Aug. 21, 1962 H. D. LOWRY 3,050,009

POSITIVE PRESSURE PUMP

Filed Oct. 28, 1960

FIG. 1.

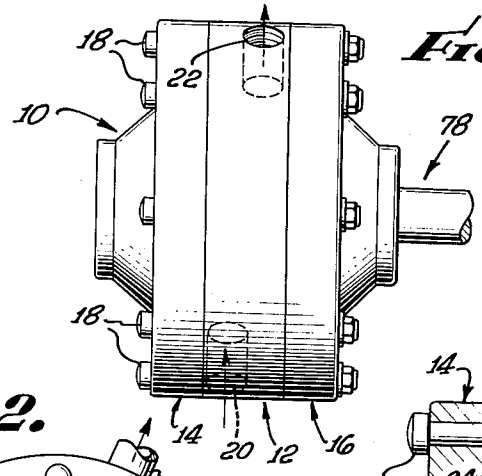


FIG. 2.

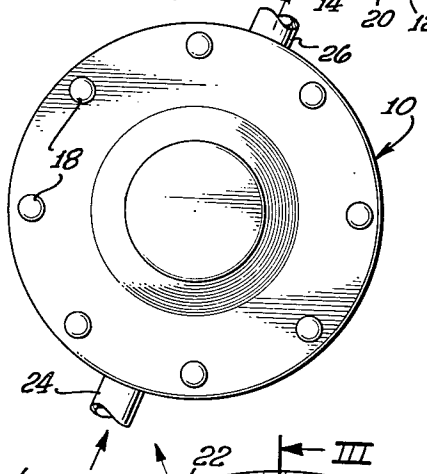


FIG. 3.

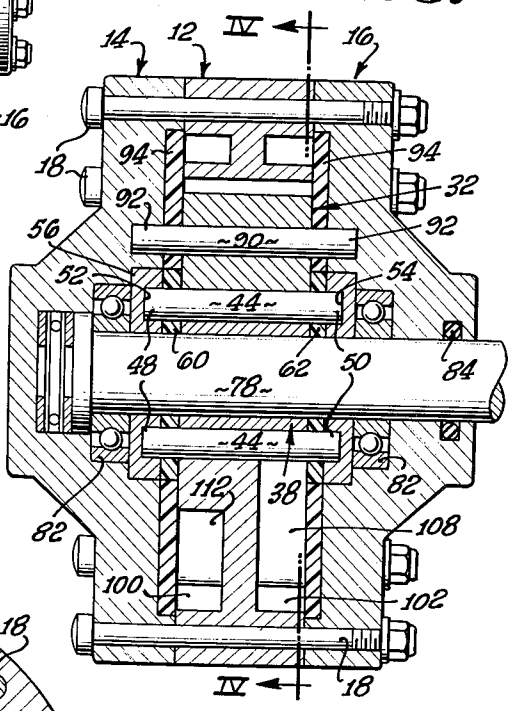


FIG. 4.

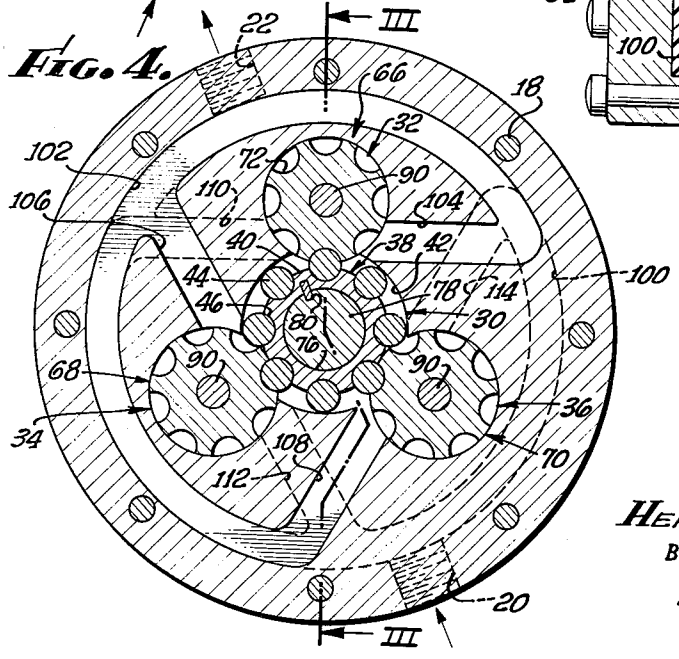
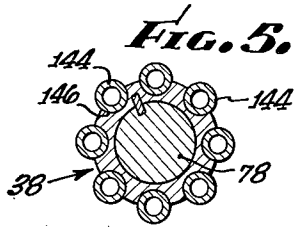


FIG. 5.



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POSITIVE PRESSURE PUMP

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The present invention relates generally to fluid pumps and more particularly is directed to a positive pressure pump having unusually high fluid pumping capacity for its size and weight.

In general the preferred embodiment of the invention hereinafter illustrated and described in detail contemplates the provision of a hollow housing or casing within which are formed a central cavity and a number of outer cavities arranged in symmetrical relation about the central cavity. The cavities are defined by generally cylindrical walls, and each of the outer cavities overlaps the inner cavity whereby the inner cavity is in fluid communication with each of the outer cavities through openings constituting interruptions in the cylindrical side walls. An impeller member or rotor is rotatably mounted within the central cavity. The rotor proper is of somewhat smaller radius than the radius of the central cavity and the periphery of the rotor is provided with a number of equally arcuately spaced ribs extending longitudinally of the rotor and projecting outwardly into sliding, virtually fluid-tight contact with the central cavity wall. In each of the outer cavities there is rotatably mounted an idler wheel having a generally cylindrical outer surface in sliding, virtually fluid-tight contact with the cylindrical side wall defining its cavity, the outer surface of the idler wheel being interrupted by a plurality of equally arcuately spaced longitudinally extending grooves. The spacing of the longitudinal ribs or ridges of the rotor and the grooves of the idler wheels, as well as their respective sizes and shapes, permits the ridges to be received in the grooves during rotation of the rotor, thereby rotatably driving the wheels. The contact of the ridges with the grooves, supplemented by contact between the peripheries of the rotor and the idler wheels, makes a continuous virtually fluid-tight seal during rotation and the end surfaces of the rotor and wheels are similarly in virtually fluid-tight contact with the internal walls of the housing. The construction includes passageways or channels whereby to feed incoming fluid to be pumped to corresponding sides of the idler wheels near their juncture with the rotor and similar output passageways or channels are provided on the opposite sides of the rolling junctures between the rotor and wheels. Rotation of the rotor by an external source of power causes pumping of fluid through the channels just mentioned in somewhat the same way as the operation of a conventional gear pump.

A particular advantage of the present invention is its adaptability for extreme light-weight construction while maintaining a volumetric efficiency approaching 100 percent. This is accomplished by the use of interference fits between the various moving parts and between the moving parts and the stationary portions of the housing, the parts in abutting sliding contact being made of a material having some yielding or resilient characteristics such as Teflon, nylon or the like. This construction virtually eliminates fluid slippage and cavitation and the pump as a result has unusually advantageous suction characteristics in use. The ridges carried by the rotor

may be integrally formed with the rotor or, as will be described hereinafter, may desirably take the form of rollers received in grooves formed in the rotor periphery, the outer ends of the rollers being received in guide channels formed in the housing of the pump. Such construction permits the rollers to distribute the wear on their surfaces and furthermore facilitates easy removal and replacement of the rollers when desired. Thus, the efficiency of the pump can be maintained at a very high level. The resilient or the yielding characteristics of the several components of the pump permit handling of fluid having some solids therein, and the presence of such small solids does not harm the pump structure. For this reason the pump is particularly well adapted to the pumping of oil and similar fluids where some solid particles may be entrained in the fluid. The rollers themselves may be hollow or tubular in form in order to additionally permit some yielding when necessary during operation.

Accordingly, it is a principal object of the present invention to provide a novel pump of high efficiency and capacity for its volume and weight. Additional objects and purposes of the invention are to disclose of the above characteristics wherein a central rotor provided with outwardly projecting ridges is effectively in mesh with a plurality of idler wheels having grooves for receiving the ridges therein, the wheels being in fluid-tight contact with the rotor and with the fixed portions of the housing of the pump; to disclose such a construction wherein major components are made of a material having at least slightly yielding characteristics in order to permit a negative or interference fit between the parts; to provide such a pump capable of handling small solid particles in the fluid pump without substantial harm to the pump itself; and for other objects and purposes as will become clear from a reading of the following description of a preferred embodiment of the invention taken in connection with the accompanying drawing in which:

FIG. 1 is a side elevational view of a pump embodying the present invention.

FIG. 2 is an end view thereof.

FIG. 3 is a sectional view of the pump taken on line III—III of FIG. 4.

FIG. 4 is a sectional view taken on line IV—IV of FIG. 3.

FIG. 5 is a fragmentary view of the central portion of FIG. 4 showing a modified construction of the rollers carried by the rotor.

Referring now in detail to the drawings, a pump embodying the present invention is indicated generally at **10** in FIG. 1 and includes a central core section indicated generally at **12** sandwiched between left and right end members indicated generally at **14** and **16**, respectively. The parts are held in assembled relation by suitable means such as through bolts **18** and the central core is provided with openings constituting inlet and outlet ports **20** and **22**, respectively. As will be seen in FIG. 2, the inlet and outlet ports may be connected to suitable conduits or pipes **24** and **26**, respectively, for connection to fluid lines as desired.

Reference to FIGS. 3 and 4 will show the internal construction of the core member **12**. A number of cavities are formed within the core including a central cavity indicated generally at **30** and a number of outer cavities indicated generally at **32**, **34** and **36**, the outer cavities being equally spaced arcuately about the center of the

central cavity 30. Each of the outer cavities is of such a size and so located relative to the central cavity 30 that the central cavity overlaps each of the three outer cavities so that the cavities are in fluid communication with one another through openings constituting interruptions in the cylindrical side walls of the several cavities.

Rotatably mounted within the central cavity is an impeller member or rotor indicated generally at 38 and having a generally cylindrical periphery 40 at a substantially smaller radius from the center of the pump than the cylindrical wall 42 defining the cavity 30. Means are provided forming in effect longitudinally extending ribs equally arcuately spaced about the periphery of the rotor 38 and projecting outwardly into sliding contact with the inner wall 42 of the central cavity. In the present illustrative embodiment of the invention such longitudinal ribs are formed by a number of rollers 44, each roller being received in a longitudinally extending groove 46 formed in the periphery of the rotor 38 and extending throughout the length of the rotor. Desirably, the rollers 44 extend beyond the ends of the rotor 38, and end portions 48 and 50 of the rollers are received in annular grooves 52 and 54, respectively, formed in roller guides 56 and 58. The latter members are seated in suitably formed recesses in the inner surfaces of the end members 14 and 16, respectively. Seal means are desirably provided between the roller guides 56 and 58 and the central core 12 such seals being here indicated at 60 and 62, respectively, and desirably being made of Teflon or a similar smooth-surfaced, preferably somewhat compressible material.

With further reference to FIG. 4, idler wheels indicated generally at 66, 68 and 70 are rotatably received within the cavities 32, 34 and 36, respectively. The idler wheels have a generally cylindrical periphery interrupted by a plurality of equally arcuately spaced longitudinally extending grooves 72. These grooves are so shaped as to partially receive rollers 44 during rotation of the rotor 38, as will be understood from a consideration of the different positions of the various parts as seen in FIG. 4. Rotor 38 is provided with a central bore 76 and is mounted upon a central shaft indicated generally at 78 and is keyed thereto at 80. Shaft 78 is carried by bearings 82 mounted within the end members 14 and 16 and the shaft projects rightwardly as seen in FIG. 3 outwardly of the pump passing through a suitable sealing means 84 to be connected to a suitable source of rotational power for operation of the pump. Under some circumstances, a thrust load may be present and in the present embodiment of the invention such a load may be borne by the thrust bearing 86 mounted in the end member 14 and abutting an enlarged portion 88 of shaft 78. The idler wheels 66, 68 and 70 may be centrally bored and mounted upon shafts 90, although this is not always necessary since the outer cavities within which the idler wheels rotate extend cylindrically well over one-half a circle and therefore the idler wheels can "float" within their respective cavities. As will be seen in FIG. 3, support shafts 90, when used, may have their end portions 92 received in bores formed in the end members 14 and 16, respectively, the end portions passing through openings formed in a pair of fixed seals 94 carried by the inner faces of the end members as shown. Seals 94 are desirably made of a material such as Teflon and it is to be particularly noted that seals 94 remain stationary during operation of the pump, while seals 60 and 62 necessarily rotate about the axis of shaft 78 during operation.

Central core 12 is provided with conduit or passageway means for leading fluid to and away from the meshing engagement of the rotor 38 and its rollers 44 with the several idler wheels. In FIG. 4 it is assumed that shaft 78 and therefore rotor 38 are rotating counterclockwise and that fluid to be pumped is entering through the port 20 and the fluid under pressure from the pump leaves through the port 22. A pair of generally arcuate passageways are formed in the core 12 and lie generally in parallel spaced planes perpendicular to the axis of the shaft 78. Thus, inlet port 20 is in communication with inlet passageway 100, while outlet port 22 is in communication with outlet passageway 102. The latter passageway is in turn in communication with inwardly directed branch passageways 104, 106 and 108, giving access to the meshing engagement of the rotor 38 with idler wheels 32, 34 and 36, respectively. Similarly, the inlet passageway 100 is in communication through branch passageways 110, 112 and 114 with the opposite sides of the idler wheels 32, 34 and 36, respectively. The two arcuate passageways 100 and 102 need not extend completely around the pump, although they may be formed in complete annuli if desired.

The rollers 44 carried by the rotor 38 may be made of metal or similar material, although by preference they are made of Teflon or equivalent material having some compressibility and desirably also self-lubricating qualities. It will be understood that the rollers 44 together with the rotor 38 and any of the idler wheels form a continuous fluid-tight connection during meshing movement of the parts in operation. For some uses it may be desirable to provide greater yielding qualities in the rollers and for such purpose the construction of FIG. 5 may be used. In accordance with this form of the invention the rollers 144 carried on the rotor 38 are of Teflon or equivalent material and are centrally bored at 146 throughout their length. This permits even greater yielding compressibility by the rollers and accordingly permits the pump to handle fluid containing some solid particles without damage to the pump as the particles pass through.

Modifications and changes from the specific forms of the invention herein shown as illustrative will occur to those skilled in the art and all such modifications and changes not departing from the spirit of the invention are intended to be embraced within the scope of the appended claims.

I claim:

1. A positive pressure pump comprising:

a housing having formed therein first and second partially overlapping cavities having cylindrical side walls interrupted to form an opening communicating between the cavities;

a rotor rotatably mounted in the first cavity provided with longitudinal grooves equally spaced about its periphery;

cylindrical rollers partially received in said grooves and in interference fit contact with the first cavity side wall;

means within the housing for retaining the rollers in said grooves during rotation of the rotor;

a wheel rotatably mounted in the second cavity and having a cylindrical periphery in interference fit contact with the second cavity side wall, said cylindrical periphery being interrupted by a series of equally arcuately spaced longitudinal grooves arranged to successively receive and mesh with the outer portions of said rollers in said opening in fluid-tight contact during rotation of the rotor and wheel, said wheel periphery and rotor periphery being in interference fit contact and said wheel and rotor being made of resilient material;

inlet and outlet conduit means in the housing communicating with opposite sides of the meshing contact between the rollers and the wheel grooves in said opening;

and means for rotating said rotor.

2. The invention as stated in claim 1 wherein said rollers are made of a resilient material.

3. The invention as stated in claim 2 wherein said rollers are tubular.

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