Nov. 8, 1960 H. T. CHAPPELLE 2,959,132

COMPOUND PISTON HYDRAULIC PUMP

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FIG. 1.

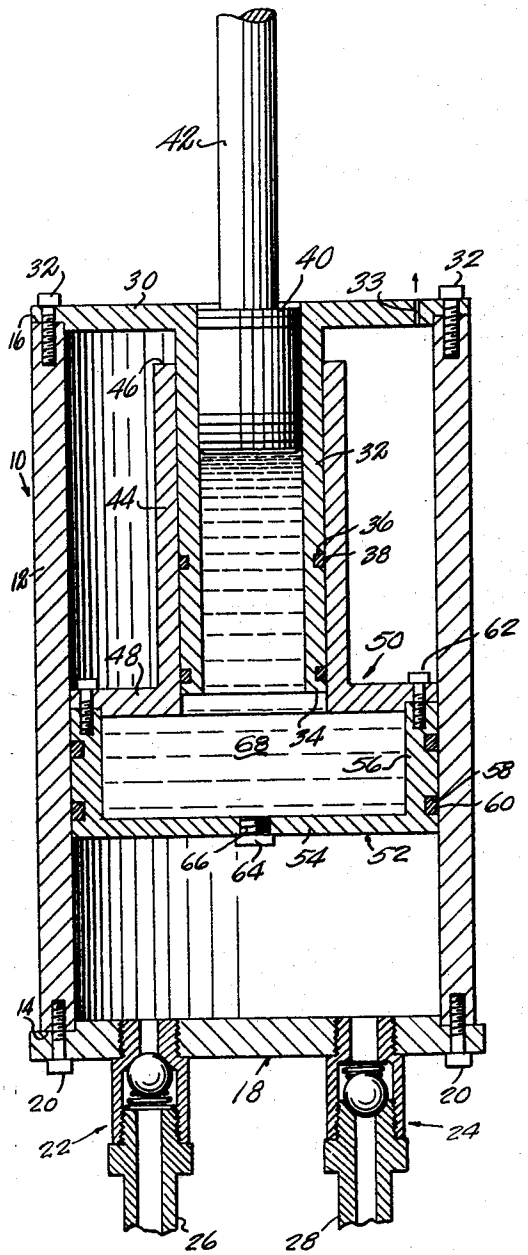
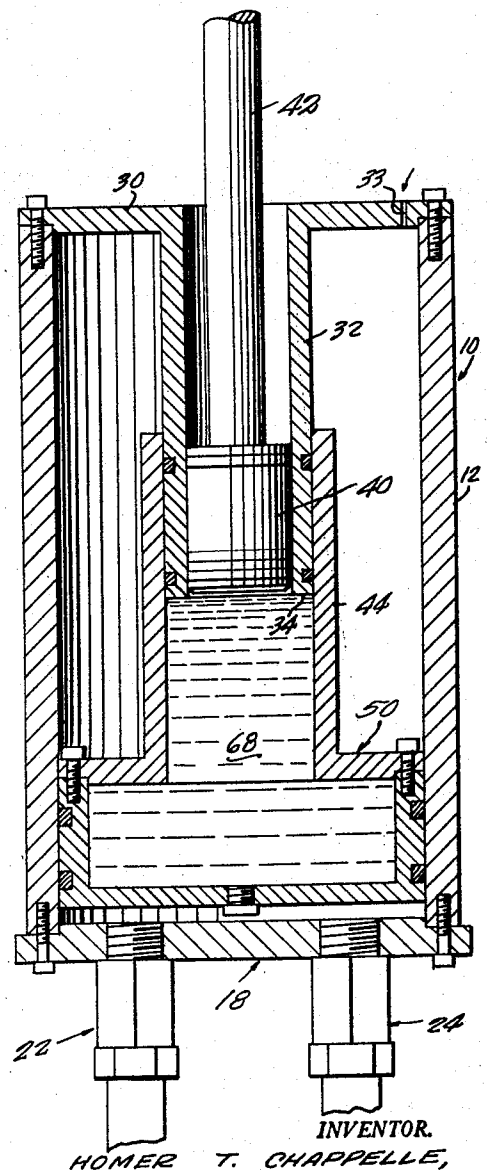


FIG. 2.



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COMPOUND PISTON HYDRAULIC PUMP

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4 Claims. (Cl. 103—44)

This invention relates to a novel and improved compound piston hydraulic pump.

The primary object of the invention is to provide a more efficient pump of the kind indicated wherein a relatively small actuating piston is hydraulically coupled to a relatively large fluid compressing or working piston, so that, on a powered stroke of the actuating piston a working force is exerted on the working piston which is proportionately greater than that exerted on the actuating piston.

Another object of the invention is the provision in a pump of the character indicated above of an open ram sleeve in which the actuating piston works, which is flanged to provide a head for one end of the cylinder in which the larger piston works, a large piston which is hollow and has an open sleeve in which the ram sleeve slides, the hydraulic fluid present in the large piston and in the sleeves serving as a hydraulic ram and connecting rod between the pistons, and oppositely opening and closing valves on the cylinder for the intake and discharge of fluid by the pumps.

A further object of the invention is to provide a simple and uncomplex pump of the character indicated above which is composed of a small number of easily assembled parts.

Other important objects and advantageous features of the invention will be apparent from the following description and the accompanying drawings, wherein, for purposes of illustration only, a specific form of the invention is set forth in detail.

In the drawings:

Figure 1 is a central longitudinal section taken through a pump of the invention, showing the pistons retracted for a pumping stroke; and,

Figure 2 is a view like Figure 1, showing the pistons in a pumping stroke.

Referring in detail to the drawings, wherein like numerals designate like parts throughout the several views, the illustrated pump comprises a pump cylinder **10** having a sidewall **12** having forward and rear free ends **14** and **16**, respectively. The forward end of the cylinder **10** is closed by a flat head **18**, secured to and in the free end **14**, as by studs **20**. A discharge check valve **22** traverses the head **18**, at one side thereof, and an intake check valve **24** traverses the head **18** at the other side thereof, and discharge and intake pipes **26** and **28**, respectively, are connected to the valves. While ball check valves are shown, any other suitable valves can be used, and can be located at any suitable places at the forward end of the cylinder **10**.

Closing the rear end of the cylinder **10** is an annular lateral flange **30** which is secured on and in the free rear end **16** of the cylinder, as by means of studs **32**. The flange **30** has a vent **33** to atmosphere and is fixed on and is preferably integral with the rear end of a cylindrical ram sleeve **32**, which is substantially smaller in diameter than and is concentrically located in the cylinder **10**. The ram sleeve **32** is substantially shorter than

the cylinder **10** and has a free and open forward end **34** which is spaced from the forward cylinder head **18**, here shown as being substantially half the length of the cylinder **10**. The ram sleeve **32** is provided with external ring grooves **36** in which compression sealing rings **38** are seated. A small ring-equipped ram piston **40**, having a rearwardly extending fixed piston rod **42**, slides in the ram sleeve **32**.

Slidably and closely circumposed on the ram sleeve **32** is a working piston sleeve **44**, which is preferably somewhat shorter than the sealing tube **32**, and has a free and open rear end **46**. Fixed on and preferably integral with the forward end of the tube **44** is a lateral annular flange **48** which constitutes the rear end wall of a hollow large working piston **50**.

The large piston **50** comprises a cup-shape element **52** having a flat forward end wall **54** and a rearwardly extending sidewall **56** which works against the cylinder sidewall **12**, and has external ring grooves **58** in which compression sealing rings **60** are seated. The flange **48** is secured on and in the open rear end of the cup-shape element **52**, as by means of studs **62**. A filler plug **64** closes a filler opening **66** in the forward end wall **54**.

The space **68** defined by the interiors of the large piston **50**, the tube **44**, the sealing tube **32**, and the small piston **40** is substantially filled with suitable hydraulic fluid, so that, on a rearward retracting or intake stroke of the small piston **40**, the fluid serves as a connecting rod between the small piston **40** and the large piston **50**, and on a forward working stroke of the small piston **40**, the fluid serves as a hydraulic force-multiplying ram, related to the differing diameters of the two pistons, for driving the large piston **50** forwardly in the cylinder **10**, so as to compress fluid present in the space between the large cylinder and the forward cylinder head **18**. Thus, fluid drawn into the cylinder **10**, through the intake valve **24** on a retracting stroke of the small piston, is discharged through the discharge valve **26** on a forward working stroke of the small piston **40**, by the forward movement imparted by the compressed hydraulic fluid in the space **68** to the large piston **50**.

It is to be observed that there is no loss of ram fluid from the pump, except such as may get by the various sealing rings, and that such as may pass between the sleeves **32** and **44** into the space in the cylinder **10** between the tubes, the large piston **50**, the cylinder sidewall **12**, and the rear cylinder head **18**, can discharge, along with air present in this space, through the vent **33**.

While there has been shown and described herein a preferred form of the invention, it is to be understood that the invention is not necessarily confined thereto, and that any change or changes in the structure of and in the relative arrangements of components thereof are contemplated as being within the scope of the invention as defined by the claims appended hereto.

What is claimed is:

1. A compound hydraulic pump comprising a closed working cylinder, a working piston working in said cylinder, said working piston being hollow, an open sleeve projecting from said working piston, an open ended ram sleeve fixed to and opening through one end of the cylinder, said ram sleeve extending into and sealingly engaging said working cylinder sleeve, an actuating ram piston working in said ram sleeve, a vent in said one end of the working cylinder, a body of hydraulic fluid confined in the working piston and ram sleeve, and intake and discharge valve means communicating with the interior of the working cylinder between the working piston and a related end of the working cylinder.

2. A compound hydraulic pump comprising a pumping cylinder having first and second closed ends, vent means extending through said second end, a ram sleeve

having a free and open first end and a second end fixed to the second cylinder end and opening therethrough, said ram sleeve being substantially smaller in diameter and shorter than the pumping cylinder with its first end spaced from the first cylinder end, an actuating ram piston sliding in said ram sleeve and having a piston rod, a hollow working piston working in the pumping cylinder between the free end of the ram sleeve and the first cylinder end, said working piston having a first end and a second end, a working piston sleeve fixed to the second end of the working piston and having a first end opening into the working piston, said working piston sleeve being slidably engaged on said ram sleeve and having a second free and open end receiving said ram sleeve, a body of hydraulic fluid confined in the working piston and in the sleeves by the ram piston, and intake and discharge valve means on the cylinder and communicating with the interior of the cylinder between its first end and the working piston.

3. A compound hydraulic pump comprising a pumping cylinder having first and second closed ends, vent means extending through said second end, a ram sleeve having a free and open first end and a second end fixed to the second cylinder end and opening therethrough, said ram sleeve being substantially smaller in diameter and shorter than the pumping cylinder with its first end spaced from the first cylinder end, an actuating ram piston sliding in said ram sleeve and having a piston rod, a hollow working piston working in the pumping cylinder between the free end of the ram sleeve and the first cylinder end, said working piston having a first end and a second end, a working piston sleeve fixed to the second end of the working piston and having a first end opening into the working piston, said working piston sleeve

being slidably engaged on said ram sleeve and having a second free and open end receiving said ram sleeve, a body of hydraulic fluid confined in the working piston and in the sleeves by the ram piston, and intake and discharge valve means on the cylinder and communicating with the interior of the cylinder between its first end and the working piston, said valve means comprising laterally spaced intake and discharge check valves open through the first end of the working cylinder.

4. A compound hydraulic pump comprising a pumping cylinder having first and second closed ends, vent means extending through said second end, a ram sleeve having a free and open first end and a second end fixed to the second cylinder end and opening therethrough, said ram sleeve being substantially smaller in diameter and shorter than the pumping cylinder with its first end spaced from the first cylinder end, an actuating ram piston sliding in said ram sleeve and having a piston rod, a hollow working piston working in the pumping cylinder between the free end of the ram sleeve and the first cylinder end, said working piston having a first end and a second end, a working piston sleeve fixed to the second end of the working piston and having a first end opening into the working piston, said working piston sleeve being slidably engaged on said ram sleeve and having a second free and open end receiving said ram sleeve, a body of hydraulic fluid confined in the working piston and in the sleeves by the ram piston, and intake and discharge valve means on the cylinder and communicating with the interior of the cylinder between its first end and the working piston, said ram piston, said working piston, and said ram sleeve having external compression sealing rings.

No references cited.