Jan. 15, 1929. 1,699,326

A. C. DURDIN, JR

DISPLACEMENT APPARATUS

Filed Aug. 2, 1926 2 Sheets-Sheet 1

Fig. 1.

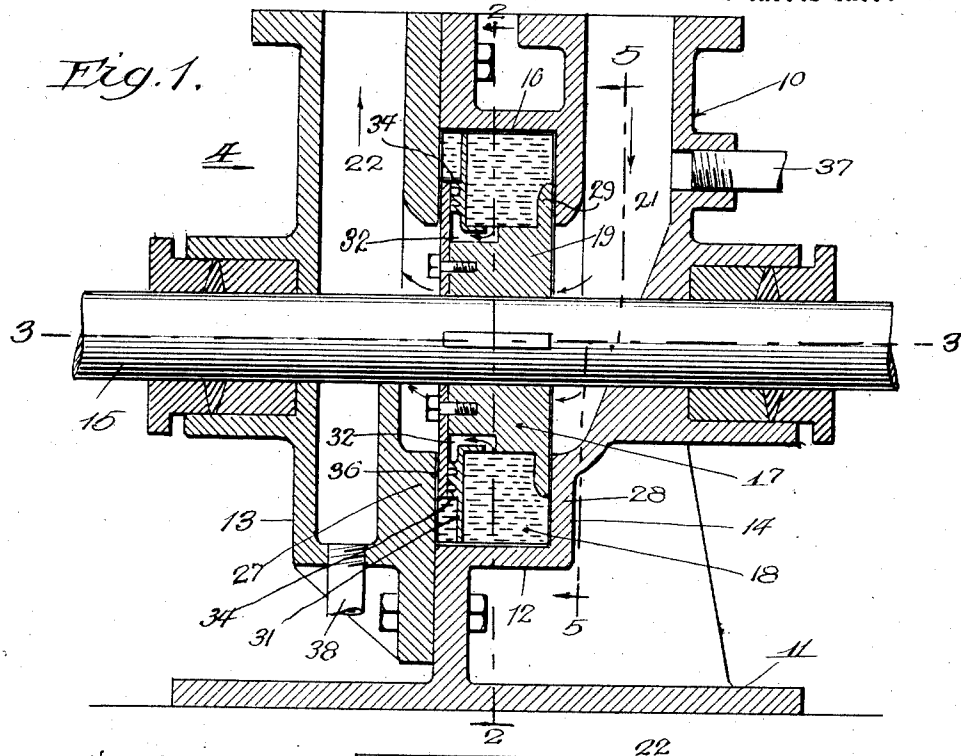
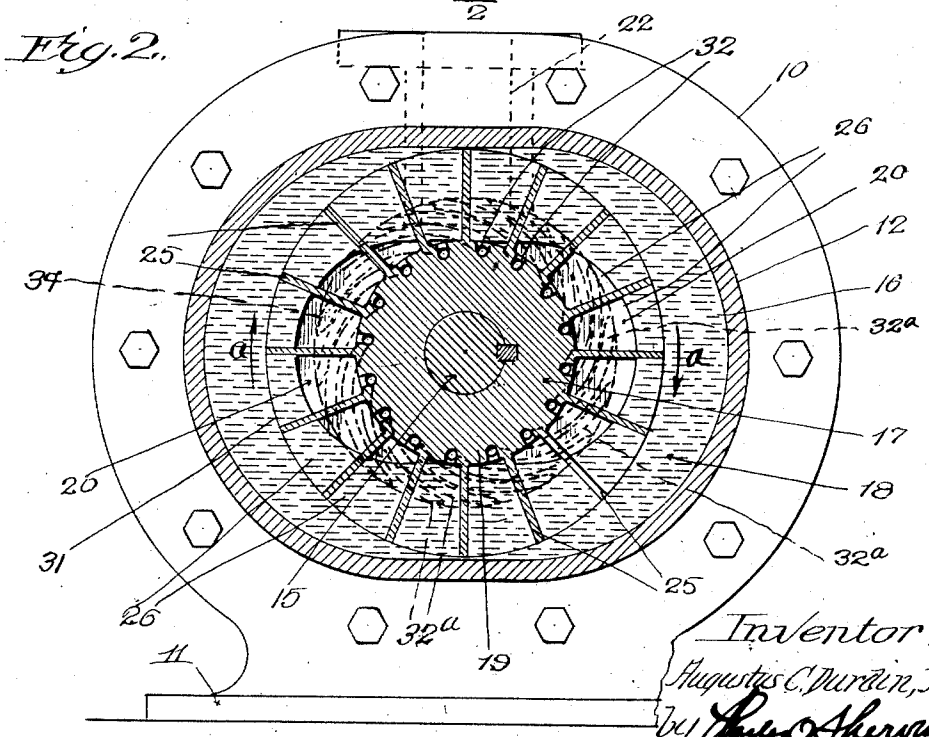


Fig. 2.



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Fig. 3.

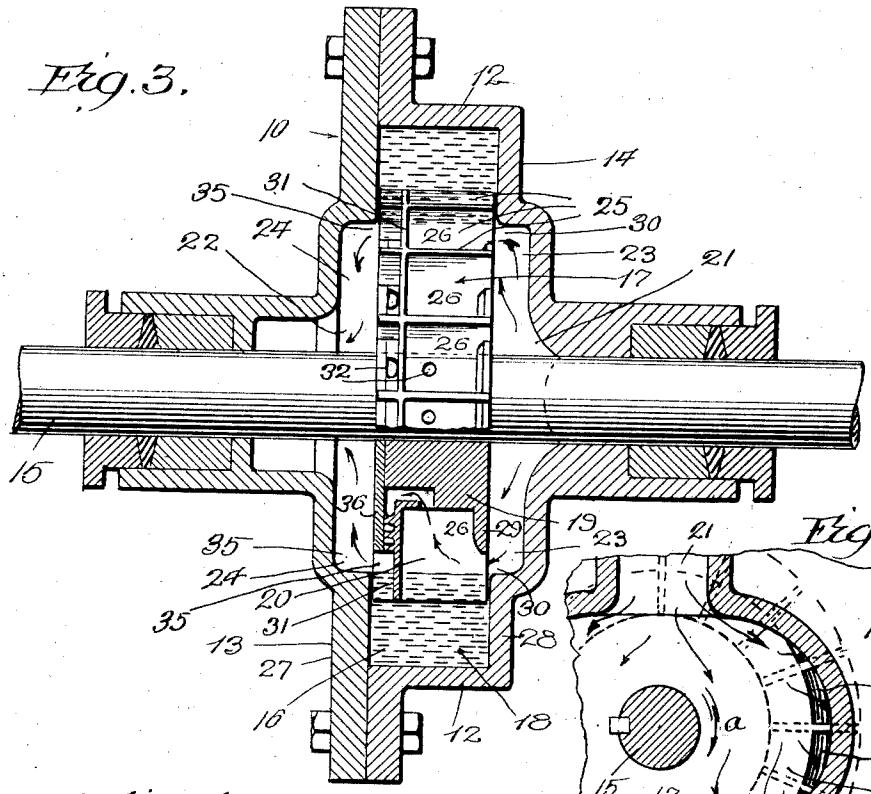


Fig. 5.

Fig. 4.

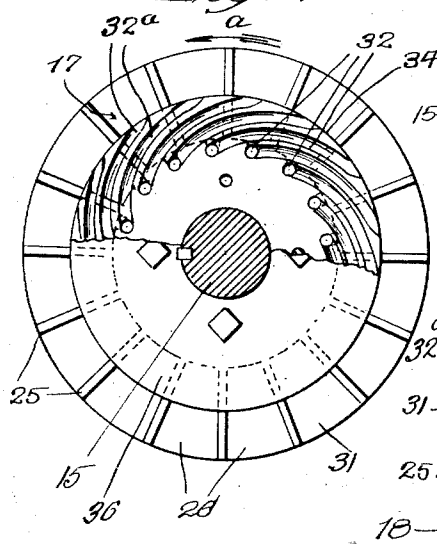


Fig. 6.

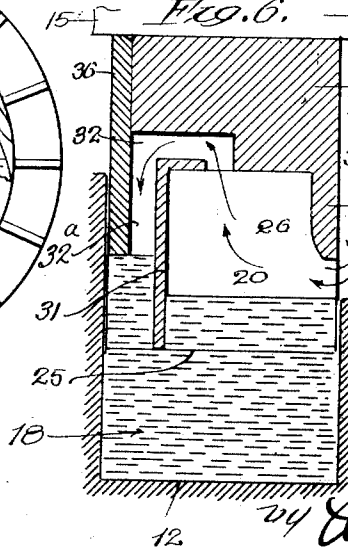
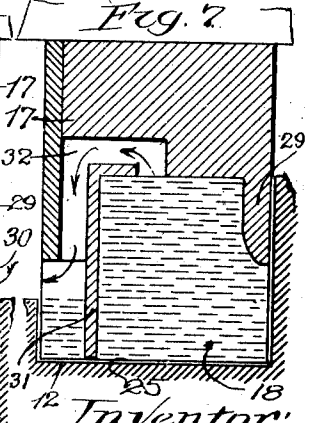


Fig. 7.



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Patented Jan. 15, 1929. 1,699,326

UNITED STATES PATENT OFFICE.

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DISPLACEMENT APPARATUS.

Application filed August 2, 1926. Serial No. 126,495.

This invention relates to displacement apparatus of that character which employs a rotor in combination with a revolving endless liquid body for obtaining the pumping action. The invention has particular reference to that type of displacement apparatus of this character, in which the rotor is provided with a series of buckets arranged circumferentially about its periphery, that are spaced apart by vanes which act to impart centrifugal force to the liquid, and one principal object of this invention is to eliminate mechanically operated valves or ports in displacement apparatus of this character. Another object is to prevent leakage which usually occurs from the wear of mechanically operated valves or ports, to increase efficiency of apparatus of this character, to simplify and otherwise improve thereon. With these and other objects and advantages in view this invention consists in displacement apparatus in which mechanically operated valves or ports are entirely eliminated. It further consists in displacement apparatus having fluid conducting conduits or passage ways, the inlet and discharge ports of which are controlled by the body of liquid contained in the casing. It further consists in the several novel features of construction, arrangement and combination of parts hereinafter fully set forth and claimed.

The invention is clearly illustrated in the drawings accompanying this specification, in which:

Fig. 1 is a central, vertical, longitudinal section through displacement apparatus embodying a simple form of the present invention; Fig. 2 is a vertical cross section taken on the line 2—2 of Fig. 1; Fig. 3 is a horizontal cross section taken on the line 3—3 of Fig. 1; Fig. 4 is an end view of the rotor looking in the direction of the arrow 4 in Fig. 1 and showing the same partly broken away; Fig. 5 is a fragmental vertical cross section taken on the line 5—5 of Fig. 1; Fig. 6 is a detail fragmental enlarged section of the rotor and casing, illustrating diagrammatically the action of the liquid on the fluid, and Fig. 7 is a view similar to Fig. 6 but showing the rotor in a different position from that seen in Fig. 6.

Referring to said drawings, the reference character 10 designates a casing mounted upon a suitable base 11, and as shown comprising an oval or elliptical wall 12 and end walls or heads 13, 14 bolted or otherwise secured together. The heads may be provided with bearings for the main drive shaft 15 which may receive power from any suitable source. The exact shape of the wall 12 is immaterial and if desired it may be made cylindrical and disposed eccentrically with respect to the drive shaft 15, but for the purpose of illustration I have shown the wall 12 as composed of two semi-circular portions connected by straight portions, each semi-circular portion being non-concentric with respect to the drive shaft, thus forming a somewhat elongated or oval shape as is clearly illustrated in Fig. 2. The wall 12 and heads 13, 14 provide a chamber 16 in which is contained a rotor 17, and a body of water or other liquid 18, which during the operation of the apparatus, is acted upon by the rotor and thrown against the inner face of the wall 12, thereby forming a ring like, or endless liquid body whose inner face roughly parallels the curved face of the wall 12 and contacts with the body 19 of the rotor at the top and bottom thereof, but leaves crescent like cavities or chambers 20 at the front and back of the rotor. As above stated it is not necessary to employ two non-concentric walls, but that the wall may be cylindrical and eccentric with respect to the drive shaft. In such case the body of water usually contacts with the rotor body at one place and leaves a crescent shaped cavity or chamber around it as is well understood by those who are skilled in the art to which this invention pertains. Formed in one of the heads is an inlet port or passage 21 which leads to the inlet side of the rotor, and formed in the other head is a discharge port or passage 22 which leads away from the discharge side of the rotor. Both the inlet passage 21 and the discharge passage 22 are elongated and made oval across the major axis of the casing as shown in Figs. 3 and 5 at 23, 24, so as to roughly parallel the wall 12, and being practically co-incident with the inner face which the revolving liquid body assumes when acted upon by the rotor.

In the operation of this apparatus thus far described, the air or other fluid to be acted upon, enters the apparatus through the inlet passage 21, is taken into pockets that are formed in the rotor, and is forced through conduits or passage-ways in the rotor by the action of the body of liquid and rotor, and discharged through the discharge passage 22.

In the form of rotor illustrated, the body portion 19 is cylindrical, and from the cylindrical face thereof projects a series of vanes 25 which extend transversely of the body and divide the space around said body into a series of spaces 26 which together with the side walls 27, of the casing, the flange 31 of the rotor, and the rotating endless liquid body 18 form pockets that receive the air or other fluid to be pumped. At its intake side, the rotor is formed with a circumferential flange 29, which covers all of the elongated inlet opening 23 to the fluid chambers 20, with the exception of the two opposite end portions, thereby leaving fluid inlet ports 30 which are somewhat crescent shape in form, and said inlet ports 30 open directly into the fluid pockets 26 as will be clearly seen in Figures 3, and 5. The flange 29 enters the liquid in the spaces between the ends of the fluid inlet ports, and at said spaces closes the passage from the inlet ports to the buckets, and in this manner the apparatus dispenses with any mechanically operated ports. On the discharge side of the rotor is a circumferential flange 31, which extends almost to the endless wall 12, and leading from each pocket 26 is a conduit 32, which extends in from the cylindrical face of the rotor and opens out through the outer side of the flange 31. At the places where the conduits 32 open out from the flange 31, said flange is reduced to a diameter substantially the same as that of the flange 29, as at 34, whereby the reduced part 34 of the flange 31 may cover most of the discharge opening 24, leaving the substantially crescent shape discharge ports 35 at the ends of said discharge opening 24. The portion 32^a (see Fig. 4) of each conduit 32 may be conveniently formed in the rotor by forming grooves in the side face of the rotor body as is clearly seen in Fig. 4 and covering said grooves with a plate 36, which may be bolted or otherwise secured to the rotor body. Each conduit 32 leads from its pocket to a point on the periphery of the flange portion 34, which is located at a considerable distance away from the inlet opening of the pocket, the distance being such that when the inlet opening to the pocket is open to a fluid chamber 20 at certain times the discharge port of said conduit is submerged in the body of liquid and vice versa, the purpose of which will be more clearly understood from the operation of the apparatus. In the present construction and arrangement, each conduit 32 leads from one pocket to a point at the side of the third pocket behind the one from which it runs, but this is not essential since with other proportion of the parts, or other arrangements thereof, the distance between the inlet and outlet openings of the conduits, or at least the number of degrees that they are spaced apart, will have to be varied to suit the particular proportions, construction and arrangement of the parts. Said pockets and conduits may be regarded somewhat in the nature of U tubes each having one enlarged end, both ends of which run into and out of a body of water or liquid.

For supplying liquid to the apparatus a supply pipe 37 is provided which delivers liquid to the interior of the casing and for the purpose of discharging any excessive amount of water a discharge pipe 38 is provided in the casing below the discharge passage 22.

In the operation of the apparatus, a sufficient quantity of liquid being supplied for its operation and the rotor being driven in the direction of the arrows indicated at *a*, the body of liquid is subjected to the action of centrifugal force from the motion imparted by the vanes of the rotor and thrown outward against the endless wall of the casing. The inner face of the revolving body of liquid roughly parallels the endless wall of the casing, and in the form of the invention illustrated, contacts with the cylindrical face of the rotor at diametrically opposite places, and defines one wall or face of each substantially crescent shaped fluid chamber, the cylindrical face of the rotor defining the opposite wall, and the portion 28 of the head of the casing and flange 29 of the rotor forming one side wall, and the flange 31 of the rotor forming the other side wall, of said fluid chamber. As the rotor revolves, air, gas or other fluid to be pumped enters the pockets 26 as they pass by the crescent shape inlet ports 30, and as the pockets travel onward, they enter the contracted portions of the fluid chambers, where the liquid body acts as a piston which enters the pockets and forces the fluid contained therein and contained in the conduits leading therefrom, out through said conduits, while the discharge openings of said conduits are passing by the crescent shape discharge ports 35.

Figs. 6 and 7 show diagrammatically the action of the liquid on the fluid which is pumped. In Fig. 6 the fluid passes through the port 30 and enters the pocket 26, which admission of fluid takes place while the pocket is moving from the contracted end of a fluid chamber 20 to its greatest width. During this movement of the pocket the inlet opening to the associated conduit 32 is uncovered by the liquid but the outlet end of said conduit is closed by the body of liquid. As the pocket approaches the wider part of the fluid chamber, the space in the pocket is enlarged, a partial vacuum created and fluid flows into the same. When the pocket approaches the other contracted end of the fluid chamber 20, (Fig. 7) the space in the pocket is contracted by the action of the liquid, which at this time enters the pocket, and at that time the outlet opening of the conduit

has run out of the liquid and has become uncovered and discharges the fluid contained in the pocket and conduit, through the discharge port 35 and into the discharge passage 24, and discharge port 22.

From the above it is apparent that the use of mechanically covered ports to and from the pockets is eliminated and that the openings or ports to the fluid conduits is controlled by the liquid, said openings or ports becoming alternately submerged in the liquid, the liquid acting to form enlarging and contracting spaces in the pockets whereby the fluid is admitted thereto on one end and expelled therefrom at the other end.

The apparatus is capable of use as a vacuum pump, or as an air compressor or for other purposes. Because of its ability to handle liquids as well as air and other fluids, it is very serviceable as a vacuum pump for discharging air, gases and water of condensation from steam heating systems.

More or less variation of the exact details of construction is possible without departing from the spirit of this invention; I desire, therefore, not to limit myself to the exact form of the construction shown and described, but intend, in the following claims, to point out all of the invention disclosed herein.

I claim as new, and desire to secure by Letters Patent:

1. A mechanism having a piston, comprising a rotating body of liquid subjected to the action of centrifugal force, combined with a fluid chamber having inlet and outlet passages which open through liquid controlled ports to said fluid chamber and are controlled by said body of rotating liquid.

2. The combination of a case chamber, and a rotor dividing the case chamber into enlarging and contracting separated spaces, with a liquid in rotation in said chamber partly filling said spaces when they are at their maximum size and completely filling said spaces when they are at their minimum size, and liquid controlled inlet and outlet ports, alternately opened and closed by said liquid for controlling said enlarging and contracting spaces.

3. In a displacement apparatus, the combination with an endless liquid piston comprising a body of liquid subjected to the action of centrifugal force, of a rotor arranged to contact with said liquid piston at one place and being nonconcentric with respect to said liquid piston, whereby a fluid chamber is maintained between the liquid piston and rotor, said fluid space being contracted at its ends and there being an inlet port leading to said fluid chamber and a discharge port leading therefrom, the rotor having fluid conduits leading from said fluid chamber to the discharge side of the rotor and the ends of said conduits being arranged to be closed and opened by movement thereof into and out of said body of liquid.

4. In a displacement apparatus, the combination of a casing, a rotor mounted to rotate in said casing and nonconcentric therewith, and a body of liquid revolving in said casing and contacting with said rotor, the inner face of said body of liquid and cylindrical face of the rotor forming therebetween a fluid chamber having contracting ends, pockets formed upon the periphery of said rotor and forming with said liquid body enlarging and contracting spaces, there being open inlet and discharge ports leading to and from said fluid chamber and there being conduits in said rotor leading from said pockets and arranged to discharge fluid at said discharge port, the inlets to said buckets and outlets from said conduits being arranged to be closed and opened by movement thereof into and out of said body of liquid.

5. In a displacement apparatus, the combination of a liquid piston comprising a body of liquid subjected to the action of centrifugal force, a rotor, forming with said liquid piston, a fluid chamber having inlet and outlet ports, there being fluid conduits in the rotor arranged to extend from said fluid chamber to the discharge port, both ends of said conduits being arranged to be alternately closed and opened by movement thereof into and out of said liquid piston.

6. In a displacement apparatus, the combination of a casing, an endless body of liquid revolving in said casing, a rotor arranged to revolve in said casing and provided with circumferentially arranged pockets, said casing having a form non-concentric with respect to the rotor whereby the body of liquid enters and recedes from said pockets, there being fluid conduits in said rotor leading from said pockets and discharging fluid from said rotor and said body of liquid acting to alternately open and close both ends of said fluid conduits.

7. In a displacement apparatus, the combination of a casing, a rotor therein dividing said casing into spaces having a contracting end portion, a body of liquid in said casing centrifugally acted upon, there being a fluid chamber formed between said rotor and body of liquid having contracting end portions, and there being an inlet port leading to said fluid chamber and a discharge port leading away from said fluid chamber, there being pockets circumferentially arranged around said rotor, dividing said fluid chamber into enlarging and contracting spaces, and there being conduits leading from said pockets and discharging from said rotor, said body of liquid acting to open and close the ends of said conduits.

8. In a displacement apparatus, the combination of a casing, a rotor mounted therein and non-concentric with respect thereto, a

body of liquid in said casing acted upon by said rotor, and forming therewith a fluid chamber having contracting end portions between said rotor and body of liquid, there being an inlet port leading to said fluid chamber and a discharge port leading therefrom, circumferentially arranged vanes upon said rotor, dividing its periphery into a plurality of fluid pockets into which the body of liquid enters and recedes, and there being fluid conduits leading from said pockets and discharging fluid from said rotor, the body of liquid acting to open and close the ends of said conduits.

9. In a displacement apparatus, the combination with a casing, of a rotor mounted to rotate therein and being nonconcentric therewith, an endless body of liquid in said casing acted upon by said rotor, and forming with said rotor a fluid chamber having contracting end portions, there being an inlet port leading to said fluid chamber and a discharge port leading therefrom, pockets upon said rotor arranged circumferentially thereof into which said body of liquid enters and recedes, and there being fluid conduits in said rotor leading from the bottom of said fluid pockets into places on the periphery of the rotor at one side thereof and said body of liquid acting to open and close the ends of said conduits.

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