March 3, 1970 K. A. PRELESNIK 3,498,229

HYDRAULIC PUMP ASSEMBLY

Filed Nov. 1, 1967 2 Sheets-Sheet 1

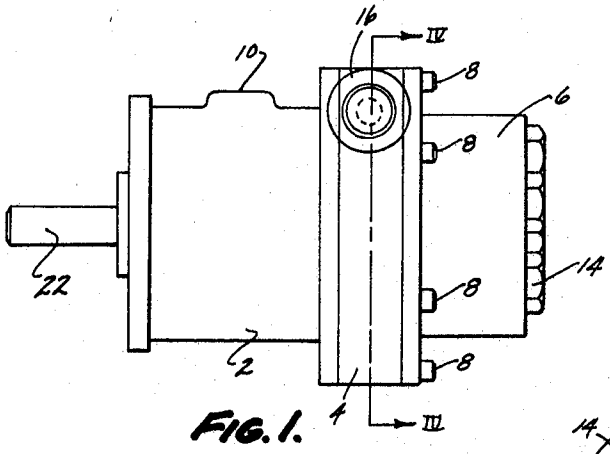

FIG. 1.

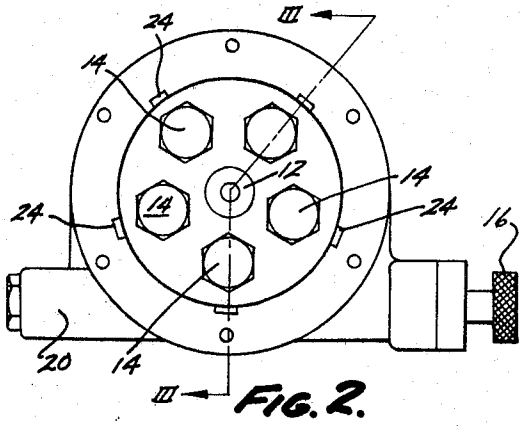

FIG. 2.

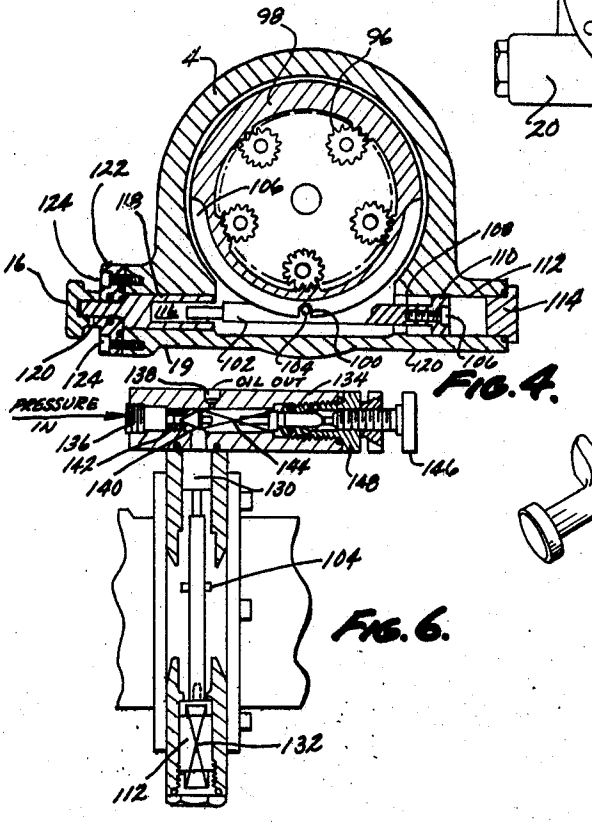

FIG. 4.

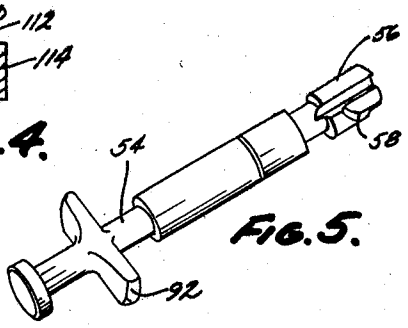

FIG. 5.

FIG. 6.

INVENTOR.
KENNETH A. PRELESNIK

BY Price, Heneveld, Huizenga & Cooper

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HYDRAULIC PUMP ASSEMBLY

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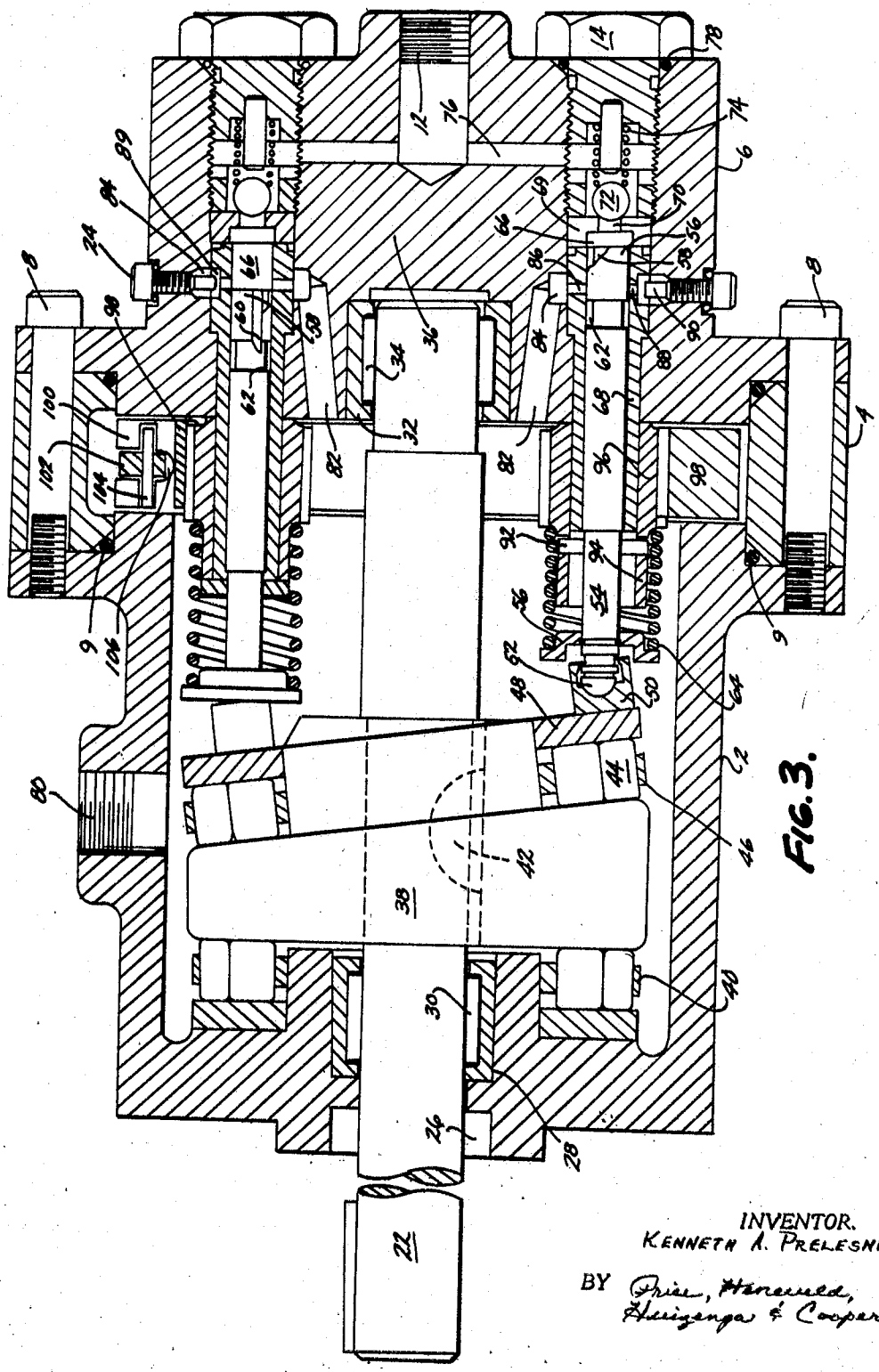

FIG. 3.

INVENTOR.
KENNETH A. PRELESNIK

BY Price, Heneveld, Huizenga & Cooper

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HYDRAULIC PUMP ASSEMBLY

Kenneth A. Prelesnik, Grand Haven, Mich., assignor to Dake Corporation, Grand Haven, Mich., a corporation of Michigan

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U.S. Cl. 103—37 4 Claims

ABSTRACT OF THE DISCLOSURE

This disclosure relates to a hydraulic pump in which a plurality of piston cylinders are circularly located. Pistons in the cylinders are driven by a rotating cam plate, and the pistons are helically grooved, whereby rotation of the pistons with respect to the piston cylinders will vary the output volume of the pump.

A linearly reciprocatable shaft actuates a circular gear ring which in turn engages a slotted collar on each gear ring. Each piston shaft has a protruding foot which slides in the slot of the slotted collar.

The output volume of the pump can be varied by employing an element responsive to the output pressure of the pump, operably connected to the linearly reciprocatable shaft. A handle or knob can also be used to adjust the position of the shaft to vary the output pump volume.

This invention relates to a hydraulic pump. In one of its aspects it relates to a means for controlling the output volume of a hydraulic pump whose piston cylinders are arranged about a circular locus, and the pistons in the cylinders are actuated by a rotary cam plate, wherein each piston shaft contains a lug or foot which slides in a slot of a collar, which when turned, will vary the output capacity of the pump.

Many piston-type hydraulic pumps employ helically grooved pistons to vary the output volume of the pump. Different means have been employed to rotate the pistons within the cylinders, and thereby vary the output of the pump.

For example, Beeh, 2,428,408, discloses a fuel pump in which a plurality of piston cylinders having helically grooved pistons are arranged about a circular locus. The piston shafts have attached thereto a ring shaped member containing teeth, which engage a circular gear ring which can be moved to adjust each piston. The ring shaped member reciprocates with the piston and thus, provides a large area of sliding engagement with the adjusting ring.

Mashinter, 2,636,439, discloses a pump similar to that of Beeh, except that the adjusting ring is bifurcated and receives an end of a plunger throttle yoke containing a slotted end, which embraces the flat shank portion of a piston rod. As the piston reciprocates, the yoke slides on the shank of the piston shaft.

I have now discovered an improved adjustment means for a pump containing a plurality of piston cylinders located about a circular locus, wherein the shaft of at least one piston contains a lug or foot which slidably engages a piston encircling ring which in turn, is rotated by a circular adjusting ring.

By various aspects of this invention, one or more of the following, or other, objects can be obtained.

It is an object of this invention to provide an improved means for adjusting the output volume of a hydraulic pump having a plurality of cylinders arranged about a circular locus, whereby frictional forces on the piston shaft from the adjusting means are minimized without loss of adjustment sensitivity.

It is a further object of this invention to provide a hydraulic pump which can be adjusted to maintain a constant output pressure, wherein sensitivity of the adjusting means is maintained.

The invention will now be described with reference to the accompanying drawings in which:

FIG. 1 is a side elevational view of the novel pump assembly according to the invention;

FIG. 2 is an end view of the novel pump assembly shown in FIG. 1;

FIG. 3 is a sectional view taken along lines III—III of FIG. 2;

FIG. 4 is a sectional view taken along lines IV—IV of FIG. 1;

FIG. 5 is a perspective view of a piston employed in the pump; and

FIG. 6 is a sectional view similar to FIG. 4 showing a second embodiment of the invention.

Referring now to FIGS. 1 and 2, a pump housing comprises a rear housing section **2**, a central housing section **4** and a front section housing **6** which sections are fastened together through bolts **8** on circular flanges of rear housing **2** and front housing **6**. The central housing **4** has a first extension **19** containing an adjusting knob **16** and a second extension **20** positioned along the line of extension **19**.

Referring now specifically to FIGS. 3 and 4, a central shaft **22** is supported by a bearing assembly ring **28** and bearings **30** at one end of housing **2** and is supported in core member **36** by bearing ring **32** and bearings **34** at the other end of the rod. An oil seal **26** is provided to prevent oil from leaking out of the interior of the pump around rod **22**. Cam member **38** is attached through key **42** to shaft **22**. A thrust bearing **40** containing rotatable bearing members permits relatively frictionless rotation of cam **38** with respect to the back portion of housing **2**. A second thrust bearing containing rotatable bearing members **44** attached to plate **46**, forces cam followers **50** journalled in sockets **52** to reciprocate piston shafts **54** containing pistons **56**. A relatively stationary plate **48** separates the second thrust bearing from cam follower **50**. A spring retainer **56** acting through spring **64**, which abuts against slotted gear **96**, maintains piston shaft **54** biased against thrust bearing **48**. Piston **56** has a helical groove **58** which cooperates with port **86** of piston sleeve **68** to vary the discharge volume in piston chamber **66**, formed by end member **69**, piston sleeve **68** and piston **56**. An annular slot **62** is provided beneath piston head **56** and communicates with chamber **66** through longitudinal groove **60**. The annular groove **58** fixes the cut-off stroke, and thus limits the pumping capacity of the piston. Screw members **24**, having pin **90** engage a slot **89** in the piston sleeve **68** to retain the piston sleeve in fixed position.

The fluid enters the pump through inlet **80** and enters the piston cylinders through ports **82** in core **36**, through annular groove **84** and through inlet ports **86** and **88**. The fluid is exhausted from chamber **66** through outlet port **70** around ball valve **72**, maintained in place by spring **74** against screw member **14**. The fluid then can leave through outlet channel **76** and through outlet port **12**. Alternately, exterior outlet ports can be provided in the end of each cylinder such as at **14**.

Piston shaft **54** has rigidly attached thereto a pair of lugs or feet **92** which engage slotted gear members **96** through a slot **94**. This mechanical linkage between the reciprocating piston shaft and the stationary but rotatable ring **96** minimizes frictional forces on the piston shaft without sacrificing sensitivity of adjustment. Gear member **96** in turn, intermeshes with a circular gear ring **98** which circumscribes all of the piston cylinders and engages each slotted gear member **96** (see FIG. 4). Gear ring **98** has a slotted channel **106** around a portion of the

outer circumference and has slots **100** to engage pin **104** of reciprocatable control rod **102** which is positioned in the circumferential channel **106**. Control rod **102** threadably engages control shaft **118** at **116**. The control shaft is attached to handle **16** and rigidly fastened thereto through a fastening screw **120**. Control rod **118** is held in the center body part by end cap **122** through suitable threaded screw **124**. The positioning of the gear ring **98** exterior of the piston cylinders provides for simple construction of the pump and leaves the interior free for the pumping function. By this arrangement, exterior oil seals in the interior of the pump are not required.

The extent of reciprocation of control rod **102** is limited by a control rod spacer **110** suitably attached to control rod **102** through pin **116**. The extent of reciprocation of end spacer **110** is limited by a motion limiting chamber **112**, having an abutting shoulder **108** at one end thereof, and an end cap **114** at the other end thereof.

In operation, when it is desirable to change the capacity of the pump, control knob **16** is merely rotated, whereby control rod **116** is caused to move upwardly or downwardly, thereby rotating circular ring **98**, which in turn axially rotates the slotted gear members **96**, which rotate pistons **56** by rotating feet **92**.

In the alternate embodiment of the invention shown in FIG. 6, knob **16** and control shaft **118** are replaced by a pressure sensitive piston **130**, which is attached to control rod **102**. A spring **132** is positioned in chamber **112** to bias the control rod upwardly. A valve **134** is employed to actuate the control rod **102** through piston **130**. The valve **134** contains an inlet port **136**, an outlet port **138** and a pilot cone **140** between the two ports. The pilot cone **140** is biased against seat **142** by spring **144**. The force exerted by spring **144** can be adjusted by knob **146** which threadably engages spring retaining guide **148**. The valve body threadably engages the spring retaining valve guide **148**. The inlet port **136** is connected to the pump outlet.

In operation, when the pressure in the pump outlet builds up, the pressure will force pilot cone **136** to be unseated. Since outlet port **138** has a relatively small aperture compared with inlet port **136**, pressure builds up against piston **130** to force control rod **102** downwardly, thereby reducing the pump output in a manner which has been hereinbefore described.

When the pump output pressure drops, the pilot cone will be forced against seat **142**, thereby closing the valve. As the pressure bleeds from the valve, spring **132** will force piston **130** and control rod **102** upwardly to increase the pump output in a manner which has been hereinbefore described.

It has been described how the manually adjustable pump of FIGS. 1–5 can be easily converted to a variable capacity pressure sensitive pump.

In still another embodiment of the invention, knob **16** can be replaced by a simple shaft or lever which can be pulled up or down to vary the capacity of the pump.

I claim:

1. In a hydraulic pump assembly comprising:

a housing having a central cavity and forming a common outlet port;

a fluid inlet port in said housing communicating with said central cavity;

a plurality of piston chambers arranged around a circular locus in said housing, each piston chamber having an inlet port communicating with said central cavity and an outlet port communicating with said common outlet port;

a piston in each piston chamber for pumping fluid entering each piston chamber through said chamber inlet port out through said chamber outlet port;

each piston having at one end thereof a helical groove which cooperates with said inlet port in said piston chamber to close off the piston chamber to said chamber inlet port and pump fluid out said chamber outlet port;

check valve means in said chamber outlet port to permit exhausting of fluid under pressure through said chamber outlet port, and to prevent flow of fluid back through said chamber outlet port;

rotary cam means in said central cavity cooperating with said pistons to produce sequential reciprocation of said pistons in said piston cylinders; and

means to axially rotate each of said pistons within said piston chambers,

the improvement in said axial rotation means including:

a foot extending radially from said piston and spaced axially from said helical groove;

a collar means positioned around each piston at said foot, each collar means having a slot engageable with said foot;

a circular ring circumscribing each of said collar means and being engageable with each collar through gear means; and

linear reciprocable means operably connected to said circular ring to vary the volume output capacity of said pump when said reciprocable means is moved along its linear axis, said linear, reciprocable means including a rod threadably engaging a rotatable shaft, and having a handle, said rod being reciprocated by rotation of said rotatable shaft.

2. A hydraulic pump assembly according to claim **1**, wherein said circular ring has a channel in an outer circumferential portion thereof, and is slotted in said channel portion, said rod is positioned in said channel, and a pin on said rod is positioned in said slot.

3. A hydraulic pump assembly according to claim **1**, wherein a control spacer is attached to said rod and said control spacer is positioned in a motion limiting cylinder, the extent of reciprocation of said rod being limited by the extent of reciprocation of said control spacer in said motion limiting cylinder.

4. A hydraulic pump according to claim **1** wherein said rotary cam means is supported on a power shaft which is journalled in said housing on both sides of said rotary cam means.

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WILLIAM L. FREEH, Primary Examiner

U.S. Cl. X.R.

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