June 5, 1956 F. W. HENRY 2,748,714

THRUST BEARING

Filed Oct. 17, 1952

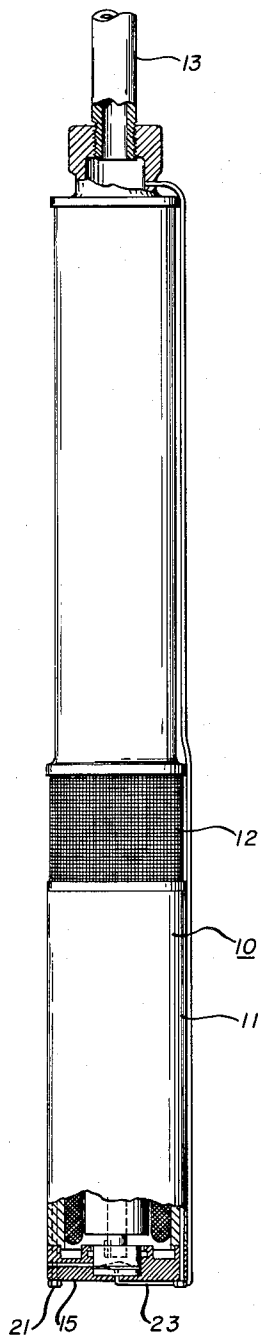
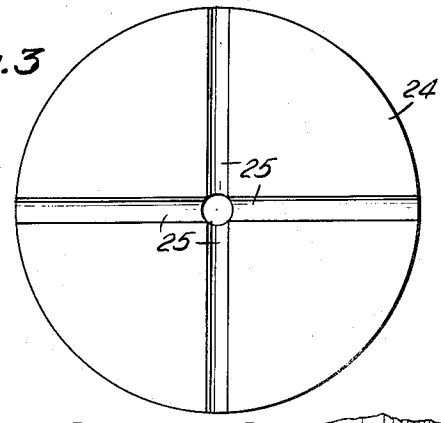



Fig. 1

Fig. 3



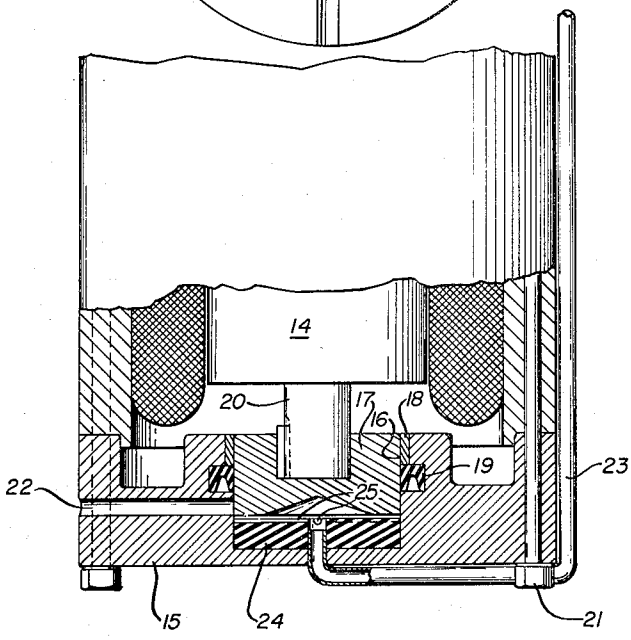




Fig. 2

INVENTOR.
FRED W. HENRY
BY Woodling and Kroost
attys

United States Patent Office

2,748,714

Patented June 5, 1956



2,748,714

# THRUST BEARING

Fred W. Henry, Wellsville, Ohio

Application October 17, 1952, Serial No. 315,324

2 Claims. (Cl. 103—112)

This invention relates to fluid thrust bearing construction in general, and relates more specifically to a thrust bearing construction for an immersed deep well water pump.

An object of this invention is to provide an improved floating thrust bearing.

Another object of this invention is to float the entire prime mover and impellers of a fluid pump upon a fluid cushion.

Another object of this invention is to use the fluid and the pressure of a fluid pump to support the rotatable members on a fluid cushion.

Still another object of this invention is to provide a resilient rubber-like cushion having radially extending grooves in the face thereof to collect abrasive silt, should any silt be encountered.

Other objects and a fuller understanding of the invention may be had by referring to the following description and claims, taken in conjunction with the accompanying drawing, in which:

Figure 1 illustrates the exterior appearance of a conventional submergible deep well water pump, with a portion at the bottom thrust bearing area broken away to show the location of the thrust bearing thereof;

Figure 2 is an enlarged illustration of the broken away end portion of Figure 1; and

Figure 3 is a plan view of the rubber pad shown in cross section in the bottom area of Figure 2.

The drawing illustrates a practical embodiment of the present invention as used to cushion the thrust of a deep well pump. Deep well pumps formerly employed a long rod extending down into the well and actuated by a reciprocation mechanism at the top of the well. Now many deep well pumps are generally compact units containing the prime mover and are designed to be submerged into the well. A power line is extended to the unit and no movable member extends to the top of the well.

The drawing illustrates a conventional deep well pump **10** having a casing **11** with an intake opening **12** to admit water into the pump mechanism. A delivery exit tube **13**, usually a conventional water pipe, extends from the top of the pump **10** to the earth's surface.

The end of the casing **11** serves also as the exterior casing of an electric motor **14** employed for driving the pumping mechanism. In most deep well pumps of this type the pumping impellers are rotating elements and are mounted on a shaft. Generally, the impeller shaft and driving motor shaft are suitably coupled into a composite central shaft **20**. Accordingly, the entire thrust of the pumping action, as well as the physical weight of the motor and impelling mechanism, is all carried by the end of the shaft **20**.

In the embodiment of this invention as adapted to such a deep well pump **10**, an end cap **15** is provided which also serves as the motor head. At the position for location of a bearing, the end cap **15** is provided with a cylindrical bore **16**. A piston member **17**, preferably of brass or bronze, is keyed to the end of the shaft **20** as illustrated



and is positioned within the cylinder **16**. Suitable bearing material **18** and packing **19** are provided in a conventional manner as illustrated. The entire assembly of end cap **15**, together with the packing, bearing material, and piston, is held in proper position upon the end of the casing **11** by means of a plurality of head bolts **21**.

According to the teaching of this invention, a fluid line **23** is tied into the high pressure area of the pump **10** at or near the entrance of the exit tube **13** into the top of the casing **11**. The fluid line extends to the end cap **15** along the exterior surface as illustrated or may be built into the casing to provide an internal fluid passageway. A separate supply of fluid pressure may be employed for devices other than pumps in order to use this type of thrust bearing. The fluid line **23** enters into the area between the piston **17** and the cylinder **16**. This area may properly be termed an expansible chamber. The size of the fluid line **23** need not be large because principally only a static pressure is desired in the expansible chamber. There is no need for a delivery of a large volume of fluid. Consequently, friction will not be a particular factor and the pressure, which may be built up in the expansible chamber, will approach close to the delivery pressure at the exit tube **13**. The dimensions of the piston **17** may be provided according to the desired amount of thrust. There will be a certain amount of end thrust due to the pumping action and gravity of the mechanism. If it is desired to produce sufficient thrust on the piston **17** to completely balance such load, then the total area of piston **17** must be large enough to produce a total thrust greater than the pumping thrust and gravity. If less than an amount equal to such thrust by the pump is necessary, then, of course, a smaller piston **17** may be employed. For example, counter-balancing mechanisms may be built into the pump **10** in which event a relatively small piston **17** will suffice.

The drawing is set forth to illustrate the present invention in principle only and is not intended to teach the proper size of the piston **17** for all particular pumps. Nevertheless, regardless of whether the piston **17** is employed for the entire thrust or only a part of the entire thrust, proper operation according to this invention will produce a floating action, so to speak. In other words, the pressure within the expansible chamber will be sufficient to move the piston upwardly and provide a water cushion under all faces of the piston **17**. The drawing illustrates the piston in a raised position as it would appear under operation with a water cushion separating the lowermost face of the piston **17** from the bottom of the cylinder. In order to limit the upward movement, for example in the event that the thrust pressure were variable and the piston were constructed large enough to counteract the largest of such variable pressures, an exhaust port **22** is provided in the side of the cylinder **16**. The piston **17** will have some endwise movement and accordingly, when in the lowermost position, will completely cover the exhaust port **22**. As the piston **17** is raised or floated, a position will eventually be reached wherein the exhaust port **22** begins to become uncovered. The drawing illustrates the piston **17** in the position just prior to opening of the exhaust port **22**. A further movement of the piston **17** will cause a bleeding of the fluid within the expansible chamber and therefore limit the pressure and, consequently, limit the endwise movement of the piston **17**. Furthermore, such bleeding will promote an exhausting of any silt which may collect in the expansible chamber.

As a further desirable improvement in such thrust bearing construction, there is provided a rubber-like pad **24** in the bottom of the cylinder **16**. A type of rubber referred to as cutlass rubber is desirable. Furthermore, it has been found that the pad **24** is more desirable and will prevent chatter and help to eliminate silt if a series

of radially extending grooves **25** are cut into the upper surface of the pad. The Figure 2 of the drawing shows one such groove aligned with the exhaust port **22** and accordingly will urge silt which may collect in the grooves outwardly to the exhaust port when fluid begins to bleed out through the exhaust port. The grooves **25** are spaced like the cuts of a pie and accordingly divide the pad into a plurality of separate segments of rubber which will tend to bend or drag a little in the direction of rotation of the piston **17**, thus tending to eliminate chatter.

Although the invention has been described in its preferred form with a certain degree of particularity, it is understood that the present disclosure of the preferred form has been made only by way of example and that numerous changes in the details of construction and the combination and arrangement of the parts may be resorted to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is:

1. A thrust bearing for a central shaft of a fluid pump having impellers on said shaft, comprising, an end cap for said pump, a cylinder in said end cap, a piston rotatable and longitudinally reciprocably mounted in said cylinder, a resilient rubber like pad in said cylinder, said piston and pad, together with the side walls of said cylinder, defining an expansible chamber, said piston secured to said shaft in fixed relationship with respect to said shaft, an exhaust port opening from the side of said cylinder, said pad having a plurality of radially extending surface grooves, one of which is registered with said exhaust port, said piston and cylinder being longitudinally reciprocable between a first relative position wherein said port is covered by said piston and a second relative position wherein said port is at least partially uncovered, and a fluid line interconnecting the high pressure exit from said pump and the chamber defined by the piston and cylinder, said exhaust port located a distance from the surface of said pad thereby assuring the spacing of the piston from the pad to prevent any physical contact therebetween during operation of the central shaft.



2. A thrust bearing for a central shaft of a fluid pump having impellers on said shaft, comprising, an end cap for said pump, a cylinder in said end cap, a piston rotatable and longitudinally reciprocably mounted in said cylinder, a resilient rubber-like pad in said cylinder, said piston and pad, together with the side walls of said cylinder, defining an expansible chamber, said piston secured to said shaft in fixed relationship with respect to said shaft, an exhaust port opening from the side of said cylinder, said pad having a plurality of radially extending surface grooves, said piston and cylinder being longitudinally reciprocable between a first relative position wherein said port is covered by said piston and a second relative position wherein said port is at least partially uncovered, and a fluid line interconnecting the high pressure exit from said pump and the chamber defined by the piston and cylinder, said exhaust port located a distance from the surface of said pad thereby assuring the spacing of the piston from the pad to prevent any physical contact therebetween during operation of the central shaft.

**References Cited** in the file of this patent

UNITED STATES PATENTS

| | | |
|---|---|---|
| 514,684 | Pessano | Feb. 13, 1894 |
| 666,869 | Jackson | Jan. 29, 1901 |
| 669,601 | Snow | Mar. 12, 1901 |
| 971,852 | Krogh | Oct. 4, 1910 |
| 1,667,992 | Sherwood et al. | May 1, 1928 |
| 1,700,856 | Schein | Feb. 5, 1929 |