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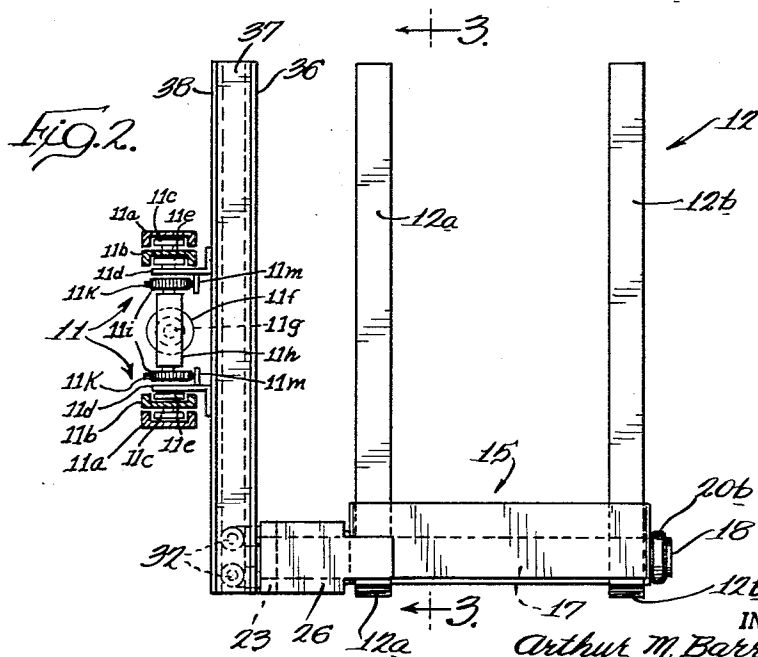
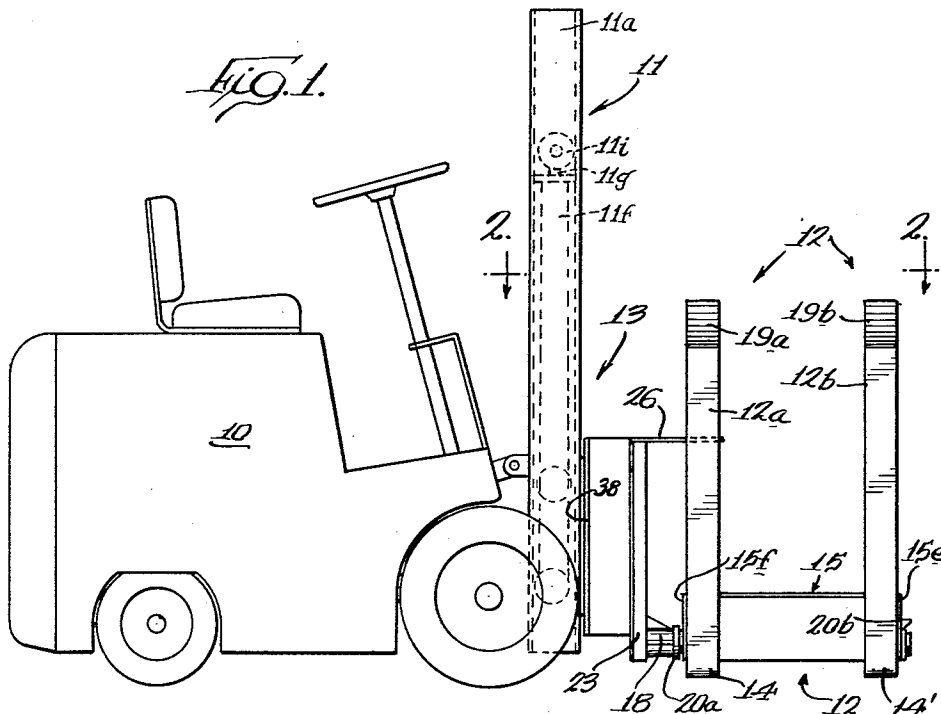
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FORK LIFT TRUCK WITH A Laterally SHIFTABLE CARRIAGE
MEANS AND FORKS THAT ARE PIVOTED ABOUT
A HORIZONTAL AXIS

Filed Nov. 16, 1959

2 Sheets-Sheet 1



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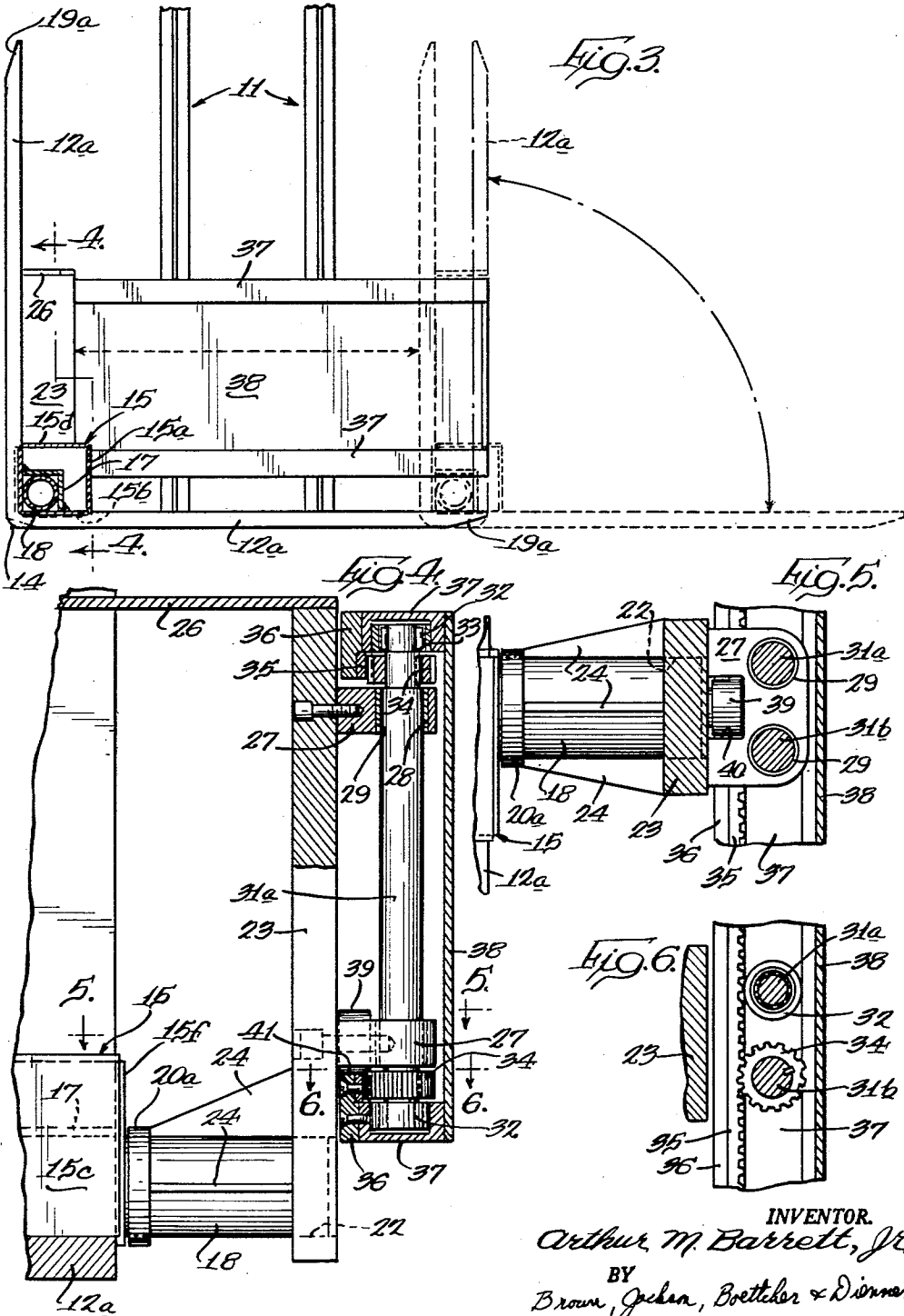
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FORK LIFT TRUCK WITH A Laterally Shiftable Carriage Means and Forks That Are Pivoted About a Horizontal Axis

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My invention pertains generally to materials handling equipment of a form called "lift truck." The invention is particularly suited for self-propelled mobile lift trucks having an elevatable load supporting surface and, for purposes of illustration, will be shown in such a structure.

The need for economical storage of materials and products requires them to be stored as compactly as possible and as quickly as possible and yet be readily available for removal from storage. By the use of lift trucks, great progress has been made in the expeditious storage and handling of materials and products. However, machines which have been developed for the purpose have required substantial amounts of room for movement through the storage area and for turning when performing their carrying lifting and storing functions.

A load may be carried through a storage area, such as a warehouse, through various aisles to the location where it is to be stored either on racks or shelves or with one palletized load being stacked directly upon another. Since, in most of the lift trucks in use, the overall length is greater than the width of the truck, the aisles require a width sufficient not only to permit the truck to come down the aisle but also to turn to face a rack, shelf or stack of materials, in order for the elevatable platform to lift the load and to shift it to the storage position. Since the storage may take place anywhere along either side of an aisle, and since the truck must turn to at least 90°, the overall length of the truck and its particular turning radius have determined the width of the aisles and therefore the available storage area which remains.

It is the principal object of my invention to provide a lift truck so improved that it will be able to discharge its load to either side of an aisle without the necessity of its having to turn out of the direction of its travel down the aisle. Since the trucks are nearly always less wide than they are long, this permits narrower aisles and therefore an increased storage space on either side of the aisle.

It is a further object of my invention to provide the foregoing lift truck structure of inexpensive but sturdy structural elements which are simple to build and assemble and which are certain in operation.

Other objects and advantages of my invention will become apparent as the following description of a preferred structure is set forth in conjunction with the drawings in which:

FIGURE 1 illustrates a self-propelled lift truck embodying my invention;

FIGURE 2 is a slightly enlarged fragmentary sectional view on the line 2-2 of FIGURE 1;

FIGURE 3 is a sectional view taken on the line 3-3 of FIGURE 2;

FIGURE 4 is a sectional view of the support structure taken on the line 4-4 of FIGURE 3, but on enlarged scale;

FIGURE 5 is a fragmentary sectional view on the line 5-5 of FIGURE 4; and

FIGURE 6 is a fragmentary sectional view on the line 6-6 of FIGURE 4.

Turning now to the drawings, FIGURE 10 designates generally a fork truck of the self-propelled type steerable by a driver and having a vertical mast structure indicated

generally by the reference numeral 11. The mast structure comprises means by which the load supporting means in the form of forks, indicated generally by the reference numeral 12, may be raised and lowered in a conventional manner. It will be understood that the truck itself and the mast structure form no part of my invention, but merely represent one form of materials handling equipment in which my invention may be suitably embodied. The mast structure 11 comprises outer channel members 11a, inner vertically movable channel members 11b having rollers 11c guided in the outer channel members 11a, and a vertically movable load supporting carriage comprised of brackets 11d having rollers 11e guided in the inner channel members 11b. Vertical movement of the mast carriage 11d is selectively effected through actuation of a central hydraulic assembly comprising a stationary cylinder 11f and a piston rod 11g. Secured to the outer end of the piston rod 11g is a cross head 11h rotatably supporting a pair of sprockets 11i over which are trained chains 11k. The chains 11k, at their one ends, are stationarily mounted relative to the truck 10, and, at their other ends, are connected as at 11m to the mast carriage 11d. When the piston rod 11g is distended, the sprockets 11i are elevated causing the chains 11k to effect elevation of the load carriage 11d.

The load supporting means 12 is associated with the elevatable mast structure 11 through support means, indicated generally by the reference numeral 13. The load supporting means 12 and the support means 13 therefor will now be described in greater detail in the form illustrated. The load supporting means 12 is formed of a pair of L-shaped members 12a and 12b which at their right portions 14a and 14b are secured to a hub structure 15 which is formed of metal plates 15a, 15b, 15c and 15d, welded together as indicated at 15 in FIGURE 3, the hub being generally square in cross section, although it could take other forms. The hub structure 15 further includes apertured end plates 15e and 15f (FIG. 1) and internally includes an angle member 17 having its free edges welded to two of the outer walls 15b and 15c of the hub structure 15, thereby producing the inner hub portion which is also square in cross section and rides on a tubular axle or bearing 18. The L-shaped members 12a and 12b, having beveled ends 19a and 19b, respectively, are spaced apart along the hub structure 15 and are welded to it. The L-shaped members, together, form a vertically extending fork and a horizontally extending fork, as may be seen most clearly from FIGURE 3.

The tubular axle 18, as best shown in FIGURES 4 and 5, has a collar 20a adapted to engage end plate 15f to limit axial movement of the hub structure 15 and the connected forks axially to the right in FIGURE 4. A similar collar 20b is employed at the outer end of the tubular axle, as is shown in FIGURE 1, for limiting axial movement of the hub structure 15 in the other axial direction, that is, to the right in FIGURE 1. Returning to FIGURE 4, it will be seen that the right-hand end of the tubular axle 18 is fixed in a mating opening 22 in a vertically extending supporting plate 23 and a series of gusset plates 24 are welded to the collar 20a, axle 18 and plate 23 in order to rigidly associate the axle with plate 23.

The L-shaped members 12a and 12b going to make up the vertical fork and the horizontal fork could, of course, be formed of separate arms rather than as L-shaped members and, further, in place of forks there might be substituted platforms having an extensive load bearing surface. In order to control the amount of rotation and the positions of the forks, there extends forwardly from the top of the vertical support plate 23 a stop means 26 in the form of a bar or plate which engages the vertically extending arm 13a of the L-shaped member. The horizontal arms of the L-shaped members, by their weight

and leverage, tend to hold the vertically extending bar 12a against the stop bar 26. (See FIG. 3.) When the load supporting means 12 has its L-shaped members rotated 90° counterclockwise in FIGURE 3 from the full line position, then those arms of the L-shaped members which are now shown horizontal will become the vertical ones and the vertical ones will assume the horizontal position by reason of the stop bar 26 limiting the rotating movement to 90°.

Bolted to the vertically extending plate 23 to the opposite side of it from the load supporting means 12 are a pair of brackets 27, each of which has a pair of apertures 28 carrying friction reducing sleeves or bearings 29 for the rotational support of a pair of vertically extending shafts 31a and 31b. At the upper and lower reduced ends of the shafts 31a and 31b are disposed roller bearings 32 which retain their positions along the shafts 31a and 31b by reason of shoulders such as the shoulder 33 and such other known retaining means as is desired. On at least one of the shafts 31 generally adjacent the outer ends thereof there is also supported and keyed to the shaft 31b a pinion 34. The upper and lower pinions 34 on shaft 31b engage with racks 35 which are carried by straps or bars 36 which in turn are secured by screws or other means to upper and lower channel shaped members 37. The rollers 32 are adapted to find bearing against the inside webs of the channel members. The channel members, in turn, which are spaced apart and parallel and generally horizontal, are secured to a plate 38 which in turn is suitably secured to the mast carriage 11d of the vertical mast structure 11.

The vertically extending support plate 23 also carries a roller 39 having a horizontal axis and disposed in an opening 40 in the lower bracket 27 (see FIG. 5). Roller 39 rides on the top surface 41 of bar 36 which is connected to the channel member 37 which, in turn, is connected to plate 38 and thence to the mast carriage 11d.

Assume now a typical use of the lift truck of my invention, namely, the transporting of a load down a narrow aisle and then lifting it and disposing it to one side of the aisle on a horizontal support. First the load supporting surface 12 will be shifted laterally to one side of the truck to take on the load, such as a palletized load, and will then be drawn back in front of the fork truck with the load in place. After loading, the truck will proceed down one or more aisles to the unloading position, and will then raise the load supporting surface 12 by the load carriage 11d of the mast structure 11 to the proper height and then the load supporting surface will be shifted to one side of the aisle onto the horizontal supporting surface and deposited there without the necessity of the truck being turned 90° in order to face the unloading position, as in prior trucks. Hence narrower aisles may be employed.

If it had been the desire to dispose the load on the opposite side of the aisle, the load would have been taken on by the load supporting forks from that other side, and that would have been readily accomplished merely by shifting the L-shaped members 12a and 12b, which go to make up the forks, around the hub 18 through a 90° angle before taking on the load. Alternatively, the unloading position would have been approached from the opposite direction in the aisle, since it is practical to unload laterally only in one direction after the load is taken on.

Referring to FIGURE 3, for example, if the forks are in the position shown by full lines and it is desired to shift the then horizontal fork to a vertical position and the vertical fork to a horizontal position for taking on a load from the opposite side, the rotation may be caused either manually or may be shifted by power means and then the support means 13 (support plate 23 and its associated rollers which support the forks) may be rolled from one side of the truck to the other. It will then be in a position for taking on a load from the side opposite

that for which it would be adapted if the forks were as shown in full lines in FIGURE 3. This shifted position is shown by the dot-dash position of the L-shaped member 12a in FIGURE 3. The dotted line view of FIGURE 3, on the other hand, shows the support mechanism shifted from the full line position to the right to take on a load from the right side as one views FIGURE 3.

It will be obvious, that in changing the position of the forks in order to take on a load from one side or the other, that the entire fork structure may be moved across the front of the truck first and then rotated 90°, or it may be rotated 90° and then shifted across the front of the truck. The procedure which is followed may be determined by the amount of clearance on the sides of the truck at the particular time the change is being made.

The load supporting surface 12 in the form of a horizontal fork comprised of horizontal arms of the L-shaped members 12a and 12b can be shifted laterally by means of the roller 39 riding on the surface 41 of bar 36 which is connected to the channel member 37, and thence to the mast carriage 11d and by means of the rollers 32 riding in the channel members 37 and engaging the inner surfaces of the arms of the channels. It will be readily seen that the vertical component of the load will be taken principally by the roller 39 riding on the surface 41, and the horizontal component will be taken by the lower roller 32 engaging the righthand inner surface of the channel member 37 and with the upper roller 32 engaging the left-hand inner surface of the channel member, because the load will tend to tip the load supporting surface downwardly. So that the rollers 32 may be kept vertically aligned and so that the load supporting surface 12 will not tip one way or the other laterally, the vertical alignment is maintained by the pinions 34 engaging the racks 35 at the upper and lower ends of the shafts 31a and 31b. It will be seen in FIGURE 3 that, if a load placed on the load supporting forks tends to cause the forks to cock the shafts 31a and 31b, it would require the upper pinion 34 to rotate, since that pinion is secured to its shaft 31b (and the two shafts are carried in the upper and lower brackets 27) the rotation of the upper pinion would be transmitted through the shaft to the lower pinion 34 and any tendency of the load to tip around the hub would be resisted by the teeth of the lower rack 35 reacting against the lower pinion 34. Accordingly, by the roller arrangement and pinion and rack arrangement, an easily and smoothly shiftable load supporting surface is provided which, preferably, is power actuated by hydraulic means (not shown) of a known type.

While I have shown a preferred form of my invention, it will be appreciated that modifications are possible within the scope of my invention, and therefore I do not intend to be limited to the preferred form, but rather to any structure coming within the scope of the appended claims.

I claim:

1. For use in a lift truck having an elevating mast mechanism and a mast carriage mechanism, the improvement comprising load supporting means, a support for said load supporting means and adapted to be connected with said mast carriage mechanism for being raised or lowered, said load supporting means being shiftable laterally relative to said support, said support comprising means spacing apart and supporting horizontally a pair of channel-like members which are generally U-shaped in cross section and have the open sides of their channels facing each other, the inner sides of said channels providing roller bearing surfaces, rack means extending parallel to each channel member, at least one vertically disposed shaft extending between said channels and connected with said load supporting means, roller means and pinion means fixed on each of the opposite ends of said shaft to respectively engage said roller bearing surfaces and said racks, whereby to respectively support the horizontal load component of said load supporting means and to prevent cocking of said load supporting means and means pro-

viding support for the vertical load component of said load supporting means.

2. For use in a lift truck having an elevating mast mechanism and a mast carriage mechanism, the improvement comprising load supporting means and a support for said load supporting means and adapted to be connected with said mast carriage mechanism for being raised or lowered, said load supporting means being shiftable laterally relative to said support and being pivotally movable about a horizontal axis from one load bearing position to another, said load supporting means including a horizontally disposed load supporting surface and a vertically disposed surface with said surfaces being joined by hub means which permits the horizontally disposed load supporting surface to be moved to a vertical position and the vertically disposed surface to be moved to the horizontal load supporting position, together with means for positioning said surfaces in one or the other of said positions; and said support comprising means spacing apart and supporting horizontally a pair of channel members which are U-shaped in cross-section and have the open sides of their channels facing each other, rack means supported by and extending parallel to each channel member, a horizontally disposed bearing surface, a vertically disposed support adjacent and to one side of said channel members and rack means, a horizontally disposed supporting shaft carried on one side of said vertically disposed support, a pair of vertically disposed shafts extending between said channels on the opposite side of said vertically disposed support, a pair of spaced brackets carried by said vertically disposed support for supporting said vertically disposed shafts, roller means carried on the lower bracket and riding on said horizontally disposed bearing surface, second roller means, said second roller means being supported adjacent the upper and lower ends of said shafts and bearing against inner vertical walls of said channel members, and pinions fixed on at least one of said shafts adjacent said second roller means and cooperating with said racks.

3. For use in a lift truck having an elevating mast mechanism and a mast carriage mechanism, the improve-

ment comprising load supporting means and a support for said load supporting means and adapted to be connected with said mast carriage mechanism for being raised or lowered, said load supporting means being disposed crosswise of the longitudinal axis of the truck and being shiftable laterally relative to said support and being pivotally movable about a horizontal axis from one load bearing position to another in a substantially vertical plane substantially parallel to the elevating mast mechanism, said support comprising means spacing apart and supporting horizontally a pair of channel-like members which are generally U-shaped in cross-section and have the open sides of their channels facing each other, rack means supported by and extending parallel to each channel member, a horizontally disposed bearing surface, a vertically disposed support adjacent and to one side of said channel members and rack means, a horizontally disposed supporting shaft carried on one side of said vertically disposed support, a pair of vertically disposed shafts extending between said channels on the opposite side of said vertically disposed support, a pair of spaced brackets carried by said vertically disposed support for supporting said vertically disposed shafts, roller means carried on the lower bracket and riding on said horizontally disposed bearing surface, second roller means, said second roller means being supported adjacent the upper and lower ends of said shafts and bearing against inner vertical walls of said channel-like members, and pinions fixed on at least one of said shafts adjacent said second roller means and cooperating with said rack means.

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