United States Patent

[11] **3,568,707**

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[54] **QUICK DROP VALVE**
17 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **137/117,**
60/52, 91/436, 91/443
[51] **Int. Cl.** **F15b 11/08**
[50] **Field of Search** 60/52
(HE), 1.9—2.8 (HC) (Inquired); 91/436, 443
(Inquired); 137/115, 116, 117, 118, 119

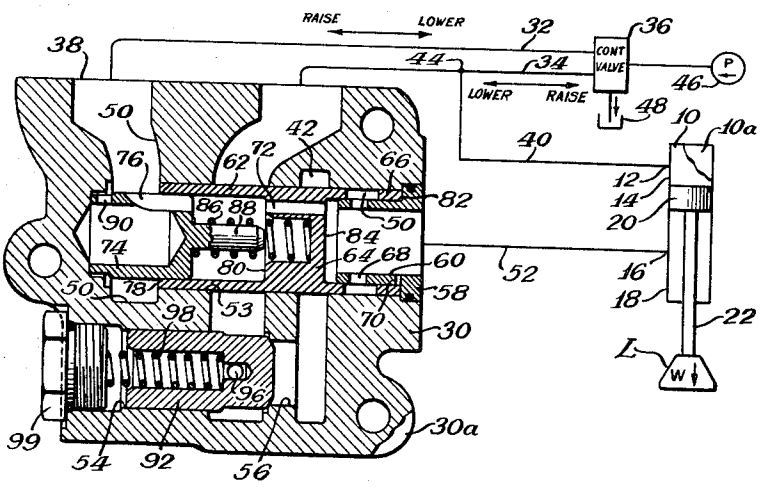
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ABSTRACT: Quick drop valve and circuit employing same for hydraulically positioning and supporting a dozer blade. The circuit includes a double acting positioning cylinder supporting the blade, a raise-lower valve connected to hoses which lead to the cylinder, and the quick drop valve which valve is interposed between the hoses and cylinder and which valve increases dropping speed of the blade by passing fluid between opposite ends of the cylinder in a direct path without the fluid passing through the control valve and cylinder hoses. The valve has a conventional check valve therein, and the only other movable valve part therein consists of a novel single valve sleeve.



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SHEET 1 OF 2

FIG. 1.

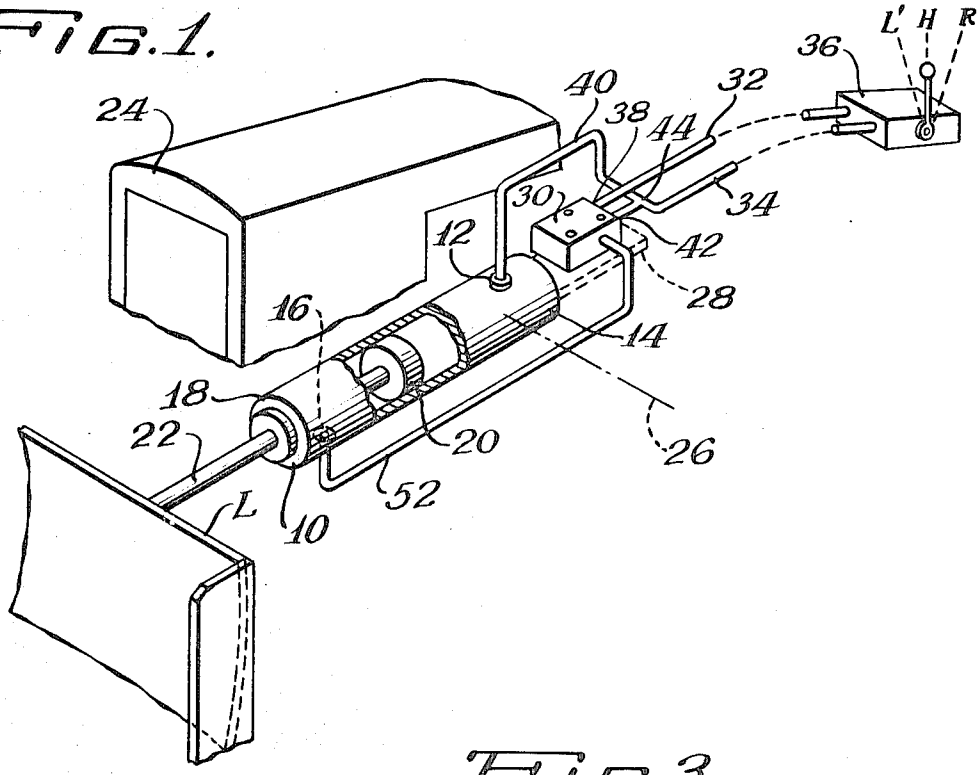
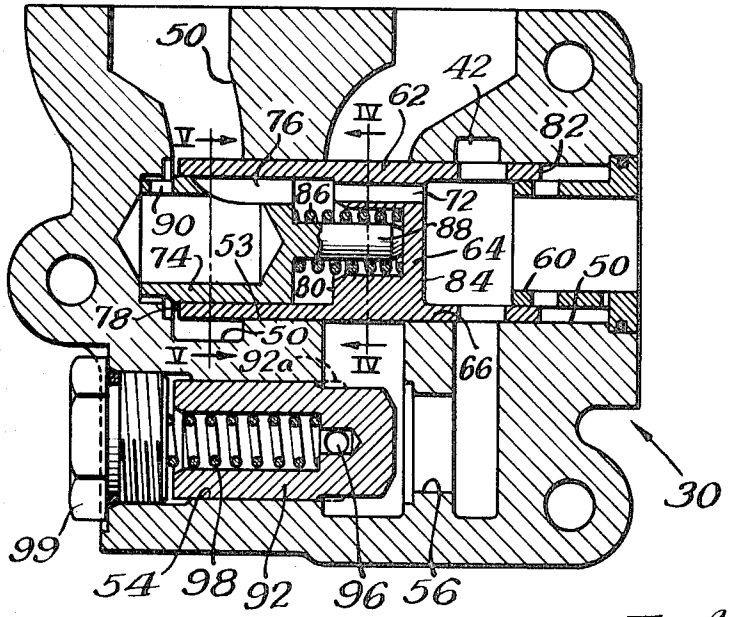


FIG. 3.



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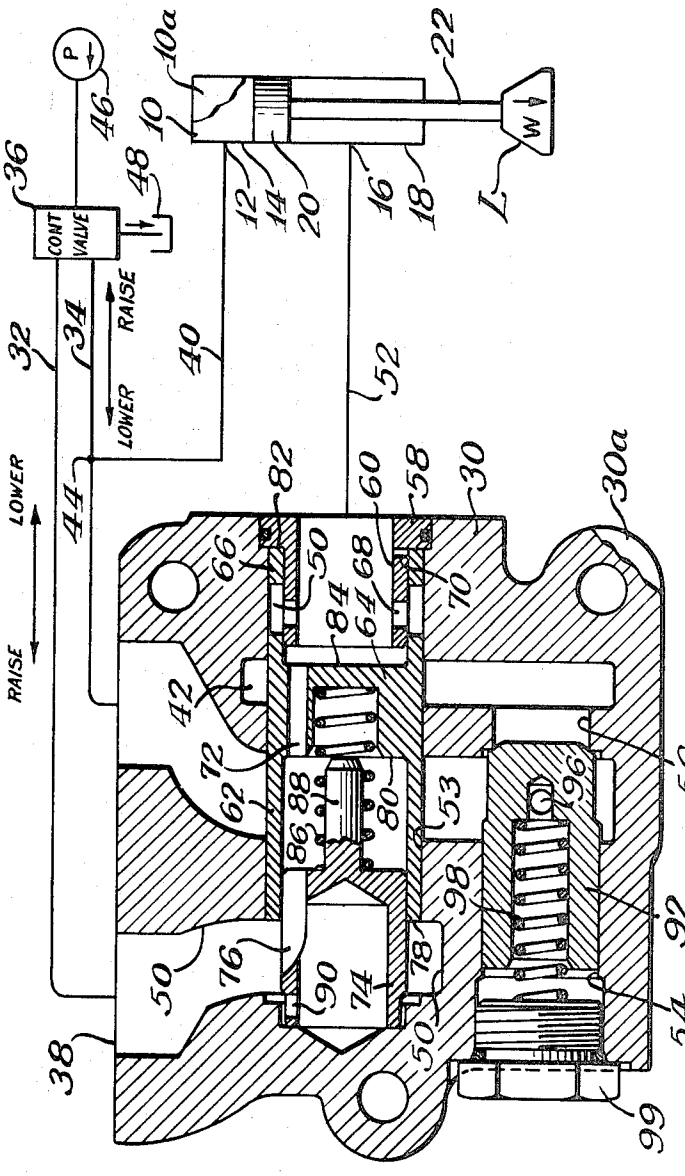


FIG. 2.

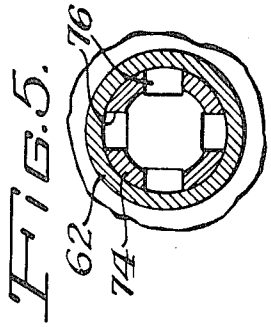


FIG. 5.

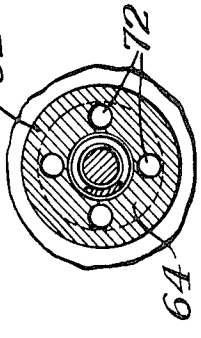


FIG. 4.

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QUICK DROP VALVE

This application relates to a working circuit for hydraulically positioning a bulldozer blade or the like, and more particularly to a raise-lower valve and a double-acting blade-connected cylinder in circuit therewith and together having interposed valve means affording quick dropping of the blade.

It is old in the art to employ interposed means in hydraulic circuits of the general type consideration for quickly dropping the blade. According to one practice in the past, a rather simple interposed means, if incorporated directly in the raise-lower valve, has afforded such quick dropping with low cavitation in the cylinder, but the practice has resulted in passing fluid always back through the raise-lower valve and the usually long lengths of connecting hoses in order to transfer such fluid between opposite ends of the cylinder. Hydraulic inefficiency has resulted.

According to another practice, the interposed means has been secured, altogether independently of the raise-lower valve, at a point directly on or adjacent the cylinder. But the function has been complicated, and it has therefore been the practice to complicate the independent valve with a number of separate moving valve elements or with high resistance pressure relief valve elements, or with valve elements both high in number and high in resistance internally of the independent valve. Hydraulic inefficiency has resulted.

The present invention reduces the aforesaid inefficiency and indirection of flow or complication of flow as the case may be, as will now be explained in detail. Various features, objects, and advantages are either specifically pointed out or will become apparent when, for a better understanding of my invention, reference is made to the following description, taken in conjunction with the accompanying drawings which show a preferred embodiment thereof and in which:

FIG. 1 is a fragmentary perspective view of a track-type bulldozer known as a hydraulically controlled dozer and embodying the present invention;

FIGS. 2 and 3 are longitudinal cross-sectional views through the quick drop valve of the invention, FIG. 2 showing the valve parts in one operating position of the valve in a schematically shown environment, and FIG. 3 showing the same valve parts shifted to another operating position; and

FIGS. 4 and 5 double-acting sectional views taken along the lines IV–IV and V–V of FIG. 3 to show the respective movable sleeve part and fixed plug part of one valve element in the quick drop valve.

In FIG. 1, a quick drop valve circuit is shown for use with a loaded, double-acting working cylinder 10, having a head inlet-outlet port connection 12 at the head end 14 of the cylinder and having a rod inlet-outlet port connection 16 at the lower or so-called rod end 18 of the cylinder 10. A piston 20 therein reciprocates under fluid pressure between opposite ends of the cylinder 10 and has a piston rod 22 connecting the piston to a load L which is positioned by and held by the rod 22.

In the example as actually illustrated in FIG 1, the circuit is shown employed by a so-called hydraulically controlled track-type tractor 24, and the load L on the cylinder 10 is at the front of the tractor and is constituted by a vertically movable bulldozer blade which is supported at the left by one lift cylinder, namely the cylinder 10, and supported at the right by an identical lift cylinder, not shown. The two lift cylinders are supported on universal mountings at the sides of the tractor 24 and swing up and down generally in individual vertical planes about a horizontal axis 26 so as to accommodate to raising and lowering movement of the blade load L. The weight of the load L establishes a generally downward dropping direction on the cylinders, thus tending to extend the lift cylinder 10 from its lifted or raised, foreshortened condition shown.

Mounted adjacent or else directly to the cylinder 10 on a head-end bracket 28 thereof, a quick drop valve 30 according to my invention is hydraulically interposed in the flexible service hoses 32 and 34 provided which lead from a raise-lower valve 36 to the cylinder 10. The raise-lower valve 36 and a first inlet-outlet port 38 on the quick drop valve 30 are directly interconnected by the hose 32.

By means of a rigid pipe conduit 40 connected to the head inlet-outlet port 12, the inlet-outlet port 12 and a bypass 42 in the valve 30 have a common T 44 by which they are jointly connected through the service hose 34 to the raise-lower valve 36.

The raise-lower valve 36 has a handle which the operator pivots from a generally upstanding hold position H, in which the valve blocks both hoses 32 and 34, either to a forwardly tilted lower position L′ or to a rearwardly tilted raise position R, all about a generally horizontal transverse axis (FIG. 1). The valve 36 connects the hose 32 to high pressure raising the blade when the valve is in the R position, and to low pressure to lower the blade when the valve is in the L′ position. The valve 36 connects the hose 34 to low pressure to raise the blade in R position of the valve, and to high pressure to lower the blade when the valve is in L′ position.

FIG. 2 shows the complete circuit. The raise-lower valve 36 selectively provides a source of high and low pressure, being connected to a pump 46 and an oil reservoir 48 which have a connection, not shown, by which the pump draws from the reservoir 48. The double-acting cylinder 10 and its referred to right double-acting cylinder indicated at 10 *a* have the valve 36 in common thereto and are identically connected therewith so as to raise and to lower in unison. An individual quick drop valve 30 is provided for the cylinder 10 and an individual quick drop valve 30*a* is provided for the cylinder 10*a*.

The body of the valve 30 is formed with two parallel blind bores having respective upper and lower positions as viewed in FIG. 2, the upper bore indicated at 53 being included in a first fluid path 50 of L-shape in the valve body. The inlet-outlet port 38 intercommunicates with the rod end 18 of the cylinder by way of the first path 50 in the valve and a rigid pipe conduit 52 leading to the rod inlet-outlet port 16 at the rod end 18.

The bypass 42 bypasses the first path and includes an open loop-shaped portion in the valve body intersected in a common port portion 56 by the lower blind bore which is indicated at 54. The rigid pipe conduit 52 which communicates with the fluid inside the rod end 18 is connected by means of a valve body fitting, not shown, to a sealed, fixed inner sleeve 58 in the valve body defining a mouth portion 60 common to the first path 50 and the first path bypass 42.

The upper bore 53 slidably receives a sleeve-type, unitary primary valve element 62 having an internal transverse wall 64 and constituting the primary movable valve member in the quick drop valve 30. A sidewise perforated sleeve part 66 integrally forming the right end of the valve element 62 as viewed in FIG. 2 is telescoped over the fixed inner sleeve 58.

The inner sleeve 58 and the first path 50 define a valve damping chamber for the valve element 62 as the integral perforated sleeve part 66 of the latter moves from a position first covering a set of posterior large ports 68 in the inner sleeve 58 and a position entirely covering an anterior small throttling port 70 in the sleeve 58.

The sleeve valve element 62 has large flow-receiving, small-pressure-dropping orifices 72 disposed four in a cylindrical ring (FIGS. 2, 3, and 4) in the internal transverse wall 64 and effective to create a pressure differential between opposite ends of the valve element 62 due to fluid flow in the first path 50.

A fixed inner plug 74 in the upper bore 53 has the sleeve valve element 62 telescoped thereover at the left end of the latter. The plug is formed with slots 76 disposed four in the cylindrical ring (FIGS. 2, 3, and 5) penetrating the side and end walls of the plug and providing first means in the first fluid path 50 directing ingoing flow of substantial amount to the rod end 18 for foreshortening the cylinder 10 to raise the load L.

The sleeve valve element 62 has positions intermediate two extreme positions, one extreme position comprising a closed disposition as shown in FIG. 2 with the integral perforated part 66 more fully telescoped over the fixed inner sleeve 58, and one extreme position comprising a closed disposition as shown in FIG. 3 with the left end of the sleeve more fully telescoped over the fixed inner plug 74.

Controlled by a spring and by pressure movable areas, the sleeve valve element 62 at the left end has a large diameter, ring-shaped pressure movable outer end area 78 and small diameter ring-shaped and circle-shaped pressure movable inner end areas 80. The integral perforated sleeve part 66 at the right end presents a large diameter, ring-shaped pressure movable outer end area 82 and, within the part 66, the transverse wall 64 presents a small diameter essentially circle-shaped pressure movable inner end area 84. The circle-shaped pressure movable inner end area 80 is inwardly recessed in the wall and receives a valve return spring 86 acting in compression between the transverse wall 64 and the fixed inner plug 74, and further receives a plug stop stud 88 which bottoms against the circle-shaped area 80 to stop movement of the sleeve valve element 62 in its valve closing direction (FIG. 3).

Manipulation of the load L by positioning of the raise-lower valve 36 is well known for all conditions of operation in this art. In the interests of brevity, only those conditions will now be described in which the quick drop valve 30 has a major or an unobvious effect on the operation.

RAISE

The compression-type return spring 86 makes the quick drop valve unit 30 accommodate to the raise condition of the cylinder 10 by the spring coils expanding and sliding the sleeve valve element 62 rightwardly into the extreme open position as shown in FIG. 2. The integral perforated sleeve part 66 of the valve element slows down to a smooth final movement due to the dashpot action of the damping chamber described and the small anterior throttling port 70 in the fixed inner sleeve 58.

Pressure fluid flows from the service hose 32 in the first path 50, directed by the slots 76 and by the large-flow-receiving orifices 72 which provide a large branch of flow through the pipe 52, thence through the rod inlet-outlet port 16 and into the rod end 18 of the cylinder. Simultaneously, fluid flows from the head end 14 in a path leading through the head inlet-outlet port 12, the pipe conduit 40 and the T 44, thence through the service hose 34 and the raise-lower valve 36 to the oil reservoir 48. The bypass 42 is at the time blocked by the sleeve valve element 62 and thus blocks off the bypass connected end of the T 44.

The cylinder 10 foreshortens, pivoting about its horizontal axis 26 (FIG. 1) toward a horizontal attitude and raising the load L.

QUICK DROP

When the valve 36 takes the lower position L' under attendant circumstances calling for a quick drop of the load L to the ground, flow through the first path 50 is in the reverse direction which is leftwardly in the common portion 60 as viewed in FIG. 3, and the sleeve valve element 62 is caused to take the closed position as shown in FIG. 3. In that position, the valve element 62 closes the first path 50 against any substantial reverse flow.

The closing is automatic because fluid flowing through the orifices 72 creates a pressure drop across the valve. An endwise force differential arises for the reason that the pressure on the large diameter and small diameter end areas 82 and 84 at the right end of the valve element exceeds the pressure on the large diameter end area 78 and the two small diameter end areas 80 at the left end of the valve element. The differential on opposed equal end areas causes movement foreshortening the compression return spring 86 and the valve element 62 assumes the extreme leftward or closed position described, completely covering the slots 76. Simultaneously, the sidewise perforated integral sleeve part 66 of the valve element opens the common portion 60 of the first path and directs the excess of outflow from the rod end 18. The outflow thus is directed sidewise into the bypass 42 as regenerative flow and in a path leading therefrom through the T 44, the pipe conduit 40, and thence through the head inlet-outlet port 12 into the head end 14 of the cylinder.

Overall, fluid flows in a path leading from the rod end 18, through the rod inlet-outlet port 16, the pipe conduit 52, the common portion 60 of the first path 50, the perforated integral valve sleeve part 66, thence through the first path bypass 42 to the T 44. At the T, the bypass flow or so-called regenerative flow joins with the flow from the service hose 34 for approximately supplementing same in a regenerative cycle to keep the head end 14 full of oil as the down-moving piston 20 recedes. That is to say for all practical purposes, the hydraulic pump 46 and valve capably prevent cavitation and they are required to supply only the fluid necessary to make up the difference of volume needed in the cylinder 10 because of piston rod displacement.

IMMEDIATE DOWN PRESSURE

The impact of the blade load L when quick dropped to the ground represents a change point at which pump pressure fluid will be required to cause further blade movement rather than weight of the blade load alone. The need for immediate and substantial hydraulic down pressure to force a power down movement on the blade is apparent.

Means is provided according to my invention to insure down pressure when the blade hits the ground. The wall of the inner plug 74 is ported with a small side orifice 90 forming a small branch in the first path 50 hydraulically parallel to the large branch (76 and 72) referred to. The orifice 90 continually bleeds off to the reservoir 48 in a minor portion of the outgoing flow from the rod end 18 so as to prevent the rod end pressure from substantially exceeding the head end pressure in the cylinder 10, and preferably allowing the head end pressure to approach or conceivable exceed the rod end pressure so that to a greater or lesser degree the full area of the piston 20 is effective to extend the cylinder when the sleeve valve element 62 occupies the closed position of FIG. 3.

In the situation just referred to, the pressure drop caused by the orifice 90 creates a pressure difference with the pressure on the valve outer end area 82 exceeding the pressure on the valve outer end area 78. A force differential which therefore results will retain the sleeve valve element 62 in the closed position as shown in FIG. 3.

SUSTAINED DOWN PRESSURE

Means is provided to sustain the down pressure in the event the resistance to the down-moving blade (soil condition) temporarily brings the piston 20 to a standstill.

Illustrative of such means is a cup-shaped check valve 92 which is slidably received in the lower blind bore 54 and which moves into the solid line position shown in FIG. 3 to accommodate bypassing the first path in the regenerative cycle. The check valve 92 has a spring chamber ported at 96 to prevent hydraulic lock and containing a compression return spring 98 seating on a fixed plug 99 in the bore. The return spring 98 accommodates bypassing by foreshortening. In the event down pressure fails to move the piston and flow temporarily ceases while the valve 30 is disposed in the unseated position as shown in FIG. 3, unwanted flow reversal is nevertheless prevented in the bypass 42 and the pump flowing being supplied through the T 44 (FIG. 2) cannot escape through the bypass 42. The reason is that the foreshortened check valve return spring 98 expands, forcing the check valve 92 into a closed seated position as shown by the dotted lines 92*a* in FIG. 3, thereby closing the common portion 56 of the lower bore 54 and the bypass 42.

However, in case residual pressure in present in the rod end 18, the side orifice 90 in the inner plug will continue to bleed down the pressure, without in turn bleeding off the pump supplied down pressure from the T 44 and reducing pressure in the head end 14 of the cylinder 10.

REGULAR DOWN PRESSURE

Regular down pressure for purposes of this discussion means down pressure not requiring the excess flow to set the valve element 62 or to sustain the valve element 62 in its

regenerative cycle position as shown in FIG. 3. Under such regular down pressure, fluid flows under pressure from the pump into the head end 14 behind the receding piston 20 to keep the volume filled, and the bypass 42 remains closed by the sleeve valve element 62. The check valve 92 is inoperative and remains seated as shown in FIG. 2, and the entire outgoing volume of fluid from the rod end 18 drains through the first branch (72 and 76) in the first path 50 to the oil reservoir 48. During low rates of flow, the sleeve valve element 62 remains in the solid line position as shown in FIG. 2 because the force differential from the pressure drop across the orifices 72 cannot overcome the opening force of the return spring 86. Hence, the full area of the piston 20 is effective to provide force downwardly, and the only hydraulic resistance encountered is offered in the rod end 18 by fluid substantially at drain pressure.

When the regular down pressure is slightly higher to produce higher rates of piston movement and higher flows, the sleeve valve element 62 shifts to a position slightly to the left of the solid line position as shown in FIG. 2 so that the reduced effective side opening area of the slots 76 at their end tends to increase the pressure drop cumulative to the drop across the orifices 72. Therefore, the valve element 62 stabilizes in an intermediate position wherein the force differential at opposite ends due to the series-combined pressure drops is balanced by the force of the return spring 86. Simultaneously, the perforated integral sleeve part 66 of the valve element will begin partially diverting flow sidewise into the bypass 42 to partially regenerate, and the check valve 92 unseats to accommodate the one-way flow through the common port portion 56.

It is apparent that the orifice 90 forming the small branch in the first path 50 functions at all times hydraulically in parallel with the large branch (76 and 72) in both directions of flow, under any circumstances when the large branch is at least partially unblocked. The flow bleedoff through the orifice 90 is comparatively insignificant in those circumstances, and on a volume basis can be ignored as a practical matter and as actually done in the description hereinabove. The orifice 90 is more so a pressure bleed down device.

In the fully open valve position as shown in FIG. 2, the outer pressure movable end area 82 on the integral sleeve part 66 of the valve element 62 engages a flange on the inner sleeve 58 to provide a stop.

The multifunction one-piece primary valve element 62 is thus seen to have: a sleeve part 66 for providing for diverting flow in the fluid path and thereby providing for increased flow from the rod end directly to the head end of the double-acting cylinder when the valve element 62 is actuated during partial or full regenerative flow; a transverse wall 84 providing orifices which alone create the necessary pressure drop for valve actuation; and means at the left end of the valve element 62 covering the inner plug and providing the necessary aid in diverting and preventing unwanted reverse flow. However, in contrast to one or more practices in the past, the primary valve element 62 does no metering because providing a metering function in the element 62 is not only unnecessary but hydraulically inefficient and undesirable.

Instead, the metering function in the valve 30 is provided solely by the small branch orifice 90, as and when the orifice acts alone under reverse flow conditions in the first path to bleed down pressure by metering some fluid from the rod end 18 and preventing excessive pressure buildup. The fact that the small branch orifice 90 offers comparatively high resistance to flow in the reverse direction, is no detriment to flow of in-going fluid in the first path to fill the rod end because flow in the in-going direction automatically allows the return spring 86 to open the large branch (76 and 72).

From the foregoing it can be seen that the raise-lower valve 36 in conjunction with the quick drop valve 30 according to my invention effectively functions to cause a double-acting differential cylinder to raise a load, to hold the load in a raised position, to lower or drop the load when the cylinder has it in a raised position under either slow control, or intermediate control providing partial regenerative action, or fast control in a full regenerative cycle, and to provide a power down action on the load so that immediate down pressure of pump pressure oil causes the load to move rather than the weight of the load along. The invention applies to a variety of earth-contacting loads exemplified by bulldozer blades or the like, including but no limited to bullgrader blades, loader buckets, and scraper bowls.

I claim:

1. In a quick drop valve circuit for use with a loaded working cylinder having a ported head end and a ported rod end, the weight of the load having a dropping direction tending to extend the cylinder from its raised, foreshortened condition, the improvement comprising:

a valve having a valve inlet-outlet port connected to a source of high and low pressure, and means intercommunicating said inlet-outlet port and the rod end of the cylinder including a conduit connection leading to the rod end of the cylinder and a first path in the valve connected between the valve inlet-outlet port and the conduit connection leading to the rod end;

a first path bypass which permits quick dropping of the load and with which the first path has a portion in common with the bypass, said bypass and a head inlet-outlet port on the head end of the cylinder being jointly connected to the source of high and low pressure;

first means in the first path directing in-going flow of substantial amount to the rod end for foreshortening the cylinder to raise the load;

unitary movable diverting valve means in the first path confronting the valve inlet-outlet port, said unitary diverting valve means cooperating in the first path with the first means to block reverse flow of any substantial amount outflowing from the rod end when quick dropping the load, and having an integral part in the common portion movable with the unitary diverting valve means to direct the excess of outflow through the bypass as regenerative flow passing through the head inlet-outlet port thence into the head end when quick dropping the load;

a permanently open orifice bleed in the first path independent of the unitary diverting valve means, and insuring limited in-going flow to the rod end from the valve inlet-outlet port when foreshortening the cylinder and limited reverse flow to the valve inlet-outlet port from the rod end when extending the cylinder from a foreshortened condition;

the regenerative flow through the bypass into the head end of the cylinder supplementing the flow thereto during a regenerative cycle; and

there being flow blocking check means in the first path bypass to prevent flow reversal near or during the regenerative cycle.

2. In a quick drop valve circuit for use with a loaded working cylinder having a ported head end and a ported rod end, the weight of the load having a dropping direction tending to extend the cylinder from its raised, foreshortened condition, the improvement comprising:

a valve having a valve inlet-outlet port connected to a source of high and low pressure, and means intercommunicating said inlet-outlet port and the rod end of the cylinder including a conduit connection leading to the rod end of the cylinder and a first path in the valve connected between the valve inlet-outlet port and the conduit connection leading to the rod end;

a first path bypass which permits quick dropping of the load and with which the first path has a portion in common with the bypass, said bypass and a head inlet-outlet port on the head end of the cylinder being jointly connected to the source of high and low pressure;

first means in the first path directing in-going flow of substantial amount to the rod end for foreshortening the cylinder to raise the load;

unitary movable diverting valve means in the first path confronting the valve inlet-outlet port, said unitary diverting valve means cooperating in the first path with the first means to block reverse flow of any substantial amount outflowing from the rod end when quick dropping the load, and having an integral part in the common portion movable with the unitary diverting valve means to direct the excess of outflow through the bypass as regenerative flow passing through the head inlet-outlet port thence into the head end when quick dropping the load;

the first means in the first path (**50**) defining therein parallel a large and small branches jointly carrying said in-going flow to the rod end to raise the load in the manner described; and

said small branch (**90**) being removed from the path of movement of and independent of the unitary movable diverting valve means, whereas said large branch (**76,72**) is disposed along the path of movement of the diverting valve means and is closed thereby in the first path to block reverse flow wherein of any substantial amount from the rod end when quick dropping the load in the manner described.

3. The invention of claim **2**, the unitary movable diverting valve means characterized by a unitary flow control valve element pressure movable in response to pressure a large-flow-receiving small-pressure-dropping orifice carried by the flow control valve element effective to create said pressure differential for the purposes described upon receiving reverse flow in any substantial amount.

4. The invention of claim **3**, characterized by:

the regenerative flow through the bypass into the head end of the cylinder supplementing the flow thereto during a regenerative cycle; and

there being flow blocking means in the first path bypass to prevent flow reversal near or during the regenerative cycle.

5. For use in interposition in an hydraulic working circuit in the individual connections between a load supporting double-acting differential cylinder having head and rod ends and a source of high and low pressure, the improvement of a three-port quick drop valve unit having:

a series connected first path of flow defined in the valve unit and an inlet-outlet port presented by the valve unit; said inlet-outlet port adapted for connection to the high and low pressure source;

a quick drop first path bypass with which the first path has a portion in common, said common portion comprising a rod port portion presented by the valve unit for connection to the rod end of the cylinder;

a head port in said bypass presented by the valve unit for connection jointly to the source of high and low pressure and to the head end of the cylinder;

first means in the first path for directing a substantial amount of in-going flow toward the rod end from the rod port portion of the valve unit to foreshorten the cylinder to raise the load;

unitary movable diverting valve means in the first path confronting the inlet-outlet port, said unitary diverting valve means cooperating in the first path with the first means to block flow of any substantial amount in the rod port portion attendant with quick dropping the load and the resulting outflowing from the rod end of the cylinder, and having an integral part in the common rod port portion movable with the unitary diverting valve means to direct the excess of outflow through the first path bypass as regenerative flow discharged by said rod port portion for quick dropping the load by supplementing the fill of the head end of the cylinder;

the first means in the first path defined in said valve unit comprising parallel large and small branches jointly carrying toward said rod port portion said in-going flow to the rod end to raise the load in the manner described; and

said small branch being removed from the path of movement of and independent of the unitary movable diverting valve means, whereas said large branch is disposed along the path of movement of the diverting valve means and is closed thereby in the first path to block reverse flow therein of any substantial amount from the rod port portion.

6. The invention of claim **5**, characterized by: flow blocking check means (**92**) in the first path bypass to prevent flow reversal near or during the regenerative cycle.

7. The invention of claim **6**, further characterized by:

said first means and said unitary movable diverting valve means in the first path constituting valve parts respectively fixed and movable and with portions mutually telescopically related; and

the small branch in the first means comprising an orifice in the latter remote to the area of relative telescoping and the large branch comprising slots in the relatively telescoping portion of the first means blocked and unblocked by the relatively telescoping portion of the unitary movable diverting valve means.

8. The invention of claim **7**, the unitary movable diverting valve means characterized by:

a unitary flow control valve element (**62**) pressure movable in response to pressure differential; and

a large-flow-receiving, small-pressure-dropping orifice (**72**) carried by the flow control valve element effective to create said pressure differential for the purposes described upon receiving reverse flow in any substantial amount.

9. The invention of claim **8**, further characterized by: said integral part of the unitary flow control valve element and the common rod port portion constituting valve parts respectively fixed and movable and with mutually telescopically related portions that divert excess flow to produce the regenerative flow described upon relative telescoping.

10. The invention of claim **8**, the valve unit characterized by:

upper and lower bores;

said upper bore (**53**) being including in the first path defined by said valve and, including therein said first means, said unitary flow control valve element and the integral part thereof, and the common rod port portion; and

the lower bore (**54**) intersecting the quick drop first path bypass and having one portion in common therewith, said flow blocking check means reciprocating in said lower bore to block and unblock the first path bypass by closing and opening the just said one common portion.

11. The invention of claim **10**, the upper and lower bores in the valve unit characterized by substantially parallel blind bores.

12. A quick drop valve housing comprising:

a bore;

a spaced-apart sleeve and plug therein;

an intervening unitary sleeve-type valve element in the bore;

the sleeve-type valve element at one end being mutually telescopically related with the plug in one end of the bore and having an integral sleeve part mutually telescopically related with the sleeve in another end of the bore to form a bypass path out of the bore;

said valve element being pressure movable into intermediate positions, and into extreme positions comprising a first extreme position more fully telescoped relative to the plug and less fully telescoped relative to the sleeve, and a second extreme position more fully telescoped relative to the sleeve and less fully telescoped relative to the plug;

means connected to the bore, forming side perforations in at least one of the sleeve and the sleeve part of the valve element and means connected to the bore, forming side openings in at least one of the plug and the valve element;

said mutual telescoping of the plug and the valve element

effecting closure of said side openings in the first position of the valve element and effecting opening of same in the second and intermediate positions thereof, said telescoping of the sleeve and sleeve part of the valve element effecting closure of said perforations in the second position of the valve element and effecting opening of same in the first and intermediate positions thereof for directing flow in the bypass path out of the bores; and

a large-flow-receiving small-pressure-dropping means carried by the sleeve-type pressure movable valve element, and connected to the bore and effective upon receiving flow in a direct path in the bore between the ends of the element to create a pressure drop for providing the pressure differential to move said pressure movable element.

13. The invention of claim 12, characterized by: bleed means (90) forming a permanently open side orifice in at least one of said plug and valve element in a location effectively remote to and uncontrolled by the relatively telescoping portions.

14. A quick drop valve housing comprising:

a bore;

a spaced-apart sleeve and plug therein;

an intervening unitary sleeve-type valve element in the bore;

the sleeve-type valve element at one end being telescopically related with the plug in one end of the bore, and having a perforated integral sleeve part, which part is telescopically related with the sleeve in another end of the bore and the perforations of which part are connected to the bore;

said valve element being pressure movable into intermediate positions, and into extreme positions comprising a first extreme position more fully telescoped relative to the plug and less fully telescoped relative to the sleeve, and a second extreme position more fully telescoped relative to the sleeve and less fully telescoped relative to the plug;

means connected to the bore forming side sleeve-type the plug covered by the valve element in the first position and uncovered thereby in the second and intermediate positions thereof, said sleeve and said perforated integral sleeve part of the valve element covering the perforations of the latter in said second position, and uncovering the perforations in the first and intermediate positions of the valve element; and

flow receiving orifice means carried by the sleeve type pressure movable valve element, and connected to the bore and effective upon receiving flow in a bore path between the ends of the element to create a pressure drop for providing pressure differential to move said pressure movable element.

15. The invention of claim 14, the valve unit characterized by:

said bore and another bore therein comprising respective upper and lower bores;

a first path, including the bore path through the upper bore (53);

a first path bypass intersected by the lower bore (54);

said sleeve (58) providing a portion common to the first path and first path bypass; and

one way valve means (92) controlling flow in a portion (56) common to the bypass and lower bore.

16. In a quick drop valve circuit for use with a loaded working cylinder having a ported head end and a ported rod end, the weight of the load having a dropping direction tending to extend the cylinder from its raised, foreshortened condition, the improvement comprising:

a valve having a valve inlet-outlet port connected to a source of high and low pressure, and means intercommunicating said inlet-outlet port and the rod end of the cylinder including a conduit connection leading to the rod end of the cylinder and a first path in the valve connected between the valve inlet-outlet port and the conduit connection leading to the rod end;

a first path bypass which permits quick dropping of the load and with which the first path has a portion in common with the bypass, a said bypass and a head inlet-outlet port on the head end of the cylinder being jointly connected to the source of high and low pressure;

first means in the first path directing in-going flow of substantial amount to the rod end for foreshortening the cylinder to raise the load;

a permanently open, pressure-dropping bleed confronting the inlet-outlet port; and

unitary pressure-differential-movable diverting valve means in the first path confronting the valve inlet-outlet port independently of the bleed, said unitary pressure differential movable diverting valve means cooperating in the first path with the first means to block, except for said bleed, the reverse flow of any substantial amount outflowing from the rod end when quick dropping the load, said unitary pressure differential movable diverting valve means having an integral part in common portion movable with the unitary pressure differential movable diverting valve means to direct the excess of outflow through the bypass as regenerative flow passing through the head inlet-outlet port thence into the head end when quick dropping the load, said unitary pressure-differential-movable diverting valve means having a large-flow-receiving, small-pressure-dropping restriction (72) carried thereby in a location in the first path downstream of the bypass, and effectively in said location creating the necessary moving differential for said unitary pressure differential movable diverting valve means.

17. For use in interposition in an hydraulic working circuit in the individual connections between a load supporting double-acting differential cylinder having head and rod ends and a source of high and low pressure, the improvement of a three-port quick drop valve unit having:

a series connected first path of flow defined in the valve unit and an inlet-outlet port presented by the valve unit, said inlet-outlet port adapted for connection to the source of high and low pressure;

a quick drop first path bypass with which the first path has a portion in common, said common portion comprising a rod port portion presented by the valve unit for connection to the rod end of the cylinder;

first means in the first path for directing a substantial amount of in-going flow toward the rod end from the rod port portion of the valve unit to foreshorten the cylinder to raise the load;

a permanently open, pressure-dropping bleed confronting the inlet-outlet port; and

unitary pressure-differential-movable diverting valve means in the first path confronting the inlet-outlet port independently of the bleed, said unitary pressure-differential-movable diverting valve means being pressure movable into cooperation in the first path with the first means to block, except for said bleed, the reverse flow of any substantial amount outflowing through the rod port portion attendant with quick dropping the load and the resulting outflowing from the rod end of the cylinder, said unitary pressure-differential-movable diverting valve means having an integral part in the common rod port portion movable with the unitary pressure-differential-movable diverting valve means to direct the excess of outflow through the first path bypass as regenerative flow discharged by said head port for quick dropping the load by supplementing the fill of the head end of the cylinder, said unitary pressure-differential-movable diverting valve means having a large-flow-receiving, small-pressure-dropping restriction (72) carried by thereby in a location in the first path downstream of the bypass and effectively in said location creating the necessary moving differential for said unitary pressure-differential-movable diverting valve means.