(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 037 125 A2**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
18.03.2009 Bulletin 2009/12

(51) Int Cl.:
F04D 9/02 *(2006.01)* ***F04D 9/06*** *(2006.01)*

(21) Application number: **08164172.2**

(22) Date of filing: **11.09.2008**

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MT NL NO PL PT RO SE SI SK TR
Designated Extension States:
AL BA MK RS

(30) Priority: **14.09.2007 IT PD20070294**

(71) Applicant: **Dab Pumps S.p.A.**
35035 Mestrino (Padova) (IT)

(72) Inventors:
- **Sinico, Francesco**
  36075 Montecchio Maggiore VI (IT)
- **Moller, Anders Lykkegaard**
  6400 Sonerborg (DK)

(74) Representative: **Modiano, Micaela Nadia et al**
Dr. Modiano & Associati SpA
Via Meravigli 16
20123 Milano (IT)

(54) **Self-priming centrifugal jet pump**

(57) A self-priming centrifugal jet pump, comprising, within the pump body (11), an ejector designed to generate the suction required to prime the liquid to be pumped, the ejector comprising a Venturi duct (12), which is contiguous to the inlet (26) of the impeller (13) of the pump (10), preceded by a nozzle (14), the Venturi duct (12) and the nozzle (14) being aligned and forming between them at least one suction orifice (15), the nozzle (14) and the Venturi duct (12) lying substantially at right angles to the rotation axis (17) of the impeller (13).

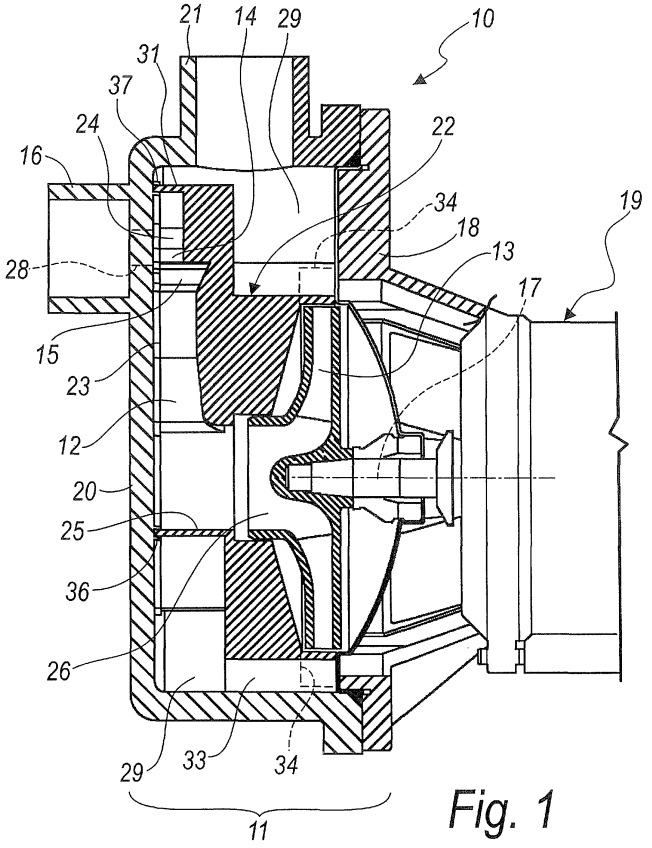


Fig. 1

EP 2 037 125 A2

Description

[0001] The present invention relates to a self-priming centrifugal jet pump.

[0002] Self-priming centrifugal jet pumps are particularly suitable for supplying water in domestic systems, small-scale farming, gardening and in general where self-priming is necessary.

[0003] These self-priming pumps generally comprise, within the pump body, which is coupled by means of a flange to the dome that contains the electric motor drive, an ejector designed to generate the suction required to prime the liquid to be pumped; such ejector is arranged coaxially and adjacent to the impeller suction port and is constituted by a Venturi tube preceded by a nozzle, which are arranged coaxially and form between them an annular suction orifice.

[0004] The pump body is constituted by a cup-shaped element with an intake port, whose axis is parallel to the rotation axis of the impeller, and a delivery port, whose axis is perpendicular to the axis of the intake port.

[0005] Such cup-shaped element has a depth, in the direction of the axis of the impeller, such as to contain a Venturi duct capable of generating the desired suction.

[0006] Coaxiality of the nozzle, the Venturi duct and the impeller determines, for the pump body, a space occupation which makes it difficult or impossible to install the pump if the installation site designed to receive it is particularly tight and difficult to access.

[0007] The aim of the present invention is to provide a self-priming centrifugal jet pump that is more compact than known pumps having a similar performance.

[0008] Within this aim, an object of the present invention is to provide a self-priming pump that has a simplified structure and therefore can be assembled quickly and easily.

[0009] Another object of the present invention is to provide a self-priming centrifugal jet pump that can be manufactured cheaply with known systems and technologies.

[0010] This aim and these and other objects, which will become better apparent hereinafter, are achieved by a self-priming centrifugal jet pump, which comprises, within the pump body, an ejector designed to generate the suction required to prime the liquid to be pumped, said ejector comprising a Venturi duct, which is contiguous to the inlet of the impeller of the pump, preceded by a nozzle, the Venturi duct and the nozzle being aligned and forming between them at least one suction orifice, said self-priming centrifugal jet pump being characterized in that said nozzle and said Venturi duct lie substantially at right angles to the rotation axis of the impeller.

[0011] Further characteristics and advantages of the invention will become better apparent from the following detailed description of four preferred but not exclusive embodiments thereof, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a sectional side view of a pump according to the invention in a first embodiment thereof;
Figure 2 is an exploded perspective view of the pump according to the invention in the first embodiment;
Figure 3 is a rear view of a detail of Figure 2;
Figure 4 is a sectional side view of a pump according to the invention in a second embodiment thereof;
Figure 5 is a front view of a detail of the pump according to the invention in the second embodiment;
Figure 6 is a sectional side view of a pump according to the invention in a third embodiment thereof;
Figure 7 is a front view of a detail of the pump according to the invention in the third embodiment;
Figure 8 is a sectional side view of a pump according to the invention in a fourth embodiment thereof;
Figure 9 is a front view of a detail of the pump according to the invention in the fourth embodiment.

[0012] With reference to the figures, a self-priming centrifugal jet pump according to the invention is generally designated, in its first embodiment, by the reference numeral 10.

[0013] The self-priming pump 10 comprises, within a pump body 11, an ejector designed to generate the suction required to prime the liquid to be pumped.

[0014] Such ejector comprises a Venturi duct 12, which is contiguous to the inlet of an impeller 13 of the pump 10 and is preceded by a nozzle 14; the Venturi duct 12 and the nozzle 14 are aligned and form between them two facing suction orifices 15 for the fluid that rises from the associated suction tube, not shown in the figures for the sake of simplicity, which is connected to a suction port 16 of the pump body 11.

[0015] The particularity of the invention resides in that the nozzle 14 and the Venturi duct 12 lie on a plane of arrangement which is substantially perpendicular to a rotation axis 17 of the impeller 13.

[0016] In particular, in the first embodiment of the invention, shown in Figures 1 to 3, the pump body 11 comprises an outer enclosure constituted by a flange 18, which is fixed at one end to a motor drive 19 of the pump 10 and at the opposite end to a housing 20, which is substantially cylindrical and on which the suction port 16 and a delivery port 21 are formed.

[0017] Within the housing 20, the Venturi duct 12 and the nozzle 14 are formed on a diffuser 22 that surrounds the impeller 13.

[0018] In this first embodiment, which must be understood as a non-limiting example of the invention, the Venturi duct 12 is constituted by two mutually opposite walls 23, which diverge in a radial direction from the outside inward and protrude toward the axis 17 of the impeller 13.

[0019] The walls 23 extend substantially radially between two first symmetrical curved walls 24, which have a substantially C-shaped transverse cross-section, and a second curved wall 25, which forms centrally a cylindrical tubular portion whose axis is parallel to the axis 17 of the impeller 13, for conveying the aspirated fluid toward an inlet 26 of the impeller 13.

[0020] The first curved walls 24 protrude from the diverging walls 23; the free ends of the two first curved walls 24 form, in a radial direction, the nozzle 14 that precedes the Venturi duct 12.

[0021] Each one of the first curved walls 24 forms, in the direction of the axis 17 of the impeller 13, a suction passage 27 for the fluid that enters the body 11 through the suction port 16.

[0022] In particular, on the housing 20 there are two through holes 28, each of which faces one of the two curved walls 24, which connect the suction port 16 to the Venturi duct 12.

[0023] The diverging walls 23, the first curved walls 24 and the second curved wall 25 are joined in a single wall 26 (inlet of the impeller 13), which in turn is provided monolithically with the diffuser 22.

[0024] The single wall 26 is partly surrounded by an air separation partition 31, which is open downward onto an internal chamber 29 of the body 11.

[0025] The partition 31 also forms rising ducts 32 for the fluid which, by recirculating in the body 11 and being pushed in the nozzle 14 and in the Venturi duct 12, determines the partial vacuum that allows suction through the orifices 15.

[0026] The rising ducts 32 have a cross-section that tapers from the bottom upward by way of the inclination of two central portions 32a, which reduce the height of the rising duct 32.

[0027] The diffuser 22 that surrounds the impeller 13 has radial protrusions 33, inside each of which there is a contoured passage 34 for conveying the fluid toward the delivery port 21.

[0028] The diffuser 22 is inserted in the housing 20, which is provided internally with grooves 36 and 37 which are contoured to accommodate the edges of the single wall 26 and of the partition 31 respectively, so as to create substantially sealed passages through which the flowing fluid cannot seep and recirculate.

[0029] The Venturi duct 12 and the nozzle 14 are provided so that the aspirated fluid follows a path which is substantially perpendicular to the axis 17 of the impeller 13 instead of being parallel to the axis 17, as in known types of pump.

[0030] This allows to provide a pump body 11 that is far less deep than a pump of the known type capable of providing a similar performance.

[0031] Further, only two components are used substasntially in order to provide the nozzle 14, the Venturi duct 12, and the air separation partition 31: the housing 20 and the diffuser 22, which supports, monolithically therewith, also the partition 31 and the single wall 26, while at least four components are generally necessary in known types of pump: the housing 20, the nozzle 14, the Venturi duct 12 and the air separation partition 31.

[0032] Moreover, the assembly of just two components is far cheaper in terms of labor than the assembly of at least four components.

[0033] The housing 20 and the diffuser 22 can be provided by molding plastic material, therefore with very low production costs.

[0034] In a second embodiment of the pump according to the invention, generally designated by the reference numeral 110 in Figure 4, the diffuser 122 supports a Venturi duct 112, which is substantially shaped like a spiral, as clearly shown also in Figure 5.

[0035] The diverging walls 123 extend substantially concentrically from the first curved walls 124 from to the second curved wall 125, which defines the portion for conveyance toward the impeller 113.

[0036] In a manner similar to what has been described for the first embodiment of the pump according to the invention, each of the first curved walls 124 forms, in the direction of the axis of the impeller 113, a suction passage 127 for the fluid that enters the body 111 by means of the suction port 116.

[0037] The air separation partition 131 is extended substantially upward to the side of the second curved wall 125; from there, parallel to the partition 131, a portion 141 extends which, together with the partition 131, defines the rising duct 132.

[0038] The ends of the partition 131 and of the portion 141 converge monolithically with the first curved walls 124 and form the nozzle 114.

[0039] Figure 5 exemplifies by means of light-colored arrows the behavior of the recirculating fluid that rises from the rising duct 132 toward the nozzle 114, and the dark arrows exemplify the behavior of the fluid that is aspirated and enters the pump body 111.

[0040] Figures 7, 8 and 12 illustrate a third embodiment of the pump according to the invention, generally designated by the reference numeral 210.

[0041] In this third embodiment, on the diffuser 222 there is a first internal wall 226, which in turn comprises monolithically the two diverging walls 223 that form a Venturi duct 212, which has a curved profile and extends upward from below, and the central curved wall 225, and a partition 231, which surrounds the first wall 226, extending substantially along the perimeter of the diffuser 222; the two ends 231a and 231b of the partition 231 are contoured so as to arrange themselves side-by-side to form the nozzle 214, proximate to where the ends of the diverging walls 223 define the inlet of the Venturi duct 212 and face the nozzle 214 so as to form the suction orifices 215.

[0042] Differently from the previously described embodiments, in this third embodiment the flow enters from the suction port 216, not at the nozzle 214 but in a region 240 between the partition 231 and the central curved wall 225, on the opposite side, with respect to the axis 217 of the impeller 213, of the nozzle 214.

[0043] Figure 7 exemplifies by means of dark arrows the behavior of the aspirated fluid that enters the pump body 211.

[0044] Figures 8 and 9 illustrate a fourth embodiment of the pump according to the invention, generally designated by the reference numeral 310.

[0045] In this fourth embodiment, on the diffuser 322 there is a first internal wall 326, which in turn comprises monolithically the two diverging walls 323 that form a substantially straight Venturi duct 312 which extends upward from below, and the central curved wall 325, and a partition 331, which surrounds the first wall 326, which lies substantially along the perimeter of the diffuser 322; the two ends 331a and 331b of the partition 331 are contoured so as to be arranged side-by-side to form the nozzle 314, proximate to where the ends of the diverging walls 323 define the inlet of the Venturi duct 312 and face the nozzle 314 so as to form the suction orifices 315.

[0046] As in the preceding third embodiment, the flow enters from the suction port 316, not at the nozzle 314 but in a region 340 between the partition 331 and the central curved wall 325, on the opposite side, with respect to the axis 317 of the impeller 313, of the nozzle 314.

[0047] Figure 9 illustrates, by way of example, by means of dark arrows the behavior of the aspirated fluid that enters the pump body 311.

[0048] In practice it has been found that the invention thus conceived solves the described drawbacks of known self-priming centrifugal jet pumps.

[0049] In particular, the present invention provides a self-priming centrifugal jet pump that is smaller than known pumps having a similar performance and therefore is easier to position even in tight spaces in which it would be unlikely to be able to install a known type of pump.

[0050] Further, the invention has provided a pump that has a simplified structure and therefore can be assembled easily and rapidly.

[0051] Further, the invention has provided a self-priming pump whose performance is not inferior to similar pumps of the known type.

[0052] Moreover, the present invention provides a self-priming centrifugal jet pump that can be manufactured cheaply with known systems and technologies.

[0053] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims; all the details may further be replaced with other technically equivalent elements.

[0054] In practice, the materials used, so long as they are compatible with the specific use, as well as the dimensions, may be any according to requirements and to the state of the art.

[0055] The disclosures in Italian Patent Application No. PD2007A000294 from which this application claims priority are incorporated herein by reference.

[0056] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A self-priming centrifugal jet pump (10), comprising, within the pump body (11), an ejector designed to generate the suction required to prime the liquid to be pumped, said ejector comprising a Venturi duct (12), which is contiguous to the inlet of the impeller (13) of the pump (10), preceded by a nozzle (14), the Venturi duct (12) and the nozzle (14) being aligned and forming between them at least one suction orifice (15), said self-priming centrifugal jet pump (10) being **characterized in that** said nozzle (14) and said Venturi duct (12) lie substantially at right angles to the rotation axis (17) of the impeller (13).

2. The pump according to claim 1, **characterized in that** the pump body (11) comprises an outer enclosure constituted by a flange (18), which is fixed at one end to the motor drive (19) of the pump (10) and at the opposite end to a substantially cylindrical housing (20), on which the suction port (16) and the delivery port (21) are formed, inside the housing (20) the Venturi duct (12) and the nozzle (14) being formed on the diffuser (22) that surrounds the impeller (13).

3. The pump according to the preceding claims, **characterized in that** said Venturi duct (12) is constituted by two mutually opposite walls (23), which diverge in a radial direction from the outside inward, protrude toward the axis (17) of the impeller (13) and extend substantially in a radial direction between two first curved walls (24), which are symmetrical and have a substantially C-shaped transverse cross-section, and a second curved wall (25), which forms centrally a cylindrical tubular portion, whose axis is parallel to the axis (17) of the impeller (13), for conveying the aspirated fluid toward the inlet (26) of the impeller (13), said first curved walls (24) extending from the diverging walls (23) with such a contour that their free ends form in a radial direction the nozzle (14) that precedes the Venturi duct (12), while each of said curved walls (24), in the direction of the axis (17) of the impeller (13), forms a suction passage (27) for the fluid that enters the body (11) by means of the suction port (16).

4. The pump according to the preceding claims, **characterized in that** on the housing (20) there are two through holes (28), each of which faces one of the two curved walls (25), which connect the suction port (16) to the Venturi duct (12).

5. The pump according to the preceding claims, **characterized in that** the diverging walls (23), the first curved walls (24) and the second curved wall (25) are joined in a single wall (26), which in turn is provided monolithically with the diffuser (22).

6. The pump according to one or more of the preceding claims, **characterized in that** said single wall (26) is partly surrounded by an air separation partition (31), which is open downward toward the internal chamber (29) of the pump body (11).

7. The pump according to the preceding claim, **characterized in that** said partition (31) forms the rising ducts (32) for the fluid which, by recirculating within the body (11) and being pushed in the nozzle (14) and in the Venturi duct (12), determines the partial vacuum that allows suction through the orifices (15).

8. The pump according to the preceding claim, **characterized in that** said rising ducts (32) have a cross-section that tapers upward from below by way of the inclination of the two central portions (32a) that reduce the height of the rising duct (32).

9. The pump according to one or more of the preceding claims, **characterized in that** said diffuser (22) that surrounds the impeller (13) has radial protrusions (33), inside each of which there is a contoured passage (34) for conveying the fluid toward the delivery port (21).

10. The pump according to one or more of the preceding claims, **characterized in that** said diffuser (22) is inserted in the housing (20), which is provided internally with contoured grooves (36, 37) for accommodating the edges of the single wall (26) and of the partition (31), so as to create substantially sealed passages from which the passing fluid cannot seep and recirculate.

11. The pump according to one or more of the preceding claims, **characterized in that** said housing (20) and said diffuser (22) are provided by molding plastic material.

12. The pump according to one or more of claims 1, 2, 4 and onward, **characterized in that** said diffuser (122) has a substantially spiral-shaped Venturi duct (112).

13. The pump according to claim 12, **characterized in that** said diverging walls (123) extend substantially concentrically from the first curved walls (124) to the second curved wall (125), which defines the portion for conveyance toward the impeller (113).

14. The pump according to claim 13, **characterized in that** the air separation partition (131) extends substantially upward from below to the side of the second curved wall (125), a portion (141) extending from said second curved wall (125), parallel to the partition (131), and forming the rising duct (132) with the partition (131).

15. The pump according to the preceding claim, **characterized in that** the ends of the partition (131) and of the portion (141) converge monolithically with the first curved walls (124) and form the nozzle (114).

16. The pump according to claims 1 and 2 and 4 to 11, **characterized in that** on the diffuser (222) there is a first internal wall (226), which in turn comprises monolithically the two diverging walls (223) that define a Venturi duct (212) which has a curved profile and extends upward from below, and the central curved wall (225), and a partition (231), which surrounds the first wall (226), extending substantially along the perimeter of the diffuser (222); the two ends (231a, 231b) of the partition (231) are contoured so as to arrange themselves side-by-side to form the nozzle (214), proximate to where the ends of the diverging walls (223) define the inlet of the Venturi duct (212) and face the nozzle (214) in order to define the suction orifices (215).

17. The pump according to the preceding claim, **characterized in that** the flow enters from the suction port (216) at a region (240) between the partition (231) and the central curved wall (225), on the opposite side of the nozzle (214) with respect to the axis (217) of the impeller (213).

18. The pump according to claims 1 and 2 and 4 to 11, **characterized in that** on the diffuser (322) there is a first internal wall (326), which in turn comprises monolithically the two diverging walls (323) that form a substantially straight Venturi duct (312) which extends upward from below, and the central curved wall (325), and a partition (331), which surrounds the first wall (326), extending substantially along the perimeter of the diffuser 322; the two ends (331a, 331b) of the partition (331) are contoured so as to arrange themselves side-by-side to form the nozzle (314), proximate to where the ends of the diverging walls (323) form the inlet of the Venturi duct (312) and face the nozzle (314) so as to define the suction orifices (315).

19. The pump according to the preceding claim, **characterized in that** the flow enters through the suction port (316) at a region (340) between the partition (331) and the central curved wall (325), on the opposite side of the nozzle (314) with respect to the axis (317) of the impeller (313).

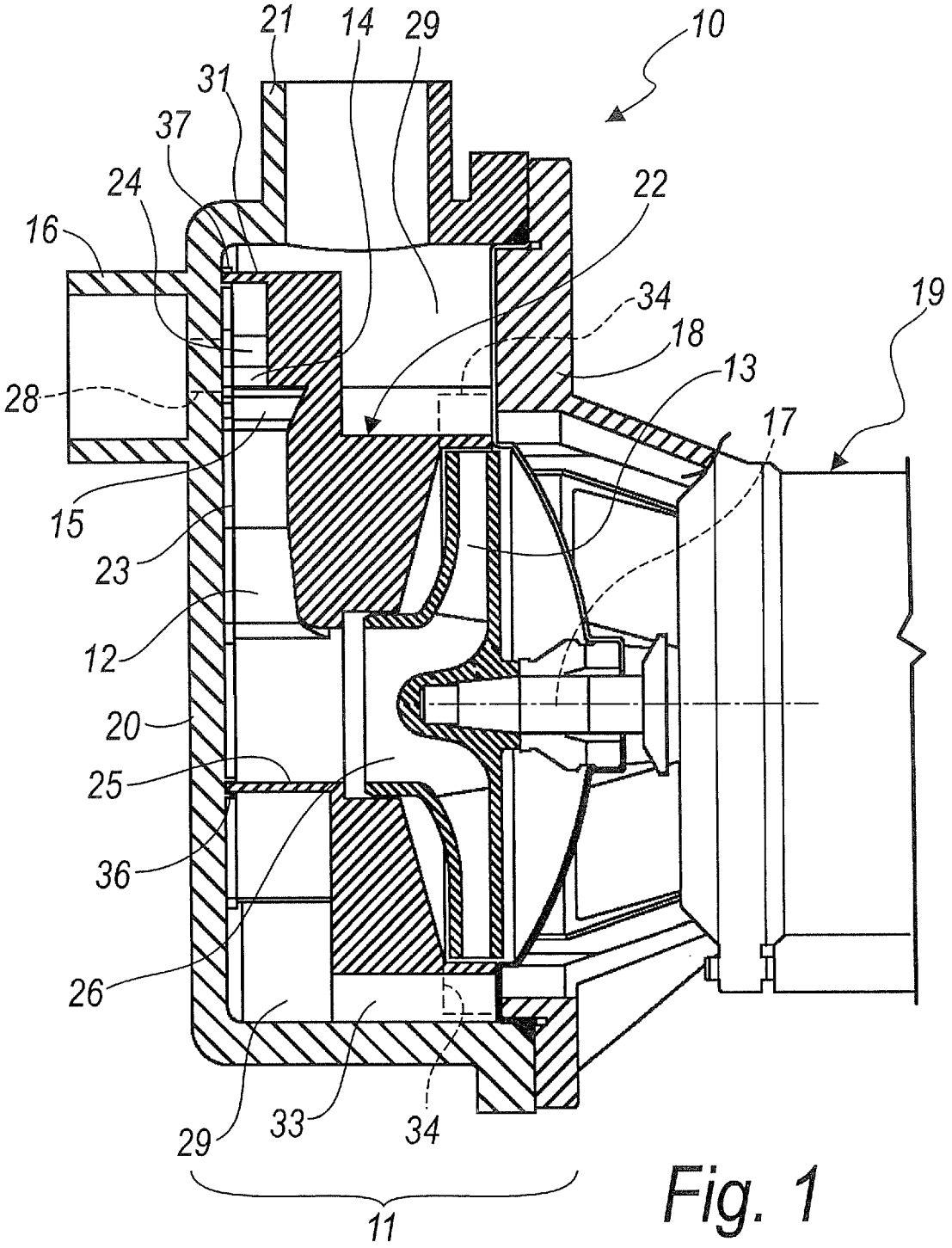

21
14
29
10
31
37
24
22
16
34
19
18
13
28
17
15
23
12
20
25
36
26
29
33
34
11

Fig. 1

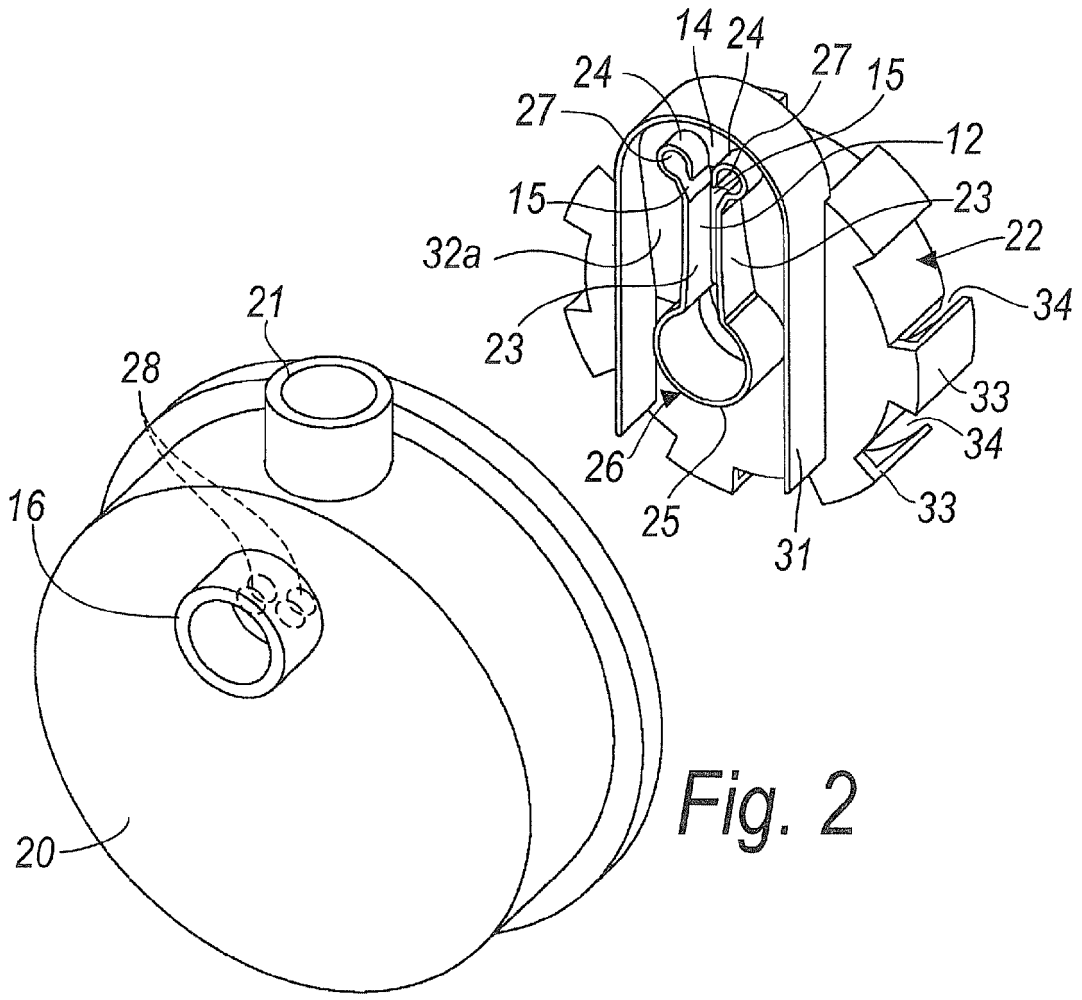

14
24
24
27
27
15
12
15
23
32a
22
34
21
23
28
33
34
26
16
25
33
31
20

Fig. 2

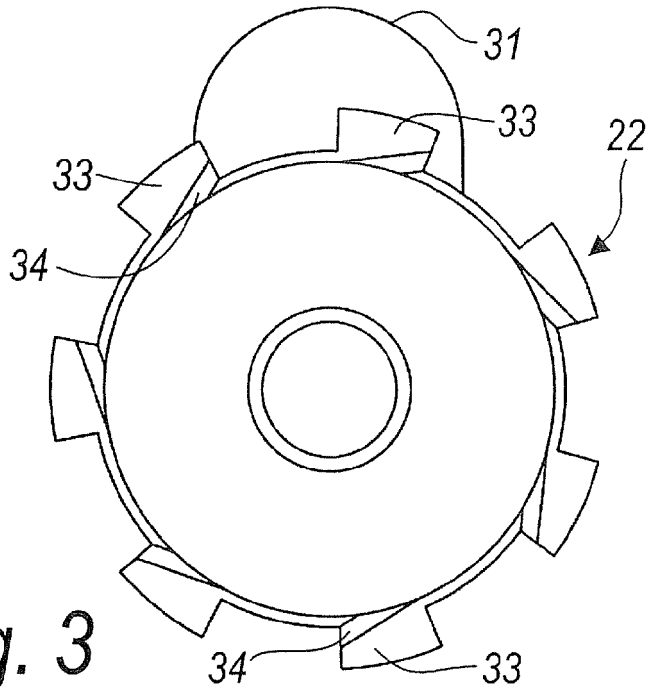

31
33
22
33
34
34
33

Fig. 3

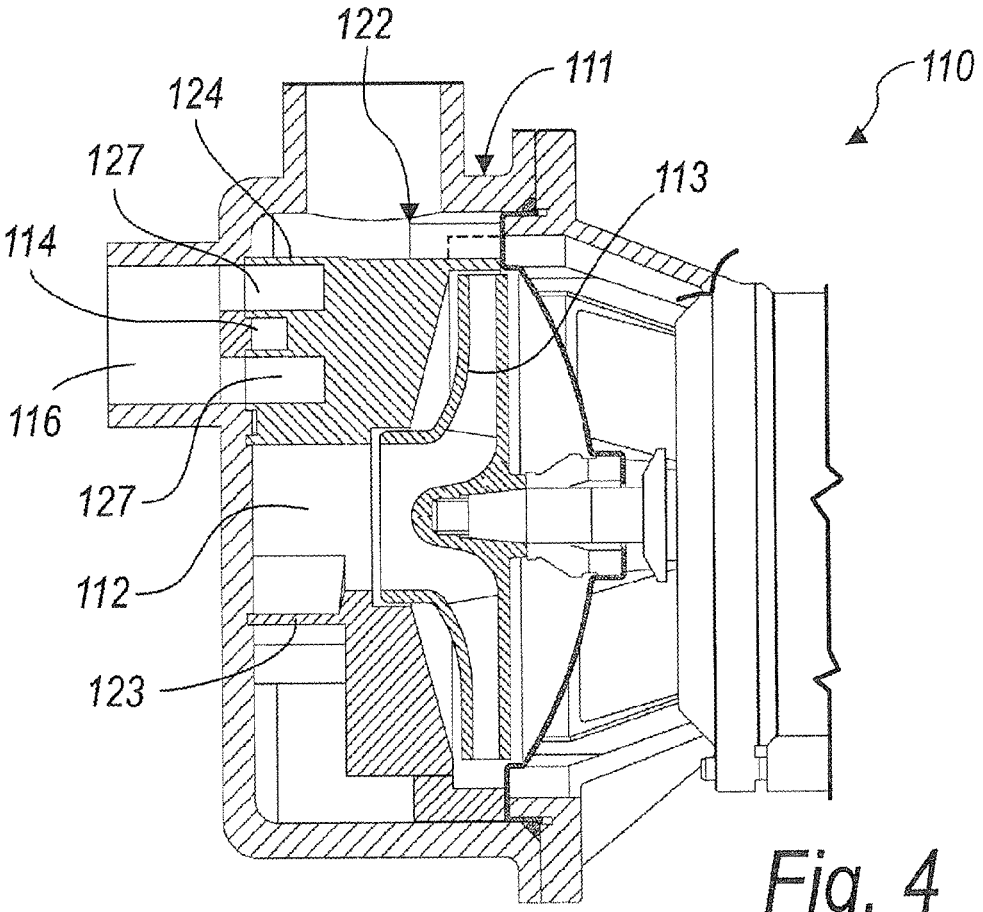

122
111
110
124
127
113
114
116
127
112
123

Fig. 4

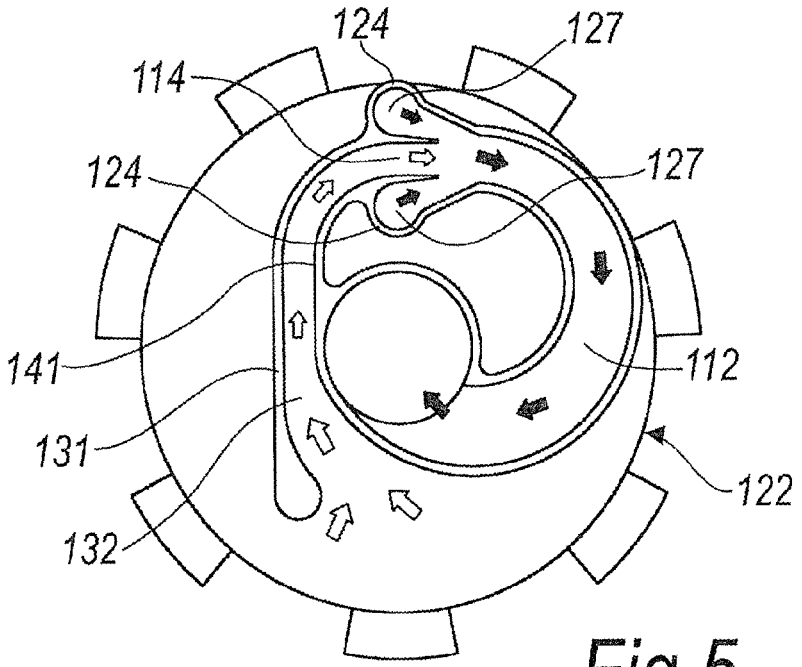

124
127
114
124
127
141
112
131
122
132

Fig.5

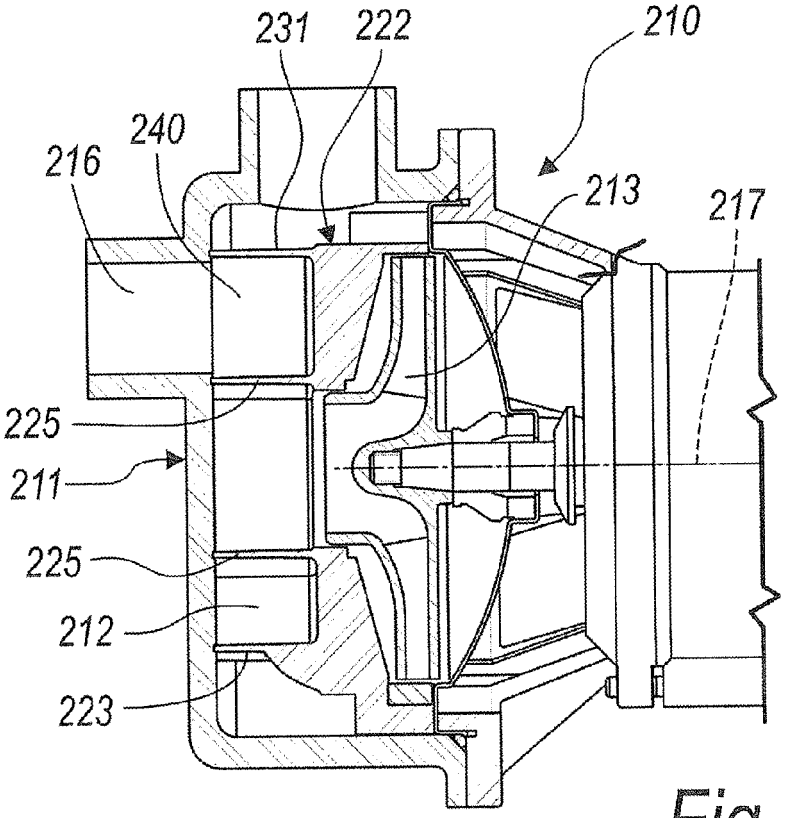

231
222
210
240
216
213
217
225
211
225
212
223

Fig. 6

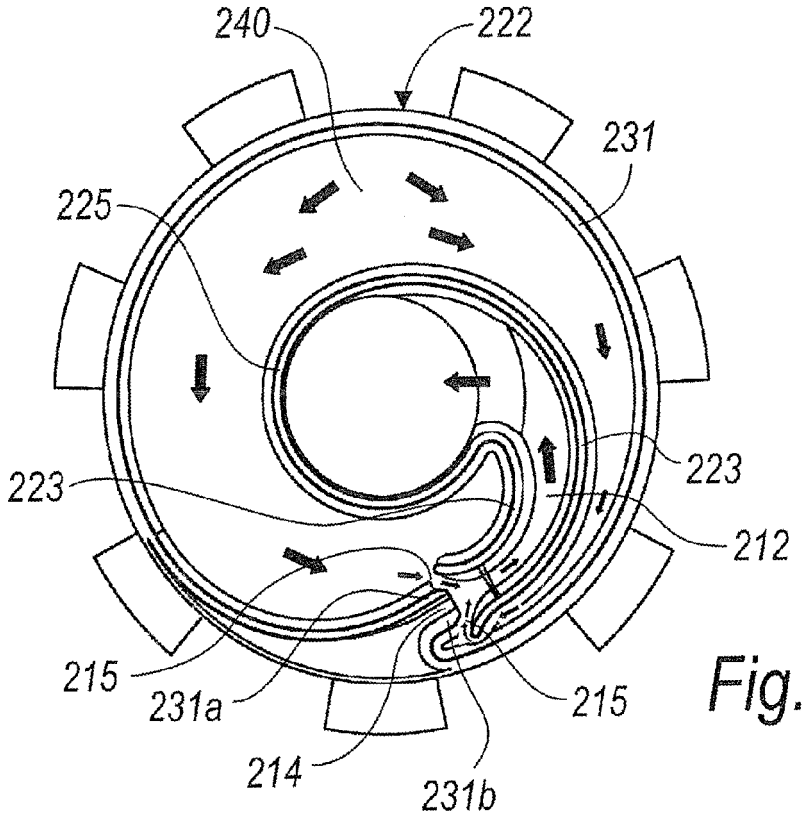

240
222
231
225
223
223
212
215
231a
215
214
231b

Fig. 7

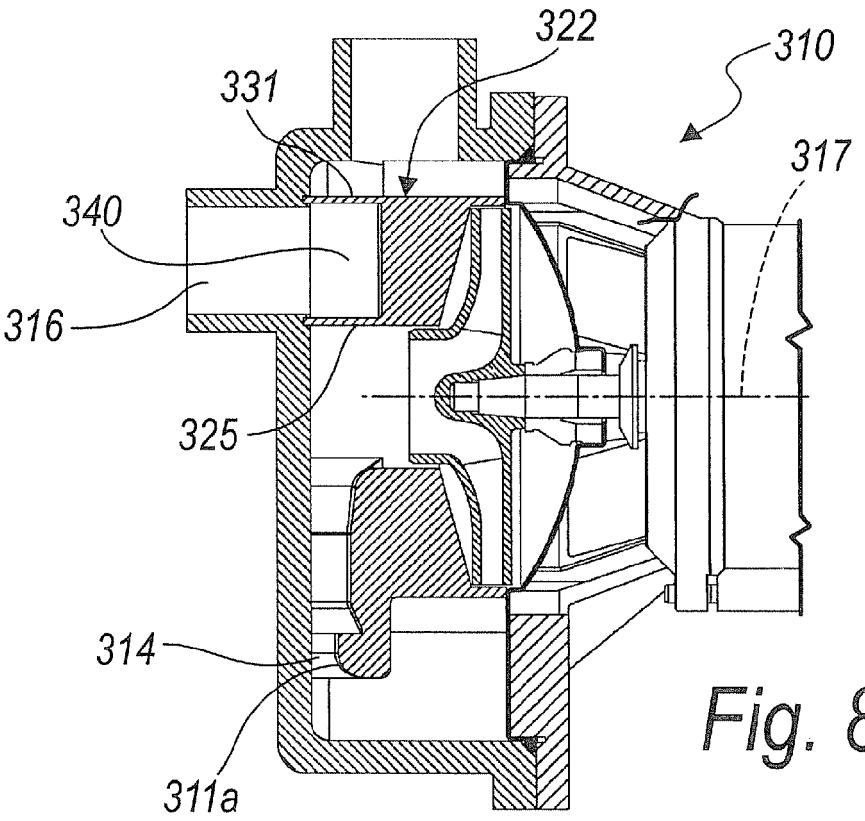

322
310
331
317
340
316
325
314
311a

Fig. 8

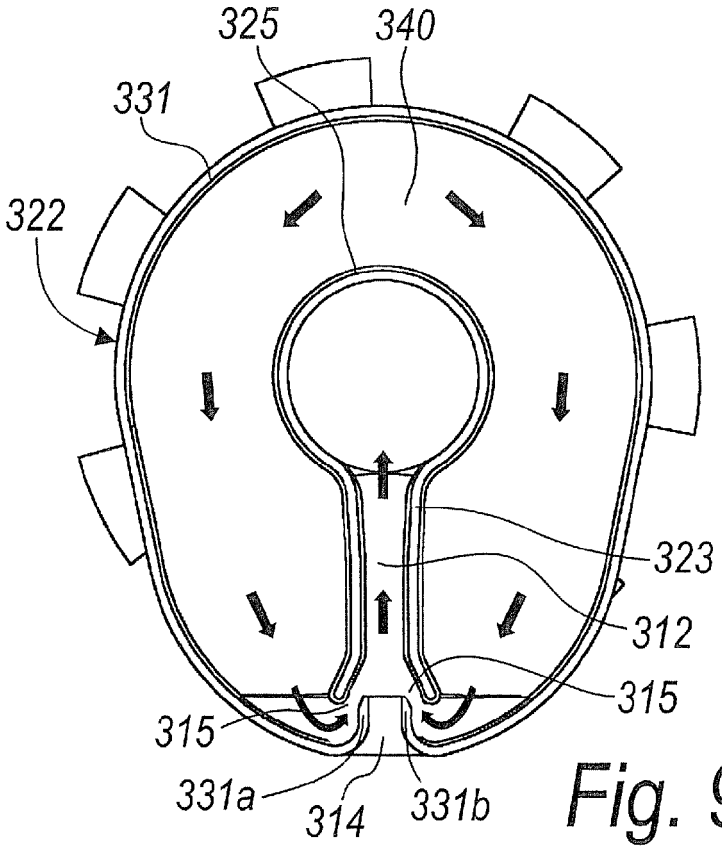

325
340
331
322
323
312
315
315
331a
314
331b

Fig. 9

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- IT PD20070294 A **[0055]**