United States Patent [19]

Skinner

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[54] **ROTARY HYDRAULIC MACHINES**

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[52] **U.S. Cl.** **417/225,** 417/391

[51] **Int. Cl.** **F04b 35/02**

[58] **Field of Search** ..... 417/342, 343, 344, 345, 417/346, 347, 225, 391, 244, 226, 227, 287; 91/492, 498; 60/53 B, 494

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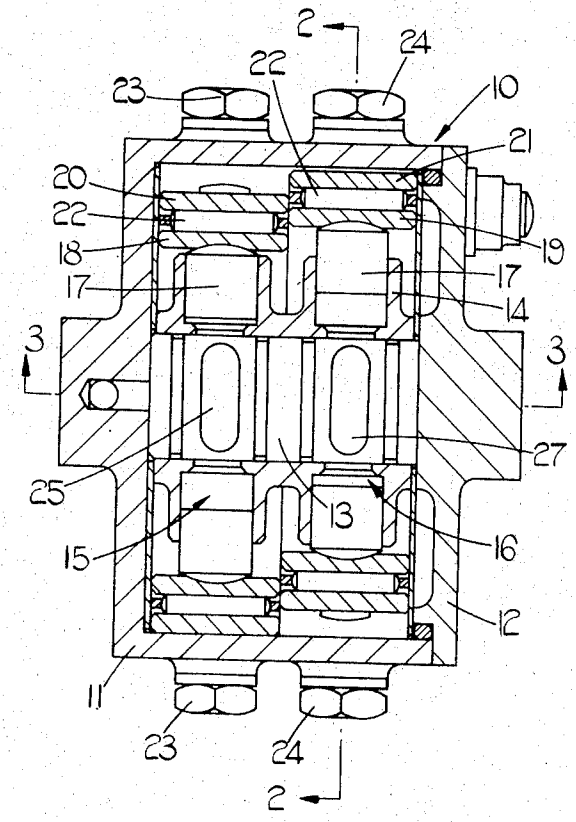
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[57] **ABSTRACT**

A rotary hydraulic machine includes a rotor with first and second rows of radial pistons therein. The rotor is journalled on a pintle which has two pairs of ports, with each pair being associated with a respective row of pistons. The pistons in the first row have a larger displacement per revolution of the rotor than the pistons in the second row. One of the ports associated with the first row communicates with an inlet and one of the ports associated with the second row communicates with an outlet for the machine. Pressurized fluid supplied to the inlet causes the pistons in the first row to act as a motor driving the pistons in the second row to act as a pump.

1 Claim, 5 Drawing Figures



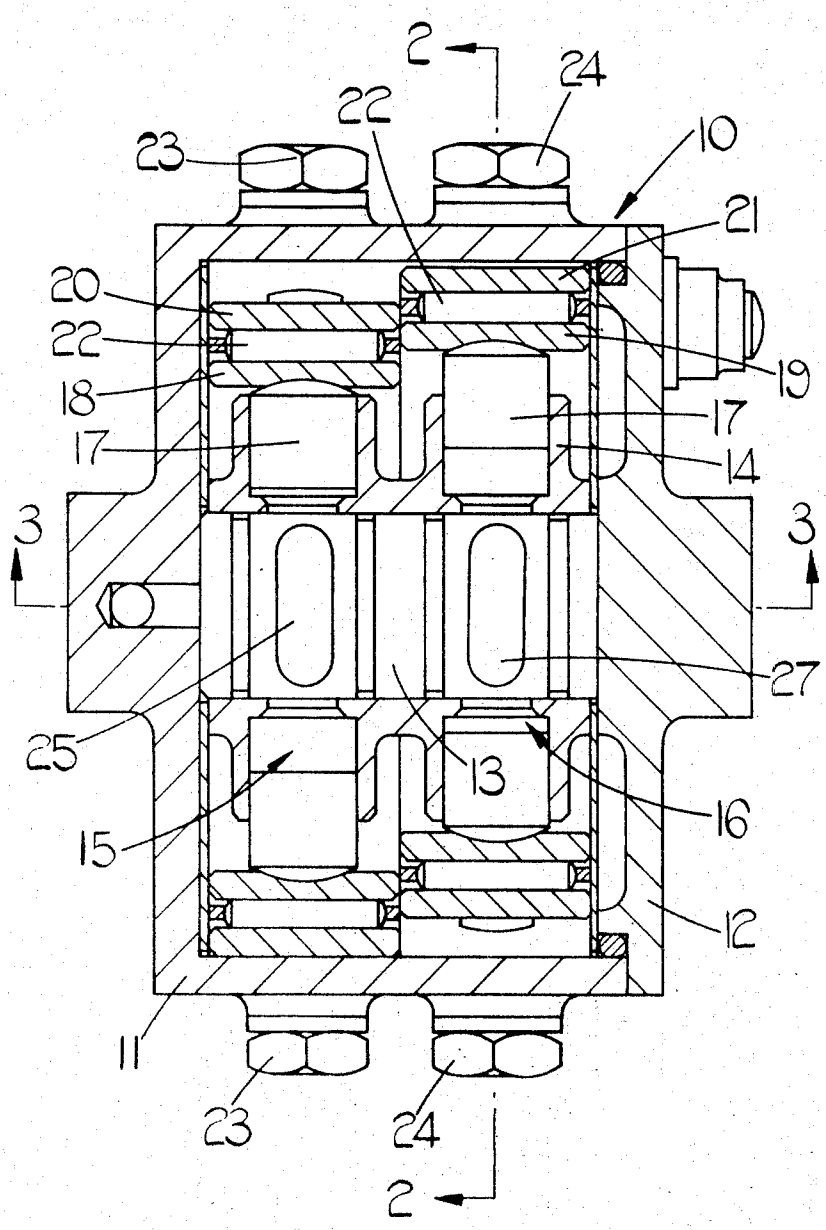


FIG. 1.

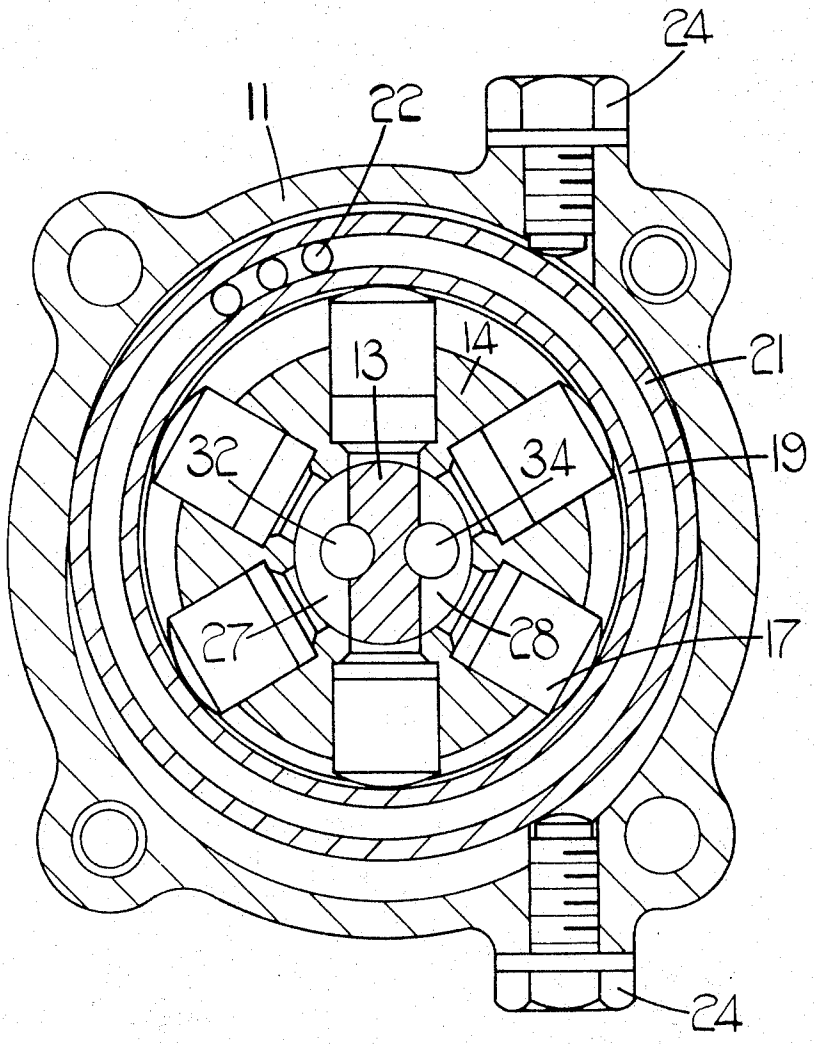


FIG. 2.

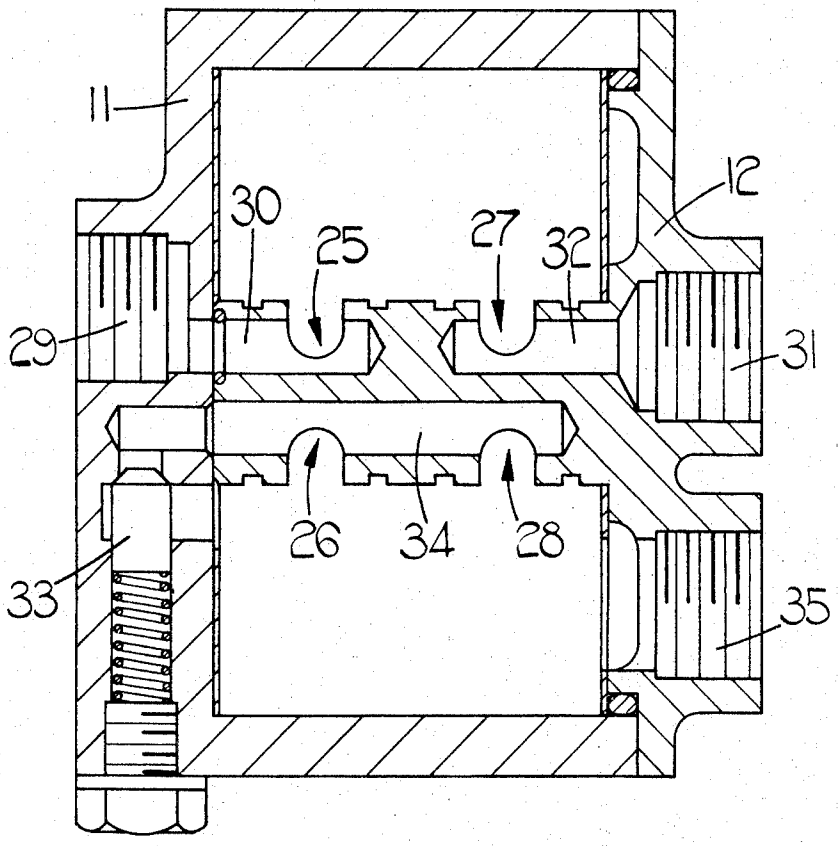


FIG. 3.

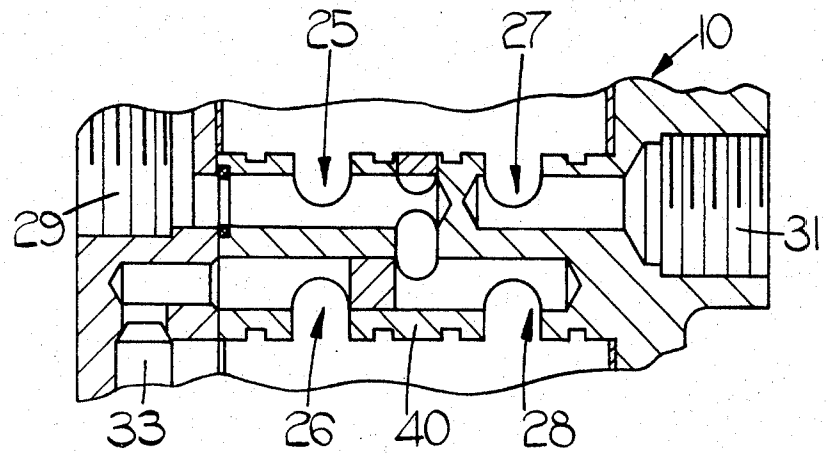


FIG. 4.

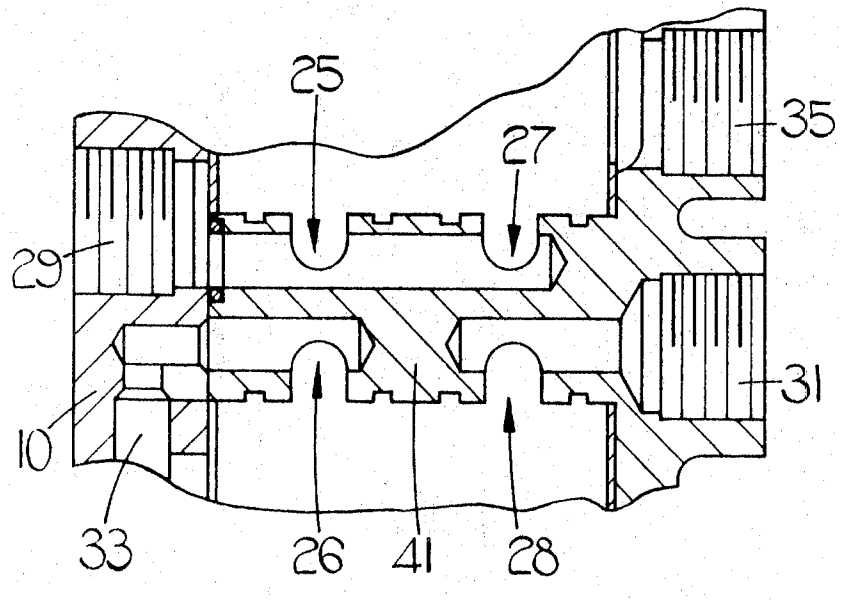


FIG. 5.

ROTARY HYDRAULIC MACHINES

BACKGROUND OF THE INVENTION

This invention relates to rotary hydraulic machines in which a fluid input at a given pressure is discharged at a higher pressure, and has an object to provide such a machine in a convenient form.

According to the invention, a rotary hydraulic machine comprises a casing, a pintle within the casing, a rotor mounted on the pintle, first and second axially spaced rows of radial bores in the rotor, a plurality of pistons slidable in the bores, a pair of cam rings surrounding the rotor within the casing and disposed eccentrically of the rotor, inside surfaces of the rings being engaged by pistons in the respective rows and the arrangement being such that, in use, the pistons in the first row have a larger displacement per revolution of the rotor than the pistons in the second row, two pairs of ports in the pintle, the bores in the respective rows successively communicating, in use, with the ports of a respective pair, an inlet for the machine communicating with one of the ports of a first pair which communicate with the bores of said first row, a first outlet for the machine communicating with one of a second ports of the pair thereof which communicate with the bores of said second row, a passage connecting a port in one of the pairs to a port in the other of the pairs and a second outlet through which is discharged, in use, fluid which is not discharged through the first outlet.

Embodiments of the invention will now be described by way of example and with reference to the accompanying drawings in which:

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is a section through a hydraulic machine,

FIG. **2** is a section on line **2—2** in FIG. **1**,

FIG. **3** is a section on line **3—3** in FIG. **1**, and with parts removed for clarity,

FIG. **4** is a fragmentary view corresponding to FIG. **3**, of an alternative form of machine, and

FIG. **5** is a similar scrap view of a further alternative form of machine.

DETAILED DESCRIPTION OF THE INVENTION

Considering first the embodiments shown in FIGS. **1** to **3**, a machine has a casing **10** formed in two parts **11**, **12**. Part **12** includes a pintle **13** extending axially into the casing **10**. Mounted on the pintle **13** is a rotor **14** which has two axially spaced rows **15**, **16** of radial bores, there being an equal number of bores in each row and the bores in row **15** being aligned with the bores in row **16**. Slidable within the bores are pistons **17**. Surrounding the rotor **14** are cam rings **18**, **19** whose inner faces are engaged by the pistons in the respective rows **15**, **16**.

The cam rings **18**, **19** are mounted in support rings **20**, **21** respectively by means of needle roller bearings **22**.

Cam rings **18**, **19** are movable to desired amounts of eccentricity with respect to the rotor **14** by means of pairs of screws **23**, **24** which respectively engage the support rings **20**, **21**.

Within the pintle **13** is an arrangement of ports which is shown in greater detail in FIG. **3**, from which the rotor **14** and cam rings **18**, **19** have been omitted for clarity. A first pair of ports **25**, **26** are arranged on opposite sides of the pintle **13** so as successively to communicate, in use, with the bores of the row **15**. A further pair of ports **27**, **28** is similarly arranged to communicate with the bores of the row **16**. An inlet **29** for the machine in casing part **11** communicates with port **25** via a passage **30**. An outlet **31** for the machine in casing part **12** communicates with port **27** via a passage **32**. Ports **26**, **28** communicate with each other and with a spring loaded relief valve **33** in casing part **11** via a passage **34**. The relief valve communicates on its downstream side with the inside of the casing **10**. A drain outlet **35** opens into the casing **10** through the part **12**.

In use, a fluid under pressure is supplied to inlet **29** and acts in a known manner on the pistons **17** in row **15** to drive the rotor **14**, with the fluid being discharged via port **26** and passage **34** into port **28**. The pistons of row **16** act as a pump to deliver the fluid via port **27** to the outlet **31**. It is arranged that the eccentricity of the cam ring **19** is less than that of cam ring **18**. The volume swept per revolution by the pistons **17** in row **16** is thus less than that swept by the pistons in row **15**. Fluid is thus delivered to the outlet **31** at a higher pressure than that at the inlet **29**. An amount of fluid equal to the difference in displacement between the motor and the pump escapes via the relief valve **33** and the drain outlet **35**. The pressure at which valve **33** operates is sufficient to ensure that even at very low rotor speeds, the pistons **17** are maintained in contact with their associated cam rings.

FIG. **4** shows a pintle **40** for an alternative form of machine according to the invention. Pintle **40** has ports **25**, **26**, **27** and **28** as above described. Ports **25**, **27** communicate, also as described, with inlet **29** and outlet **31** respectively. Port **26** communicates, via relief valve **33** with the inside of casing **10**. Port **28** communicates, however, with port **25** instead of with port **26**. The motor and pump portions of the machine are thus connected in parallel to the inlet **29**, with all fluid passing through the motor being discharged to a drain via relief valve **33**. Fluid passing through the pump portion is discharged via outlet **31**, as before.

FIG. **5** shows a pintle **41** for yet another alternative form of machine. Pintle **41** also has ports **25**, **26**, **27**, and **28**. Port **25** communicates with inlet **29** as before and port **26** communicates via relief valve **33** with the inside of casing **10**. Port **27**, however, communicates with inlet **29** and port **25**. Port **28** communicates with outlet **31**, from which, in use, fluid is delivered at high pressure.

The pump and motor portions are thereby, once again, connected in parallel, with the ports **25**, **27** respectively forming the inlet ports. In this arrangement the cam rings **18**, **19** are arranged so that their eccentricities with respect to the rotor are both on the same side of the latter.

I claim:

1. A rotary hydraulic machine comprising a casing, a pintle within the casing, a rotor mounted on the pintle, first and second axially spaced rows of radial bores in the rotor, a plurality of pistons slidable in the radial bores constituting a motor and a pump respectively, a pair of cam rings surrounding the rotor within the casing and disposed eccentrically of the rotor, said rings having inside surfaces engaged by the pistons in the respective rows and the arrangement being such that, in use, the pistons in the first row constituting the motor

have a larger displacement per revolution of the rotor than the pistons in the second row constituting the pump, two pairs of opposed ports in the pintle, the bores in the respective row successively communicating, in use, with the ports of a respective pair, an inlet for the machine communicating with one of the ports of a first pair thereof which communicates with the bores of said first row, a first outlet for the machine communicating with one of the ports of a second pair thereof which communicates with the bores of said second row, a passage connecting the other port of each pair, a spring loaded relief valve for said passage communicating on its downstream side with the casing interior and a second outlet communicating with the casing interior and through which is discharged, in use, fluid which is not discharged through the first outlet via the pistons in the second row.

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