and 102 so that pivotal movement of crank members 72 and movement limiting members 104 about the axis of shafts 102 causes a small horizontal arcuate movement of rollers 58 with shafts 110 when the carriage assembly 22 is not mounted in the upright. Such movement occurs inasmuch as the axis of shafts 110 is located in eccentric relation to the axis of shafts 102. Since members 104 pivot about the axis of shafts 102 eccentrically connected shafts 110 move slightly arcuately rearwardly upon counterclockwise movement of crank members 72 as viewed in FIGURE 4. The normal position of the lower roller, crank and movement limiter assembly is illustrated in FIGURES 2, 3 and 5, as well as in the solid and dotted line position of the parts in FIGURE 4. In this position compression springs 82 urge support and anchor member 80 downwardly against any upward lifting force applied to chains 96 by hoist motor 20 when fork tines 24 do not support a load. Member 80 assumes a normal down position in which crank arms 72 are pivoted in a clockwise direction with shafts 70 and 102, as viewed in FIGURE 4, to the aforementioned position in which the vertical forward surfaces of projections 106 abut adjacent vertical surfaces of stop members 108. With the assembly so located, the downwardly directed force of springs 82 is sufficient to support the weight of the unloaded assembly 22 and the vertically movable I-beams 18. Therefore, upwardly directed movement of hoist motor 20 to first lift the carriage assembly by means of chains 96 and then lift the carriage and the I-beams 18 together, in known manner, does not overcome the downward force of springs 82. Thus, the lower roller and crank arm assemblies 58 and 72 will remain in the position illustrated in which limit control members 104 abut stop members 108 and in which fork tines 24 are preferably located in parallel relation to the floor or other supporting surfaces.

When the truck is moved adjacent a non-palletized load and the upright 14 extended to the end of arms 10 to insert fork tines 24 under the load for lifting movement thereof in the upright 14, it is desirable that the fork tines be initially tilted forwardly so that the tips thereof touch the floor, and that upon engaging the load the fork tines be tilted slightly rearwardly of such normal position so that the load does not tend to move forwardly relative to the fork tines during maneuvering of the truck while carrying the load. Forward tilting of the fork and carriage assembly is provided by means of a rearwardly inclined plane surface 116 formed in the lower flange portion of each I-beam 18, as best illustrated in FIGURE 4. It will be appreciated, of course, that the weight of the load and/or carriage assembly 22 maintains at all times upper rollers 64 in rolling contact with the forward flange portions of I-beams 18 and lower rollers 58 in rolling contact with the rearward flange portions of the I-beams.

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Therefore, as the carriage assembly is actuated downwardly in the lower portion of the I-beams, lower rollers 58 follow the contour of inclined plane portion 116 which causes the carriage and fork assembly to tilt forwardly of a level position, thereby facilitating entry of the fork tines beneath a non-palletized load. Raising the carriage assembly above the inclined plane portion in I-beams 18 returns the fork and carriage assembly to a position parallel to the truck supporting surface when the crank and lower roller assembly 72 and 58 is in the solid line position of FIGURE 4.

Upon engagement and initial lifting movement by hoist motor 20 and chains 96 of a load on the fork tines 24 sufficient to overcome the downward force of springs 82, the opposing lifting force of the chains causes compression of springs 82 and actuates support and anchor member 80 upwardly which carries end portions 74 of crank members 72 therewith in counterclockwise rotation (FIG. 4) about the axis of the crank members until end portions 78 of member 80 abut stop blocks 118 which are secured to the inner opposed surfaces of carriage plates 60. Such pivotal movement of the crank members 72 and shafts 102 causes like pivotal movement of limit control members 104 away from stop blocks 108 to the chained line position thereof illustrated in FIGURE 4, which in turn causes pivotal movement of eccentrically mounted lower rollers 58 from the solid to the chained line position thereof.

As pointed out hereinabove, lower rollers 58 tend upon such counterclockwise motion of crank members 72 to move arcuately rearwardly as a result of the eccentric mounting thereof in respect of the axes of shafts 102. However, when the carriage assembly is mounted in the upright, rollers 58 being in continuous abutment with the rearward inner flange portion of I-beams 18 necessarily follow the contour of the flange portion. Except for the provision of the inclined plane portion 116 at the lower end of the I-beams, the inner surface of said flange portion is vertical so that the lower rollers are forced to move slightly downwardly in a vertical direction, not arcuately rearwardly. This downward movement of the lower rollers is represented in FIGURE 4 by the illustrated downward shift of the roller shaft 110 which mounts the roller on limit control member 104, the axis of the shaft 110 moving from point 120 to point 122. Such movement forces the entire carriage and fork assembly outwardly of the upright in a counterclockwise direction about the axis of upper roller shafts 62, which remains in essentially fixed position, so that as the crank members 72 are actuated in a counterclockwise direction against springs 82 the axes of shafts 70 and 102 are moved essentially horizontally forwardly from the location indicated at point 124 to the location indicated at point 126.

It will be understood, of course, that for any given design the particular relationship or distance between the axes of the upper and lower rollers and between the axes of the lower rollers and the crank arms may be varied to provide different fork carriage tilting characteristics as desired, that illustrated in the figures being merely representative. It will also be understood, however, that in any given design the distance between the axis of the upper rollers 64 and the axis of the crank arms 72 will remain constant at all times inasmuch as both the rollers and the crank arms are mounted in carrier plates 60, and, likewise, the distance between the axes of lower rollers 58 and the axis of the crank arms will remain fixed at all times irrespective of the position of the crank arms and rollers, whether in fork tilt or non-tilt position. It has been found that approximately 2° forward tilt is adequate with the carriage assembly in the lowered position, and that the provision of approximately 3° rearward tilting movement of the carriage assembly coincident with full cranking action of cranks 72 is adequate to offset the elastic deflection of the fork tines under heavy load and to prevent slippage of the load relative to the forks during

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maneuvering of the truck. Of course, if with the carriage assembly in a lowered position, and therefore in a 2° forward tilt position in accordance with the foregoing example, the load is engaged and initially lifted by chains 96 to actuate crank arms 72 until members 78 contact stop blocks 118, the total rearward tilting movement effected thereby in such position will be 1°. On the other hand, with the fork carriage lifted above the inclined plane portion 116 such rearward tilt will be 3° in accordance with the foregoing example. These results are illustrated somewhat schematically in FIGURES 6, 7, 8 and 9. FIGURE 6 illustrates the major component parts of the fork carriage assembly in association with the lower portion of the one I-beam of the upright when the assembly is in normal position preparatory to engaging a load, in which position the fork is tilted slightly forwardly, 2° in the foregoing example, of a level position relative to the floor line. FIGURE 7 illustrates the aforesaid 1° rearward tilt position of the fork and carriage assembly with crank arms 72 fully actuated. FIGURE 8 illustrates the normal level position of the fork and carriage assembly with the assembly raised above the inclined plane portion 116 and preparatory to engaging a load, and FIGURE 9 illustrates the full 3° rearward tilt position of the fork and carriage assembly.

From the foregoing it will be appreciated that I have provided in a fork truck having a non-tilting mast, a fork carriage assembly which includes mechanism for tilting same rearwardly of a level position upon engagement with the load, while providing a normal level fork position when the fork is out of engagement with the load whether or not I-beams 18 and/or carriage assembly 22 is lifted by chains 96 to any given elevation in the upright 14. In addition, inner movable upright sections 18 are formed to provide for the forward tilting of the fork and carriage assembly when the latter is located in the lower portion of the upright. Of course, it will be recognized that inclined plane portions 116 can be extended upwardly to any desired elevation relative to the length of I-beams 18, depending upon the desired slope and the thickness of the flanged sections of the I-beams. If, for example, the inclined plane portion extended throughout the length of the I-beams it will be apparent that a slight forward tilt would exist throughout elevation of the unloaded carriage assembly, although this has not been found to be desirable. It has been found to be most desirable to provide forward tilt only at the lower end of the upright, in which position some difficulty would otherwise be encountered in projecting the fork under floor supported non-palletized loads, and to limit the length of the inclined portion such that the fork tines will assume the rearward tilt position of FIGURE 9, under predetermined load, when the fork tines have been elevated to a height at which the mast 14 with its load can be retracted above the outrigger legs 10 for transporting the load.

The invention as illustrated and described in the single embodiment hereof discloses the preferred construction, although I do not intend to be limited to any such construction.

Now, while I have shown and described what I believe to be a preferred embodiment of my present invention, it will be understood that various rearrangements and modifications in design, parts and construction may be made therein without departing from the spirit and scope of my invention.

I claim:

1. A load carrier for lift trucks comprising load support means, a pair of transversely spaced members secured to the load support means, a crank arm mounted in each said member for pivotal movement relative thereto, means interconnecting said crank arms, resilient means secured to the load support means and connected to said interconnecting means for urging the crank arms in pivotal movement in a direction away from the connection of the resilient means to the load support means, and load

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lifting means operatively connected to the crank arms for lifting the load carrier and pivoting the crank arms in a direction opposed to the urging of the resilient means when the load carrier supports a predetermined load.

2. A load carrier for lift trucks comprising load support means, means extending transversely of and secured to the load support means, a crank arm mounted in the transverse means for pivotal movement relative thereto, resilient means operatively connected to the crank arm and secured to the load support means, roller means operatively connected to the crank arm and disposed on the opposite side of the transverse means having an axis of rotation which is eccentric in relation to the axis of rotation of the crank arm, and load lifting means operatively connected to the crank arm for lifting the load carrier and pivoting the crank arm in opposition to the resilient means, such pivotal movement of the crank arm causing the axis of the roller means to shift its position relative to the axis of the crank arm.

3. A load carrier comprising generally L-shaped load support means, a pair of transversely spaced carriage members extending rearwardly of the support means, first roller means mounted in the upper and outer portion of each carriage member, pivotable crank means rotatably mounted in the lower inner portion of each carriage member, second roller means mounted in the lower outer portion of each carriage member and operatively secured for movement with the crank means in eccentric relation thereto, said crank means being interconnected by means transverse to the carriage members, means connected to the interconnecting means for urging the crank means in one direction, and lifting means operatively connected to the crank means for pivoting same in a direction opposing the latter means, such pivotal movement of the crank means causing a displacement in the location of the lower roller means.

4. A load carrier as claimed in claim 3 wherein movement limiting means is associated with said crank means for limiting pivotal movement thereof in one direction.

5. A load carrier as claimed in claim 3 wherein the radii between the axes of said upper roller means and said crank means is constant, the radii between the axes of said lower roller means and said crank means is constant, and pivotal movement of said crank means causes the radii between the axes of said upper and lower roller means to vary.

6. A load carrier as claimed in claim 3 wherein rotatable movement limiting means is mounted for pivotal movement with said crank means, said lower roller means being mounted for pivotal movement with said movement limiting means and having an axis of rotation displaced from the axis of rotation of said crank means, pivotal movement of said crank means causing arcuate movement of said lower roller means with pivotal movement of said movement limiting means about the axis of said crank means.

7. An upright mast and load carrier assembly for use in lift trucks comprising a pair of laterally spaced upright mast members having opposed channel portions inwardly thereof, load support means supported forwardly of the mast members and having a pair of laterally spaced rearwardly extending carrier members, upper and lower roller means mounted outwardly of each carrier member for engagement in said channel portions supporting the load support means therein, a pair of inwardly disposed crank means mounted for pivotal movement in the lower inner portions of the carrier members, means interconnecting said crank means, resilient means supported from the interconnecting means at one end and secured to the load support means at the opposite end for urging said crank means in downward pivotal movement, load carrier lifting means associated with the upright mast and operatively connected to the crank means and resilient means for actuating the load support means

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vertically in the upright mast, said lifting means effecting upward pivotal movement of the crank means in opposition to the resilient means under a predetermined load supported by the load support means.

8. An assembly as claimed in claim 7 wherein said lower roller means are mounted in eccentric relation to the crank means and for movement upon actuation of the crank means whereby to actuate the load support means in outward pivotal movement about a pivot axis associated with the upper roller means.

9. An assembly as claimed in claim 8 wherein such movement of the lower roller means reacts against a portion of the upright mast such that the crank means and load support means is caused to swing somewhat forwardly of the upright mast about the axis of the upper roller means.

10. A load carrier and upright mast assembly for lift trucks comprising a pair of laterally spaced movable upright members supported from the truck, load support means supported forwardly of the upright members, upper and lower roller means connecting the load support means to the upright members for relative vertical movement, a pair of pivotable members connected to the load support means adjacent one of said roller means, a transverse member interconnecting said pivotable members, means urging the interconnecting means and pivotable members in one direction relative to the load support means in said pair of upright members, said urging means to the interconnecting means for raising the load support means in said pair of upright members, said urging means being constructed to support the weight of the load carrier during elevating movement thereof by the motor means.

11. An assembly as claimed in claim 10 wherein said load support means is caused to tilt to a rearward inclination upon lifting movement thereof under predetermined load, such rearward tilting movement being effected by actuation of the pivotable members against the urging means in cooperation with a shift in location of the said one roller means.

12. An assembly as claimed in claim 11 wherein said one roller means is mounted for movement relative to the pivotable members in a manner to effect movement in translation of the pivotable members with pivotal movement of the load support means about the axis of the other roller means.

13. A load carrier and upright mast assembly for lift trucks comprising a pair of laterally spaced upright members, transversely extending load support means mounted forwardly of the upright members, upper and lower roller means mounting the load support means in the upright members for elevation of the load support means in the upright members, said upper roller means being mounted in fixed relation to the load support means, said lower roller means being mounted in movable relation to the load support means, pivotable crank means mounted adjacent the lower roller means and in fixed mounting relation to the load support means, and means operatively connected to the crank means for elevating the load support means in the upright members, said latter means under predetermined load effecting pivotal movement of said crank means which effects movement of the lower roller means relative to the load support means.

14. A load carrier and upright mast assembly for lift trucks comprising a pair of laterally spaced upright members supported from the lift truck, load support means mounted in the upright members for elevation forwardly thereof, laterally spaced pairs of upper and lower roller means connecting the load support means to the upright members, pivotable means connected to the load support means and to the lower rollers in axially spaced eccentric relation, the axis of said pivotable means being at a fixed distance from the axis of the upper rollers and from the axis of the lower rollers, and load support lifting means operatively connected to the pivotable means for actuating

same under a predetermined load on the lifting means, such actuation effecting a lengthening of the distance between the axes of the upper and lower roller means.

15. An assembly as claimed in claim 14 wherein actuation of the pivotable means effects downward movement of the lower roller means relative to the upper roller means and against the upright members causing arcuate movement of the lower end of the load support means forwardly of the upright members.

16. An assembly as claimed in claim 14 wherein stop and movement limiting means are associated with the pivot means for limiting the range of pivotal movement thereof in either direction.

17. A load carrier and upright mast assembly for lift trucks comprising a pair of laterally spaced upright members supported from the truck, load support means mounted for vertical movement in the upright members forwardly thereof, hoist motor means mounted in the upright member and operatively connected to the load support means for elevating same in the upright members, upper and lower pairs of roller means supporting the load support means in the upright members, said upper roller means being mounted in fixed axial relation to the load support means, a pair of crank means mounted transversely inwardly of the lower roller means and in fixed axial relation to the load support means, said crank means extending forwardly of its axis, a transverse member interconnecting the forwardly extending end portions of the crank means, spring means secured to the load support means and mounted upon the transverse member for urging same downwardly with the end portions of the pair of crank means, said hoist motor means being also operatively connected to the transverse member for urging same upwardly with the crank means in opposition to the spring means, movement limiting means pivotable with the crank means for limiting pivotal movement thereof in at least

one direction, said lower roller means being mounted upon said movement limiting means in spaced relation to the axis of the crank means, pivotable movement of the crank means effecting substantially vertical movement of the lower roller means, said spring means being adapted to maintain said crank means and transverse members in a downward location relative to the load support means until such time as an opposing lifting force applied by the hoist motor means under a load disposed on the load support means actuates the transverse member upwardly and pivots the crank means.

18. A load carrier and upright mast assembly for lift trucks comprising a pair of laterally spaced upright members supported from the truck, load support means mounted for vertical movement in the upright members including upper and lower roller means engaging forwardly and rearwardly disposed portions of the upright members respectively, a portion of the rearwardly disposed portion of the upright members being inclined at an angle to the vertical whereby to effect forward tilting of a load support means during vertical movement thereof in said inclined portion of the upright members, and means operatively connected to said lower roller means and to said load support means for actuating the lower roller means in a manner to effect actuation of the load support means to a reverse tilt position about the axis of the upper roller means upon lifting of the load support means in the upright members under predetermined load.

References Cited in the file of this patent

UNITED STATES PATENTS

1,912,816	Anthony	June 6, 1933
1,975,252	Clark	Oct. 2, 1934
2,569,053	Healy	Sept. 25, 1951
2,899,093	Morrell	Aug. 11, 1959