This invention relates to a novel triple lift upright assembly for an industrial lift truck.

Those persons skilled in the art will appreciate that there are certain advantages in using triple lift uprights to support a load lifting carriage on a truck. Thus, the load carriage will be supported on uprights that will be quite short when telescoped, but that can extend upwardly a relatively great distance so that the carriage can be lifted to an extremely high position. Also, the load carriage can have a large amount of free lift, meaning the lifting movement that is allowed to the carriage before the uprights begin to extend. To operate effectively, the various uprights and the carriage naturally must move in controlled relation to one another. The contribution of my invention is an exceedingly novel and ingenious upright assembly of the particular kind, having features that will achieve improved operation and control.

In accordance with my invention, I provide a novel latch arrangement which first locks the tertiary uprights to the secondary uprights during free lift of the carriage and also during elevation of the secondary uprights, whereby the tertiary uprights are elevated in unison with the secondary uprights until the secondary uprights are fully elevated, and which thereafter releases the tertiary uprights for extension relative to the extended secondary uprights, while at the same time locking the secondary uprights to the primary uprights to hold the secondary uprights in the elevated position during extension of the tertiary uprights.

With this arrangement, the tertiary uprights are held down by the weight of the secondary uprights during free lift of the load carriage, the tertiary and secondary uprights then elevated in unison, and the tertiary uprights thereafter released for extension relatively to the secondary uprights, while the secondary uprights are held extended relatively to the primary uprights. During the lowering cycle, the tertiary uprights first lower relatively to the extended secondary uprights and thereafter the tertiary uprights and secondary uprights lower together relatively to the primary 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 thereto.

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.

Referring now to the drawings,

FIG. 1 shows my novel triple lift assembly mounted on a truck;

FIG. 2 shows a vertical section of my assembly in extended position;

FIG. 3 shows latch means that I utilize in my assembly;

FIG. 4 illustrates the operation of the latch means when transferring the locking from the tertiary to the primary uprights;

FIG. 5 shows the latch means in position locking the secondary to the primary uprights;

FIG. 6 shows the latch means as viewed on the line 6--6 of FIG. 5;

FIG. 7 is a diagrammatic view showing the position of my assembly when the load lifting carriage is in lowered position;

FIG. 8 shows the position of the assembly at the end of the free lift stage of the carriage;

FIG. 9 shows the assembly with the carriage lifted further; and

FIG. 10 shows the fully extended position of the assembly.

Referring now more particularly to FIG. 1 of the drawings, I show a portion of an industrial truck T that is equipped with my novel upright assembly, indicated generally by the numeral 10. The upright assembly 10 includes vertically extending primary, secondary and tertiary uprights 11, 12, 13, best shown in FIG. 2. The primary upright 11 is mounted on a part of the truck, such as the axle 14, and the tertiary upright supports a load lifting carriage 15, with pairs of rollers 16, 17 and 18 utilized to mount the various uprights and carriage 15 for sliding movement. As is conventional, the uprights 11, 12, 13 may comprise pairs of vertical members formed with channels, but those details are not important to an understanding of my invention and I believe it will suffice to refer merely to single uprights 11, 12, 13.

A relatively short lift ram cylinder 20, FIG. 2, is supported on a lower cross member 11a on the primary upright 11, and has telescoping ram pistons 23a, 21 that extend upwardly. Ram piston 21 is equipped at its upper end with a cross head 22 on which is a lifting wheel 23. The tertiary upright 13 has a lower cross member 24, FIG. 2, that is arranged on the rear side of that upright, and that supports a chain wheel 25. The upper end of the tertiary upright 13 has a cross member assembly 26 on which I mount a pair of chain wheels 27 in fore and aft relation to each other.

Referring again to FIG. 2, I utilize a load chain 30 that is anchored to the lower cross member 11a on the primary upright 11, as through a rod 31, and that extends upwardly and over the lifting wheel 23 on the ram piston. Chain 30 then is reeved rearwardly on chain wheel 25, and forwardly on chain wheels 27 to a point of attachment indicated at 32 on the lifting carriage 15. Thus, the upward extension of ram piston 21, but it is important for lifting the tertiary upright 13. Further, the upper cross member assembly 26 has a portion 34 that will at times be engaged by the ram cross head 22, the ram then acting directly for lifting the tertiary upright 13, as I shall describe.

Before going into full detail as to the operation of my novel assembly, it will be necessary to describe that part of my construction through which I control the relation of the various uprights. Thus, referring to FIG. 2, I utilize latch means that are indicated generally by the numeral 35, including two latch levers 36, 37 of bellcrank shape, that I shall term a tertiary latch and a primary latch. The tertiary and primary latches 36, 37 are mounted on a lower cross member 38 at the rearward side of the secondary upright 12, utilizing for that purpose a pair of vertical bracket plates 39 that are best seen in FIGS. 3 to 5, and that support pivots 40, 41 for each corresponding latch 36, 37. I may indicate here that secondary upright 12 has an upper cross member 12a, but it is important to know merely that member 12a is arranged to
move with clearance relatively to other parts of the assembly.

As best shown in FIG. 6, I prefer to arrange the tertiary latch 36 in position between the bracket plates 39, while constructing the primary latch 37 in two parts arranged at opposed sides of plates 39 and integrally joined by a member 42.

The tertiary latch 36 has an upper hook portion 43 as seen in FIG. 4, but better shown in FIG. 3, that will be projected in a forward direction by a coil spring 44 on the cross member 38, and a lower cam portion 45 extending in a rearward direction. The primary latch 37 is somewhat like the tertiary latch 36, but an upper hook portion 46 on latch 37 is adapted to project rearwardly, and a lower cam portion 47 of that latch extends forwardly. Coil springs 48, FIGS. 3 and 6, act between the bracket plates 39 and primary latch 37 for projecting the hook portion 46 of that latch.

Referring particularly to FIG. 3, the lower cross member 24 on tertiary upright 13 has a lower portion 50 adapted to co-act with the cam portion 47 of primary latch 37, and is equipped with a roller 51 adapted to be engaged by the hook portion of tertiary latch 36. FIG. 3 actually shows the position of latch means 35 when tertiary upright 13 is in fully lowered position, telescoped within secondary upright 12, as in FIG. 1. Thus, tertiary latch 36 is held projected in FIG. 3 by the spring 44, with its hook portion 43 engaged with roller 51, locking secondary upright 12 to the tertiary upright 13. Secondary upright 12 will remain so locked after tertiary upright 13 starts to rise, so that those uprights will rise together.

As shown in FIG. 2, primary upright 11 has at its rearward side an upper cross member 52, which is equipped with a bracket 53 adapted to coact with tertiary and primary latches 36, 37. A pair of rollers 54, both of which may be seen in FIG. 6, are mounted on the bracket 53. Those rollers 54 are so positioned that, as secondary upright 12 moves to fully extended position relatively to primary upright 11, the upper surface of the hook portion 46 on primary latch 37 engages the rollers 54 causing the primary latch 37 to rotate in a clockwise direction against the pressure of spring 48 until the hook portion 46 passes the rollers 54. When the hook portion 46 passes the rollers 54, the latch 37 is rotated in the counterclockwise direction by the spring 48 to position the hook portion 46 over the rollers 54, as shown in FIG. 4. At the same time or slightly thereafter, the cam portion 45 on tertiary latch 36 engages a lower surface 55 on bracket 53, and on further upward movement of the secondary upright 12 relatively to the primary upright 11, the tertiary latch 36 is rotated in a counterclockwise direction against the pressure of spring 44, thereby retracting its hook portion 43 from the roller 51, as also shown in FIG. 4, to release the secondary upright 12 from the tertiary upright 13.

During this upward movement of the secondary upright 12 to the position in which the hook portion 43 is released from the tertiary upright 13, the hook portion 46 on primary latch 37 moves a slight distance above the rollers 54, as indicated by the clearance between the hook portion 46 and the rollers 45 in FIG. 4. Therefore, when the secondary upright 12 is released, it drops by gravity until the hook portion 46 on primary latch 37 engages rollers 54 to lock the secondary upright 12 against further downward movement relatively to the primary uprights. Thus, the tertiary upright 13 will be released from the secondary upright 12 so that the tertiary upright can continue upward extending movement, while latch 37 holds secondary upright 12 against downward movement relatively to primary upright 11.

It will be well to note that when the secondary upright 12 drops by gravity after release from the tertiary upright 13, the pressure on the cam portion 45 of latch 36 by the surface 55 of bracket 53 is relieved, allowing tertiary latch 36 to pivot in a clockwise direction by pressure of spring 44 to the position shown in FIG. 5, when the lower portion 50 of the tertiary upright 13 has moved above latch 36. Later, when the tertiary upright 13 moves downwardly toward telescoped position, the portion 50 will act against surface 56 on tertiary latch 36, causing that latch to retract. As tertiary upright 13 becomes telescoped relative to secondary upright 12, tertiary latch 36 will engage over roller 51, in a position substantially that shown in FIG. 3. At this time, primary latch 37 still supports the secondary upright 12 on the primary upright 11, and a slight further movement of tertiary upright 13 in telescoping direction will cause the lower portion 50 on the tertiary cross member 24 to move downwardly a sufficient distance to actuate the cam portion 47 of primary latch 37. That will rotate the latch portion 46 to retracted position so that the secondary upright 12 no longer will be locked to the primary upright 11. Then, a slight dropping of secondary upright 12 relatively to tertiary upright 13 will place the latches 36, 37 in a position like that in FIG. 3, and latch 36 will support secondary upright 12 on the tertiary upright 13 so as to descend with the upright 13.

Let us now refer to the diagrammatic FIGS. 7 to 10 of the drawings in order to review the operation of my novel upright assembly 10. In those figures, I indicate the latch means 35 by way of illustrating the locking of certain uprights. Referring particularly to FIG. 7, the load carrying 15 is in an initial lowered position, all of the uprights 11, 12 and 13 being in fully telescoped relation to one another. Normally, the ram 20 is in full telescoped position. Moreover, the latch means 35 holds tertiary upright 13 locked to secondary upright 12. Secondary upright 12 is not locked relatively to primary upright 11, and is free to rise.

If fluid pressure now is applied to hydraulic ram 20, the ram will move lifting wheel 23 upwardly, acting through chain 30 to lift the load carriage 15. It will be noted that the carriage 15 may have free lift, as indicated in FIG. 8, tertiary upright 13 must remain down, with chain 30 moving around the chain wheels 25, 27, as will be appreciated. Theoretically, the forces applied to those wheels will be balanced in a vertical direction so that tertiary upright 13 will not rise. In practice, as I have already described, those forces will not be balanced and may press tertiary upright 13 in upward direction. However, the weight of secondary upright 12 will hold tertiary upright 13 down, since those uprights are locked through the latch means 35. That will be effective, under normal conditions, to enable the load lifting carriage 15 to have the full free lifting movement for which the assembly is designed, or in other words, to the position indicated in FIG. 8.

Under certain conditions, as when for some reason there is undue friction or binding, the lifting pressure that the chain 30 applies to tertiary upright 13 may be exceedingly high during the free lift of carriage 15. When that is the case, the tertiary upright 13 may rise, but latch means 35 need not accept excessive pressure since they merely need lift the secondary upright 12 as tertiary upright 13 rises. Of course, when secondary upright 12 is lifted prematurely in that way, the operator will be warned that the lifting mechanism is not operating in the proper manner, but no great strain will be applied to latch means 35.

When carriage 15 operates normally and has completed the free portion of its lift, the ram crosshead 22 will engage the top cross member assembly 26, as indicated in FIG. 8. Crosshead 22 then will act directly to lift tertiary upright 13 as in FIG. 9, lifting also secondary upright 12 because of the locking position of latch means 35. Ram 20 will continue to act and the chain 30 to lift the load carriage 15.

In FIG. 9, it will be understood that the carriage 15 is rising faster than are the uprights 12 and 13. In due time, carriage 15 will engage the stop 33 which is at the top of tertiary uprights 13. The chain 30 then will act.
through carriage 15 to lift the tertiary upright 13 farther until that upright reaches its fully extended FIG. 10 position. In the meanwhile, as will be appreciated, tertiary upright 13 has lifted secondary upright 12 to its fully extended position, and the latch means 35 have acted to release tertiary upright 13 for continued extending movement, while locking secondary upright 12 to primary upright 11, as indicated in FIG. 10. Then secondary upright 12 will be positively supported in extended position on primary upright 11, and cannot drop while tertiary upright 13 moves to the fully extended position which is illustrated in FIG. 10. It will be appreciated that the full extending movement of tertiary upright 13, together with the high lift of the carriage 15 in FIG. 10, has been achieved while using the telescoping ram 29 that is relatively short when in retracted position.

Incidental to lowering of the load carriage 15, there will be merely a reverse operation of the various parts of my assembly. Thus, it will be understood that secondary upright 12 will remain locked to primary upright 11 until tertiary upright 13 is returned to its fully telescoped relation to secondary upright 12. At that time, latch means 35 will automatically transfer the locking of secondary upright 12 from primary upright 11 to tertiary upright 13. It will be appreciated that secondary and tertiary uprights 12 and 13 then will return together to the lowered position, after which the carriage 15 will be lowered through that part of its movement which corresponds to free lift.

I believe that the operation of my extremely novel assembly will now be understood, and that its advantages will be fully appreciated. Through my invention, I am able to use a hydraulic lift ram that extends a relatively large amount, while achieving very effective operation and control of truck uprights. Not only do I achieve a large amount of free lift for a load carriage, but I do that while locking the tertiary upright through latch means that need accept no great strain. Actually, my novel assembly will operate very well, even though the tertiary upright may at times be subjected to an exceedingly large lifting force. Therefore, I believe that the very considerable value of my invention will be understood, and that the merits of my invention will be appreciated by those skilled in the art.

I now claim:

1. In a lift truck of the class described, a primary upright, a secondary upright mounted for movement to an extended position relatively to the primary upright, a tertiary upright in turn mounted for movement to an extended position relatively to the secondary upright, and a load lifting carriage movable on the tertiary upright, latch means engageable alternately to lock the secondary to the tertiary upright and to lock the secondary upright to the primary upright, means controlling said latch means to hold the secondary upright locked to the tertiary upright while the tertiary upright is in fully extended position, and the load lifting carriage movable on the tertiary upright, means through which the ram acts to extend the tertiary upright and therefore the secondary upright after the free carriage lift, and means actuating said latch means to transfer the locking of the secondary upright from the tertiary to the primary upright when the secondary upright reaches extended position, so as to hold the secondary upright in extended position while enabling the tertiary upright to extend further.

2. In a lift truck of the class described, a primary upright, a secondary upright mounted for movement to an extended position relatively to the primary upright, a tertiary upright in turn mounted for extension relatively to the secondary upright, and a load lifting carriage movable on the tertiary upright, latch means engageable alternately to lock the secondary to the tertiary upright and to lock the secondary upright to the primary upright, means controlling said latch means to hold the secondary upright locked to the tertiary upright while leaving the secondary upright free to extend relatively to the primary upright, a lift ram mounted on the truck, a flexible member through which said lift ram lifts the load carriage, guide wheels around which said flexible member is reeved at lower and upper points on the tertiary upright between the ram and carriage, and means actuating the latch means to transfer the locking of the secondary upright from the tertiary to the primary upright when the secondary upright reaches extended position, so as to hold the secondary upright in extended position while enabling the tertiary upright to extend further.
rights locked together until the secondary upright reaches its extended position,
a lift ram for lifting the load carriage,
the weight of said secondary upright acting through the tertiary latch for holding the tertiary upright retracted while the lift ram effects free lift of the carriage relatively to the tertiary upright,
means through which the ram acts to extend the tertiary and secondary upright while in locked relation to one another after the free carriage lift,
a part with which the primary latch coacts on the primary upright to lock the secondary to the primary upright when the secondary reaches extended position,
and cam means engaging between the primary and tertiary latch to move that latch to a release position when the primary latch effects locking of the secondary upright, whereby to enable the ram to extend the tertiary upright while the primary latch supports the secondary upright.

5. In a lift truck of the class described,
a primary upright, a secondary upright mounted for movement to an extended position relatively to the primary upright, a tertiary upright in turn mounted for extension relatively to the secondary upright, and a load lifting carriage movable on the tertiary upright,
tertiary latch parts engaged between the secondary and tertiary uprights to hold those uprights locked together until the secondary upright reaches its extended position,
a lift ram mounted on the truck,
a flexible member through which said lift ram lifts the load carriage,
guide wheels around which said flexible member is reeved at lower and upper points on the tertiary upright between the ram and the carriage, and at times accepting from said member unbalanced forces that tend to extend the tertiary upright while the ram acts to effect free lift of the carriage, the secondary upright being free to extend relatively to the primary upright so that the tertiary latch parts need merely accept the weight of the secondary upright in order to oppose extension of the tertiary upright during the free lift,
means through which the lift ram acts to extend the tertiary upright and therefore the secondary upright upon completion of the free carriage lift, primary latch parts engaging between the secondary and primary uprights to lock those uprights to one another when the secondary upright reaches extended position, and means disengaging the tertiary latch parts upon engagement of the primary latch parts, enabling the tertiary upright to extend farther while the secondary upright is supported through its locked relation to the primary upright.

References Cited by the Examiner

UNITED STATES PATENTS
2,595,120 4/52 Barnes ----------------- 187—9
2,906,373 9/59 Hastings et al. --------- 187—9
2,987,140 6/61 Olson ----------------- 187—9
3,051,265 8/62 Boyajian et al. -------- 187—9

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