United States Patent

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[54] **RESERVOIR ASSEMBLY**

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[52] **U.S. Cl.** **137/590**, 137/592, 220/86

[51] **Int. Cl.**.....**F15b 1/04**

[58] **Field of Search** 137/590, 592; 220/86; 303/85

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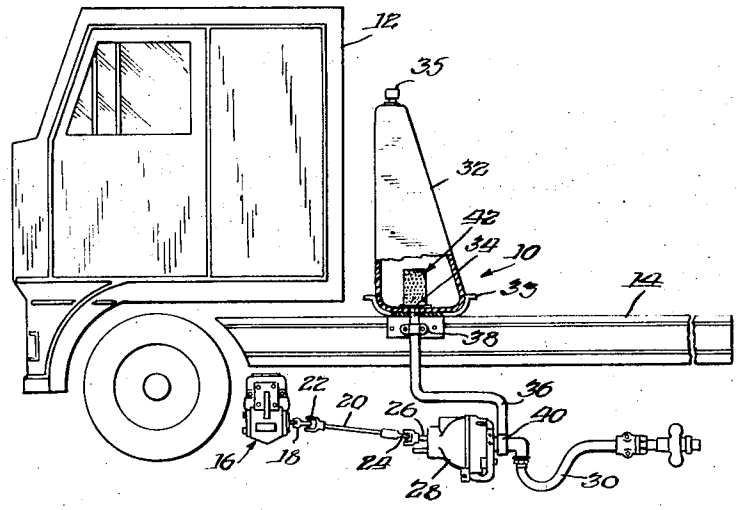
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[57] **ABSTRACT**

A reservoir assembly for use as a fluid storage component in systems for actuating hydraulically operated devices. An apertured diffuser is disposed within the reservoir for reducing the velocity of fluid returning to the reservoir without decreasing the rate of fluid flow. In one aspect of the invention, the reservoir assembly is made entirely of a non-corrosive material to prevent contamination of the hydraulic fluid. To this end, for example, the reservoir comprises a one piece, seamless plastic container, while the diffuser is likewise, for example, made of plastic material.

4 Claims, 3 Drawing Figures



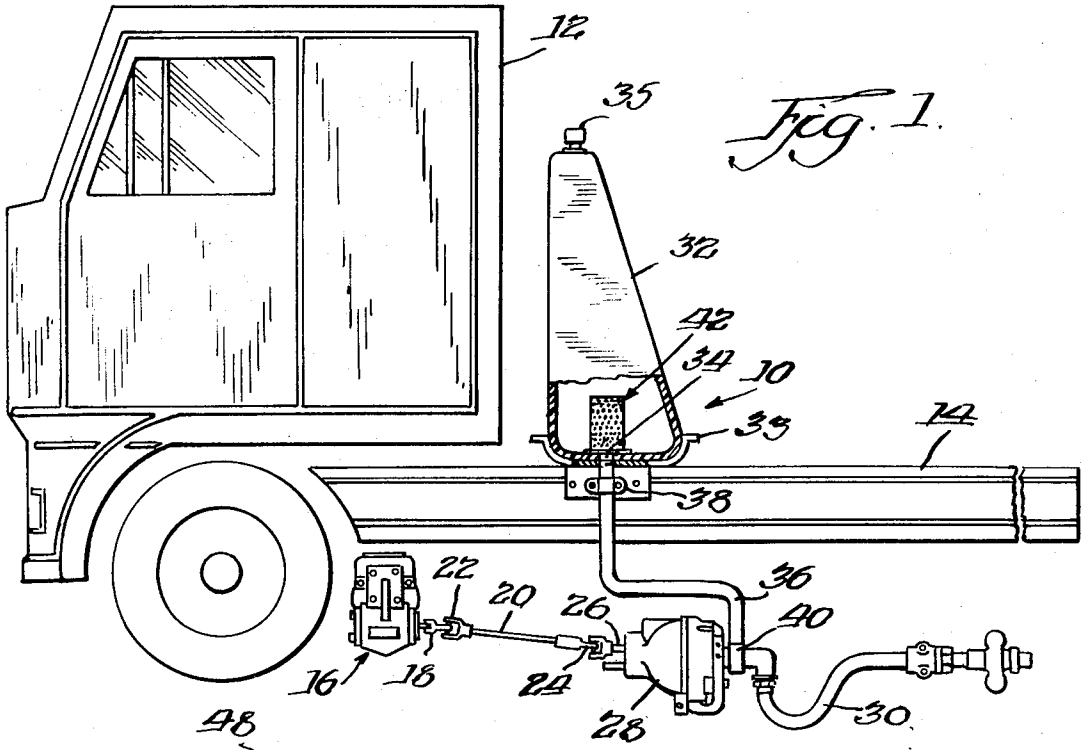


Fig. 1.

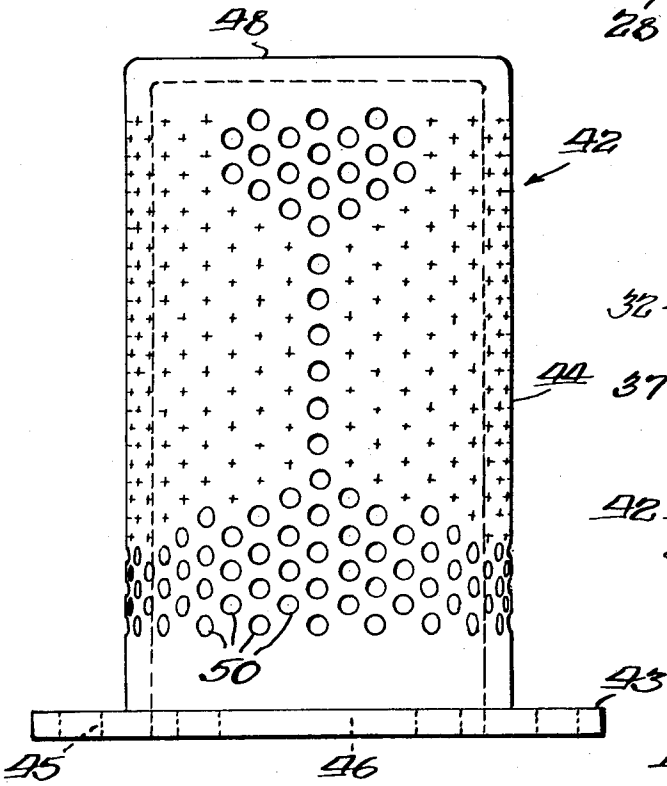


Fig. 2.

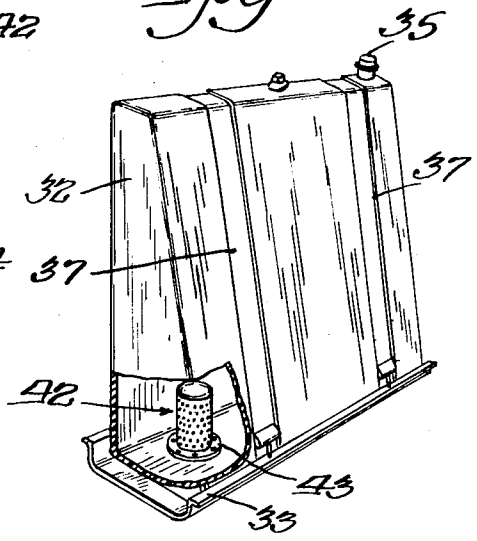


Fig. 3.

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RESERVOIR ASSEMBLY

BACKGROUND OF THE INVENTION

This invention relates to a reservoir assembly for storing fluid in a system for actuating hydraulically operated devices. More particularly, the present invention comprises a reservoir assembly for storing hydraulic fluid in a contaminant free environment, wherein the velocity of flow of hydraulic fluid to the reservoir is decreased without reducing the rate of fluid flow in gallons per minute.

Fluid handling and storage systems are known in the prior art which use conventional metal reservoirs as storage components for the hydraulic fluid. These metal reservoirs have welded seams which may or may not be uniform in bond, depending on the skill and attitude of the welder. Conventional reservoirs also are unable to prevent contamination of the fluid, which is the largest cause of failures in hydraulic systems. The types of contaminents usually found in a fabricated metal tank are welding slag, sand, rust, and excessive moisture. The particulate size of these contaminants is in the 100–200 micron range, which causes difficulty since high pressure hydraulic components cannot pass contaminants larger than 10 microns without eventually being destroyed.

It has also been found that conventional reservoir assemblies lack effective means to reduce the velocity, but not the flow rate, of the fluid returning to the reservoir. As a result, the high velocity of returning fluid weakens the conventional reservoir at its seams and eventually causes it to break open.

It is also not uncommon for the returning fluid to be blown through a breather cap and deposit a film of oil on the outside of the reservoir as well as on nearby equipment. Attempts to overcome this problem in the prior art have included the installation of baffle plates situated vertically in the reservoir, dividing it into two sections. This, however, functions more as an anti-sloshing device and has proven to be quite ineffective in controlling the velocity of the returning fluid. A second use of the baffle plate has been to place it in the reservoir a few inches above and across the return port. However, this usage does not allow an even disposal of the fluid stream, thereby causing the formation of air bubbles and foam in the fluid which in turn, causes cavitation in hydraulic pumps.

SUMMARY OF THE INVENTION

In the present invention, the possibility of the reservoir weakening at the seams and bursting open is drastically reduced, if not eliminated altogether.

It will be apparent from the foregoing that a primary object of the present invention is to provide a reservoir assembly for a hydraulic fluid storage and handling system which eliminates the possibility of contaminants such as welding slag, sand, rust, or moisture from mixing with the hydraulic fluid in the system.

Another object of the present invention is to provide a hydraulic fluid handling and storage system including a reservoir assembly in which pressure build-up is prevented by reducing the velocity of fluid returning to the reservoir without reducing the volumetric flow rate in gallons per minute.

It is a further object of the present invention to provide a corrosion free storage component for a hydraulic fluid storage and handling system which is seamlessly constructed and has uniform wall thickness, and which results in outstanding toughness and the elimination of weak areas and leaky seams.

Another object of my invention is to provide a reservoir assembly for a hydraulic fluid storage and handling system wherein the possibility of the reservoir assembly bursting under pressure is drastically reduced, if not eliminated altogether.

Other objects of my invention will become apparent from the specification which follows and from the drawing to which reference is now made.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 schematically illustrates the present invention installed in a vehicle with the reservoir component shown partly in section located rearwardly of the cab of the vehicle;

FIG. 2 is an enlarged view of the diffuser illustrated in the cut-away section of the reservoir of FIG. 1; and

FIG. 3 is a perspective view of the reservoir assembly of the present invention, partly cut away to show a preferred location for the diffuser located therein.

DESCRIPTION OF THE PREFERRED EMBODIMENT

FIG. 1 discloses the reservoir assembly **10** of the present invention installed on a truck **12** as the storage component of a hydraulic system for supplying fluid under pressure to hydraulically actuated devices, such as a dump body (not shown) mounted on the rear portion of truck frame **14**. The hydraulic system may also be used to supply fluid under pressure to additional fluid operated equipment associated with the vehicle, such as hoists, winches, lifts, etc.

Power for the hydraulic system is supplied by a power take-off unit **16** which is driven by the truck engine, not shown. A driven output shaft **18** transfers power from power take-off unit **16** to drive shaft **20** through a universal connection **22**. At the other end of drive shaft **20**, a slip length universal joint **24** attaches drive shaft **20** to input shaft **26** of hydraulic pump **28**. Hydraulic fluid is conveyed under pressure from pump **28** through conduit **30** to the dump body actuating mechanism, or to other hydraulically operated equipment associated with truck **12**.

Hydraulic fluid for use in the above described system is stored in reservoir assembly **10** which comprises a reservoir **32** mounted by means of a platform **33** to truck frame **14**. Straps **37** extend around the periphery of reservoir **32** and fasten the reservoir assembly **10** to platform **33** (FIG. 3). A breather cap **35** is provided on top of reservoir **32** to prevent build-up of pressure inside the reservoir. A port **34** is provided in the bottom of reservoir **32** and extends through platform **33**. Conduit **36** is fastened at one end to vehicle frame **14** by means of clamp coupling or bracket **38**, located on the underside of reservoir **32** and platform **33** directly adjacent port **34**. The other end of conduit **36** is connected by an "El" joint **40** to conduit **30** at or near the point where conduit **30** is affixed to pump **28**.

Pump **28** is adapted to pump hydraulic fluid stored in reservoir **32** through port **34** and conduit **36**, and thence through conduit **30** to the hydraulically operated equipment associated with truck **12**. Assum-

ing such equipment comprises a conventional dump body, hydraulic fluid passing from pump **28** to conduit **30** will function to raise the dump body to an inclined position relative to the truck frame **14**. When it is desired to lower the dump body from a raised position, pump **28** is operated in reverse by means of power take-off unit **16** to convey the fluid in conduit **30** back to reservoir **32** through conduit **36** and port **34**.

When fluid under pressure in conduit **36** returns to reservoir **32**, the velocity of the returning fluid has been known to result in weakening of conventional reservoirs at the seams, causing them to eventually burst open. Conventional welded reservoir tanks are unable to withstand higher stresses when subjected to fluid under pressure, due to non-uniform seams, and walls of non-uniform thickness. Also, it is not uncommon for the fluid returning to an ordinary reservoir to blow though the breather cap and distribute a film of oil over the outside of the reservoir and on nearby equipment.

The reservoir assembly disclosed herein overcomes the disadvantages mentioned above by providing a fluid storage component of uniform construction. The reservoir assembly also is able to withstand the higher stresses normally occassioned in the hydraulic systems found in modern vehicles by reducing the velocity of the fluid returning to the reservoir, without reducing the flow rate. To this end, a diverging device such as diffuser **42** is affixed to the inside bottom portion of reservoir **32** directly adjacent port **34**. Flange means **43** are provided adjacent the open end **46** of diffuser **42**. Mounting holes **45** are provided in flange **43** by which means diffuser **42** may be securely fastened to the inside bottom surface of reservoir **32** (FIG. 3). As shown in more detail in FIG. **2**, diffuser **42** comprises a cylindrical body **44** having an open port **46** at one end and a capped or closed end **48**. The cylindrical body **44** of the diffuser **42** includes apertures **50** located in staggered relationship throughout the entire surface area of the diffuser wall. As best illustrated in FIG. **1**, the inside diameter of the diffuser **42** is larger than the inside diameter of conduit **36** and the diameter of port **34**.

The flow path of fluid entering reservoir **32** from conduit **36** expands when it passes port **34** due to the larger diameter of diffuser **42**. The volumetric displacement and the quantity of open area in the diffuser wall provided by apertures **50**, and the net head or pressure of the hydraulic fluid, are the parameters which determine the flow rate of the fluid stream, usually measured in gallons per minute. Due to the divergent character of diffuser **42** relative to the size of conduit **36** and port **34**, the velocity of the fluid stream entering reservoir **32** is reduced without a corresponding reduction in the fluid flow rate in gallons per minute. When the fluid stream is slowed down, a portion of the kinetic energy in the stream is converted to potential, or pressure energy. The pressure of the fluid in the diffuser **42**, therefore, is greater than the pressure downstream in conduit **36**. This pressure is distributed by the diffuser **42**, wherein the staggered placement of the apertures **50** allows a uniform dispersal of the fluid stream in reservoir **32**.

As stated previously, the conventional hydraulic system reservoir is a welded metal pressure vessel which has varying stress capabilities depending on the quality of the welded seam. Also, a metal tank contains contaminants such as welding slag, sand, rust, and moisture, and these contaminants may cause permanent damage to hydraulic components if they enter the fluid stream. The construction of the reservoir **32** and diffuser **42** of the present invention eliminates the problem of non-uniform seams and contaminants. In the preferred embodiment of my invention, the reservoir **32** is a rotationally molded, seamless, high density polyethylene vessel with walls of uniform thickness. Being constructed of polyethylene, the reservoir **32** is free of the corrosion causing contaminants usually found in metal welded tanks, and removes the responsibility for providing a contaminant free tank from the mechanics installing the hydraulic system. The polyethylene material provides a tank which is tough, rigid, lightweight, abrasion resistant and corrosion free. Preferably, the diffuser **42** is also made from high density polyethylene to further reduce the possibility of foreign matter entering the hydraulic fluid stream.

In some installations, another parallel hydraulic system with apparatus identical to pump **28** and conduits **30** and **36** may be operational on the opposing side of the vehicle **12**. It is within the scope of the present invention to provide a reservoir **32** with two ports **34** and two diffusers **42** located on either side of the reservoir to cooperate with two conduits **36**.

The foregoing embodiment is exemplary of the invention and may be used as a model for constructing the invention, however, many variations may be made without departing from the spirit and scope of the invention as defined in the following claims.

I claim:

1. A reservoir assembly for a hydraulic system having a high-pressure return flow from a hydraulically activated device in the hydraulic system, said reservoir assembly comprising:

a seamless reservoir for storing hydraulic fluid, said seamless reservoir being formed from a non-corrosive material to prevent said seamless reservoir from producing contaminant particles to contaminate the hydraulic fluid stored in said seamless reservoir and having port means for passing hydraulic fluid to and from said seamless reservoir;

cylindrical diffuser means positioned over said port means in said reservoir, said diffuser means having a plurality of apertures therein, the number of said apertures being sufficient to reduce the velocity of hydraulic fluid flow into said seamless reservoir without decreasing the rate of flow of hydraulic fluid into said seamless reservoir; and

means for coupling said reservoir to said hydraulically activated device to permit flow of hydraulic fluid to and from said hydraulically activated device.

2. The reservoir assembly of claim **1** wherein said diffuser means is formed from a non-corrosive material to prevent said diffuser means from producing contaminant particles to contaminate the hydraulic fluid stored in said seamless reservoir.

3. The reservoir assembly of claim **2** wherein said seamless reservoir is rotationally molded from high density polyethylene.

4. The reservoir of claim **3** wherein said diffuser means is formed from high density polyethylene.

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