May 7, 1946. P. R. GUERIN 2,399,632

INDUSTRIAL TRUCK

Filed June 6, 1945 2 Sheets-Sheet 1

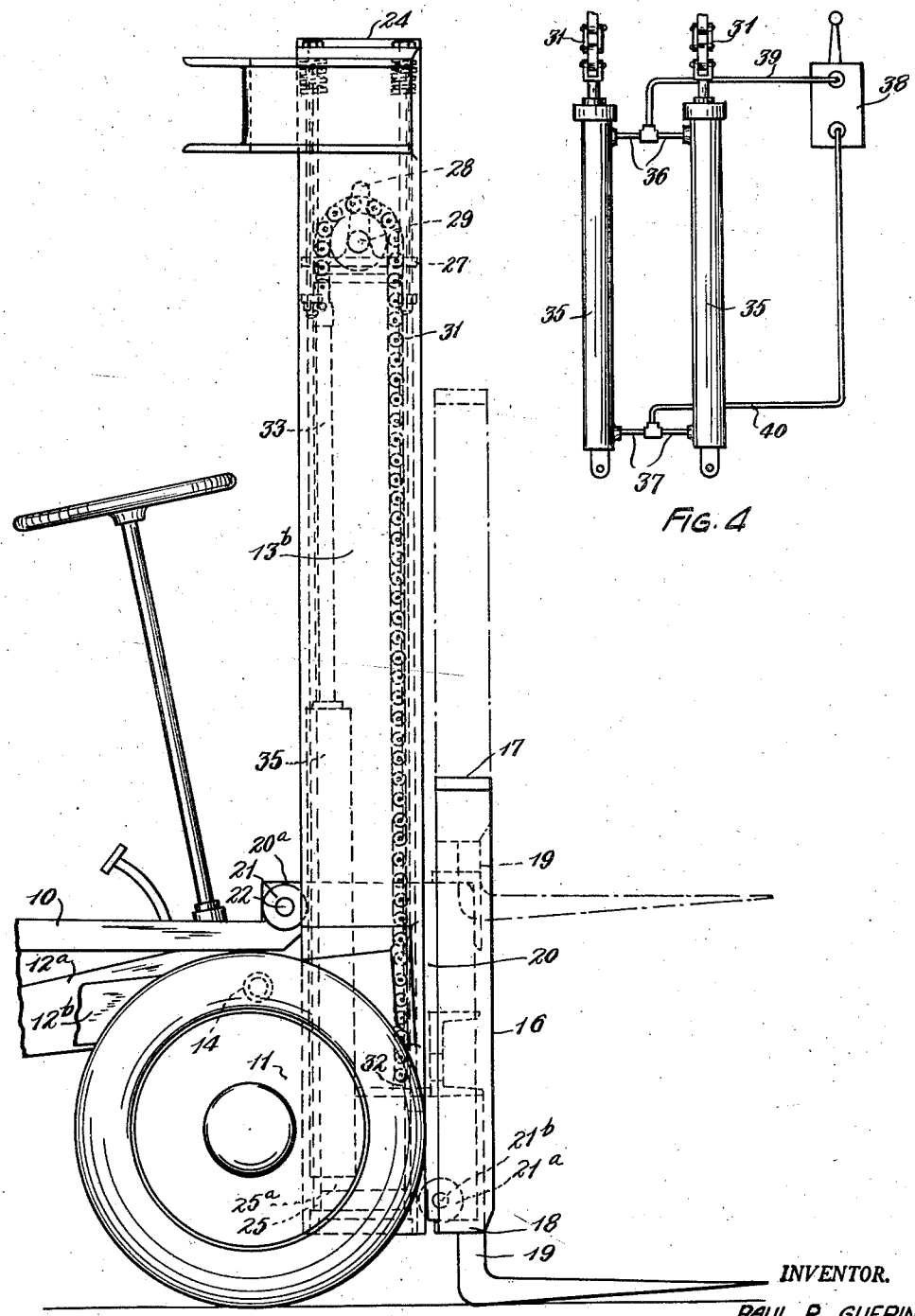


FIG. 1

FIG. 4

INVENTOR.
PAUL R. GUERIN
BY Hull & West
ATTORNEYS

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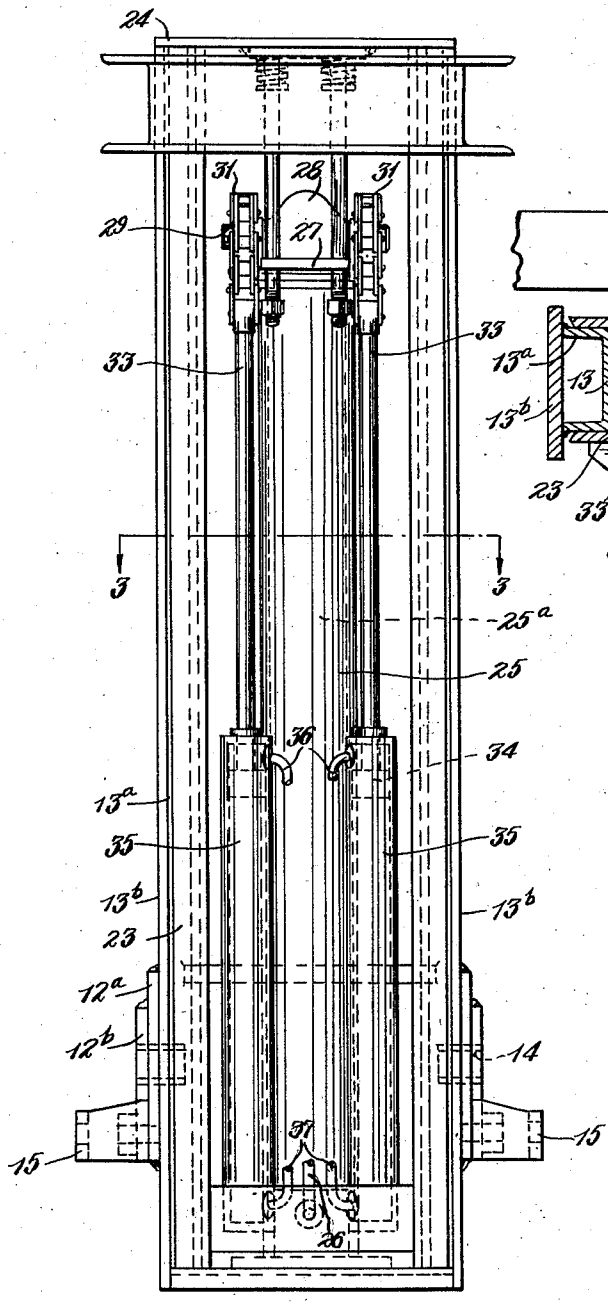


FIG. 2

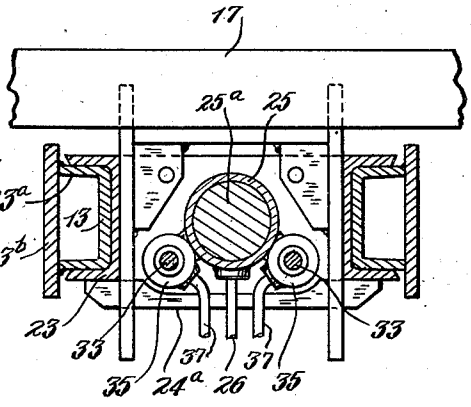


FIG. 3

INVENTOR.
PAUL R. GUERIN
BY Hull Hast
ATTORNEYS

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UNITED STATES PATENT OFFICE

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INDUSTRIAL TRUCK

Paul R. Guerin, East Cleveland, Ohio, assignor to Towmotor Corporation, Cleveland, Ohio, a corporation of Ohio

Application June 6, 1945, Serial No. 597,764

5 Claims. (Cl. 187—9)

This invention relates to industrial trucks of the type which are provided each with a mast assembly and with a carriage slidably mounted on said mast assembly and provided with load-engaging members (usually in the form of forwardly projecting forks) by means of which loads are supported, transported and/or elevated before being discharged. More particularly, the invention relates to trucks of this type wherein the mast assembly comprises a lower main mast and an extension mast telescoped thereupon whereby the over-all height of the mast assembly may be increased where necessary to enable the forks or other load-engaging means to be elevated a sufficient distance to enable the load thereon to be deposited at a correspondingly high elevation. In some of the trucks which are equipped with such extension masts, the parts are so constructed and arranged that the forks or other load-engaging means may be elevated a comparatively short distance before the extension mast is elevated. The amount to which the said forks or other load-engaging means can be raised before resorting to the use of the extension mast is referred to as the "free lift"; but the amount of "free lift" heretofore obtainable has been insufficient to enable the stacking of a second, and sometimes a third, tier of merchandise in places having low ceilings, such as the roofs of box cars.

It is the general purpose and object of this invention to provide trucks of the type referred to with means whereby this "free lift" may be greatly increased. I accomplish this object in and through the construction and arrangement of parts shown in the drawings hereof, wherein Fig. 1 represents a side elevational view of the front of an industrial truck having my invention incorporated therein, the position of the carriage when elevated by the use of my "free lift" construction being shown in broken lines; Fig. 2 is a rear elevational view of the mast assembly; Fig. 3 a sectional view corresponding to the lines 3—3 of Fig. 2; and Fig. 4 a diagrammatic view of the means for controlling the supply of liquid to the auxiliary cylinders, which constitute part of the means for realizing my invention.

Describing the various parts by reference characters, 10 denotes generally the forward end of the body of an industrial truck, 11 the front wheels of the same, and 12a and 12b one of a pair of tilting arms connected at their forward ends to opposite sides of the lower portion of the main mast whereby the mast assembly may be tilted from a vertical position. As shown in Fig. 2, each tilting arm in turn is, for purposes of strength, preferably made of two members in the shape of plates or laminations 12a, 12b, rigidly connected to the lower portions of plates 13b which in turn are welded or otherwise suitably secured to the flanges 13a of channel members 13 constituting the sides of the main mast. Bearing sleeves 14 are provided in the said arms, rearwardly of the mast assembly, for the reception of a shaft supported by the truck frame. Hydraulic cylinders (not shown) connected to the rear ends of said arms enable the mast to be tilted, in a well-known manner.

15 denotes bracket arms, shown as secured to the tilting arm members 12a, to which and to the truck frame the usual springs (not shown) may be attached for assisting in restoring the mast assembly to a vertical position after it shall have been tilted from such position by the arms 12a, 12b.

16 denotes generally a carriage which is slidably mounted upon the mast assembly, the said carriage as shown being of usual construction and comprising an upper transverse frame member 17 and a lower transverse frame member 18, the said carriage supporting the lifting forks 19. The carriage is provided with cheek pieces 20 having arms 20a extending from opposite sides of the upper portion thereof and each carrying a roller 21 adapted to engage the adjacent rear flange of the channeled side member 23 of the extension mast, the said rollers being mounted upon a shaft 22 connecting the rear ends of said cheek pieces. Rollers 21a mounted upon a shaft 21b supported by said cheek pieces engage the front flanges of the extension mast.

24 denotes a cross bar or plate which is carried by the tops of the side members 23 of the upper or extension mast, the side members of the said mast being of channeled formation and being telescoped upon the channeled sides of the lower mast section. 24a denotes a brace bar connecting the lower portions of the side members 23.

25 denotes a vertically arranged main hoisting cylinder which is mounted between the side members of the main mast and to the lower portion of which liquid may be supplied by the pipe 26 and which contains a fluid-pressure-operated element, preferably in the form of a plunger 25a, the top of which supports a cross head 27 having its upper end preferably provided with a bumper 28 which, by the elevation of the said element, is adapted to engage the cross bar or plate 24. The cross head is provided at its opposite ends with shafts 29 on which are mounted

rollers 30 around the tops of which flexible members, shown as chains 31, pass. The lower ends of these flexible members are connected to the carriage, as shown at 32. The construction thus far described is substantially identical with that which has been employed by Towmotor Corporation, in its production of industrial trucks, and hence needs no further description; an instance of such truck construction is shown in Weaver Patent No. 2,270,664, issued January 20, 1942. However, the elevation of the carriage has been effected heretofore solely by the upward movement of the fluid-pressure-operated element in the cylinder 25, the ends of the chains 31 opposite to those which are attached to the carriage 16 being anchored to some immovable part of the truck as, for instance, the forepart of the frame. In operation, as soon as the bumper 28 on the cross head 27 strikes the abutment constituted by the cross bar or plate 24, the extension mast will be elevated. In some installations, sufficient clearance has been provided between the bumper at the top of the cross head and the cross bar or plate 24 to allow a "free lift" of as much as approximately two feet before the upper or extension mast will begin to be elevated.

In order to obtain such an increase in the "free lift" as will enable industrial trucks equipped with my invention to stack articles in a number of horizontal tiers and in a space having a low ceiling, I have connected the ends of the flexible members 31, opposite to those which are connected to the carriage, to the tops of fluid-pressure-operated elements, shown as piston rods 33, the pistons 34 of which are mounted in vertical auxiliary cylinders 35, which are conveniently located within the lower portion of the mast assembly and which may be compactly and securely mounted within the said assembly by securing the same, as by welding, to opposed portions of the rear surface of the main cylinder 25. The auxiliary cylinders are provided each with pipes 36 and 37 connected respectively to the top and the bottom thereof, the supply to the cylinders being controlled in the manner shown in the diagrammatic view of Fig. 4, wherein 38 denotes a double-acting valve assembly one end of which communicates with the pipe 39 for supplying liquid to the pipes 36, while another pipe 40, leading from the bottom thereof, communicates with the pipes 37. A double acting valve will be unnecessary where the carriage and lifting devices are of heavy construction, which will enable them to descend by gravity without resort to the use of the pipes 37 and 40.

With the parts constructed and arranged as described, it is believed that the operation will be readily understod. Assuming that it is necessary to stack material or objects such as bales, crates, rolls of paper, etc., in a box car or other place having a low ceiling, liquid will be supplied to the pipes 36, thereby depressing the pistons and piston rods in the auxiliary cylinders a sufficient distance to enable the objects to be stacked at different elevations until such time as the pistons reach the bottoms of their respective auxiliary cylinders. The amount of the "free lift" thus obtained will be limited only by the length of the auxiliary cylinders and pistons. By making the auxiliary cylinders a little more than half the length of the main cylinder, plus the distance the cross head extends thereabove when the main piston is lowered, the operating lengths of the auxiliary piston rods will be slightly less than half the length of the main cylinder.

The "free lift" will also vary with the height of the main mast; and it is possible by the use of the auxiliary cylinders and piston rods to obtain a "free lift" of nearly one-half the height of the main mast. Obviously, the free lift which is obtainable by the complete depression of the auxiliary piston rods can be increased by thereafter elevating the main piston rod until the bumper on the cross head strikes the cross bar or plate 24. When it is desired to utilize the extension mast, this can be accomplished by retaining the piston rods 33 in their lowered positions, whereupon the main cylinder and piston will operate in the usual manner to lift the carriage to any desired elevation permitted by the length of the chains and the elevation of the extension mast.

While my invention is particularly useful in operating under low ceilings with an extension mast, it is also useful where a main mast only is employed. It enables me, by the use of the auxiliary cylinders and pistons, to obtain as high a lift of the carriage with a short main mast as can be obtained with a longer main mast.

Having thus described my invention, what I claim is:

1. In an industrial truck, the combination of a frame, a substantially vertical mast supported by said frame, a carriage slidably mounted upon said mast and means for raising and lowering the said carriage, said means comprising a vertically extending main cylinder located adjacent to the said mast, a fluid-pressure-operated element reciprocably mounted in said cylinder and projecting through the top of the latter, a roller supported by the said element above the said cylinder, an auxiliary vertically extending cylinder located in proximity to the first mentioned cylinder, a fluid-pressure-operated element reciprocably mounted in said auxiliary cylinder and having its upper end projecting through the upper end of said auxiliary cylinder, and a flexible lifting member connected at one end to the said carriage and passing over the top of said roller and connected at its opposite end to the upper end of the second fluid-pressure-operated element, and means for supplying operating fluid to the said cylinders.

2. In an industrial truck, the combination of a frame, a substantially vertical mast supported by said frame and comprising a lower or main mast and an extension mast slidably mounted upon the main mast, a carriage slidable upon the said masts, a main vertically extending cylinder located adjacent to the main mast, a fluid-pressure-operated element reciprocably mounted in said cylinder and projecting through the top of the latter, a roller supported by the said element above the said cylinder, the said element being adapted when elevated to elevate the extension mast, a vertically extending auxiliary cylinder located adjacent to the main cylinder, a fluid-pressure-operated element reciprocably mounted in said auxiliary cylinder and having its upper end projecting through the upper end of said auxiliary cylinder, a flexible lifting member connected to the upper end of the second fluid-pressure-operated element and extending around the top of the said roller and connected at its lower end to the said carriage, and means for supplying fluid to the said cylinders.

3. In an industrial truck, the combination of a frame, a substantially vertical mast supported by said frame and comprising a main mast, and an extension mast slidably mounted upon the

main mast and having an abutment at the top thereof, a carriage slidable upon the said masts, a main vertically extending cylinder located adjacent to the main mast, a fluid-pressure-operated element reciprocably mounted in said cylinder and projecting through the top of the latter and having a cross head supported by the upper end thereof and adapted by its elevation to engage the abutment at the top of the extension mast, rollers on opposite ends of the said cross head, vertically extending auxiliary cylinders located adjacent to the main cylinder, a fluid-pressure-operated element reciprocably mounted in each of the auxiliary cylinders and each having its upper end projecting through the upper end of its cylinder, flexible lifting members connected respectively to the upper ends of the two last mentioned reciprocably mounted elements and extending around the tops of the said rollers and connected at their lower ends to the said carriage, and means for supplying fluid to the said cylinders.

4. In an industrial truck, the combination of a frame, a substantially vertical main mast supported by said frame and comprising side members, an extension mast comprising side members slidable upon the side members of the main mast and having an abutment at the top thereof, a carriage slidable upon said side members and means for moving the same therealong, the said means comprising a vertical main cylinder located between the said side members of the main mast, a fluid-pressure-operated element reciprocably mounted in said cylinder and projecting through the top of the latter, a cross head supported on top of said element, rollers mounted on opposite ends of said cross head, a pair of vertically arranged auxiliary cylinders adjacent to the main cylinder, a fluid-pressure-operated element reciprocably mounted in each of the auxiliary cylinders and each having its upper end projecting through the upper end of its cylinder, flexible lifting members connected respectively to the upper ends of the two last mentioned reciprocably mounted elements and extending around said rollers and connected at their opposite ends to the said carriage, and means for supplying operating fluid to the said cylinders.

5. In the industrial truck set forth in claim 4, the auxiliary cylinders being attached to opposite side portions of the main cylinder.

PAUL R. GUERIN.