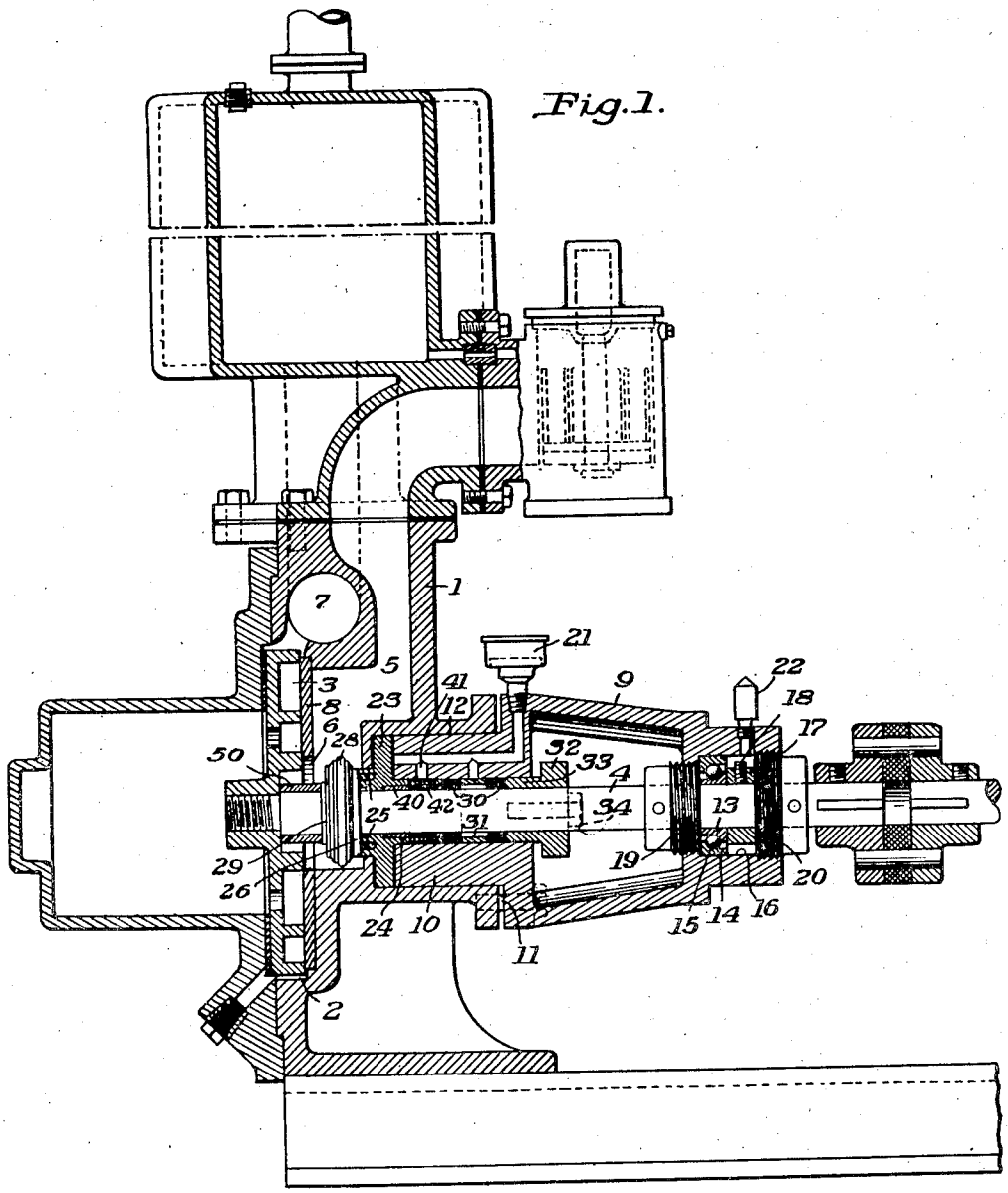
Nov. 9, 1948. D. MURPHY 2,453,249

SEAL FOR CENTRIFUGAL PUMPS

Filed Feb. 10, 1944 2 Sheets-Sheet 1

Fig. 1.



INVENTOR

Daniel Murphy

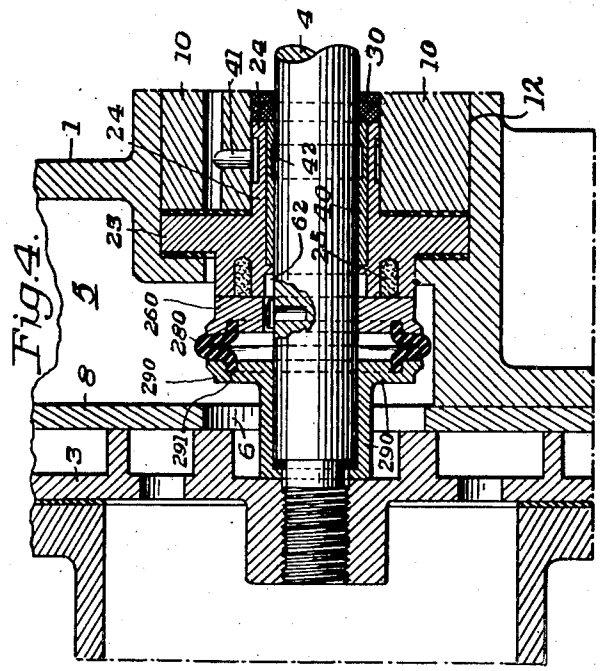
by Christy, Parmelee and Strickland

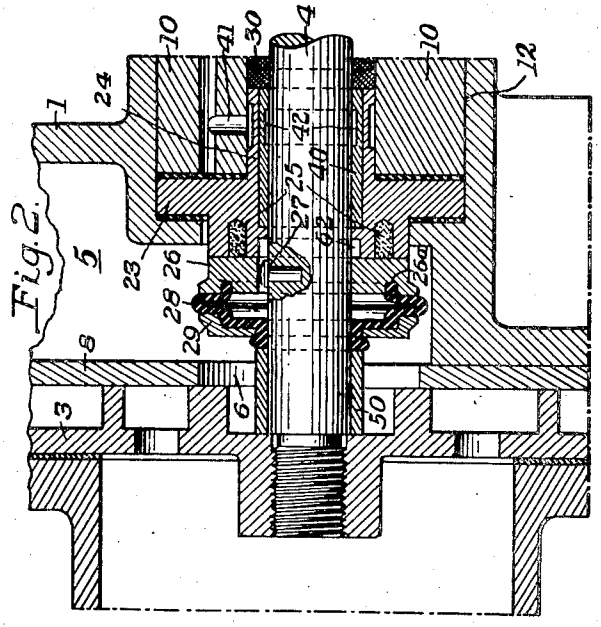
his attorneys

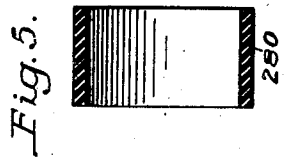
Nov. 9, 1948. D. MURPHY 2,453,249

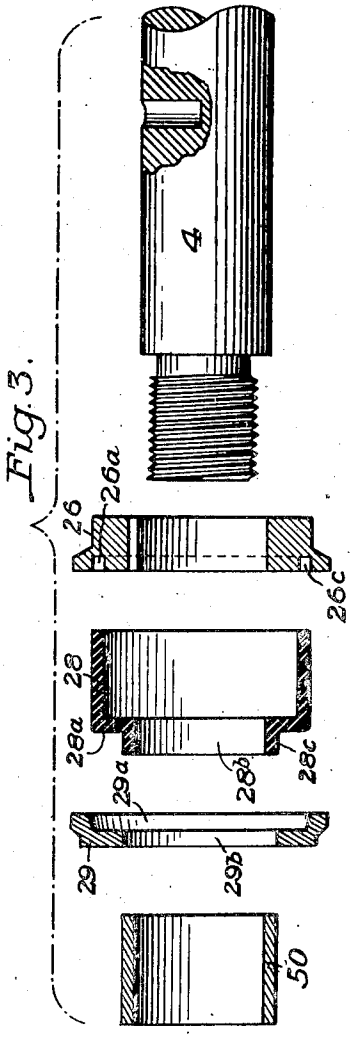
SEAL FOR CENTRIFUGAL PUMPS

Filed Feb. 10, 1944 2 Sheets-Sheet 2









INVENTOR
Daniel Murphy
by Christy, Parmelee and Strickland
his attorneys

Patented Nov. 9, 1948 2,453,249

UNITED STATES PATENT OFFICE

2,453,249

SEAL FOR CENTRIFUGAL PUMPS

Daniel Murphy, New Castle, Pa.

Application February 10, 1944, Serial No. 521,771

3 Claims. (Cl. 286—11)

1

My invention relates to rotary pumps, and particularly to a device for sealing such pumps against the escape or infiltration of fluid between the rotating shaft of the pump and the pump body portion or wall through which the shaft extends.

The invention consists in certain new and useful improvements in the construction of rotary pumps, especially though not exclusively pumps that operate on fluids containing abrasive particles.

In an application for Letters Patent, Serial No. 477,703, filed March 2, 1943, now Patent No. 2,355,390, I have illustrated and described a pump that has enjoyed success in pumping "slip" in the pottery industry, and it is in association with such pump that I shall describe my present invention, noting that the invention will find utility in many different forms of pumps operating on liquids or gases that may or may not carry abrasive particles.

In the accompanying drawings Figure 1 is a view, partly in side elevation and partly in vertical section, of a pump in which, in exemplary way, the invention has been embodied;

Figure 2 is a fragmentary view, showing partly in side elevation and partly in vertical section, the structure in which the invention is centered;

Figure 3 is an "exploded" view, corresponding to Figure 2, and showing the several elements of the essential structure moved apart for better visual consideration;

Figure 4 is a view similar to Figure 2, illustrating a modified form of the structure of the invention; and

Figure 5 is a sectional view of one of the component parts of the modified structure.

The pump shown in the drawings comprises a body 1, within which is formed the usual impeller chamber 2, and within the chamber a vaned impeller 3 is borne upon a rotary shaft 4. Under the influence of the rotating impeller, liquid is drawn from an intake passage 5 through the eye 6 of the pump, and is delivered at the periphery of chamber 2 to a discharge passage 7. When the pump is in operation, the pressure upon the delivery side, exerted upon the rotating impeller, holds the impeller under pressure in abutment upon the side wall on the right (as seen in Figure 1) of the pump chamber 2. This side wall is advantageously formed as a removable and replaceable plate 8.

The body 1 of the pump carries rigidly mounted upon it a housing 9; and within the housing two bearings are formed, which carry rotatably

2

the shaft 4 of the impeller. The shaft 4 at its outer end (to the right, Figure 1) is adapted to be coupled to or otherwise brought into power-transmitting connection with a suitable motor; and the mounting of the shaft in said two spaced-apart bearings is effective to prevent whipping of the shaft when the pump is in operation.

One of the bearings includes an annular block 10, made in one piece with the housing 9; and the block 10, and with it the integral housing, is secured by set-screws 11 in a cylindrical seat 12, formed exteriorly upon the body 1 of the pump. The other bearing consists of concentric rings 13 and 14 with rolling members, here shown to be balls 15, arranged in the race formed for them by and between the rings. The inner ring 13 fits snugly upon the shaft 4; the outer fits snugly within, but is adapted to slide longitudinally within, a bore 16, formed in the housing 9. The bearing 13, 14, 15 abuts laterally upon a ring 17, that, by set-screws 18, is secured to the shaft 4. The assembly of bearing and ring is held between two nuts 19 and 20, that, encircling the shaft 4 and movable freely along shaft 4, make screw-thread engagement with the bore 16. The housing 9 is made in the form of a cage, as shown, to afford access to the inner nut 19, for adjusting it.

Means are provided for lubricating the two bearings, and conventional means are here shown, consisting of lubricant cups 21 and 22, with ducts leading to the bearing surfaces.

It will be seen that in the second bearing (the bearing to the right), and particularly in the ring 17 and the co-operating nuts 19 and 20, means are found for adjusting the shaft 4 longitudinally, in compensation for wear of the impeller 3 upon the plate 8.

It is requisite that provision be made against withdrawal of lubricant from the bearings by the suction of the operating pump, and against ingress to the bearings, when the pump is at rest, of the liquid that is pumped, a supply of which remains standing in passageway 5. In the means to such end, and in the structural organization of such means with associate parts, the present invention exists.

In the seating of the bearing block 10 in the body 1 of the pump an annular shaft-encircling plate 23 is, by the screws 11, clamped to place at the left-hand end (Figure 1) of the cylindrical seat 12. This annular plate is provided with a sleeve-like extension 24. The extension may be integral with the plate itself, as shown. In the assembly it extends through the orifice in the

pump wall formed for the passage of shaft 4, and in this case into the passage 5. This extension is adapted for diminution of friction in the rotation of an adjacent body rotating in abutment upon it; and to such purpose it is provided at its extremity (to the left) with bores filled with suitable lubricant 25, such as a graphite mixture or Babbitt metal. The plate 23 with its sleeve-like extension 24, when clamped to place, constitutes within block 10 the bearing member proper. The extension 24 carries interiorly a bronze bushing 40, within which the shaft turns. Lubrication ducts are indicated at 41, 42. The annular plate is clamped with sealing effect to the wall of the pump casing, and its integral sleeve-like extension is the immediate bearing member for the shaft; and, accordingly, I term the member 23, with its shaft-encompassing portion 24, the inner bearing and sealing member.

In the assembly the plate 23 with its sleeve-like extension 24 snugly encircles the shaft. The fit is, however, not so snug as to exert any restraint upon the free turning of the shaft within the sleeve. The central bore through the bearing block 10 is of sufficiently larger diameter to form a packing gland for the shaft in its bearing block 10. In the cylindrical space formed by and between the shaft and the block 10, and closed to the left by the plate 23 with its extension 24, are arranged bodies 30 of packing that may in familiar manner be assembled in alternation with a lantern ring 31. The packing will be of the usual sort known as composition packing, as distinguished from rubber packing, and will typically consist of a strip or ring of asbestos filled with graphite. The gland is at its outer end closed by an annular block 32 with a sleeve-like extension 33, that may be adjustably anchored in the bearing block 10 by set-screws 34.

A sealing device cooperates with the shaft-encompassing portion 24 to prevent liquid from being sucked into the pump from the bearing structure (42, etc.) when the pump is in operation, and to prevent liquid from draining from the pump into the bearing structure when the pump is at rest. The sealing device comprises a collar portion 26 keyed, as at 27, to the shaft 4. The collar portion is thus made to rotate with the shaft, while being adapted to slide on the shaft to maintain, as presently will appear, snug contact with the self-lubricating face of the stationary portion 24.

Organized with the collar portion or member 26 is a tubular member 28 formed of flexible and elastic material that is resistant to deterioration under the effects of the liquid being pumped and the lubricant used in the bearing structure. A synthetic rubber known on the market as "neoprene" has been found to be a suitable material of which to form the member 28, but it will be understood that the invention is not predicated upon the selection of the particular material which may be used. Important characteristics of the member 28 are that it is mounted in shaft-encircling position; that at one end of its tubular or ring-like body it is secured in sealed union to the collar portion 26, and at opposite end is secured in sealed union to the shaft, or to a portion that is united to the shaft in such way that the effect is the same; that it (still referring to the member 28) is adapted to rotate in unison with the shaft and the collar portion 26; and that it is adapted to permit axial movement of the said collar portion on the shaft without breaking the sealed unions mentioned. Preferably, if not essentially, the elastic body of the member 28 is so organized in the assembly that it operates to press and maintain the collar portion 26 in snug "running" contact with the face of the stationary portion 24, whereby a sealed engagement of the relatively rotatable portions 24 and 26 is maintained both when the pump is in operation and when it is idle. The member 28, by virtue of its physical nature, is adapted to maintain such sealed engagement even though a slight misalignment exists between the relatively rotatable parts.

The member 28 may take the form of a cylindrical sleeve, shown in Figure 3, and the collar member 26 is provided with a circular slot 26a that in assembly receives the right-hand edge of the sleeve 28. At its left-hand end the sleeve is provided with a wall 28a having a circular opening 28b through which the impeller shaft 4 extends. Cooperating with the left-hand end of the sleeve is a collar member or disk 29 that is recessed, as at 29a, to receive and support the left-hand end of the sleeve. The member 29 includes an orifice 29b that peripherally engages a flange portion 28c formed integrally at the edge of the opening 28b in the sleeve, and this flange, when the parts are assembled on the shaft 4, extends through the orifice in the disk member 29, and is engaged by the right-hand end of a rigid sleeve 50 that is slideable on the shaft. The proportions and dimensions of the several elements of the sealing device are such that, when the elements are assembled in service positions, the body of the impeller, screwed into place on the threaded end of the shaft, forces the rigid sleeve 50 to the right; under the pressure of the right-hand edge of sleeve 50 against the flange portion 28c on the shaft-encircling sleeve member 28, the flange portion is caused to bulge outward over the edge of the orifice in member 29, whereby, under the urging of the sleeve 50 pressed to the right on the shaft, the disk member 29 also moves to the right, affecting the outward bulging of the elastic, cylindrical body of the member 28. As the impeller reaches fully screwed-on position, the parts are arranged as they are shown in Figure 2. The outward bulging of the cylindrical body of the member 28 causes such body to press tightly against and to envelop the outer edge of the circular slot 26a formed in collar member 26, whereby a fluid-tight seal between the member 26 and the right-hand end of the member 28 is provided. At the opposite end of the member 28, the pressure of the edge of rigid sleeve 50 against the elastic flange 28c compresses the body of the flange and secures it in fluid-tight engagement with the surface of the shaft at a point between the collar member 26 and the impeller 3. The rigid sleeve 50, disk member 29, flexible member 28, and collar member 26 all rotate in unison with the impeller shaft. While a helical spring may be provided within the member 28 on the shaft 4, and compressed between members 26 and 29, I have found that the inherent resilience or elasticity of the axially compressed body of the member 28 provides adequate thrust to press and hold the collar member 26 in fluid-tight engagement with the face of the shaft-encompassing portion 24 carried by the pump body. Thus, a seal of the sort desired is provided—a seal that remains liquid-tight and effective even though there be such misalignment of the parts that the rotating collar member 26 has to wobble to main-

tain proper engagement with the face of the stationary portion 24.

In modification, it will be understood that a helical spring of conventional form may be used instead of the rigid sleeve 50. Such a spring will be compressed axially on the shaft between the body of the impeller and the disk member 29, and at its right-hand end the first turn or coil of the spring will engage the flange 28c of the member 28 with the effect described.

I have described the flexible sealing member 28 to be in fluid-tight engagement with the impeller shaft 4, but it will be understood that the engagement with the shaft need not be immediate. It may be with a portion fixed in fluid-tight position on the shaft, as illustrated in Figure 4. In this modification the sleeve and disk portions (50 and 29 of Figure 2) are formed as a single element 290 secured upon the impeller shaft by means of an integral flange 500 clamped between the shoulder 60 on the shaft and the body of the impeller, with a compressible gasket 61 interposed to insure a sealed union. The disk portion of the unit 290 includes a circular groove 291, similar to the groove 26a formed in the collar member 26. The flexible sealing sleeve is of the modified form (280) shown in Figure 5, and in the assembled structure the two ends of the sleeve 280 are secured and sealed to the members 260 and 290, respectively, after the manner that the right-hand end of the member 28 is secured and sealed to the collar member 26. Manifestly, the modified structure is effective to provide the desired seal between the rotary shaft 4 and the stationary body of the pump into which the shaft extends.

It will be perceived that I have sealed the passage of the pump shaft through the wall of the pump, against leakage, and by means of simple organization, and that I have provided bearing for the pump shaft that is easily assembled and separated, that, as in course of operation the wearing plate 8 and the impeller 3 are worn away, they may readily be removed and replaced; and that, as operation continues, the adjustment nuts 19 and 20 constitute means for compensating for gradual wearing away.

It may be noted that within the face of the stationary shaft-encompassing portion 24 of the structure, I provide a clearance or groove 62 that extends circumferentially of the impeller shaft. This groove provides a recess in which lubricant may be retained.

Within the terms of the appended claims many variations and modifications are permissible. Indeed, it is contemplated that the seal of this invention may be used to seal the rotating shafts of machines and apparatus other than centrifugal pumps.

I claim as my invention:

1. A sealing device for a shaft comprising two collar portions arranged to be secured upon the shaft for rotation therewith and for movement relatively to one another axially of the shaft, at least one of said collar portions having an annular groove encompassing the shaft and opening towards, or facing, the other collar portion, a shaft-encompassing tubular sealing element arranged between said collar portions and in fluid-tight engagement therewith, one end of said tubular sealing element being positioned in said annular groove, and means for securing the two collar portions in juxtaposition, with the medial body portion of said sealing element bulged radially outward beyond said groove and pressed between said collar portions, whereby the body material of the sealing element is compressed in fluid-tight engagement with the outer edge of said groove.

2. The structure of claim 1, wherein both of said collar portions include an annular groove, as defined, with the two ends of said tubular sealing element severally positioned in such grooves, and with the body material of the outwardly bulged medial portion of said sealing element compressed in fluid-tight engagement with the outer edge of each of said annular grooves.

3. A sealing device for a shaft comprising two collar portions arranged to be secured upon the shaft for rotation therewith and for movement relative to one another axially of the shaft, said collar portions having substantially flat opposed surfaces adjacent their peripheries, a shaft-encompassing tubular sealing element arranged between said collar portions and in fluid-tight engagement therewith, means securing the ends of said tubular element in fluid-tight engagement with said collar portions radially inwardly of said substantially flat surfaces, and means for securing the two collar portions in juxtaposition, with the medial body portion of said sealing element bulged radially outward beyond said securing means between said substantially flat surfaces with the sealing element in engagement with the complete extent of both of said substantially flat surfaces and extending beyond the outer radial edges of the collars.

DANIEL MURPHY.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
664,445	Surth	Dec. 25, 1900
1,897,280	Schwitzer	Feb. 14, 1933
1,931,723	Fageol	Oct. 24, 1933
2,027,505	Winkler	Jan. 14, 1936
2,236,902	Haller	Apr. 1, 1941
2,347,118	Matter	Apr. 18, 1944

FOREIGN PATENTS

Number	Country	Date
322,711	Great Britain	1929
458,262	Great Britain	1936
664,854	France	1929