June 18, 1957 J. D. BOURKE 2,796,029

HELICAL GEAR PUMP WITH ADJUSTABLE STATOR COMPRESSION

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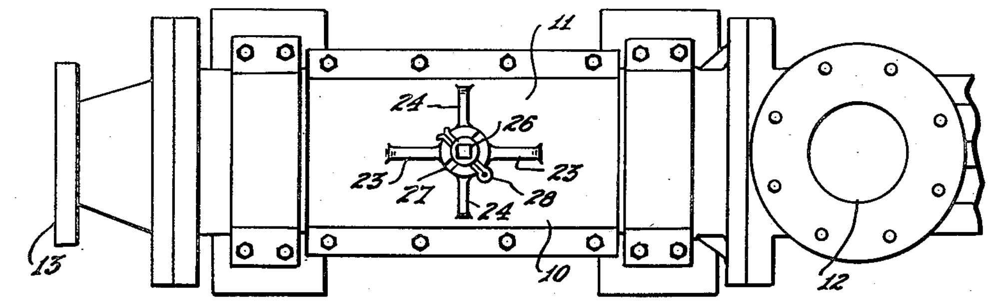

FIG. 1.

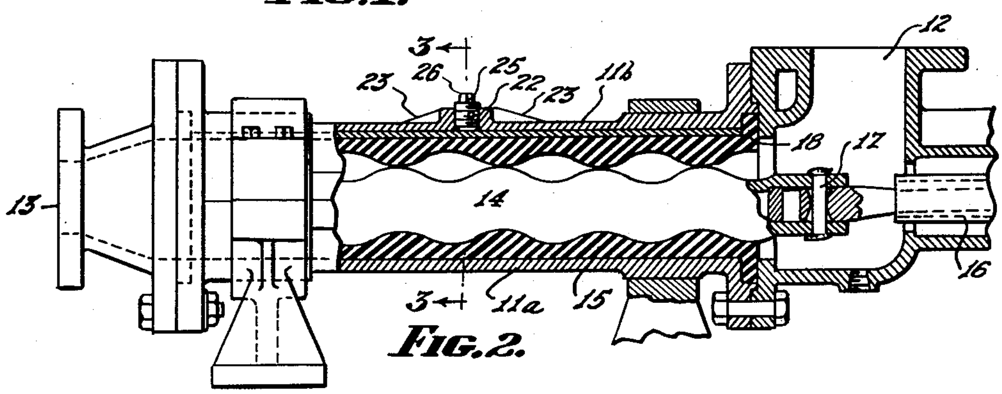

FIG. 2.

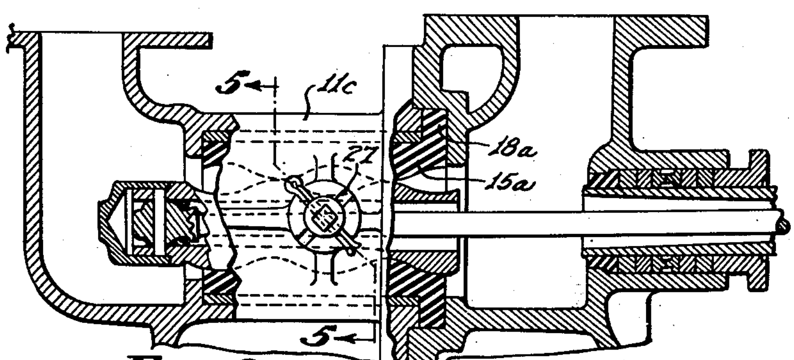

FIG. 4.

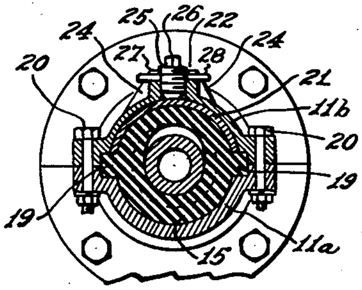

FIG. 3.

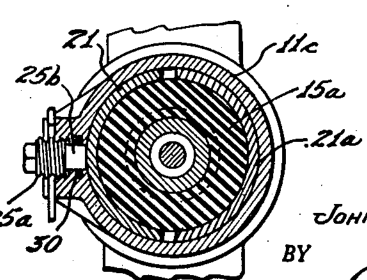

FIG. 5.

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HELICAL GEAR PUMP WITH ADJUSTABLE STATOR COMPRESSION

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6 Claims. (Cl. 103—117)

This invention relates to helical gear pumps of the type invented by R. J. L. Moineau wherein a helically externally threaded rotor coacts with an internally helically threaded stator, said stator having one more thread than said rotor. Pumps of this generally type are now conventional built with a metallic rotor which is rigid and a stator which is of a flexible or resilient material such as rubber. Pumps of this type are advantageous particularly in handling abrasive materials but it has been found that the abrasive materials produce wear and that this wear is usually greatest toward the discharge end of the pump.

With these considerations in mind, it is an object of the present invention to provide means for adjusting the stator compression in a helical gear pump and to provide such means which may be adjusted from the exterior of the pump so that it is unnecessary to take the pump apart to make the adjustment.

It is another object of the invention to provide adjusting means which will be self-aligning so that the adjustment may compensate for increased wear toward one end of the pump or the other.

It is still another object of the invention to make it possible to increase the capacity of such a pump at higher pressures or in other words to reduce the degree to which the capacity drops off as the pressure is increased. Yet another object of the invention is to provide means whereby the maximum efficiency of the pump may be made to occur at higher pressures than has been possible heretofore.

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

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

Figure 1 is a plan view of a typical pump to which the invention may be applied.

Figure 2 is an elevational view of the same with parts in section.

Figure 3 is a cross-sectional view taken on the line 3—3 of Figure 2.

Figure 4 is an elevational view with parts in section of a modified type of pump, and

Figure 5 is a cross-sectional view taken on the line 5—5 of Figure 4.

Briefly, in the practice of the invention, I provide between the flexible or resilient stator and the pump casing surrounding the stator a part-cylindrical rigid casing liner extending substantially the full length of the stator. Substantially centrally thereof I provide a boss in the casing having a threaded hole to accept a threaded screw. The threaded screw at its outer end is provided with means for attachment of a wrench or the like and means are provided for locking the screw in a desired adjusted position. The screw bears against the casing liner and forces it

against the stator. In some types of pumps, it is necessary to provide sealing means for the screw and in others sealing means may be omitted.

Referring in greater detail to the drawing, a pump is indicated generally at **10** having a casing **11** and ports **12** and **13**. The pump itself will not be described in detail except insofar as is necessary for an understanding of the present invention. The pump comprises a rotor **14** which is of rigid material and a stator **15** which is of rubber or rubber-like material. The rotor **14** is connected to a drive shaft **16** by means of a universal joint generally indicated at **17**.

In the particular embodiment of Figures 1, 2 and 3, the stator is provided with the end flanges **18**, one at each end, and with the lateral extensions **19** by means of which it is non-rotatably held in the casing **10**. As best seen in Figure 3, the casing is in two parts, the lower portion being designated **11*a*** and the upper portion being designated **11*b***. The two parts are held together by bolts **20** passing through flanges in the casing portions **11*a*** and **11*b*** and when the casing portions **11*a*** and **11*b*** are secured together, the extensions **19** are clamped in position.

In the embodiment of Figures 1 to 3, it will be observed that the interior of the casing portions **11*a*** and **11*b*** is cylindrical but that the radius inside the portion **11*b*** is larger than that inside the portion **11*a***, so that room is left between the stator **15** and the casing portion **11*b*** for a rigid casing liner element **21**. The liner element **21** and the casing portion **11*a*** snugly embrace the cylindrical stator **15**.

Substantially centrally of the casing portion **11*b*** I provide a boss **22** which may be reinforced by the webs **23** and **24**. This boss has a threaded hole to accept the screw **25** which may be squared at its outer end as at **26**. It will now be clear that as the screw **26** is tightened it causes the liner member **21** to bear against the stator **15** and thus to put pressure on the stator. Because the screw **25** operates substantially centrally of the member **21**, the member **21** is in effect self-aligning and the member **21** can pivot in relation to the screw.

To fix the screw in a desired adjusted position, I preferably slot the boss **22** as at **27** and the screw itself is drilled to accept a cotter pin **28**. In the figures, I have shown two slots **27** normal to each other so that the screw may be fixed at any desired quarter turn position. It will be clear that a single slot could be used or that more than two slots could be used if a finer adjustment is desired.

In the pump of Figures 1 to 3, because the stator **15** is sealed in relation to the casing members **11*a*** and **11*b*** by virtue of the flanges **18** and the lateral extensions **19**, no sealing means need be provided for the screw **25**.

In the embodiment of Figures 4 and 5, wherein the pump is of the same general type, there is a flange **18*a*** at only one end of the stator **15*a***, and for this reason it is necessary to provide sealing means for the screw. As best seen in Figure 5, an O-ring is provided at **30** to seal the entrance of the screw **25*a***. The screw is slightly modified in that it has a portion **25*b*** free of threads to cooperate with the O-ring **30**.

In the embodiment of Figures 4 and 5, it will also be observed that the interior of the casing **11*c*** is cylindrical and therefore a supplementary lining member **21*a*** is provided to cooperate with the liner **21** in snugly embracing the stator **15*a***. The casing in the pump of Figures 4 and 5 is in one piece as compared with that of Figures 1 to 3 which is in two pieces, and the stator of course does not have the lateral extensions **19**. The function of the adjusting screw and the manner of locating it are the same as described above.

I have found that taking a typical pump with no adjustment of the screw having a capacity at zero pressure of about one hundred seventeen gallons per minute, that capacity drops to one hundred four gallons per minute at one hundred pounds per square inch and has dropped to eighty-six gallons per minute at one hundred fifty pounds per square inch and to fifty-six gallons per minute at two hundred pounds per square inch. After putting one full turn on the screw, the capacity at zero pressure was one hundred twelve gallons per minute, at one hundred pounds per square inch it was one hundred six gallons per minute, at one hundred fifty pounds per square inch it was ninety-six gallons per minute, and at two hundred pounds it was seventy-two gallons per minute. With two full turns on the screw the capacity was one hundred four gallons per minute at zero pressure and remained at one hundred four gallons per minute up to one hundred pounds per square inch, had dropped only to one hundred gallons per minute at one hundred fifty pounds per square inch and to ninety-three gallons per minute at two hundred pounds per square inch. Thus, while the capacity was not changed greatly at about one hundred pounds per square inch by adding one or two turns to the screw, the capacity at two hundred pounds per square inch was very much greater with two turns of the screw than with only one turn or no turns.

Adjustment of the screw to increase compression on the stator does not appreciably affect the maximum efficiency of the pump but it shifts the point of maximum efficiency to different pressures. Thus, for example, the same pump with no turns on the screw had a maximum efficiency of about 70% at eighty-five pounds per square inch. When one turn was put on the screw, the point of maximum efficiency was shifted to about one hundred ten pounds per square inch and when two turns were put on the screw, the point of maximum efficiency was shifted to about one hundred forty-five pounds per square inch.

An advantage of the construction disclosed herein, therefore, is that a standard pump may be adjusted to operate at maximum efficiency at the specific pressure encountered.

It will be clear that various modifications may be made without departing from the spirit of the invention and I therefore do not intend to limit myself otherwise than as set forth in the claims hereinafter.

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

1. In a helical gear pump wherein an externally helically threaded rigid rotor pumpingly coacts with an internally helically threaded resilient stator, the said stator being retained within a rigid casing element; a part-cylindrical rigid casing liner element interposed between said stator and casing element, said stator being snugly embraced by said casing element and liner, a boss in said casing element having a threaded hole, and a screw in said hole, the inner end of said screw bearing against said liner, whereby by adjustment of said screw the pressure of said stator against said rotor may be adjusted from the outside.

2. A pump according to claim 1, wherein said boss has at least one diametral slot and said screw has a diametral hole, whereby a cotter pin may be passed through said hole in said screw when in alignment with said slot to fix the position of said screw.

3. A pump according to claim 1, wherein two less-than-half-cylindrical liner elements are interposed between the said stator and casing element, said screw acting upon one of said liner elements.

4. A pump according to claim 1, wherein said casing element is constituted in two halves, one half having a larger internal diameter than the other, said liner element lying in said one half and having an internal diameter equal to that of the other half.

5. A pump according to claim 1, wherein means are provided to seal the said screw with respect to said hole.

6. A pump according to claim 5, wherein said seal means includes an O-ring, and said screw has a smooth shank contacting said O-ring.

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