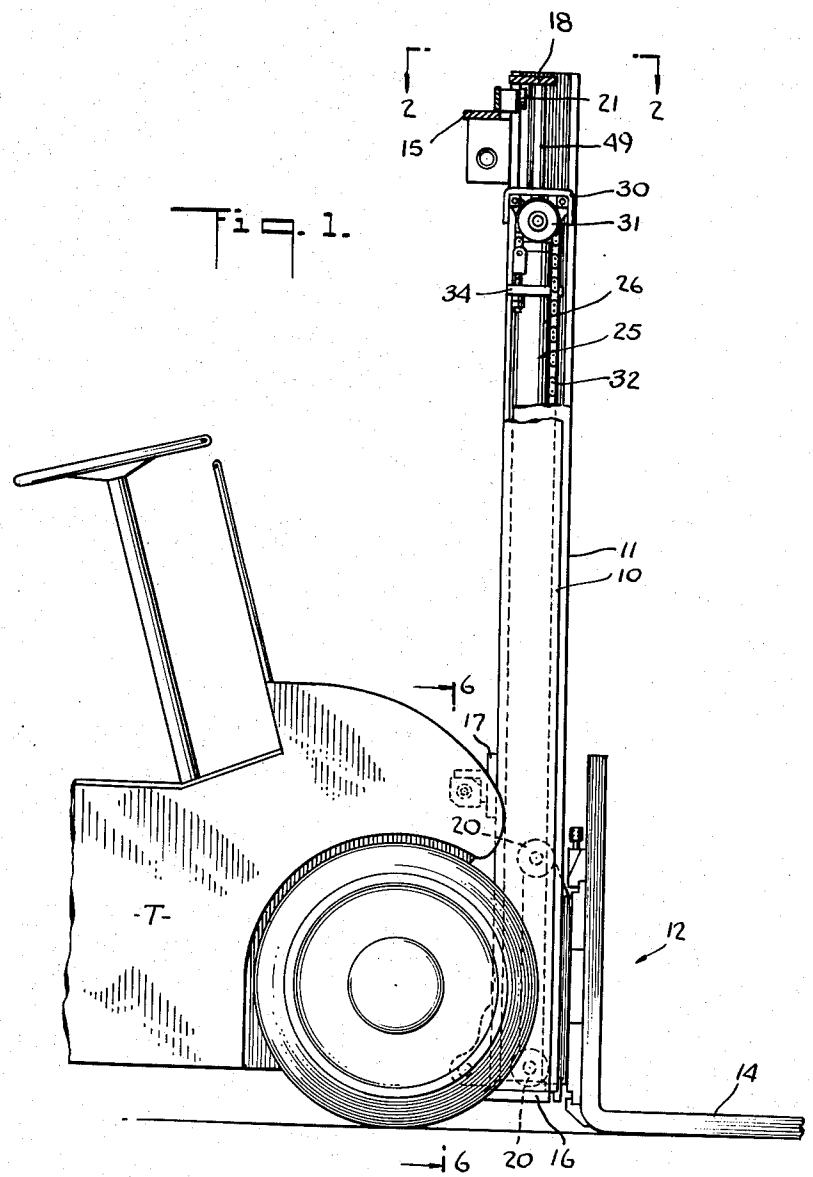
Oct. 11, 1960 C. S. SCHROEDER 2,955,676

UPRIGHT PULL-DOWN

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4 Sheets-Sheet 1

Fig. 1.



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Fig. 2.

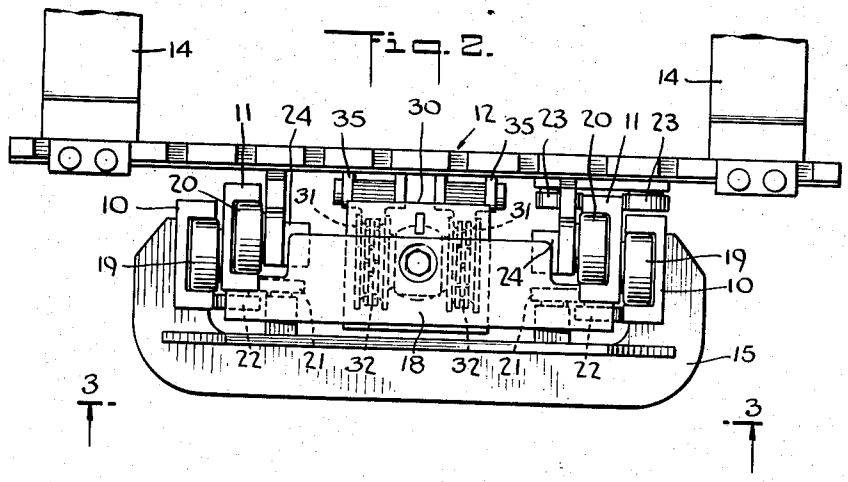
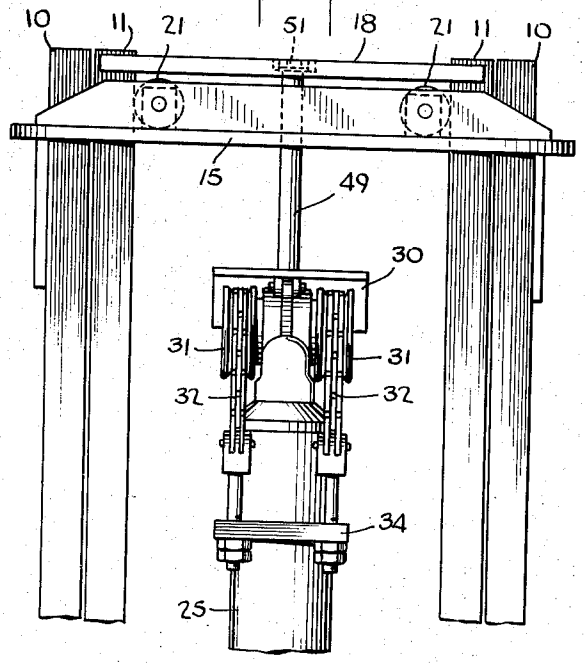


Fig. 3.



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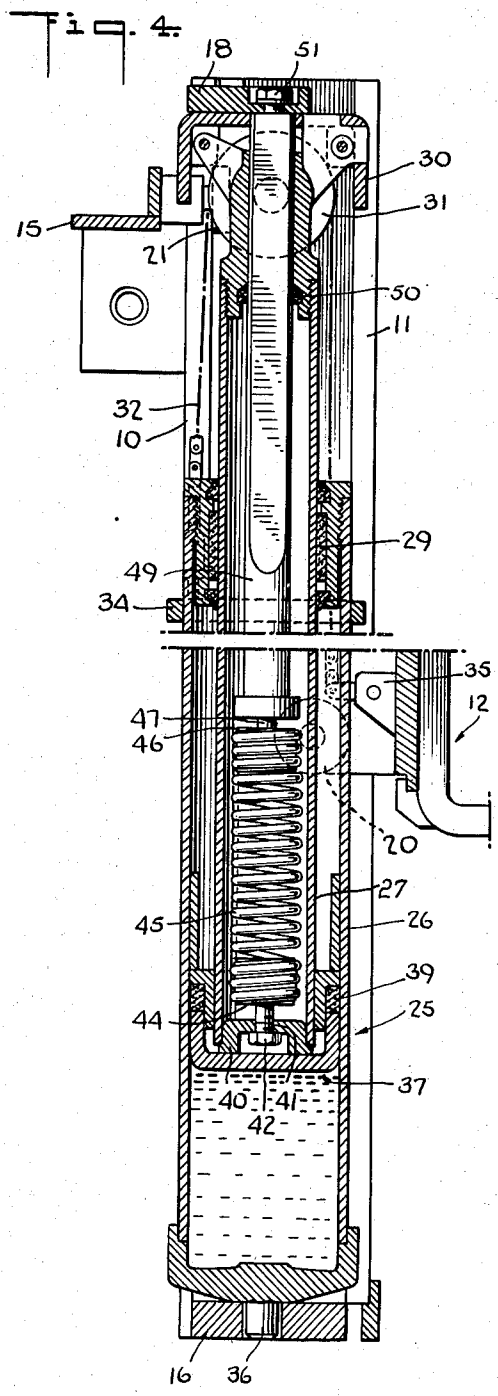
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UPRIGHT PULL-DOWN

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Fig. 4.



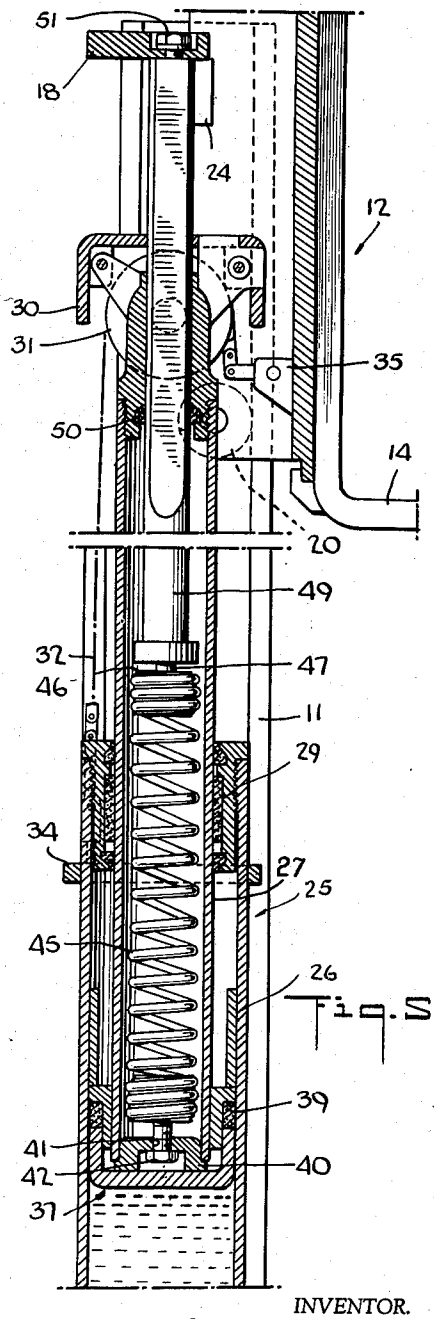


Fig. 5.

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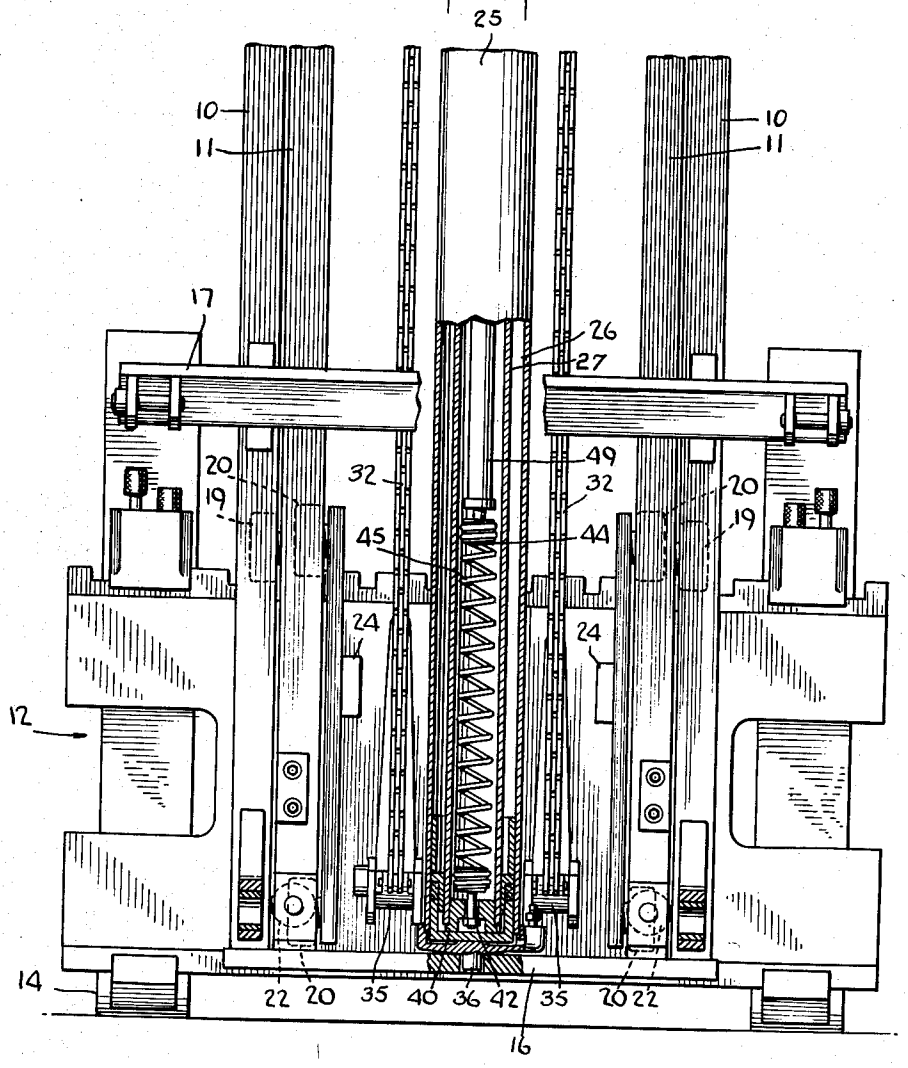
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Fig. 6.



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United States Patent Office 2,955,676 Patented Oct. 11, 1960

2,955,676

UPRIGHT PULL-DOWN

Charles S. Schroeder, Villanova, Pa., assignor to The Yale and Towne Manufacturing Company, Stamford, Conn., a corporation of Connecticut

Filed Aug. 22, 1958, Ser. No. 756,675

5 Claims. (Cl. 187—9)

This invention relates to industrial trucks and, more particularly, to such trucks in which a hydraulic ram is employed to lift a load relatively to uprights carried by the truck.

Heretofore, it has been a frequent practice to construct trucks of the class described in which a carriage is elevated relatively to secondary uprights, and the secondary uprights are, in turn, elevated relatively to primary uprights, all through the operation of a single hydraulic ram. This hydraulic ram lifts the carriage through a set of chains, the ram moving freely of the secondary uprights for a short distance during which it lifts the carriage twice the distance of its own movement due to the run of the chains. This movement of the carriage relatively to the secondary uprights is known as the free lift. After the free lift, it is usual for the piston of the lifting ram to contact the secondary uprights and elevate them directly while the carriage continues to move at double the piston speed. After some lifting in this manner, the carriage, because of its double speed movement relatively to the piston contacts the secondary uprights and lifts them away from the ram piston even though the piston is still being extended. On the other hand, the truck may be so constructed that the carriage itself contacts the secondary uprights after the free lift and raises them at double the piston speed.

As the piston moves downward, it is possible for the secondary uprights to cock and jamb or stick in an upper position because there is no positive connection between the uprights and the piston. Then after some vibration due to further downward movement of the piston and carriage, the secondary uprights frequently become loosened and drop sharply, often causing considerable damage.

For many years, important segments of the industry viewed the teachings of the patent to Dunham, No. 2,178,370, as the best available means of combatting this problem. Dunham taught the use of a long bolt extending between the secondary uprights and the ram piston by a lost motion connection so that the piston would pull the secondary uprights down after moving a distance corresponding to the free lift of the carriage. While this construction was recognized as a partial remedy, it was never completely satisfactory due to the fact that the secondary uprights could still drop sharply a sufficient distance to cause serious damage.

Other efforts were directed towards cushioning the drop of the secondary uprights, it being generally well recognized that a drop of material consequence is inherent in trucks of the class described.

I have conceived by my invention a novel construction that enables me to eliminate entirely any sharp dropping of the secondary uprights relatively to the primary uprights.

In essence, my invention resides in the utilization of yielding means continuously urging the secondary uprights downwardly relatively to the primary uprights.

While it is felt that my invention is of greatest utility in the combination I have outlined, it is quite readily seen that the contribution I have made may be utilized to control the lowering movement of load members other than secondary uprights.

As a feature of my invention, I connect one end of the yielding means to a part that is urged downwardly by whatever load has been raised by the hydraulic ram. In the preferred structure this part is the ram piston itself. Therefore, I connect the yielding means to the ram piston at one end while the other end is connected to the secondary uprights. As a more particular feature of this aspect of my invention, I prefer to use as my yielding means a helical spring that I mount inside the ram, preferably within the piston of the ram which is hollow, one end of the spring being connected to the piston. To the other end of this spring, I connect a rod that extends outwardly of the piston and is fixed to the secondary uprights.

As a further feature of my invention, the spring is connected so as to have an initial torsion when the carriage and secondary uprights are in their normal lowermost position.

As another feature of my invention, the initial tension on the spring is such that during the free lift, as the piston rises but the secondary uprights remain stationary, the spring will not be collapsed sufficiently to reach a state of no tension. By reason of this arrangement, the spring continuously exerts a downward pull on the secondary uprights, regardless of the relative positions of the various parts.

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.

A specific embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings.

In the drawings:

Fig. 1 is a side view of a truck embodying my novel pull-down;

Fig. 2 is a plan view taken along line 2—2 of Fig. 1;

Fig. 3 is a partial view taken along line 3—3 of Fig. 2;

Fig. 4 is a longitudinal section view illustrating details of the pull-down with the ram piston partially extended to lift the load carriage;

Fig. 5 is a view similar to Fig. 4 but illustrating the relation of the parts with the secondary uprights partially elevated; and

Fig. 6 is a view taken along line 6—6 of Fig. 1 and partly broken away to illustrate the relation of the parts when the carriage and secondary uprights are in their normal lowermost position.

Referring now to the drawings, and particularly to Fig. 1, there is shown an industrial truck T having a pair of primary uprights 10, a pair of secondary uprights 11, and a load carriage 12 provided with lifting forks 14. The primary uprights 10 are integrally connected by an upper cross member 15, a lower cross member 16 and an

intermediate cross member **17**. A cross member **18** integrally connects the secondary uprights at their upper ends.

As shown in Fig. 2, the uprights **10** and **11** are formed as channel members, with rollers **19** engaged in the channels of the primary uprights **10** to guide the secondary uprights **11** for vertical movement relatively to the primary uprights, and rollers **20** similarly guiding the carriage **12** for vertical movement relatively to the secondary uprights.

In Figs. 1, 2 and 3, I show a pair of rollers **21** on the upper cross member **15** for guiding lateral movement of the secondary uprights. A further pair of rollers **22** serve a similar purpose at the lower ends of the uprights **11** as shown in Figs. 2 and 6. Additionally, the carriage **12** has a pair of rollers **23** (Fig. 2) for guiding it laterally relatively to the secondary uprights **11**, and a pair of lugs **24** for a purpose to be later described.

A hydraulic ram **25** is supported on the lower cross member **16** and serves to lift both the load carriage **12** and the secondary uprights **11**. This ram **25** has a cylinder **26** mounted on the cross member **16** between the secondary uprights **11**. A piston **27** is disposed within the cylinder **26** and a packing gland **29** (Figs. 4 and 5) is applied between the piston and cylinder to prevent leakage of hydraulic fluid.

On the upper end of the piston **27** is a cross head **30** having a pair of grooved wheels or sheaves **31** over which lifting chains **32** are reeved. These chains **32** are secured at one end to the ram cylinder **26** through a bracket **34** (Figs. 1 and 3), and at the other end to the load carriage **12** through brackets **35** (Fig. 6).

From the description thus far, it will be seen that as the ram piston **27** is first extended upwardly from its position shown in Figs. 1 and 6 to its position shown in Fig. 4, the carriage **12** is raised through chains **32**. When the cross head **30** engages the cross member **18** of the secondary uprights, as shown in Fig. 4, further extension of the ram piston **27** moves the secondary uprights **11** upwardly relatively to the primary uprights as the carriage **12** continues to move upwardly at double the piston speed. When the carriage **12** reaches the limit of its upward movement relatively to the secondary uprights **11**, the carriage lugs **24** engage the cross member **18** of the secondary uprights to lift these uprights whereby the carriage causes the cross member **18** to draw away from the cross head **30** on the piston **27**.

Upon lowering the piston **27**, the carriage **12** begins to move downwardly allowing the secondary uprights also to descend. During the descent of the secondary uprights, the cross member **18** comes into contact with the cross head **30** and, remaining in such contact, is guided in its downward movement by the piston **27** until the secondary uprights reach their normal lowermost position, after which the carriage continues to move downwardly a distance equal to its free lift.

At any time during the descent of the secondary uprights, they may tend to cock in a transverse or longitudinal direction and to jamb. This may be due to eccentric loading or unevenness of the ground surface.

I shall now describe in detail the novel construction of my pull-down by which I prevent jambing of the secondary uprights relatively to the primary uprights.

Referring to Figs. 4 and 6, I show the lower end of the cylinder **26** formed with a depending pin **36** extending into a suitable hole in the cross member **16** of the primary uprights. The piston **27** in the cylinder has a head **37** provided with a suitable packing gland **39** to prevent leakage of hydraulic fluid between the piston head and the interior wall of the cylinder. Secured to the inner surface of the piston head **37** is a U-shaped bracket **40** having a central hole **41**. A bolt **42** extends through this hole **41** and is fixed to a circular spring block **44** which may be formed with helical grooves to receive several of the end turns of a helical spring **45** so as to facilitate

securing the block and spring together. The other end of the spring **45** is similarly secured to a second spring block **46** that is in turn fixed through a short stud **47** to a rod **49**. This rod **49** extends upwardly through a packing gland **50** at the upper end of the piston, through the cross head **30** to the cross member **18** at the top of the secondary uprights. The rod **49** is fixed to this cross member by a bolt **51**.

As I have already mentioned, and as shown in Fig. 6, the spring **45** is connected so as to have an initial tension when the carriage and secondary uprights are in their lowermost position. With this in mind, I shall now describe the operation of my present contribution.

Referring now to Fig. 4, it will be seen that as the ram piston is extended it first raises the cross head **30** that in turn raises the sheaves **31** causing the chains **32** to elevate the carriage **12** at a rate of speed double that of the piston. During this phase of the operation, the secondary uprights **11** are stationary as is the rod **49**. Since the lower end of the spring **45** moves with the piston, it will be seen that the spring, having had an initial tension, is brought to a position of less tension. I prefer that the spring be so arranged relatively to the rod **49** and the piston that it be under tension even when the piston is at its highest position relatively to the rod **49**.

When the cross head **30** reaches a position adjacent the secondary upright cross member **18**, it begins to lift that member, as already described. During this movement, the piston and secondary uprights move together so that the spring tension remains unchanged.

As the carriage **12** catches up to the cross member **18**, it engages this member and draws it, along with the secondary uprights, upwardly at a faster rate than the piston until the secondary uprights are brought to a position of maximum elevation due to the lifting action of the carriage. The spring, therefore, is stretched from its position of minimum tension to one of greater tension.

As the carriage is lowered, the relationship of the parts is reversed. That is, the secondary uprights are first permitted to descend at the same rate of speed as the carriage, or at double the piston speed, until the cross member **18** contacts the piston cross head **30**. During this movement, the rod **49** moves downwardly faster than the piston so that the spring returns to its condition of minimum tension pulling the secondary uprights downwardly. Following contact between cross member **18** and cross head **30**, the secondary uprights are permitted to descend at the same speed as the piston until their lowermost position is reached. During this movement the spring tension pulling the secondary uprights downwardly remains unchanged.

After the secondary uprights have reached their lowermost position, the cross member then abutting the cross member **15**, the carriage continues downwardly a distance equal to its free lift as the piston continues to lower, its cross head **30** moving away from secondary upright cross member **18**. As this movement occurs, it will be seen that the rod **49** remains stationary while the piston moves towards its lowermost position so that the spring is again stretched from a position of minimum tension to one of greater tension, to complete a full cycle of operation, the parts once again assuming the positions shown in Fig. 6.

From the foregoing description, it will be seen that I have contributed a novel upright pull-down by which I have eliminated entirely any sharp dropping of the secondary uprights relatively to the primary uprights. It will further be seen that my contribution is based upon means that continuously and positively urge the secondary uprights downwardly relatively to the primary uprights.

I believe that the construction and operation of my novel invention will now be understood, and that the advantages of my contribution will be fully appreciated by those persons skilled in the art.

I now claim:

1. In a truck of the class having a main frame, a primary upright, a secondary upright movable vertically on said primary upright, a carriage movable vertically on said secondary upright, and a hydraulic ram for lifting said carriage through the intermediary of a chain at double the speed of movement of the ram piston, with said piston contacting and moving the secondary upright only after said carriage has been moved a predetermined degree on said secondary upright while said secondary upright is stationary, the improvement comprising a connection between said ram piston and secondary upright including a spring means that allows separation of said secondary upright from said ram piston while urging said ram piston and secondary upright toward one another.

2. In a truck of the class described, a main frame, a primary upright mounted on said main frame, a secondary upright movable vertically on said primary upright, a carriage movable vertically on said secondary upright, a hydraulic ram comprising a piston and cylinder, means mounting said cylinder for support on said primary upright with the piston separated from said secondary upright when the piston is in its fully retracted position and the secondary upright is fully lowered, a multiplying chain through which the piston when moved vertically relatively to said cylinder lifts the carriage on said secondary upright at double the speed of movement of said piston, the said carriage moving on said secondary upright and said secondary upright remaining stationary until the piston is extended to abut a portion of the secondary upright, and a connection between said ram piston and said secondary upright including a spring means that allows separation of said secondary upright from said ram piston while urging said ram piston and secondary upright toward one another.

3. In a truck of the class described, a main frame, a primary upright mounted on said main frame, a secondary upright movable vertically on said primary upright, a carriage movable vertically on said secondary upright, a hydraulic ram comprising a piston and cylinder, means mounting said cylinder for support on said primary upright with the piston separated from said secondary upright when the piston is in its fully retracted position and the secondary upright is fully lowered, a multiplying chain through which the piston when moved vertically relatively to said cylinder lifts the carriage on said secondary upright at double the speed of movement of said

piston, the said carriage moving on said secondary upright and said secondary upright remaining stationary until the piston is extended to abut a portion of the secondary upright, the piston thereafter lifting the secondary upright until the carriage contacts the secondary upright to lift the secondary upright at double the speed of movement of the piston, and a connection between the ram piston and the secondary upright including a spring means that allows separation of said secondary upright from said ram piston while urging said ram piston and secondary upright toward one another.

4. In a truck of the class described a main frame, a primary upright mounted on said main frame, a secondary upright movable vertically on said primary upright, a carriage movable vertically on said secondary upright, a hydraulic ram comprising a movable part and a stationary part, means mounting said stationary part for support on said primary upright, a multiplying chain through which the movable part when moved vertically relative to said stationary part lifts the carriage on said secondary upright at double the speed of movement of said movable part, said movable part contacting and moving said secondary upright until the carriage contacts the secondary upright and moves the secondary upright away from said movable part, and a resilient connection between said movable part and the secondary upright allowing separation of said secondary upright from said movable part while urging said movable part and the secondary upright towards one another.

5. In a truck of the class having a main frame, a primary upright, a secondary upright movable vertically on said primary upright, a carriage movable vertically on said secondary upright, and a hydraulic ram for lifting said carriage through the intermediary of a chain at double the speed of movement of the ram piston, with said piston contacting and moving the secondary upright only after said carriage has been moved a predetermined degree on said secondary upright while said secondary upright is stationary, the improvement comprising a resilient connection between said ram piston and secondary upright that allows separation of said secondary upright from said ram piston while urging said ram piston and secondary upright toward one another.

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