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(54) **Fastening system of an outer casing of a centrifugal pump body**

(57) Fastening system to fixedly (1) secure the coupling between an outer tubular casing (3) of a pump body (21) and an intermediate separating piece (4) which hermetically separates the pump body from an electric drive motor, in a predetermined operating position, the system comprising elastic means (5) which, in the operating position of the system, axially exert an elastic force (F_e) on said outer casing in longitudinal direction and in the sep-

aration direction between the outer casing and the intermediate separating piece; fastening means (6) of the outer casing in said operating position, intended to fit in respective transversal housings (7) made in the intermediate separating piece; and fixing means (8) of the fastening means, said fastening means can be introduced in the respective housings when the outer casing is in an assembly position overcoming the elastic action of the elastic means.

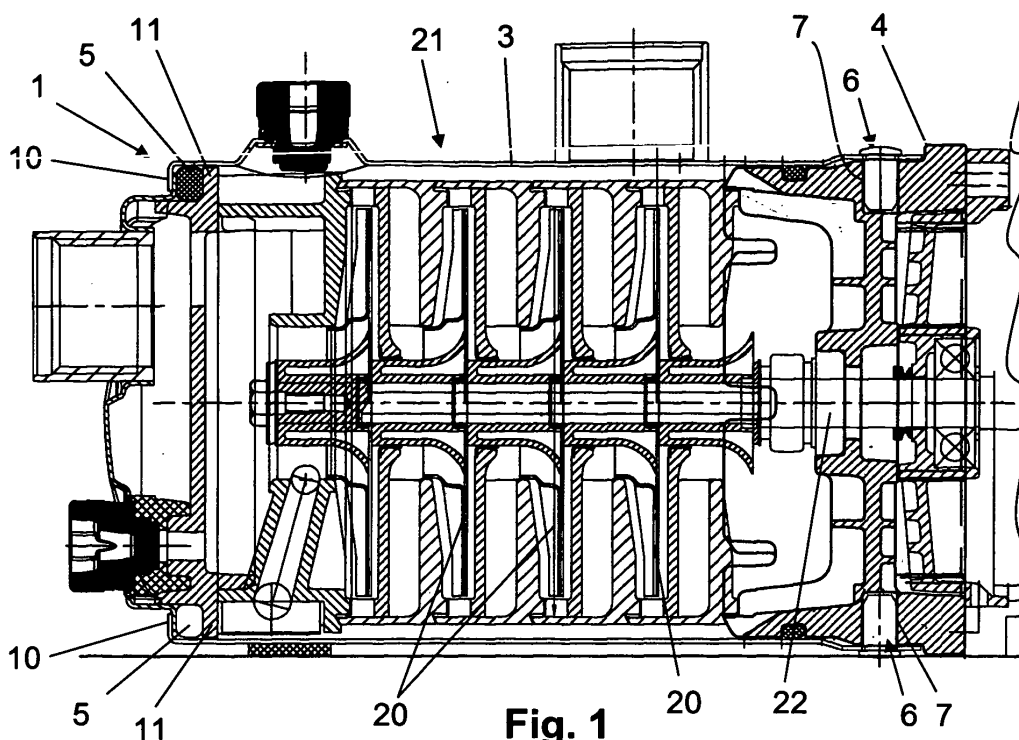


Fig. 1

Description

Technical field of the invention

[0001] The present invention relates to a fastening system to secure the coupling between an outer tubular casing of a multi-stage centrifugal pump body and an intermediate piece, which hermetically separates the pump body from a drive motor whereto it is axially coupled, in a predetermined operating position.

Background of the invention

[0002] Multiple embodiments are known of multi-stage suction-discharge pumps, normally coupled axially to an electric motor, which are typically used, for example for lifting water.

[0003] The turbines of multi-stage pumps are usually housed in an enclosure or chamber which separates them from the electric motor. Said enclosure is traversed by the shaft of the electric motor in the wall adjacent thereto, also called intermediate separating piece, maintaining the watertightness between both, and it is connected to the outside by the intake and outlet of the fluid designed to be impelled by the turbines. The configuration of the enclosure of the turbines is essential to optimize the fluid dynamics of the pump. For this reason, the fluid should circulate through the turbines, from its intake to its outlet from the pump, preserving the watertightness of the rest of the enclosure. Furthermore, the enclosure should withstand the strong pressure to which it will be subjected during the functioning according to the hydraulic characteristics of the pump and the system of use.

[0004] In single-stage centrifugal pumps, which are characterized in that they comprise a single turbine, said enclosure has a profile of dimensions which are slightly greater than those of the corresponding turbine and, for this reason, it can be formed by a piece which acts as casing on being coupled to the intermediate body adjacent to the electric motor. Nevertheless, multi-stage pumps are usually designed to transform much greater power than in the first ones and, therefore, comprise a plurality of turbines. In consequence, the enclosure of the multi-stage turbines should have considerable dimensions at the same time as meeting all the aforementioned technical requirements. In these cases, the solution of forming the enclosure using a single piece which acts as casing, as occurs in single-stage pumps, which can be directly coupled to the intermediate separating piece, is usually inadequate since its large dimensions lead to expensive manufacturing as well as difficult subsequent handling, such as, for example, for the assembly of the pump.

[0005] As solution to this problem, different configurations are known of pieces which can be coupled together so that, once mounted and coupled to the intermediate separating piece of the pump, they form said enclosure. In this regard, the most widely used configuration is that

of the wall with the form of straight cylinder which acts as casing of the plurality of turbines and which is generally provided with an outlet for the impelled fluid. Said cylinder is covered on its free base with a second piece, which is usually designed for the intake of fluid, the casing being coupled to the intermediate separating piece of the pump by its other base, open. Said configuration of the enclosure which houses the turbines enables a more comfortable manufacturing and handling of its components than in other cases.

[0006] On the other hand, it is also interesting that the fixing of the casing or housing is removably-mounted, so that it can be dismounted to be able to perform maintenance or repair operations. Even so, the fixing to the intermediate separating piece should be totally secured, avoiding any accidental decoupling and guaranteeing all the requirements of watertightness and resistance necessary for the correct functioning of the pump.

[0007] To achieve said fixing, joining elements such as threaded rods or rivets are normally used. Nevertheless, this system has the drawback that the costs and time necessary for its assembly and dismantling are very high.

Explanation of the invention

[0008] The fastening system object of the present invention is designed to fixedly secure the coupling between an outer tubular casing of a centrifugal pump body, preferably multi-stage, and an intermediate separating piece which hermetically separates the pump body from an electric drive motor whereto it is axially coupled, in a predetermined operating position.

[0009] In essence, the system is characterized in that it comprises elastic means which, in said operating position of the system, axially exert an elastic force on said casing in its longitudinal direction and in the separation direction between the outer casing and the intermediate separating piece; fastening means intended to fit in respective transversal housings made in the intermediate separating piece; and fixing means of the fastening means to said fastening means whereby they can be introduced in the respective housings when the outer casing is in an assembly position overcoming the elastic action of the elastic means.

[0010] According to another characteristic of the invention, the fastening means comprise at least one rod which also comprises a main body and a head joined by a neck, said main body being designed to be introduced in the housings, while the neck is of smaller section than that of the main body and that of the head, determining a groove.

[0011] In accordance with another characteristic of the invention, the fixing means are constituted by through-holes made in the casing whose inner edges can fit in the grooves of the rods which constitute the fastening means.

[0012] Another noteworthy aspect of the fastening sys-

tem object of the invention is that the outer casing is provided, on the edge of one of its ends, with an annular rib overhanging inwards, designed to compress the elastic means against a stop fixed with respect to the intermediate separating piece when the casing moves from an initial position, prior to the assembly position, in direction to the assembly position.

[0013] According to an embodiment of the invention, the elastic means comprises at least one elastic compression seal, arranged between the annular rib of the outer casing and the stop fixed with respect to the intermediate separating piece.

Brief description of the drawings

[0014] The page of drawings of the present specification represents an example of non-limitative embodiment of the fastening system according to the present invention. In said drawings;

Fig. 1 is a longitudinal section of a multi-stage pump provided with the fastening system according to the invention, the fastening system being arranged in its operating position;

Fig. 2 is a detailed view of the fastening system in an intermediate assembly position;

Fig. 3 is another detailed view of the fastening system in an assembly position, subsequent to that of Fig. 2; and

Fig. 4 is a detailed view of Fig. 1, and specifically of the fitting of the inner edges of the through-holes of the casing in the grooves of the rods which constitute the fastening means in the embodiment of said Fig. 1.

Detailed description of the drawings

[0015] Fig. 1 represents a multi-stage suction-discharge pump 1 for pumping water. The pump body 21 comprises a plurality of turbines 20 coupled to the shaft 22 of an electric motor, not represented, wherefrom they are hermetically separated by an intermediate separating piece 4, with discoid configuration, which is axially traversed by said shaft 22.

[0016] The pump body 21 is laterally covered by an outer tubular casing 3. To firmly secure said outer casing 3 to the intermediate separating piece 4, the pump incorporates the fastening system object of the present invention, whose components are explained below.

[0017] The outer casing 3 is provided, on the edge of the free end of the pump body 21, with an annular rib 10 overhanging inwards, designed to rest against an elastic compression seal 5, also resting on a fixed stop 11 of the pump body 21. At its opposite end, the outer casing 3 is provided with a series of through-holes 8, regularly distributed in annular direction around said outer casing 3.

[0018] On the other hand, the fastening system comprises fastening means 6 of the outer casing 3 designed to traverse it through the through-holes 8 and to be in-

troduced in respective transversal housings 7 made in the intermediate separating piece 4. Fig. 2 shows in greater detail that said fastening means 6 consists of rods formed by a main body 61 and a head 63, joined by a neck 62. The main body 61 is designed to be introduced in the housings 7, while the neck 62 is of smaller section than that of the main body and that of the head 63, determining a groove 9.

[0019] In Fig. 1 the fastening system 1 is in the operating position, so that, as has already been mentioned, it fixedly secures the coupling between the outer casing 3 of the pump body 21 and the intermediate separating piece 4. In this position, the elastic means 5 are compressed by the annular rib 10 of the outer casing 3, so that they tend to recover their original position forcing the introduction of the inner contour of the through-holes 8 in the grooves 9 of the rods which constitute the fastening means 6. In consequence, on the one hand it prevents the movement of the casing 3 in longitudinal direction to the pump 1 and, on the other hand, also prevents the movement of the rods which constitute the fastening means 6, in the direction of its extraction, by a stop against the inner edge of the through-holes 8. The edges of these through-holes 8 thus act as fixing means of the fastening means 6.

[0020] To arrange the system in said operating position it must pass through some other intermediate positions, following the assembly steps below.

[0021] To couple the casing 3 in the intermediate separating piece 4 we start from an initial position, represented in Fig. 2, wherein the casing 3 is placed covering the centrifugal pump body 21 laterally, not yet being secured by the fastening means 6. In said position, the annular rib 10 of the casing 3 rests against the fixed stop 11, it being possible to apply an effort force E to the casing 3 in axial direction and in the direction of approximation to the electric motor, to press said elastic compression seal 5.

[0022] The following step to assemble the fastening system 1 from the initial description described, precisely consists of increasing the effort force E on the casing 3, compressing the elastic seal 5 until reaching the assembly position represented in Fig. 3. In said assembly position, the through-holes 8 are perfectly aligned with corresponding housings 7, it being possible to introduce the main body 61 of the rods which constitute the fastening means 6 through said through-holes 8 until their head 63, with greater diameter than that of the through-holes 8, abuts against the outer surface of the casing 3.

[0023] Having reached this point, the effort force E is no longer applied, so that the elastic seal 5 tends to automatically recover its initial positional, exercising an elastic decompression force Fe on the annular rib 10 of the outer casing 3, which moves the outer casing 3 in the opposite direction, of extraction, making it pull back. Nevertheless, the movement of the outer casing 3 is limited by the rods which constitute the fastening means 6, partially introduced in the housings 7. As is observed in Fig.

4, the casing 3 can only move back a distance close to the depth of the groove 9 of the rods of the fastening means 6, since in the example of Figs. 1 to 4 the diameter of the through-holes 8 adjusts to the diameter of the main body 61 of said rods.

[0024] In this position represented in Fig. 4, the rods which constitute the fastening means 6 are fastened by the inner edges of the holes 8 of the outer casing 3, which are introduced in the corresponding grooves 9, so that it is impossible to extract them from the housing 7, which secures the coupling of the outer casing 3 to the intermediate separating piece 4 and, therefore, the fastening system 1 remains in the operating position.

[0025] Preferably, the head 63 of the rods of the fastening means 6 is smooth and the edges 64 of its contour are appreciably thin, to avoid them from excessively protruding from the surface of the casing 3 and can be accidentally forced.

Claims

1. Fastening system (1), particularly applicable to the coupling between an outer tubular casing (3) of a centrifugal pump body (21), preferably multi-stage, and an intermediate separating piece (4) which hermetically separates the pump body from an electric drive motor where to it remains coupled axially, the system being of the type that secure the fixed coupling between said outer casing and the intermediate separating piece in a predetermined operating position, **characterized in that** it comprises:

- elastic means (5) which, in the operating position of the system axially exerts an elastic force (Fe) on said outer casing in longitudinal direction and in the separation direction between the outer casing and the intermediate separating piece;
- fastening means (6) of the outer casing in said operating position, intended to fit in respective transversal housings (7) made in the intermediate separating piece; and
- fixing means (8) of the fastening means whereby said fastening means can be introduced in the respective housings when the outer casing is in an assembly position overcoming the elastic action of the elastic means.

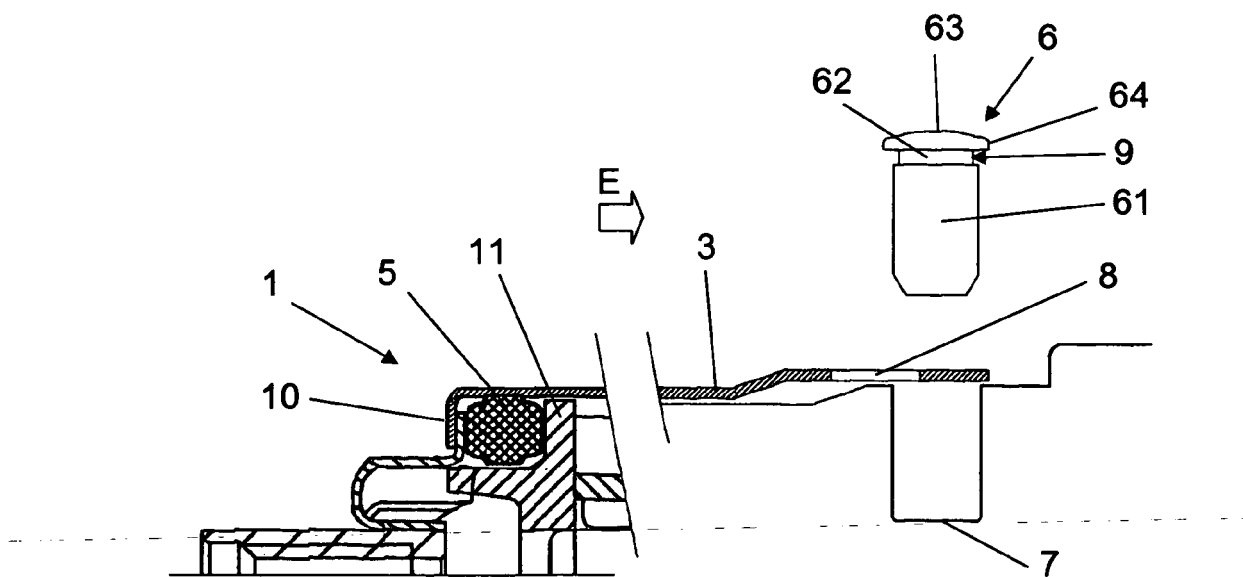
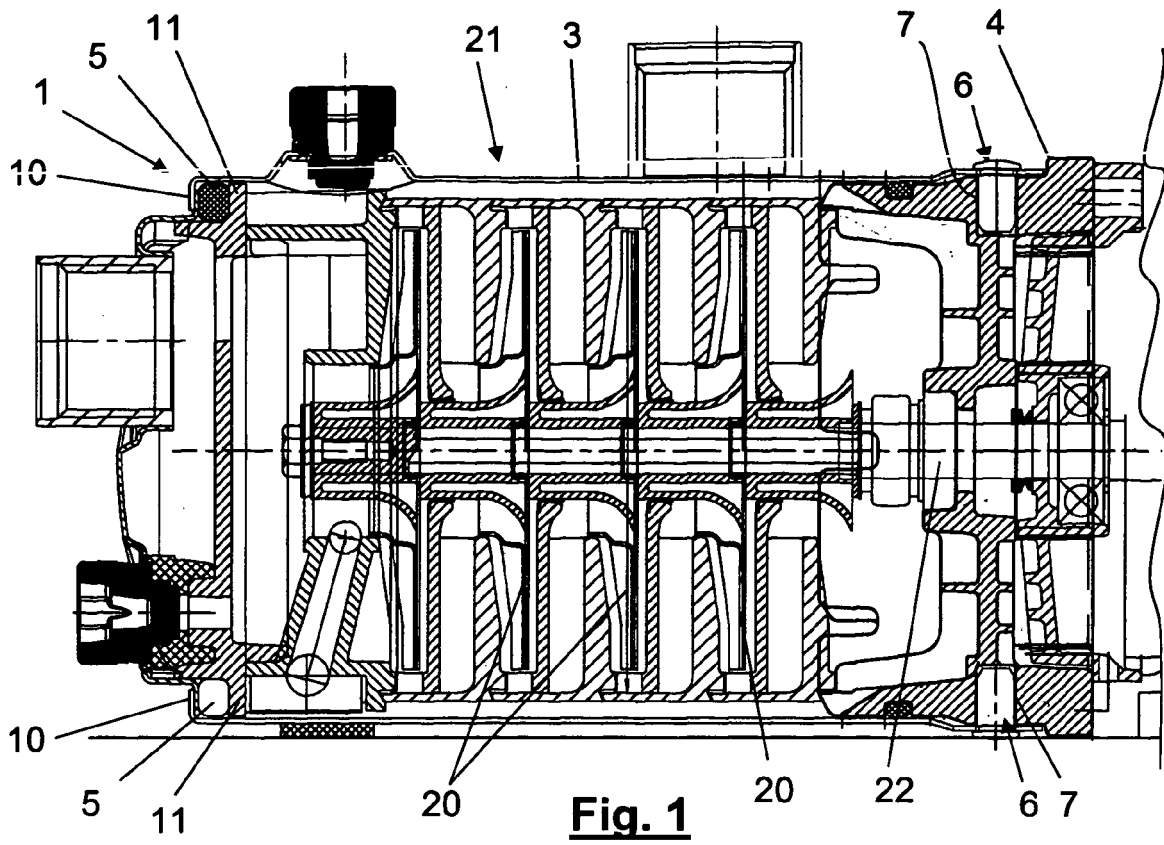
2. Fastening system (1) according to the preceding claim, **characterized in that** the fastening means (6) comprise at least one rod which comprises a main body (61) and a head (63) joined by a neck (62), said main body being designed to be introduced in the housings (7), while the neck is of smaller section than that of the main body and that of the head, determining a groove (9).

3. Fastening system (1) according to claim 1 **characterized in that** the fixing means (8) are constituted

by through-holes made in the casing (3), whose inner edges can fit in the grooves (9) of the rods which constitute the fastening means (6).

4. Fastening system (1) according to any one of the preceding claims, **characterized in that** the outer casing (3) is provided, on the edge of one of its ends, with an annular rib (10) overhanging inwards, intended to compress the elastic means (5) against a stop (11) fixed with respect to the intermediate separating piece (4) when the casing moves from an initial position, prior to the assembly position, in direction to the assembly position.

5. Fastening system (1) according to claim 4, **characterized in that** the elastic means (5) comprise at least one elastic compression seal, arranged between the annular rib (10) of the outer casing (3) and the stop (11) fixed with respect to the intermediate separating piece (4).



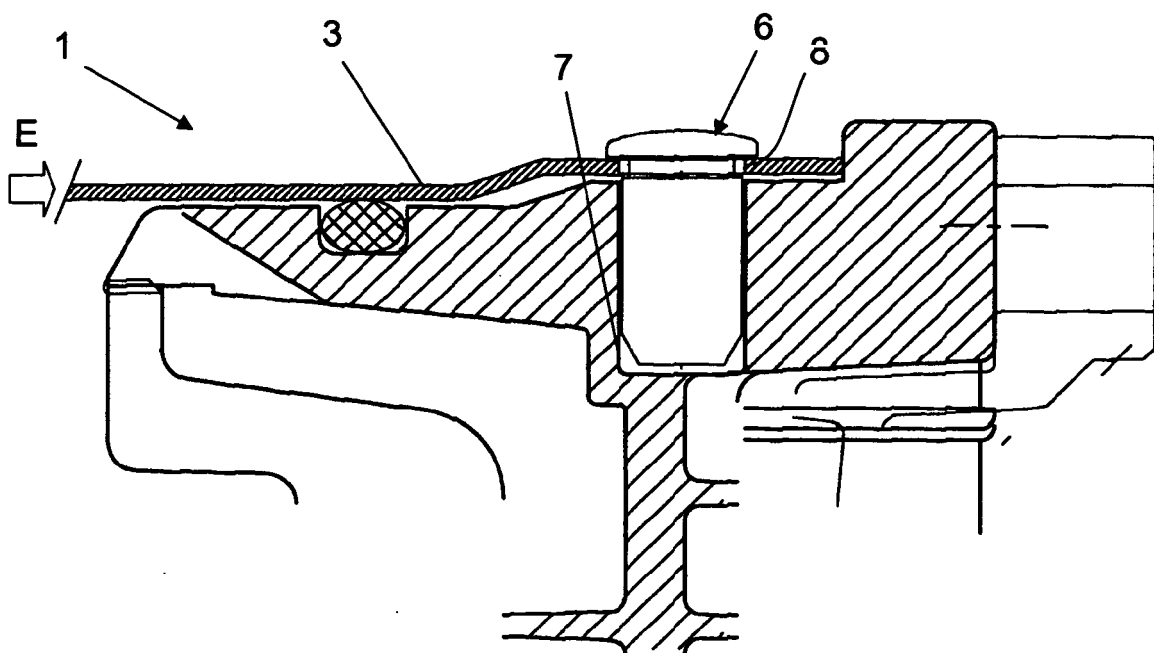


Fig. 3

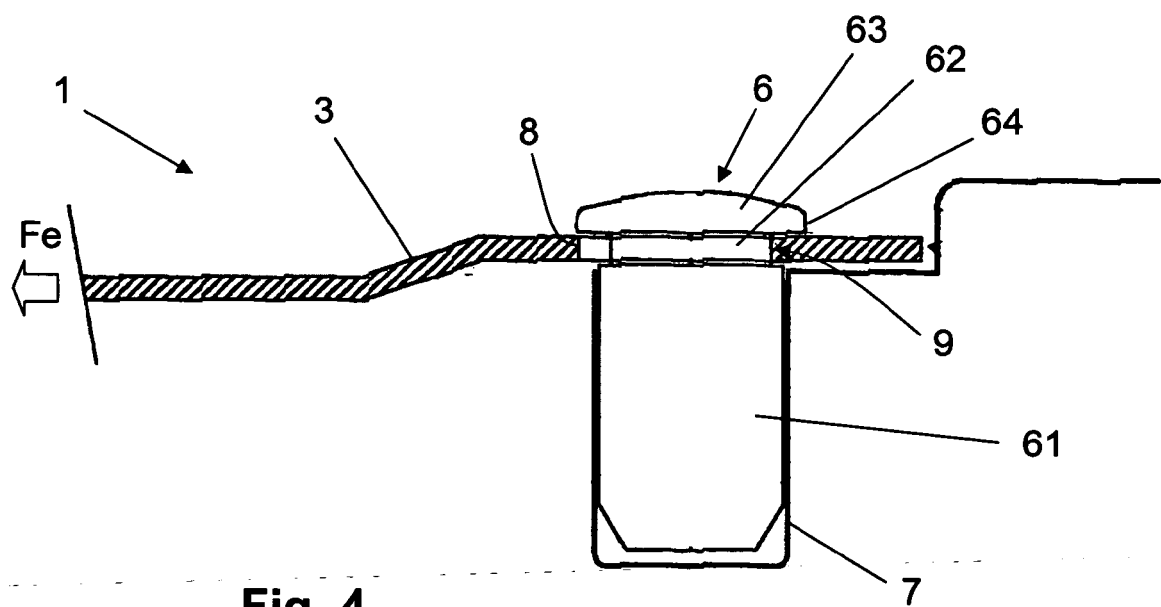


Fig. 4