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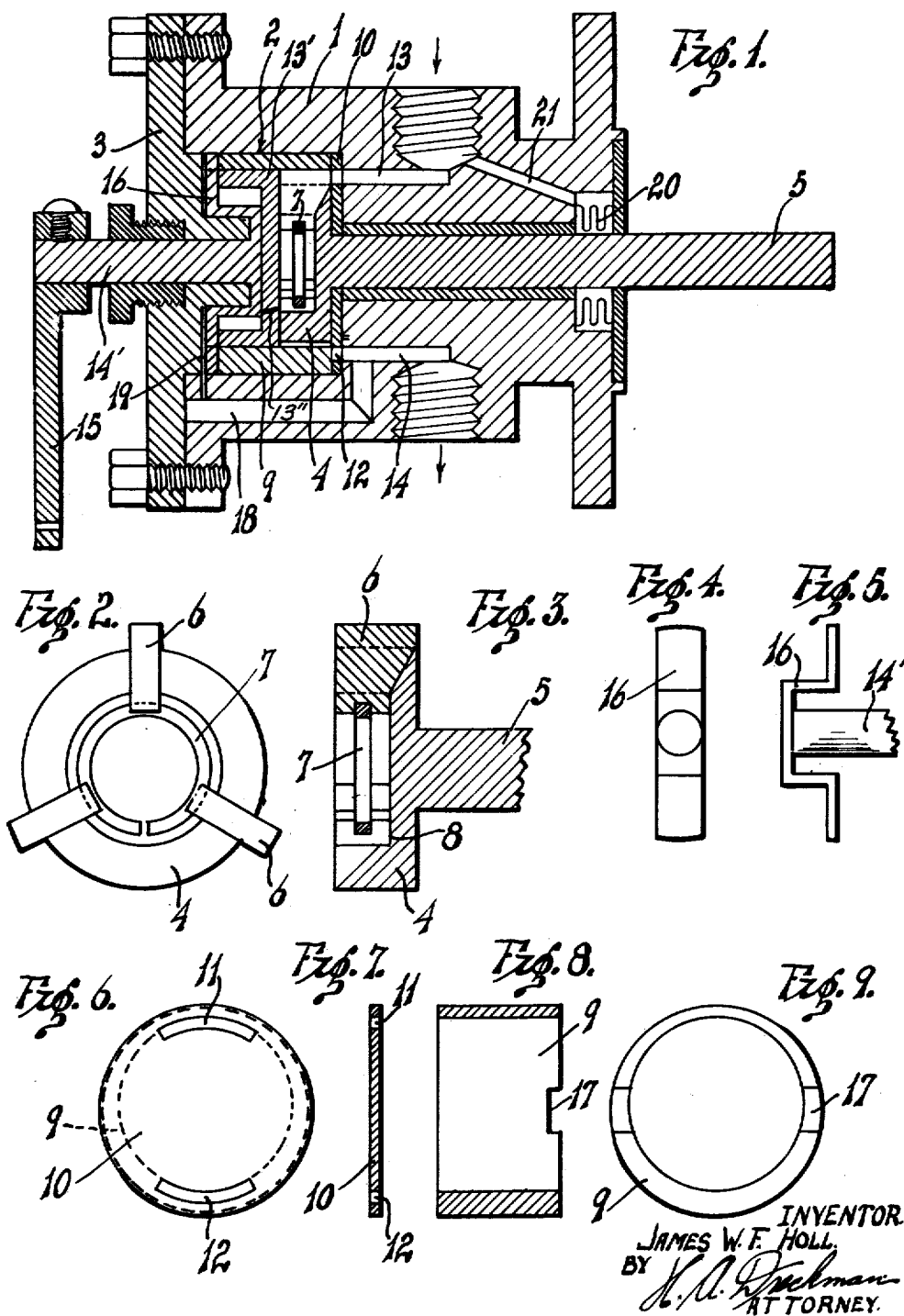
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2,359,558

VARIABLE VOLUME ROTARY PUMP

Filed Oct. 14, 1940

2 Sheets-Sheet 1



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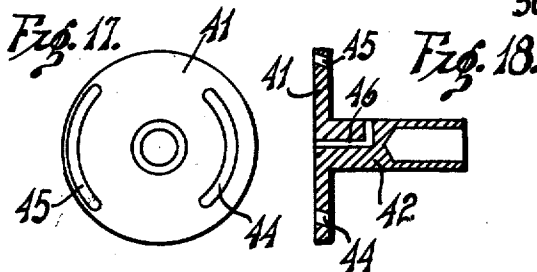
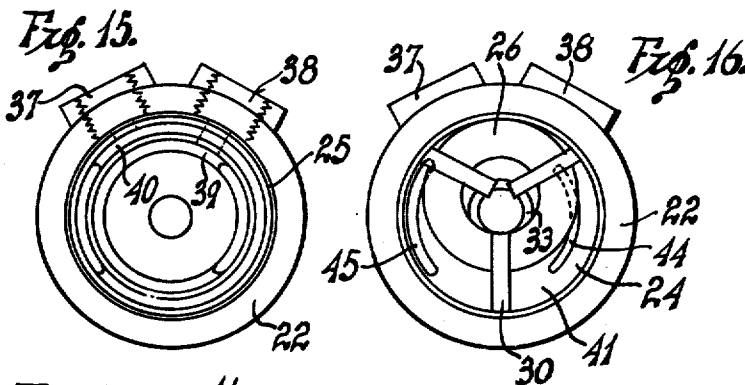
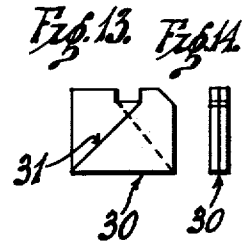
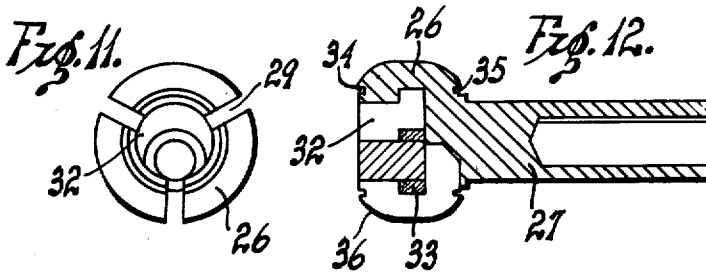
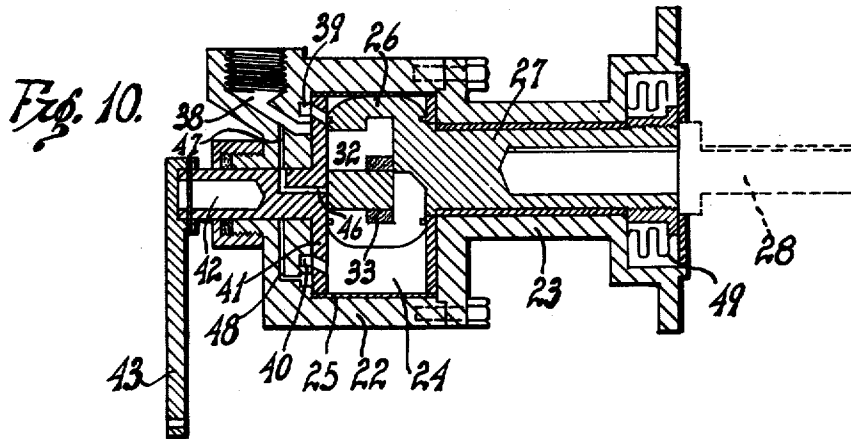
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VARIABLE VOLUME ROTARY PUMP

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2 Sheets-Sheet 2



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VARIABLE VOLUME ROTARY PUMP

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2 Claims. (Cl. 103—120)

This invention relates to a variable volume rotary pump, the prime object of which is to provide a simple and effective means of varying the volume of the pump by means of an exterior lever or arm.

Another object of my invention is to provide a novel means of varying the volume of a rotary pump by rotation either of an eccentric in the pump or a ported plate.

Another object of my invention is to provide a novel means of compensating for wear and heating expansion of parts by internal hydraulic pressure against the rotor and other parts within the pump.

A feature of my invention resides in the novel blade arrangement in the rotor whereby these blades are urged against the wall of the pumping chamber by a resilient means, and are also urged against the side walls of the chamber, thus enabling the pump to efficiently operate at low speeds.

Still another object of my invention is to provide a novel variable volume rotary pump, which is also reversible by operation of an external arm or lever.

A feature of my invention resides in the ability to adjust the pump to any point between zero output and full output.

Other objects, advantages and features of invention may appear from the accompanying drawings, the subjoined detailed description, and the appended claims.

In the drawings:

Figure 1 is a longitudinal, sectional view taken in a vertical plane of my pump.

Figure 2 is an end view of the rotor.

Figure 3 is a fragmentary, vertical sectional view of the rotor.

Fig. 4 is an end view of the volume changing finger or actuator.

Figure 5 is a fragmentary, side elevation of the same.

Figure 6 is a side elevation of the ported plate.

Figure 7 is a vertical, sectional view of the same.

Figure 8 is a transverse, sectional view of the eccentric.

Figure 9 is an end view of the same.

Figure 10 is a vertical, sectional view of a slightly modified form of variable volume pump embodying my invention.

Figure 11 is an end view of the rotor.

Figure 12 is a vertical sectional view of the same.

Figure 13 is a side elevation of blade pack.

Figure 14 is an end view of the same.

Figure 15 is an end view of the housing with the bearing portion of the housing removed, and also the rotor removed.

Figure 16 is a view similar to Figure 15 but with the rotor in position.

Figure 17 is a side elevation of the ported and adjustable plate.

Figure 18 is a vertical, sectional view of the same.

Referring more particularly to the drawings, the numeral 1 indicates a housing in which a chamber 2 is formed. The open end of the chamber 2 is closed by a head 3, which is bolted or otherwise fixedly attached to the end of the housing 1. A rotor head 4 is formed or fixedly mounted on the end of a shaft 5, the shaft protruding from the housing 1 and the head being positioned within the chamber 2 and rotatable therein, all of which is usual in the art. A suitable driving means is attached or connected to the shaft 5 at its outer end so as to rotate the runner or head 4. It is understood that the driving connection to the shaft 5 shall permit longitudinal movement of this shaft in the housing 1—that is, the shaft and head 4 will float. The purpose of this is to permit a sealing against the side walls of the rotor, as will be subsequently described.

A plurality of blades 6 are mounted in the head 4 in proper spaced relation, and these blades may be radially arranged, and also they may consist of a single block of metal, fiber, or the like, or they may be formed of a plurality of segments or strips, as will be subsequently described. An annular resilient ring 7 engages each of the blades 6 and urges these blades outwardly against the wall of the pumping chamber. It will be noted that the head 4 is undercut, as shown at 8, and the resilient spring or element 7 is positioned within this undercut portion so as to engage substantially the center of each of the blades 6. Each of the blades may be recessed or grooved to receive the spring element 7, thus insuring an even outward push against these blades, and the grooves also serving to retain the spring 7 in position.

An eccentric cylindrical pump wall sleeve 9 is mounted in the chamber 2 and closely fits the wall of this chamber, that is the outer surface of the eccentric wall fits the chamber 2. The eccentric cylindrical pump wall sleeve 9 which is concentrically disposed in chamber 2 and has an inner periphery which is eccentric to the axis of the housing and its chamber and is

rotatable within the chamber 2, as will be further described. The rotor 4 is positioned within the eccentric sleeve 9, and the blades 6 are pressed against the inner wall of the eccentric. A plate 10 is mounted within the chamber 2 and positioned at the end of this chamber, the eccentric sleeve 9 being pressed endwise against this plate. The plate 10 is provided with an arcuate intake port 11, and an arcuate exhaust port 12. An intake duct 13 is provided in the housing 1, and this duct extends to the port 11, and similarly an outlet duct 14 is provided in the housing, this outlet duct extending to the port 12. The plate 10 is pinned to the housing 1 so that it cannot rotate. Rotation of the eccentric sleeve 9 over the ports 11 and 12 will vary the volume of the pump in a self evident manner.

A cup 13' fits closely within the eccentric 9 and bears against the end of the rotor 4, substantially as shown in Figure 4. Rotation of the eccentric sleeve 9 and the cup 13' is accomplished by the adjusting shaft 14', which extends through the head 3. A lever or arm 15 attached to the outer end of the shaft 14' enables this shaft to be rotated for the purpose of adjusting the volume of the pump. On the inner end of the adjusting shaft 14', there is fixedly attached or integrally formed a spring finger 16. This spring finger extends outwardly and fits into notches 17 in the eccentric, thus causing the eccentric to rotate when the arm 15 is swung. The outer surface of the eccentric 9 is concentric with the shaft 5, and the eccentric is rotatable about the axes of the shafts 5 and 14'. The shafts 5 and 14' are preferably in alignment.

A bypass pressure duct 18 is formed in the housing 1 and extends from the outlet 14. A port 19 extends back of the finger 16 and within the cup 13', thus introducing fluid under pressure back of the cup 13', and pressing this cup against the side of the rotor 4. The cup 13' is also bled into the center of the rotor 4 by passage or port 13'', thereby introducing fluid under pressure into the rotor, which will assist in pressing the blades 6 outwardly. This hydraulic pressure will also hold the rotor 4 against the plate 10 at all times and will compensate for wear. The spring finger 16, as well as hydraulic pressure, will press the cup 13' against the rotor, also for the purpose of compensating for wear.

The shaft 5 is journaled in the housing 1 and an oil seal 20, of usual and well-known construction, is provided at the outer end of the housing 1 and surrounds the shaft 5. A port 21 extends from the oil seal 20 to the intake 13 of the pump for the purpose of returning any excess oil which might accumulate from the bearing of the shaft 5.

In the type of pump thus far described, and disclosed in Figures 1 to 9 inclusive, the ported plate in which the inlet and outlet ports are provided is stationary, and an eccentric is rotatably mounted adjacent to this ported plate, the end of the eccentric bearing against the plate and rotation of the eccentric will vary the size of the inlet and outlet ports through which fluid is permitted to pass.

In Figures 10 to 18 inclusive the variable volume pump consists of a housing 22, to which a bearing head 23 is bolted or otherwise removably attached. A pumping chamber 24 is provided in the housing 22, and a sleeve 25 of hard material is pressed into this chamber for the purpose of presenting a hard-wearing surface for the rotor. The rotor includes a head 26, which is formed or

mounted on the end of a shaft 27. The shaft is journaled in the bearing case 23, and is preferably splined internally to receive a suitable driving coupling 28. The head 26 is provided with a plurality of slots 29, which receive blade packs 30. These blade packs consist of a plurality of thin strips of metal, fiber or the like, each strip being arranged in pairs which are cut angularly as shown at 31, so that outward pressure against the blade pack will cause the parts of the blades to be pushed sideways against the side wall of the pumping chamber. This provides a side wall seal. The cuts 31 may be alternately arranged in the blade packs so as to prevent leakage through the blade packs. The head 26 is undercut, as shown at 32, and an annular resilient element 33 bears against each of the blade packs for the purpose of urging these blades outwardly. It is to be noted that the head 26 is eccentrically mounted in the chamber 24. The blade packs 30 are curved to receive the spring element 33 the same as previously described in Figures 1 to 9 inclusive.

The head 26 is also provided with annular grooves 34 and 35 in each wall thereof to provide an oil seal. Note also that the head is rounded, particularly at the inner end thereof, as shown at 36. This allows fluid carry-over by way of this rounded area between the blades. The housing 22 is provided with ports 37 and 38, either of which may be the intake or the outlet. The port 37 extends to an annular groove 39 in the end wall of the housing 22, and the port 38 extends to an annular groove or passage 40 also in the end wall of the housing. A plate 41 is positioned within the chamber 24, and is mounted or fixed to the inner end of an adjusting shaft 42. An adjusting arm or lever 43 is fixed to the shaft 42 for the purpose of rotating this shaft and the ported plate 41 for the purpose of varying the volume of the pump.

The plate 41 is provided with arcuate ports 44 and 45, which coincide with the annular grooves 39 and 40 respectively. Thus, it will be evident that rotation of the shaft 42 and the plate 41 will vary the position of the arcuate ports 44 and 45 relative to the eccentrically mounted rotor 26, thus varying the volume of the pump in a self-evident manner. A 180 degree rotation will completely reverse the flow of fluid to and from the pump. A bleed port 46 is formed in the shaft 42 and extends into the chamber 24 for the purpose of introducing fluid under pressure back of the blades 30 for the purpose of urging these blades outwardly against the wall of the chamber 24. The port 46 will connect with either of the ducts 47 or 48, depending upon which is the pressure side of the pump. An oil seal 49 is provided at the outer end of the bearing housing 23 and this seal is of usual and well-known construction.

I claim:

1. A variable volume rotary pump comprising a housing having a chamber therein and inlet and outlet ports communicating with an end of the chamber, a rotatable sleeve having an internal eccentric periphery positioned in said chamber and defining eccentric sleeve ends, a longitudinally shiftable rotor having a plurality of blades positioned within said sleeve, means connected to said rotor to effect driving of the same, a plate having ports therein disposed between said rotor and the end of said chamber with which the ports of the housing communicate and having its ports communicating with the housing ports, the respective end of said sleeve

bearing against said plate, said respective end of said sleeve being arranged upon rotation thereof to cover and uncover to varying degrees said plate ports to control the extent of opening of said plate ports and consequently the fluid flow through said inlet and outlet ports, a cup adjacent the opposite end of the sleeve and engageable by said rotor and shiftable therewith longitudinally in the sleeve, and means for turning said sleeve whereby the flow through the respective inlet and outlet ports may be varied, the housing being provided with a passage leading from its outlet port for delivering fluid under pressure against the cup and effecting shifting of the cup against the rotor in the sleeve toward the ported end of the chamber.

2. A variable volume rotary pump comprising a housing having a chamber therein and inlet and outlet ports communicating with one end of the chamber in spaced relation to each other circumferentially thereof, a rotatable sleeve having an internal eccentric periphery positioned in said chamber and defining eccentric sleeve ends, a hollow longitudinally movable rotor having a plurality of blades positioned within said sleeve, 25

means connected to said rotor to effect driving of the same, a plate having ports therein between said rotor and one end of said chamber, the respective end of said sleeve thus bearing against said plate, said plate ports respectively communicating with said housing ports, said respective end of said sleeve being arranged upon rotation thereof to cover and uncover to varying degrees said plate ports to control the extent of opening of said plate ports and consequently the fluid flow through said inlet and outlet ports, a cup adjacent the opposite end of the sleeve and engageable by said rotor, a bleed port formed through the bottom of said cup providing communication between the interior of the cup and the hollow rotor, the housing being formed with a port between the cup and one of said inlet and outlet ports whereby fluid pressure built up by said rotor may act against the interiors of the cup and the rotor and press the rotor against said plate thereby compensating for wear thereof, and means for turning said sleeve whereby the flow through the respective inlet and outlet ports may be varied.

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