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H. A. THRUSH

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PUMPING APPARATUS

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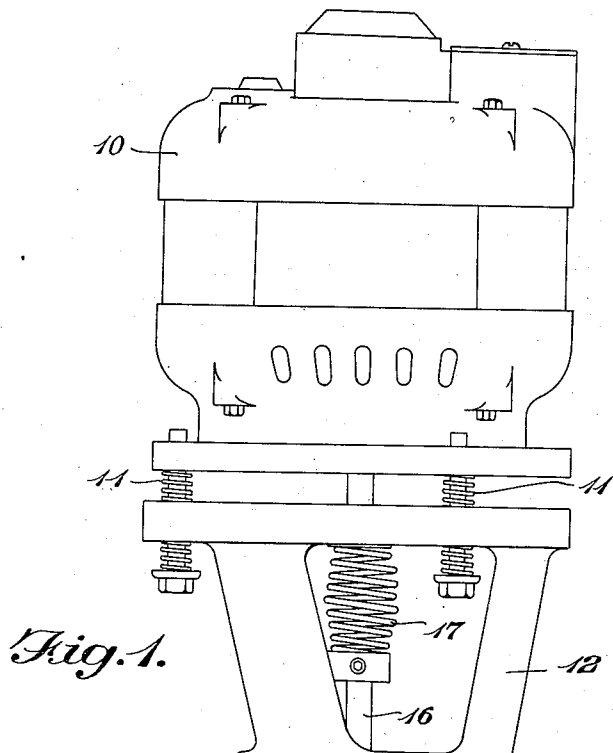


Fig. 1.

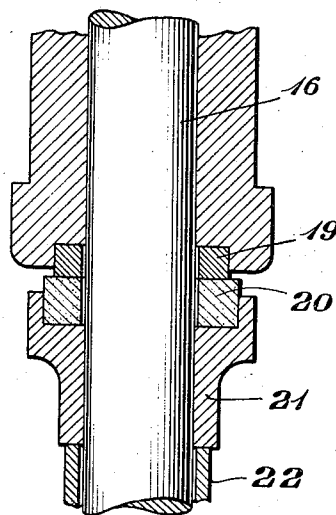
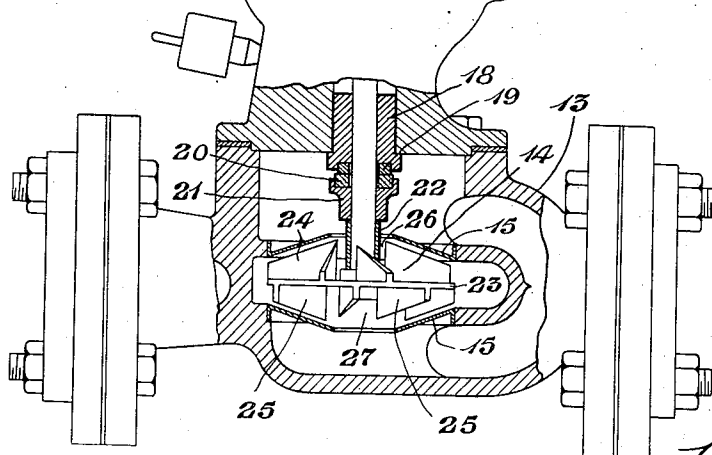


Fig. 2.



Inventor

H. A. Thrush

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Hyatt D. Dowell
Attorney

UNITED STATES PATENT OFFICE

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PUMPING APPARATUS

Homer A. Thrush, Peru, Ind., assignor to H. A. Thrush & Company, Peru, Ind., a corporation of Indiana

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3 Claims. (Cl. 103—111)

This invention relates to pumping apparatus and more particularly to a shaft seal arrangement for use in connection with the sealing of pumping casings at the point where the shaft extends through the casing and connects the pumping element with the prime mover. The use of conventional packing at this location has been found to be awkward, bulky, and generally inefficient in that much power is lost in overcoming the friction of the packing itself.

It has also been suggested that rubber and various synthetic materials be substituted for conventional packing in a gland or other arrangement located at the point where the shaft passes through the pump casing. Experience has shown, however, that this proposed solution is not entirely satisfactory in that these materials have a tendency to swell and deteriorate in a relatively short period of time making for trouble in that replacement is necessary which is not always convenient, and further the expense involved in this replacement is considerable.

Although it has been known that carbon is an excellent material for use as a seal, its satisfactory installation at the proper location on the shaft has indeed been a problem left for applicant to solve.

It has been the practice to mount a carbon seal in rubber or some synthetic material at the point where the shaft passes through the pump casing. While this arrangement has been more satisfactory than those installations which merely involve the utilization of simply conventional packing material, rubber, or other synthetic material, yet this arrangement is subject to marked deterioration and swelling, for even though the carbon element remains intact with some exception due to wear, yet the rubber or synthetic material associated with the carbon element is definitely not free of deterioration, swelling, or other deformation which is unsatisfactory. As no suitable material for use in conjunction with the carbon seal has been found, it remained for applicant to devise a method and means of installation of his carbon seal so that it would operate successfully without any other collateral sealing material.

This application is a continuation in part of the copending application Serial No. 143,825 filed May 20, 1937.

It is an object of the invention to provide a carbon seal and seal holder assembly which will not appreciably swell or deteriorate.

It is a further object of the invention to provide a pump assembly comprising a carbon seal

and holder therefor which may be readily fabricated of materials which do not appreciably swell or deteriorate.

Other objects and the nature and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

Fig. 1 is a view in elevation, partly in section, illustrating the carbon seal and mounting therefor; and

Fig. 2 is an enlarged detailed view, in section, of the carbon seal and its mounting.

Referring to the drawing a motor 10 is resiliently supported through the medium of spring 11 on the bonnet-support 12. The pump casing 13 upon which the bonnet-support 12 is mounted, houses the impeller wheel 14 in the impeller wheel casing 15. The motor 10 is drivingly connected to the impeller wheel 14 through the medium of impeller shaft 16 and flexible coupling 17.

To reduce friction, when the pump is in operation, an upper bearing, which may be made of bronze, is located within the portion of the bonnet-support 12, which is not in section and hence is not shown. This bearing is associated with the bonnet-support on the impeller shaft in the conventional manner. To further eliminate friction and hold the impeller shaft in proper alignment when the device is in operation, a second lower bearing 18, which also may be fabricated of bronze is mounted within the lower portion of the valve bonnet 12 and in bearing relation with the impeller shaft 16 as illustrated in Fig. 1.

Secured in the lower portion of the lowest bronze bearing 18 by a "press-fit" is a hardened steel pressure washer 19 which is arranged in bearing relation with the carbon seal 20, which is secured to the holder 21 in the following manner. In the fabrication of the holder and seal assembly, the holder is first expanded by heating and the carbon seal inserted in position. As the holder cools it shrinks to the carbon seal and makes it substantially the equivalent of a solid piece or unit. This method of fabrication not only makes the assembly tight so that it will not leak water or air, but it will then remain more or less permanent without shrinkage or expansion, either of which is extremely undesirable in apparatus of the character described. After the seal and seal holder have been assembled, the seal holder is secured to the impeller shaft 16 by what is known to the trade as a "press-fit." When many of the pumping units are fabricated,

in order that uniformity may be attained, a spacer sleeve 22, preferably made of brass, may be inserted between the seal holder 21 and the upper portion of the hub of the impeller wheel 14.

The impeller wheel 14 generally comprises a central disc or plate 23, having on opposite sides thereof blades 24 and 25 respectively, which are preferably tapered from the innermost to the outermost ends and of overall curved contour, the blades 24 being staggered with respect to the blades 25, and having their inner ends radially spaced from the axis of the disc 23, defining annular inlet portions 26 and 27 respectively.

To affect the proper sealing relations between carbon seal 20 and the hardened steel washer, the impeller wheel is so constructed and arranged with respect to the impeller wheel casing or chamber that an upward thrust is effected both when the pump is in operation and also when in static condition.

Various constructions of parts may be adopted to create a differential pressure on opposite sides of the impeller shaft 16. One section of the construction involves the mounting of the impeller wheel 14 on its shaft 16, in such relation to the impeller casing or chamber 15 that there is slightly less clearance between the impeller wheel 14 and the bottom portion of the casing or chamber, than between the impeller wheel 14 and the top portion of the impeller casing or chamber.

The resulting axial thrust phenomenon will be apparent from an analysis of the forces involved. When one side of an impeller wheel having dual vane surfaces is unloaded, an axial thrust will be exerted in a direction toward that side which is unloaded. This is due to the fact that both sides of the wheel, when in operation, are always tending to unload themselves because the medium pumped tends to take the path of least resistance. If, then, one side is purposely partially unloaded, the other side in its tendency to unload will exert a thrust toward the side partially unloaded.

This is the construction utilized in the present instance, although the difference in spacing is very slight but yet effective. With this construction, an efficient, positive, satisfactory operation is insured.

Even when the impeller or the pump is idle, the normal pressure in the system is sufficient to exert an upward thrust on the impelling unit by reason of its design for the impeller shaft occupies a portion of the area on the upper side and not on the bottom, which design results in a greater area being available on the bottom side of the impeller wheel, which when acted upon by the pressure of the fluid at the pump inlet, effects the holding of the impeller wheel, and impeller shaft, in its uppermost position and maintains the shaft seal tight.

From the above it will readily be appreciated that applicant has devised a method and means of producing an efficient, long lived pumping apparatus incorporating a carbon seal assembly which comprises a holder fabricated of metal and a carbon ring which is designed to engage a hardened seal ring, the former adapted to rotate with the impeller shaft and the latter secured to a static bronze bearing. The unique method of securing the carbon seal to its holder, described above, increases, substantially, the life of the entire seal, as well as the entire pumping apparatus, in that it does away with the necessity of rubber or other means which formerly was needed to secure the carbon seal to the holder, and the usual replacement which was formerly necessary when the rubber or plastic elements became deformed or otherwise deteriorated.

It will be obvious to those skilled in the art that various changes may be made in this device without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawing and described in the specification but only as indicated in the appended claims.

I claim:

1. In a pump assembly, a casing, and an impeller mounted in said casing, a rotating shaft fixed to said impeller and extending through said casing, a bearing for said shaft where the latter enters the casing, a seal coacting with said bearing and including a carbon ring, a metallic holder for said carbon ring fixed to said shaft, said carbon ring being fixed to said holder, the impeller, impeller shaft, holder, and carbon ring making up a substantially rigid sub-assembly, said impeller being so arranged relative to said casing as to effect an axial thrust in a direction from said impeller towards said seal.

2. The structure recited in claim 1, said impeller having two sides with a set of fluid forcing vanes on each side, each set of vanes cooperating with a portion of said casing to provide a fluid forcing unit, said impeller being mounted within said casing in a manner such that the relative clearance between the first side of said impeller and a first portion of said casing is at variance with the clearance between a second side of said impeller and a corresponding second portion of said casing to cause the impeller to partially unload on that side where there is most clearance to augment the normal pressure of the fluid being pumped in exerting an axial thrust on the impeller and the shaft in the direction of the shaft seal.

3. The structure recited in claim 1, said metallic holder being press-fixed to said shaft, and said carbon ring being held within said holder by a shrink fit of the latter.

HOMER A. THRUSH.