Sept. 25, 1951 L. C. DANIELS 2,569,126

PULLDOWN CYLINDER ASSEMBLY FOR MAST SLIDES

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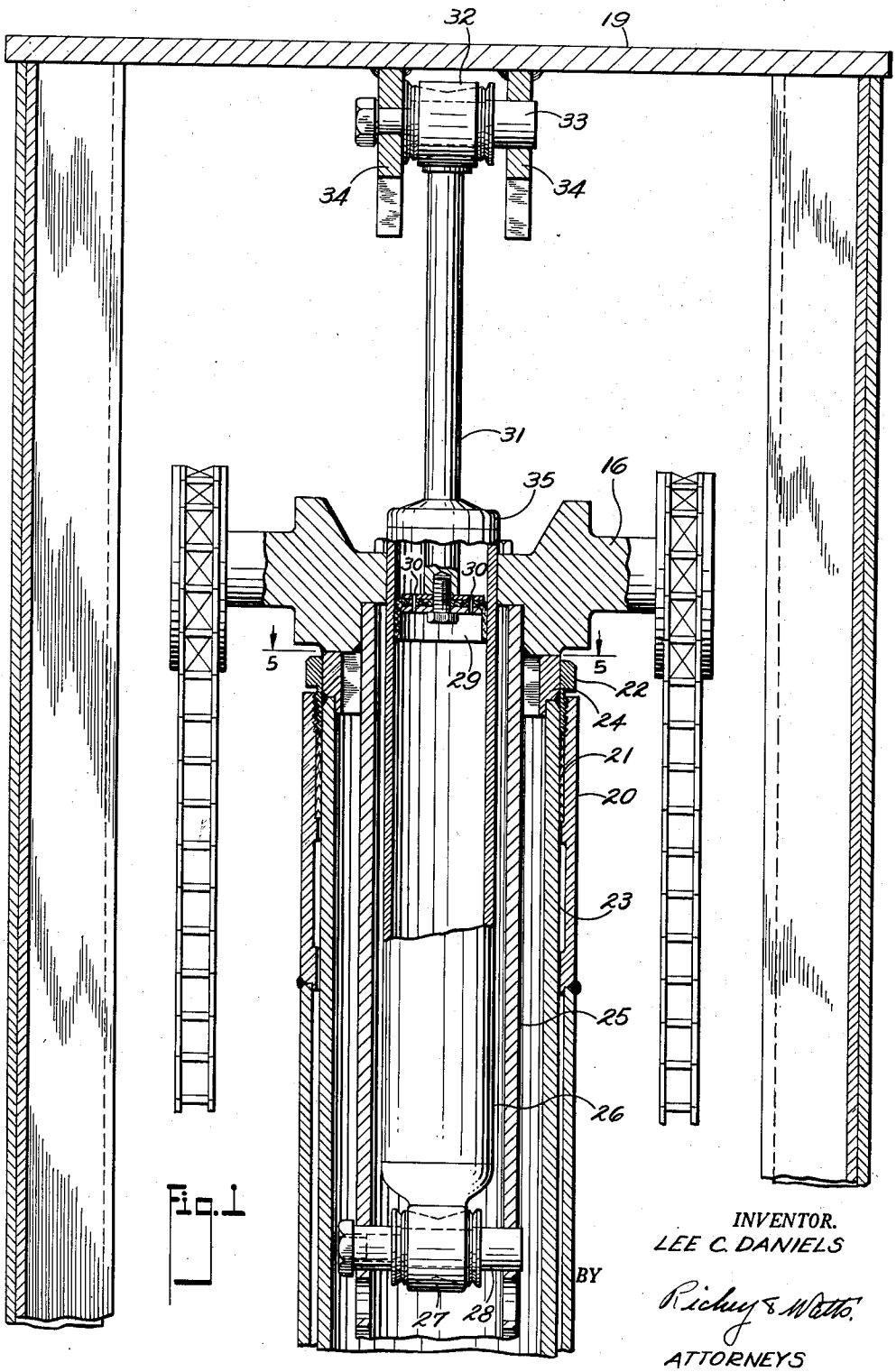


Fig. 1

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Fig. 2

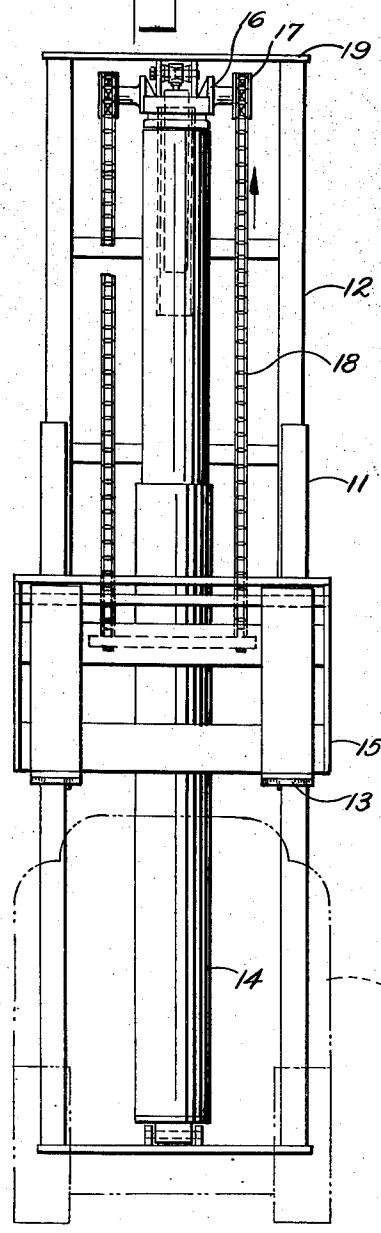
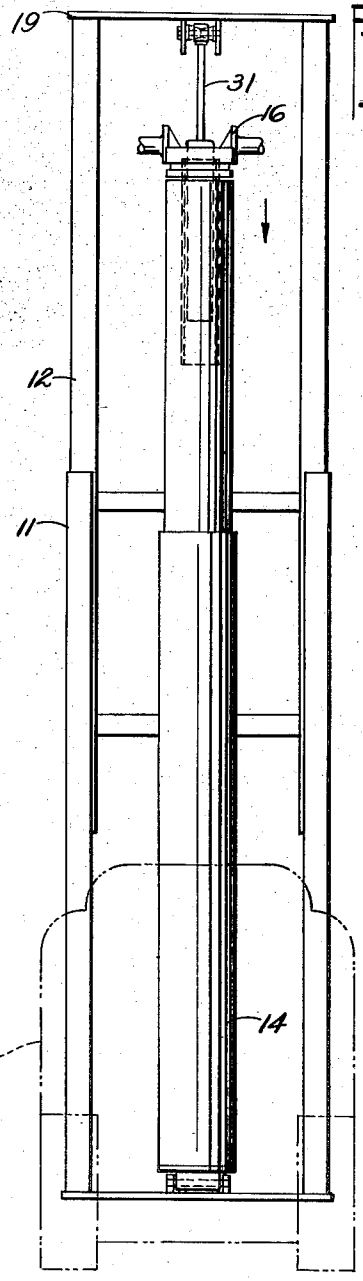


Fig. 3



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Fig. 4

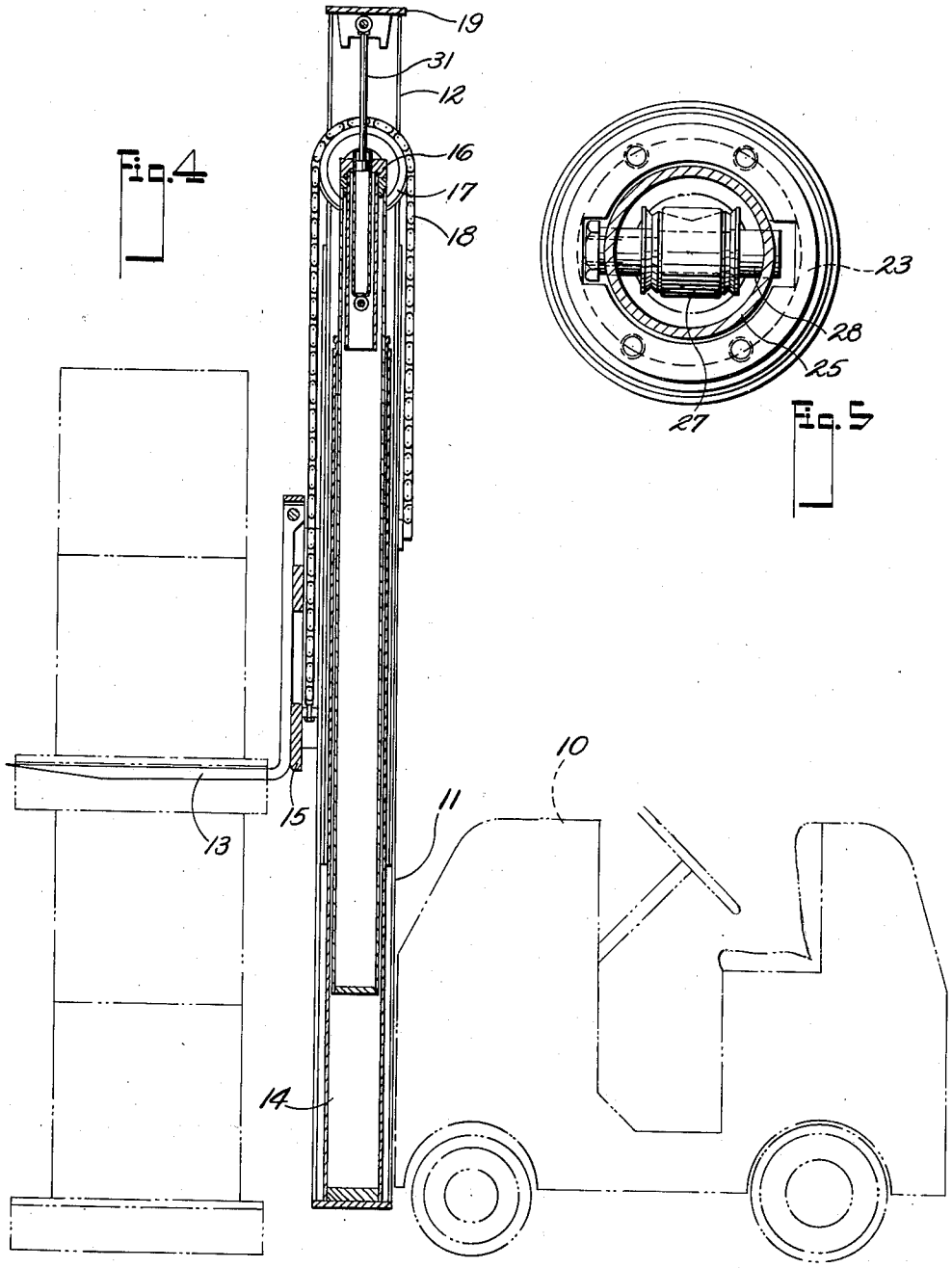


Fig. 5

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PULLDOWN CYLINDER ASSEMBLY FOR MAST SLIDES

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Application October 20, 1949, Serial No. 122,476

6 Claims. (Cl. 187—9)

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This invention relates broadly to lift trucks, and more specifically to improvements in the mechanism employed to effect the retraction of the mast slide.

In detail, the invention pertains to lift trucks of the type that are provided with a mast having an extensible slide thereon, a ram for the elevation thereof, and a carriage on the slide mounted for limited reciprocative movement relative thereto. In such structure it is customary to interlink the ram with the slide to assure the descent thereof during the retraction of the ram and to provide a lost-motion connection in the linkage to facilitate the action of the free lift mechanism for the carriage during the initial elevation of the ram. An objectionable characteristic of the lost-motion mechanism resides in the freedom of the slide to drop under the influence of gravity whenever the tensive strain on the pulldown linkage is relaxed, as occurs in stacking, dock loading, and similar operations when the carriage is brought to rest during the descent of the slide, but before the pulldown links have traversed the escapement plate of the lost-motion mechanism.

The present invention eliminates the foregoing objection through the provision of a piston cylinder assembly disposed between the top of the slide and the cross-head on the free end of the ram, the assembly being designed to pull the slide down during the descent of the ram and snub the free movement thereof when the tension on the piston rod is released.

Further objects of the invention reside in the provision of a slide-retracting mechanism which may be assembled within the hydraulic ram, a structure which will cushion the shock upon the slide when the movement of the ram is reversed, a device to retard the sudden descent of the slide when the load is removed from the carriage while in an elevated position, and an assembly which is efficient of operation, durable of structure, and economic of manufacture.

Other objects and advantages, more or less ancillary to the foregoing, and the manner in which all the various objects are realized will appear in the following description, which, considered in connection with the accompanying drawings, sets forth the preferred embodiment of the invention.

In the drawings:

Fig. 1 is a vertical sectional view of a fragmentary portion of a lift truck mast embodying the improved slide-retracting mechanism, the slide being illustrated in its lowered position;

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Fig. 2 is a front elevational view of the mast illustrating the position of the parts thereof during the ascent of the ram;

Fig. 3 is a similar elevational view illustrating the position of the parts of the assembly during the descent of the slide;

Fig. 4 is a similar elevational view showing the carriage in an elevated position (resting on a platform with the load released therefrom) and the mast slide in a partially retracted position; and

Fig. 5 is a transverse sectional view of the upper portion of the ram and associated parts of the assembly, the section being taken on a plane indicated by the line 5—5 in Fig. 1.

Referring first to Fig. 4, the lift truck chosen herein for the purpose of illustration comprises a motor propelled vehicle 10 having a mast 11 on the forward end thereof, an extensible slide 12 mounted thereon, a load-carrying platform 13 associated with the slide, and a hydraulic ram 14 for raising and lowering the slide. The load-carrying platform is mounted on a carriage 15 which is organized for limited reciprocative movement along the slide during the initial movement of the ram. The ram is constructed with a cross-head 16 on the free end thereof, a pair of sheaves 17 carried thereby with chains 18 roved thereover, which are anchored at one end to the mast and at the other end, to the carriage. The side rails of the slide are united at their upper ends by a cross member 19 which is disposed for engagement with the cross-head during the elevation of the ram, but spaced therefrom when the slide and ram are in their lowered position (Fig. 1). With this construction the initial movement of the ram will elevate the sheaves and pull the carriage upwardly until the cross-head engages the cross member 19; thereafter the chains will merely roll over the sheaves during the remaining elevation of the ram. When the ram is retracted, the slide will normally descend therewith under the influence of gravity, the weight thereof being borne by the head of the ram until the slide is brought to rest by engagement of the cross member 19 with the upper ends of the mast. Frequently, however, when the engaging surfaces of the mast and slide are worn or improperly lubricated, the slide will cock during the descent of the ram and remain in an elevated position, particularly when the load has been removed from the lift forks or platform associated with the carriage. In order to avoid this condition and the consequent sudden descent of the slide when thus held in a distended position, the ram and

slide, according to the present invention, are united by a hydraulic piston cylinder assembly which is constructed to pull the slide downward through the normal stroke of the ram and snub the descent thereof through the free lift or lost-motion cycle of the carriage.

As will be seen in Fig. 1, the ram cylinder 20 is provided at its upper end with a packing gland 21 retained by a nut 22 threaded in the cylinder. The ram piston 23 is affixed to a ring 24 which is machined for snug sliding movement within the nut 22. The ring 24 is disposed for abutting engagement with the cross-head 16, the lower face thereof being bored for the reception of a tube 25 constituting a supporting member for the lower end of a hydraulic shock absorber 26. The cap or end wall of the lower end of the shock absorber is formed with an eye 27 for the reception of a wrist pin 28 which is seated in aligned cross bores adjacent the free end of the tube 25. The shock absorber is of conventional form, embodying a piston 29 which is formed with restricted openings 30 therein to permit the flow of fluid from one side of the piston to the other. The cross-head 16 is bored for the reception of the end portion of the shock absorber cylinder, and the outer end of the piston rod 31 is provided with an eye 32 having a wrist pin 33 therein which is supported in lugs 34 affixed to and depending from the lower face of the slide cross member. The free ends of the lugs 34 are notched (Fig. 4) to clear the shock absorber cylinder cap 35 when the slide is in its fully retracted position.

In operation, when the motive fluid is introduced into the ram cylinder 20, the piston 23 will be distended and thus cause the elevation of the carriage 15 until the cross-head engages the lugs 34; whereupon the slide will be elevated as shown in Fig. 2. During the descent of the ram, the piston rod 31 will pull the slide downwardly until the movement thereof is arrested by the engagement of the cross member 19 with the end of the mast 26. As the shock absorber piston rod is distended during the descent of the slide, the oil will flow through the restricted openings 30 in the piston, and thus cushion the shock imposed upon the cross member.

When the carriage is brought to rest before the load-carrying platform reaches its lowermost position, as occurs in stacking operations (Fig. 4), the tension on the chains 18 and shock absorber piston rod 31 will be relaxed; and the weight of the slide will be imposed upon the extended piston rod and effect the reversal of flow of the fluid through the opening 30 in the piston, thus snubbing the sudden descent of the slide.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. In combination with a lift truck embodying a mast having a slide associated therewith and a hydraulic ram for elevating said slide, mechanism for retracting and cushioning the descent of the slide comprising a cylinder mounted on said ram, a piston therein connected to the slide, and means in the piston cylinder assembly to snub the retraction of the piston.

2. In a lift truck embodying a mast, a slide mounted for reciprocative movement relative thereto, a hydraulic ram for the actuation thereof, a load-supporting carriage mounted on the slide, and flexible connections between the carriage and mast engaged by the ram to effect the movement of the carriage relative to the slide, mechanism for pulling the slide downwardly with the ram and snubbing the descent thereof when the ram is brought to rest when the tension on the flexible connections is relaxed.

3. In a lift truck embodying a mast having a slide thereon, and a hydraulic cylinder having a hollow piston therein disposed for abutting engagement with the slide for the elevation thereof, mechanism for retracting said slide and snubbing the descent thereof comprising a tube affixed within the free end of the hollow piston, a hydraulic shock absorber cylinder supported in the lower end of said tube, a piston in said shock absorber cylinder connected to said slide, and a cap on said shock absorber cylinder engaged with said piston during the initial descent of said hollow piston.

4. Mechanism for the retraction of a power-actuated mast slide in a lift truck comprising a hydraulic piston cylinder assembly constituting a slide pulldown member and a shock absorber, one of the parts of said assembly being attached to said slide, and the other part of said assembly being attached to the power-actuating mechanism for the slide, whereby said slide will be pulled downwardly during the initial movement of the power actuating mechanism for the slide and subsequent movement thereof will be retarded.

5. In a lift truck embodying a mast, a slide mounted for reciprocative movement therein, a hydraulic ram piston for elevating the slide, and a cross-head on the free end of the piston, mechanism to pull the slide downwardly comprising a member affixed to and depending from the cross-head, a hydraulic shock absorber cylinder connected thereto, a second member affixed to and depending from the slide, and a hydraulic shock absorber piston connected to the last-named member.

6. In a lift truck embodying a mast, a slide frame thereon and a hydraulic ram plunger arranged for abutting engagement with the slide frame, mechanism for retracting the slide frame comprising a hydraulic cylinder, a cap on the bottom thereof pivotally connected to said plunger, a cap on the top of said cylinder, a piston in said cylinder engageable with the cap on the top of the cylinder, a piston rod on said piston protruding through the cap on the top of the cylinder, said piston rod being pivotally connected to said slide frame, said cylinder being mounted so that the piston will be disposed adjacent the cap on the bottom of the cylinder when the ram plunger is in its lowered position and will engage the cap on the top of the cylinder during the descent of the ram plunger.

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