This invention relates to industrial lift trucks. More particularly, my invention relates to the mounting of a hydraulic ram of telescopic construction so that the ram is adapted to elevate secondary uprights relatively to primary uprights on a lift truck, while also adapted to elevate a load carriage or tertiary uprights relatively to the secondary uprights.

To preserve the alignment of the parts of the hydraulic ram, it is rather usual in trucks of the particular class to mount the ram so that it will have some movement of adjustment as it operates to lift the secondary uprights, load carriage, or other lifting member to which it may be connected. It is extremely difficult, however, to mount efficiently a ram of the type in which there are two pistons moving in a cylinder as may be required to obtain multiple lifting, or the lifting of a load carriage relatively to secondary uprights and also the lifting of secondary uprights relatively to primary uprights. In suchrams, one piston acts to elevate the load carriage or tertiary uprights, and the second piston acts to lift the secondary uprights and the load carriage relatively to the primary uprights. Generally the two pistons are in telescoping relation, one being a sleeve type piston and the other a solid piston. Those pistons must move in correct alignment relatively to one another and also relatively to the outer cylinder of the ram, so that the lifting and lowering movements may be accomplished without affecting the packings that are utilized to prevent the escape of hydraulic fluid, and without causing any unusual wear.

I have conceived an exceedingly novel ram mounting that will enable a hydraulic ram to be utilized on a truck of the class described while preserving the correct alignment of the ram parts, and that will be particularly useful when the ram is of the type having telescoping pistons. In my invention, I mount the ram in such a way relatively to the secondary uprights on the truck that it may have some limited movement of adjustment, whereby the ram will operate with its pistons and cylinder actually extending in a single straight line between the main frame of the truck or the base of the primary uprights, and the point at which it acts to lift the load carriage or tertiary uprights, where those uprights are utilized.

As a feature of my invention, I utilize means mounting one part of the ram on the secondary uprights, and against downward vertical movement relatively thereto. That part of the ram generally will be the ram cylinder, one piston then acting in one direction to lift the load carriage and also the tertiary uprights, when utilized, and the second piston acting in the opposite direction to lift the secondary and tertiary uprights together with the load carriage relatively to the truck. While holding the ram cylinder against downward movement relatively to the secondary uprights, the mounting nevertheless allows the ram cylinder to have rather free movement in transverse directions, so that the ram cylinder and pistons automatically will maintain their correctly aligned relation.

Actually, my novel construction is of particular value in those lift trucks where a sleeve type of piston extends upwardly from the ram cylinder to lift tertiary uprights and also to lift, through chains a load carriage relatively to the tertiary uprights. A second piston extends downwardly from the ram cylinder and sleeve piston upon actuation thereof, and bears relatively to the truck frame so as to lift the secondary and tertiary uprights and load carriage relatively to the primary uprights. Through my novel ram mounting, the ram actually will be supported relatively to the secondary uprights, but will have a movement of adjustment relatively to those uprights that will enable the ram cylinder and both pistons to be held in a single straight line between the points at which the pistons act relatively to the primary uprights, tertiary uprights and load carriage.

More in detail, I utilize flexible means extending between the secondary uprights and a part of the hydraulic ram, preferably the outer cylinder thereof, for supporting the ram. Those flexible means will hold the ram against substantial bodily movement, but nevertheless will allow a certain movement of adjustment in fore and aft and transverse directions. In the construction that I prefer, the flexible means are links that have sufficient looseness therein to allow some adjustment, sufficient for my purpose, to maintain effectively the correct alignment to which I have earlier alluded.

I have thus outlined rather broadly the more important features of my invention in order that the detailed description thereof that follows may be better understood, and in order that my contribution to the art may be better appreciated. There are, of course, additional features of my invention that will be described hereinafter and which will form the subject of the claims appended hereto. Those skilled in the art will appreciate that the conception on which my disclosure is based may readily be utilized as a basis for the designing of other structures for carrying out the several purposes of my invention. It is important, therefore, that the claims be regarded as including such equivalent constructions as do not depart from the spirit and scope of my invention, in order to prevent the appropriation of my invention by those skilled in the art.

In the drawings:

Fig. 1 shows an industrial lift truck that utilizes my novel ram mounting.

Fig. 2 shows the ram mounting in further detail.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Referring now more particularly to Fig. 1 of the drawings, I indicate my ram mounting generally by the numeral 10, and I show that mounting utilized to support a hydraulic ram cylinder 11 on secondary uprights 13 of an industrial truck T. In the particular construction that I have chosen to illustrate, the truck T is equipped with primary uprights 13 on which the secondary uprights 12 slide, and has also tertiary uprights 14 that slide vertically on the secondary uprights 12. A load lifting carriage 15 is mounted for vertical movement on the tertiary uprights 14, and is elevated relatively to uprights 14 through load chains 16.

Ram cylinder 11 has a piston 17 that extends upwardly, and that acts relatively to the chains 16 for lifting the carriage 15. The piston 17 has an upper end portion 18 that is adapted to engage a cross member 19 on the tertiary uprights 14, whereby piston 17 also will elevate those uprights. Ram cylinder 11 has further a piston 20 that bears against a lower cross member 21 on primary uprights 13 whereby that piston, when extended in a downward direction, will lift the secondary and tertiary uprights 12, 14 and carriage 15 relatively to the truck. I shall describe my invention as applied to an operating combination such as here outlined because my invention is of greatest value in such a combination. However, my invention is usable in other arrangements of lifting means and uprights as will be presently apparent.
Those persons skilled in the art will appreciate that the ram cylinder 11 and pistons 17, 20 must move in a correct aligned relation to one another in order to avoid any unusual wear on the parts of the ram, and to prevent damage to the packings of the ram. It will be appreciated also that the uprights 12 and 14 will have a tendency to tilt and were it not for the moment of the truck, and the load on the carriage 15, thus tending to deflect the ram pistons 17 and 20 and ram cylinder 11 out of aligned relation to one another. I shall now describe the exceedingly novel construction of my ram mounting 10, whereby I am able to preserve the correct alignment of the ram cylinder 11 and its pistons or pistons.

In the form of my invention that I prefer, secondary uprights 12 have secured thereto cross member 22 arranged at the rear side of ram cylinder 11. Cross member 22 is shaped so that there may be substantial clearance between its central part 23 and the cylinder 11, as seen in Fig. 3. Cross member 22 is used also to anchor the carriage lifting chains 16, but that is generally conventional. Formed integrally with the cross-member are support lugs 25, Figs. 2 and 3, one lug being formed on member 22 at each side of the ram cylinder 11. A pair of links 24 is pivoted through a pivot pin 26, one of which is shown in Fig. 3, to each of the lugs 25 on the cross member, Figs. 2 and 3.

For reasons that will appear, I arrange a certain looseness between the links 24 and lugs 25. Thus, I may very well form the lugs 25 with openings 27 that are slightly larger than the pivots 26, while arranging links 24 in slightly spaced relation to lugs 25 as shown in Fig. 2. I attach the lower ends of links 24 to the ram cylinder 11 through pivot pins 28 extending through openings in ears 29. Ears 29 may be secured in various ways to ram cylinder 11, but for the purposes of disclosure I show nuts 32 securing those ears 29 to a collar 31 that is welded to the ram cylinder 11. Links 24 are loose relatively to ears 29, somewhat as I have described with respect to the lugs 25, utilizing slightly enlarged openings 30 in ears 29, Fig. 3.

From my description, it will be understood that the links 24 will act to support the ram cylinder 11 against downward movement relatively to the secondary uprights 12. Those links 24 will, however, rotate on the pivots 26, 28 to contribute fore and aft adjustment of the ram cylinder 11. Moreover, it will be observed that the links 24 can swing in a transverse direction because of their looseness relatively to the surfaces of lugs 25 and ears 29. Thereby, the links 24 can have a universal rotating movement that will contribute transverse as well as fore and aft movement of adjustment of the ram cylinder 11. In effect, then, the ram cylinder 11, together with its pistons 17, 20 will have universal adjustment relatively to the truck uprights, while the cylinder 11 is fully supported against downward movement relatively to the secondary uprights 12 of the truck. Because of that movement of adjustment, the ram cylinder 11 and pistons 17, 20 always will extend in a straight line between the lower cross member 23 and the primer's end through the cylinder 16 or the cross member 19 on the tertiary uprights. Thereby I am able actually to preserve the correct alignment of the ram cylinder and pistons relatively to one another, despite the fact that the truck uprights and carriage may move somewhat out of aligned relation during the normal movement of the truck.

While my invention has a particular value when utilized on a truck that has primary, secondary, and tertiary uprights, as I have described, I do not wish to be limited to the particular truck, since it will be obvious to those skilled in the art that my novel ram mounting may be used to advantage to preserve the alignment of the parts of a ram on a lift truck that has merely one set of uprights. In other words, my invention will be exceedingly effective on any lift truck, to preserve the aligned relation of a ram piston and cylinder when the point of application of the ram piston tends to move out of proper aligned position. I believe, therefore, that the very considerable value of my novel ram mounting will be understood, and that the merits of my invention will be fully appreciated.

I now show in detail:

1. In a truck of the class described, having uprights and a load carriage mounted on said uprights for lifting movement relatively thereto, a ram having an outer cylinder and a piston, means through which said ram piston acts when extended relatively to the ram cylinder to lift the said load carriage, a substantially vertical movement on each side of the cylinder of said ram, pivots securing opposed ends of each link to the ram cylinder and uprights whereby to support the cylinder on said links against downward vertical movement relatively to the said uprights, said pivots formed with surfaces on which the links have universal rotation to contribute fore and aft and transverse movement of adjustment of said ram cylinder while supporting the cylinder relatively to the uprights, and said ram cylinder by movement of adjustment on said links permitting said piston to extend from said ram cylinder in a straight line including the axis of said cylinder, substantially for the purpose described.

2. In a truck of the class described, primary uprights, secondary uprights mounted for lifting movement relatively to the primary uprights, tertiary uprights, means for mounting the tertiary uprights relatively to the secondary uprights, a load carriage, means mounting said load carriage for lifting movement relatively to the tertiary uprights, a ram having an outer cylinder and a pair of telescoping pistons, a substantially vertical link on each side of the cylinder of said ram, pivots securing one end of each link to a portion of the ram cylinder and the other end of each link to a portion of the secondary uprights whereby to support the cylinder on said links against downward movement relatively to said secondary uprights, said links rotating on said pivots to contribute movement of adjustment of the ram cylinder in a fore-and-aft direction relatively to the secondary uprights, said telescoping pistons of said ram equipped with means adapted to bear against the tertiary uprights for lifting the said tertiary uprights and load carriage relatively to the secondary uprights, the other of said telescoping pistons bearing against a part of said truck fixed relatively to said secondary uprights, and said ram cylinder by its movement of adjustment on said links permitting the extension of said pistons from said ram in a straight line including the axis of said cylinder.

3. In a truck of the class described, having uprights and a load carriage mounted on said uprights for lifting movement relatively thereto, a ram having an outer cylinder and a load carriage mounted on said uprights for swinging movement relatively to said uprights, said ram cylinder having a substantially vertical movement on each side of the cylinder of said ram, pivots securing opposed ends of each link to the ram cylinder whereby to support the cylinder on said links against downward vertical movement relatively to said uprights, said movement of adjustment of said ram cylinder permitting said piston to extend from said ram cylinder in a straight line including the axis of said cylinder, substantially for the purpose described.

References Cited in the file of this patent
UNITED STATES PATENTS
2,670,811 Shaffer Mar. 2, 1954
2,747,689 Abbe May 29, 1956