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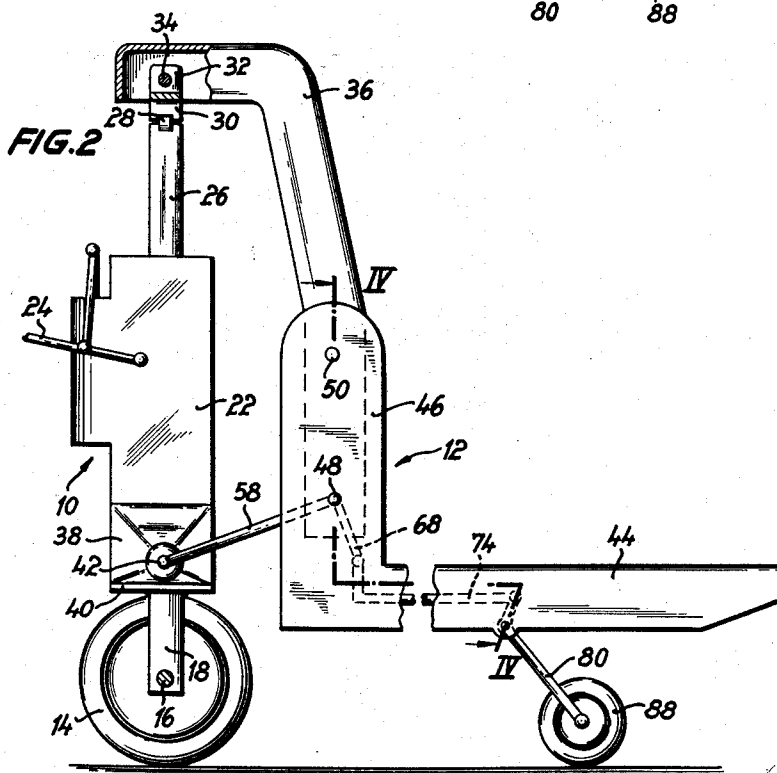
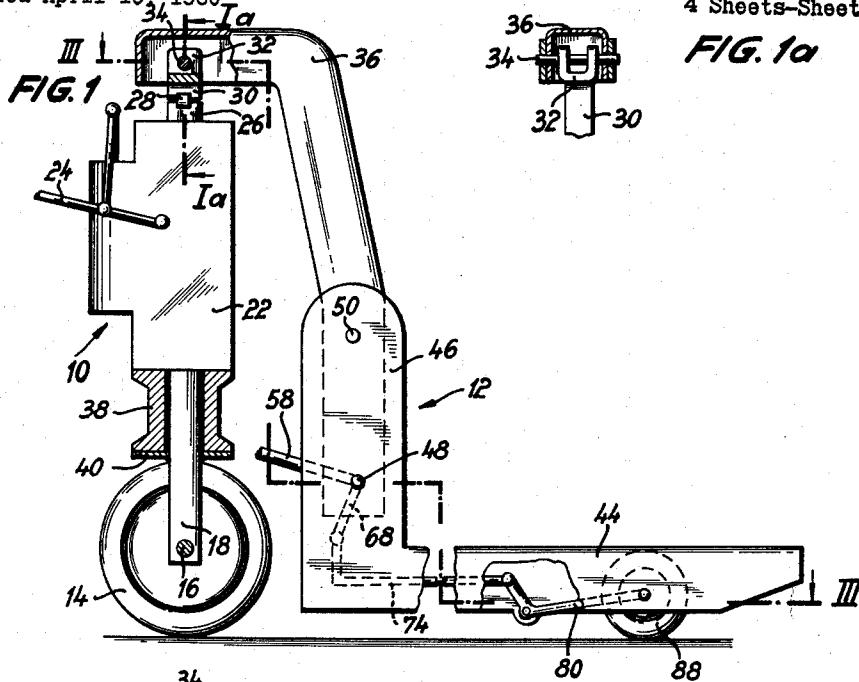
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3,072,418

FORK LIFT TRUCK

Filed April 19, 1960

4 Sheets-Sheet 1



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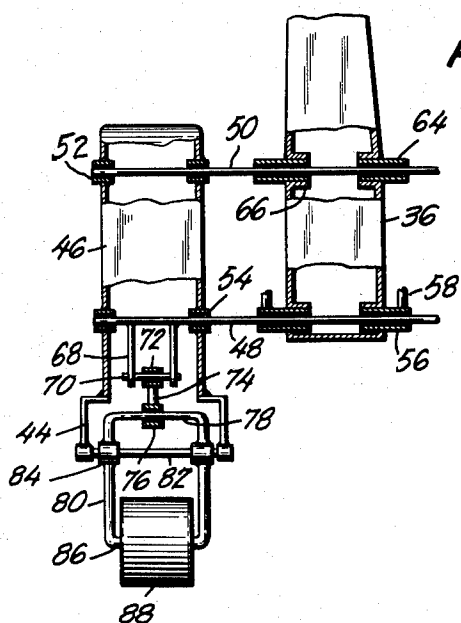
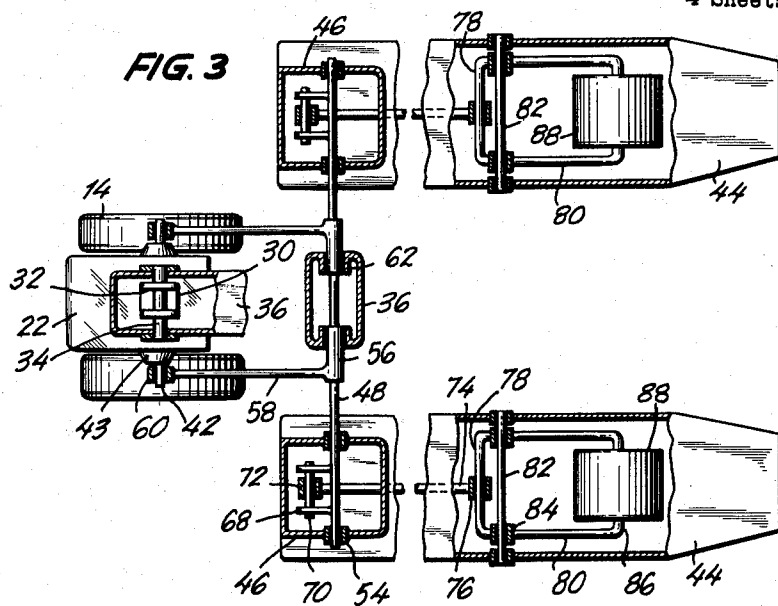
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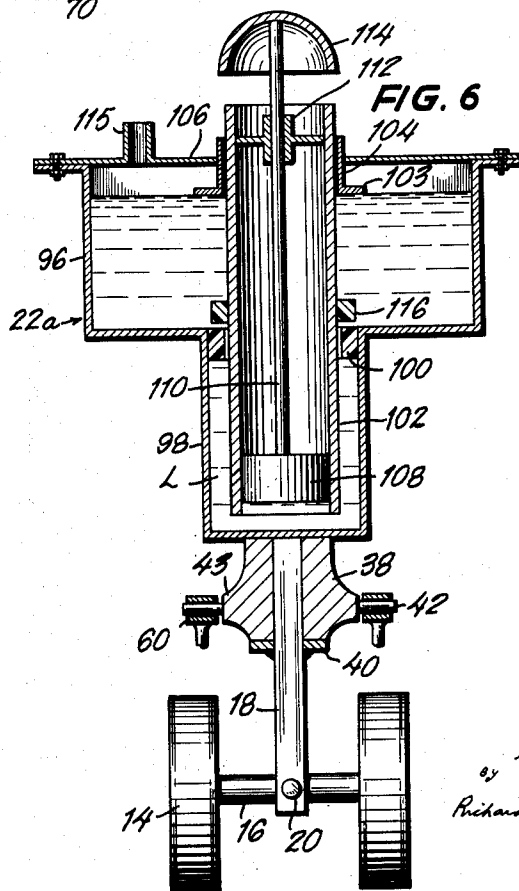
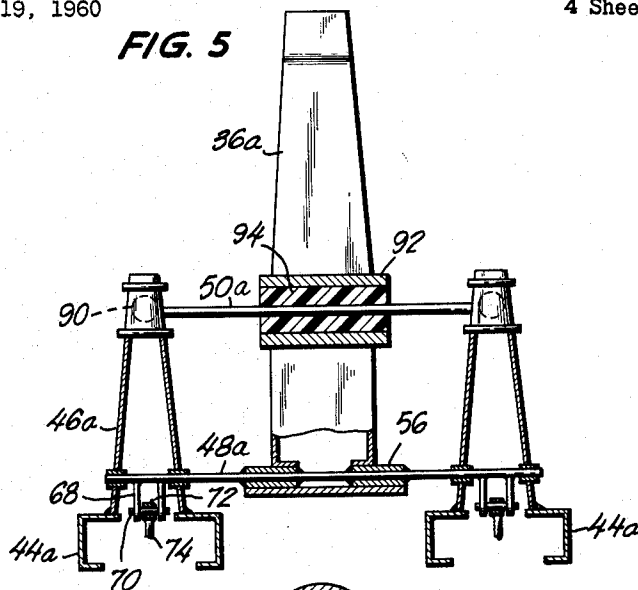
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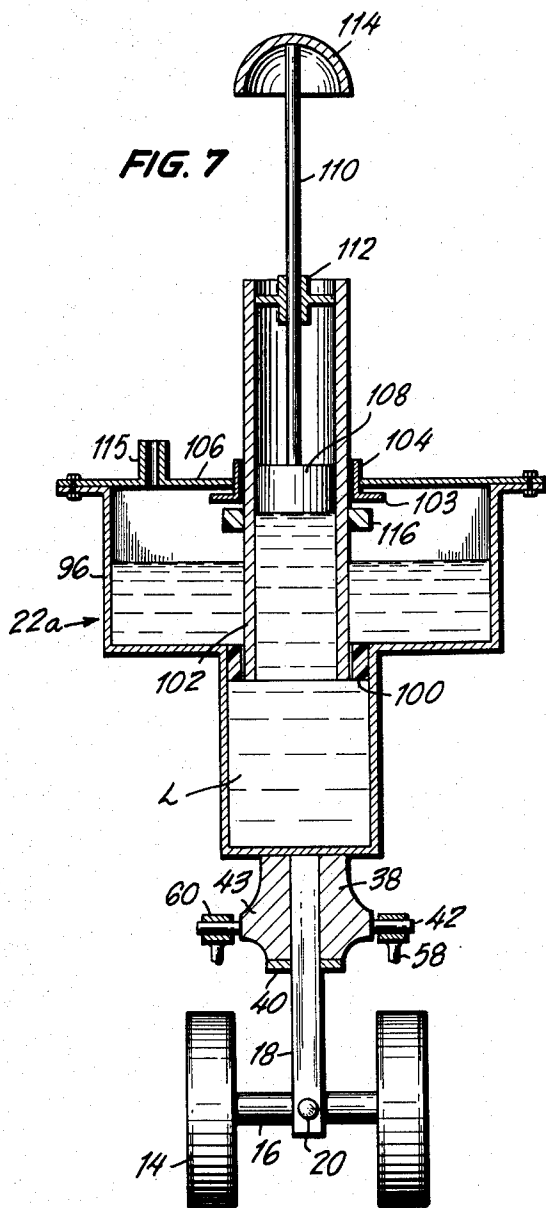


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FORK LIFT TRUCK

4 Sheets-Sheet 4



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3,072,418

FORK LIFT TRUCK

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6 Claims. (Cl. 280—43.12)

The present invention relates to a fork lift truck, and particularly to a hydraulic fork lift truck.

Hydraulic lift trucks now known generally consist of a front carriage with steerable front wheels and a hydraulic lifting jack operation in a vertical direction, and a rear carriage borne by a lift member or piston of the hydraulic lifting jack. The rear carriage comprises a lift fork having two fork tines which are connected with each other via a pair of transverse shafts. A lift arm is connected to one shaft. The lift arm acts on the end of the lift fork facing the front carriage. On the ends of the tines extending rearwardly away from the front carriage there are arranged vertically adjustable wheel suspensions. On the forward end of the fork at the crossbar the lift arm is vertically supported. A lift shaft is rotatably supported at the forward end of the fork and is joined at one end to the front carriage by a connecting link or links seated nonrotatably on the shaft. At its other end, the lift shaft acts via a lever system on the vertically adjustable wheel suspensions. When the lift jack is operated, the lift shaft is turned and a vertical displacement of the wheel suspensions is effected simultaneous with the lifting of the lift fork.

In the prior known lift fork trucks, the fork tines of the lift fork were connected rigidly with each other by a transverse member. The lift arm was supported in or on this transverse member and the hydraulic lift member was fastened to the lift arm. In order to impart to the lift fork the required stiffness to resist twisting, the fork tines had to be connected in a rigid nondetachable manner with the transverse member. This necessitated a considerable amount of labor and material. Furthermore, because of the rigid non-detachable connection of the fork tines with the transverse member, a large number of lift forks corresponding to the many diversified requirements of customers had to be kept in stocks of dealers at all times. Also, the rigid one-piece construction of the lift forks took up considerable space in storage and transportation.

The present invention is directed at overcoming the foregoing difficulties and disadvantages by providing a lift truck having a novel lift fork construction. The lift fork includes a lift arm and fork tines which are separably interconnected. The tines and lift arm are connected by spaced horizontal lift shafts. Each fork tine includes a beam of channel or box profile and having a channel or box superstructure secured thereto. The superstructure may be detachably or integrally joined to the tine. The spaced lift shafts for the lift arm and tines are seated in the superstructures of the tines. Due to the separable construction of the tines, superstructures, lift shafts and lift arm, the entire assembly can readily be disassembled for shipment and storage in the most economical and space saving arrangement. If any one component is damaged in use, it can readily be replaced. Due to the separable structure, fork tines of different sizes can be combined with different sizes of connecting lift shafts and lift arms. It is possible according to the invention to seat one or both lift shafts rotatably in the lift arm and superstructures. This provides a certain amount of flexibility in the support of the tines especially adapting the lift truck for use on rough, uneven and inclined floor surfaces.

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The lift arm preferably has a box profile. The connecting lift shafts pass transversely through opposite sides of the hollow lift arm. The lift arm is connected with the piston rod of the hydraulic jack by a universal joint. Connecting links are fastened in a non-turnable manner on one of the lift shafts at opposite sides of the lift arm. These links are pivoted on pivot pins arranged parallel to the lift shafts and carried by the front carriage of the lift truck. The pivot pins may be carried on a cross-member which is turnable about a steering column of the front carriage and supported so that it is fixed against movement in the axial direction of the steering column.

Within the superstructures of the lift tines there are disposed cranks which act via a lever system on the wheel suspensions of the rear carriage.

It is possible to provide a telescopic type of hydraulic jack for lifting the fork. Such a type of jack permits the amount of power expended in lifting the fork to remain substantially constant during the vertical movement or stroke of the fork.

It is therefore one object of the present invention to provide a lift truck in which a lift fork includes separate and detachable tines having superstructures connected by lift shafts, at least one of which shafts is journaled for rotation in the superstructures.

A further object is to provide a carriage for a lift truck in which a fork includes separate and detachable tines having superstructures connected by spaced lifting shafts passing through a lift arm, one of the shafts being connected by a linkage to wheel suspensions for depressing the wheels while the tines are lifted.

Another object is to provide a lift truck provided with a telescopic hydraulic jack for lifting a lift fork.

Still another object is to provide a lift fork structure including tines having superstructures connected by lift shafts rotatably seated in the superstructures with ball joints for one of the shafts to permit limited independent movements of the tines.

Other and further objects and advantages of the invention will become apparent from the following description taken together with the drawing, wherein:

FIG. 1 is a side view of the lift truck in accordance with the invention, partially in section, with the lift fork in lowered position;

FIG. 1a is a section along the line Ia—Ia of FIG. 1;

FIG. 2 is a side view, corresponding to FIG. 1, partially in section, with the lift fork in raised position;

FIG. 3 is a section along the line III—III of FIG. 1;

FIG. 4 is a section along the line IV—IV of FIG. 2;

FIG. 5 is a section corresponding to that of FIG. 4 showing a modified embodiment;

FIG. 6 is a section through a front truck, equipped with telescopic lift jack, with the lift jack in retracted position; and

FIG. 7 is a section corresponding to that of FIG. 6 with the lift jack in extended position.

The lift truck shown in side view in FIGS. 1 and 2 consists of a front carriage 10 and a rear carriage 12. The front carriage 10 comprises a pair of wheels 14. The wheels 14 are supported on an axle 16. This axle 16 is a floating half-axle and is fastened to the lower end of a steering column 18 by a hinge pin 20. The steering column 18 is rigidly fastened to the lower end of a housing 22. This housing 22 contains a pump (not shown) which is actuated by a rocker lever 24 and a hydraulic jack (not shown). The hydraulic jack has a piston rod 26.

The piston rod 26 is connected via a pin 28, the axis of which lies in the plane of the drawing, with an articulation member 30. The articulation member 30 bears at its upper end a fork 32 (see FIG. 1a.) The fork 32 is

pivoted by a pivot pin 34 to a lever arm 36, which has a U-profile. The fork 32 has some play in axial direction on the pivot pin 34.

A cross-member 38 is turnably supported on the steering column 18. This cross-member 38 is held fixed in axial direction of the steering column 18 by a thrust plate 40. The cross-member 38 bears two pivot pins 42 extending through bosses 43 formed on member 38.

The rear carriage 12 comprises a fork with two fork tines 44. The fork tines 44 bear superstructures 46 on their ends facing the front carriage 10. The superstructures 46 are welded firmly onto the forks 44. The superstructures 46 are traversed by a lift shaft 48 and an additional connecting lift shaft 50 (see FIG. 4). The horizontal, parallel lift shafts 48 and 50 are supported in each of the superstructures, the shaft 48 in bearings 54 and the shaft 50 in bearings 52. The shaft 48 is turnably supported in the bearings 54. By means of the shafts 48 and 50, an approximately rigid connection of the two superstructures 46 and thus of the two fork tines 44 is produced. On the lift shaft 48 there are seated in non-turnable manner sleeves 56. These sleeves are welded or keyed onto the shaft and bear connecting arms 58. The connecting arms 58 are provided with connecting eyes 60 which extend around the pivot pins 42 of the cross-member 38. The lift shaft 48 passes through the lift arm 36 and is turnably supported with the sleeves 56 in bushings 62 of the lift arm 36. The shaft 50 also traverses the lift arm 36. It is provided with sleeves 64 at the place of passage through the lift arm 36, these sleeves being supported in non-turnable manner in bushings 66 of the lift arm.

The superstructures 46 are carried on the shafts 48 and 50.

Within the superstructures 46, cranks 68 are fastened to the lift shaft 48, for instance by welding or keying. These cranks 68 can also be fastened to the lift shaft 48 after the superstructures 46 have been mounted in place. The cranks 68 are bored at their free ends. A pivot pin 70 is inserted in the bores. The pivot pin 70 passes through a pivot eye 72 at one end of an angle bar 74. The angle bar 74 bears at its other end a pivot eye 76. This pivot eye 76 engages around a transverse bar 78 of a bent strap 80. The bent strap 80 is rotatably supported on a shaft 82 by means of bearing eyes 84. The shaft 82 is supported in the profile beams forming the fork tines 44. A wheel 88 is turnably supported on another transverse bar 86 of the bent strap 80.

When the hydraulic lift press of the front track is moved out into extended position, the lift fork is raised by the lift arm 36. The movement of the lift fork upwards effects a rotation of the lift shaft 48 (see FIGS. 1, 2). Due to this rotation, the angle bar 74 is pressed towards the right by the cranks 68 and the bent strap 80 is turned in clockwise direction around the shaft 82. In this way, the wheels 88 are forced downward against the supporting surface on which the fork lift truck rests.

A modified embodiment is shown in FIG. 5. The superstructures 46a taper in upward direction in this embodiment. The connecting shaft 50a is supported by means of ball joints 90 in the superstructures. In the lift arm 36a, a bushing 92 is provided through which passes shaft 50a. This bushing 92 surrounds the shaft 50a with the interposition of an elastic sleeve 94. Because of this type of support of the shaft 50a, the lift fork has a certain flexibility, i.e. the two fork tines 44a can be turned independently somewhat around the lift shaft 48a.

In FIG. 6 there is shown a section through a front truck which, differing from the embodiment of FIG. 1, is equipped with a telescopic lift jack. The housing 22a comprises a tank or container 96 of fluid. At the bottom of the container is a cylinder 98. In the cylinder 98 is provided a guide ring 100. In this guide ring 100 an

annular piston 102 is guided. Annular piston 102 is also is also guided by a guide bushing 104 in a cover 106 of the tank 96. A nipple 115 on the cover opens into tank 96. Within the annular piston 102 another piston 108 is guided. This other piston has a piston rod 110. Piston rod 110 is guided in a journal bearing 112 of ring piston 102 and at its free end bears a ball 114 of a universal joint. To the annular piston 102, there is fastened a stop ring 116 which limits the movement of the annular piston downward by interaction with the guide ring 100 and limits the movement of the annular piston upward by interaction with flange 103 of guide bushing 104.

If liquid L is introduced into the cylinder 102 by application of hydraulic pressure via nipple 115, a joint displacement of the two pistons 102 and 108 first of all takes place. Only after the ring 116 comes against the bushing 104 is the piston 108 displaced with respect to the annular piston 102. The telescopic lift press is shown in partially extended position in FIG. 7.

Various changes and modifications may be made without departing from the spirit and scope of the present invention and it is intended that such obvious changes and modifications be embraced by the annexed claims.

What is claimed is:

1. A fork lift truck comprising front and rear carriages, said front carriage including a horizontal support, steerable wheels carrying said support, a hydraulic jack on said support, said jack having vertical movable piston means, said rear carriage including a pair of horizontally spaced fork tines, a horizontal lift shaft rotatably mounted on said tines, link means connected at one end to said lift shaft and connected at the other end to said support, another horizontal shaft parallel to the horizontal lift shaft and engaged with said tines, a vertical lift arm connected at one end to said other horizontal shaft and connected at its other end to said piston means, other wheels for supporting said tines, and means operatively connecting said other wheels to said horizontal lift shaft for adjustably spacing said other wheels vertically from said tines as the tines are elevated by said lift arm, the horizontal shafts being the sole connection means between the two tines.

2. A fork lift truck according to claim 1, wherein said other horizontal shaft is twistable with respect to the horizontal lift shaft so that the wheels remain in contact with an uneven floor in all positions of the tines when under load.

3. A fork lift truck according to claim 1, wherein each of said tines has two spaced upright walls, at least one of the shafts being connected twice to each tine at the upright walls thereof.

4. A fork lift truck according to claim 1, further comprising elastic means connecting said other horizontal shaft to said vertical lift arm and to said tines.

5. A fork lift truck according to claim 1, further comprising pivot means connecting said other horizontal shaft to said vertical lift arm and to said tines.

6. A fork lift truck according to claim 1, wherein the means connecting said other wheels to the horizontal lift shaft includes a pair of bent straps, each of the straps rotatably carrying a different one of the other wheels at one end thereof, means pivotally mounting each strap to one of the tines, a crank in each tine connected to the horizontal lift shaft, and a bar in each tine connecting each crank to the other end of the strap thereat.

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