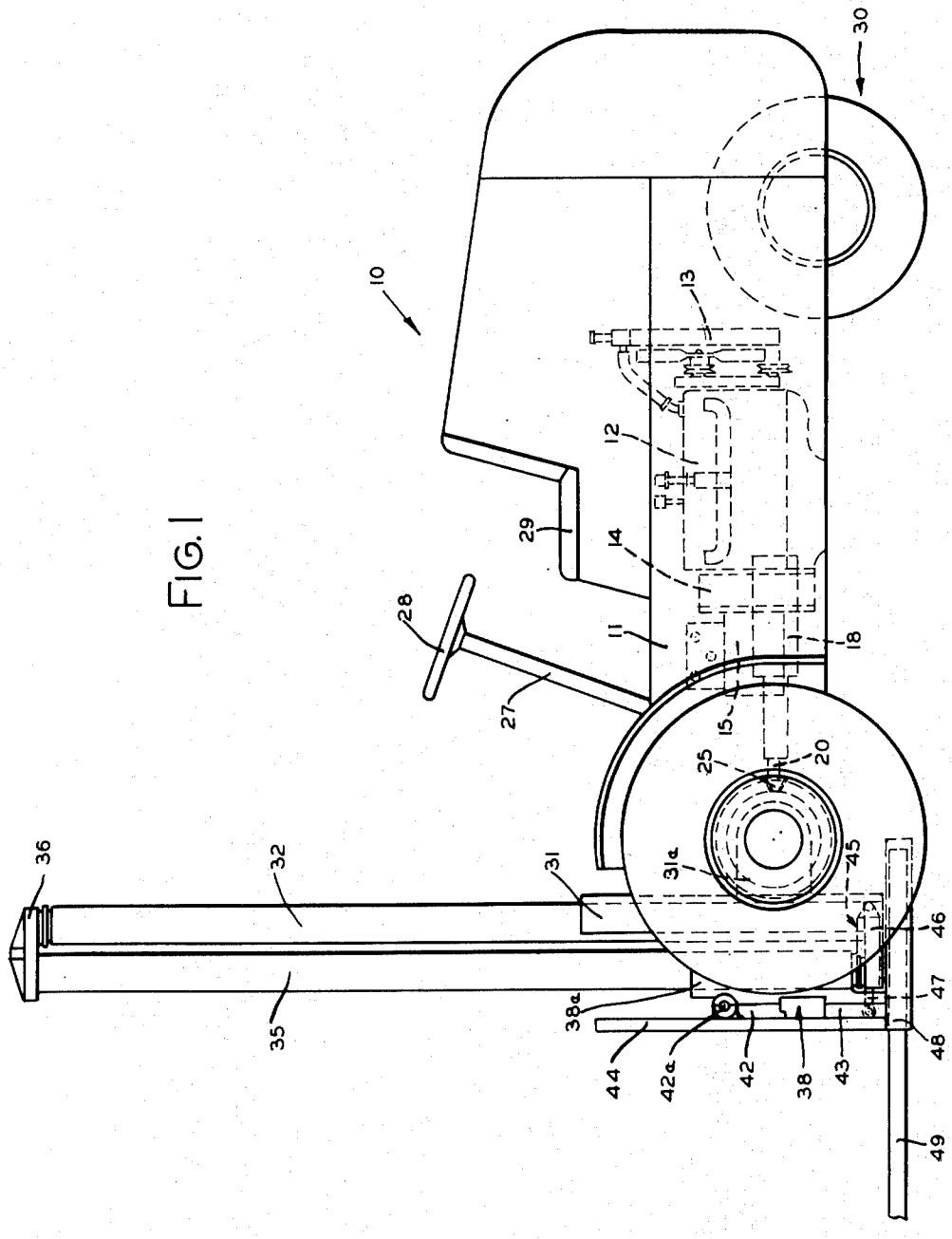
July 14, 1953 G. L. TURNER 2,645,306

INDUSTRIAL TRUCK

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FIG. 1



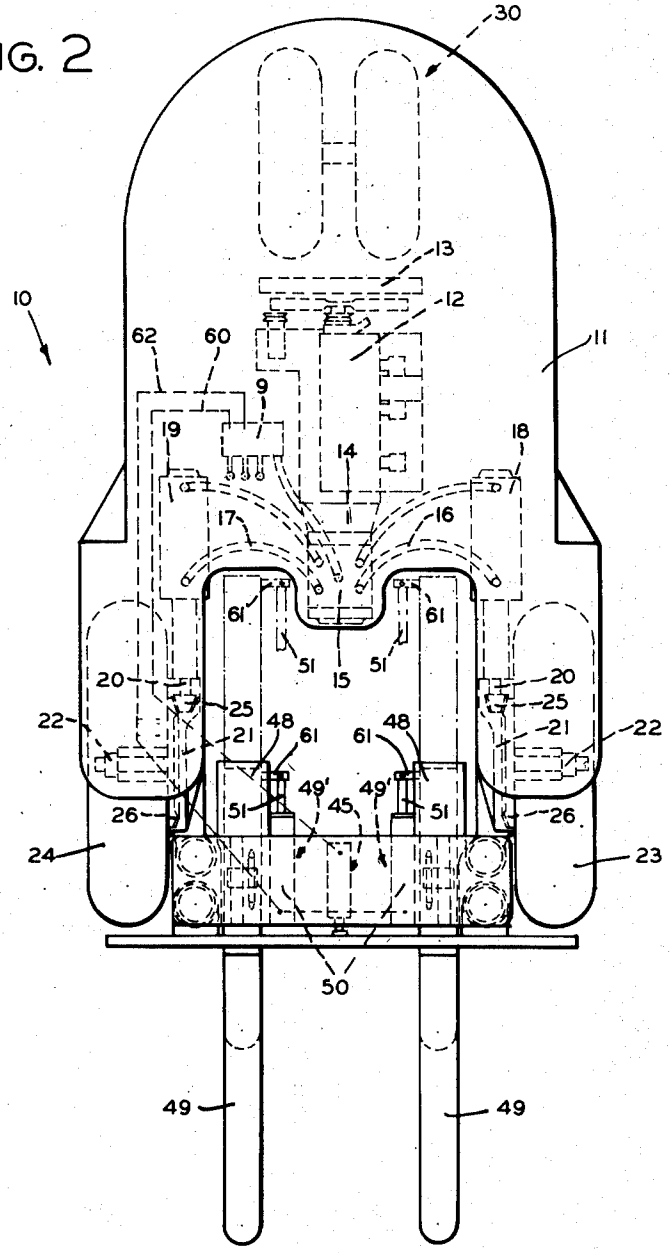
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FIG. 2



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FIG. 3

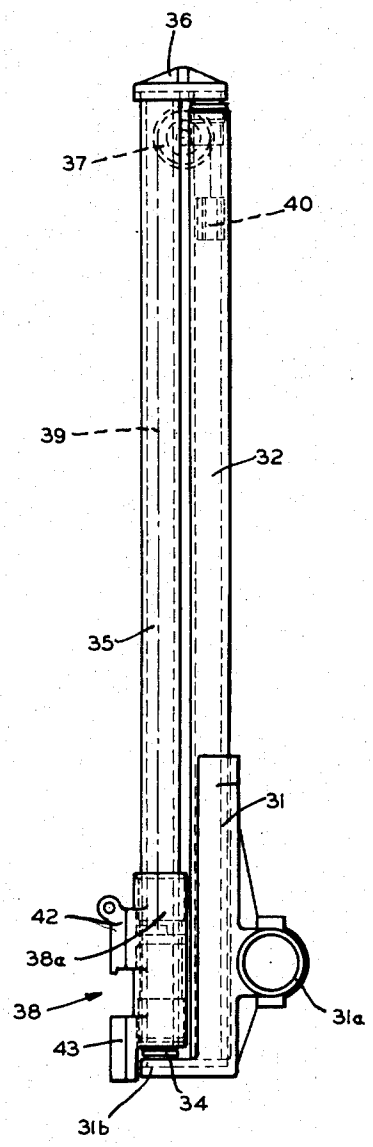
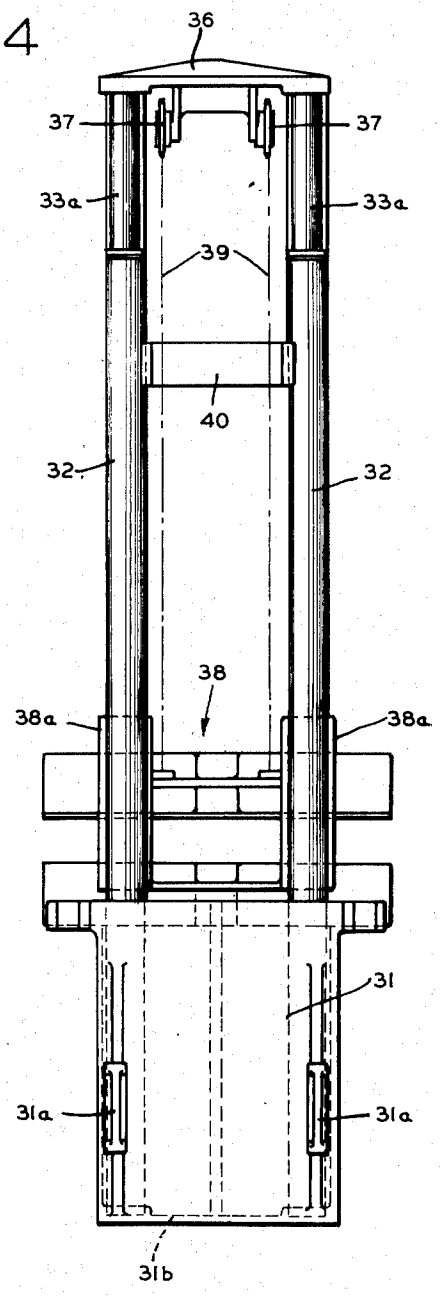


FIG. 4



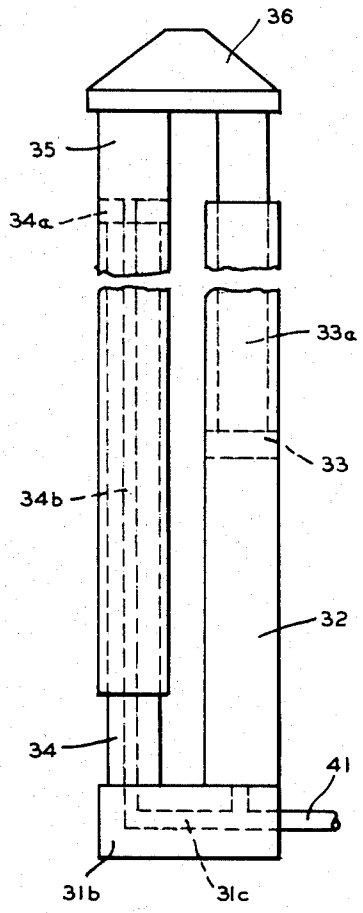
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FIG. 5



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UNITED STATES PATENT OFFICE

2,645,306

INDUSTRIAL TRUCK

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Application July 28, 1950, Serial No. 176,377

12 Claims. (Cl. 187—9)

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My invention relates generally to industrial trucks and, more specifically, is directed to a mast construction for industrial trucks.

Present mast constructions for use with industrial trucks generally comprise a pair of vertically extending telescopic assemblies, each comprising a pair of telescopic C-shaped channel members, one of which is adapted to be mounted in fixed relation on the main frame of the industrial truck and the other of which is movable relative to the one channel member. The movable channel members are connected at their upper ends by a crosshead which carries a pair of sprocket gears. Disposed between the pair of telescopic assemblies is a vertically extending hydraulic piston and cylinder assembly which is fixed at its lower end to the main frame of the truck and at its upper end is fixed to the crosshead for effecting movement of the latter and the movable channel members. Guided for vertical movement in the movable channel members is a load supporting carriage to which the one ends of a pair of chains are fixed. The chains are trained over the sprocket gears and are fixed at their other ends to the fixed channel members. Vertical movement of the crosshead and movable channel members, through the chains, effects a corresponding vertical movement of the load supporting carriage. While this mast construction has proven satisfactory from a mechanical operation standpoint, it has proven quite unsatisfactory from a safety standpoint. That is, since the hydraulic piston and cylinder assembly for effecting movement of the load supporting carriage is disposed between the pair of telescopic assemblies, it is directly in front of and in line with the operator of the industrial truck, thus partially obscuring his vision and producing a blind spot. This is not only hazardous, but also decreases the speed with which the truck can be maneuvered, since the operator must operate the truck cautiously due to the blind spot directly in front of him.

It is an object of my present invention to provide a mast construction for use with an industrial truck which will not obscure the operator's vision directly in front of the truck.

In the preferred embodiment of my present invention, I contemplate the provision of a forward pair of vertically extending piston and cylinder assemblies in which the pistons are adapted to be mounted in fixed relation, with respect to the main frame of the truck, and in which the cylinders are movable relative to the pistons. I further contemplate the provision of a rear pair of vertically extending piston and cylinder assemblies in which the cylinders are adapted to be mounted in fixed relation to the main frame of the truck and in which the pistons are movable relative to the cylinders. A crosshead is

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provided for connecting the upper ends of the cylinders of the forward pair of piston and cylinder assemblies and the upper ends of the piston rods of the pistons of the rear pair of piston and cylinder assemblies. The crosshead is adapted to carry a pair of sprocket gears. A load supporting carriage is slidably mounted on the cylinders of the forward pair of piston and cylinder assemblies and a pair of chains are fixed at their one ends to the load supporting carriage. The chains are trained over the sprocket gears and are fixed at their other ends to the cylinders of the rear pair of piston and cylinder assemblies. When fluid is admitted to the cylinders of the front and rear piston and cylinder assemblies, the crosshead is raised which, through the chains, causes upward movement of the load supporting carriage. The load supporting carriage is lowered by bleeding the fluid from the cylinders of the front and rear piston and cylinder assemblies. It will be apparent, from the above description, that I have provided a mast construction for use with an industrial truck which will not obscure the operator's vision directly in front of the truck, since I have eliminated the conventional centrally located vertically extending hydraulic piston and cylinder assembly.

While I have described the mast construction as comprising four piston and cylinder assemblies, it will be understood that either a greater or lesser number may be employed, depending on the load carrying capacity of the mast desired. I also do not wish to be limited to fluid actuated piston and cylindler assemblies, as obviously other forms of prime movers may be used as long as they are disposed within the confines of each piston and cylinder assembly.

Now, in order to acquaint those skilled in the art with the manner of constructing and using the devices of my present invention, I shall describe in connection with the accompanying drawings a preferred embodiment of my invention.

In the drawings:

Figure 1 is a side elevational view of an industrial truck incorporating the mast construction of my present invention;

Figure 2 is a plan view of the industrial truck and mast construction shown in Figure 1;

Figure 3 is a side elevational view of the mast construction of Figure 1 in a retracted position;

Figure 4 is a rear elevational view of the mast construction of Figure 3 in an intermediate extended position; and

Figure 5 is a side elevational view of a portion of the mast construction of Figure 3 in an intermediate extended position.

Referring now to the drawings, there is shown an industrial truck, indicated generally by the reference numeral 10, which comprises a horizontally

extending U-shaped main frame 11. The main frame 11 provides support for a prime mover or engine 12, which is preferably of the internal combustion type, having a radiator 13 and a clutch housing 14. Connected to the clutch housing 14 is a combination hydraulic pump and motor unit 15, preferably of the compound type, having three stages of delivery of fluid under pressure which may be controlled through any suitable valve mechanism in conjunction with the throttle control of the engine 12.

The pump and motor unit 15 is adapted to have outlet lines 16 and 17 leading therefrom to fluid operated motors 18 and 19, respectively, these fluid motors being so arranged that fluid under pressure will operate to impart rotary movement to the pinion shafts 20, extending outwardly therefrom. The pinion shafts 20 project into drive housings 21, suitably mounted on the frame 11 of the truck 10, which drive housings 21 support wheel spindles 22. Mounted on the wheel spindles 22, on the outboard side of the drive housings 21, are drive wheels 23 and 24. Pinions 25 are secured to the outer ends of the pinion shafts 20 and are disposed in meshing engagement with beveled ring gears 26 mounted on the spindles 22 and are adapted to impart rotary movement to the drive wheels 23 and 24.

The main frame 11 of the industrial truck 10 also provides support for a conventional steering column 27 having a hand steering wheel 28 mounted adjacent the upper end thereof. Disposed closely adjacent the steering column 27 is a driver's seat 29. Suitable control levers 9, illustrated diagrammatically in Figure 2, are disposed closely adjacent the driver's seat 29.

The steering column 27 has suitable connection to control means which is adapted to selectively admit fluid to either of the fluid motors 18 or 19, individually or conjointly, in the same or in opposite directions for varying the torque delivered to the drive wheels 23 and 24. A caster wheel assembly, indicated generally by the reference numeral 30, is suitably mounted to the main frame 11, adjacent the rear end thereof. Since the drive means and control means form no part of my present invention, it is believed that the brief description will be sufficient for the purposes of the present application.

I shall now describe a preferred form of mast construction of my present invention.

Referring to Figures 3, 4, and 5, there is shown a frame member 31 which is adapted to be mounted to the main frame 11 of the industrial truck 10, transversely thereof, by spaced brackets 31*a*. Rigidly mounted to the frame member 31, adjacent each side thereof, are a pair of vertically extending tubular cylinders 32 in which are slidably mounted pistons 33 and piston rods 33*a*. The forwardly projecting leg 31*b* of the frame member 31 is adapted to support, adjacent each side thereof, immediately forward of cylinders 32, a pair of vertically extending piston rods 34, having pistons 34*a*, about which are slidably mounted vertically extending tubular cylinders 35.

The upper ends of the piston rods 33*a* and cylinders 35 are interconnected by means of a horizontal crosshead 36, which provides support for a pair of horizontally spaced rotatable sprocket gear members 37.

A load supporting carriage, indicated generally at 38, is provided, having spaced vertically extending tubular portions 38*a* slidably mounted on the cylinders 35. Suitable chains 39 are trained over the sprocket gears 37 and have connection

adjacent their one ends to the load supporting carriage 38 and at their other ends to a cross member 40, suitably mounted between the cylinders 32.

The frame member 31 has suitable fluid passageways 31*c* formed therein, which communicate with the interior of the cylinders 32 and, through central openings 34*b* formed in the piston rods 34, with the interior of the cylinders 35. The fluid passageways 31*c* in the frame member 31 are adapted to be selectively placed in communication with a source of fluid under pressure through a hose line 41.

The mast construction of my present invention is shown in its normal retracted position in Figure 3. When the operator of the truck 10 desires to raise the load supporting carriage 38, he need only operate the suitable control lever at 9 which selectively admits fluid under pressure through hose line 41 to the fluid passageways 31*c* formed in the frame member 31. From the passageways 31*c* fluid is transmitted to the cylinders 32 forcing the pistons 33, together with piston rods 33*a*, upwardly, and simultaneously fluid is transmitted through the central openings 34*b* formed in the piston rods 34 to the upper end of the cylinders 35, reacting on the piston 34*a*, forcing cylinders 35 upwardly. Upward movement of the piston rods 33 and cylinders 35 causes upward movement of the crossheads 36, together with the sprocket gears 37, rotatably mounted thereon. Since the chains 39 are fixed at their one ends to the cross-member 40, the other ends, which are connected to the load supporting carriage 38, are urged upwardly thereby causing the load supporting carriage 38 to slide upwardly on the cylinders 35. The mast construction is shown in an intermediate extended position in Figure 4. The load supporting carriage 38 may be lowered by bleeding the fluid from the fluid passageways 31*c* in the frame member 31. From the foregoing description, it will be seen that I have provided a mast construction which will not obscure the operator's vision in front of the truck.

As shown in Figures 1 and 2, the load supporting carriage 38 comprises a pair of vertically spaced transversely extending frame members 42 and 43. Pivotally mounted to the upper transverse frame member 42, about a horizontal axis 42*a*, is a vertically extending load engaging rack 44, which rack 44 is adapted to be pivoted about its horizontal mounting by means of a centrally located hydraulic piston and cylinder assembly, indicated generally by the reference numeral 45, which comprises a cylinder 46 pivotally mounted to the frame member 31 and a piston rod 47, pivotally mounted to the lower end of the load engaging rack 44.

By selectively operating one of the control levers at 9, fluid under pressure may be admitted to the cylinder 46 of the hydraulic piston and cylinder assembly 45, through fluid lines 60, thereby causing the piston rod 47 to be extended, which, in turn, effects outward movement of the lower end of the load engaging rack 44, causing the latter to pivot about the connection 42*a*. Upon release of pressure from the cylinder 46, the piston rod 47 is adapted to return to its normal position, as shown in Figure 1, thereby disposing the load engaging rack 44 in a substantially vertical position. When the load engaging rack 44 is in its normal position, the lower portion thereof is adapted to abut against the lower transverse frame member 43 of the load supporting carriage 38.

Secured to the lower edge of the load engaging rack 44 are a pair of horizontally spaced fork housings 48 which extend lengthwise of the truck 10. Disposed within the fork housings 48 are a pair of fork frames 49 which are adapted to be extended and retracted relative to the fork housings 48 by means of a pair of hydraulic piston and cylinder assemblies, indicated generally by the reference numeral 49, which each comprise cylinders 50 suitably mounted to the fork housings 48 and piston rods 51 pivotally mounted to laterally extending link members 61 secured to the fork frames 49. Upon actuation of the suitable control lever of the group at 9, fluid under pressure is adapted to be admitted, through fluid lines 62, to the closed ends of the cylinders 50 of the hydraulic piston and cylinder assemblies 49. Admission of fluid to the cylinders 50 extends the piston rod 51 rearwardly, thereby causing the fork frames 49 to be retracted inwardly toward the industrial truck 10, relative to the fork housings 48, to the dotted line position shown in Figure 2. Upon admission of fluid under pressure to the opposite ends of the cylinders 50, the piston rods 51 are caused to be retracted inwardly of the cylinders 50, thereby causing the fork frames 49 to be extended away from the industrial truck 10, relative to the fork housings 48, to the solid line position shown in Figure 2.

While I have described a specific form of load engaging rack and retractable load engaging forks, it will be understood that various other load engaging devices may be secured to the load supporting carriage 38.

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

I claim:

1. For use with an industrial truck having a main frame, a mast construction comprising, a pair of vertically extending telescopic assemblies each comprising a pair of telescopic elements one of which is adapted to be mounted in fixed relation on said main frame, and the other of which is movable relative to said one element, means for extending said pair of movable elements being disposed within the confines of each telescopic assembly, a load supporting carriage guided for movement solely on one element of each of said telescopic assemblies, and means between said telescopic assemblies and said load supporting carriage for effecting upward movement of the latter when said movable elements are extended.

2. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically, one of said elements being adapted to be mounted in fixed relation on said main frame, and the other element being movable relative to said one element, a load supporting carriage guided for movement on one element of each pair of said fluid actuated assemblies, and means between said fluid actuated assemblies and said load supporting carriage for effecting upward movement of the latter when said movable elements are extended.

3. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically, one of said elements being adapted to be mounted in fixed relation on said main frame, and the other element being movable relative to said one element, a load supporting carriage guided for movement on said pair of movable elements, and means between said fluid actuated assemblies and said load supporting carriage for effecting upward movement of the latter when said movable elements are extended.

4. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically, one of said elements being adapted to be mounted in fixed relation on said main frame, and the other element being movable relative to said one element, a load supporting carriage guided for movement on said pair of movable elements, and means between said movable elements and said load supporting carriage for effecting upward movement of the latter when said movable elements are extended.

5. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically, one of said elements being adapted to be mounted in fixed relation on said main frame, and the other element being movable relative to said one element, a load supporting carriage guided for movement on said pair of movable elements, a horizontal crosshead connecting the upper ends of said movable elements, and means carried by said crosshead for effecting upward movement of said load supporting carriage when said movable elements are extended.

6. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically, one of said elements being adapted to be mounted in fixed relation on said main frame, and the other element being movable relative to said one element, a load supporting carriage guided for movement on said pair of movable elements, a horizontal crosshead connecting the upper ends of said movable elements, a sprocket gear carried by said crosshead, a chain trained over said sprocket gear and being fixedly mounted at its one end and mounted at its other end to said load supporting carriage.

7. For use with an industrial truck having a main frame, a mast construction comprising, a pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said piston element is adapted to be mounted in fixed relation on said main frame and said cylinder element is movable relative to said piston element, fluid passageways formed in said piston elements and opening into said cylinder elements, said passageways being adapted to be placed in communication with a source of fluid under pressure for effecting movement of said cylinder elements relative to said piston elements, a load supporting carriage guided for movement on said pair of cylinder elements, and means carried by said cylinder elements and having connection with said load supporting

means for effecting upward movement of the latter when said cylinder elements are extended.

8. For use with an industrial truck having a main frame, a mast construction comprising, a first pair of vertically extending telescopic assemblies each comprising a pair of telescopic elements one of which is adapted to be mounted in fixed relation on said main frame, and the other of which is movable relative to said one element; a second pair of telescopic elements one disposed rearwardly of each of said first pair of telescopic assemblies, each of said second pair of telescopic assemblies comprising a pair of telescopic elements one of which is adapted to be mounted in fixed relation on said main frame, and the other of which is movable relative to said one element; means for extending said movable elements of said first and second pair of telescopic assemblies being disposed within the confines of each telescopic assembly, a load supporting carriage guided for movement on one element of each of said first pair of telescopic assemblies, and means between said telescopic assemblies and said load supporting carriage for effecting upward movement of the latter when said movable elements of said first and second pair of telescopic assemblies are extended.

9. For use with an industrial truck having a main frame, a mast construction comprising, a first pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which one of said elements is adapted to be mounted in fixed relation on said main frame, and the other element of which is movable relative to said one element; a second pair of fluid actuated assemblies one disposed rearwardly of each of said first pair of fluid actuated assemblies, each of said fluid actuated assemblies comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which one of said elements is adapted to be mounted in fixed relation on said main frame, and the other element of which is movable relative to said one element; a load supporting carriage guided for movement on one element of each of said first pair of fluid actuated assemblies, and means between said fluid actuated assemblies and said load supporting carriage for effecting upward movement of the latter when said movable elements are extended.

10. For use with an industrial truck having a main frame, a mast construction comprising, a first pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said piston element is adapted to be mounted in fixed relation on said main frame and said cylinder element is movable relative to said piston element; a second pair of fluid actuated assemblies one disposed rearwardly of each of said first pair of fluid actuated assemblies, each of said fluid actuated assemblies comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said cylinder element is adapted to be mounted in fixed relation on said main frame and said piston element is movable relative to said cylinder element; a load supporting carriage guided for movement on said cylinder elements of said first pair of fluid actuated assemblies, and means carried by said cylinder elements of said first pair of fluid actuated assemblies and having connection with said load supporting means for effecting upward movement of the latter when said cylinder elements of said first pair of fluid actuated assemblies and said piston elements of said second pair of fluid actuated assemblies are extended.

11. For use with an industrial truck having a main frame, a mast construction comprising, a first pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said piston element is adapted to be mounted in fixed relation on said main frame and said cylinder element is movable relative to said piston element; a second pair of fluid actuated assemblies one disposed rearwardly of each of said first pair of fluid actuated assemblies, each of said fluid actuated assemblies comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said cylinder element is adapted to be mounted in fixed relation on said main frame and said piston element is movable relative to said cylinder element; a load supporting carriage guided for movement on said cylinder elements of said first pair of fluid actuated assemblies, a horizontal crosshead connecting the upper ends of said cylinder elements of said first pair of fluid actuated assemblies and said piston elements of said second pair of fluid actuated assemblies, and means carried by said crosshead for effecting upward movement of said load supporting carriage when said cylinder elements of said first pair of fluid actuated assemblies and said piston elements of said second pair of fluid actuated assemblies are extended.

12. For use with an industrial truck having a main frame, a mast construction comprising, a first pair of fluid actuated assemblies each comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said piston element is adapted to be mounted in fixed relation on said main frame and said cylinder element is movable relative to said piston element; a second pair of fluid actuated assemblies one disposed rearwardly of each of said first pair of fluid actuated assemblies, each of said fluid actuated assemblies comprising piston and cylinder elements having their lengthwise axes extending substantially vertically and in which said cylinder element is adapted to be mounted in fixed relation on said main frame and said piston element is movable relative to said cylinder element; a load supporting carriage guided for movement on said cylinder elements of said first pair of fluid actuated assemblies, a horizontal crosshead connecting the upper ends of said cylinder elements of said first pair of fluid actuated assemblies and said piston elements of said second pair of fluid actuated assemblies, a sprocket gear carried by said crosshead, and a chain trained over said sprocket gear and being fixed at its one end to said cylinder elements of said second pair of fluid actuated assemblies and at its other end to said load supporting carriage.

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