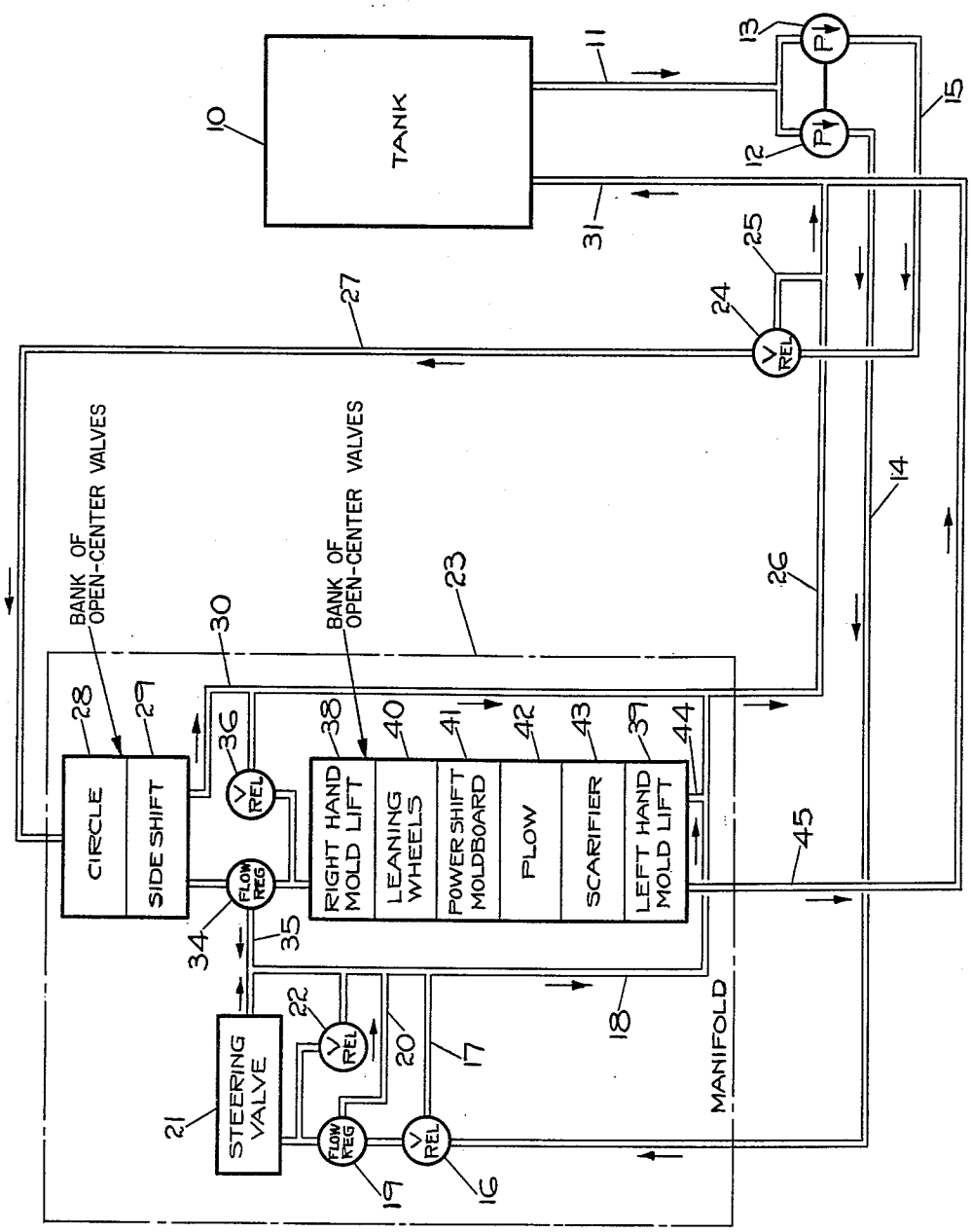
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HYDRAULIC CONTROL FOR MOTOR GRADERS

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HYDRAULIC CONTROL FOR MOTOR GRADERS

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1 Claim. (Cl. 60—52)

The instant invention relates to motor graders and more particularly to a novel hydraulic control circuit for operating the various devices of the motor grader.

It is the object of this invention to provide a novel hydraulic control circuit for a motor grader, in which certain of the devices of the grader are operated at a constant speed by the hydraulic control circuit.

It is another object of the instant invention to provide a novel hydraulic control circuit for a motor grader, in which hydraulic fluid is supplied to a steering valve at a constant rate for operating the steering means of the grader at a constant speed.

It is a further object of the instant invention to provide a novel hydraulic control circuit for a motor grader, in which hydraulic fluid is supplied at a constant rate to a plurality of hydraulic controls for the mold lift, the wheel leaning means, the power shift mold board, the plow and the scarifier, for operating each of the latter at a constant speed.

It is still another object of the instant invention to provide a novel hydraulic control circuit for a motor grader, in which there is provided a plurality of hydraulic controls for the circle, the side shift, the mold lift, the wheel leaning means, the power shift mold board, the plow and the scarifier, with the hydraulic fluid being supplied to the circle and side shift hydraulic controls directly from a pump which delivers the fluid from a reservoir tank, and including hydraulic means for delivering the fluid from the circle and side shift hydraulic controls at a constant rate to the hydraulic controls for the mold lift, the wheel leaning means, the power shift mold board, the plow and the scarifier, for operating the latter devices at a constant speed.

Other objects of the invention will appear hereinafter, the novel features and combinations being set forth in the appended claim.

The drawing herein diagrammatically illustrates the novel hydraulic control circuit for the motor grader.

The instant invention is in a novel hydraulic control circuit for a motor grader, in which the mechanical elements of the grader may be of a conventional form, for example as illustrated in Pat. No. 2,340,169, issued January 25, 1944, for Road Grader. The motor grader includes a mold board to which there is attached a blade. The mold board is secured to a circle which may be rotated through 360° for the purpose of adjusting the angle of the blade. The circle is mounted on a laterally shiftable frame for adjusting the position of the mold board laterally of the main frame of the motor grader, side shift means being provided for this purpose.

The mold board may also be shifted laterally with respect to the circle for extending the mold board and its blade to one side or the other of the main frame of the motor grader, and for this purpose the power shift mold board control is provided. The controls for the motor grader also include a right hand and a left hand mold lift which are utilized to adjust the elevation of one side or the other of the mold board and its blade. The right hand and left hand mold lift controls may also be operated together to elevate the mold board and blade.

The motor grader includes a pair of wheels at the front end thereof, which may be leaned in one direction or the other, depending on the operation of the motor grader, for the purpose of counteracting forces which tend to shift the motor grader to one side or the other during the operation thereof. In conjunction with the leaning of the front wheels, these wheels may be steered for assisting the leaning of the front wheels in counteracting forces which tend to shift the motor grader to one side or the other during the operation thereof. The motor grader also includes a scarifier which may be lowered into contact with the ground, or raised from the ground so as to be inactive, and for this purpose the motor grader controls include a control for raising and lowering the scarifier. As an accessory device there may be provided a plow for moving snow or a bulldozer blade, which is attached at the front end of the main frame of the grader. A control is provided for operating the plow, or the bulldozer blade. The plow, or the bulldozer blade, is not normally attached to the grader, but is added when it is desired to use either of these devices, there being provided a single control for one or the other of these.

The above described structure of the motor grader is conventional, and will be recognized as such by those skilled in the art. Accordingly, there is not included herein a detailed description of the same, since the various devices and the operating means therefor in the motor grader are not of themselves novel, the instant invention being in the hydaulic control circuit for controlling the operation of these devices.

Referring to the drawing, the novel hydraulic control circuit comprises a reservoir tank 10 which contains a supply of hydraulic fluid. A conduit 11 leads from the tank 10 to each of a pair of pumps 12, 13 which are arranged in tandem and are driven together from the grader motor, whereby the rate of delivery of hydraulic fluid by the pumps 12, 13 will vary in accordance with the speed of the grader motor. The pump 12 supplies hydraulic fluid under pressure through conduit 14 for operating the steering means of the motor grader. The hydraulic pump 13 supplies hydraulic fluid under pressure through conduit 15 for operating the other devices of the motor grader.

The conduit 14, which leads from the pump 12, includes a relief valve 16 which is connected by a conduit 17 to a fluid return line 18. The hydraulic fluid is delivered by the line 14 through the pressure relief valve 16 to a bypass and restrictor type flow regulator 19, which includes a bypass line 20 connected to the return line 18. The flow regulator 19 regulates the flow of hydraulic fluid to the steering valve 21, and maintains the supply of hydraulic fluid to the valve 21 at a constant rate, irrespective of the rate of delivery of hydraulic fluid by pump 12. A pressure relief valve 22 is connected between the flow regulator 19 and the return line 18 to relieve any excess pressure in the hydraulic fluid delivered to the steering valve 21.

The steering valve 21 is disposed at the operator's station of the motor grader, and is operated by a steering wheel. The steering valve 21 is a rotary valve that is operated by rotation of the steering wheel, which permits the hydraulic fluid to flow through the steering valve for the purpose of operating the hydraulic steering means, to turn the front wheels of the motor grader in accordance with the direction in which it is desired to operate the motor grader. The hydraulic fluid discharges from the steering valve 21 through the discharge line 18.

The steering valve 21 and each of the other hydraulic

controls for the various operating devices of the motor grader are located at the operator's station on the motor grader and disposed in a manifold **23**, indicated diagrammatically by a broken line in the drawing.

The pump **13** delivers hydraulic fluid from the tank **10** through the conduit **15** and through a pressure relief valve **24**, which is connected by a line **25** to the fluid return line **26**. The hydraulic fluid that flows through the relief valve **24**, is directed through the hydraulic conduit **27** to a bank of hydraulic control valves which control the operation of the various devices of the motor grader, as is described hereinafter.

The hydraulic conduit **27** delivers the hydraulic fluid under pressure from the pump **13** to a hydraulic control valve **28** for controlling the operation of the circle, and a second hydraulic control valve **29** for controlling the operation of the side shift. The hydraulic control valves **28**, **29** are secured to each other and the discharge of the valve **28** communicates directly with the intake of the valve **29**. These valves are of a conventional type and each comprises a reciprocable spool mounted within the valve casing, which in neutral position permits the hydraulic fluid to flow freely through the valve. The spool of each of the valves **28**, **29** may be reciprocated by means of an operating handle to either side of the neutral position thereof for directing the flow of fluid in one direction or the other. A hydraulic conduit **30** is connected to the control valve **29** and receives the seepage of hydraulic fluid from the control valves **28**, **29**, and directs this seepage through the conduit **26** and the return conduit **31** to the tank **10**. The hydraulic fluid discharges from the control valves **28**, **29** to a bypass and restrictor type flow regulator **34** which controls the rate of delivery of hydraulic fluid to the remaining control valves, by limiting the rate of delivery of hydraulic fluid to a predetermined maximum. The flow regulator **34** is connected to the fluid return line **18** by a conduit **35** to discharge the surplus of hydraulic fluid. Below the flow regulator **34** there is a relief valve **36** connected to the seepage conduit **30** for the purpose of relieving any excessive pressure of the hydraulic fluid that may occur at this point.

The hydraulic fluid, which is delivered from the flow regulator **34** at a predetermined maximum rate of flow, flows through a bank of six valves each of which is of the same type and construction as the valves **28**, **29**. The valves **38**, **39** control the operation of the right hand mold lift and the left hand mold lift, respectively. The valve **40** controls the operation of the wheel leaning means, the valve **41** controls the operation of the power shift mold board, the valve **42** controls the operation of the snow plow or bulldozer blade, and the valve **43** controls the operation of the scarifier. As in the case of valves **28**, **29**, previously described, each of the valves **38** to **43** is connected with the discharge of one valve being joined to the intake of a succeeding valve, so that the hydraulic fluid flows directly through all of the valves **38** to **43**. A conduit **44** forms a connection from the valve **39** to the seepage conduit **30** for the discharge of the seepage fluid from the valves **38** to **43**. The hydraulic fluid discharges from the valves **38** to **43** through the conduit **45**, which directs the flow of hydraulic fluid through the return conduit **31** to the reservoir tank **10**.

The various hydraulic control valves **28**, **29**, **38** to **43**, are located at the operator's station of the motor grader, as part of the manifold **23**, and each valve is provided with a handle for reciprocating the spool of the valve and, thereby, effecting a control of the devices of the motor grader according to the direction in which the fluid flows through the valve being used at a given time. The hydraulic control valves **28**, **29**, **38** to **43** may be of any suitable form, for example as illustrated in Pat. No. 2,486,087, issued October 25, 1949, for Hydraulic Valve. The valves **28**, **29** are connected to each other for flow of the hydraulic fluid therethrough, and the valves **38** to **43** are similarly connected to each other for the flow of hydraulic fluid therethrough, which connections may be made in the manner disclosed in said Pat. No. 2,486,087. In accordance with the invention, the rate at which the hydraulic fluid is delivered to each of the control valves **38** to **43** is limited to a predetermined maximum, whereby the operating speed of the right and left hand mold lift, the wheel leaning means, the power shift mold board, the snow plow or bulldozer blade, and the scarifier is controlled in accordance with the rate of delivery of hydraulic fluid to the control valves **38** to **43**. Similarly, the hydraulic fluid delivered to the steering valve **21** is delivered at a constant rate, whereby the operation of the steering means is at a constant speed. Since the hydraulic fluid for operating the steering means is delivered by the pump **12** independently of the pump **13**, which delivers the hydraulic fluid to the other control valves, the speed of operation of the steering means may be different from that of the other devices of the motor grader.

Obviously those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of the invention as defined by the claim hereto appended, and applicant therefore wishes not to be restricted to the precise construction herein disclosed.

Having thus described and shown an embodiment of the invention, what it is desired to secure by Letters Patent of the United States is:

In a motor grader comprising a hydraulic control circuit for operating a plurality of individual hydraulic actuators, one hydraulic actuator being provided for actuation of each of the circle, the side shift, the right hand mold lift, the wheel leaning means, the power shift mold board, the plow, the scarifier, and the left hand mold lift, said hydraulic control circuit including a first bank of open center hydraulic control valves comprising an individual hydraulic control valve for control of the respective hydraulic actuator for each of the circle and the side shift, and a second bank of open center hydraulic control valves comprising an individual hydraulic control valve for control of the respective hydraulic actuator for each of the right hand mold lift, the wheel leaning means, the power shift mold board, the plow, the scarifier, and the left hand mold lift, a pump for delivering hydraulic fluid under pressure to the open center inlet of the first valve bank at a variable rate of flow, a fluid conduit interconnecting the open center outlet of the first valve bank to the open center inlet of the second valve bank for directing the flow of hydraulic fluid from the first valve bank to the second valve bank, and a flow regulator valve in the interconnecting conduit means between the first bank of hydraulic control valves and the second bank of hydraulic control valves for limiting the rate of flow of hydraulic fluid to the second valve bank to a predetermined maximum.

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