Nov. 18, 1952 W. W. MacDONALD 2,618,360

FREE LIFT HOIST

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Fig. 1.

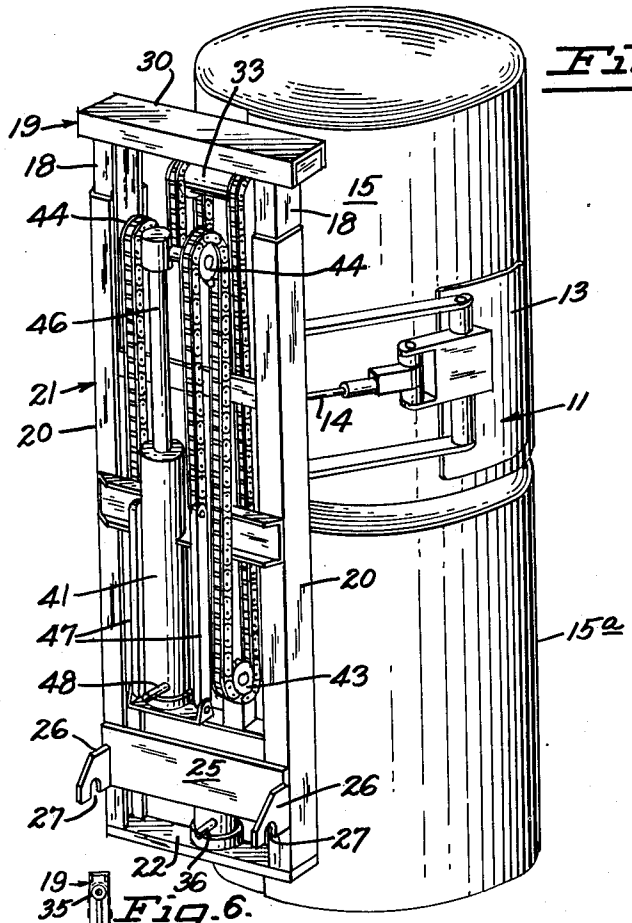

Fig. 5.

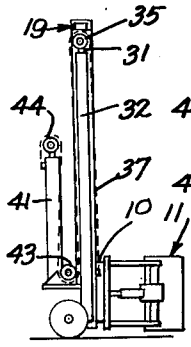

Fig. 6.

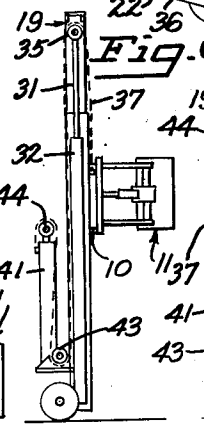

Fig. 7.

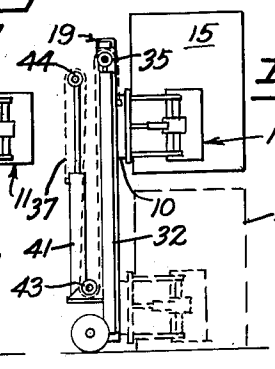

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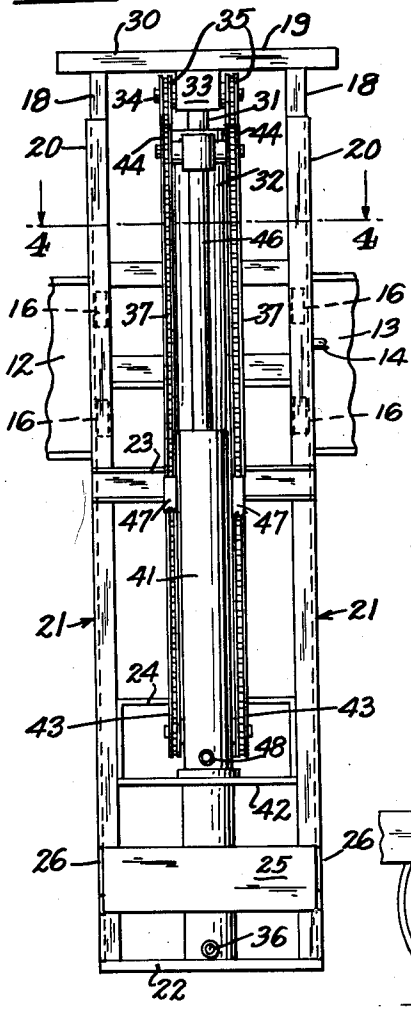
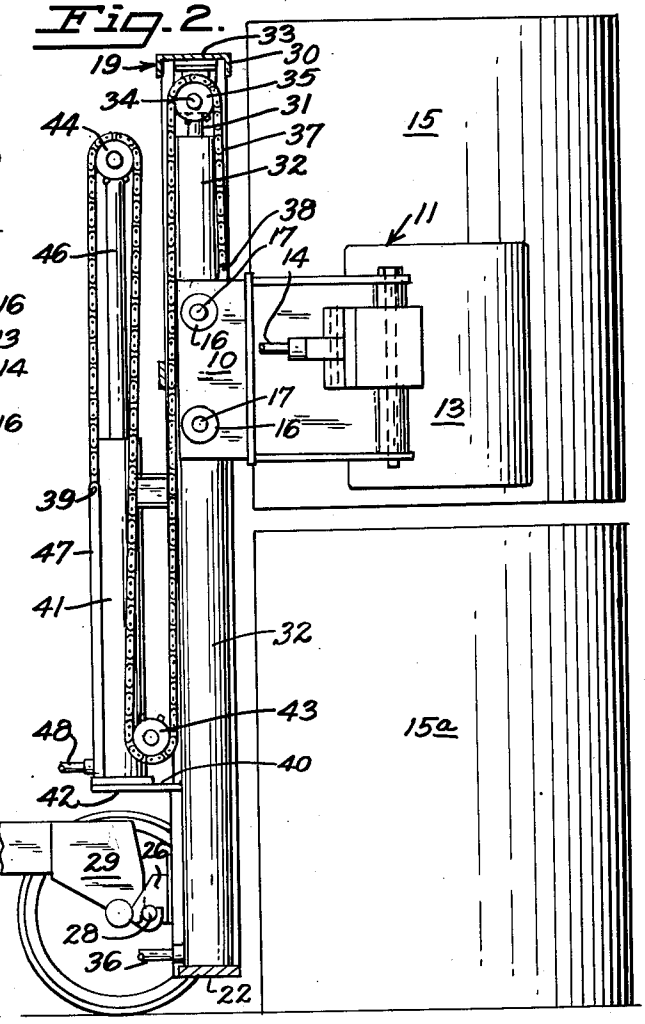
Fig. 3.



CEILING OF FREIGHT CAR

Fig. 2.



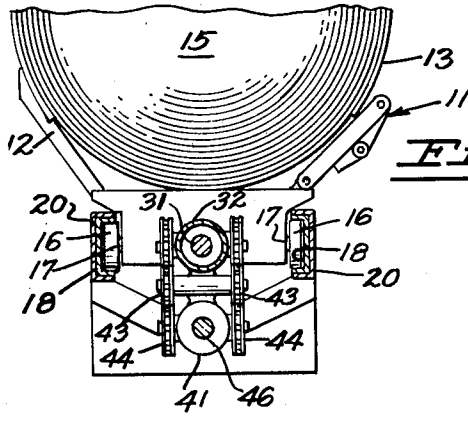


Fig. 4.

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Patented Nov. 18, 1952 2,618,360

UNITED STATES PATENT OFFICE

2,618,360

FREE LIFT HOIST

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Application August 17, 1951, Serial No. 242,322

7 Claims. (Cl. 187—9)

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This invention relates to improvements in attachments for lift trucks.

In particular the invention relates to a lifting mast arrangement which makes it possible for the carriage to lift a weight a substantial height off the floor with no increase in the height of the mast, while still retaining operability of the mast to lift to its full lifting height.

The problem solved by this invention involves the heretofore existing restricted use of lift trucks in the loading of freight cars and in like restricted areas where the roof and door openings are not much higher than the mast when the latter is in its down position.

Objects of the present invention are to provide for lifting the carriage (and supported freight) without lifting the mast; to provide in a single lift device a choice of means for lifting the carriage; to provide means for lifting an object off the floor (or from high on a stack and then for lowering it and the mast) so that entry can be made into a space where there is a low ceiling; and to provide other advantages which will become apparent from the following description.

Variations in structural details from the preferred embodiment described herein pursuant to revised statutes No. 4888 are contemplated as being included in the patent.

In the drawings:

Fig. 1 is an isometric view of the device (with the lift truck body omitted) showing a roll of paper about to be placed on top of a previously placed roll and with the top section of the mast still in its lowest position;

Fig. 2 is a similar view in side elevation and partly in section; in this case showing the lower front end of the lift truck body;

Fig. 3 is a view in rear elevation of the device showing the free lift cylinder;

Fig. 4 is a plan view of the device taken on about the line 4—4 of Fig. 2;

Fig. 5 is a diagrammatic view of the device with the carriage in its lowermost position;

Fig. 6 is a like view with the carriage raised partway but with the mast also raised; and

Fig. 7 is a like view showing how the carriage can be raised without raising the mast when working within confined areas.

While the device is illustrated with a carriage having a clamp for handling rolls of paper, a fork or other weight supporting means may be substituted on the carriage. Also the device is shown as detachably secured to the front end of the truck body because it is adapted to be used on any make of vehicle. The hydraulic valves,

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hose, and pressure source to actuate the pistons in the lift cylinders are omitted because such are well known in this art. The invention has to do with the new combination of parts whereby the carriage, mounted on a vertically movable mast can be elevated either without elevating the mast or by elevating the mast.

In the drawings, the carriage 10 is shown with a clamp 11 comprised of a fixed jaw 12 and a movable jaw 13. A piston (not shown) moves the rod 14 to control the jaw 13 so that a heavy roll of paper 15 can be held while being lifted about. The construction of these lifting clamps is now well known and no further description is necessary except to say that the driver may move the lift truck so the jaws 12 and 13 are on opposite sides of a roll of paper and by moving suitable valve levers the jaws will clamp the roll of paper tightly enough to support it free of the floor or other support.

The carriage 10 has rollers 16 journaled on pins 17 in the carriage frame. These rollers just fit inside the channels 18 which form the uprights of the liftable mast 19. The carriage and rollers will move up or down in the channel track. The liftable mast 19 is in turn mounted to slide vertically inside the channels 20 of the main mast 21.

The main mast 21 is made up of the channel sections 20 with a bottom cross member 22 and suitable cross members 23, 24, 25. The member 22 has the ears 26 with notches 27 to pivot the mast to an axle shaft 28 supported on the front end of the truck body 29. The upper end of the mast 21 is supported near its top by a brace (not shown) which extends from the truck.

The liftable mast 19 has a top cross piece 30 to which is secured the upper end of the piston rod 31 of the main cylinder 32. Included beneath the cross piece is a bearing mounting 33 having stub shafts 34 on which chain idler sprockets 35 are journaled. The main cylinder 32 is anchored at the bottom to the cross member 22, where a suitable inlet 36 admits fluid under pressure to move the piston (not shown) to lift the mast 19. Chains 37 pass over the sprockets 35 and are secured to the carriage at 38 and to a suitable place 39 on the main mast 21.

The structure so far described is the conventional carriage hoist mechanism, except that the chain 37 would not be secured at 39 but at a point near the lead line 40 near the base of the mast. The carriage 10 will move upwardly whenever the piston in the main cylinder 32 lifts the liftable mast 19 because the chain is secured to the carriage. The carriage moves at twice the speed of

the mast. This movement is shown diagrammatically in full lines in Fig. 6. The problem created by this upward movement of the mast 19 in effecting the vertical upward movement of the carriage 10 is that the mast 19 requires a room or door with a high vertical clearance in which to operate. This bars use of the device in freight cars. For lifting outside of the freight car (or any other low ceilinged space like a refrigerator) it is necessary that the mast 19 be able to move vertically to its full extent for stacking high in a warehouse. The present invention makes this high stacking possible while at the same time provides an arrangement by which the carriage 10 can be lifted as shown in Fig. 7 without lifting the mast 19.

This is accomplished as follows: A free lift cylinder 41 is mounted on a bracket 42 behind the main mast 21. The lift chains 37 are extended from the point 40 where they have been secured heretofore, and are passed over idler sprockets 43 suitably mounted on the main mast 21; then over the sprockets 44 mounted on the cross shaft 45 on the piston rod 46 of the free lift cylinder 41; and then they are secured to the main mast frame by the links 47. The cylinder 41 is preferably about half the length of the cylinder 32 or of the height of the mast 19. Its effective length will be determined by the height of the doorway or of the ceiling in which the hoist is to be used for the guiding determination is that the sprockets 44 should not have to be raised above the top of the load supported on the carriage to lift the load so that its top is just beneath the door or ceiling height. The top of the mast 19 in its down position also is to be below the height of the door or the ceiling. Thus when the piston in the cylinder 41 is at its full lifting stroke, the sprockets 44 preferably will be just below the top of the liftable mast 19, when the latter is in its lowest position. Fluid under pressure to lift the piston in the cylinder 41 enters at 48.

When it is remembered that one end of each of the chains 37 is secured to the carriage 10 and the other end of each is secured to the main mast 21, it will be seen that as the sprockets 44 are moved upwardly an inch, the carriage will move upwardly at twice the speed or two inches. Fig. 5 shows diagrammatically how the carriage 10 can be at the bottom of the mast when the sprockets 44 are down and the mast 19 is down and Fig. 7 shows how it can be in its raised position when the sprockets 44 are at their top position. Note that the top of the liftable mast 19 has not been raised. In Fig. 2 the dot and dash line above the drawing represents the ceiling and door height of a freight car, or the like, and shows how the carriage 10 can be raised to lift the roll of paper 15 to the height necessary to place it on top of another roll 15a. Note that no part of the lifting mast projects above the top of the roll of paper. This is also shown in Fig. 1.

Now suppose that the roll of paper 15 was stored three or four tiers high in the warehouse and it is desired to load it into a freight car, then the combination of the present invention makes this possible. The roll of paper is picked up by raising a liftable mast 19 to lift the carriage 10 to where it can grab the roll of paper or other load. Then the operator will let the mast 19 drop thus bringing it and the roll of paper to about the position shown in Fig. 5. This clears the mast 19 out of the way so that entry into the freight car is possible. If the roll of paper is

the first tier in the car, the operator will lift it off the warehouse floor by energizing the cylinder 41 which will lift the sprockets 44 and will bring the carriage and the roll of paper to a carrying position. If the roll of paper is the second tier in the car, the operator will further energize the cylinder 41 which will lift the sprockets 44 and the roll of paper into the position shown in Fig. 7.

The invention gives great flexibility of operation to the device and makes possible its use in very confined spaces with low vertical clearance, and yet it enables the operator to deposit or to pick up objects several tiers high.

The sprockets illustrated in this description may be rollers or any other form of anti-friction support for a chain or cable by which the carriage is raised or lowered. The sprockets 43 can be mounted on the main frame or on the power cylinder 32 anywhere along its vertical height up to a point about in line with the sprockets 44 when the latter are in the position shown in Fig. 5.

What I claim as my invention is:

1. In a lift truck device adapted for operating within a minimum vertical clearance the combination of a main mast; a liftable mast associated therewith; means for raising said liftable mast; a carriage slidable vertically in relation to said masts; a second liftable means secured in predetermined relation to said main mast, said means when extended having a stroke which does not carry it substantially above the vertical height of said liftable mast when the latter is in its lowest position; a flexible connecting means operatively fastened at one end to said carriage and at the other end to said main mast, said means passing upwardly from said carriage over anti-friction rollers on said liftable mast, thence downwardly under anti-friction rollers secured to said main mast, thence upwardly over anti-friction rollers on said second liftable means, and thence downwardly to the aforementioned fastening to said main mast; whereby said carriage may be raised by the upward movement of either of said liftable means or lowered by the downward movement of either thereof and when lifted by said second liftable means, the latter will not extend substantially above the height of said liftable mast in its lowest position.

2. In a lift truck device adapted for operating within cramped quarters, the combination of a main mast; a carriage slidable vertically in relation thereto; a first liftable mast associated with said main mast; means for lifting said mast; a second liftable means also associated with said main mast, anti-friction roller means operatively secured to said liftable mast and to said liftable means and to said main mast between said liftable mast and said liftable means; flexible connecting means secured at one end to said carriage and at the other end to said main mast, said means between said ends passing over said roller means on said liftable mast and said liftable means and over said roller means secured to said main mast, whereby movement of either said liftable mast or said liftable means will effect a movement of said carriage.

3. The device of claim 2 in which said liftable means when lifted to raise said carriage to operative height does not project substantially above the top of said liftable mast when the latter is not raised.

4. In a lift truck attachment adapted for operation in spaces where there is a low vertical clearance, as well as in spaces where the load is

to be stacked high on a pile and to be used on lift trucks having a suitable source of energy and controls for activating power means, the combination of a main frame; a liftable mast slidable vertically in said frame; a power means supported in said frame and connected to lift said mast; anti-friction rollers operatively secured to said mast; a supporting carriage slidable vertically in relation to said main frame and said mast; a second power means supported on said main frame and having anti-friction rollers thereon which are lifted vertically upon energization thereof; anti-friction rollers carried on said main frame in operative alignment with both the aforementioned rollers; a flexible connecting means secured at one end to said slidable carriage, thence passed over said rollers on said liftable mast, thence under said rollers on said main frame, thence over said rollers on said second power means, and thence secured to said main frame; and connections between the aforesaid power means and the energy source of said lift truck whereby either of said power means may be energized.

5. The device of claim 4 in which the stroke of said second power means will not lift its associated rollers substantially above the height of said liftable mast when the latter is in its lowest position to clear any given ceiling or doorway.

6. In a lift truck attachment adapted for operation in spaces where there is a low vertical clearance, as well as in spaces where the load is to be stacked high on a pile and to be used on lift trucks having a suitable source of energy and controls for actuating power means, the combination of a main frame comprising a pair of tracks; a liftable mast slidable in the tracks in said frame; a carriage slidable vertically in said liftable mast; a power cylinder with a piston therein and a rod projecting therefrom, secured between said main frame and said liftable mast so that upon energization said mast will be lifted in said frame; rollers secured on horizontal shafts placed near the upper end of said mast; rollers secured on horizontal shafts placed on said frame; a second power cylinder with a piston therein and a rod projecting therefrom, secured to said main frame behind the aforementioned cylinder, so that upon energization its rod will rise independently of said mast; rollers secured on horizontal shafts near the outer end of the rod of said second cylinder; and a flexible connecting means for lifting said carriage in said mast, secured at one end to said carriage and at its other end to said main frame and in between said ends being passed over said rollers whereby upon energization of either of said power cylinders, the movement of its associated rollers will lift said carriage.

7. The device of claim 6 in which said second power cylinder when energized alone sufficiently to lift said carriage to any desired vertical height will not project the rollers carried by it to a height substantially above the top of said slidable mast in its lowest position.

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No references cited.