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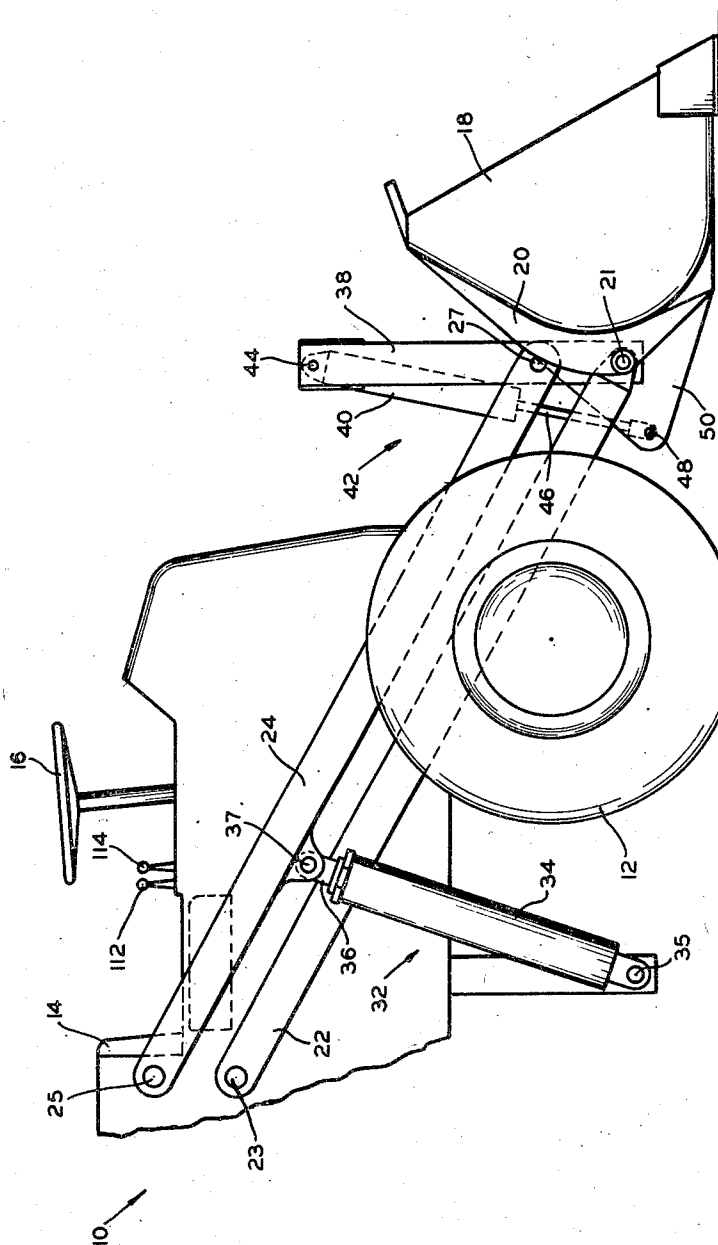
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POSITIONING SYSTEM FOR TRACTOR SHOVELS AND THE LIKE

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2 Sheets-Sheet 1

FIG. 1



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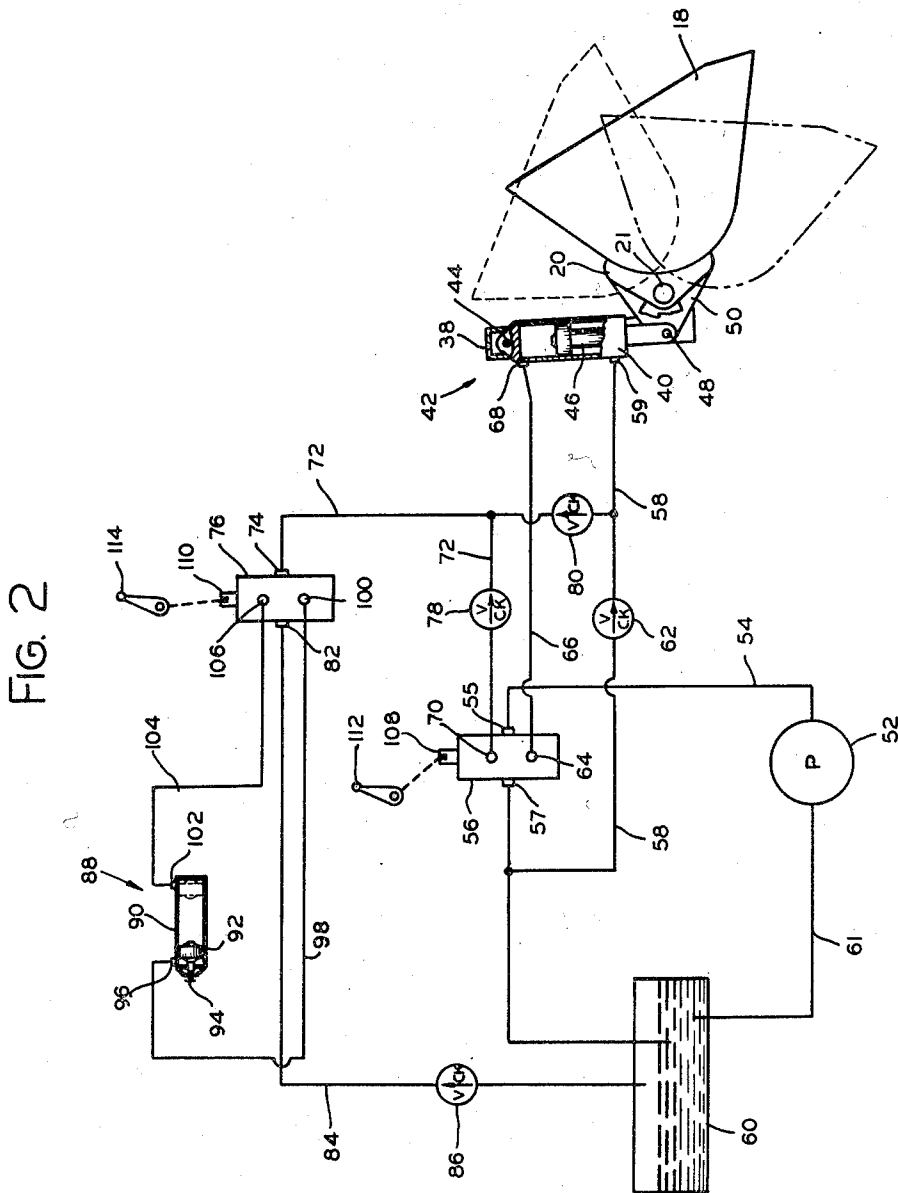
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POSITIONING SYSTEM FOR TRACTOR SHOVELS AND THE LIKE

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This invention relates to positioning systems, and more particularly to positioning systems for use with mechanisms actuated by reciprocating hydraulic motors and the like.

My invention is described herein in a form suitable for use with shovel tilting mechanisms on vehicle mounted shovels; however, it is not limited to such use but may be used with equal facility for positioning other mechanisms.

Known tractor shovel vehicles have power actuated shovels arranged at the forward ends thereof. Such a shovel is pivotally mounted to the forward end of elevating arm members the latter of which are pivoted, at their rear ends, to the vehicle frame. The arm members are pivoted by suitable power actuated means for effecting elevation of the shovel.

A shovel of the general character to which I refer is generally employed in one of three rotative positions. The shovel is employed in one extreme position for dumping loads, in the other extreme position for transporting loads, and in an intermediate rotative position for engaging loads, such as loose material, by digging or scooping. Suitable power actuated means is provided for effecting movement of the shovel between its three rotative positions. No difficulty is encountered in disposing the shovel in either the extreme clockwise position or the extreme counter-clockwise position since such positions correspond to the limits of movement of the power actuating means. However, it is quite difficult to rapidly and accurately position the shovel in an intermediate scooping or load engaging position with known tilting mechanisms. Since the shovel is normally located forwardly and downwardly of the operator's seat, it is difficult, if not impossible, for the operator to properly position the shovel, by sight, at the correct scooping angle.

Various devices have been employed to aid an operator of the vehicle in positioning the shovel at the proper intermediate scooping angle. For example, aligning marks may be arranged on adjacent relatively movable portions of the mechanism that is employed for actuating the power tilting means, but this has not proved satisfactory due to the time required of the operator of the vehicle to carefully position the control lever relative to the aligning marks.

It is an object of my present invention to provide automatically operable means for facilitating the disposition of the shovel at the proper intermediate scooping position.

In the accomplishment of the foregoing object, I provide hydraulic actuating assembly means for effecting pivotal movement of the shovel. Suitable fluid lines are provided for directing fluid under pressure from a source of fluid pressure to the hydraulic actuating assembly means and fluid reservoir means is provided for receiving the fluid forced from the hydraulic actuating assembly means during actuation of the latter. The amount of fluid which is received by the fluid reservoir determines

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the extent of pivotal movement of the shovel. That is, as the fluid reservoir becomes filled with fluid from the hydraulic tilt assembly, no further fluid can be forced from the hydraulic assembly and thus actuation of the latter is stopped as well as tilting of the shovel. This arrangement provides for automatically positioning the shovel in an intermediate scooping position.

Should it become desirable to tilt the shovel beyond the intermediate scooping position, selectively operable means, associated with the fluid reservoir, may be actuated for by-passing the latter to permit all the fluid to be forced from the hydraulic actuating assembly means and returned to the source of fluid pressure. Such by-passing operation permits the hydraulic actuating assembly means to be actuated through its full range, thus permitting the shovel to be tilted between one extreme position and the other extreme position.

Now, in order to acquaint those skilled in the art with the manner of constructing and using positioning mechanisms in accordance with the principles of my present invention, I shall describe in connection with the accompanying drawings a preferred embodiment of my invention.

In the drawings:

Figure 1 is a partial side elevational view of my present invention embodied with a tractor shovel; and Figure 2 is a diagrammatic showing of my present invention including a fluid circuit therefor.

Referring now to the drawings, there is indicated generally by the reference numeral 10 a tractor shovel vehicle, having suitable drive wheels 12 at the forward end thereof. Suitable prime mover and transmission means (not shown) are provided for driving the forward drive wheels 12. The vehicle 10 is further provided with an operator's seat 14, forwardly of which is arranged a hand steering wheel 16 operatively connected through suitable linkage means with the rear steering wheels (not shown) of the vehicle.

A shovel or scoop member 18 is arranged at the forward end of the vehicle 10 and is provided with rearwardly extending spaced apart bracket members 20 which are pivotally mounted on a transverse shaft 21. The shaft 21 is carried at the forward end of rearwardly extending arm members 22, one arranged on either side of the truck 10. The arm members 22, at their rear ends, are secured to the ends of a shaft 23 journaled in the truck frame. Extending parallel to and above the arm members 22, at either side of the truck, are arm members 24, which are secured at their rear ends, to the ends of a transverse shaft 25 journaled in the truck frame. The arm members 22 and 24 constitute a parallelogram type linkage mechanism and are employed for a purpose to be more fully described hereinafter.

Power operated hydraulic actuating assemblies, indicated generally by the reference numeral 32, one arranged on either side of the truck 10, are provided for pivoting the arm members 24 whereby elevation of the shovel 18 may be effected. Each hydraulic actuating assembly 32 comprises a cylinder 34 pivotally mounted at 35 to the truck frame, and a piston rod 36 pivotally mounted at 37 to the adjacent arm member 24. By selectively admitting fluid under pressure to the lower ends of the cylinders 34 of the hydraulic actuating assembly means 32, the piston rods 36 may be distended for effecting counter-clockwise pivotal movement of the arm members 24 about the pivotal mounting 25. Clockwise pivotal movement of the arm members 24 may be effected by bleeding fluid from the lower ends of the cylinders 34, which operation permits the piston rods 36 to move inwardly of the cylinders 34, under the force of gravity.

Pivotally connected to the forward ends of the arm

members 24 about pivot pins 27, and also pivotally connected to shaft 21, is a generally inverted U-shaped frame or yoke member 38. The cylinder 40 of hydraulic actuating assembly means, indicated generally by the reference numeral 42, is pivotally mounted at 44 to the upper bight portion of the inverted U-shaped frame member 38. The hydraulic actuating assembly means 42 further comprises a piston rod 46 which is pivotally connected at 48 to a flange member 50 suitably secured to the shovel 18, preferably at a location centrally between the ends of the shovel.

The afore-described arrangement of the arm members 22 and 24 in the form of a parallelogram serves to maintain the shovel 18 in any predetermined position relative to the ground during elevation of the shovel 18 by pivoting of the arm members 22 and 24.

Referring now to Figure 2, there is shown diagrammatically, the shovel 18 in its three primary operating positions, the hydraulic actuating assembly means 42, and the hydraulic fluid circuit associated therewith which I shall now describe in detail.

The vehicle 10 is provided with a source of fluid pressure which may for example assume the form of a hydraulic fluid pump 52. The delivery or pressure side of the pump 52 is connected through a fluid line 54 with the port 55 of a valve indicated generally by the reference numeral 56. A port 57 of the valve 56, in turn, is connected through a fluid line 58 with a sump tank indicated generally at 60 and a port 59 at the lower end of the cylinder 40 of the hydraulic actuating assembly 42. The intake side of the pump 52 has connection with the sump tank 60 through a line 61. A check valve 62 is interposed in the fluid line 58. The port 64 of the valve 56 has connection through a fluid line 66 with a port 68 at the upper end of the cylinder 40 of the hydraulic actuating assembly means 42. The port 70 of the valve 56 has connection through a line 72 with the port 74 of a second valve 76 and with the aforedescribed fluid line 58. A pair of check valves 78 and 80 are interposed in the branches of the fluid line 72. The port 82 of the valve 76 has connection through a fluid line 84 with the sump tank 60. Interposed in the fluid line 84 is a check valve 86.

Arranged at a convenient location on the truck is a shovel tilt positioning control mechanism indicated generally by the reference numeral 88. The mechanism comprises a cylinder 90, closed at both ends, which serves as a fluid reservoir, and a free floating piston 92 mounted for axial movement therein. Adjustable threaded stop means 94 is arranged at the left end of the mechanism 88, as viewed in Figure 2, and may be adjusted for varying the extent of travel of the piston 92.

The port 96 at the left end of the cylinder 90 communicates through a fluid line 98 with the port 100 of the valve 76. The port 102 at the right end of the cylinder 90 communicates through a fluid line 104 with the port 106 of the valve 76.

The valves 56 and 76 are of the conventional spool-type which are readily available on the market and therefore it is thought that a full showing and description thereof is not necessary for purposes of the present disclosure. The valves 56 and 76 are provided with valve plungers 108 and 110 which have connection through suitable linkage respectively with control levers 112 and 114 arranged closely adjacent to the operator's seat of the vehicle 10.

Assuming that the shovel 18 is in the position shown in Figure 1 and in solid lines in Figure 2, the industrial truck 10 may be driven forwardly for forcing the shovel 18 into a pile of material that is to be picked up. After the truck 10 has been driven forwardly, and the shovel 18 has been filled with material, the control lever 112 adjacent the driver's seat may be actuated for causing the valve plunger 108 to be moved upwardly while the valve

plunger 110 remains fixed. Such actuation of the valve plunger 108 permits fluid under pressure to flow from the pump 52 through the fluid line 54, the port 55, the valve 56, the valve port 64, the fluid line 66, and the port 68 into the upper end of the tilt cylinder 40 for causing the piston rod 46 to be moved outwardly of the cylinder 40. Downward movement of the piston rod 46 forces fluid from the bottom end of the cylinder 40 through the fluid line 58, the check valve 80, the fluid line 72, the port 74, the valve 76, the port 82, the fluid line 84, and the check valve 86 to the sump tank 60. The check valves 62 and 78 serve to prevent the flow of fluid therepast in the direction in which the fluid is forced from the lower end of the cylinder 40.

As a consequence of the distending of the piston rod 46, the flange member 50 and bucket or shovel 18 are pivoted counter-clockwise from the solid line scooping or digging position shown in Figure 2 to the dash line load carrying or transporting position. The shovel 18 may be maintained in the load transporting position shown in dash lines by returning the control lever 112 to a neutral position which effects the return of the valve plunger 108 to a neutral or hold position. During movement of the shovel 18 from the solid line scooping position to the dash line load carrying position, it is to be noted that the tilt positioning control mechanism 88 remains unactuated due to the fact that the valve 110 is maintained in a neutral or hold position.

The shovel 18 may now be elevated by selectively admitting fluid under pressure to the lower ends of the cylinders 34 of the hydraulic actuating assembly means 32 for effecting counter-clockwise pivotal movement of the arm members 22 and 24 in a manner previously described hereinbefore. After the shovel 18 has been elevated, the truck 10 may be driven to the location where the contents of the shovel 18 are to be deposited.

The contents of the shovel 18 may be dumped or emptied by suitable actuation of the control levers so as to effect movement of the valve plunger 108 downwardly and the valve plunger 110 upwardly. After actuation of the plungers 108 and 110 in such a manner, fluid is permitted to flow from the pump 52 through line 54, port 55, valve 56, port 70, fluid line 72, check valve 78, and hence to port 74 of the valve 76. From the port 74, the fluid under pressure flows through the valve 76, port 100, fluid line 98, and port 96 to the left end of the cylinder 90 of the tilt positioning control mechanism 88. This flow of fluid under pressure causes the free floating piston 92 to be moved from the solid line position shown (at the left) in Figure 2 to the dash line position (at the right). The fluid which is displaced from the cylinder 90 is forced through port 102, fluid line 104, port 106, valve 76, port 82, fluid line 84, and check valve 86, to the sump tank 60.

Simultaneously, the force of gravity urges the shovel 18 to pivot clockwise from the dash line load carrying position to the double dot dash line dump position. During such clockwise movement of the shovel 18, the piston rod 46 is moved upwardly within the cylinder 40 of the tilt mechanism 42 which creates a suction force at the lower end of the cylinder 40 for drawing oil therein from the sump tank 60 through the line 58 and the check valve 62. At the same time, fluid is forced from the upper end of the cylinder 40 through the port 68, line 66, port 64, valve 56, port 57 and line 58 to the sump tank 60. Now, by returning the control valves to their neutral position the valve plungers 108 and 110 are returned to their neutral or hold positions for maintaining the shovel 18 in the double dot dash line dump position.

If it is now desired to return the shovel 18 to the digging or scooping position shown in solid lines in Figures 1 and 2, the control levers 112 and 114 need only be actuated for moving the valve plunger 108 upwardly and the valve plunger 110 downwardly. Upon such actuation of the plungers 108 and 110, fluid under pressure will flow from

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the pump 52 through the fluid line 54, port 55, control valve 56, port 64, fluid line 66, and port 68, to the upper end of the cylinder 40 for urging the piston rod 46 downwardly. Downward movement of the piston rod 46 causes fluid within the lower end of the cylinder 40 to be forced through the port 59, fluid line 58, check valve 80, port 74, valve 76, port 106, fluid line 104, and port 102, to the right end of the cylinder 90 of the tilt positioning control mechanism 88. This movement of the fluid under pressure into the cylinder 90 causes the free floating piston 92 to be moved from the right hand dash line position to the left hand solid line position. Fluid which was contained in the left end of the cylinder 90 is forced through the port 96, fluid line 98, port 100, valve 76, port 82, fluid line 84, and check valve 86 to the sump tank 60.

At such time as the piston 92 reaches the solid line position shown in Figure 2, no further flow of fluid from the tilt cylinder 40 is permitted and thus downward movement of the piston rod 46 is stopped at a point intermediate of its extreme ends of normal travel. The position at which the piston rod 46 is stopped in movement depends upon the volume of the cylinder 90 and the position of the adjusting means 94 of the tilt positioning control mechanism 88.

It will thus be seen that with the mechanism of my present invention the piston rod 46 may be automatically stopped in an intermediate position for disposing the shovel 18 in the solid line digging or scooping position. By returning the control levers to neutral positions, the valve plungers 108 and 110 may be returned to their neutral or hold positions and the shovel 18 maintained in the solid line position shown in Figures 1 and 2. The above described cycle of operation may then be repeated.

If desired, additional tilt positioning control mechanisms may be associated with the hydraulic tilt mechanism 42 under which circumstances the shovel 18 may be automatically positioned in any one of a plurality of intermediate tilt or rotative positions.

Now, while I have shown and described what I believe to be a preferred embodiment of my present invention, it will be understood by those skilled in the art that various modifications or rearrangements may be made therein without departing from the spirit and scope of my present invention.

I claim:

1. A positioning mechanism for a shovel carried by a vehicle and mounted for limited pivotal movement, comprising movable fluid means carried by the vehicle for effecting pivotal movement of said shovel, said fluid means discharging fluid during pivotal movement of the said shovel, and reservoir means for receiving a portion of the fluid dischargeable from the said fluid means when said shovel reaches a predetermined pivotal position.

2. A positioning mechanism for a shovel carried by a vehicle and mounted for limited pivotal movement between two extreme positions, comprising power actuated fluid means carried by the vehicle for effecting pivotal movement of said shovel, said fluid means discharging fluid during pivotal movement of the said shovel, and selectively operable reservoir means for receiving a portion of the fluid dischargeable from the said fluid means when said shovel reaches a predetermined intermediate pivotal position.

3. For use with a vehicle, the combination of a shovel, arm means pivoted at one end to the vehicle and at the other end to said shovel, first power actuated fluid means carried by the vehicle and having connection with said arm means for effecting pivotal movement of the latter whereby said shovel may be raised or lowered, second power actuated fluid means carried by said arm means for effecting pivotal movement of said shovel relative to said arm means, said second power actuated fluid means

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discharging fluid during pivotal movement of the said shovel relative to the said arm means, and reservoir means for receiving a portion of the fluid dischargeable from the said second power actuated fluid means for automatically interrupting actuation of the second power actuated fluid means when said shovel reaches a predetermined pivotal position relative to said arm means.

4. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, movable fluid means carried by the vehicle for effecting pivotal movement of said shovel, said fluid means discharging fluid during pivotal movement of the said shovel, reservoir means for receiving a portion of the fluid dischargeable by the said movable fluid means and automatically interrupting movement of said movable fluid means when said shovel reaches a predetermined pivotal position, and means associated with said reservoir means for by-passing the latter in order that said shovel may be pivoted beyond said predetermined pivotal position.

5. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, movable fluid means carried by the vehicle for effecting pivotal movement of said shovel, said movable fluid means discharging fluid during pivotal movement of the said shovel, tilt limiting reservoir means including multi-position valve means for receiving fluid discharged from the said movable fluid means and automatically interrupting movement of said movable fluid means when said valve means is in one position and said shovel reaches a predetermined pivotal position, and means associated with said valve means and operable when the latter is in another position for by-passing said tilt limiting reservoir means in order that said shovel may be pivoted beyond said predetermined pivotal position.

6. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, hydraulic actuating assembly means carried by the vehicle for effecting pivotal movement of said shovel, a source of fluid pressure, means for directing fluid under pressure from said source of fluid pressure to one end of said hydraulic actuating means, the said hydraulic actuating means discharging fluid from the other end when pressure is applied and fluid admitted to the said one end, reservoir means for blocking the discharge of fluid from said other end of said hydraulic actuating means when said shovel reaches a predetermined pivotal position, and selectively operable means associated with said reservoir means for by-passing the latter to permit fluid to return from said hydraulic actuating assembly means to said source of fluid pressure in order that said shovel may be pivoted beyond said predetermined pivotal position.

7. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, hydraulic actuating assembly means carried by the vehicle for effecting pivotal movement of said shovel, a source of fluid pressure, means for directing fluid under pressure from said source of fluid pressure to one end of said hydraulic actuating assembly means, means for receiving the fluid forced from the other end of said hydraulic actuating assembly means during actuation of the latter, and said last named means having a fluid capacity less than the fluid capacity of said hydraulic actuating assembly means whereby the extent of actuation of said hydraulic means is limited for automatically preventing tilting of said shovel beyond a predetermined rotative position.

8. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, hydraulic actuating assembly means carried by the vehicle for effecting pivotal movement of said shovel, a source of fluid pressure, means for directing fluid under pressure from said source of fluid pressure to one end of said hydraulic actuating assembly means,

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means for receiving the fluid forced from the other end of said hydraulic actuating assembly means during actuation of the latter, said fluid receiving means having a fluid capacity less than the fluid capacity of said hydraulic actuating assembly means whereby the extent of actuation of said hydraulic actuating assembly means is limited for automatically preventing tilting of said shovel beyond a predetermined rotative position, and selectively operable means associated with said fluid receiving means for by-passing the latter to permit fluid forced from the other end of said hydraulic actuating assembly means to flow to said source of fluid pressure in order that said shovel may be pivoted beyond said predetermined rotative position.

9. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, hydraulic actuating assembly means carried by the vehicle for effecting pivotal movement of said shovel, a source of fluid pressure, means for directing fluid under pressure from said source of fluid pressure to one end of said hydraulic actuating assembly means, a tilt positioning control cylinder having a free floating piston therein for receiving the fluid forced from the other end of said hydraulic actuating assembly means during actuation of the latter, said tilt positioning control cylinder having a fluid capacity less than the fluid capacity of said hydraulic actuating assembly means whereby the extent of actuation of said hydraulic actuating assembly means is limited for automatically preventing tilting of said shovel beyond a predetermined rotative position, and selectively operable means associated with said tilt positioning control cylinder for by-passing the latter to permit fluid forced from the other end of said hydraulic actuating assembly means to flow to said source of fluid pressure in order that said shovel may be pivoted beyond said predetermined rotative position.

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10. For use with a vehicle, the combination of a shovel carried by the vehicle and mounted for limited pivotal movement, hydraulic actuating assembly means carried by the vehicle for effecting pivotal movement of said shovel, a source of fluid pressure, means for directing fluid under pressure from said source of fluid pressure to one end of said hydraulic actuating assembly means, tilt limiting means including a cylinder having a free floating piston therein and multi-position valve means having one position for directing to said cylinder the fluid forced from the other end of said hydraulic actuating assembly means during actuation of the latter, said cylinder having a fluid capacity less than the fluid capacity of said hydraulic actuating assembly means whereby the extent of actuation of said hydraulic actuating assembly means is limited for automatically preventing tilting of said shovel beyond a predetermined rotative position, and means associated with said valve means and operable when the latter is in another position for by-passing said tilt limiting means in order to permit fluid forced from the other end of said hydraulic actuating assembly means to flow to said source of fluid pressure in order that said shovel may be pivoted beyond said predetermined rotative position.

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