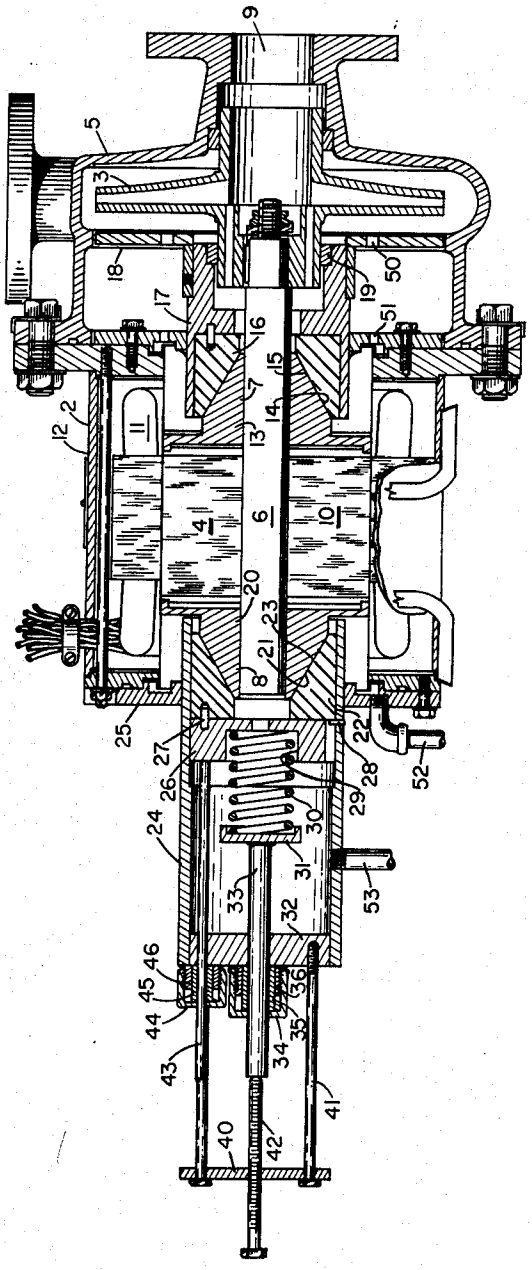
Dec. 17, 1963 L. H. LEONARD, JR 3,114,322

HERMETIC PUMP

Filed April 9, 1959



INVENTOR.
LOUIS H. LEONARD, JR.

BY Herman Seid

ATTORNEY

United States Patent Office 3,114,322
Patented Dec. 17, 1963

3,114,322
HERMETIC PUMP

Louis H. Leonard, Jr., East Syracuse, N.Y., assignor to Carrier Corporation, Syracuse, N.Y., a corporation of Delaware

Filed Apr. 9, 1959, Ser. No. 805,282
8 Claims. (Cl. 103—87)

This invention relates to centrifugal pumps and, more particularly, to a hermetic centrifugal pump for use in an absorption refrigeration system employing a saline solution such as a mixture of water and lithium bromide as an absorbent and water as a refrigerant.

In absorption refrigeration systems of this type, it has been found that occasionally metal plating such as copper plating occurs in many parts of the system, particularly on moving parts such as pump seal faces, pump bearings, etc. It is believed lithium bromide dissolves small amounts of copper from the cuprinickel or copper elements employed in the system which are exposed to solution. After limited solubility is reached, it is believed that the metal plates out in the form of pure copper. As a result of such plating it has been found that the pump bearings soon seized as a result of plating on the bearing surfaces. It has also been found desirable to assure long life of the pump in service that a type of bearing be provided which would have long life in use and withstand wear during the extreme service in which it is placed.

The chief object of the present invention is to provide a hermetic pump for use in absorption refrigeration systems in which the disadvantages of prior pumps are obviated.

An object of the present invention is to provide a hermetic pump including a bearing structure adapted to compensate for wear or plating of the cooperating bearing surfaces.

A further object is to provide a hermetic pump including a bearing construction so arranged that upon wear of the cooperating bearing surfaces separate portions of the bearing construction will be resiliently urged toward one another while upon plating of the cooperating surfaces such separate sections of the bearing construction will be moved away from one another thus maintaining at all times a desired loading on the cooperating surfaces of the bearing structure to prevent seizure of the bearing. Other objects of the invention will be readily perceived from the following description.

This invention relates to a hermetic pump specifically adapted for use in absorption refrigeration systems employing a solution of lithium bromide and water. The pump consists of a housing having an inlet and an outlet. An impeller is placed in the housing. A motor is provided for actuating the impeller. A shaft carries the impeller, the shaft being connected to the motor. Bearings support the shaft in desired position to permit rotation thereof. At least one bearing includes a fixed member and a movable member having cooperating surfaces. One of said members, and preferably both members, possesses a tapered surface. Means are provided for resiliently urging one of the cooperating surfaces toward the adjacent cooperating surface so that a desired loading will be maintained on the bearing surfaces upon the occurrence of wear or plating of the cooperating surfaces.

The attached drawing is a sectional view of a hermetic pump embodying the present invention.

Referring to the attached drawing, there is shown a housing 2 containing an impeller 3 and a motor 4. While the housing may be formed as a single element, it is preferable to form separate housing sections to enclose the impeller and the motor, the sections being bolted together and sealed to prevent substantial leakage between the impeller section and the motor section.

Impeller 3 is placed in housing section 5 and is attached to a shaft 6 journaled in bearing 7, 8 mounted in the housing. Impeller section 5 includes an inlet 9 and an outlet (not shown) to circulate solution in the absorption refrigeration system.

Motor 4 includes a rotor 10 mounted upon shaft 6 and a stator 11 placed in the motor section 12 of the housing. In the construction shown, shaft 6 extends horizontally, although it will be understood, if desired, the pump may be placed in a vertical position.

It will be appreciated bearing member 7, 8 support the shaft in substantially horizontal position. In bearing 7 a rotatable member 13 is provided attached to shaft 6. Member 13 has a tapered surface 14 adapted to cooperate with a tapered surface 15 of a fixed member 16 which is pinned to bearing hub 17 secured to a partition wall 18 separating pump sections 5, 12. Casing rings 19 are provided to seal the sections from one another.

At its opposite end, shaft 6 is mounted in bearing member 8. Bearing member 8 includes a fixed member 20 mounted on shaft 6 and adapted to rotate therewith. Member 20 is conical in contour as viewed in FIGURE 1 and possesses a tapered surface 21. A movable bearing member 22 is provided, movable in the sense that it is adapted to have, in effect, a reciprocating motion toward and from member 20. Movable member 22 includes a tapered surface 23 adapted to cooperate with tapered surface 21 of member 20. This bearing 8 is mounted in a barrel 24 extending into the end wall 25 of housing 2. A spring plate 26 is placed in contact with member 22 and is secured thereto by pin 27 to assure that member 22 does not rotate while it possesses a characteristic of movement in a reciprocating horizontal direction as shown in the drawing. Plate 26 is prevented from rotation by means of a pin 28 extending through the wall of barrel 24.

Plate 26 possesses a recess 29 in which a spring 30 is seated. At the opposite end of spring 30 a spring retainer 31 is placed thereover. The barrel 24 is plugged as shown at 32. A plunger 33 extends through plug 32 and is in contact with spring retainer 31. A packing cap 34, compression ring 35 and packing gland 36 is placed about plunger 33 to seal the plunger against ambient or leakage from the barrel. An adjustment plate 40 is mounted on barrel 24 by means of cap screws 41. An adjustment member 42 is threaded through plate 40 and is in contact with plunger 33. Thus, forces of compression applied to spring 30 may be varied as desired. If desired, a gauging member 43 may extend through plug 32 against spring plate 26 to permit the operator of the pump to measure the forces applied against the spring in the barrel to assure proper adjustment of the bearing construction during use. It will be understood, of course, that a packing cap 44, compression ring 45 and packing gland 46 is employed to seal the opening in the barrel through which member 43 extends.

Considering operation of the construction in use, assuming wear between the cooperating bearing surfaces occurs, spring 30 resiliently urges member 22 toward member 20 and member 13 toward member 16. It will be appreciated some slight movement of rotor 10 is permitted without affecting the operation thereof. If plating occurs between the cooperating surfaces, it will be appreciated the movable member 22 will be urged in the opposite direction, toward the left as shown in the figure, thus preventing seizing of the bearing construction. Similarly, if plating occurs between members 13 and 16, member 13 is moved away from member 16, toward the left as shown in the figure, so that the bearing will not seize.

It is desirable to provide flow of cooling solution between cooperating surfaces of the bearing and to dissipate motor heat. For this purpose, if desired, a port 50 may be provided in wall 18 adjacent the outlet of impeller 3,

a port 51 permitting solution to flow into motor section 12, the solution flowing between the cooperating surfaces 14, 15 and passing between the rotor 10 and the stator 11 to an outlet 52 from which it returns to the inlet of the impeller. It will be understood that solution passes between cooperating surfaces 21, 23 of bearing 8 and that any excess solution may pass through outlet 53 and return to the inlet of the pump. Such construction provides a low pressure circulation through the bearings and dissipates motor heat.

The present invention provides a simple hermetic pump construction including an improved bearing construction which prevents unsatisfactory operation due to wear of the cooperating bearing surfaces or seizure of the pump due to plating between the cooperating bearing surfaces. The improved bearing construction so provided serves in effect as a combination radial and thrust bearing thus reducing the costs involved in the structure.

It will be appreciated the present invention eliminates an extremely difficult problem in absorption refrigeration systems employing a saline solution as an absorbent and water as a refrigerant by taking advantage of the fact that uniform metal plating occasionally may occur in the rubbing surfaces of the pump bearings exposed to the absorbent. It will be appreciated the bearing construction herein provided permits the cooperating surfaces of the bearing to engage one another and as such surfaces are worn or plated the cooperating surfaces may move apart or toward one another thus maintaining a desired loading on the bearing surfaces.

The present invention eliminates the solution pump seal problem in absorption refrigeration since it does not attempt to prevent solution from contacting the pump bearings or is it necessary to provide the expensive mechanical seals, seal water assemblies and make up water lines theretofore employed. The operation of the system is more quiet for motor noises are confined in the system and are muffled by the walls of the housing and solution.

While a preferred embodiment of the invention has been described it will be understood that the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a pump, the combination of a housing having an inlet and an outlet, an impeller in said housing, means for actuating the impeller, a shaft carrying said impeller and connected to the actuating means, a bearing supporting the shaft in desired position to permit rotation thereof, the bearing including a fixed member and a movable member having contacting, tapered surfaces, load compensating means responsive to variations in load on said contacting tapered surfaces upon wear or plating thereof to effect displacement of said movable bearing member with respect to said fixed bearing member to maintain selected loading on said members, and adjustable load selecting means operative to vary the response of said load compensating means.

2. A pump according to claim 1 in which the fixed member is attached to said shaft.

3. A pump according to claim 1 in which, said load compensating means includes a spring, a spring plate in contact with the movable bearing member and a spring retainer to secure the spring in desired position between the plate and the retainer.

4. A pump according to claim 3 including a retaining pin to secure the plate and the movable member as a unit.

5. A pump according to claim 4 in which a retaining pin extends through the housing to prevent rotation of said plate.

6. In a pump the combination of a housing having an inlet and an outlet, an impeller in said housing, means for actuating the impeller, a shaft carrying said impeller and connected to the actuating means, a bearing supporting the shaft in desired position to permit rotation thereof, the bearing including a fixed member and a movable member having cooperating tapered surfaces and means for resiliently urging one cooperating surface toward the adjacent cooperating surface to maintain a desired loading on said members upon wear or plating of the cooperating surfaces, said resilient means including a spring, a spring plate in contact with the movable bearing member and a spring retainer to secure the spring in desired position between the plate and the retainer, and adjustable means for applying compressive forces against the spring, said adjustable means including a plunger extending through an end of said housing in contact with the spring retainer, an adjustment plate spaced from said end of said housing, and threaded adjusting means extending through said adjustment plate against the end of said plunger to regulate the compressive forces applied against the spring.

7. A pump according to claim 6 including a retaining pin to secure the plate and the movable member as a unit and a second retaining pin extending through the housing to prevent rotation of the plate.

8. In a motor driven pump, the combination of a pump housing comprising first and second chambers, partition means separating said chambers, said first chamber having inlet and outlet passages therein, a motor housing attached to said second chamber, a shaft extending through said motor and pump housing, bearing means in said motor housing rotatably supporting said shaft, an impeller in said first chamber fixed to said shaft, motor means in said motor housing comprising a stator fixed to said motor housing and a rotor attached to said shaft, said bearing means including a fixed member and an axially movable member, said bearing members having contacting tapered surfaces, load compensating means responsive to variations in load on said contacting tapered surfaces upon wear or plating thereof to effect displacement of said movable bearing member with respect to said fixed bearing member to maintain selected loading on said members, adjustable load selecting means operable to vary the response to said load compensating means, first port means in said partition communicating said first and second chambers whereby said impeller forces a portion of the medium pumped into said second chamber, second port means in said pump housing communicating said second chamber with said motor housing whereby medium in said second chamber flows into said motor housing, said medium cooling said motor and bearings therein, and means returning said medium from said motor housing to said first chamber inlet passage.

References Cited in the file of this patent

UNITED STATES PATENTS

580,692	Himes	Apr. 13, 1897
1,156,188	Sorensen	Oct. 12, 1915
1,425,308	Woock et al.	Aug. 8, 1922
2,520,880	Harlamoff	Aug. 29, 1950
2,687,695	Blom et al.	Aug. 31, 1954

FOREIGN PATENTS

109,991	Australia	Mar. 14, 1940
586,760	Great Britain	Mar. 31, 1947
106,595	Switzerland	Sept. 1, 1924