

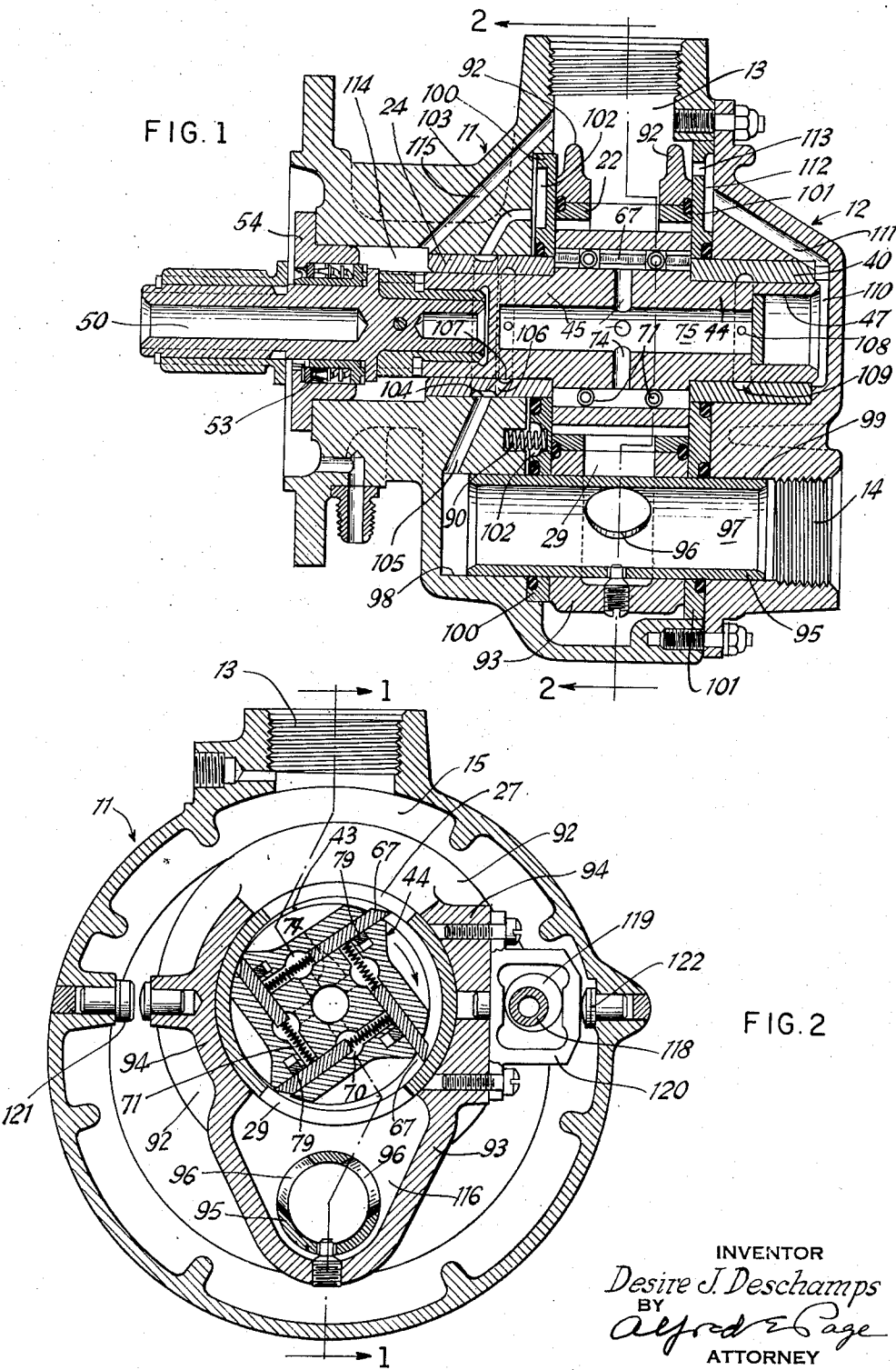
Sept. 13, 1960

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2,952,215

VARIABLE DELIVERY HIGH SPEED AND PRESSURE VANE PUMP

Original Filed Dec. 12, 1949



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VARIABLE DELIVERY HIGH SPEED AND PRESSURE VANE PUMP

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Original application Dec. 12, 1949, Serial No. 132,492, now Patent No. 2,708,884, dated May 24, 1955. Divided and this application May 17, 1955, Ser. No. 508,955

5 Claims. (Cl. 103—120)

This invention relates in general to rotary vane pumps and more particularly to high speed vane pumps especially adapted to supply fuel at high pressures to aircraft turbine engines.

The present application is a division of my copending application Serial No. 132,492, filed December 12, 1949 for "High Speed and Pressure Vane Pump," now Patent No. 2,708,884, issued May 24, 1955.

The present invention is directed to a vane pump capable of pumping fluids of low viscosity and of poor lubricating characteristics, which may be operated at high speeds and with comparatively high outlet pressures such as required for delivery of fuel to aircraft turbines and the like. Vane pumps, characterized by simplicity in design and manufacture, small size for a given output, high volumetric efficiency with smooth flow and ability to develop high suction so as to be easily primed, have been extensively adopted as a very satisfactory means for pumping lubricating oils, the so-called hydraulic fluids and the like, but these pumps have not been completely successful in pumping low viscosity fluids such as gasoline, for example, when operated at speeds above 2500 r.p.m. and with outlet pressures above 25 p.s.i.

More particularly, the present invention is directed to a variable capacity pump which also has a novel arrangement of internal parts including a movable pump housing supported for adjustable springing movement on a tubular high pressure outlet member arranged within the shell and having the ends thereof communicating with the outlet part of the shell and with high pressure fluid passages within the shell for accomplishing lubrication and automatic end adjustment of cooperating parts.

A particular feature of the present invention is the application of the outlet pressure to maintain a pair of end wall members in fluid-tight engagement with the ends of a pump cylinder enclosing the pump rotor.

For a better understanding of the invention principles, reference is made to the following description of a typical embodiment thereof as illustrated in the accompanying drawings.

In the drawings:

Fig. 1 is a longitudinal sectional view of a variable displacement pump embodying the invention, taken as indicated by the line 1—1 of Fig. 2; and

Fig. 2 is a cross-sectional view taken as indicated by the line 2—2 of Fig. 1.

Referring to the drawings, the pump 10 illustrated therein has the same type of rotor and vane construction, including the vane sealing features, as described in my said copending application. Specifically, the outlet pressure is applied to the inner ends of the rotor vanes to force the vanes into fluid-tight engagement with the pump cylinder.

The pump 10 has a housing body 11 and a housing cover 12, with an inlet port 13 in the upper part of the body 11 and an outlet port 14 in the lower portion of

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the cover 12. Sleeve bearings 24 and 40 are carried respectively in the body 11 and cover 12 to receive shafts 45 and 47 which project from a rotor 44. This rotor 44 carries vanes 67.

Pump cylinder 22 is not supported directly by the housing body 11, but is carried by an adjustable member 91 comprising a pair of rings 92, disposed in spaced relation and merging with a hollow yoke 93 embracing arcuate walls 94 which engage opposite sides of the cylinder 22. The cylinder 22 has inlet port means 27 communicating with the internal space 15 of the body 11, which in turn communicates with the inlet port 13. The outlet port means 29, in the lower part of the cylinder 22, communicates with the discharge space or passage 16 formed within the hollow yoke 93. The space 16 communicates with the interior of a tube 95 through openings 96 in such tube, and the lumen 97 of the tube 95 communicates with the outlet port 14 of the housing cover 12, as shown in Fig. 1. The tube 95 forms hollow trunnions for the adjustable member 91 which project respectively into axially aligned openings 98 and 99 in the members 11 and 12.

Circular plates 100 and 101 are disposed within the housing of the pump on opposite sides of the inner adjustable casing member 91 in engagement with axially spaced parallel walls of the pump cavity forming seats for the plates, and one of these plates is adjusted into operative position by fluid pressure. There is a small clearance between plate 100 and the adjacent surface of body 11. This clearance, and a chamber 102 in plate 100, receive liquid at pump outlet pressure through a duct 103, in the housing body 11, which is connected to the opening 98 through an annular chamber or channel 104 on the outer surface of the bearing member 24 and a duct 105. Fluid pressure acting against the leftward face of the plate 100 urges the plate rightwardly into operative relation to the leftward face of the cylinder 22, and shifts the cylinder 22 and the adjustable member 91 rightward into operative position against the plate 101. A duct 106 in the bearing member 24 connects the channel 104 with an internal channel 107 which is in turn connected to the chamber 75 of the rotor 44 and its shafts. This internal chamber 75 is connected through radial openings 74 to the spaces at the inner ends of the vanes 67 and radial opening 108 in the shaft member 47 connects the chamber 75 with an annular channel 109 in the internal space of the bearing member 40. Liquid under pressure, accordingly, is conducted into the channels 107 and 109 from which the liquid is fed into the bearing spaces. Leakage from the bearing 40 passes into the space 110, from hence it is conducted to the low pressure inlet chamber 15 by a duct 111 in the housing cover 12 and ducts 112 and 113 in the plate 101. Leakage of fluid from the bearing 24 passes into a chamber 114 formed within the housing body 11 adjacent the leftward end of the bearing 24, and a diagonal duct 115 carries this leakage into the inlet port 13. The pump is provided with a drive coupling 50 which passes through a low pressure sealing device 53 carried by the housing body 11.

The adjustable inner housing member 91 may be swung on the axis of the tube 95 so as to move the cylinder 22 from a position concentric to the rotor 24 through various positions of eccentricity within the range of movement provided for the cylinder 22. For adjusting the member 91 a shaft 118 is extended into the pump housing through the cover member 12. On the shaft 118 there is an eccentric 119 which engages opposite sides of a frame 120 which is secured to the member 91. Stops 121 and 122 are provided in the housing 11 to limit the adjusting movement of the member 91 by the cam 119.

In the same manner as described in my said copending

application, springs 90 are provided to bias plate 100 toward cylinder 22, and thus to bias the cylinder toward plate 101 during starting of the pump and before the outlet pressure reaches its full value. When the outlet pressure builds up, the fluid at outlet pressure applied in clearance space 32 against the left face (Fig. 1) of plate 100 maintains plates 100 and 101 in fluid-tight engagement with the ends of cylinder 22.

While a specific embodiment of the invention has been shown and described in detail to illustrate the application of the invention principles, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. In a rotary pump; an outer casing having an inlet opening and an outlet opening; a vane rotor supported in said casing; a cylinder in said casing surrounding said rotor and formed with an inlet port and an outlet port; and means for supporting said cylinder in said casing so that it may be moved relatively to said rotor in different degrees of eccentricity, said means comprising a hollow pivot member defining an axis on which said cylinder is swingable and having a port intermediate its ends communicating with the cylinder outlet port; the interior of said pivot being in communication with the casing outlet opening and said pivot being open at both ends to balance the outlet pressures axially of the pivot.

2. In a rotary pump; housing means including a pump cavity having a pair of spaced parallel walls and having an inlet passage and an outlet passage; a ported pump cylinder in said pump cavity in communication with said passages; a pump rotor rotatably supported in said housing means and within said cylinder to pump fluid from said inlet passage to said outlet passage; plate means having outer faces, and inner faces engaging the ends of said cylinder to close the latter; said outer faces having recesses therein cooperating with said walls to form chambers; means forming a passage in said housing means in communication with said outlet passage and one of said chambers to deliver fluid under pressure to the outer face of one of said plate means to force said plate means against the ends of said cylinder; and means mounting said cylinder for adjustment laterally of said rotor to different degrees of eccentricity relative to said rotor.

3. In a rotary pump; housing means having an inlet passage and an outlet passage; a ported pump cylinder in said housing means in communication with said passages; a pump rotor rotatably supported in said housing and within said cylinder to pump fluid from said inlet passage to said outlet passage, said rotor having vane slots therein; vanes movably mounted in said slots and having outer ends engaging said pump cylinder; a pair of circular plates mounted between the ends of said cylinder and seats in said housing means to close said cylinder and having running clearance only with the ends of said rotor and the full extent of the side edges of said vanes; one of said plates having a chamber in its seat engaging surface; means forming a passage in said housing means in communication with said outlet passage and said chamber to deliver fluid under pressure to the outer face of said one plate to force said plates against the ends of said cylinder; said rotor having an axial passage therein connected to the inner ends of said slots by radial passages intermediate the side edge of said vanes; cooperating passage means in said housing means and rotor connecting said axial passage to said outlet passage to deliver fluid under pressure to the inner ends of said vanes to force the outer ends of the vanes against said pump cylinder;

and means mounting said cylinder for adjustment laterally of said rotor to different degrees of eccentricity relative to said rotor.

4. In a rotary pump; housing means having an inlet passage and an outlet passage; a ported pump cylinder in said housing means in communication with said passages; a pump rotor rotatably supported in said housing and within said cylinder to pump fluid from said inlet passage to said outlet passage; plate means having inner faces engaging the ends of said cylinder to close the latter; means forming a passage in said housing means in communication with said outlet passage to deliver fluid under pressure to the outer face of one of said plate means to force said plate means against the ends of said cylinder; means mounting said cylinder for adjustment laterally of said rotor to different degrees of eccentricity relative to said rotor; an eccentric cam rotatable in said housing; and a cam follower embracing and continuously engaged with said cam and connected to said cylinder for positive adjustment and positioning of said cylinder in both directions.

5. In a rotary pump; housing means having an inlet passage and an outlet passage; a ported pump cylinder in said housing means in communication with said passages; a pump rotor rotatably supported in said housing and within said cylinder to pump fluid from said inlet passage to said outlet passage; plate means having inner faces engaging the ends of said cylinder to close the latter; means forming a passage in said housing means in communication with said outlet passage to deliver fluid under pressure to the outer face of one of said plate means to force said plate means against the ends of said cylinder; means mounting said cylinder for adjustment laterally of said rotor to different degrees of eccentricity relative to said rotor; an eccentric cam rotatable in said housing; a cam follower embracing and continuously engaged with said cam and connected to said cylinder for positive adjustment and positioning of said cylinder in both directions; and stop means on said housing means engageable with said cylinder to limit the extent of adjustment thereof.

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