United States Patent

Roth

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[54] EXPANSIBLE CHAMBER DEVICE WITH INTERNAL ACCUMULATOR

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[30] **Foreign Application Priority Data**

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[51] **Int. Cl.** **F01b 19/00**

[58] **Field of Search** 92/60, 134, 92; 138/30

[56] **References Cited**

UNITED STATES PATENTS

2,753,036	7/1956	Joy	92/60
3,021,926	2/1962	Wasdell	92/60 X
3,191,506	6/1965	Ledeen	92/60 X
3,410,549	11/1968	Cheak	267/64
3,442,292	5/1969	Jacuzzi	92/92

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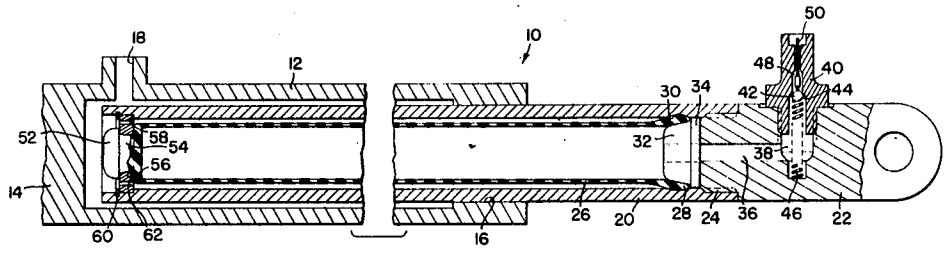
[57] **ABSTRACT**

An extensible and retractable hydraulic motor having an internal accumulator comprising a cylinder, a piston reciprocally mounted within the cylinder, the piston being hollow and forming a chamber open to the interior of the cylinder, and an elastic container within the chamber filled with a compressible gas.

5 Claims, 2 Drawing Figures



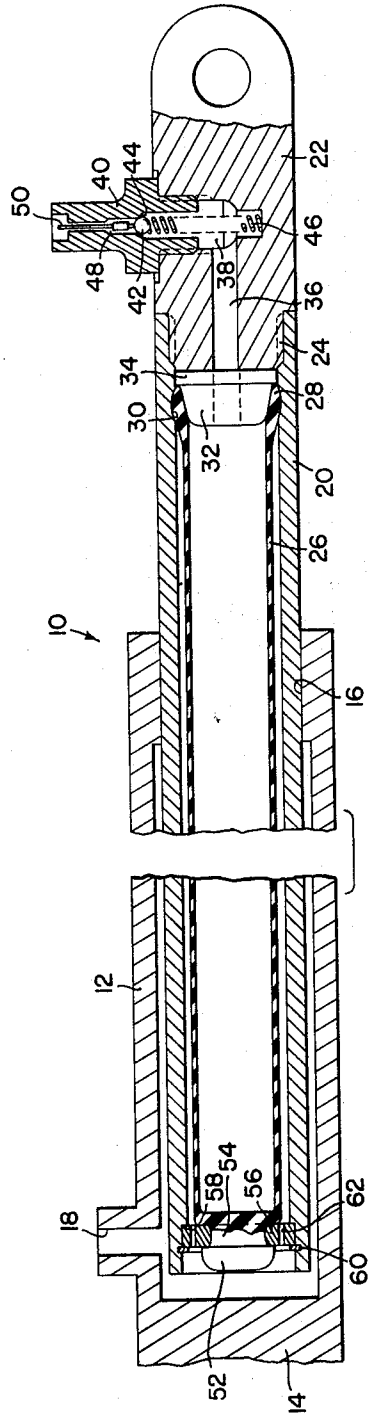


FIG. 1

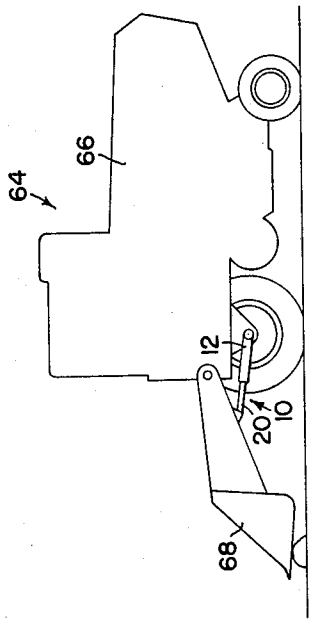


FIG. 2

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EXPANSIBLE CHAMBER DEVICE WITH INTERNAL ACCUMULATOR

BACKGROUND OF THE INVENTION

The present invention relates generally to an extensible and retractable hydraulic motor and accumulator combination, and more particularly relates to an extensible and retractable hydraulic motor having an integral accumulator.

In hydraulic systems, it is often necessary for a hydraulic motor to be connected to a pressure storage means or an accumulator so that high-pressure peaks can be absorbed. Also, in some applications of extensible and retractable hydraulic motors, the accumulator assists the movement of the part controlled by the hydraulic motor. For example, when an extensible and retractable hydraulic cylinder is used to control the height of the harvesting platform on a combine, the accumulator will assist the platform in floating over obstructions so that the full weight of the platform does not bear on the obstruction.

Prior to the present invention, the typical arrangement for a hydraulic motor and accumulator combination was to make the accumulator separate from the hydraulic motor and to connect the two by pressure lines. This arrangement had the disadvantages of requiring additional pressure lines, long assembly times, additional storage space for the accumulator, and was subject to leaks in the pressure lines and connections.

Another known arrangement of hydraulic motor and accumulator combinations was to provide an elongated piston for the hydraulic motor, provide a bore in the piston which was open to the cylinder, and to reciprocally mount a pressure-storing piston within the bore of the main piston so that compressible gas could be trapped between the pressure-storage piston and the closed end of the bore. This arrangement had the disadvantage of requiring the entire length of the running track for the pressure-storage piston to be accurately machined and was also subject to leaks across the seals for the pressure-storage piston.

SUMMARY OF THE INVENTION

The principal object of the present invention is to provide an extensible and retractable hydraulic motor and accumulator combination which avoids all the disadvantages of prior hydraulic motor and accumulator combinations.

A more specific object of the present invention is to provide an extensible and retractable hydraulic motor which has a hollow piston forming a chamber open to the interior of the cylinder, and an elastic container filled with a compressible gas disposed within the hollow cylinder.

A further object of the present invention is to provide an extensible and retractable hydraulic motor having a hollow piston forming a chamber open to the interior of the cylinder and an elastic container filled with a compressible gas disposed within the container, and means for varying the amount of gas within the container.

Yet another object of the present invention is to provide an extensible and retractable hydraulic motor having a hollow piston forming a chamber, an elastic container filled with a compressible gas disposed within the chamber, and throttle bores establishing communications between the chamber and the interior of the cylinder.

The above objects and advantages of the present invention will become apparent along with additional objects and advantages from a reading of the following detailed description when taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

In the drawing:

FIG. 1 is a sectional view of a hydraulic motor having an internal accumulator according to the present invention; and,

FIG. 2 is a schematic view of a conventional combine illustrating one use of the extensible and retractable hydraulic motor illustrated in FIG. 1.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawing, the hydraulic motor is indicated generally by the reference numeral **10** and includes a cylinder **12** closed at one end **14** and provided with a piston-receiving aperture **16** at its other end. The cylinder **12** is provided with a port **18** adjacent its closed end. The piston of the hydraulic motor includes an elongated cylindrical portion **20** and a head portion **22**. The cylindrical portion **20** of the piston is reciprocally mounted in the cylinder and extends through the bore **16**. The outer end of the cylindrical portion **20** is threaded to receive a similarly threaded end **24** of the head portion **22**.

The cylindrical portion **20** of the piston forms a chamber in which is disposed a tubular elastic container **26** which is closed at one end and opened at the other end. At its open end, the wall of the container **26** is provided with an annular bead **28** which is adapted to seat it in an internal annular groove **30** provided in the piston. A frusto-conical stopper member **32** which may either be integral with or separate from the head portion **22** of the piston extends into the open end of the container **26**. The large end **34** of the stopper member **32** is of a size to slightly be fit within the cylindrical portion **20** of the piston so that when the head portion is threaded into the cylindrical portion, the beaded wall portion **28** of the container **26** is wedged between the stopper member **32** and the wall of the annular groove **30** to form a seal.

A bore or passage means **36** extends through the stopper member and into the head portion of the piston where it intersects a second bore or passage means **38** which extends inwardly from one side of the head. The bore **38** is threaded to receive a check valve **40** which includes a ball **42** normally biased against internal shoulders **44** by a spring **46**. The ball **42** closes a passageway **48** within the valve **40** to prevent the exhaust of gas from the elastic container **26**. A valve stem **50** positioned within the passage **48** can be depressed to move the ball **42** off the shoulders **44** to permit the exhaust of gas from the container **46**. Of course, gas can be supplied to the container **26** through the valve **40** in a conventional manner.

The closed end of the container **26** is provided with an elastic head **52** having a groove **54**. A thrust ring **56** surrounds the head **52** and extends into the groove **54**. The thrust ring **56** bears against an outwardly facing shoulder **58** provided in the cylindrical portion **20** and is retained thereagainst by a snap ring **60**. By retaining the closed end of the container **26** near the open end of the cylindrical portion **20**, the thrust ring **56** prevents the container **26** from collapsing longitudinally. A plurality of throttle bores **62** extend through the thrust ring **56** and establish communication between the interior of the cylinder **12** and the space between the wall of the container **26** and the internal wall of the cylindrical portion **20**.

In FIG. **2**, the hydraulic motor **10** is illustrated on a conventional combine **64** which includes a main body **66** and a harvesting platform **68** which is pivotally mounted to the main body. The hydraulic motor **10** has its cylinder end **12** pivotally connected to the front axle of the combine and its piston end **20** pivotally connected to the platform so that upon extension of the hydraulic motor, the platform is raised, and upon retraction of the hydraulic motor, the platform is lowered.

Prior to use, the flexible container **26** is filled with a compressible gas to any desired pressure through the valve **40**. When oil under pressure is supplied to the cylinder **12** through the port **18**, the piston will extend until the pressure of the oil within the cylinder **12** exceeds the gas pressure within the container **26**. When the oil pressure within the cylinder **12** exceeds the gas pressure within the container **26**, the container is compressed radially over its entire length to compress the gas. If the platform **68** of the combine encounters an obstacle, part of the weight of the platform is taken by the obstruction to raise the platform over the obstacle. As this happens, the compressed gas within the container **26** expands to maintain pressure on the piston to thus assist in lifting the platform over the

obstacle. Thus, the compressed gas within the accumulator **26** serves to float the platform over the obstacle and prevent damage to the platform. The amount of weight carried by the compressed gas is totally dependent upon the initial gas pressure in the container.

The compressed gas within the container **26** also serves to absorb peak pressure loads which may be caused by bouncing of the platform **68** as the combine moves over rough ground. In this manner, the accumulator lessens the possibility of one of the hydraulic lines leading to the hydraulic motor from rupturing.

From the foregoing description of the preferred embodiment of the invention and the description of one of its uses, it can be seen that the present invention provides a hydraulic motor and accumulator combination which does not include the disadvantages of prior hydraulic motor and accumulator combinations and which is extremely simple in design, manufacture and assembly.

Although only a single preferred embodiment of the invention has been described and illustrated, various modifications within the spirit and scope of the invention will become apparent to those skilled in the art and can be made without departing from the underlying principles of the invention.

I claim:

1. An extensible and retractable hydraulic motor comprising: a cylinder closed at one end and having a piston-receiving aperture at the other end; an elongated piston slidably mounted within the aperture with one end projecting into the cylinder and the other end projecting exteriorly of the cylinder; an elongated bore provided in the piston and open to the interior of the cylinder; an elongated flexible container disposed within the piston bore adapted to contain a compressible gas under pressure; the piston including a hollow cylindrical portion and a head portion; the cylindrical portion of the piston being slidably mounted in the aperture; the head portion of the piston having one end of reduced diameter inserted into one end of the cylindrical portion of the piston; fastener means acting between the head and cylindrical portions of the piston to retain the one end of the head portion within the one end of the cylindrical portion; the flexible container being of tubular shape, closed at one end and open at the other; a stopper member of generally truncated conical shape on the one end of the head portion of the piston positioned within the opened end of the flexible container and clamping the open end of the flexible container to the inside wall of the cylindrical portion of the piston to retain the end of the flexible container in fixed position within the piston and to provide seals between the flexible container and the stopper member and between the flexible container and the inside wall of the cylindrical portion of the piston; passage means in the head portion of the piston extending from the surface of the head portion through the stopper member to the flexible container to provide for charging of the flexible container; valve means in the passage means normally closing the passage means to prevent the escape of gas from the flexible container; a grooved head provided on the closed end of the tubular container; a thrust ring positioned around the head and extending into the groove; an internal outwardly facing shoulder provided on the cylindrical portion of the piston adjacent the end thereof opposite from the head portion; and the thrust ring being positioned within the cylindrical portion in abutment with the shoulder to retain the elastic container in its elongated condition.

2. The hydraulic motor set forth in claim **1** wherein at least one throttle bore is provided in the thrust ring to permit fluid to flow between the cylinder and the space between walls of the container and the cylindrical portion of the piston.

3. The hydraulic motor set forth in claim **2** wherein the container wall is provided with a beaded end section at its open end, the cylindrical portion of the piston is provided with an internal annular groove adjacent the head portion, and the beaded end section of the container is clamped between the stopper member and the groove in the cylindrical portion.

4. An extensible and retractable hydraulic motor including a cylinder closed at one end and having a piston-receiving aperture at the other end, an elongated piston slidably mounted within the aperture with one end projecting into the cylinder and the other end projecting exteriorly of the cylinder, an elongated bore provided in the piston and having one end open to the interior of the cylinder, an elongated, flexible, tubular container disposed within the piston bore and adapted to contain a compressible gas under pressure, means anchoring one end of the flexible container in a fixed position at the inner end of the piston bore, a grooved head provided on the other end of the tubular container, a thrust ring positioned around the head and extending into the groove, and an outwardly facing shoulder provided in the piston bore adjacent the open end thereof, the thrust ring being positioned in abutment with the shoulder to retain the container in its elongated condition, whereby pressure peaks within the cylinder will be absorbed by compression of the gas within the container and the container will be compressed in a radial direction only.

5. The hydraulic motor set forth in claim **4** wherein at least one throttle bore is provided in the thrust ring to permit fluid to flow between the cylinder and the space between the walls of the bore and the container.

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