United States Patent [19]

Shearwood

[11] **3,712,764**

[45] **Jan. 23, 1973**

[54] **ADJUSTABLE CONSTRUCTION FOR MATING SURFACES OF THE ROTOR AND PORT MEMBER OF A LIQUID RING PUMP**

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[73] Assignee: **Nash Engineering Company**, South Norwolk, Conn.

[22] Filed: **April 19, 1971**

[21] Appl. No.: **135,341**

Related U.S. Application Data

[63] Continuation of Ser. No. 833,442, June 16, 1969, abandoned.

[52] **U.S. Cl.** **418/68**

[51] **Int. Cl.** **C11c 1/04**

[58] **Field of Search** 308/70, 71; 417/68

[56] **References Cited**

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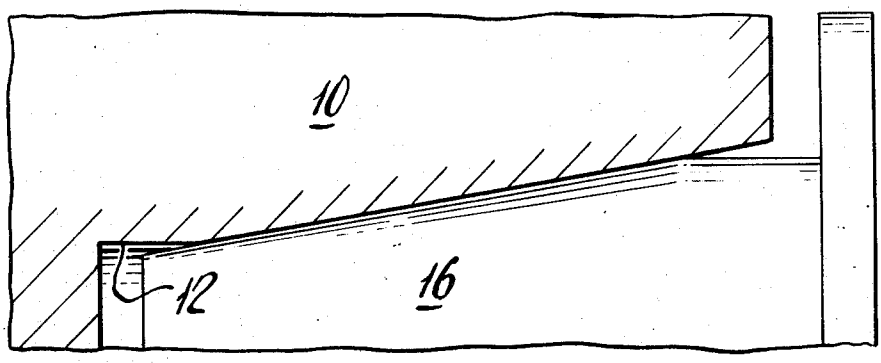
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Assistant Examiner—Frank Susko
Attorney—Nolte and Nolte

[57] **ABSTRACT**

A liquid ring pump has a conical port member located within the corresponding central opening in the rotor and defines with the rotor a working clearance. Wear on the surfaces defining the working clearance reduces the efficiency of the pump. The present construction offers the ability to readjust the position of the port member so that the original clearance between the port member taper and the rotor can be re-established, and the pump performance increased to its full capacity. This adjustment may be made without the disassembly of the pump.

8 Claims, 6 Drawing Figures



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SHEET 1 OF 2

Fig. 1.

(PRIOR ART)

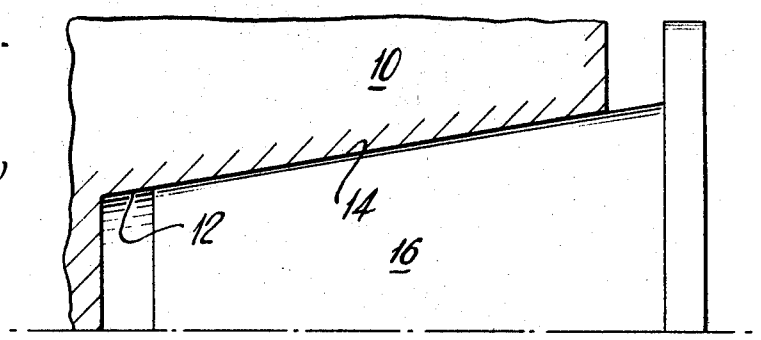


Fig. 2.

(PRIOR ART)

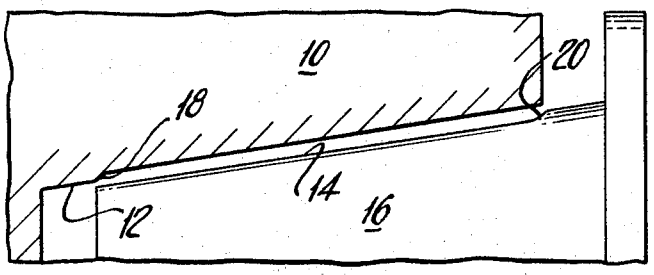


Fig. 3.

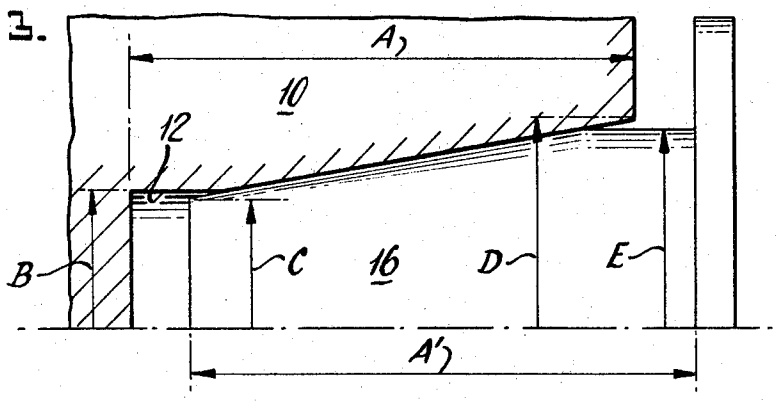
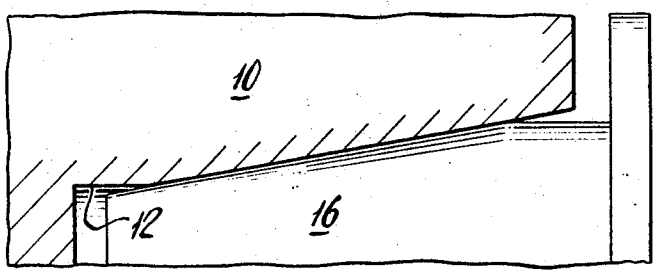


Fig. 4.



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Fig. 5.

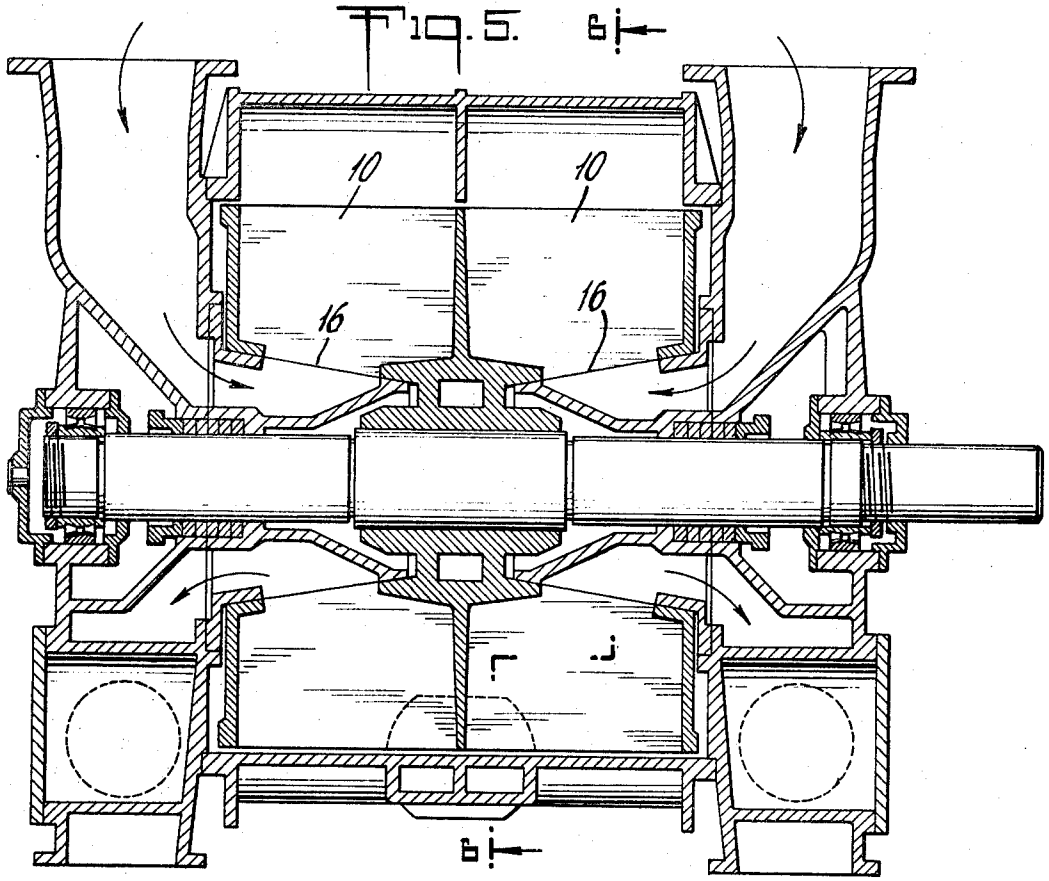
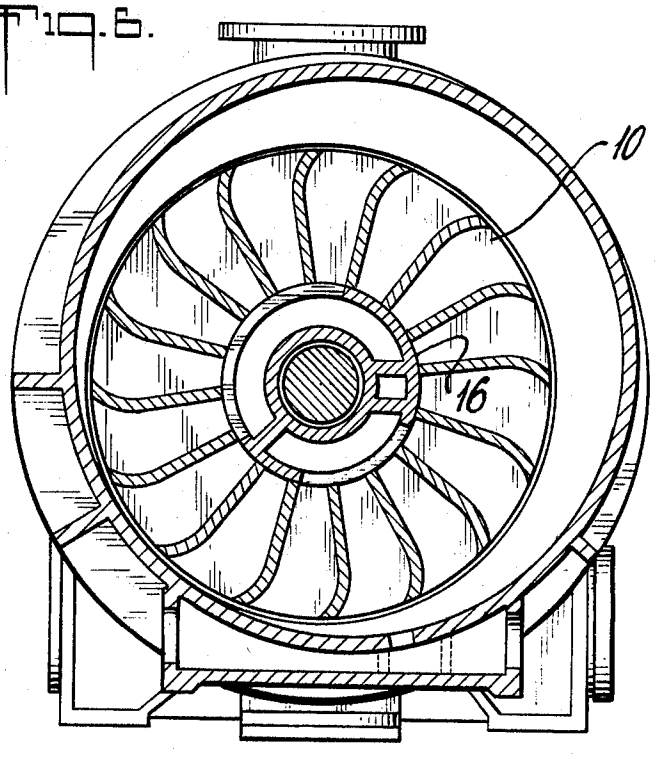


Fig. 6.



ADJUSTABLE CONSTRUCTION FOR MATING SURFACES OF THE ROTOR AND PORT MEMBER OF A LIQUID RING PUMP

BACKGROUND OF THE INVENTION

A problem existing with liquid ring pumps of the kind having a conical port member received within a correspondingly shaped opening in the rotor as for example that described in Patent 3,154,240, issued October 27, 1964 to I. C. Jennings, is that after a period of service wear or due to foreign matter passing through the pump, small shoulders and wear areas appear at opposite ends of the mating surfaces of the rotor and cone. These wear areas form enlarged clearances or steps at opposite ends of the mating surfaces and the increased spacing between the aforesaid mating surfaces results in a reduced performance of the pump. Heretofore, when these steps appeared at opposite ends of the mating surfaces readjustment of the mating conical surfaces was not possible and the pump had to be disassembled, and the steps formed in the cone machined away. After the machining step, the pump was then reassembled, making sure that the mating surfaces had the original clearance therebetween. This procedure was time consuming and costly.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a mating construction of the rotor and cone assembly of a liquid ring pump, or other types of conical pumps in which the forming of small shoulders by service wear between the mating surfaces of the rotor and cone are prevented.

Another object of the present invention is to provide a means to readjust the position of the cone relative to the rotor, so that the original clearance between the cone and the rotor can be reestablished.

A further object of the present invention is to provide a construction in which the resulting mating surfaces between the rotor and the cone are such that the small end of the cone extends one thirty-second of an inch or more beyond the intersection of the cone taper and the bore of the rotor. In a corresponding manner, mating surfaces at the large end of the cone are also one thirty-second of an inch inside the large end of the rotor taper bore.

It should be apparent that an adjustment can be made to the mating surfaces at the location of the pump and without disassembly thereof.

These and other objects, features and advantages of the present invention will become obvious from the following description of the specific embodiments of the invention, taken in conjunction with the accompanying drawings which form an integral part thereof and in which:

FIG. 1 is schematic represents of the prior art construction.

FIG. 2 is another schematic representation of the prior art construction after a period of time in which the service wear has caused the formation of small shoulders at the mating surfaces of the rotor and cone;

FIG. 3 is a schematic representation of the construction in accordance with the teachings of the present invention showing the relationship between the rotor and cone before service wear; and

FIG. 4 is a schematic representation similar to FIG. 3 but after a period of wear and after an adjustment between the cone and the rotor, and

FIG. 5 is a cross-sectional view of a single lobe pump of the kind to which the present invention may be applied and which is described in detail in the aforementioned U.S. Pat. No. 3,154,240.

FIG. 6 is a section on the line 6—6 of FIG. 5.

The pump in FIGS. 5 and 6 is one well known in the prior art and is of the single lobe kind having a pair of cones 16 and a rotor 10. The pump is that in U.S. Pat. No. 3,154,240 and for this reason is not described in detail herein for it is the rotor 10 and port members 16 and the working clearances therebetween with which this invention is especially concerned.

Referring to FIGS. 1 and 2 of the drawings in which the prior art constructions are illustrated, a rotor 10 is shown having a bore 12 that is tapered to correspond with the mating peripheral surface 14 of the stationary cone 16. It should be noted that the taper surfaces extend approximately the full depth and length of both the bore diameter and the cone diameter. FIG. 1 shows the initial relationship between the cone 16 and the bore 12, however, after a period of service wear, at the mating surfaces of the bore and the cone or also as a result of an amount of foreign material passing through the pump, a shoulder 18 is formed in the rotor 10, and at the other end of the structure a shoulder 20 is formed in the peripheral surface of the cone 16. At the same time, due to wear, there is an increase in spacing between the mating surfaces of cone 16 and the bore 12 thereby decreasing the seal therebetween resulting in a reduced performance of the pump, and it then becomes necessary to reestablish the original clearance between the rotor and cone to bring the pump back to its full operating efficiency.

FIG. 3 shows the structure of the present invention in which the rotor 10 is machined to a precise bore D and a depth A. It should be apparent that only half of bore D is illustrated in FIG. 3, it being understood that the other half thereof is identical. The taper of the bore 12 starts from a dimension D and terminates in a dimension B and in the present example is 8°. The cone 16 is machined to a precise diameter E and a length A'. The diameter E is always about 0.010 inch less than the bore D and the length A' is the same as the depth A. The cone taper is then machined so that the diameter C at the small end of the cone 16 is about 0.010 inch less than the dimension B of bore 12. As a result of the foregoing pump fabrication process, the resulting mating surfaces are such that the small end of the cone 16 extends a selected distance of at least one thirty-second of an inch beyond the intersection of the taper and the dimension B of the bore 12. In a corresponding manner the mating surfaces at the large end of the cone taper extend a selected distance of at least one thirty-second of an inch from inside the large end of the taper bore D.

It should be apparent that the present construction permits a certain amount of axial adjustment of position of the cone 16 so that the original clearance between the cone taper and the rotor may be reestablished after service wear without the disassembly of the pump for machining operations.

The adjustment of the cone 16 is clearly shown in FIG. 4 after a period of wear has occurred in the struc-

ture, it being noted that the cone **16** is shifted laterally to the left.

It is to be appreciated that the arrangement is one in which the smaller base of the frustoconical surface of the cone is of lesser diameter than the corresponding base of the rotor or, put another way, one in which considering the apex of the conical surfaces, the smaller base of the port member is closer to that apex than is the smaller base of the rotor.

I claim:

1. A liquid ring pump comprising a rotor having a plurality of angularly spaced vanes disposed in generally axial planes to define a plurality of working chambers opened at their radially inner and outer ends, the radially inner edges of said vanes defining a bore within which is received a stationary port member having circumferentially spaced apart inlet and outlet ports formed in its surface, the radially inner ends of the working chambers alternately passing the inlet and outlet ports of the port member as the rotor turns, said bore and port member having mating frustoconical surfaces defining a running clearance therebetween, the frustoconical surface of said port member being that in which said inlet and outlet ports are formed, the diameter of the smaller base of the frustoconical surface of the port member being lesser than the diameter of the smaller base of the frustoconical surface of the bore of the rotor and the diameter of the larger base of the frustoconical surface of the port member being no greater than the diameter of the larger base of the frustoconical surface of the bore of the rotor whereby after wear causes an increase in the running clearance, insertion of the port member more deeply into the bore reestablishes the original clearance.

2. A liquid ring pump comprising a rotor having a plurality of angularly spaced vanes disposed in generally axial planes to define a plurality of working chambers opened at their radially inner and outer ends, the radially inner edges of said vanes defining a bore within which is received a stationary port member having circumferentially spaced apart inlet and outlet ports formed in its surface, the radially inner ends of the working chambers alternately passing the inlet and outlet ports of the port member as the rotor turns, the surface of the bore and the adjacent surface of the port member being frustoconical and of equal cone angle and defining therebetween a running clearance, the lesser base of said port member surface being located closer to the cone apex than the lesser base of the rotor surface and the greater base of the port member surface being located no further away from the cone apex than the greater base of said rotor surface whereby after wear causes an increases in the running clearances, displacement of the port member relatively to the rotor and towards the cone apex reestablishes the original clearance.

3. A liquid ring pump as claimed in claim **1** in which the diameter of the larger base of the frustoconical surface of the port member is less than the diameter of the larger base of the frustoconical surface of the bore of the rotor.

4. A liquid ring pump as claimed in claim **2** wherein the greater base of the port member is located closer to the cone apex than is the greater base of said frustoconical surface of said rotor.

5. A liquid ring pump as claimed in claim **1** wherein said larger diameter of said port member is lesser than the larger diameter of said rotor by about 0.010 inch and the smaller diameter of said port member is about 0.010 inch inches less than the smaller diameter of said rotor.

6. A liquid ring pump as claimed in claim **2** wherein said lesser base of the port member is smaller than the lesser base of said rotor by about 0.010 inch and said greater base of said port member is smaller than the diameter of said greater base of said rotor by about 0.010 inch.

7. A liquid ring pump as claimed in claim **1** wherein the smaller base of said cone is located about one thirty-second of an inch closer to the cone apex than is the smaller base of said rotor surface.

8. A liquid ring pump as claimed in claim **2** wherein the lesser base of said port member surface is about one thirty-second of an inch closer to the apex of the cone than is the lesser base of the rotor surface.

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Disclaimer

3,712,764.—*Raymond S. Shearwood*, Norwalk, Conn. ADJUSTABLE CONSTRUCTION FOR MATING SURFACES OF THE ROTOR AND PORT MEMBER OF A LIQUID RING PUMP. Patent dated Jan. 23, 1973. Disclaimer filed Nov. 18, 1975, by the assignee, *Nash Engineering Company*.

Hereby enters this disclaimer to all claims of said patent.

[*Official Gazette January 13, 1976.*]