Sept. 8, 1959 M. PELLADEAU 2,902,942

ROTARY PUMPS

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FIG. 1

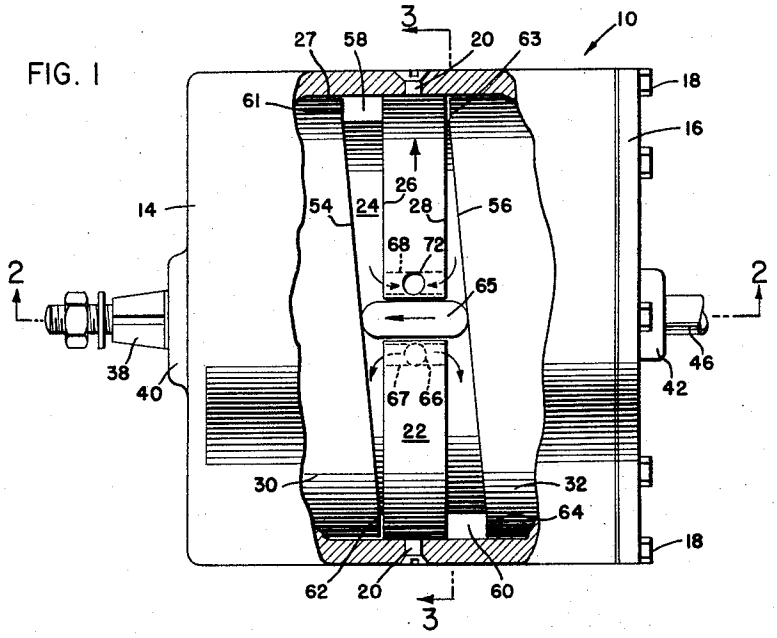
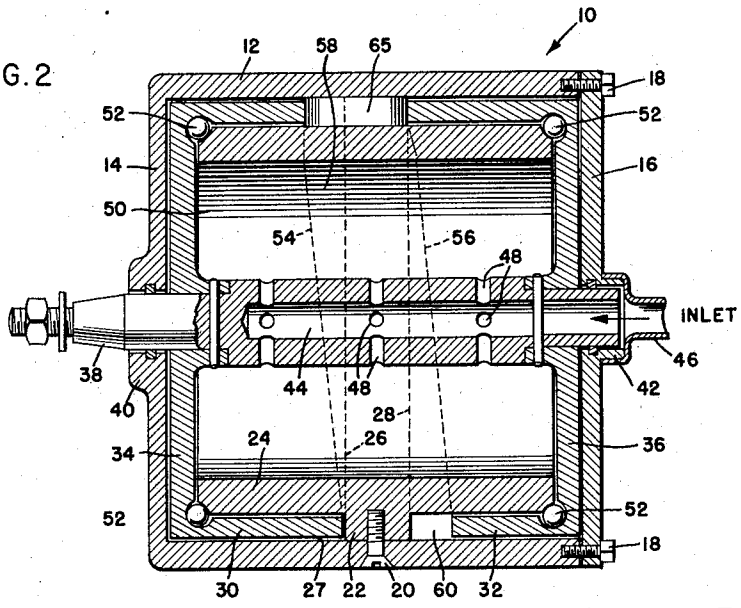


FIG. 2



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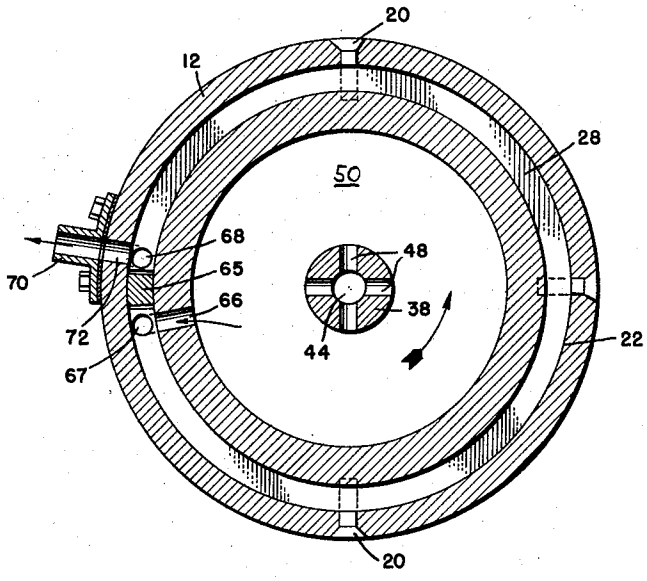
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FIG. 3



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United States Patent Office

2,902,942

Patented Sept. 8, 1959

2,902,942

ROTARY PUMPS

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Application June 26, 1956, Serial No. 593,982

3 Claims. (Cl. 103—121)

The present invention relates to a rotary pump. More particularly, the present invention relates to a rotary pump having a movable abutment which cooperates with a pair of symmetrically formed pumping chambers to provide for a uniform pumping action free of pulsations, thereby giving a constant, uninterrupted flow from the pump.

It has been found that rotary pumps of the movable vane or abutment type are generally satisfactory for delivering a constant volume of pumping fluid with a maximum of efficiency. However, prior to the instant invention, the heretofore known rotary pumps which incorporated a movable abutment were unduly complicated, comprising many moving parts, including gearing systems. These prior known movable abutment type rotary pumps have heretofore been uneconomical and impractical for any extensive use. Moreover, these heretofore known rotary pumps were too easily damaged and thus were found to be undesirable for long and continuous operations.

It is therefore an object of the present invention to provide a rotary pump of the movable abutment type which is simple in operation, economical to use and which comprises relatively few moving parts.

Another object of the invention is to provide a rotary pump which includes a pair of symmetrical operating chambers which cooperate with a movable abutment to effect a constant volume pumping action.

Still another object of the present invention is to provide a movable abutment type rotary pump which includes a pair of cylinders having inclined inner faces which cooperate with an annular projection or collar to define pumping chambers.

Still another object of the present invention is to provide a rotary pump having an abutment which is movable between the inclined faces defined by the operating chambers of the pump.

Still another object is to provide a rotary pump having a fluid inlet through the drive shaft.

A further object is to provide inlet and outlet ports in the annular projection between the cylinders, and on each side of the abutment, respectively.

A further object is to provide a pump containing two volumes, one of which diminishes constantly and regularly as it flows from the pump chamber, the other of which increases constantly and regularly as it is delivered to the pump chamber, the sum of the volumes remaining constant so that the flow from the pump is without pulsations.

Still a further object is to provide regions of tangency between the cylinders and annular projection in the pumping chambers to temporarily close off the inlet and outlet ports in one chamber while maintaining them open in the other.

Other objects, and the nature and advantages of the instant invention, will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Figure 1 is an elevational view of the rotary pump embodied in the present invention with a portion of the casing broken away.

Figure 1 is a sectional view taken along the line 2—2 of Figure 1, and

Figure 3 is a sectional view taken along the line 3—3 of Figure 1.

Referring now to the drawings, and particularly to Figure 2, the rotary pump embodied herein is generally indicated at **10** and includes a hollow housing **12** which is formed with an integral end wall **14** and which has an opposite end wall **16** secured thereto by bolts **18**. Secured interiorly to the housing **12** by bolts **20** is an annular projection or collar **22** which is formed integral with an inner cylinder or tubular member **24**. The sides of the collar **22** are defined by plane, annular faces **26** and **28**, each of which forms a wall of a symmetrical operating chamber to be hereinafter more fully described.

An annular space **27** is formed between the outer periphery of the inner tubular member **24** and the housing **12** and receives therein a pair of hollow cylinders **30** and **32** which are spaced from each other, one on each side of the collar **22**.

The cylinders or rotors **32**, **30** include end walls **34**, **36**, respectively, and are secured to a shaft **38**. The shaft **38** is journalled in bearings **40** and **42** which are formed in the end walls **14** and **16**, respectively, of the housing **12**. Formed centrally in the shaft **38** is a fluid passage **44** which communicates with a fluid inlet conduit **46** secured to the end wall **16**. Also communicating with the passage **44** are a plurality of radially extending passages **48** which are adapted to direct fluid from the passage **44** into a chamber **50** defined by the interior of the inner tubular member **24**.

In order to provide for smooth and uniform rotation of the cylinders **30**, **32** with respect to the inner member **24**, the interior corners of the cylinders or rotors are deformed into annular depressions in which are positioned anti-friction ball bearings **52**. As shown in Figure 2, the corresponding annular portions of the inner member **24** are also slightly deformed to provide a ball race for the ball bearings **52**.

Referring now to Figure 1, the cylinders **30**, **32** are shown being formed with faces **54**, **56**, respectively, which define the end walls of the cylinders and which are arranged in parallel relation. These faces **54**, **56** are inclined with respect to the walls of the annular collar **22** and thereby define with said walls a pair of symmetrically formed operating chambers **58** and **60**, respectively. As shown particularly in Figure 1, the faces **54**, **56** are formed with portions **61**, **62** and **63**, **64**, respectively, which are parallel with the side walls of the annular collar **22**. The portions **62** and **63** are adapted to be brought into tangential relation with the side walls **26** and **28**, respectively of the collar **22** and thus define tangential regions or fluid cut-off positions. In such position, the operating chambers **58** and **60**, which normally communicate with each other through ports **67**, **68**, are cut off when the portions **62** or **63** obstruct the ports **67—68**. This detail of the operation of the machine will be more fully discussed herein.

Positioned in a lateral opening formed in the collar **22** is a movable vane or abutment **65** which is formed with rounded end edges and one of these edges is adapted to be maintained in constant engagement with one of the faces **54** and **56** of the operating chambers **58** and **60**, respectively, the abutment simultaneously sweeping the two chambers in operation. Formed in the inner cylinder **24** and communicating with the chamber **50** is an inlet port **66** which, as illustrated in Figure 3, is located in front, or to the left, of the abutment **65**. The inlet port further communicates with an opening **67** formed

in the collar 22 which provides communication between the chambers 58 and 60 on the forward side of the abutment 65. Extending through the collar 22 on the rear side of the abutment 65, or to the right thereof as seen in Figure 3, is an opening 68 which provides for communication of the chambers 58 and 60 rearwardly of the abutment. The opening 68 is also in communication with a discharge conduit 70 through a port 72 formed in the wall of the housing 12.

In operation, the housing 12 and inner cylinder 24 which includes the collar 22 may be fixed in position and the shaft 38 may be rotated by a prime mover or some suitable source of power. Rotation of the shaft 38 will impart rotation to the cylinders or rotors 30 and 32 and will thereby cause the inclined faces 54 and 56 of the rotors to rotate with respect to the collar side walls 26 and 28.

However, it will be assumed for the purposes of this description that the housing rotates together with the inner cylinder 24 and annular collar 22. The shaft 38 and cylinders 30 and 32 will then be held in fixed position. Assuming, then, that the collar 22 is rotating in the direction of the arrow shown thereon in Figure 1, the abutment 65 will thus be shifted laterally to the left as it moves toward the top of the housing, the ends thereof being maintained in engagement with the inclined faces 54 and 56. Pressure is exerted on the volume of fluid disposed in the chambers 58 and 60 in advance of the moving abutment 65 and the fluid will be discharged through the opening 68, port 72 and discharge conduit 70. That volume of the operating chambers 58 and 60 in back of the abutment 65 is subjected to a suction and fluid is withdrawn from the chamber 50 and is forced into the operating chambers 58, 60 by way of the port 66 and opening 67. When the abutment 65 reaches the upper position of the housing in Figure 1, the face 56 of the cylinder 32 is tangential to the collar 22 at 63 and communication between the chambers 58 and 60 is cut off momentarily. The passages 67 and 68 are simultaneously closed off and, theoretically, pump delivery at this point is zero. The tangential regions 62 and 63 thus define the operating volumes in each chamber.

For example, in Figure 1, each operating volume has two parts, separated by the annular projection 22, one part being defined by that part of chamber 60 outlined by the space below the abutment 65, between the walls 28 and 56 and extending around the chamber to the tangential region 63, and the other part being defined by that part on the other side of the collar 22, in the chamber 58, below the abutment 65 and defined by walls 26 and 54 around the chamber to the tangential region 62.

The other operating volume likewise has two parts separated by the collar 22. Still referring to Figure 1, one part is defined by that part of chamber 60 above the abutment 65 and bounded by the walls 28, 56 around the chamber to the tangential region 63. The other part is defined by that part of chamber 58 above the abutment 65, bounded by the walls 26, 54 around the chamber to the tangential region 62.

It will be seen that as the collar 22 rotates in the direction of the arrow in Figure 1, the second volume, which is in advance of the abutment 65, is diminished at a constant rate which causes the fluid therein to flow through the opening 68, port 72 and discharge conduit 70. As the second volume decreases, the first volume increases at a constant rate, creating a suction, thereby causing fluid to be drawn through port 66 and opening 67. When the abutment reaches the tangential point 63, the passages 67 and 68 are temporarily closed, thereby closing off communication between the chambers 58 and 60. As soon as the abutment 65 passes the point of tangency 63, that part of chamber 60 which had been receiving fluid is now put under pressure and the fluid is caused to be exhausted through the outlet opening 68 and outlet port 72. The portion of the chamber 60 just exhausted begins to receive fluid from the chamber 50 and the cycle repeats. The same phenomena is produced in chamber 58 when the abutment 65 passes the point of tangency 62. The abutment 65 reciprocates axially between the inclined surfaces 54, 56 as the collar 22 rotates. Thus, as the collar rotates, there is a constant discharge of the fluid in advance of the abutment. It will be seen, therefore, that there is a rapid change in the volume of fluid in the chambers 58 and 60 when the abutment 65 moves beyond the regions of tangency 62 and 63. Apart from this rapid change the volumes in advance of the abutment change from a maximum to a minimum as the chamber decreases in size and this is due to the advance of the abutment 65 at the rear part of these chambers. The volumes behind the abutment change from a minimum to a maximum as the chambers increase in size and this is due to the advance of the abutment 65 at the front part of these chambers. The sum of the volumes being discharged and received, however, is always constant, and accordingly the pump delivery is constant, being uninterrupted, uniform, and without pulsations.

Although the operation of the pump has been described to illustrate the housing 12, collar 22 and abutment 65 as rotating, it is to be understood that the housing and collar may be held fixed or stationary and the shaft 38 rotated. In this case, the cylinders or rotors 30, 32 will be rotated, and the action of the inclined faces 54 and 56 on the abutment 65 will cause it to reciprocate and the machine will function as described.

It will further be understood that the pump described herein may be operated under very high pressures since there are relatively few moving parts or elements subjected to wear; moreover, the fluid seals provided are effective to maintain high pressures and since the delivery of the pump is uniform at all speeds, the pump is both efficient and economical to operate.

The machine may be operated either as a fluid motor or as a compressor, if desired, without departing from the spirit of the invention.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

I claim:

1. In a rotary machine, the combination comprising a housing, a tubular means secured to said housing having an annular projection formed thereon and providing a space between said housing and tubular means, cylindrical means positioned in said space and movable relatively with respect thereto, the radially outer and inner cylindrical surfaces of said cylindrical means being in sealing contact, respectively, with the radially inner cylindrical surface of said housing and the radially outer cylindrical surface of said tubular means, a portion of the side of said cylindrical means being in sealing contact with the sides of said annular projection, and the remaining portions of the sides of said cylindrical means being spaced from the sides of said projection to define operating chambers, a shaft extending through said housing and tubular means and secured to said cylindrical means, an abutment extending through said annular projection and reciprocable with respect thereto upon relative movement of said tubular means and cylindrical means, whereby a fluid medium is moved into and out of said operating chambers at a uniform rate, a fluid inlet passage extending through said shaft, said fluid inlet passage communicating with the interior of said tubular means, fluid inlet openings formed in said projection adjacent one side of said abutment and communicating with the interior of said tubular means, said fluid inlet openings also communicating with said operating chambers and directing fluid thereto from the interior

of said tubular means, discharge openings formed in said projection on the other side of said abutment and communicating with said operating chambers, and a discharge conduit formed on said casing and communicating with said discharge openings, said discharge conduit receiving the fluid discharged from said operating chambers through said discharge openings.

2. In a pump, the combination comprising a housing, an inner tubular member secured to said housing and having an annular collar formed thereon, a pair of cylinders located between the walls of said housing and said inner tubular member, a shaft extending through said housing and cylinders and being secured to said cylinders for rotation therewith said cylinders being spaced on opposite sides of said collar, the radially outer and inner cylindrical surfaces of said cylinders being in sealing contact, respectively, with the radially inner cylindrical surface of said housing and the radially outer cylindrical surface of said tubular member, the end faces of said cylinders being inclined with respect to the side walls of said collar, a portion of said faces being in sealing contact with the sides of said collar and the remaining portion of the inclined faces of said cylinders being spaced from the sides of said collar to define operating chambers, an abutment extending through said collar and engaging said inclined faces, said abutment separating said operating chambers into suction and discharge spaces, fluid inlet means including a fluid inlet passage extending through said shaft, said fluid inlet passage communicating with the interior of said tubular means, fluid inlet openings formed in said annular collar adjacent one side of said abutment and communicating with the interior of said tubular means, said fluid inlet openings also communicating with said suction space, and fluid discharge means including discharge openings formed in said annular collar on the other side of said abutment and communicating with said discharge space, and a discharge conduit formed on said housing and communicating with said discharge openings, relative rotation between said cylinders and collar causing said abutment to reciprocate in said collar while maintaining contact with said inclined faces, a fluid medium thereby being moved into and out of said operating chambers at a uniform rate.

3. In a pump, the combination comprising a housing, an inner tubular member secured to said housing and

having an annular collar formed thereon, a pair of cylinders disposed between said housing and inner tubular member and spaced on opposite sides of said collar, the inner end faces of said cylinders being inclined with respect to the sides of said collar and defining operating chambers therewith, an abutment extending through said collar and engaging said inclined faces, said abutment separating said operating chambers into suction and discharge spaces, a shaft secured to said cylinders and having fluid inlet passages formed therein communicating with the interior of said tubular member, and fluid inlet and exhaust openings formed in said collar and located on opposite sides of said abutment, said exhaust opening communicating with said discharge spaces and a discharge passage formed in the housing wall and said inlet opening communicating with said suction spaces and with the interior of said tubular member, said inclined faces formed on said cylinders having spaced portions which are parallel to said collar side walls, the spaced parallel portions defining regions of tangency with respect to said collar side walls, and cooperating with said abutment to define the suction and discharge spaces, said regions of tangency forming a cut-off point for said inlet and exhaust openings, relative rotation between said cylinders and said collar causing said abutment to reciprocate in said collar while maintaining contact with the inner faces of said cylinders, the volume of said discharge and suction spaces of said operating chambers being alternately varied from a maximum to minimum to effect a pumping action, the sum of the volumes of the fluid being discharged and received remaining constant.

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