

[54] **PITCH-TILT HYDRAULIC CIRCUITS FOR DOZER BLADES**

[75] Inventor: **Rudolf Horsch**, Davenport, Iowa
[73] Assignee: **J. I. Case Company**, Racine, Wis.
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[51] Int. Cl. **E02f 3/76**
[58] Field of Search 172/805, 804, 803;
91/412; 60/53 R; 37/DIG. 7

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Primary Examiner—Robert E. Pulfrey
Assistant Examiner—Stephen C. Pellegrino
Attorney—Cullen, Settle, Sloman & Cantor

[57]

ABSTRACT

A hydraulic circuit for pitch-tilt cylinders of a dozer blade constructed for selective manipulation and for selective connection of the cylinders in series or parallel, for tilting or pitching the blade as desired.

1 Claim, 6 Drawing Figures

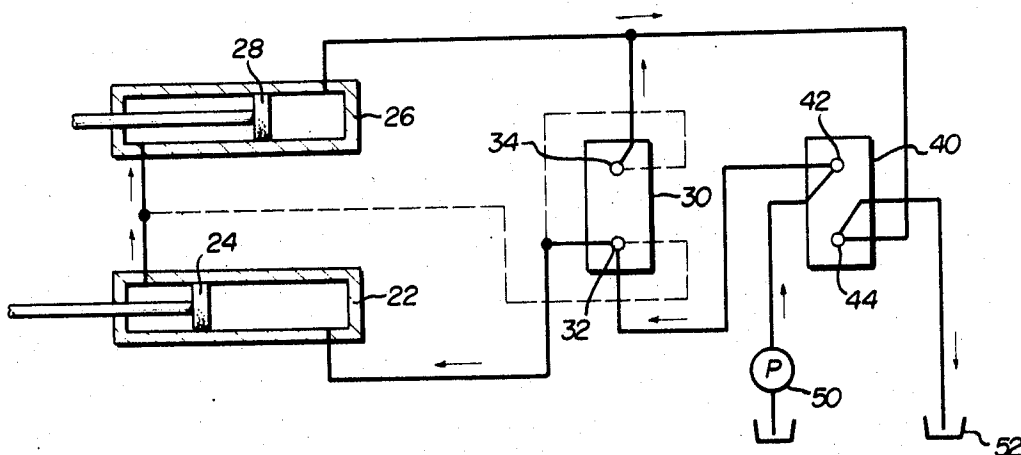


FIG. 1

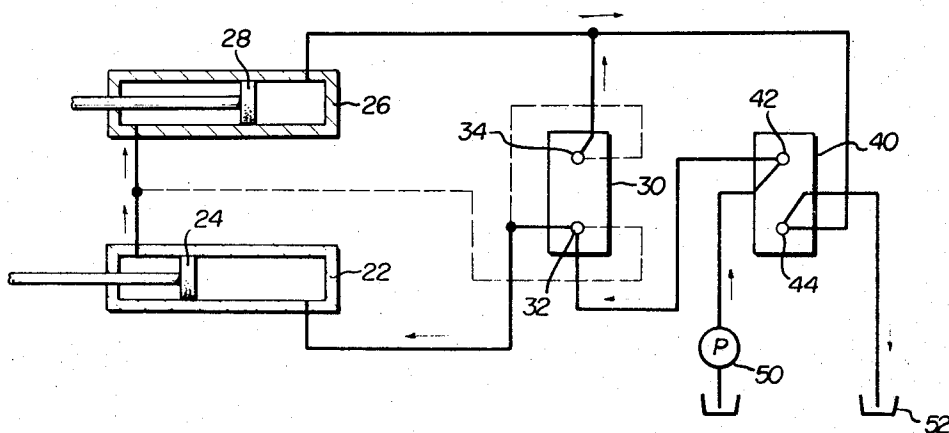


FIG. 2

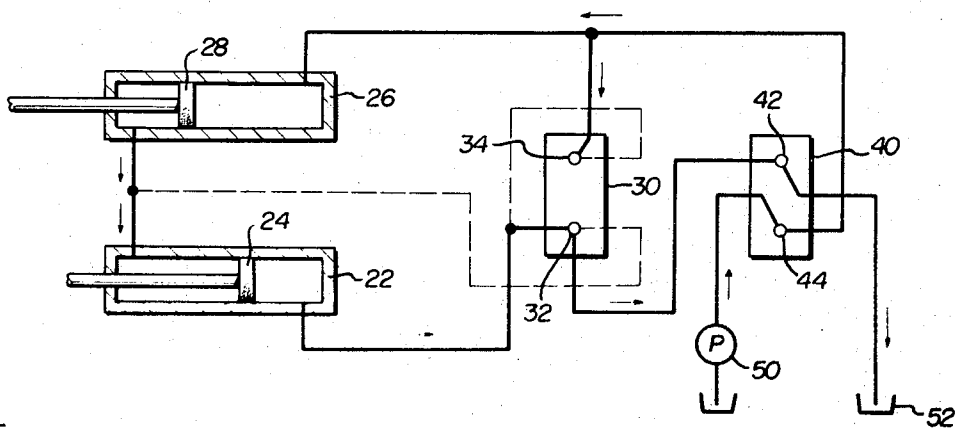


FIG. 5

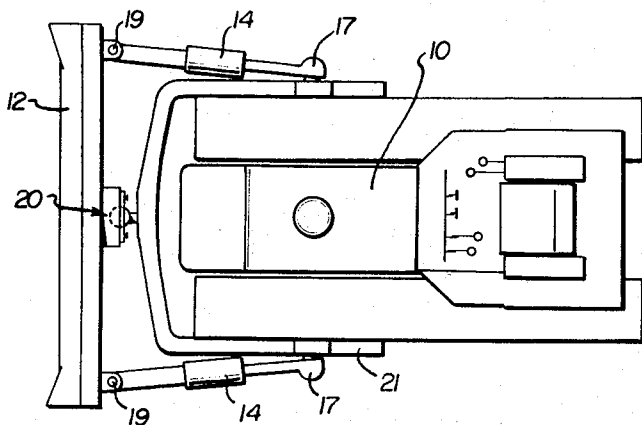
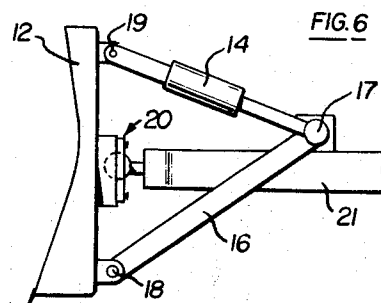


FIG. 6



INVENTOR.
RUDOLPH HORSCH.

BY

CULLEN, SETTLE, SLOMAN & CANTOR.
ATT'YS.

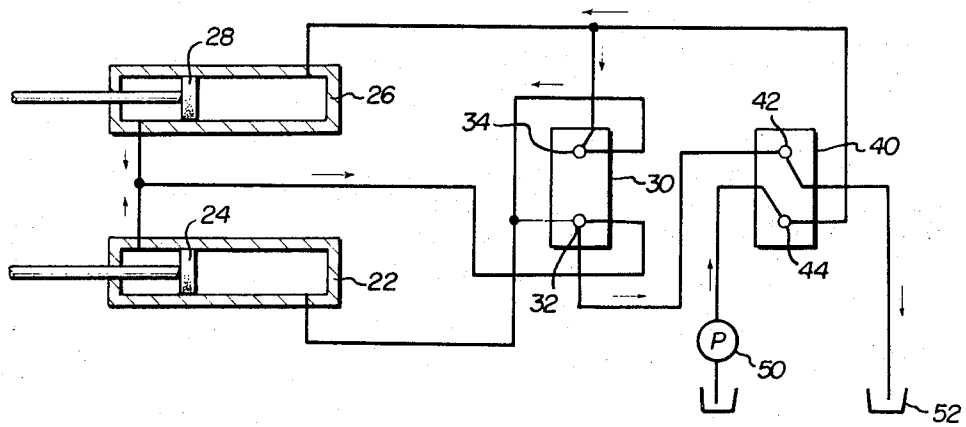


FIG. 3

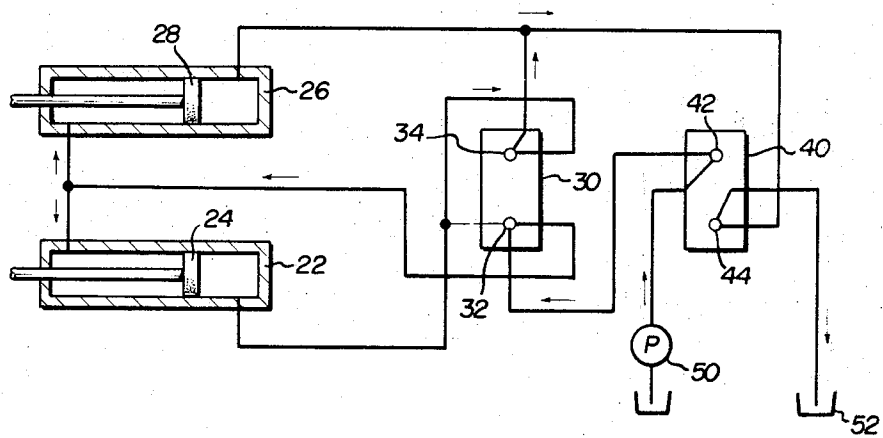


FIG. 4

INVENTOR.
 RUDOLPH HORSCH.
 BY
 CULLEN, SETTLE, SLOMAN & CANTOR
 ATT'YS.

PITCH-TILT HYDRAULIC CIRCUITS FOR DOZER BLADES

GENERAL DISCUSSION

A bulldozer has a forward blade. Connected to the left and right hand ends of an edge of such blade, illustrated as the upper edge, although it could be also the lower edge, are hydraulic cylinder-piston means for tilting and pitching the blade as desired. A properly valved hydraulic circuit including the cylinder piston means and a pressurized fluid source and a return fluid receiver is provided for selective manipulation of the pistons in the cylinders for tilting and pitching the blade.

An object of the present invention is to provide valve means so constructed that they may be manipulated for placing the cylinders in series or parallel.

When the cylinders are placed in series, the piston in one cylinder is extended and the piston in the other cylinder is retracted and this causes the blade to tilt sideways, that is to say, about a horizontal axis perpendicular to the plane of the blade. The valves may also be manipulated to connect the cylinders in parallel, whereupon both pistons will be extended or both will be retracted, in unison, for pitching the blade, that is to say, for tilting it about a horizontal axis parallel to the blade plane.

It will be understood that in this application, tilting is the action of moving the blade about a horizontal axis perpendicular to the blade; pitching is the action of moving the blade about a horizontal axis parallel to the blade plane.

A further object is to provide a circuit enabling all desired, four for example, pitch and tilt movements of a dozer blade to be effected by but one, dual type, pitch-tilt hydraulic cylinder-piston means, illustrated as a single pair of such piston means, one at each end of the blade.

THE DRAWINGS

A presently preferred embodiment of this invention, is disclosed diagrammatically in the appended drawings. In these drawings:

FIGS. 1-4 show different positions of the circuit parts, with passageways which are non-functional in particular valve positions being represented by dotted line.

FIG. 5 is a diagrammatic view of a vehicle such as a bulldozer showing particularly the blade and the pitch-tilt cylinders, in plan.

FIG. 6 is an elevation diagrammatic view, as if on arrow 6 of FIG. 5.

More specifically, FIG. 1 shows the manipulation of the valves in a manner to place the cylinders in series for tilting the blade to the right.

FIG. 2 is a similar view showing the cylinders connected in series in a manner to tilt the blade to the left.

FIG. 3 shows the valves manipulated to connect the cylinders in parallel, extending both pistons for pitching the blade forward.

FIG. 4 is a similar view, showing the valves manipulated for connecting the cylinders in parallel with the pistons retracted for pitching the blade rearward.

DETAILED DESCRIPTION

FIGS. 5-6 show a vehicle such as a typical dozer tractor 10 having a dozer frame 21 and a forward blade 12. At the left and right ends of the upper edge of such

blade are the two pitch-tilt means 14, each a hydraulic cylinder-piston means.

FIG. 6 shows the blade 12 as partly supported on the dozer frame 21 by the one, dual type, hydraulic cylinder-piston means, one at each end of the blade. Support for the blade is also partly provided by links 16, pivotally connected to the dozer frame 21 at 17, and to the blade 12 at 18, the latter also being pivotally connected to means 14 at 19, with means 14 connected to the dozer frame 21 at 17. Blade 12 is connected to dozer frame 21 at 20 by a conventional ball-type universal joint.

Now to be described is the valved circuit. This enables the one, dual type, piston means, the single pair shown at 14, to give all necessary, four in all, movements to the blade 12, greatly simplifying the construction, and eliminating the need for more complex and costly mechanisms for such purpose.

It will be understood that while the one, dual type, piston means is shown as comprising only two individual piston means, other arrangements might be employed. For example, each means 14 may itself be of two piston means, operating as but one.

THE HYDRAULIC CIRCUIT

The hydraulic circuit shown in FIGS. 1 to 4 includes a lefthand cylinder 22 having the lefthand piston 24 therein and a righthand cylinder 26 having a righthand piston 28 therein, these pistons being connected to the edge of the blade as previously illustrated and described.

The circuit also includes a diverter valve 30 having a lefthand port 32 and a righthand port 34.

The circuit also includes a control valve 40 having ports 42 and 44.

The circuit also includes a source of fluid under pressure illustrated as a pump 50 and a return flow receiver such as a tank 52.

Various lines connect the valves and cylinders and the pump and tank and will be referred to in the description of the operation which follows.

THE VALVES

Inasmuch as the valves used in the circuit hereof are well known valves now on the market, no attempt is here made to illustrate such valves. They are identified, however, as follows:

The diverter valve 30 is exemplified in a presently preferred embodiment as a double selector valve, Model D5-75 of Greesen Manufacturing Company of Minneapolis, Minn., zip code 55418, 405 35th Ave., N.E. This valve is of the spool type and has a pressure balanced spool with several positions of the spool selected by manual operation. The valve is such that it enables the user to operate two double acting cylinders with one four-way control valve and direct flow in a hydraulic system to the two separate hydraulic lines.

Other suitable valves to be used as the diverter valve are identified as follows:

Diverter valve XVA 135-0 of Cessna Valve Manufacturing Company of P.O. Box 1028, Hutchinson, Kansas 67501.

Still another valve is the valve identified as Part No. D34424 of the J.I. Case Company parts book, Model 310G, Tractor Diversion Valve. This is undoubtedly the same as the valve previously referred to by the same number as a Greesen Valve. Still another valve may be

Diverter Valve R 24 819 of the Cross Mfg., Inc., Lewis, Kansas 67552.

The control valve 40 may be identified as follows: It is a spool type valve described as parallel circuit, manually operated, four way, three position valve with the work parts blocked to flow when the spool is in the neutral position and which is provided with a spring return of the spool to neutral position. One identification is Catalog No. A 35 shown on page 37 of the Catalog of Commercial Shearing and Stamping Company of 1775 Logan Ave., Youngstown, Ohio 44505.

OPERATION

Neutral. In this desired state, the control ports 42 and 44 of control valve 40 are closed and the flow from pump 50 to tank 52 is through the open center of the control valve 40 and there is no effect upon the cylinders 22 and 26.

FIG. 1. FIG. 1 shows the control port 42 as open to the pump 50 and to diverter valve 30 and the control port 44 is open to the tank 52. The diverter port 32 is in a position to connect cylinder 22 by way of port 42 to pump 50. Diverter port 34 is closed. Fluid under pressure will traverse from pump 50 through port 42, port 32 to cylinder 22 and in series therewith to cylinder 26, thus extending piston 24 to the left and retracting piston 28 to the right. This causes the blade 12 to tilt to the right.

Return flow will be from cylinder 26 to tank 52 by way of port 44. In the tilt position of diverter valve 30, illustrated in both FIGS. 1 and 2, the passageways indicated by dotted lines are blocked at valve 30, and therefore are not operative.

FIG. 2. Port 44 is open to pump 50 and to cylinder 26 and port 42 is open to tank 52. Port 32 connects port 42 to cylinder 22. Port 34 is closed.

Fluid under pressure from pump 50 will traverse the circuit through port 44, to cylinder 26 and in series therewith to cylinder 22 to extend piston 28 and retract piston 24. This will serve to tilt the blade 12 to the left.

Return flow will be from cylinder 22 through port 32 to port 42 and to receiver or tank 52.

FIG. 3. Port 44 will be open to pump 50 and to port 34. Port 42 will be open to tank 52 and to port 32. Diverter valve port 32 will connect port 42 to the rod side of both cylinders 22 and 26. Port 34 of the diverter valve 30 will connect the head side of both cylinders to pump 50 by way of control valve port 44. The cylinders 22 and 26 will be in parallel and the pistons in both will be extended and this will cause the blade 12 to pitch forward. The pressurized flow is from pump 50 by way of control valve port 44 to cylinder 26 and, by way of diverter valve port 34 to cylinder 22, both cylinders being in parallel. Return flow will be from the far side of both cylinders 22 and 26 to diverter valve port 32, control valve port 42 and tank 52. In the pitch position of diverter valve 30, as illustrated in FIGS. 3 and 4, the short passage interconnecting the passage leading from the right end of cylinder 22 with port 32, is blocked by valve 30, and is therefore indicated by dotted lines.

FIG. 4. Control valve port 42 will be open to pump 50 and port 32. Control valve port 44 will be open to tank 52. Diverter valve port 32 will connect port 42 to the rod side of both cylinders 22 and 26. Diverter valve port 34 will connect the head side of both cylinders 22 and 26 to tank 52 by way of control valve port 44. Fluid under pressure from pump 50 by way of port 42, port

32, will act upon both cylinders simultaneously to retract both pistons 24 and 28 in unison for pitching blade 12 rearwardly. Return flow from the two cylinders 22 and 26, from their near ends, will go to tank 52 by way of diverter valve port 34 and control valve port 44.

SERIES AND PARALLEL CONNECTIONS

It is important to observe that the valves 40 and 30 function to place the cylinders 22 and 26 in series or parallel as desired, extending and retracting the pistons as desired, oppositely or in unison as desired, all as described above and as will be recapitulated below.

FIG. 1. Proper manipulation of the valves 40 and 30 places the two cylinders in series with the flow being in such a direction that the piston 24 in the lefthand cylinder 22 will be extended, whereas the piston 28 in the righthand cylinder 26 will be retracted, causing a tilt of blade 12 to the right.

In FIG. 2, the cylinders are still in series, but this time, the flow is in the reverse direction from the flow of FIG. 1 and this time the righthand piston 28 will be extended and the lefthand piston 24 will be retracted and the blade will be tilted to the left.

In FIG. 3, the valves are so manipulated that the cylinders are connected in parallel and the direction of flow is such that both pistons 22 and 28 will be extended and this will cause the blade to pitch forward. In FIG. 4, the cylinders are still connected in parallel but their direction of flow is reversed, causing both pistons 24 and 28 to be retracted for pitching the blade rearwardly.

CONCLUSION

There has here been disclosed a hydraulic circuit, including valves, a source of fluid under pressure, a return flow receiver, and hydraulic cylinder piston means for a dozer blade, with particular emphasis upon the arrangement which permits manipulation of the valves as desired to place the cylinders in series or parallel as desired, and to provide for the direction of flow to be in either one of two directions as desired, for enabling the pistons of the cylinders to be extended simultaneously, or retracted simultaneously, or one to be extended while the other is retracted, or reversely, one to be retracted while the other is extended, all for the purpose of enabling the dozer blade to be tilted left or right as desired, pitched forwardly or rearwardly as desired, all by means of nothing more than two cylinder piston means, one at each end of an edge of the dozer blade.

Now having described the presently preferred embodiment herein shown by way of example, reference should be had to the claims which follow.

I claim:

1. In a vehicle having a pivotally mounted dozer blade, said blade pivotally supported on said vehicle by a pair of double acting fluid pressure cylinders, each cylinder having a piston and a rod, said cylinder being connected to said blade on opposite sides of the vertical pivot axis and vertically spaced from the horizontal pivot axis, the improved fluid control circuit for controlling tilt and pitch of the blade which comprises:

- a source of fluid pressure;
- an exhaust conduit;
- a diverter valve for selecting the tilt and pitch functions;

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a control valve for selecting the direction of tilt and pitch;
said control valve being connected in series between a first port of said diverter valve and both said source of fluid pressure and said exhaust conduit, 5
said control valve also being selectively connected to a first end of one of said fluid cylinders at said first port when said diverter valve is in its tilt position;
said control valve being further connected in series 10
between the corresponding end of the other of said fluid cylinders and both said source of fluid pressure and said exhaust conduit;
said first ends of both said fluid cylinders being selectively connected to each other and to said control 15
valve at a second port of said diverter valve when said diverter valve is in its pitch position;
the opposite ends of both said fluid cylinders being continuously connected to each other by a linking conduit, which is in turn selectively connected to 20
said control valve at said first port of said diverter

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valve when said diverter valve is in its pitch position;
said control valve, when in a first non-neutral position, connecting one of said diverter valve ports to said source of fluid pressure and the other of said diverter valve port to said exhaust conduit and reversing said connection when in a second non-neutral position;
whereby both tilt and pitch functions are controlled with two fluid cylinders and two valves, with the exhausting end of one fluid cylinder supplying pressurizing fluid to the corresponding end of the other fluid cylinder via said linking conduit when said diverter valve is in its tilt position, and with a first pair of corresponding ends of said fluid cylinders being simultaneously pressurized and a second pair of corresponding ends of said fluid cylinders being simultaneously exhausted, as controlled by said control valve, when said diverter valve is in its pitch position.

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