May 16, 1944. U. O. GUIGNARD ET AL 2,348,899

LOADER

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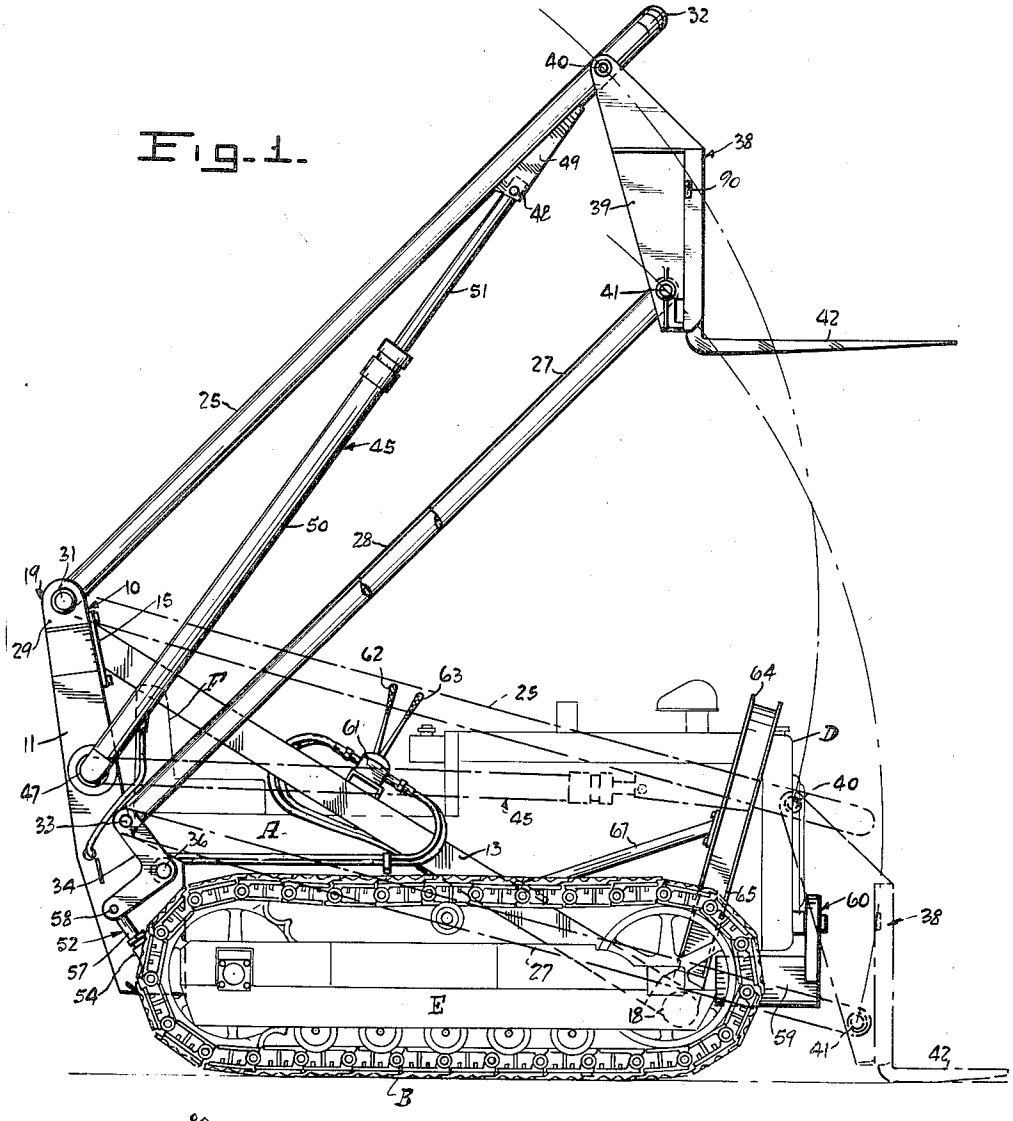
Fig. 1.



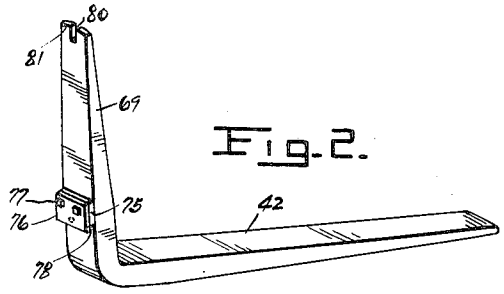


Fig. 2.

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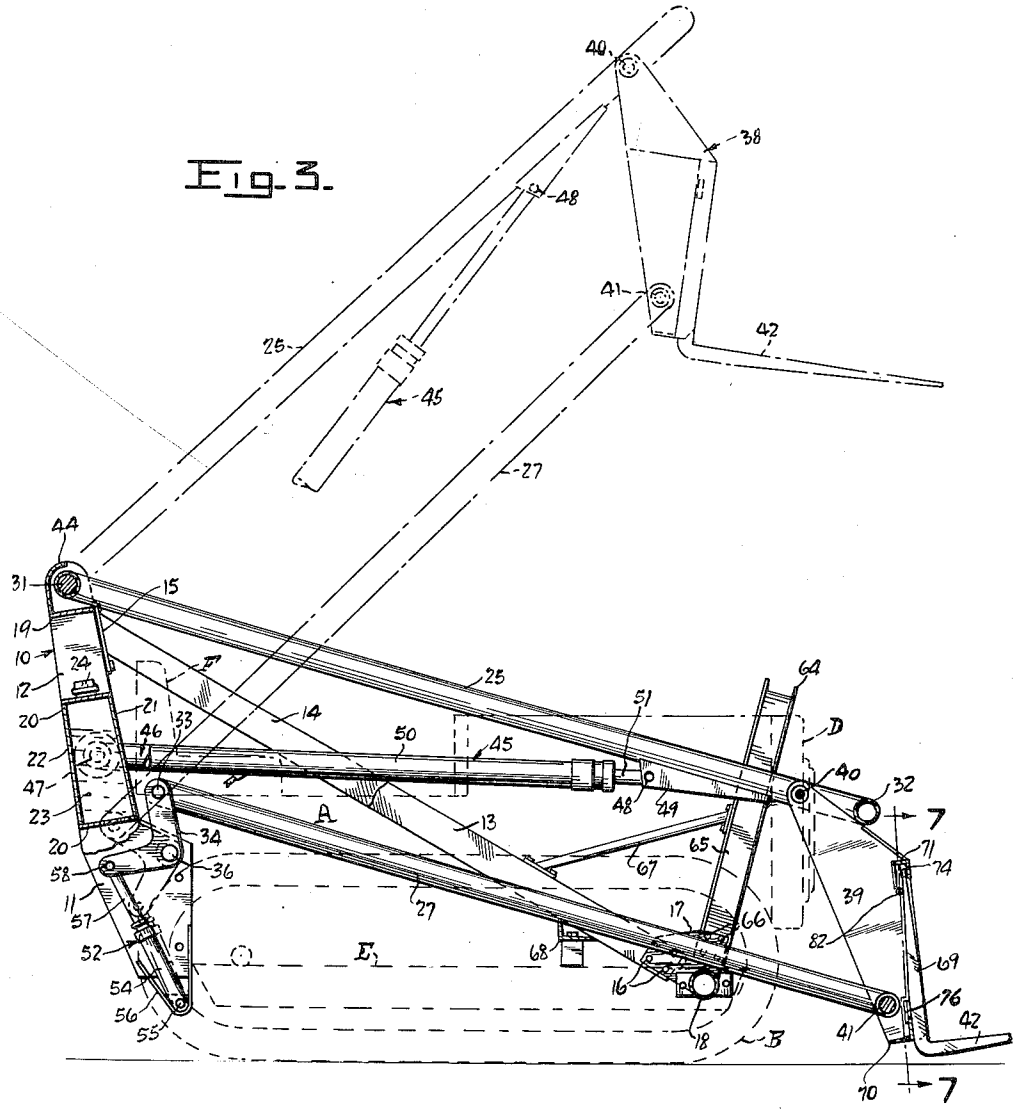
Fig. 3.



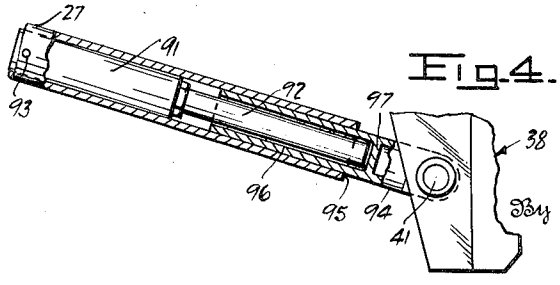


Fig. 4.

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Fig. 5.

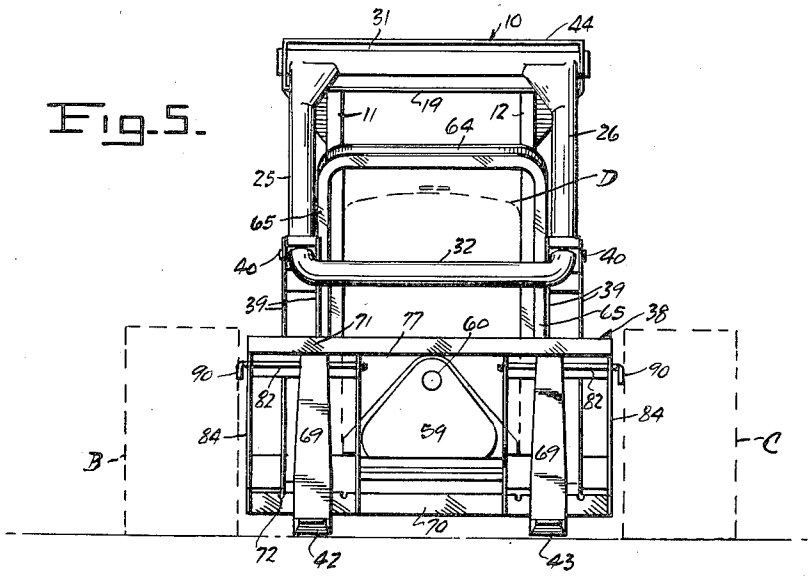
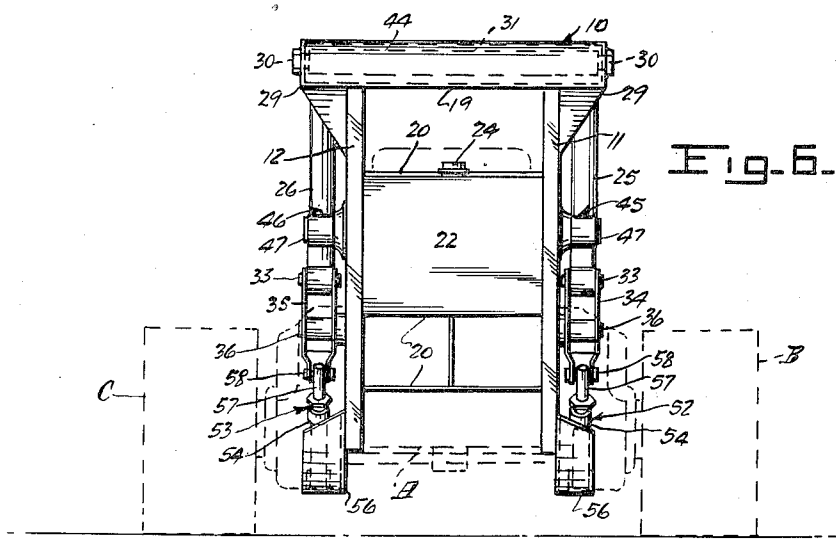


Fig. 6.



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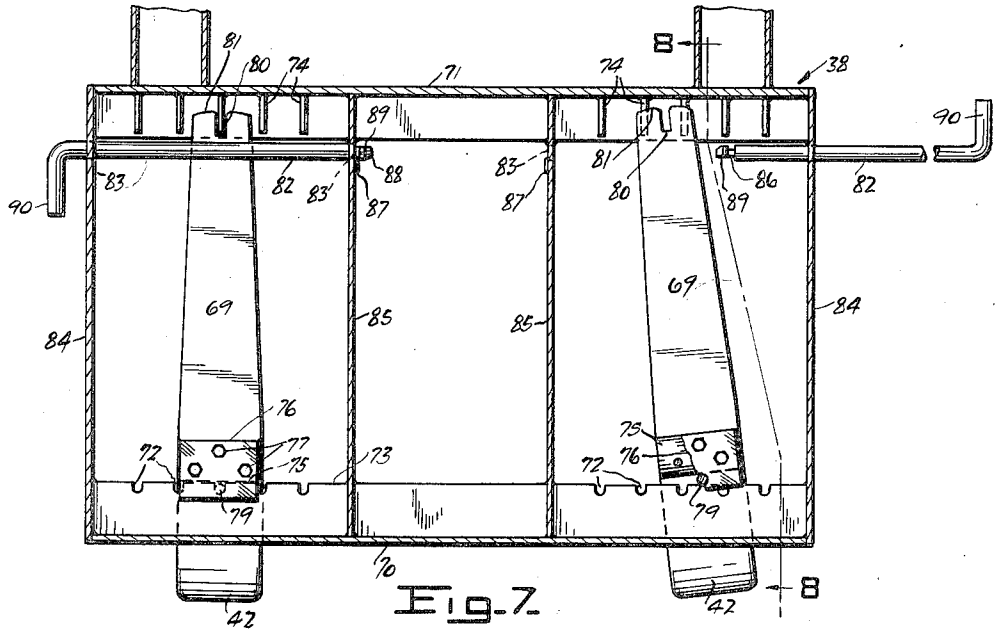

Fig. 7.

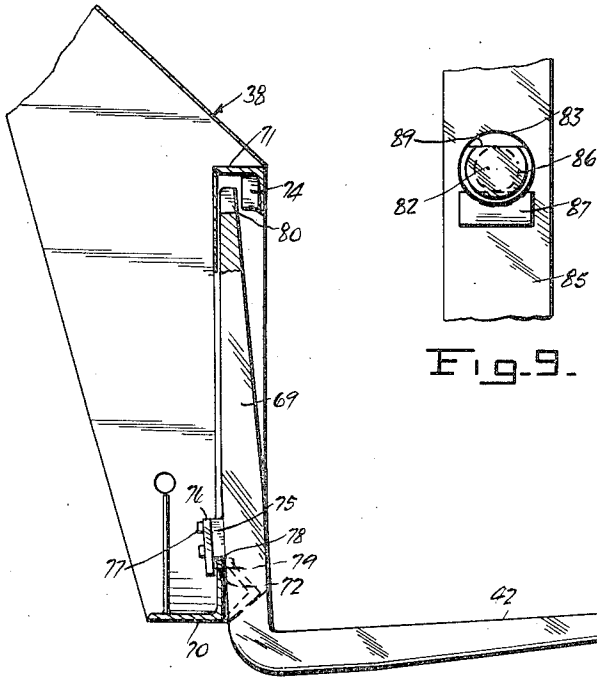

Fig. 8.

Fig. 9.

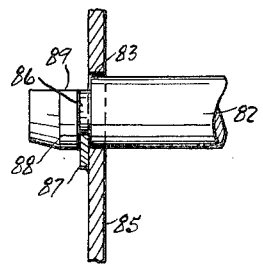

Fig. 10.

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UNITED STATES PATENT OFFICE

2,348,899

LOADER

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Application November 2, 1942, Serial No. 464,160

5 Claims. (Cl. 214—131)

This invention relates to improvements in loaders for lifting, carrying and delivering boxes, crates and similar objects.

The primary object of the invention is to provide a tractor mounted device of this nature embodying power actuated means for carrying out the desired operations of lifting, carrying and delivering or depositing such articles as boxes and crates and with such delicacy of control over all such operations as to permit the delivery of the articles in good order to any point. The loader thus fulfills all of the requirements for an effective means of loading goods in large transport aircraft where such goods, often of a delicate although heavy nature, must be elevated to a considerable height and deposited with great nicety in the cargo space.

Another object is to provide a loader embodying as its lifting elements two pairs of normally parallel arms which may be raised and lowered and by parallel-lever action will maintain the load at a level position, but in which one arm of each pair is arranged for movement about an adjustable and controllable pivot in such manner as to tilt the load as may be required either to hold its securely in place while being transported in an elevated position or as an aid in depositing the load at its desired location. Still another object is to provide in a device of this kind a novel and effective load carrying fork or work holder capable of convenient adjustment to accommodate boxes, crates and other particles of many sizes and forms.

These and other more detailed and specific objects will be disclosed in the course of the following specification, reference being had to the accompanying drawings, in which—

Fig. 1 is a side view of our loader as mounted upon a track laying type of tractor and showing the fork holder or fork in full lines in an elevated position, and in a lowered position in broken lines.

Fig. 2 is a perspective view of one of the load carrying forks.

Fig. 3 is a side elevation, the tractor being shown in dotted lines, and illustrating two positions of the fork as well as the manner in which it is tilted forward or rearward by adjustment of the pivot center of one arm of each pair.

Fig. 4 is a fragmentary sectional view of one end of one of the load carrying arms, showing a modified structure for tilting the load.

Fig. 5 is a front end elevation with the fork in lowered position and showing the tractor in dotted lines.

Fig. 6 is a rear end elevation, again with the tractor shown in dotted lines.

Fig. 7 is an enlarged vertical and cross sectional view taken substantially along the line 7—7 in Fig. 3 illustrating the manner of mounting the load carrying forks in their frame.

Fig. 8 is a vertical, longitudinal section along the line 8—8 in Fig. 7, showing the fork in process of being adjusted.

Fig. 9 is an enlarged end view of one fork locking pin and associated parts.

Fig. 10 is a vertical section through the structure of Fig. 9.

Referring now more particularly and by reference characters to the drawings, we have shown our loader as mounted upon a conventional form of track laying tractor, although it may as well be arranged on the usual wheeled tractor or truck, the vehicle of whatever kind serving not only as the carrier for the loader but providing the power for its operation. The tractor here shown includes a chassis frame A alongside which the tracks B and C are arranged and the usual engine (not shown) is employed, being located rearwardly of the radiator D. Other parts of the tractor will be referred to in the course of this specification in connection with the loader parts secured thereto.

Secured to the back of the tractor chassis A is the main frame or support structure 10 of the loader comprising transversely spaced uprights or sides 11 and 12 which at lower ends are rigidly affixed in any suitable manner to the chassis and which are further braced by side braces 13 and 14 secured near upper ends of the uprights at 15 and extending forwardly and downwardly therefrom inside of the tracks B and C. At forward ends these braces are secured at 16 to brackets 17 welded or otherwise fastened upon a cross beam 18 which is mounted horizontally and transversely between the frame members E of the tractor tracks B and C. The uprights 11 and 12 are braced transversely by a header 19 secured at their upper ends and by cross members 20.

As best seen in Figs. 3 and 6 a pair of vertically spaced bracing members 20 for the uprights 11 and 12 may be joined by front and rear plates 21 and 22 and made liquid tight to provide a tank 23 to carry the fuel for the tractor engine, where the mounting of the loader upon the tractor requires the removal of the fuel tank from its usual position at the rear end. A filler opening and cap 24 are of course provided as well as suitable fuel connections to the engine in such case.

Arranged one at each side of the tractor, in-

wardly of the tracks B and C, are swinging side frames made up of upper arms or booms 25 and 26 and similar lower arms or booms 27 and 28 all of which may be conveniently fabricated of tubular material as here shown. The upper arms 25 and 26 are pivoted on a common transversely and horizontally extending axis at rear ends to the upper end of the frame structure 10, the pivot being formed by brackets 29 secured to the uprights 11 and 12 and in which bracket a pin 30 is journaled as clearly shown. These pivoted rear ends of the upper arms are joined by a cross member 31 from which the pin 30 extends, and forward ends of the arms are joined by a forward cross member or yoke 32 welded or otherwise secured. The upper arms are thus formed into a rigid frame which may swing upwardly and downwardly and the lengths are such that the forward cross member 32 will clear the tractor radiator some distance when the arms are lowered. The lower arms 27 and 28 are pivoted at rear ends at 33 between the upper ends of the sides of bell cranks or bell crank levers 34 and 35 which in turn are fulcrumed at 36 upon the uprights 11 and 12. The lower arms are thus arranged to swing upwardly and downwardly at forward ends in the same planes as the upper arms, the brackets 29 being offset laterally from the uprights 11 and 12 (Fig. 6) sufficiently to bring this about. The arms of course clear the braces 13 and 14 in their movements.

The forward ends of both pairs of arms are attached to the work holder or load carrier which includes a rigid fork frame 38 including transversely spaced pairs of upright webs or flanges 39 between which the ends of the arms loosely extend. The upper arms 25 and 26 are then pivoted by pins 40 between upper ends of these webs (rearwardly of the cross member 32) while the ends of the lower arms 27 and 28 are pivoted by similar pins 41 between the webs near their lower ends. The distance between the centers of the respective pivot pins 40 and 41 at each side corresponds to the distance between the pivot axes of the rear ends of the arms so that, the frame 38 being rigid, the arms will have a parallel-lever action. Thus so long as the bell cranks 34 and 35 are locked in proper positions in which the respective upper and lower arms are substantially parallel as in Fig. 1, by means presently to be described, the fork frame 38 will maintain its upright position without forward or rearward tilting as it is raised and lowered. The fork frame serves as an attachment and mounting for forwardly directed forks or fingers 42 and 43, the exact mounting and arrangement of which will also be presently described. A housing 44 partially encloses the rear pivoted ends of the upper arms and the cross member 31 between the brackets 29.

Extending substantially diagonally between the (normally) parallel upper and lower arms of each swinging frame is a hydraulic cylinder device or ram, designated at 45 and 46 for the respective frames. The rear ends of these rams are pivoted at 47 to the sides or upright members 11 and 12 just above the bell cranks 34 and 35 while the forward ends are pivoted at 48 to brackets 49 secured to the upper arms 25 and 26 immediately to the rear of the fork frame 38. As here shown the rear end portions 50 of the rams constitute the cylinders while forward ends 51 are the plungers working therein, but this arrangement may vary, of course. In any event the construction of the rams is such that when they are retracted or reduced in length the frames (and fork frame 38) will be lowered while as the rams are extended the force exerted on the upper arms 25 and 26 will swing the frames upwardly.

The bell cranks 34 and 35 are adjusted and locked in adjusted positions by smaller hydraulic cylinder and plunger units or rams designated generally at 52 and 53. Each unit comprises a cylinder 54 which is pivoted at a lower end at 55 in a bracket or hanger 56 depended from the lower end of one of the uprights 11 and 12 and from each of which cylinders a plunger 57 extends upwardly as clearly shown. Upper ends of the plungers 57 are pivoted at 58 to the rearwardly extending arms of the bell cranks and the arrangement is obviously such that extension or retraction of these ram plungers will oscillate the bell cranks in vertical planes to adjust the pivots 33 for the lower arms 27 and 28 forwardly and rearwardly.

The various rams are supplied with oil or other fluid under pressure for their operation by suitable pumps (not shown) actuated by the tractor engine and as here shown such pumps may be arranged within a forwardly located housing 59 with suitable driving connection made to the forward end of the engine crankshaft as represented at 60. Such arrangement may of course be varied to best suit the tractor upon which the loader is mounted. For controlling the admission of fluid to the rams, and the return of fluid therefrom, suitable valves designated generally at 61 controlled by separate handles 62 and 63 may be employed and may be mounted on the brace 13 convenient to the hand of the tractor operator seated on the seat F. One valve may be used to control fluid flow to and from the rams 45 and 46 and the other valve may similarly control the fluid flow to and from the rams 52 and 53.

An inverted U-shaped arch member or yoke 64 is arranged over the hood and radiator of the tractor and supported thereover by securing lower ends of its legs 65 at 66 to the brackets 17. This yoke will serve to prevent side sway of the arms when the fork or work holder is lowered, the arms just nicely clearing the upright portions of the yoke as clearly shown. Diagonal brace 67 are secured at each side between the yoke and the side braces 13 and 14 to further stiffen the structure. Brackets 68 are secured to the side braces 13 and 14 and to frame parts of the tractor to further support said braces.

In operation the load, be it crates, boxes or other articles, is placed upon the forks 42 and it may then be raised from the ground, transported to any desired location by the tractor, and finally delivered to its destination as will be clearly evident. The raising and lowering operation will not disturb the level of the forks 42 normally, due to the parallel lever action of the arms, but should it be desired to tilt the forks upwardly at forward ends to hold the load more securely in place while transporting, the rams 52 and 53 may be readily operated to swing the upper ends of the bell cranks 34 and 35 forwardly whereupon the lower arms 27 and 28 will be projected forwardly as seen in the full lines in Fig. 3. The result is to swing the lower end of the fork frame 38 forwardly and the load will obviously be more securely held by the forks in such position particularly in travel over rough terrain. On the other hand the forks 42 may be tilted downwardly at forward ends as an aid in depositing their load by manipulating the rams 52 and 53 to swing upper ends

of the bell cranks rearwardly and correspondingly pull the lower arms 27 and 28 and lower end of the fork frame in a rearward direction as seen in the broken lines in Fig. 3.

All of the adjustments both as to elevating or lowering the load and tilting it forwardly or rearwardly may be carried out with great nicety and delicacy of control making it possible to handle heavy but fragile goods with great ease and facilitating loading or unloading operations of all kinds.

Referring more in detail now to the work holder it is seen that the forks 42 have upwardly turned ends 69 disposed at right angles and which ends are secured in the fork frame 38. This frame includes a lower cross bar or angle 70 against which the forks may rest and an upper cross bar or angle 71 spaced some distance above the lower and disposed forwardly of the vertical plane thereof. The lower cross bar near each end (Figs. 4 and 5) has a series of notches 72 in its upper edge 73 while the upper bar has a series of narrow flanges or fingers 74 near each end and spaced apart at distances corresponding to the spacing of the notches, these flanges being positioned on a rear side of the upper bar and in vertical alignment with the corresponding notches below.

The ends 69 of the forks near their lower extremities have rearwardly projecting bosses or shoulders 75 on rear surfaces of which are detachably mounted the retainer plates 76, by means of bolts 77. Said plates overhang the bosses forming downwardly opening grooves 78 adapted to loosely receive and bear upon the upper edge 73 of the bar 72 as best seen in Fig. 8. A pin or dowel 79 on each plate 76 protrudes into the groove 78 to engage any one of the notches 72, this pin forming a rib beneath the boss above.

The upper extremities of the fork ends 69 have upright, upwardly opening notches 80 adapted to receive and engage the fingers 74. The vertical distances between the pins 79 and notches 80 are such that when the boss 75 bears on the upper edge of the lower cross bar 70 the notches 80 will just nicely receive the proper fingers 74 above, thus preventing either upward or downward displacement of the forks. At the same time the retainer plates 76 overhanging the rear of the lower cross bar 70 will prevent either forward or rearward dislodgement of the forks, it being noted that the forks bear rearwardly on the lower cross bar 70 and forwardly on the upper bar 71 under load to better support the weight.

To adjust the forks they may be swung upwardly at forward ends, as seen in Fig. 8, to swing the notched upper ends rearwardly clear of the fingers 74 whereupon they may be lifted sufficiently to clear the pins 79 from the notches 72. Then the forks may be shifted laterally along the lower bar 70, as seen in Fig. 7, to positions in alignment with any of the notches and fingers and restored to operative position by dropping the pins into the desired notches and releasing the front ends of the forks so that of their own weight they will swing forwardly at upper notched ends into reengagement with the fingers 74. The ends 69 are, of course, of such length that they may be lifted, when cleared from the fingers 74 to clear the pins 79 as described, while remaining within the limits imposed by the upper cross bar 71, and these notched ends of the forks are each cut or rounded off on a radius as indicated at 81, so that the forks may be tilted to either side (Fig. 7) to facilitate their movement laterally in the frame.

To prevent rearward swinging movements of the notched ends of the forks we provide retaining pins or keys 82 which may be inserted through horizontally and transversely aligned openings 83 in the upright end and center members 84 and 85 of the fork frame, one pin being thus mounted at each end of the frame behind the upper end portion of each fork as clearly shown. The inner ends of these pins 82 have reduced portions or grooves 86 which may engage lugs 87 welded on the center frame members 85 to partially close the openings 83 therein, the heads 88 thus formed on the pins, by these grooves, overhanging the lugs to prevent the pins from being drawn outwardly. However, the heads 88 are flattened on one side, as indicated at 89, so that, by rotating the pins one half turn, these flats will clear the lugs 87 permitting outward withdrawal of the pins when adjusting the forks. The outer ends of the pins 82 have ends 90 turned at right angles forming handles for their manipulation and in the locked position of the pins these ends will hang downwardly, their weight serving to maintain the locked condition of the parts. To remove the pins the ends 90 are grasped and turned upwardly (Fig. 7) and then pulled outwardly as will be apparent.

Referring particularly now to Fig. 4 we have shown therein a modification of the fork tilting means wherein a hydraulic ram 91, having a plunger 92, is arranged and secured by a pin 93 in the forward end of each lower arm 27 of the swinging side frames. The lower pivot 41 for the fork frame 38 is then caried by an extension or end member 94 slidably mounted in the open end 95 of the arm and having a bore 96 to receive the plunger but with the bore plugged as at 97 to engage the plunger end. Obviously by operation of the ram 91 to extend or retract the plunger 92, the end member 94 may be projected forwardly or moved rearwardly (by weight of the fork) so that the fork frame will swing about its upper pivots 40 to bring about the desired forward or rearward tilting movements. The ram and sliding end member might equally well be arranged at the rear end of the arm or at either end of the upper arm as will be apparent.

It will be noted that the pivot centers 33—41 for the lower arms are located forwardly of the vertical planes of the corresponding pivot centers 31—40 for the upper arms. As a result the forward ends of the lower arms are given the necessary forward projection so that the fork frame may clear the front of the tractor as it is raised and lowered, while permitting the fork structure as a whole to be placed closely adjacent the tractor front where the weight of the load will exert the least possible raising leverage upon the tractor. Of equal, or greater importance, this arrangement provides the widest possible spacing between the arms in their raised positions, enhancing their truss effect, as will be evident.

It is understood that suitable modifications may be made in the structure as disclosed, provided such modifications come within the spirit and scope of the appended claims. Having now therefore fully illustrated and described our invention,

what we claim to be new and desire to protect by Letters Patent is:

1. A tractor mounted loader comprising a frame supported rearwardly on the tractor, a load carrier disposed forwardly of the tractor, longitudinally extending vertically spaced, substantially parallel boom arms pivotally mounted at their rear ends on the frame and pivotally connected at their forward ends to the load carrier, said frame, carrier and boom arms forming an articulated substantial parallelogram construction which when actuated to raise and lower the carrier will retain the latter in predetermined working angle, an extensible lifting ram disposed entirely within the vertical limits of the boom arms and extending diagonally of such parallelogram and connecting the frame to one of said arms, and power means for operating the lifting ram to thereby actuate the parallelogram construction and operate the carrier.

2. A tractor mounted loader comprising a frame member mounted on the rear of the tractor, vertically spaced, substantially parallel booms extending forwardly from pivot connections with said frame member, a load carrier supported by the forward ends of the booms and connected thereto by spaced pivots, and a fluid operated lifting ram directly connecting said fram member, at a point spaced between the rear ends of the booms, to the upper of said booms, and disposed angularly with respect thereto whereby extension of the ram will operate to lift the booms and load carrier.

3. In a tractor mounted loader, a frame, a boom extending forwardly from a pivot connection with the frame, a load carrier pivotally attached at its upper end to the forward end of the boom, an extensible fluid operated ram forming a diagonal lift connection between the frame and a forward part of the boom, and a longitudinally adjustable arm connecting a lower part of the load carrier to the frame, said arm being in substantial parallelism with the boom to thereby maintain a predetermined working angle of the load carrier when the latter is raised and lowered.

4. In a tractor mounted loader, a frame, a boom extending forwardly from a pivot connection with the frame, a load carrier pivotally attached at its upper end to the forward end of the boom, an extensible fluid operated ram forming a diagonal lift connection between the frame and a forward part of the boom, and an arm connecting a lower part of the load carrier to the frame, said arm being in substantial parallelism with the boom to thereby maintain a predetermined working angle of the load carrier when the latter is raised and lowered, and fluid operated means associated with said arm to tiltably adjust the angle of the load carrier.

5. In a tractor mounted loader, a frame, a boom extending forwardly from a pivot connection with the frame, a load carrier pivotally attached at its upper end to the forward end of the boom, an extensible fluid operated ram forming a diagonal lift connection between the frame and a forward part of the boom, and an arm connecting a lower part of the load carrier to the frame, said arm being in substantial parallelism with the boom to thereby maintain a predetermined working angle of the load carrier when the latter is raised and lowered and fluid operated means associated with said arm to tiltably adjust the angle of the load carrier, said means comprising a lever fulcrumed on the frame with one part supporting said arm, and a fluid operated ram connecting said lever to the frame.

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