Jan. 4, 1949. W. C. PIKE 2,458,023

VARIABLE STROKE PUMP

Filed March 2, 1944 3 Sheets-Sheet 1

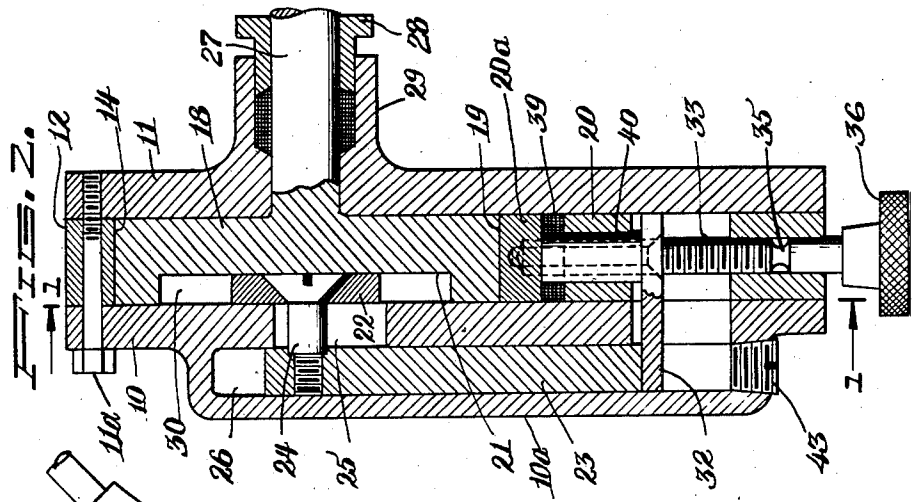


Fig. 2.

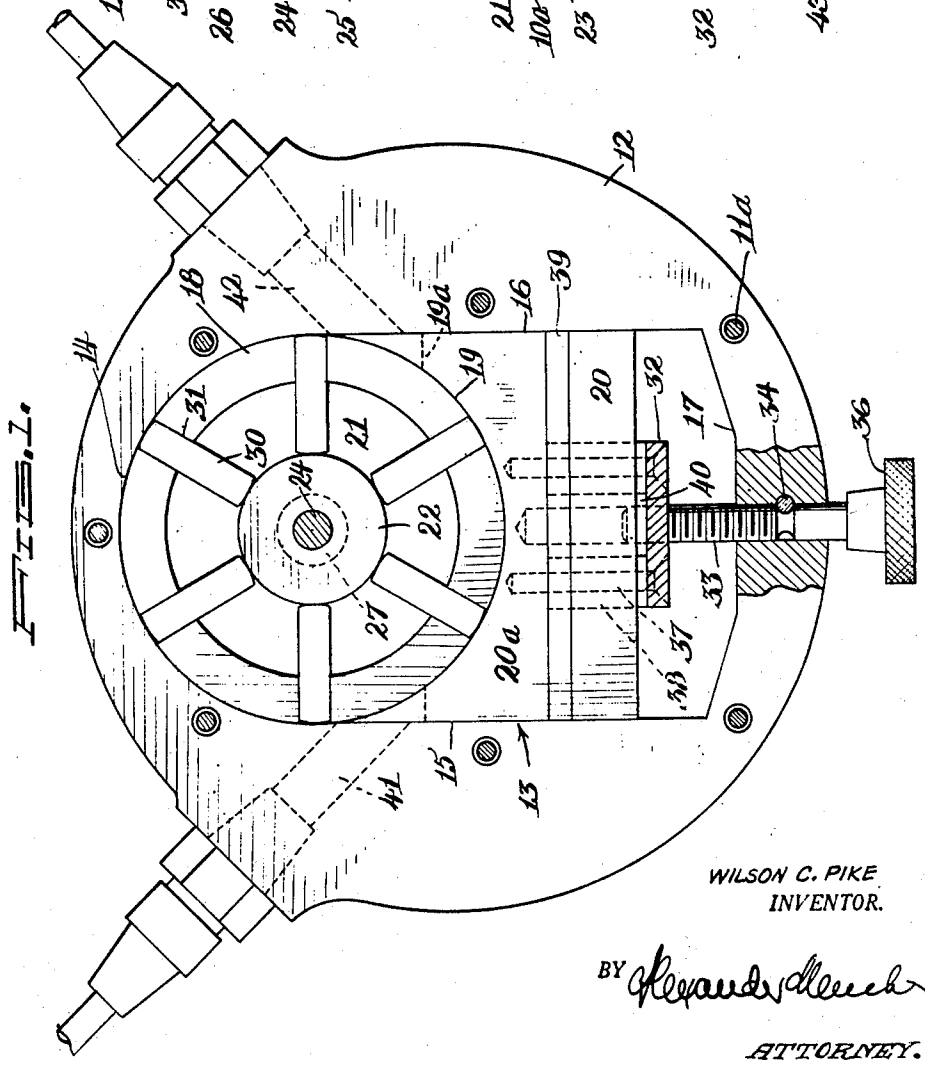


Fig. 1.

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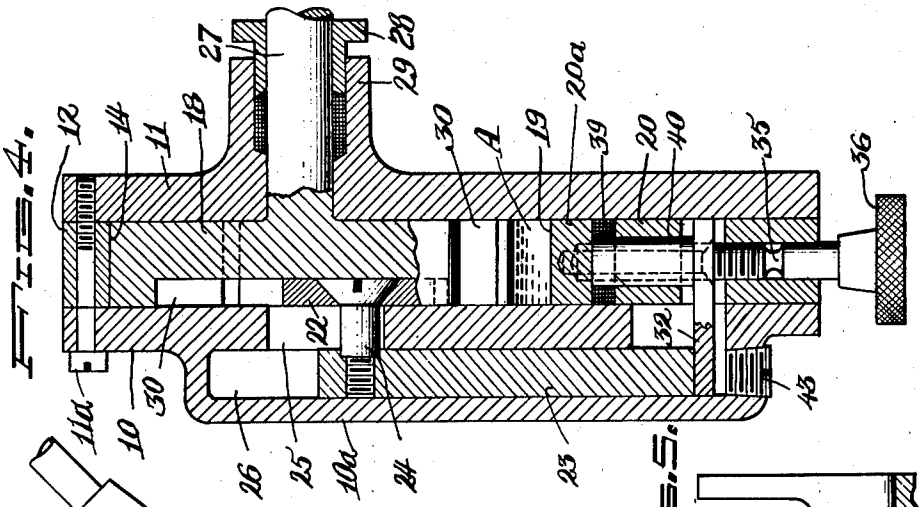


FIG. 4.

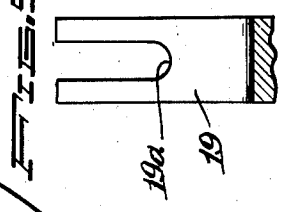


FIG. 5.

FIG. 3.

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FIG. 7.

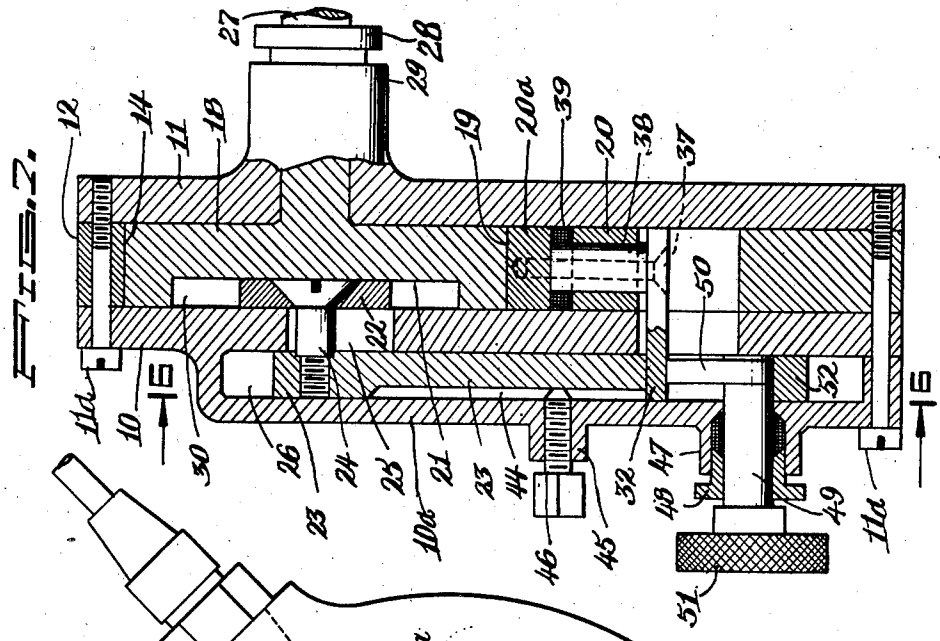
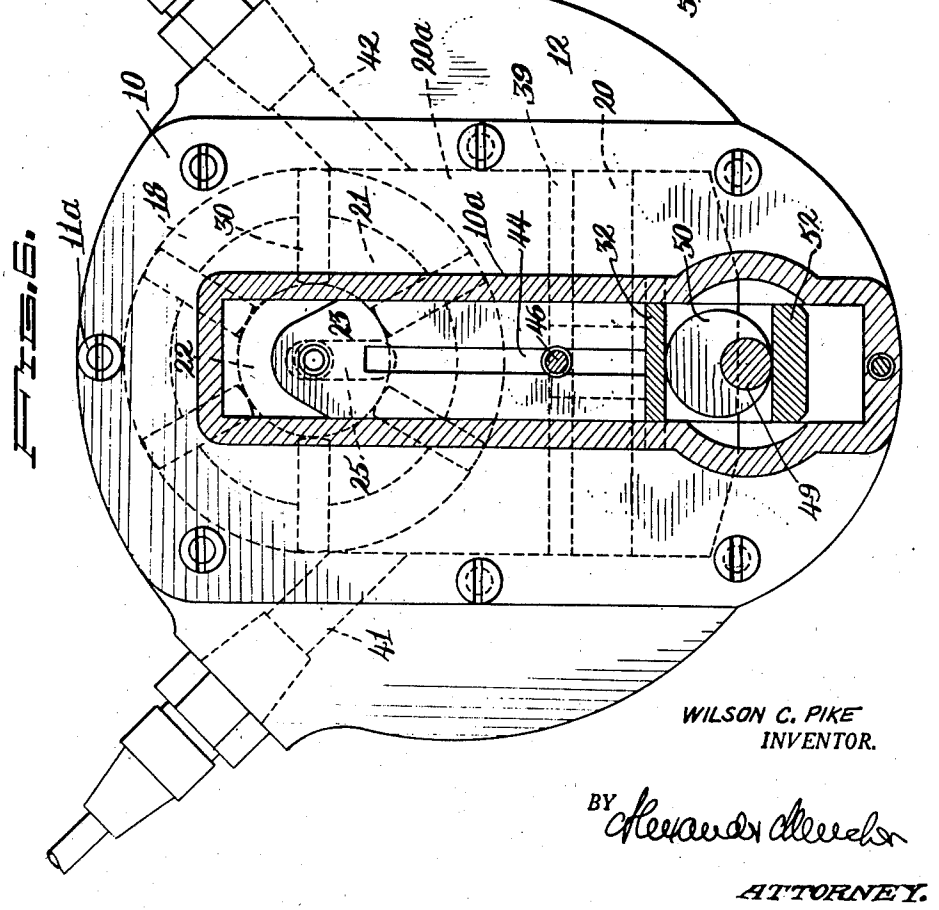


FIG. 6.



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UNITED STATES PATENT OFFICE

2,458,023

VARIABLE STROKE PUMP

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Application March 2, 1944, Serial No. 524,730

2 Claims. (Cl. 103—120)

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This invention relates generally to hydraulic pumps of the rotating and reciprocating blade type, and may be characterized as a variable displacement pump in which the pumping chamber capacity is made to vary by altering the concentricity of a portion thereof with respect to a rotor.

The main object of the invention resides in the means used to vary the fluid holding capacity of the pumping chamber thereby varying fluid displacement and pressure available at discharge. In the pump herein described, the speed thereof is preferably constant regardless of the fluctuations in load and displacement.

Another object of the invention resides in the provision of a small, light and compact pump of the above type which is comprised of a minimum number of parts wherein a minimum of precisely machined parts is required and wherein the use of springs for operative connections and displacement of parts is eliminated.

Further objects reside in the low cost of manufacture, simplicity and performance of a variable displacement pump or motor.

These objects and other incidental ends and advantages of the invention will hereinafter appear in the progress of the disclosure and as pointed out in the appended claims.

Accompanying this specification are drawings showing preferred forms of the invention wherein:

Figure 1 is a front view in elevation of the device partly in section showing the front wall of the casing removed and the pumping chamber at zero volumetric capacity, and is a sectional view of Figure 2 along the plane 1—1.

Figure 2 is a sectional view of the device along the vertical axis when the pumping chamber is at zero volumetric capacity.

Figure 3 is a view similar to Figure 1 showing the pumping chamber in operative condition at a selected volumetric capacity for a particular displacement and pressure.

Figure 4 is a sectional view of the device along the vertical axis when the pumping chamber is at the volumetric capacity shown in Figure 3.

Figure 5 is a fragmentary view in elevation partly in section showing the two end portions of the lower pumping chamber wall taken along the plane 5—5 of Figure 3.

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Figure 6 is a front view in elevation partly in section of a modified form of the device taken along plane 6—6 of Figure 7.

Figure 7 is a sectional view taken along the vertical axis of the device showing an alternate manner of varying the volumetric capacity of the pumping chamber.

In accordance with the invention and the preferred forms shown, a casing 12 having a front wall 10 and a rear plate 11 suitably secured together as by bolts 11a provides a main chamber generally designated by numeral 13. This chamber has a semi-cylindrical top wall 14, tangentially disposed and straight side walls 15 and 16 and a lower transverse wall 17.

A rotor 18 of the same radius as wall 14 is rotatably mounted in the upper portion of main chamber 13 and is in rotary engagement with said wall while in the lower portion of main chamber 13 is slidably mounted a member 20—20a having an upper semi-cylindrical wall 19 which is registrable with wall 14 of the main chamber 13 to form a cylindrical sleeve or bore for the rotation of rotor 18 therewithin.

Member 20—20a by being displaced downwardly in chamber 13 forms with the lower half of the perimeter of rotor 18 a pumping chamber A into which fluid is introduced and discharged under pressure by the action of reciprocating blades associated with rotor 18 as will hereinafter appear. It is to be observed that the volumetric capacity of pumping chamber A depends upon the extent of displacement of the top wall 19 from registration with wall 14 and may be regarded as a movable pumping chamber casing element which may be urged into eccentricity with respect to the lower perimeter of rotor 18. Moreover, with such displacement or eccentricity a guide member for the blades and operably connected to member 20—20a is also displaced from concentric position relative to rotor 18 to urge the blades from the inner ends thereof into the pumping chamber A and to cause the outer ends to be in sliding engagement with wall 19. The spacing between wall 19 and the lower perimeter of the guide member is maintained constant during lineal movement of these connected members.

Thus, rotor 18 is provided with a concentric recess 21 on the forward face thereof and is adapted to support a reciprocable guide member

or track 22 thereagainst, said guide member 22 being suitably connected with member 20—20a as will hereinafter appear. As shown, guide member 22 is secured to a sliding block 23 by suitable means such as a screw 24, front wall 10 affording a vertical slot 25 for reciprocation of screw 24 while a chamber 26 is afforded by the forward housing 10a of front wall 10 for block 23.

Rotor 18 is suitably secured to a driving shaft 27 which is mounted in a stuffing box 28 secured in hub 29 at the rear face of plate 11. Associated with rotor 18 are a series of reciprocable blades 30 mounted in radially disposed slots 31, the displaceability of the blades beyond the lower perimeter of rotor 18 being controlled by the position of guide member 22. When the latter is concentric with rotor 18 as shown in Figure 1, the ends of the blades are in sliding engagement with the bore of the registering cylindrical walls 18 and 19 and the perimeter of guide member 22. During this relationship, the pumping chamber is at zero capacity.

Block 23, as shown may be connected to member 20—20a by means of a transverse plate 32 penetrating wall 10 through an appropriate slot to permit vertical reciprocation, the plate being secured to member 20—20a by a suitable means such as a pair of screws 37 within bushings 38. Movement of member 20—20a whereby wall 19 is rendered eccentric or concentric with respect to the lower perimeter of rotor 18 may be effectuated in any well known manner such as by pressure regulation in the output line; for when the pressure rises after the travel of some operating unit has been completed, the rising pressure through suitable control means as hydraulically may force the wall 19 into concentricity for zero displacement thus stopping the flow in the lines. And since leakage in variable displacement pumps tends to reduce the pressure in the outlet line, the pump has to move to a partial displacement position sufficient to pump an amount of fluid equal to the leakage.

However, as shown, the displacement value of the pump is controlled by hand. Thus, member 20—20a is moved by manipulating a thumb screw 33 projecting through the bottom of casing 10 and penetrating the main chamber 13 for engagement with an internally threaded bushing 40 disposed in member 20—20a and supported on plate 32. Screw 33 has an annular recess 35 in rotatable engagement with a key 34 on the casing to prevent movement of the screw when the knurled screwhead 36 is turned. However, during such turning bushing 40 is made to move carrying therewith member 20—20a to vary the capacity of chamber A and to displace the position of eccentric 22.

Means to prevent leakage between the movable parts may be conventional; however, member 20—20a is shown having intermediate packing 39 and a plug 43 is also shown whereby fluid which has leaked to the bottom of main chamber 13 may be tapped. Moreover, a conventional inlet 41 and an outlet 42 lead in and from pumping chamber A and in order that fluid enter and pass out when the volumetric capacity is small, the ends of wall 19 of member 20—20a are each provided with a U-shaped slot 19a intermediate the width thereof.

It is understood that outlet 42 is provided with a relief valve (not shown) which may lead to the source of the fluid or to inlet 41 to relieve excessive loading or to circulate the fluid when the pumping chamber has capacity and there is no load.

It is to be observed that when guide member 22 is displaced from its normal concentric position relative to rotor 18 by the turning of knob 36, the blades at the inner ends facing wall 19 are positively forced outwardly beyond the lower perimeter of rotor 18 and the outer ends engage wall 19. Thus, the device does not depend on centrifugal force for the reciprocation of the blades since a loaded condition would interfere therewith.

Since blades 30 at the outer ends are curved to fit the bore of walls 14 and 19 when they are in registration, there will be line contact only with wall 19 when the latter is in a displaced position and hence low resistance to leakage. Wear between wall 19 and the outer ends of blades 30 will also take place at the higher speeds especially where the liquid pumped has low lubricating value. To prevent effective shortening of blades 30, they may be made of a resilient material.

In Figures 6 and 7, the device is provided with a modified form of manual adjustment for the capacity of the pumping chamber. Thus, block 23 is provided with an intermediate vertical narrow slit 44 extending along the outer face whereby a thumb screw 46 mounted on an extension 45 on the outer wall of housing 10a may secure an adjustment of the positions of member 20—20a and guide member 22. This adjustment is accomplished by the use of an eccentric engaging block 23 at plate portion 32 and a lower part 52. Thus, the front wall 10a has a forwardly extending hub 47 provided with a bore through which a shaft 49 penetrating wall 10a is mounted within a stuffing box 48. Shaft 49 at the outer end has a manually operable knob 51 and carries at the inner end an eccentric 50 controlling the movement of block 23.

I wish it understood that the device described has been illustrational only and that all modifications are contemplated which come within the scope of the appended claims.

I claim:

1. In a variable stroke hydraulic pump or motor, a rotor and radial slots therein, a semicircular movable wall having straight side edges tangential with the perimeter of the said rotor and being engageable therewith and forming a pumping chamber of variable capacity when variably displaced therefrom, a plurality of free radially disposed blades reciprocable in said rotor slots, a cylindrically shaped guide member slidable on a rotor face and connected for movement with said wall and engageable with the inner ends of the blades, means to move said wall at various displacement values beyond the rotor to form a pumping chamber of a variable capacity, the guide member following said movement to urge the blades into the pumping chamber and the outer ends thereof into sliding engagement with the movable wall, an inlet for the pumping chamber and an outlet therefor.

2. In a variable stroke hydraulic pump or motor, a rotor and radial slots therein, a semicircular movable wall having straight side edges tangential with the perimeter of the said rotor and being engageable therewith and forming a pumping chamber of variable capacity when variably displaced therefrom, a plurality of free radially disposed blades reciprocable in said rotor slots, a cylindrically shaped guide member slidable on a rotor face and engageable with the inner ends of the blades, being connected to the

said movable wall and being concentric with the rotor when the movable wall is in engagement with the rotor, means to move said wall at various displacement values beyond the rotor to form a pumping chamber of variable capacity, the guide member following said movement being urged into eccentricity to force the blades into the pumping chamber and the outer ends thereof into sliding engagement with the movable wall, an inlet for the pumping chamber and an outlet therefor, and feeding means in communication with said inlet and outlet disposed along the straight edges of the semi-circular movable wall leading to the pumping chamber.

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