

March 20, 1951

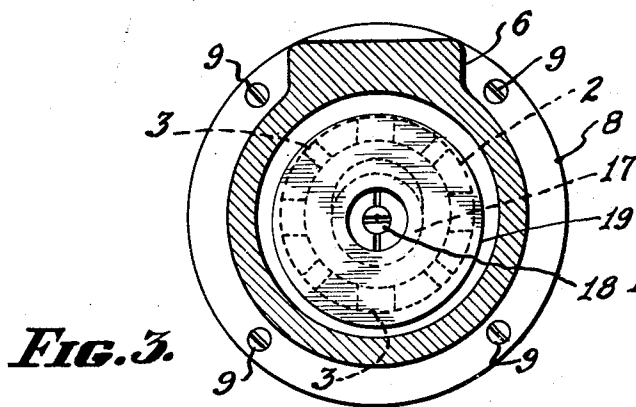
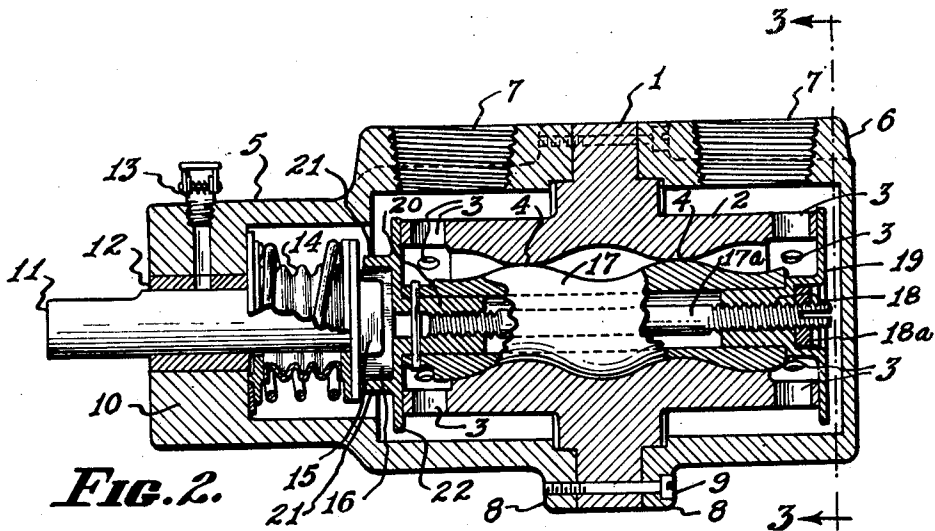
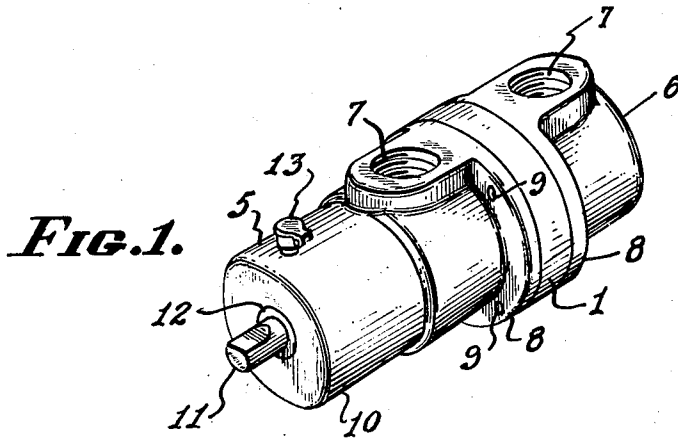
F. C. BYRAM

2,545,604

PUMP

Filed Feb. 1, 1946

2 Sheets-Sheet 1



INVENTOR.
FREDERICK CAMERON BYRAM.
BY *Allen & Allen*
ATTORNEYS.

March 20, 1951

F. C. BYRAM

2,545,604

PUMP

Filed Feb. 1, 1946

2 Sheets-Sheet 2

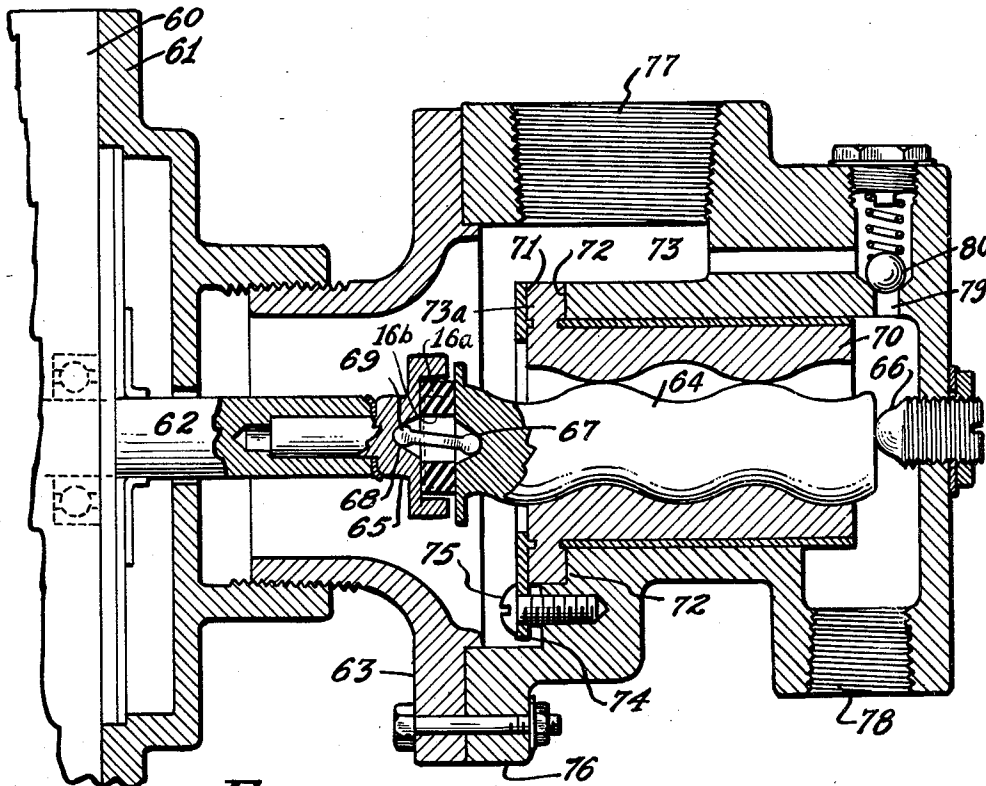


FIG. 5.

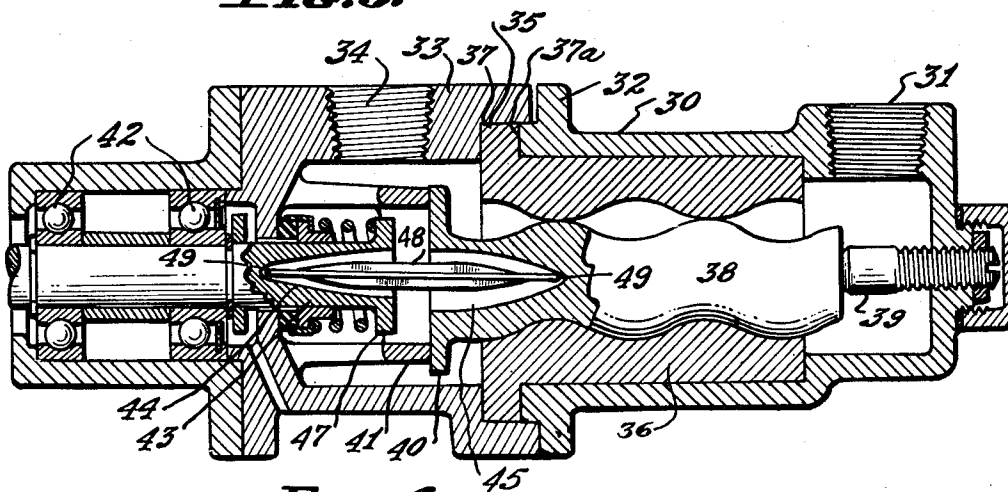


FIG. 4.

INVENTOR.
FREDERICK CAMERON BYRAM.
BY *Allen & Allen*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,545,604

PUMP

Frederick Cameron Byram, Springfield, Ohio, assignor to Robbins & Myers, Inc., Springfield, Ohio, a corporation of Ohio

Application February 1, 1946, Serial No. 644,812

13 Claims. (Cl. 103—117)

1

My invention relates to pumps operating on the principle of the U. S. Patent to R. Moineau No. 1,892,217. In pumps of this character in their simplest form there is an hollow external element and within it an internal element, both of them having developed thereon helical contours. The helical contour within the outer member (hereinafter called a stator), in the simplest form is in the form of two threads, and on the inner member or rotor there is a single thread. In the commonest form a cross section of the stator presents a straight sided oval hole at any point. A cross section of the rotor at any point presents a circular outline which corresponds to the ends of the oval. The pitch of the thread in the rotor is half that of the pitch of the threads in the stator.

In a pump of this character where the stator is held against movement, and the rotor caused to revolve, it is to be noted that the center axis of the rotor must move in an orbital path. The type of pump according to Moineau, which has been used commercially in this country has been driven by means of a universally connected rigid link. Thus, the driving shaft is connected by a universal joint to this link and the link is connected by another universal joint to the end of the rotor. This construction does not have the compactness and mechanical efficiency that is most desirable and the object of my invention, among other things, is to provide an improved driving arrangement for the rotor of such a pump.

Another object is to provide for the thrust on the rotor structure and the stator structure in such a pump within the pump casing itself. Another object is to cut down the size of the pump casing by means of a stator construction in which the stator is locked into the casing and forms part thereof, the stator ends being the thrust bearing surfaces for the rotor construction. In such a case, the stator itself may be cut with orifices for exit and entrance into the space between the rotor and stator.

I have illustrated in the appended drawings, a preferred but exemplary form of my invention, and will describe this in detail in order to explain the nature of my invention. In the claims appended to the specification, to which reference is hereby made, will be found a statement of the novel features which are considered to be my invention of which the said disclosure is but an example.

In the drawings:

Figure 1 is a perspective view of a complete pump according to my invention.

2

Figure 2 is a central longitudinal section thereof.

Figure 3 is a section on the line 3—3 of Figure 2.

Figure 4 is a longitudinal section showing a modification in the structure of my pump.

Figure 5 is a like section showing a second modification.

The stator structure of the pump in the preferred form is made from laminated phenol-formaldehyde resin. It has a median circumferential flange 1, and an elongated hollow cylindrical body 2. The ends of this cylindrical body have a series of holes 3 therein for exit of fluid and entrance of fluid with reference to the interior of the hollow body. The interior of the body is formed with a pair of helical threads 4, 4 extending throughout. If the holes 3 are omitted, then the thrust plates for the rotor to be described below may be provided with influx and efflux orifices.

The outer casing of the pump is formed of two heads 5 and 6 which are bolted together through the flange 1 of the stator. In each head there is formed a threaded opening 7 for entrance and exit of fluid to the interior. Each head has a flange 8, which is seated against the stator flange, the bolts or screws 9 passing through matching holes serving to grip the stator flange fast between the two head flanges.

In the form of pump illustrated the head 5 is different from the head 6. This is not necessary as both heads could be the same, but since the driving shaft must be provided with a gland of some sort to seal its entrance and it is only necessary to reverse the direction of drive for the rotor, to reverse the direction of operation of the pump, it is considered simpler to have but one entrance head 5. This head has developed thereon a cylindrical body 10, with a journal for the drive shaft 11 therein. I have shown a bushing 12 serving as a bearing for the drive shaft at this point. An oil hole and cap 13 provides for lubrication of this bushing. A Sylphon bellow seal 14 is mounted on the shaft and the end of the shaft has a head 15 which is slotted for the reception of a sliding block 16 which may be of laminated phenolic condensation product material, if desired.

Where the stator has a double thread, as by developing an oval shaped hole in a helical curve lengthwise thereof, the rotor 17 will have a single thread of one half the pitch length of either stator thread. As already noted, where variations from this standard are followed, the efficiency of the device is sacrificed.

As a convenient way of mounting the rotor, it

3

is cored out and supported by a spindle 17a. A thimble 18 is threaded on one end of this spindle, said thimble fitting the core of the rotor. A flange on this thimble at 19 engages the end of the stator. This flange, which is in effect a thrust plate on the end of the rotor must move orbitally as well as revolve. By preference the thimble is formed of a hardened metal and is held in place by a nut 18a on the end of the spindle. The drive end of the rotor is equipped in like manner with a head 20, which has a transverse slot therein as at 21. The head has a flange 22, also, which bears against the end of the stator. The flange 19 and the flange 22 constitute thrust bearings for the rotor.

Instead of making the stator of one kind of material as a unit as indicated, it can be built up of different materials secured together. For example, the stator shown could have a bonded rubber core, and a metallic exterior and end pieces for the thrust surfaces.

The sliding block 16 held loosely in the slot of the driving shaft head, also engages loosely in the slot 21 of the rotor head, when the slot in the rotor head is at right angles to the slot in the driving shaft head. As so arranged a universal but purely torsional drive is supplied, and there being no requirement on the driving shaft for carrying the lengthwise thrust on the rotor, this drive is all that is needed to permit the rotor while it revolves at the same time, to rotate about on its axis, on an orbit, the clearance of the block from the slots in which it is placed aiding in permitting this full movement.

There are various possible modifications of the particular structure described.

Instead of using the stator flange as part of the casing of the pump it can be employed to secure the stator in other ways. Thus in Figure 4 there is shown a pump having a casing 30 with an outlet orifice 31, which casing is flanged as at 32 and secured thereby to the head 33, which has the entrance orifice 34 therein. The flange 35 at one end of the stator 36 is engaged between the casing 30 and a shoulder 37 on the head 33. Also the stator engages a shoulder at 37a on the main casing.

In this instance I have shown a different mode of supplying a pure torque drive to and taking up the thrust of the rotor. Thus the rotor 38 has one end bearing slidably on the adjustable abutment post 39. The rotor has a flange 40 which engages as a bearing on the margin of an annulus 41 developed in the head 33. The thrust on the rotor is thus taken up in the casing but not by means of bearing on the ends of the stator. This leaves the stator open at both ends for influx and efflux of fluid during operation of the pump.

In this case I have shown a ball bearing 42 instead of a sleeve or bushing type of bearing for the rotor shaft at one end. As a drive the inner end 43 of the drive shaft, and the flanged end of the rotor are provided with elliptical recesses 44 and 45 respectively. The margin of the annulus 41 slidably engages the flanged end of the rotor. A drive link 48 is provided which is ribbed intermediate its ends and has its ends narrowed to rounded edge blades 49, the ends of which are curved longitudinally thereof. The inner ends of the two recesses are also brought to a flat sided conformation so as to take a torque engagement on the narrowed ends or blades of the link. This drive will be a substitute for the type of drive illustrated in the other figures

4

of the drawings, which is known as an Oldham drive. It is immaterial what kind of a single plane torque drive is substituted for the ones shown, and, of course, certain features of my invention are well adapted for use in pumps which have the normal universal joint connected drive link for the rotor.

In Figure 5 is shown a pump for direct attachment to a drive motor casing. In this instance the drive motor is indicated at 60, and its flanged housing portion at 61. The motor drive shaft 62 (suitably sealed) projects into a space surrounded by a flanged ring 63 that screws onto the motor housing. The pump rotor 64, in this instance takes its thrust in one direction on the motor shaft. The single plane universal drive element 65, which is of the same general construction as that shown in Figure 2, couples the end of the rotor to the drive shaft. In this instance the block 16a, corresponding to the block 16 of Figure 2, is apertured as at 16b, for the passage of the dumb bell shaped piece 69, which transmits axial thrust between the drive shaft 62 and the rotor 64. The other end of the rotor bears against a round ended plug 66 in the casing. Instead of this rounded plug a thrust structure such as is shown in the universal drive element 65 may be used. Thus the rotor shaft may be hollowed out as indicated at 67, at both ends, and the drive shaft coupling and the plug be hollowed out as at 68 and a dumb bell shaped piece 69 be used as a thrust member at each end of the rotor.

In this instance the stator flange is used in a different way to provide an immovable mounting for the stator. The stator 70 has a flange 71 which seats on a shoulder 72 in the cylindrical portion 73 of the pump casing. A ring 73a having ears 74 to receive mounting bolts 75 is bolted in place over the end of the stator flange, holding it firmly on the said seat.

The balance of the pump casing includes a flanged portion 76 which is bolted to the ring 63, in which portion is the entrance opening 77 of the pump. The exit opening 78 of the pump is in the closed end of the casing. In this case also I have shown a bypass 79 with a spring controlled ball check 80 to maintain the pressure of the exit of fluids at a controlled value.

From these modifications the man skilled in the art will see various other modes of utilizing the principles of my novel structure, and it is not intended by the inclusion of the forms shown to exclude others or exclude combinations containing some but not all of the structures differently arranged.

It is intended that the claims that follow express the novelty inherent in the exemplary structures, together with the equivalents thereof.

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

1. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads and so related that to revolve the rotor within the stator enforces an orbital path upon the rotor, a drive for the rotor including a torsion producing element arranged to permit orbital movement of said rotor, means for holding the stator against movement, and an independent thrust member associated with said torsion producing element for absorbing the axial thrust of said rotor, whereby said torsion producing element is freed of axial thrust.
2. The combination of claim 1 in which means

is provided for sealing one end of the stator from the other.

3. The combination of claim 1 in which the means for holding the stator comprises a flange on the stator which acts as a barrier between the ends of the stator.

4. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads, the stator having one more thread than the rotor, so that to revolve the rotor within the stator enforces an orbital path upon the rotor, bearing plates on both ends of the rotor slidably engaging the ends of the stator, and means for holding the stator against movement.

5. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads, the stator having one more thread than the rotor, so that to revolve the rotor within the stator enforces an orbital path upon the rotor, thrust means on the rotor arranged to apply thrust in both directions to the ends of the stator, and means for holding the stator against movement.

6. The combination of claim 5 in which the stator has orifices in its sides adjacent its ends for influx and efflux of fluid to be pumped.

7. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads and so related that to revolve the rotor within the stator enforces an orbital path upon the rotor, bearing plates on both ends of the rotor slidably engaging the ends of the stator; and means for holding the stator against movement, said pump having casing means embracing the stator, said casing means having parts for each end of the stator, a drive shaft journaled in said casing, and a connection between the drive shaft and the rotor having a sliding key between the two parts, thus permitting orbital movement of the rotor while being rotated.

8. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having interengaging helical threads enforcing an orbital path upon the rotor when revolved within the stator, a circumferential flange on the stator intermediate the ends thereof and a casing for the pump comprising two hollow heads embracing the stator, said heads engaging the said stator flange and fixedly held in such engagement, whereby the stator is held against endwise and rotary movement, a rotor spindle and means on the rotor spindle to slidably engage each end of the stator.

9. The combination of claim 1 in which the pump is provided with a casing and the independent thrust member for the rotor is applied to the casing.

10. The combination of claim 1 in which said drive includes a drive shaft, and in which the independent thrust member for the rotor is applied for thrust in one direction at least to the drive shaft for said rotor but independent of the torsion producing element thereof.

11. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads and so re-

lated that to revolve the rotor within the stator enforces an orbital path upon the rotor, a drive for the rotor including a torsion producing element arranged to permit orbital movement of said rotor, a circumferential flange on the stator and a casing for the pump comprising two hollow members one of which at least embraces the stator, said members engaging the said flange and fixedly held in such engagement for holding the stator against movement, and an independent thrust member associated with said torsion producing element for absorbing the axial thrust of said rotor, whereby said torsion producing element is freed of axial thrust.

12. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads and so related that to revolve the rotor within the stator enforces an orbital path upon the rotor, a drive for the rotor including a torsion producing element arranged to permit orbital movement of said rotor, a circumferential flange on the stator intermediate the ends thereof and a casing for the pump comprising two hollow members embracing the stator, said members engaging the said flange and fixedly held in such engagement for holding the stator against movement, and an independent thrust member associated with said torsion producing element for absorbing the axial thrust of said rotor, whereby said torsion producing element is freed of axial thrust.

13. In a pump having a hollow cylindrical stator and a rotor therein, the respective parts having cooperating helical threads and so related that to revolve the rotor within the stator enforces an orbital path upon the rotor, a drive for the rotor including a torsion producing element arranged to permit orbital movement of said rotor, a circumferential flange on the stator and a casing for the pump, said casing having means for engaging said flange and enclosing said flange at both sides so as to form a barrier between the two ends of the stator on the outside thereof and serving to hold the stator against endwise and rotary movement, and an independent thrust member associated with said torsion producing element for absorbing the axial thrust of said rotor, whereby said torsion producing element is free of axial thrust.

FREDERICK CAMERON BYRAM.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,892,217	Moineau	Dec. 27, 1932
2,290,137	Aldridge	July 14, 1942

FOREIGN PATENTS

Number	Country	Date
113,009	Australia	Apr. 28, 1941
360,335	Great Britain	Nov. 5, 1931
446,291	Great Britain	Apr. 27, 1936
534,682	Germany	Sept. 10, 1931
780,791	France	Feb. 11, 1935