May 10, 1949. H. J. FRAMHEIN 2,469,638

WHEEL LIFTING LINKAGE FOR PALLET TRUCKS

Filed July 20, 1943 2 Sheets-Sheet 1

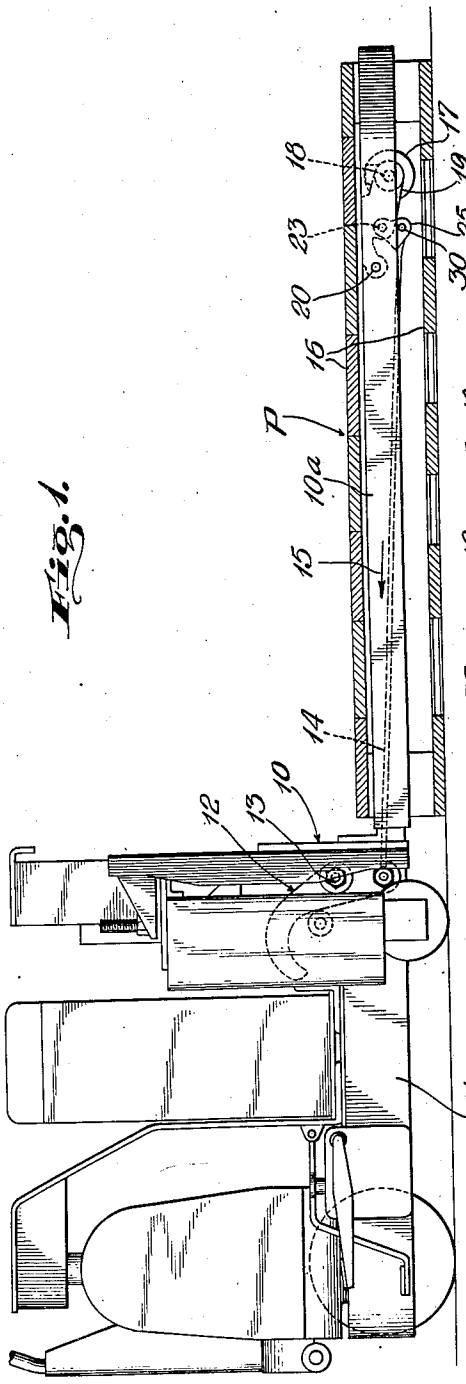

Fig. 1.

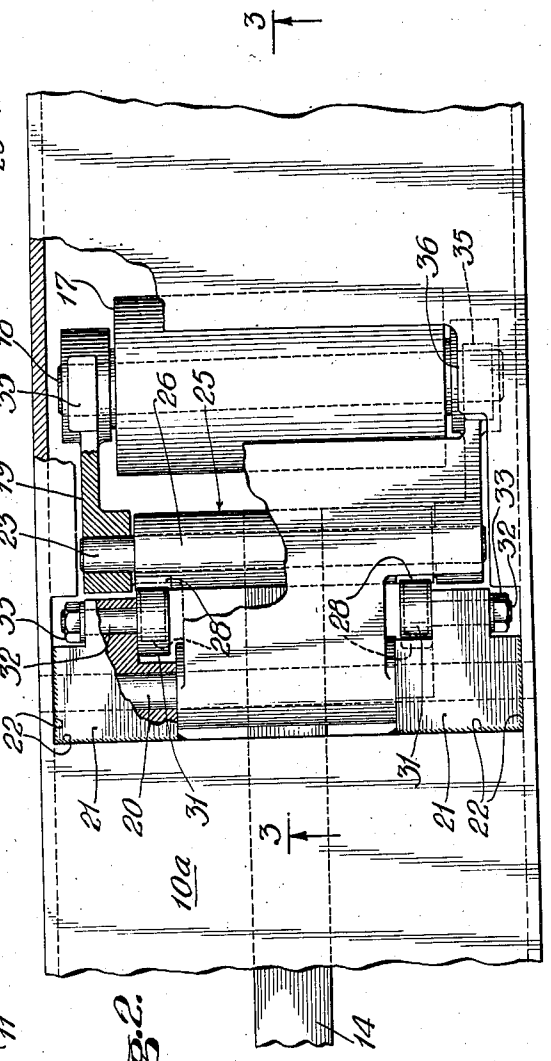

Fig. 2.

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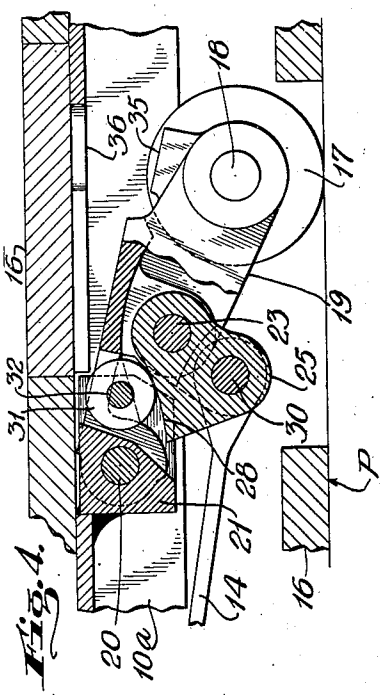

Fig. 4.

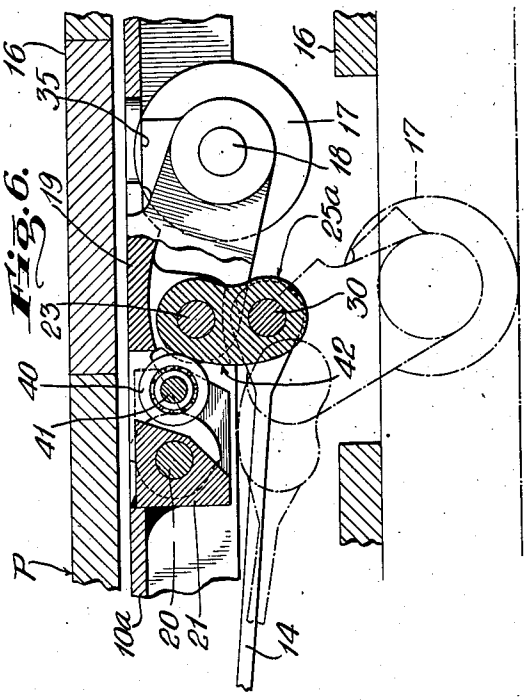

Fig. 6.

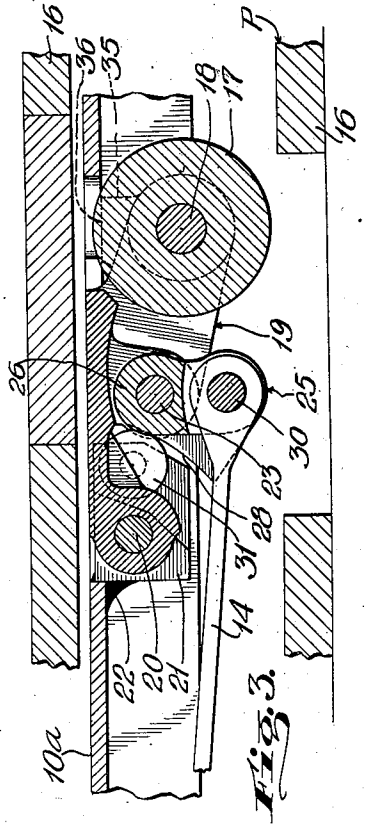

Fig. 3.

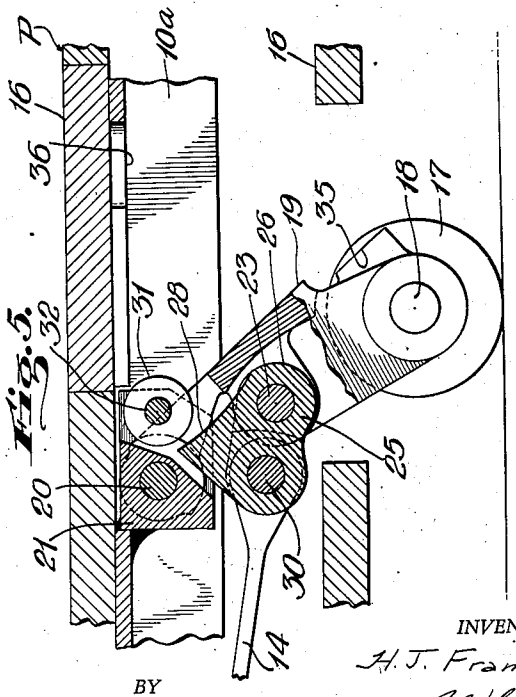

Fig. 5.

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UNITED STATES PATENT OFFICE

2,469,638

WHEEL LIFTING LINKAGE FOR PALLET TRUCKS

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Application July 20, 1943, Serial No. 495,453

6 Claims. (Cl. 280—44)

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This invention relates to an industrial truck of the type in which an elevating platform is adapted to lift a skid or pallet, and thereafter to transport the skid or pallet to a point where it is to be deposited. More specifically, my invention relates to a truck of the type that is disclosed in the Quayle Patent No. 2,274,164 and in my earlier applications Serial Nos. 432,177, filed February 25, 1942, now Patent No. 2,399,596, April 30, 1946; 481,957, filed April 6, 1943, now Patent No. 2,439,599, April 13, 1948; 458,035, filed September 11, 1942, now Patent No. 2,415,090, Feb. 4, 1947, and 469,324, filed December 17, 1942, now Patent No. 2,417,394, March 11, 1947.

In the truck shown in the Quayle patent and in my earlier applications, an elevating platform is adapted to be lifted at its rear end by the downward swinging movement of lifting wheel links pivoted to the elevating patform and carrying lifting wheels. Operating members, such as rods, cables, levers, or the equivalent, are employed in my earlier applications and in the Quayle patent, to pull the lifting wheel links and thereby rotate the said links on their pivots relatively to the elevating platform so as to lift the elevating platform. These members, which may be called tension members, are naturally mounted for movement under the elevating platform and are pivoted to the lifting links on which the lifting wheels are carried.

Because in these earlier structures the elevating platform is lowered almost against the ground so that it may enter between the upper and lower floors of a pallet, there is naturally very little room available for a satisfactory connection between the lifting wheel links and the tension members. In addition, the lifting wheel links must move almost to a horizontal position when the elevating platform is fully lowered. Therefore, since the tension members are secured to the lifting links, their direction of pull is but slightly offset from the axis about which the lifting wheel links are rotatable to lift the elevating platform. Because of this relationship of the parts, the initial lifting of the elevating platform in prior art trucks of the particular class described is extremely difficult. It may be well to indicate that the use by me of the descriptive term tension member is merely to facilitate the description of my invention. Actually, it is conceivable that the members connected to the lifting wheel links, may be other than tension members.

In those disclosures shown in my Patents 2,415,090 and 2,417,394 where the lifting wheels are held upwardly from the ground, the lowering of the lifting wheels during their first movement against the ground is facilitated because the lifting wheels are not required to lift a load during the first movement. Once the lifting wheels contact the ground, the problem of moving the lifting

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wheel links thereafter is the same in the structure of the said Patents 2,415,090 and 2,417,394 as it is in my Patents 2,399,596 and 2,439,599, in which the lifting wheels are not lifted off the ground.

The object of this invention is to devise means whereby downward swinging movement of the lifting wheel links may be more readily and easily effected. As a feature of my invention whereby the said object is achieved, I utilize an intermediate link between each of the lifting wheel links and the means used for swinging the said links downwardly. More particularly, a feature of my invention resides in an intermediate link that is preferably pivotally connected to a lifting wheel link and to a tension member, whereby to transmit the movement of the tension member to the lifting wheel link.

As a further feature of my invention, the intermediate link connected to the tension member and the lifting wheel link, is guided so that the pivot between it and the tension member is vertically displaced from its pivotal connection with the lifting wheel link so that the line of tension is considerably displaced from the pivotal axis of the lifting wheel link. In this way, a more efficient operation of the lifting wheel link by the tension member is obtained.

As a still further feature of the invention, a guide means is used for guiding the intermediate link so that its pivotal connection with the tension member is considerably below its pivotal connection with the lifting wheel link, whereby to allow the application of the force of the tension member in an efficient manner. As a further detailed feature of my invention, the guide means may take the form of a fulcrum stud in one modification of my invention, and a roller in another form of my invention, all as will be made quite apparent hereinafter.

I have thus presented generally the problem solved by my invention, as well as a broad outline of the structure of my invention, in order that the contribution of my invention to the prior art may be better appreciated. There are, of course, additional features of my invention that I have not as yet set forth, but which I shall describe in the specification and claim in the claims appended hereto. It will be well to consider that my invention is a broad and valuable one and that I am entitled to claims that will prevent the appropriation of my invention in physical forms other than the particular forms shown and described.

Referring now to the drawings,

Fig. 1 is a vertical elevation of a truck to which my invention is applied.

Fig. 2 is a view looking downwardly on one leg of the U-platform of the truck of Fig. 1.

Fig. 3 is a section taken along lines 3—3 of

Fig. 2 showing the lifting wheels lifted off the ground.

Fig. 4 is a vertical view similar to Fig. 3 but showing the lifting wheels against the ground.

Fig. 5 is a view showing the lifting links in their fully lifted position.

Fig. 6 is a view similar to Fig. 3 illustrating a modification of my invention and showing in phantom the parts thereof when in a lifting position similar to that of Fig. 5.

Referring now more particularly to the drawings and especially Fig. 1, my invention there is shown applied to a truck of the type illustrated in my Patent 2,415,090. So far as the present invention is concerned, it is only necessary to know that the said truck has an elevating platform 10 and a lifting head 11, and that when the elevating platform is raised, cams 12 will be rotated about pivots 13 to move tension bars 14 in the direction of the arrow 15.

Trucks of the particular type are adapted to have their platforms enter between the upper and lower floors 16 of a pallet P and to raise the pallet when the elevating platform is lifted. Lifting movement is imparted to the rear end of the elevating platform by lifting wheels 17 mounted on axles 18 carried by lifting links 19. In the truck to which my invention is shown applied, the elevating platform 10 is of the U-type and is formed with two legs 10*a*, each leg 10*a* having a lifting link 19 on which is mounted a lifting wheel 17. In describing my invention further, I shall describe the structure of but one of the legs 10*a* of the U-platform 10, and the lifting link 19 and the operating mechanism associated therewith.

The lifting link 19 is pivoted about shaft 20 supported by the opposed bearing blocks 21 welded as at 22 to the leg 10*a* of the platform 10 (Fig. 2). In the trucks of the prior art, and in the truck of my earlier applications and of the Quayle patent, it is the custom to pivotally connect the tension bar 14 directly to the lifting link 19 for swinging that link downwardly from its position of Figs. 3 and 4 to the position of Fig. 5. If this is done, the pivotal connection must be approximately in the axis of a shaft designated by reference numeral 23 in Figs. 3 and 4. Those skilled in the art will readily appreciate that any tension that may be brought by the tension bar 14, if secured as about pivot shaft 23 to the lifting link 19, will be in a line extremely close to the pivot shaft 20 about which the lifting link 19 is rotatable. Therefore, the application of lifting effort through the tension bar 14 at the beginning of the lifting stroke, is extremely inefficient in pallet trucks of the prior art.

For obtaining greater lifting efficiency I have utilized what I term an intermediate link 25. This intermediate link 25 is formed with an upper tubular portion 26 that is pivoted to the lifting link 19 through the intermediary of a shaft 23. The intermediate link 25 is formed with a pair of cam surfaces 28, one at each end thereof, the purpose of these cams being to guide or fulcrum the intermediate link as it transmits lifting effort from the tension bar 14 to the lifting wheel link 19. The tension bar 14 is pivoted through shaft 30 to the intermediate link 25 and through the said shaft 30 imparts motion to the intermediate link.

For cooperation with the cam surfaces 28, I employ a pair of studs 31, one for each of the cam surfaces 28. Each of the studs 31 is carried on

the end of a stud shaft 32 that passes through a bore in one of the opposed bearing blocks 21. A nut 33 is secured on the threaded end of each of the stud shafts 32, for holding the shafts and studs 31 in position.

Where the construction of my Patent 2,415,090 is utilized; that is, a construction in which the lifting wheels 17 are initially spaced from the ground, the parts will occupy the position of Fig. 3 in the lowered position of the elevating platform 10. Should tension be applied to the tension bar 14, the tension bar will pull on the intermediate link 25 through the pivot shaft 30. The cam surfaces 28 of the intermediate link 25 bear against the studs 31, with the studs acting as fulcrums, so that the pull of the tension bar 14 will swing the lifting link 19 downwardly into the position of Fig. 4. The shape of each of the cam surfaces 28 is such that the said cam surfaces will merely roll about the surfaces of the fulcrum studs 31, thereby making it unnecessary to use rollers in the place of the said studs. It will of course be quite apparent that the pull of the tension bar 14 will be displaced considerably more from the pivot shaft 20 of the lifting link 19 than in the prior art structures where the tension bar 14 is secured directly to the lifting link 19. This, together with the lever-like action of intermediate link 25 contributes a much more efficient application of the force of tension bar 14 than heretofore possible.

If we consider the structure of Fig. 4 as illustrative of the type of truck shown in the Quayle patent in which the lifting wheels are always against the ground, it will be noted that there also it is possible to obtain a much more efficient application of the force of the tension bar 14 than in the prior art. With the parts in the position of Fig. 4, application of tension through the tension bar 14 will of course move the parts from the position of Fig. 4 to the final lifted position of Fig. 5. It is interesting to note that in the position of the parts in Fig. 5, the particular cam surface 28 of lifting link 19 that is shown, has moved away from its stud 31. It will be well to note that this movement of the cam surfaces 28 away from the studs 31, takes place as soon as the pivot shafts 23 and 30 are aligned with the direction of pull of the tension bar 14.

With the parts in the position of Fig. 5, should the elevating platform be lowered, the parts will of course move backwards to the position of Fig. 4 and thence to the position of Fig. 3 all as is quite apparent. A block 35 extends upwardly from the link 19 and impinges against a limit surface 36 on the elevating platform to limit the upwardly swinging movement of the lifting link 19.

In Fig. 6 I show a modified form of my invention in which the studs 31 are eliminated, there being substituted therefor rollers 40 mounted for rotation about stud shafts 41 that are secured in place as are the shafts 32 of the first modification. The cam surfaces 28 of the first modification are eliminated, and instead, the intermediate link, designated here by reference numeral 25*a*, is formed with a simple cam surface 42 that cooperates with the rollers 40. The simple surface 42 will not roll about the rollers 40, and it is therefore necessary to use rollers instead of the circular studs 31 of the first modification. Other than the particular difference set forth, the structure in Fig. 6 operates exactly as does the structure of Fig. 5. I believe that the operation of my invention and its

meritorious features will now be quite apparent to those skilled in the art.

I now claim:

1. In a truck of the class described, a lifting wheel link, means rotatably mounting said link on a part of said truck, a lifting wheel mounted on said link, tension means for pulling said link to rotate it on said mounting means in a downwardly extending arc from an upward position to a lowered position, an intermediate link pivoted to said lifting wheel link at one end and to said tension means at its other end and through which said tension means swings said lifting link downwardly, and a guide member mounted on a fixed point on said truck part for guiding said intermediate link and so located that when said lifting wheel link is in its upward position the pivot between said intermediate link and said tension means is vertically below the pivot between said intermediate link and said lifting wheel link.

2. In a truck of the class described, a lifting wheel link, means rotatably mounting said link on a part of said truck, a lifting wheel mounted on said link, tension means for pulling said link to rotate it on said mounting means in a downwardly extending arc from an upward position to a lowered position, an intermediate link pivoted to said lifting wheel link at one end and to said tension means at its other end and through which said tension means swings said lifting link downwardly, and a fulcrum member mounted at a fixed point on said truck part for guiding said intermediate link and so located that when said lifting wheel link is in its upward position the pivot between said intermediate link and said tension means is vertically below the pivot between said intermediate link and said wheel link, the pull of said tension means acting to move said intermediate link about said fulcrum member whereby to rotate said lifting wheel link.

3. In a truck of the class described, a lifting wheel link, means rotatably mounting said link on a part of said truck, a lifting wheel mounted on said link, tension means for pulling said link to rotate it on said mounting means in a downwardly extending arc from an upward position to a lowered position, an intermediate link pivoted to said lifting wheel link at one end and to said tension means at its other end and through which said tension means swings said lifting link downwardly, and a guide member mounted at a fixed point on said truck part for guiding said intermediate link and so located that when said lifting wheel link is in its upward position the pivot between said intermediate link and said tension means is vertically below the pivot between said intermediate link and said lifting wheel link, the pull of said tension means acting to align said pivots with the direction of the pull of said tension means, whereupon said intermediate link is released from the control of said guide member.

4. In a truck of the class having a lifting head and an elevating platform mounted for lifting movement relatively to said lifting head and movable from a low position adjacent the ground to an elevated position, a lifting wheel link, means rotatably mounting said link on the underside of the rear end of said elevating platform for lifting said rear end, a lifting wheel mounted on said link, a tension member extending under the elevating platform from its forward end to said lifting wheel link for rotating said link in a downwardly extending arc from an upward position whereby to lift the elevating platform, and a short intermediate link pivoted to said lifting wheel link and to said tension member with the line between the pivots substantially vertical when said lifting wheel link is in its upper position, said tension member swinging said lifting wheel link downwardly through the intermediary of said intermediate link.

5. In a truck of the class having a lifting head and an elevating platform mounted for lifting movement relatively to said lifting head and movable from a low position adjacent the ground to an elevated position, a lifting wheel link, means rotatably mounting said link on the underside of said elevating platform, a lifting wheel mounted on said link, said lifting wheel link lying with the axis of rotation of said lifting wheel thereon approaching the level of the axis of rotation of said lifting wheel link on said mounting means when said elevating platform is lowered, a tension member extending under the elevating platform from its forward end to said lifting wheel link for rotating said link in a downwardly extending arc on said mounting means whereby to lift the elevating platform, an intermediate link pivoted to said lifting wheel link and to said tension member and with the pivots substantially vertically aligned, and a fulcrum for said intermediate link against which it is urged and relatively to which it is moved by said tension member to swing said lifting wheel link downwardly.

6. In a truck of the class having a lifting head and an elevating platform mounted for lifting movement relatively to said lifting head and movable from a low position adjacent the ground to an elevated position, a lifting wheel link, means rotatably mounting said link on the under side of said elevating platform, a lifting wheel mounted on said link, said lifting wheel link lying with the axis of rotation of said lifting wheel thereon approaching the level of the axis of rotation of said lifting wheel link on said mounting means when said elevating platform is lowered, a tension member extending under the elevating platform from its forward end to said lifting wheel link for rotating said link in a downwardly extending arc on said mounting means to lift the elevating platform, an intermediate link pivoted to said lifting wheel link and to said tension member and through the intermediary of which said tension member swings said lifting link downwardly, and means guiding the movement of said intermediate link so located that when said lifting wheel link is in its upward position and said platform is lowered, the pivot between said tension means and intermediate link will be vertically displaced below the pivot between said intermediate link and said lifting wheel link.

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