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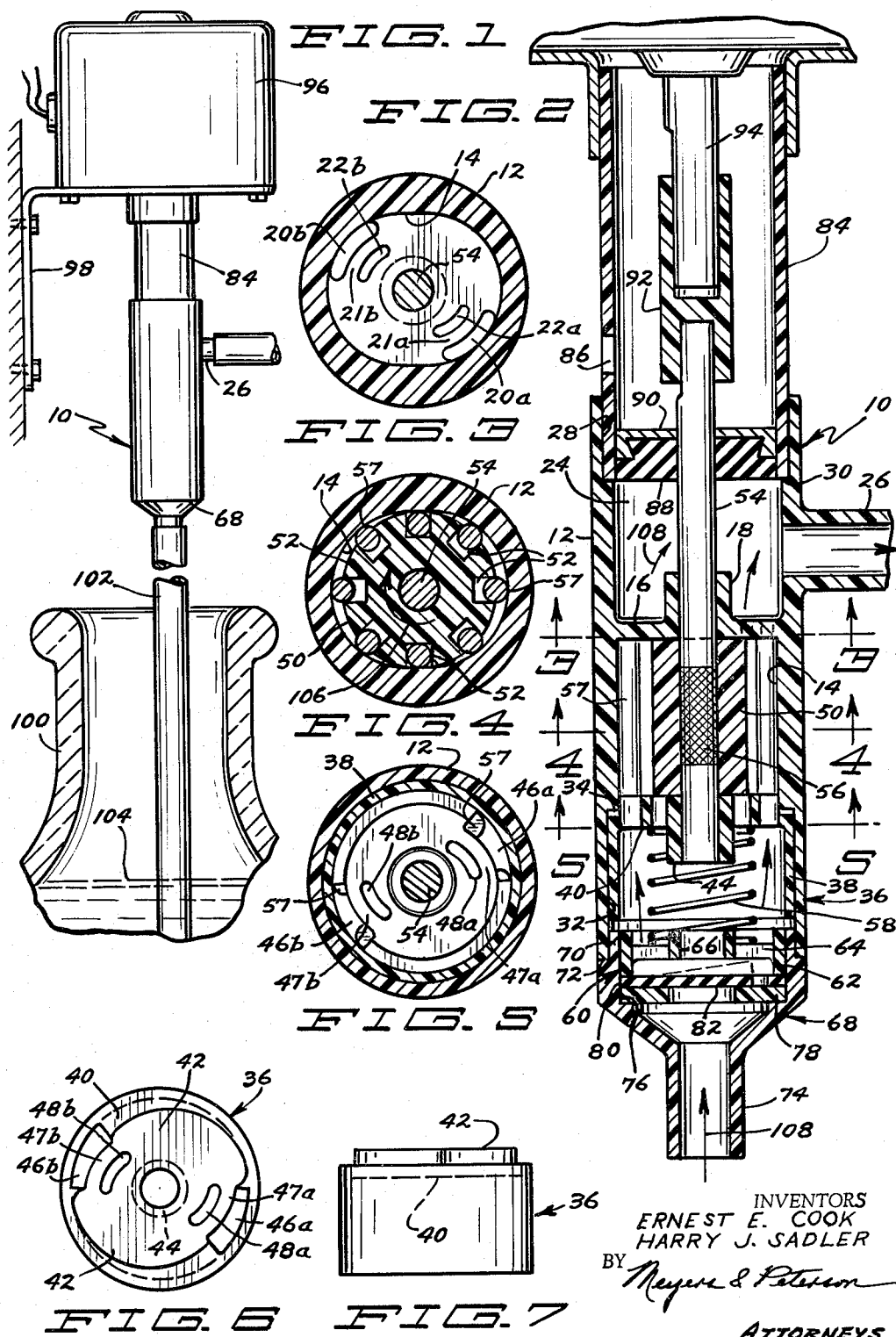
E. E. COOK ETAL

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SPRING LOADED END PORT ROTARY PUMP

Filed Jan. 10, 1963

2 Sheets-Sheet 1



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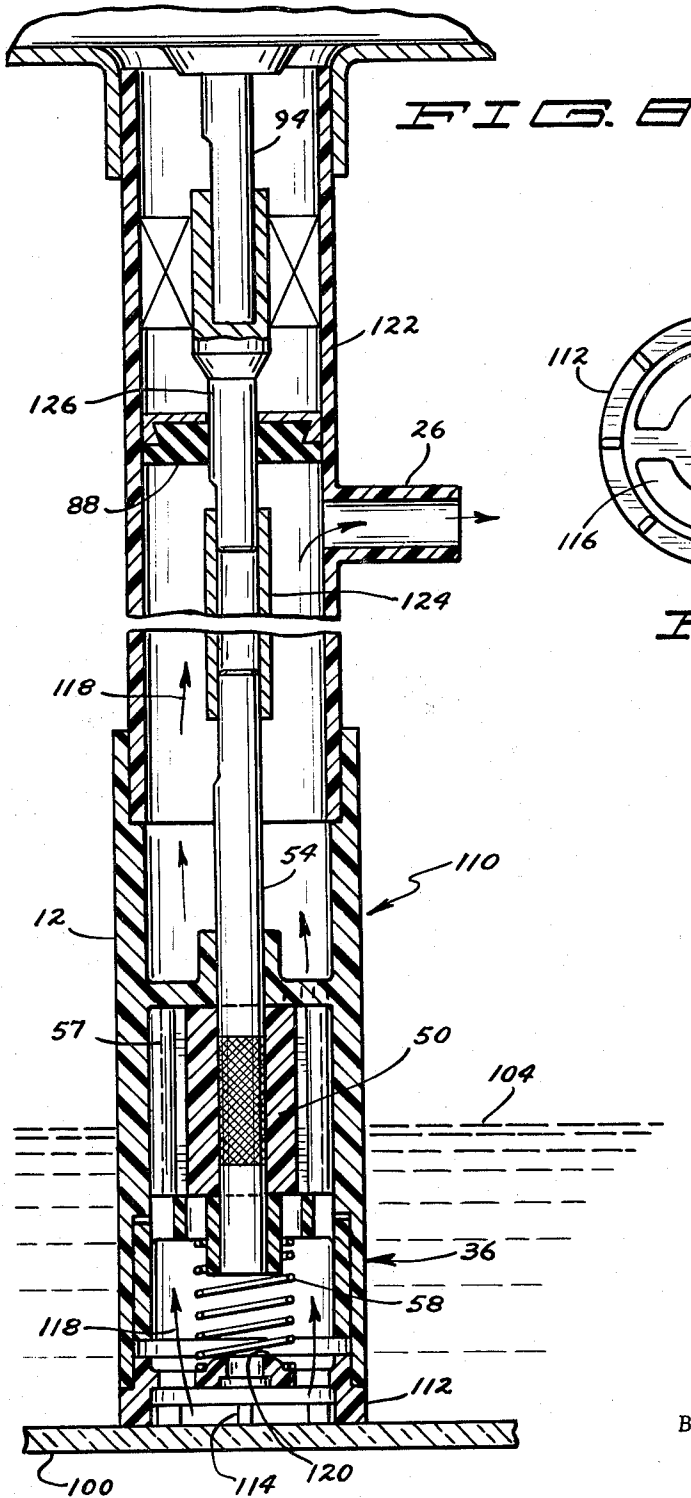
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SPRING LOADED END PORT ROTARY PUMP
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1 Claim. (Cl. 103-136)

This invention relates generally to a rotary pump, and pertains more particularly to a pump provided with a rotor having a plurality of grooves or recesses for the accommodation of a number of centrifugally actuated impeller rollers that provide the pumping action as they traverse a curvilinear path within a pumping chamber having a varying radius.

One general object of the invention is to provide a rotary pump having a large volumetric capacity for the physical size of the pump. Also, a pump constructed in accordance with the teachings of the present invention has a high efficiency, thereby requiring a relatively small motor for driving the pump. It is also an aim of the invention to provide a rotary pump construction that lends itself readily to a double port design to enhance further its capacity for a given size.

Another object of the invention is to provide a rotary pump that can be manufactured at a comparatively low cost. More specifically, the invention envisages the use of a structure in which endwise tolerances are relatively unimportant.

Another object of the invention, which follows from the preceding object, is to provide an automatic relieving action should the pressure within the pumping chamber build up to too high a value. Accordingly, the invention contemplates a spring loaded take-up plate that is urged in the direction of one end of the rotor.

Still another object of the invention is to provide a pump having a housing or body that is jointless in the region of the pumping chamber, thereby obviating the likelihood of leakage.

Yet another object of the invention is to provide a rotary pump that can be used satisfactorily with small-mouthed containers. In this regard, the pump of the instant invention can be either inserted into the container itself or can have a tube depending downwardly into the container when the pump is mounted exteriorly. In this latter situation, provision is made for a check valve to prevent reverse flow or loss of suction when the pump is not operating, the check valve that is planned occupying but very little space.

These and other objects and advantages of the invention will more fully appear from the following description, made in connection with the accompanying drawings, wherein like reference characters refer to the same or similar parts throughout the several views and in which:

FIGURE 1 is a side elevational view of one form my pump can assume, the pump being pictured exteriorly of a small-mouthed container;

FIGURE 2 is a vertical sectional view of the pump of FIGURE 1 in order to show its internal construction;

FIGURE 3 is a sectional view taken in the direction of line 3-3 of FIGURE 2 for the purpose of showing one end plate that is integral with the pump body and the ports that are disposed therein;

FIGURE 4 is a sectional view through the pumping chamber and the rotor disposed therein, the view being taken in the direction of line 4-4 of FIGURE 2;

FIGURE 5 is a sectional view in the direction of line 5-5 of FIGURE 2 for the purpose of showing the lower end plate and the ports contained therein, this particular end plate being slidably urged upwardly toward the lower end of the rotor;

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FIGURE 6 is a top plan view of the cup-shaped member providing the end plate depicted in FIGURE 5;

FIGURE 7 is a side elevational view of the cup-shaped member shown in FIGURE 6;

FIGURE 8 is a vertical longitudinal view in section illustrating a somewhat modified type of pump; and

FIGURE 9 is a bottom end view of the embodiment shown in FIGURE 8.

Referring now to FIGURES 1 and 2, especially the latter figure, it will be observed that the double ported pump there shown has been designated generally by the reference numeral 10. The pump 10 includes a body molded from a suitable plastic material, such as nylon. As best seen from an inspection of FIGURE 4, the body has an oval pumping chamber 14 formed with an imperforate sidewall. More precisely, the pumping chamber 14 is composed of two semicircular walls at each end separated by relatively narrow parallel walls, these walls producing the above-mentioned oval shape. Inasmuch as this chamber configuration appears in FIGURE 4, further description is believed unnecessary. However, it is important to note that the body 12 additionally includes an integral end plate 16 formed with a tubular boss or sleeve 18 which serves as a bearing means as will be better understood from the ensuing description. The integral end plate 16 is formed with outer arcuate ports 20a, 20b. An arcuate strip 21a and a similar strip 21b separate the ports 20a, 20b from inner arcuate ports 22a, 22b. As will be understood from an examination of FIGURE 3, these ports 20a, 20b and 22a, 22b are disposed in a diametrical relationship with each other.

Continuing with the description of the body 12, a discharge chamber 24 is provided immediately above the integral end plate 16, there being outward communication from the chamber 24 via a discharge spout 26. For a purpose hereinafter made manifest, a counterbore 28 is provided at the upper end of the body 12 forming a shoulder at 30. In a similar fashion, a lower counterbore 32 is provided and forms a shoulder 34. The counterbores 28, 32 thus form cylindrical skirt portions.

A cup-shaped member denoted generally by the reference numeral 36 includes a relatively large sleeve portion 38 that is slidably received in the skirt portion forming the counterbore 32. At the upper end of the cup-shaped member 36 is a second end plate 40 having upwardly projecting lobes or keys 42 (FIGURE 6) which fit or extend into the lower end of the oval pumping chamber 14. The function of the lobes 42 is to prevent the cup-shaped member 36 from becoming twisted or angularly misaligned during the operation of the pump. The member 36 additionally includes a smaller sleeve portion 44 which functions as a bearing means as will hereinafter be explained. It is important to note, though, that outer arcuate ports 46a, 46b are formed in the plate 40, these arcuate ports being boundaried by arcuate strips 47a, 47b which reside intermediate the ports 46a, 46b and additional ports 48a, 48b which are disposed radially inwardly from the ports 46a, 46b. Here again, the ports 46a, 46b and 48a, 48b are arranged diametrically with respect to each other. By comparing FIGURES 3 and 5, it will be additionally noted that the ports just referred to are quadrantly oriented with respect to the earlier-mentioned ports 20a, 20b and 22a, 22b. Through the agency of the lobes 42, which prevent the cup-shaped member 36 from turning within the counterbore 32, the lower ports can be retained in a proper 90° angular relationship with the upper ports.

At this time, attention is drawn to the presence of a rotor indicated by the numeral 50. This rotor is shown in FIGURE 4 as being of cylindrical configuration, the rotor having a diameter corresponding to the distance between the flat or parallel sides of the imperforate side-

walls. As with the pump body 12, the rotor may be molded from a suitable plastic material, such as the previously-mentioned nylon. The rotor has a length substantially equalling the length of the pumping chamber 14 in which it is disposed. Although the number is susceptible to variation, it will be observed that the rotor 50 in the present instance is formed with eight longitudinal grooves or recesses 52, each having parallel sides and extending the full length of the rotor. A shaft 54 extends through the rotor 50, and to assure retention of the shaft within the rotor, a central or intermediate portion thereof can be serrated or knurled, as indicated at 56 in FIGURE 2.

It will be appreciated that the oval pumping chamber 14 is boundaried at its upper end by the integral end plate 16 and at its lower end by the end plate 40. The end plate 40, owing to the slidable reception of the cup-shaped member 36 within the counterbore 32, is movable relative to the lower end of the rotor 50. However, it is contemplated that the end plate 40 be urged upwardly in the direction of the rotor 50, and to fulfill this purpose a coil spring 58 has its upper end positioned so as to bear against the lower side or face of the end plate 40. The other end of the coil spring reactively bears against a spider 60 having a rim 62, spokes 64, and a tubular hub 66. A reducer 68 comprised of a cylindrical flange 70 has a shoulder 72. Centrally located at the lower end of the reducer 68 is a nipple 74. Within the confines of the reducer 68 is an internal shoulder 76. The shoulder 76 supports an annular seat element 78. Between the rim 62 of the spider 60 and the annular seat 78 is interposed a check valve 80 in the form of a disc of flexible material having a flap portion 82 which is readily deflectable upwardly when there is a flow of liquid in an upward direction. The deflected position of the flap portion 82 is shown in dotted outline, and it is apparent that this deflected position readily permits the movement of liquid upwardly but prevents any reverse flow that might otherwise occur through the reducer 78.

It has been previously mentioned that the pump body 12 is formed with a counterbore at 28. The purpose of this counterbore is to accommodate or receive a tube 84 having a vent or opening at 86. A resilient seal 88 is located at the lower end of the tube 84 and circumscribes the rotor shaft 54. The seal 88 is held in place by a seal retainer 90. Contained within the tube 84 is a coupling 92 that mechanically connects the upper end of the shaft 54 to the lower end of a shaft 94 depending downwardly from an electric motor 96. The electric motor is mounted on a fixed bracket 98. In the embodiment that has been denoted in its entirety by the reference numeral 10, it is planned that the motor 96 be located so that the pump is immediately above a small-mouthed bottle 100. Therefore, a vertical intake tube 102 is provided which extends downwardly into the bottle 100 and it may be assumed that the bottle contains a liquid 104 such as would be used in making a beverage.

Having presented the foregoing information, a brief operational sequence will now be presented. Assuming that the rotor 50 is rotating in the direction of the arrow 106 shown in FIGURE 4, this being a clockwise direction as viewed in this particular figure and also as viewed when looking upwardly in FIGURE 2, the particular cylindrical roller 57 at the twelve o'clock position in FIGURE 4 will be bearing against the imperforate side-wall of the chamber 14 and will also be in close proximity with the base of the recess 52 in which this particular roller 57 is located. Concentrating on the curvilinear path traversed by the particular roller 57 that we have referred to, it follows that as this roller is moved in the direction of the arrow 106 toward the three o'clock position, it is at the same time moved outwardly by reason of the centrifugal force that is developed due to the rotational speed of the rotor 50. As the roller 57, that is, the one with which we are presently concerned, moves

outwardly, this particular roller provides a space between it and the base of the groove in which it is disposed. Also, as it progresses in a clockwise direction, a lunate space develops behind this roller. From this information, it will be appreciated that a lower pressure is produced so as to draw liquid up through the ports 46a and 46b of the lower end plate 40. More specifically, the space between the base of the groove or recess 52 in which the roller 57 now under discussion resides is instrumental in causing flow of liquid upwardly through the arcuate port 48a, whereas the lunate space is responsible for drawing liquid up through the arcuate port 46a. This action continues until the particular roller 57 that we are referring to passes beyond the ends of these two ports 46a, 48a. From then on, the liquid that has been drawn upwardly into the alluded to spaces is forced upwardly through the ports 20a, 22a of the upper end plate 16 which is integral with the body 12, as previously explained. Because the liquid is forced outwardly through the ports 20a, 22a, the liquid from the container or bottle 100 is pumped therefrom and traverses a route indicated by the arrows 108.

Because of the above operational description, it is believed readily understood that the particular roller 57 that is shown in the six o'clock position of FIGURE 4, owing to the double ported construction, does the same thing as the roller starting from the twelve o'clock position. However, the roller starting from the six o'clock position acts in conjunction with the ports 46b, 48b, 20b and 22b. Stated somewhat differently, the ports 46a, 46b, 48a and 48b serve as inlet ports, whereas the ports 20a, 20b, 22a and 22b function as discharge ports in the disclosed double ported pump.

It will be discerned that the flap portion 82 of the check valve 80 is readily deflected into the dotted line position shown in FIGURE 2 to permit the passage of liquid upwardly in the direction of the arrows 108. This flap portion 82 quickly returns to a seating position with respect to the annular seat 78 whenever the pump is stopped. Hence, the liquid that would remain in the pumping chamber 14 cannot escape downwardly into the container or bottle 100. Hence, the pump 10 will always be in immediate readiness for any subsequent operation thereof.

Should the pressure in the pumping chamber 14 build up excessively, then the end plate 40 will be forced downwardly against the biasing action of the coil spring 58 to relieve the pressure. In other words, the cup-shaped member 36, more specifically, its plate 40, acts as a relief valve should circumstances so require. Such an arrangement also minimizes the need for close endwise tolerances between the rotor 50 and the end plate 40, for the plate 40 will simply adjust to the proper position against the lower end of the rotor 50.

Whereas the pump 10 is intended for use exteriorly of the small-mouthed bottle 100, the embodiment depicted in FIGURE 8 is intended for submersion into the liquid to be pumped. This pump 110 is generally similar to the earlier-described embodiment 10 but differs somewhat by reason of the lower end thereof.

Instead of the reducer 68, there is employed in the modification of FIGURE 8 a retainer 112 having a plurality of spaced supporting feet 114 which can rest directly against the bottom of the bottle 100, a fragmentary portion of the bottom of this bottle appearing in FIGURE 8. The retainer 112 has a series of angularly spaced apertures 116 so that the liquid taken in between the supporting feet 114 can flow upwardly in the direction of the arrows 118. The same type of spring is employed in this situation and it will be noted that the lower end of the spring 58 bears against a centering boss 120. Thus, the coil spring in the embodiment of FIGURE 8 is held captive by virtue of the retainer 112, the spring bearing against the centering boss 118 thereof

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at the lower end and against the spider 60 at its upper end.

The operation is identical to that which takes place when using the pump 10. The liquid is drawn upwardly, as already indicated, in the direction of the arrows 118 and passes through the pumping chamber 14 and out the discharge spout 26 by the action imparted to the liquid by the rotor 50.

It will, of course, be understood that various changes may be made in the form, details, arrangements, and proportions of the parts without departing from the scope of my invention as set forth in the appended claim.

What is claimed:

A rotary pump comprising:

- (a) a body forming an elongated pumping chamber therewithin provided with an imperforate sidewall and an integral plate at one end of said chamber having a port for the passage of fluid therethrough;
- (b) a second plate received within said body at the other end of said chamber having a port displaced angularly from said first port;
- (c) a rotor within said pumping chamber journaled for rotation about an axis nearer said sidewall at one angular location than at another,
- (d) said rotor having a plurality of radially directed recesses extending from one end thereof to the other; and
- (e) an elongated piston member freely disposed in each of said recesses,
- (f) whereby when said rotor is rotated about its said axis the ends of said pistons will successively pass said ports to cause fluid to be drawn into said pumping

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chamber via one of said ports and to be forced outwardly via said other port;

- (g) a resilient member for urging said second plate against the end of the rotor adjacent thereto;
- (h) said resilient member constituting a coil spring;
- (i) a spider member fixedly disposed with respect to said body,
- (j) the ends of said coil spring bearing against said second plate and said spider member;
- (k) the port of said first plate acting as a discharge port and the port of said second plate acts as an inlet port,
- (l) a check valve adjacent the opposite side of said spider member from said spring;
- (m) said check valve constituting a layer of resilient material having a deflectable flap portion, and
- (n) an annular element serving as a seat for said flap portion.

References Cited by the Examiner

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,207,079

September 21, 1965

Ernest E. Cook et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, lines 23 to 28, strike out the list of references and insert the following list:

619,653	2/99	Asbury et al-----	103-119
746,482	12/03	Evans-----	103-119
1,050,905	1/13	Baade-----	103-119
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2,611,320	9/52	Morrison-----	103-119
2,739,539	3/56	Gardiner-----	103-136
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2,780,070	2/57	Meade-----	103-119
2,884,865	5/59	Pettibone-----	103-136
2,967,488	1/61	Gardiner-----	103-136
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Signed and sealed this 26th day of April 1966.

(SEAL)

Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents