HELICAL GEAR PUMP WITH BY-PASS

John David Bourke, Springfield, Ohio, assignor to Robbin & Myers, Inc., Springfield, Ohio, a corporation of Ohio
Filed Aug. 13, 1957, Ser. No. 696,139
4 Claims. (Cl. 103—41)

This invention relates to helical gear pumps of the type invented by R. J. L. Moineau wherein a helically externally threaded rotor coaxes with an internally helically threaded stator, said stator having one more thread than said rotor. Pumps of this general type are now conventionally built with a metallic rotor which is rigid and a stator which is of flexible or resilient material such as rubber.

It is an object of the present invention to provide for variable flow in pumps of the kind described above by means of an internal by-pass. It is an ancillary object of the invention to utilize the structure disclosed in my earlier Patent No. 2,796,029 dated June 18, 1957 and in my co-pending application, Serial No. 690,241 filed October 15, 1957, now Patent No. 2,874,643, in order to achieve control of the cross sectional area of the by-pass.

It is another object of the invention to provide a by-pass from the suction to the discharge end of the pump by means of one or more passage ways which are formed in part at least by the flexible material of the stator so that by the means disclosed in my said co-pending application and in my said patent the cross-sectional area of the by-pass passage can be varied.

It is another object of the invention to provide a by-pass which at a given head will by-pass the full flow of the pump so that the capacity of the pump at that given head can be varied as desired from zero to full flow.

It is still another object of the invention to provide an arrangement whereby the area of the by-pass passage can be varied by means of fluid pressure so that remote flow control may be had whereby various advantages are achieved.

These and other objects of the invention which I shall point out in more 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 certain exemplary embodiments.

Reference is made to the drawings forming a part hereof and in which FIGURE 1 is a longitudinal cross-sectional view through a typical helical gear pump to which my invention is applied.

FIGURES 2 and 3 are cross-sectional views taken on the line 2—2 of FIGURE 1 showing how the area of the by-pass passage is varied.

FIGURES 4 and 5 are views similar respectively to FIGURES 2 and 3 showing a modification in the by-pass passage.

FIGURE 6 is a cross-sectional view similar to FIGURE 2 showing another modification.

Briefly, in the practice of my invention, I provide a by-pass passage extending from the discharge to the suction end of the pump such that at least one wall of the passage is formed by the deformable material of the stator and I then utilize the disclosure of my said patent and application to apply pressure to the stator to vary the dimensions of the passage. In one embodiment, the passage is formed wholly within the material of the stator and in another embodiment the passage is formed in the rigid casing within which the stator is retained and the dimensions of the passage are changed by forcing the material of the stator into the casing passages.

As mentioned above pumps of the type under consideration are usually provided with a stator of flexible or resilient material such as rubber. Hereinafter the word "rubber" is used to designate such material whether it be natural or artificial rubber or other suitable flexible and resilient material.

Referring now more particularly to FIGURE 1, the pump is contained within a rigid casing which may be made in two parts, 10 and 11. The two parts are flanged and are bolted together as clearly shown in FIGURES 2 to 6 inclusive. At the entrance casing 10 and 11 and which is connected to the discharge port is provided in a casing 47 which is bolted to the casings 10 and 11 as shown.

Within the cylindrical space provided by the casings 10 and 11 there is disposed the rubber stator 18 which coaxes with the metallic rotor 19 which is coupled to the connecting rod 14 by means of the universal joint 20. It is understood that the connecting rod 14 is coupled to the drive shaft 16 by another universal joint 21. The rubber stator is preferably flanged as at 22 and 23 so that it is longitudinally positioned with respect to the casings 10, 11, 12 and 17. The stator 18 is also provided with the longitudinal flanges 24 and 25 which are gripped between the casings 10 and 11 to hold the stator against rotation.

From a consideration of FIGURES 2 to 6 inclusive it will be noted that the cylindrical interior of the casing 10 is somewhat larger than that of the casing 10 and that the thickness of a part-cylindrical shim 26. The casing 11 is also provided with the boss 27 in which is threaded the adjustment screw 28.

In the embodiment of FIGURES 1 to 3 inclusive, the by-pass passage is indicated at 29 and it is formed wholly in the material of the stator 18. Preferably this passage is arcuate so that it may be more readily closed by application of pressure to the screw 28 against the shim 26.

From what has been said above, it will be clear that with the parts in the position of FIGURES 1 and 2, a portion or all (depending upon the dimensions of the passage) of the flow is by-passed but that when the adjusting screw 28 is screwed in as shown in FIGURE 3, the passage 29 may be entirely closed. Thus, by adjustment of the adjusting screw 28 the flow of the pump may be varied by infinitesimal amounts.

In the modification of FIGURES 4 and 5, the by-pass passage is passed in the form of a number of passages 30 constituted in part by grooves in the rigid casing portion 10 and in part by the outside surface of the rubber stator 18. As shown in FIGURE 5, when the adjusting screw is screwed in, the material of the rubber stator 18 is forced into the grooves 30 to close them to a desired degree.

It will be clear that while the figures show three such passages, this is by way of example only and is not to be considered as a limitation on the invention.

In both the embodiments of FIGURES 1 to 3 inclusive and the embodiment of FIGURES 4 and 5, the adjustment of the by-pass is accomplished manually.

In FIGURE 6 I have shown a modification where the adjustment may be made automatically if desired. In this embodiment, the metallic shim 26 is permanently bonded to the rubber stator 18 and the casing portion 11 is relieved as indicated at 31 over substantially the entire length of the shim to constitute a pressure chamber. The adjusting screw 26 is omitted so that a hole 32 is provided which may be connected by suitable piping as indicated to a source of fluid pressure which may be either hydraulic or pneumatic. In this way the flow of the pump may be controlled hydraulically or pneumatically and
thus the pump may be readily tied in to instrumentation and automation if desired. It will be understood that while in FIGURE 6 I have used the by-pass arrangement of FIGURES 1 to 3 inclusive, that of FIGURES 4 and 5 could be used instead. It will be understood that the slot 29 or total cross-sectional area of the slots 30 may be designed to by-pass the full flow of the pump at a given head. If this is done, the flow of the pump at that head can be varied from zero to full flow by adjustment of the adjusting screw. Such an arrangement is useful for variable speed drives and the like and accomplishes the desired result in a simpler and less expensive way. Furthermore, it will be observed that there are no moving parts in the flow area which is of great importance where the pump is pumping abrasive or corrosive materials.

It will be understood that numerous 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 which follow.

Having now fully described the invention, what is claimed as new and desired to be secured 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 bypass passage having the cross-section of an arc concentric with said stator and extending from end to end of said stator on one side thereof, and formed in part, at least, by said resilient stator, rigid part cylindrical shim means disposed within said casing and arranged to bear against said stator in the region of said passage, and means operable from outside said casing for forcing said shim means against said stator transversely thereof to deform said stator and said passage, to vary the cross-sectional area of said passage.

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