Oct. 1, 1963 R. L. BEYERSTEDT ETAL 3,105,603

TRACTOR LOADERS

Filed May 28, 1959 3 Sheets-Sheet 1

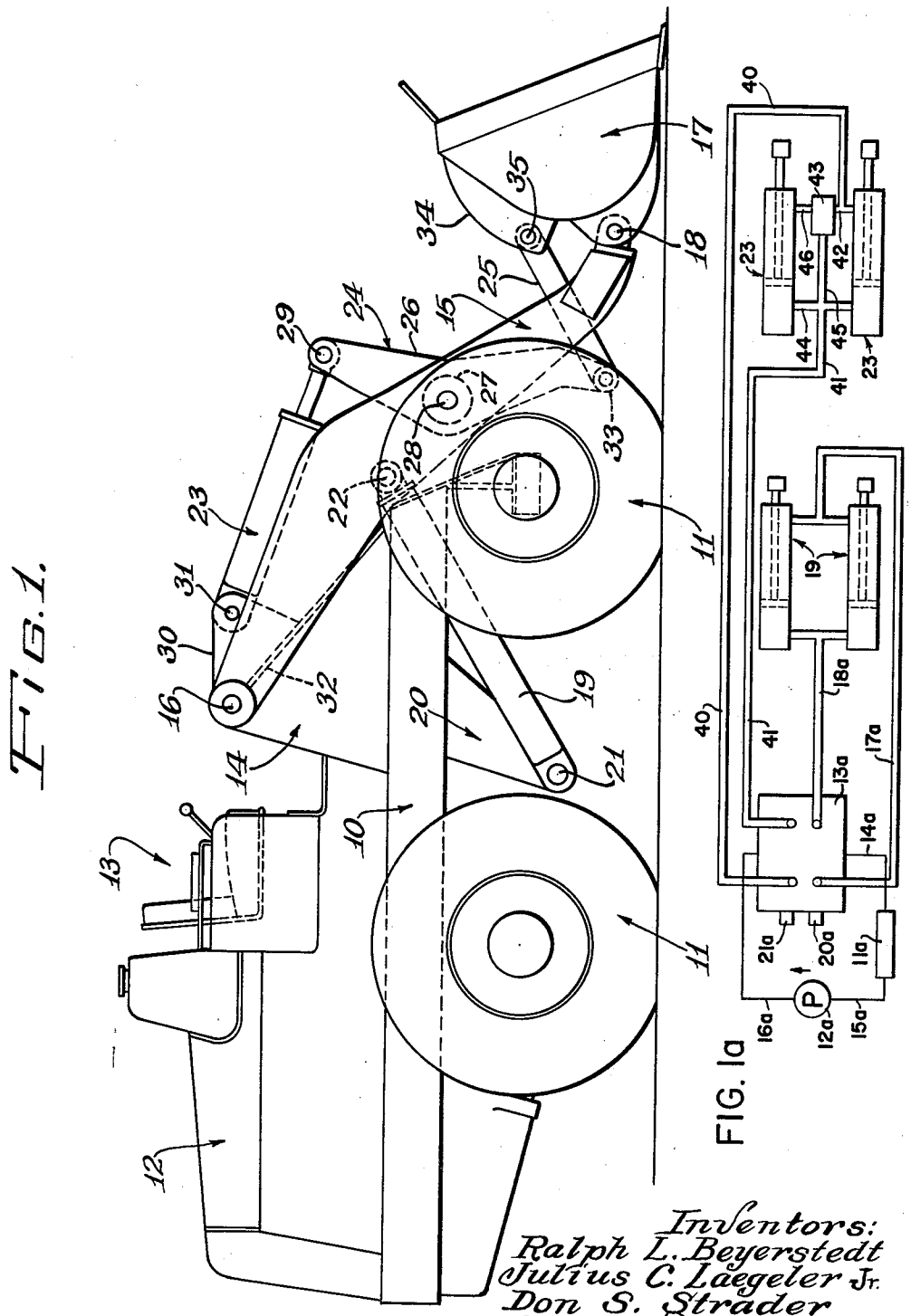


FIG. 1

FIG. 1a

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TRACTOR LOADERS

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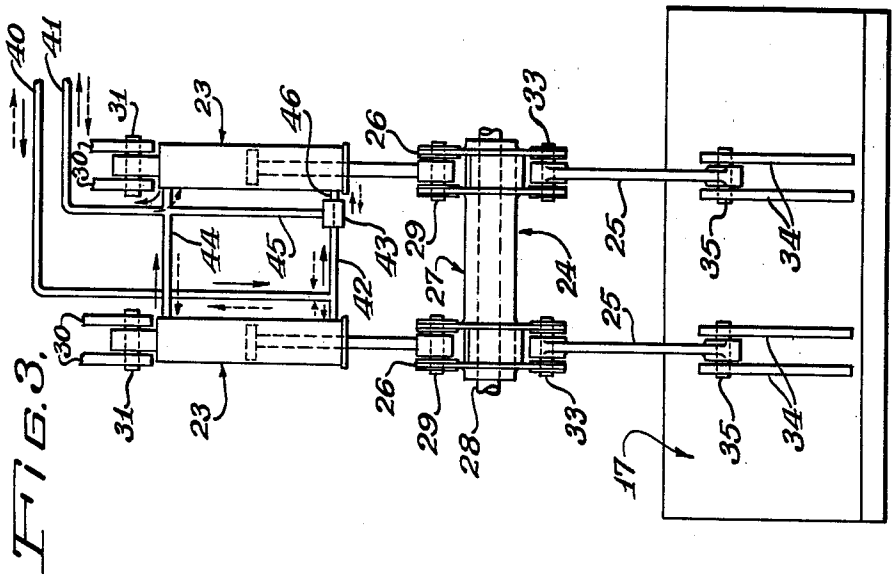


FIG. 3.

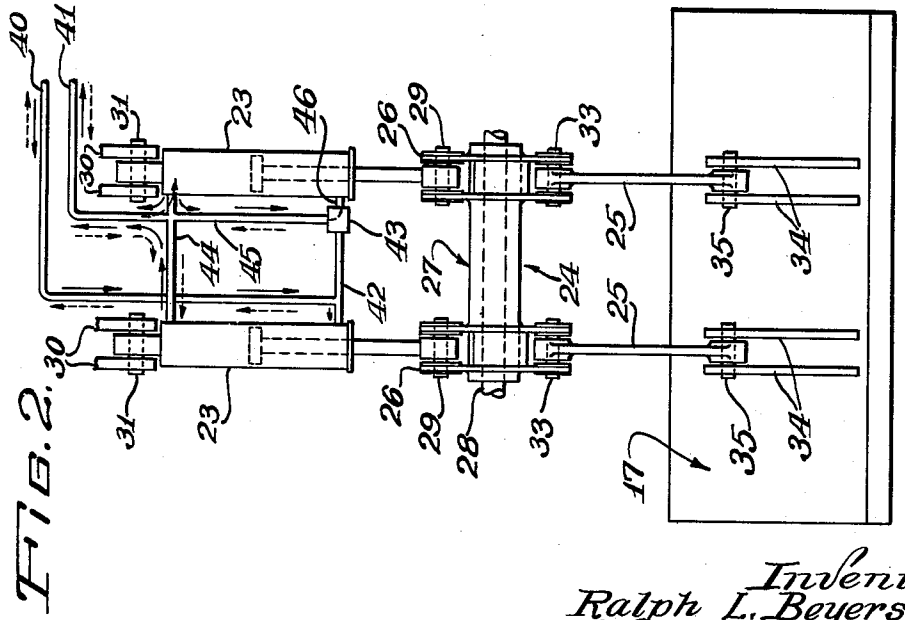


FIG. 2.

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TRACTOR LOADERS

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FIG. 4.

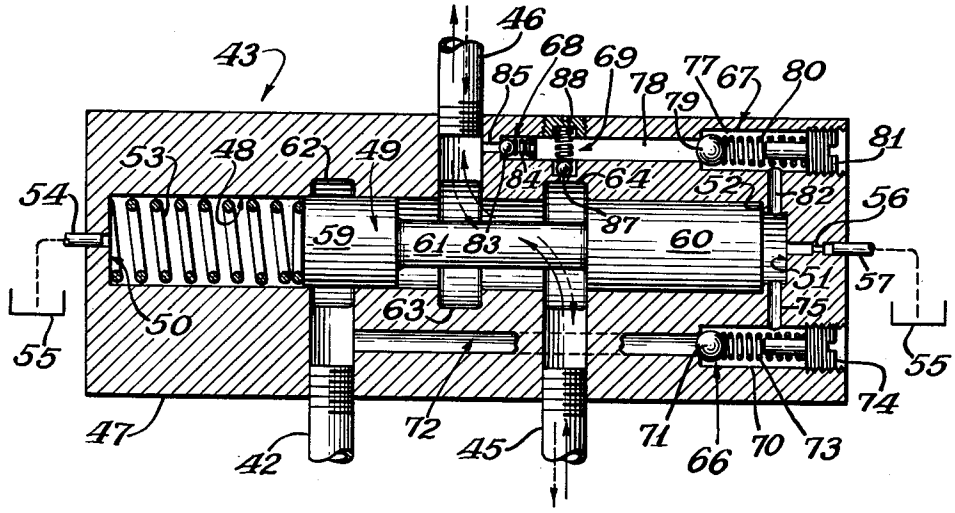
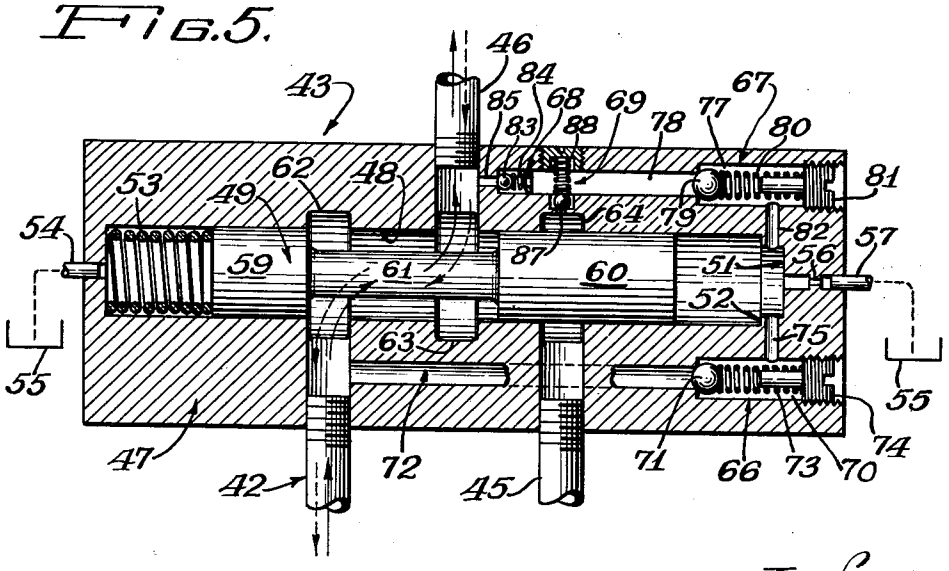


FIG. 5.



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3,105,603

TRACTOR LOADERS

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12 Claims. (Cl. 214—140)

This invention relates generally to tractor loaders, and more specifically to certain hydraulic circuits and valving in a tractor loader having a pair of hydraulic rams or motors acting in concert so that the hydraulic fluid pressure available for operation of the rams may be alternatively directed to one or simultaneously to both hydraulic rams.

In the art of tractor loaders it is a rather common construction to provide a pair of hydraulic rams so connected that they operate together to perform some loader function. This is generally done for reasons of economy and ease of design, although generally one cylinder of twice the size of each of the pair of cylinders could be substituted therefor. Further, it is common in the tractor loader art to provide a single hydraulic fluid pump of a substantially constant volume for operation of the various hydraulic rams of the loader mechanism. With such arrangements the speed of extension and retraction of the hydraulic rams is fairly constant under most conditions of loading. As the loading on the various members of a tractor loader can greatly vary, it is sometimes desirable to extend the hydraulic rams at a substantially greater speed under conditions of relatively light loading. The present invention accomplishes this result by providing certain hydraulic circuits and valving such that when the loading is light enough so that one hydraulic ram can provide sufficient force to act against the load, means is provided for directing the available hydraulic fluid to one of the hydraulic rams to provide for operation thereof at a speed which is substantially twice the speed of operation of the rams when both are supplied with the available hydraulic fluid under pressure.

Therefore it may be seen that the object of the present invention is to provide in a tractor loader having a pair of hydraulic rams of the same function, means for alternatively delivering hydraulic fluid from a single hydraulic pump to one of the hydraulic rams or simultaneously to both of the hydraulic rams.

It is another object of the present invention to provide in a tractor loader having a pair of hydraulic rams of the same function, means automatically operating responsive to the loading on said hydraulic rams for directing the available hydraulic fluid under pressure to one of the hydraulic rams or simultaneously to both hydraulic rams dependent upon the degree of loading.

It is a further object of the present invention to provide certain hydraulic valve and circuit means for the bucket pivoting rams of a tractor loader which may be operated to direct the available hydraulic fluid under pressure to one of the hydraulic rams to cause a relatively rapid pivoting of the bucket or simultaneously to both of the hydraulic rams to cause a relatively slower pivoting of the bucket but with the application of a correspondingly greater force applied thereto.

It is a further object of the present invention to provide a certain hydraulic circuit for a tractor loader having a pair of rams having the same function wherein a valve may be used therein to deliver the available hydraulic fluid under pressure to one of the hydraulic rams or simultaneously to both of the hydraulic rams and providing for the delivery of relatively low pressure hydraulic fluid to the hydraulic ram which is not connected to high pressure hydraulic fluid source in order to keep both sides of the piston of that ram filled with hydraulic fluid.

Other objects and features of the present invention will be apparent upon a perusal of the following specification and drawings of which:

FIGURE 1 is a side elevational view of a tractor loader constructed according to the present invention;

FIGURE 1*a* is a schematic drawing of a hydraulic circuit for operation of the present invention;

FIGURE 2 is a partial top plan view of the tractor loader shown in FIGURE 1, showing the linkage means for pivoting the bucket and the directions of hydraulic fluid flow when hydraulic fluid under pressure is applied to only one of the rams;

FIGURE 3 is a view similar to FIGURE 2 except for its showing of the directions of hydraulic fluid flow when hydraulic fluid under pressure is simultaneously supplied to both of the hydraulic rams, and

FIGURE 4 is an enlarged cross sectional view of the valve shown in FIGURE 2 and FIGURE 5 is an enlarged cross sectional view of the valve shown in FIGURE 3.

The present embodiment is the preferred embodiment, but it is to be understood that changes can be made in the present embodiment by one skilled in the art without departing from the spirit and scope of the present invention.

For a general description of the present invention reference is made to the drawings. The specific tractor loader shown is only one of many types that can be used in the present invention. In the tractor loader shown, a bucket is pivotally carried in a boom structure and is pivotally moved relative to the boom by a pair of hydraulic rams operating through a lever and linkage arrangement. The pair of hydraulic rams are pivotally carried on the tractor at their head ends and are both pivotally connected to the lever and linkage arrangement at their rod ends so that if hydraulic fluid under pressure is applied to one of the hydraulic rams to extend or retract that ram, the other ram is identically moved by the lever and linkage arrangement by which the rams are mechanically interlocked. When hydraulic fluid under pressure is supplied to both of the hydraulic rams, it may be seen that both will operate to move the linkage and lever arrangement and pivot the bucket. As the pair of hydraulic rams are of the same size, it may be seen that with a source of hydraulic fluid under pressure delivering a constant volume of fluid, the connection of that source of hydraulic fluid to only one of the rams will cause the lever and linkage arrangement to be moved at a speed which is twice that when the source of hydraulic fluid is delivered to both hydraulic rams, and the force applied is one-half of that when the source of hydraulic fluid is connected to both of the hydraulic rams. The hydraulic circuits and valving of the present invention provides that in one operated position of the valving, hydraulic fluid under pressure is directed in either direction through one of the bucket pivoting rams with the rod end of the other hydraulic ram connected to its head end. In another operated position of the hydraulic circuits and valving, hydraulic fluid is directed in either direction simultaneously through both bucket pivoting rams. Although it is contemplated that a manually operated valve could be used, the present embodiment of the invention discloses a pressure responsive valve which will automatically operate when the loading on the bucket is relatively light to connect the high pressure hydraulic fluid to only one of the bucket pivoting rams and permitting the other hydraulic ram to follow the movement of the first by interconnecting each end of that ram, and further automatically operating when the loading on the bucket is

relatively heavy to connect the source of hydraulic fluid under pressure to both of said bucket pivoting rams for joint operation thereof in either direction.

Turning next to a detailed description of the present invention continued reference is made to the drawings. The tractor loader of the present embodiment comprises a frame 10 supported on wheels 11 with the frame 10 carrying an engine compartment 12 at the rearward end thereof, an operator's compartment 13 substantially at the longitudinal center of the frame 10 and an open platform portion at the forward end thereof. A pair of sometriangular plates 14 are provided on the open platform portion of the tractor on each side thereof and are mounted thereon to upstand therefrom. A boom 15 comprising duplicate boom arms is pivotally connected at one end thereof to the upper ends of the plates 14 by means of pins 16. The boom 15 extends forwardly of the tractor and at the other end thereof is pivotally connected to a digging bucket 17 by means of pins 18. The boom is raised and lowered by a pair of hydraulic rams 19 mounted one on each side of the tractor. Each of the hydraulic rams 19 is pivotally connected to a flange 20 by means of a pin 21. Each of the flanges 20 is secured to the frame 10 to depend therefrom. The rod end of each hydraulic ram 19 is pivotally connected to one of the boom arms of the boom 15 intermediate the ends thereof by means of pins 22. Thus it may be seen that as the hydraulic rams 19 are extended the boom 15 is raised and as these rams are retracted the boom is lowered about the pivotal axis of pins 16.

The linkage means providing for pivoting of the bucket 17 relative to the boom 15 comprises a pair of hydraulic rams 23, a lever assembly 24 and a pair of links 25. The lever assembly 24 comprises a pair of levers 26 which are secured intermediate their ends on each end of a cylindrical member 27 to form an integral assembly. The cylindrical member 27 is rotatively carried on a pin 28 which is secured between the arms of the boom 15 intermediate the ends thereof. The upper end of each of the levers 26 is pivotally connected to the rod end of one of the hydraulic rams 23 by means of a pin 29. The head end of each of the hydraulic rams 23 is pivotally connected to a flange 30 by means of a pin 31. Each of the flanges 30 is mounted on a plate 32 which is secured to the upstanding plates 14 across the forward marginal edges thereof. The lower end of each of the levers 26 is pivotally connected to one of the links 25 by means of a pin 33. The other end of each of the links 25 is pivotally connected to flanges 34 mounted on the rear wall of the bucket 17 by means of pins 35. The pins 35 are spaced upwardly from the pins 18. Thus it may be seen that when the hydraulic rams 23 are extended and retracted, the lever assembly 24 is pivoted to in turn move the links 25 to cause a pivoting of the bucket 17 about the axis of pins 18. It may further be seen that since the lever assembly 24 of levers 26 and cylindrical member 27 is a rigid unitary assembly, the extension and retraction of hydraulic rams 23 must always be in unison. One of the rams 23 cannot be extended while the other is retracted.

One suitable hydraulic circuit for operation of the hydraulic rams 19 and 23 is shown schematically in FIGURE 1*a*. A reservoir 11*a*, pump 12*a* and a hydraulic main valve or control valve 13*a* are interconnected by a return conduit 14*a*, suction conduit 15*a* and supply conduit 16*a*. The head end of the hydraulic rams 19 are parallel connected through a conduit 18*a* and at the other end are connected to the hydraulic main valve 13*a*. Similarly the rod end of the hydraulic rams 19 are parallel connected to a conduit 17*a* at one end and at the other end thereof the conduit 17*a* is connected to the hydraulic main valve 13*a*. The conduit 40 connected at one end to the valve 43 and the rod end of one of the other hydraulic rams 23 is connected at the other end to the hydraulic main valve 13*a*. The conduit 41 connected at one end to the conduits 44 and 45 is connected at the other end to the hydraulic main valve 13*a*. Two valve spools 20*a* and 21*a* are provided within the hydraulic main valve 13*a* such that the one valve spool 20*a* selectively directs pressure fluid under pressure from the supply conduit 16*a* to the conduits 17*a* and 18*a* for operation of the hydraulic rams 19. The other valve spool 21*a* selectively directs pressure fluid under pressure from the supply conduit 16*a* to either conduit 40 or 41 for the operation of the hydraulic ram 23 and the valve 43. It is to be understood that the hydraulic main valve 13*a* is of the open center type construction as the preferred form and that any suitable means can be provided for selectively moving the valve spools 20*a* and 21*a* for operation of the hydraulic rams 19 and 23. It is to be further understood that when the valve spools 20*a* and 21*a* are moved from their non-operative position to an operative position such that pressure fluid under pressure is selectively directed to the conduits 17*a* and 40 the other conduits 18*a* and 41 are vented to the reservoir 11*a* through the return conduit 14*a*.

As previously mentioned one end of conduits 40 and 41 partially shown in FIGURES 2 and 3 are connected to the main hydraulic valve 13*a* so that high pressure hydraulic fluid from the pump 12*a* and low pressure hydraulic fluid to the reservoir 11*a* may be directed through conduits 40 and 41 in the indicated directions of either the solid lines or dotted lines. The other end of conduit 40 is connected into conduit 42 intermediate the ends thereof. One end of conduit 42 is connected to the rod end of one of the hydraulic rams 23 and the other end of conduit 42 is connected to valve 43 at what will be referred to in the claims as the first port. The other end of conduit 41 is connected into conduit 44 intermediate the ends thereof and each end of conduit 44 is connected to the head end of one of the hydraulic rams 23. Conduit 45 is connected between conduit 44 and valve 43 at what will be referred to in the claims as the second port, and conduit 46 is connected between the rod end of the other hydraulic ram 23 and valve 43 at what will be referred to in the claims as the third port.

The valve 43, which is shown in its two operated positions in FIGURES 4 and 5, is shown somewhat diagrammatically therein. The valve housing or body 47 is provided with a valve bore 48 in which a valve spool 49 is slidably carried. One end of the valve bore 48 is closed by a wall 50 and the other end thereof is closed by a wall 51. A reduced annular section or shoulder 52 is provided in the valve bore 48 adjacent the end wall 51 and the shoulder 52 in abutting one end of the valve spool 49 determines one operated valve position of the valve 43. A compressed coil spring 53 is provided in the other end of the valve bore 48 between the end wall 50 and the other end of the valve spool 49 to bias the valve spool 49 against the shoulder 52. End wall 50 is provided with a conduit 54 connected therethrough and to the reservoir designated with the numeral 55 to drain any fluid accumulations from the chamber defined by the end wall 50 and the cooperating end of the valve spool 49. The end wall 51 is also provided with an opening therethrough, however, an orifice 56 is formed in this opening. The orifice 56 is of a size sufficiently small to permit the development of fluid pressures in the chamber defined by the end wall 51 and the cooperating end of the valve spool 49 to move the valve spool 49 against the bias of spring 53 to the other or second operated position which is shown in FIGURE 5. Conduit 57 is connected between the orifice 56 and the reservoir 55 to permit fluid to drain from that end of the valve bore 48 to permit the valve spool 49 to return to the first position under the bias of spring 53. The valve spool 49 is formed to have two lands 59 and 60 separated by a reduced section or annular groove 61. The valve bore 48 is provided with three annular grooves 62, 63 and 64. The annular grooves 62, 63 and 64 and the lands 59 and 60 of the valve spool 49 are so positioned that in the first position of the valve, that in which the valve spool

49 abuts the shoulder 52, annular groove 64 is connected in free fluid communication with annular groove 63 by the reduced section 61 of the valve spool 49 and annular groove 62 is blocked by the land 59 of valve spool 49, and so that when the valve spool 49 is moved to the second position, that wherein the valve spool is moved toward end wall 50 until the coiled spring 53 is substantially completely compressed, the land 60 will first block annular groove 64 after which the annular groove 62 will be connected in free fluid communication with annular groove 63 by the reduced section 61 of valve spool 49. Annular groove 62 is connected through the valve body 47 and the first port to conduit 42. Annular groove 63 is connected through the valve body 47 and the third port to conduit 46, and annular groove 64 is connected through the valve body 47 and the second port to conduit 45.

Valve 43 further includes four one-way or check valves 66, 67, 68 and 69. Check valve 66 comprises a valve chamber 70 having a valve seat at the inner end thereof cooperating with a ball 71 and connected by passageway 72 to annular groove 62. The ball 71 is adjustably biased against the valve seat by the coiled spring 73 and the set screw 74 threaded into the outer end of the chamber 70. The valve chamber 70 is connected in free fluid communication with the reduced portion of the valve bore 48 at the end wall 51 by a passageway 75. Thus it may be seen that when the fluid pressure in conduit 42 and annular groove 62 attains a pressure sufficiently high enough to unseat the ball 71, hydraulic fluid will flow from conduit 42, through passageway 72, through valve chamber 70, and passageway 75 to the reduced section of the valve bore 48 at end wall 51.

The one-way valve 67 is substantially identical in construction to that of valve 66, having a valve chamber 77 having its inner end connected to passageway 78, and a ball 79 biased to close the end of passageway 78 by a coiled spring 80, the bias of which is adjusted by the set screw 81 threaded into the outer end of valve chamber 77. Valve chamber 77 is also connected in free fluid communication with the reduced section of the valve bore 48 at the end wall 51 and this is accomplished by a passageway 82 formed through the valve body 47. The check valves 68 and 69 are both mounted in the other end of passageway 78. Check valve 68 which comprises ball 83 and compressed coiled spring 84 is connected to conduit 46 and annular groove 63 by passageway 85. Check valve 68 prevents any hydraulic fluid in passageway 78 from flowing into conduit 46 and annular groove 63 but permits fluid to flow in the opposite direction. Check valve 69 comprises ball 87 and compressed coiled spring 88. The check valve 69 is connected to annular groove 64 by a short unnumbered passageway. Check valve 69 will operate to prevent any hydraulic fluid flow from passageway 78 into annular groove 64 but will permit hydraulic fluid to flow in the opposite direction.

Turning next to a detailed description of the operation of the present invention in order that the construction thereof may be more readily understood, continued reference is made to the drawings. Assuming first that it is desired to pivot the bucket 17 clockwise as viewed in FIGURE 1 such as in dumping or forcing the cutting edge of the bucket downwardly into some load, this operation requires a retraction of the hydraulic rams 23. Further considering that the loading upon the bucket is relatively light such as would generally occur in a dumping operation, the pertinent figures are FIGURES 2 and 4 of the drawings. The path taken by the hydraulic fluid under these conditions is shown in the solid line arrows in FIGURES 2 and 4. The main hydraulic valve 13*a* is operated to direct high pressure hydraulic fluid to conduit 40 and to connect conduit 41 to the reservoir 11*a*. The high pressure hydraulic fluid will then flow through conduit 40 and 42 into the rod end of one of the hydraulic rams 23. Hydraulic fluid will also flow from the head end of that hydraulic ram 23, through conduit 44, and conduit 41 to the reservoir 11*a*. As the one hydraulic ram is caused to retract by the flow of hydraulic fluid, the lever assembly 24 will be pivoted and this in turn will cause the other hydraulic ram 23 to be retracted. As the other hydraulic ram 23 is retracted, hydraulic fluid will flow from the head end thereof, through conduit 45, into a valve 43, annular groove 64, valve bore 48 about the reduced section 61 of the valve spool 49, annular groove 63, and conduit 46 to the rod end of that hydraulic ram. The excess of hydraulic fluid which is substantially equal to the volume of the piston rod thereof, will flow through conduit 44 and conduit 41 to the reservoir. As the hydraulic fluid flowing through the valve is of a relatively low pressure, the one way valve 67 will not be operated.

Assuming next, the same operation of the main hydraulic valve 13*a*, that for dumping or clockwise pivoting of the bucket as viewed in FIGURE 1, but that a certain substantially larger loading is encountered by the bucket, which will also result in a reaction against retraction on the piston of the hydraulic ram 23 which is being supplied high pressure hydraulic fluid. This reactive force will cause the hydraulic fluid pressure in conduit 40 to rise and when the pressure reaches the value for which the valve 66 has been adjusted, the hydraulic fluid pressure acting through passageway 72 will unseat ball 71 to permit hydraulic fluid to flow through chamber 70, and passageway 75 into the reduced section of the valve bore 48 at end wall 51. This hydraulic fluid under pressure operating against the end of the valve spool 49 will move the valve spool 49 compressing the coiled spring 53. The first action of the valve spool 49 will be a blocking of the conduit 45 by the land 60. Further operation will interconnect conduits 42 and 46. The valve 43 will then be positioned as shown in FIGURE 5, and the hydraulic fluid flow will be that shown in the solid line arrows of FIGURE 3. Hydraulic fluid will flow through conduit 40, and into conduit 42 wherein the flow will be divided, one portion entering the rod end of one of the hydraulic rams 23, with the other portion flowing from conduit 42 into valve 43, annular groove 62, through valve bore 48 about the reduced section 61 of the valve spool 49, annular groove 63 and conduit 46 to the rod end of the other hydraulic ram 23. Hydraulic fluid from the head end of the first hydraulic ram 23 will flow through conduit 44 and 41 to the reservoir 11*a*. As conduit 45 is now blocked, hydraulic fluid from the head end of the other hydraulic ram 23 will flow from conduit 44 into conduit 41 to the reservoir 11*a*. Since the hydraulic fluid from conduit 40 is divided to enter the rod end of both hydraulic rams 23, it may be seen that with each hydraulic ram 23 receiving one-half of the volume delivered, the hydraulic rams will retract at substantially one-half of the speed at which a retraction took place as above described under a light load. Although the speed of retraction of the hydraulic rams 23 is substantially one-half of that of the light load, the force applied by the hydraulic ram 23 to the lever assembly 24 will be substantially twice that which is applied upon the bucket during light loading. In the present invention the valves 67 and 66 are so adjusted that the force required to unseat valve 67 is substantially less than that required to unseat valve 66. A pressure setting for valve 67 which is about one-half of that for which valve 66 is set has been found satisfactory. Since there is an immediate fluid pressure drop when conduit 42 is interconnected with conduit 46, valve 66 will close. However, before valve 66 can close, the hydraulic fluid under pressure will in flowing through passageway 85 open check valve 68 and valve 67 to admit hydraulic fluid through passageway 82 into the reduced section of the valve bore 48 at the end wall 51 to maintain the valve 43 in the position shown in FIGURE 5. Check valve 69 will function to prevent any hydraulic fluid in passageway 78 from flowing into annular groove 64 which is connected to conduit 45. If the load on the bucket lightens sufficiently to permit valve 67 to close, the fluid in the valve bore 48

at the end wall 51 will drain off through the orifice 56 permitting the spring 53 to return the valve spool 49 to a position such as shown in FIGURE 4 again switching the operation of the hydraulic rams 23 to one hydraulic ram as previously described in reference to FIGURE 2.

Assuming next that it is desired to pivot the bucket 17 rearwardly or counterclockwise as viewed in FIGURE 1, such as in breaking away a loaded bucket from some material being worked, and assuming that the loading on the bucket is relatively light, the hydraulic fluid flow will be directed as shown in the dotted line arrows in FIGURES 2 and 4. Hydraulic fluid under pressure entering at conduit 41 will flow into conduit 44. From conduit 44 some amount of fluid will enter the hydraulic ram 23 to which conduit 46 is connected. The other portion of the hydraulic fluid will flow through conduit 44 to enter the head end of the other or first hydraulic ram 23. Hydraulic fluid from the rod end of the first hydraulic ram will enter conduit 42 and from conduit 42 will flow through conduit 40 to return to the reservoir 11*a*. Additionally, hydraulic fluid from the rod end of the other hydraulic ram 23 will flow through conduit 46 and into valve 43, annular groove 63, through the valve bore 48 and about the reduced section 61 of the valve spool 49, annular groove 64 and through conduit 45. From conduit 45 the hydraulic fluid may flow through conduit 44 and into the head end of that hydraulic ram 23 to aid in filling the cylinder as that hydraulic ram 23 follows the movement of the first hydraulic ram in extending. Thus it may be seen that the hydraulic fluid under pressure delivered through conduit 41 is used to extend the first hydraulic ram 23 and replace in the other hydraulic ram a volume of fluid equal to the volume of the piston rod thereof. Since conduit 42 is connected to the reservoir, the fluid pressure therein will not be sufficient to cause any operation of valve 66. Further, at this time the hydraulic fluid pressure in conduit 46 and annular groove 64 will not be high enough to operate the valve 67.

Assuming next that the bucket 17 is continued to be pivoted rearwardly, but that the loading thereon increases substantially or sufficiently high enough to operate hydraulic valve 67. Valve 67 will then operate, the ball 79 being unseated to permit hydraulic fluid to flow therethrough and through passageway 82 to the reduced section in the valve bore 48 at the end wall 51. This hydraulic fluid under pressure in the valve bore 48 will cause valve spool 49 to be moved to a position such as shown in FIGURE 5 with a consequent fluid flow such as shown in the dotted line arrows in FIGURES 3 and 5. The increased loading on the bucket will result in a substantially increased pressure in conduit 45 and annular groove 64, which pressure will be applied through the check valve 69 to operate the valve 67 as previously described. As the valve spool 49 is moved to the position such as shown in FIGURE 5, annular groove 64 is blocked from fluid communication with annular groove 63 before annular grooves 62 and 63 are connected in free fluid communication. The continued high pressure of the hydraulic fluid in conduit 45 will continue to be applied about land 60 of valve spool 49 and through check valve 69 to valve 67 maintaining hydraulic fluid pressure on the end of the valve spool 49. Hydraulic fluid will then flow through conduit 41 and from conduit 44 into hydraulic rams 23. Hydraulic fluid from the rod end of the first hydraulic ram 23 will flow into conduit 42 and from conduit 42 into conduit 40. Hydraulic fluid from the rod end of the other hydraulic ram 23 will flow through conduit 46 into valve 43, annular groove 63, through valve bore 48 about the reduced section 61 of valve spool 49, annular groove 62, conduit 42 to and through conduit 40. Thus it may be seen that the delivered hydraulic fluid under pressure from conduit 41 is now equally divided between the two hydraulic rams 23 causing a reduced speed of operation of the hydraulic rams at substantially twice the applied force over that which occurred for the above described single operation of the first hydraulic ram 23. If the hydraulic fluid pressure in conduit 45 drops below that necessary to maintain valve 67 operated, valve 67 will close and valve spool 49 will return to the position shown in FIGURE 4 under the bias of coiled spring 53 as the fluid gradually passes through the orifice 56 to the reservoir 55.

Having described the invention what is considered new and desired to be protected by Letters Patent is:

1. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a fluid reservoir, a pair of hydraulic rams mechanically interlocked for performing the same material handling function, a hydraulic valve operable to two positions, hydraulic fluid conduit means interconnecting said source of hydraulic fluid, said reservoir, the head and rod ends of said hydraulic rams and said valve, said hydraulic fluid conduits being connected and said hydraulic valve being formed so that in the first operated position of said hydraulic valve, the head and rod ends of one of said hydraulic rams are respectively connected to said source of hydraulic fluid and said reservoir and the head and rod ends of the other of said hydraulic rams are connected in free fluid communication, and so that when said hydraulic valve is operated to the second position the head and rod ends of both of said hydraulic rams are respectively connected to said source of hydraulic fluid and said reservoir.

2. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a reservoir, a pair of hydraulic rams mechanically interlocked for performing the same material handling function, a hydraulic valve operable to two positions, hydraulic fluid conduit means connected between said source of hydraulic fluid, said reservoir, the head and rod ends of said hydraulic rams and said valve, said hydraulic fluid conduit means being connected and said valve being formed so that in the first operated position of said valve, the head and rod ends of one of said hydraulic rams are separately connected to said source of hydraulic fluid and said reservoir and the head and rod ends of the other of said hydraulic rams are interconnected in free fluid communication, and so that when said valve is operated to the second position, the head and rod ends of both of said hydraulic rams are separately connected to said source of hydraulic fluid and said reservoir, and means formed in said valve and operating responsive to any loading on said hydraulic rams below a certain amount for operating said hydraulic valve to said first position and operating responsive to any loading on said hydraulic rams above said certain amount for operating said hydraulic valve to said second position.

3. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a reservoir, a pair of hydraulic rams mechanically interlocked for performing the same material handling function, a hydraulic valve comprising a valve spool slidable to first and second operated positions, and a coiled spring positioned therein to bias said valve to said first position, hydraulic fluid conduit means connected between said source of hydraulic fluid, said reservoir, the head and rod ends of said hydraulic rams and said valve, said hydraulic fluid conduit means being connected and said valve being formed so that in said first operated position of said valve, the head and rod ends of one of said hydraulic rams are separately connected to said source of hydraulic fluid and said reservoir and the head and rod ends of the other of said hydraulic rams are interconnected in free fluid communication, and so that when said valve is operated to said second position, the head and rod ends of both of said hydraulic rams are separately connected to said source of said hydraulic fluid and said reservoir, and adjustable check valve means formed in said valve and operating responsive to hydraulic fluid pressures in said valve below a certain amount for permitting said coiled spring to move said spool to operate said hydraulic valve to said first position and operating re-

sponsive to any hydraulic fluid pressures in said valve above said certain amount for admitting hydraulic fluid under pressure to one end of said valve spool to move said valve spool against the bias of said coiled spring to operate said valve to said second position.

4. In a tractor loader, a boom pivotally mounted on said tractor and extending forwardly thereof, a digging bucket pivotally carried on the outer end of said boom, linkage means pivotally connected between said tractor, said boom and said bucket for pivoting said bucket relative to said boom, said linkage means including a pair of hydraulic rams mechanically interlocked and operating to pivot said bucket relative to said boom, a source of constant volume hydraulic fluid under pressure for operating said pair of hydraulic rams, hydraulic circuit means including a hydraulic valve connected between said source of hydraulic fluid and said pair of hydraulic rams and being operable to one position to deliver substantially all of the available hydraulic fluid from said source of hydraulic fluid to one of said hydraulic rams for operation thereof while interconnecting the head and rod ends of the other of said pair of hydraulic rams in free fluid communication whereby said other hydraulic ram will follow the operation of said one of said hydraulic rams, said hydraulic circuit means including said hydraulic valve being further operable to another position to deliver substantially all of the available hydraulic fluid from said source of hydraulic fluid simultaneously to both of said hydraulic rams for operation thereof.

5. In a tractor loader, a boom pivotally mounted on said tractor and extending forwardly thereof, a digging bucket pivotally carried on the outer end of said boom, linkage means pivotally connected between said tractor, said boom and said bucket for pivoting said bucket relative to said boom, said linkage means including a pair of hydraulic rams mechanically interlocked and operating to pivot said bucket relative to said boom, a source of constant volume hydraulic fluid under pressure for operating said pair of hydraulic circuit rams, hydraulic circuit means connected between said source of hydraulic fluid and said pair of hydraulic rams and being operable to one position to deliver substantially all of the available hydraulic fluid from said source of said hydraulic fluid to one of said hydraulic rams for operation thereof while connecting the head and rod ends of the other of said pair of hydraulic rams in free fluid communication whereby said other hydraulic ram will follow the operation of said one of said hydraulic rams, said hydraulic circuit means further operable to another position to deliver substantially all of the available hydraulic fluid from said source of said hydraulic fluid simultaneously to both of said hydraulic rams for operation thereof, and one hydraulic valve means within said circuit operating responsive to any loading on said bucket below a certain amount for operating said hydraulic circuit means to said one position and operating responsive to any loading on said bucket above said certain amount for operating said hydraulic circuit means to said another position.

6. In a tractor loader, a boom pivotally mounted on said tractor and extending forwardly thereof, a digging bucket pivotally carried on the outer end of said boom, linkage means pivotally connected between said tractor, said boom and said bucket for pivoting said bucket relative to said boom, said linkage means including a pair of hydraulic rams mechanically interlocked and operating to pivot said bucket relative to said boom, a source of constant volume hydraulic fluid under pressure for operating said pair of hydraulic rams, a hydraulic valve operable to two positions, a coiled compressed spring disposed in said valve for biasing said valve to the first operated position, adjustable hydraulic check valves formed in said valve and operating responsive to a certain predetermined hydraulic fluid pressure for operating said hydraulic valve to the second position, hydraulic fluid conduit means interconnecting said source of hydraulic fluid, said pair of hydraulic rams and said valve, said hydraulic fluid conduits being connected and said hydraulic valve being formed so that in said first operated position of said hydraulic valve, one of said hydraulic rams is connected to receive substantially all of the hydraulic fluid available from said source of hydraulic fluid and the head and rod ends of the other of said hydraulic rams are interconnected in free fluid communication, and so when said hydraulic valve is operated to said second position substantially all of the available hydraulic fluid from said source of hydraulic fluid is simultaneously delivered to both of said hydraulic rams for operation thereof, said adjustable check valve means being connected to said hydraulic fluid conduits so that said valve is operated to said first position for any hydraulic fluid pressures in said valve below a certain amount and so that said valve is operated to said second position for any hydraulic fluid pressures in said valve above said certain amount.

7. In a tractor loader, a boom pivotally mounted on said tractor and extending forwardly thereof, a digging bucket pivotally carried on the outer end of said boom, linkage means pivotally connected between said tractor, said boom and said bucket for pivoting said bucket relative to said boom, said linkage means including a pair of hydraulic rams mechanically interlocked and operating to pivot said bucket relative to said boom, a source of constant volume hydraulic fluid under pressure for operating said pair of hydraulic rams, a hydraulic valve operable to two positions, hydraulic fluid conduit means interconnecting said source of hydraulic fluid, said pair of hydraulic rams and said valve, said hydraulic fluid conduits being connected and said hydraulic valve being formed so that in the first operated position of said hydraulic valve, one of said hydraulic rams is connected to receive substantially all of the hydraulic fluid available from said source of said hydraulic fluid and the head and rod ends of the other of said hydraulic rams are interconnected in free fluid communication, and so that when said hydraulic valve is operated to the second position substantially all of the available hydraulic fluid from said source of hydraulic fluid is simultaneously delivered to both of said hydraulic rams for operation thereof.

8. In a tractor loader, a boom pivotally mounted on said tractor and extending forwardly thereof, a digging bucket pivotally carried on the outer end of said boom, linkage means pivotally connected between said tractor, said boom and said bucket for pivoting said bucket relative to said boom, said linkage means including a pair of hydraulic rams mechanically interlocked and operating to pivot said bucket relative to said boom, a source of constant volume hydraulic fluid under pressure for operating said pair of hydraulic rams, a hydraulic valve operable to two positions, hydraulic fluid conduit means interconnecting said source of hydraulic fluid, said pair of hydraulic rams and said valve, said hydraulic fluid conduits being connected and said hydraulic valve being formed so that in the first operated position of said hydraulic valve, one of said hydraulic rams is connected to receive substantially all of the hydraulic fluid available from said source of said hydraulic fluid and the head and rod ends of the other of said hydraulic rams are interconnected in free fluid communication, and so that when said hydraulic valve is operated to the second position substantially all of the available hydraulic fluid from said source of hydraulic fluid is simultaneously delivered to both of said hydraulic rams for operation thereof, and means formed in said valve and operating responsive to any loading on said bucket below a certain amount for operating said hydraulic valve to said first position and operating responsive to any loading on said bucket above said certain amount for operating said hydraulic valve to said second position.

9. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a reservoir, a

pair of hydraulic rams mechanically interlocked for performing the same material handling function, first and second hydraulic fluid conduits alternately connectable at one end of each thereof to said source of hydraulic fluid and said reservoir, a hydraulic valve having three ports, means connecting the other end of said first conduit in parallel to the rod end of one of said hydraulic rams and to the first port of said valve, means connecting the other end of said second conduit in parallel to the head ends of both of said hydraulic rams and to the second port of said valve, means connecting the third port of said valve to the rod end of the other of said hydraulic rams, said hydraulic valve being formed so that in one operated position thereof, said first port is blocked and said second and third ports are connected in free fluid communication so that in a second operated position thereof said second port is blocked and said first and third ports are connected in free fluid communication.

10. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a reservoir, a pair of hydraulic rams mechanically interlocked for performing the same material handling function, first and second hydraulic fluid conduits alternately connectable at one end of each thereof to said source of hydraulic fluid and said reservoir, a hydraulic valve having three ports, means connecting the other end of said first conduit in parallel to the rod end of one of said hydraulic rams and to the first port of said valve, means connecting the other end of said second conduit in parallel to the head ends of both of said hydraulic rams and to the second port of said valve, means connecting the third port of said valve to the rod end of the other of said hydraulic rams, said hydraulic valve being formed so that in one operated position thereof said first port is blocked and said second and third ports are connected in free fluid communication and so that in a second operated position thereof, said second port is blocked and said first and third ports are connected in free fluid communication, means in said valve releasably maintaining said valve operated to said one operated position, fluid pressure responsive means formed in said valve and operating responsive to a fluid pressure at said first port above a certain predetermined amount for operating said valve to said second operated position, and second fluid pressure responsive means formed in said valve and operating responsive to hydraulic fluid pressures at said second and third ports less than said certain predetermined amount for operating and maintaining said valve in said second position.

11. In a tractor loader as claimed in claim 10 wherein a digging bucket is provided and pivotally carried from the forward end of said tractor, and wherein said pair of hydraulic rams are mechanically interconnected between said tractor and said bucket to dump said bucket responsive to retractions of said pair of hydraulic rams.

12. In a tractor loader having a source of constant volume hydraulic fluid under pressure and a reservoir, a pair of hydraulic rams mechanically interlocked for performing the same material handling function, first and second hydraulic fluid conduits alternately connectable at one end of each thereof to said source of hydraulic fluid and reservoir, a hydraulic valve having three ports, means connecting the other end of said first conduit in parallel to the rod end of one of said hydraulic rams and to the first port of said valve, means connecting the other end of said second conduit in parallel to the head ends of both of said hydraulic rams and to the second port of said valve, means connecting the third port of said valve to the end of the other of said hydraulic rams, said hydraulic valve comprising a valve bore having a valve spool slidably carried therein, said valve ports connected to said valve bore and said valve spool being formed so that in one position of said valve spool said first port is blocked and said second and third ports are connected in free fluid communication and so that in a second position of said valve spool, said second port is blocked and said first and third ports are connected in free fluid communication, a first coiled spring disposed within said valve bore and biasing said valve spool to said one position, adjustable check valve means connected between said three ports and said valve bore at the other end of said valve spool for admitting hydraulic fluid above certain pressures to said valve bore to move said valve spool to said second position.

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