

[54] CONTROL MEANS FOR A SNOW PLOW

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[56] References Cited

UNITED STATES PATENTS

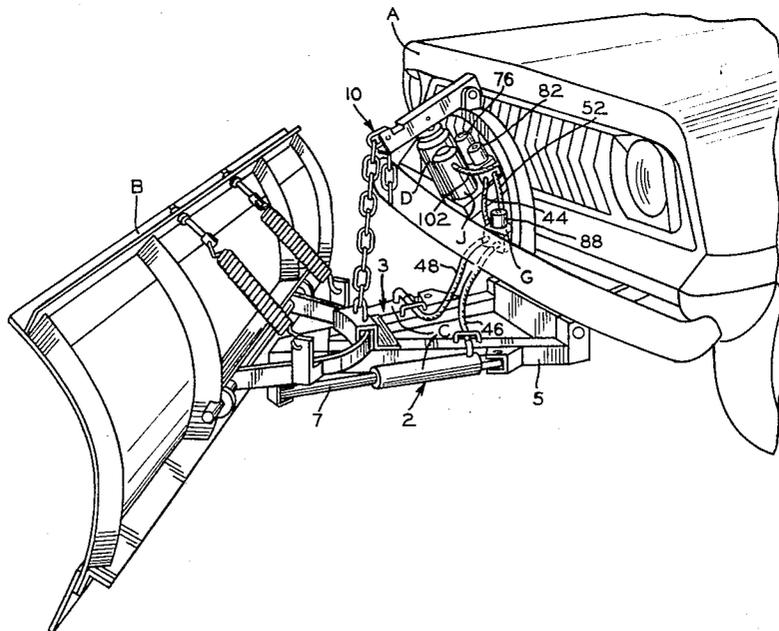
Table with 4 columns: Patent Number, Date, Inventor, and Reference Number. Rows include 3,587,750 (6/1971 Cantral), 3,201,878 (8/1965 Markwardt), and 3,307,275 (3/1967 Simi).

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[57] ABSTRACT

The disclosure shows ram means connected to control the angle of the snow plow to push snow straight ahead or to either side, and a single-acting ram connected to lift the plow. An electric motor-driven pump delivers oil through a check valve to a selector valve connected to the lift ram and to an angle control valve and operable to direct oil under pressure to either the lift ram or the angle control valve to the exclusion of the other. A plow-lowering valve connecting the lift ram and the tank is operable to permit oil flow from the lift ram to allow the plow to come down, or to block such flow. The angle control valve has two connections with the angling ram means, with the selector valve as aforesaid, and with the tank, the tank connection being through a check valve normally positioned to prevent flow from the angle control valve to the tank but when there is pressure in the conduit connecting the selector valve and the angle control valve, the check valve is inoperative and oil flows to the tank. The three valves are solenoid-operated, the controls therefor being at the operator's station.

9 Claims, 2 Drawing Figures



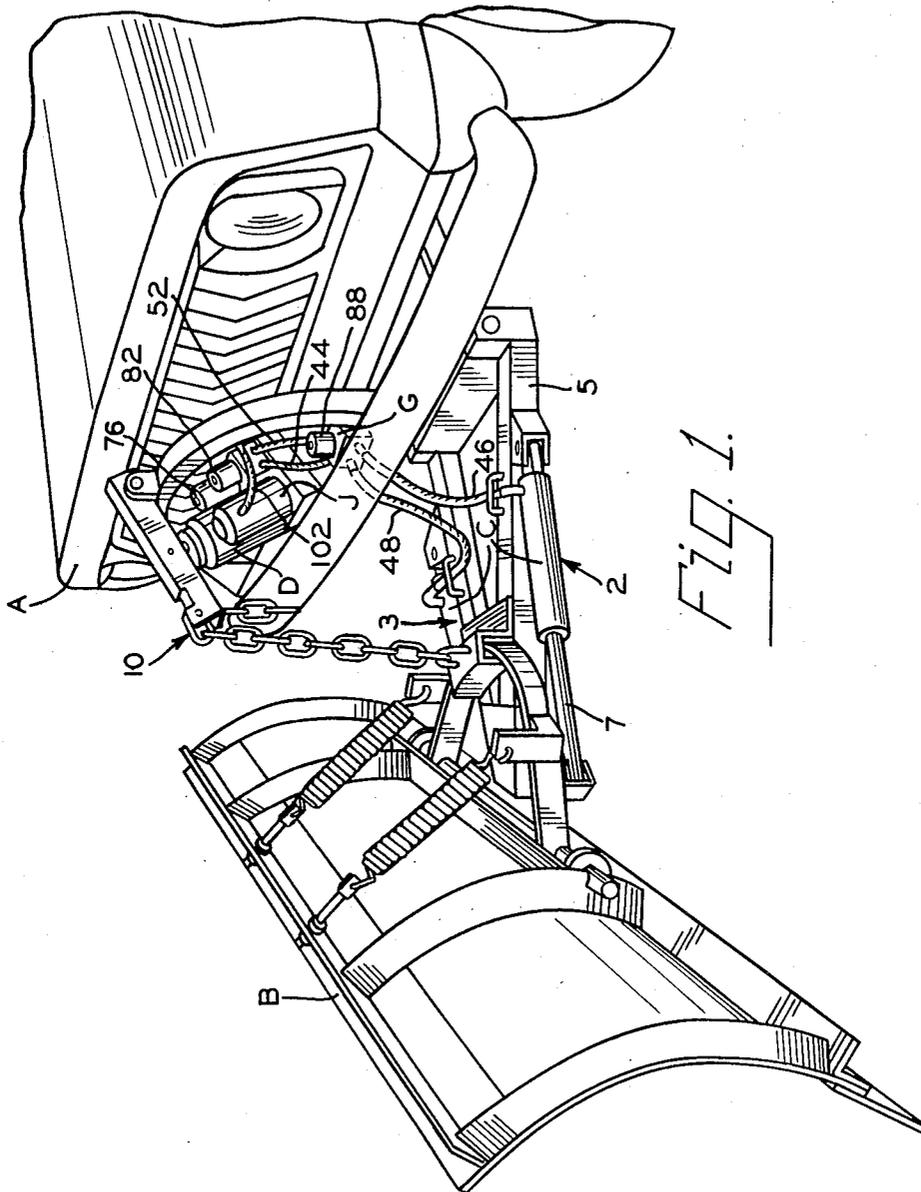
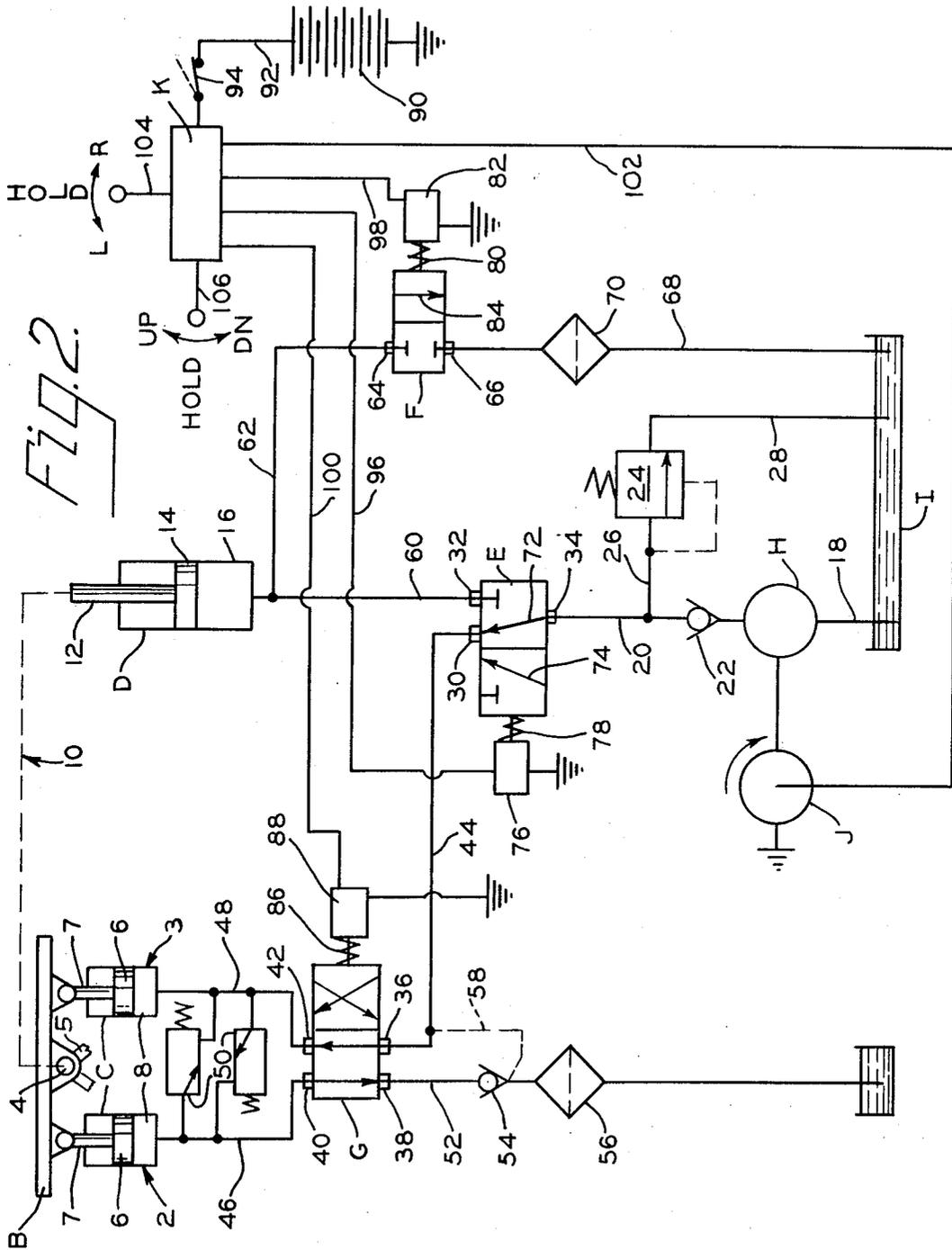


FIG. 1.

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## CONTROL MEANS FOR A SNOW PLOW

## BACKGROUND OF THE INVENTION

The field of the invention is snow plows for automotive vehicles and controls therefor, and more specifically, controls for snow plows mounted on passenger cars, trucks and the like.

Prior art devices concern themselves to a great extent with controls for commercial snow plows or snow removal equipment, which are much more sophisticated than is necessary for the average gas station attendant or farmer who needs much less expensive equipment and can do with a system that provides the minimum essential features of a control system. In smaller prior art snow removal equipment much of it is concerned with Bowden cable controls of the valves, which is unsatisfactory because of cable kinking, corrosion, binding, etc. in such devices.

## SUMMARY OF THE INVENTION

The invention relates to a simplified and inexpensive system for controlling a snow plow to be mounted on the front of a car, small truck, etc. Three small and inexpensive solenoid-operated valves are the center of the invention. One of the valves is a selector valve which determines whether oil under pressure will go to the single-acting ram to lift the plow or to the angle control valve to orient the plow to a position in which it would plow straight ahead or to one side or the other. The selector valve handles only oil under pressure directly from the pump. Conversely, the lowering valve handles only exhaust oil or oil under atmospheric pressure discharging from the single-acting ram as the plow comes down due to its weight. The angle control valve is a pressure-exhaust valve in that it handles oil flow in both directions, that is to say, into one connection of hydraulic ram means and out of another connection. A check valve between the angle control valve and the tank is normally positioned to prevent such flow to the tank but is provided with means, such as with a pilot pressure connection, so that pressure in the conduit connecting the selector valve with the angle control valve will release the check valve to permit flow from the hydraulic ram means to the tank. Each of the valves (selector, angle control, and plow-lowering) is a two-position valve, is spring biased into one position and solenoid-operated against the spring into its other operating position. The two check valves permit the system to be operated in such a way that the electric motor runs to drive the pump only when some plow adjustment requiring power is desired. At other times, the electric motor and the pump do not run.

It is accordingly an object of the invention to provide a simplified device for operating and controlling a snow plow which is adapted to be located on the front of an ordinary passenger automobile, or a utility vehicle such as a pick-up truck or the like and employs solenoid valves for at least the power angling function of the device.

It is another object of the invention to provide a snow plow for a vehicle wherein the controls for the plow are the bare essentials to accomplish a minimum of manipulation of the plow and to do it at a minimum of expense, the controls being electrical and the hydraulic valves being remote from the operator or driver of the vehicle. Other objects and advantages will be apparent to those skilled in the art.

## THE DRAWINGS

The invention may take physical form in certain parts and arrangements of parts, a preferred embodiment of which will be described in detail in this specification and illustrated in the accompanying drawings which form a part thereof and wherein:

FIG. 1 shows a portion of the front end of an automotive vehicle on which is mounted a snow plow provided with the preferred embodiment of the invention; and,

FIG. 2 provides a purely schematic showing of a snow plow adapted to be mounted on one end of a vehicle as in FIG. 1 and a schematic showing of a combined hydraulic and electrical system to control the snow plow.

## DESCRIPTION

Referring now to the drawings in detail wherein the showing is for the purpose of illustrating the preferred embodiment of the invention only and not for the purpose of limiting the same, the drawings show an automotive vehicle A on one end of which is mounted a snow plow B. Hydraulic ram means C may be connected in any suitable way to snow plow B for the purpose of angling the blade or plow to deflect snow to either side or to orient the plow for a straight-ahead push. A single-acting ram D is shown, in FIG. 1, as being connected to lift the blade or plow B. A plurality of valves are arranged and connected to enable a minimum of manipulation of the snow plow, the valves consisting of a selector valve E, a lowering valve F, and an angle control valve G. A pump H takes oil from a tank I and is driven by an electric motor J. Valves E, F, and G are solenoid operated, so the controls are electrical and are centered in a control box K, which also controls the operation of motor J. The control box is located in the cab of the vehicle for operation by the driver. Consequently, only electrical lines or conductors extend from the cab to the operating device.

## THE HYDRAULIC SYSTEM

Hydraulic ram means C can take one of a number of forms. For example, a double-acting ram can be provided or, as here shown, two individual single acting rams shown generally at 2 and 3 may be pivotally connected with plow B which is pivotally mounted at 4 on a frame 5. Each ram 2 and 3 has a piston 6 secured to a piston rod 7 and reciprocable in a cylinder 8. For vertical control of snow plow B, 10 indicates generally a connection between plow B and the piston rod 12 carrying a piston 14 slidable in cylinder 16 of the single-acting ram D.

Pump H takes oil from tank I by way of a fluid conduit 18 and discharges fluid under pressure to the selector valve E through a fluid conduit 20. A ball check valve 22 is provided in the fluid conduit for a reason that will be explained in detail below. A pressure relief valve of a suitable conventional type is shown at 24 having a connection 26 with the pressure fluid conduit 20 and a connection 28 with the tank I.

Selector valve E is a "pressure valve" in the sense that it passes only oil under pressure. The drawing is purely schematic, but it will be understood by those skilled in the art that pressure, or selector, valve E may be a conventional valve having a housing and a movable valve element in the housing. The housing of valve

E is provided with two pressure delivery connections 30 and 32 and a pressure-input connection 34.

Angle control valve G is similarly provided with a conventional housing and a conventional valve element movable in the housing. Such details are not indicated in the purely schematic showing in the drawing, but angle control valve G is shown as having two connections 36 and 38, connection 36 being a pressure-input connection and connection 38 being an exhaust connection to the tank. Valve G is further provided with two additional connections 40 and 42, which will be pressure or exhaust connections, depending upon the orientation of the movable valve element in the housing.

Pressure delivery connection 30 of the selector valve E is connected with pressure-input connection 36 of angle control valve G by a conduit 44. Connection 40 of valve G is connected with individual ram 2 of ram means C by a conduit 46, and connection 42 of valve G is connected with the other individual ram 3 of ram means C by a fluid conduit 48. Oppositely disposed pressure relief valves 50 are shown connected between the conduits 46 and 48 to insure that a relief valve will pop open to relieve excessive pressure in either line before a hose breaks.

A conduit 52 connects exhaust connection 38 of valve G with the tank through a check valve 54 and a filter 56. It will be noted from the drawing that check valve 54 is disposed in conduit 52 in such a way as to prevent the flow of oil from valve G to the tank. Check valve 54 is releasable and means are provided responsive to pressure in conduit 44 to render the valve ineffective and permit flow from valve G to the tank as long as pressure of a suitable minimum value exists in conduit 44. More specifically, check valve 54 has a pilot pressure connection 58 with conduit 44, so that as soon as the pressure in conduit 44 has reached a predetermined value, check valve 54 is rendered inoperative, such valves being conventional so that details thereof need not be disclosed here. Such a valve, as valve 54, is sold by Fluid Controls, Inc. of Mentor, Ohio and is identified as a "pilot check valve."

Referring again to selector valve E, it will be noted that pressure delivery connection 32 of valve E is connected by a conduit 60 with the pressure chamber of single-acting ram D. A conduit 62 is connected at one end with conduit 60 and thereby through a portion of conduit 60 with the pressure chamber end of ram D; the other end of conduit 62 is connected with a connection 64 of lowering valve F which has another connection 66 that goes to tank I by way of a conduit 68 wherein there is provided a filter 70.

Each of the valves E, F and G is of a type wherein the valve element movable in the housing has two operating positions and is biased into one of those positions by a spring, being actuatable into its other operating position by movement under an external force which overcomes the spring bias. Such valves are available in commerce from many suppliers of valves and the details need not be set forth here. It will suffice to point out that two flow passages 72 and 74 in the movable valve element of valve E permit connecting the input-connection 34 with either of the pressure delivery connections 30, 32. Suitable blocks or plugs in the valve are arranged to provide that the connection 30 or 32 which

is not connected with the input connection 34 is blocked so as to trap fluid in its connected conduit from movement through valve E. A solenoid 76 is shown at one end of valve E, and a spring 78 is shown as positioned to bias the movable element of valve E into the orientation shown in the drawing wherein input connection 34 is connected through passage 72 with delivery connection 30 while the delivery connection 32 is blocked against flow through the movable valve element. If now the solenoid 76 is energized to overcome the resistance of spring 78, then the movable valve element will be shifted so that passage 74 will communicate input connection 34 with delivery connection 32, in which orientation the delivery connection 30 will be blocked to prevent flow from conduit 44 through valve E.

In a similar manner, plow-lowering valve F may be referred to as an exhaust valve because the only fluid flowing through valve F is fluid at exhaust pressures. Exhaust valve F is biased into the position shown in the drawing by a spring 80 and is movable against the bias of that spring by a solenoid 82. When the movable valve element of valve F is in the position indicated in the drawing, flow through the valve is completely blocked. When solenoid 82 is energized to move the valve element to the left against the bias of spring 80, then passage 84 is in position to communicate connection 64 with connection 66 and permit flow from single-acting ram D to the tank by way of the upper portion of conduit 60, conduit 62, valve passage 84, and conduit 68.

Because angle control valve G allows fluid to flow from the pump to the ram means C and from the ram means C to the tank, it may be called, in a functional sense, a pressure-exhaust valve. The movable valve element of valve G is biased into the position shown in the drawing by a spring 86, and is shifted into its other operating position against the bias of spring 86 by a solenoid 88. With the shiftable valve element of valve G in the position shown in the drawing, conduit 44 is connected with conduit 48 and conduit 46 is connected with conduit 52. If the movable valve element of valve G is shifted into its other operating position by energization of solenoid 88, then the supply line or conduit 44 will be connected with conduit 46, and conduit 48 in that position will be connected with conduit 52.

#### THE ELECTRICAL SYSTEM

Reference is made above to solenoids 76, 82, and 88 connected to operate valves E, F, and G respectively, and also to electric motor J. Each of the solenoids and the electric motor is energized or powered by a conventional automobile storage battery 90 through aforesaid control box K; to that end, each of these electrical components has one grounded terminal, as shown. Battery 90 is connected with box K by a wire 92 wherein a switch 94 is disposed, switch 94 being conventionally operated by the so-called ignition key of a passenger automobile. Box K has wires 96, 98, 100, and 102 going to solenoids 76, 82, 88 and motor J, respectively.

Operating levers 104 and 106 on box K serve to control the electrical system and, in turn, the hydraulic system. Lever 104 has three positions, L (for left), R (for right) and Hold, while lever 106 has positions Up, Dn (for down) and Hold. Because lever 104 is actuatable

in a horizontal plane, and lever 106 is actuatable in a vertical plane, they can be combined and their functions performed by a single control lever.

The internal structure of box K need not be detailed here; it will suffice to list the system functions as follows:

#### LEVER 104 POSITIONS

In L, solenoids 76, 82 and 88 are deenergized, motor J is running.

In R, solenoids 76 and 82 are deenergized, solenoid 88 is energized, motor J is running.

In Hold, all three solenoids are deenergized, motor J is not running.

#### LEVER 106 POSITIONS

In Up, solenoid 76 is energized, solenoids 82 and 88 are deenergized, motor J is running.

In Dn, solenoid 82 is energized, solenoids 76 and 88 are deenergized, motor J is not running.

In Hold, all three solenoids are deenergized, motor J is not running.

#### OPERATION

Taking as a beginning the parts in the position shown in the drawing, if the electric motor J is not operating, then pump H is not delivering oil under pressure. Under those conditions, check valve 22 will be seated as shown in the drawing as will also check valve 54, because there will be no pressure in conduit 44. Accordingly, fluid will be trapped in the ram means C, holding the plow B in the position shown, and fluid will be trapped in single-acting ram D by the weight of the plow and by the fact that flow through valve F is blocked because of the position of the shiftable valve element in that valve. Of course there is no possibility of fluid flowing out of ram D by way of conduit 60 through valve E because flow through the connection 32 is blocked by the position of the shiftable valve element in valve E. Accordingly, the snow plow B will hold whatever elevation or vertical position it is in.

If it now be assumed that the operator wishes to lift the plow B, he moves lever 106 to Up so as to energize solenoid 76, shifting the valve element of valve E so as to communicate conduit 20 with conduit 60. With motor J and pump H running, fluid will then be delivered to the pressure chamber of single-acting ram D, with conduit 62 blocked by the position of the shiftable valve element of valve F. Accordingly, fluid under pressure will be admitted to the single-acting ram D, and the blade or plow B will be lifted until the operator decides to stop the lifting motion or until the end of the stroke is reached. The operator can stop the motion before the end of the stroke is reached by moving lever 106 to Hold, thus turning off electric motor J and deenergizing solenoid 76, whereupon the system locks up and traps fluid in ram means C and in ram D. If the operator then desires to lower the snow plow B, he can do so by moving lever 106 to Dn to energize solenoid 82, shifting the shiftable element of valve F so that passage 84 communicates the two connections 64 and 66, whereupon oil will discharge from the single-acting ram D because of the weight of the snow plow. It may be noted that the pump H need not run in order to lower the plow by means of the valve F.

If the operator now wishes to change the attitude of the plow B relative to the normal straight ahead movement of vehicle A, he moves lever 104 to L to deenergize all three solenoids, permitting spring 78 to move the shiftable valve element of valve E into the position shown in the drawing. In that position, pressure conduit 20 is connected with conduit 44 through passage 72 in valve E. Pressure conduit 44 is then connected with conduit 48 through the appropriate passage in valve G, so that individual ram 3 of ram means C is exposed to fluid pressure, moving its piston 6 up as seen in FIG. 2. Meanwhile, the pressure in conduit 44 communicates through the pilot pressure conduit 58 with the check valve 54, lifting the ball off the seat so that the individual ram 2 of ram means C may be connected to the tank by way of conduit 46, valve G, conduit 52, and the now-open check valve 54. Piston 6 of ram 2 moves down as seen in FIG. 2. The operator stops angling movement by moving lever 104 to Hold, shutting off the electric motor J. If he now wishes to angle the blade or plow B to the right, he moves lever 104 to R, energizing solenoid 88 to shift the movable element of valve G against the bias of spring 86, whereupon conduit 44 will be connected with the individual ram 2 of ram means C by way of conduit 46, and individual ram 3 of ram means C will be connected with the tank by way of conduit 48, valve G and conduit 52, the check valve 54 again being opened up because of the pilot pressure connection 58 and the pressure in conduit 44. With motor J running, piston 6 of ram 2 moves up and piston 6 of ram 3 moves down. The operator arrests the angling movement by moving lever 104 to Hold, shutting off the electric motor J, whereupon the check valves 22 and 54 will seat to trap fluid in the rams 2 and 3 and ram D and to hold the plow B in the position it occupies at that time.

If only a lifting function is to be performed, the lines 44, 52 and conductor 100 are removed and valve E is set in a position with line 20 connected with line 60. Operation of motor J raises the blade B and shifting of valve F by solenoid 82 allows the blade to drop due to its weight.

The invention has been described with reference to the preferred embodiment. Obvious modifications and alterations will occur to others upon the reading and understanding of this specification. It is my intention to include all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalence thereof.

What is claimed is:

1. A device for controlling the position of a plow blade of the type hydraulically lifted and lowered by gravity, said blade being attached to and driven by a vehicle having a front, said device comprising:
  - a. a first cylinder secured onto said vehicle;
  - b. ram means in said first cylinder and connected to said blade for raising said blade when pressurized liquid is introduced into said first cylinder to move said ram means from said cylinder;
  - c. a supply of liquid;
  - d. a pump means having an inlet communicated with said supply and an outlet for pressurized liquid;
  - e. means adjacent the front of the vehicle for driving said pump means;
  - f. a first conduit connecting said outlet and said first cylinder;

- g. first valve means in said first conduit and having a first position connecting said outlet with said first cylinder and a second position blocking communication of said outlet and said first cylinder;
- h. a second conduit communicating said first cylinder with said supply;
- i. second valve means in said second conduit and having a first position with said first cylinder communicated with said supply and a second position blocking communication between said first cylinder and said supply;
- j. a pressure relief means in said first conduit and between said first valve means and said outlet for allowing flow to said supply when pressure in said first conduit exceeds a given value;
- k. a control means located remote from said first and second valve means for controlling said first and second valve means, said control means including:
- i. a first electrical solenoid means secured adjacent to said first valve for selectively moving said first valve means between said first and second positions of said first valve means;
  - ii. a second electrical solenoid means secured adjacent to said second valve for selectively moving said second valve means between said first and second positions of said second valve means;
  - iii. manually operated means located remote from said vehicle front for controlling said first and second electrical solenoid means;
  - iv. said manually operated means having first and second selectable conditions;
  - v. first control means for causing said first electrical solenoid means to shift said first valve means into said first position of said first valve means when said manually operated means is in said first condition;
  - vi. second control means for causing said second electrical solenoid means to shift said second valve means into said second position when said manually operated means is in said first condition whereby operation of said pump means causes movement of said ram from said first cylinder and raising of said blade; and,
  - vii. third control means for causing said second electrical solenoid means to shift said second valve means into said first position of said second valve means when said manually operated means is in said second condition whereby the weight of said blade can force said ram into said first cylinder and allow lowering of said blade; and,
- l. said cylinder, ram means, pump means, first electrical solenoid means and second electrical solenoid means being joined as a unit and secured adjacent said front of said vehicle.
2. A device as defined in claim 1 wherein said manually operated means includes a lever movable between a first position and a second position, said first position of said lever corresponding to said first condition and said second position of said lever corresponding to said second condition.
3. A device as defined in claim 1 including angling means for changing the angular disposition of said blade with respect to said vehicle, said angling means includes:

- a. second cylinder means spaced from said unit for receiving pressurized liquid;
  - b. third cylinder means spaced from said unit for receiving pressurized liquid;
  - c. ram means operable by liquid in said second and third cylinder means for changing the position of said blade in a first direction when liquid is forced into said second cylinder means and for changing the position of said blade in a second direction when liquid is forced into said third cylinder means;
  - d. a third conduit communicated with said outlet;
  - e. a fourth conduit communicated with a sump for liquid;
  - f. third valve means having a first position with said third conduit connected to said second cylinder means and said fourth conduit connected to said third cylinder means and a second position with said third conduit connected to said third cylinder means and said fourth conduit connected to said second cylinder means.
4. A device as defined in claim 3 including a third electrical solenoid means for selectively shifting said third valve means between said first and second positions of said third valve means.
5. A device as defined in claim 4 wherein said third electrical solenoid means is joined onto said unit.
6. A device as defined in claim 4 including a fourth valve means for selectively connecting said third conduit to said outlet and fifth valve means in said fourth conduit and having a first position allowing flow through said fourth conduit and a second position blocking flow through said fourth conduit and means responsive to pressure in said third conduit for shifting said fifth valve means into said first position and means for causing said fifth valve means normally to assume said second position.
7. A device as defined in claim 3 including a fourth valve means for selectively connecting said third conduit to said outlet and fifth valve means in said fourth conduit and having a first position allowing flow through said fourth conduit and a second position blocking flow through said fourth conduit and means responsive to pressure in said third conduit for shifting said fifth valve means into said first position and means for causing said fifth valve means normally to assume said second position.
8. A device for changing the angular position of a plow blade with respect to a vehicle on the front of which the blade is mounted, said device comprising:
- a. first cylinder means for receiving pressurized liquid;
  - b. second cylinder means for receiving pressurized liquid;
  - c. ram means operable by liquid in said first and second cylinder means for changing the position of said blade in a first direction when liquid is forced into said first cylinder means and for changing the position of said blade in a second direction when liquid is forced into said second cylinder means;
  - d. a supply of liquid;
  - e. an externally mounted pump means secured to the front of said vehicle having an inlet connected to said supply and an outlet for pressurized liquid;
  - f. a first conduit connected with said outlet;
  - g. a second conduit connected to a sump for liquid;

- h. first valve means having a first position with said first conduit connected to said first cylinder means and said second conduit connected to said second cylinder means and a second position with said first conduit connected to said second cylinder means and said second conduit connected to said first cylinder means; 5
  - i. an electrical solenoid means for selectively shifting said first valve means between said first and second positions; and, 10
  - j. a second valve means for selectively connecting said first conduit to said outlet of said pump and third valve means in said second conduit and having a first position allowing flow through said second conduit and a second position blocking flow through said second conduit and means responsive to pressure in said first conduit for shifting said third valve means into said first position and means for causing said third valve means normally to assume said second position. 15
9. A device for controlling the position of a plow blade of the type hydraulically lifted and lowered by gravity, said blade being attached to and driven by a vehicle having a front, said device comprising: 25
- a. a first cylinder secured onto said vehicle;
  - b. ram means in said first cylinder and connected to said blade for raising said blade when pressurized liquid is introduced into said first cylinder to move said ram means from said cylinder; 30
  - c. a supply of liquid;
  - d. a pump means having an inlet communicated with said supply and an outlet for pressurized liquid;
  - e. means for driving said pump means;
  - f. a first conduit connecting said outlet and said first cylinder; 35
  - g. first valve means in said first conduit and having a first position connecting said outlet with said first cylinder and a second position blocking communication of said outlet and said first cylinder; 40
  - h. a second conduit communicating said first cylinder with said supply;
  - i. second valve means in said second conduit and having a first position with said first cylinder com-

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- municated with said supply and a second position blocking communication between said first cylinder and said supply;
- j. a control means for controlling said first and second valve means, said control means including:
  - i. a first electrical solenoid means secured adjacent to said first valve for selectively moving said first valve means between said first and second positions of said first valve means;
  - ii. a second electrical solenoid means secured adjacent to said second valve for selectively moving said second valve means between said first and second positions of said second valve means;
  - iii. manually operated means located remote from said vehicle front for controlling said first and second electrical solenoid means;
  - iv. said manually operated means having first and second selectable conditions;
  - v. first control means for causing said first electrical solenoid means to shift said first valve means into said first position of said first valve means when said manually operated means is in said first condition;
  - vi. second control means for causing said second electrical solenoid means to shift said second valve means into said second position when said manually operated means is in said first condition whereby operation of said pump means causes movement of said ram from said first cylinder and raising of said blade; and,
  - vii. third control means for causing said second electrical solenoid means to shift said second valve means into said first position of said second valve means when said manually operated means is in said second condition whereby the weight of said blade can force said ram into said first cylinder and allow lowering of said blade; and
- k. at least said cylinder, ram means, pump means, and second electrical solenoid means being joined as a unit and secured adjacent said front of said vehicle.

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