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(54) **Electric motor-driven water pump for a washing machine**

(57) An electric motor-driven water pump (1) for a washing machine, having: a pumping chamber (5) having an intake duct (11) and a drain duct (12); an impeller (6) housed inside the pumping chamber (5), rotating about a rotation axis (9), and having: a central hub (14) coaxial with the rotation axis (9), a round base plate (15) coaxial with the rotation axis (9) and surrounding the central hub (14), and a number of pumping blades (16), each con-

nected at the bottom to the base plate (15) and laterally to the central hub (14); and an electric motor (7) having a revolving shaft (8) connected to the impeller (6) to rotate the impeller (6) about the rotation axis (9); each pumping blade (16) of the impeller (6) has a top edge (17) on the opposite side to the base plate (15), and which is curved so that an axial dimension of the pumping blade (16) substantially increases towards the rotation axis (9).

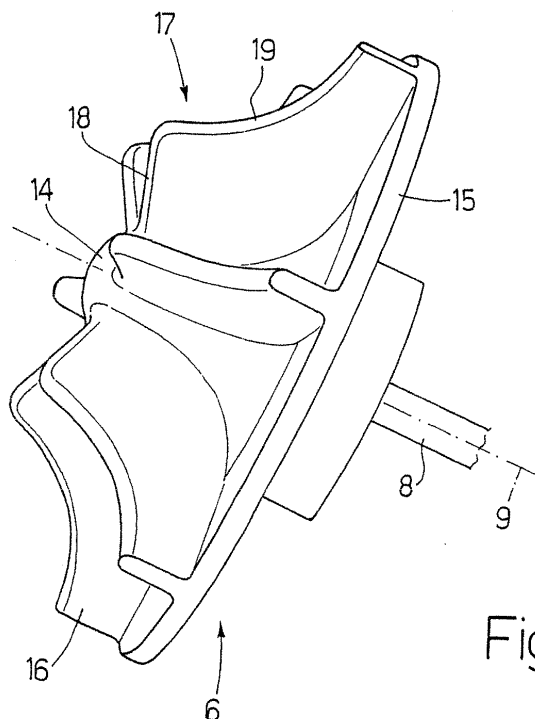


Fig.3

Description

TECHNICAL FIELD

[0001] The present invention relates to an electric motor-driven water pump for a washing machine.

[0002] The electric motor-driven water pump according to the present invention may be used to particular advantage for drainage, to which the following description refers purely by way of example.

BACKGROUND ART

[0003] Washing machines are normally equipped with electric motor-driven water pumps for drainage. An example of an electric motor-driven water drain pump for a washing machine is described in EP1571252A1.

[0004] An electric motor-driven water drain pump for a washing machine has an impeller connected to an electric motor shaft rotating about a central rotation axis inside a pumping chamber having an intake duct and a drain duct. In known water pumps, the impeller is connected mechanically to the electric motor shaft by an articulated joint, which allows a certain amount of relative rotation (e.g. 120°) between the shaft and impeller, so that, when the electric motor is started, the electric motor shaft, as opposed to immediately rotating the impeller, initially rotates substantially idly to greatly reduce peak starting current. The high hydraulic inertia of the stationary water in the pumping chamber, in fact, initially generates a high resisting torque on the impeller, and hence on the electric motor shaft.

[0005] The articulated joint, however, has several drawbacks, by containing a certain amount of grease, which may lose its properties during the working life of the joint, thus resulting in noise or even jamming of the joint. It has been proposed to eliminate the articulated joint. In this case, however, a much more powerful electric motor is required to counteract the high hydraulic inertia of the stationary water in the pumping chamber, thus greatly increasing cost and size.

DISCLOSURE OF INVENTION

[0006] It is an object of the present invention to provide an electric motor-driven water pump for a washing machine, designed to eliminate the aforementioned drawbacks, and which is cheap and easy to implement.

[0007] According to the present invention, there is provided an electric motor-driven water pump for a washing machine, as claimed in the accompanying Claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows an exploded view in perspective of a water pump in accordance with the present invention;

Figures 2 and 3 show two different views in perspective of an impeller of the Figure 1 water pump;

Figure 4 shows an underside view in perspective of an impeller and casing of the Figure 1 water pump;

Figure 5 shows a cross-section view in perspective of an impeller and casing of the Figure 1 water pump;

Figure 6 shows a schematic cross section of an impeller and casing of the Figure 1 water pump.

PREFERRED EMBODIMENTS OF THE INVENTION

[0009] Number 1 in the attached drawing indicates as a whole an electric motor-driven water drain pump for a washing machine. Water pump 1 comprises a rotor housing 2 having a coupling flange 3 connectable to a stator casing 4 to form a pumping chamber 5 for an impeller 6. The electrical part of the pump, which is known, comprises an electric motor 7 (e.g. a synchronous permanent-magnet electric motor, or an asynchronous permanent-magnet, synchronous or asynchronous motor), housed inside rotor housing 2 and having a revolving shaft 8 connected directly and rigidly to impeller 6 to rotate impeller 6 about a central rotation axis 9. It is important to point out that impeller 6 is connected directly and rigidly to shaft 8 of electric motor 7 with no articulated joint in between, and therefore with no degree of freedom between impeller 6 and shaft 8 of electric motor 7.

[0010] Stator casing 4, which is fixed to the washing machine casing, comprises a substantially dome-shaped body 10 fitted removably and in fluidtight manner to rotor housing 2 to internally define pumping chamber 5 for impeller 6. Dome-shaped body 10 has an axial intake duct 11 extending along (i.e. coaxial with) rotation axis 9 of impeller 6; and a radial drain duct 12 extending laterally with respect to dome-shaped body 10 (i.e. perpendicular to rotation axis 9).

[0011] A flexible spacer 13 may be fitted between coupling flange 3 of rotor housing 2 and stator casing 4. Flexible spacer 13 acts as a seal for ensuring sealed coupling of coupling flange 3 and rotor housing 2, and also as a vibration-damper for preventing vibration being transmitted from rotor housing 2 to stator casing 4.

[0012] As shown in Figures 2-5, impeller 6 is housed inside pumping chamber 5, rotates about rotation axis 9, and has a central hub 14 coaxial with rotation axis 9; a round base plate 15 coaxial with rotation axis 9 and surrounding central hub 14; and a number of (e.g. six) pumping blades 16. Each pumping blade 16 is connected at the bottom to base plate 15, and laterally to central hub 14, and is preferably flat and coaxial with rotation axis 9.

[0013] Each pumping blade 16 of impeller 6 has a top edge 17 on the opposite side to base plate 15, and which is curved so that an axial dimension of pumping blade 16 substantially increases towards rotation axis 9. More specifically, top edge 17 of each pumping blade 16 has

a straight inner portion 18 closer to rotation axis 9; and a curved outer portion 19, so that an axial dimension of pumping blade 16 substantially increases towards rotation axis 9.

[0014] Straight inner portion 18 of top edge 17 of each pumping blade 16 preferably slopes slightly, so that, close to rotation axis 9, an axial dimension of pumping blade 16 decreases towards rotation axis 9.

[0015] In a preferred embodiment, the distance between rotation axis 9 and an inner surface 20 of pumping chamber 5 varies. More specifically, the distance between rotation axis 9 and inner surface 20 of pumping chamber 5 is maximum at drain duct 12 and is minimum opposite drain duct 12.

[0016] Inner surface 20 of pumping chamber 5 preferably has a spiral (e.g. a logarithmic spiral) cross section, and is preferably symmetric with respect to a plane coaxial with rotation axis 9 and through drain duct 12. This feature, combined with the fact that each pumping blade 16 of impeller 6 is flat and coaxial with rotation axis 9, enables impeller 6 to rotate indifferently in both directions (clockwise and anticlockwise).

[0017] Water pump 1 as described above has numerous advantages, by being easy to implement and highly effective and efficient.

[0018] In particular, by virtue of the design of pumping blades 16, impeller 6 does not generate a high initial resisting torque when the water in the pumping chamber is stationary. Consequently, even rigidly connecting impeller 6 and shaft 8 of electric motor 7, a particularly powerful electric motor 7 is not required to rotate impeller 6.

[0019] Moreover, by virtue of the design of inner surface 20 of pumping chamber 5, combined with the design of pumping blades 16, water pump 1 as described above provides for high effective flow, and is therefore not penalized with respect to a conventional known water pump.

Claims

1. An electric motor-driven water pump (1) for a washing machine, comprising:

a pumping chamber (5) having an intake duct (11) and a drain duct (12);

an impeller (6) housed inside the pumping chamber (5), rotating about a rotation axis (9), and having: a central hub (14) coaxial with the rotation axis (9); a round base plate (15) coaxial with the rotation axis (9) and surrounding the central hub (14); and a number of pumping blades (16), each connected at the bottom to the base plate (15) and laterally to the central hub (14);

an electric motor (7) having a revolving shaft (8) connected to the impeller (6) to rotate the impeller (6) about the rotation axis (9);

the water pump (1) being **characterized in that** each pumping blade (16) of the impeller (6) has a top edge (17) on the opposite side to the base plate (15), and which is curved so that an axial dimension of the pumping blade (16) substantially increases towards the rotation axis (9).

2. A water pump (1) as claimed in Claim 1, wherein the top edge (17) of each pumping blade (16) has a straight inner portion (18) closer to the rotation axis (9); and a curved outer portion (19), so that an axial dimension of the pumping blade (16) substantially increases towards the rotation axis (9).

3. A water pump (1) as claimed in Claim 2, wherein the straight inner portion (18) of the top edge (17) of each pumping blade (16) is such that, close to the rotation axis (9), an axial dimension of the pumping blade (16) decreases towards the rotation axis (9).

4. A water pump (1) as claimed in any of Claims 1 to 3, wherein the distance between the rotation axis (9) and an inner surface (20) of the pumping chamber (5) varies.

5. A water pump (1) as claimed in Claim 4, wherein the intake duct (11) is coaxial with the rotation axis (9), and the drain duct (12) is perpendicular to the rotation axis (9); the distance between the rotation axis (9) and the inner surface (20) of the pumping chamber (5) is maximum at the drain duct (12) and is minimum opposite the drain duct (12).

6. A water pump (1) as claimed in Claim 5, wherein the inner surface (20) of the pumping chamber (5) has a spiral cross section.

7. A water pump (1) as claimed in Claim 5 or 6, wherein the inner surface (20) of the pumping chamber (5) is symmetric with respect to a plane coaxial with the rotation axis (9) and through the drain duct (12).

8. A water pump (1) as claimed in any of Claims 1 to 7, wherein each pumping blade (16) of the impeller (6) is flat and coaxial with the rotation axis (9).

9. A water pump (1) as claimed in any of Claims 1 to 7, wherein the impeller (6) is connected directly and rigidly to the shaft (8) of the electric motor (7) with no degree of freedom between the impeller (6) and the shaft (8) of the electric motor (7).

10. A water pump (1) as claimed in any of Claims 1 to 9, wherein the water pump (1) is a water drain pump (1).

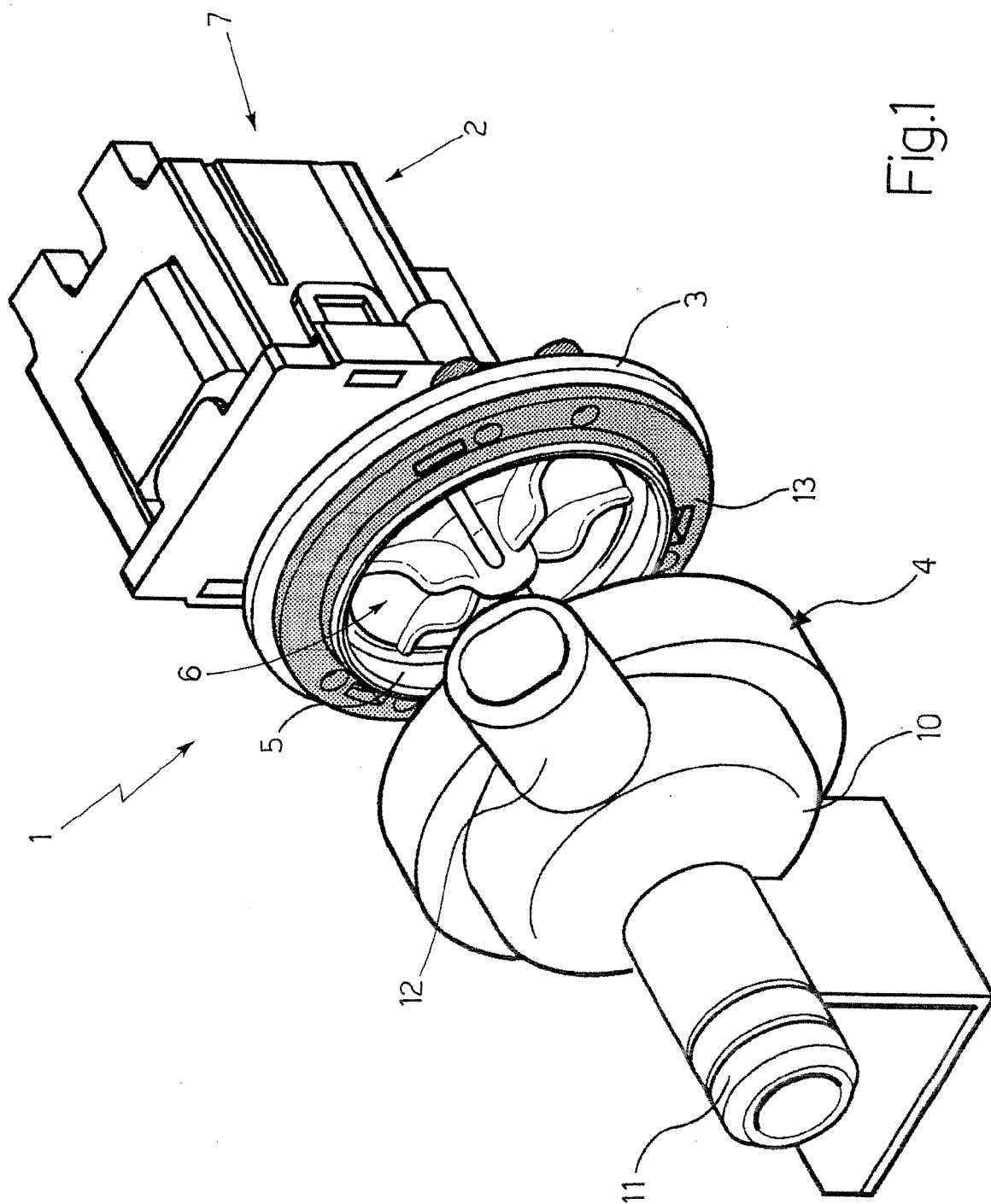


Fig.1

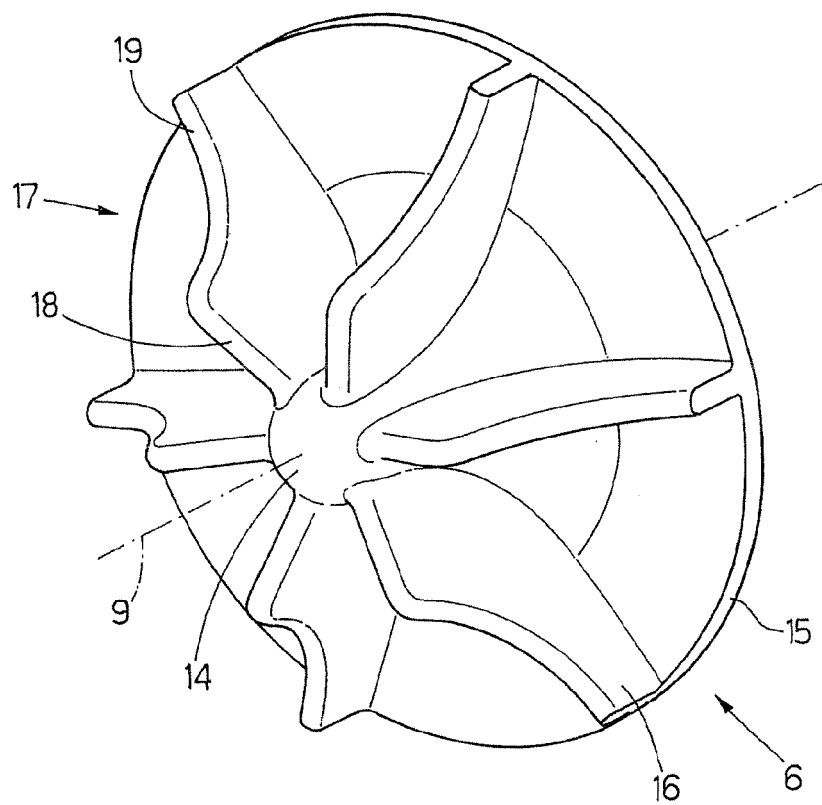


Fig.2

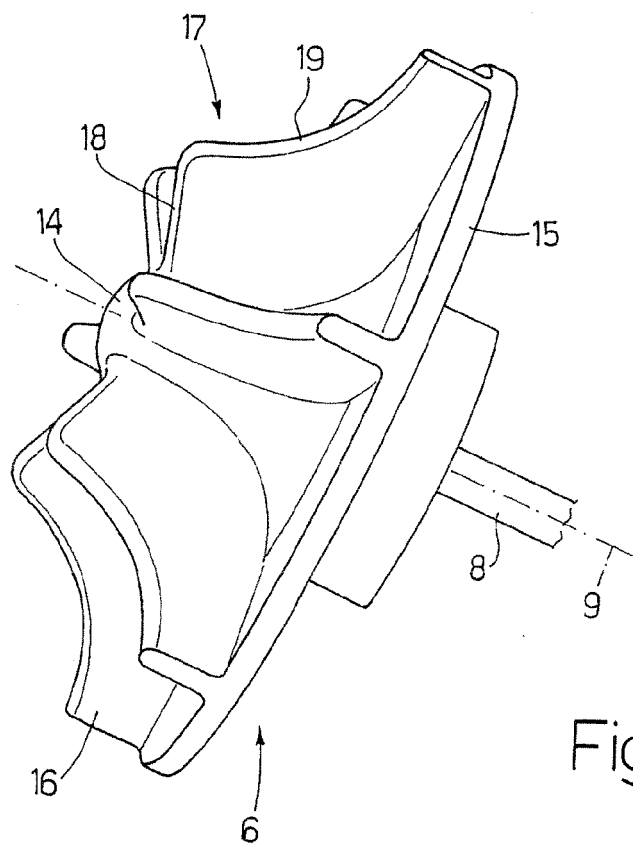


Fig.3

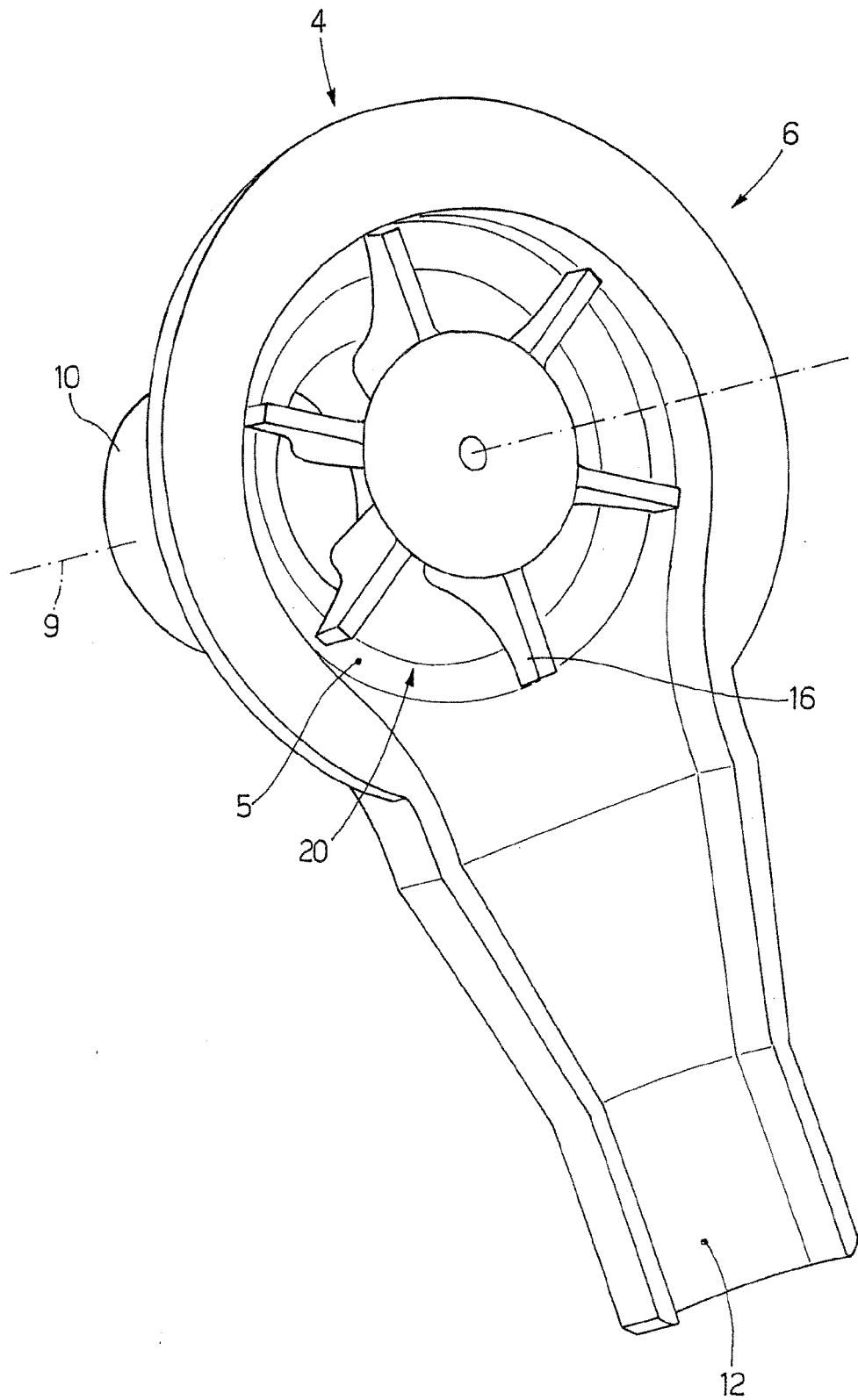


Fig.4

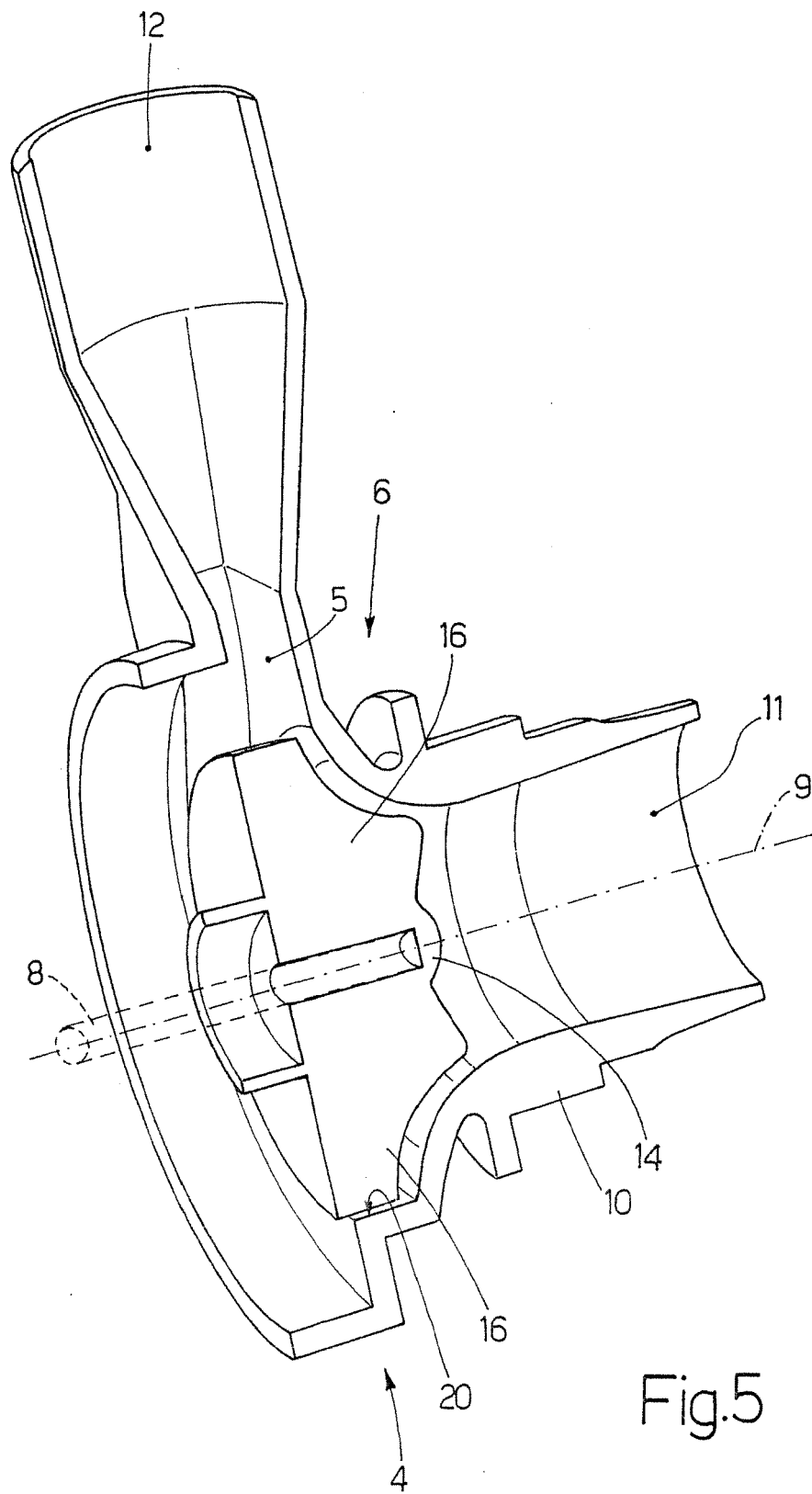


Fig.5

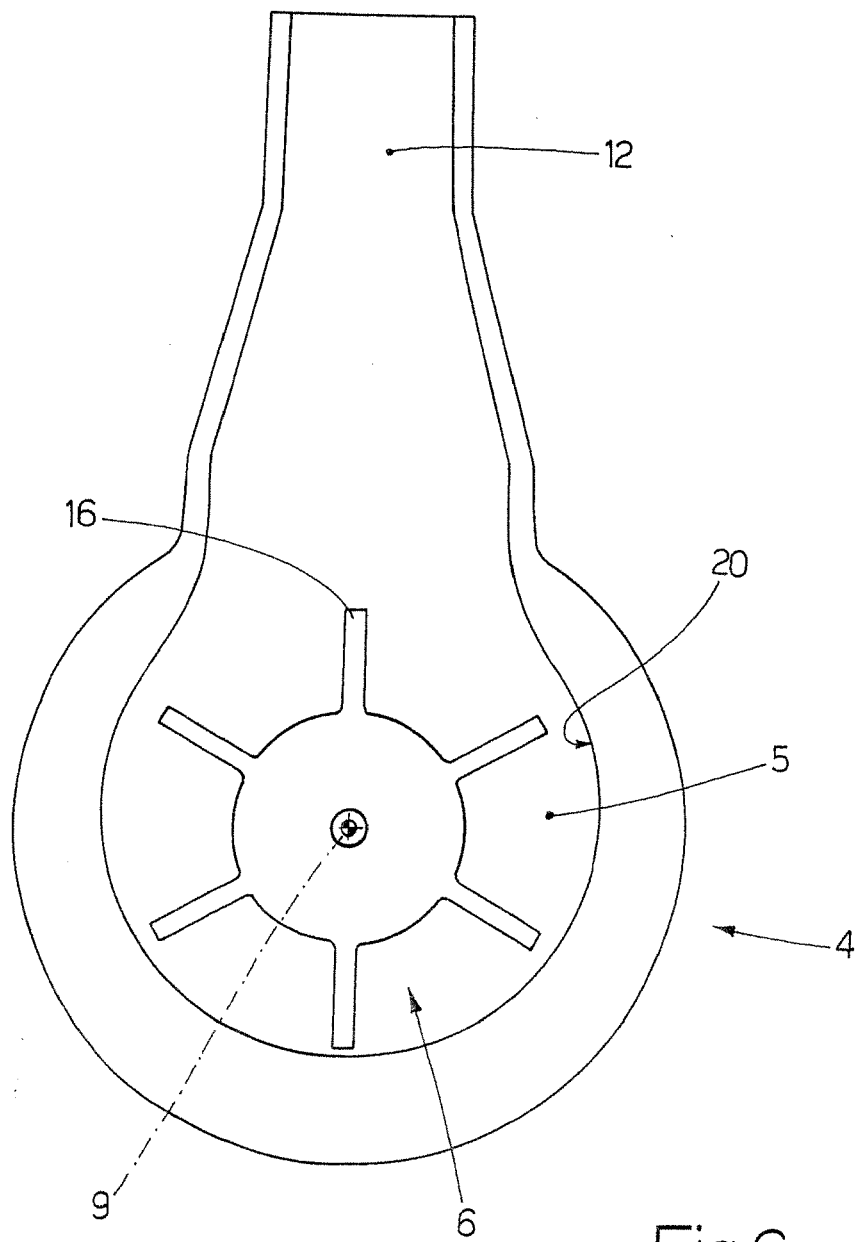


Fig.6



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 11 8507

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Place of search Munich		Date of completion of the search 10 January 2007	Examiner Lodato, Alessandra
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			

2

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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