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(54) **Direct joint system for drive shaft-flexible rotor for self-priming pumps**

(57) The rotor (G), made up by an annular central body (C) provided externally with flexible radial blades (R) forming a sole body with said annular body, is characterized in that it includes, as integral part, means for the rotation coupling with the provided shaft end (A) for supporting the rotor (C) ; said means being machined in

the shaft (A) and in the rotor (C); said means being obtained by total press-molding in a sole piece of the annular body and the flexible radial wings of the rotor (C).

According to a simple and economical embodiment said means are made up of a wall or rib (D) that crosses diametrally the rotor hole and that is engaged with a corresponding groove provided on the shaft end.

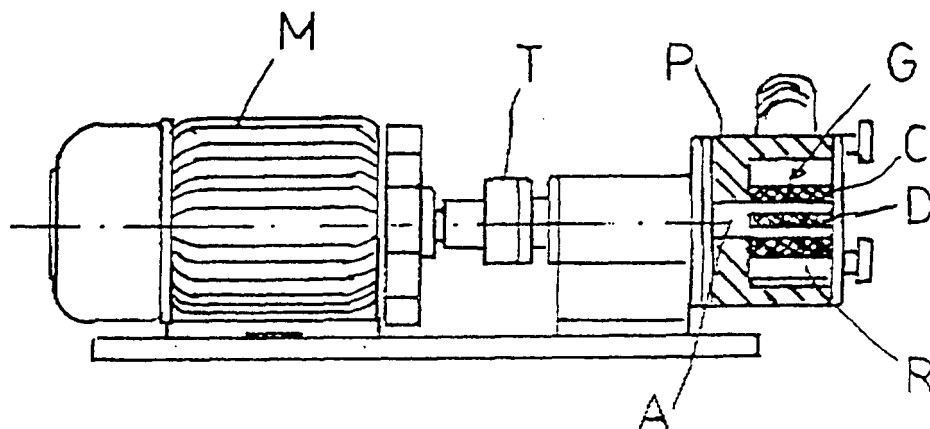


FIG. 1

Figure 1

Description

[0001] This invention refers to flexible rotors for self-priming pumps used for liquid and dense products.

[0002] As it is well-known the flexible rotors used nowadays in self-priming pumps are made up of an annular body supplied externally with flexible radial wings. These wings are obtained by a press-molding operation starting from elastomeric material such as silicone rubbers, neoprene (Cr), nitrile (NBR) and the like or the materials known with the trade mark name DUTRAL (EPDM).

[0003] For being able to make the stable coupling for avoiding rotation between the shaft end and the rotor, this last rotor had in the previous technics a metallic bush having a section or shape corresponding to shaft end.

[0004] The bush was fixed into the rotor central hole during the press-molding phase of the body formed by the hub and radial wings. Obviously the presence of the internal bush, usually made of stainless steel, caused a rotor cost increase.

[0005] A further drawback of the metal bush was the incompatibility with the acid materials that have the tendency to corrode easily metals, also metals resisting to oxidation such as the stainless steel.

[0006] Further for improving the bush anchorage to the rotor hub, before injecting the elastomeric material or the like, the bush external surface was sprinkled with a special glue or mastic. This construction did not allow its use in contact with foodstuffs according to European Community standards, also if the rotor, for example, was made of silicone certified for use with foodstuffs.

[0007] Nevertheless, notwithstanding the great care applied in the selection and in the glue smearing and in the moulding process, in practice after a certain time use, due to repeated torsion stresses applied on the shaft by the rotor, the bush had the tendency to be unglued from the hub, the same rotor being so useless. Then, in the case in which the bush were in contact with highly aggressive fluids, the bush detachment was more frequent.

[0008] Further the presence of the metallic bush did not allow to use rotors in corrosive acid ambients and the users were compelled to use titanium bushes, whose cost is high, with consequent increasing of the rotor and whole pump costs.

[0009] The aim of this invention is to provide a rotor press-molded in a sole piece with flexible external wings suitable for being used in self-priming pumps for liquid and dense products that avoids the disadvantages of well-known rotors and that has a simple and very economical construction, and that has a sure coupling with the pump shaft and finally that it can be used in any industry field, such as the chemical, pharmaceutical, cosmetic, foodstuff, oenological, liqueur, gassed drink fields, etc. and also with corrosive acids and foodstuff materials. According to the invention, this aim is obtained creating a play between the shaft slot and the full rotor sector. The rotor is made up of flexible material and has, as integral part, the rotation coupling means with the shaped

shaft end made for driving the pump, said means being also obtained by a press-molding phase together with the hub and radial wings.

[0010] According to an advantageous and economical embodiment of the rotor, said means are made up of a rib or diametral wall having a valuable thickness that crosses the rotor hub hole and that is suitable to be engaged with a corresponding slot made on a pump shaft part.

[0011] In this manner the rotor, made of elastomeric material or the like, is not supplied with additional o glued components (bush), and then it is not subject to its removal due to breackage of glueing points and it is possible its use in all possible fields owing to the absence of metallic components. Finally the rotor according to the invention is economical and has a long duration owing to its greater resistance.

[0012] Further advantages and characteristics of the invention shall be evident from the following description referred to annexed drawings that show, with the sole example aim and without any limiting characteristic, a preferred embodiment of the rotor. The drawings show:

Figure 1 shows in lateral view, a motor-driven pump cutaway in conjunction with the rotation shaft end coupled to the rotor;

Figure 2 shows a front view of the electric pump in Figure 1;

Figure 3 shows, in enlarged scale, the external end of the rotation shaft foreseen for being engaged with the rotor according to the invention;

Figure 4 shows the axial section of the rotor according to the invention, foreseen to be coupled on the shaft end in Figure 3; and

Figure 5 shows, in front view, the rotor in Figure 4; Figure 6 shows another type of shaft section with groove shaped as two trapeziums opposed with one another of a second embodiment;

Figure 7 shows a central rotor part related to the second embodiment with central hole having a two trapezium form.

[0013] With reference to the electric pump shown in Figure 1 it is indicated by M the drive electric motor and by P the self-priming pump (shown in section view), whose shaft A is driven in rotation by the motor through the joint T. The shaft end A supports the flexible rotor according to the invention that is indicated by G.

[0014] The Figure 2 shows, among other parts, the input coupling E and output coupling U of the pump.

[0015] As it is evident in Figure 3, the shaft end A has a diametral slot K for being engaged by dry connection with the corresponding element made up of the rotor G, that is shown in more details in Figures 4 and 5.

[0016] Said rotor includes an annular body C provided externally with flexible radial wings R and, according to the invention, a diametral wall or rib D obtained by press-molding together with the body C and wings R.

[0017] Naturally the press-molding operation is single and the used material is an elastomeric material and the like.

[0018] Said rib D forms the rotor element foreseen to be inserted in the slot K of the element A for forming a sure rotation coupling among these parts.

[0019] It is clear that the sizes of the slot K and rib D must be suitable to allow the shaft end and same rib to resist to repeated stresses caused by the shaft A.

[0020] Practical tests in laboratory have shown that optimal values of mechanical resistance and duration are obtained by a rib D having a length slightly lower than the rotor hole dimension F and a thickness (s) substantially equal to the thickness (S) of the annular body C.

[0021] The construction solution of the rotor part foreseen to be engaged with the shaft can vary according to practical requirements. So, for example, instead of using a diametral rib, it can be used two ribs in cross form and also three radial ribs spaced by 120° with one another and, correspondingly, the shaft end shall have slots or grooves in cross layout or spaced by 120° with one another.

[0022] Another construction solution is shown in Figures 6 and 7, in which the Figure 6 shows another type of shaft section with groove shaped as two trapeziums counterposed with one another owing to a second embodiment, and the Figure 7 shows a central rotor part related to said second embodiment with central hole having the form of two trapeziums. Obviously this solution has the advantage of a higher rest surface between shaft and rotor that allows to use also greater powers and then to obtain greater flow rates with respect to the ones provided by the connection made by right rib.

[0023] In any case the construction solution must not cause the weakening of the shaft end section and/or of the rotor for not reducing its duration, also considering the particular pump running conditions.

Claims

1. Rotor made of elastomeric material and the like for self-priming pumps for liquid and dense products made up of an annular body (or hub) provided externally with flexible wings, **characterized in that** it includes, as integral parts, means for rotation coupling with shaped shaft end (A) driving the pump, which means are obtained press-molding the annular body (C) and flexible radial wings (R).
2. Flexible rotor for self-priming pumps according to claim 1, **characterized in that** the above mentioned coupling means are made up of a wall or rib (D) crossing diametrically the hole (F) of the same rotor (G) and being engaged with a corresponding groove (K) on the shaft end part (A).
3. Flexible rotor for self-priming pumps according to

claim 1, **characterized in that** the wall or diametral rib has a length hardly lower than the hole length (F) of the rotor and a thickness (s) substantially equal to the thickness (S) of the rotor hub (or annular body).

4. Flexible rotor for self-priming pumps according to preceding claims, **characterized in that** it has a shaft section type supplied with groove shaped as two trapeziums counterposed and **in that** the related central rotor part is supplied with similar rib having a two trapezium form, or saw teeth form or with any other form suitable for increasing the bearing surface of the rotor onto the shaft.
5. Flexible rotor for self-priming pumps according to preceding claims, **characterized in that** the rotor is obtained by a press-molding operation of elastomeric material such as silicone rubbers (for foodstuff and pharmaceutical uses), neoprene (Cr), nitrile (NBR) and the like or the materials well-known with the trade mark name DUTRAL-EPDM (for the use with corrosive acids).
6. Flexible rotor for self-priming pumps according to preceding claims, **characterized in that** the rotor is supplied with diametral rib or with two crossed ribs or further with three radial ribs spaced by 120° and, correspondingly, the shaft end shall have grooves or slots in cross shaping or spaced by 120° angular pitch.
7. Flexible rotor for self-priming pumps according to preceding claims, **characterized in that** the rotor is made up of press-molded materials that can be used in any industrial field such as the chemical, pharmaceutical, cosmetic, foodstuff, oenologic, liquor, gassed drink fields, etc., in particular also with corrosive acids (EPDM) and in contact with foodstuffs (white SILICONE).
8. Pump in particular self-priming motor-driven pump for liquid and dense products using the flexible rotor according to one or more of preceding claims.

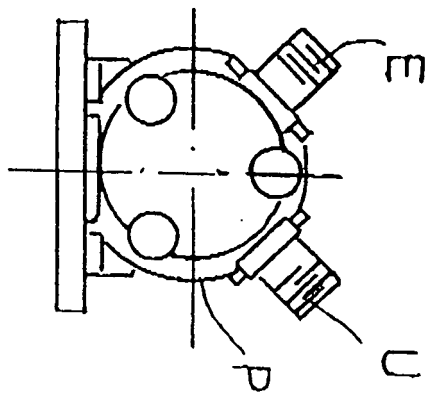


FIG. 2

Figure 2

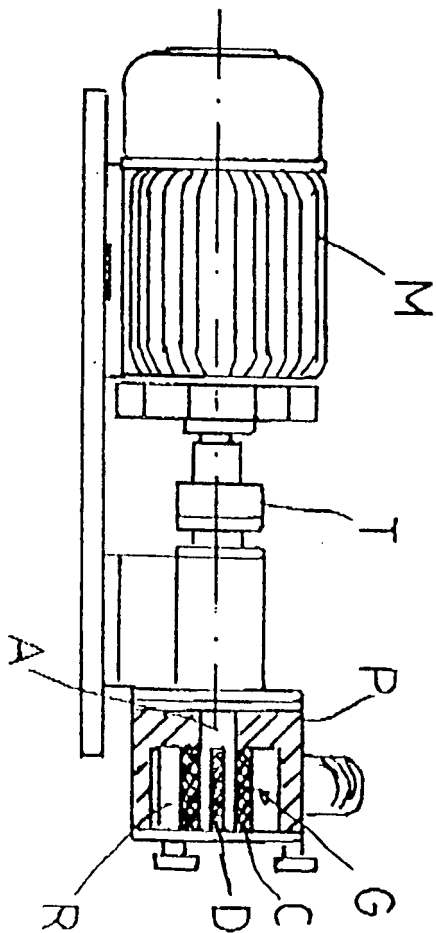
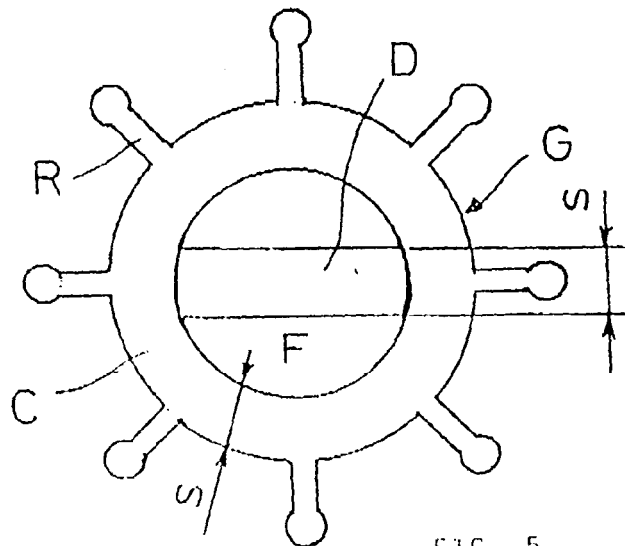
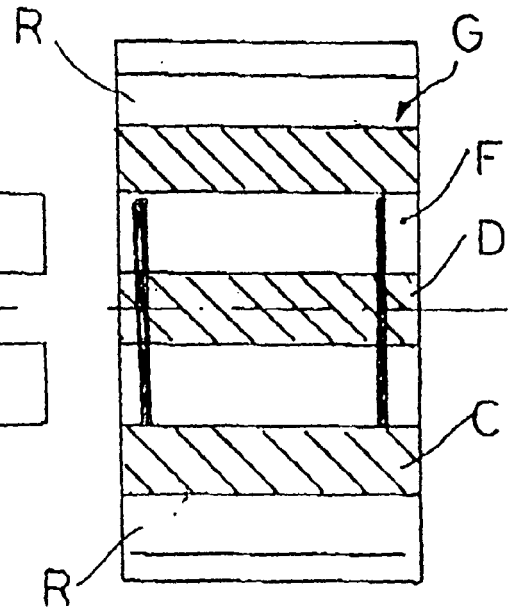
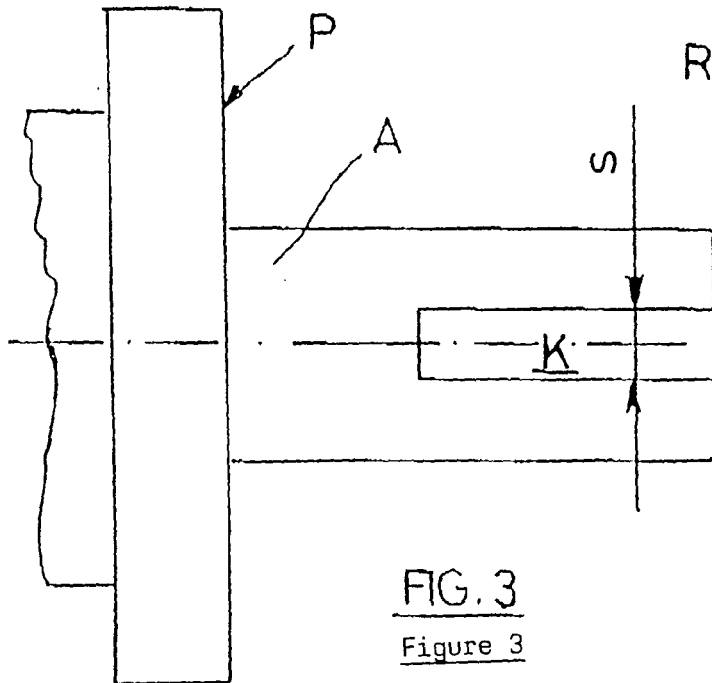


FIG. 1

Figure 1



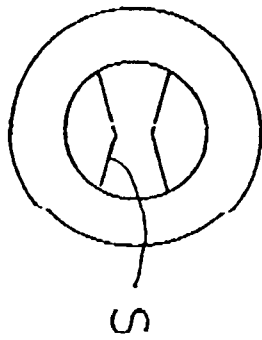


FIG. 6

Figure 6

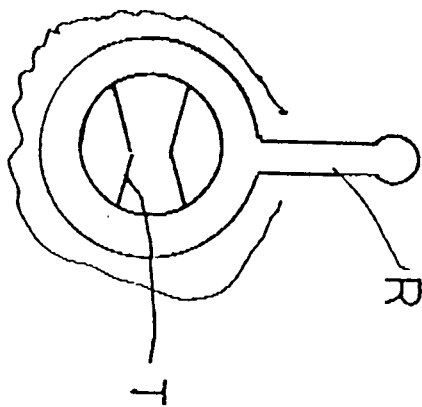


FIG. 7

Figure 7