June 27, 1950 W. F. BROWN 2,512,593

ROTARY VANE FLUID PRESSURE MACHINE

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Fig. 1.

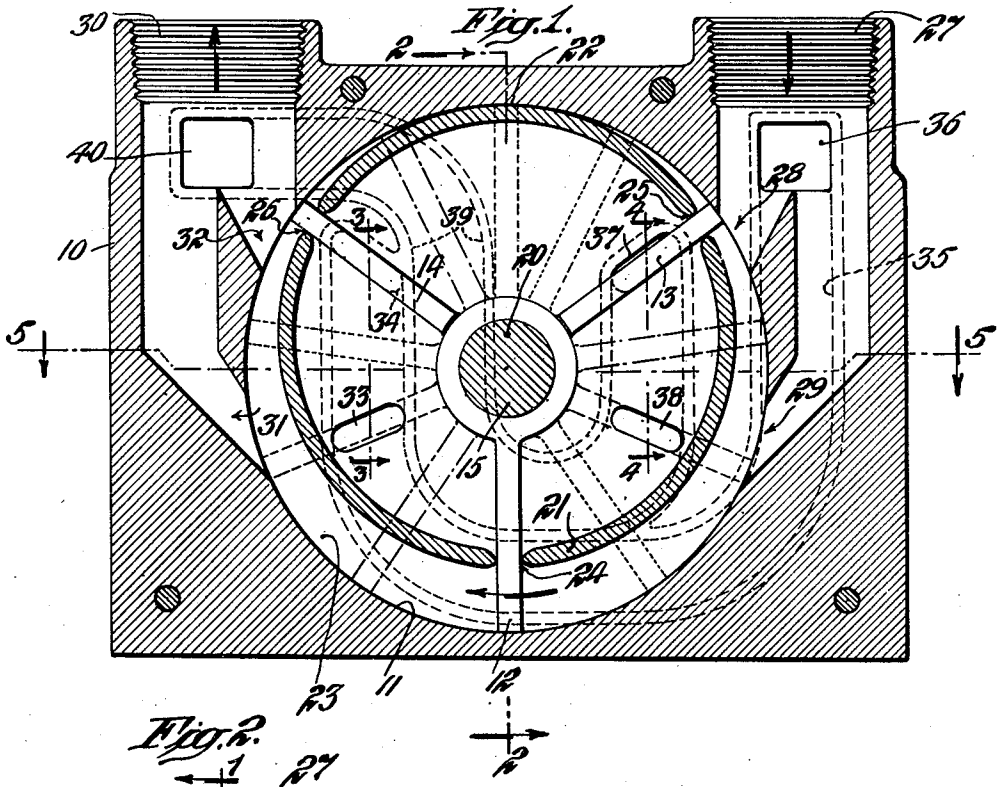


Fig. 2.

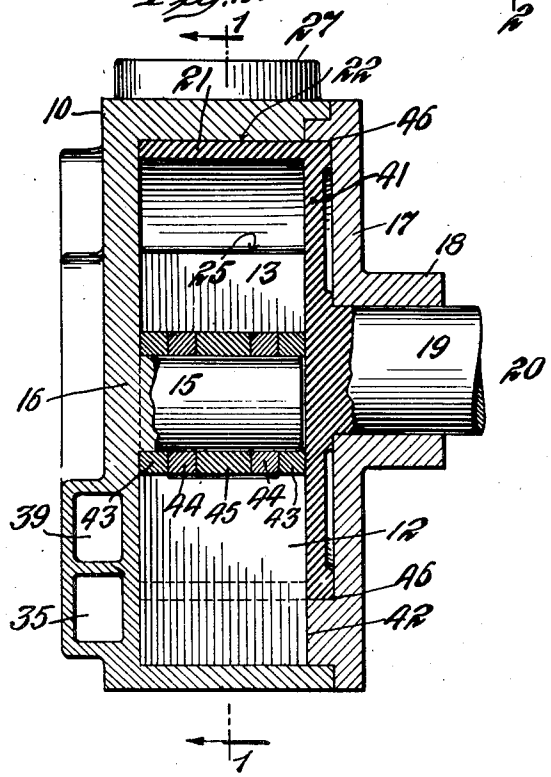


Fig. 3.

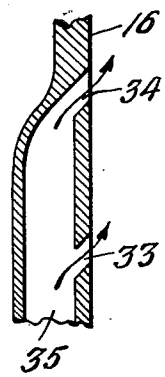
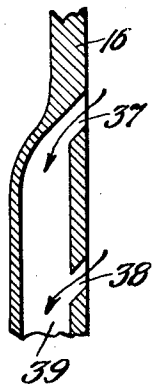


Fig. 4.



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Fig. 5.

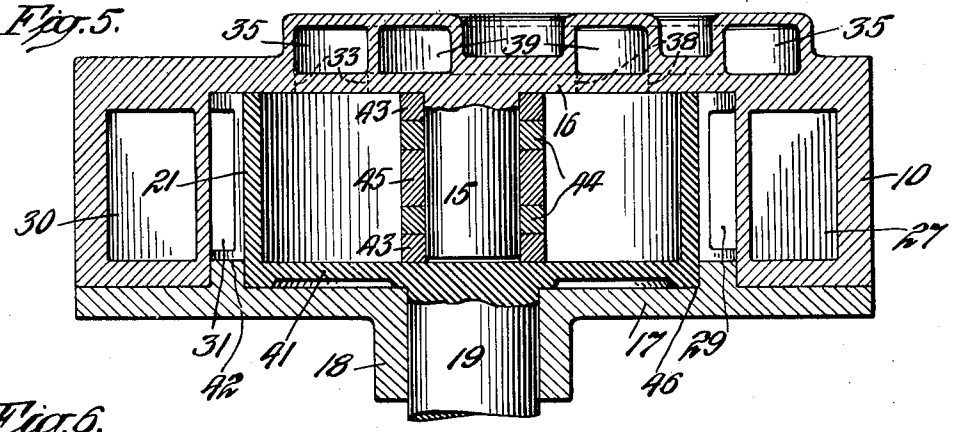


Fig. 6.

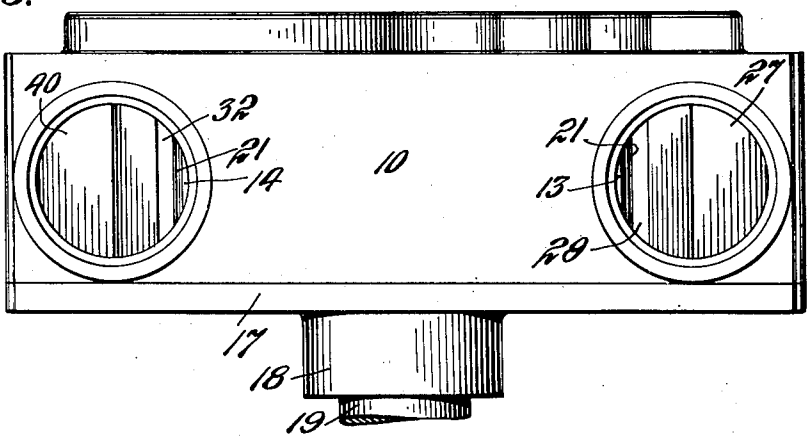


Fig. 7.

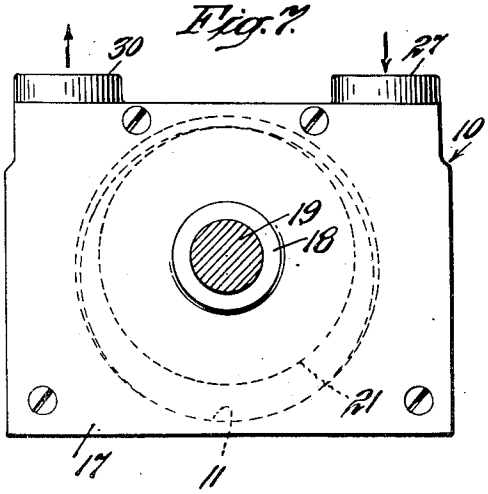
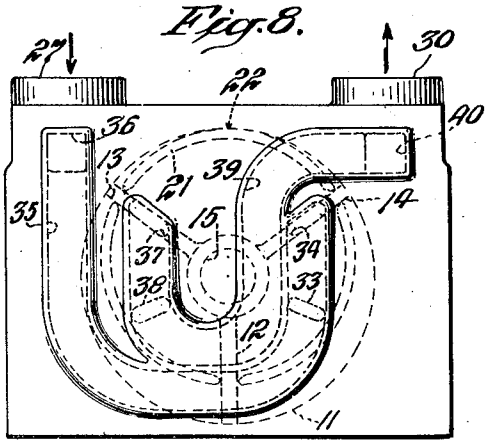


Fig. 8.



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Fig. 9.

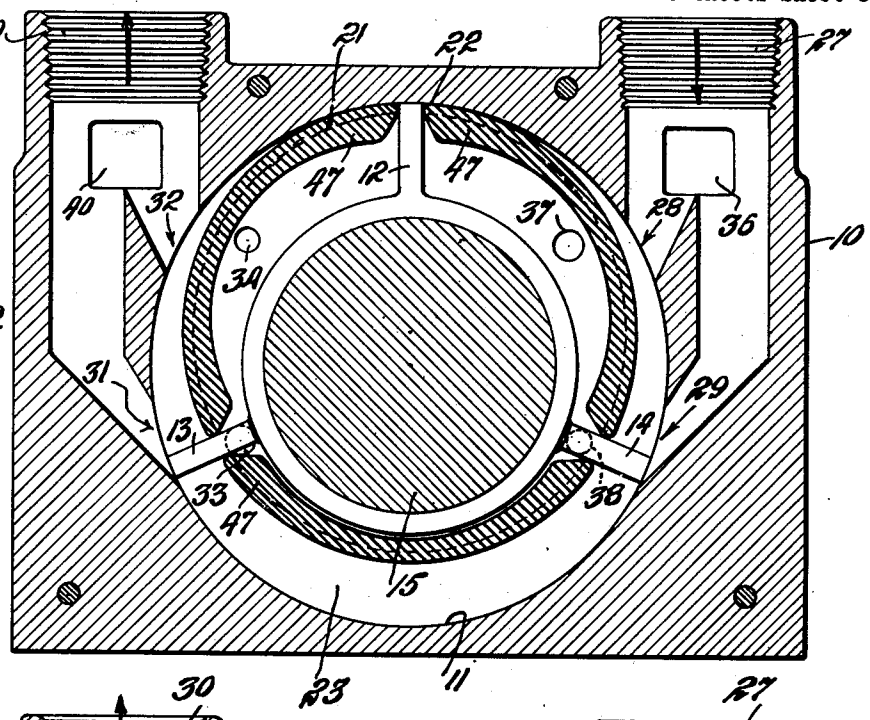
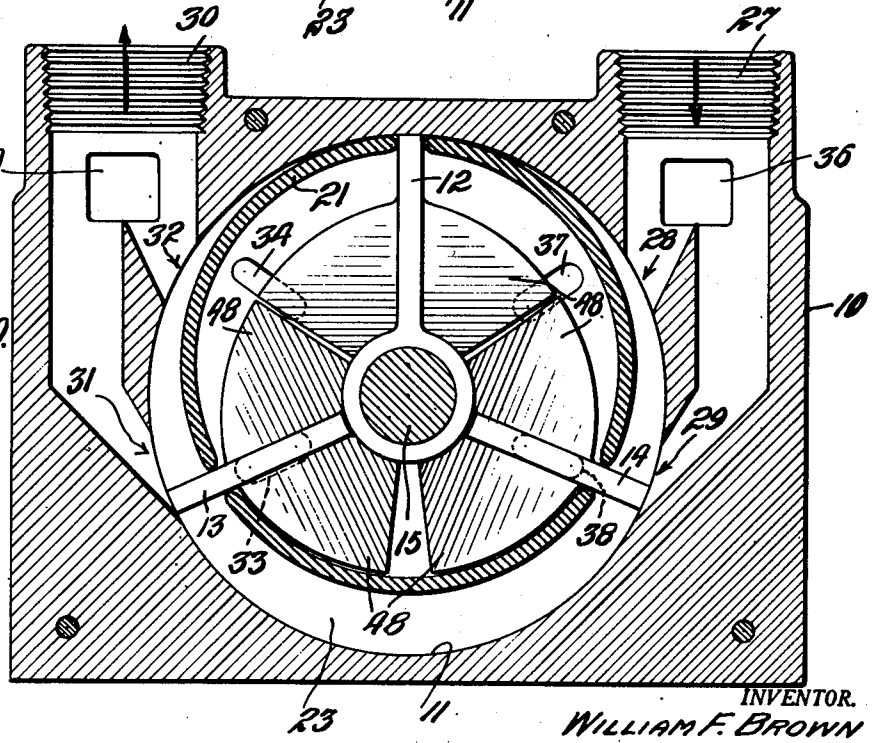


Fig. 10.



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Patented June 27, 1950 2,512,593

UNITED STATES PATENT OFFICE

2,512,593

ROTARY VANE FLUID PRESSURE MACHINE

William F. Brown, Flushing, N. Y., assignor, by direct and mesne assignments, of thirty per cent to Philip S. McLean, Bloomfield, N. J., ten per cent to Frank L. Davis, College Point, and ten per cent to Howard D. Flicker, Queens Village, N. Y.

Application December 27, 1943, Serial No. 515,824

1 Claim. (Cl. 103—144)

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The invention herein disclosed relates to fluid pressure machines, particularly rotary pumps of the type disclosed in copending patent application Ser. No. 454,775 filed August 14, 1942, now Patent 2,370,934 issued March 6, 1945.

Special objects of the invention are to provide a rotary pump of the positive displacement type, which will have large volumetric capacity, create direct flow of liquid without setting up turbulence and produce smooth continuous flow free of pulsation.

Further important objects are to provide a machine of few, simple, sturdy parts, operating on their own centers, free of reciprocating movements, which will be light in weight and small, for the work accomplished, which will operate on a low power factor and which can be operated efficiently at slow speeds, as well as the higher speeds and which can be utilized to develop desired pressures at different speeds.

Other desirable objects and the novel features by which the purposes of the invention are attained will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain practical embodiments of the invention. Structure however, may be modified and changed as regards the present disclosure, all within the true intent and broad scope of the invention as will be apparent from the following specification and claim.

Fig. 1 in the drawings is a vertical sectional view of an embodiment of the invention, this view being taken on substantially the plane of line 1—1 of Fig. 2.

Fig. 2 is a vertical sectional view at right angles to that shown in Fig. 1 and taken on substantially the plane of line 2—2 of Fig. 1.

Figs. 3 and 4 are broken sectional details showing inlet and outlet port constructions for the inner pumping chamber and taken substantially on lines 3—3 and 4—4 of Fig. 1.

Fig. 5 is a broken horizontal sectional view on substantially the plane of line 5—5 of Fig. 1.

Fig. 6 is a top plan view of the machine.

Figs. 7 and 8 are elevations illustrating opposite sides of the machine.

Figs. 9 and 10 are vertical sectional views illustrating modified forms of the invention.

As shown particularly in Fig. 1, the body or casing 10, of the machine, is formed with a cylindrical working chamber 11, and the piston blades, in this case, three in number, designated 12, 13, 14, are mounted concentrically within this chamber, rotating on a stationary post 15, carried by and projecting from the back wall 16, of the chamber.

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The front wall 17, is shown as separately formed and removably secured in place and as carrying the bearing 18, for the shaft member 19. The center 20, of this shaft, as best shown in Figs. 1 and 2, is offset above the blade center and the purpose of this is to support the cylindrical rotor 21, which it carries, in running sealing engagement with the upper peripheral portion of the pump chamber at 22, and to define the crescent shaped pumping space 23.

The cylindrical rim portion of the rotor has three equi-distantly located slots 24, 25, 26, through which the rotary piston blades project into correlation with the walls defining the crescent-shaped displacement space.

Inlet and outlet passages are provided in the casing, opening into the displacement chamber at opposite sides of the tangential sealing engagement 22, between the rotor and surrounding chamber.

The inlet 27, is formed with two ports or passes 28, 29, opening through the peripheral wall of the cylindrical chamber in angularly offset relation, one in advance of the other. The first port 28, is located relatively near the sealing line 22, in position to be uncovered by blade 13, shortly after it passes the seal between inlet and outlet sides of the pump. The second port 29, is located far enough in advance of the first to remain open substantially up to the maximum displacement established within the crescent chamber.

Similarly, the outlet 30, is shown as having separate discharge ports 31, 32, angularly offset, the first in this case located to be opened at substantially the instant of maximum displacement and the second to remain open after the first is closed and while the final fraction is being swept out of the chamber.

In the full line position of the parts appearing in Fig. 1, the forward blade 12, is drawing from both ports 28 and 29. In the next position represented by dot and dash lines, the blade 13 has closed the first inlet port 28, so the forward blade 12 is drawing through the forward port 29, and will continue to so operate until the dash line position is reached, at or about which moment of maximum displacement volume, the blade 13 will close the second inlet port 29. Approximately at this instant, the forward blade 12, will uncover the first outlet port 31, to enable the following blade 13 to start discharge through that port. As the parts reach the dotted line position, blade

13 continues discharge through the first outlet port and then as the forward blade reaches the full line position where blade 14 is shown, both outlet ports will be fully open and the second port will remain in service for sufficient time after the first port has been closed, to enable substantial clearance of the remaining portion of the chamber. In its further travel, the blade at the 14 position will aid in maintaining the tangential seal between the rotor and surrounding pump wall.

The successively acting ports enable the blades to operate at best efficiency, to completely fill the chamber and to start discharge immediately the chamber is filled, thus assuring smooth continuous flow and maximum volume, substantially free of pulsation.

The eccentric disposition of the blades within the rotor effects displacement within the rotor, substantially the reverse of that effected in the crescent chamber and such displacement is utilized in the present disclosure by providing separate angularly offset inlet ports 33, 34, opening from a passage 35, through the back wall of the casing into the open end of the rotor, the first at a point to be uncovered when the space between adjoining blades commences to enlarge and the second at a point to be closed when the space between adjoining blades has reached a maximum. The passage 35, is shown extending back in a loop to a port 36, branching from the main inlet passage.

Outlet ports 37, 38, are shown provided in the back wall 16, at the opposite side from the inlet ports, in position, the first to open when maximum volume between adjoining blades within the rotor is attained and the second to be closed when the displacement space between adjoining blades within the rotor is substantially at a minimum. The interiorly located outlet ports are shown connected by branch passage 39, leading to a discharge port 40, opening into the side of the main outlet 30.

The interior pump passages 35 and 39 may be cored or otherwise formed in or on the back wall of the casing or they may be provided by separate pipe connections. Further, instead of being connected with the main pump inlet and outlet, they may be connected with other liquid or fluid holders.

As shown particularly in Figs. 3, 4 and 8, the inner pumping passages, provided by conduits 35, 39 and the ports 33, 34 and 37, 38, may be curved or directed in the general direction of rotation, so as to pass the fluid freely without disturbance or tubulence.

By utilizing the space within as well as the space without the rotor, a maximum pumping effect is obtained and a substantially continuous and pulsationless flow can be maintained with maximum efficiency and low power consumption.

The rotor and the three blades are the only moving parts and these all turn on their own centers. The blades may be driven by their engagement in the slots, or if desired, through linkage connections with the rotor as disclosed in the copending patent application above identified. As a further possibility, the blades may be driven from a centrally located drive shaft and the rotor be separately mounted and operated through the slot connections or by linkage such as mentioned.

Various other modifications are possible, but the simple form of construction illustrated, has many manufacturing and operating advantages. As shown in the several views, the rotor may be

formed simply as a hollow cup on the end of a shaft, with slots cut through to the solid back wall 41, of the rotor and the inner face of this wall may be flush with the adjacent side wall 42, of the crescent chamber, substantially as indicated in Fig. 2. With such construction, the blades may be plain straight sided elements, closely fitting in the cup of the rotor and coacting with the surrounding walls of the crescent chamber. The hinge loops of the blades may be offset to interlock substantially as shown in Figs. 2 and 5, where one blade such as 12, may have two outer hinge loops 43, another blade 13, the two loops 44, to stand inside the outer loops and the third blade 14, a single center loop such as 45. The rotor is shown turning in a seat 46, in the front cover, acting partly as a bearing and seal for the shaft and serving to bring the inside wall of the cup formation into flush relation with the front wall 42 of the pump chamber.

To take up space in the inner chamber not actually serving for pumping purposes, the hinge post 15, and hinge loops of the blades may be made of larger diameter, as indicated in Fig. 9, so as to occupy practically all of the space within the rotor, between adjoining blades defining the minimum volume space.

To complete this effect or as a substitute for the large diameter post, the rotor may be contoured on its inner wall between the blade slots as indicated at 47, to substantially fill the space between blades in the minimum volume position, that is, when two adjoining blades, such as the two blades 13, 14 at the bottom in Fig. 9 are in closest conjunctivity to the surrounding wall of the rotor.

As a further possibility, the blades may carry fillers 48, on their opposing faces, which in the minimum volume position will come together to substantially fill in this entire space as indicated in Fig. 10.

The provision of the inner pumping ports and passages in the back wall of the casing is of advantage in providing all the fluid connections on the main body of the machine. Also, the mounting of the pivot post on the back wall is of advantage in enabling the machine to be assembled by simply dropping the blades into position over this post and then, while the blades are so held, engaging the slotted rim of the rotor over the blades. It is contemplated however that these relations may be reversed, that is, the inner ports be located in the cover wall, and or the pivot post be mounted on the cover and the rotor be journalled in the body portion of the machine.

While disclosed primarily as a pump, it will be realized that features of the invention are applicable to other than strictly pump constructions and the disclosure accordingly is to be so considered and the claims so construed.

The double inlet and outlet ports separated in the angular relation shown are highly effective in providing maximum pumping capacity, partly because of the fact that the solid wall surfaces between companion ports cooperate with the blades in the travel of the blades between ports. In the construction shown, all three blades are working, that is, performing useful but different pumping functions at all times. These coactive efforts of the three blades accomplish a maximum pumping ability with the fewest number of parts and renders any additional blades or parts unnecessary or possibly even disadvantageous.

For operating on some fluids or liquids, where uninterrupted flow is particularly important, or

for other causes, some overlap may be provided in the porting arrangement, so that an outlet port will be open at one side actually before the inlet port has been closed at the opposite side.

What is claimed is:

A rotary pump comprising a casing having a cylindrical chamber, a cylindrical rotor of smaller diameter journalled eccentrically in said chamber in tangential sealing relation with the surrounding wall of said chamber and forming in conjunction therewith a crescent-shaped displacement space, said rotor having equi-distant radial slots opening through the peripheral portion of the same, radially extending rotary piston blades pivoted concentrically in said cylindrical chamber and extending through said slots into cooperative relation with the surrounding wall defining said crescent-shaped space, the casing having inlet and outlet passages opening into the ends of said crescent shaped space at opposite sides of the point of tangency of the rotor, said inlet having separated ports located one in advance of the other in the direction of rotation of the blades, and positioned the one in advance to remain open to the crescent space between two adjoining blades up to substantially the maximum volume of the crescent space between adjoining blades and to be closed to said last named space by the second of said blades substantially at the instant of change to decreasing volume space and the outlet passage having a port positioned to be uncovered to said last named crescent space by the first of said two blades substantially at said instant of changing to lesser volume, the following blade during said port controlling movements of the other two blades traversing the tangential sealing portion of the chamber between the inlet and outlet passages and said casing having spaced, interconnected inlet ports and spaced, interconnected outlet ports opening into the space within the rotor at opposite sides of the center of rotation and into minimum and maximum displacement areas defined between adjoining blades within the rotor.

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