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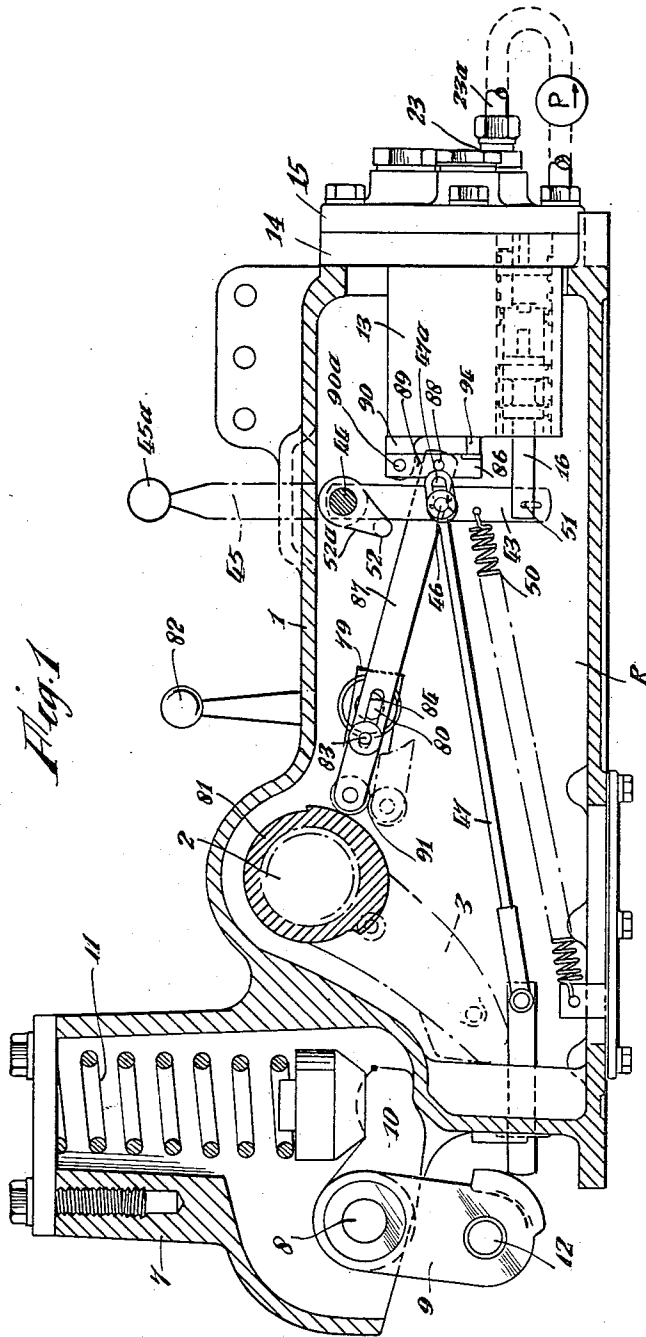
H. R. BENFORD

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HYDRAULIC CONTROLLED HITCH

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Inventor:
Harold R. Benford
Rene O. Pippel
Atty.

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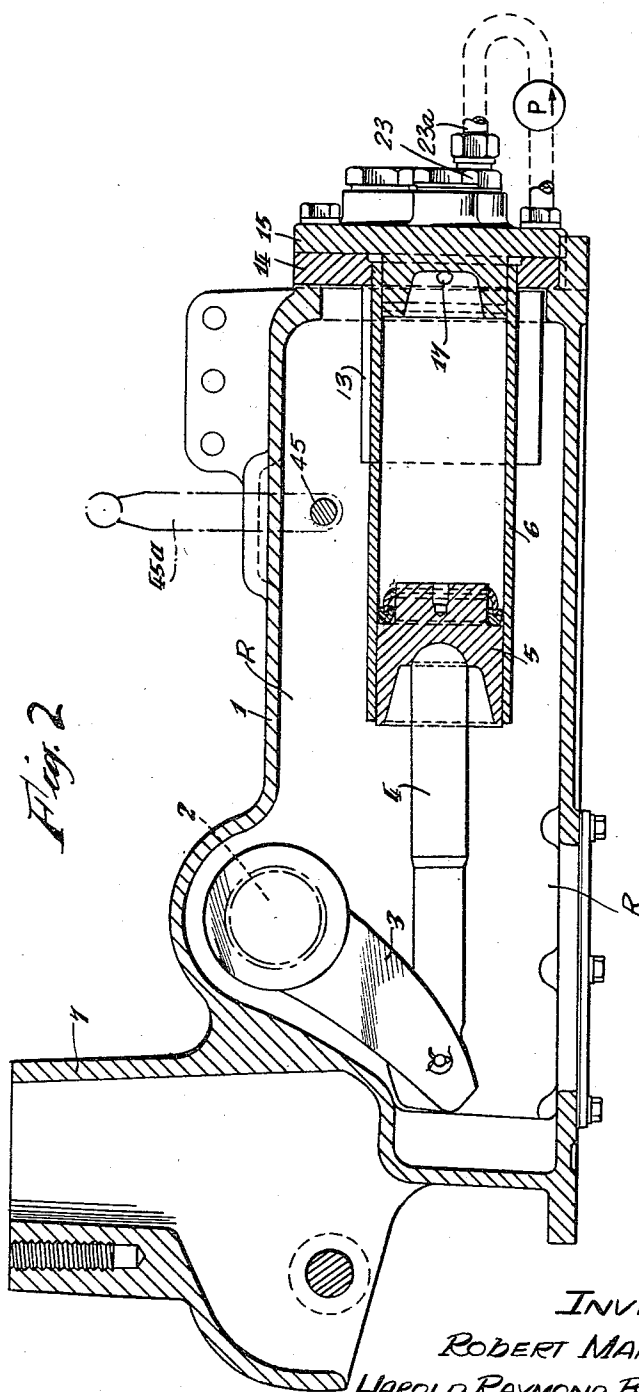
H. R. BENFORD

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INVENTORS
ROBERT MARINDIN
HAROLD RAYMOND BENFORD
Paul O. Pippel
ATTORNEY

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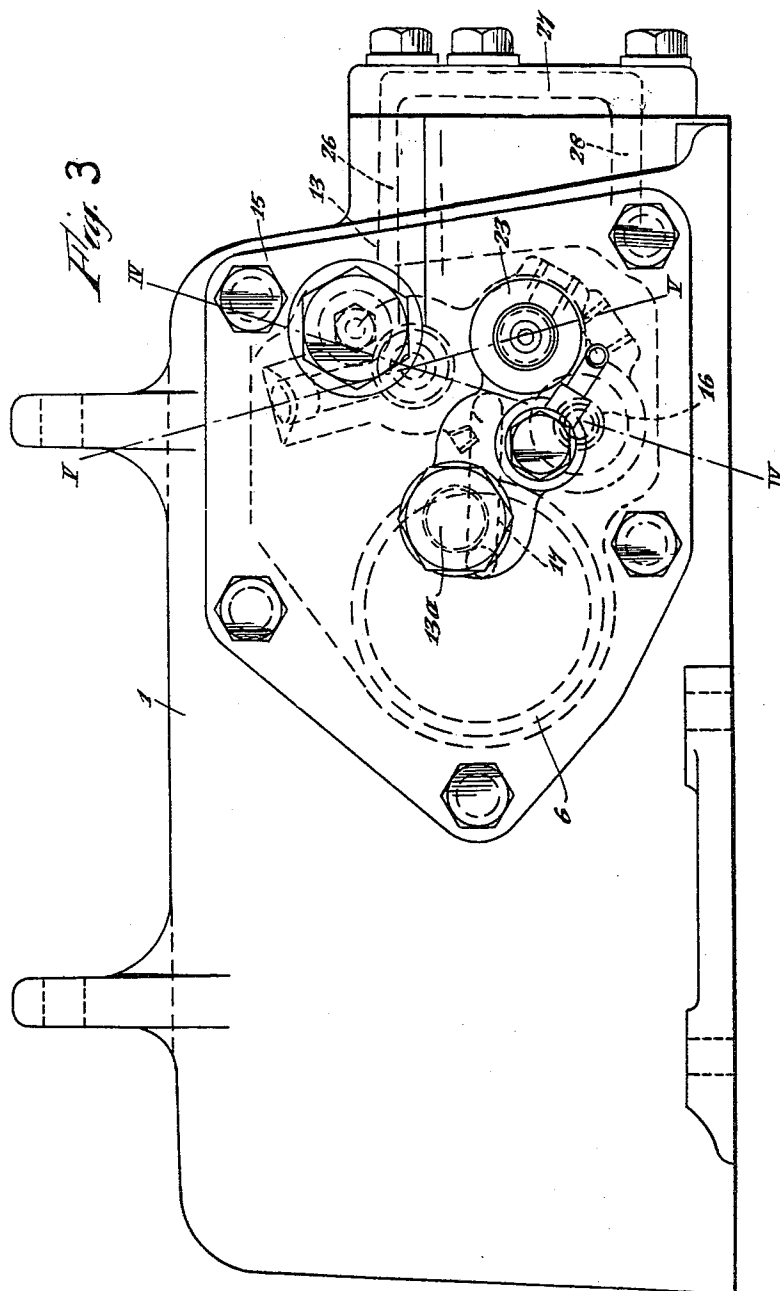
H. R. BENFORD

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INVENTORS
ROBERT MARINDIN
HAROLD RAYMOND BENFORD
Paul O. Pippel
ATTORNEY

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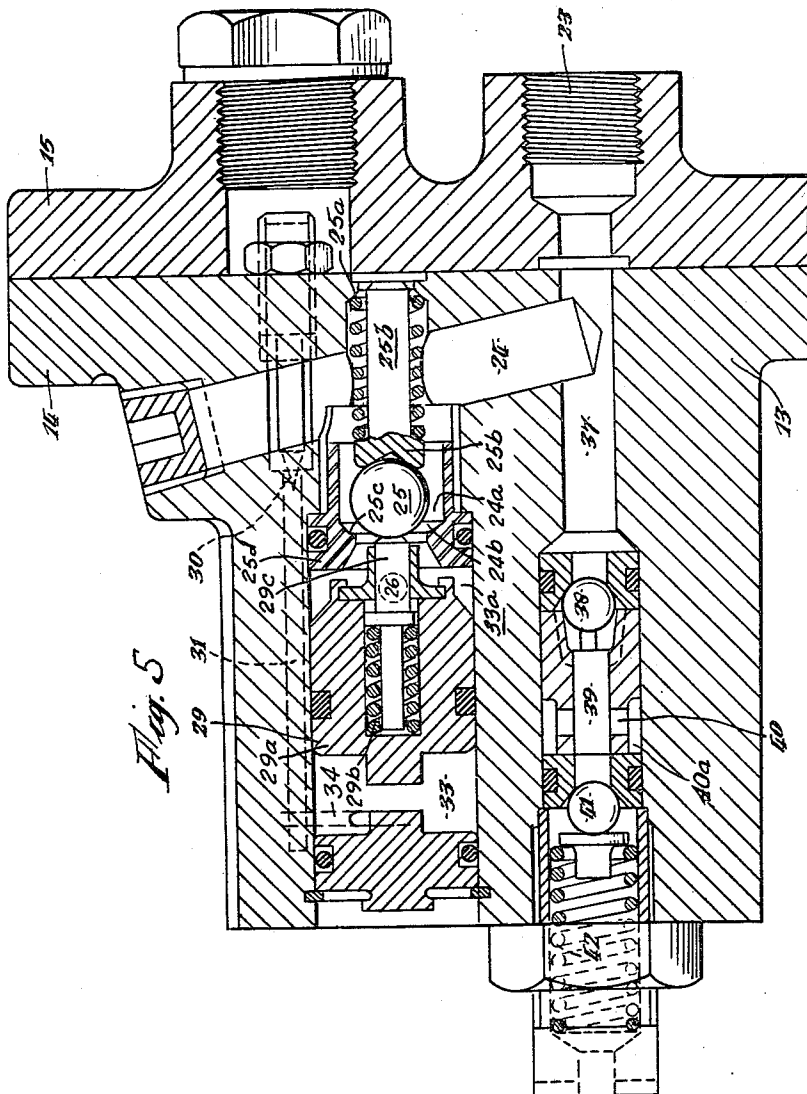
H. R. BENFORD

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INVENTORS
ROBERT MARINDIN
HAROLD RAYMOND BENFORD
Paul O. Pippel

ATTORNEY

1

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HYDRAULIC CONTROLLED HITCH

Harold R. Benford, Hexthorpe, Doncaster, England, assignor to International Harvester Company, Chicago, Ill., a corporation of New Jersey

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This invention relates to tractors employing implement-attaching linkage and in particular to a hydraulic power lift system for operating and controlling the implement-attaching linkage.

This is an improvement of hydraulic power lift systems as shown in U.S. Patent 3,014,536.

In all power lift systems wherein the implement-attaching linkage is supported at an elevated or transport position by the power lift, maintenance of the linkage at the selected position depends on the establishment of a hydraulic lock preventing any release of hydraulic fluid from the ram cylinder of the power lift. Any leakage of hydraulic fluid through the control valve means will result in gradual lowering of the linkage from the selected elevated position, with consequent danger of damage to an implement carried by the linkage. It is well-known that in power lift systems having alternative position control, the action of the cam in the position control arrangement will function to move the control valve means to the lifting position if the implement-attaching linkage falls below the selected position determined by the setting of the position control, thereby safeguarding against inadvertent lowering of the linkage due to leakage from the ram cylinder of the power lift.

The invention has for its object to provide improvements in the control valve means of the power lift system whereby the depth-limiting control may function to compensate for any leakage occurring in the control valve means.

FIG. 1 is a longitudinal section of a power lift system as described and embodying a depth-limiting control in conjunction with automatic draft control means; and

FIG. 2 is a detail section of the improved control valve means according to the invention for use in the power lift system shown in FIG. 1.

FIG. 3 is an end elevation corresponding to FIG. 1, but drawn to an enlarged scale;

FIG. 4 is a detail section of the control valve means on the line *iv-iv*, FIG. 3;

FIG. 5 is a detail section on the line *v-v*, FIG. 3.

In carrying the invention into effect according to one embodiment, and as illustrated in the accompanying diagrammatic drawings, the hydraulic power lift system of a tractor is housed in a casing 1 which supports a cross-shaft 2 provided with externally arranged lift arms (not shown) and an operating arm 3 connected to a rod 4 coacting with a piston 5 disposed in a ram cylinder 6 of the power lift. The casing 1 is provided at the rear end with a housing 7 supporting a transverse pivot 8 for a bell crank lever 9 having an upper forwardly extending arm 10 coacting with a vertically disposed draft load reaction spring 11 and adapted at the lower end of the forwardly extending arm for the pivotal connection at 12 of the top link of a three-point linkage.

The control valve means in the form of a unit 13 is formed integrally with an end plate 14 for the casing 1, which end plate 14 also carries the ram cylinder 6 held in position by a cap member 15. The valve unit 13 comprises a main control valve member 16 in the form of a plunger having axially spaced lands 16a, 16b. A passage 17 communicates between the ram cylinder and a passage 18 in the valve unit. When the valve member 16 is moved from the neutral position shown in the

2

drawings to the left for operating the power lift to lower an implement carried by the attaching linkage, the passage 18 is placed in communication with a space 20 by way of passages 101, 102, port 95 (when valve member 92 is in open position), 98, and 19, and thence through a port 21 with a passage 22 communicating with a reservoir within the casing 1.

Hydraulic fluid supplied from a continuously operating hydraulic pump P is delivered through a pipe 23a to an inlet connection 23 and thence through a passage 24 to a by-pass valve arrangement including a ball or other valve member 25 which is normally held off its seating so as to establish a low pressure by-pass condition for the hydraulic fluid delivered through the passage 24, the fluid passing out from the by-pass valve through a passage 26 and through passages 27, 28 for return to the reservoir.

The valve member 25 of the by-pass valve is normally held off its seating by a piston 29 maintained in the position shown in the drawings by pressure of fluid admitted from the passage 24 through an adjustable restriction 30 and passages 31, 32 to the cylinder space 33 behind the piston 29. The piston 29 consists of cylinder housing 29a containing a spring 29b and a plunger 29c which is urged by spring 29b outwardly of the housing 29a against ball valve 25 which is urged against the opposing spring loaded member 25b when fluid is trapped in space 33 permitting the main body of the fluid to bypass from passage 24 to chamber 24a, port 24b to chamber 33a and into passage 26 therein to passages 27 and 28 to the reservoir. A passage 34 also communicating with the space 33 leads to a port 35 controlled by the land 16a of the valve member 16 in such manner that, when the valve member 16 is moved from the neutral position shown to the right for operating the power lift to lift the implement, fluid can escape from the cylinder space 33 through the passage 34, port 35 and passage 36 to the reservoir. On release of pressure in the space 33 acting on the piston 29, the valve member 25 of the by-pass valve will be closed or seated against surfaces 25c of valve seat 25d by the action of a spring 25a, the piston 29 being correspondingly displaced to the left. On closing of the by-pass valve member 25, hydraulic fluid under pressure supplied through the connection 23 is diverted through a passage 37, non-return valve 38, passage 39 and port 40 through a passage 40a associated with port 101, the fluid under pressure flowing through passages 18 and 17 to the ram cylinder 6. A relief valve 41 loaded by means of a spring 42 limits the maximum pressure in the system.

The valve member 16 is operable through a lever 43, either by the manual control 45a for lifting or lowering, or by movement of the draft-responsive member, i.e. the bell crank lever 9, against the reaction spring 11, acting through a rod 47 connected to the lever 43 by a pin and slot connection 46, 47a. The lower end of the lever 43 is connected to the valve member 16 through a pin and slot connection 51. A lever member 52a rigidly connected to the crank 44 is provided with a projection 52 which coacts with the lever 43 when the shaft 45 is moved anti-clockwise by means of a manually controlled lever 45a. Any suitable friction means is provided for maintaining the control lever 45a in the position to which it is set against any force exerted by the draft control mechanism. The lost-motion provided by the slot 47a enables the lever 43 to swing about the axis of the crank 44 of the control shaft 45 against the action of the spring 50 to move the valve member 16 to the right whereby, in the manner described above, the by-pass valve member 25 is allowed to close and pressure fluid admitted to the ram cylinder for exerting lift.

3

A link 87 is pivoted at 88 to a lever 89 depending from, and pivoted at 90a to, a projection 90 on the control valve unit 13, and at the other end is provided with a roller 91 coacting with a cam, such as the cam 81, mounted on the power lift cross-shaft 2. The link 87 can be swung upwards or downwards about the pivot 88 by means comprising a crank 79 having a crank pin 83 engaging a slot 84 in the link, the crank being fixed to a shaft 80 operable by a control lever 82.

As shown in FIG. 4, the control valve unit 13 comprises an auxiliary piston valve member 92 which is normally urged towards the left by a spring 93 so that a projecting end portion 94 of the valve member 92 abuts the lower end 86 of the lever 89. A land 92a of the piston valve member 92 controls a port 95. Normally, when automatic draft control is in operation and the link 87 is in an inoperative position where it is swung down so that the roller 91 cannot be contacted by the cam 81, the piston valve member 92 is positioned by contact of the land 92a with a washer 96 held in place by a circlip 97, and the port 95 is open. The port 19 with which the land 16b of the main control valve member co-operates, is thus in communication with the port 95 through a passage 98, while the port 95 is in communication with the passage 18 through a passage 99 surrounding an intermediate reduced portion of the piston valve member 92, a port 100, passage 101 and passage 102.

Frictional positioning means is provided for the control lever 82.

The operation of the arrangement shown in the drawings is as follows: If the control lever 82 is moved anti-clockwise so that the link 87 is swung down to a lowermost position, the roller 91 cannot be contacted by the cam 81 and the automatic draft control mechanism will function under the control of the lever 45a. If, however, it is desired to operate with the implement at a selected depth, the control lever 82 is positioned so that when the control lever 45a is moved clockwise from its neutral position to lower the implement, the implement falls to a depth corresponding to the setting of the lever 82, the cam 81 contacting the roller 91 and moving the link 87 to the right to operate the auxiliary piston valve member 92 to shut off return flow of fluid from the ram cylinder through the port 19 which is uncovered by the piston member 16 when the lever 45a is set to lower. If the control lever 82 is then moved anti-clockwise, the implement will follow movement of the lever 82 and fall farther until the cam 81 again acts to move the auxiliary piston valve member 92 to shut off the port 95. Movement of the control lever 82 in the clockwise direction from the setting for the selected depth has no effect as regards lifting the implement, lifting and lowering of the implement being controlled by the lever 45a acting through the lever 43 on the main control valve member 16 in the manner before described. If the lever 45a is set at the point where lowering commences, a relatively light draft load will be sufficient to over-ride the depth-limiting control so that the valve member 16 is operated to raise the implement and thereby reduce the draft. Lifting of the implement from the depth determined by the setting of the control lever 82 causes the cam 81 to retract relatively to the roller 91 so that the auxiliary piston valve member 92 moves to open the port 95. Thus, when the draft is reduced sufficiently for the automatic draft control mechanism to operate in the reverse direction to move the main control valve member 16 to the implement-lowering position, the port 95, being open, permits return flow of fluid from the ram cylinder until the port 95 is again shut off by the action of the cam 81 when the implement reaches the depth determined by the setting of the control lever 82. If the control lever 45a is moved clockwise to the position corresponding to full depth setting when operating with automatic draft control, the draft necessary to cause the automatic draft control mechanism to over-ride the depth-limiting control

4

will be so great that over-riding will never occur. Between these two limits there is a wide range in which the amount of draft load necessary to cause the automatic draft control mechanism to over-ride the depth-limiting control is variable at will. The general effect of the arrangement is to enable an implement to be operated at a selected depth determined by the setting of the lever 82 and providing means whereby an increase in depth, together with an increase in draft will be prevented until conditions return to normal, whereupon the implement is returned to the selected depth setting.

By the arrangement described, one control lever, 82, is operable to bring the depth-limiting control into action for the selection of a predetermined working depth, while the other lever, 45a, controls lifting and lowering of the implement and also enables the automatic draft control mechanism to be brought into action, if desired, to over-ride the action of the depth-limiting control to a variable degree which can be selected at the will of the operator.

It will be appreciated that the maintenance of the implement-attaching linkage in the pre-selected position determined by the setting of the lever 82 normally depends on fluid-tightness of the land 92a of the valve member 92 in the bore constituted by the passage 99. However, due to manufacturing tolerances, the clearance between the land 92a and the passage 99 may be sufficient to allow hydraulic fluid to leak from the ram cylinder, and continued leakage at this point will allow the linkage to move downwards from the selected position. In order to safeguard against this possibility, the control valve means is provided with a circumferential groove in the land 92a of the valve member 92, the groove 104 communicating through a radial passage 105 and axial passage 106 discharging into the reservoir through a radial passage 107. An additional port 103 communicates through a passage 34 with the space 33 behind the piston 29 operating the bypass valve 25. The passage 34 also communicates with the port 35 through an annular groove 108. The groove 104 is so arranged in relation to the port 103 that if leakage occurs after the land 92a has shut off the port 95, the groove 104 will come into line with the port 103 and thus allow hydraulic fluid to escape from the space 33 by way of the passage 34, port 103 and passages 105, 106, 107. Relief of pressure in the space 33 allows the piston 29 to move back so that the by-pass valve 25 closes, and pressure fluid is then diverted from the passage 24 through the pressure-regulating valve 38 and passage 40a which communicates directly with the passage 101 and thence with the passage 18. Lifting will continue until the groove 104 is again displaced to the left sufficiently to close the port 103 communicating with the space 33. Build-up of pressure in the space 33 through the passage 31 then causes the piston 29 to open the by-pass valve 25 to restore the low pressure by-pass condition. Thus, an implement supported by the linkage will be held at the position set by the lever 82 irrespective of any leakage which may occur.

If the lever 82 is moved anti-clockwise the implement-attaching linkage will fall to a lower position provided that the main valve member 16 is in the lowering position with the land 16b uncovering the port 19. Lifting of the linkage is effected by moving the main valve member 16 to the lifting position in which the port 19 is closed and the port 35 opened. If the main valve member 16 is left at the lowering position, movement of the lever 82 clockwise in the normal manner will not result in lifting of the linkage. Lifting by use of the lever 82 can only be accomplished by moving the lever clockwise in small increments or at a rate corresponding to the lifting movement, so that the groove 104 is kept more or less in register with the port 103. This, however, would be impracticable and lifting of the linkage is therefore effected by the lever 45a operating on the main valve member 16.

It will be understood that the invention is not limited

5

to the particular embodiment hereinbefore described. For example, the control valve means may be constructed in any other suitable manner within the scope of the appended claims.

I claim:

1. In a device of the class described, an implement position control assembly including a draft responsive means and a hitch position control operator and hitch operating ram means connected with the operator and movable with the operator, a pump delivering fluid, a reservoir communicative with the pump, bypass means from the pump to the reservoir having an open position diverting fluid from the pump to the reservoir and a close position diverting the fluid to the ram means for movement of the ram means, conduit means operatively connected with the bypass means and having a predetermined pressure maintaining the bypass means in an open position, control valve means on the device operatively associated with the draft responsive means and ram means and operative of the ram means, means mounted on the device being provided with linkage disposed in movement reflection relationship between the operator and the control valve means, said control valve means comprising a passage means between the ram means and the reservoir and first and second interconnected valve means, said first valve means being operatively connected with the draft responsive means and said second valve means operatively engaging with said linkage and movable therewith in the passage means from a first to a second position and the passage means having fluid under a predetermined pressure between the second valve means and the ram means holding the ram means fixed in the first position of the second valve means, said second valve means having fluid discharge means to the reservoir selectively communicating with the conduit means and having flow control means in the first position of the second valve means operatively blocking communication of said conduit means with the fluid discharge means and communicating the pump with the reservoir by way of the bypass means and upon a loss of fluid in the passage means with consequential movement of the ram means and operator and the second valve means to the second position communicating the fluid discharge means with the conduit means reducing the pressure in the conduit means and communicating the pump with the ram means.

2. In a device of the class described, an implement position control assembly including a hitch position control operator and hitch operating ram means connected with the operator and movable with the operator, a pump

6

delivering fluid, a reservoir communicative with the pump, bypass means from the pump to the reservoir having an open position diverting fluid from the pump to the reservoir and a close position diverting the fluid to the ram means for movement of the ram means, conduit means operatively connected with the bypass means and having a predetermined pressure maintaining the bypass means in an open position, control means on the device operatively associated with the ram means and operative of the ram means, means mounted on the device being provided with linkage disposed in movement reflection relationship between the operator and the control means, said control means comprising a passage means between the ram means and the reservoir and valve means operatively engaging with said linkage and movable therewith in the passage means from a first to a second position and the passage means having fluid under a predetermined pressure between the valve means and the ram means holding the ram means fixed in the first position of the valve means, said valve means having fluid discharge means to the reservoir selectively communicating with the conduit means and having flow control means in the first position of the valve means operatively blocking communication of said conduit means with the fluid discharge means and communicating the pump with the reservoir by way of the bypass means and upon a loss of fluid in the passage means with consequential movement of the ram means and operator and the valve means to the second position communicating the fluid discharge means with the conduit means reducing the pressure in the conduit means and communicating the pump with the ram means.

3. The invention according to claim 2 and said linkage including a link having roller means at one end and engaging with the valve means at the other end, and said controlled operator comprising cam means having engagement with the roller means.

4. The invention according to claim 2 and said valve means comprising a valve member in the passage means, and the discharge means to reservoir comprising a passage in the valve member communicating with the conduit means in the second position of the valve means.

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