Aug. 8, 1950 G. F. QUAYLE 2,518,251

INDUSTRIAL TRUCK

Filed Jan. 23, 1948 5 Sheets-Sheet 1

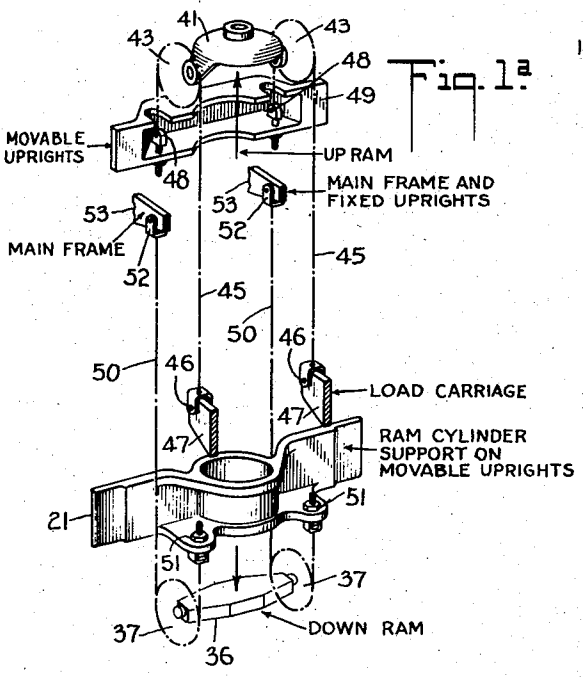


Fig. 1a.

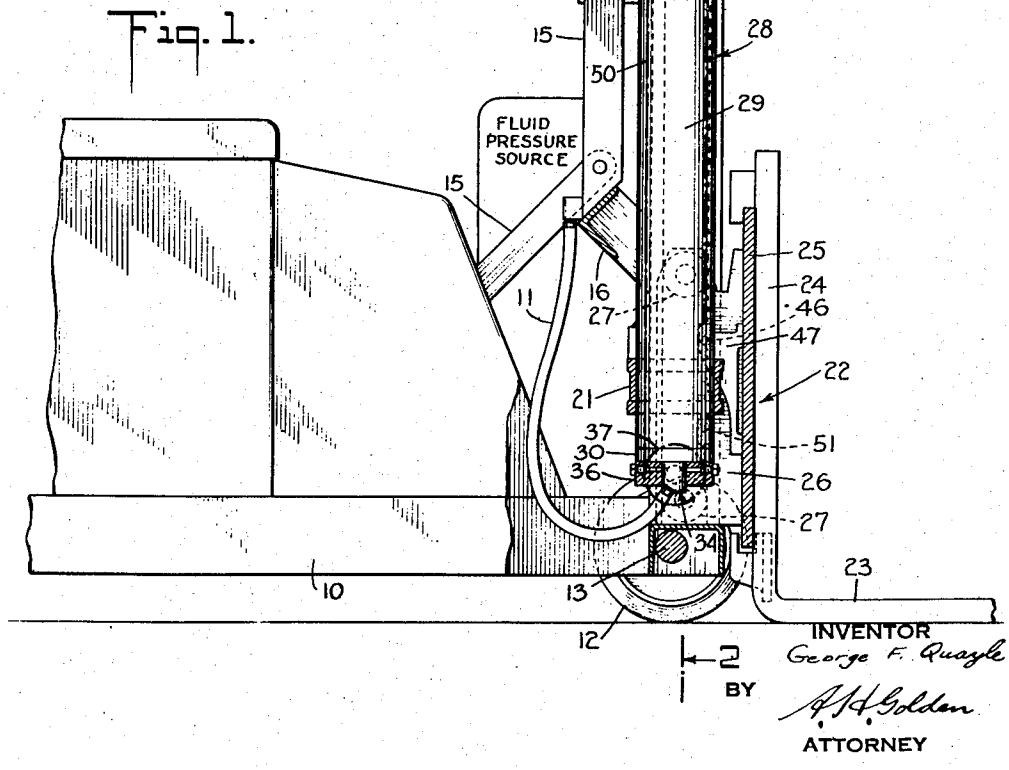


Fig. 1.

INVENTOR
George F. Quayle
BY
A. H. Golden
ATTORNEY

Aug. 8, 1950 G. F. QUAYLE 2,518,251

INDUSTRIAL TRUCK

Filed Jan. 23, 1948 5 Sheets-Sheet 2

Fig. 2.

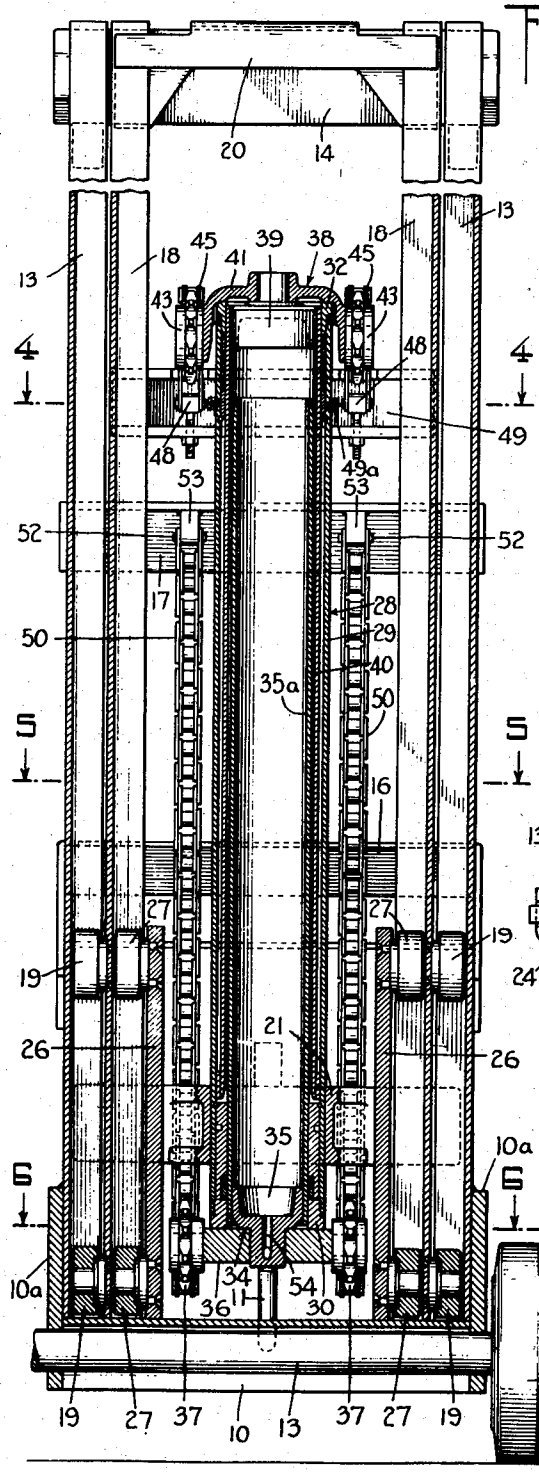


Fig. 3.

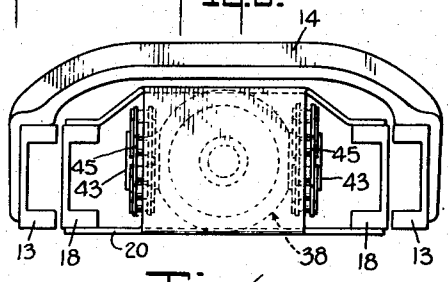


Fig. 4.

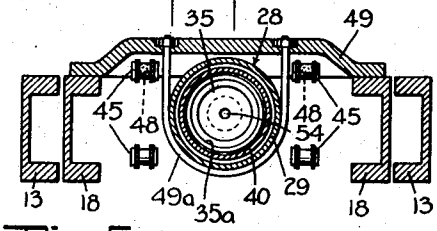


Fig. 5.

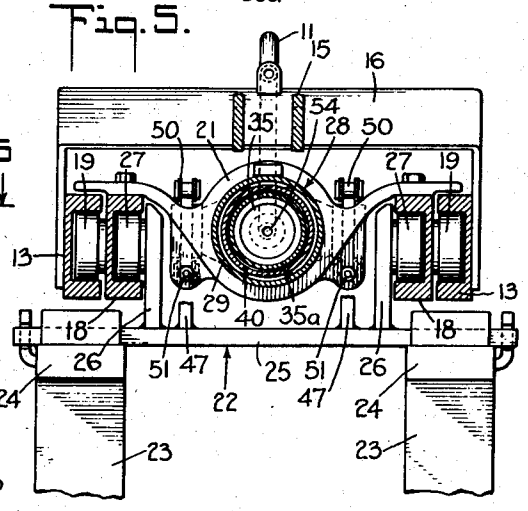
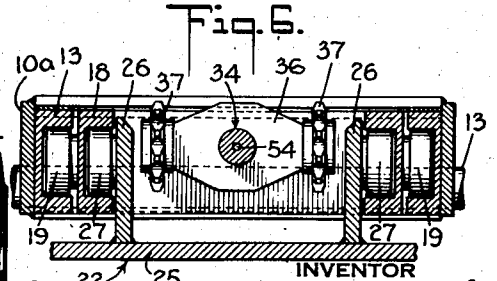


Fig. 6.



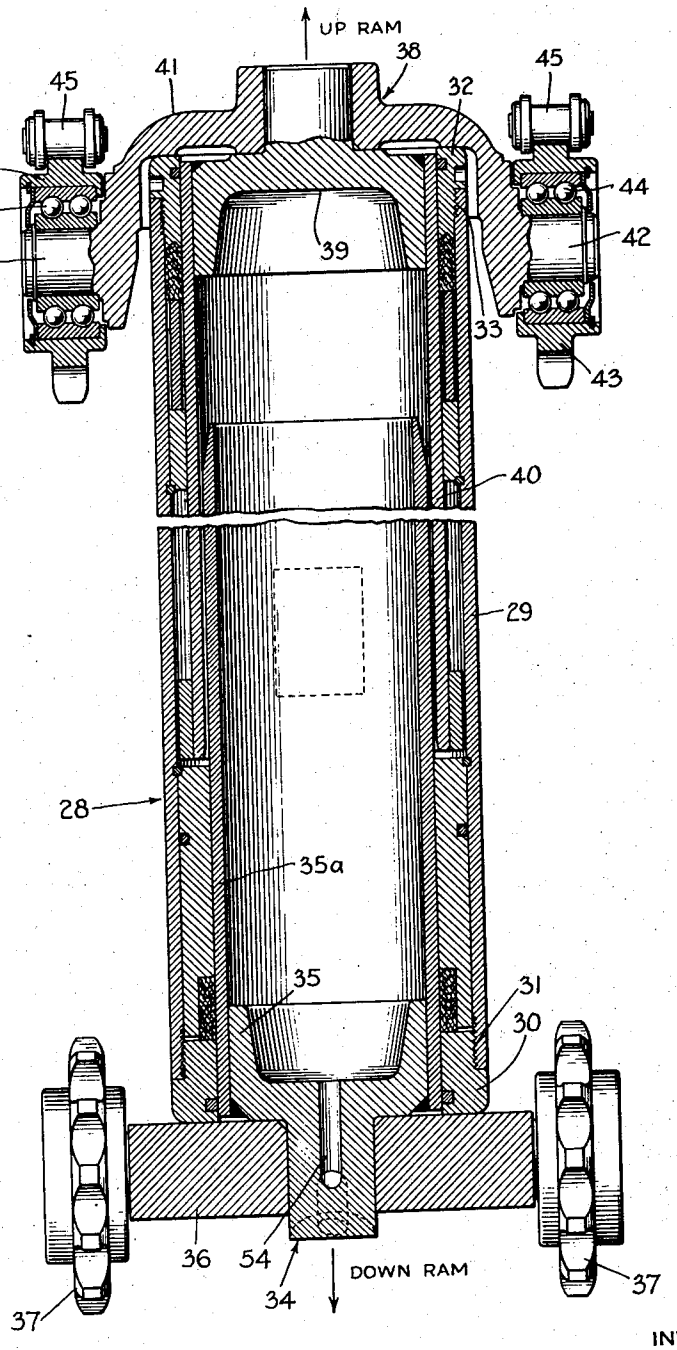
INVENTOR
George F. Quayle
BY
ATTORNEY

Aug. 8, 1950 G. F. QUAYLE 2,518,251

INDUSTRIAL TRUCK

Filed Jan. 23, 1948 5 Sheets-Sheet 3

Fig. 7.



INVENTOR
George F. Quayle
BY A. H. Golden
ATTORNEY

Aug. 8, 1950 G. F. QUAYLE 2,518,251

INDUSTRIAL TRUCK

Filed Jan. 23, 1948 5 Sheets-Sheet 4

Fig. 8.

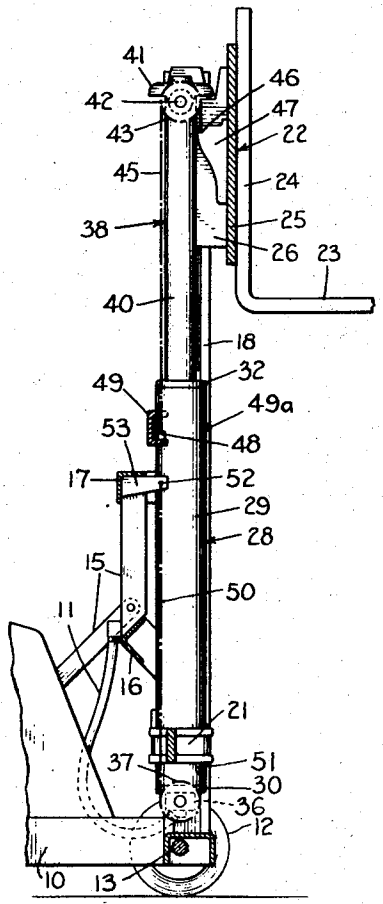
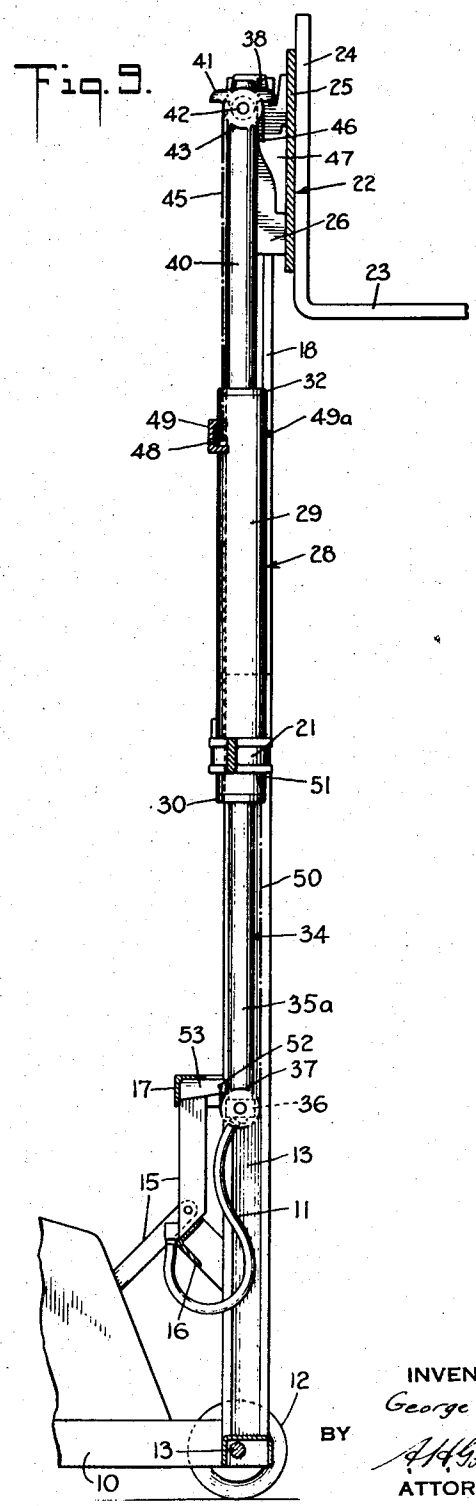


Fig. 9.



INVENTOR
George F. Quayle
BY
A. H. Golden
ATTORNEY

Aug. 8, 1950 G. F. QUAYLE 2,518,251

INDUSTRIAL TRUCK

Filed Jan. 23, 1948 5 Sheets-Sheet 5

Fig. 12.

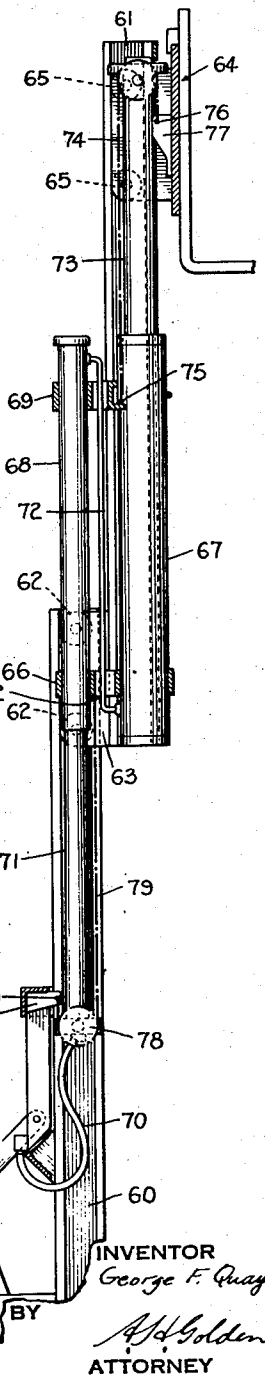


Fig. 13.

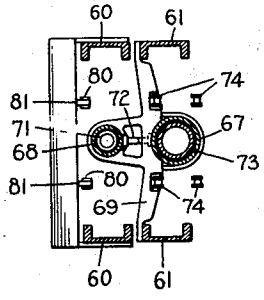


Fig. 14.

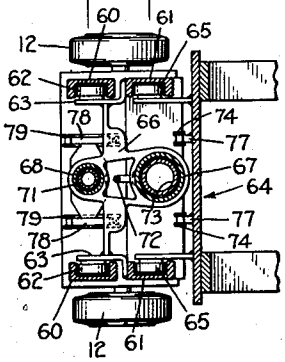


Fig. 10.

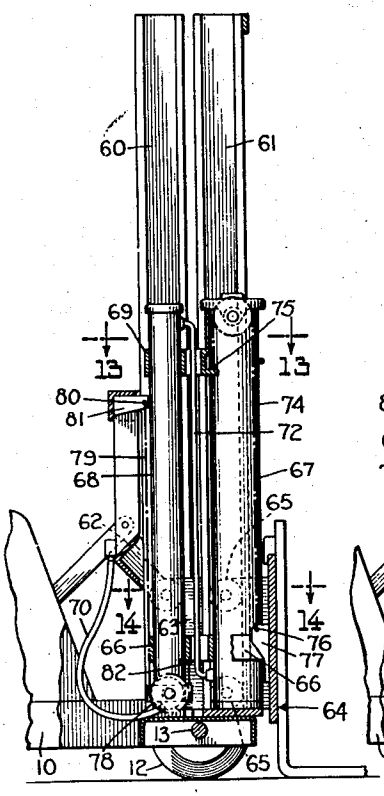
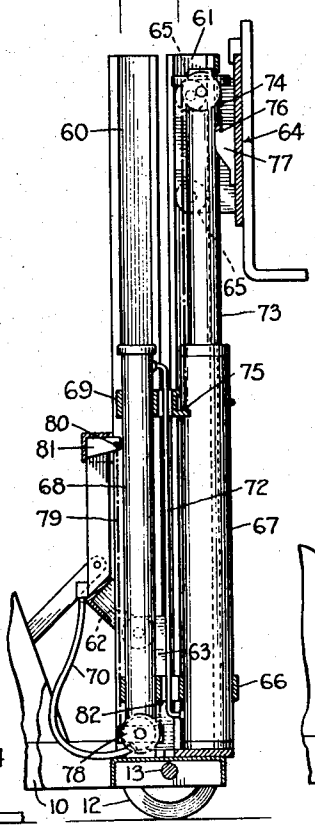


Fig. 11.



INVENTOR
George F. Quayle
BY
A. H. Golden
ATTORNEY

Patented Aug. 8, 1950 2,518,251

UNITED STATES PATENT OFFICE

2,518,251

INDUSTRIAL TRUCK

George F. Quayle, Philadelphia, Pa., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Application January 23, 1948, Serial No. 3,853

27 Claims. (Cl. 187—9)

1

This invention relates to an industrial truck of the type in which a load elevating carriage is moved vertically with respect to a main frame for lifting and lowering a load.

In trucks of the particular class, it is customary to mount the load elevating carriage for lifting movement on a pair of secondary uprights, the secondary uprights being in turn mounted for vertical movement on primary uprights. For lifting the carriage on the secondary uprights, and for further lifting the secondary uprights on the primary uprights, it is customary in one type of truck to use a hydraulic ram, comprising a cylinder within which operates a ram that takes the form of a sleeve or solid piston.

As those skilled in the art will fully appreciate, it is exceedingly important that the load elevating carriage be capable of some lifting movement prior to the movement of the secondary uprights, so that the overall height of the truck shall not be increased when the carriage is lifted a limited amount. This arrangement is especially necessary where a truck is used for moving loads in and out of freight cars, it being there essential that the overall height of the truck be maintained at a minimum, while the load elevating carriage moves to stack the load within the freight car or to remove a load from a stack in the car. It is also essential in trucks of the particular class that the elevating ram itself be not unduly exposed, and that it shall not extend above the primary or secondary uprights during the lifting movement of the elevating carriage.

In one form of prior art truck, the elevating ram is adapted to raise the elevating carriage through means of a chain, while adapted to elevate the secondary uprights through direct physical contact between the ram piston and the said secondary uprights. This direct physical contact is not made until after the ram has moved a predetermined degree to lift the elevating carriage a relatively short distance from the ground. Because the distance the carriage may move prior to the movement of the secondary uprights is limited, the particular form of prior art truck cannot be used successfully in many load handling installations.

In an application for patent filed by Bronislaus I. Ulinski, Ser. No. 692,465, there is disclosed an ingenious solution for the problem in which two rams are utilized for lifting the load elevating carriage and the secondary uprights. One of the rams operates between the secondary uprights and the load elevating carriage to lift the carriage, while the other ram operates between

2

the primary uprights and the secondary uprights to lift the secondary uprights together with the carriage relatively to the primary uprights. This truck has been very successful commercially, as those skilled in the art fully appreciate.

It is the object of my invention to improve the prior art trucks of the particular class described by contributing a more effective and efficient mechanism.

A feature of my invention resides in the utilization of a pair of hydraulic rams, with one ram preferably pressing upwardly to lift the carriage relatively to the secondary uprights, while the other ram presses vertically downwardly to lift the secondary uprights relatively to the primary uprights. By mounting the two rams on the secondary uprights, and by directing their operation as indicated, I am able to effect a considerable saving in hydraulic connections while utilizing to the very minimum a flexible hose connection between the fluid pressure source on the main frame and the rams on the moving secondary uprights. Moreover, I am able to obtain a full lift of the load carriage prior to any lift of the secondary uprights. These contributions are of exceeding importance, as those skilled in the art will understand.

As a further feature of the invention, the two rams may be telescoped for operation, thereby requiring only a single cylinder, the larger of the two rams pressing upwardly to lift the carriage relatively to the secondary uprights, while the smaller of the two rams presses downwardly to lift the secondary uprights relatively to the primary uprights. As a further feature of this part of the invention, no control means are utilized for directing the fluid against either of the rams, the fluid moving inherently against the larger ram because it has a larger area than the smaller ram and also carries the lighter load. The smaller of the two rams naturally operates last to raise the secondary uprights relatively to the primary uprights. Actually, I have found that even if the two rams are the same size, as may be the case where I utilize two cylinders rather than one cylinder, the ram operating against the carriage will move first because it handles the lighter load, the other ram being required, naturally, to move both the carriage and secondary uprights as well as the rams themselves.

A further feature of the invention resides in the utilization of an extremely short flexible hose connection between the fluid pressure source on the main frame and the rams. As a still fur-

ther feature of this part of the invention, the ram assembly of my invention is arranged so that the fluid from the pressure source enters the ram cylinder or cylinders through the downwardly pressing ram, making possible thereby an extremely short flexible hose connection, all as will be very clear after a reading of the specification.

A further feature of my invention resides in the efficient utilization of flexible members such as chains for lifting the secondary uprights by downward pressure of a ram.

I have thus outlined the general nature of my invention and its relation to the prior art in order that the 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 the 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 a vertical elevation and partial section of the load lifting end of a truck of the particular class described. Fig. 1*a* is a perspective diagrammatic sketch illustrating the functional operation of my two rams. Fig. 2 is a section taken along lines 2—2 of Fig. 1. Fig. 3 is a view looking downwardly on the structure of Fig. 2. Figs. 4, 5, and 6 are sections taken respectively along lines 4—4, 5—5, and 6—6 of Fig. 2. Fig. 7 is a vertical section through the telescopic ram assembly. Fig. 8 is a view of the structure of Fig. 1, showing the elevating carriage in its fully elevated position relatively to the secondary uprights. Fig. 9 is a view along the same lines as Fig. 8, showing the secondary uprights raised relatively to the primary uprights. Fig. 10 is a view similar to that of Fig. 1, but showing a modification in which two cylinders are utilized for the two rams. Fig. 11 is a view showing the modification of Fig. 10, with the elevating carriage raised relatively to the secondary uprights. Fig. 12 is a view similar to that of Fig. 11, but showing the secondary uprights raised relatively to the primary uprights. Figs. 13 and 14 are sections taken respectively along lines 13—13 and 14—14 of Fig. 10.

Referring now more particularly to the drawings, and more especially to Figs. 1, 8, and 9, the main frame of a standard industrial truck is designated by reference numeral 10, the particular truck being of that type which is electrically propelled and which is equipped with an electrically operated pump for generating hydraulic pressure that is supplied through a flexible hydraulic line 11 to suitable rams. The truck is supported at one end by wheels 12 mounted on an axle 13, the other end of the truck being not shown, but being of the usual class well known in this art. Since my invention relates particularly to the mounting and movement of the elevating carriage and secondary uprights, I think it unnecessary to describe in further detail the truck per se.

Referring now more particularly to Fig. 2, considered with relation to the remaining Figs. 1 to 9 showing my first modification, the main

frame 10 of the truck is equipped with side plates 10*a* to which are welded a pair of vertical primary fixed uprights 13. These primary fixed uprights 13, as shown in Fig. 3, are reinforced by a transverse bar 14 and are otherwise braced relatively to the truck by structural frame members 15, 16, and 17 best illustrated in Fig. 1. A pair of secondary uprights 18 is equipped with upper and lower rollers 19 for vertical movement relatively to the primary uprights 13. Secondary uprights 18 are braced at their upper ends by a cross assembly 20, and are further reinforced at an intermediate point by ram supporting casting 21, probably best illustrated in Fig. 1*a*, where it is shown in perspective.

The load elevating carriage is designated generally by reference numeral 22 and is here shown equipped with forks 23, each having vertical portions 24 carried by plate 25 best illustrated in Figs. 5 and 6. Plate 25 has welded thereto rearwardly extending brackets 26 carrying upper and lower rollers 27 through which the load elevating carriage 22 is adapted to move vertically relatively to the secondary uprights 18. As thus far described, my truck resembles closely the trucks of the prior art.

In the first modification of my invention to be here described, I use a pair of rams operating within a single ram cylinder through the telescoping of the said rams. Thus, referring now particularly to Fig. 7 taken with relation to Fig. 2 and the remaining figures showing the first modification, the cylinder used by me is designated generally by reference numeral 28. Cylinder 28 comprises an outer sleeve 29 having a lower cap 30 screwed thereto at 31 and an upper cap 32 screwed thereto at 33. The inner telescoping ram is termed by me the down ram and is designated generally by reference numeral 34. Down ram 34 is formed of a head casting 35 and a sleeve portion 35*a* welded together as is clearly illustrated and adapted to move downwardly for actuating a cross bar 36 on which is rotatably mounted a pair of opposed sprockets 37.

The outer telescoping ram is called by me the up ram and is designated generally by reference numeral 38. Up ram 38 is formed of a head casting 39 and a sleeve portion 40 mounted as illustrated best in Fig. 7 for vertical sliding movement. A cross bar 41 is carried by the up ram 38 and is formed with stub shafts 42 relatively to which are mounted sprockets 43 through means of ball bearings 44. It is well at this point to indicate that the sprockets 37 are mounted on the down ram 34 in the same manner as the sprockets 43 are mounted on the up ram 38. It will be well also to indicate that I utilize certain spacer and sealing sleeves within the ram cylinder in addition to various hydraulic seals, all as shown in my drawings, but which I do not believe need be described in detail as they are customary in the art and per se form no part of my invention herein claimed.

The ram cylinder 28 is adapted to be carried and supported by the secondary and movable uprights 18 through the casting 21 best illustrated in Figs. 1*a* and 5, and to be further supported relatively to uprights 18 by a cross assembly 49, best seen in Fig. 4, through a U-bail 49*a*. Preferably, the ram assembly will be welded to the casting 21, but it may be otherwise secured thereto, if desired. For the purposes of my invention, it merely need be appreciated that the ram cylinder 28 will be fixed to the secondary uprights for movement bodily therewith.

Referring now more particularly to Figs. 1, 1a, and 2, a pair of sprocket chains, each designated by reference numeral 45, is utilized for lifting the load carriage 22 relatively to the secondary or movable uprights 18. Each chain 45 is secured at 46 to a bracket 47 welded to the plate 25 of the load carriage 22, as best illustrated in Fig. 5. The other end of each chain 45 is secured at 48 relatively to the reinforcing cross assembly 49 welded to the secondary or movable uprights 18 as probably best shown in Fig. 2. Chains 45 are maintained in an upwardly extending vertical bight with each chain in engagement with a sprocket 43 of the up ram 38. Obviously, movement of the up ram 38 will act on the chains to lift the load carriage relatively to the secondary uprights, the rate of movement being twice the speed of movement of the ram itself.

For lifting the secondary uprights 18 relatively to the primary or fixed uprights 13, I utilize a pair of chains each designated by reference numeral 50. One end of each chain 50 is secured at 51 to the ram cylinder supporting casting 21, as is best seen in Figs. 1a and 5. The other end of each chain 50 is secured at 52 to a bracket 53 that is an integral part of the main frame, as probably best illustrated in Figs. 1, 8, and 9. Each of the chains 50 is reeved to form a downwardly extending bight passing around sprockets 37 moving with the down ram 34. Upon downward movement of the down ram 34 relatively to the ram cylinder 28, since brackets 53 of the main frame are stationary, it follows that the ram cylinder 28 will be moved upwardly. Therefore, the casting 21 will also move upwardly and will carry with it the secondary uprights. I believe this arrangement to be a novel and important contribution to the art.

For supplying fluid to the ram cylinder 28, the head casting 35 of the down ram 34 is formed with bored passages 54 in communication with the flexible hose 11. Thereby, upon the operation of suitable valve mechanism of a class well understood in the art and therefore not here described in detail, the source of hydraulic pressure will direct fluid through the flexible hose 11 into the ram cylinder for operation against the head casting 35 of the down ram 34 and the head casting 39 of the up ram 38.

The operation of my invention will now be summarized through reference to Figs. 1, 1a, 8 and 9. In the position of the parts in Fig. 1, the two rams are fully telescoped and the secondary or movable uprights 18 are in their fully lowered position relatively to the fixed or primary uprights 13. Let us say that fluid under pressure is now introduced into the ram cylinder 28 through bored passages 54 of down ram 34. Because the up ram 38 has a larger cross sectional area than the down ram 34, and because the up ram is required to lift a lighter load than the down ram 34, it is obvious that the fluid will act first on the up ram 38 to move it from the position of Fig. 1 to the position of Fig. 8. This movement of the up ram 38 effects, through the sprockets 43, the movement of the chains 45 from the position of Fig. 1a to the position of Fig. 8. Thus, in the position of Fig. 8, the relatively limited movement of the up ram 38 has, through the chains 45, effected a lifting movement of the load carriage 22 that is double the movement of the ram 38.

With the load carriage 22 now fully elevated relatively to the secondary uprights, greater pressure will be developed within the ram cylinder 28 and this pressure will now actuate the down ram 34. Upon movement of the down ram 34 relatively to the cylinder 28 from the position of Fig. 8 to the position of Fig. 9, the chains 50 will be moved from the position of Figs. 1a and 8 to the position of Fig. 9. Since, as earlier described, brackets 53 cannot move, the relative movement between the down ram 34 and the ram cylinder 28 will effect the upward movement of the cylinder and the movable or secondary uprights 18 to the position of Fig. 9. Thus, it will be appreciated that the introduction of fluid into the ram cylinder 28 will effect a lifting of the load carriage relatively to the secondary uprights and thereafter a lifting of the secondary uprights relatively to the primary uprights.

It will be interesting to note by reference to Figs. 8 and 9 that the flexible hose 11 has very little movement contributed thereto during the lifting operation. This is due to the fact that while the secondary or movable uprights move vertically upwardly to the position of Fig. 9, the ram 34 itself moves downwardly relatively to the secondary uprights with a net upward movement that is quite limited. Therefore, the effective movement of the movable end 11a of the hose 11 will be extremely small with relation to the movement of the load carriage 22. This is of extreme importance, as those skilled in the art will understand. Moreover, it is important to appreciate that my invention requires the utilization of but the single short hose 11 rather than the rather extensive movable hose connections of the prior art.

Referring now to Figs. 10 to 14 inclusive, I show there a modified form of my invention in which the down ram and the up ram are mounted in separate cylinders. The functional operation of the two rams is identical in every way, however, with that of the two rams of the first modification.

The fixed or primary uprights of my second modification are designated by reference numeral 60 and mount for movement relatively thereto movable secondary uprights 61 through suitable upper and lower rollers 62 supported by brackets 63 extending from the secondary uprights 61 as best illustrated in Fig. 14. The load carriage of my second modification is designated by reference numeral 64, and it is adapted for movement through upper and lower rollers 65 relatively to the secondary or movable uprights 61.

Secondary uprights 61 have secured thereto a lower ram supporting casting 66 similar in many respects to the casting 21 of the first modification, except that it is adapted to support an up ram cylinder 67 and a down ram cylinder 68. Preferably, I utilize an additional upper ram supporting casting 69 for bracing and otherwise securing in position the two ram cylinders 67 and 68. A flexible hose 70 extends, as does the flexible hose 11 of the first modification, to the down ram 71, this down ram being bored as is the down ram 34 of the first modification, so that fluid may enter therethrough into the down ram cylinder 68. Fluid is then conducted from the upper end of the down ram cylinder 68 through a pipe 72 to the lower end of the up ram cylinder 67 for action against the up ram 73.

Up ram 73 is equipped with suitable sprockets acting against a pair of chains 74 similar to chains 45 of my first modification. One end of each of the chains 74 is secured at 75 to the casting 69 forming part of the secondary or movable

uprights. Each chain is secured at its other end at 76 to a bracket 77 forming part of the load elevating carriage 64. The movement of up ram 73 will obviously lift carriage 64 just as the carriage 22 of the first modification is lifted by its up ram 38.

Down ram 71 operates through a pair of sprockets 78 against a pair of chains 79. One end of each of the chains 79 is secured at 80 to a bracket 81 forming part of the main frame as in the case of the first modification. Each chain 79 has its other end secured at 82 to the ram cylinder supporting casting 66 forming part of the secondary uprights 61. The movement of down ram 71 will lift the secondary uprights 61 just as the movement of down ram 34 lifts the secondary uprights 22 of my first modification.

The two ram cylinders 68 and 67 may actually be made the same size and will operate sequentially because ram cylinder 67 is adapted to lift through its ram 73 a smaller load than is to be lifted by ram 71 of cylinder 68. However, in the drawings, I show the ram 71 to be smaller in size than the ram 73 in order to better emphasize the invention.

It will now be quite clear that when fluid is first introduced through the flexible hose 70 into the cylinder 68, it will flow through the pipe 72 against the relatively larger ram 73 to lift the load carriage 64 to its position of Fig. 11 on the secondary uprights 61. As soon as this is accomplished, the pressure will be increased so as to act on the smaller ram 71, and to lower that ram relatively to its cylinder 68. This movement will operate through the chains 79 relatively to the fixed points 80 so as to raise the secondary uprights together with the primary uprights and the carriage to the position of Fig. 12. As I have already indicated, the functional operation of the two rams 71, 73 is exactly the same as that of the down ram 34 and up ram 38 of the first modification. It will be noted further that, just as in the first modification, it is necessary to use but a very short flexible hose 70 and that this flexible hose will have but very little movement because of its particular connection in the hydraulic system.

I believe that the considerable merits and the great simplicity of my invention will now be understood and appreciated by those skilled in the art.

I now claim:

1. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, and means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights.

2. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram pressing downwardly when hydraulic pressure is applied thereto and the other ram pressing upwardly when hydraulic pressure is applied thereto, means whereby one of said rams lifts said carriage relatively to said secondary uprights, and means whereby the other of said rams lifts said uprights relatively to said primary uprights.

3. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto, means whereby one of said rams lifts said carriage relatively to said secondary uprights, and means whereby the other of said rams lifts said uprights relatively to said primary uprights.

4. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, means whereby the upwardly moving ram lifts said load carriage relatively to said secondary uprights, and means whereby the downwardly moving ram lifts said secondary uprights relatively to said primary uprights.

5. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a flexible member secured at one end to said secondary uprights and at the other end to said load carriage, means whereby said upwardly moving ram applies pressure to said flexible member whereby to move said carriage upwardly relatively to said secondary uprights, a second flexible member secured at one end to said primary uprights and at the other end to said secondary uprights, and means whereby said downwardly moving ram upplies pressure to said flexible member to lift said secondary uprights relatively to said primary uprights.

6. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a flexible member secured at one end to said secondary uprights and at the other end to said load carriage while forming an upward bight, means whereby said upwardly

moving ram applies pressure to said flexible member whereby to move said carriage upwardly relatively to said secondary uprights, a second flexible member secured at one end to said primary uprights and at the other end to said secondary uprights while forming a downward bight, and means whereby said downwardly moving ram applies pressure to said flexible member to lift said secondary uprights relatively to said primary uprights.

7. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a chain secured at one end to said secondary uprights and at the other end to said load carriage, a sprocket whereby said upwardly moving ram applies pressure to said chain to move said carriage upwardly relatively to said secondary uprights, a chain secured at one end to said primary uprights and at the other end to said secondary uprights, and a sprocket whereby said downwardly moving ram applies pressure to said chain to lift said secondary uprights relatively to said primary uprights.

8. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto, a chain secured at one end to said secondary uprights and at the other end to said load carriage while forming an upward bight, a sprocket whereby said upwardly moving ram applies pressure to said chain to move said carriage upwardly relatively to said secondary uprights, a chain secured at one end to said primary uprights and at the other end to said secondary uprights while forming a downward bight, and a sprocket whereby said downwardly moving ram applies pressure to said chain to lift said secondary uprights relatively to said primary uprights.

9. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load cariage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted on said secondary uprights for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a chain secured at one end to said secondary uprights and at the other end to said load carriage while forming an upward bight, a sprocket whereby said upwardly moving ram applies pressure to the bight of said chain to move said carriage upwardly relatively to said secondary uprights, a chain secured at one end to said primary uprights and at the other end to said secondary uprights while forming a downward bight, and a sprocket whereby said downwardly moving ram applies pressure to the bight of said chain to lift said secondary uprights relatively to said primary uprights.

10. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, and means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights.

11. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, means whereby the upwardly moving ram lifts said load carriage relatively to said secondary uprights, and means whereby the downwardly moving ram lifts said secondary uprights relatively to said primary uprights.

12. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a flexible member secured at one end to said secondary uprights and at the other end to said load carriage, means whereby said upwardly moving ram applies pressure to said flexible member whereby to move said carriage upwardly relatively to said secondary uprights, a second flexible member secured at one end to said primary uprights and at the other end to said secondary uprights, and means whereby said downwardly moving ram applies pressure to said flexible member to lift said secondary uprights relatively to said primary uprights.

13. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, a chain secured at one

end to said secondary uprights and at the other end to said load carriage, a sprocket whereby said upwardly moving ram applies pressure to said chain to move said carriage upwardly relatively to said secondary uprights, a chain secured at one end to said primary uprights and at the other end to said secondary uprights, and a sprocket whereby said downwardly moving ram applies pressure to said chain to lift said secondary uprights relatively to said primary uprights.

14. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights, said downwardly moving ram having a bore therethrough whereby fluid is transmitted into said hydraulic ram cylinder and against said rams, said bore extending to an outer lower surface of said ram, and means of connection between a source of hydraulic pressure and said bore.

15. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, means whereby the upwardly moving ram lifts said load carriage relatively to said secondary uprights, means whereby the downwardly moving ram lifts said secondary uprights relatively to said primary uprights, said downwardly moving ram having a bore therethrough whereby fluid is transmitted into said hydraulic ram cylinder and against said rams, said bore extending to an outer lower surface of said ram, and means of connection between a source of hydraulic pressure and said bore.

16. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a hydraulic ram cylinder mounted on said secondary uprights, a pair of telescoping rams in said cylinder adapted for movement relatively thereto with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights, said downwardly moving ram telescoping within the upwardly moving ram and having a bore therethrough whereby fluid is transmitted into said hydraulic ram cylinder and against said rams, said bore extending

to an outer lower surface of said ram, and a flexible hose connection between a source of hydraulic pressure and said bore.

17. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic ram cylinders mounted on said secondary uprights, a ram in one of said cylinders moving downwardly when hydraulic pressure is applied thereto, a ram in the other of said cylinders moving upwardly when hydraulic pressure is applied thereto, and means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights.

18. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic ram cylinders mounted on said secondary uprights, a ram in one of said cylinders moving downwardly when hydraulic pressure is applied thereto, a ram in the other of said cylinders moving upwardly when hydraulic pressure is applied thereto, means whereby the upwardly moving ram lifts said load carriage relatively to said secondary uprights, and means whereby the downwardly moving ram lifts said secondary uprights relatively to said primary uprights.

19. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic ram cylinders mounted on said secondary uprights, a ram in one of said cylinders moving downwardly when hydraulic pressure is applied thereto, a ram in the other of said cylinders moving upwardly when hydraulic pressure is applied thereto, a flexible member secured at one end to said secondary uprights and at the other end to said load carriage, means whereby said upwardly moving ram applies pressure to said flexible member whereby to move said carriage upwardly relatively to said secondary uprights, a second flexible member secured at one end to said primary uprights and at the other end to said secondary uprights, and means whereby said downwardly moving ram applies pressure to said flexible member to lift said secondary uprights relatively to said primary uprights.

20. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic ram cylinders mounted on said secondary uprights, a ram in one of said cylinders moving downwardly when hydraulic pressure is applied thereto, a ram in the other of said cylinders moving upwardly when hydraulic pressure is applied thereto, a chain secured at one end to said secondary uprights and at the other end to said load carriage, a sprocket whereby said upwardly moving ram applies pressure to said chain whereby to

move said carriage upwardly relatively to said secondary uprights, a chain secured at one end to said primary uprights and at the other end to said secondary uprights, and a sprocket whereby said downwardly moving ram applies pressure to said chain to lift said secondary uprights relatively to said primary uprights.

21. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a ram cylinder, a pair of telescoping hydraulic rams in said cylinder for moving said secondary uprights relatively to said primary uprights and said load carriage relatively to said secondary uprights, means whereby a source of hydraulic pressure is connected to said cylinder for the flow of fluid against said rams, one of said rams being larger than the other ram in relation to the loads accepted thereby to a degree sufficient to direct the fluid pressure first to the relatively larger ram and then to the relatively smaller ram.

22. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a ram cylinder, a pair of telescoping hydraulic rams in said cylinder, means whereby a source of hydraulic pressure is connected to a bore in one of said rams whereby to introduce fluid under pressure into said ram cylinder for action against both rams, means whereby one of said rams lifts said load carriage relatively to said secondary uprights while the other of said rams lifts said secondary uprights relatively to said primary uprights, and the load thus applied to one of said rams being lighter in proportion to its pressure area than the load thus applied to the other ram whereby one of said rams is actuated automatically in advance of the other ram.

23. In a truck of the class described, a pair of uprights, load carrying means, means mounting said load carrying means for vertical movement on said uprights, a ram cylinder fixed on said load carrying means, a ram in said cylinder adapted for downward vertical movement relatively to said ram cylinder and load carrying means upon the application of fluid pressure to said ram, and means whereby downward movement of said ram lifts said load carrying means relatively to said pair of uprights.

24. In a truck of the class described, a pair of uprights, load carrying means, means mounting said load carrying means for vertical movement on said uprights, a ram cylinder fixed on said load carrying means, a ram in said cylinder adapted for downward vertical movement relatively to said ram cylinder and load carrying means upon the application of fluid pressure to said ram, a chain secured at one end to said pair of uprights and at the other end to said load carrying means, and means whereby the downward movement of said ram acts against said chain to lift said load carrying means relatively to said pair of uprights.

25. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted with one ram moving downwardly when hydraulic pressure is applied thereto and the other moving upwardly when hydraulic pressure is applied thereto, and means whereby said rams lift said carriage relatively to said secondary uprights and said secondary uprights relatively to said primary uprights.

26. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams positioned with one ram pressing downwardly when hydraulic pressure is applied thereto and the other ram pressing upwardly when hydraulic pressure is applied thereto, means whereby one of said rams lifts said carriage relatively to said secondary uprights, and means whereby the other of said rams lifts said uprights relatively to said primary uprights.

27. In a truck of the class described, primary uprights, secondary uprights, means mounting said secondary uprights for movement vertically relatively to said primary uprights, a load carriage, means mounting said load carriage for movement vertically relatively to said secondary uprights, a pair of hydraulic rams mounted with one ram pressing downwardly when hydraulic pressure is applied thereto and the other ram pressing upwardly when hydraulic pressure is applied thereto, means whereby the upwardly pressing ram lifts said load carriage relatively to said secondary uprights, and means whereby the downwardly pressing ram lifts said secondary uprights relatively to said primary uprights.

GEORGE F. QUAYLE.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,320,600	Howell	June 1, 1943
2,381,729	Dunham	Apr. 7, 1945