HEXICAL GEAR PUMP WITH BACKED-UP NONRIGID CASING

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Attorneys.
This invention relates to a helical gear pump with a backed-up non-rigid casing.

In a co-pending application in the names of Frederick Cameron Byram and George H. Zimmer, Jr., Serial No. 150,079, filed April 29, 1960, now Patent No. 2,612,945, there is disclosed a helical gear pump with a non-rigid casing. The pump disclosed therein is very useful for many purposes but is not entirely satisfactory in pumping against pressure for the reason that the non-rigid casing tends to bulge outwardly and interfere with the operation of the pump.

It is an object of the present invention to retain the advantages of the pump disclosed in said co-pending case in situations where the pump is required to pump against pressure. It is another object of the present invention to provide a pump similar to that disclosed in said co-pending case but wherein said non-rigid casing becomes rigid under back pressure and wherein the stator element proper is still resiliently connected to the non-rigid casing member.

It is yet another object of the invention to provide a pump as outlined combined in a single unit with a driving motor therefor and to provide a casing structure such that condensation on the pump casing walls resulting from contact of the air with the casing walls which are being cooled by the water being pumped cannot injure the bearing of the shaft or the winding of the motor.

It is yet another object of the invention to provide modification in the arrangement of fittings for improved performance.

These and other objects of the invention which I shall set forth in more detail hereafter or which will be apparent to one skilled in this art upon reading these specifications I accomplish by that certain construction and arrangement of parts of which I shall now describe certain exemplary embodiments.

Reference is made to the drawings forming a part hereof and in which:

Figure 1 is a plan view of one form of pump according to the invention.

Figure 2 is a cross sectional view of the same taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged fragmentary cross sectional view taken on the line 3—3 of Figure 2.

Figure 4 is a plan view of another modification.

Figure 5 is a cross sectional view of the same taken on the line 5—5 of Figure 4, and

Figure 6 is a fragmentary cross sectional view similar to Figure 2 showing a modification in the stator member.

Briefly, in the practice of my invention I use a pump operating on the general principles disclosed in said co-pending application, except that I provide a rigid casing member for the non-rigid casing element to conform substantially on its inside to the external configuration of the non-rigid casing element so that under a pressure head the non-rigid casing member is limited as to its expansion. I provide a resilient connection between the non-rigid casing portion and the stator portion proper so that the latter may orbit in a cylindrical path as the rotor rotates on its true axis.

In one embodiment I provide an integral motor pump unit in which the pump casing head is separated from the motor head providing a ventilated space therebetween so that condensate of moisture on the pump casing wall can flow down and out of the casing without damaging the bearing of the motor windings.

Referring now in more detail to the drawings and referring first to that embodiment disclosed in Figures 1 to 3 inclusive, there is shown a motor pump unit comprising a motor enclosed within a housing indicated generally at 10 and a pump enclosed within a housing indicated generally at 11. The motor and pump housing is made in two portions which are secured together by the bolts 12. The motor proper does not form a feature of the present invention and will therefore not be described in detail. The motor housing 10 has a spider-like wall 11a having perforations 12a for ventilation purposes. Centrally thereof is provided a boss 13 within which there is mounted a ball bearing 14 for the motor shaft 15.

Toward the left from the spider 11a is a ventilation space indicated generally at 16 and the motor casing is closed at the pump end by a head 17 having a more or less frusto conical central portion 18 which is provided with a central boss 19 and a boss 20 which is cored out to provide an exhaust port 21. The boss 19 is provided with a shaft aperture 22 and a recess 23 for a seal member 24. The seal member itself forms no part of the present invention and will not be described in detail.

The pump casing 11 is provided with the annular flange 25 which is bolted to the head 17 by the bolts 12 and is provided with an intake port 26.

The pump rotor indicated at 27 is secured to the motor shaft 15 and rotates on its true axis. The pump stator member comprises a cylindrical portion 28 having internal helical threads to engage with the external helical threads on the rotor 27. As is well known in pumps of this
type, the stator member has one thread more than the rotor member so that in operation with the rotor member rotating on its true axis the stator portion 28 will be forced to move in a cylindrical path.

The stator member is provided with a non-rigid casing portion 29 which is similar to the funnel-shaped non-rigid casing member disclosed in said copending application. According to said copending application the space between the portions 28 and 29 constitutes the discharge casing of the pump. As pointed out hereinabove when the pump has to operate against pressure the portion 29 would tend to bulge and interfere with the proper operation of the pump. According to the present invention therefore the portion 29 is enclosed within a rigid casing referred to hereinabove at 1 having an internal configuration conforming substantially to the external configuration of the portion 29 so that the portion 29 can bulge out only slightly, if at all and if it does bulge out, then it becomes rigid against the casing portion 11. Since the casing portion 29 becomes rigid under pressure, provision must be made so that the portion 28 can move in a cylindrical orbit with respect to the portion 29, and for this reason it will be observed that the internal helical threads of the portion 28 are relieved over a distance indicated at X from that end of the stator where the portions 28 and 29 join.

I have found that a certain amount of relief is absolutely necessary in order to permit the portion 28 to move as required with respect to the portion 29, the entire stator, including the portions 28 and 29, being molded from a single piece of resilient material such as rubber or the like. I have found that the minimum length of the dimension X should be 17 per cent of the length of the portion 28. Beyond that the effect is to cut down the working length of the pumping element and there is no reason to go beyond a 30 per cent relief. Between the members 28 and 29 there is a steplike configuration indicated at 30 which I have found to be particularly suitable. However the configuration does not need to be as shown in 30 in Figure 2 but may be as shown at 30b in Figure 6. According to the motor casing portion 10 there are a series of cored out openings 31 communicating with the chamber 15 so that air circulation may take place through the openings 31, the chamber 15, the openings 12 and the inside of the motor casing. The motor of course gives off heat and the pump generally is pumping cold water. There is therefore always a tendency for moisture to condense on the pump casing head. In the present instance the condensation would take place on the right hand side of the wall 17 and the conical portion 18 and around the boss 20. Because of the fact that ventilation is provided the degree of condensation is minimized and any condensation which does form simply runs down the walls 18 and 17 and can drip out through one of the cored openings 31. Any condensation dripping onto the shaft 15 is thrown off by means of a slinger ring 32 secured to the shaft and rotating therewith. In this manner condensation cannot reach the bearings 14 and of course cannot have access to the motor windings.

It will also be observed that the ports 21 and 26 are upwardly directed whereas in the said copending case the ports were laterally directed. I have found that there is an advantage in extending the ports upwardly rather than sidewise in that the pumping elements remain submerged at all times and maintain in the pump a body of liquid being pumped to seal the pumping surfaces. This is in the nature of a self-priming or permanent priming arrangement for the pump. It will also be observed that a fitting 33 for a line 34 leading to a pressure switch 35 is provided in the upper portion of the casing as best seen in Figure 1. In the pump shown in the Byram Patent No. 2,513,764 the pressure switch fitting was in the lower part of the casing and had a tendency to become fouled by sediment. This objection is avoided according to the present construction.

In Figures 4 and 5 I have shown an inexpensive pump embodying some of the principles of the present invention wherein the pump is separate from a motor. It will be observed that the rotor 27 and stator 28, 29 are identical with the structure described above, as is the casing portion 11. In this embodiment however a pump head member is provided at 40 having an exhaust port 41 and having a shaft aperture 42 with a recess 43 for a seal 44. The casing portion 11 is bolted to the head 40 by means of bolts 45. The entire pump casing, including the portions 11 and 40 are bolted to a bearing bracket member indicated generally at 46 by means of bolts 47. The bracket 46 is provided with a boss 48 having the bearing 49 for the pump shaft 50. Since in this case the motor is separate from the pump, there is no reason for concern as to the problem of condensation. However, the pump of Figures 4 and 5 embodies the same principles discussed heretofore in connection with the configuration and operation of the stator member. In both the embodiment of Figures 1 to 3 and the embodiment of Figures 4 and 5 the portion 29 of the stator has an annular flange 50 which has a portion seating in an annular recess 51 in the head portion 17 of the Figures 1 to 3 and 40 of Figures 4 and 5. The portion 29 is held in position by the flange 25 of the casing member 11.

It will be understood that numerous modifications may be made without departing from the fundamental spirit of the invention and that I therefore do not intend to limit myself in any manner other than that set forth in the claims which follow.

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

1. A stator for a helical gear pump, comprising a cylindrical member having internal helical grooves and a substantially cylindrical casing member surrounding said cylindrical member and connected thereto at one end with an annular space therebetween, said internal helical grooves being relieved at said end for a distance from said end to permit orbital movement of said cylindrical member with respect to said casing member, said stator being of resilient material.

2. A stator for a helical gear pump, comprising a cylindrical member having internal helical grooves and a substantially cylindrical casing member surrounding said cylindrical member and connected thereto at one end with an annular space therebetween, said internal helical grooves being relieved at said end for a distance from said end which is at least 17 percent of the length of said cylindrical member, said stator being of resilient material.

3. A stator for a helical gear pump, comprising
a cylindrical member having internal helical grooves and a substantially cylindrical casing member surrounding said cylindrical member and connected thereto at one end with an annular space therebetween, said internal helical grooves being relieved at said end for a distance from said end which is from 17 percent to about 30 percent of the length of said cylindrical member, said stator being of resilient material.

4. A helical gear pump comprising a stator constituted of a cylindrical member having internal helical grooves and a substantially cylindrical casing member surrounding said cylindrical member, connected thereto at one end with an annular space therebetween, and open at the other end, said internal helical grooves being relieved at said end for a distance from said end to permit orbital movement of said cylindrical member with respect to said casing member, said stator being of resilient material, a rigid casing member having an inlet port and having an internal configuration conforming substantially to the external configuration of said cylindrical casing member, a casing head member for closing the open end of said cylindrical casing member and rigid casing member, said casing head member having an exhaust port, a shaft aperture and sealing means, a shaft extending through said aperture and sealing means and having secured thereto a rotor having external helical grooves in operative relationship to the internal helical grooves of said stator.

5. A pump according to claim 4, in which said internal helical grooves are relieved at said end for a distance from said end which is at least 17 percent of the length of said cylindrical member.

6. A pump according to claim 4, in which said internal helical grooves are relieved at said end for a distance from said end which is from 17 percent to about 30 percent of the length of said cylindrical member.

7. A pump according to claim 4, in which said inlet and exhaust ports are disposed above the engaging surfaces of said rotor and stator, and are upwardly directed.

8. A pump according to claim 4, in which an automatic pressure switch is provided, and in which a fitting for connection to said pressure switch is located in the upper portion of said casing head member.

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