Sept. 14, 1943. R. BRENNAN 2,329,386

ROTARY PUMP

Filed Feb. 7, 1942

Fig. 1

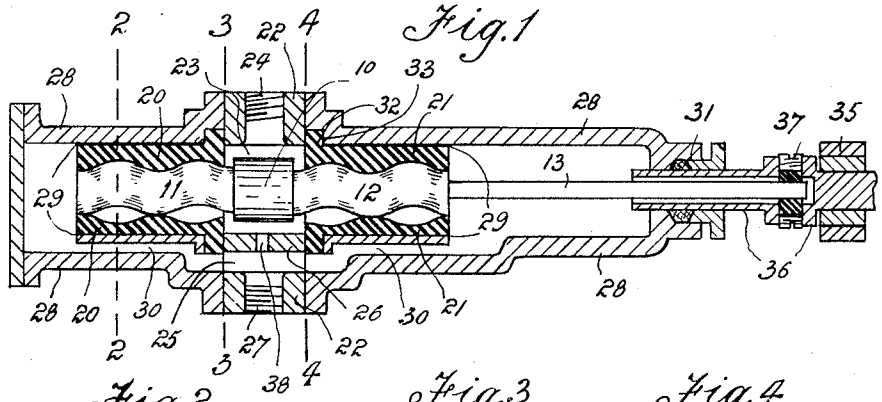



Fig. 2

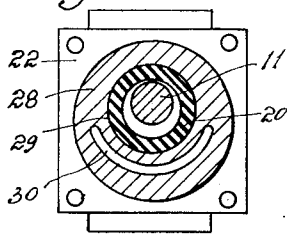



Fig. 3

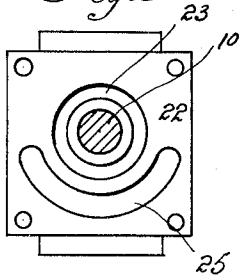



Fig. 4

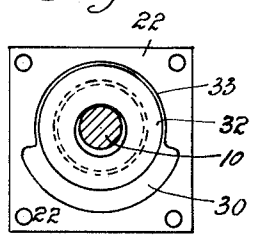



Fig. 5

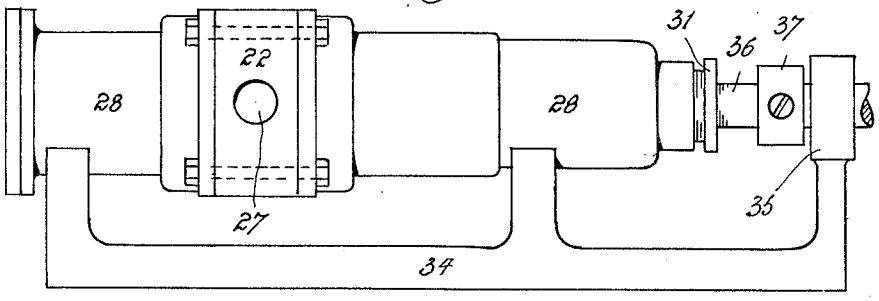
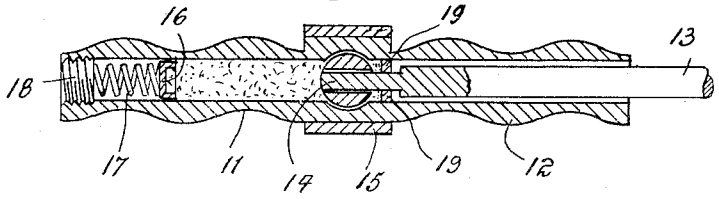



Fig. 6




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# UNITED STATES PATENT OFFICE

2,329,386

## ROTARY PUMP

Robert Brennan, Auckland, New Zealand

Application February 7, 1942, Serial No. 429,941
In New Zealand November 8, 1940

1 Claim. (Cl. 103—117)

This invention relates to a pump construction of known type in which the pumping elements comprise the combination of a cylindrical stator member and a rotor member arranged axially within the stator, shaped with co-operating surfaces of helical formation, and one of which surfaces is made of a flexible nature. The rotation of the rotor member within the stator, while such rotor member is restrained from longitudinal movement, causes a displacement of fluid from one end of the stator to the other and performs the pumping action.

The rotor is driven by axial longitudinal connection through universal or flexible joints, with a driving shaft to which rotation is imparted. In the operations of the rotor therefore, a longitudinal re-action upon the rotor takes place and this re-action tends to displace the rotor axially within the stator. Consequently in the general construction of the pump, means must be provided to counteract this tendency to displacement which is in effect a thrust upon the rotor driving connections and upon their bearings. In the restricted space available and also because of the difficulty of lubrication, this thrust load is a very undesirable factor in respect of this class of pump. Any means for relieving the joints from this load would greatly increase the efficiency of the pump and help to eliminate excessive wear.

The present invention has been devised with the object of providing for the balancing of the end thrust upon the rotor and its associated parts and also for the doubling of the capacity of the pump as concerned with the diameter of the rotor.

The invention comprises, therefore, a construction of pump of this class in which the stator and rotor members are duplicated in longitudinal end to end association, and in which each unit combination of rotor and stator has its helical formation formed or arranged in opposition to that of the other. Thus one unit combination is made with a left hand helix and the other with a right hand helix. This duplicated arrangement is combined with a cylinder construction under which the adjacent and inner ends of the two units open from an inlet chamber, and the remote and outer ends, open to a common outlet, to provide for each unit acting to convey or pump the fluid from the inlet to the outlet. The respective relative positions of the inlet and outlet may, however, be reversed.

The invention also comprises means for the conveyance of rotation to the said duplicated rotor.

In fully describing the invention, reference will be made to the accompanying sheet of drawings, in which—

Figure 1 is a sectional plan of the complete pump, the rotor, however, being shown in plan.

Figures 2, 3 and 4 are cross sections upon the respective lines 2—2, 3—3 and 4—4 of Figure 1, in all cases looking to the right of the said lines.

Figure 5 is a side elevation of the complete pump.

Figure 6 is a longitudinal section on an enlarged scale, of the double or two ended rotor and showing means for the connection of the driving spindle thereto.

In giving effect to the invention a compound or duplicated rotor member is provided having a medial portion 10 and ends 11 and 12 each formed of the helical nature common to this known type of rotary pump, but so made that the helix of one is of right hand nature while that of the other end is of left hand, or opposed nature. In the form shown, this rotor member is made (as shown in Figure 6) hollow throughout its length and its driving spindle 13 is caused to pass in through one end of the hollow and has its end connected with the medial portion 10 by means of a suitable universal joint 14, so formed as to ensure of the joint being kept liquid tight as by surrounding the joint by the sleeve 15. Into the other end of the hollow a plunger 16 is fitted and outside this a spring 17 is arranged in compression between the plunger and a plug 18 screwed into the hollow end. The space within the plunger is packed with a suitable lubricant and such lubricant is forced by the plunger and spring, in around the universal joint 14 to keep it lubricated. A washer 19 of leather or other suitable material is arranged around the spindle 13 upon the other side of the joint 14 to keep the lubricant from passing out through the other end of the hollow.

This duplicate rotor member has each helical end enclosed within a stator member 20—21 respectively. Such stator is of the usual flexible nature, generally being formed of rubber, characteristic of these pumps and the stator for each end has its helical groove made in correspondence with the rotor end associated therewith to effect the pumping action by which liquid may be passed, or forced, through the stator from one end to the other. As the two ends and their stators are formed with opposing helices the course of the liquid in each instance is in an op-

posite direction to that of the other. Consequently by mounting the rotor and its stators within a suitable arrangement of chambers, provision may be made for liquid led into the space between the two stators being pumped out through both stators and delivered through their outer ends, or reversely, liquid may be pumped from the outer ends and delivered at their inner ends.

It will be apparent that in such an arrangement of rotor and stators, the two ends being opposition one to the other in respect of the longitudinal thrust on the members in the pumping, there is an absence of any resultant lengthwise thrust on the rotor as a whole. Consequently there is also an absence of thrust upon the driving spindle and its bearings. The power required to drive the rotor is therefore lessened in relation to the pump's capacity, while with a given diameter of rotor, the pump's capacity is doubled as compared with that of a pump having the usual single rotor.

The construction and arrangement of cylinder and chambers for the mounting of the said rotor and stators, as shown in the drawing, comprise a block **22** formed with an open ended inlet chamber **23** in its centre and into which chamber an inlet port **24** opens from one side of the block, and also formed with an outlet chamber **25** divided from the inlet chamber by a partition member **26**, and which chamber **25** also opens to both ends of the block and has an outlet port **27** leading out through the block side opposite that on which the inlet port is situated. On each end of the block a cylinder **28** is fitted to extend outward, such cylinder having a bore **29** which coincides with and opens to the end of the inlet chamber **23** and also being formed with a separate passage **30** in its wall extending longitudinally throughout the same length as that of the bore and which passage at its inner end coincides with and opens to the corresponding end of the outlet chamber **25**. Each cylinder at its outer end extends beyond the outer ends of the bore **29** and passage **30** to provide a connection between such ends. One cylinder has its outer end closed while the other cylinder is formed at its outer end with a gland bearing **31** through which the driving spindle **13** of the rotor is designed to be passed.

The compound or duplicated rotor is disposed to extend across the inlet chamber **23** of the block **21** so that its medial portion **10** is positioned in such chamber and its two helical ends **11** and **12** extend into the respective bores **29** of the two cylinders. Into the inner end of each cylinder bore the corresponding stator member **20—21** is fitted to surround its associated portion of the rotor. Such stator is secured in position by forming it with a flange **32** on its inner end which engages with a shoulder **33** surrounding the bore end and which flange is then clamped by the fastening of the cylinder end to the block **22**, to thereby effect a composite and firm assembly of the whole.

This assembly is supported upon any suitable base plate **34** and such base plate may have combined therewith at one end a standard bearing **35** to receive the end of the power shaft **36** which also passes in through the gland **31**. This power shaft is connected by any approved form of universal joint **37** with the outer end of the driving spindle **13** to effect the driving of the pump rotor in the manner characteristic of pumps of this nature.

The rotation of the rotor in the required direction will cause liquid to be drawn in through the inlet port **24** into the chamber **23**, and then forced out by both rotor ends to the outer ends of the respective cylinders and then to pass through the passages **30** to the outlet chamber **25** and out through the port **27**.

In order to provide for the continuous lubrication of the rotor and stators by the passage of liquid through them should the inlet supply fail for any cause, provision is made for the re-circulation of the liquid remaining in the pump in such a circumstance. For this purpose a hole **38** is formed in the partition member **26** dividing the inlet chamber **23** from the outlet chamber **25**. The operations of the rotor will thus cause the liquid to be circulated from the inlet chamber through the cylinders and back from the outlet chamber again to the inlet chamber.

Other ways of connecting the rotor with the power shaft through the driving spindle **13** may be employed without departing from the spirit of the invention. The manner of connection shown in the drawing by which the driving spindle is connected to the rotor at about midway in its length is preferred as providing for the rotative power being distributed evenly to both rotor ends.

I claim:

A rotary pump comprising a pair of cylindrical stator members each having an internal helical surface, a rotor member extending axially through the stator members, said motor having a helical surface at each end thereof co-operating with and corresponding to the helical surfaces of the stator members and being hollow throughout its length, an inlet for one open end of each stator, an outlet for the other open end of each stator, a chamber communicating with the outer ends of the two stators, a drive shaft, a universal joint in the hollow portion of the rotor member at the approximate intermediate point of the length thereof connecting said shaft to the rotor member to rotate the latter, and means in the hollow portion of the rotor to lubricate the universal joint.

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