

May 10, 1960

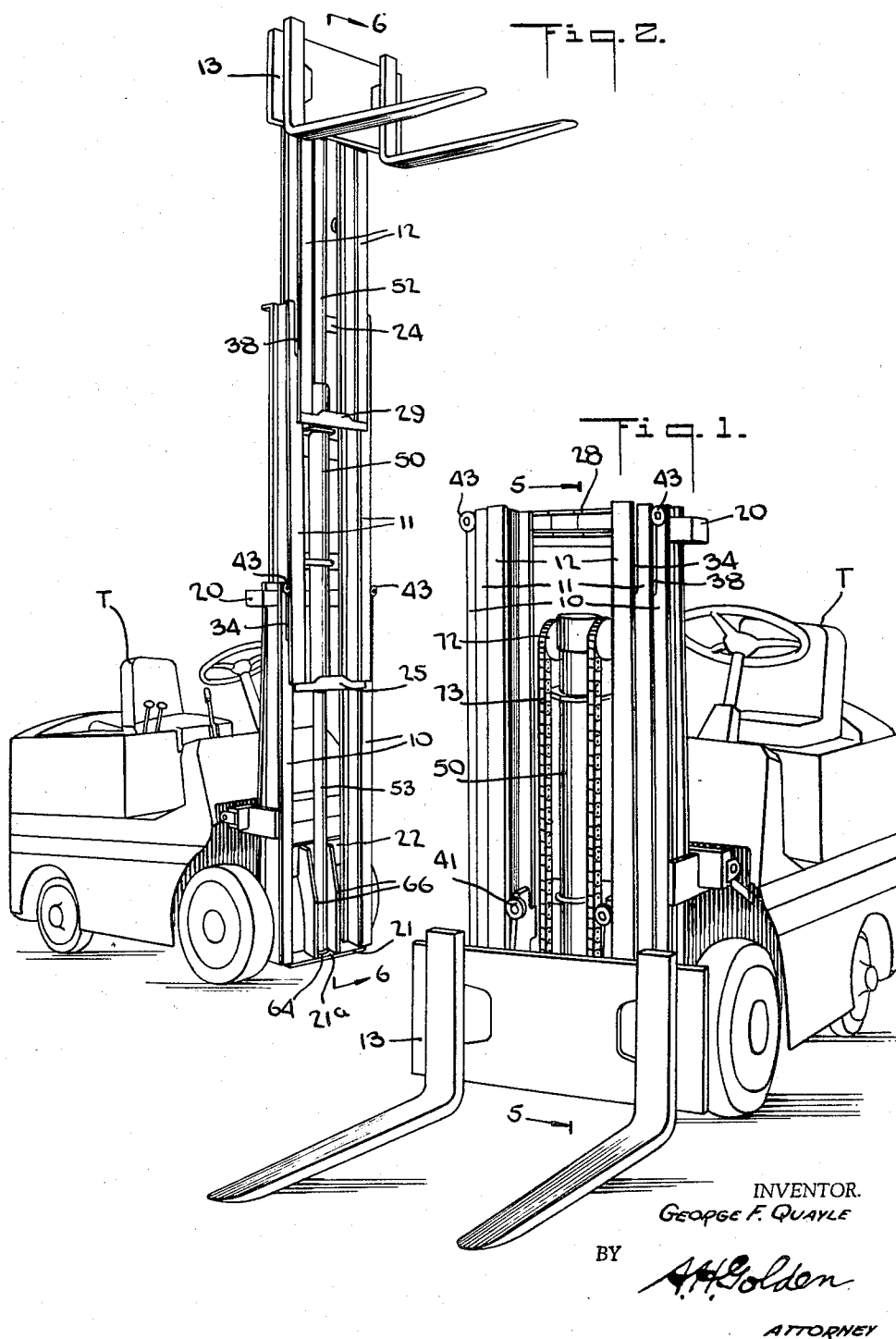
G. F. QUAYLE

2,936,047

LIFT TRUCK

Filed Oct. 16, 1957

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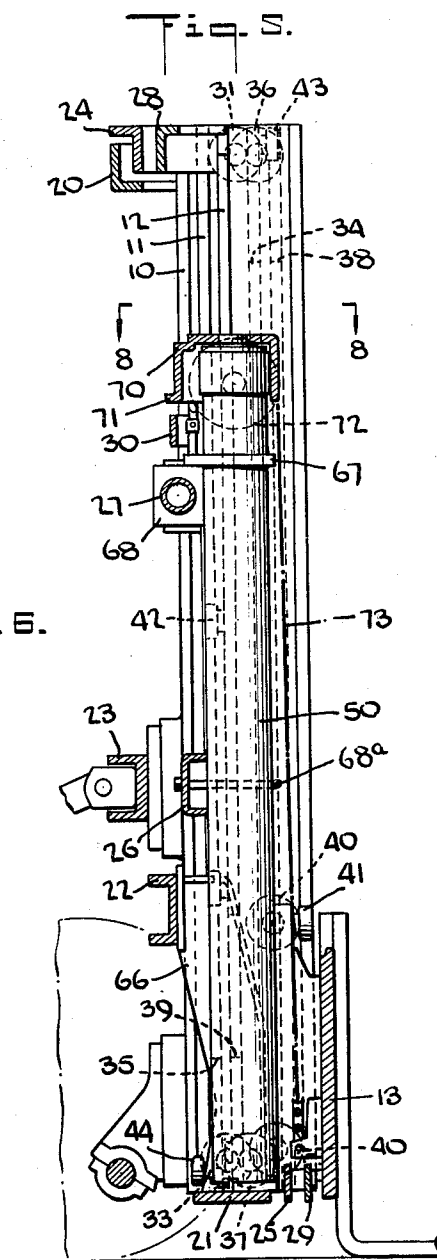
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Filed Oct. 16, 1957

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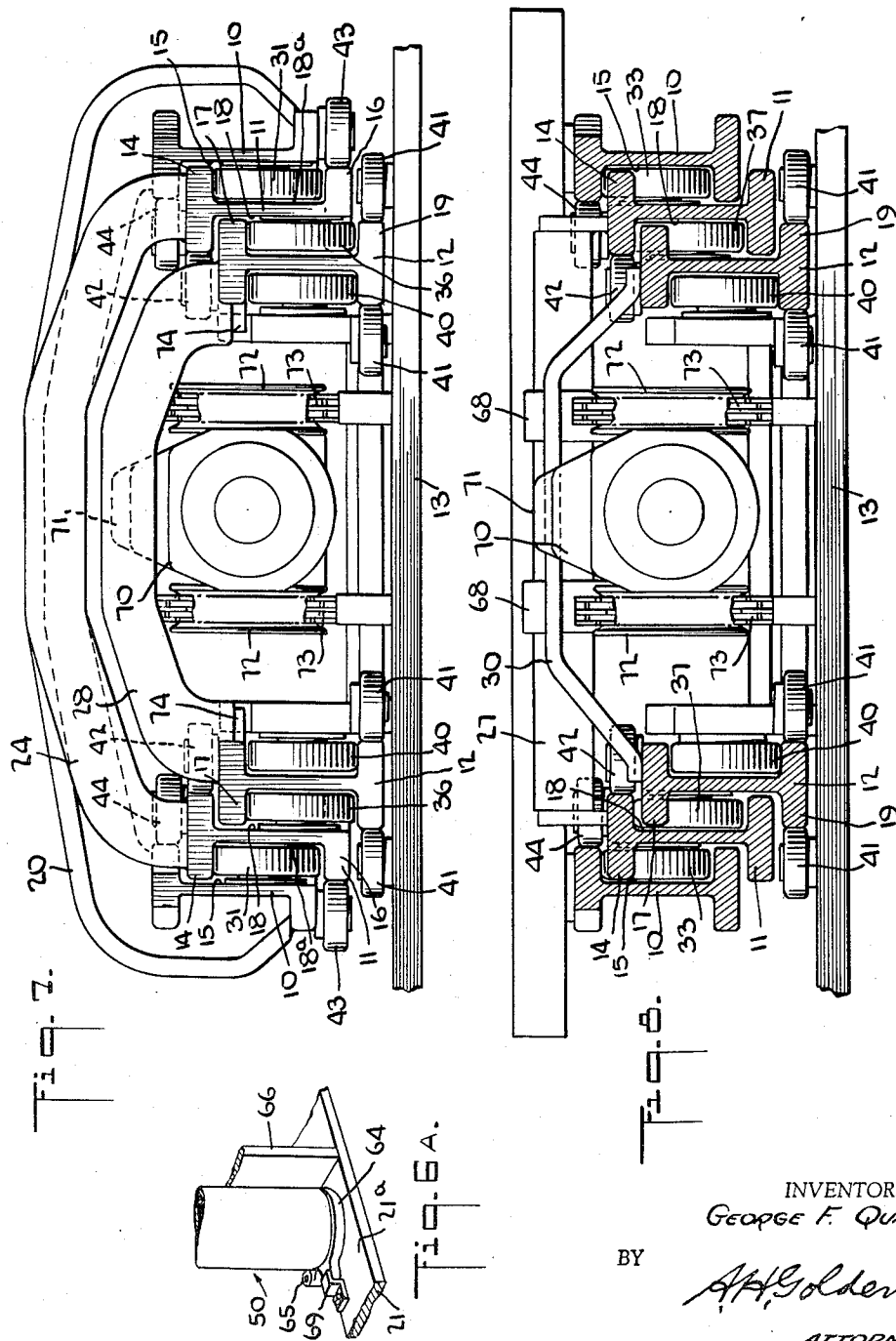
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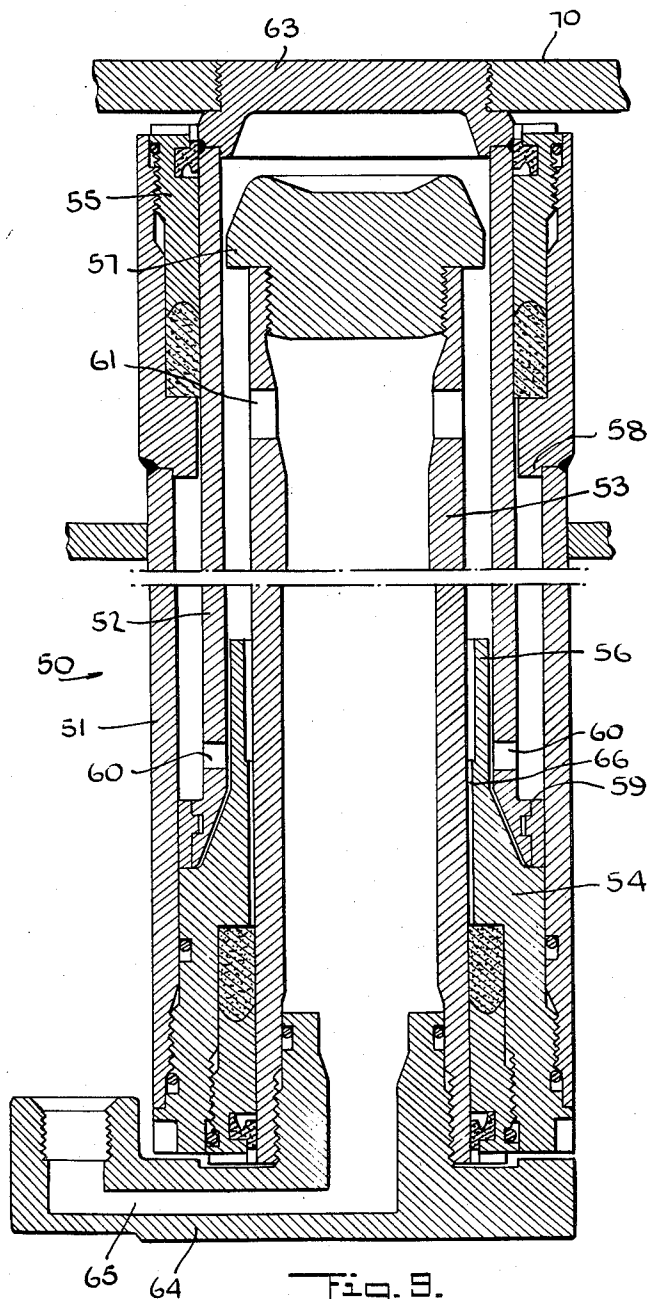


Fig. 3.

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2,936,047

LIFT TRUCK

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Application October 16, 1957, Serial No. 690,476

3 Claims. (Cl. 187—95)

This invention relates to industrial trucks of the class having a load carriage, with primary, secondary and tertiary uprights that support the carriage for vertical movement relatively to the truck.

It will be appreciated that the trucks of the particular class have very definite advantages since the secondary and tertiary uprights, by extending upwardly relatively to the primary uprights, enable the trucks to achieve extremely high lifting of the load carriage. However, due to the high lift and the particular movements that must be imparted to the carriage and uprights, the designing of the trucks presents a very considerable problem.

Thus, persons that are skilled in the art will be aware that the primary, secondary and tertiary uprights in a truck of this class must offer a strong and rigid support for the load carriage. For that purpose, a structural channel section is utilized for each upright. Then, the load carriage and uprights are assembled to one another through rollers that are engaged in the channels. Each upright in that construction may be quite rigid, but it is difficult to achieve through the rollers a fully satisfactory support for the secondary and tertiary uprights.

Actually, uprights of I-section are much to be preferred, that section not only being strong but having two opposed channels whereby an upright can accept a roller at each side thereof. This enables each secondary and tertiary upright to be supported through rollers that are spaced apart a maximum distance in a vertical direction, whereby to achieve a more rigid support for those uprights and the carriage. To illustrate, an I-section secondary upright can accept at one side a roller that is mounted on the upper end of a primary upright, while the lower end of the secondary upright carries a roller engaged in a channel of the primary upright. The I-section enables the opposed side of the same secondary upright to accept a roller mounted on the lower end of a tertiary upright, while the upper end of the secondary upright has a roller engaged in a channel of the tertiary upright. With the rollers thus mounted on the end portions of the uprights, the rollers will have a maximum vertical spacing that contributes very materially to the strength and rigidity of the upright assembly.

It has already been proposed that the particular roller arrangement be utilized on lift trucks. Nevertheless, when utilizing that arrangement, it has been thought necessary to mount the rollers through shafts that are removable, since the rollers and their shafts, when engaged in the channels of the I-section uprights, cannot pass one another in a vertical direction to enable the uprights to be assembled and disassembled. This presents a further difficulty in design since the mounting of each roller on its upright must be extremely strong and rigid.

I have conceived by my invention an exceedingly novel construction that will enable me, while utilizing the particular roller arrangement, to weld the roller shafts to the uprights, whereby to form a very strong roller support that actually is an integral part of the upright. To do this, my construction has what may be termed a bayonet

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joint between primary, secondary, and tertiary uprights, those uprights being formed with slots that enable the rollers to pass one another upon a relative movement of the uprights beyond a predetermined limit position. To prevent the movement of the uprights beyond that limit position during the normal operation of the truck, so that the uprights will not accidentally become separated, I utilize the lifting means that act in my truck to lift the secondary and tertiary uprights and load carriage. Those lifting means are themselves exceedingly novel and form a part of my invention.

More particularly, I utilize a novel hydraulic lift ram that has a part mounted on the secondary uprights, a downwardly extending part acting to lift the secondary uprights on the primary uprights, and a part that extends upwardly to lift the load carriage and tertiary uprights. The parts that extend upwardly and downwardly are equipped with stop means that limit their extending movements relatively to the part that is mounted on the secondary uprights. I then secure the downwardly extending part against separation relatively to the primary uprights so that the part can act to limit the extending movement between the primary and secondary uprights. Further, I arrange the upwardly extending part to limit the extending movement between the secondary and tertiary uprights, utilizing for that purpose pull-down means with which I equip the truck to insure downward movement of the tertiary uprights.

Actually, as will be appreciated in due course, my invention has novel features that will have very considerable value when utilized on those trucks in which a load carriage is supported merely through primary and secondary uprights. It will be understood, therefore, that those features are not necessarily limited to a truck having tertiary uprights.

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 perspective view showing an industrial truck that utilizes my invention.

Fig. 2 shows my truck with the secondary and tertiary uprights and load carriage in elevated position.

Fig. 3 is an exploded view showing the uprights and load carriage.

Fig. 3A is a somewhat diagrammatic view showing the manner in which I assemble the uprights.

Fig. 4 is a detail view showing a roller and its mounting.

Fig. 5 is a vertical section on the line 5—5 in Fig. 1.

Fig. 6 is a vertical section on the line 6—6 in Fig. 2, but with the carriage and uprights somewhat below high lift position.

Fig. 6A shows means that I utilize to secure the lower end of the lift ram.

Fig. 7 is a plan view showing the upright and ram assembly of my truck.

Fig. 8 is a cross section on the line 8—8 in Fig. 5.

Fig. 9 is a longitudinal section showing the construction of the hydraulic lift ram that I utilize in my invention.

Referring now more particularly to Figs. 1 and 2 of the drawings, I indicate my truck generally by the letter T, and I show a pair of primary uprights 10 mounted on the truck frame, secondary uprights 11 that move vertically on the primary uprights 10, a pair of tertiary uprights 12 that in turn move vertically on the secondary uprights 11, and a load carriage 13 mounted for vertical movement on tertiary uprights 12. Those skilled in the art will recognize that the uprights have the general arrangement that is usually found in trucks of the particular class.

To understand my invention, it is important to observe that each of the primary, secondary and tertiary uprights, 10, 11, 12, is a structural I-section, as best shown in Figs 7 and 8. Those I-sections are arranged in a nested but somewhat offset relation to one another. Thus, each secondary upright 11 has a flange 14 that is arranged partly in the inward facing channel 15 of the juxtaposed primary upright 10, and a flange 16 that is offset relatively to that primary upright 10 in a direction longitudinally of the truck. Similarly, each tertiary upright 12 has a flange 17 arranged in the inwardly facing channel 18 of the secondary upright 11 and a flange 19 that is longitudinally offset relatively to that secondary upright. Because of the offset relation of the I-section uprights 10, 11, 12, it will be appreciated that those uprights provide narrow exposed surfaces for guide rollers, as will presently appear.

The primary uprights 10 are assembled to one another through top, bottom and intermediate cross members 20, 21, 22, 23, best seen in Fig. 3. Similarly, the secondary uprights 11 have cross members 24, 25, 26, 27, and the tertiary uprights 12 have cross members 28, 29, 30. I shall refer again to certain of those cross members on the uprights 10, 11, 12, but I shall first describe the particular manner in which the secondary and tertiary uprights 11, 12 are mounted for vertical movement.

Thus, referring to Figs. 3 and 7 of the drawings, I utilize a roller 31 mounted on the upper end portion of each primary upright 10, that roller 31 being in position to engage in the outwardly facing channel 18a of the juxtaposed secondary upright 11. My invention enables me to mount roller 31 through a roller shaft 32 that is integrally welded to upright 10, Fig. 4, as will be understood as my description proceeds. Further, I utilize on the lower end portion of each secondary upright 11 a roller 33, Figs. 3 and 8, that roller 33 being mounted through an integrally welded shaft like the shaft 32, and engaging in the inwardly facing channel 15 of the primary upright 10. With the rollers 31 and 33 mounted on the opposed end portions of their corresponding uprights 10, 11, it will be appreciated that those rollers will act at points that are spaced a maximum distance relatively to one another and will make possible a very effective support for the secondary uprights 11.

It will be understood that the rollers 31, 33 and their shafts 32 will so obstruct one another that they cannot be moved through the ends of their respective upright channels. Further, the roller shafts, being integrally welded to their respective uprights, will not be removed for purposes of assembly. I shall now call attention to the fact that, in my invention, I form the upper portion of each primary upright 10 with a slot 34, well shown in Fig. 3 and 3A, that slot 34 extending in a part of the forward flange that is below the roller 31. Further, I form the lower portion of each secondary upright 11 with a slot 35, Figs. 3 and 3A, that extends in the rearward flange 14 above the roller 33. Slots 34 and 35 are so formed that the secondary uprights 11, when moved upwardly to an extreme position, as indicated in Fig. 3A, will place the rollers 33 in aligned relation to the slots 34, while placing the slots 35 in aligned relation to the rollers 31. It is then possible, through a horizontal movement of the secondary uprights 11, as shown by the horizontal arrows in Fig. 3A, to move the rollers 33 and 31 out of the channels in which they are engaged. Thereby

I contribute what may be termed a bayonet joint through which the secondary uprights 11 can be assembled and disassembled relatively to primary uprights 10. To do that, I do not need to remove the rollers 31, 33 or the shafts on which they rotate, and I am able to utilize roller shafts, like the shaft 32, Fig. 4, that are welded to the uprights.

I believe it will be unnecessary to describe in detail the mounting of the tertiary uprights 12 on the secondary uprights 11, because those uprights are mounted in substantially the same manner as are the secondary uprights 11. I shall state merely that the upper end portions of secondary uprights 11 carry rollers 36, Figs. 3 and 7, that are in position to engage in channels of the tertiary uprights 12, while the lower end portions of tertiary uprights 12 have rollers 37, Figs. 3 and 8, engaging in the channels 18 of secondary uprights 11. The uprights 11, 12 then have slots 38, 39 on opposed end portions, enabling me to assemble and disassemble the tertiary uprights 12 relatively to the secondary uprights 11 in the way that I have already described in connection with the uprights 10 and 11.

I mount the load carriage 13 on the tertiary uprights 12 through rather conventional means, with rollers 40 that engage in the upright channels, Figs. 3, 7 and 8. I prefer to guide the load carriage 13 in a transverse direction through the utilization of the construction that is disclosed in the patent to Uliniski No. 2,759,562, that being made possible through the offset relation of my I-section uprights. Thus, I equip the load carriage 13 with rollers 41, those rollers engaging the sides of the flanges 19 on tertiary uprights 12. Further, I can effect transverse guiding of tertiary uprights 12 through rollers 42 that are mounted on those uprights, Figs. 3, 7 and 8, and that engage flange 14 on each secondary upright 11. To guide the secondary uprights 11 in a transverse direction, I can utilize guide rollers 43 on the upper end portions of primary uprights 10, Figs. 3 and 7, and guide rollers 44 on the lower end portions of secondary uprights 11, Figs. 3 and 8.

The construction that I have thus far described enables me to support secondary and tertiary uprights 11, 12, through rollers that have a maximum spacing in a vertical direction, while mounting those rollers on shafts that actually are integral parts of the uprights. Moreover, I can do this while utilizing structural I-sections for the uprights, with those sections in nested relation to one another. The extreme value of that construction will be fully appreciated when it is realized that it enables me to achieve a primary, secondary and tertiary upright assembly that is exceedingly rigid, and that will provide a very satisfactory support for the load carriage despite the high lift of the carriage.

At this point, we will recall the fact that the primary, secondary, and tertiary uprights 10, 11, 12 will be disassembled through the movement of the secondary and tertiary uprights to an extreme upper position. In my invention, I utilize a part of my novel lifting means to limit the movement of the secondary and tertiary uprights so that those uprights normally will not move to that position, whereby the uprights will not become disassembled through accident. To describe my lifting means, it will be best to refer first to Fig. 9 of the drawings, in which I show a hydraulic ram assembly 50 having an outer cylinder 51, and telescoping tubular pistons 52, 53 that are adapted to extend relatively to the opposed upper and lower ends of cylinder 51. The ram assembly 50 resembles to some extent the ram shown in my earlier patent, No. 2,518,251, but has extremely novel and important features, as will appear.

Thus, in my ram assembly 50, Fig. 9, the effective area of piston 52, that I shall call the up piston, has approximately a two-to-one ratio to the area of the opposed or down piston 53. That arrangement leaves a considerable space between the inner surface of piston 52

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and the outer surface of piston 53, as is clearly shown in Fig. 9. Further, I so form cylinder 51 as to leave a substantial space around the outer surface of piston 52. Integrally secured to the lower end of ram cylinder 51 is a cap member 54 on which the down piston 53 slides, while a cap member 55 is integrally secured to the upper end of the cylinder 51, on which piston 52 slides.

I form the lower cap member 54 with a stop portion 56, Fig. 9, that is arranged in the space between the two pistons 52, 53. That stop portion 56 is adapted to coact with a shoulder portion 57 on the down piston 53 whereby to act as a limit stop for the extending movement of that piston. Moreover, the upper end cap 55 has a stop portion 58 that is arranged in the space between the piston 52 and cylinder 51, in position to coact with a flange portion 59 on the up piston 52, whereby to act as a limit stop for the extending movement of that piston. Thus, it will be understood that my ram assembly is equipped with means that will act positively to limit the extending movement of each piston. I form the up piston 52 with openings 60, those openings being arranged a short distance from flange portion 59 on that piston. Also I form the down piston 53 with openings 61 arranged a short distance from shoulder 57. The particular position of openings 60, 61 is important, as will be understood as my description proceeds.

The outer end of piston 52 is closed by a head 63, Fig. 9, while I close the lower end of down piston 53 through an end member 64. That end member 64 is formed with a passage 65 through which fluid pressure will be applied to the ram assembly. The fluid pressure that is applied through passage 65 will pass into the interior of down piston 53 and thence through openings 61 so that the pressure will act between piston 53 and cylinder 51 and will tend to extend that piston 53. The fluid pressure will act also against up piston 52, and since that piston has a relatively large effective area, the pressure will extend piston 52 first. Naturally, the pressure will pass through openings 60 in up piston 52, but that merely balances the pressures on flange 59 and will not in itself effect movements of piston 52. However, due to the movements of the piston 52, the flange 59 will cause the fluid to flow through the openings 60.

Further, as will be seen in Fig. 9, I form the stop portion 58 to have a small clearance relatively to the piston 52. When piston 52 is near limit position, with its flange 59 approaching stop portion 58, the openings 60 will move past the stop portion 58, so that the flow of fluid through openings 60 will be restricted by the small clearance between piston 52 and stop portion 58. Thus, the fluid will check the extending movement of up piston 52, and will act very effectively to cushion the movement of flange 59 against stop portion 58. Similarly, the openings 61 in the down piston 53 will move past the stop portion 56 when piston 53 moves near its limit position. A part 66 of stop portion 56 has a small clearance relatively to piston 53, so that the flow of fluid through openings 61 will then be checked to cushion the movement of piston 53. Thereby, my ram construction not only has a positive limit stop for the extending movement of each piston, but will cushion the movements of the pistons against those stops.

To utilize the ram assembly 50 in my invention, I mount the ram cylinder 56 relatively to the secondary uprights 11 of the truck T. The particular means through which the cylinder 51 is mounted is not important to an understanding of the invention that forms the subject of this application. Merely for the purpose of disclosure, I show cylinder 51 equipped with a flange 67, Figs. 5 and 6, that is supported on brackets 68 secured to the cross-member 27 on secondary uprights 11, and I show a part 68a, Fig. 5, holding cylinder 51 relatively to cross-member 26 on uprights 11. I also may utilize the mounting that is disclosed in my earlier application, Serial No. 676,012.

With ram cylinder 51 mounted relatively to the second-

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ary uprights 11, the down piston 53 is in position to act relatively to the bottom cross-member 21 on primary uprights 10, as shown in Figs. 2 and 6. I particularly arrange the end member 64 on the down piston 53 in contact with a bearing surface 21a on the cross-member 21, Figs. 6 and 6A, with end member 64 adapted to slide in transverse directions on that surface 21a. That, naturally, enables the down piston 53 and cylinder 51 to act directly between the primary and secondary uprights 10, 11 to lift the secondary uprights, while enabling the down piston 53 to have a certain transverse movement of adjustment. Thereby the down piston 53 will remain in properly aligned relation to ram cylinder 51, despite the fact that the cylinder may move somewhat out of a vertical position due to a slight tilting of secondary uprights 11.

As may be seen in Figs. 6 and 6A, I secure to the bottom cross-member 21 a Z-shaped clip 69 that engages over an edge portion of end member 64 on piston 53. The clip 69 does not prevent horizontal sliding of the end member 64, but is effective to hold that member and piston 53 against upward movement relatively to primary uprights 10. Thus, since the extending movements of down piston 53 are limited through the ram construction that I have already described, and piston 53 can not move upwardly due to clip 69, that piston 53 will limit a predetermined position the upward extending movements of secondary uprights 11.

Actually, I utilize for the bottom cross-member 21 on the primary uprights 10, a plate that is quite thin. With that thin member or plate 21, I utilize a pair of vertical brackets 66, Figs. 2, 3, and 6, that are welded to the member at opposite sides of the bearing surface 21a. I then weld the upper ends of those brackets 66 to the cross member 22 on the primary uprights 10, so that those uprights will accept through the brackets the forces that the down piston 53 may apply to the bottom cross-member or plate 21. Since that construction enables member 21 to be thin, it contributes to the lifting distance that can be achieved through the extending movements of the lift ram 50.

Referring now to Figs. 5, 6, 7, and 8, I equip the head 63 on the up piston 52 with a bearing portion 70 that will move against the top cross-member 28 on tertiary uprights 12 when piston 52 is extended. Further, that bearing portion 70 has a ledge 71 that is adapted to move against the intermediate cross-member 30 on tertiary uprights 12, whereby to insure the downward movement of the tertiary uprights when the piston 52 moves downwardly a predetermined distance. Further, I mount a pair of sheaves 72 on the head 63. Load chains 73 are reeved over those sheaves 72 and are attached at their opposed ends to the load carriage 13 and to the brackets 68 on the secondary uprights 11. It will be appreciated that the up piston 52, when extended, as in Fig. 6, will lift the load carriage 13 through chains 73, and will act also to lift the tertiary uprights through contact between the bearing portion 70 and cross-member 28. Then, should the tertiary uprights 12 fail to move downwardly upon a predetermined downward movement of piston 52, the ledge 71 on the piston will act against cross-member 30 to insure downward movement of those uprights.

I equip the upper portion of each tertiary upright 12 with a carriage stop 74, shown in Fig. 7. When load carriage 13 moves near its extreme high lift position, it will move against stops 74 whereby the carriage 13 will then lift the tertiary uprights 12 to the position shown in Fig. 2. During that particular of the lifting movement, the cross-member 30 on tertiary uprights 12 will move upwardly into contact, or nearly so, with the ledge 71 piston 52. Thus, piston 52 will prevent any further upward movement of tertiary uprights 12. That is true since the piston movement is limited through the construction of my ram assembly 50 that I have already described while referring to Fig. 9.

When the up piston 52 is fully extended, the fluid pressure applied to the ram cylinder 51 will act to extend the down piston 53. Therefore, when up piston 52 has fully lifted the load carriage 13 and tertiary uprights 12 relatively to secondary uprights 11, the down piston 53 will extend to effect sequential lifting of the secondary uprights 11, together with tertiary uprights 12 and load carriage 13. Again, since my ram construction limits the extending movement of the down piston 53, as I have described, and because clip 69 holds piston 53 relatively to primary uprights 10, that piston will limit the upward movement of secondary uprights 11. Thus, my ram assembly 50 will prevent any accidental movement of the secondary and tertiary uprights 11, 12 beyond a normal lifted position. Therefore, those uprights cannot move to that further upward position at which they may become disassembled.

I believe that the operation and advantages of my extremely novel construction will now be understood. Through my invention, I am able to support a load carriage through a primary, secondary, and tertiary upright assembly that is exceedingly strong and rigid. That is possible because I can assemble I-section uprights into nested relation to one another, while supporting the moving uprights through roller shafts that in fact are integral parts of the uprights. Actually, the uprights are very readily assembled and disassembled relatively to one another, yet I am able, through the lifting means of my invention, to prevent accidental separation of the uprights. Further, those lifting means act very effectively to impart sequential lifting movements to the load carriage, tertiary uprights, and secondary uprights. To do that, my lifting means require merely one pair of load chains, thus making unnecessary the use of further chains that would obstruct the view of the operator. Naturally, parts of my invention can be utilized to exceedingly good advantage on those trucks that do not have tertiary uprights, but that merely support the load carriage on primary and secondary uprights. I believe, therefore, that those persons skilled in the art will fully appreciate the very considerable value of the novel construction that I contribute by my invention.

I now claim:

1. In a truck of the class described, a channel-shaped upright having a web and flanges, a second channel-shaped upright, a roller secured to said first upright adjacent one end thereof and extending into the channel of said second upright, a roller secured to said second upright adjacent one end thereof and extending into the channel of said first upright, said flanges on said uprights having cutaway portions adjacent each roller of a size to permit the rollers on each upright to move laterally into the channel of the other upright when said uprights are in their fully extended position and said cutaway portions are in a position of alignment with said rollers, thereby to permit assembly and disassembly of said uprights without removal of said rollers, a load carriage carried by said uprights, and power means for effecting relative vertical movement between said uprights and

relative vertical movement between said carriage and said uprights.

2. In a truck of the class described, a channel-shaped upright having a web and flanges, a second channel-shaped upright, a roller secured to said first upright adjacent one end thereof and extending into the channel of said second upright, a roller secured to said second upright adjacent one end thereof and extending into the channel of said first upright, said flanges on said uprights having cutaway portions adjacent each roller of a size to permit the roller on each upright to move laterally into the channel of the other uprights when said uprights are in their fully extended position and said cutaway portions are in a position of alignment with said rollers, thereby to permit assembly and disassembly of said uprights without removal of said rollers, a load carriage carried by said uprights, power means for effecting relative movement between said uprights and relative movement between said carriage and said uprights, and stop means acting normally to prevent said uprights from moving to said fully extended position whereby said uprights will not become disassembled.

3. In a truck of the class described, a channel-shaped upright having a web and flanges, a second channel-shaped upright, a roller secured to said first upright adjacent one end thereof and extending into the channel of said second upright, a roller secured to said second upright adjacent one end thereof and extending into the channel of said first upright, said flanges on said uprights having cutaway portions adjacent each roller of a size to permit the roller on each upright to move laterally into the channel of the other uprights when said uprights are in their fully extended position and said cutaway portions are in a position of alignment with said rollers, thereby to permit assembly and disassembly of said uprights without removal of said rollers, a load carriage carried by said uprights, a hydraulic ram cylinder and piston acting when extended to impart relative movement between said uprights and relative movement between said carriage and said uprights, and means whereby said piston and cylinder act when in extended position to hold said uprights against movement to their fully extended position whereby said uprights will not become disassembled.

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Notice of Adverse Decision in Interference

In Interference No. 92,408 involving Patent No. 2,936,047, G. F. Quayle, Lift truck, final decision adverse to the patentee was rendered June 4, 1963, as to claims 1 and 2.

[Official Gazette August 27, 1963.]