

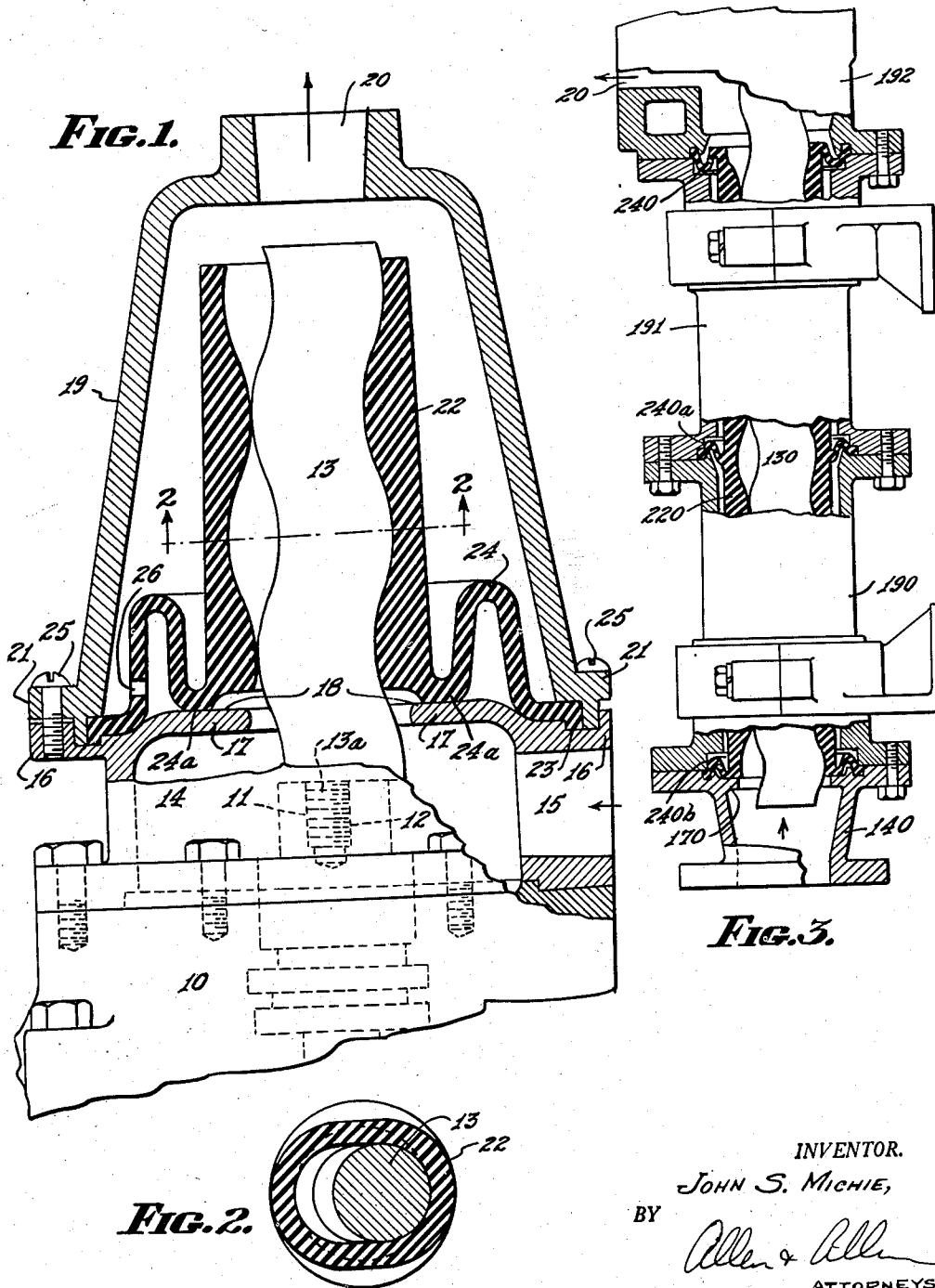
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HELICAL GEAR PUMP WITH BELLOWS STATOR

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HELICAL GEAR PUMP WITH BELLOWS STATOR

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This invention relates to a helical gear pump wherein the pump is basically of the type disclosed by R. J. L. Moineau in Patent No. 1,892,217 of December 27, 1932. This pump has a stator member having internal helical grooves or threads and a rotor member with external helical grooves or threads, the stator member having one thread more than the rotor member.

In the Byram Patent No. 2,532,145 of November 28, 1950, there is disclosed a pump of the general type outlined above, wherein the stator is an elongated generally cylindrical member of rubber or the like having a flange by which it is secured to the casing. In the operation of the pump, the stator orbits in a conical path. To permit such conical orbital movement a deep annular groove is provided adjacent the flange.

In the Byram and Zimmer Patent, No. 2,612,845 of October 7, 1952, there is shown another form of resilient stator member which wobbles during the operation of the pump but in this improvement the fastening flange for the stator extends from the outboard end of the stator and constitutes a casing for the stator.

Another modification of this design is disclosed in the Zimmer Patent No. 2,691,347 of October 12, 1954.

In a pump of a type outlined above wherein the stator is of rubber or other resilient material and is flanged at its inboard end and the rotor is so mounted that in the operation of the pump the stator is required to orbit, some provision must be made to permit such orbital movement of the stator member and its flange. When discharge pressure builds up, it has been found that the rubber stators, in following the eccentricity of the rotor, have moved by a flowing of the rubber rather than by a flexing and as a result of this considerable forces are found to act on the pump shafts normal to their axis and as a result there has been a breakage of the pump shaft.

It is therefore an object of the present invention to provide for a stator construction such that greater flexibility is permitted whereby the stator follows the eccentricity of the rotor by flexing rather than by flowing.

In this connection, it is yet another object of the invention to provide thrust means to insure the maintenance of the bellows construction which permits flexing of the stator flange.

These and other objects of the invention which will be pointed out in greater detail hereinafter or which will be apparent to one skilled in the art upon reading these specifications, I accomplish by that certain construction and arrangement of parts of which I shall now disclose an exemplary embodiment.

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

Figure 1 is a fragmentary view with parts in cross-section of a motor driven pump according to the invention.

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

Figure 3 is an elevational view with parts in cross-section showing a modification.

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Briefly, in the practice of the invention I provide the rubber stator member with a sinuous bellows-like flange to permit free movement of the stator with respect to its fastening flange and in order to maintain the bellows condition, I provide a thrust bearing as will be described in more detail hereinafter.

Referring now to the drawings, a motor is indicated generally at 10 and the motor has an extending shaft 11, which shaft is drilled and tapped as at 12 for the mounting of the pump rotor 13. The rotor is provided with an axial threaded extension 13a by means of which it is assembled to the motor shaft 11. It will be understood that the motor shaft, where it issues from the motor housing, is suitably sealed.

Secured to the motor housing is a casing portion 14 having an inlet port 15. This casing portion surrounds the motor shaft 11 and is provided with the annular fastening flange 16 and the annular web 17 providing an annular bearing face 18.

The pump casing proper is indicated at 19 and it is provided with an outlet port 20 and an annular flange 21.

The stator proper is indicated at 22 and it is provided with the annular flange 23 having the portion which is sinuous, or U-shaped in cross-section at 24. In assembly, the casing portion 19 is secured to the casing portion 14 by screws 25 passing through the flange 21 and threaded into the flange 16. The flange 23 of the stator is clamped between the flanges 16 and 21 in this assembly.

When the pump is operating, fluid is drawn in through the port 15 into the casing portion 14 and is thence pumped upwardly between the rotor and stator and out through the port 20. The interior of the casing portion 19 outside the stator 22 is at discharge pressure and the normal tendency would be for the stator 22 to be pushed by this pressure downwardly in Figure 1. To prevent this action, I have provided the bearing surface 18 against which the portion 24a of the stator may bear.

Furthermore, in order to prevent collapse of the portion 24 as a result of its being subjected to the discharge pressure on the outside, I provide a perforation or port 26 so that the inside of the U-shaped portion 24 will be at the same pressure as the outside and there will, therefore, be no tendency to collapse the U-shaped portion 24. Additionally, the fluid entering inside the U-shaped portion 24 through the aperture 26 serves to lubricate the bearing face 18.

It will be understood that the rotor and stator may be slightly tapered as disclosed in the Byram Patent 2,532,145 mentioned above to obtain advantages in connection with reduced starting loads and better sealing action under pressure. It will be understood that the taper is so small that it cannot be clearly illustrated in the Figure and the presence or absence of taper does not affect the details of the present invention.

From the foregoing description, it will be seen that the bellows configuration or U-shaped cross-section 24 permits the stator 22 to orbit in following the eccentricity of the rotor 13, although the flange 23 is securely clamped between the casing portions 14 and 19 and that there will be a true flexing of the portion 24 rather than a flowing action. Thus, the lateral thrust against the rotor and the motor shaft is very greatly reduced and the likelihood of shaft breakage is substantially eliminated.

It will also be seen that the provision of the thrust bearing surface 18 insures that the stator will not be forced along the rotor to the point where the bellows configuration would be flattened and that the provision of the port 26 equalizes the pressure inside and outside the bellows configuration will prevent collapse thereof while at the same time providing for lubrication of the bearing face 18.

Where multiple staging is required, to pump against

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high pressures, greater torque must be absorbed and more than one flange is required. In Figure 3 I have illustrated a modification suitable for such types of industrial pumps. In this embodiment the stator 220 has three of the sinuous or U-shaped or bellows-like flanges 240, 240a and 240b. One of these (240) is preferably reversed with respect to the other two, and again the thrust bearing surface 170 is provided for the flange 240b, the direction of pumping being upward in Figure 3. The flanges and the manner of securing them are the same in detail as is shown in Figure 1. The casing portion 140 corresponds to the portion 14 of Figure 1, and the portion 190 corresponds to the portion 19. Additional casing portions 191 and 192 are required for clamping the additional flanges 240a and 240, and to provide the outlet port 200.

In the embodiment of Figure 3, the stator is annularly supported at three points, and because this invention makes it possible to design a pump with greater eccentricity, the length of the pump is less than with the presently known construction.

It will be clear that various modifications may be made without departing from the spirit of the invention. I therefore do not intend to limit myself except as 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 helical gear pump comprising a stator constituted of an elongated member of resilient flexible material having internal helical grooves and at least one annular flange having a sinuous portion in cross-section, a motor having an extending shaft, a casing element having a fluid port secured to said motor about said extending shaft and having an annular fastening flange, a helical rotor, having external threads in pumping engagement with the helical grooves of said stator, secured to said shaft, at least one flanged pump casing, means securing said pump casing flange and stator flange to said fastening flange to position said stator in operative engagement with said rotor, a second fluid port for said pump, and thrust bearing means for said stator to prevent the discharge pressure of said pump from moving said stator axially to straighten out said sinuous portion, whereby said stator may move in the orbital path enforced upon it by said rotor, with said sinuous portion flexing between said stator and its fixed flange.

2. A helical gear pump according to claim 1, wherein said sinuous portion is perforated to equalize pressure on both sides of said sinuous portion.

3. A helical gear pump according to claim 1, wherein said rotor and stator are slightly tapered, being thicker at said motor end.

4. A helical gear pump according to claim 1, wherein said motor and stator are slightly tapered, being thicker at said motor end, and wherein said sinuous portion is perforated to equalize pressure on both sides of said sinuous portion.

5. A helical gear pump comprising a stator constituted of an elongated member of resilient flexible material having internal helical grooves and at least one annular flange having a sinuous portion in cross-section, a motor having an extending shaft, a casing element hav-

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ing a fluid port secured to said motor about said extending shaft and having an annular fastening flange, an annular bearing face rigid with said casing element and coaxial with said extending shaft, a helical rotor, having external threads in pumping engagement with the helical grooves of said stator, secured to said shaft and extending through said annular bearing face, a flanged pump casing having a fluid outlet, means securing said pump casing flange and stator flange to said fastening flange to position said stator in operative engagement with said rotor and with said stator engaging said annular bearing face, and a second fluid port for said pump, whereby said stator may move in the orbital path enforced upon it by said rotor, with said sinuous portion flexing between said stator and its fixed flange.

6. A helical gear pump according to claim 5, wherein said sinuous portion is perforated to equalize pressure on both sides of said sinuous portion.

7. A helical gear pump according to claim 5, wherein said rotor and stator are slightly tapered, being thicker at said motor end.

8. A helical gear pump according to claim 5, wherein said rotor and stator are slightly tapered, being thicker at said motor end, and wherein said sinuous portion is perforated to equalize pressure on both sides of said sinuous portion.

9. A helical gear pump comprising a stator constituted of an elongated member of resilient flexible material having internal helical grooves and a plurality of annular flanges each having a sinuous portion in cross-section, a motor having an extending shaft, a casing element having a fluid port secured to said motor about said extending shaft and having an annular fastening flange, additional casing portions in number equal to the number of annular flanges in excess of one, having fastening flanges at each end, means securing a flange of the first additional casing portion and a first stator flange to the flange of said casing portion having a fluid port, means securing succeeding additional casing portion flanges and stator flanges to prior flanges, a terminal casing portion having a fluid port and a fastening flange, means for securing said terminal flange and the last stator flange to the last prior flange, a helical rotor, having external threads in pumping engagement with the helical grooves of said stator, secured to said shaft and in operative relation with said stator, and an annular bearing face within one at least of said casing portions and rigid therewith, engaging a stator flange to prevent axial movement of said stator, whereby said stator may move in the orbital path enforced upon it by said rotor, with said sinuous portions flexing between said stator and its fixed flanges.

References Cited in the file of this patent

UNITED STATES PATENTS

2,603,161	Lloyd	July 15, 1952
2,612,845	Byram et al.	Oct. 7, 1952
2,691,347	Zimmer	Oct. 12, 1954
2,695,565	Seinfeld	Nov. 30, 1954
2,695,694	Seinfeld	Nov. 30, 1954
2,733,854	Chang	Feb. 7, 1956