March 7, 1961 G. F. QUAYLE 2,973,835

LIFT TRUCK

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Fig. 2.

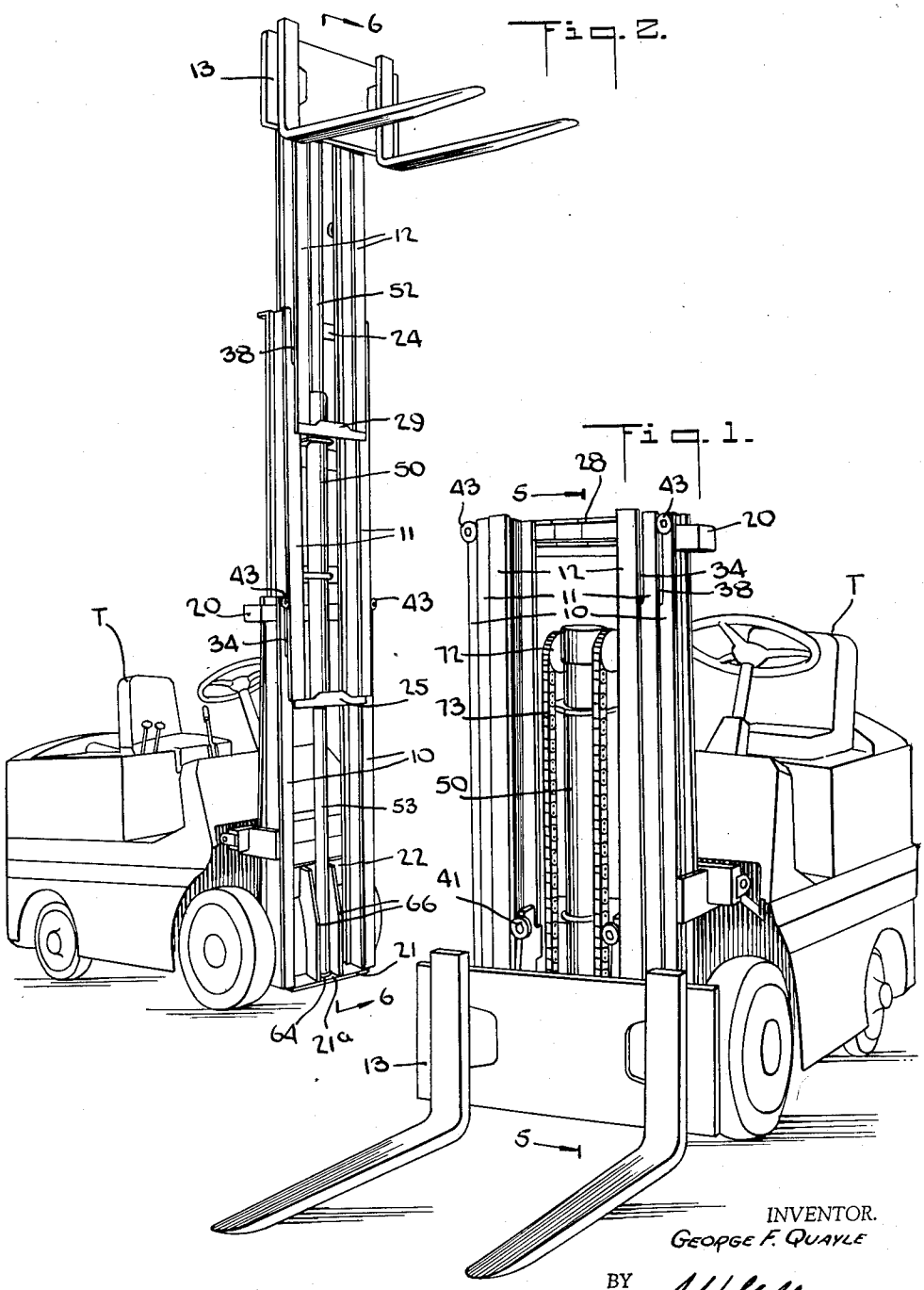

Fig. 1.

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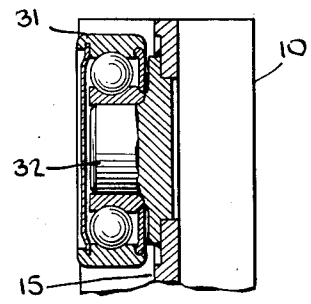


Fig. 4.

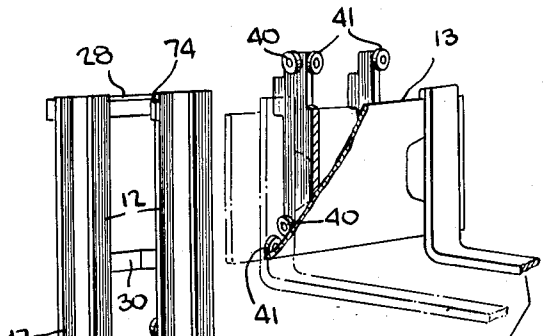
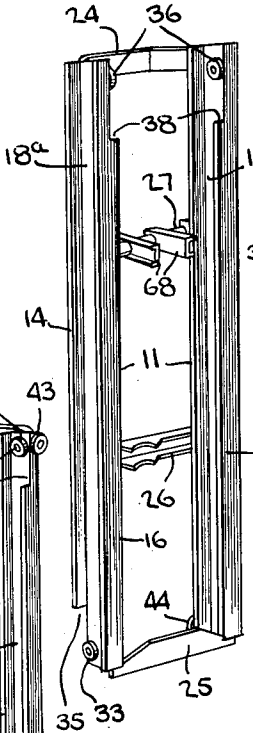


Fig. 3.



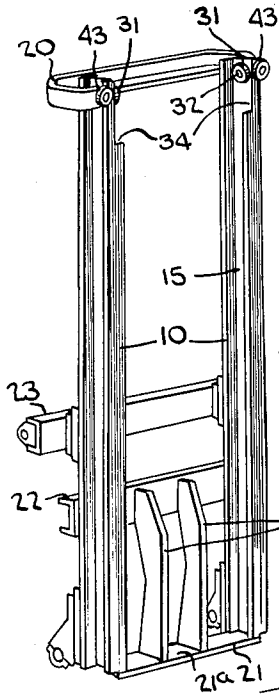
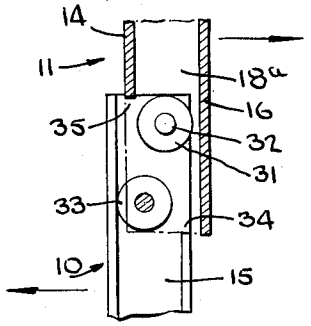


Fig. 3A.



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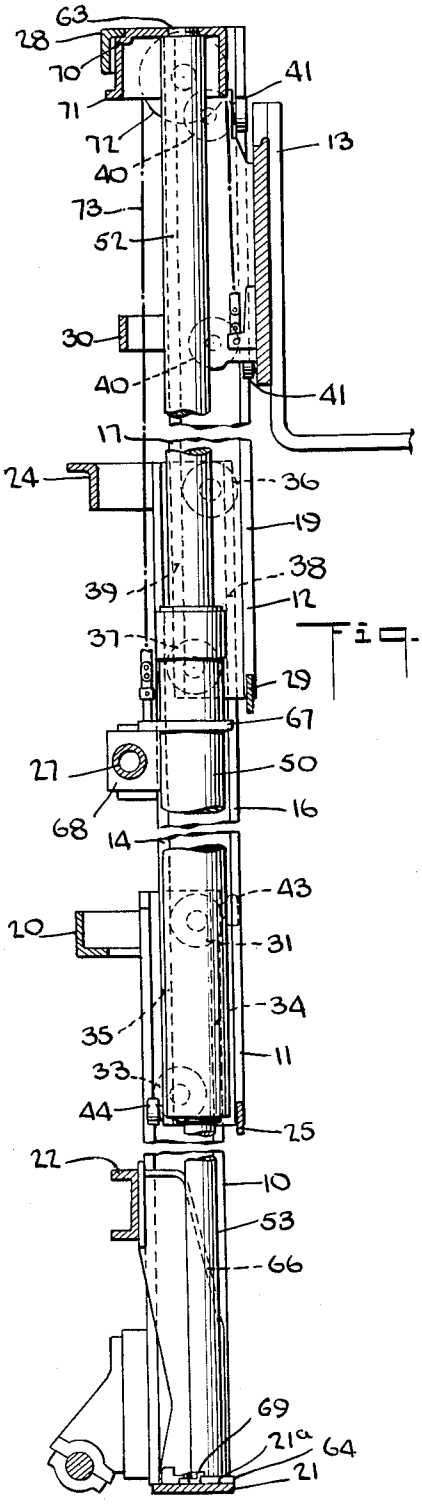
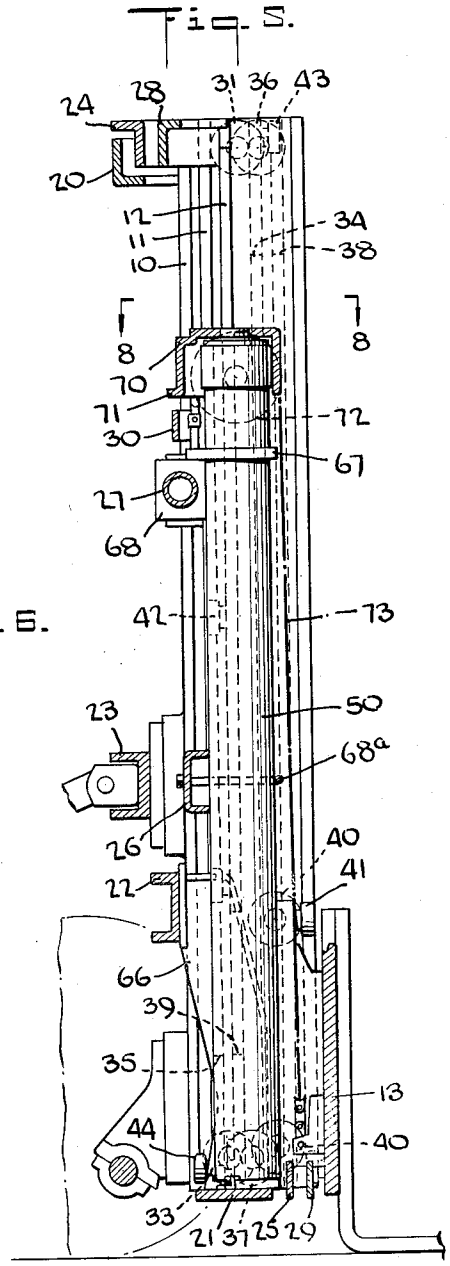


Fig. 6.

Fig. 5.



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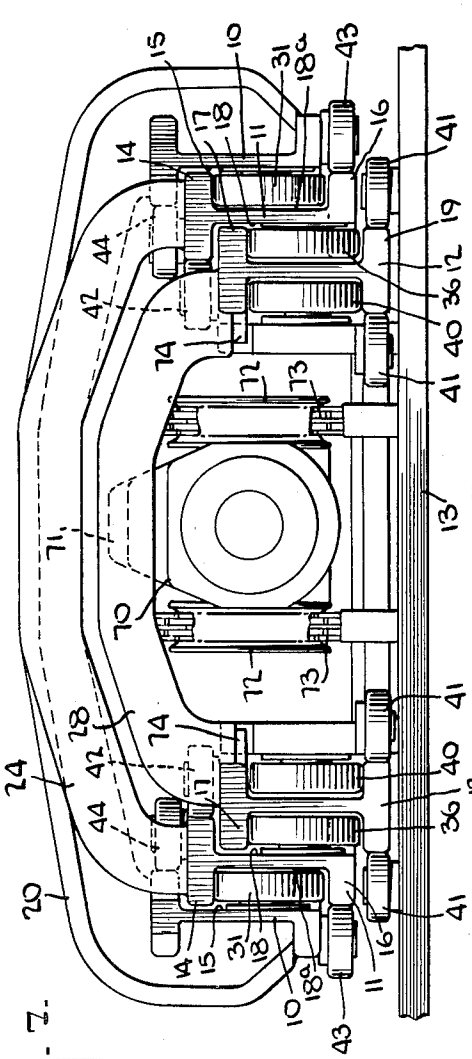

Fig. 7.

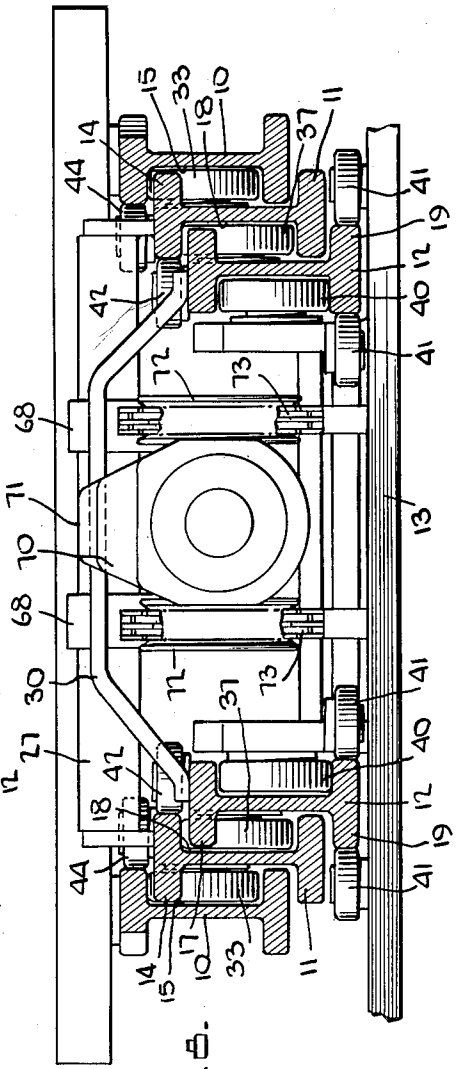

Fig. 8.

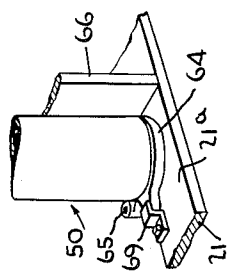

Fig. 6A.

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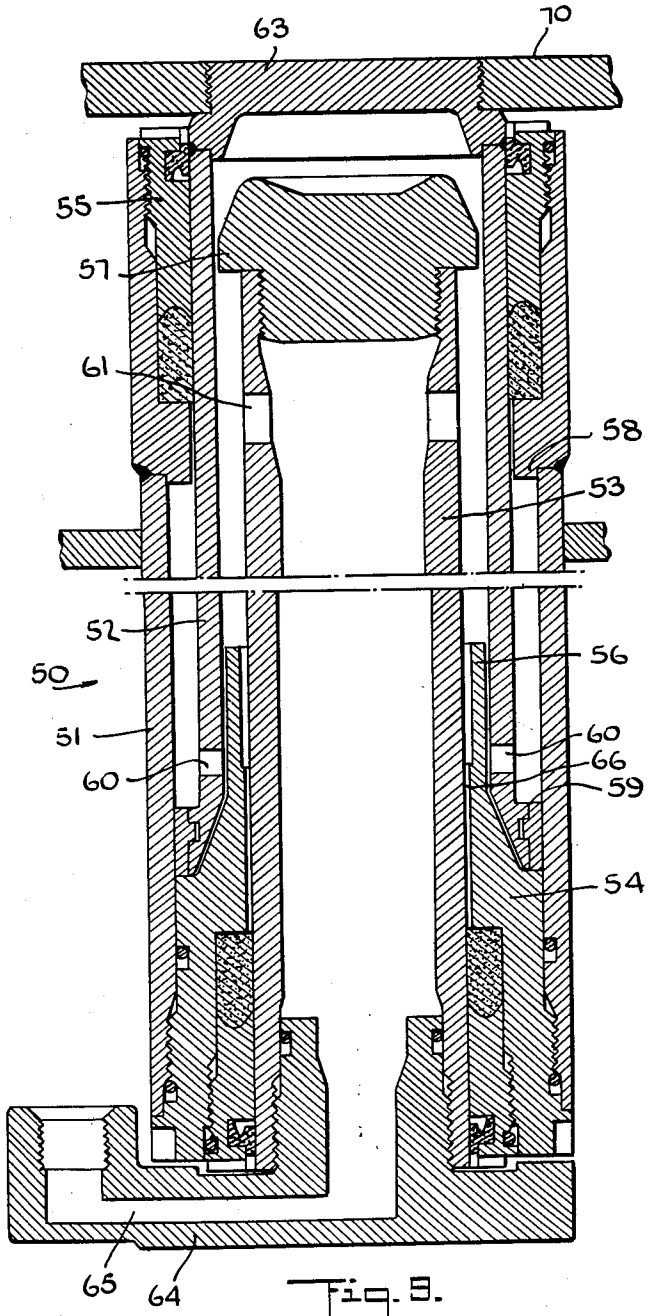

Fig. 8.

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United States Patent Office 2,973,835 Patented Mar. 7, 1961

2,973,835

LIFT TRUCK

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Original application Oct. 16, 1957, Ser. No. 690,476, now Patent No. 2,936,047, dated May 10, 1960. Divided and this application Nov. 16, 1959, Ser. No. 854,995

7 Claims. (Cl. 187—9)

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. This application is a division of my copending application, Serial No. 690,476, filed October 16, 1957, now Patent No. 2,936,047.

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.

In the parent application, Serial No. 690,476, I disclose and claim an exceedingly novel construction that enables 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 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. The invention of the instant application is directed to an arrangement of the uprights and the lifting means for lifting the secondary and tertiary uprights and the load carriage whereby the lifting means prevents movement of the uprights beyond said limit position during normal operation of the truck, so that the uprights will not accidentally become separated.

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 prime 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 inwardly 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 **11**. 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 **18***a* of the juxtaposed secondary upright **11**. My invention as covered by parent application, Serial No. 690,476 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 as covered by parent application, Serial No. 690,476, I form the upper portion of each primary upright **10** with a slot **34**, well shown in Figs. 3 and 3*a*, 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 3*a*, 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. 3*a*, will place the rollers **33** is 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. 3*a*, 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 Ulinski 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** 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 **48**, 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 **68***a*, 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 secondary 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 **21***a* on the cross-member **21**, Figs. 6 and 6A, with end member **64** adapted to slide in transverse directions on that surface **21***a*. 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 at a predetermined position the upward extending movement 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 **21***a*. 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 **12** 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 part of the lifting movement, the cross-member 30 on tertiary uprights 12 will move upwardly into contact, or nearly so, with the ledge 71 on 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, primary uprights on the main frame of the truck, secondary uprights mounted for vertical movement on the primary uprights, tertiary uprights mounted for vertical movement on the secondary uprights, a load carriage mounted for vertical movement on the tertiary uprights, a hydraulic ram having a part mounted on said secondary uprights, a ram part adapted to extend downwardly relatively to the part that is mounted on the secondary uprights, said downwardly extending part being in bearing relation to a member that is in fixed relation to the primary uprights on the truck whereby that ram part when extended will lift the secondary and tertiary uprights and load carriage relatively to the primary uprights, a further part on said ram adapted to extend upwardly relatively to the ram part that is mounted on the secondary uprights, a chain through which said upwardly extending part acts when extended to lift said load carriage relatively to the tertiary uprights, a bearing portion on said upwardly extending part of the ram moving into contact with the tertiary uprights upon predetermined lifting of the carriage whereby to lift said tertiary uprights, and a ledge on said upwardly extending ram part in opposed relation to a portion on said tertiary uprights whereby to insure downward movement of those uprights upon movement of said upwardly extending part to a lowered position.

2. In a truck of the class described, primary uprights on the main frame of the truck, secondary uprights mounted for vertical movement on the primary uprights, tertiary uprights mounted for vertical movement on the secondary uprights, a load carriage mounted for vertical movement on the tertiary uprights, a hydraulic ram having a part mounted on said secondary uprights, parts of said hydraulic ram in telescoping relation to one another with one of those parts adapted to extend upwardly and the other downwardly relatively to the part that is mounted on the secondary uprights, stop means on said ram limiting the extending movements of said parts of the ram, surfaces through which the downwardly extending ram part is in bearing relation to the primary uprights whereby that part when extended will lift the secondary and tertiary uprights and load carriage relatively to the primary uprights, means holding said downwardly extending ram part relatively to the primary uprights whereby the ram by its stop means will limit at a predetermined position the upward extending movement of the secondary uprights, a chain through which said upwardly extending part of the ram acts when extended to lift said load carriage relatively to the tertiary uprights, a bearing portion on said upwardly extending part moving into contact with the tertiary uprights upon predetermined lifting of the carriage whereby to lift said tertiary uprights, and a ledge on said upwardly extending ram part in opposed relation to a portion on said tertiary uprights whereby the ram by its said stop means will limit at a predetermined position the upward extending movements of the tertiary uprights.

3. In a truck of the class described, primary uprights on the main frame of the truck, secondary uprights mounted for vertical movement on the primary uprights, tertiary uprights mounted for vertical movement on the secondary uprights, a load carriage mounted for vertical movement on the tertiary uprights, a hydraulic ram having a part mounted on said secondary uprights, a ram part adapted to extend upwardly relatively to the ram part that is mounted on the secondary uprights, a chain through which said upwardly extending part acts when extended to lift said load carriage relatively to the tertiary uprights, a bearing portion on said upwardly extending part of the ram moving into contact with the tertiary uprights upon predetermined lifting of the carriage whereby to lift said tertiary uprights, a part on said ram adapted to extend downwardly relatively to the ram part that is mounted on the secondary uprights, a bottom cross member on said primary uprights and against which the downwardly extending ram part acts to enable the ram to lift the secondary uprights, and said cross member and downwardly extending ram part formed with bearing surfaces that are in horizontal sliding relation to one another whereby to enable said part to have transverse movement of adjustment when the ram moves due to a slight tilting movement of the secondary uprights.

4. In a truck of the class described, primary uprights, secondary uprights mounted for lifting movement relatively to the primary uprights, tertiary uprights, means mounting the tertiary uprights for lifting movement relatively to the secondary uprights, a load carriage, means mounting said load carriage for lifting movement relatively to the tertiary uprights, a hydraulic ram having an outer cylinder and a pair of upwardly and downwardly extending pistons in telescoping relation to one another, means securing the ram cylinder relatively to said secondary uprights, means through which the upwardly extending piston of said ram acts when extended to lift said tertiary uprights and load carriage relatively to the secondary uprights, means acting as a stop for the up-

ward movement of said upwardly extending piston relatively to the ram cylinder, surfaces in opposed relation to one another on said upwardly extending piston and tertiary uprights whereby said piston when against its stop will limit the upward movement of the tertiary uprights, said downwardly extending piston bearing against a part on the truck fixed relatively to the primary uprights whereby that piston when extended lifts the secondary and tertiary uprights and load carriage, means holding said downwardly extending piston against upward movement relatively to the said part on the truck, and means acting as a stop for the downward movement of said downwardly extending piston relatively to the ram cylinder whereby to limit the upward movement of the secondary uprights relatively to the primary uprights.

5. In a truck of the class described, primary uprights, secondary uprights mounted for lifting movement relatively to the primary uprights, tertiary uprights, means mounting the tertiary uprights for lifting movement relatively to the secondary uprights, a load carriage, means mounting said load carriage for lifting movement relatively to the tertiary uprights, a hydraulic ram having an outer cylinder, means securing the ram cylinder relatively to said secondary uprights, a pair of upwardly and downwardly extending pistons in telescoping relation to one another in said ram cylinder, stop portions on said ram cylinder limiting the extending movements of each piston relatively to the cylinder, means through which the upwardly extending piston of said ram acts when extended to lift said tertiary uprights and load carriage relatively to the secondary uprights, surfaces in opposed relation to one another on said upwardly extending piston and tertiary uprights whereby said piston when against its stop will limit the upward movement of the tertiary uprights, said downwardly extending piston bearing against a part of the truck fixed relatively to the primary uprights whereby that piston when extended lifts the secondary and tertiary uprights and load carriage, means holding said downwardly extending piston against upward movement relatively to the said part on the truck whereby said piston when against its stop will limit the upward movement of the secondary uprights relatively to the primary uprights, an opening in each piston through which fluid flows during the movements of that piston relatively to the ram cylinder, and a portion on said cylinder restricting fluid flow through the opening in each piston as the piston moves toward its stop whereby to cushion the movements of the secondary and tertiary uprights to their limit positions.

6. In a truck of the class described, primary uprights on the main frame of the truck, secondary uprights mounted for vertical movement on the primary uprights, tertiary uprights mounted for vertical movement on the secondary uprights, a load carriage mounted for vertical movement on the tertiary uprights, a hydraulic ram having a part mounted on said secondary uprights, a ram part adapted to extend downwardly relatively to the part that is mounted on the secondary uprights, said downwardly extending part being in bearing relation to a member that is in fixed relation to the primary uprights on the truck whereby that ram part when extended will lift the secondary and tertiary uprights and load carriage relatively to the primary uprights, a further part on said ram adapted to extend upwardly relatively to the ram part that is mounted on the secondary uprights, a chain through which said upwardly extending part acts when extended to lift said load carriage relatively to the tertiary uprights, a bearing portion on said upwardly extending part of the ram moving into contact with the tertiary uprights upon predetermined lifting of the carriage whereby to lift said tertiary uprights, and means on said upwardly extending ram part in opposed relation to a portion on said tertiary uprights whereby to insure downward movement of those uprights upon movement of said upwardly extending part to a lowered position.

7. In a truck of the class described, primary uprights, secondary uprights mounted for lifting movement relatively to the primary uprights, tertiary uprights, means mounting the tertiary uprights for lifting movement relatively to the secondary uprights, a load carriage, means mounting said load carriage for lifting movement relatively to the tertiary uprights, a hydraulic ram having an outer cylinder and a pair of upwardly and downwardly extending pistons in telescoping relation to one another, means securing the ram cylinder relatively to said secondary uprights, means through which the upwardly extending piston of said ram acts when extended to lift said tertiary uprights and load carriage relatively to the secondary uprights, means acting as a stop for the upward movement of said upwardly extending piston relatively to the ram cylinder, surfaces in opposed relation to one another on said upwardly extending piston and tertiary uprights whereby said piston when against its stop will limit the upward movement of the tertiary uprights, said downwardly extending piston bearing against a part on the truck fixed relatively to the primary uprights whereby that piston when extended lifts the secondary and tertiary uprights and load carriage, and means acting as a stop for the downward movement of said downwardly extending piston relatively to the ram cylinder whereby to limit the upward movement of the secondary uprights relatively to the primary uprights.

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UNITED STATES PATENT OFFICE

CERTIFICATION OF CORRECTION

Patent No. 2,973,835 March 7, 1961

George F. Quayle

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1, 2, and 3, for "George F. Quayle, of Philadelphia, Pennsylvania," read -- George F. Quayle, of Philadelphia, Pennsylvania, assignor to The Yale & Towne Manufacturing Company, of Stamford, Connecticut, a corporation of Connecticut, --; line 12, for "George F. Quayle, his heirs" read -- The Yale & Towne Manufacturing Company, its successors --; in the heading to the printed specification, lines 3 and 4, for "George F. Quayle, % The Yale & Towne Mfg. Co., 11000 Roosevelt Blvd., Philadelphia 15, Pa." read -- George F. Quayle, Philadelphia, Pa., assignor to The Yale & Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut --.

Signed and sealed this 26th day of September 1961.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

DAVID L. LADD
Commissioner of Patents