Feb. 21, 1933. H. F. VICKERS 1,898,914

VANE PUMP OR MOTOR

Filed Feb. 25, 1929 2 Sheets-Sheet 1

Fig. 1.

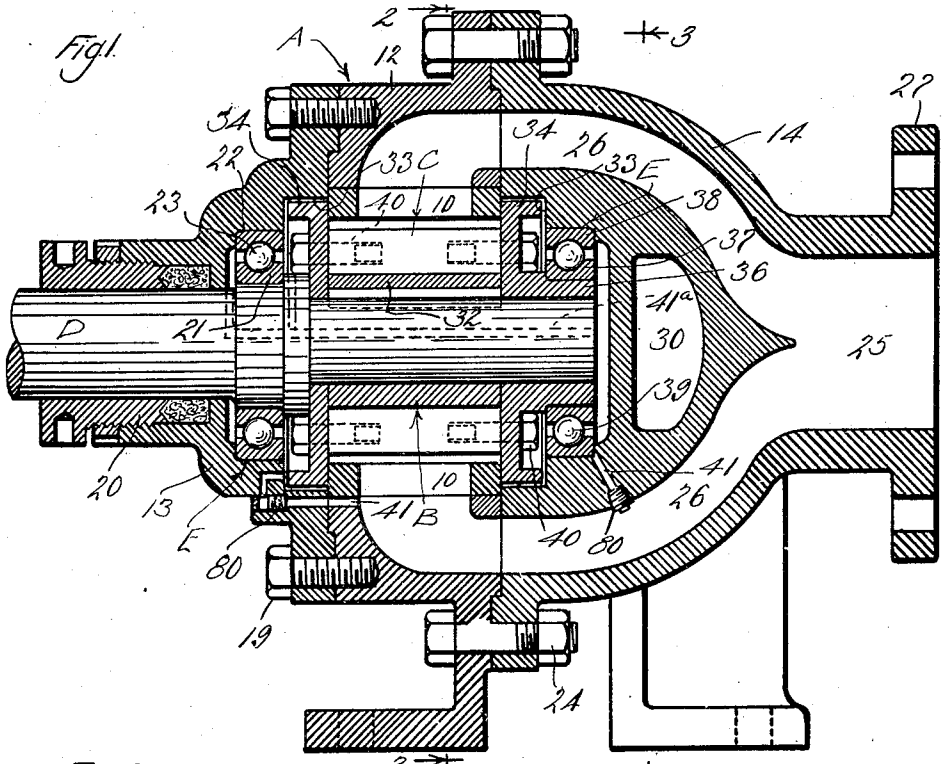

Fig. 2.

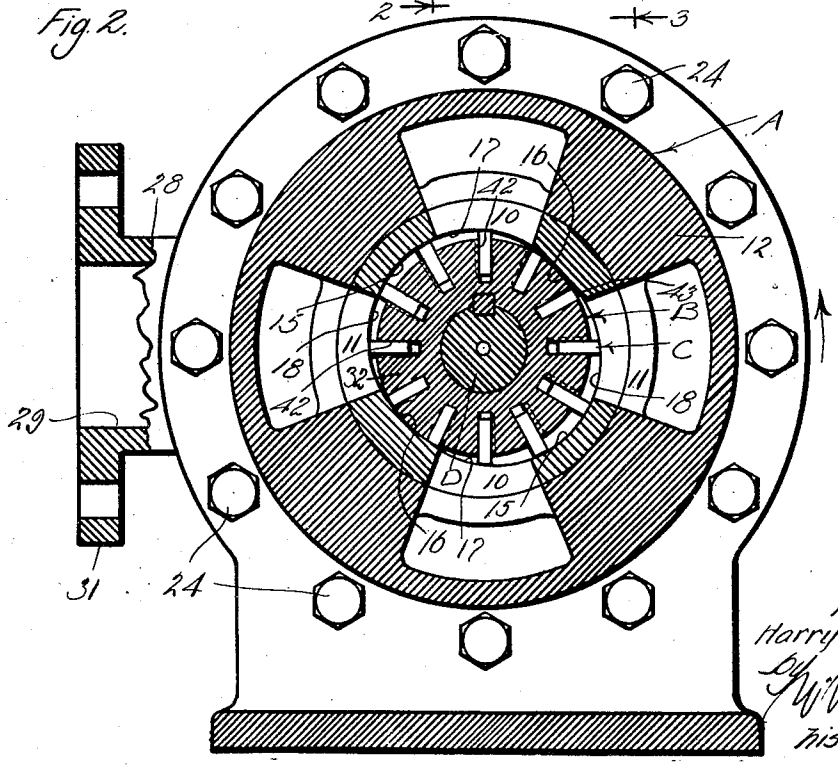

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Fig. 3.

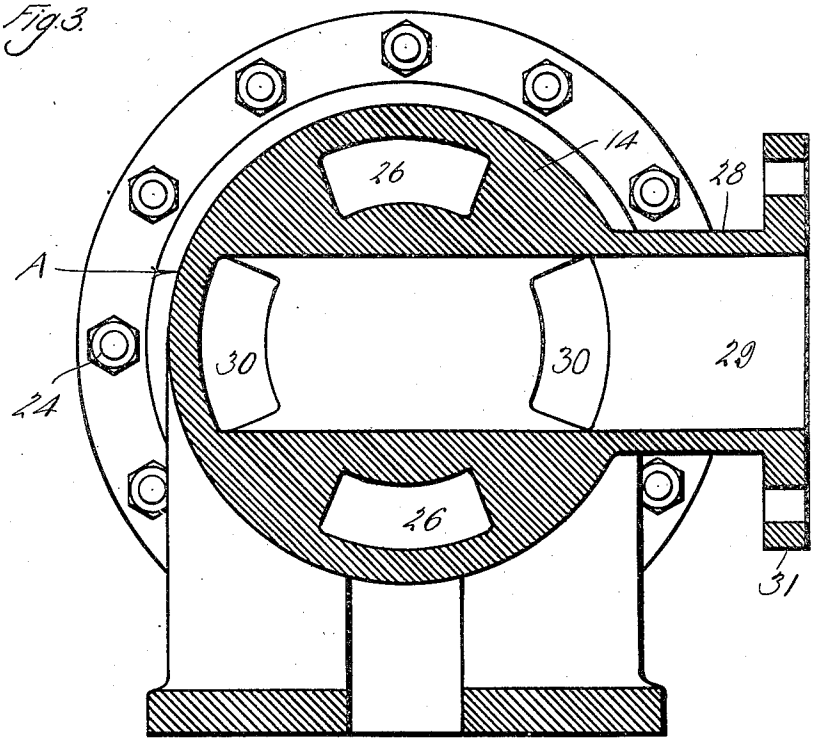
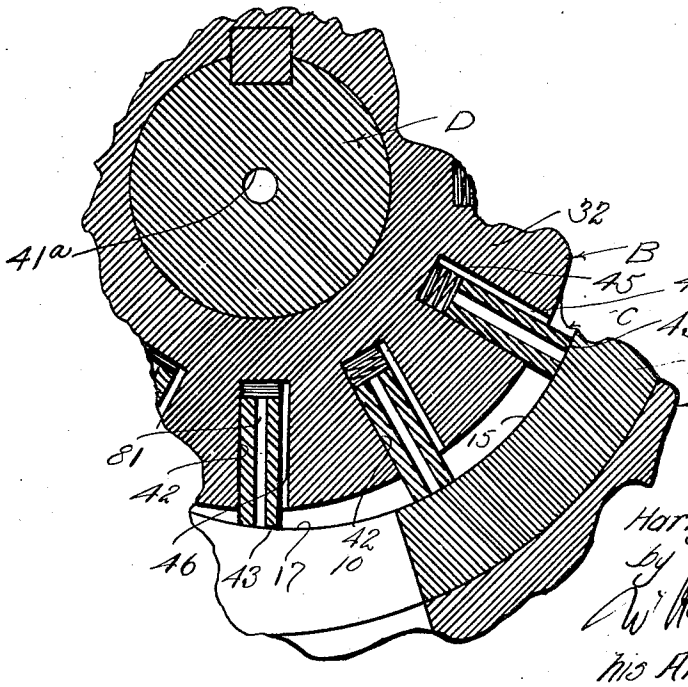


Fig. 4.



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UNITED STATES PATENT OFFICE

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VANE PUMP OR MOTOR

Application filed February 25, 1929. Serial No. 342,602.

This invention has to do with a mechanism for handling fluid and relates particularly to a rotary blade or vane type mechanism useful either as a motor or as a pump, or pressure generator. It is a general object of the invention to provide a simplified, efficient and improved mechanism of the character mentioned.

Blade or vane type rotary mechanisms of the general character mentioned have been devised and used with varying degrees of success. Heretofore these mechanisms have had certain limitations due to excess pressures and wear on the vanes and/or to excess pressures on the bearings supporting the revolving elements.

It is a general object of this invention to provide a mechanism of the general type mentioned, that is a rotary blade or vane type mechanism, useful either as a motor or pressure generator, wherein the vanes or blades operate freely and with a minimum of friction so that they do not impair the mechanical efficiency of the machine and are not subject to excessive wear.

It is another object of the invention to provide an arrangement and formation of parts in a mechanism of the character mentioned whereby the pressures occurring on the moving or rotating element are so balanced and distributed as to neutralize or counteract themselves, relieving the rotor bearings of excessive pressures which ordinarily occur in mechanisms of this character.

It is an object of the invention to provide various other refinements and improvements in a mechanism of the character mentioned including improvements in the formation of the rotor, in the mounting of the vanes in the rotor, etc.

The various objects and features of the invention will be best and more fully understood from the following detailed description of a typical form and application of the invention, throughout which description reference is had to the accompanying drawings, in which:

Fig. 1 is a longitudinal detailed sectional view of the mechanism embodying the invention. Fig. 2 is a transverse sectional view of the mechanism being a view taken substantially as indicated by line 2—2 on Fig. 1. Fig. 3 is a sectional view taken as indicated by line 3—3 on Fig. 1, and Fig. 4 is an enlarged detail sectional view of a portion of the mechanism.

The mechanism provided by this invention is intended primarily to handle or to be actuated by liquid, say, for instance, oil. The invention may be used for or applied to a wide variety of uses and therefore may be embodied in various forms. In the following disclosure particular reference will be had to the mechanism as a motor, that is to its being actuated by fluid pressure, and reference will be made to one particular form or embodiment of the invention that has been found particularly suitable for motor use. It is to be understood that the broader principles of the invention are not to be construed as limited to details that will be hereinafter set out.

The mechanism includes, generally, a housing A, a rotor B, and blades or vanes C carried by the rotor and operable in the casing. In the form of the invention illustrated the rotor B is fixed on a shaft D which extends into the housing from one end. The shaft is supported in the housing through suitable bearings E.

The housing or casing A forms an enclosure or compartment to carry the rotor and blades and is provided with ports which communicate with the compartment as will be hereinafter more fully set forth. The ports are provided to conduct fluid to and from the chamber which carries the rotor and are provided in sets each set including an inlet port 10, and an outlet port 11. The several ports are distributed around the outer or peripheral portion of the rotor compartment of the casing with the inlet and outlet ports of each set adjacent each other and with the several sets of ports symmetrically disposed around the central axis of the mechanism. In the case illustrated I provide two sets of ports and I relate the ports of each set and the sets of ports so that the two inlet ports 10 occur diametrically opposite each other with reference to the central axis of the mechanism, while the outlet ports 11 occur diametrically

opposite each other with reference to said axis. This arrangement or relationing of ports is clearly shown in Fig. 2 of the drawings and is a very important and significant feature of the invention.

The casing A is preferably built up of a plurality of sections or parts suitably assembled and secured together. In the construction illustrated the casing A comprises a central body section 12 and end sections 13 and 14 secured to the two ends of the body.

The body section 12 of the casing is annular in its general configuration. The body has a central opening extending through it from one end to the other. This opening forms the chamber for the rotor and blades. The opening is symmetrical or regular in configuration but is not circular. In accordance with the present invention, the wall portions 15 of the body opening occurring between the ports 10 and 11 of each set are formed concentric with the axis of the rotor B and are substantially larger in diameter than the wall portions 16 of the opening occurring between the sets of ports. The wall portions 16 are likewise formed concentric with the axis of the rotor. The wall portions 17 at the inlet ports 10 and the wall portions 18 at the outlet ports 11 join the wall portions 15 and 16, the curvature occurring in the wall portions 17 and 18 causing them to join, the walls 15 and 16 being gradual, preferably harmonic, as illustrated in Fig. 2 of the drawings. The several ports 10 and 11 are located in the body 12 so that they enter the central opening of the body between the ends of the body leaving wall portions 17 and 18 at the sides of the ports 10 and 11, respectively, for cooperation with the blades C. In the preferred formation of parts the port openings formed in the body 12 extend to one end of the body to join port openings in the end 14, as will be hereinafter described.

The end 13 of the casing is secured to one end of the body 12 as by cap screws 19 and is provided with a central opening to pass the shaft D. A suitable packing gland 20 is carried by the end 13 to pack around the shaft D, as is clearly shown in Fig. 1 of the drawings. The shaft D is rotatably supported in the end 13 through a bearing E. In the drawings I have shown the bearing E in the form of a ball bearing having an inner race 21 carried on the shaft, an outer race 22 seated in the end 13, and a series of balls 23 between the races.

The end 14 of the casing is secured to the other end of the body 12 as by bolts 24 and is in the nature of a manifold in that it has ports communicating with the ports of the body 12 and serves as a fitting for making connections with suitable fluid conduits. The end 14 projects a substantial distance from the body 12 in the direction of the axis of the device and is provided in its outer or projecting part with a central port 25. Branch ports 26 extend from the port 25 to the ports 10 of the body so that fluid admitted to the port 25 passes through the ports 26 to the intake ports 10. In the case illustrated a connecting flange 27 is provided at the outer or projecting end of the end 14 so that a suitable fluid conduit may be connected with the end 14 to deliver fluid to the port 25. The end 14 has a lateral or side projection 28 having a port 29. The port 29 communicates with ports 30 joining the outlet ports 11 so that the fluid from the outlet ports 11 is communicated to the port 29. The projection 28 is provided with a coupling flange 31 to facilitate connection with a suitable fluid conduit.

The rotor B is fixed on the shaft D, for instance, keyed to the shaft, and the assembly of shaft and rotor is mounted in the casing so that the rotor is concentric with the opening in the body 12 of the casing. The rotor includes a central part or body 32 which extends longitudinally through the opening of the body 12 of the casing and is round in cross section. The body 32 of the rotor is made to slidably fit the wall portions 16 of the casing opening, as shown in Fig. 2 of the drawings. Flanges 34 extend radially outward at the ends of the body 32 and in the preferred arrangement the flanges extend into recesses 33 provided in the ends 13 and 14, as clearly illustrated in Fig. 1 of the drawings. The recesses are proportioned so that the flanges may project outwardly beyond the opening in the body 12 and thus seal or close the ends of the body opening. In the construction shown the flange 34 located in the end 14 of the casing is provided with a hub extension 36 carrying a bearing E whereby the inner end of the shaft D is mounted in the casing. In the arrangement illustrated an inner race 37 is carried on the hub extension 36, an outer race 38 is carried on the end 14, and a series of balls 39 is provided between the races. The flanges 34 are formed separate from the body 32 and are secured to the ends of the body by cap screws 40, or the like.

In the preferred construction drain openings 41 connect into the recesses 33. The drain openings may extend to an inlet port. This relieves pressure from the ends of the housing. Further, an opening 41ª may be provided in the shaft to connect the two recesses. I may provide check valves 80 in the drain openings to prevent entrance of pressure from the ports to the recesses. This is important when the device is to be operated in either direction.

The vanes or blades C are carried by the rotor B so that they follow the contour of the central opening of the casing body 12.

In accordance with the invention I provide a plurality of blades C which slidably fit be-

tween the ends or flanges 34 of the rotor and are carried in slots 42 formed in the body 32 of the rotor. The slots extend longitudinally of the rotor and are preferably arranged to extend radially with reference to the central axis of the rotor, as clearly illustrated in Fig. 2 of the drawings. There is a blade C slidably fitted or carried in each slot 42 each blade having its outer edge 43 curved on a radius corresponding to that of the wall portions 15 of the opening through the casing body 12. The blades are movable to "in" positions in the slots allowing them to pass through or operate over the wall portions 16 of the casing opening and are movable to "out" or extended positions where they operate over and cooperate with the wall portions 15 of the casing opening. The blades operate along or engage with the wall portions 17 and 18 occurring at the ports 10 and 11 respectively, in their passage between the wall portions 15 and 16. The blades are normally urged or held outwardly against the various wall portions of the casing opening by centrifugal force set up by rotation of the rotor. In practice this action may be supplemented by springs 45 arranged in the bottom of the slots 42 to normally urge the blades outwardly. Further, in accordance with the present invention grooves or pressure passages 46 are provided in the side walls of the slots 42 to admit pressure behind the blades or into the bottoms of the grooves back of the blades when the blades are in the extended position. The passages 46 are preferably at the pressure sides of the vanes.

This equalizes the fluid pressure at the two ends of the blades so that fluid pressure occurring in the mechanism does not tend to press the blades in either direction in the slots. Holes 81 may be formed through the blades to have a similar action.

From the foregoing description it is believed that the operation of the device will be fully understood. When operating as a motor, fluid, say, for instance, oil under pressure, is admitted to the port 25 to pass through the ports 26 to the intake ports 10. This oil under pressure acts on the blades C in engagement with the wall portions 15 causing the rotor to turn in the direction indicated by the arrow in Fig. 2. After the fluid passes between the wall portions 15 and the body of the rotor, it enters or is exhausted into the outlet ports 11 from which it flows through the ports 30 to the outlet port 29. The two inlet ports being diametrically opposite each other and the two outlet ports being diametrically opposite each other, the inward pressures occurring on the rotor are balanced so that the bearings which support the rotor in the casing are not subjected to excessive pressures. Further, as the blades C operate to hold fluid pressure, that is as they operate along the wall portions 15 and 16, they do not move or operate in the rotor, and therefore while they are under pressure they do not move relative to their supporting parts. All of the radial movement, or movement of the blades relative to the rotor, occurs while the blades are at the ports 11, and therefore not under pressure, or not holding pressure. This is a very important feature of the invention as it results in dependable, smooth operation of the blades, and, in view of the fact that the blades operate or move only when in active or when not holding pressure, they are not subject to any appreciable wear in the slots of the rotor.

It will be apparent that the mechanism of the present invention may be operated as a pressure generating device. In such case the shaft D would be driven and the rotation of the rotor in the casing would cause fluid to be drawn into the mechanism through one set of ports and discharged through the other, depending upon the direction of rotation of the rotor. In this connection it is to be noted that the mechanism when operating as a motor may be operated in a direction opposite to that hereinabove described upon introduction of the fluid under pressure into the ports named as outlet ports instead of into the ports named as inlet ports.

Having described only a typical preferred form of my invention, I do not wish to limit myself to the specific details set forth, but wish to reserve to myself any changes or variations that may appear to those skilled in the art or fall within the scope of the following claim.

Having described my invention, I claim:

A mechanism of the character described including, a rotor, a shaft carrying the rotor, a housing having an opening carrying the rotor, parts on the rotor projecting radially therefrom and in to recesses in the housing, vanes carried by the rotor between said parts and cooperating with the outer wall of the opening, there being spaced inlet and outlet ports in the outer wall of the opening, and means for relieving pressure from the recesses, including a passage in the shaft connecting the recesses and a passage in the housing connecting the recesses and the inlet port.

In witness that I claim the foregoing I have hereunto subscribed my name this 25th day of January, 1929.

HARRY F. VICKERS.