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PACKING GLAND FOR CENTRIFUGAL PUMPS

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Fig. 1.

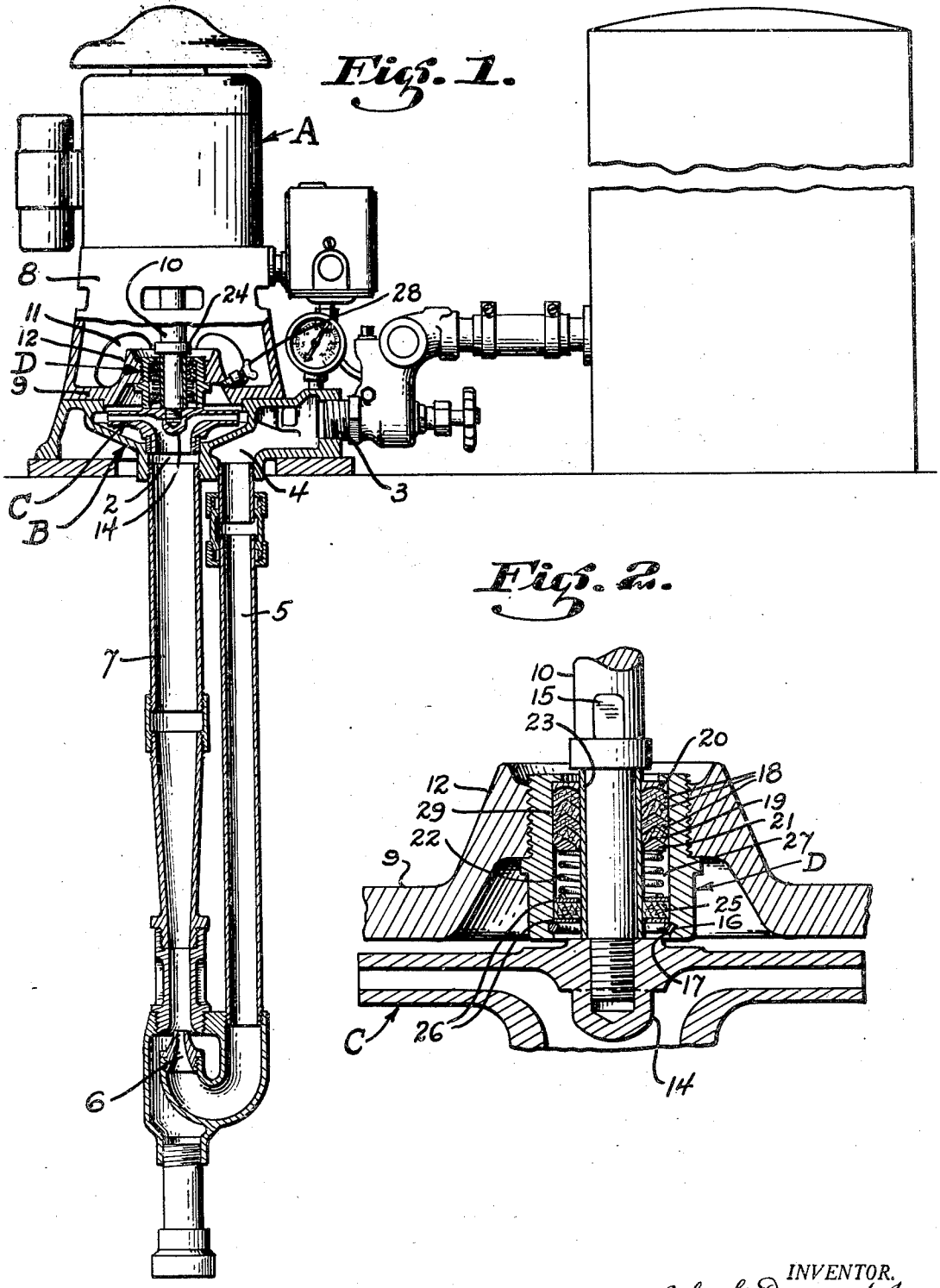

Fig. 2.

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PACKING GLAND FOR CENTRIFUGAL PUMPS

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8 Claims. (Cl. 286—7)

This invention relates to centrifugal pumps, and especially to the stuffing box or gland which surrounds the impeller shaft of the pump.

In many instances the impeller of a centrifugal pump is secured to and directly driven by the shaft of an electric motor. In such structures no bearings are formed in the pump housing which encloses the impeller, as the bearings in the motor itself are designed to take care of both the rotating element of the motor and the impeller. A stuffing box or gland is, however, required where the shaft enters the pump housing, and as the shaft, or in other words the portion thereof which enters the housing, in order to support and drive the impeller, is made as short as possible, the couple between the motor and pump obviously reaches a minimum. Clearance space and accessibility to insert and replace packing is similarly reduced, and if the gland is not given proper care, excess wear and leakage will soon develop.

The object of the present invention is generally to improve and simplify the construction and operation of packing glands of the character described; to provide a packing gland which is accessible regardless of the close spacing between the motor and pump; to provide a packing gland which is cartridge-like in construction and removable as a unit from the inner side of the pump cover; and further, to provide a cartridge-like packing gland from which the packing itself may be readily removed and new packing replaced whenever required.

The packing gland is shown by way of illustration in the accompanying drawing, in which

Fig. 1 is a side elevation, partially in section, showing one type of motor-driven pump, to which the packing gland may be applied; and

Fig. 2 is an enlarged central vertical section of the packing gland, said view also showing a portion of the motor shaft, and the pump cover and the impeller.

Referring to the drawing in detail, and especially to Fig. 1, an electric motor driven centrifugal pump of the ejector type is shown in which A indicates the electric motor, B the volute or pump housing having a suction intake 2 and a discharge connection 3, and an auxiliary discharge or by-pass 4 through which a portion of the water discharged by the impeller C is bypassed and directed downwardly through a pipe 5 to operate an injector 6 mounted in the suction or inlet pipe 7 of the pump. Pumps of this character are well known and are extensively used where the pump is mounted above a well or similar source of water supply.

In pumps of this kind, speed is most essential in maintaining efficiency and low cost of production; hence motors of 3600 R. P. M. are most suitable. However, due to the high speed and the fact that the pump impeller is secured directly to the motor shaft, a close coupling must be maintained between the motor and pump to avoid eccentricity of the motor shaft, which might create an unbalanced and unsatisfactory operating condition. To permit the close coupling required, the lower bell 8, and particularly the base 9 of the motor, is in this instance employed to function as the pump cover. The motor shaft 10 must accordingly extend therethrough, and as this is the case, a stuffing gland, generally indicated at D, will also be required to prevent water and grit from entering the motor.

The low stature of the pump and the short motor shaft would ordinarily present problems in packing the shaft, as it can readily be seen that the low structure prohibits the use of any conventional type of packing gland on the top side of the cover 9 encasing the impeller of the pump.

Furthermore, it would be impossible to get at the packing for adjustment and renewal, as the packing is inacessible through the small windows 11 leading into the limited space between the lower end of the motor and the cover encasing the impeller. I therefore have provided an abbreviated cone 12 on the cover encasing the impeller, and on the underside of the cone a recess is formed in which is inserted a cartridge packing gland D, detachably secured to the cone of the cover encasing the impeller by means of a screw thread.

The cartridge packing gland D is fully illustrated in Fig. 2; and besides functioning efficiently as a packing for the shaft, it must also overcome and eliminate obstacles detrimental to the successful operation of the pump, namely:

Accessibility for renewal or replacement is provided for by a self-contained cartridge encasing the packing assembly, which is screwed into or easily removed from the cone 12 of the pump cover. It is readily accessible by removing the impeller C by putting a socket wrench on a hexagonal hub 14 of the impeller and another wrench on a flat 15 of the motor shaft, and unscrewing the impeller from the motor shaft. Then by applying a wrench on a hexagonal exterior surface of the body of the cartridge pack-

ing gland, the whole packing assembly can be quickly removed and replaced as a unit.

Another feature lies in the novel construction whereby the packing can be renewed and replaced without unscrewing the cartridge packing from the cone of the cover. A snap ring 16 fits into a groove 17, and to release the packing from the cartridge container D, the snap ring 16 is removed and the whole packing assembly may be withdrawn from the shell of the cartridge. This cartridge packing has a dual purpose and can be repacked in place or the entire packing box can be quickly replaced with a new unit, and the old cartridge can be reloaded for future use. This feature saves much time and cost, as compared to the conventional type of packing gland that has to be repacked from the top side; and in connection with pumps described above, where the space is so limited, it requires much more time and expense to replace the conventional type of packing while in place.

Another feature in favor of putting the packing in from the bottom is that there is no danger of injuring the sharp fin edges of the V rings 18, as the V packing rings slide over the motor shaft back side first and this prohibits any possible injury to the essential sharp and delicate edges of the V rings.

Anti-friction packing is another advantage derived, because any packing used on ejector pumps and especially those of small horse power must be as free from friction losses as possible. This is provided for by the use of a series of especially treated leather V rings 18 and a lubricated felt V ring 19. These V rings are held in place at the top with a special form fitting brass retainer ring 20 and a brass expander ring 21 on the bottom.

A spring 22 is provided for holding the packing rings in their workable position, but this spring, unlike most spring loaded packing glands, has no other function than to keep the packing in its position and to allow for freedom of the packing, due to expansion from the swelling of the packing rings. Spring tension is most essential on other types of spring loaded packing, but on the packing illustrated above the spring is not depended on as the water pressure does the sealing of the packing automatically by pressure on the expander ring 21, the V felt ring 19, and the leather V rings 18.

A renewable shaft sleeve is provided in the form of a special non-corrosive high nickel bronze sleeve 23 slipped over the shaft and clamped in place between the impeller and the spacer collar 24, and not only protects the motor shaft from wear and corrosion, but reduces friction against the packing to a minimum. A special feature of this sleeve is that the design of the packing gland permits the sleeve to be turned end for end when the sleeve becomes worn, while in contact with the V ring packing and by reversing the sleeve, the other end engaging the new packing rings and thereby giving the sleeve double life.

A high grade felt ring 25 is clamped between two brass washers 26 by the spring 22 on the top and the snap ring 16 on the bottom, and thus serves as a felt filter ring. The felt ring allows only filtered water to seep through and fills the chamber or reservoir 27 full of clean and grit-free water. As there is no flow of water at any time through the V packing rings, the reservoir 27 remains full of filtered water, and as the felt filter ring 26 also is not subjected to a flow of water, there is no circulation, thus eliminating any chance of grit or dirt working through. Therefore, it will be noted that any slight amount of water consumed in lubricating the V rings 18 of packing comes from the reservoir 27 of clean filtered water and protects the V packing from wear and tear, which would occur if dirty water was allowed to contact the V packing rings.

Exhaustive tests have proven that the reservoir of filtered water is an important element in assuring exceedingly long life to the whole packing assembly.

The operation is as follows: when the pump is primed and the air exhausted through the vent cock 28 (see Fig. 1) the water seeps through the filter felt 25 (see Fig. 2) and fills the reservoir 27 full of clean filtered water. Then when the pump is started, the pressure generated transmits pressure through the filter felt ring 25 and onto the water in the reservoir 27 which in turn automatically exerts pressure on the expander ring 21 which transfers pressure to the V rings 18 and 19 of the packing which seal the outer surface of the shaft sleeve 23 and the inner wall 29 of the cartridge packing body or shell.

While these and other features of my invention have been more or less specifically described for purposes of illustration, I wish it understood that various changes may be resorted to in construction and operation, all within the scope of the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A packing gland comprising a cylindrical shell having an annular inturned shoulder at one end, a returning ring engaging said shoulder, an expander ring spaced therefrom, a plurality of packing rings interposed between the retainer and the expander ring, said packing rings being V-shaped in cross section, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber for water filtered through the semi-porous gasket, and detachable means securing the last named gasket within the shell.

2. A packing gland comprising a cylindrical shell having an annular inturned shoulder at one end, a retaining ring engaging said shoulder, an expander ring spaced therefrom, a plurality of packing rings interposed between the retainer and the expander ring, said packing rings being V-shaped in cross section, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber for water filtered through the semi-porous gasket, detachable means securing the last named gasket within the shell, and means maintaining a spacing between the semi-porous gasket and the expander ring.

3. A packing gland comprising a housing member, a retaining ring secured in said housing, an expander ring spaced therefrom, a plurality of packing rings and a lubricating ring interposed between said retainer and expander rings, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber for water therebetween, and detachable means for securing said last named gasket within said housing.

4. A packing gland comprising a housing member, a retaining ring secured in said housing, an expander ring spaced therefrom, a plurality of packing rings and a lubricating ring inter-

posed between said retainer and expander rings, said packing rings and said lubricating rings being V-shaped in cross section, a semi-porous packing and water filter gasket spaced from said expander ring to form a chamber for water filtered through said semi-porous gasket for lubrication of said packing rings, and detachable means securing the last named gasket within the housing.

5. A packing gland comprising a cylindrical shell having an annular inturned shoulder at one end, a retaining ring engaging said shoulder, an expander ring spaced therefrom, a plurality of packing rings interposed between the retainer and the expander ring, said packing rings being V-shaped in cross section, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber for water filtered through the semi-porous gasket, detachable means securing the last named gasket within the shell, and a compressing spring in the water-receiving chamber to maintain the packing rings under slight compression and the semi-porous gasket against the detachable securing means.

6. In combination with a pump cover of the character described and a driving shaft extending therethrough, a recess formed in the inner face of the cover concentric to the shaft, a cylindrical shell, detachable means for securing the shell in the recess in a position to permit the driving shaft to extend centrally and longitudinally therethrough, a retainer and an expander ring within the shell, a plurality of packing rings interposed between the retainer and the expander rings to prevent water leakage through the shell, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber within the shell for water filtered through the semi-porous gasket, a spring in the chamber maintaining the space between said gasket and the expander ring, and detachable means securing the semi-porous gasket, the spring, the expander ring, and the packing rings within the shell.

7. In combination with a pump cover of the character described and a driving shaft extending therethrough, a recess formed in the inner face of the cover concentric to the shaft, a cylindrical shell, detachable means for securing the shell in the recess in a position to permit the driving shaft to extend centrally and longitudinally therethrough, a retainer and an expander ring within the shell, a plurality of packing rings interposed between the retainer and the expander rings to prevent water leakage through the shell, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber within the shell for water filtered through the semi-porous gasket, a spring in the chamber maintaining the space between said gasket and the expander ring, detachable means securing the semi-porous gasket, the spring, the expander ring, and the packing rings within the shell, and a wearing sleeve on that portion of the driving shaft which extends through the shell, said sleeve being end-to-end reversible.

8. In combination with a pump cover of the character described and a driving shaft extending therethrough, a recess formed in the inner face of the cover concentric to the shaft, a cylindrical shell, detachable means for securing the shell in the recess in a position to permit the driving shaft to extend centrally and longitudinally therethrough, a retainer and an expander ring within the shell, a plurality of packing rings and a lubricating ring V-shaped in cross section interposed between the retainer and the expander rings to prevent water leakage through the shell, a semi-porous packing and water filter gasket spaced from the expander ring to form a chamber within the shell for water filtered through the semi-porous gasket, a spring in the chamber maintaining the space between said gasket and the expander ring, detachable means securing the semi-porous gasket, the spring, the expander ring, and the packing rings within the shell, and a wearing sleeve on that portion of the driving shaft which extends through the shell, said sleeve being end-to-end reversible.

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