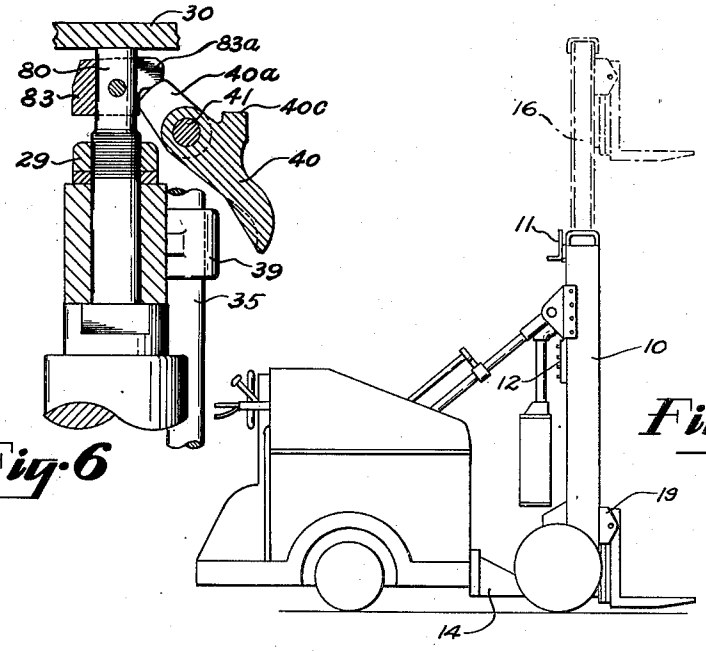
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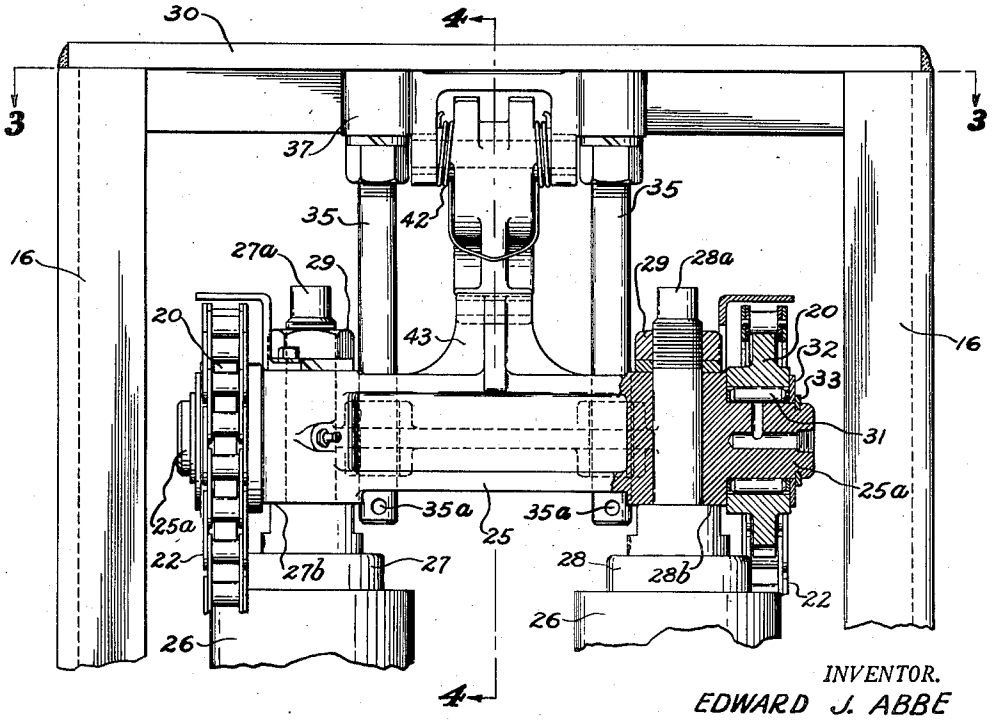
HYDRAULICALLY OPERATED TIER-LIFT MECHANISM

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Fig·6

Fig·1



Fig·2

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HYDRAULICALLY OPERATED TIER-LIFT MECHANISM

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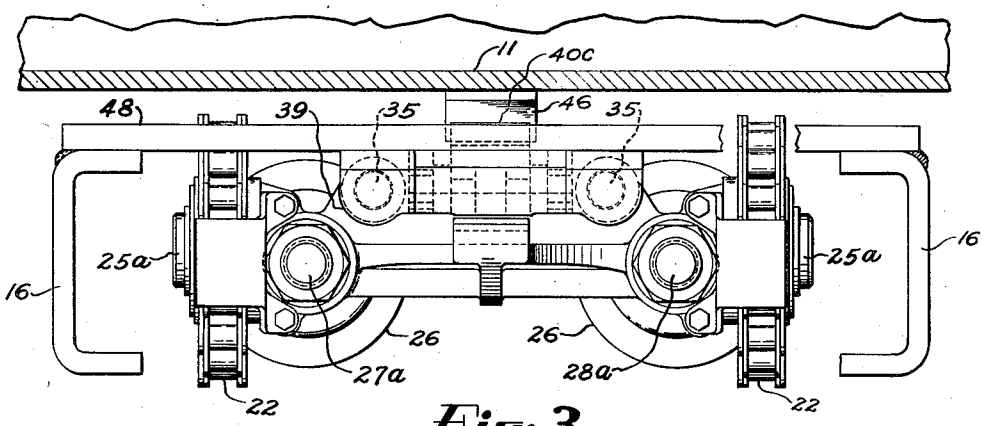


Fig. 3

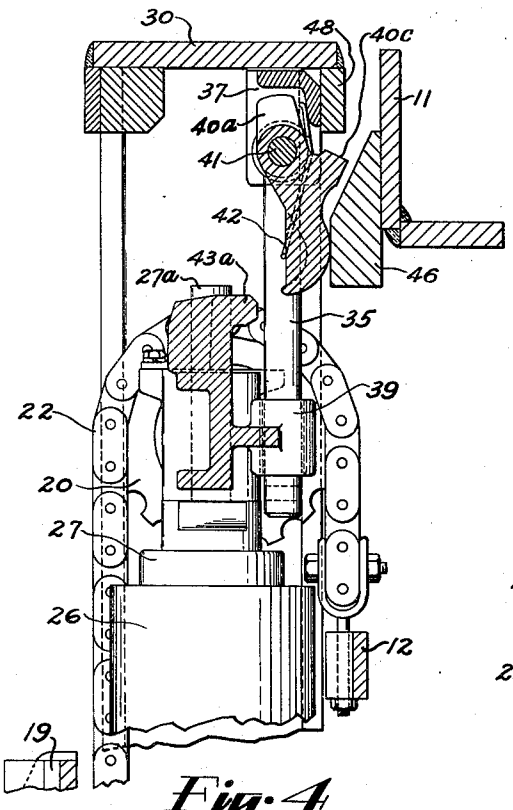


Fig. 4

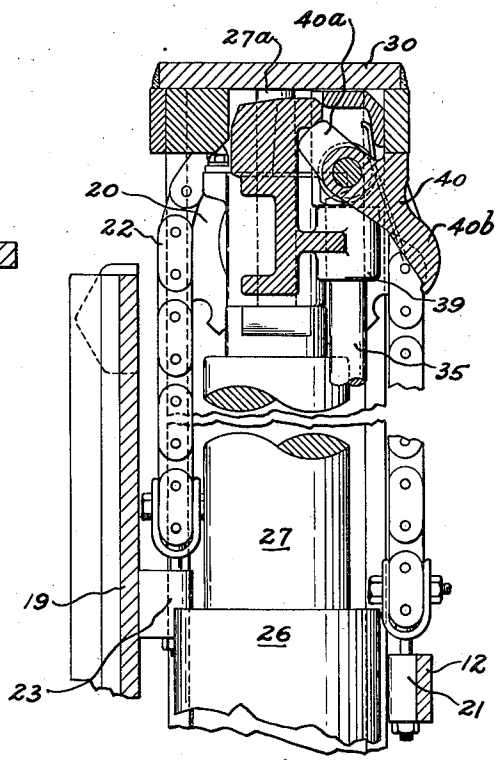


Fig. 5

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2,527,384

HYDRAULICALLY OPERATED TIER-LIFT MECHANISM

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Application March 4, 1949, Serial No. 79,617

3 Claims. (Cl. 187—9)

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This invention is concerned with improvements in industrial trucks and more particularly with industrial trucks of the tier-lift type wherein hydraulic rams are employed to effect lifting of the load.

An object of my invention is to eliminate some of the difficulties heretofore experienced in the use of hydraulic rams in telescoping load elevating mechanisms used in trucks of the type mentioned.

A further object of the invention is to provide a specific cross-head arrangement in association with the piston or pistons of the ram, or rams, as the occasion may be, in such manner that the floating action of the hydraulic mechanism is permitted while the elevating action throughout the more critical high lifting portion thereof is effected by a direct thrust of the piston or pistons upon the telescopic or elevatable part of the upright structure.

A still further object of the invention is to provide an arrangement of means located on the head of the movable frame and in association with a piston and frame locking mechanism whereby the upper ends of the pistons are guided in a loose manner during a lost motion period in the relative movements of the piston and the telescopic frame.

Other objects and advantages of the invention will be apparent from the following detailed description of preferred forms of embodiment of the invention, reference being made to the accompanying drawings wherein—

Figure 1 is a side elevation of an industrial truck of the tier-lift telescoping frame type and showing in dot and dash lines the movable load lifting elements extended to the uppermost position, the dot and dash parts being retractable downwardly within that part of the upright frame shown in full lines;

Figure 2 is an enlarged rear elevation partly in section of the upper parts of the ram mechanism and of the telescopic frame structure;

Figure 3 is a top cross-sectional view taken substantially along the line 3—3 of Figure 2;

Figure 4 is a cross-sectional elevation taken substantially along the line 4—4 of Figure 2 and showing the relation of the ram mechanism and the upper part of the telescopic frame structure when both these mechanisms are in a down position;

Figure 5 is a view similar to Figure 4, but showing the relation of the upright frame and the ram mechanism during the elevating movement of the telescopic frame and during the downward movement of that frame; and

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Figure 6 is a modification of the embodiment of the invention as applied when a centrally located single ram unit is used as the hydraulic motivator.

Referring to the drawings, I have shown a twin piston arrangement, although it will be apparent that the mechanism to be described can be applied to a single piston ram means with equal or greater advantage.

Telescopic tier-lift trucks of the industrial type generally are provided with a tiltable upright frame structure comprising inwardly facing channel members 10 cross connected by members 11 and 12. The frame 10, 11, 12 is pivotally connected to the front end of the truck chassis structure 14. The tiltable frame structure has a lower end structure (not shown), which affords a thrust seat for the ram mechanism. An inner elevatable frame structure comprising channel members 16, upper cross-plates 30 and 48 and suitable other cross-bracing, not shown, is elevatable to the position shown by the dot and dash lines in Figure 1. Disposed to traverse the channels of the elevatable frame members 16 is a fork carriage mechanism 19. A twin ram mechanism is disposed between the described upright structures, including sprockets 20 and chain reaches 22 and so arranged that one pair of ends of the chain reaches are connected to the cross-frame member 12, as shown at 21 in Figure 5, and the other pair of ends to the carriage mechanism 19, as shown at 23 of the same figure.

The general arrangements hereinabove set forth now is well known to have certain advantages and particularly with reference to door clearance. However, it now also is determined that if the hydraulic mechanism is to have a reasonable degree of continuous performance without requiring servicing, the lower end or ends of the rams must not be angularly rigidly fixed to the lower end structure of the tiltable frame 10, but should thrust thereagainst while being retained thereon. Crown and ball seats have been found satisfactory and are known and hence are not shown here. The ram arrangement here shown is such that the upper effective end of the piston is permitted to have a certain amount of floating movement relative to the frame with which it cooperates and the ram cylinder follows the sway of the piston, thus prolonging the life of the piston-cylinder packing.

In the form of my improvement shown in the drawings a cross-head structure 25 is shown spanning the two pistons 27 and 28 and the connections between these elements are such that the upper ends 27*a* and 28*a* of the respective pis-

tons project upwardly through suitable bores formed in cross-head structure and are adapted to abut against the under surface of a top plate 30 comprising the top structure of the telescopic frame. As shown, the upwardly projecting ends of the pistons are considerably reduced in diameter relative to the main hydraulically effective diameter of the pistons. Thus, the cross-head may rest on shoulders 27*b* and 28*b* formed on the pistons and suitable securing means, such as lock nuts 29 in threaded engagement with the piston extensions, may serve to fix the cross-head upon the pistons. At each end of the cross-head structure I provide stud shaft formations 25*a* for supporting roller bearings 31 upon which the chain sprockets 20 are mounted. The bearings and sprockets are retained in position by end disks 32 held in position by split rings 33 fixed in grooves formed at the ends of the stud shafts.

In my Patent No. 2,419,938 I disclosed and claimed a means for locking the piston of a hydraulic elevator to the telescopic frame of a tier-lift truck. In that patent the hydraulic ram mechanism was shown as being completely free of any upper stabilizing influences other than when the locking mechanism was in engagement with the ram mechanism. In the present instance I utilize two guide bars 35 in association with the locking mechanism and the cross-head structure whereby that part of the locking mechanism on the cross-head structure may be guided properly into coordination with the part which is on the top of the telescopic frame. These guide bars are disposed forwardly of the vertical plane of the center line of the pistons, as shown in Figs. 3, 4 and 5, and the upper ends thereof are in threaded engagement with a lock bracket 37 secured to the under face of the top cross-plate 30. The bars 35 thus depend from the top of the telescopic frame structure in parallel relation and are in sliding engagement with the cross-head structure through suitable bores formed in the integral cross-head bosses 39. Located adjacent the lower ends of the guide bars 35, cotter pin openings 35*a* are formed whereby, should it be desired to lift the pistons 27 and 28 out of the cylinders 26 this may be done by inserting pins in the openings 35*a* whereupon the entire telescopic frame, cross-head and pistons may be lifted as a unit by an extraneous crane.

The locking means as here used may comprise a cam and spring operated detent lever rockable on a pin 41 carried by the bracket member 37. The bracket is bifurcated in formation and the lever is disposed at the center. A spring 42 tends to keep the lever swung to the position shown in Fig. 5. A central extension 43 is integrally formed on the cross-head member to project vertically upward almost the height of the piston extensions 27*a* and 28*a* and the upper end is provided with a locking shoulder 43*a*, under which the detent end 40*a* of lever 40 is adapted to swing and engage the shoulder, as shown in Fig. 5. This is the locked relationship of the various elements during most of the upward movement of the telescopic frame. However, during a predetermined preliminary upward movement of the carriage corresponding to twice the distance between the piston ends 27*a* and 28*a* and the under surface of the top cross-plate 30, the telescopic frame is not elevated and during this period the cam end 40*b* of detent lever 40 is held in the unlock position shown in Figure 4 by a cam 46 secured to the inner face

of the non-elevatable frame member 11. A stop heel 40*c*, formed on the detent lever abuts the under edge of a cross-bar 48 comprising part of the top structure of the telescopic frame thereby limiting the inward swing of the detent lever under the influence of the spring 42. Thus, the vertical disposition of the cam 46 must be such as to be effective on the detent lever only when the telescopic upright approaches the last part of its lowering movement.

The size of the sprockets 20 is such that the chain reaches 22 will not project above the projecting ends 27*a* and 28*a* of the pistons and yet be of sufficient diameter to permit reasonably close disposition of the chain reaches to the cylinders 26.

It will be apparent that the extent of the floating or free sway movement of the piston-cylinder units and the cross-head is determined by the extent of looseness with which the guide bars 35 slide in the bores of the bosses 39 of the cross-head structure, i. e., insofar as relative lateral movement between the telescopic frame and the hydraulic units are concerned. The pistons act directly upon this frame and in a dual arrangement thus have an added vertical aligning influence on the frame relative to the central lines of the cylinders. There is, of course, some play between the two telescopic upright structures but the locked relationship of the hydraulic units and the elevatable frame structure at all times during any elevation of that frame prevents any possibility of the units retracting downwardly away from the elevated frame. When a single cylinder ram mechanism is used the slewing action, due to some variation between the loads being exerted upon the two chain stretches when unbalanced loads are being elevated by the carriage forks, is limited by the guide bars even though only a single piston extension is acting at the center of the cross-plate 30. This arrangement is more or less diagrammatically shown in Fig. 6 wherein the detent lever 40 latches directly upon the locking shoulder 83*a* of the adaptor 83 which is pinned to piston extension 30.

I claim:

1. In an industrial truck having a hydraulically operated load tiering mechanism comprising two inner and outer relatively movable telescoping frame structures and a loosely mounted piston and cylinder ram mechanism operatively disposed therebetween and having a load carriage operated by the piston through chain and sprocket connections, the combination of a cross-head mounted upon a vertical extension of the piston which projects above the cross-head means, locking means for connecting the piston and cross-head to said top structure, and guiding means associated with said locking means to direct said cross-head into engagement with said locking means, said guiding means comprising bars extending downwardly from the top of the inner telescoping frame structure and through openings in the cross-head.

2. In an industrial truck of the hydraulically operated tier-lift type the combination of vertically extending telescopic frame structures operatively supporting a load lifting carriage, two spaced-apart hydraulic piston and cylinder ram mechanisms mechanically disposed between the telescopic frame structures to effect relative vertical movement between the structures, a load lifting carriage arranged to traverse the frame structure, a cross-head structure fixed to a ver-

tical projection of each of the pistons, spaced-apart sprockets on the cross-head, chain reaches passing over the sprockets and having ends thereof secured to one of the frame structures and the other ends attached to the carriage, said piston extensions being adapted to act directly upon the top structure of one of the frame structures after a predetermined relative movement between the piston and the top structure has taken place, locking means on said top structure to connect said cross-head to said top structure, cross-head guiding means depending from the said top structure and through openings in the cross-head for guiding the cross-head to said locking means when said relative movement is taking place, said locking means being disposed between the guiding means and effective to maintain the cross-head in locked relation to the said top structure during simultaneous movement of the cross-head and top structure consequent to movement of said piston extensions.

3. In an industrial truck having a hydraulically operated load tiering mechanism comprising two inner and outer relatively movable telescoping frame structures and a loosely mounted piston and cylinder ram mechanism operatively disposed therebetween and supported on one of the frame structures and having a load

carriage operated by the piston through chain and sprocket connections to traverse the structures, the combination of a cross-head mounted upon a vertical extension of the piston which projects above the cross-head thereby to engage the top of the inner frame structure, locking means to connect said cross-head to said top of the inner frame structure, said locking means comprising a projection fixed to said cross-head and a detent lever mounted on the top of the inner frame structure to engage said projection, and means disposed at opposite sides of the locking means to guide the cross-head and projection into engagement with the detent lever, said guiding means comprising guide bars extending downwardly from said top structure of the inner telescoping frame and through openings in the cross-head.

EDWARD J. ABBE.

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