Nov. 29, 1932. J. B. WOODBURY ET AL 1,889,269

POWER SNOWPLOW

Filed Dec. 28, 1929 3 Sheets-Sheet 1

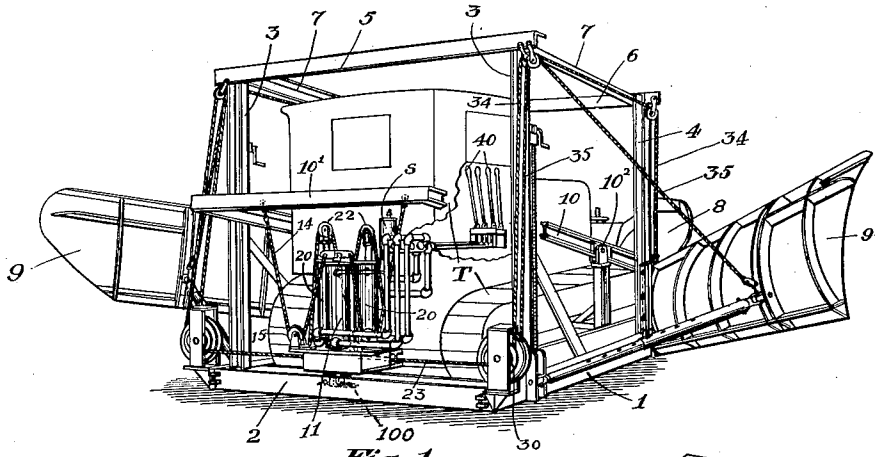


Fig. 1

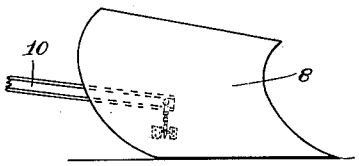


Fig. 2

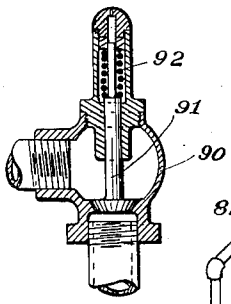


Fig. 4

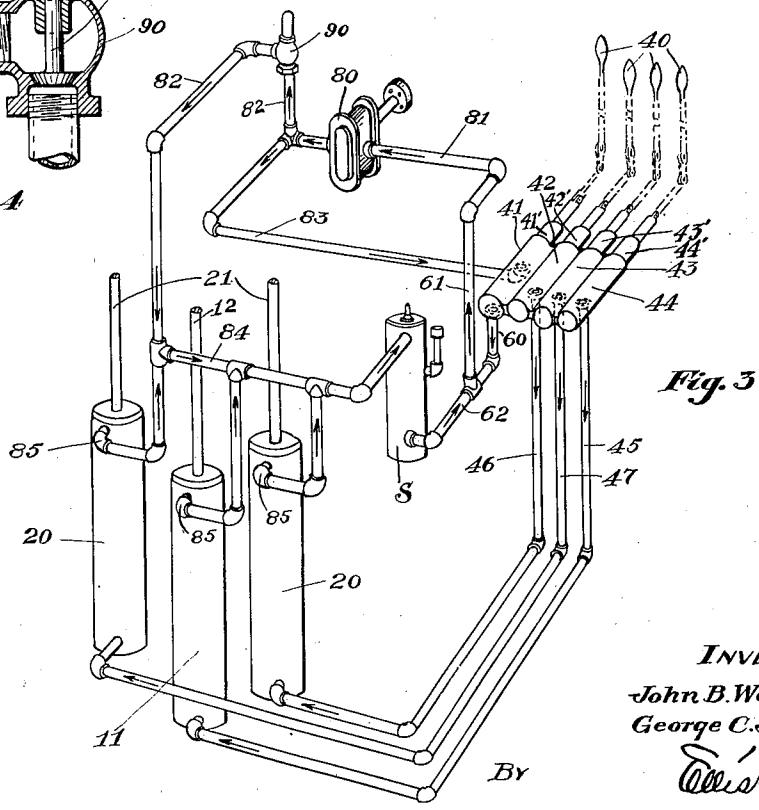


Fig. 3

INVENTORS.
John B. Woodbury.
George C. Soule.
By Ellis Spear Jr.
Attorney.

Nov. 29, 1932. J. B. WOODBURY ET AL 1,889,269

POWER SNOWPLOW

Filed Dec. 28, 1929 3 Sheets-Sheet 2

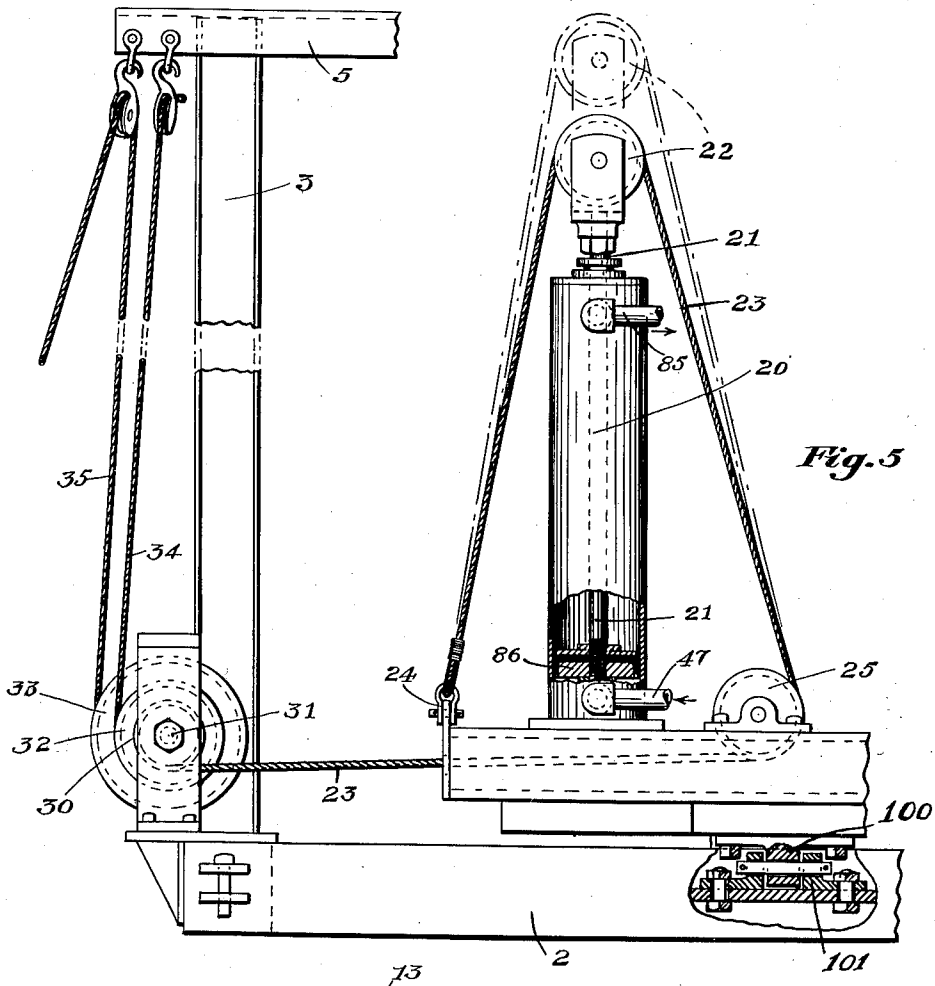


Fig. 5

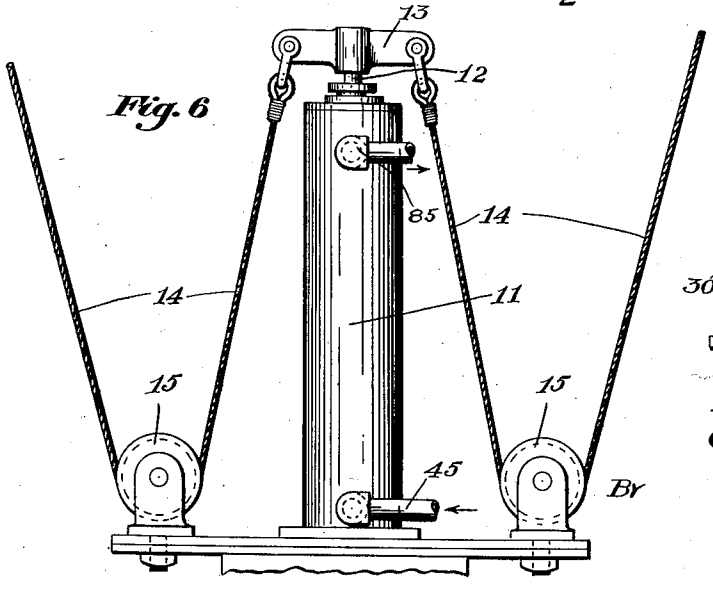


Fig. 6

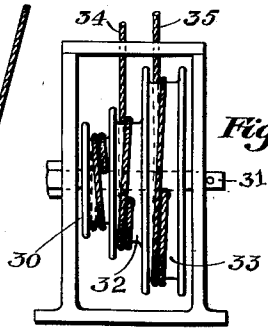


Fig. 7

INVENTORS.
John B. Woodbury.
George C. Soule.
By Ellis Spear
Attorney.

Nov. 29, 1932. J. B. WOODBURY ET AL 1,889,269

POWER SNOWPLOW

Filed Dec. 28, 1929 3 Sheets-Sheet 3

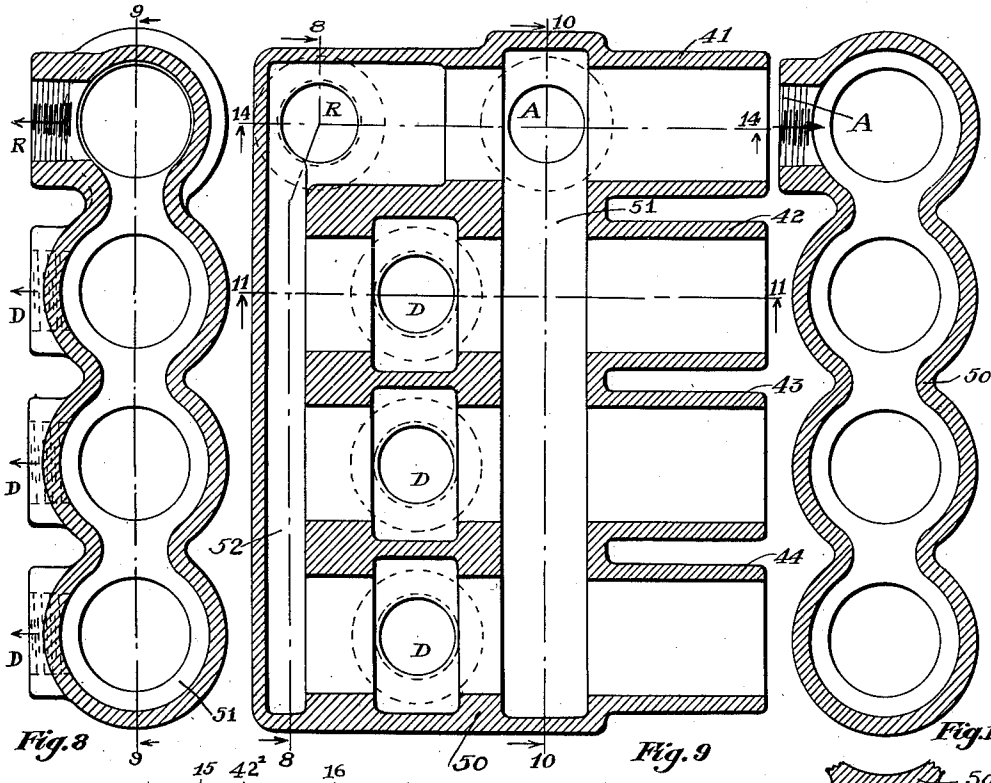


Fig. 8 Fig. 9 Fig. 10

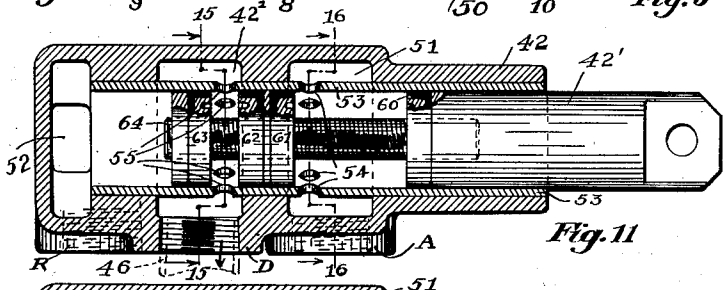


Fig. 11

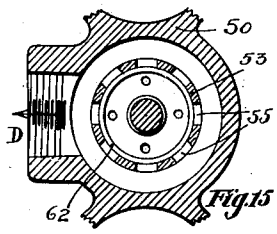


Fig. 15

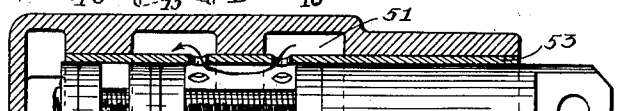


Fig. 12

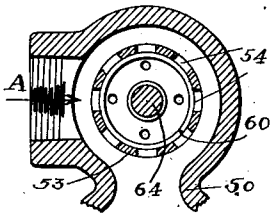


Fig. 16

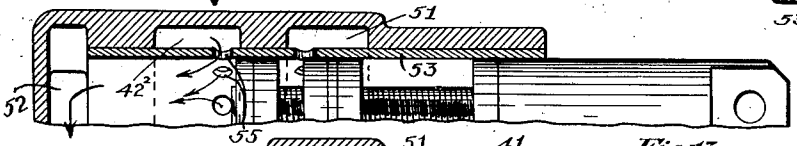


Fig. 13

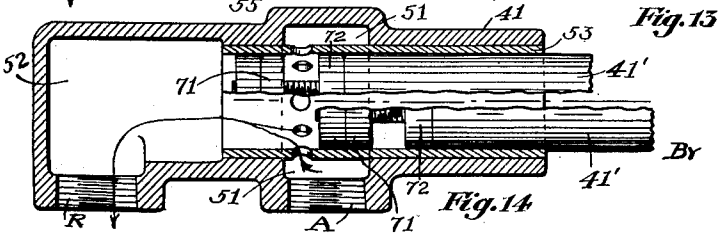


Fig. 14

INVENTORS.
John B. Woodbury.
George C. Soule.
By Ellis Spear.
Attorney.

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UNITED STATES PATENT OFFICE

JOHN B. WOODBURY AND GEORGE C. SOULE, OF SOUTH PORTLAND, MAINE, ASSIGNORS TO MAINE STEEL PRODUCTS COMPANY, OF PORTLAND, MAINE, A CORPORATION OF MAINE

POWER SNOWPLOW

Application filed December 28, 1929. Serial No. 417,173.

In the manipulation of snow plows, especially where there are adjustable lateral wings, as well as an adjustable nose, the control of such parts has become of very great importance. This is particularly true in the case of motor driven equipment where the aim is rapidity of operation as well as high power.

In the clearance of snow, especially on highways where conditions change from point to point, the more rapidly moving motor driven plow needs to be constantly adjusted and with an increased celerity over hand methods. If this is not possible the plow must either be slowed down to give time for wing or nose adjustment, or else adjustments must be slighted, with correspondingly imperfect results. For these reasons it has been proposed to provide power adjustments and the engine of motive equipment, as for example tractor or truck, offers a ready source for such power.

The trouble has been that the rig through which the plow and tractor are brought together is necessarily one in which considerable flexibility and freedom of movement must be provided. It has been found difficult to provide a practical working basis sufficiently simple to afford a mechanical control with sufficient detachability to permit the tractor to be removed from the plow where it is desired to utilize the tractor for other purposes.

The present invention contemplates equipment having certain novel features and advantages among which the following may be noted. For many reasons a so-called hydraulic control has been deemed desirable as it affords both the needed power and the wide range of flexibility which road conditions call for.

There are two main reasons for providing hydraulic controls on snow plows. The comfort and safety of the operator are very practical factors in working efficiency. With hand operated plows one or more operators are required to stand at the rear of the plow to work hand winches for raising and lowering the wings and nose. They are exposed to cold and snow and ice conditions and are of necessity standing much of the time on a slippery and unsteady platform violently agitated by the movement of the tractor over open ditches and rough ground. This made the work not only difficult to perform, but involved considerable risk to the operator.

Another reason for providing hydraulic control is the demand for greater productivity in snow plowing. With the development of greater tractive power in motor equipment, wings may be designed of greater length to make wider cuts and consequently must be heavier to withstand the strains. The operation of such wings by hand is slow and exhausting.

Mechanical control such as hydraulic power is also of great importance in that it makes possible a high quality of snow plowing at greater speed. Roads may be plowed cleaner and more effectively by such control than by hand.

The matter of speed of adjustment is important in that snow conditions are extremely variable due to different configurations of the ground, varying widths of road, and the action of wind which may blow one piece of ground bare and pile the blown snow in high drifts just beyond.

On account of this variable condition it is necessary within very short distances to change the elevation of the wings from a position in which they scrape close to the ground to clear a maximum width of light snow to a position high in the air to permit the plow to penetrate deep drifts or to push back on one side or the other high side banks.

This necessity for changing wing position in actual practice is extremely frequent and if the change can only be accomplished by a slow hand control it becomes necessary to slow down or stop the tractor or truck the corresponding frequency to give time to make the adjustments. With hydraulic equipment the wing is raised or lowered in a very few seconds and the motor equipment can be driven at its highest operating speed without delay for its adjustment which very largely increases the productivity of the equipment.

This ease of operation goes to make better

and more efficient work as it avoids the tendency of the operator to place the wings in a middle position and to avoid re-adjustment as far as possible which would mean that the wings would not plow clean where the snow was light and are often carried suspended midway without doing any work at all, all of which tends towards improper road conditions. The foregoing applies to both tractor operated and truck operated snow plows.

Such a system requires a pump and in order to utilize the power of the tractor motor itself, it is desirable that the pump be located on the tractor itself. One difficulty has been in connecting a pump on a tractor with the hydraulic cylinder on the plow without having such connections subjected to destructive strains due to the motion and vibration incident to the relative movements of the tractor and plow.

One important concept of the present invention lies in mounting the hydraulic cylinder on the tractor itself so that permanent pump connections may be made without danger of strain and leakage.

The invention furthermore conceives of a basis of connecting such hydraulic control with the wing and nose hoists of the plow so that they may be readily connected and disconnected and yet when connected operate with a maximum of efficiency and ease of control.

The ease and versatility of the control is also of obvious importance. As before stated the rapidly moving plow must be rapidly and accurately adjusted to meet the variant conditions. Furthermore, as a practical matter due to the usual condition of cold or storm, it is necessary that the operator be afforded every facility to do his work properly in spite of the handicaps imposed upon him.

The present invention therefore contemplates a system of control by which wing and nose hoists may be quickly and positively operated either to raise, hold, or lower the plow part or parts to be adjusted.

In this connection another improvement is afforded by the present invention. In hydraulic controls where the pump is continuously operated from the tractor motor, a considerable amount of horse power is required if the hydraulic control is held to its work incessantly. In solving this problem the present invention has maintained the complete and immediate availability of reserve power without actually drawing continuously on the motor and thus effects a very considerable saving in the power of the tractor itself and its fuel consumption.

In such systems, furthermore, where oil is circulated as a fluid medium, difficulty has been experienced with back pressures and the present invention avoids this difficulty.

The inventions involved are capable of various embodiment, but for the purposes of illustration a typical equipment will be shown in the accompanying drawings, as both illustrative of the principles and as in itself of proven efficiency and worth. Throughout the specification and drawings like reference characters are employed to indicate corresponding parts.

As illustrative of the present invention the accompanying drawings illustrate an embodiment which shows both the principle and mechanical details of equipment, according to the invention. In these drawings:—

Fig. 1 is a perspective of a tractor driven plow equipment viewed from the rear end.

Fig. 2 is a detail of the nose.

Fig. 3 a somewhat diagrammatic view of the hydraulic control.

Fig. 4 a sectional view of the relief valve.

Fig. 5 a fragmentary detail in rear elevation and partial section of the hydraulic wing hoist.

Fig. 6 is a rear elevation of the nose hoist.

Fig. 7 is an elevation of the differential drum for the wing hoist.

Fig. 8 is a transverse section of the control valve cylinder block on the line 8—8, of Fig. 9.

Fig. 9 a section on the line 9—9, of Fig. 8.

Fig. 10 a section on the line 10—10 of Fig. 9. Figs. 8 to 10 inclusive show the valve block only, without sleeves or valves.

Fig. 11 is a longitudinal section of a valve completely assembled and shown in holding position, section being taken on the line 11—11, of Fig. 9.

Fig. 12 shows the valve plunger in position to allow the oil to pass to the jack cylinder.

Fig. 13 is a corresponding section but showing the relief of the oil in a cylinder to permit lowering.

Fig. 14 is a similar section of the relief valve assembly taken on the line 14—14, of Fig. 9, the valve plunger being broken longitudinally and shown in two positions.

Fig. 15 is a section on the line 15—15, of Fig. 11, and

Fig. 16 a transverse section on the line 16—16, of Fig. 11.

In the drawings we have shown an equipment which as in Fig. 1 is particularly adapted to tractor use. In that figure the tractor is indicated as T and removably disposed within the frame of the plow.

The frame may be variously constructed, but as shown consists of longitudinal base or runner members 1 and the transverse beam 2. At the ends of the longitudinal members are erected rear columns 3 and front columns 4. These are connected transversely by front and rear beams 5 and 6 and side beams 7. The rear beam 2 is removable to permit of the tractor entering the frame work of the plow.

This constitutes the general frame of the plow proper. The plowing members are indicated as a nose 8 and wing members 9. The wings 9 are slidably mounted on the columns 4 so as to be vertically adjustable and also pivoted to tilt on their connection so as to be angularly adjustable with reference to the road surface.

The nose member 8 is mounted at the forward ends of the runners 1 of the plow frame. It is vertically adjustable relative to said plow frame by the side levers 10 which are pivoted as at 10^2 on fulcrums carried by the frame of the tractor. The general frame structure of the plow is linked to the tractor by a member 100 which is connected with the platform member on the tractor and is pinned to a pair of ears 101 on the rear beam 2 of the frame of the plow. The plow frame therefore is pivotally connected to the tractor at this point and its adjustments are made from this point as a pivotal basis.

The wings 9 and nose 8 are the plowing factors requiring the ready and easy adjustment above referred to. The controls comprise as shown a triple cylinder hydraulic jack mounted on a base to form a unit and carried on an extension platform on and at the rear of the tractor. Of these the jack 11 is for the nose hoist and has its plunger 12 provided with a yoke 13. To this are attached cables 14 (see Fig. 6) which pass under sheaves 15 spaced apart on the base and secured at their other ends to the cross bar 10′ of the levers 10 at some distance apart to maintain balance and equalization. The jack 11 therefore has a balanced control of the nose levers 10 so that the nose 8 can be raised or lowered as desired. The control of the two wings 9 are independent as by the cylinders 20. These jacks 20 have plungers 21, respectively, (as shown in Fig. 5) and a sheave 22 over which is passed a cable 23. The cable 23 is attached at one end as at 24 to the base of the hoist unit and is led under another sheave 25 from which it runs to a drum 30 on which it is wound.

The drum 30 is fixed on a shaft 31 (see Fig. 7) on which are a pair of differential drums 32 and 33. On these are wound the control cables of the wing hoists by which the wings 9 are raised or lowered as desired.

These hoists consist of a front end cable 34 and a rear end cable 35. The drums 32 and 33 are so proportioned that the front end cable 34 is taken up at about one-half of the speed of the rear end cable 35.

The jack cylinders 11 and 20 are connected with a fluid pressure source as the pump 80 which supplies the cylinders 11 and 20 under the control of a valve system operated by levers 40 located in the cab of the tractor T.

This valve control system is diagrammatically shown in Fig. 3 and is connected up as follows.

The supply tank S stores surplus of the operating fluid beyond that in the cylinders which for this work is a low temperature oil. The pump 80 takes this fluid supply through the intake 81 and delivers it under pressure to the line 83. In the line 82 is a pressure control 90 including a valve 91 adjustably held to its seat by a spring 92. Upon resistance to passage of oil in the main delivery line 83, this valve opens up the general by-pass lines 82 and 84, to which the upper ends of the cylinders 11 and 20 are connected for relief. The by-pass line 84 returns to the storage reservoir S.

The main or pressure operating line 83 from the pump 80 is provided with a valve control. In this installation there are four valve cylinders, 41, 42, 43 and 44, within which operate sliding valves or plungers 41^1, 42^1, 43^1 and 44^1 (the two latter not shown, but in reality duplicates of 42^1) (see Figs. 11 to 14). 41^1 is the by-pass or idling valve, 42^1 controls the right wing hoist, 43^1 the left wing hoist, and 44^1 the nose hoist.

The valve 41^1 is simply a by-pass which when opened permits the pump 80 to operate with the minimum of resistance. The plungers 42^1 43^1 and 44^1 control the fluid pressure supply to the lifting jack cylinders 11 and 20. As shown in Fig. 3 the valve cylinder 44 controls the supply line 45 to the nose hoist cylinder 11. The other two valve cylinders 42 and 43 control the lateral wing hoists by connections 46 and 47, respectively.

The cylinders 41, 42, 43 and 44 as shown in Fig. 9 are incorporated in a casting 50 and constitute the housings for the valves 41^1 to 44^1. These cylinders are arranged in a parallel disposition and having a common chamber 51 which extends midway of the casting 50 and as at A is in constant communication with the line 83 from the pump 80.

Each of the valve cylinders connects at its end with a common passage 52 at the end of the casting 50, this passage or chamber being in open communication as at R with a pipe line 60 and a branch 61 to the intake 81 of the pump. The line 60 extends also to a branch 62 entering the tank S. The three cylinders 42, 43 and 44 which control the two wing hoist jacks 20 and the nose hoist jack 11 are of the same construction and are shown in section in Figs. 11, 12 and 13, these figures representing different positions of the valve plunger. In these cylinders the sleeves 53 are provided with ports 54 and 55 which at a certain position of their plungers permit communication respectively between the common oil pressure chamber 51 and the respective connections D with 45, 46 and 47 extending to the jack cylinders. Referring to Fig. 11 which is a section through the valve assembly 42 controlling the elevating of the right wing, the ports 55 connect with

the surrounding individual chamber 42^2 into which the line 46 is tapped.

The valve plunger 42^1 (Fig. 11) is provided with the usual leather cup packings 60, 61, 62 and 63 which are adjustably spaced on the stem 64 to provide opposite pairs and constituting shut-offs between the common pressure feed chamber 51 and the delivery to the jack which it controls. The valve plunger 41^1 of the valve cylinder 41 is somewhat similarly constructed but its piston packing cups 71 and 72 define only a single passageway which may block off the supply chamber 51 as when in the position shown in the upper part of Fig. 14 or may open up the chamber 51 to the relief chamber 52 when it is desired to permit the oil to by-pass, as illustrated in the lower position of the plunger.

With the parts positioned as in Fig. 11 the valve in its cylinder 42 is positioned so as to cut off the intake from the passage 51. In this position no fluid is delivered to the jack which it controls. This, therefore, is the position of the valve both prior to the operation of any jack and its position after a jack has been operated to any desired position which is to be maintained.

In order to operate the jack the valve is advanced to the position shown in Fig. 12 which connects up the pressure supply from the common passage 51 with its delivery chamber so that the oil passes through the line 46 (connection D) to operate the jack 20 which in this case is the jack operating the right wing. If it is desired to lower the wing the valve is withdraw to the position shown in Fig. 13 in which the chamber 51 is cut off and the ports 55 uncovered, permitting the oil to be forced back from the jack and escape through the passage 52 to the connections 60 and 61 and so back to the pump.

Each of the jacks is provided near its top with a pressure relief pipe 85 which connects up with the return line 84 which leads to the tank S. The object of this construction is to provide relief from the oil pump pressure acting on the bottom of the piston 86 when the latter rises to its limit of upward movement in the jack cylinders 11 and 20 which position is slightly above the opening out of the connections at 85. This line is also connected with the line 82 from the relief valve 90 which has been previously described.

Through such a control either or both wing and nose may be raised or lowered or held in any desired position, rapidly and with the minimum effort on the part of the operator. The by-pass control relieves the pump 80 which is driven by the motor from unnecessary work and thereby reduces the burden on the tractor motor. The connections permit the tractor with its hydraulic jack unit to be withdrawn by merely disconnecting the rope members at any convenient point as by sockets (not shown) and by removing the connecting pins (not shown) which connect the nose levers to the nose, and unshackling the cross member 2 of the plow frame. In reassembling the equipment the rear frame of the plow is opened up as at 2, the tractor driven in, the hoists connected up and the nose connected with the levers 10 which are carried by the tractor.

What we therefore claim and desire to secure by Letters Patent is:—

1. In a snow plowing equipment, a plow comprising a frame, nose and wing members vertically adjustable thereon relative to said frame, hoists for raising and lowering said nose and wing members, a plurality of hydraulic cylinders connected with said hoists, a motor driven vehicle removably located within the plow frame, a hydraulic cylinder control unit independent of the plow frame disposed on the rear of the vehicle and operativly connected with said hoists and including control means for filling or emptying any cylinder or for by-passing the oil when a cylinder is filled, and independent means for by-passing the oil regardless of the cylinder condition.

2. In a snow plowing equipment, a plow comprising a frame, nose and wing members vertically adjustable thereon relative to said frame, hoists for raising and lowering said nose and wing members, a motor driven vehicle removably located within the plow frame, a hydraulic control unit independent of the plow frame disposed on the rear of the vehicle and operatively connected with said hoists and including a pump, a supply tank, a plurality of cylinders connected to said pump and to said tank by connections including connections from the pump to each cylinder and from the cylinders to the tank, control means for filling or emptying any cylinder or for by-passing the oil when a cylinder is filled, and independent means for by-passing the oil regardless of the cylinder conditions.

3. In a snow plow equipment, a plow comprising a frame, nose and wing members adjustable relative to said frame, hoists for raising and lowering said members, a motor driven vehicle removably located within the plow frame, a motor driven hydraulic control independent of the plow frame and mounted on the vehicle, and means for connecting the hoists and the hydraulic control.

4. In a snow plow equipment, a plow comprising a frame, nose and wing members adjustable relative to said frame, hoists for raising and lowering said members, a motor driven vehicle removably located within the plow frame, a motor driven hydraulic control independent of the plow frame and mounted on the vehicle, and means for connecting the hoists and the hydraulic control,

and means for detachably connecting the plow frame to the vehicle.

5. In a snow plow equipment, a plow comprising a frame, nose and wing members adjustable relative to said frame, hoists for raising and lowering said members, a motor driven vehicle removably located within the plow frame, a motor driven hydraulic control independent of the plow frame and mounted on the vehicle, and means for connecting the hoists and the hydraulic control, and means for detachably connecting the plow frame to the vehicle through the hoists.

6. In a snow plow equipment, a plow comprising a frame, a nose adjustable relative to said frame, a nose lever for raising and lowering the nose, a motor driven vehicle removably located within the plow frame, and pivotally supporting said nose lever, a motor driven hydraulic control independent of the plow frame and mounted on the vehicle, and means for connecting the lever and the hydraulic control.

7. A propulsion unit for snow plows or the like comprising a motor driven vehicle, a hydraulic control unit independent of the plow and carried on the vehicle at the rear end thereof including a pump, a supply tank, a plurality of cylinders connected to said pump and to said tank by connections including connections from the pump to each cylinder, and from the cylinders to the tank, and a sliding three port valve included in each cylinder connection for filling or emptying any cylinder or for by-passing the oil from pump to tank when a cylinder is filled, and independent means for by-passing the oil regardless of the cylinder condition, the by-pass ports of said valves having entry to a common by-pass passage.

8. A propulsion unit for snow plows or the like comprising a motor driven vehicle, a hydraulic control unit independent of the plow and carried on the vehicle including a pump, a supply tank, a plurality of cylinders connected to said pump and to said tank by connections including connections from the pump to each cylinder, and from the cylinders to the tank, and a three port valve included in each cylinder connection for filling or emptying any cylinder or for by-passing the oil from pump to tank when a cylinder is filled, and independent means for by-passing the oil regardless of the cylinder condition.

9. In a snow plow equipment, a plow comprising a frame, a plow nose vertically adjustable relative thereto, a motor vehicle removably located within said frame, elevating means on said vehicle and extended to the rear thereof and connected to said nose, a wing vertically adjustable on said frame, a wing hoist carried on said frame, a plural cylinder hydraulic control independent of the plow and on the vehicle, and connections between said control members and said nose and wing hoists.

10. In a snow plow equipment, a plow comprising a frame, a plow nose vertically adjustable relative thereto, a motor vehicle removably located within said frame, elevating means on said vehicle and extended to the rear thereof and connected to said nose, a wing vertically adjustable on said frame, a wing hoist carried on said frame and extended to the rear thereof, a plural cylinder hydraulic control independent of the plow and at the rear of the vehicle, and connections between said control members and said nose and wing hoists.

11. In a snow plow equipment, a plow comprising a frame, a plow nose vertically adjustable relative thereto, a motor vehicle removably located within said frame, a lever fulcrumed on said vehicle and extended to the rear thereof and connected to said nose, a wing vertically adjustable on said frame, a flexible wing hoist carried on said frame and extended to the rear thereof, a plural cylinder hydraulic control independent of the plow and on the rear of the vehicle, and connections between said control members and said nose and wing hoists.

12. In a snow plow equipment, a plow comprising a frame, a motor vehicle removably located within said frame, a wing vertically adjustable on said frame, front and rear flexible wing hoists carried on said frame and extended to the rear thereof, a pair of drums of different diameter one for each of said flexible hoists, an operating drum, said drums rotating together a hydraulic control independent of the plow and on the rear of the vehicle, comprising a cylinder and piston, and a flexible connection from said piston and wound on said operating drum.

13. In a snow plow equipment, a plow comprising a frame, a plow nose vertically adjustable relative thereto, a motor vehicle removably located within said frame, a lever fulcrumed on each side of said vehicle and extended to the rear thereof, and connected at its forward end to said nose, a wing vertically adjustable on said frame, flexible front and rear end wing hoists carried on said frame and extended to the rear thereof, a plural cylinder hydraulic control independent of the plow and on the rear of the vehicle, a connection from the nose lever to one control member, differential drums on the rear of the frame, said drums receiving the front and rear hoists of the wing, an operating drum for the receiving drums, and a flexible connection wound on said drum in reverse to the winding of the wing hoists on the differential drums and connected to one of the hydraulic controls.

14. In a snow plow equipment, a plow comprising a frame, a plow nose vertically adjustable relative thereto, a motor vehicle re-

movably located within said frame, a lever fulcrumed on each side of said vehicle and extended to the rear thereof, and connected at its forward end to said nose, lateral wings vertically adjustable on said frame, flexible front and rear end wing hoists for each carried on said frame and extended to the rear thereof, a plural cylinder hydraulic control independent of the plow and on the rear of the vehicle, a pair of laterally spaced connections from the nose lever to one centrally located control cylinder, a pair of differential drums at each side of the vehicle rear, each drum pair receiving the front and rear hoists of one of the wings, an operating drum on each drum pair and a flexible connection wound on said drum in reverse to the winding of the wing hoists on the differential drums and connected to one of the hydraulic cylinders.

15. In a snow plow equipment, a plow member having adjustable snow handling elements, and a motor driven propulsion member detachably associated therewith, power controls carried by the propulsion member in permanent assembly therewith and independent of the plow and detachable control connections carried by the plow whereby plow and propulsion members may be separated without disturbing the power control assembly.

16. In a snow plow equipment, a plow frame having adjustable snow handling elements, a motor driven vehicle for propelling said plow frame, a plurality of hydraulic operating jacks mounted on said vehicle independently of the plow frame, a pump line to said jacks, a valved control for the supply of each jack, and a valved by-pass all having a common connection to the pump line and all having a common discharge, and a by-pass line from said discharge to said pump, each valved control being operable to connect or disconnect the pump supply to its jack cylinder or to by-pass its supply to hold the jack piston at any desired position.

17. In a snow plow equipment, a plow frame having adjustable snow handling elements, a motor driven vehicle for propelling said plow frame, a plurality of hydraulic operating jacks mounted on said vehicle independently of the plow frame, a pump supply line to said jacks, a supply control comprising a valve for each jack, and a valved by-pass and all having a common connection through the by-pass intake to the pump line and all having a common discharge through the by-pass discharge into a by-pass line to said pump, each valved control being operable to connect or disconnect the pump supply of its jack cylinder, and the by-pass anticipating the cylinder supply to hold any jack piston at any desired position.

18. In a snow plow, a plow frame, a motor driven vehicle removably located therein, a nose and a wing vertically adjustable relative to said plow frame, a wing hoist mounted on said plow frame, a nose-lifting element fulcrumed on said vehicle, a plural cylinder hydraulic control unit mounted on the vehicle with its cylinders individually connected, respectively, to said wing hoist and nose lifting element, and manually operable controls also mounted on the vehicle and controlling the respective cylinders of said hydraulic unit.

19. A snow plow as claimed in claim 18 wherein the plural cylinder control unit is mounted on the vehicle at the rear thereof and the manually operable controls are also mounted on the vehicle adjacent the front end thereof for convenient actuation from the driver's seat.

In testimony whereof we affix our signatures.

JOHN B. WOODBURY.
GEORGE C. SOULE.