April 25, 1950 C. S. SCHROEDER 2,505,009

LIFT TRUCK

Filed Dec. 16, 1948 4 Sheets-Sheet 1

Fig. 1.

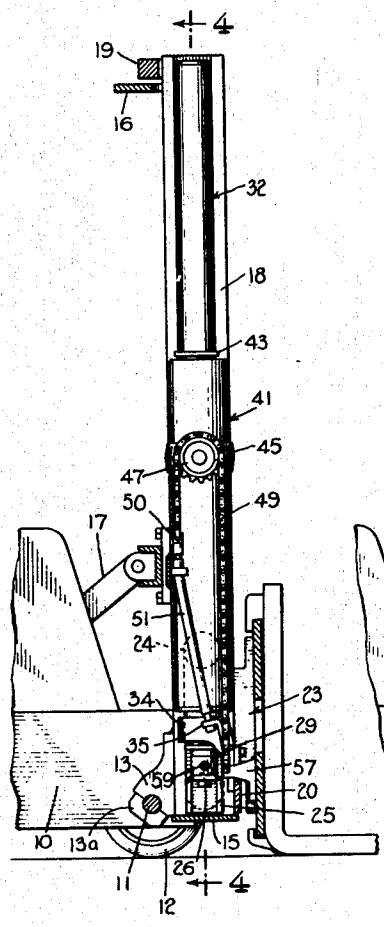


Fig. 2.

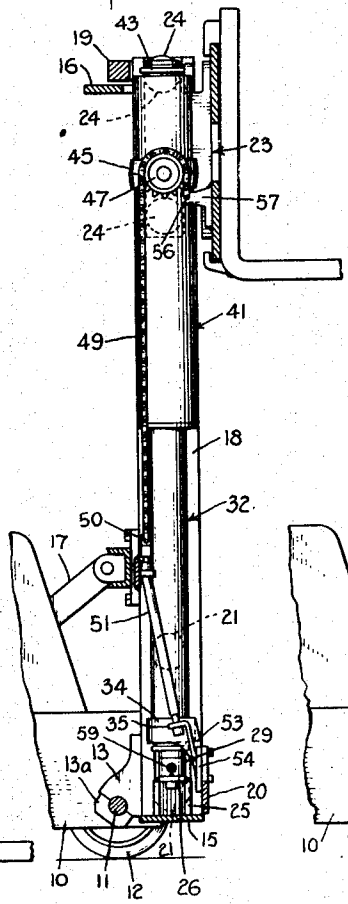
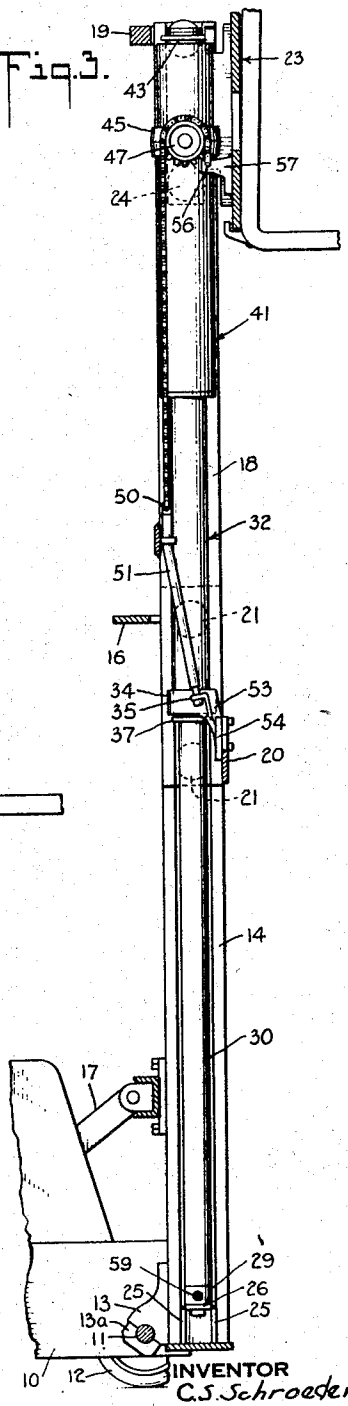


Fig. 3.



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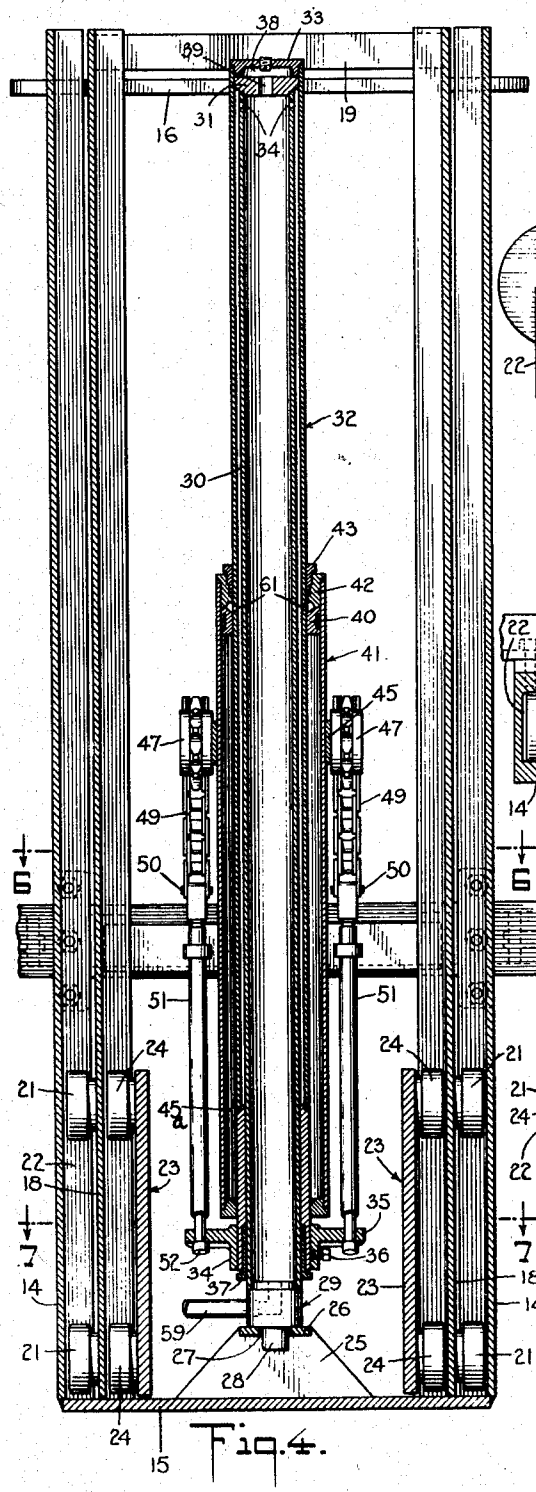


Fig. 4.

Fig. 5.

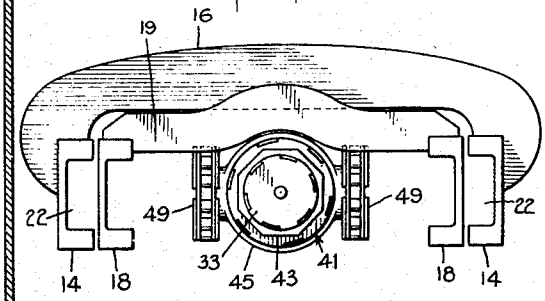


Fig. 6.

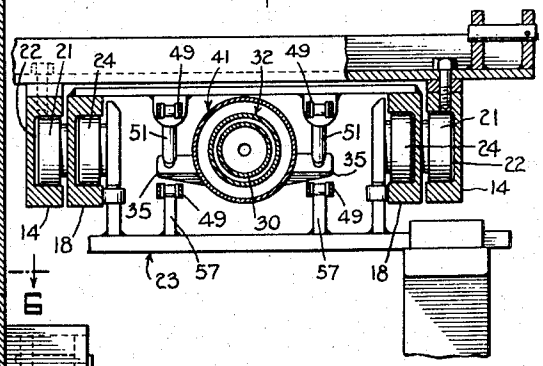
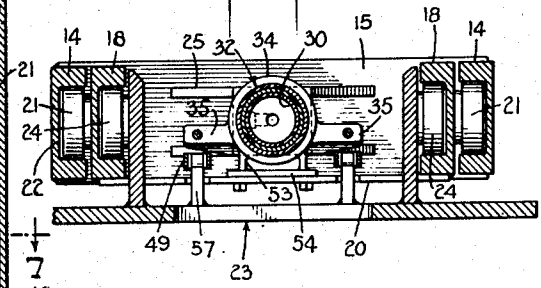


Fig. 7.



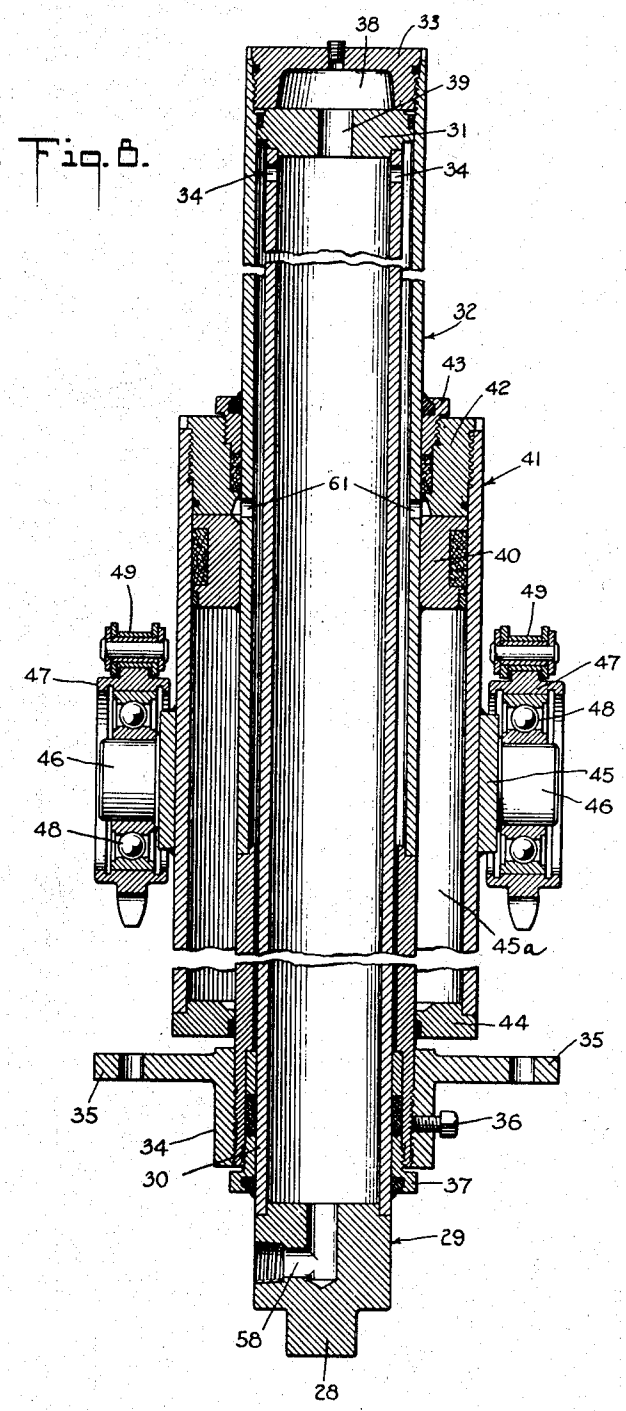
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Fig. 8.



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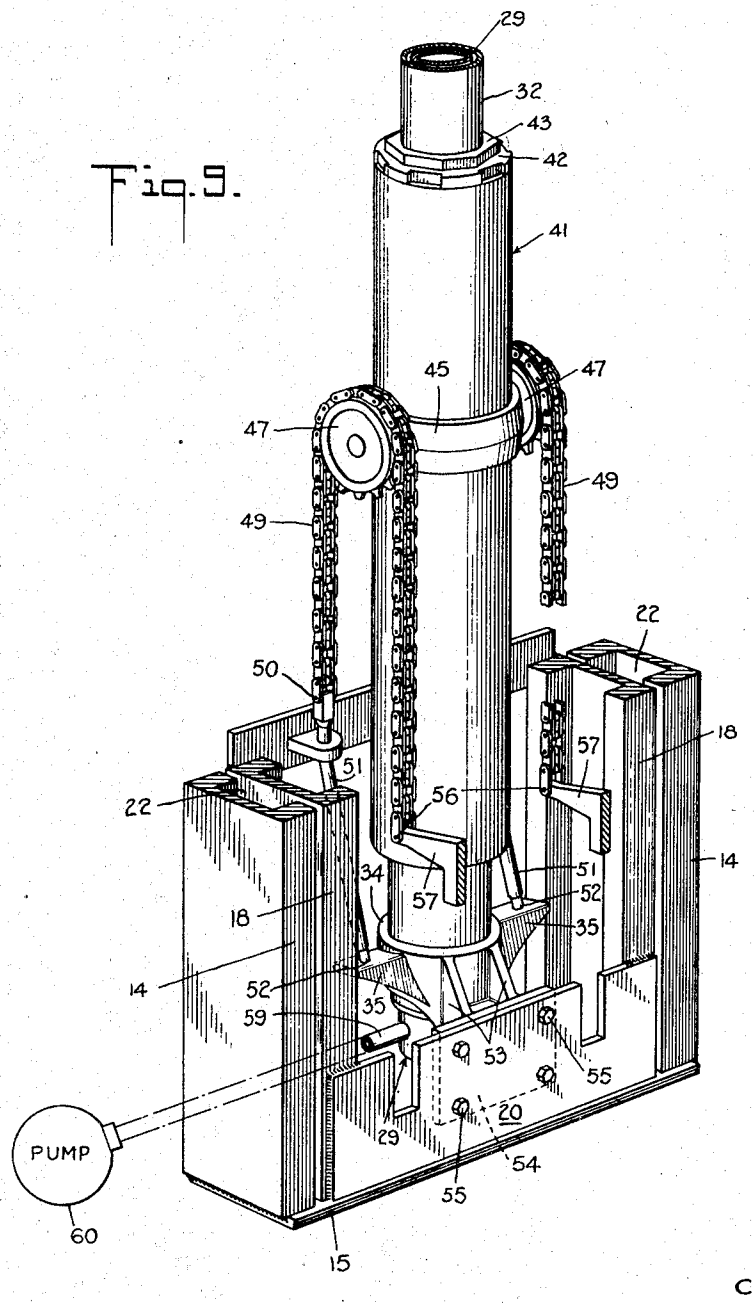
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Fig. 9.



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Patented Apr. 25, 1950 2,505,009

UNITED STATES PATENT OFFICE

2,505,009

LIFT TRUCK

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Application December 16, 1948, Serial No. 65,662

9 Claims. (Cl. 187—9)

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This invention relates to an industrial truck of that type in which an elevating carriage is adapted for vertical movement on secondary uprights that are in turn mounted for vertical movement on primary uprights carried by the main frame of the truck. It is the object of this arrangement to obtain a relatively high lift of the carriage relatively to the main frame of the truck.

As is fully set forth in the Ulinski application, Ser. No. 692,465 filed August 15, 1946, owned by The Yale & Towne Manufacturing Company, to whom this application is assigned, it is extremely desirable to lift the elevating carriage a considerable amount without increasing the overall height of the truck. The purpose of the particular arrangement is to maintain at a minimum the height of the truck while the carriage is partially elevated so that the truck may be manipulated into and out of a freight car and within a freight car. In the Ulinski application, the elevating carriage and the secondary uprights are raised by hydraulic ram assemblies, one hydraulic ram assembly lifting the carriage relatively to the secondary uprights while another ram assembly lifts the secondary uprights relatively to the primary uprights. Through the utilization of the particular arrangement, the elevating carriage may be raised for its entire distance relatively to the secondary uprights without vertical movement of the secondary uprights, and without movement of a part of the ram assembly above the secondary uprights or primary uprights. For the purposes of his invention, Ulinski utilizes a pair of relatively short ram assemblies, each performing its lifting operation through the medium of chains. Moreover, in the Ulinski construction, a rather considerable movement of flexible hose is made necessary because of the movement of one ram assembly relatively to the other ram assembly in a particular manner.

It is the object of my invention to contribute a truck of the particular class described, but with a different arrangement of the hydraulic assemblies. As one feature of my invention, I eliminate a considerable amount of the chain previously required in trucks of this class. Thus, more particularly, I utilize an extremely long ram assembly operating between the secondary and primary uprights and adapted to lift the secondary uprights by direct application of lifting pressure. As a still further feature of my invention, this ram assembly carries means constituting a secondary ram assembly for lifting

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the elevating carriage relatively to the secondary uprights.

As a further feature of my invention, I eliminate the moving hose previously required in trucks of the particular class. Thus, a single piece of hose, which may be a fixed pipe where the uprights are fixed to the truck, is used, this hose bringing fluid under pressure directly into the primary ram assembly for suitable distribution thereto and to the secondary ram assembly. As a more particular feature of this part of the invention, fluid under pressure is brought into a hollow or sleeve-like piston forming part of the primary ram assembly, this fluid operating in this piston against a cylinder forming the other half of the primary ram assembly. By means of particular passages, the fluid is further directed to the cylinder of the secondary ram assembly for actuating that assembly.

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 to be granted me shall be of sufficient breadth to prevent the appropriation of my invention by those skilled in the art.

Referring now to the drawings, Fig. 1 is an elevation of the rear end of an industrial truck showing my invention embodied therein. Fig. 2 shows the elevating carriage of Fig. 1 raised fully by the operation of the secondary ram assembly. Fig. 3 shows the manner in which the secondary uprights, together with the elevating carriage are lifted by the primary ram assembly. Fig. 4 is a vertical section taken along lines 4—4 of Fig. 1. Fig. 5 is a view looking downwardly on the uprights and hydraulic assemblies. Figs 6 and 7 are views taken respectively along lines 6—6 and 7—7 of Fig 4. Fig. 8 is an enlarged vertical section showing the construction of my primary and secondary ram assemblies. Fig. 9 is a perspective view showing the relation of the ram assemblies to the vertical uprights.

Referring now more particularly to the draw-

ings, and especially to Figs. 1, 2, 3, and 9, the main frame of an industrial truck to which my invention is applied is designated by reference numeral 10. The particular construction of the truck is of no importance here and will not be described. Mounted on the main frame 10 is an axle 11 on which are rotatably mounted the usual opposed load wheels 12. A pair of brackets 13 bear on the axle 11 and are assembled relatively thereto by complementary parts 13a suitably bolted thereto as is common in this art. Brackets 13 are welded or otherwise secured to a pair of primary uprights 14 welded to a base plate 15 so as to form a unitary assembly. At their upper ends the primary uprights 14 are connected by a reinforcing member 16 securely welded thereto as best shown in Fig. 5. From the description of the invention thus far presented, it is apparent that the primary uprights 14 will pivot with the brackets 13 about the axle 11. Pivotal movement will be imparted to the primary uprights 14 about the said axle 11 by an operating bar 17 that may be actuated by a hydraulic ram or by other means as is well known in this art. The particular assembly I have thus described is quite old in the art and per se is not the invention of this application.

The secondary uprights of my invention are designated by reference numeral 18 and are held assembled at their lower ends by a reinforcing plate 20 and at their upper ends by a cross bar 19. Secondary uprights 18 are equipped with upper and lower rollers 21 at each side thereof, these rollers moving in the channels 22 of the primary uprights 14, as is clearly shown in Figs. 4, 6, and 7, and as is standard in this art. Through the particular arrangement, the secondary uprights 18 are adapted for movement from the position of Fig. 1 to the position of Fig. 3 relatively to the primary uprights 14.

The load elevating carriage is designated generally by reference numeral 23 and may be in the form of a boom, forks, or a mere platform, depending upon the type of load to be handled. The load elevating carriage 23 is equipped with upper and lower rollers 24, and through these rollers is mounted for vertical movement relatively to the secondary uprights from the position of Fig. 1 to the position of Fig. 2. I shall now describe the means whereby the load elevating carriage is lifted and lowered relatively to the secondary uprights and whereby the secondary uprights together with the carriage are lifted and lowered relatively to the primary uprights.

The base plate 15 welded to the primary uprights 14 has welded thereto a gusset 25 having a bearing plate 26 formed with an opening 27 in which rests the lower tip 28 of a ram piston designated generally by reference numeral 29 and best illustrated in Fig. 8. Ram piston 29 together with the other parts of my hydraulic ram assemblies may be fabricated in various ways, but I prefer the method of fabrication shown in the drawings, since through that method, I am able to achieve the results of my invention most economically. Thus, as best seen in Fig. 8, ram piston 29 is formed with a solid bottom of which tip 28 is integral. A sleeve 30 is secured to the solid bottom portion to form an integral part thereof and extends vertically terminating at a cap 31. Cap 31, sleeve 30, and the solid bottom of the ram piston 29 thus form a single hollow piston. Mounted about the ram piston 29, and for vertical movement relatively thereto, is what I term a primary ram cylinder 32. Ram cylinder 32

forms with ram piston 29 the primary ram assembly adapted for lifting the secondary uprights relatively to the primary uprights by direct application of force by the cylinder 32 to the secondary uprights.

Ram cylinder 32 is formed with a threaded cap 33 at its upper end, and has threaded about its lower end a collar 34 having opposed bracket flanges 35. A stud 36 secures collar 34 against release rotation relatively to the ram cylinder 32 as is quite apparent from Figs. 4 and 8. Secured also to the lower end of the ram cylinder 32 is a sleeve 37 utilized as a stuffing box as is standard in this art. It will be noted that the cap 33 is formed with a hollow chamber 38 in communication with the internal chamber of the hollow piston 29 through a bore 39 in the cap 31 of the piston 29. The sleeve portion of the piston 29 is formed with a series of bores 34 in communication with a space between primary cylinder 32 and the outer surface of the ram piston 29.

The outer surface of the primary ram cylinder 32 has welded thereto a ring 40 as best seen in Fig. 8 carrying the usual stuffing box material. Mounted about the ring 40 and about the primary cylinder 32 is what I term a secondary ram cylinder 41. Secondary ram cylinder 41 forms with primary ram cylinder 32 what I term a secondary ram assembly. The upper end of the secondary ram cylinder 41 has threaded thereto a sleeve 42 that in turn carries a short threaded sleeve 43, it being the function of the two sleeves 42, 43 to coact with the surface of the primary cylinder 32 during sliding movement therebetween to prevent leakage of hydraulic fluid as is common in this art. The lower end of the secondary cylinder 41 is formed from a ring 44 adapted to slide relatively to the outer surface of the primary cylinder 32. The seal between the ring 44 and the outer surface of the primary cylinder 32 does not prevent the movement of air into and out of the chamber 45a shown in Fig. 8 as formed by the internal surface of the hollow cylinder 41 and the external surface of the cylinder 32.

Welded to the secondary cylinder 41 is a ring 45, and this ring 45 carries trunnions 46, on each of which is mounted for rotation a sprocket 47 through the intermediary of a ball bearing 48. Each of the sprockets 47 coacts with a sprocket chain 49 as probably best seen in Fig. 9. One end of each of the sprocket chains 49 is secured at 50 to a rod 51 that is in turn secured at 52 to one of the flanges 35 of the collar 34. Collar 34 has a pair of brackets 53 at its rear formed integrally therewith and terminating in a plate 54 that is securely fastened by bolts 55 to the plate 20 welded to the secondary uprights 18. It is, therefore, rather clearly apparent that one end of each of the chains 49 is securely fastened to the secondary uprights and the primary ram cylinder 32. In other words, the secondary uprights, the primary ram cylinder 32 and one end of each of the chains 49 are secured to one another and against relative movement.

The other end of each of the chains 49 is secured at 56 to a bracket 57, the two brackets 57 being in turn welded to the load elevating carriage 23 as probably best seen in Figs. 1, 2, and 3.

The lower solid end of the primary ram piston 29 is bored as shown at 58 in Fig. 8 for a hose 59 best shown in Figs. 4 and 9, the hose 59 extending to a pump 60, those skilled in the art appreciating, of course, that the pump 60 will supply fluid under pressure to the hollow ram piston

29 in the usual way common to hydraulically operated lift mechanisms in industrial trucks.

It will be well now to see just what happens when fluid is introduced to the hydraulic ram assemblies I have described when the load elevating carriage 23 is in its lowermost position of Fig. 1, the ram assemblies being then in the position illustrated in Figs. 4, 8, and 9. Fluid under pressure will move through the hollow primary ram piston 29 and thence through the several passages 34 into the space between the primary ram cylinder 32 and the ram piston 29. From the said space the fluid will then flow through a series of bores 61 in the cylinder 32 exerting pressure against the sleeve 42 of the secondary cylinder 41 to separate it from the ring 40 welded to the primary ram cylinder 32. This will effect a vertical upward movement of the secondary ram cylinder 41 from the position of Figs. 1, 8, and 9 to the position of Fig. 2. During this movement air will move out of the chamber 45a between cylinder 41 and cylinder 32, and the bottom ring 44 of the cylinder 41 will move up to a position against the lower surface of the ring 40 welded to the cylinder 32. During this movement the sprockets 47 will act on the chain 49 and raise the load elevating carriage 23 to its position of Fig. 2. It will be appreciated that during this movement of the elevating carriage no movement whatsoever will be imparted to the secondary uprights 18, and that no vertical movement of any of the hydraulic mechanism above the secondary and primary uprights will take place.

Upon completion of this movement of the secondary ram cylinder and the load elevating carriage, the pressure within the hydraulic system will increase and this increased pressure will be applied against the upper end of the primary ram cylinder 32 so as to lift that cylinder relatively to the stationary hollow ram piston 29. Since cylinder 32 is fixed through collar 35 and brackets 53 to the secondary uprights, the vertical movement of the cylinder 32 will consequently effect movement of the secondary uprights relatively to the primary uprights, so that the secondary uprights will move from the position of Fig. 2 to the position of Fig. 3. It will be noted that this movement will be imparted to the secondary uprights without chains, due to the length of the hollow ram piston 29 and its coaction with the long primary cylinder 32 applied directly against the secondary uprights.

Of course, it will be appreciated by those skilled in the art that because of the rather considerable area against which the hydraulic fluid can act on the secondary cylinder 41, plus the fact that this cylinder carries a lighter load than that lifted by the primary cylinder, the fluid will act first to raise the secondary cylinder 41. Therefore, my mechanism contributes that sequential operation that is required by this art. I believe it will be quite apparent also that my construction will yield an extremely high lift of the load elevating carriage without requiring the rather considerable number of chains that have heretofore been utilized in constructions of the particular class. It will be further apparent that through the utilization of my construction it is necessary to have but a very short length of hose connecting the lower end of the ram piston 29 with a source of fluid pressure. As a matter of fact, rigid piping can be used where the uprights are not pivoted, but where the pivoted construction of my invention is utilized, an extremely short length of hose will still suffice. I believe now that the rather considerable merit of my contribution will be apparent.

I now claim:

1. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a hollow ram piston bearing at its lower end on said main frame, means for admitting hydraulic fluid under pressure into the lower end of said hollow ram piston, a first ram cylinder about said ram piston and constituting therewith a first ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, means whereby said second ram assembly lifts said load carriage relatively to said secondary uprights, and means whereby said first ram assembly lifts said secondary uprights together with said carriage relatively to said primary uprights.

2. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a ram piston bearing at its lower end on said main frame, a first ram cylinder about said ram piston and constituting therewith a first ram assembly, means for admitting hydraulic fluid under pressure to said ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, means whereby said second ram assembly lifts said load carriage relatively to said secondary uprights, and means whereby said first ram assembly lifts said secondary uprights together with said carriage relatively to said primary uprights.

3. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a ram piston bearing at its lower end on said main frame, a first ram cylinder about said ram piston and constituting therewith a first ram assembly, means for admitting hydraulic fluid under pressure to said ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, a flexible lift member secured at one end to said carriage and at its other end relatively to said secondary uprights, means

whereby the cylinder of said secondary ram assembly presses against said flexible lift member to lift said load carriage relatively to said secondary uprights, and the cylinder of said first ram assembly bearing against said secondary uprights to lift said secondary uprights together with said carriage relatively to said primary uprights.

4. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a hollow ram piston bearing at its lower end on said main frame, means for admitting hydraulic fluid under pressure into the lower end of said hollow ram piston, a first ram cylinder about said ram piston and constituting therewith a first ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, a flexible lift member secured at one end to said carriage and at its other end relatively to said secondary uprights, means whereby the cylinder of said secondary ram assembly presses against said flexible lift member to lift said load carriage relatively to said secondary uprights, and the cylinder of said first ram assembly bearing against said secondary uprights to lift said secondary uprights together with said carriage relatively to said primary uprights.

5. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a hollow ram piston bearing at its lower end on said main frame and extending upwardly substantially the height of said primary uprights, means for admitting hydraulic fluid under pressure into the lower end of said hollow ram piston, a first ram cylinder about said ram piston closed at its upper end and constituting with said piston a first ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, means whereby said second ram assembly lifts said load carriage relatively to said secondary uprights, and means whereby said first ram assembly lifts said secondary uprights together with said carriage relatively to said primary uprights.

6. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a hollow ram piston bearing at its lower end on said main frame and extending upwardly substantially the height of said primary uprights, means for admitting hydraulic fluid under pressure into the lower end of said

hollow ram piston, a first ram cylinder about said ram piston closed at its upper end and constituting with said piston a first ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, a flexible lift member secured at one end to said carriage and at its other end relatively to said secondary uprights, means whereby the cylinder of said secondary ram assembly presses against said flexible lift member to lift said load carriage relatively to said secondary uprights, and the cylinder of said first ram assembly bearing against said secondary uprights to lift said secondary uprights together with said carriage relatively to said primary uprights.

7. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a ram piston bearing at its lower end on said main frame and extending upwardly substantially the height of said primary uprights, a first ram cylinder about said ram piston closed at its upper end and constituting with said piston a first ram assembly, means for admitting hydraulic fluid under pressure to said ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, means whereby said second ram assembly lifts said load carriage relatively to said secondary uprights, and means whereby said first ram assembly lifts said secondary uprights together with said carriage relatively to said primary uprights.

8. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a ram piston bearing at its lower end on said main frame and extending upwardly substantially the height of said primary uprights, a first ram cylinder about said ram piston closed at its upper end and constituting with said piston a first ram assembly, means for admitting hydraulic fluid under pressure to said ram assembly, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the first ram cylinder moves vertically together with said second ram cylinder on said ram piston, a flex-

ible lift member secured at one end to said carriage and at its other end relatively to said secondary uprights, means whereby the cylinder of said secondary ram assembly presses against said flexible lift member to lift said load carriage relatively to said secondary uprights, and the cylinder of said first ram assembly bearing against said secondary uprights to lift said secondary uprights together with said carriage relatively to said primary uprights.

9. In a truck of the class described, a main frame having primary uprights, a pair of secondary uprights slidable on said primary uprights, a load carriage slidable on said secondary uprights, a ram piston, a first ram cylinder about said ram piston and constituting therewith a first ram assembly, means whereby the opposed ends of said ram assembly extend functionally between said primary and secondary uprights whereby fluid under pressure introduced to said ram assembly will lift said secondary uprights

relatively to said primary uprights, a second ram cylinder shorter than said first ram cylinder and positioned about said first ram cylinder and constituting therewith a second ram assembly, means whereby fluid under pressure is admitted to said first ram assembly, means whereby said first ram assembly is in fluid communication with said second ram assembly whereby fluid introduced into said first ram assembly will enter said second ram assembly to move said second ram cylinder vertically on said first ram cylinder, after which the fluid will move the first ram cylinder together with said second ram cylinder relatively to said ram piston, and means whereby said second ram assembly lifts said load carriage relatively to said secondary uprights.

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No references cited.