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(54) **Centrifugal pump**

(57) A centrifugal pump comprising an impeller (1) provided with a first blading (2) suitable for sucking liquids from at least one inlet conduit (4) and pumping them towards a manifold (5) arranged around the impeller (1), the blades of this first blading (2) being oriented for pumping according to a rotation direction (3) of the impeller (1), which is mechanically linked to a shaft (7) which can be driven by a motor (8), is provided with a second blading (15) oriented in the direction opposite to

the direction of the first blading (2) and is linked to the shaft (7) by means of a screw mechanism (9, 11, 12) so that the rotation of the shaft (7) in one direction (3) or in the other one (18) causes the axial advancing or moving back, respectively, of the impeller (1) in a housing (13) obtained in the body of the pump and the consequent arrangement of the blading (2, 15) suitable for pumping according to the rotation direction (3, 18) of the shaft (7) close to at least one opening (17) which connects the housing (13) of the impeller (1) to the manifold (5).

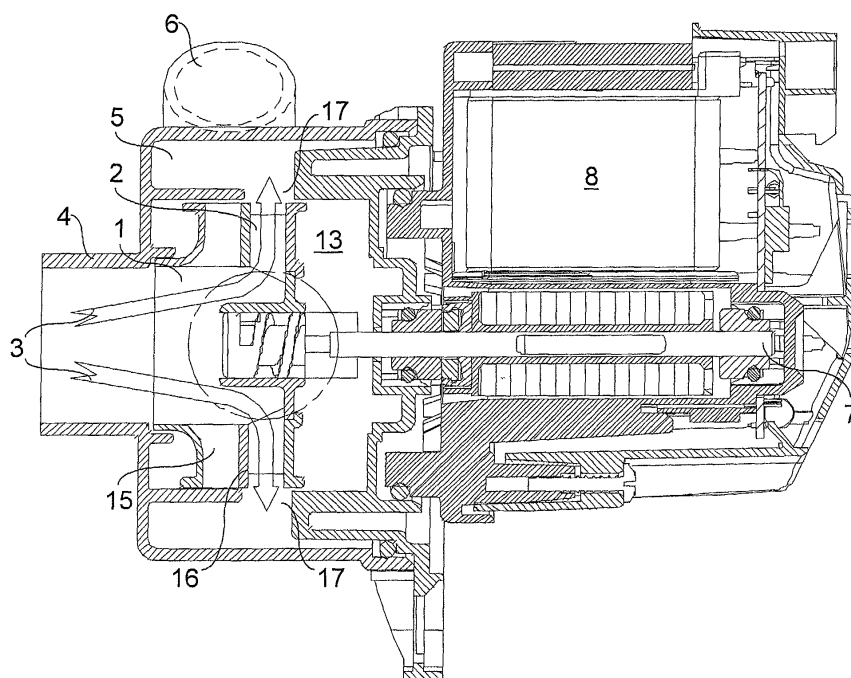


Fig. 1

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Description

[0001] The present invention relates to a centrifugal pump, and in particular to a pump which can pump liquids in a manner effective and independent from the rotation direction of the impeller.

[0002] The known centrifugal pumps, in particular those for electric household appliances, can be driven by asynchronous or synchronous electric motors. Synchronous motors are preferable, since they are more reliable than the asynchronous ones, however they need an electronic system for controlling the rotation direction, because they can randomly rotate in one direction or in the other one. Therefore, the costs and the manufacture complexity of the pump are increased by this control system required to impose only one rotation direction to the synchronous motor.

[0003] The object of the present invention is therefore to provide a pump free from this drawback, that is a pump which can work in a manner correct and independent from the rotation direction of the shaft of the motor, in particular of a synchronous electric motor. Said object is achieved with a pump whose main features are specified in the first claim and other features are specified in the following claims.

[0004] By virtue of the double blading of the impeller and of the screw mechanism which moves the impeller according to the rotation direction thereof, the pump according to the present invention automatically selects the blading suitable for the liquid pumping, so as to work correctly even if directly linked to a synchronous electric motor.

[0005] The double blading of the impeller can even be used for other objects, for example to obtain two different types of pumping according to the rotation direction of the impeller, controlled from the outside.

[0006] Further advantages and features of the pump according to the present invention will be evident to those skilled in the art from the following detailed and non-limiting description of some embodiments thereof with reference to the attached drawings wherein:

- figure 1 shows a longitudinal sectional view of the pump according to a first embodiment of the invention in a rotation direction;
- figure 2 shows a front view of the pump of figure 1;
- figure 3 shows an enlargement of the pump of figure 1;
- figure 4 shows a longitudinal sectional view of the pump of figure 1 in the opposite rotation direction;
- figure 5 shows a front view of the pump of figure 1 in the opposite rotation direction;
- figure 6 shows a partial longitudinal sectional view of the pump according to a second embodiment of the invention; and
- figure 7 shows a partial longitudinal sectional view of the pump according to a third embodiment of the invention.

[0007] Referring to figure 1, it is visible that the centrifugal pump according to the first embodiment of the invention comprises in a known way an impeller 1 provided with a first blading 2 suitable for pumping liquids from an axial direction to a radial direction, as indicated by arrows 3. These liquids are sucked in by at least one inlet conduit 4 and pumped towards a manifold 5, generally having a substantially cylindrical shape, which is arranged around impeller 1 and is provided with one or more delivery conduits 6 for the liquids pumped by impeller 1.

[0008] Figure 2 shows the blades of blading 2 (drawn with partially broken lines) which are suitably oriented to pump liquids towards manifold 5 in the direction of arrows 3 according to the rotation direction (counter-clockwise in the figure) of impeller 1.

[0009] Referring also to figure 3, it is visible that impeller 1 is mechanically linked to a shaft 7 which can be driven by a motor 8 through a mechanism comprising a screw 9 which is fixed to shaft 7 and is rotatably arranged inside a cylindrical hub 10 joined to impeller 1, in particular integral thereto. The cylindrical hub 10 is suitably provided with an inner protrusion 11 suitable for sliding along the helicoidal canal 12 of screw 9, so that the rotation of shaft 7 in one direction or in the other one causes the advancing or the moving back, respectively, of impeller 1 in a housing 13 having a substantially cylindrical shape obtained in the body of the pump. The axial movement of impeller 1 with respect to shaft 7 is limited by a pair of cylindrical shoulders 14 which are arranged at the two ends of screw 9 and stop the sliding of the internal protrusion 11 along the helicoidal canal 12.

[0010] According to the invention, impeller 1 is provided with a second blading 15 which is oriented in the opposite direction with respect to the direction of the first blading 2, is arranged in a substantially coaxial way with the latter and is divided therefrom by a cover disk 16. The selection of bladings 2 or 15 with the orientation suitable for pumping the liquids coming from the inlet conduit 4 toward manifold 5 is automatically accomplished by the pump according to the rotation direction of shaft 7, since the rotation thereof in one direction or in another one causes the axial moving of impeller 1 in housing 13 and the consequent arrangement of blading 2 or 15 suitable for pumping according to the rotation direction of shaft 7 close to one cylindrical opening 17 which connects housing 13 of impeller 1 with manifold 5. For this purpose, the height of opening 17 is substantially equal to the height of bladings 2 and 15, that is to the height of the two conduits of impeller 1 which comprise these bladings and are divided by the cover disk 16.

[0011] Referring now to figures 4 and 5, it is visible that the inversion of the rotation direction of shaft 7 causes the sliding of the internal protrusion 11 of hub 10 along screw 9 and thus the axial moving of impeller 1 toward motor 8. This causes the arrangement of the sec-

ond blading 15 (drawn with broken lines in figure 5) close to opening 17 and the simultaneous arrangement of the first blading 2 close to the inner wall of housing 13, so as to make the latter blading inactive. Therefore, the flow of the liquids coming from the inlet conduit 4 and pumped by the second blading 15 towards manifold 5 follows the direction (clockwise in figure 5) indicated by arrows 18 and induced by this blading. A further inversion of the rotation direction of shaft 7 would cause another axial moving of impeller 1, which would be arranged again as in figures 1 to 3.

[0012] Figure 6 shows a second embodiment of the invention, which differs from the first one because the shoulders 14 limit the sliding of hub 10 and not of protrusion 11 into the helicoidal canal 12.

[0013] Figure 7 shows a third embodiment of the invention, which differs from the previous one because the helicoidal canal 12 is obtained in the internal wall of hub 10, so as to form a female screw 9 integral with the latter, while protrusion 11 is rigidly connected to shaft 7.

Claims

1. A centrifugal pump comprising an impeller (1) provided with a first blading (2) suitable for sucking liquids from at least one inlet conduit (4) and pumping them towards a manifold (5) arranged around the impeller (1), the blades of this first blading (2) being oriented for pumping according to a rotation direction (3) of the impeller (1), which is mechanically linked to a shaft (7) which can be driven by a motor (8), **characterized in that** the impeller (1) is provided with a second blading (15) oriented in the direction opposite to the direction of the first blading (2) and is linked to the shaft (7) by means of a screw mechanism (9, 11, 12) so that the rotation of the shaft (7) in one direction (3) or in the other one (18) causes the axial advancing or moving back, respectively, of the impeller (1) in a housing (13) obtained in the body of the pump and the consequent arrangement of the blading (2, 15) suitable for pumping according to the rotation direction (3, 18) of the shaft (7) close to at least one opening (17) which connects the housing (13) of the impeller (1) to the manifold (5).
2. A centrifugal pump according to the previous claim, **characterized in that** said screw mechanism (9, 11, 12) comprises a screw (9) fixed to the shaft (7) and is rotatably arranged inside a hub (10) which is joined to the impeller (1) and is provided with a protrusion (11) suitable for sliding along the helicoidal canal (12) of the screw (9).
3. A pump according to claim 1, **characterized in that** said screw mechanism (9, 11, 12) comprises a protrusion (11), which is rigidly linked to the shaft (7)

and is suitable for sliding along a helicoidal canal (12) obtained in the internal wall of a hub (10) joined to the impeller (1), so as to form a female screw (9) integral with this hub (10).

4. A pump according to one of the previous claims, **characterized in that** the axial moving of the impeller (1) with respect to the shaft (7) is limited by a pair of shoulders (14) which are placed at the two ends of the screw mechanism (9, 11, 12).
5. A pump according to claim 4, **characterized in that** said shoulders (14) stop the sliding of the protrusion (11) along the helicoidal canal (12).
6. A pump according to claim 4, **characterized in that** said shoulders (14) stop the axial sliding of the hub (10) of the impeller (1).
7. A pump according to one of the previous claims, **characterized in that** the second blading (15) is arranged substantially coaxial to the first blading (2).
8. A pump according to one of the previous claims **characterized in that** the first (2) and the second blading (15) are divided by a cover disk (16).
9. A pump according to one of the previous claims, **characterized in that** the height of the opening (17) which links the housing (13) of the impeller (1) to the manifold (5) is substantially equal to the height of the first (2) or of the second (15) blading.
10. A pump according to one of the previous claims, **characterized in that** the shaft (7) is linked to a synchronous electric motor (8).

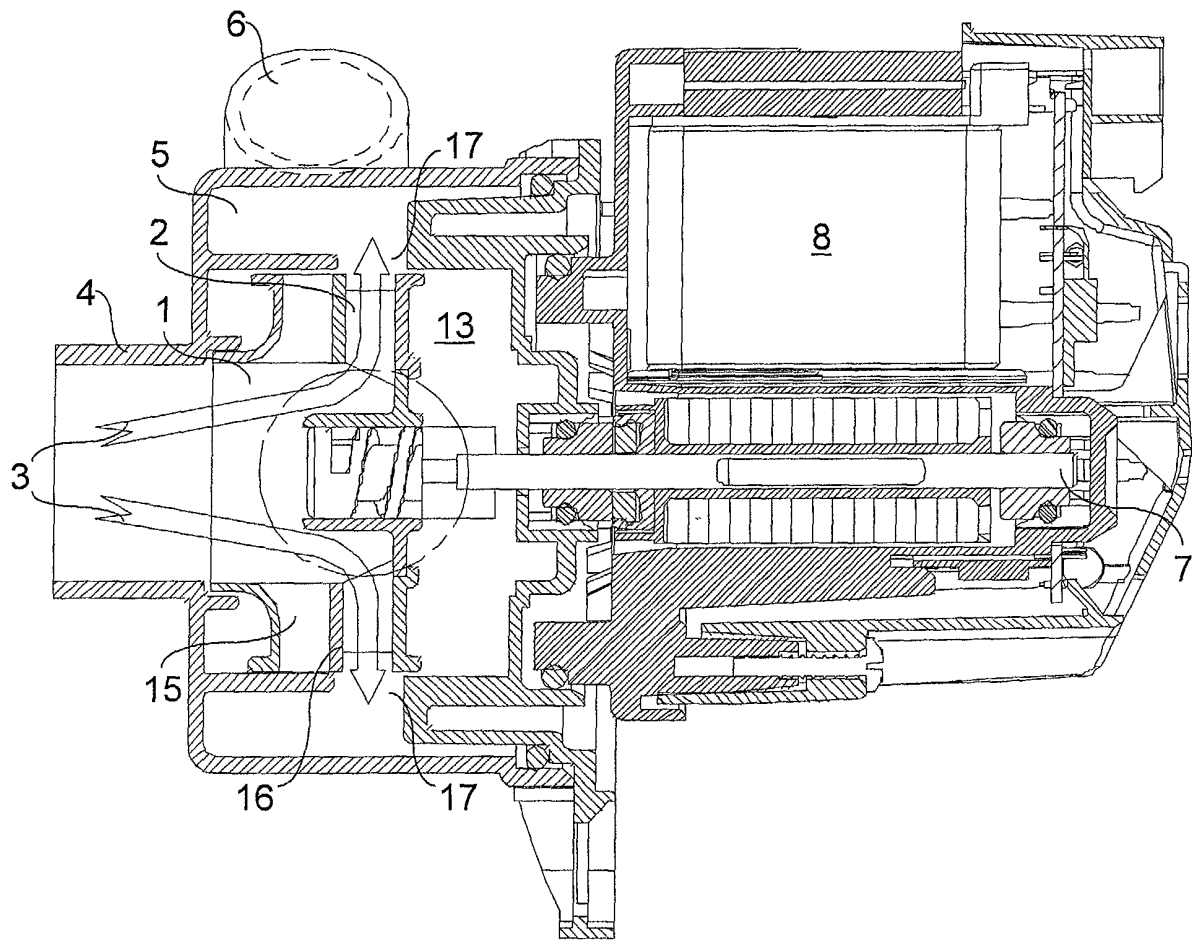


Fig. 1

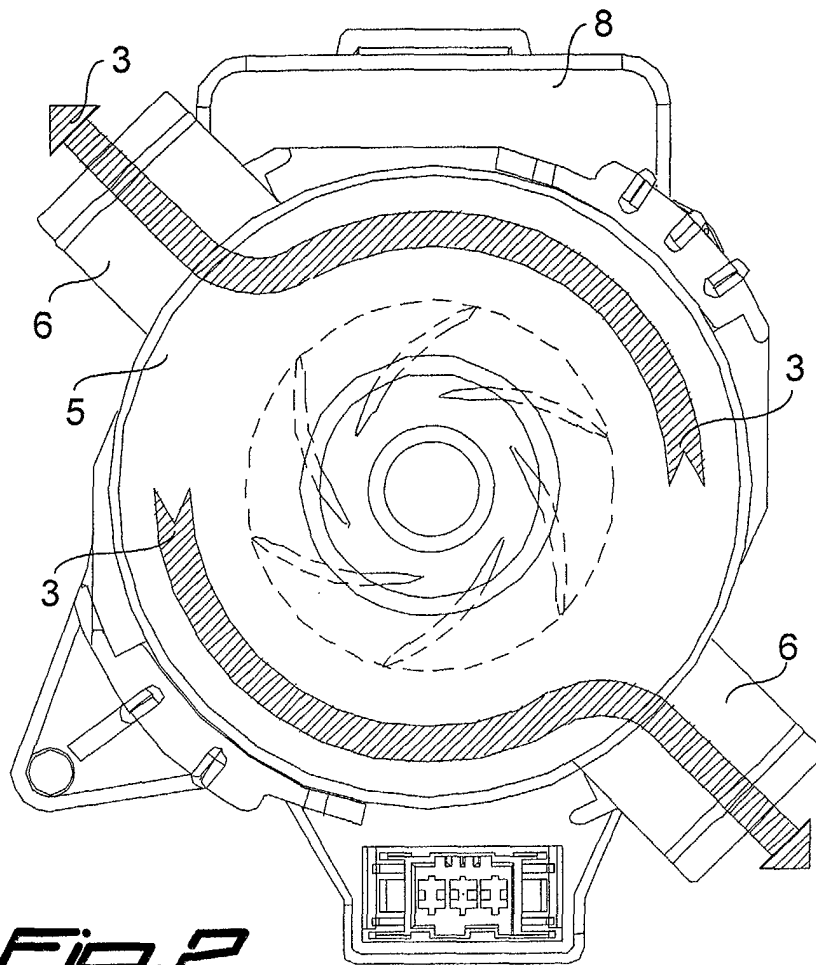


Fig. 2

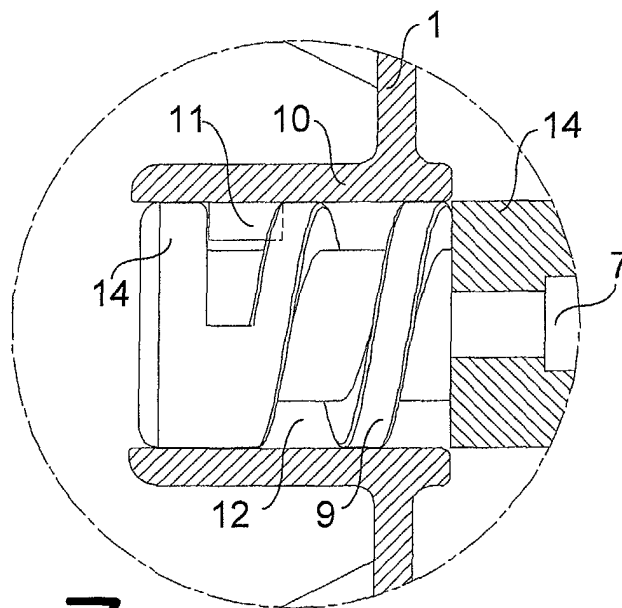


Fig. 3

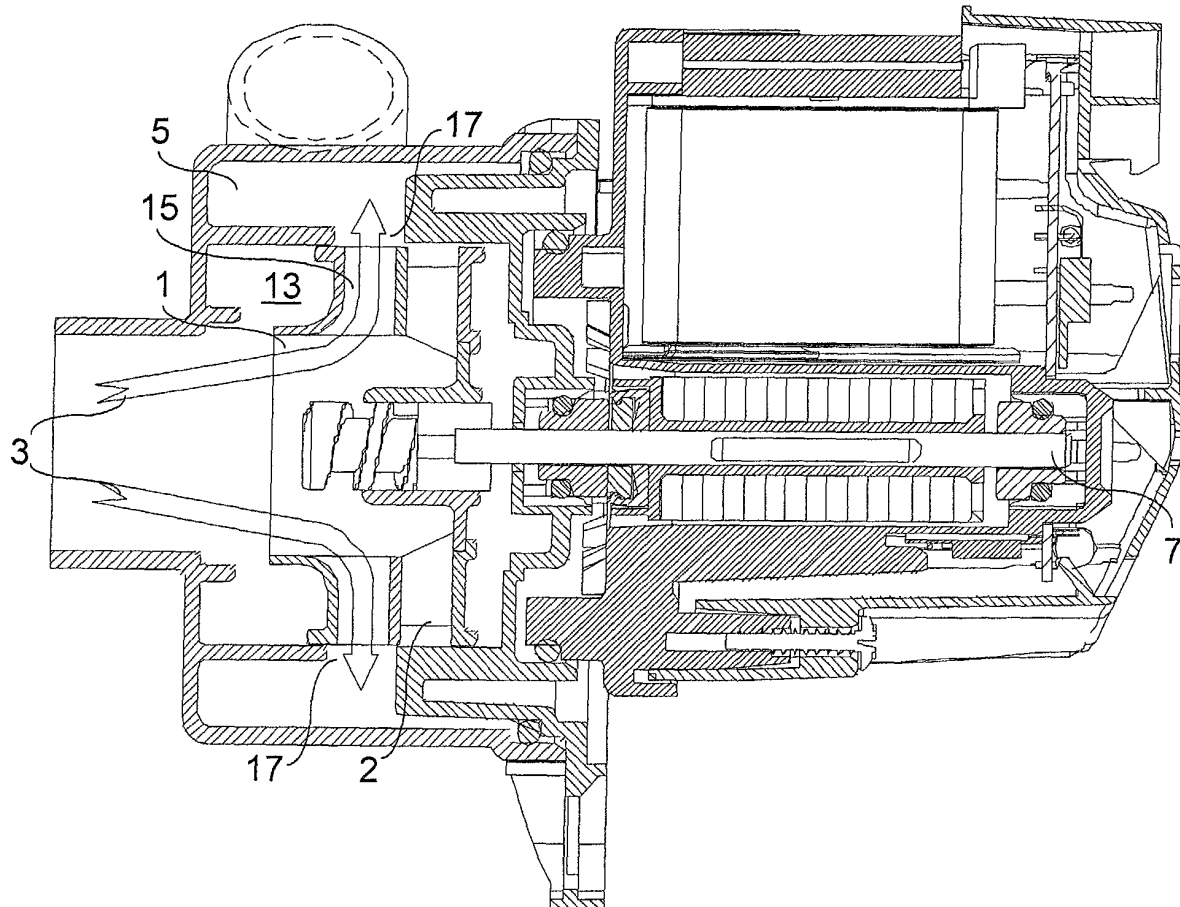


Fig. 4

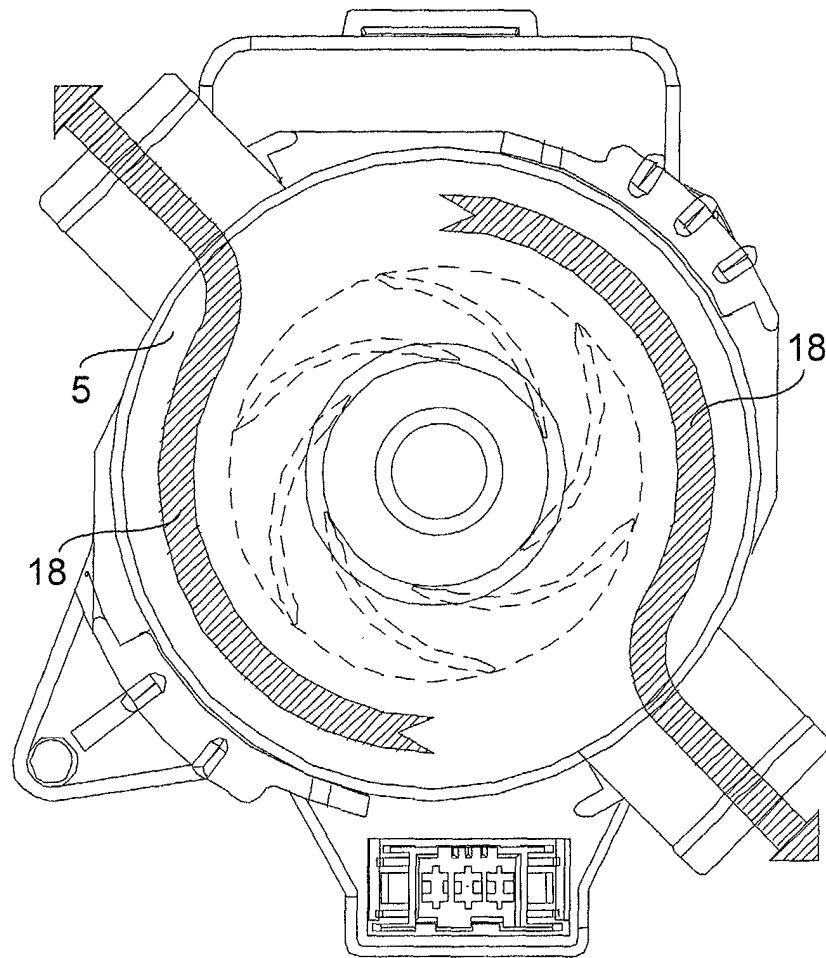
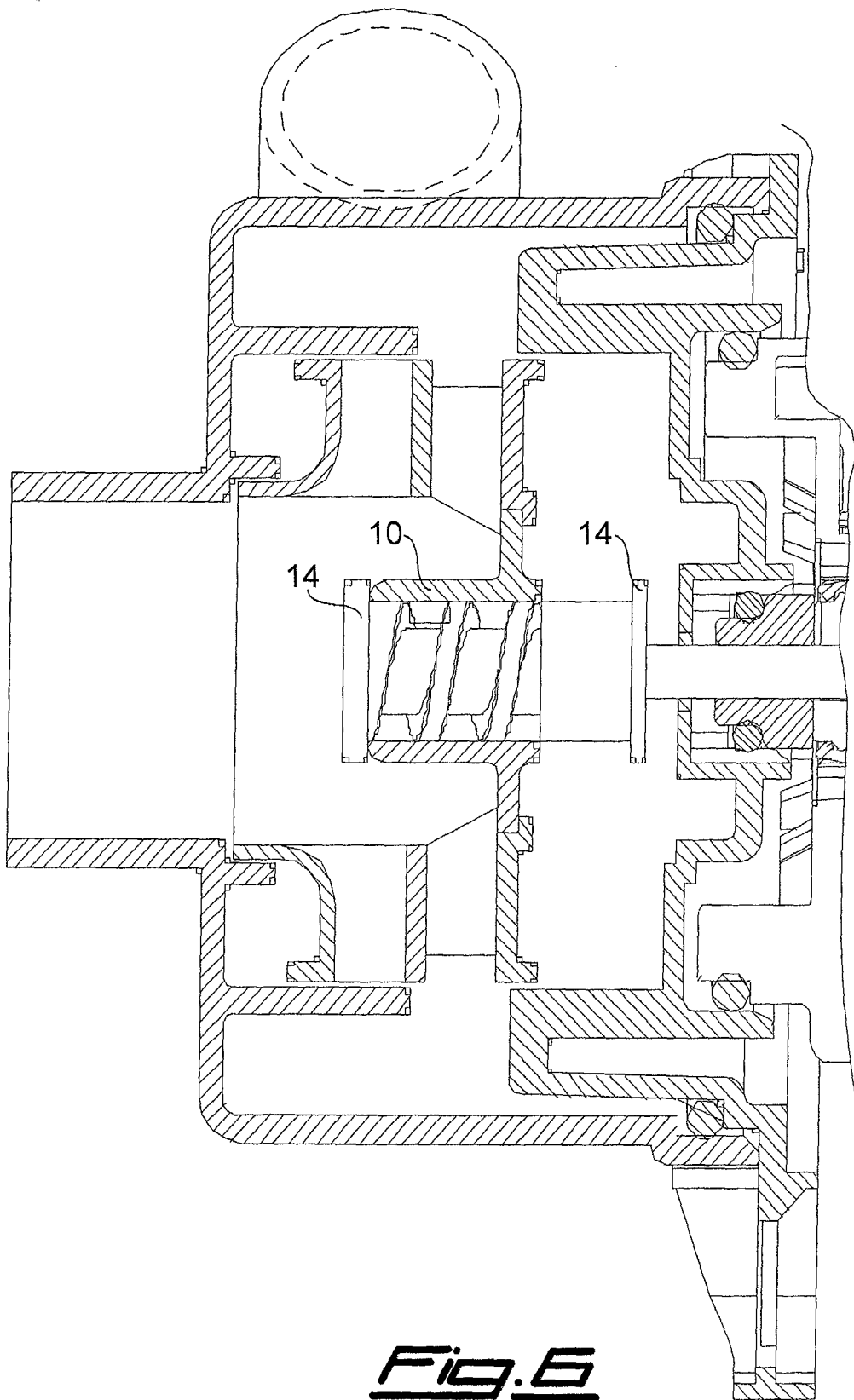
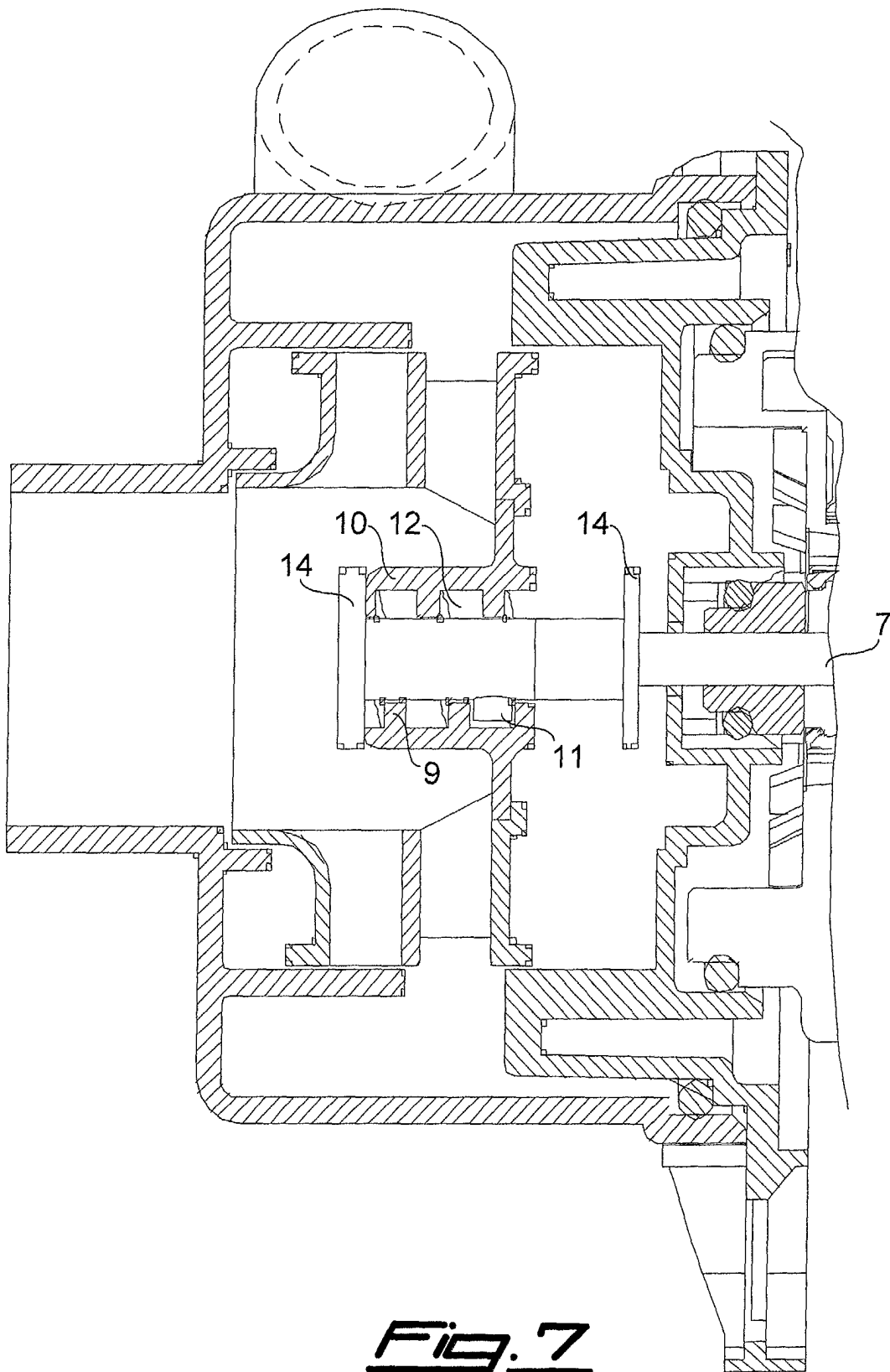


Fig. 5







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EUROPEAN SEARCH REPORT

Application Number
EP 02 42 5599

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	GB 1 398 148 A (ESSWEIN SA) 18 June 1975 (1975-06-18) * column 2, line 41 - line 71 * * column 3, line 25 - line 42 * * figures 2,3 * ---	1	F04D13/14 F04D29/22
A	US 4 941 801 A (TAKAKURA YOSHINARI) 17 July 1990 (1990-07-17) * column 1, line 51 - line 55 * * column 2, line 9 - line 26 * * figure 1 * ---	1	
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A	EP 0 465 787 A (ZANUSSI ELETTRODOMESTICI) 15 January 1992 (1992-01-15) * the whole document * -----	1	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (Int.Cl.7) F04D A47L
Place of search MUNICH		Date of completion of the search 10 February 2003	Examiner Giorgini, G
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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