Nov. 10, 1959 S. P. THOMPSON 2,911,920

PUMP WITH FLEXIBLE IMPELLER

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Fig. 1.

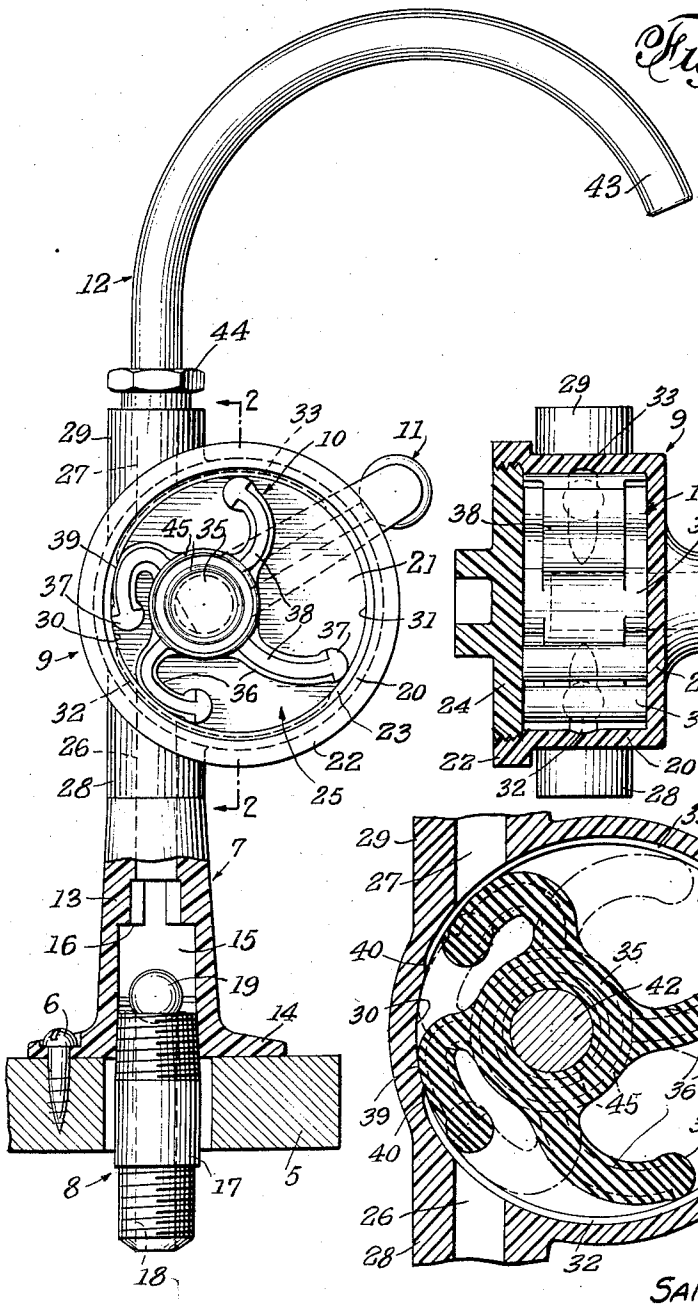


Fig. 2.

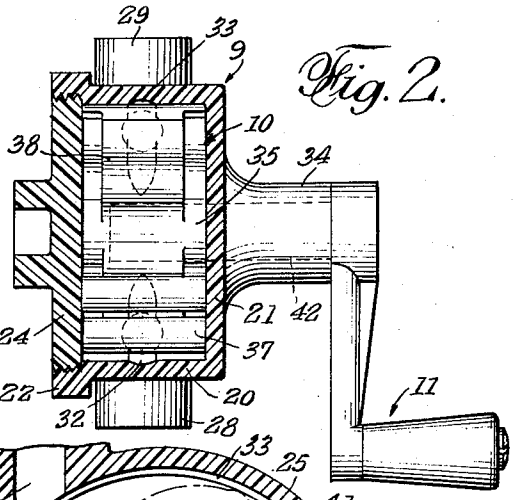


Fig. 3.

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PUMP WITH FLEXIBLE IMPELLER

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5 Claims. (Cl. 103—117)

This invention relates to a pump with a flexible impeller and deals more particularly with a pump that may be used in trailers and like installations for delivering water to a sink or the like.

In the interests of long and efficient life, economy of manufacture, and general utility, it is an object of the present invention to provide a rotary flexible blade-impeller pump in which both the impeller and the housing are non-metallic and are adapted to be produced entirely by molding techniques, not requiring expensive machining operations.

Another object of the invention is to provide a rotary pump of the character above referred to that is readily reversible to pump or prime, as desired, merely by rotation of an operating handle in the proper direction.

A further object of the invention is to provide a flexible blade-impeller pump that provides a constant flow or steady delivery, rather than an intermittent one.

A still further object of the invention is to provide a rotary pump having a cylindrical housing and in which a multi-armed flexible impeller is provided to transfer liquid between opposite ports in said housing and to effectively seal between said ports after delivery of liquid, thereby retaining the prime of the pump and insuring constant delivery.

The invention also has for its objects to provide such means that are positive in operation, convenient in use, easily installed in a working position and easily disconnected therefrom, economical of manufacture, relatively simple, and of general superiority and serviceability.

The invention also comprises novel details of construction and novel combinations and arrangements of parts, which will more fully appear in the course of the following description. However, the drawing merely shows and the following description merely describes, one embodiment of the present invention, which is given by way of illustration or example only.

In the drawing, like reference characters designate similar parts in the several views.

Fig. 1 is a side elevational view, partly in vertical section and with a housing cover removed, showing a pump according to the present invention.

Fig. 2 is a vertical sectional view as taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional view, taken at right angles to the section of Fig. 2, through the pump housing and impeller.

The present pump is adapted to be mounted on a support 5 as by means of screws or bolts 6.

The pump that is illustrated comprises, generally, a standard 7, a check valve 8 carried by said standard, a pump housing 9 affixed to the upper end of the standard, an impeller 10 mounted in said housing, an operating handle 11 for rotating the impeller, and an outlet gooseneck 12 for delivering liquid raised by the pump past the check valve 8.

Both the standard 7 and housing 8 are advantageously formed of a rigid plastic material, of which Bakelite and

similar synthetic resins are examples. Irrespective of which particular plastic is choosen, the parts 7 and 8 may come from the molds in which they are formed of such smoothness that machining operations are not necessary. It may be feasible to make parts 7 and 8 as one integral molded part. In any case, said parts 7 and 8 are permanently joined, substantially as shown.

The impeller 10 is preferably made of a flexible material. While natural soft rubber may be used, synthetic rubber, known in the trade as "neoprene," or a comparable compressible material, is preferred. The impeller may be used as it comes from the mold, only excessively long burrs or fins needing removal.

The standard 7 is shown as a tubular part 13 that is provided with a support flange 14 through holes in which screws or bolts 6 are applied. Part 13 has a longitudinal passage 15 that is formed to have a seat 16.

The check valve 8 is shown as a tubular fitting 17 that extends downwardly from standard 7, the same being provided with a passage 18 that opens on passage 15. A ball check 19 gravitationally seeks a position closing passage 18 and the mentioned seat 16 limits the movement of said ball away from its seat on fitting 17.

The housing 9 comprises a cylindrical wall 20 that has a flat wall 21 on one side, said walls defining a relatively narrow cup in the rim 22 of which is provided an annular shoulder 23. A closure wall 24, opposed to wall 21, has a position limited by shoulder 23 and having threaded connection with wall 20. In the above manner, the housing 9 is provided with a cylindrical chamber 25, the same being defined by walls 20, 21 and 24.

Offset from the center of said cylindrical chamber and aligned along a chord thereof, the housing 9 is provided with ports 26 and 27 formed in hubs or collars 28 and 29, respectively. In this instance, port 26 constitutes an extension of passage 15 and is the inlet port of the pump. The port 27 is the outlet port. With the ports 26 and 27 thus offset from the center of chamber 25, the wall 20 has a relatively short spanning surface 30 on the side toward which said ports are offset, and a relatively longer spanning surface 31 on the opposite side.

As can be seen best in Figs. 2 and 3, the surface 30—31, between the walls 21 and 24 and aligned with and, therefore, intersected by the ports 26 and 27, is provided with arcuate grooves 32 and 33, the former opening on the inlet port 26 and the latter on the outlet port 27. The circumferential extent of said grooves will be set forth in connection with the description of the impeller 10.

Transverse to the chord on which the ports 26 and 27 are located and disposed on an axis between the center of the housing and said chord, the housing is provided with a hub or boss 34 that projects laterally outward from wall 21. This hub constitutes the axis for the impeller 10. Thus it will be seen that both the ports of the pump and the axis of the impeller thereof are offset from the center of the pump chamber and that said axis is disposed between said center and the line of offset of the ports.

The impeller 10 comprises an integrally formed hub 35 and four uniformly spaced and similar radial arms 36, each provided on its outer end with a round sealing bar 37. The arms themselves are relatively thinner than said bars and are formed to have side ribs 38 that have wiping engagement with walls 21 and 24. The arms are of such great flexibility as to be capable of being tightly flexed, as needed, between said hub 35 and the near surface 30 of the housing. It will be noted that the longest distance between the center of the impeller hub and the surface 31 is less than the distance between said center and the end of each arm 36. Thus, while molded

straight, said arms are at all times flexed when the impeller is disposed in the housing, the flexure varying according to nearness of surface 30—31 to said impeller center and with which the end 37 of an arm is engaged.

Under conditions of greatest flexure, not only the bar end 37 but also an intermediate line 39 of each arm 36, has wiping and sealing engagement with the surface 30. Thus, although the arms 36 are initially uniformly spaced, when in the housing, the ends of said arms vary in their mutual spacing as the impeller is rotated, and the effective or sealing spacing of the arms is further varied by the mentioned contact thereof along line 39. Therefore, the arms that are most sharply flexed have sealing portions that are circumferentially closely spaced, and those with the least flexure have sealing portions that are circumferentially widely spaced. The change in spacing varies progressively as the impeller is rotated.

The ends 40 of the grooves 32 and 33 are located on surface 30 between ports 26 and 27. The opposite ends 41 of said grooves are located on surface 31 and are spaced a greater distance from each other than are ends 40.

The impeller 10 includes a shaft 42 that has bearing in the boss 34 and is bonded to the hub 35 of said impeller.

The handle 11 is connected to said shaft and may be a generally conventional means for effecting rotation of the impeller.

The gooseneck 12 is shown as a curved tube 43 that, by means of a fitting 44, is connected to port 27. The same is adapted for a desired delivery position around the axis of the hub 29.

The full-line showing of the impeller arms is for a clockwise rotation, which is the pump-priming rotation. By immersing the end of the gooseneck tube 43 in a vessel of water, said rotation will draw water from said vessel clockwise around the chamber 25 and deposit said water into port 26 and passage 15. Valve 8 remaining closed, the pump becomes fully charged with water and, therefore, is primed.

When the impeller 10 is rotated counter-clockwise, the impeller arms 36 become reversely flexed, as shown by the dot-dash lines of Fig. 3. As the rotation of the impeller is continued, the arms thereof will draw water from chamber 15 and port 26 and expel the same into port 27. A source of water connected to fitting 17 will continue to supply water to the pump, the ball 19 unseating to permit this.

It will be seen that the delivery to port 27 is constant since the groove 33 effects communication between a discharging pocket between two arms 36 and the next pocket to discharge. The delivery is positive because the outlet port 27 is effectively sealed from the inlet port.

The grooves 32 and 33 provide for a balanced pump that gives constant delivery with a minimum of air inclusion. Intermittent or squirting operation is thereby obviated. As a pair of vanes 36 cooperate to form a liquid-transferring pocket, the groove connected to the inlet port allows full filling of said pocket to the substantial exclusion of air. As the trailing vane moves past the end of said groove, the liquid being transferred simultaneously bleeds into the opposite or outlet groove. Then, when the outlet port is fully open, the full discharge takes place. The smoothness of the resulting operation will be evident from the foregoing. When priming, the same action occurs in connection with groove 32.

Because the vanes 36 flex tightly, as shown at the left of Fig. 1, the material at the point of flexure bulges outwardly and binds against the side walls 21 and 24 of the pump housing. By providing the vanes with the relatively thin ribs 33, this bulging is greatly minimized and yet there is afforded sealing engagement of the impeller with said side walls.

At the hub 35, in order to seal between the pockets formed by the vanes and also to obviate a too tight interfit of the parts, the opposite end faces of said hub are provided with shallow concentric sealing beads 45 that effect a proper seal not only between pockets but also prevent leakage on the side of the housing that has boss 34.

Because the arms 36 are never permitted to become fully straightened, regardless of the direction of rotation of the impeller, the mentioned sealing is always effective, as well as the transport of water between ports. Also, the arms retain their direction of flexure, but the same is readily reversed because of the strong frictional engagement of the rubber impeller with the plastic housing at the time that such reversal is being effected.

While the foregoing has illustrated and described what is now contemplated to be the best mode of carrying out the invention, the construction is, of course, subject to modification without departing from the spirit and scope of the invention. It is, therefore, not desired to restrict the invention to the particular form of construction illustrated and described, but to cover all modifications that may fall within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A pump comprising a housing having a cylindrical bore, two aligned ports disposed along a chord of said bore and substantially offset from the bore center, a partially circumferential groove formed in the bore of the housing and into which the ports open, each groove extending from its communicating port on one side more than on the other, and an impeller on a center of rotation between said bore center and the chordal line on which the ports are disposed and provided with a hand-rotational handle, said impeller comprising a hub provided with uniformly spaced radial and flexible arms, said arms being equally flexible in both directions and longer than the greatest distance between the impeller center and the bore, whereby the same are in flexed condition in all rotated positions of the impeller in the housing bore.

2. A pump according to claim 1 in which the impeller arms, as they move past the nearest portion of the housing bore, are so tightly flexed as to bring intermediate portions of said arms into wiping contact with the bore.

3. A pump comprising a housing having a cylindrical bore, two aligned ports disposed along a chord of said bore and substantially offset from the housing center, a partially circumferential groove formed in the bore of the housing and into which the ports open, each groove extending from its communicating port on one side more than on the other, and an impeller on a center of rotation between said bore center and the chordal line on which the ports are disposed and provided with a hand-rotational handle, said impeller comprising a hub provided with uniformly spaced radial and flexible arms, said arms being equally flexible in both directions and longer than the greatest distance between the impeller center and the housing, and all of the arms being flexed, the flexure being greatest as the arms move past the side of the housing nearest to the center of the impeller.

4. A pump comprising a housing having a cylindrical bore, two aligned ports disposed along a chord of said bore and substantially offset from the housing center, a partially circumferential groove formed in the bore of the housing and into which the ports open, each groove extending from its communicating port on one side more than on the other, and an impeller on a center of rotation between said bore center and the chordal line on which the ports are disposed and provided with a hand-rotational handle, said impeller comprising a hub provided with uniformly spaced radial and flexible arms, said arms being equally flexible in both directions and longer

than the greatest distance between the impeller center and the housing, one port being an inlet port and the other an outlet port, a tubular extension from the inlet port and constituting a mounting member for the pump, and a check valve carried by said member to prevent outward flow from the inlet port.

5. A handle-operated pump comprising a housing having a cylindrical bore, two partially circumferential grooves in the wall of said bore, the grooves, at one side, being closer together than on the other side, two aligned ports disposed along a chord of said bore and closer to said closer-together groove ends than to the opposite ends, said grooves, thereby, constituting circumferential extensions of the chordal ports, and an impeller within said bore on a center of rotation eccentric to the center of the bore and provided with a hand-rotational handle, said center of rotation being located between the bore center and the mentioned chord, said impeller being provided with a plurality of uniformly-spaced, radial and flexible arms, said arms being longer than the greatest distance between the center of the bore and the axis of rotation of the impeller whereby, in all positions of the impeller in the bore, all of the arms are in flexed condition.

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