Sept. 29, 1953 LE GRAND H. LULL 2,653,722

TILTING MECHANISM FOR TRACTOR LOADERS

Filed April 3, 1950 3 Sheets-Sheet 1

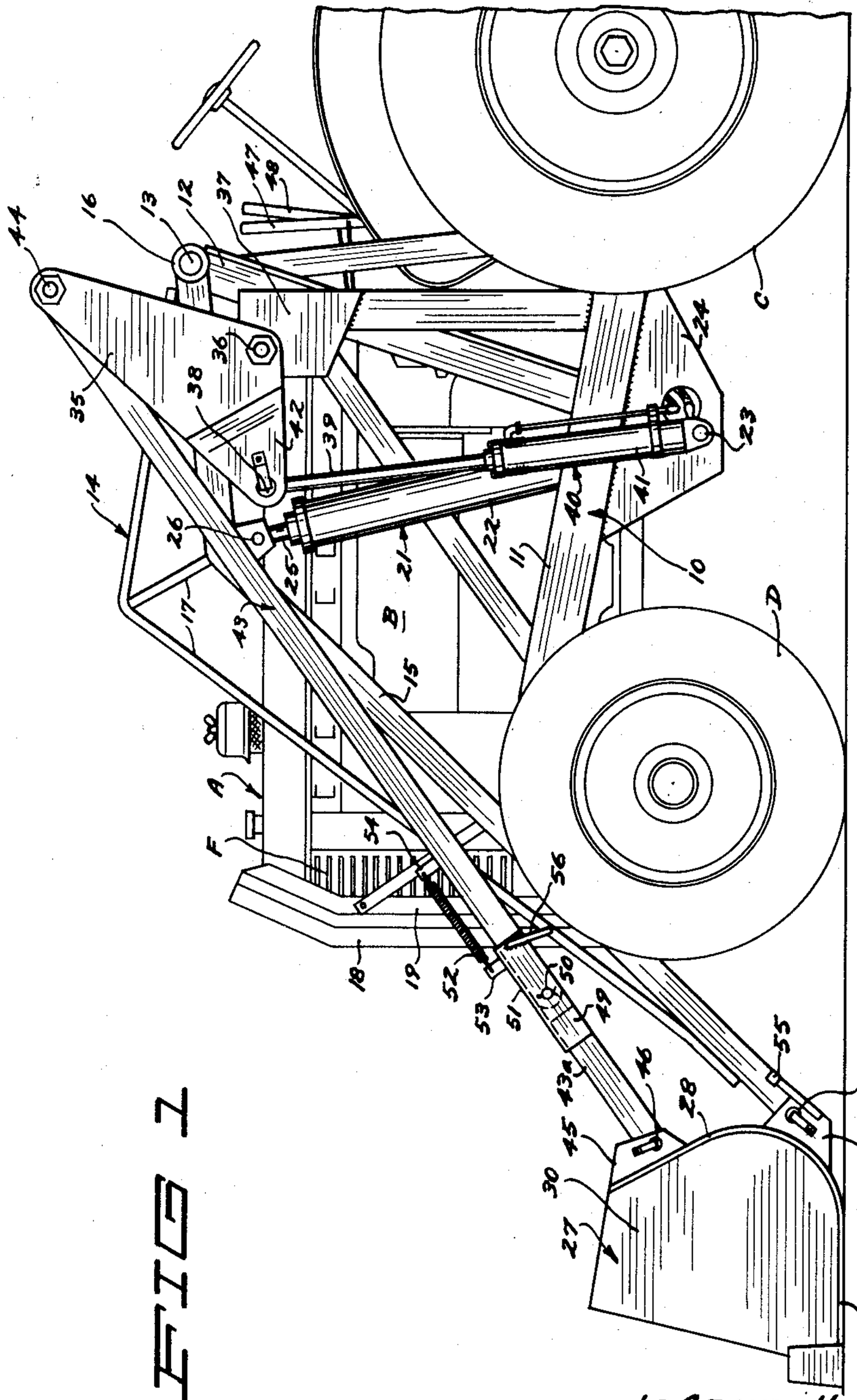

FIG. 1

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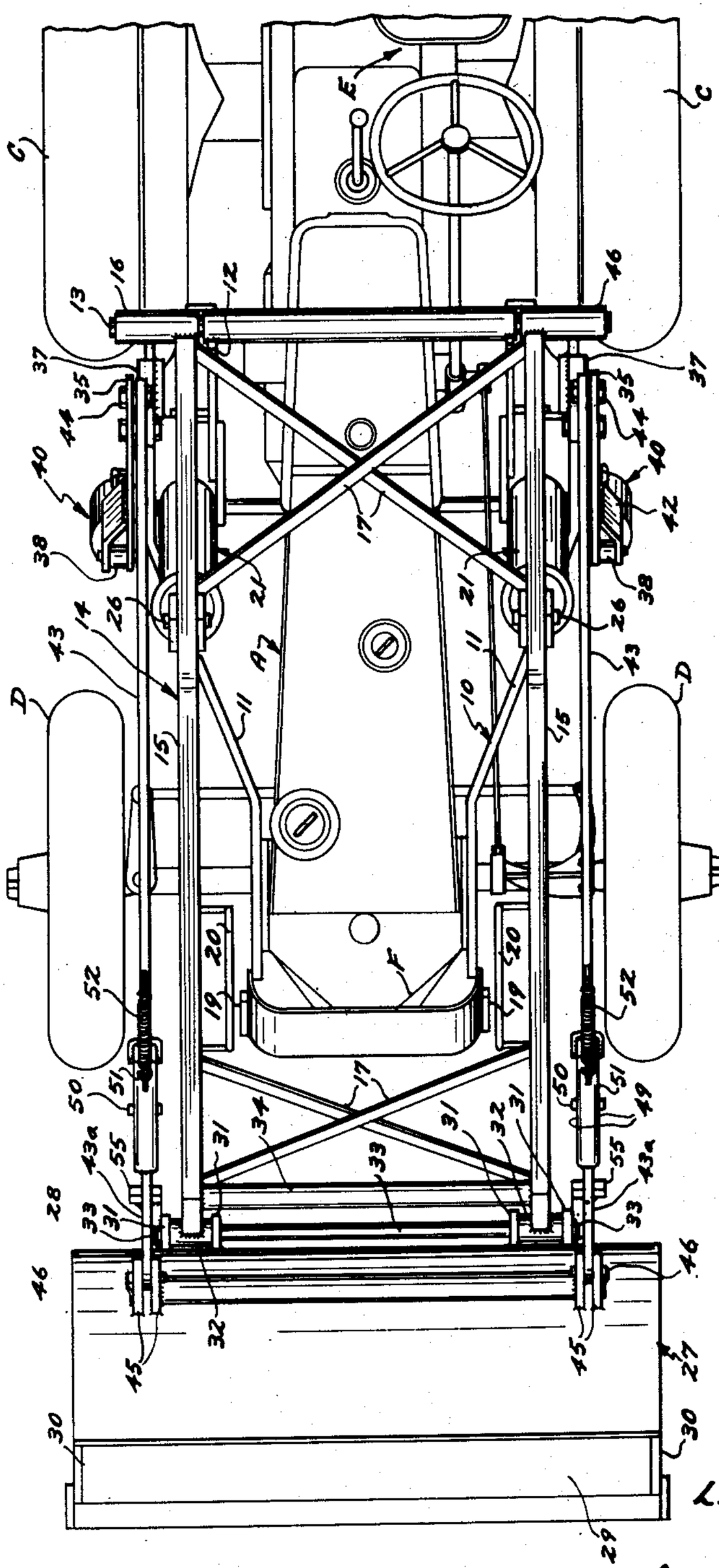

FIG 2

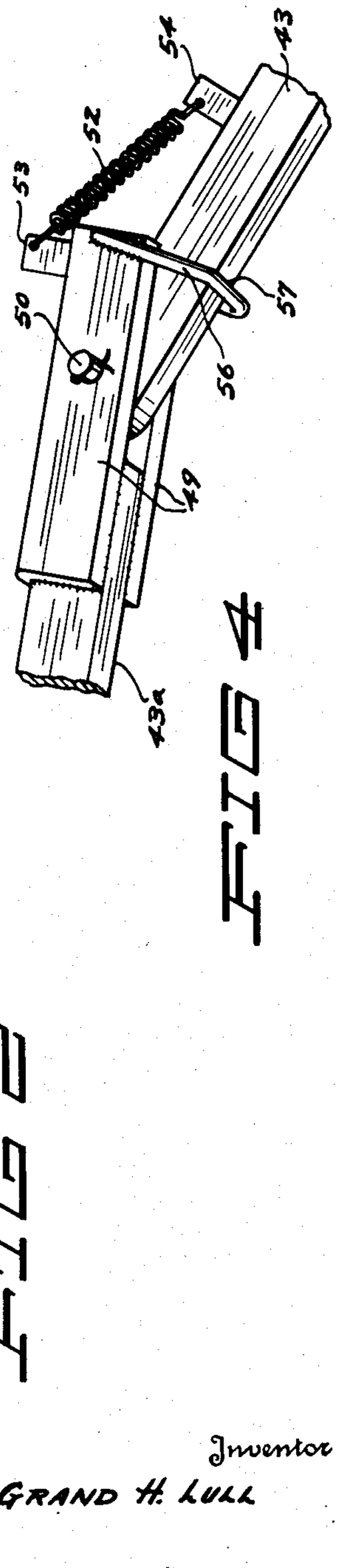

FIG 4

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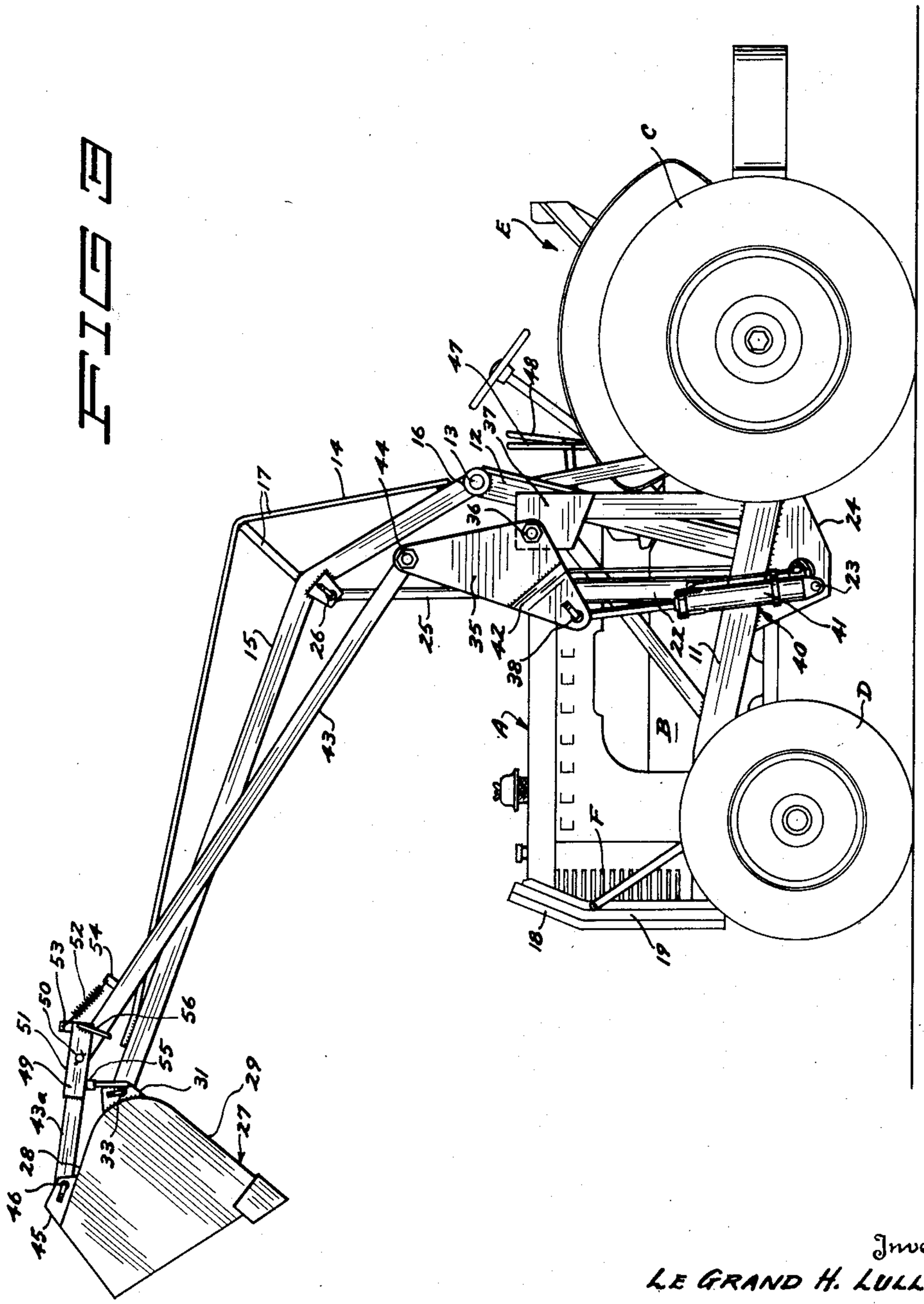
FIG 3



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TILTING MECHANISM FOR TRACTOR LOADERS

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4 Claims. (Cl. 214—140)

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This invention relates generally to improvements in tractor mounted material loaders and shovels of the general type now so widely used for various industrial operations. The invention further relates to improvements upon the type of loader disclosed in my prior co-pending application Serial No. 692,482 filed August 23, 1946, and now Patent No. 2,517,582 issued August 8, 1950.

As disclosed in that application the loader comprises a wheel borne frame mounted upon a tractor of any conventional style and type and forming a pivot support for the rear end of a vertically swingable and forwardly extending boom assembly. The load carrier, whether it be a fork, a shovel or whatever, is then tiltably mounted upon the forward end of said boom assembly and by the use of suitable hydraulic lifting rams the boom assembly is swung upwardly and downwardly to correspondingly position the load carrier. In addition, provision is made for adjusting and controlling the tilt angle of the load carrier with respect to the boom assembly and to the ground so that in the operation of a bucket, for example, the same may be tilted back to hold a load in place as it is elevated and then tilted forwardly to discharge the load whenever and wherever required.

My present invention has as its primary object the improvement of tilting mechanisms of this kind designed not only to simplify their construction but to facilitate the control of the load carrier level under all working conditions. A further object is to provide tilting mechanism which may be adjusted to bring about a parallel-motion effect such as to maintain the load carrier at a pre-selected tilt angle as it is raised and lowered but with complete and independent control such as to readily tilt the carrier to any desired angle at any time. Particularly in the case of material handling buckets it is furthermore desirable to tilt them sharply forward in order to quickly and completely discharge their contents and it is a further important object of my present invention to provide a tilting mechanism which will operate in this fashion but without at any time becoming ineffective to control the bucket angle or return it from its sharply tilted dumping angle.

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 elevation of a loader and tilting mechanism according to my present invention showing the same as mounted upon a tractor and as operating a material handling bucket which is shown in a lowered position.

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Fig. 2 is a plan view of the assembly shown in Fig. 1.

Fig. 3 is a side view similar to Fig. 1 but on a reduced scale and showing the bucket as elevated as well as tilted sharply forward to a dumping position.

Fig. 4 is an enlarged fragmentary detail perspective view of the joint in the tilting link which permits the bucket to be tilted to the sharp dumping angle shown in Fig. 3.

Referring now more particularly and by reference characters to the drawing, A designates generally one conventional style of tractor to which the loader of my invention may be applied and it is, of course, to be understood that by minor structural and framing changes the loader may be adapted to installation and use upon most any well known commercially available type tractor The tractor here shown for example has the usual engine and chassis assembly B which is supported upon rear traction wheels C and dirigible front wheels D with a rearwardly located operator's station indicated at E. Such other parts of this conventional tractor assembly as necessary to an understanding of the present invention will be referred to in the course of this specification.

The loader assembly per se comprises a main or mounting frame indicated generally at 10 which is rigidly attached to the tractor in any suitable fashion. So far as material to the present disclosure it may be noted that this frame 10 comprises side beams 11 disposed forwardly and rearwardly alongside the engine-chassis assembly B, and adjacent the traction wheels C, but inwardly thereof, the side beams 11 support generally upright support bars 12. These support bars are suitably braced to the frame assembly 10 and at their upper ends support a main cross shaft 13 which operates as the rear pivot for a boom assembly, designated generally at 14. This boom assembly 14 comprises main side bars 15 provided at their rear ends with tubular bearings 16 to pivot upon the shaft 13 and these side bars 15 are further rigidly trussed and cross connected as designated throughout at 17. The boom assembly extends forwardly of the tractor for some distance, with the side bars 15 located at opposite sides of the tractor radiator F, and for the projection of the radiator I provide a shield 18 which is suitably secured to the main frame assembly 10. This shield 18 has upright rub plates 19 upon its sides and the boom side bars 15 are provided

with inwardly projecting guide yokes **20** which may engage said rub plates. The forward end of the boom assembly **14** is swung vertically with reference to the tractor and the ground by means of hydraulic lift rams **21** located one at each side of the tractor. The rams **21** comprise cylinders **22** pivotally supported at their lower ends upon a transverse pin **23** carried by heavy hanger plates **24** depending from the side beams of the frame **10** and further include upwardly extending and extensible plungers **25** pivotally attached at **25** to the side bars **15** of the boom. The arrangement is thus obviously such that the admission of fluid under pressure to the lower ends of the cylinders **22** will thrust the plungers **25** upwardly and correspondingly swing the forward end of the boom in the upward direction. When the fluid is permitted to return from the lower ends of the cylinders **22** the boom assembly may swing downwardly again by force of gravity, or if preferred the rams **21** may be of the double acting variety, in which case fluid will be admitted to the upper ends of the cylinders in order to forcefully move the boom assembly in the downward direction. Fluid for this operation of the rams **21** may, of course, be supplied from a pump (not shown) operated by the tractor engine, but the precise details of hydraulic systems of this nature are so well known to those skilled in the art as to require no further description herein.

While the loader may be used with various load carriers and work holding devices, according to the nature of the work to be performed, I have shown it herewith as equipped with a material handling bucket **27** having a curved back **28** terminating in a forwardly extending bottom **29** forming an edge which may be thrust into a pile of material in order to pick up a load thereof. The shovel is, of course, closed at its ends or sides but open across the front and it will therefore be understood that the bucket must be held at such an angle as to keep its load or material in place until it is tilted forwardly for dumping its contents. For this reason the bucket is tiltably mounted upon the boom assembly **14** and has on its lower rear sides spaced bracket pairs **31** between which tubular bearings **32** upon the forward ends of the side bars **15** are disposed. A cross shaft **33** is then placed through the brackets **31** and bearings **32** establishing a pivot connection such as to cause the shovel to be raised and lowered with the forward end of the boom, but about which connection the bucket may be tilted in upright, forwardly and rearwardly extending planes. To prevent lateral sway the forward ends of the side bars **15** of the boom assembly are rigidly connected by a torque tube **44** adjacent the point where the tilting connection is made to the bucket, as best shown in Fig. 2.

According to my present invention, I provide mechanism for tilting, adjusting, and holding the bucket **27**, or other load carrier, and the same comprises a triangular or three cornered crank plate **35** which is pivotally attached at **36** by one corner to a side bracket **37** rigidly supported in any suitable manner by the main frame **10**. While I herein describe only one complete tilting mechanism as located at one side only of the loader, it is to be understood that it may be duplicated upon the opposite side as desired and as may be required in a machine for particularly heavy duty. In fact, in Fig. 2 I show tilting mechanisms at both sides of the machine and indicate corresponding parts of each by identical reference characters. The pivot **36** for the crank

plate **35** is located outwardly, forwardly and downwardly with respect to the rear end boom pivot **13—16** and the crank plate has a second relatively forwardly located corner to which I pivot at **38** the plunger **39** of tilting ram **40**. Like the lifting rams this tilting ram has a cylinder **41** which is pivotally attached at its lower end to the same cross pin **23** supporting the lifting rams. Thus it will be evident that the selective admission of fluid to opposite ends of the tilting ram cylinder **41** will upwardly project or downwardly retract its plunger **39** to rock the crank plate **35** about its pivot **36**. There results then a swinging forward end rearward motion of the third and upper corner of the crank plate as will be clearly apparent. To best accommodate the pivot connection **38** for the tilting ram plunger the adjacent corner of the crank plate is bifurcated at **42**. This forwardly and rearwardly swinging upper end of the crank plate **35** is connected to the bucket **27** by means of a tilting link, indicated generally at **43**. This link extends in a forwardly and rearwardly angling position and at its rear end is pivotally attached at **44** to the crank plate. The forward end of the tilting link is then disposed between brackets **45** upon the upper rear side of the bucket **27** and pivotally attached thereto by means of a connector pin **46**. It will now be understood that operation of the tilting ram **40** to swing the crank plate **35** will move the link **43** forwardly or rearwardly and correspondingly tilt the bucket **27** about its pivots **33**. I am thus enabled to control the tilt angle of the bucket, or other load carrier, with ease and precision and by means of a construction which is extremely simple. Furthermore, the construction has the distinct advantage of providing a so-called "self-leveling" effect upon the bucket such as to cause the bucket to maintain any pre-selected tilt angle as it is raised and lowered by the boom assembly. This effect is brought about by the parallel-motion of the side bars **15** of the boom assembly and the tilting link **43**. By reference to Fig. 1 it will be readily apparent that the crank plate **35** may be adjusted to position or reference the pivot **44** to the boom assembly pivot **13—16** to exactly the angle and spacing between the bucket pivots **33** and **46**, or the relation between these four pivot points may be so adjusted that the bucket will be tilted back as it is elevated in order to maintain its load against unwanted discharge. Extremely precise control and adjustment is permissible by the link mechanism described and the control is further facilitated by the provision of control handles **47** and **48** located side by side, convenient to the operator's station E, so that both or either may be grasped or manipulated by the right hand of the operator. These handles are connected to the respective control valves (not here shown) which regulate the admission of fluid to the lifting and tilting rams and in connection with this phase of the operation it is to be noted that the same "tilt then lift" effect may be obtained as defined and claimed in my co-pending application hereinbefore identified.

The forward tilt angle of the bucket **27** would be limited by the use of an inflexible tilting link **43** by the fact that the bucket could not then be permitted to go past a point at which the pivot **46** would pass dead center with reference to the pivots **33**, since otherwise the bucket could not then be pulled back to its normal position. As an important further and correlative featura

of my present invention I therefore provide the tilting link 43 with what may be termed a buckle joint adjacent its forward end as will now be described. In actuality the link 43 comprises an elongated rear section which enters at its forward end between the bifurcated sides 49 of a shorter forward link section 43*a*. A cross pin 50 joins the sections at some distance rearwardly of the bucket forming a pivot joint about which the link may fold or buckle in an upward direction. Downward buckling motion is prohibited, however, by the provision upon the sides 49 of a stop flange 51 which overlies the forward end of the main link section rearwardly of the pivot pin 50. The forward link section 43*a* normally is held in alignment with the remainder of the link by means of a retractile coil spring 52 stretched between lugs 53 and 54 upon the link sections. This buckle joint is furthermore so located with reference to the bucket that as the same tilts forwardly to its dumping position a contact member or shoe 55 carried upon one of the brackets 31 will meet the underside of the forward link section 43*a* ahead of the pivot pin 50. As this contact occurs the link will be buckled or folded upwardly as clearly shown in Fig. 3 to permit the bucket to tilt considerably further forward without losing control over the return of the bucket. This is, of course, for the reason that a rearward pull upon the tilting link will exert a force in a line substantially upon the pivots 33 as is necessary in order to pull the bucket toward its level position. The upward buckling motion about this joint is limited by a U-shaped stop yoke 56, the sides of which are secured to the rear ends of the forward link section 43*a* rearwardly of the pivot pin 50. As most clearly shown in Fig. 4 this stop yoke 56 has a closed lower end 57 adapted to contact the lower edge of the main rear portion 43 of the link and thus operate to limit the relative upward folding motion.

It will be apparent from the foregoing that I have thus provided a tilting and positioning mechanism for load carriers of loaders of the general nature described which is simple in construction and operation, and permits all of the necessary adjustments of the carrier which may be advantageous in various operations to be carried out under the convenient control of the operator.

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 my invention, what I claim to be new and desire to protect by Letters Patent is:

1. For a vehicular loader of the character described having a frame, a boom assembly pivoted to the frame and extending forwardly therefrom, means for swinging the forward end of the boom upwardly and downwardly, and a load carrier pivoted on the forward end of the boom assembly for tilting movements forwardly from a loading position to a dumping position; the improvement which comprises a tilting mechanism for the load carrier and including an operating member on the frame, a tilting link pivoted at its rear end to said operating member and pivoted at its forward end to the load carrier, the said link including front and rear sections and means pivoting these sections together for relative buckling movements whereby in the dumping position of the load carrier the

link will buckle and the carrier will tilt past a dead center position with reference to its pivot connection to the boom assembly, and means for limiting said buckling movements of the link sections whereby the link will be operative to push the load carrier to its dumping position.

2. For a vehicular loader of the character described having a frame, a boom assembly pivoted to the frame and extending forwardly therefrom, means for swinging the forward end of the boom upwardly and downwardly, and a load carrier pivoted on the forward end of the boom assembly for tilting movements forwardly from a loading position to a dumping position; the improvement which comprises a tilting mechanism for the load carrier and including an operating member on the frame, a tilting link pivoted at its rear end to said operating member and movable forwardly and rearwardly thereby, means pivoting the forward end of the link to the load carrier above its pivot connection to the boom, said link comprising front and rear sections pivotally connected for relative upward and downward buckling movements, means on one link section engaging the other to prevent downward buckling movement, and means on one link section engaging the other to limit upward buckling movement whereby the link will provide positive control over the load carrier even when buckled.

3. For a vehicular loader of the character described having a frame, a boom assembly pivoted to the frame and extending forwardly therefrom, means for swinging the forward end of the boom upwardly and downwardly, and a load carrier pivoted on the forward end of the boom assembly for tilting movements forwardly from a loading position to a dumping position; the improvement which comprises a tilting mechanism for the load carrier and including an operating member on the frame, a tilting link pivoted at its rear end to said operating member and movable forwardly and rearwardly thereby, means pivoting the forward end of the link to the load carrier above its pivot connection to the boom, said link comprising front and rear sections pivotally connected for relative upward and downward buckling movements, means on one link section engaging the other to prevent downward buckling movement, means on one link section engaging the other to limit upward buckling movement whereby the link will provide positive control over the load carrier even when buckled, and a spring connected between the link sections to resist upward buckling at their pivot connection.

4. For a vehicular loader of the character described having a frame, a boom assembly pivoted to the frame and extending forwardly therefrom, means for swinging the forward end of the boom upwardly and downwardly, and a load carrier pivoted on the forward end of the boom assembly for tilting movements forwardly from a loading position to a dumping position; the improvement which comprises a tilting mechanism for the load carrier and including an operating member on the frame, a tilting link pivoted at its rear end to said operating member and movable forwardly and rearwardly thereby, means pivoting the forward end of the link to the load carrier above its pivot connection to the boom, said link comprising front and rear sections pivotally connected for relative upward and downward buckling movements, means on

one link section engaging the other to prevent downward buckling movement, means on one link section engaging the other to limit upward buckling movement whereby the link will provide positive control over the load carrier even when buckled, and means on the load carrier for engaging the forward link section as the bucket tilts and forcing it upward to buckle the link sections.

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