

Nov. 23, 1965

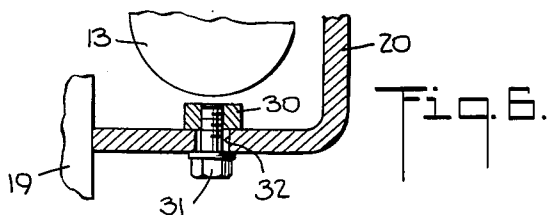
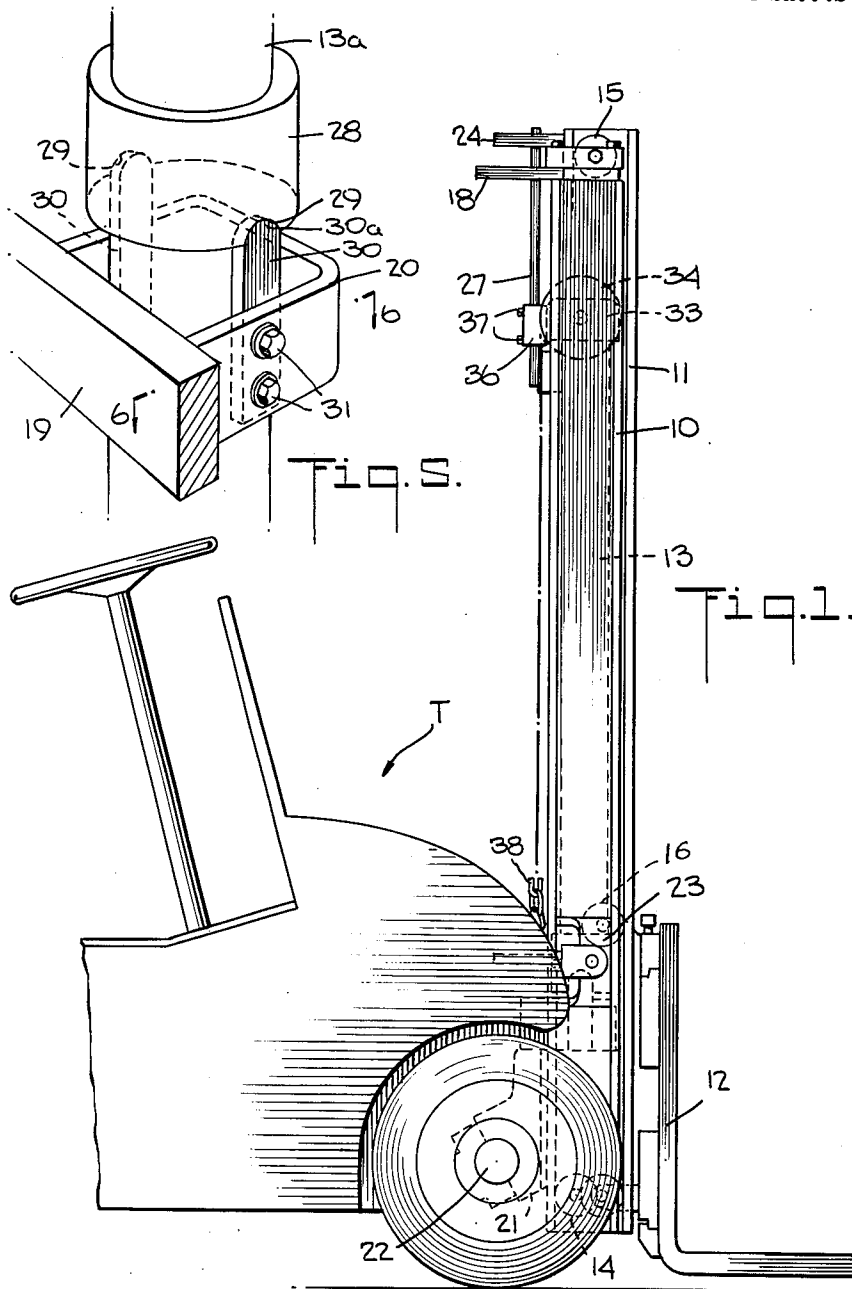
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3,219,150

LIFT TRUCK

Filed Dec. 16, 1963

4 Sheets-Sheet 1



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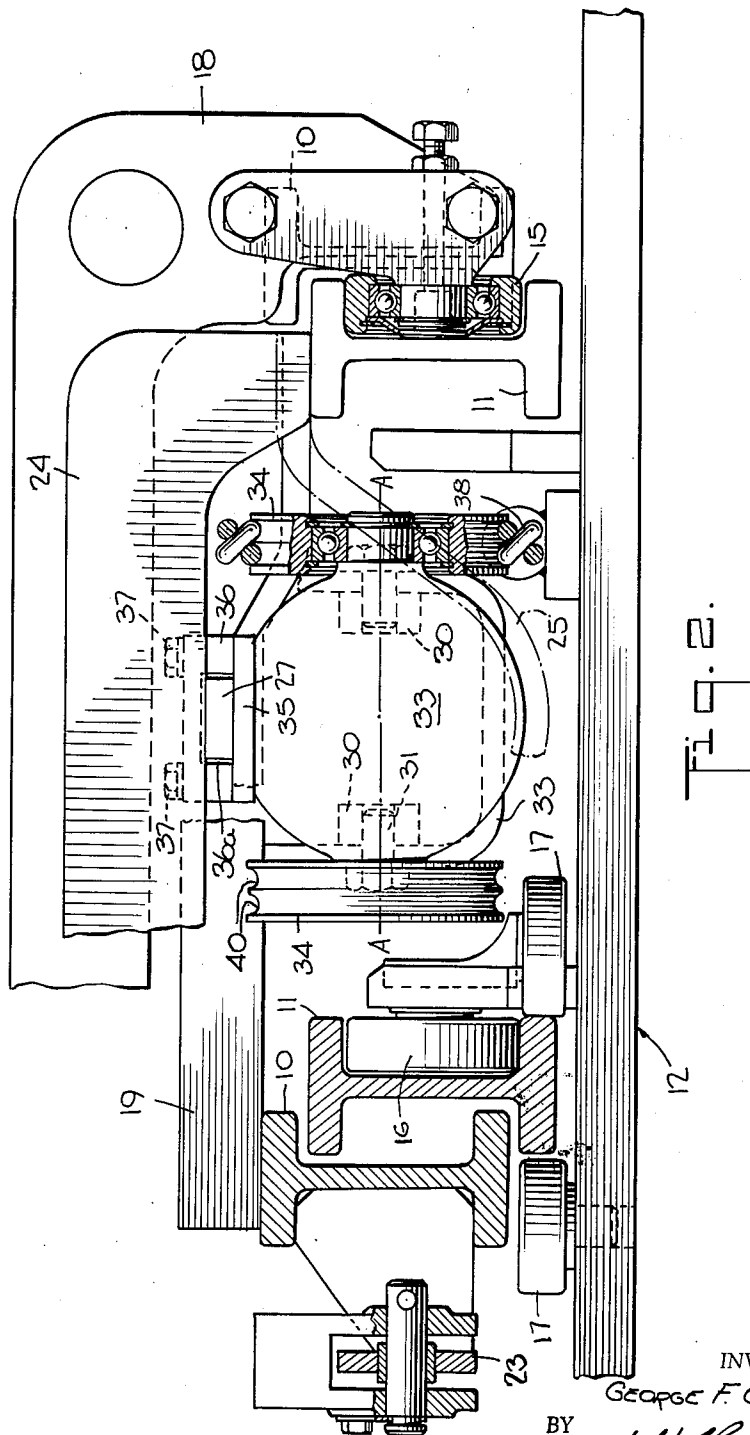
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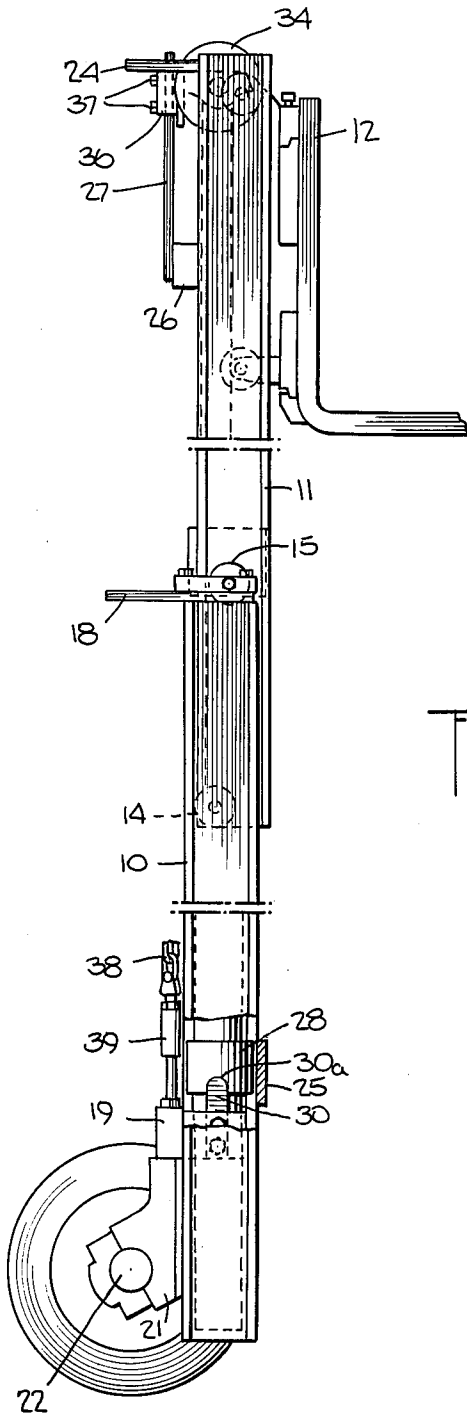
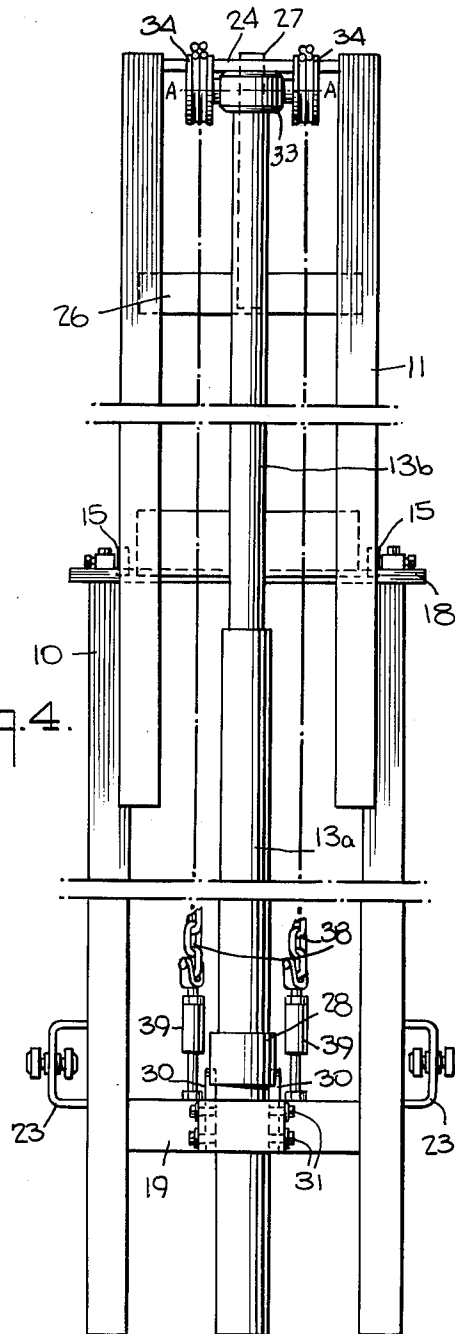


Fig. 3.

Fig. 4.



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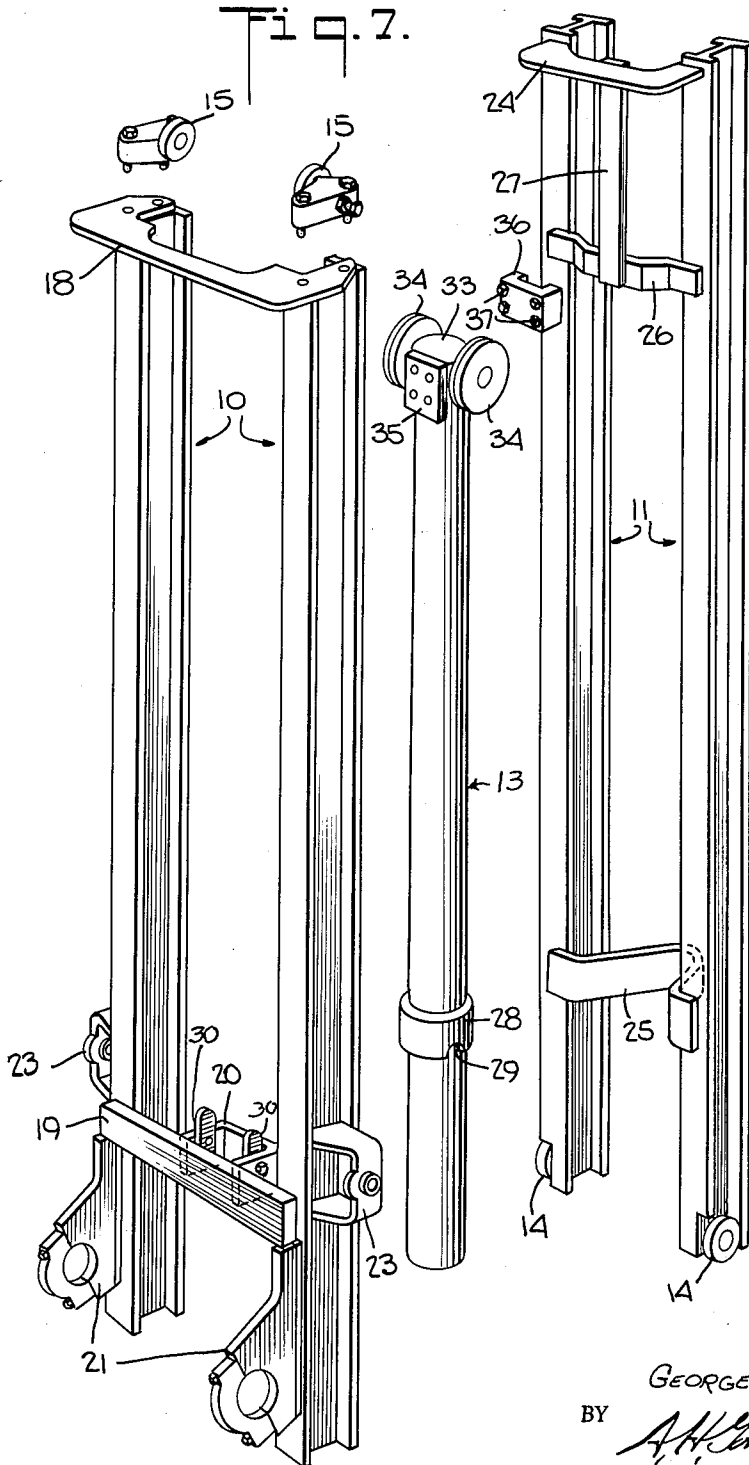
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4 Sheets-Sheet 4



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LIFT TRUCK

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7 Claims. (Cl. 187—9)

My invention relates to an industrial truck having extendible telescoping uprights, a lifting load carriage mounted for vertical movement on the uprights, and a power assembly including a hydraulic ram, lift chains and sheaves for extending the uprights and elevating the load carriage.

The purpose of my invention is to provide an improved power assembly, including mounting and guiding structure for the hydraulic lift ram, which is simpler, less expensive, and more easily fabricated than assemblies heretofore used, and which at the same time provides a stronger, more dependable assembly.

To this end, I utilize a simple lift ram for providing power for lifting the uprights and load carriage. On the lower end of the ram cylinder, I weld or otherwise secure a collar having diametrically opposed, semicylindrical recesses formed in the lower edge thereof, and I support the ram cylinder for pivotal movement relatively to the primary uprights through lugs which are received in the semicylindrical recesses in the collar on the ram cylinder. I mount the lugs on the primary uprights by means of simple bolts and particular sized holes so that I can quickly and easily adjust the position of the ram cylinder to prevent the ram from being subjected to damaging bending stresses.

On the upper end of the lift ram piston, I provide a header member which supports sheaves for the lift chains. On this header member I have a bearing formed with an opening which fits about a vertically extending guide rod that is coextensive with the secondary uprights and integral therewith at its upper and lower ends. This guide rod, in cooperation with the bearing secured to the header member of the piston serves to support and guide the upper end of the ram piston during extension of the ram piston relatively to the secondary uprights. Preferably, the guide rod is of rectangular cross section whereby to accept torsional or twisting forces exerted on the ram piston. With this arrangement, all components of the mounting and guiding structure which are carried by the uprights may be welded to the uprights during fabrication of the uprights, and the ram thereafter quickly and easily assembled to the uprights by means of a few bolts.

Further, I effect lifting of the load carriage through the use in a novel manner of simple, relatively inexpensive cross link chains. The chain sheaves are provided with parallel shallow grooves in the peripheries thereof and the cross link chains are oriented in a novel angular relation relatively to the sheaves with the planes of the links thereof extending at 45° to the axis of rotation of the sheaves. Therefore the longitudinal portions of the interlocking links are parallel and ride in the parallel grooves of the sheaves. This arrangement reduces the relative movement between adjacent links of the chains as they pass around the sheaves, thereby decreasing wear and increasing the life of the chains. In addition, the particular arrangement of the chain makes possible the use of relatively simple sheaves formed with parallel grooves. Those skilled in the art will recognize that a standard arrangement of links of the particular class described requires a sheave equipped with pockets which, in turn, necessitates a sheave of relatively large diameter. Of course, it will also be recognized that the particular conventional link that can be used in my new combination is much less expensive and less difficult to apply than the flat roller type chain that is now required.

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I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in order to prevent the appropriation of my invention by those skilled in the art.

In the drawings:

FIG. 1 is a partial side elevational view of a truck constructed in accordance with the invention,

FIG. 2 is a top plan view, partly in section, of the upright assembly of the truck shown in FIG. 2,

FIG. 3 is a side elevational view, with parts broken away, showing the carriage and uprights elevated,

FIG. 4 is a front view of the upright assembly as shown in FIG. 3,

FIG. 5 is a perspective view showing the pivotal mounting of the lift ram on the primary uprights,

FIG. 6 is a sectional view, taken on the line 6—6 of FIG. 5, and

FIG. 7 is an exploded view showing the disassembled uprights and lift ram.

Referring now to the drawings, and in particular to FIG. 1, there is shown a lift truck T constructed in accordance with the invention. The truck T includes a pair of primary or stationary uprights 10, a pair of secondary or extendible uprights 11 mounted for vertical movement on the primary uprights 10, a load carriage 12 mounted for vertical movement on the secondary uprights 11, and a lift ram 13 positioned between the uprights for lifting the load carriage and the secondary uprights.

In the particular truck illustrated, both the primary and secondary uprights are of I-shaped cross section, and the secondary uprights 11 are nested within the primary uprights with flanges thereof extending within the channels formed by the flanges of the primary uprights 10.

A first set of antifriction rollers 14 are mounted on the lower ends of the secondary uprights 11 in a position to engage and ride on flanges of the primary uprights 10, and a second set of rollers 15 are detachably secured to the tops of primary uprights 10 in a position to engage and ride on the inside surfaces of the overlapping flanges of the secondary uprights 11. The two sets of rollers therefore accept the forces between the uprights during extension of the secondary uprights 11 relatively to the primary uprights 10.

The load carriage 12 is guided for vertical movement on the secondary uprights 11 by antifriction rollers 16 which are secured to the carriage 12 and extend in to the channels of the secondary uprights 11. Twisting of the carriage 12 is prevented by side thrust rollers 17 which are secured to the carriage 12 and engage and ride on the edges of the forward flanges of the stationary uprights 11, as shown in FIG. 3.

As best shown in FIG. 7, the primary uprights 10 are secured together to form a rigid mast structure by an upper cross brace 18 which is welded or otherwise secured to the top surfaces of the primary uprights 10, and a lower cross brace 19 which is secured to the rear surfaces of the primary uprights 10 adjacent the lower ends of the uprights. A U-shaped bracket 20 is welded or otherwise secured to the lower cross brace 19 and extends in between the uprights 10. As will be described

in detail hereafter, the bracket 20 forms part of the mounting structure for the lift ram 13.

The lower ends of the primary uprights 10 are provided with bearings 21 through which the primary uprights may be pivotally attached to the front axle 22 of the truck as shown in FIG. 1, and are also provided with brackets 23 on the sides thereof through which tilting rams (not shown) may be attached to the primary uprights 10 for tilting the uprights a few degrees from the vertical in the fore and aft direction of the truck.

The secondary uprights 11 are secured together to form a rigid mast structure by an upper cross brace 24 which is welded or otherwise secured to the rear surfaces of the secondary uprights 11 and a lower cross brace 25 which is also secured to the rear surfaces of the secondary uprights 11 adjacent the lower ends of the uprights. The lower cross brace 25 is curved inwardly between the uprights 11 to clear the lift ram 13 when the ram is assembled between the uprights.

The secondary uprights 11 also include a third cross brace 26 which is secured to the rear surfaces of the secondary uprights 11 a substantial distance below the upper cross brace 24. A vertically extending bar or plate 27 is secured at its upper end to the upper cross brace 24 and at its lower end to the cross brace 26. As will be described in detail hereafter, the vertical bar 27 forms a part of the guiding structure for the upper end of the lift ram 13.

The lift ram 13 is a simple ram and includes a ram cylinder 13a and a ram piston 13b, best shown in FIG. 4. A collar 28, having diametrically opposed semicylindrical recesses 29 formed in the lower edge thereof, is welded or otherwise secured to the ram cylinder 13a adjacent the lower end of the cylinder. The ram cylinder 13a is supported for pivotal movement on the primary uprights 10 by means of spaced lugs or bearing plates 30 which are secured by bolts 31 to the opposed legs of the U-shaped bracket 20 and have curved upper ends 30a which are received in the recesses 29 in the lower edge of the collar 28. As best shown in FIG. 6, the bolts 31 extend through oversized holes 32 in the opposed legs of the U-shaped bracket 20 so that the points of support of the ram cylinder 13a may be adjusted in the fore and aft direction of the truck as necessary to prevent the ram from being subjected to lateral bending stresses.

As best shown in FIGS. 2, 4 and 8, a header member 33, which rotatably supports a pair of lift chain sheaves 34, is secured to the upper end of the lift ram piston 13b. The rear surface of the header 33 is flattened and a suitable bearing plate 35 is welded or otherwise secured to the flattened surface. A U-shaped bearing member 36 having a rectangular shaped recess 36a surrounds the rectangular guide bar 27 on the secondary uprights 11, and the U-shaped bearing member 36 is secured to the plate 35 on the header member 33 by four bolts 37. The upper end of the lift ram piston 13b is thereby supported and guided on the guide bar 27 during initial extension of the lift ram. Because of the rectangular cross section of the bar 27 and the rectangular recess in the U-shaped bearing member 35, through which the guide bar 27 extends, the guide bar 27 accepts torsional or twisting forces exerted on the ram piston 13b.

As best shown in FIGS. 1, 3 and 4, a pair of lift chains 38 are anchored through suitable coupling members 39 to the lower cross brace 19 of the primary uprights, extend upwardly and over the sheaves 34 on the header member 33 of the ram piston 13b, and are secured at their opposite ends to the load carriage 12. Initial extension of the lift ram 13 therefore serves to effect free lift of the load carriage 12 through the lift chains 38 relatively to the uprights 10 and 11 while the upper end of the ram piston 13a is guided on the guide rod 27. When the header member 33 reaches the cross

brace 24 at the top of the secondary uprights 11, the secondary uprights 11 and load carriage 12 are elevated relatively to the primary uprights 10 by further extension of the lift ram 13 until they reach the fully extended position as shown in FIGS. 3 and 4.

As shown in FIGS. 2, 3 and 4, the lift chains 38 are cross link chains, rather than roller chains as commonly used on conventional lift trucks. As best shown in FIG. 2, each of the sheaves 34 has a pair of relatively shallow grooves 40 formed in the periphery thereof which receive the parallel longitudinal portions of the links of the chains 38 so that the planes of the individual links extend at 45° to the axis of rotation A—A of the sheaves 34. This arrangement reduces the relative movement between the adjacent links of the chains 38 as they pass around the sheaves 34, thereby decreasing wear and increasing the life of the chains.

From preceding descriptions, it can be seen that there is provided an improved power assembly for a lift truck, including mounting and guiding construction for the hydraulic lift ram, which is simpler, less expensive and more easily fabricated than assemblies heretofore used and which therefore provides a stronger, more dependable assembly. With the arrangement of the invention, the uprights 10 and 11 may be first completely fabricated and assembled in telescoping nested relationship, and the lift ram 13 thereafter quickly and easily assembled to the uprights by seating the recesses 29, formed in the lower edge of the collar member 28 of the lift ram, on the upper surfaces 30a of the bearing members 30 and then placing the U-shaped bearing member 36 around the vertical guide bar 27 and securing the bearing member 36 to the header member 33 by the four bolts 37. The lug or bearing members 30 may then be adjusted in the fore and aft and vertical directions as necessary to properly align the lift ram 13 with the guide bar 27 to prevent binding of the U-shaped bearing 36 on the guide bar 27 and to prevent lateral bending stresses being imposed on the ram. The bolts 31 may then be tightened to secure the bearing members 30 to the U-shaped bracket 20 in the properly adjusted positions.

While a preferred form of the invention has been shown and described, it will be appreciated that this is for the purpose of illustration and explanation and that changes and modifications will be made therein without departing from the spirit and scope of the invention.

I now claim:

1. A lift truck comprising a pair of laterally spaced primary uprights, a pair of laterally spaced secondary uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said secondary uprights, a lift ram having a collapsed length less than the height of said uprights and having a cylinder and a piston which extends upwardly from said cylinder, a collar secured to and surrounding the lower end of said ram cylinder, said collar having diametrically opposed semicircular recesses formed in the lower edge thereof, a cross brace secured to and extending between said primary uprights adjacent the lower ends of said primary uprights, a U-shaped bracket welded to said cross brace and surrounding the lower end of said ram cylinder, an upwardly extending bearing plate secured to each leg of said U-shaped bracket by means of bolts extending through oversized holes whereby said plates may be adjusted relatively to said U-shaped bracket, each of said plates having an upper semicylindrical shaped end which is received in one of said semi-circular recesses in said collar whereby said ram cylinder is supported on said upper ends of said bearing plates for pivotal movement relatively to said primary uprights, a first cross brace secured to and extending between the upper ends of said secondary uprights, a second cross brace secured to and extending between said secondary uprights a substantial distance below said first cross brace, a vertical bar of

rectangular cross section secured at its upper and lower ends to said first and second cross braces of said secondary uprights, a header member secured to the upper end of said ram piston, a U-shaped bearing member secured to one side of said header member and having a rectangular recess slideably receiving said vertical bar whereby the upper end of said piston is supported and guided during extension of said piston relatively to said uprights, chain sheaves mounted for rotation on said header member, each of said chain sheaves having a pair of parallel grooves in the periphery thereof, cross link lift chains secured at one end to said primary uprights, said chains extending upwardly around said sheaves and secured at the other end to said load carriage, the links of said lift chains being so oriented relatively to said chain sheaves that the planes of said links extend at 45° to the axis of rotation of said chain sheaves and the sides of alternate links engage in said parallel grooves of said chain sheaves as said links pass over said chain sheaves.

2. A lift truck comprising a pair of laterally spaced primary uprights, a pair of laterally spaced secondary uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said secondary uprights, a lift ram having a collapsed length less than the height of said uprights and having a cylinder and a piston which extends upwardly from said cylinder, a collar secured to and surrounding the lower end of said ram cylinder, said collar having diametrically opposed semicircular recesses formed in the lower edge thereof, a cross brace secured to and extending between said primary uprights adjacent the lower ends of said primary upright, a U-shaped bracket welded to said cross brace and surrounding the lower end of said ram cylinder, an upwardly extending bearing plate secured to each leg of said U-shaped bracket by means of bolts extending through oversized holes whereby said plates may be adjusted relatively to said U-shaped bracket, each of said plates having an upper semicylindrical shaped end which is received in one of said semicircular recesses in said collar whereby said ram cylinder is supported on said upper ends of said bearing plates for pivotal movement relatively to said primary uprights, a first cross brace secured to and extending between the upper ends of said secondary uprights, a second cross brace secured to and extending between said secondary uprights a substantial distance below said first cross brace, a vertical bar of rectangular cross section secured at its upper and lower ends to said first and second cross braces of said secondary uprights, a header member secured to the upper end of said ram piston, a U-shaped bearing member secured to one side of said header member and having a rectangular recess slideably receiving said vertical bar whereby the upper end of said piston is supported and guided during extension of said piston relatively to said uprights, chain sheaves mounted for rotation on said header member, and lift chains secured at one end to said primary uprights, said chains extending upwardly around said sheaves and secured at the other end to said load carriage.

3. A lift truck comprising a pair of laterally spaced primary uprights, extendible uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said extendible uprights, a lift ram having a cylinder and a piston which extends upwardly from said cylinder, a collar secured to and surrounding the lower end of said ram cylinder, said collar having diametrically opposed semicircular recesses formed in the lower edge thereof, a cross brace secured to and extending between said primary uprights adjacent the lower ends of said primary uprights, a U-shaped bracket secured to said cross brace and surrounding the lower end of said ram cylinder, an upwardly extending bearing plate secured to each leg of said U-shaped bracket by means of bolts extending through oversized holes

whereby said plates may be adjusted relatively to said U-shaped bracket, each of said plates having an upper semicylindrical shaped end which is received in one of said semicircular recesses in said collar whereby said ram cylinder is supported on said upper ends of said bearing plates for pivotal movement relatively to said primary uprights, means on said extendible uprights for supporting the upper end of said ram piston, lift chains operatively connected with said carriage and extendible uprights for elevating said carriage upon extension of said ram piston relatively to said ram cylinder.

4. A lift truck comprising primary uprights, extendible uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said extendible uprights, a lift ram having a cylinder and a piston which extends upwardly from said cylinder for elevating said load carriage and extendible uprights, a collar secured to and surrounding the lower end of said ram cylinder, said collar having diametrically opposed recesses formed in the lower edge thereof, spaced upwardly extending bearing lugs secured to said primary uprights adjacent the lower ends thereof, said lugs being spaced apart the distance between said recesses and received in said recesses whereby said cylinder is supported for pivotal movement, and means for adjusting said lugs in a vertical plane relatively to said primary uprights.

5. A lift truck comprising a pair of laterally spaced primary uprights, laterally spaced extendible uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said extendible uprights, a lift ram having a collapsed length less than the height of said uprights and having a cylinder and a piston which extends upwardly from said cylinder, means mounting said cylinder between said primary uprights for fore and aft pivotal movement, a first cross brace secured to and extending between the upper ends of said extendible uprights, a second cross brace secured to and extending between said extendible uprights a substantial distance below said first cross brace, a vertical bar secured at its upper and lower ends to said first and second cross braces of said extendible uprights, a header member secured to the upper end of said ram piston, a bearing member secured to one side of said header member and having a recess slideably receiving said vertical bar whereby the upper end of said piston is supported and guided during extension of said piston relatively to said uprights.

6. A lift truck comprising laterally spaced primary uprights, laterally spaced extendible uprights mounted for vertical movement on said primary uprights, a load carriage mounted for vertical movement on said extendible uprights, a lift ram having a collapsed length less than the height of said uprights and having a cylinder and a piston which extends upwardly from said cylinder, means mounting said cylinder on said primary uprights between said primary uprights, a first cross brace secured to and extending between the upper ends of said extendible uprights, a second cross brace secured to and extending between said extendible uprights a substantial distance below said first cross brace, a vertical bar secured at its upper and lower ends to said first and second cross braces of said extendible uprights, a header member secured to the upper end of said ram piston, a bearing member secured to one side of said header member and having an opening slideably receiving said vertical bar whereby the upper end of said piston is supported and guided during extension of said piston relatively to said uprights.

7. A lift truck comprising uprights, a load carriage mounted for vertical movement on said uprights, a lift ram mounted on said uprights, a rotatable chain sheave operatively connected with said lift ram and movable vertically by extension of said lift ram, said chain sheave having a pair of parallel grooves in the periphery thereof, a cross link lift chain operatively connected with said

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uprights and load carriage and extending around said sheave whereby said load carriage is elevated by movement of said sheave, the links of said lift chain being so oriented relatively to said chain sheave that the planes of said links extend at 45° to the axis of rotation of said chain sheave and the sides of alternate links engage in said parallel grooves of said chain sheave as said links pass over said chain sheave.

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