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[54] **HYDRAULIC FLUID CIRCUIT FOR VEHICLE HAVING ARTICULATED SECTIONS**

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[52] **U.S. Cl.** ..... **180/53 R**

[51] **Int. Cl.** **F15b 15/18**

[58] **Field of Search** ..... 180/66 R, 14 R, 51, 53 R, 180/477; 60/472, 327; 91/6, 41

[56] **References Cited**

UNITED STATES PATENTS

2,675,097	4/1954	Dorsey	180/14 R X
2,833,362	5/1958	Martin	180/66 R
2,913,061	11/1959	Beyerstedt	180/51 X
3,222,865	12/1965	Miller	60/327
3,222,866	12/1965	Lehmann	60/327
3,234,855	2/1966	Freedy	91/41
3,521,720	7/1970	Korotkin	180/66 R

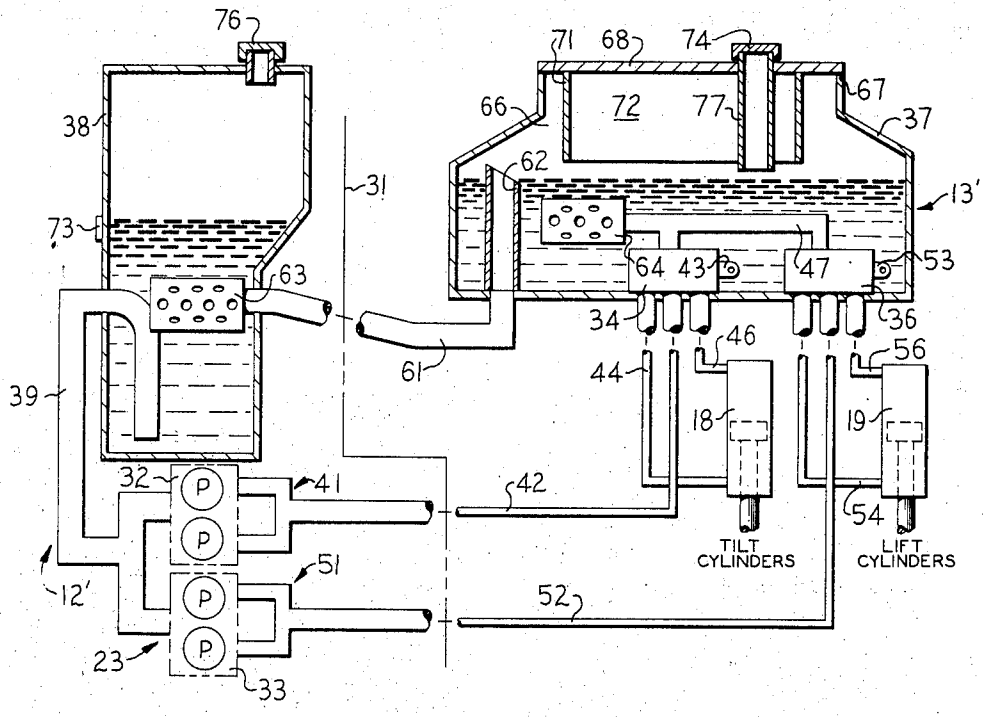
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[57] **ABSTRACT**

A hydraulic circuit having one or more pumps adjacent motor means in a machine with hydraulic motors which are supplied by the circuit being located in a relatively remote location from the pumps. A control valve is associated with each hydraulic motor and includes a return line in communication with a first hydraulic fluid tank. An assembly of one or more pumps for delivering fluid under pressure to the control valves is located adjacent the motor means and is driven by the motor means. A second hydraulic fluid tank is associated with the pump assembly, the second tank providing fluid to the pumps and being in communication with the first tank by a return conduit for delivering fluid from the first tank to the second tank. To prevent rupture of the first tank, a baffle is preferably arranged within that tank to assure a constant air pocket above the fluid.

2 Claims, 2 Drawing Figures



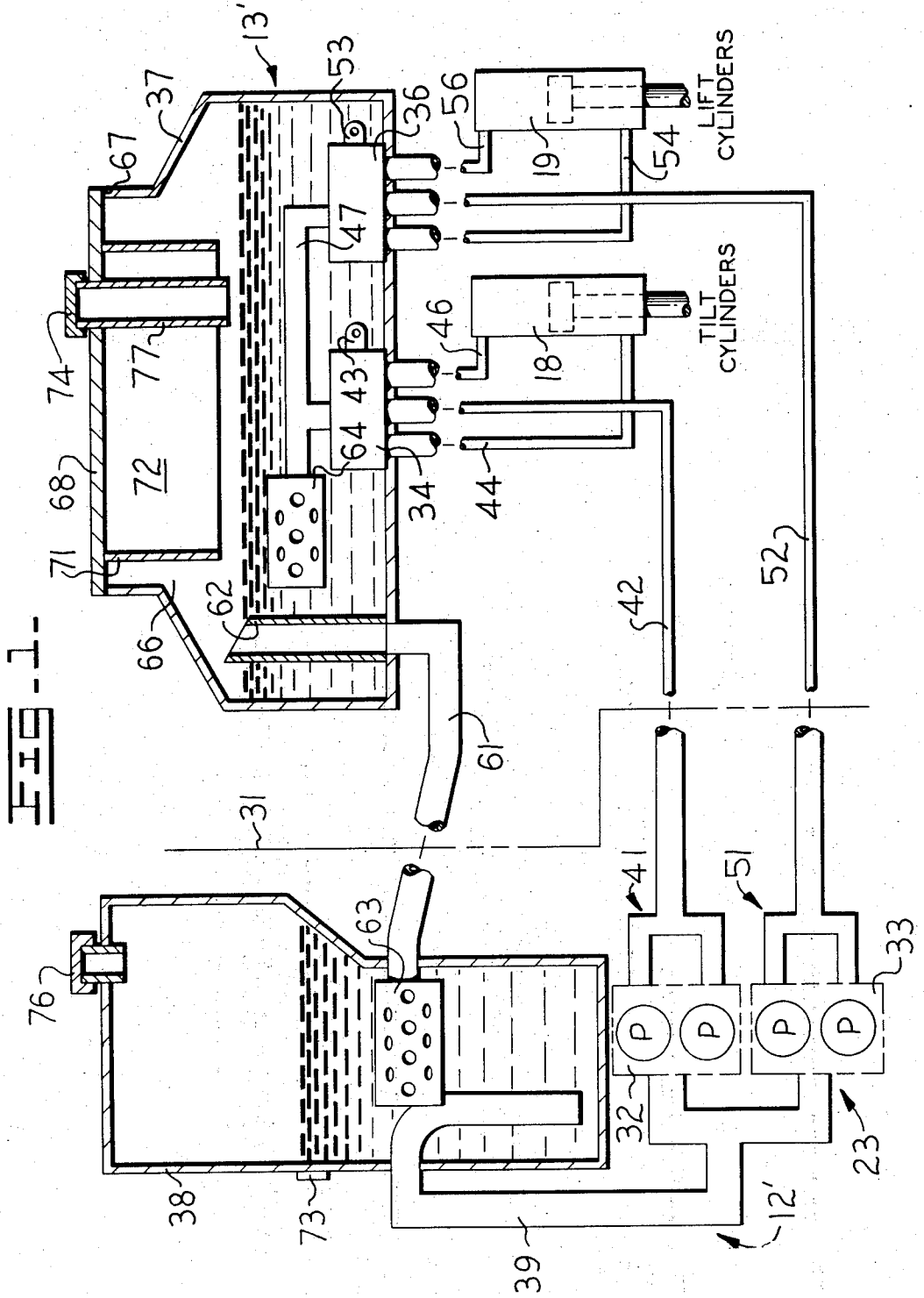


Fig. 1

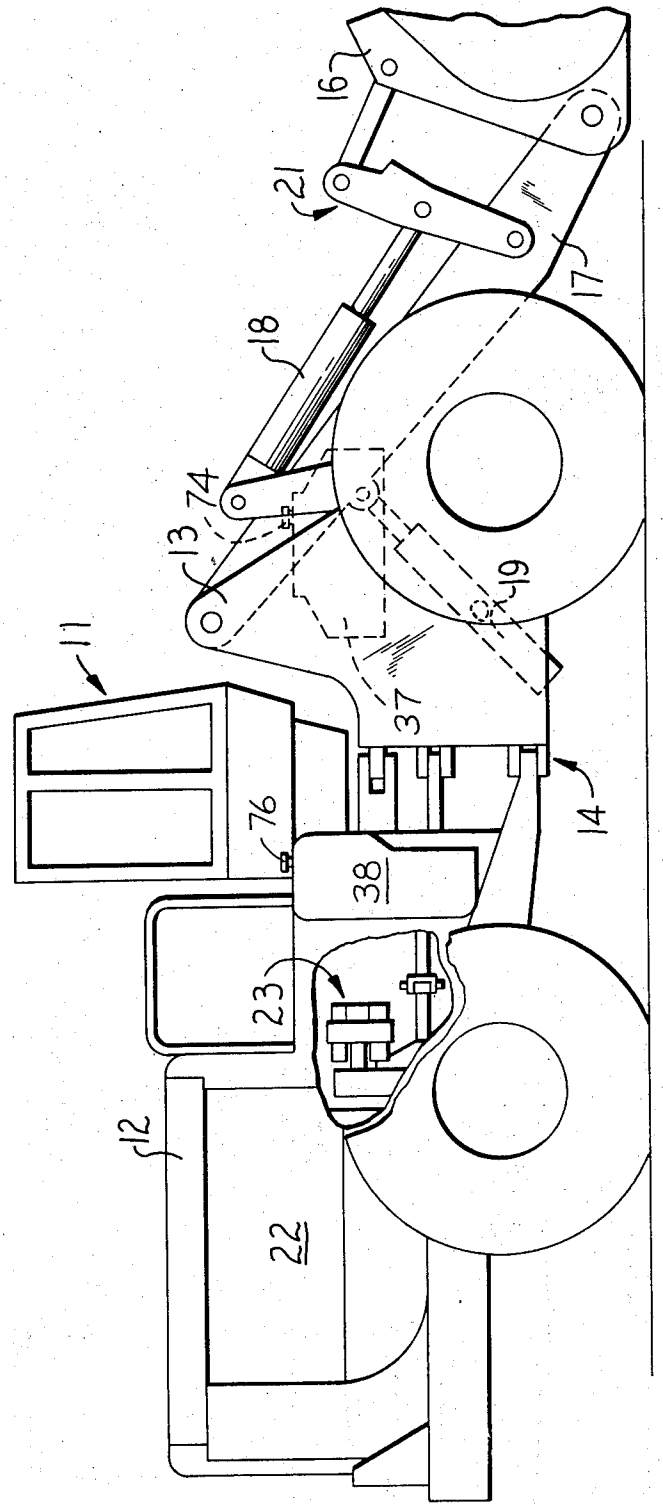


FIG. 2.

HYDRAULIC FLUID CIRCUIT FOR VEHICLE HAVING ARTICULATED SECTIONS

This application is a division of Ser. No. 834,776 filed June 19, 1969, now U.S. Pat. No. 3,604,205.

The present invention relates to a hydraulic circuit on a machine for circulating fluid between pumps driven by motor means such as an engine and one or more control valves which are adjacent to and regulate hydraulic motors supplied by the circuit. The present invention particularly contemplates the circuit for use in applications where one or more hydraulic motors are relative remote from the motor means employed to drive one or more hydraulic pumps in the circuit.

The present invention is described below within an exemplary environment provided by an articulated material handling vehicle such as a bucket loader having motor means for an engine on one articulated section and implements powered by hydraulic motors on the other articulated section. In such an environment, it is desirable to locate pumps for the circuit closely adjacent **38** engine from which they are driven. In the prior art, a hydraulic fluid tank or reservoir is commonly located adjacent the pumps with hydraulic fluid under pressure being communicated to the remote hydraulic motors and exhaust fluid from the motors being returned to the tank. When control valves for regulating fluid flow to the motors are located within the hydraulic fluid tank, as is common to place the control valves in a protective environment, numerous high-pressure supply lines and low-pressure return lines are necessary to properly communicate the tank and pumps with the hydraulic motors. The arrangement of such circuits is particularly complicated on articulated vehicles of the type mentioned above since each of the lines must cross the articulated axis of the vehicle and accordingly must include a swivel joint.

The present invention substantially minimizes these problems and simplifies the hydraulic circuit through the use of two hydraulic fluid tanks. One of the tanks is associated with the hydraulic pump or pumps while the other tank is associated with one or more remotely located hydraulic motors and regulating control valves.

In such a hydraulic circuit, one of the tanks commonly has inlet means for receiving fluid under pressure, for example, from the hydraulic motors supplied by the circuit. The tank also has outlet means through which fluid exits the tank. Normally, the tank is maintained in a condition where it is partly filled with fluid and has an air pocket above the fluid. Surges of fluid into the tank from the inlet means are normally prevented from rupturing the tank by the air pocket which tends to absorb any increasd pressures. However, during operation, air commonly tends to leak out of the tank, for example, through gasket material used to close the tank particularly under high-pressure conditions caused by the fluid surges. If all of the air in the tank leaks into the atmosphere and the tank becomes filled with fluid, high pressures caused by subsequent fluid surges may tend to damage or rupture the tank.

To solve this problem, the present invention contemplates the use of baffle means for maintaining an air pocket in the tank and preventing leakage of the air.

The manner in which the present invention fulfills these purposes is illustrated by the following description wherein additional objects and advantages of the invention are also believed to be made apparent. The

invention is described below having reference to the accompanying drawings.

In the drawings:

FIG. **1** is a schematic representation of the present hydraulic circuit with various components of the circuit being shown in section; and

FIG. **2** is a side view in elevation of an articulated vehicle employing the present hydraulic circuit.

The present invention is described with particular reference to an articulated vehicle of the type illustrated in FIG. **2.** However, it will be apparent that the hydraulic circuit may be employed in other vehicles or machines which are not necessarily articulated but wherein motor means such as an engine for driving pumps of the circuit is located remotely from hydraulic motors supplied by the circuit.

Momentarily referring to FIG. **2,** an articulated vehicle **11** for which the present hydraulic circuit is particularly contemplated has two sections **12** and **13** joined together by an articulated joint indicated at **14.** For purposes of an example, the vehicle is illustrated as a bucket loader having a bucket **16** pivotally supported by one or more lift arms such as that indicated at **17.** The position of the bucket is controlled by hydraulic tilt motors, one of which is indicated at **18,** and hydraulic lift motors, one of which is indicated at **19.** Each tilt motor is interconnected between the vehicle and the bucket by tilt linkage generally indicated at **21.** Each hydraulic lift motor is pivotally interconnected between the vehicle and one of the lift arms **17.**

The tilt motors and lift motors together with the bucket **16** are commonly supported by one of the articulated sections, for example that indicated at **13.** An engine **22** for driving the vehicle is commonly located on the other articulated section **12.**

When a hydraulic circuit of the type illustrated in greater detail in FIG. **1** is adapted to such a vehicle, it is desirable that the hydraulic pumps be located closely adjacent the engine **22** by which they are driven. Accordingly, a cluster arrangement **23** of hydraulic pumps is shown adjacent the engine **22** upon the articulated section **12.**

The present invention is believed to substantially simplify construction of a hydraulic circuit for properly interconnecting the pump cluster **23** with the hydraulic motors such as those indicated at **18** and **19.** A hydraulic circuit constructed according to the present invention is illustrated in FIG. **1** to which reference is now made. Components of the circuit in FIG. **1** are divided into two groups by a section line indicated at **31.** When the circuit is adapted to a vehicle of the type illustrated in FIG. **2,** one group indicated generally at **12'** and including those components to the left of the section line **31** in FIG. **1** are arranged upon the articulated vehicle section **12** including the engine **22.** Another group indicated at **13'** and generally including those components to the right of the section line **31** in FIG. **1** are arranged upon the other articulated section **13** which also supports the bucket implement **16.** As illustrated in FIG. **1,** the pump cluster **23** includes two double sectioned pumps **32** and **33.** Fluid under pressure from the pumps **32** and **33** is selectively directed to the hydraulic motors **18** and **19** by control valves **34** and **36** respectively. The circuit also includes a first hydraulic fluid tank or reservoir **37** which receives fluid from the control valves **34, 36** and a second hydraulic fluid tank **38** from

which fluid is drawn into the pumps **32, 33** by an inlet conduit **39.**

To describe various components of the circuit in greater detail, the control valves are of a type suitable for immerging in hydraulic fluid. Accordingly, the control valves **34, 36** are shown within the first tank **37.** The tank **37** has a generally low, wide profile so that the control valves may be arranged in generally horizontally relation adjacent the bottom of the tank.

Fluid under pressure from the pump **32** is combined in a manifold **41** from where it passes into an outlet conduit **42.** The conduit **42** is also in communication with the control valve **34.** The valve **34** includes a spool, generally indicated at **43,** which may be positioned to direct fluid from the conduit **42** into either end of the hydraulic motor **18** by respective conduits **44** and **46.** The spool **43** may also be positioned so that fluid from the conduit **42** passes directly into a fluid return line **47** which communicates the control valve **34** with the first tank **37.** When the control valve is adjusted to direct fluid into either end of the motor **18,** exhaust fluid from the other end of the motor **18** is also delivered by the control valve into the return conduit **47.**

The other pump **33** is similarly in communication with the control valve **36** by a manifold **51** and a high-pressure outlet conduit **52.** The control valve **36** includes a control spool generally indicated at **53.** The control valve **36** is similarly in communication with both ends of the hydraulic motor **19** through respective conduits **54** and **56** and with the first tank **37** by means of the same fluid return line **47.**

The first tank **37** is in communication with the second tank **38** by means of a return conduit indicated at **61.** The return conduit **61** is in communication with the first tank **37** by means of a stand pipe **62** which normally establishes the fluid level in the first tank **37.** A baffle assembly **63** is arranged at one end of the return conduit **61** to prevent aeration of the fluid entering the second tank **38.** A similar baffle assembly **64** is mounted on the fluid return **47** in communication with the first tank **37.** Under normal operating conditions, both tanks **37, 38** are partly filled with hydraulic fluid to form air pockets in the tops of the tanks. Fluid under pressure is delivered into the first tank **37** through the fluid return **47** which tends to increase pressure in its air pocket generally indicated at **66.** When the fluid level in the first tank **37** is above the top of stand pipe **62,** the increased pressure causes excess fluid to flow into the second tank **38.** Thus, pressure within the first tank **37** will normally be slightly higher than air pressure in the second tank **38** by the differential pressure drop required to transmit fluid through the return conduit **61.** The two tanks **37, 38** are relatively positioned so that the normal fluid level in the first tank **37** is somewhat higher than the fluid level in the second tank **38.**

Since all return fluid from the control valves **34, 36** is delivered to the first tank **37,** surges of fluid, for example exhausted from the hydraulic motors **18** and **19** may substantially increase the pressure in the first tank. These pressure surges tend to cause air within the tank **37** to leak to the atmosphere, particularly across the gasket material **67** which seals the cover **68** in place atop the first tank **37.** If this leakage is permitted to continue, the first tank **37** could become entirely filled with fluid. In that event, subsequent fluid surges into the tank **37** could rupture the tank.

To prevent this from happening, the present invention contemplates baffle means **71** forming a region **72** at the top of the tank **37.** The baffle **71** is preferably a cylindrical structure secured to the cover **68** and opening downwardly toward fluid within the tank **37.** Since the cover **68** to which the baffle is secured is generally continuous, leakage of air from the region **72** is prevented so that a substantial air pocket is assured at the top of the first tank **37** during operation of the system. This air pocket provides a cushion for pressure surges within the tank and thereby prevents damage to the tank itself.

To commence operation of the present hydraulic circuit, hydraulic fluid is first introduced into the first tank **37** until it reaches the top of stand pipe **62.** The second tank **38** is then filled with fluid to a somewhat lower level which may be determined for example by a sight gauge **73.** The pumps **32, 33** are then momentarily operated so that all of the conduits and other components of the circuit are filled with fluid. The pumps are then shut down and the second tank **38** is again filled to a level somewhat lower than the fluid level determined by the stand pipe **62** in the first tank **37.**

The fluid may be added to the first and second tanks by means of filler caps indicated at **74** and **76** respectively. To completely prevent leakage of air from the region **72** past the filler cap **74,** a cylindrical pipe **77** supporting the cap **74** is hermetically secured to the cover **68** and extends downwardly at least as far as the baffle **71.**

What is claimed is:

1. A hydraulic circuit for a vehicle having an engine and a hydraulic motor remotely located from the engine of the vehicle, the vehicle having two sections joined in articulated relation, the engine being on one articulated section and the hydraulic motor being on the other articulated section, comprising

at least one hydraulic pump associated in driven relation with the engine,

a control valve associated with the hydralic motor, said control valve being in communication with a fluid outlet conduit of said pump, said control valve being selectively operable to deliver fluid under pressure for operating the hydraulic motor,

a first hydraulic fluid tank associated with said control valve, said first tank being in communication with a fluid return from said valve,

a second hydraulic fluid tank associated with said pump, said second tank being in communication with an inlet conduit to said pump,

said pump and second tank being located on the one articulated section, said valve and first tank being located on the other articulated section, and

a return conduit providing substantially free communication between said first and second tanks for delivering hydraulic fluid from said first tank to said second tank, said return conduit including a stand pipe in said first tank for establishing a normal fluid level therein.

2. A hydraulic circuit for a vehicle having motor means, at least one implement and a hydraulic motor for operating the implement being remotely located from the motor means, comprising

a hydraulic pump associated with and coupled in driven relation to the motor means,

a control valve hydraulically associated with the hydraulic motor, said control valve being in communication with said pump by a high pressure fluid conduit,

a first hydraulic fluid tank associated with said control valve, said first tank being in communication with a fluid return line from said valve,

a second hydraulic fluid tank associated with said pump, said second tank being in communication with an inlet conduit for delivering hydraulic fluid to said pump,

a return conduit substantially freely communicating said two tanks for delivering fluid from said first tank to said second tank, said return conduit including a stand pipe in said first tank for establishing a normal fluid level therein, and

wherein the vehicle is comprised of two articulated sections, the motor means, said pump and second tank being located on one articulated section, the implement, said control valve and first tank being located on the other articulated section.

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