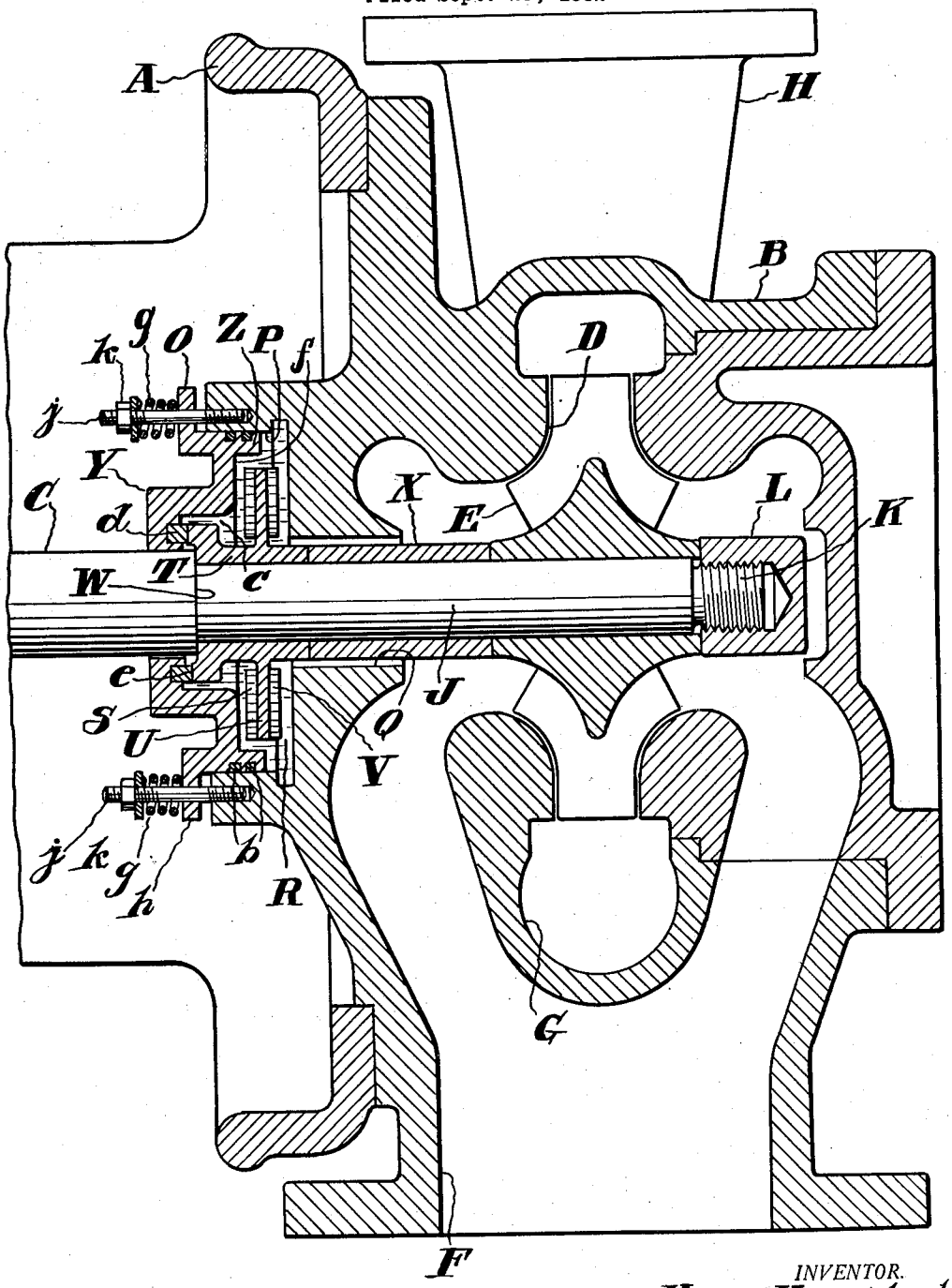
Oct. 24, 1933. H. HORNSCHUCH 1,932,214

SEALING DEVICE

Filed Sept. 29, 1932



INVENTOR.
Hanns Hornschuch
BY Richard Adler
HIS ATTORNEY.

Patented Oct. 24, 1933 1,932,214

UNITED STATES PATENT OFFICE

1,932,214

SEALING DEVICE

Hanns Hornschuch, Easton, Pa., assignor to Ingersoll-Rand Company, Jersey City, N. J., a corporation of New Jersey

Application September 29, 1932
Serial No. 635,323

7 Claims. (Cl. 286—9)

This invention relates to sealing devices, and more particularly to a sealing device applicable to centrifugal pumps, turbines and the like, of which the opposite sides of the casing wall through which the shaft extends are exposed to different pressures.

One object of the invention is to assure an effective seal between the pump chamber and the exterior of the pump.

Another object is to avoid contact between the rotatable and non-rotatable elements of the sealing device during the normal operation of the pump and thus prolong the period of usefulness of these elements.

Other objects will be in part obvious and in part pointed out hereinafter.

The accompanying drawing illustrating the invention and a practical application thereof is a longitudinal vertical section of a centrifugal pump having the invention applied thereto.

Referring more particularly to the drawing, A designates, in general, a pump comprising a casing B into which extends a shaft C which may be connected to be rotated by any suitable power device (not shown). Within the casing B is the usual pump chamber D wherein is arranged an impeller E mounted on the shaft C to pump the water from an inlet passage F to a discharge chamber G.

The discharge chamber G, as is customary, encircles the impeller E and communicates with a discharge connection H whence the fluid discharged from the impeller E may flow to a desired destination.

The portion J of the shaft which extends into the pump chamber D, and whereon the impeller E is mounted, is of reduced diameter. Its free end K is threaded for the accommodation of a cap nut L which may seat directly against the hub of the impeller to retain the impeller, and such other elements as may be disposed on the reduced portion J, against longitudinal movement.

The sealing device, constructed in accordance with the practice of the invention, and which is designated in general by O, is disposed about the shaft C adjacent the portion of the casing B through which the shaft extends. It comprises a sealing chamber P, in the wall of the casing B, which encircles the reduced portion J of the shaft and communicates with the pump chamber through a bore Q in the casing and through which the shaft extends. The chamber P is preferably of cylindrical shape and contains a body of sealing liquid R which may be of the same substance as that being pumped by the impeller E.

Mounted upon the reduced portion J of the shaft is an impeller S which, upon rotation of the shaft, impels the sealing liquid R towards the outer portion or bounding surface of the chamber P to maintain an annulus of sealing liquid at that point.

The impeller S may be of a known type comprising a hub T through which the reduced portion J of the shaft extends. On the periphery of the hub is a disk U carrying, on opposite sides thereof, wings V whereby the sealing liquid R is thrust outwardly into the outermost portion of the chamber P. One end of the hub T may, as shown, seat directly against a shoulder W at the juncture of the reduced and enlarged portions of the shaft and with its other end against a sleeve X interposed between the hub T and the hub of the impeller so that, upon tightening the nut L upon the threaded end K of the shaft, the impellers E and S will be clamped fixedly to the shaft.

A closure is provided for the sealing chamber P in the form of a cover Y through which the shaft C extends. The cover Y includes a cylindrical flange Z which extends slidably into the sealing chamber P. In the outer periphery of the cylindrical flange Z are packing members *b* which seat against the adjacent surface of the wall of the sealing chamber P.

In the inner surface of the cover Y is a recess *c* into which the outer end of the hub T extends, and in the bottom of the recess *c* is a packing member *d* which, when the cover Y occupies its innermost position, seats against the adjacent end surface *e* of the hub T.

The inner surface of the cover Y constitutes a pressure surface *f* against which the annulus of sealing liquid acts to move the cover Y outwardly in the chamber P. The pressure of the sealing liquid is, however, opposed by a spring or series of springs *g* acting against the outer surface of the cover Y, in this instance against lugs *h* on the cover.

As a preferred form of construction the springs *g* encircle bolts *j* threaded into the casing B and extending through the lugs *h*. The outer ends of the bolts *j* are threaded for the accommodation of nuts *k* against which the outer ends of the springs *g* may act and whereby the springs *g* may be adjusted to exert a desired pressure upon the cover Y.

The operation of the device is as follows: Let it be assumed that the shaft C and the elements affixed thereto are rotating at the normal speed

required for pumping the water from the inlet passage F to the discharge chamber G. With the shaft thus operating the impeller S forces the sealing liquid R into the outer portion of the sealing chamber P and retains it there in the form of a rotating annulus, it being of course understood that the sealing liquid will be of a quantity sufficient to constantly cover at least the outermost portion of the impeler S. As will be readily understood, therefore, with the disk U in the form of a solid member and with the annulus of water overlapping the disk and extending to the outer wall of the chamber P, communication between the interior and the exterior of the pump will be completely cut off so that, in such instances as where the intake pressure is below atmospheric pressure, air will be prevented from leaking into the pump through the aperture Q in the casing through which the shaft extends.

As will be readily appreciated the force of the impeller S creates a pressure in the sealing liquid R and, by acting against the pressure surface *f*, the pressure of the sealing liquid causes the cover Y to move outwardly and, by so doing, move the packing member *d* out of contact from the surface *e* on the hub T. This outward movement of the cover Y, of course, compresses the springs *g* which may be adjusted to yield to a certain predetermined pressure against the pressure surface *f*. During the subsequent operation of the pump the packing *d* will be retained out of contact from the rotating elements of the pump and it is, therefore, not subjected to the wearing action of the movable parts of the pump.

When the pump is again brought to rest so that the pressure of the sealing liquid R falls below that exerted by the springs *g* against the cover Y, the springs *g* will move the cover in the direction of the impeller S and the packing member *d* will then seat against the surface *e* and prevent leakage of fluid from the pump to the exterior thereof.

In practice, the present invention has been found to be particularly desirable for use on pumps to which the liquid being pumped is supplied under a head so that the pumping chamber is filled with liquid both during the pumping and idle periods. In such case of course liquid will flow from the pump chamber along the shaft into the sealing chamber P and with the springs *g* properly adjusted to exert a predominating pressure on the exterior of the cover Y the packing member *d* will be retained in sealing relationship with the end of the hub T so that no loss of liquid will take place through leakage at this point.

I claim:

1. In a centrifugal pump, the combination of a casing having sealing and pumping chambers and a shaft rotatable in the chambers, means in the sealing chamber rotatable with the shaft to maintain an annulus of sealing liquid in the sealing chamber, and a floating cover for the sealing chamber having a sealing member and being actuated by the pressure of the annulus of sealing liquid in the sealing chamber to maintain the sealing member out of sealing position during the operation of the pump.

2. In a centrifugal pump, the combination of a casing having sealing and pumping chambers and a shaft rotatable in the chambers, an impeller in the sealing chamber rotatable with the shaft to maintain an annulus of sealing liquid in the sealing chamber, and a spring-pressed floating cover for the sealing chamber having a sealing member and being actuated by the pressure of the annulus of sealing liquid in the sealing chamber to maintain the sealing member out of sealing position during the operation of the pump.

3. In a centrifugal pump, the combination of a casing having sealing and pumping chambers and a shaft rotatable in the chambers, sealing liquid in the sealing chamber, a floating cover for the sealing chamber, a rotatable seat for the cover, and rotary means in the sealing chamber to maintain an annulus of sealing liquid under pressure in the sealing chamber and to move the cover out of contact from the seat.

4. In a centrifugal pump, the combination of a casing having sealing and pumping chambers and a shaft rotatable in the chambers, a body of sealing liquid in the sealing chamber, a floating cover for the sealing chamber and being movable longitudinally of the sealing chamber, an impeller to create an annulus of sealing liquid in the sealing chamber to act against the cover for moving said cover in one direction, and springs for moving the cover in an opposite direction.

5. In a centrifugal pump, the combination of a casing having pumping and sealing chambers and a rotary shaft in the chambers, means rotatable in the sealing chamber to maintain an annulus of sealing liquid therein, a rotatable shoulder in the sealing chamber, a cover for the sealing chamber having a sealing surface and being actuated longitudinally of the sealing chamber by the annulus of sealing liquid to prevent contact between the sealing surface and the shoulder during the normal operation of the pump, and means for maintaining the sealing surface in sealing relationship with the shoulder during the idle period of the pump.

6. In a centrifugal pump, the combination of a casing having a pumping chamber and a sealing chamber and a shaft rotatable in the chambers, a shoulder on the shaft and lying within the sealing chamber, means in the sealing chamber rotatable with the shaft to maintain an annulus of sealing liquid in the sealing chamber during the operation of the pump, a cover for the sealing chamber having a sealing surface adapted to seat against the shoulder, a pressure surface on the cover against which the annulus of sealing liquid acts to actuate the cover for maintaining the sealing surface out of contact from the shoulder, and means for maintaining the sealing surface in sealing relationship with the shoulder during the idle period of the pump.

7. In a centrifugal pump, the combination of a casing having sealing and pumping chambers and a shaft rotatable in the chambers, sealing liquid in the sealing chamber, a hub on the shaft and rotatable therewith, a disk on the hub having wings to maintain an annulus of sealing liquid in the outer portion of the sealing chamber, a cover for the sealing chamber and being slidable longitudinally thereof, a packing member in the cover adapted to seat against the hub, a pressure surface on the cover against which such sealing liquid acts to move the cover for maintaining the packing member out of contact from the shoulder during the normal operation of the pump, and means exerting a pressure on the cover to actuate said cover for pressing the packing member into sealing relation with the hub when the pressure of the sealing liquid falls below that exerted by the said means.

HANNS HORNSCHUCH.