

Nov. 24, 1959

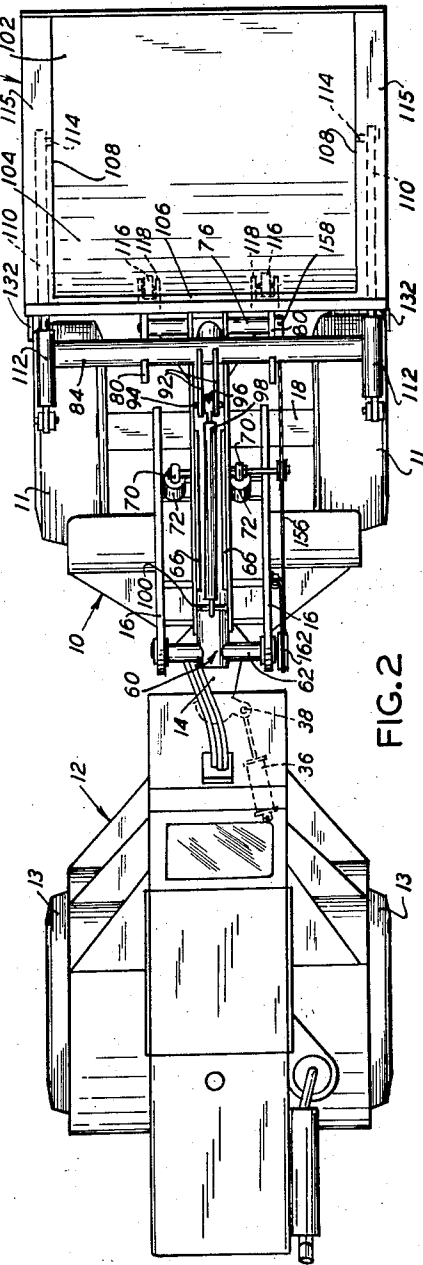
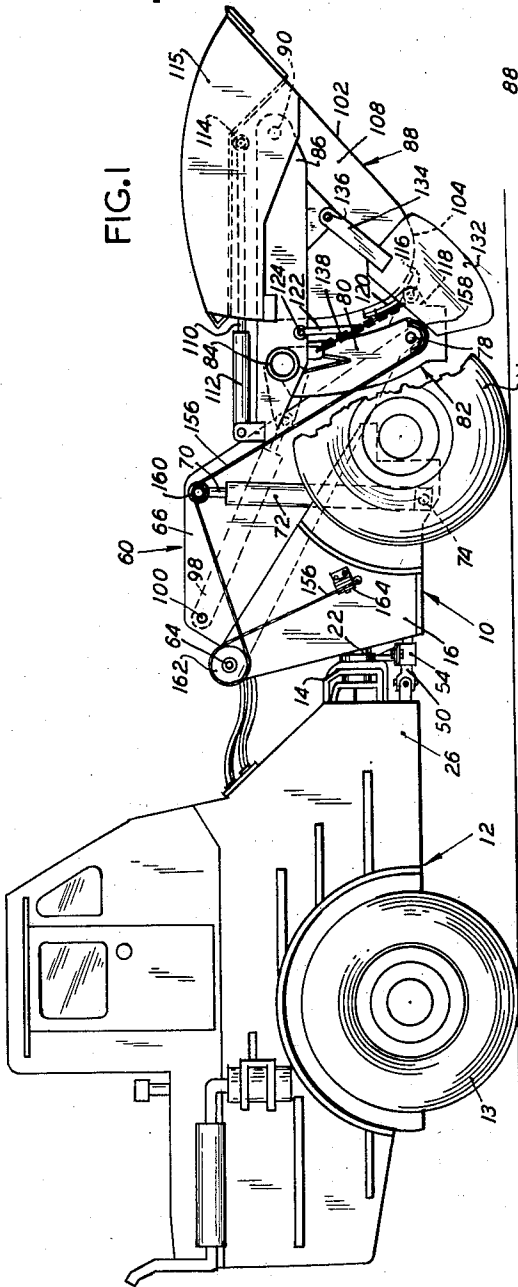
E. B. WAGNER

2,914,202

LOADER VEHICLE

Filed Sept. 16, 1957

3 Sheets-Sheet 1



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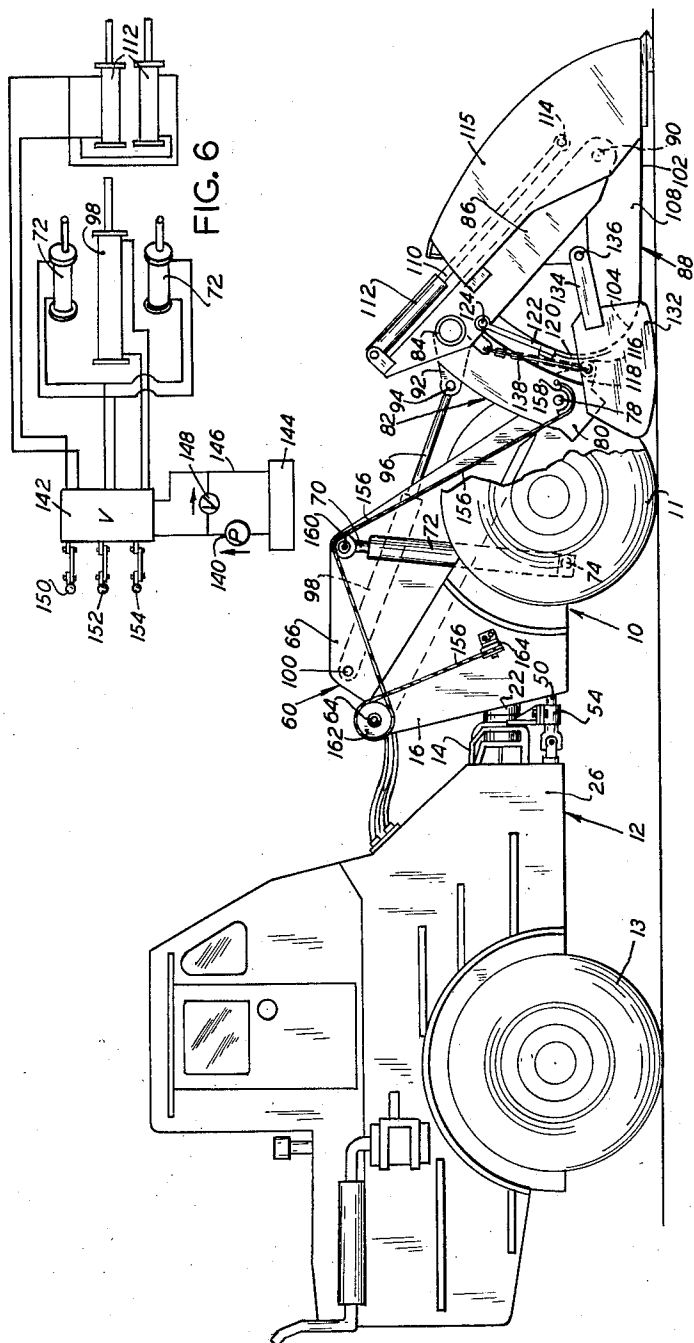
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3 Sheets-Sheet 2



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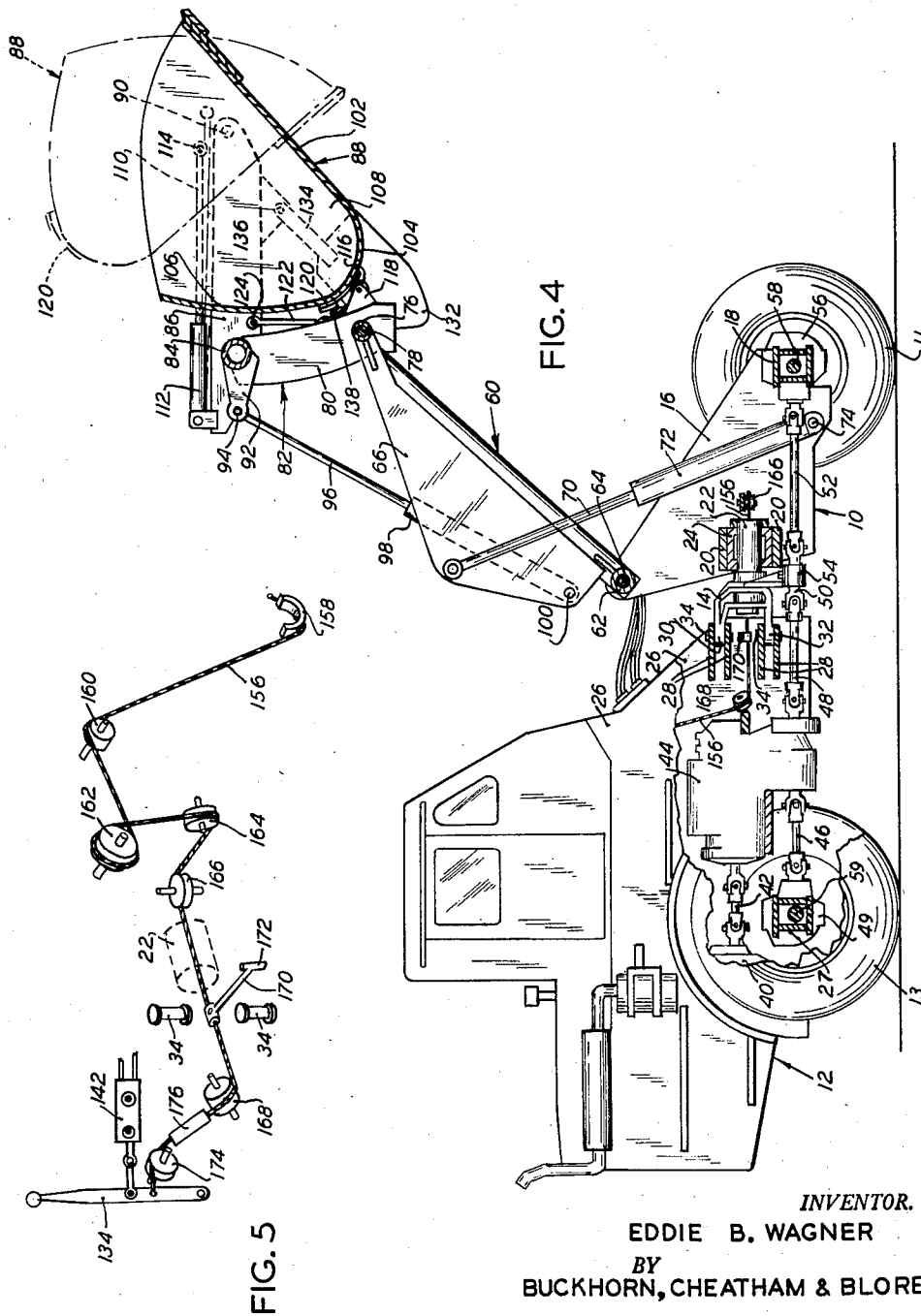
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3 Sheets-Sheet 3



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LOADER VEHICLE

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Application September 16, 1957, Serial No. 684,116

15 Claims. (Cl. 214—140)

This invention relates to a loader vehicle and more particularly to a vehicle in which a bucket is carried by a bucket carriage in turn carried on the end of a boom, the bucket being pivotally connected to the carriage and the carriage being pivotally connected to the boom so that the bucket can be loaded at a low elevation and dumped at a high elevation without requiring a boom of excessive length and in which provision is made for supporting the bucket at points spaced from its pivot during loading to transmit stress directly from the bucket to the carriage and boom, in which provision is made to prevent material being loaded from falling behind the bucket during the loading operation and in which provision is also made to prevent rearward tipping of the bucket during raising of the boom to its upper or dumping position.

In accordance with the present invention, a boom is pivoted to a vehicle so as to extend forwardly of the vehicle and so as to be capable of being raised and lowered by a power means. A bucket carriage is pivoted to the forward end of the boom for movement by a power means between an upright position and a forwardly tipped position. The bucket carriage has a portion extending upwardly from the pivotal connection of the carriage to the boom and has spaced side members extending forwardly from the upper end of the upwardly extending support portion. A bucket is positioned between such side portions and is pivotally connected adjacent its upward forward portion to the forward ends of such side portions for movement by a power means between a retracted position and a forwardly tipped position.

In the specific embodiment of the invention shown, the boom has laterally spaced reinforcing side plates extending upwardly therefrom and the power means for raising and lowering the boom is a pair of fluid actuated cylinders and pistons extending in a general vertical direction and connected between the vehicle and the upper portions of such side plates. The power means for the bucket carriage is a fluid actuated cylinder and piston positioned above the boom between such side plates and extending generally forwardly and rearwardly between the rear end of the boom and the upper end of a support portion of the bucket carriage. The power means for the bucket is a pair of fluid actuated cylinders and pistons one of which is connected to the rear end of each of the side members of the bucket carriage and to the bucket adjacent the pivotal connection thereof to such side members. The structure just described enables the bucket carriage to be tipped forwardly when the boom is in its lower position to move the bucket to loading position in which the front wall of the bucket is close to the ground or other loading surface. In the loading position, the bucket is backed up by rollers carried by the bucket carriage in position to engage the rear wall of the bucket and is also held against forward tipping in the carriage by pivoted bucket locking members engaging stops on the bucket. The rollers and locking members transmit loading stresses more directly from the bucket

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to the bucket carriage and then to the boom. Also, the rollers provide supports for the loaded bucket when it is in load carrying position.

The loaded bucket can be brought to its upright or load carrying position with the boom in its lower position by tipping the bucket carriage rearwardly to its upright position. Raising of the boom to an upper position would then tend to tip the bucket rearwardly. The machine of the present invention, however, includes a device for preventing such rearward tipping including a flexible connecting element extending from the bucket carriage to a position adjacent the operator's position to move the operator's control lever for the bucket carriage to cause the power means for the bucket carriage to be operated to maintain the bucket carriage in upright or level position during raising of the boom. That is to say, the bucket carriage can be tipped forwardly from an upright position at any position of the boom but cannot be tipped rearwardly from an upright position by raising the boom.

When the loader of the present invention is employed to load material which can be damaged by crushing, such as sugar beets, such material should be prevented from reaching a position beneath the wheel of the vehicle. It has been found that the material being loaded tends to flow or fall around the back of the bucket when the bucket is in loading position and is moved into a pile of material to be loaded. Such material is run over by the front wheels of the vehicle. The present machine is provided with a pair of guard members, one on each side of the bucket, which are pivoted to the bucket carriage and extend rearwardly from sides of the bucket adjacent the loading surface when the bucket is in loading position. Such guard members largely prevent material being loaded from reaching a position behind the bucket and in front of the front wheels of the vehicle.

The loader of the present invention is preferably divided into a front vehicle portion and a rear vehicle portion connected together by a pivotal connection for movement both about a centrally positioned vertical axis and a horizontal axis extending longitudinally of and centrally of the vehicle. The motion about the vertical axis provides for steering the vehicle and moving the bucket in the desired direction while the horizontal pivot enables the vehicle to traverse rough ground. The flexible connecting element for preventing backward tipping of the bucket during raising of the boom passes through the axes of such pivots and is maintained in such axes during pivotal movement between the two portions of the vehicle and during limited longitudinal controlling movements of the element for preventing backward tipping of the bucket. The vehicle is preferably of the four-wheel drive type having an engine in its rear portion and a drive shaft extending between the front and rear portions. Such drive shaft is positioned below the pivotal connection between the front and rear portions of the vehicle referred to above, since it has been found that the vehicle may be provided with greater road or ground clearance than when the drive shaft extends through the pivotal axes. Also placing the drive shaft below the pivotal connection between the two portions of the vehicle provides space for running the flexible connecting element through the two pivotal axes of the pivotal connection.

It is therefore an object of the present invention to provide a loader vehicle having an improved mechanism for mounting and controlling a bucket for loading and dumping operations.

Another object of the invention is to provide an improved loader structure in which a bucket pivotably mounted in a bucket carriage pivoted to the end of a boom is backed up by bucket engaging rollers and also

by stop members carried by the bucket carriage and engaging the bucket when the bucket is being loaded so as to transmit loading stresses more directly to the bucket carriage and boom.

Another object of the invention is to provide an improved mounting for a bucket in a loader by which the bucket may be loaded when positioned adjacent a supporting surface for the vehicle and may be raised to a relatively high elevation with a relatively short boom and dumped at such elevation.

Another object of the invention is to provide an improved loader having provision for returning the bucket to an upright load carrying position when the boom is in its lower position and for preventing rearward tipping of the bucket when the boom is moved to an upper position.

A further object of the invention is to provide a loader having a mechanical interconnection between a bucket carriage and a manual control for the power means for tipping the bucket carriage relative to a boom by which such control is automatically actuated to prevent rearward tipping of the bucket.

A still further object of the invention is to provide a loader in which guard members are provided for preventing material reaching a position behind the bucket during loading operation so as to keep such material out of the way of the wheels of the loader vehicle.

A still further object of the invention is to provide a loader in which a bucket carrying boom is secured to a forward portion of the vehicle and a rearward portion of the vehicle is connected to such forward portion by a hinge structure providing for relative movement of such portion about both a vertical axis and a longitudinally extending horizontal axis and in which a drive shaft extending between such portions extends below such pivotal connection to provide better road clearance and to provide space for a flexible connecting element moving between the forward and rearward portions of said vehicle for preventing backward tipping of the bucket.

Other objects and advantages of the invention will appear in the following description of a preferred embodiment of the invention shown in the attached drawings of which:

Fig. 1 is a side elevation of the loader of the present invention with parts broken away to show internal structure;

Fig. 2 is a plan view of the loader of Fig. 1;

Fig. 3 is a view similar to Fig. 1 showing the bucket in loading position;

Fig. 4 is a view similar to Fig. 1 with parts broken away and showing the bucket in its upper upright position in full lines and in its dumping position in dot-dash lines;

Fig. 5 is a diagrammatic perspective view showing the flexible connecting element extending between the front and rear portions of the vehicle for automatically controlling the manual control lever for the bucket carriage power means; and

Fig. 6 is a partial diagrammatic view of the hydraulic control system for the actuators for the boom, the carriage for the bucket, and the bucket.

Referring to Figs. 1 to 4 of the drawings, the loader of the present invention includes a vehicle having a front portion 10 and a rear portion 12 pivotally connected together by a yoke member 14, best shown in Fig. 4. The front portion of the vehicle includes a pair of upstanding generally triangularly shaped side plates 16 connected together at their forward ends by axle housing 18 and adjacent their rear ends by laterally extending vertically spaced plates 20. The yoke 14 has a forwardly extending tubular portion 22 journaled in a bearing 24 positioned between and secured to the plates 20. The tubular member 22 is positioned centrally of the vehicle and extends longitudinally thereof to provide a

longitudinally extending horizontal pivotal axis between the front and rear portions of the vehicle. The rear portion 12 of the vehicle also includes a pair of laterally spaced upstanding side plates 26 connected together by a rear axle housing 27 and a plurality of cross members, four of which members 28 are shown in Fig. 4 adjacent the front end of the rear portion 12 of the vehicle. The cross members 28 are arranged in pairs and the upper pair receives therebetween a rearwardly extending upper arm 30 of the yoke member 14 and the lower pair receives therebetween a rearwardly extending lower arm 32 of the yoke member. The arms 30 and 32 are connected to their respective pairs of cross members 28 by pivot pins 34 to provide a vertically extended pivotal axis between the front portion 10 and rear portion 12 of the vehicle, such axis being positioned generally centrally of the vehicle. It will be apparent that the two portions of the vehicle may be pivoted about the vertical axis provided by the pivot pins 34 for steering the vehicle and that they may pivot about the horizontal axis provided by the tubular member 22 and bearing member 24 to allow the vehicle to traverse rough terrain. The vehicle may be steered hydraulically and for this purpose a hydraulic cylinder 36, shown in dotted lines in Fig. 2, may extend between the frame of the rear portion 12 and an arm 38, also shown in dotted lines in Fig. 2, as extending laterally from one side of the yoke member 14. Any suitable or known type of hydraulic control mechanism including a follow up valve (not shown) may be employed to steer the vehicle by controlling the operation of the cylinder 36.

The vehicle is preferably of the four-wheel drive type and is provided with an engine 40, the front end of which is shown in Fig. 4. The drive from the engine is through a forwardly extending drive shaft 42 having a pair of universal joints therein to a transmission 44. The transmission is of the automatic type and has a downwardly extending portion to which is connected a rear drive shaft 46 having a pair of universal joints therein and extending to a rear differential 49 forming part of the axle housing 27. A forwardly extending drive shaft is also connected to the downwardly extending portion of the transmission 44 and has a rear portion 48, an intermediate portion 50 and a front portion 52 all connected together by universal joints, the rear portion 48 also being connected to the transmission 44 by a universal joint. The intermediate portion 50 of the shaft is journaled in a bearing member 54 extending downwardly from and rigidly secured to the yoke 14. The front portion of the front drive shaft 52 is connected to a front differential 56 by another universal joint. It will be apparent that each of the shafts or shaft portions 42, 46, 48 and 52 and particularly the shaft portion 48 may have a sliding joint (not shown) therein to take care of variations in distances between the various universal joints. The front axle housing 18 contains axle shafts 58 driving the front wheels 11 and the rear axle housing contains axle shafts 59 driving the rear wheels 13. It will be apparent that the front wheels 11 as well as the rear wheels 13 may be driven from the engine 40 through the transmission 44 in any position of the front portion of the vehicle relative to the rear portion thereof.

The side plates 16 of the front portion 10 of the loader vehicle extend upwardly and rearwardly and a boom 60 extends forwardly from the upper rear portion of such side plates. The boom has a laterally extending tubular bearing member 62 (Figs. 2 and 4) at its rear end journaled on a cross shaft 64 secured in the upper rear portions of the side plates 16. The boom 60 also has a body portion of tubular formation secured to the tubular bearing member 62 and also has a pair of upstanding side plates 66 secured to the sides of the body portion of the boom so as to be spaced laterally from each other. Such side plates are of generally triangular form and each has the upper end of a piston rod 70 of a hydraulic

cylinder 72 pivoted thereto adjacent its upper edges and intermediate its length. Each cylinder 72 is connected at its lower end by a pivot 74 being positioned between the side plates 16, the cylinders 72 being positioned between the side plates 16 of the front portion of the vehicle and extending upwardly on each side of the boom 60. It will be apparent that the hydraulic cylinders 72 may be employed to raise and lower the boom 60.

The side plates 66 of the boom 60 extend beneath the body of the boom at the front end thereof as shown most clearly in Fig. 4 and are secured to a laterally extending tubular bearing member 76 which receives a cross shaft 78. The cross shaft 78 has its ends secured to laterally spaced support members 80 forming a support portion of a bucket carriage. The shaft 78 is thus journaled in the forward end of the boom 60 to form a pivotal connection between the boom 60 and the bucket carriage 82 which provides for the upright position of the carriage 82 as shown in Figs. 1 and 4 and the forwardly tipped position of the carriage 82 shown in Fig. 3. The support members 80 extend upwardly on opposite sides of the forward end of the boom 60 and are joined together adjacent their upper ends by a laterally extending tubular member 84. A side member 86 is secured to each end of the tubular member 84 so as to extend forwardly therefrom. A bucket 88 is positioned between such side members 86 and is pivotally connected by a pivot 90 to an end of each of such side members. An arm 92 extends rearwardly from the center portion of the tubular member 84 and is pivotally connected by a pivot 94 to the piston rod 96 of a hydraulic cylinder 98 positioned between the side plates 66 of the boom 60. The cylinder is pivotally connected by a pivot 100 to such side plates above and adjacent the rear end of the boom 60. It will be apparent that the hydraulic cylinder 98 may be employed to pivot the bucket carriage 82 about the pivot 78 from an upright position, shown in Figs. 1 and 4, to a forwardly tipped loading position shown in Fig. 3.

The bucket 88, when in its upright position shown in Fig. 1, has a forwardly inclined front wall 102, a curved lower rear portion 104 and an upwardly extending back wall 106 as well as upwardly extending side wall 108 positioned adjacent the forwardly extending side members 86 of the bucket carriage 82. The pivot 90 is secured to such side wall 108 and the piston rod 110 of each of a pair of hydraulic cylinders 112 has its end pivoted to each side wall 108 of the bucket 88 by a pivot 114. The other end of each cylinder 112 is pivotally connected to a rearwardly extending portion of the side members 86 so that a piston 112 and piston rod 110 is positioned above each of the side members 86. The pivot 114 is above and to the rear of the pivot 90 when the bucket carriage is in its upright position, and the bucket is in its retracted position, shown in Fig. 1. It will be apparent that actuation of the hydraulic cylinder 112 to project the piston rod 110 will pivot the bucket 88 about the pivot 90 from its retracted or load carrying position shown in dash-dot line in such figure. The bucket has shroud members 115 which extend from the open top of the bucket and partly down the sides thereof to cover and protect the piston rods 110 and pivots 114 and 90.

The bucket is loaded by forward travel of the vehicle while the bucket is in loading position shown in Fig. 3. In such loading position the bucket is in its retracted position with respect to the bucket carriage 82 but the bucket carriage 82 is in a forwardly tipped position with respect to the boom 60. A pair of rollers 116, shown in dotted line in Fig. 3 and Fig. 2 and in full line in Fig. 4, are journaled in forwardly extending ears 118 secured to the support members 80 forming part of the bucket carriage 82. The rollers 116 positioned adjacent the curved rear and lower portion 104 of the bucket when the bucket is in its retracted position and such curved

portion of the bucket has a curved reinforcing plate 120 secured to each side thereof in alignment with each of the rollers 116. The lower rear portion of the bucket is concentric with the pivot 90 at the area of attachment of the plates 120 and such plates are also concentric with the pivot 90. When the bucket is in the loading position shown in Fig. 3, the major loading stresses are in general alignment with boom 60 and are transmitted from the bucket 88 directly to the rollers 116 and thus to the support members 80 of the bucket carriage 82. The rollers 116 are close to the pivot 78 between the bucket carriage 82 and the boom 60 and the axes of the rollers and the pivot 78 are in general alignment with the major stresses so as to transmit such loading stresses substantially directly to the boom 60. Also, in the load carrying position of the bucket shown in Fig. 1 and in full line in Fig. 4, the load in the bucket is largely supported on the rollers 116 secured to the bucket carriage 82, thus relieving the pivot 90 between the bucket and the bucket carriage of a substantial portion of the load stresses.

When the bucket is in the loading position shown in Fig. 3, the loading stresses also tend to rotate the bucket in a clockwise direction in Fig. 3 about the bucket pivot 90. Such motion is resisted by a pair of bucket locking members 122 pivoted at their upper end by pivots 124 to the side members 86 of the bucket carriage 82. The pivoted members 122 are positioned to have their lower ends engage the upper edge of the reinforcing plates 120, such that each of the pivoted members 122 acts as a pawl and the upper edge of each of the plates 120 acts as a stop member to resist clockwise pivotal movement of the bucket when the bucket is in the loading position of Fig. 3. When the bucket carriage 82 is returned to its upright position of Figs. 1 and 4, the pivoted members 122 swing rearwardly by gravity to clear the upper edge of the plates 120 so that the bucket can be dumped by the hydraulic cylinder 112.

In the loading position of the bucket shown in Fig. 3, materials being loaded, for example sugar beets, will tend to fall behind the bucket from the side thereof as the bucket is pushed into a pile of the material. The materials being loaded thus get in the path of the front wheels 11 of the loader and are likely to be crushed. To prevent such material from falling or rolling behind the bucket, guard members 132 are positioned adjacent the rear portion of the bucket when the bucket is in loading position, one of the guard members 132 being positioned on each side of the bucket. Each guard member 132 is in the form of a vertically extending plate extending rearwardly from the bucket from a position adjacent the rear side portion of the bucket and having its lower edge close to or in engagement with the loading surface. The guard members 132 are each carried by an arm 134 pivoted to the lower forward portions of a side member 86 by a pivot 136. The guard members 132 are prevented from falling below the position shown in Fig. 1 by a flexible chain 138 connected between such guard member and a side member 86 of the bucket carriage. The guard members may thus ride over any obstruction present on the loading surface but enable the bucket to be pushed deeper into a pile of material to be loaded without resulting in a portion of such material getting behind the bucket into the path of the wheels 11.

A suitable hydraulic control circuit for the cylinders 72, 98 and 112 for the boom, bucket carriage and bucket, respectively, is shown in Fig. 6. Such control system may have a pump 140 delivering hydraulic fluid under pressure to a valve block 142 from a storage tank 144. Hydraulic fluid from the valve block 142 may be returned to the tank 144 through a line 146 and the output of the pump 140 may be connected to the line 146 through a pressure relief valve 148 so as to maintain a constant pressure of the hydraulic fluid entering the valve block 142. The valve block 142 may contain three con-

ventional 4-way valves, each actuated by a manual lever, there being a manual lever 150 for the bucket actuating cylinders 112, a manual lever 152 for the boom actuating cylinders 72 and a manual lever 154 for the bucket carriage actuating cylinder 98. Moving the lever 150 toward the valve block 142 from a neutral position will cause the bucket actuating cylinder 112 to tip the bucket forward relative to the bucket carriage and moving such lever to the left in Fig. 6 from the neutral position will return the bucket to its retracted position. Movement of the lever 152 from a neutral position to the left in Fig. 6 will cause the boom to be raised by its actuating cylinder 72 and conversely moving said lever to the right in Fig. 6 from the neutral position will lower the boom. Similarly, moving the lever 154 to the right from a neutral position in Fig. 6 will cause the bucket carriage to be tipped forwardly from its upright position by its cylinder 98 and moving the lever to the left from its neutral position in Fig. 6 will cause the bucket carriage to be returned to its upright position. All of the valves are of the type which resiliently return to neutral position to return the associated control lever to neutral position in the absence of control forces exerted on the levers by an operator or otherwise.

The lever 154 may also be automatically actuated by the position of the bucket carriage 82 relative to the vehicle 16. That is to say, any attempted actuation of the bucket carriage rearwardly past the upright position shown in Figs. 1 and 4 will cause the lever 154 to be moved to the left in Figs. 5 and 6 by a flexible connecting member 156, shown most clearly in Fig. 5 but also shown in Figs. 1 and 2. The flexible connecting element 156 has its forward end trained about the external curved surface of a semicircular member 158 secured to one of the support members 80 of the bucket carriage 82 so as to be concentric with the cross shaft 78 providing for pivotal movement between the bucket carriage 82 and the forward end of the boom 60. The flexible member 156 is then trained over an idler pulley 160 mounted on the end of the pivot 68 forming the pivotal connection between one of the piston rods 70 and a side plate 66 of the boom 60, such idler pulley 160 serving to carry the flexible member 156 above the raising and lowering mechanism for the boom. The flexible member 156 is then trained about an idler pulley 162 journaled on one end of the cross shaft 64 forming the pivotal connection between the boom 60 and the side plates 16 of the front portion of the vehicle. The flexible member is then trained over idler pulleys 164 and 166 suitably supported in the front portion 10 of the vehicle so as to bring the flexible element 156 into alignment with the axis of the tubular portion 22 of the yoke member 14. The flexible member 156 passes rearwardly through the tubular member 22 and through the vertical pivotal axis of the yoke provided by the pivot pins 34 to an idler pulley 168 carried by the rear portion 12 of the vehicle.

In order to insure that the flexible member 156 is held in position to pass through the axes of the pivot pins 34 forming the vertical pivotal axis of the yoke when the front portion 10 and rear portion 12 of the vehicle pivot relative to each other about such pivot, an arm 170 pivoted at one end to the rear portion 12 of the vehicle by a pivot 172 spaced laterally from the axis of the pivot pins 34 is secured to the flexible member 156 approximately in the axis of the pivot pins 34. It will be apparent that such arm in conjunction with the pulleys 166 and 168 will hold the flexible member 156 both in the axis of the pivot pins 34 and the axis of the tubular member 22 of the yoke 14 when the front portion 10 of the vehicle is pivoted with respect to the rear portion 12 about either or both axes. From the pulley 168, the member 156 extends inwardly, backwardly and upwardly of the rear portion 12 of the vehicle over another pulley 174 and has its rear end con-

nected to the manually operated lever 154 for the hydraulic cylinder 98 actuating the bucket carriage. A casing 176 containing a spring (not shown) may be interposed in the flexible member 156 to prevent breakage of the flexible member 156 in case the hydraulic cylinder 98 for the bucket carriage should fail to function during raising of the boom and also to enable manual actuation of the lever 154 to the left in Fig. 5 to override automatic operation of such lever if the operator should so desire. Such overriding control will ordinarily take a considerable greater manually applied force than for normal control.

The flexible member 156 is trained under the lower portions of the semicircular member 158 carried by the bucket carriage and under the lower portion of the idler pulley 162 carried by the pivot shaft 64 pivoting the boom to the front portion 10 of the vehicle. The distance between the centers of the pulley 162 and of the semicircular member 158 remains constant and radius of the pulley 162 is made the same as the radius of the semicircular member 158. Under these conditions movement of the end of the flexible member attached to the lever 154 will not be produced by tension in the flexible member so long as the semicircular member and pulley do not rotate relative to each other about their axes. When the semicircular member 158 is moved from a lower to an upper position by raising the boom, the amount of flexible member wound on the pulley 162 is exactly equal to the amount unwound from the member 158 if there is no relative rotation of the pulley 162 and member 158. That is to say, so long as the bucket carriage 82 remains in its upright position the boom may be raised and lowered without moving longitudinally of itself the portion of the flexible element 156 which is positioned to the left of the pulley 162 in Fig. 5. Any rotation of the bucket carriage backwardly past a vertical position will rotate the semicircular member 158 in a counterclockwise direction in Fig. 5 relative to the pulley 162 and will produce tension in the flexible member 156 to move the lever 154 in a counterclockwise direction about its pivot in Fig. 5. This will cause automatic actuation of the hydraulic cylinder 98 to pivot the bucket carriage in a clockwise direction. This pivotal movement of the bucket carriage 82 will rotate the semicircular member 158 relative to the pulley 162 to slacken the flexible member 156 and allow the lever 154 to return to its neutral position. Thus, the bucket carriage is prevented from rotating backwardly about its pivot 78 to the boom 60 from the upright position shown in Figs. 1 and 4. It may be manually tipped forwardly about its pivot 78 at any time by actuation of the lever 154, since such tipping motion will merely slacken the flexible member 156.

In operation of the loader vehicle of the present invention, the load carrying or transporting position of the various parts of the vehicle is shown in Fig. 1. In this position the vehicle is driven from the engine 40 through the transmission 44 and various drive shafts extending to the differentials 48 and 56 of the front and rear axles, respectively, to drive the wheels 11 and 13. The vehicle may be steered hydraulically by a hydraulic steering mechanism of known or suitable type which will pivot the front portion 10 of the vehicle relative to the rear portion 12 about the vertical axis provided by the pivot pins 34 extending through the arms 30 and 32 of the yoke 14 and through the cross members 28 of the rear portion 12 of the vehicle. The front portion 10 of the vehicle may also pivot relative to the rear portion 12 about a longitudinal horizontal axis provided by the tubular portion 22 of the yoke 14, the yoke being journaled in a bearing member 24 carried by the cross members 20 of the front portion 10 of the vehicle.

For loading the bucket 88, the manually operated control lever 154 is moved to the right in Figs. 5 and 6 to cause operation of the hydraulic cylinder 98 to pivot the

bucket carriage 82 forwardly about the cross shaft 78 with respect to the forward end of the boom 60. This brings the bucket 88 to the position shown in Fig. 3 and loading is accomplished by forward movement of the vehicle. During such loading operation, stresses due to loading are transmitted from the rear portion of the bucket through the rollers 116 carried by the support portions 80 of the bucket carriage 82 engaging the curved backing plates 120 on the bucket and are thus transmitted to the cross shaft 78 and then to the boom 60 in approximately a straight line. Also forces tending to rotate the bucket 88 about its pivots 90 with respect to the bucket carriage 82 are resisted by the bucket locking members 122 which are pivoted by gravity to cause them to engage behind the upper ends of the plates 120.

As the bucket 88 enters a pile of material to be loaded, such material tends to fall or roll behind the bucket 88 and the guard members 132 are effective to prevent such material from getting behind the bucket. The guard members 132 are pivoted at 136 to the bucket carriage 82 and are thus free to ride over obstructions upon the loading surface. The guard members 136 are restrained against downward movement to positions below that shown in Fig. 1 by the chains 138.

When the bucket has received a load, it can be returned to the upright position of Fig. 1 by reverse actuation of the lever 154 of Figs. 5 and 6 to cause the hydraulic cylinder 98 to move the bucket carriage to upright position. The flexible element 156 is slack during the time the bucket carriage 82 is tipped forwardly from its upright position, but as soon as the bucket carriage reaches its upright position, such flexible element becomes taut and pulls the lever 154 forwardly to neutral position to prevent rearward tipping of the bucket carriage 82, thus preventing rearward tipping of the bucket 88.

Upon moving the control lever 152 to the left in Fig. 6, the hydraulic cylinders 72 are actuated to raise the boom. This further tensions the flexible element 156, since the bucket carriage 88 tends to tip rearwardly as the boom is raised to thereby rotate the semicircular member 158 relative to the pulley 162. This moves the control lever 154 in Figs. 5 and 6 to the right in such figures and causes actuation of the hydraulic cylinder 98 to tip the bucket carriage 82 forwardly relative to the boom 60. This relieves the tension in the flexible member to allow the lever 154 to return to neutral position. The two motions compensate such that the bucket carriage 82 and bucket supported thereby remain level. The bucket carriage can be tipped forwardly at any time by actuation of the lever 154 to the right in Figs. 5 and 6 but cannot be tipped rearwardly unless unusual force is exerted upon the lever 154 to override the spring in the casing 176. The bucket cannot be tipped rearwardly when the bucket carriage is in its upright position.

The bucket 88 may be tipped forwardly with respect to the bucket carriage 82 at any time to dump the bucket but will ordinarily be dumped in the elevated position of Fig. 4. Actuation of the lever 150 of Fig. 6 will cause the hydraulic cylinder 112 to tip the bucket 88 forwardly about its pivot 90 with respect to the bucket carriage 82 and it will be noted that the major portion of the bucket is raised by such action since the pivot 90 connecting the bucket to the bucket carriage is positioned adjacent the front and upper portion of the bucket. The hydraulic cylinders 112 for tipping the bucket are positioned above and to the rear of the bucket out of the way of the bucket and the load therein and it will be apparent that the improved loader may be employed to load materials from the ground or other loading surface and to dump such materials at a relatively high elevation, for example, over the side of a railroad car of the gondola type. When in the load carrying position, a considerable portion of the load in the bucket 88 is supported upon the rollers 116 carried by the bucket carriage 82 and it will be further

noted that the bucket locking members 122 have pivoted by gravity out of the path of the plate 120 so that the bucket is free to be tipped forwardly for the dumping operation.

The bucket may be returned to its upright position by manual actuation of the lever 150 of Fig. 6 to the left in such figure to cause the hydraulic cylinder 112 to move the bucket to retracted position. The boom 60 may then be lowered by actuation of the control lever 152 of Fig. 6 to cause the hydraulic cylinders 72 to retract their piston rods 70 and thus lower the boom. The bucket is thus carried to the loading position of Fig. 3 but if it is desired to bring the bucket to the transport position shown in Fig. 1 between the elevated position of the bucket shown in Fig. 4 and the loading position of the bucket shown in Fig. 3, the lever 154 can be manually urged to the left in Figs. 5 and 6 during lowering of the boom so that the bucket arrives at the transport position shown in Fig. 1 when the boom is lowered.

While I have disclosed the preferred embodiment of my invention, it is understood that the details thereof may be varied and that the scope of the invention is to be determined by the following claims.

I claim:

1. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and having laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward ends of said side members for movement between an upright position and a forwardly tipped position, power means for raising and lowering said boom, power means for moving said carriage about said pivotal connection of said carriage to said boom and a fluid actuated power means pivotally connected to the rearward end of each of said side members and pivotally connected to said bucket adjacent said pivotal connection of said bucket to said carriage for moving said bucket about said pivotal connection of said bucket to said carriage.

2. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward ends of said side members for movement between an upright position and a forwardly tipped position, power means for raising and lowering said boom, power means for moving said carriage about said pivotal connection of said carriage to said boom and a fluid actuated power actuator means pivotally connected to the rearward end of each of said side members and pivotally connected to said bucket adjacent said pivotal connection of said bucket to said carriage for moving said bucket about said pivotal connection of said bucket to said carriage, said fluid actuated power means being positioned above one of said side members.

3. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal con-

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nection to the other end of said boom for movement between an upright position and a forwardly tipped bucket loading position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward ends of said side members for movement between an upright position and a forwardly tipped dumping position, said pivotal connection of said bucket to said carriage being between the side walls of said bucket and said side member and being adjacent the upward forward portion of said bucket when said bucket is in its upright position, power means for raising and lowering said boom, power means for moving said carriage about said pivotal connection of said carriage to said boom and a fluid actuated power means pivotally connected to the rearward end of each of said side members and pivotally connected to said bucket adjacent and above said pivotal connection of said bucket to said carriage for moving said bucket about said pivotal connection of said bucket to said carriage.

4. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket assembly having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, said assembly when in its upright position having a portion extending upwardly from said pivotal connection of said assembly to said boom, said boom having laterally spaced reinforcing plates extending upwardly therefrom, a fluid actuated power means connected to said vehicle and to the upper portion of each of said plates for raising and lowering said boom, a fluid actuated power means positioned between said plates and connected to the rearward end of said boom and to said assembly above said pivotal connection of said assembly to said boom for moving said assembly about said pivotal connection of said assembly to said boom.

5. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and having laterally spaced side members extending forwardly from the upper end of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward end of said side members for movement between an upright position and a forwardly tipped position, said pivotal connection of said bucket to said boom being adjacent the upper forward portion of said bucket when said bucket is in its upright position, said boom having laterally spaced reinforcing plates extending upwardly from its sides, a fluid actuated power means connected to said vehicle and to the upper portion of each of said plates for raising and lowering said boom, a fluid actuated power means positioned between said side plates and connected to the rearward end of said boom and to the upper end of said support portion for moving said carriage about said pivotal connection of said carriage to said boom, and a fluid actuated power means connected to the rearward end of each of said side members to said bucket above said bucket connection of said bucket to said carriage for moving said bucket about said pivotal connection of said bucket to said carriage.

6. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal

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connection to the other end of said boom for movement between an upright position and a forwardly tipped bucket loading position, a bucket having a pivotal connection to said carriage for movement between an upright position and a forwardly tipped dumping position, power means between said boom and said vehicle for raising and lowering said boom, power means between said boom and said carriage for moving said carriage about said pivotal connection of said carriage and said boom, power means between said carriage and said bucket for moving said bucket about said pivotal connection of said bucket to said carriage, said bucket having a forward wall portion extending substantially horizontally when said carriage is in loading position and side walls extending upwardly from said forward wall, a pair of side guards having a pivotal connection to said carriage and extending rearwardly from said pivotal connection and from the side walls of said bucket to prevent material being loaded from falling behind said bucket, said side guards being freely movable upwardly about said pivotal connection by contact with the surface upon which said loader is supported during operation of said loader.

7. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket assembly including a bucket, said assembly being carried by the other end of said boom and having a pivotal connection to said boom for movement between an upright position and a forwardly tipped position, power means between said boom and said vehicle for raising and lowering said boom, power means between said boom and said assembly for moving said bucket to a loading position, said bucket having a forward wall portion extending substantially horizontally when said carriage is in said loading position and side walls extending upwardly from said forward wall, a pair of side guards having a pivotal connection to said assembly and extending rearwardly from said pivotal connection and from the sides of said bucket to prevent material being loaded from falling behind said bucket, said side guards being freely movable upwardly about said pivotal connection by contact with the surface upon which said loader is supported during operation of said loader.

8. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped bucket loading position, said carriage when in its upright position having a support portion extending upwardly from said carriage pivotal connection and laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward end of said side members for movement between an upright load carrying position and a forwardly tipped dumping position, said pivotal connection of said bucket to said carriage being adjacent the upper forward portion of said bucket when said bucket is in its upright position and the rear wall of said bucket being adjacent said support portion of said carriage and having a portion concentric with said pivotal connection of said bucket, said bucket remaining in said position relative to said bucket carriage when said bucket carriage is tipped forwardly to said loading position and rollers carried by said support portion and engaging said portion of said rear wall of said bucket to provide a backing for said bucket effective during pivotal movement of said bucket relative to said carriage about said pivotal connection of said bucket during the loading of said bucket in said loading position and a support for said bucket in said load carrying position.

9. A loader comprising a vehicle, a boom extending

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forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped bucket loading position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward end of said side members for movement between a retracted position and a forwardly tipped dumping position, said pivotal connection of said bucket to said carriage being adjacent the upper forward portion of said bucket when said bucket is in its retracted position, power means for raising and lowering said boom, power means for moving said carriage between said upright position and said forwardly tipped position, power means for moving said bucket between said retracted position and said forwardly tipped position, said bucket having a stop member carried by its rear wall and said carriage having a stop engaging member pivoted to said carriage above said stop member when said bucket is in retracted position and said carriage is in forwardly tipped position so that said stop engaging member engages said stop to transmit stresses from said bucket to said carriage during loading of said bucket, said stop engaging member being positioned to pivot out of contact with said stop by the action of gravity on said stop engaging member when said carriage is returned to said upright position.

10. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket and carriage assembly including a bucket carriage and a bucket having a pivotal connection to said carriage, power means between said boom and said vehicle for raising and lowering said boom, power means between said boom and said assembly for moving said bucket between a load carrying position and a loading position, said bucket having a stop carried by its rear wall and said carriage having a stop engaging member pivoted to said carriage above said stop member when said bucket is in said loading position so that said stop engaging member engages said stop to transmit stresses from said bucket to said carriage during loading of said bucket, said stop engaging member being positioned to pivot out of contact with said stop by the action of gravity on said stop engaging member when said carriage is returned to said load carrying position.

11. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, said carriage when in its upright position having a support portion extending upwardly from said pivotal connection of said carriage to said boom and laterally spaced side members extending forwardly from the upper part of said support portion, a bucket positioned between said side members and having a pivotal connection to the forward end of said side members for movement between an upright position and a forwardly tipped position, power means connected between said boom and said vehicle for raising and lowering said boom, power means connected between said boom and said support portion of said carriage for moving said carriage about said pivotal connection of said carriage to said boom, power means connected between said carriage and said bucket for moving said bucket about said pivotal connection of said bucket to said carriage, the combined movement of said carriage about said pivotal connec-

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tion of said carriage to said boom and of said bucket about said pivotal connection of said bucket to said carriage being sufficient to tip said bucket rearwardly when said boom is in raised position, and means controlled by the relative position of said bucket and said vehicle and controlling said power means between said boom and said carriage to prevent such rearward tipping of said bucket.

12. A loader comprising a vehicle, a boom extending forwardly of said vehicle and being pivotally connected at one end to said vehicle to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, a bucket having a pivotal connection to said carriage for movement between a retracted position and a forwardly tipped dumping position, power means connected between said boom and said vehicle for raising and lowering said boom, power means for said carriage connected between said boom and said carriage for moving said carriage about said pivotal connection of said carriage to said boom, power means connected between said carriage and said bucket for moving said bucket about said pivotal connection of said bucket to said carriage, the combined movement of said carriage about said pivotal connection of said carriage to said boom and of said bucket about said pivotal connection of said bucket to said carriage being sufficient to tip said bucket rearwardly when said boom is in raised position, a control lever for controlling said power means for said carriage, and flexible connector means extending between said carriage and said lever for actuating said lever to control said power means for said carriage to prevent rearward tipping of said bucket.

13. A loader comprising a vehicle having a forward portion and a rearward portion pivotally connected together for relative movement about a vertical axis and about a horizontal axis extending longitudinally of said vehicle, a boom extending forwardly from the forward portion of said vehicle and being pivotally connected thereto at one end to provide for raising and lowering said boom, a bucket carriage having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, a bucket pivotally connected to said carriage for movement between a retracted position and a forwardly tipped position, the combined movement of said bucket and said carriage about their pivotal connections being sufficient to cause rearward tipping of said bucket when said boom is in a raised position, means for preventing rearward tipping of said bucket when said boom is in a raised position including a flexible connector extending between said bucket carriage and the rear portion of said vehicle, said connector being supported for motion lengthwise of said connector but being restrained so as to pass through both said vertical axis and said horizontal axis in any relative position of said front and rear portions of said vehicle.

14. A loader comprising a vehicle having a forward portion and a rearward portion pivotally connected together for relative movement about a vertical axis and about a horizontal axis extending longitudinally of said vehicle, a boom extending forwardly from the forward portion of said vehicle and being pivotally connected thereto at one end to provide for raising and lowering said boom, a bucket assembly having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, power means for moving said assembly about its pivotal connection to said boom, a control lever for said power means carried by said rear portion of said vehicle, the movement of said assembly about its pivotal connection to said boom being sufficient to cause rearward tipping of said bucket when said boom is in a raised position, means for preventing rearward tipping of said bucket when said boom is in said raised position including a flexible con-

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necter extending between said assembly and said control lever, said flexible connector being supported for motion lengthwise of said flexible connector but being restrained to pass through both of said horizontal axis and said vertical axis in relative positions of said front and rear portions of said vehicle.

15. A loader comprising a vehicle having a forward portion and a rearward portion pivotally connected together for relative movement about a vertical axis and about a horizontal axis extending longitudinally of said vehicle, a boom extending forwardly from the forward portion of said vehicle and being pivotally connected thereto at one end to provide for raising and lowering said boom, a bucket assembly having a pivotal connection to the other end of said boom for movement between an upright position and a forwardly tipped position, power means for moving said assembly about its pivotal connection to said boom, a control lever for said power means carried by said rear portion of said vehicle, the movement of said assembly about its pivotal connection to said boom being sufficient to cause rearward tipping of said bucket when said boom is in a raised position,

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means for preventing rearward tipping of said bucket when said boom is in said raised position including a flexible connector extending between said assembly and said control lever, said flexible connector being supported for motion lengthwise of said flexible connector but being restrained to pass through both of said horizontal axis and said vertical axis in relative positions of said front and rear portions of said vehicle, said vehicle having a drive shaft extending between its front portion and rear portion and said drive shaft being positioned below said horizontal axis.

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