May 18, 1965 G. J. TRUSOCK ETAL 3,183,989

HAND LIFT TRUCK

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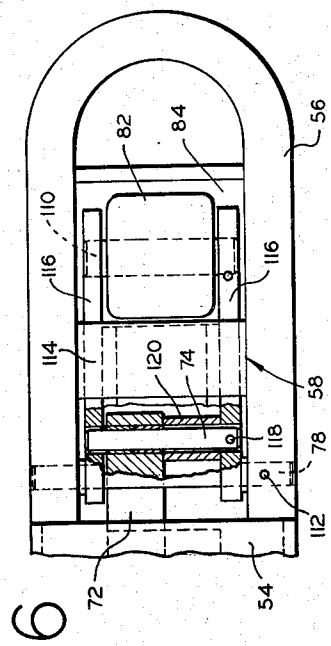

FIG. 6

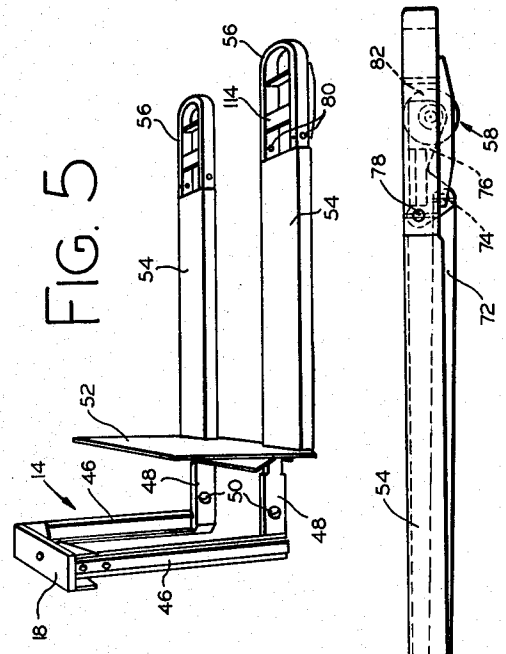

FIG. 5

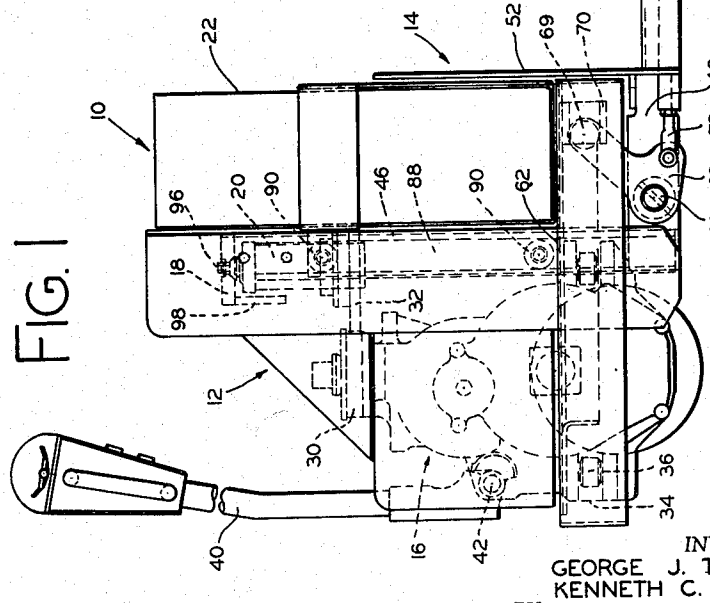

FIG. 1

INVENTORS
GEORGE J. TRUSOCK
KENNETH C. JOHNSON

BY J. C. Wiessler

ATTORNEY

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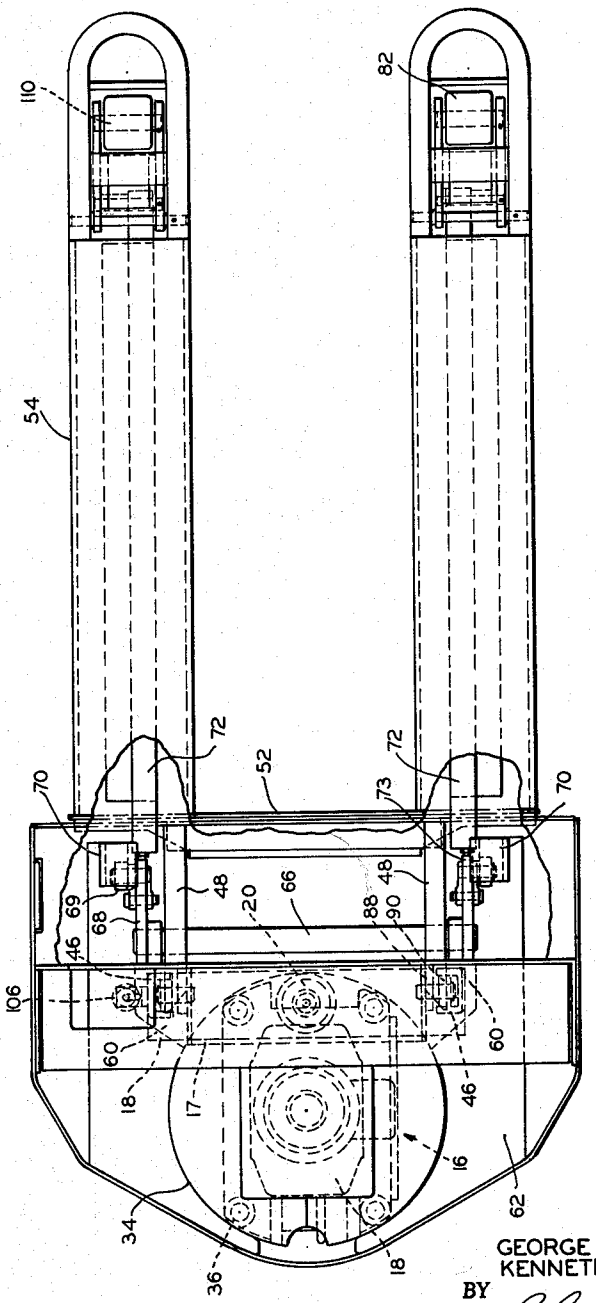
FIG. 2



INVENTORS
GEORGE J. TRUSOCK
KENNETH C. JOHNSON

BY P. C. Wiessler

ATTORNEY

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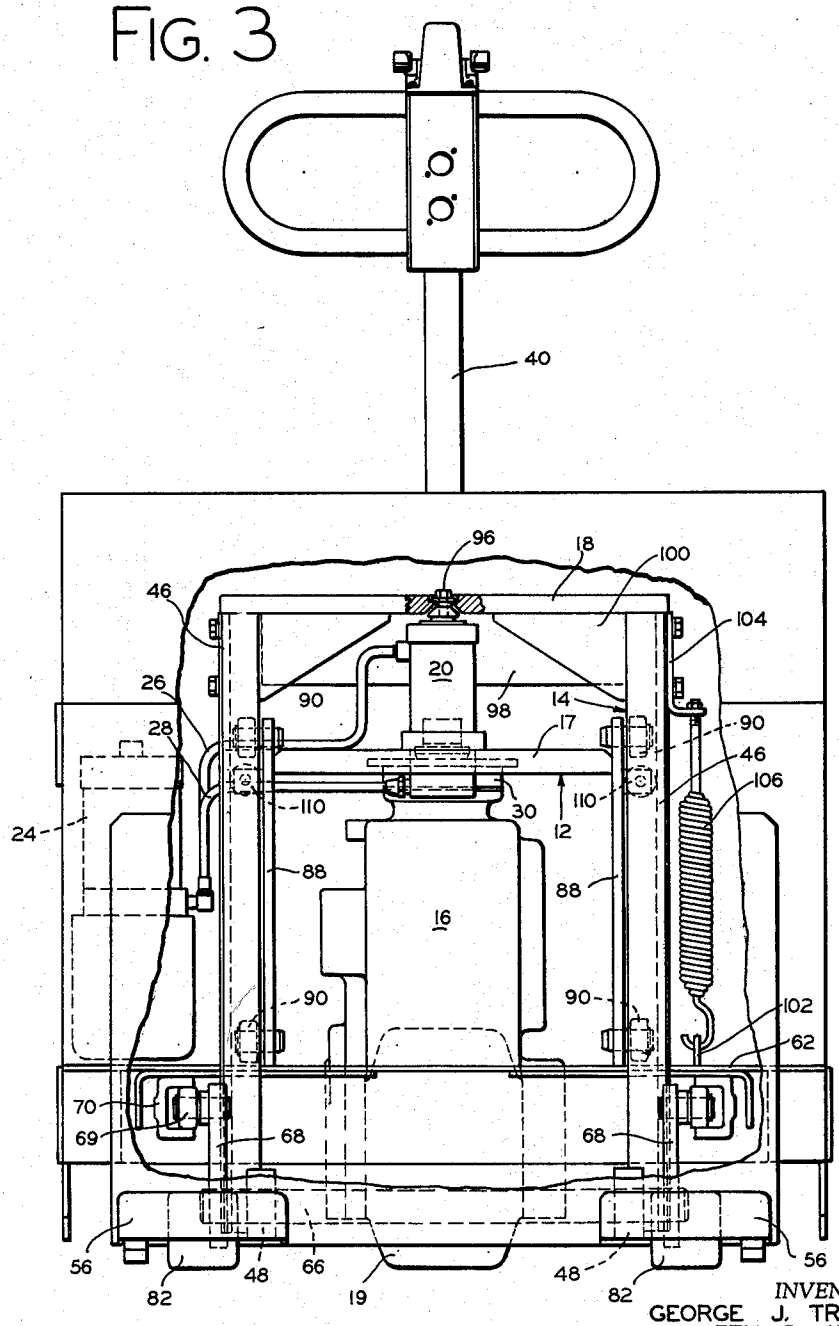
FIG. 3



INVENTORS
GEORGE J. TRUSOCK
KENNETH C. JOHNSON

BY J. C. Wiessler

ATTORNEY

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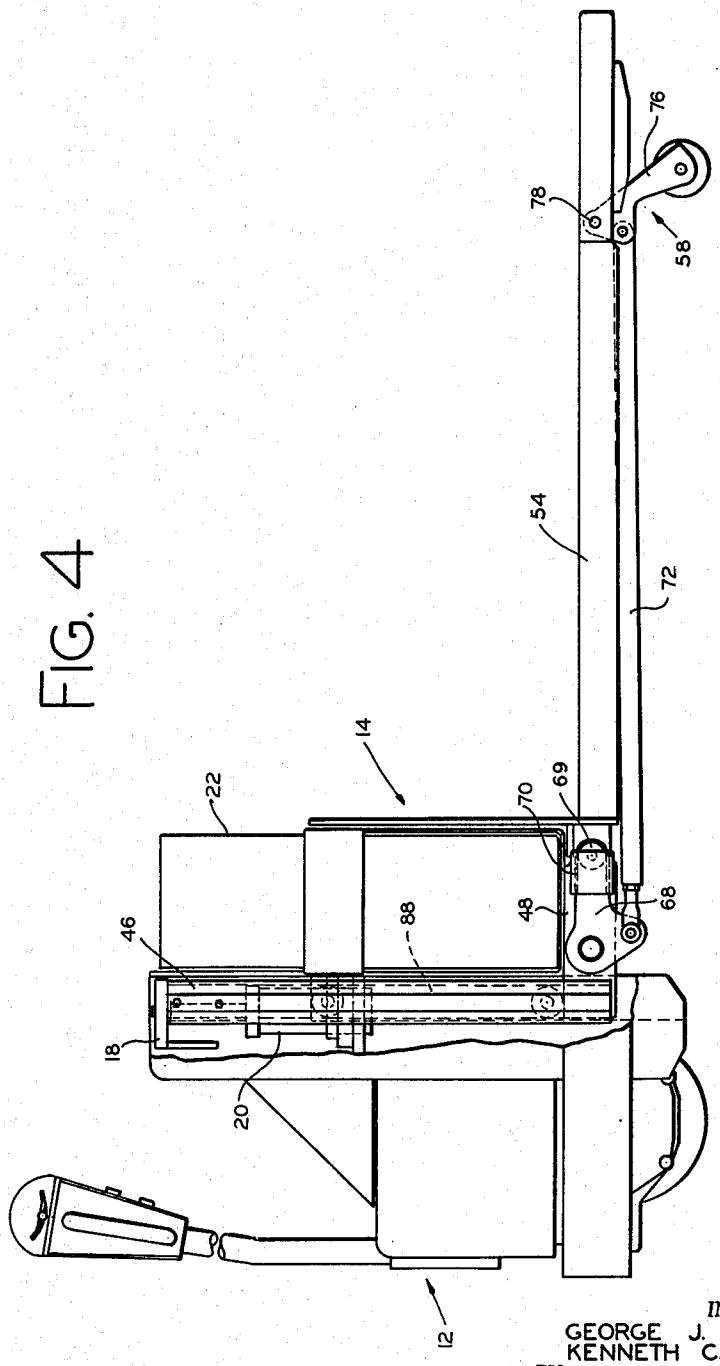
FIG. 4



INVENTORS
GEORGE J. TRUSOCK
KENNETH C. JOHNSON
BY J. C. Wiessler
ATTORNEY

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3,183,989

HAND LIFT TRUCK

George J. Trusock, Battle Creek, and Kenneth C. Johnson, Kalamazoo, Mich., assignors to Clark Equipment Company, a corporation of Michigan

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9 Claims. (Cl. 180—13)

Our invention relates generally to power operated hand lift trucks, and more specifically to the construction of the frame and lifting means therefor.

Presently, powered hand lift trucks commonly comprise the primary elements of a main frame which is supported by a drive head and wheel unit rotatably mounted therein about a vertical axis, and a load supporting frame disposed forwardly of the main frame and supported at its forward end by means of extensible wheels. The load supporting frame is mounted for vertical movement on the main frame by means of vertical slides and roller members. Vertical movement of the load supporting frame is commonly effected by means of a pair of transversely spaced hydraulic piston and cylinder assemblies connected by suitable linkage means to the extensible wheel assemblies for extending and retracting the latter to elevate and lower the load supporting frame which, as mentioned above, is guided on the main frame by means of the vertical slides and roller members.

It is a primary object of our present invention to provide in a hand lift truck of an improved construction of the load supporting means and of the means for elevating the load supporting means.

It is another object of our invention to provide in a hand lift truck improved means for facilitating lateral adjustment of the pallet legs thereof.

Another object of the invention is to provide a simplified, less costly and more efficient hand truck construction than heretofore, while maintaining a short length of the main frame.

A further object is to improve the frame construction of trucks of the type contemplated.

In carrying out the invention, we have provided a generally L-shaped load carrying frame mounted for elevating movement on the upstanding legs of a reversed generally L-shaped main frame carrying a drive head and drive-steer wheel for powering the truck. A centrally located single hydraulic cylinder-piston motor is connected operatively between the adjacent upstanding legs of the load supporting and main frames for elevating the support frame relative to the main frame and for actuating forwardly extending linkage members which are connected to lever supported trail wheels adjacent the front end of the load supporting frame for raising the front end thereof with the rear end upon actuation by the hydraulic motor. The lift linkage means are located transversely outwardly of portions of the horizontal legs of the load supporting frame such that the pallet arms extending forwardly of said frame can be adjusted laterally within limits without requiring any change in basic truck structure.

Other objects, features and advantages of the invention will become apparent to persons skilled in the art in view of the description below of one embodiment of the invention taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a side view of a hand lift truck which embodies our invention;

FIGURE 2 is a plan view of FIG. 1 showing certain portions broken away;

FIGURE 3 is an enlarged partially broken-away view of the truck taken from the right-hand end thereof as viewed in FIGS. 1 and 2;

FIGURE 4 is a broken-away side elevational view of the truck showing the load supporting frame in an elevated position;

FIGURE 5 is a reduced perspective view showing the load supporting frame per se; and

FIGURE 6 is an enlarged plan view of the tip portion of one of the pallet legs showing the manner of mounting the trail wheel assembly.

Referring now in detail to the drawing, there is indicated generally by the reference numeral **10** a hand lift truck which comprises a reversed generally L-shaped main frame **12**, a forwardly extending L-shaped load supporting frame **14** having the vertical leg means thereof mounted in telescoping relation to the vertical leg means of main frame **12**, said frames **12** and **14** including transverse frame members **17** and **18**, respectively, having mounted centrally therebetween and extending vertically thereof a single, relatively short hydraulic cylinder-piston motor **20** for lifting frame **14** relative to frame **12**.

Rotatably mounted about a vertical axis in the main frame **12** is a drive head unit indicated generally by numeral **16** which is supported on a ground engaging drive-steer wheel **19**. Wheel **19** is powered by an electric motor enclosed in the drive head unit and adapted to have driving connection with the drive wheel through suitable gearing, and to have electrical connection with the battery carried by the truck in battery compartment **22**. The truck may include a motor driven pump unit **24** having a suitable electrical and hydraulic connections for operating hydraulic devices on the truck, such as piston and cylinder assembly **20** by way of conduits **26** and **28**.

The upper end of drive head unit **16** is secured in the inner race of a tapered roller bearing assembly **30**, the outer race of which is secured in a horizontal plate member **32** suitably connected to the main frame **12**. The lower end of the drive head unit **16** is supported and guided in a circular ring or track member **34** which is secured to the main frame. Four spaced rollers **36** are connected to the drive head unit and engage track **34** such that the drive unit **16** and drive wheel **19** may be steered 90° in either direction by a steering and driving operator's control handle assembly **40** which is pivoted to the drive unit **16** by a pin **42**, and which is also adapted to control the application of and release of brakes, not shown, associated with drive unit **16**. The construction and mounting of drive unit and wheels **16** and **18** in the main frame of lift truck **10** is described in detail in U.S. Patent No. 2,762,444, issued on September 11, 1956, in the name of R. H. Gardner.

As best shown in FIG. 5, the load supporting frame **14** comprises a pair of vertical transversely spaced inwardly opening channel members **46**, a pair of forwardly extending transversely spaced frame members **48** having axially aligned openings **50** therein, an upstanding transverse plate member **52** connected to the front end of frame members **48**, and a pair of forwardly extending pallet legs **54** located somewhat transversely outwardly of members **48** and secured, as by welding, to the lower corner portions of plate **52**. Each pallet leg **54** comprises a generally inverted U-shaped construction having an open framed end portions **56** adapted to receive a trial wheel and lift lever linkage assembly **58**. The load support frame **14** is mounted in relation to main frame **12** such that plate **52** lies immediately forward of battery compartment **22**, members **48** extend rearwardly beneath the main frame, and vertical members **46** extend upwardly and behind battery compartment **22** through openings **60** cut out of the horizontal base plate **62** of the main frame. A plurality of body or cover plate members, as shown in the figures, are connected to each other and to the main frame **12**, and

cover the drive head assembly 16, frame 12, battery compartment 22 and parts of frame 14.

A transverse torque tube 66 is journaled in openings 50, and supports transversely outwardly of the members 48 a pair of bell crank members 68 keyed to the ends of said shaft. On the upper end of each bell crank 68 is mounted a roller 69 which is received in a short longitudinally extending and inwardly facing guide track 70 secured to and beneath floor portion 62. A forwardly extending arm of each bell crank is connected to an elongated pull rod 72 by a threaded link 73. The pull rod extends through and beneath the pocket of each inverted U-shaped leg 54 and is pivotally connected at its forward end by a pin 74 to a lifting lever 76 of each trail wheel assembly 58 which is supported for lifting movement beneath each pallet leg by means of a pivot pin 78 mounted in a pair of openings 80 in each pallet leg 54. Each lift lever 76 is bifurcated to receive a trail wheel 82 properly disposed within an open pocket 84 formed by the forward portion 56 of each pallet leg when the latter is disposed in a lowered position as shown in FIG. 1.

Secured to and extending upwardly in transverse spaced relation from floor 62 of the main frame is a pair of frame members 88, outwardly of each of which is mounted a pair of upper and lower rollers 90 which engage the channels of inwardly opening channel members 46 whereby to support for vertical movement in main frame 12 the load supporting frame 14. Transverse member 17 extends between and is secured to frame members 88 adjacent the upper pair of rollers 90.

During assembly of the truck, and after the load supporting frame 14 is mounted in main frame 12 and drive motor 16 is mounted in the main frame, as described above, lift cylinder 20 is mounted centrally of plate 17, and in partial overlapping relation to drive motor 16 and drive motor support 34, 36, following which upper-most frame plate 18 is secured to the upper ends of channels 46 while the piston rod is secured centrally of plate 18 by the bolted connection 96. An apron 98 depends downwardly from mounting plate 18 behind cylinder 20 to protect the piston rod when it is extended, and a pair of gusset plates 100 are secured forwardly of cylinder 20 between the forward flanges of channels 46 and the underside of plate 18. Connected between an eye 102 in base plate 62 and the one leg of an L-shaped bracket 104 secured to the one channel 46 is a cylinder return tension spring 106 which functions to return the load supporting frame to a lowered position as shown in FIG. 1. Release of pressure fluid in cylinder 20 following extension thereof to elevate the load supporting frame permits spring 106 to pull load supporting frame members 18 and 46 downwardly to return the hydraulic motor 20 to a retracted position whereby to lower the load supporting frame. A pair of side thrust rollers 110 are secured by bracket members to the outer surfaces of frame members 88 and contact the web portions of channels 46 to aid in taking up side thrust and twisting moments between the load supporting and main frames.

It will be appreciated that the foregoing construction which enables the driving and load supporting ends of the truck to be coupled together for movement and elevation of the load supporting end relative to the drive end effects a minimum length of the drive end, which is desirable, for any given length of the load supporting end. This minimization of drive end length is a result largely of the construction by means of which the lifting and coupling assembly comprising fixed frame members 88, movable channel members 46, hydraulic motor 20, and overlying and underlying transverse members 18 and 17, are located partially in the vertical plane of the drive motor assembly 16 and mounting track 34, 36. This manner of construction and assembly also simplifies the construction of the drive end of such trucks, lessens the cost of the truck, and eliminates the prior problem of synchronizing a pair of transversely spaced lifting motors previously utilized in such trucks for the same purpose as hydraulic motor 20 in the present invention.

Considering the foregoing description, and particularly FIGS. 1, 3 and 4, it will be appreciated that in elevating the load support assembly 14 pressure fluid is directed to the bottom of hydraulic motor 20 through conduit 28 which actuates the piston rod thereof upwardly from the FIG. 1 and 3 to the FIG. 4 position, thereby actuating upwardly therewith channel members 46 with mounting member 18 and horizontal frame members 48, whereby torque tube 66 is actuated upwardly with frame members 48 which causes levers 68 to be actuated from the FIG. 1 to the FIG. 4 position wherein rollers 69 are located in the extreme right-hand ends of short channels 70, thereby causing each rod 72 to be actuated as shown to pivot each lever 76 clockwise about the respective pins 78 as shown in FIG. 4. The lifting motion of the pair of levers 76 is synchronized through the actuation of link rods 72 and the operation of torque tube 66 in lifting the front end of the pallet legs 54 with frame members 46 and 48.

In FIGS. 2 and 3 it will be noted that torque tube 66 extends through and transversely beyond frame members 48, and that levers 68 are connected to shaft 66 outwardly of frame members 48; channel members 70 and actuating rods 72 are also located outwardly of frame members 48. With this construction, and the turn-around construction of each wheel assembly 58, described below, it is possible to adjust the spacing of pallet legs 54 transversely within predetermined limits without the necessity of providing any different or additional parts than those illustrated in the drawing, and with a minimum reorientation of the parts already shown.

Referring especially to FIGS. 2 and 6 it will be noted that each lever 76 includes bifurcated or spaced arms 116 in which a roller 82 is mounted on a stub shaft 110, said lever being mounted for pivotal movement about pin 78 which is received in openings 80 and held in position by vertical pin 112, and having an overlying member 114 forming a part of pocket 84 and functioning as a stop limiting pivotal movement of wheel assembly 58 in a counterclockwise direction. Rod 72 is received between the sides 116 of the downwardly extending nose portion of lever 76, being retained in position by transverse pin 74 which is held in position by a vertical pin 118. The forward end of each rod 72 comprises a hollow sleeve and spacer member 120 which is adapted to receive the pin 74 and which extends transversely outwardly of the end of rod 72. At the time of assembly of the truck, or after some use thereof, the spacing of pallet legs 54 may, for example, be fixed at 24 inches (from one outer side to the other) or 27 inches. As shown in FIG. 2, pallet legs 54, rods 72 and wheel assemblies 58 are positioned with the wider available spread. The narrower spread may be accomplished in the truck of FIG. 2 by detaching each wheel assembly from link rods 72, detaching pallet legs 54 from plate member 52, moving each pallet leg 54 transversely inwardly 1½ inches, in the above example, resecuring, as by welding or bolting, the rear end of each pallet leg to plate 52, removing pin 74, rotating each rod 72 180° about connector link 73, and reassemblying wheel assemblies 58 on the end of pallet legs 54 and link rods 72 by means of pins 74 and 78. Rotation of link rods 72, as aforesaid, causes transversely extending sleeve 120 to be projected to the opposite side of the link rod and therefore to space arms 116 of each wheel assembly towards the opposite pallet leg 54 relative to its respectvie link rod 72 rather than away from the other pallet leg relative to said link rod, as in FIGS. 2 and 6. It is, therefore, a relatively simple matter to adjust the spacing of pallet legs 54, such adjustment requiring merely detachment of wheel assemblies 58 from the pallet legs, rotation of the link rods 180°, adjustment of the pallet legs 54 on supporting plate 52, and reassembly of wheel assemblies 58 in pockets 84 in the new relationship to the respective link rods 72. Heretofore, major

alteration in the truck frame or other parts was required in order to effect a change in the lateral spacing of the pallet arms.

Although only one embodiment of our invention has been illustrated and described, it will be apparent to those skilled in the art that changes and modifications in the structure and relative arrangement of parts may be made to suit individual requirements without necessarily departing from the scope of the invention.

We claim:

1. In a hand lift truck, the combination of a drive head and main frame, a pair of forwardly extending load support members mounted on said main frame for elevation relative thereto, each of said pair of members supporting adjacent the forward end thereof a pivoted trail wheel assembly, and actuating link and lever means connected to each said trail wheel assembly, said latter connection including a transverse member mounting said actuating linkage in eccentric relation to each said trail wheel assembly and being reversible relative to said trail wheel assembly so as to dispose the latter in oppositely disposed eccentric relation to said actuating linkage, each of said load support members being reconnectable at a second position transversely of the load support frame upon a reversal in the position of said trail wheel assembly relative to the actuating linkage, as aforesaid, whereby the spacing between said pair of load support members can be varied.

2. In a hand lift truck, the combination of a generally L-shaped forwardly extending load support frame, a generally L-shaped rearwardly extending main frame coupled to said load support frame, a single fluid lift cylinder means mounted vertically and longitudinally centrally of the truck and operatively connected between the coupled L-shaped frames for actuating the load support frame vertically relative to the main frame, the upstanding legs of said L-shaped frames each comprising a pair of transversely spaced members, one of which pairs is located transversely outwardly of the other pair, a pair of vertically spaced transversely extending support members connected to the respective pairs of said upstanding legs, said lift cylinder means being connected to and between said transversely extending members and located at least partially within the transverse projection of the upstanding legs, a mounting means formed in said main frame, a drive motor and wheel assembly mounted in said mounting means, said lift cylinder means being mounted at least partially within the vertical projection of said mounting means and above the horizontal plane thereof, and a battery compartment extending transversely of the truck located on the main frame immediately forwardly of said pairs of upstanding legs and of said lift cylinder means.

3. In a hand lift truck, the combination of load supporting and main frame assemblies each of generally L-shaped configuration and each having a pair of transversely spaced upstanding legs, said pairs of upstanding legs being mounted in transverse coupled relation to each other such that the load supporting frame is elevatable on and relative to the main frame, a pair of vertically spaced transversely extending members connected to respective pairs of said upstanding legs, a single longitudinally centrally located pressure fluid actuated cylinder-piston motor having opposite ends thereof connected to opposite ones of said transversely extending members and located at least partially within the transverse projection of the upstanding legs, a circular mounting means formed in said main frame, and a drive motor and wheel assembly mounted in said mounting means, said cylinder-piston motor being mounted at least partially within the vertical projection of said circular mounting means and above the horizontal plane thereof, and a battery located on the main frame immediately forwardly of said pairs of upstanding legs.

4. In a hand lift truck, the combination of a generally L-shaped forwardly extending load support frame, a generally L-shaped rearwardly extending main frame coupled to said load support frame, a single fluid lift cylinder means mounted vertically and longitudinally centrally of the truck and operatively connected between the coupled L-shaped frames for actuating the load support frame vertically relative to the main frame, the upstanding legs of said elevatable load support frame comprising a pair of outer transversely spaced members and the upstanding legs of said main frame comprising a pair of inner transversely spaced members coupled to said outer pair of such members, an upper transverse support member connecting the upper end portions of said outer members, a lower transverse support member spaced beneath said upper member and connected to said inner members, said single lift cylinder means being fixedly connected to said lower support member and movably connected to said upper support member and located at least partially within the transverse projection of the upstanding legs, whereby said lift cylinder means is extendable to elevate said outer pair of upstanding legs on said inner pair thereof, a battery compartment extending transversely of the truck located on the main frame immediately forwardly of said pairs of upstanding legs and of said lift cylinder means, a circular mounting means formed in said main frame, and a drive motor and wheel assembly mounted in said mounting means, said lift cylinder means being mounted at least partially within the vertical projection of said mounting means and above the horizontal plane thereof.

5. In a hand truck, the combination of a main frame, a generally L-shaped load supporting frame mounted for vertical movement in said main frame, said L-shaped frame including a pair of transversely spaced L-shaped members, shaft means supported on the horizontal leg portions of said L-shaped members and extending transversely outwardly thereof, a pair of actuator levers mounted on the outwardly extending ends of said shaft means, guided relative to said main frame and operatively connected to a pair of lift wheel assemblies which are mounted adjacent the forward end of the load supporting frame, each operative connection including a longitudinally extending rod which is connected to the respective lift wheel assembly by means of a transversely extending member which extends outwardly of one side of said rod, said transversely extending member being adjustable with said rod so that it extends either transversely outwardly or inwardly of the respective rod, said pair of transversely extending members associated with said pair of rods being adapted to vary the transverse spacing between the lift wheel assemblies, and said horizontal leg portions of the load support frame being reconnectable at first and second positions on the load support frame corresponding to the transverse spacing of said pair of lift wheel assemblies.

6. A hand lift truck as claimed in claim 2 wherein an elongated tension spring is connected outwardly of the upstanding legs of the load support frame for lowering said latter legs and frame relative to the main frame.

7. In a battery-powered lift truck, the combination of a generally L-shaped forwardly extending load support frame, a generally L-shaped rearwardly extending main frame coupled to said load support frame, said load support frame being movable vertically relative to the main frame, a single fluid lift cylinder means mounted vertically and longitudinally centrally of the truck and operatively connected between the coupled L-shaped frames for actuating the load support frame vertically relative to the main frame, the upstanding portion of said load support frame comprising a pair of transversely spaced vertical members located transversely outwardly of a pair of transversely spaced upstanding legs of the main frame, said pairs of upstanding legs being coupled for guiding and supporting vertical movement of the load support frame, a pair of vertically spaced transversely extending support members connected to respective pairs of said upstanding legs, said lift cylinder means being connected to and between said transverse support members and located at

least partially within the transverse projection of the upstanding legs, a battery compartment extending transversely of the truck located on the main frame immediately forwardly of said pairs of upstanding legs and of said lift cylinder means, and a drive motor and wheel assembly mounted in said main frame rearwardly of said upstanding legs, said lift cylinder means being mounted at least partially within the vertical projection of said assembly and above said assembly.

8. In a hand lift truck, the combination of a generally L-shaped forwardly extending load support frame, a generenally L-shaped rearwardly extending main frame coupled to said load support frame, a single fluid lift cylinder means mounted vertically and centrally of the truck and operatively connected between the coupled L-shaped frames for actuating the load support frame vertically relative to the main frame, the upstanding legs of said L-shaped frames each comprising a pair of transversely spaced members, one of which pairs is located transversely outwardly of the other pair, a pair of vertically spaced transversely extending support members connected to respective pairs of said upstanding legs, said lift cylinder means being connected to and between said transversely extending members, shaft means supported from and extending transversely of each of a pair of transversely spaced horizontal leg portions of said load support frame, an actuator lever mounted on each opposite end portion of said shaft means, guided relative to said main frame and operatively connected to a pair of lift wheel assemblies mounted adjacent the forward ends of said horizontal leg portions, said operating connection including a longitudinally extending rod connected to each lift wheel assembly by means of a transversely extending member which extends outwardly of one side of said rod, said latter transversely extending

member being adjustable to extend transversely outwardly or inwardly of said rod so that the transverse spacing of said pair of lift wheel assemblies is adjustable.

9. In a hand lift truck having forwardly extending pallet fork means for elevating loads on the truck, a trail wheel pallet lifting assembly connected to the end portion of each fork member by transverse pin means, said trail wheel assembly including a bifurcated lever mounted on said pin means and extending forwardly thereof, a trail wheel mounted adjacent the forward end of said lever, actuating rod means connected between the arms of and to said lever in eccentric relation to said lever, said connection including a transversely extending member connected to the end of said rod and extending outwardly thereof in one direction therefrom for holding said rod in eccentric relation to said lever when said rod is mounted between the arms of said lever, removal of said transverse pin permitting said lever to be disassembled from said rod, whereupon said transverse member and rod may be adjusted so that the transverse member extends outwardly of said rod in the opposite direction, said lever and rod being thereupon reassembled with said transverse pin and disposing said lever and wheel in a transversely adjusted position relative to the first position thereof.

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A. HARRY LEVY, *Primary Examiner.*

PHILIP ARNOLD, *Examiner.*