

May 30, 1961

J. E. PATTISON
INDUSTRIAL TRUCK MAST

2,986,236

Filed May 4, 1954

3 Sheets-Sheet 1

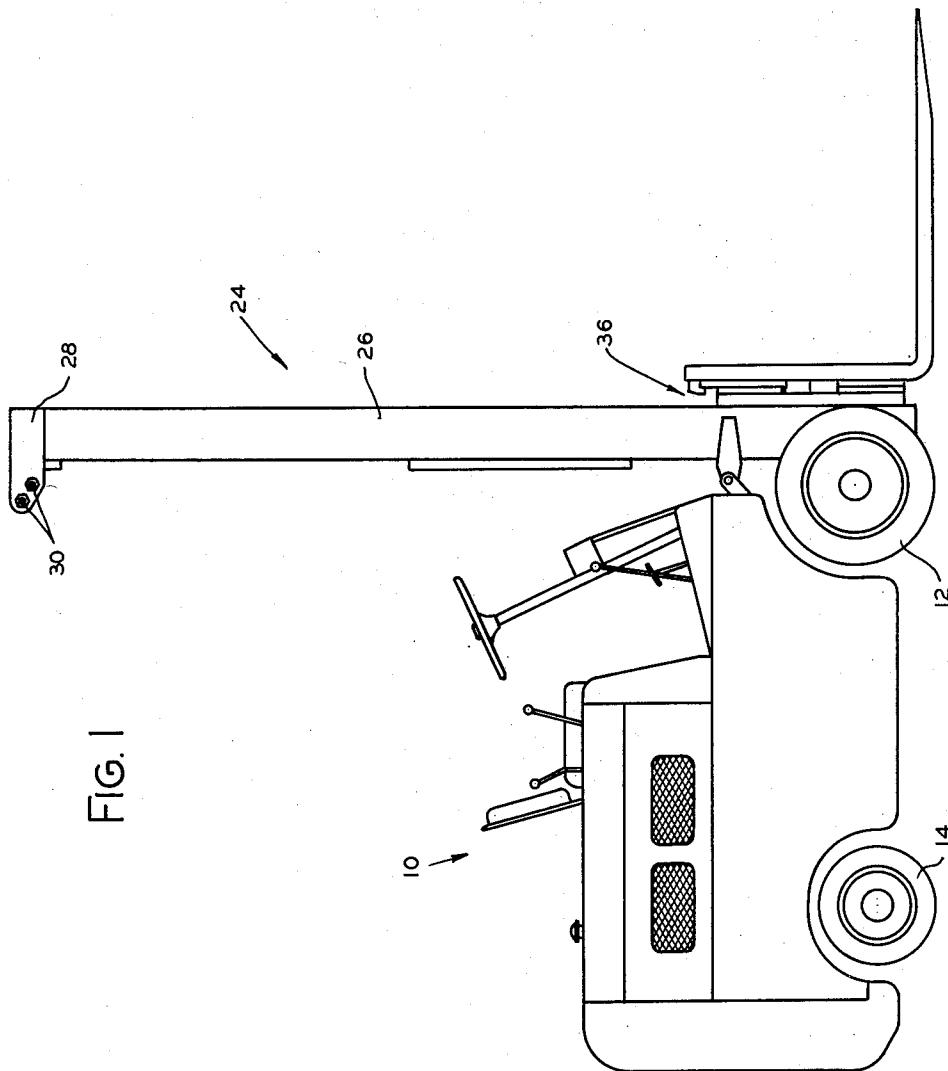


FIG. 1

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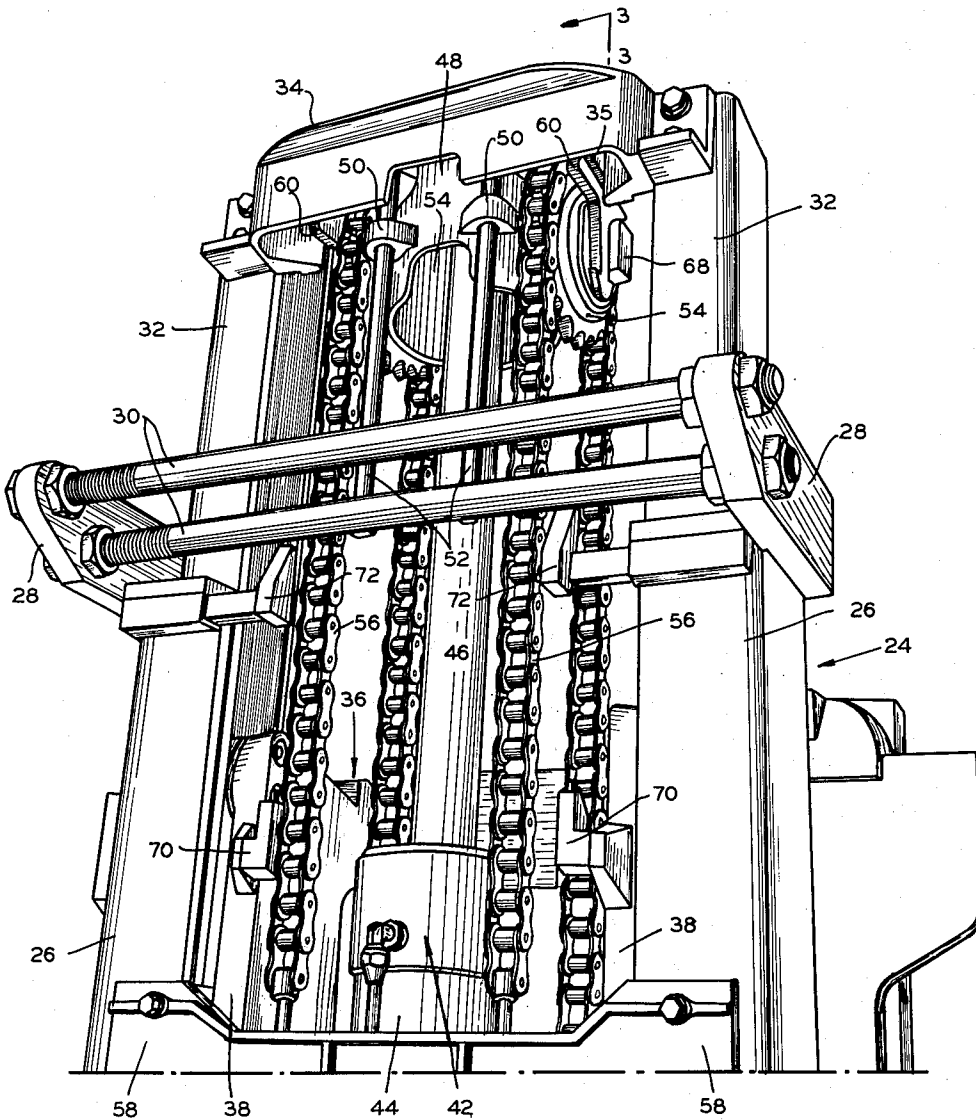
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3 Sheets-Sheet 2

FIG. 2



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3 Sheets-Sheet 3

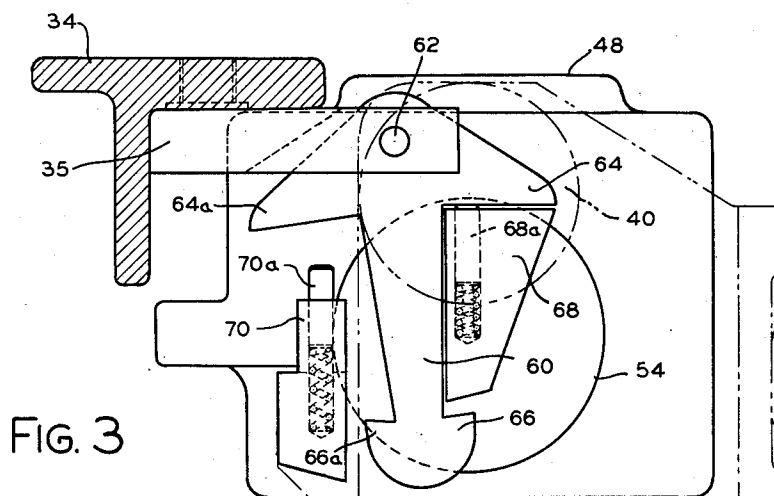


FIG. 3

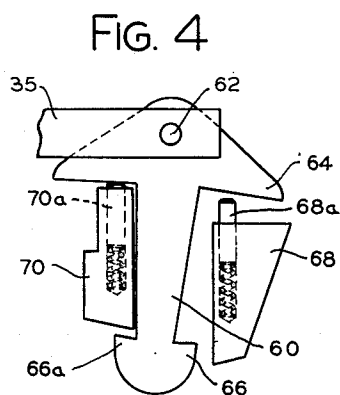


FIG. 4

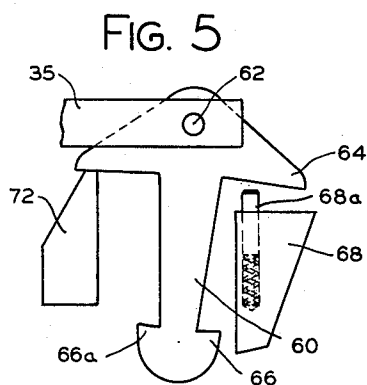
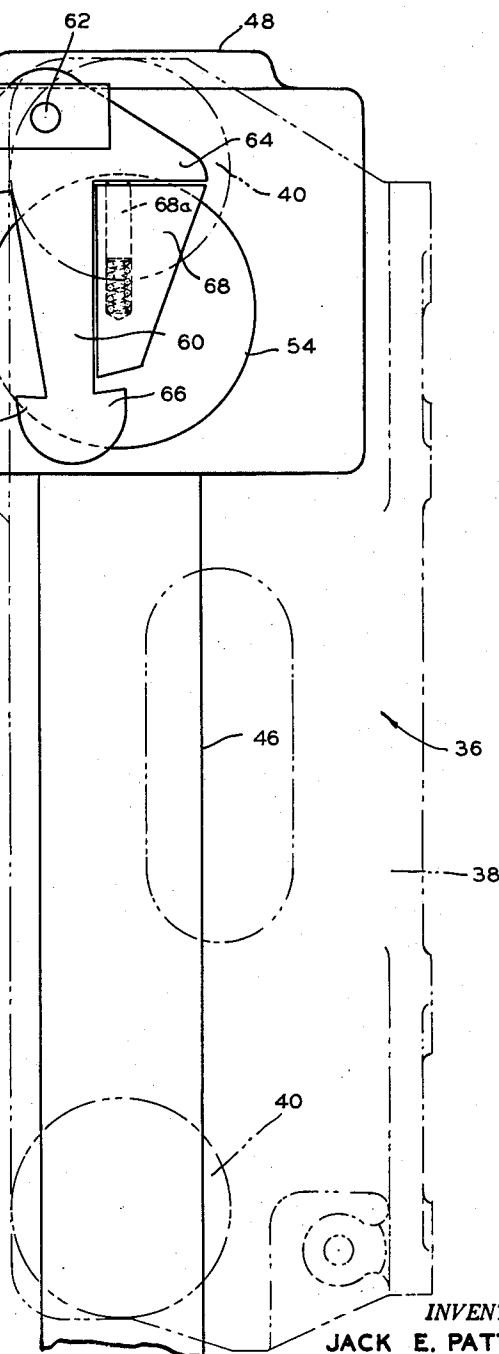


FIG. 5



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2,986,236

INDUSTRIAL TRUCK MAST

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Filed May 4, 1954, Ser. No. 427,610

9 Claims. (Cl. 187—9)

My present invention relates generally to industrial trucks, and, more specifically, is concerned with telescopic masts embodied with industrial trucks.

One presently known form of industrial truck mast comprises outer channels, inner channels slidably mounted in the outer channels, and a load supporting carriage slidably mounted in the inner channels. An elevating mechanism, including a suitable hydraulic piston and cylinder assembly having a vertically movable piston rod, is provided for moving the inner channels within the outer channels and for moving the carriage within the inner channels. The piston rod commonly includes a crosshead at its upper extremity, and chains or other flexible members trained over the crosshead for providing motion multiplication. The elements of the described mast are arranged so that the carriage is initially moved upwardly in the inner channels before the latter are moved upwardly in the outer channels. Moreover, the arrangement is such that near the upper end of the operating range of the mast portions of the inner channels are capable of being elevated to a greater height than the piston rod crosshead. Although the hydraulic assembly provides a positive force for moving the inner channels and carriage upwardly, it does not provide a continuous positive force for drawing the inner channels downwardly within the outer channels when the carriage is being lowered within the inner channels.

In the afore-noted mast construction, the inner channels may have a tendency, when in an elevated position, to bind within the outer channels, as the carriage is being lowered. This tendency is especially pronounced when the carriage is supporting a heavy load. If the inner channels stick within the outer channels for a portion of a downward operation, then when the inner channels do break loose or are pulled loose by some mechanism, they drop suddenly, and this may cause damage to the mast and/or the load supported by the carriage. There are available lost motion mechanisms which will pull the inner channels down after an interval of sticking, but I am not aware of any mechanism which provides a continuous positive downward force on the inner channels beginning immediately that the carriage starts down.

It is an object of my present invention to provide improved automatically operable mechanism which will serve to draw the inner channels of the mast downwardly under a continuous positive force, while the carriage is being lowered, so as to prevent the inner channels from initially binding and then dropping suddenly.

I accomplish the aforesaid object by providing the inner channels with latch means which, when the hydraulic assembly is actuated for downward movement, initially locks the inner channels to the load carriage, and then locks the inner channels to the piston rod of the hydraulic assembly. Thus, through the entire range of downward movement of the inner channels, a positive force is imposed thereon for preventing binding of the latter within the outer channels.

Another object of the present invention is to provide

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an improved elevating mast construction wherein automatically operable mechanism serves to permit the inner channels during the terminal portion of the elevating movement out of the mast to be elevated above the hoist motor means while being connected to the carriage.

Now, in order to acquaint those skilled in the art with the manner of constructing and using masts in accordance with the principles of my present invention, I shall describe in connection with the accompanying drawings a preferred embodiment of my invention.

In the drawings:

Figure 1 is a side elevational view of an industrial truck and the mast of my present invention which is embodied therewith;

Figure 2 is a perspective view of the rear of the mast of Figure 1; and

Figure 3 is a partial sectional and partially schematic view of the latch mechanism of Figure 2;

Figure 4 is a view, reduced in size, of a part of Figure 3 showing the latch mechanism in a different operational position; and

Figure 5 is a view similar to Figure 4 showing the latch engaging a dog member on the fixed portion of the mast.

Referring now to the drawings, there is indicated generally by the reference numeral 10 an industrial truck having forward wheels 12 and rear wheels 14. Supported on the forward end of the truck 10 is a generally vertically extending mast or upright 24, which comprises laterally spaced vertically extending outer channel members 26 that define fixed guide means. Rearwardly extending brackets 28 are secured to the upper ends of the channel members 26, and the brackets 28 are maintained in proper spaced relation by means of transverse bars 30.

Slidably mounted in the outer channel members 26 are inner channel members 32 which are interconnected at their upper ends by a transverse frame member 34. The inner channels 32 and frame member 34 define guide means which are movable telescopically in the outer channel members 26. Slidably mounted in the inner channel members 32 is load supporting means, in the form of a conventional load supporting carriage indicated generally at 36, which comprises laterally spaced vertical lift brackets 38. The lift brackets 38 are provided at their upper and lower ends with rollers 40 that have rolling engagement with the respective inner channel members 32.

Vertical movement of the inner channel members 32 and the load supporting carriage 36 is adapted to be effected by means of a vertical hydraulic piston and cylinder assembly 42 which is carried by the mast intermediate of the inner channel members 32. The hydraulic assembly 42 comprises a cylinder 44, which is held stationary relative to the outer channel members 26, and a piston rod 46, which is actuatable vertically by admitting fluid under pressure to the lower end of the cylinder 44.

The upper end of the piston rod 46 has secured thereto a crosshead member 48 which is spaced below the frame member 34 when the piston rod 46 is fully retracted. The piston rod crosshead 48 is formed with rearwardly extending bosses 50 arranged for sliding movement on vertical guide rods 52 that are affixed at their upper ends to the transverse frame member 34. The guide rods 52 are provided for maintaining the hydraulic assembly 42 in proper alignment between the channel members 26 and 32. These rods 52, if provided with suitable heads on the lower ends, may serve also as lost motion connections between the inner channels and the crosshead 48 to pull the inner channels down after a brief lag, in the event that the latch mechanism disclosed herein fails to operate properly for any reason.

The piston rod crosshead 48 carries at each side a rotatable sprocket gear 54. Trained over these sprocket gears 54 are chains 56 that are secured, at their one ends,

to the lower portion of the load supporting carriage 36, and are anchored, at their other ends, to a cross member 58 which interconnects the outer channel members 26.

The mechanism of my present invention, which controls the movement of the inner slides 32 within the outer slides 26, comprises latch members 60 and associated mechanism to be described. The latch members 60 are pivotally mounted about horizontal pin members 62 (see Figure 3) which are axially aligned and are secured to the frame member 34 at points immediately inwardly of the inner channel members 32. As shown, the pins 62 are mounted in members 35 which are in turn fastened to frame member 34 in a suitable manner such as by welding. The latch members 60, as shown in Figure 3, comprise forwardly extending upper arm portions 64, rearwardly extending upper arm portions 64a, and forwardly and rearwardly extending lower finger portions 66 and 66a.

Cooperating with the latch members 60 are dog members 68 that are secured to the sides of the piston rod crosshead 48, dog members 70 that are secured to the lift brackets 38 of the load supporting carriage 36, and dog members 72 that are secured to the upper ends of the fixed outer channel members 26. As illustrated, dog members 68 and 70 are provided respectively with spring loaded pins 68a and 70a. These pins take up slack between the tops of the dogs and the upper arm portions of the latch, which occurs when the direction of operation of the carriage is changed from upward to downward.

The springs beneath these pins are not strong enough that the pins will operate the latch when the pins initially engage the latch during an upward movement. The spring merely collapses and the latch is not operated until engaged by the dog. However, the springs are strong enough to prevent false operation of the latch during a reversal of the carriage by maintaining pressure on an upper arm of the latch even though the dog which has been in contact with the upper arm pulls away slightly when the motion of the carriage changes from upward to downward. It is necessary of course for the dogs to be slightly smaller than the space between the upper and lower arms of the latch, and this produces the slight downward movement of a dog with respect to the latch when a reversal occurs. The pins project approximately one-half inch above the dogs when the pins are fully extended.

Figure 3 is a view which is partially in section and partially schematic and is taken along the line 3—3 of Figure 2 looking to the left in the direction of the arrow. In Figure 3 the sprocket 54 has been shown merely as a circle and the chains have been eliminated in order to simplify this figure. The carriage 36 including the vertical lift brackets 38 and the rollers 40 have been shown in phantom to indicate the location of the carriage at the position of the mast structure illustrated in this figure. In this figure the inner slide member is supported on the piston rod inasmuch as cross frame member 34 of the inner slide member is resting on cross head 48 which is connected to the piston rod 46.

The mechanism of my present invention operates as follows: Fluid under pressure is selectively directed, by the operator of the truck, to the lower end of the cylinder 44 of the hydraulic assembly 42. The fluid pressure forces the piston rod 46 and the piston rod head 48 upwardly. The inner channel members 32 remain stationary until the piston rod head 48 engages the free member 34, at the position illustrated in Figure 2, whereupon the inner channel members 32 are moved upwardly conjointly with the piston rod 46 and head 48.

Moreover, when the piston rod head 48 approaches the frame member 34, the dogs 68 engage the forwardly extending arm portions 64 of the latch members 60 and cause the forwardly extending finger portions 66 of the latter to be swung beneath the dogs 68. Thereafter,

should the piston rod 46 be retracted, the dogs 68 are in position to act on the adjacent finger portions 66 to pull the inner channel members 32 downwardly.

It is to be noted that the sprocket gears 54, which are elevated with the piston rod head 48, cause the ends of the chains 56 that are secured to the load supporting carriage 36 to be pulled upwardly at a speed which is twice the travel speed of the piston rod 46. The chains 56 serve to move the load supporting carriage 36 within the inner channels 32 initially as the latter remain stationary and then as they are moved upwardly within the outer channels 26.

Now, when the load supporting carriage 36, during its upward travel, approaches the piston rod head 48, as illustrated in Fig. 3, the carriage dogs 70 engage the rearwardly extending arm portions 64a of the latch members 60 for causing the rearwardly extending finger portions 66a of the latter to be swung beneath the dogs 70 as shown in Fig. 4. At this point, the latches 60 serve to lock the inner channels 32 and load supporting carriage 36 together. Simultaneously, the inner channels 32 are released from locking engagement with the piston rod head 48 because the forwardly extending finger portions 66 of the latches 60 are withdrawn from beneath the dogs 68. Thereafter, the load supporting carriage 36 is operable to elevate the inner channels 32 until the upper end of the latter is positioned at a point above the limit of upward travel of the piston rod head 48.

The primary function of the latch mechanism of my present invention is to insure that the inner channels 32 are drawn downwardly by a continuous positive force when the load supporting carriage 36 is being lowered. Lowering of the load supporting carriage is effected by bleeding the fluid from the lower end of the cylinder 44 of the hydraulic assembly 42. The weight of the carriage, or the carriage plus the load, then pulls the carriage down.

If the inner channels 32 tend to stick or bind, as the carriage is being lowered, the carriage dogs 70 engaging the rearwardly extending finger portions 66a of the latches 60 pull the inner channels 32 downwardly. As the inner channels 32 move downwardly, the frame member 34 engages the piston rod head 48, and the forwardly extending arm portions 64 of the latches 60 engage the dogs 68. The dogs 68 cause the rearwardly extending finger portions 66a of the latches 60 to be withdrawn from beneath the carriage dogs 70 as shown in Fig. 4 and the forwardly extending finger portions 66 to be disposed beneath the dogs 68 as shown in Fig. 3.

As a result of such actuation of the latches 60, the carriage 36 is permitted to move downwardly relative to the inner channels 32 while the latter are drawn downwardly conjointly with the piston rod head 48 through the interaction of the latches 60 and dogs 68. In the lowermost position of the inner channels 32, the rearwardly extending arm portions 64a of the latches 60 engage the channel dogs 72 as illustrated in Fig. 5 and the forwardly extending finger portions 66 of the latches 60 are withdrawn from beneath the dogs 68 for permitting the piston rod head 48 to move downwardly, relative to the inner channels 32, to its lowermost position. During the aforedescribed downward movement of the piston rod 46, the carriage is moved from the upper to the lower end of the inner channels, in a manner that is well known in the art.

From the foregoing description it will be realized that I have provided an automatically operable mechanism which is effective in causing the inner channels of the mast to be moved downwardly under a continuous positive force so as to prevent the inner channels, in any range of vertical movement, from suddenly dropping and causing damage to the mast and/or load carried by the load supporting carriage.

Now, while I have shown and described what I believe to be a preferred embodiment of my present invention, it

will be understood that various rearrangements and modifications may be made therein without departing from the spirit and scope of my invention.

I claim:

1. For use with an industrial truck, the combination of a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in said outer channel members, a load supporting carriage mounted for vertical movement in said inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of said carriage within said inner channel members and movement of said inner channel members within said outer channel members, and latch means carried by said inner channel members and operable sequentially and in coordination with portions of said carriage and said piston rod to first lock the inner channel members to said carriage through an initial range of downward movement of said piston rod during at least a portion of which movement the upper ends of said inner channel members are elevated above the upper end of said piston rod, and to then lock said inner channel members to said piston rod through an intermediate range of downward movement of the latter.

2. For use with an industrial truck, the combination of a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in said outer channel members, a load supporting carriage mounted for vertical movement in said inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of said carriage within said inner channel members and movement of said inner channel members within said outer channel members, latch means carried by said inner channel members, a first member carried by said carriage and locked to the latch means through an initial range of downward movement of said piston rod and from a position of elevation wherein the upper ends of the inner channel members are located above the upper end of the piston rod, and a second member carried by said piston rod and operable to cause the latch means to become unlocked from said first member and locked to said second member through an intermediate range of downward movement of said piston rod wherein the inner channel members and the piston rod are moved downwardly together in latched relation.

3. For use with an industrial truck, the combination of a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in said outer channel members, a load supporting carriage mounted for vertical movement in said inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of said carriage within said inner channel members and movement of said inner channel members within said outer channel members, latch means carried by said inner channel members, a first member carried by said carriage and locked to the latch means through an initial range of downward movement of said piston rod and from a position of elevation wherein the upper ends of the inner channel members are located above the upper end of the piston rod, a second member carried by said piston rod and operable to cause the latch means to become unlocked from said first member and locked to said second member through an intermediate range of downward movement of said piston rod wherein the inner channel members and the piston rod are moved downwardly together in latched relation, and a third member carried by said outer channel members and operable to cause the latch means to become unlocked from said second member through a final range of downward movement of said piston rod.

4. For use with an industrial truck having a vertical mast comprising outer channel members, inner channel

members mounted for vertical movement in the outer channel members, a load supporting carriage mounted for vertical movement in the inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of the carriage within the inner channel members and movement of the inner channel members within the outer channel members, the combination of latch means carried by the inner channel members, first dog means carried by the carriage and locked to said latch means through an initial range of downward movement of the piston rod and from a position of elevation wherein the upper ends of the inner channel members are located above the upper end of the piston rod, second dog means carried by the piston rod and operable to cause said latch means to become unlocked from said first dog means and locked to said second dog means through an intermediate range of downward movement of the piston rod wherein the inner channel members and the piston rod are moved downwardly together in latched relation, and third dog means carried by the outer channel members and operable to cause said latch means to become unlocked from said second dog means through a final range of downward movement of the piston rod.

5. For use with an industrial truck, the combination of a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in said outer channel members, a load supporting carriage mounted for vertical movement in said inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of said carriage within said inner channel members and movement of said inner channel members within said outer channel members, sprocket means carried by said piston rod, chain means trained over said sprocket means and secured at one end to said carriage whereby the latter is moved at a greater speed than said piston rod, at least one latch member pivotally mounted to one of said inner channel members and comprising upper forwardly and rearwardly extending arm portions and lower forwardly and rearwardly extending finger portions, at least one first dog member carried by said carriage and operable to engage the rearward arm portion of said latch to cause the rearward finger portion to swing beneath said first dog member whereby said latch is locked to the latter through an initial range of downward movement of said piston rod, at least one second dog member carried by said piston rod and operable to engage the forward arm portion of said latch to cause the rearward finger portion to swing from beneath said first dog member and the forward finger portion to swing under said second dog member whereby said latch is locked to the latter through an intermediate range of downward movement of said piston rod, and at least one third dog member carried by one of said outer channel members and operable to engage the rearward arm portion of said latch to cause the forward finger portion to swing from beneath said second dog member whereby said latch is unlocked from the latter through a final range of downward movement of said piston rod.

6. For use with an industrial truck having a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in the outer channel members, a load supporting carriage mounted for vertical movement in the inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of the carriage within the inner channel members and movement of the inner channel members within the outer channel members, sprocket means carried by the piston rod, chain means trained over the sprocket means and secured at one end to the outer channel members and at the other end to the carriage whereby the latter is moved at a greater speed than the piston rod, the com-

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bination of at least one latch member pivotally mounted to one of the inner channel members and comprising upper forwardly and rearwardly extending arm portions and lower forwardly and rearwardly extending finger portions, at least one first dog member carried by the carriage and operable to engage the rearward arm portion of said latch to cause the rearward finger portion to swing beneath said first dog member whereby said latch is locked to the latter through an initial range of downward movement of the piston rod, at least one second dog member carried by the piston rod and operable to engage the forward arm portion of said latch to cause the rearward finger portion to swing from beneath said first dog member and the forward finger portion to swing under said second dog member whereby said latch is locked to the latter through an intermediate range of downward movement of the piston rod, and at least one third dog member carried by one of the outer channel members and operable to engage the rearward arm portion of said latch to cause the forward finger portion to swing from beneath said second dog member whereby said latch is unlocked from the latter through a final range of downward movement of the piston rod.

7. For use with an industrial truck, the combination of a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in said outer channel members, a load supporting carriage mounted for vertical movement in said inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of said carriage within said inner channel members and movement of said inner channel members within said outer channel members, latch means carried by said inner channel members, one dog means carried by said piston rod and operable to cause the latch means to become locked to the said one dog means through a portion of the range of upward movement of said piston rod during which movement said inner channel members and said piston rod are operably latched one to the other, and another dog means carried by said carriage and operable to cause the latch means to become unlocked from the said one dog means and locked to the said other dog means through a subsequent portion of the range of upward movement of said piston rod during the terminal portion of which movement the upper ends of said inner channel members are elevated above the piston rod.

8. For use with an industrial truck having a vertical mast comprising outer channel members, inner channel members mounted for vertical movement in the outer channel members, a load supporting carriage mounted for vertical movement in the inner channel members, hydraulic means carried by the mast and including a vertically movable piston rod for effecting movement of the carriage within the inner channel members and movement of the inner channel members within the outer channel members, sprocket means carried by the piston rod, chain means trained over the sprocket means and secured at one end to the outer channel members and at the other end to the carriage whereby the latter is moved at a greater speed than the piston rod, the combination of at least one latch member pivotally mounted to one of the inner channel members and comprising upper forwardly and rearwardly extending arm portions and lower forwardly and rearwardly extending finger

portions, one dog member carried by the piston rod and operable to engage the forward arm portion of said latch to cause the forward finger portion to swing under the said one dog member whereby said latch is locked to the one dog member through a portion of the range of upward movement of the piston rod, another dog member carried by the carriage and operable to engage the rearward arm portion of said latch to cause the forward finger portion to swing from beneath the said one dog member and the rearward finger portion to swing under said other dog member whereby said latch is locked to the other dog member through the balance of the range of upward movement of the piston rod, the said latch remaining locked to the said other dog member through an initial range of downward movement of the piston rod whereby the carriage positively pulls the inner channel members down with the carriage during such initial range of downward movement of the piston rod, the said one dog member carried by the piston rod engaging the forward arm portion of the said latch to cause the rearward finger portion to swing from beneath the said other dog member and the forward finger portion to swing under the said one dog member whereby said latch is again locked to the said one dog member through an intermediate range of downward movement of the piston rod whereby the piston rod positively pulls the inner channel members downwardly through such intermediate range, and a third dog member carried by one of the outer channel members and operable to engage the rearward arm portion of said latch to cause the forward finger portion to swing from beneath said one dog member whereby said latch is unlocked from the one dog member through a final range of downward movement of the piston rod.

9. A mast structure for an industrial truck comprising fixed guide means, movable guide means mounted for vertical movement relative to the said fixed guide means, load support means mounted for vertical movement relative to said movable guide means, motor operated means carried by the mast and including a vertically movable member operatively connected to the load support means and to the movable guide means for effecting vertical movement of said load support means relative to said movable guide means and vertical movement of said movable guide means relative to said fixed guide means, and latch means carried by said movable guide means and operable sequentially and in coordination with portions of said load support means and said vertically movable member during upward movement of said movable guide means to first secure the movable guide means to the said vertically movable member in a lower portion of the operating range of the mast and to then secure the movable guide means to the load supporting means in an upper portion of the operating range of the mast, the upper part of said movable guide means being elevatable by said vertically movable members in said upper portion of the operating range to a position above said vertically movable member.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 2,986,236

May 30, 1961

Jack E. Pattison

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.

Column 3, line 64, for "The" read -- This --; line 67, for "free" read -- frame --.

Signed and sealed this 17th day of October 1961.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

DAVID L. LADD

Commissioner of Patents

USCOMM-DC