

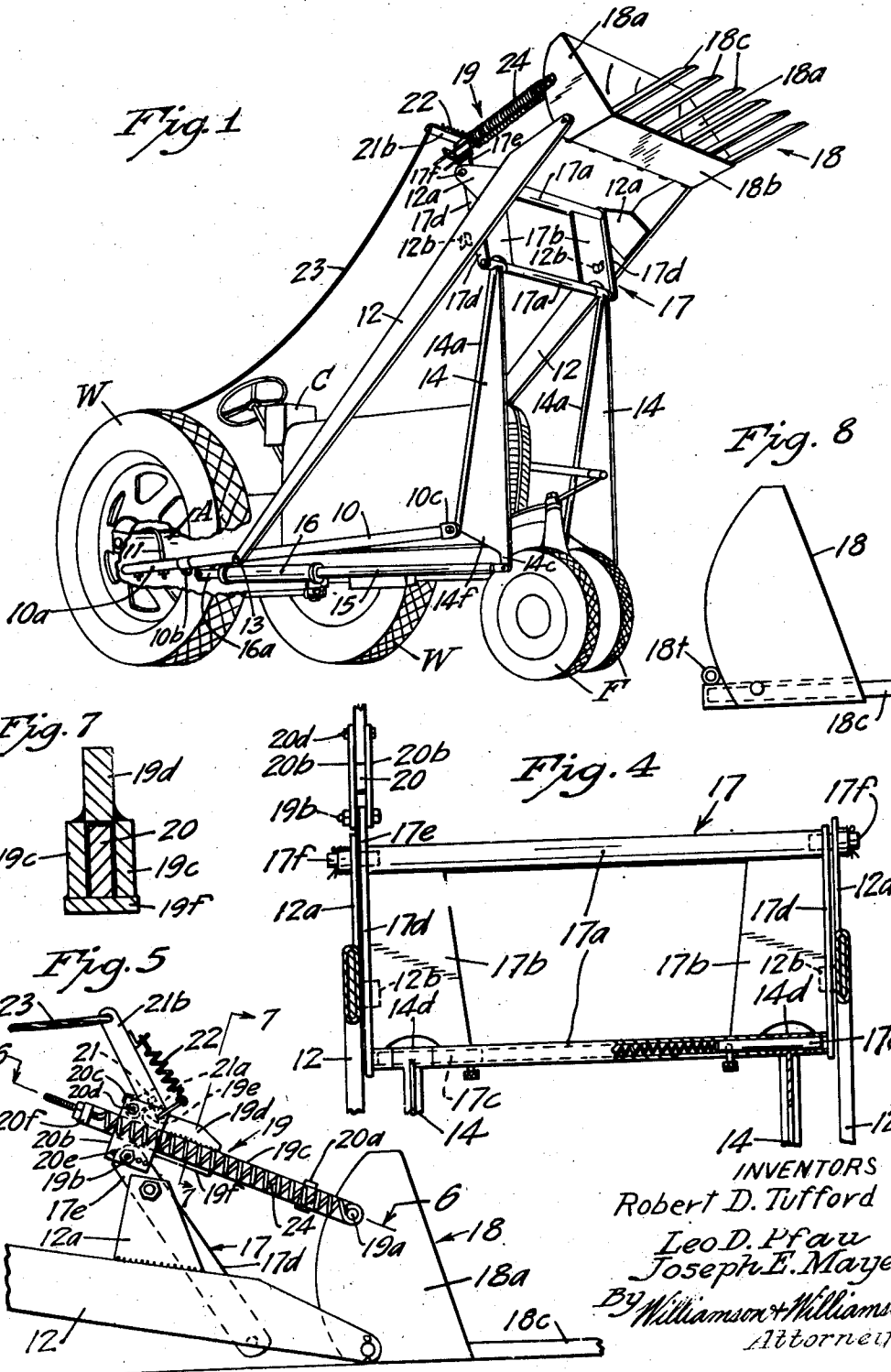
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L. D. PFAU ET AL
FRONT END LOADER

2,490,155

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2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2

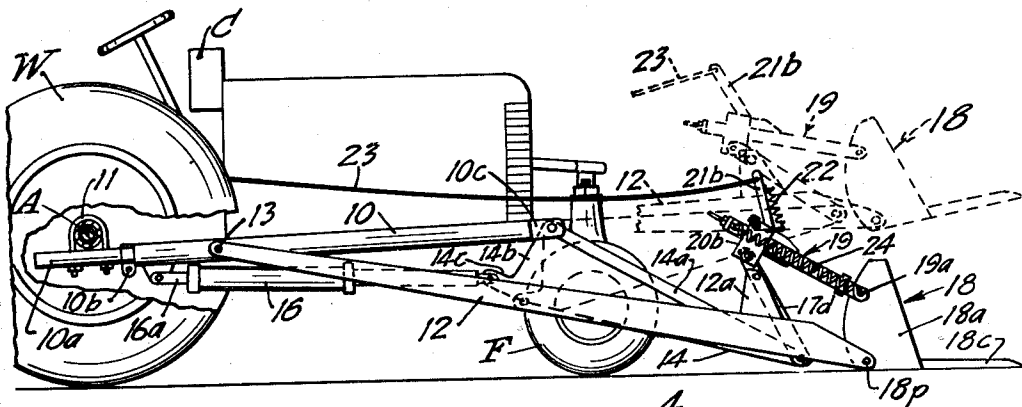
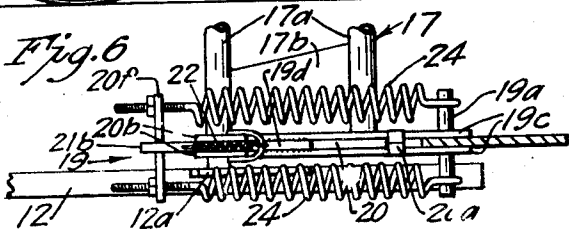
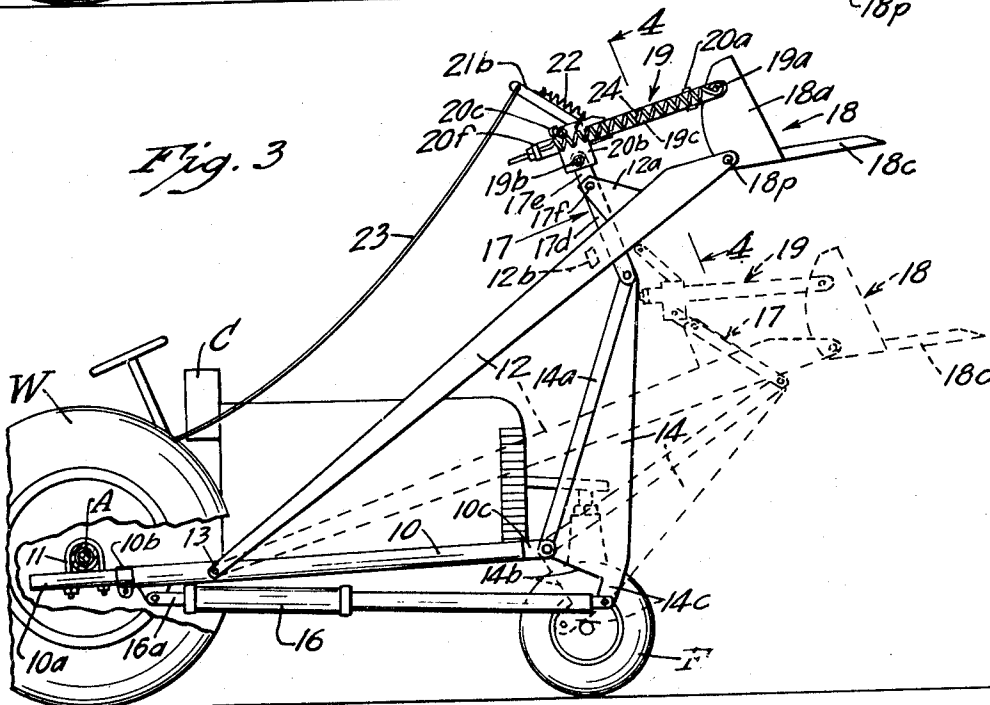


Fig. 3



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UNITED STATES PATENT OFFICE

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FRONT END LOADER

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Application May 27, 1946, Serial No. 672,417

8 Claims. (Cl. 214-140)

1

Our invention relates to power actuated front end loading apparatus for self-propelled vehicles, such as tractors, trucks, patrol graders and other automotive vehicles and relates particularly to apparatus of this character which may conveniently be embodied in attachments for conventional types of self-propelled vehicles and which are adapted to gather or scoop up material by pushing action at the front end of the vehicle and to subsequently elevate the material gathered, transport the same and dump the same from an elevated position for loading or piling.

This invention embodies improvements on the structure disclosed in the pending application of Leo D. Pfau, one of the applicants herein, entitled "Loading device," Serial Number 559,603, filed October 20, 1944.

It is an object of our present invention to further improve upon the efficient and commercially successful structure disclosed in said Pfau application to the end that lifting force is applied by thrust from below to the outer portion of the boom more uniformly and with less variance in power required throughout the entire lifting operation and with less friction on working parts; while maintaining the general underslung and simplified construction of said Pfau device as well as distribution of the load during elevation.

A further object is the provision of a simplified and highly efficient front end loader wherein elevation of the boom and load supported from the outer end thereof is obtained through cantilever thrust and toggle connection between the power source (preferably hydraulic) and the outer or front end of the boom and wherein the application of power and its connection with the cantilever boom swinging mechanism are disposed at all times in very low relation to the main frame of the vehicle chassis, the mounting of all parts being mainly below the tractor height and preferably at the level or below the level of the main chassis frame of the traction vehicle. With such structure, distribution of the load stress incurred by the elevation thereof is efficiently obtained during loading or gathering and during transportation of the load to the point of dumping.

Another important object is the provision in combination with the cantilever thrust mechanism for elevating the boom, of means actuated by the same cantilever structure for automatically leveling and maintaining the load holder or bucket a predetermined pitch throughout the elevation of the load.

A more specific object is the provision of a

2

front end loader attachment for tractors and the like wherein a source of power, preferably hydraulic, is applied by thrust from beneath the load to a forwardly extending swingable boom through the medium preferably of a bell crank lever-toggle principle wherein the bell crank is pivoted at a low point on the vehicle chassis and wherein all parts of the device are mounted below the overall height of the tractor with distribution of stresses and strains efficiently upon the frame and support of the traction vehicle and with elimination of upstanding or overhanging mountings or other parts to obstruct the vision and manipulation of the operator.

Another object is the provision in a loader of the class described, of cantilever equalizing connections between the longer arm of the bell crank, boom elevating mechanism and the boom whereby required thrust elevating power throughout the entire arc of elevation is reasonably constant.

A still further object is the provision in structure of the class described of an improved latch construction for releasing the load carrier to effect instant dumping through gravity and effective upon dumping of a load to again lock the load carrier in cooperative loading and elevating relation to the boom.

These and other objects and advantages of our invention will be more apparent from the following description made in connection with the accompanying drawings, wherein like reference characters refer to similar parts throughout the several views and in which:

Fig. 1 is a perspective view showing an embodiment of our invention applied to the tractor of conventional type with the boom structure and load carrier disposed in fully elevated position for dumping of the load.

Fig. 2 is a side elevation of the same with the boom disposed in lowermost position for applying thrust in gathering a load and with the boom and cooperating parts shown in dotted lines in partially elevated position.

Fig. 3 is a similar side elevation showing the boom, load carrier and associated parts in almost fully elevated relation while showing an intermediately elevated position of said parts in dotted lines.

Fig. 4 is a detail cross section showing the equalizing linkage between the outer end of the bell crank mechanism and the boom taken approximately on the line 4-4 of Fig. 3 with the latch mechanism for the load carrier removed.

Fig. 5 is a side elevation of the outer portion of the boom and the load carrier in lowered posi-

tion and showing our improved latch mechanism for controlling the dumping of the load and with some parts broken away and others shown in section.

Fig. 6 is a detail view mostly in top plan, showing the said latch mechanism and its relation with the load carrier and equalizing linkage;

Fig. 7 is a detail cross section taken on the line 7-7 of Fig. 5; and

Fig. 8 is a fragmentary, side view of the load carrier detached.

In the drawings, our improved apparatus is attached to a self-propelled vehicle, as shown, in the form of a conventional farm tractor having the usual chassis and large rear traction wheels W provided with the usual small front wheels F which are spaced closely apart and converge towards their lower peripheries and are of much smaller diameter than the rear wheels, W. The heavy, rear axle housing designated as A, journals the axles of the rear wheels in conventional manner and is preferably utilized as the base or rear attachment medium for our apparatus.

Our improved loader apparatus, preferably utilizes a stress absorber mounting frame comprising a pair of heavy mounting tubes 10 disposed longitudinally along the two sides of the chassis of the vehicle and each having telescoped in the rear end thereof an adjustable extender tube or rod 10a which is rigidly connected with one end of the rear axle A by suitable means such as a heavy U-bolt 11. Suitable means such as a set screw or clamp 10b is interposed between the mounting tube 10 and the telescoped extender 10a to adjustably and longitudinally secure said parts together. The forward ends of longitudinal mounting tubes 10 are provided with pivot-forming yokes 10c and are rigidly and detachably connected with suitable heavy mounting brackets or stub shafts provided by the tractor chassis or rigidly attached thereto in a number of conventional tractors. The mounting bars 10 are thus very rigidly affixed to the two sides of the vehicle chassis and extend nearly horizontally and in substantially parallel relationship. The working parts of our loader attachment are all directly or indirectly connected with said stress absorbing mounting frame and the pivots or axes for the boom structure, thrust-lift mechanism and hydraulic jacks are all provided by the said mounting frame and of predetermined relationship regardless of the wheel base or other proportions of the tractor or other self-propelled vehicle to which our mechanism is applied.

Our apparatus includes a boom structure comprising an elongated, rigid pair of boom arms 12, the rear ends of which are pivoted and axially aligned upon heavy trunnions or pivot members 13 which are affixed and extend laterally from the rear portion of the mounting tubes 10. Boom arms 12 are of such length as to extend for some distance beyond the front end of the vehicle, work always in parallel, spaced relationship and are interconnected and reinforced at their outer portions by equalizing linkage and the load carrier itself, as will later be more fully developed. The boom arms 12 adjacent their outer ends have heavy, upstanding thrust-applying lugs 12a rigidly connected therewith to which the elevating means in the form of a cantilever thrust mechanism is connected.

The cantilever elevating mechanism includes a pair of transversely aligned, heavy bell crank levers 14 constructed as shown, from large tri-

angular plates of rigid material and having rolled or tubular, longitudinal edges 14a at one side thereof, constituting the longer arms of the bell crank levers. The short arms 14b of the bell crank levers are defined by the short sides of the triangular plates and in the form shown, extend nearly at right angles (from 90 to 120 degrees in angulation) from the line of the longer bell crank arms 14a. The corners of the bell crank levers 14 are heavily reinforced and are pivotally connected in a predetermined relationship to boom pivots 13 with the pivot yokes 10c furnished by the stress absorbing mounting frame.

Fluid connections preferably of the flexible type (not shown), are made in conventional manner between the hydraulic cylinders 16 and a hydraulic pump equipped with conventional valve means and circulating system and controlled from a suitable box or control panel C mounted for convenient access to the driver.

Elevating thrust is imparted to the outer portion of the boom structure through an equalizing linkage comprising a cantilever action frame indicated as an entirety by the numeral 17 and of rectangular form and comprising a pair of transversely extending and parallel, tubular sides 17a interconnected by heavy link plates 17b which are welded or otherwise rigidly affixed at their ends thereto and which it will be noted, are disposed respectively in longitudinal alignment with the outer ends of the bell crank levers 14. The lower side of the equalizing linkage or cantilever frame is pivotally connected by horizontal stub shafts or the like, 17c which telescope within the lower tube 17a of the frame and which extend also through heavy pivot sleeves 14d secured to the ends of the longer bell crank arms of levers 14. The cantilever linkage frame 17 includes also, as shown, a pair of rigid side link plates 17d which may be integrally formed or welded with the link plate 17b and rigidly connected with the sleeve 17a. One of said side link plates 17d has an upper extension 17e which extends for a few inches beyond the upper frame tube 17a constituting an actuator lever for controlling the level of the load carrier during the entire elevation thereof. The upper end or side of the cantilever linkage frame is pivotally connected by heavy trunnion pins 17f with the heavy upstanding lugs 12a on the outer portions of the boom arms 12, said trunnion pins extending through bearings carried by said lugs and telescoping within the outer portions of the tubular upper side of the link frame. The load carrier which may assume a number of various attachment implementations and forms, is pivotally interposed and connected between the outer ends of the two boom arms 12 serving when assembled, to additionally interconnect the arms of the boom and to reinforce the outer portion of the boom structure. In the embodiment illustrated the load carrier attached, comprises a tine-equipped scoop bucket well adapted for gathering and loading material such as manure, boulders, trash, bundles, etc. The scoop bucket 18 has a pair of parallel end walls 18a rigidly secured to the bucket-shaped bottom 18b and is also provided with forwardly projecting rigid tines 18c adapted to gather and guide material to the bucket during thrust action upon the beams in lowered position, when the traction vehicle is moved forwardly. The load carrier 18 is pivoted by short pivot shafts 18p to the outer ends of arms 12. These pivots 18p in the form of load carrier 75 shown, are related to the center of gravity of the

empty bucket in such manner that the bucket without a load would swing or dump forwardly without the addition of a restraining, counterbalancing force. By reference to Fig. 8, it will be noted that in the load carrier construction, a rigid torque tube 18T is welded throughout the length of the bucket to the scoop or back thereof as well as to the top of the bottom or time cover, thus preventing twisting or sagging of the load carrier through tilting and maintaining of uniform pitch due to its link connection 19 with one side of the boom structure only.

A releasable link connection is provided between one end of the bucket and the actuator lever extension 17e of one of the side links 17. This link connection includes a latch mechanism for releasing the bucket for dumping but has as essential features, a pivotal connection 19a at its forward end with the adjacent end of the bucket and at a point widely eccentric of the bucket trunnions or pivots 18p. The link connection indicated as an entirety by the numeral 19 is pivotally connected at its rear end with actuator lever extension 17e of the linkage, by a pivot 19b. Thus, by means of the link structure 19, the bucket is slightly tilted during the elevation of the boom to elevate and maintain substantially the same pitch for properly retaining the load from the time the bucket has been raised off the ground throughout the elevation cycle.

The latch-equipped link connection 19 in the form shown, comprises a pair of elongated spaced bars 19c disposed in parallel side by side relation and interconnected at their outer ends to the eccentric bucket pivot 19a. Said bars at their rear portions are welded or otherwise rigidly connected with a centrally disposed upper latch arm 19d extending longitudinally thereof and having a rearwardly projecting latch hook 19e provided with a shoulder formed in the upper longitudinal edge thereof. A bottom guide plate 19f is welded or otherwise affixed to the bottom edges of the rear ends of slide bars 19c and with the lower edge of the latch arm 19d and the opposed vertical faces of bars 19c, forms a slide for receiving a bar 20 which has affixed to the rear portion thereof, a bracket on which is pivoted the releasable latch member or dog 21. The bar 20 extends throughout the greater part of the length of the spaced bars 19c and is connected for relative sliding therewith and as shown, has welded or otherwise rigidly attached to the outer end thereof, a guide channel member 20a which may comprise a pair of shallow, vertically disposed channel strips welded together and to the forward extremity of bar 20, defining channels on the outer faces thereof wherein the spaced bars 19c are guided. The latch pivoting bracket referred to, as shown, comprises a pair of vertically disposed rectangular plates 20b (Figs. 5 to 7) welded or otherwise affixed to the side face of bar 20 near the rear end thereof and as shown, reinforced at the upper rear corners thereof by a transverse angle stop member 20c, the upper spaced portions of rectangular plates 20b accommodating the latch member or catch hook 19e. The latch dog 21 at its working end is pivoted between rectangular plates 20b and is journaled thereon on a pivot pin 20d having a tooth 21a for engagement with the shoulder of catch arm 19e and having an upwardly and rearwardly extending rigid lever arm 21b which is normally urged forwardly by a contractile spring 22 and to the outer ex-

trinity of which a cord or flexible operation element 23 is attached.

The pivot bolt 19b for attachment of the link connection 19 with the actuator lever 17e on one side of the cantilever linkage frame may be selectively received for varying the pitch angle of the bucket or other load carrier by accommodation in any one of a series of transversely bored bearing apertures 20e extending in longitudinally spaced relation through the lower portions of the bracket plates 20b. The rear extremity of the bar 20 has welded thereto, a cross head bracket 20f which is apertured at its ends for connection of a pair of heavy counterbalancing springs 24 (see Fig. 6), said springs through bolt and nut connection being adjustable to connect at their rear ends with said bracket and having their forward ends connected with a cross pin which may constitute the pivotal connection bolt 19a on the bucket. Stop or abutment blocks 12b are secured to the inner faces of boom arms 12 projecting inwardly to prevent overswinging of the toggle linkage at a point ahead of dead center relationship of the pivots 17f and 18c. These blocks will operate against the rearward edges of the link sides 17d and both in elevation of the boom and in the subsequent dumping action of a heavy load, will prevent unbuckling of the toggle structure beyond the desired extended position.

Operation

To gather or collect material upon the bucket or load carrier, the boom and other parts of the apparatus are lowered by releasing pressure of the hydraulic fluid in cylinders 16 and the apparatus is disposed, as shown in Fig. 2. The tractor is then moved forwardly, the boom arms 12 placing a straight line thrust upon the load carrier with most of the strain being distributed and imposed upon the heavy rear axle housing A. Such thrust stress as is imposed upon the bell crank levers 14, is distributed through the stress-absorbing frame comprising the tubular member 10.

When the load carrier 18 is filled, the operator, through the control valve, actuates the hydraulic jacks, causing the jack pistons 15 to be projected forwardly and thereby operating the bell crank levers 14 which, through their toggle connection with the boom structure elevates the load carrier. Usually, it is desirable to elevate the load to the dotted line position shown in Fig. 2 for transportation to the place of dumping. In the carrying position of our apparatus with the boom structure disposed substantially horizontally, no parts are disposed above the hood and motor of the tractor and the vision of the driver is unencumbered.

When the vehicle has transported the load to a truck, pile or other place of dumping, the boom structure is further elevated to the desired, raised position such as is shown in full lines in Figs. 1 and 3, the load being disposed still forward of the front wheels of the vehicle.

Thereafter, the latch cord 23 may be pulled to release the bucket for dumping, the weight of the load readily causing the bucket 18 to dump, overcoming the slight counterbalancing effect of the counterbalance springs 19. After dumping, the counterbalance springs return the bucket to normal loading position and the latch mechanism is locked to cause the load carrier to be link-connected with the upper extended end or actuator arm 17e of the cantilever linkage frame.

In the upward swinging of the boom structure (see Figs. 2 and 3), the pitch or angulation of the load-supporting portions of the load carrier 18, are automatically maintained to best advantage through the link connection 19 with the upper actuator arm 17e of the cantilever linkage frame 17. Thus, it will be noted (see Fig. 2) that in the initial lifting of the load from the ground, the bucket is tilted counterclockwise slightly and in the subsequent elevated positions (see Fig. 3), remains substantially at the same pitch or angulation. If a greater angulation or pitch is desired during the carrying position of the bucket 18 (see dotted lines position in Fig. 2) and throughout the subsequent elevation of the boom, the angulation may be varied but nevertheless maintained substantially constant by adjustment of the pivot pin 19b in the appropriate bearing aperture 20e of bracket 20.

Our improved cantilever elevating mechanism materially improves the equalization or uniformity of power requirements throughout the entire elevating cycle of the apparatus. By the interposition of the cantilever linkage frame 17, properly proportioned and related with reference to the pivots of the elongated bell crank levers and the pivotal connection with the boom structure, the range of thrust pressure required throughout the entire lifting arc is comparatively restricted as contrasted with the commercial embodiments of the structure disclosed in said earlier application of the applicant, Leo D. Pfau. Thus, in the lowered position of the boom, it will be noted that the cantilever frame 17 is inclined rearwardly with respect to the boom and outer end of the bell crank triangles 14, applying leverage more efficiently in the initial "load-breaking" position than would be the case if a slidable or pin connection were made between the end of the bell cranks and the boom. In the subsequent elevating positions, particularly in the arc of elevation somewhat above the dotted line position in Fig. 3 to the extreme upper position, the toggle principle of application of thrust to the boom with its cantilever function, minimizes the power requirements as contrasted with bell crank lifting mechanism, the outer end of which is connected slidably with the boom structure. The longer arms of the bell cranks 14 and the height of cantilever linkage frame 17 and the relation of the pivotal points have been determined to obtain substantially a maximum lift with leverage application of power to minimize the power requirements, particularly in the upper arc of elevation and in the initial lifting action, while enabling a straight line thrust from the hydraulic jacks to be utilized against the short arms of the bell crank levers. It will further be noted that the same cantilever linkage is employed to maintain proper pitch or angulation of the load carrier throughout the entire elevating cycle.

It will further be seen that with our improved structure regardless of the make, wheelbase, proportions or type of traction vehicle, the relation of the boom pivots 13, bell crank pivots 10c and attachment pivots 10d of the jack structure, remain constant thus assuring highly efficient operation without requiring numerous adjustments for different types of tractors. It will further be seen that the stress-absorbing frame comprising the tubular members 10 and their rigid connection with the heavy axle housing A and brackets at the forward portion of the chassis frame, result in a highly efficient distribution of stresses during the elevation of the boom, the mainte-

nance of the boom in substantially horizontal, carrying position, and in maximum elevated position. With such structure, loads in excess of two thousand pounds may be safely handled without danger of deforming or bending portions of the vehicle chassis or any mountings thereon.

From the foregoing description, it will be seen that we have provided a highly efficient but nevertheless, quite simple front end loader construction adapted for substantially universal application to farm tractors and other traction vehicles now extensively utilized and adapted to withstand hard, continued usage with minimum wear on working parts.

It will of course, be understood that various changes may be made in the form, details, and arrangement of parts without departing from the scope of our invention.

What we claim is:

1. Material gathering and loading apparatus for a vehicle such as a tractor having in combination, a pair of interconnected boom arms swingably connected at their inner ends with the rear portion of a vehicle on a horizontal axis extending transversely of said vehicle and at a point below the top of the vehicle chassis, the forward ends of said arms extending beyond the front end of said vehicle, cantilever, boom-elevating mechanism adapted to also stabilize said boom, comprising precisely as essential elements a pair of lever arms lying substantially in vertical planes with the outer portions of said boom arms, the inner ends of said lever arms being pivoted on a common axis which extends transversely of the forward and lower portion of said vehicle said lever arms extending forwardly of said vehicle when said boom arms are lowered and a rectangular, rigid cantilever frame pivotally connected at its lower end to the outer ends of said lever arms and pivotally connected at its upper end to the outer portions of said boom arms and means adjacent the outer ends of said boom arms for attaching a load carrier.
2. The structure set forth in claim 1 and a hydraulic jack connected with said vehicle and having a longitudinally projectible element connected with said lever arms for swinging the same upwardly.
3. The structure set forth in claim 1 wherein said lever arms are in the form of bell cranks and power actuated, longitudinally projectible means connected with said vehicle and connected to corresponding arms of said bell cranks for actuating the same.
4. Material-carrying and loading apparatus for a vehicle such as a tractor having in combination a boom structure comprising a pair of spaced boom arms pivotally connected at their inner ends with an end portion of the vehicle on a common transverse axis below the top of the vehicle chassis, said arms at their outer ends extending at least to the opposite end of said vehicle, a load carrier pivotally connected to the forward ends of said boom arms, boom-elevating and stabilizing mechanism comprising a toggle structure having a pair of longer lower arms pivoted on a common transverse axis adjacent the opposite end of the vehicle and comprising an upper linkage in the form of a rigid, generally rectangular frame pivotally connected at its lower end to the two lower arms of said toggle structure and having spaced pivotal connections at its upper end with the outer portions of said boom arms and power means for swinging the lower arms of said toggle structure upwardly.

5. Material-carrying and loading apparatus for a vehicle such as a tractor having in combination a boom structure comprising a pair of

spaced boom arms pivotally connected at their inner ends with an end portion of the vehicle on a common transverse axis below the top of the vehicle chassis, said arms at their outer ends extending at least to the opposite end of said vehicle, a load carrier pivotally connected to the forward ends of said boom arms, boom-elevating and stabilizing mechanism comprising a toggle structure having a pair of longer lower arms pivoted on a common transverse axis adjacent the opposite end of the vehicle and comprising an upper cantilever linkage in the form of a generally rectangular rigid member pivotally connected at its lower end to the two lower arms of said toggle structure and having pivotal connections at its upper end with the outer portions of said boom arms, said cantilever linkage having an actuator arm extending above its pivotal connection with said boom and a link connecting said actuator arm with a point above and eccentric of the axis of said load carrier for maintaining the pitch of said load carrier substantially constant throughout the elevation of said boom and power means for swinging the lower arms of said toggle structure upwardly.

6. Material gathering and loading apparatus for a vehicle such as a tractor, having in combination a boom structure adapted to be swingably connected at its inner end with an end portion of the vehicle and extending at its outer end beyond the opposite end of said vehicle, a load carrier pivotally attached to the outer end of said boom structure for swinging on a horizontal axis disposed transversely of the vehicle, a toggle boom elevating mechanism interposed between the outer end of said boom structure and the adjacent end of said vehicle, said toggle having a lower arm pivoted to the vehicle and having an upper arm pivoted to said boom structure, power means for swinging the lower arm of said toggle upwardly, the upper arm of said toggle having an actuator extension disposed beyond the pivot of said arm with the boom structure and a link connecting said actuator extension with said load carrier at a point disposed above and eccentric of the axis of said load carrier for maintaining the pitch of said load carrier substantially constant throughout the elevation of said boom.

7. Material-carrying and loading apparatus for a vehicle such as a tractor, having in combination a boom structure adapted to be swingably connected at its inner end with the lower rear portion of a vehicle and extending at its forward end to at least the forward end of said vehicle, underlift boom-elevating mechanism com-

prising a forwardly jack-knifing toggle structure having its lower linkage pivoted to the lower forward portion of the vehicle on a transverse

axis and having its upper linkage in the form of a rigid, substantially rectangular frame pivoted at spaced axially aligned points to the outer portion of said boom structure and a hydraulic jack connected with said lower linkage to swing the same upwardly and to thereby elevate said boom by cantilever action and means for attaching a load-carrier to the outer end of said boom.

8. Material-carrying and loading apparatus for a vehicle such as a tractor, having in combination a boom structure adapted to be swingably connected at its inner end with an end portion of the vehicle on a transverse axis at a low level on the chassis and extending at its outer end to at least the opposite end of said vehicle, means adjacent the outer end of said boom structure for attaching a load carrier thereto and boom-elevating and stabilizing mechanism comprising a bell crank lever structure having its fulcrum pivoted on an axis extending transversely of the last mentioned end portion of the vehicle, said bell crank structure having a thrust-receiving arm and an upwardly swingable lift arm, power means for imparting thrust against said thrust-receiving arm and a link structure connecting the outer end of said lift arm with the outer portion of said boom structure, said link structure comprising a rigid, generally rectangular frame disposed transversely of said vehicle and having spaced connections at its lower end with said bell crank structure and having spaced connections at its upper end with said boom structure to stabilize the latter during elevation of a load.

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