



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
15.06.2011 Bulletin 2011/24

(51) Int Cl.:
F01C 5/02 (2006.01) **F01C 21/08 (2006.01)**
F04C 2/44 (2006.01) **F04C 5/00 (2006.01)**

(21) Application number: **10191138.6**

(22) Date of filing: **15.11.2010**

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

(72) Inventor: **Manzini, Roberto**
40026 Imola (Bologna) (IT)

(74) Representative: **Lanzoni, Luciano**
Bugnion S.p.A.
Via di Corticella, 87
40128 Bologna (IT)

(30) Priority: **25.11.2009 IT BO20090766**

(71) Applicant: **Manzini, Roberto**
40026 Imola (Bologna) (IT)

Remarks:

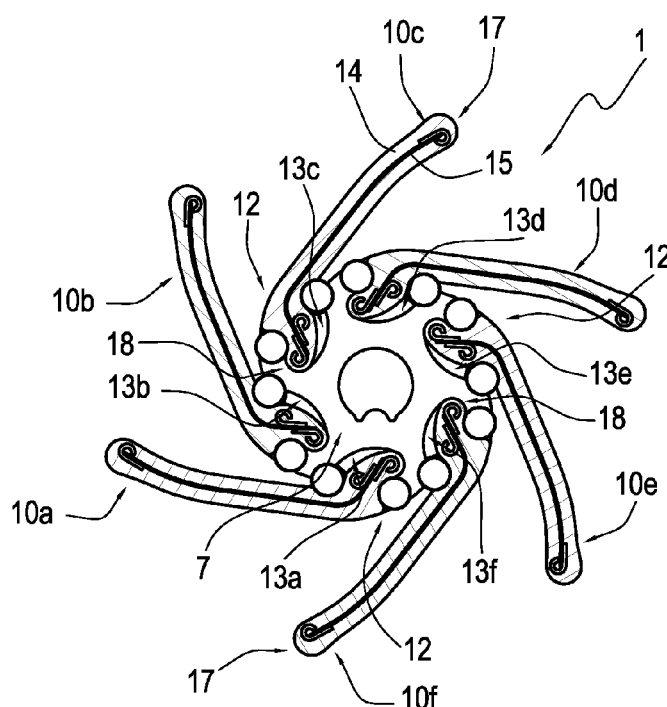
The application is published incomplete as filed (Rule 68(1) EPC).

(54) **Pump rotor**

(57) A volumetric pump rotor comprising a central casing (7) equipped with a peripheral edge (8) and a hollow seat (16) for engaging a respective rotary shaft, at least two elastically deformable vanes (10a, 10b, 10c, 10d, 10e, 10f) connectable to the central casing (7) in such a

way as to protrude from the peripheral edge (8) in order to transfer a fluid into a volumetric pump, each vane comprises a core (15) made of a metallic material and a cover layer (14) for at least partly covering the core (15) at least at the latter's distal end.

FIG.2



Description

[0001] This invention addresses the technical sector relating to pumps used mainly in wine-making for pumping wine.

[0002] More specifically, this invention relates to a pump rotor.

[0003] Widely used in the wine-making industry are volumetric pumps provided with rubber vanes and a rotor housed in a cavity inside a containment casing where a first and a second conduit converge for feeding and receiving the fluid to and from the cavity, respectively.

[0004] The rotor comprises a main casing having a substantially star-shaped outer edge.

[0005] An element equipped with a plurality of radial expansions is fitted to the main casing in such a way that each radial expansion is positioned at a vertex of the star-shaped outer edge.

[0006] This element is made substantially of rubber.

[0007] The radial expansions form a plurality of rubber vanes, the distal ends of which are designed to contact the inside wall of the cavity in order to transfer the fluid inside the pump from the first to the second conduit.

[0008] If left idle for even just a few days, these pumps will give considerable problems upon restarting.

[0009] That is because the vanes, on restarting, remain fixed in the position adopted during the period of inactivity, that is to say, the vanes are subject to a sort of permanent plastic deformation.

[0010] Thus, the vanes are no longer in sealed contact with the inside wall of the housing and, as a result, there is backflow of the fluid pumped in during operation.

[0011] This irreversibly reduces the performance of the pump which no longer attains the head needed to transfer the fluid inside the cavity from the first to the second conduit.

[0012] This invention therefore has for an aim to provide a rotor which can overcome the above mentioned drawbacks and which is at once simple and inexpensive to construct.

[0013] According to the invention, this aim is achieved by a pump rotor and a pump comprising the technical features described in one or more of the appended claims.

[0014] The technical characteristics of the invention, with reference to the above aims, are clearly described in the claims below and its advantages are apparent from the detailed description which follows, with reference to the accompanying drawings which illustrate a preferred, non-limiting example embodiment of the invention provided, and in which:

- Figure 1 is a cutaway perspective view of a preferred embodiment of the rotor according to the invention;
- Figure 2 is a cross section of the rotor according to the invention, illustrated in Figure 1;
- Figure 3 illustrate a detail of the rotor according to the invention;

- Figure 4 illustrates the rotor according to the invention;
- Figures 5, 6 and 7 are cross sections of the rotor according to the invention illustrated in Figure 1 mounted in a pump and in different operative configurations;
- Figures 8, 9 and 10 are cutaway perspective views of the rotor according to the invention illustrated in Figures 5, 6 and 7, respectively.

[0015] With reference to the accompanying drawings, the numeral 1 in Figures 1 and 2 denotes in its entirety the rotor according to the invention forming part of a volumetric pump 2.

[0016] The rotor 1 is illustrated in Figures 5 to 10 mounted inside a cavity 4 of a containment casing 3 of a volumetric pump 2.

[0017] The rotor 1 comprises a central casing 7 provided with a peripheral edge 8 and a plurality of elastically deformable vanes 10a, 10b, 10c, 10d, 10e, 10f mounted in such a way as to protrude from the central casing 7.

[0018] More specifically, but without limiting the scope of the invention, the preferred embodiment comprises six vanes 10a, 10b, 10c, 10d, 10e, 10f. Each of the vanes 10a, 10b, 10c, 10d, 10e, 10f comprises a first end 17 designed to contact the inside wall 9 of the cavity 4 of the pump 2 when the rotor 1 is installed in the pump 2 and hereinafter referred to as the distal end, away from the central casing 7, and a second end 18, designed to be connected to the central casing 7 and hereinafter referred to as the proximal end, close to the central casing 7.

[0019] The proximal end 18 of the vane 10a, 10b, 10c, 10d, 10e, 10f has a substantially enlarged section.

[0020] Each vane 10a, 10b, 10c, 10d, 10e, 10f comprises a core 15 and a cover layer 14 for covering the core 15.

[0021] The cover layer 14 is made preferably of rubber.

[0022] Alternatively, the cover layer 14 may be made of another deformable material able to guarantee the seal between the vane 10a, 10b, 10c, 10d, 10e, 10f and the inside wall 9 of the cavity 4 when the rotor is mounted inside the cavity 4 of the pump 2, as illustrated, for example, in Figure 5 for the vanes 10b, 10c, 10f, 10e.

[0023] The cover layer 14 is fixed to the core 15 preferably, but not necessarily, by vulcanization. Alternatively, the cover layer 14 may be removably fixed to the core 15 by rivets.

[0024] The cover layer 14 preferably, but not necessarily, encloses the core 15 in such a way as to seal it so that the core 15 is not in contact with the fluid. This advantageously prevents damage to the core 15 caused by prolonged contact with the fluid.

[0025] The core 15 is made of a metallic material, advantageously stainless spring steel, which does not oxidize and also has excellent elastic properties.

[0026] The core 15 is intended to be elastically deformed, and, when the deformation ceases, the core 15 springs back to the shape it had before being deformed.

[0027] The core 15 thus enables the vanes 10a, 10b, 10c, 10d, 10e, 10f to be deformed in perfectly elastic manner.

[0028] The central casing 7 comprises, at the centre, a hollow seat 16 for accommodating a rotary shaft of a volumetric pump 2.

[0029] The central casing 7 is made preferably of stainless steel but, alternatively, other materials, either metallic or plastic, might be used.

[0030] At its peripheral edge 8, the central casing 7 has a plurality of seats 13a, 13b, 13c, 13d, 13e, 13f made in it.

[0031] Each of the seats 13a, 13b, 13c, 13d, 13e, 13f is designed to receive the proximal end 18 of a respective vane 10a, 10b, 10c, 10d, 10e, 10f.

[0032] The rotor 1 also comprises a plurality of cylinders 20 fixed in twos to the central casing 7 at the seats 13a, 13b, 13c, 13d, 13e, 13f in the latter. Each pair of cylinders 20 is therefore fixed to opposite walls of the inlet section of the seat 13a, 13b, 13c, 13d, 13e, 13f.

[0033] Each of the vanes 10a, 10b, 10c, 10d, 10e, 10f is inserted in the respective seat 13a, 13b, 13c, 13d, 13e, 13f by making it slide in a direction substantially perpendicular to the axis B of the central casing 7.

[0034] The cylinders 20 therefore prevent the vanes 10a, 10b, 10c, 10d, 10e, 10f from sliding radially out of the respective seats 13a, 13b, 13c, 13d, 13e, 13f of the central casing 7 once the vanes 10a, 10b, 10c, 10d, 10e, 10f have been placed inside the respective seats 13a, 13b, 13c, 13d, 13e, 13f.

[0035] The seats 13a, 13b, 13c, 13d, 13e, 13f and the enlarged end portion of each vane 10a, 10b, 10c, 10d, 10e, 10f form a shape fit.

[0036] This shape fit constitutes means for connecting the vanes 10a, 10b, 10c, 10d, 10e, 10f to the central casing 7.

[0037] The cylinders 20 form fixing elements allowing each vane 10a, 10b, 10c, 10d, 10e, 10f to be fixed inside the respective seat 13a, 13b, 13c, 13d, 13e, 13f and preventing the vanes 10a, 10b, 10c, 10d, 10e, 10f from coming out of the respective seats 13a, 13b, 13c, 13d, 13e, 13f in a radial direction on account of centrifugal force and friction against the inside wall 9 during rotation of the rotor 1 inside the pump 2.

[0038] Figure 1 illustrates the rotor 1 with all the vanes partly cut away, while Figure 4 shows the rotor 1 in a fully assembled condition.

[0039] The volumetric pump 2, illustrated in Figures 5 to 10, designed to receive the rotor 1 of this invention, comprises a containment casing 3 provided with a cavity 4 for containing the fluid.

[0040] The containment casing 3 also comprises a first conduit 5 and a second conduit 6 which are in fluid communication with the cavity 4 in order to feed and receive the fluid to and from the cavity 4, respectively.

[0041] A shaft, not illustrated, is mounted inside the

cavity 4 where it is rotationally driven by respective motor means, also not illustrated.

[0042] The rotor 1 is thus fixed to the shaft of the pump 2 in order to transfer the fluid from the first conduit 5 to the second conduit 6, or vice versa, when the shaft is rotationally driven.

[0043] The pump 2 can operate in three different operative configurations: a first configuration for transferring fluid from the first to the second conduit (Figures 5 and 8), a second configuration for keeping the fluid in the cavity in circulation (Figures 6 and 9) and a third configuration for transferring fluid from the second conduit to the first conduit (Figures 7 and 10).

[0044] The user switches the pump 2 from one operative configuration to another by changing the relative distance in a vertical plane of the axis of the shaft of the rotor 1 with respect to the axis of the cavity 4 using suitable means (not illustrated) for displacing the shaft of the rotor 1 relative to the cavity 4 of the containment casing 3.

[0045] In each of the above mentioned three operative configurations, the rotor 1 always rotates in the direction denoted by the reference character R. Below is a description of rotor 1 operation with reference to the first operative configuration, illustrated in Figures 5 and 8, where the fluid is fed from the first conduit 5 and received by the second conduit 6.

[0046] In this operative configuration, the rotor 1 is in a substantially eccentric position inside the cavity 4.

[0047] In effect, the axis A of the rotor 1 and the axis B of the cavity of the containment casing 3 lie in the same vertical plane and, more specifically, with reference to Figures 5 and 8, the axis A of the rotor 1 is positioned above the axis B of the containment casing 3.

[0048] The rotor 1 is rotationally driven in a predetermined direction R of rotation so as to transfer fluid into the volumetric pump 2.

[0049] The core 15 of each vane 10a, 10b, 10c, 10d, 10e, 10f, since it is made of a material especially designed to be elastically deformed, is deformed during operation and springs back to its original balanced position when the force causing its deformation ceases to be applied.

[0050] The cover layer 14 of each vane 10a, 10b, 10c, 10d, 10e, 10f, on the other hand, maintains sealed contact with the inside wall 9 of the cavity 4 of the containment casing 3, thus preventing backflow of the fluid transferred during pump 2 operation. Even if the rotor 1 remains inoperative for a prolonged period of time, its vanes 10a, 10b, 10c, 10d, 10e, 10f do not undergo permanent deformation. In effect, since the core 15 is made of metal, it is not permanently deformed even after a prolonged period of inactivity.

[0051] Thus, when the pump 2 is restarted after a period of inactivity, whether short or long, the vanes 10a, 10b, 10c, 10d, 10e, 10f are still able to maintain sealed contact with the inside surface 9 of the cavity 4 of the pump 2.

[0052] Advantageously, the core 15, made of stainless

spring steel, can be elastically deformed and its elastic properties are not deteriorated by aging, as occurs instead with other materials.

[0053] Moreover, the elasticity of the core 15 is not altered in significantly appreciable manner by temperature variations within normal summer/winter temperature ranges in the rooms where the pump is used or by temperature variations due to operation of the rotor.

[0054] The pump 2 therefore remains at practically constant levels of performance, with excellent reliability.

[0055] The elastic deformation of the core 15 prevails over any inelastic effects there might be in the cover layer 14 since the modulus of elasticity of metallic materials is much higher than that of rubber or similar materials the cover layer 14 may be made of.

[0056] The rotor 1 also works in the same way in the second operative configuration, where the fluid in the pump cavity 4 is kept in circulation, and in the third operative configuration where the fluid is transferred from the second conduit 6 to the first conduit 5.

[0057] Advantageously, the preferred embodiment makes it possible for even just one of the vanes 10a, 10b, 10c, 10d, 10e, 10f to be substituted quickly and easily without having to remove the rotor 1 from the shaft of the pump 2.

[0058] This has the advantage of allowing a broken vane to be substituted at minimal cost even if the breakage is only partial.

[0059] In other embodiments, not illustrated in the drawings, the cover layer 14 of the rotor 1 is applied round the core 15 at a distal end 17 of the core.

[0060] In this embodiment, the cover layer 14 is still able to guarantee sealed contact with the inside wall 9 of the cavity 4 so as to be able to transfer the fluid inside the pump 2.

[0061] In yet further embodiments, not illustrated in the drawings, the core is removably connected to the central casing by one or more screws which are inserted in respective holes made at the proximal end of the core and which screwably engage the inside of respective threaded holes in the central casing so that the core is attached to the central casing in such a way that it can be removed.

[0062] The screws constitute removable elements for fastening the core to the central casing.

[0063] The removable fastening elements constitute means for connecting the vanes to the central casing.

[0064] The cover layer covers the surface of the core at least at the distal end of the core.

[0065] The cover layer is fixed to the core preferably, but not necessarily, by vulcanization.

[0066] This embodiment has the same technical and functional features as those described above with reference to the preferred embodiment.

[0067] The invention described above is susceptible of industrial application and may be modified and adapted in several ways without thereby departing from the scope of the inventive concept. Moreover, all the details of the invention may be substituted by technically equiv-

alent elements.

Claims

1. A volumetric pump rotor (1) comprising:

- a central casing (7) equipped with a peripheral edge (8) and a hollow seat (16) for engaging a respective rotary shaft;
- at least two elastically deformable vanes (10a, 10b, 10c, 10d, 10e, 10f), positioned on the central casing (7) in such a way as to protrude from the peripheral edge (8) in order to transfer a fluid in a volumetric pump, the rotor (1) being **characterized in that** each vane (10a, 10b, 10c, 10d, 10e, 10f) comprises a core (15) made of a metallic material and a cover layer (14) for at least partly covering the core (15) at least at the latter's distal end.

2. The rotor according to the foregoing claim, **characterized in that** the core (15) is made of spring steel.

3. The rotor according to claim 1 or 2, **characterized in that** the cover layer (14) is made of rubber.

4. The rotor according to any of the foregoing claims from 1 to 3, **characterized in that** the cover layer (14) coats the core (15) in order to seal it.

5. The rotor according to any of the foregoing claims from 1 to 4, **characterized in that** it comprises connecting means (12) for removably connecting the vanes (10a, 10b, 10c, 10d, 10e, 10f) to the central casing (7).

6. The rotor according to claim 5, **characterized in that** said connecting means (12) comprise removable elements for fastening the core (15) to the central casing (7).

7. The rotor according to claim 6, **characterized in that** the cover layer (14) is removably connected to the core (15).

7. The rotor according to claim 4, **characterized in that** the connecting means (12) comprise a shape fitting defined by a seat (13a, 13b, 13c, 13d, 13e, 13f), formed in the central casing (7) at its peripheral edge (8), and by a portion of the vane (10a, 10b, 10c, 10d, 10e, 10f) shaped to match the seat (13a, 13b, 13c, 13d, 13e, 13f) in order to slot into the latter.

8. The rotor according to claim 7, **characterized in that** the connecting means (12) further comprise at least one locking element (20), fixed to the central

casing (7) at each seat (13a, 13b, 13c, 13d, 13e, 13f) in order to hold the vane (10a, 10b, 10c, 10d, 10e, 10f) within the seat (13a, 13b, 13c, 13d, 13e, 13f) when said portion of the vane (10a, 10b, 10c, 10d, 10e, 10f) is inserted into the seat (13a, 13b, 13c, 13d, 13e, 13f). 5

9. A volumetric pump (2) comprising a containment casing (3) that is provided with a cavity (4) for containing a fluid, a first conduit (5) and a second conduit (6) placed in fluid communication with the cavity (4) in order, respectively, to feed and receive the fluid to and from the cavity (4), a shaft positioned in the cavity (4), means for rotationally driving the shaft, the pump (2) being **characterized in that** it comprises the rotor (1) according to any of the claims from 1 to 8 fastened to the shaft in order to transfer the fluid in the pump (2) from the first conduit (5) to the second conduit (6) when the shaft is rotationally driven. 10 15 20

25

30

35

40

45

50

55

FIG.1

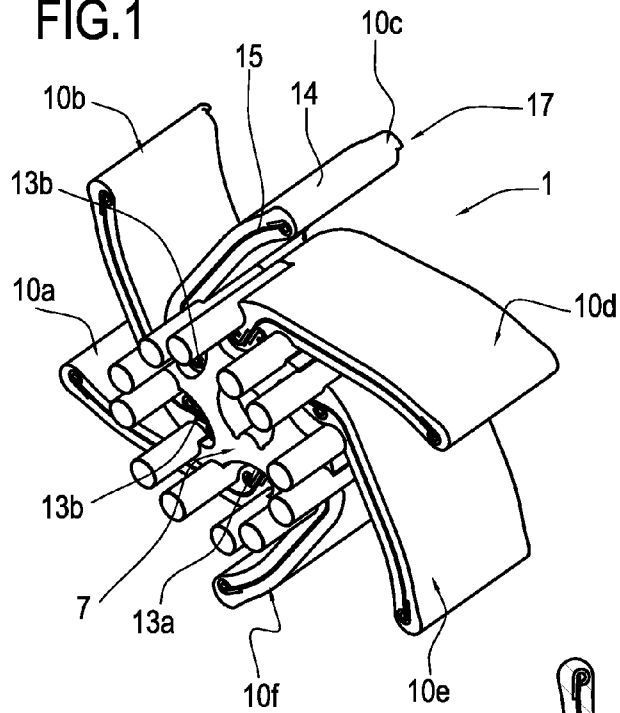


FIG.2

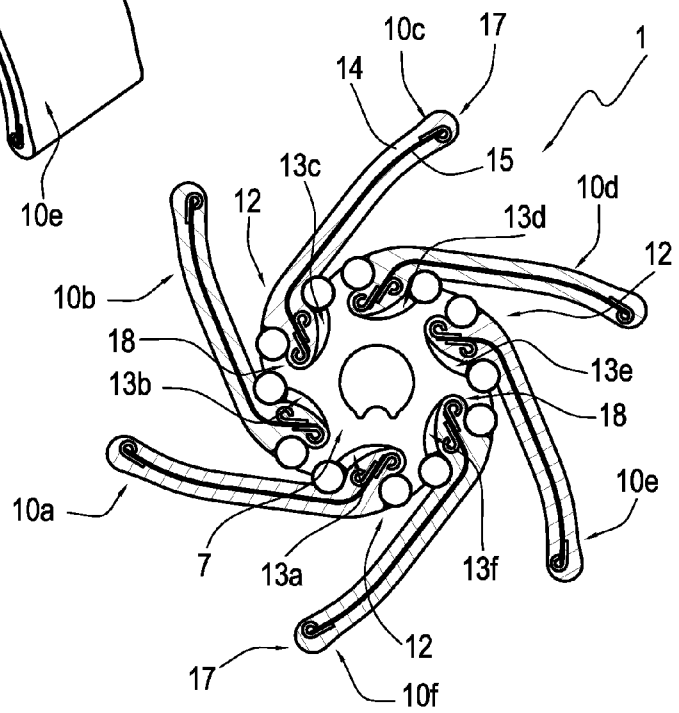


FIG.3

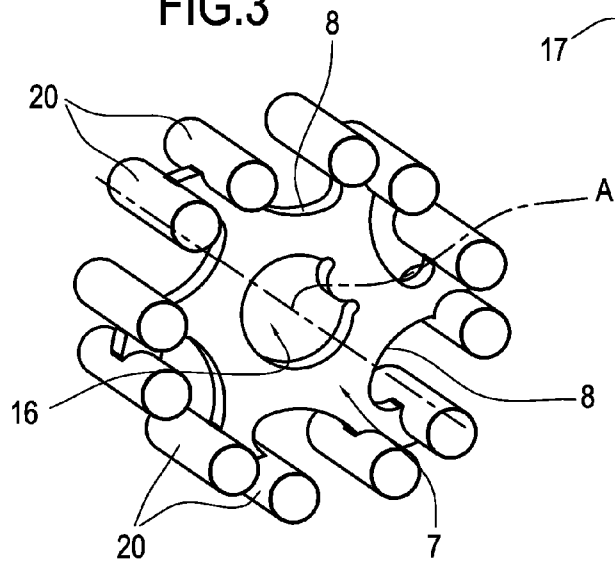


FIG.4

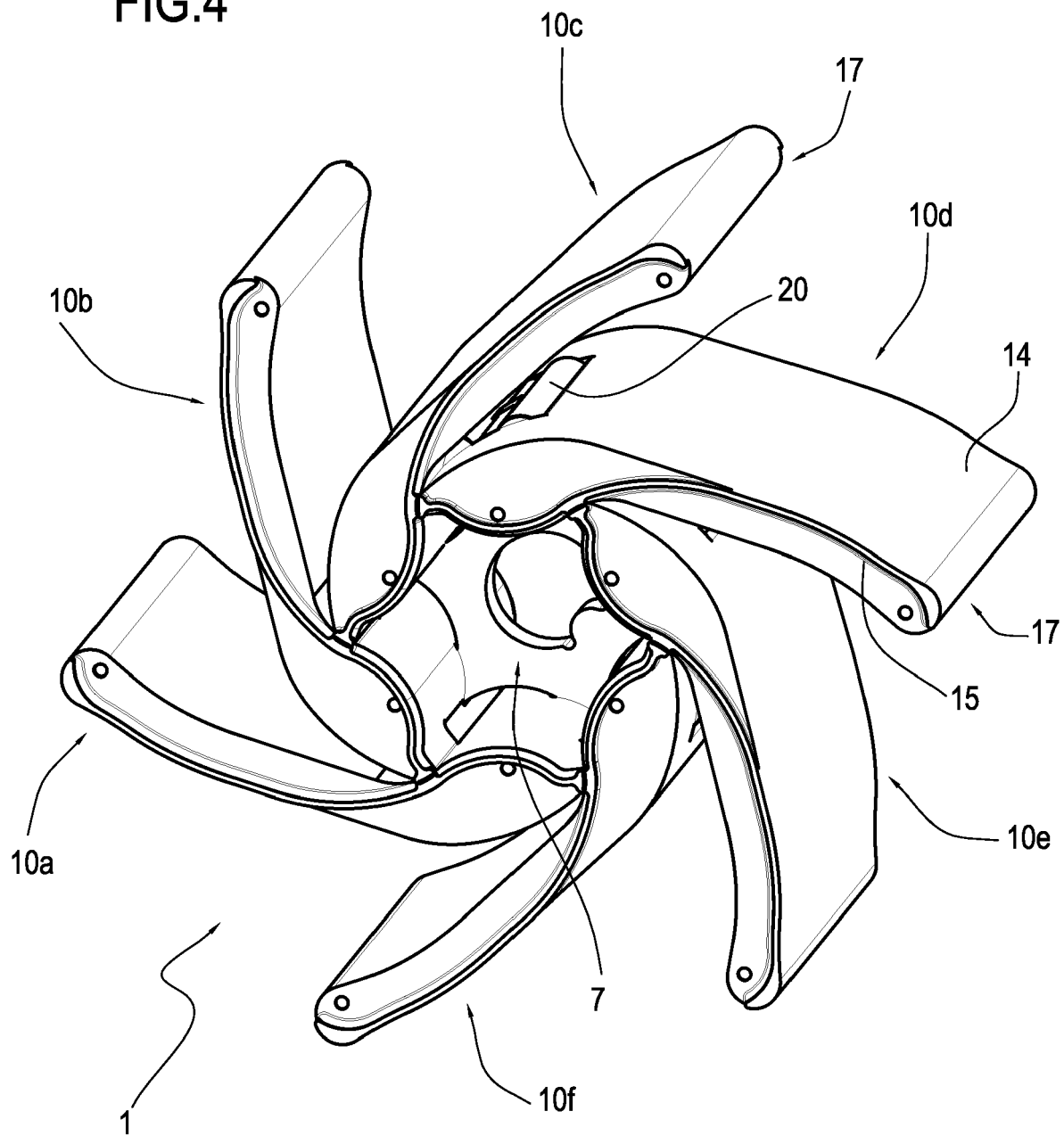


FIG.5

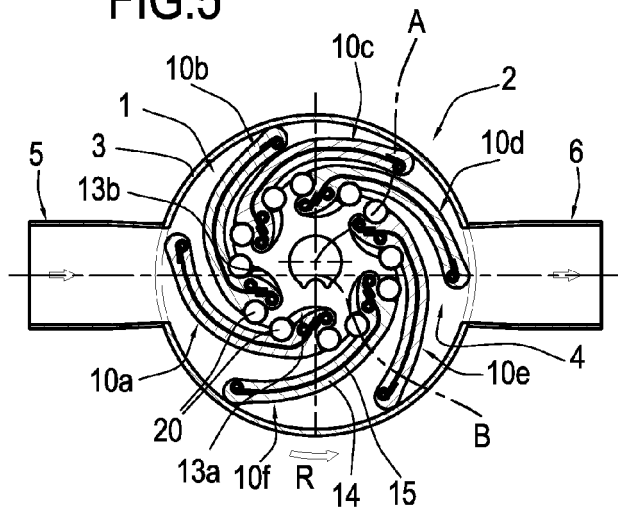


FIG.8

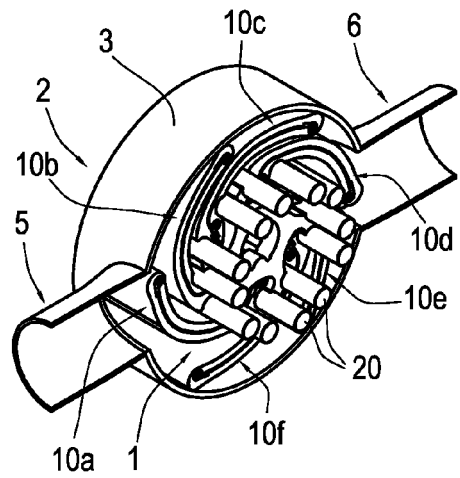


FIG.6

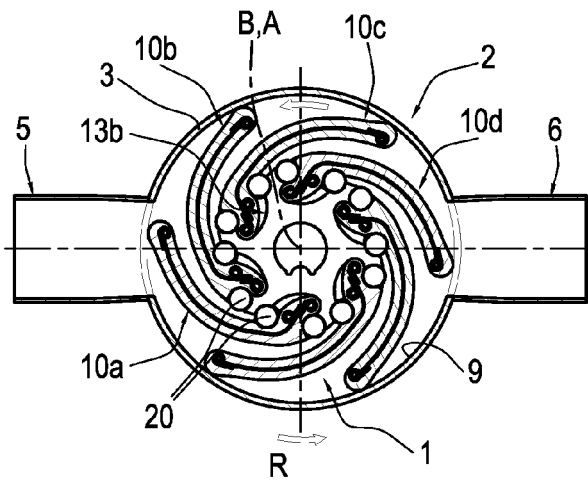


FIG.9

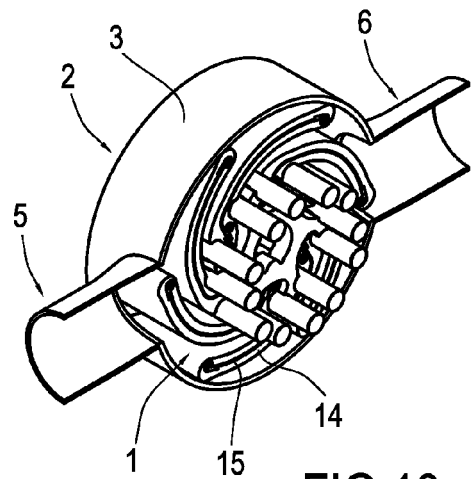


FIG.7

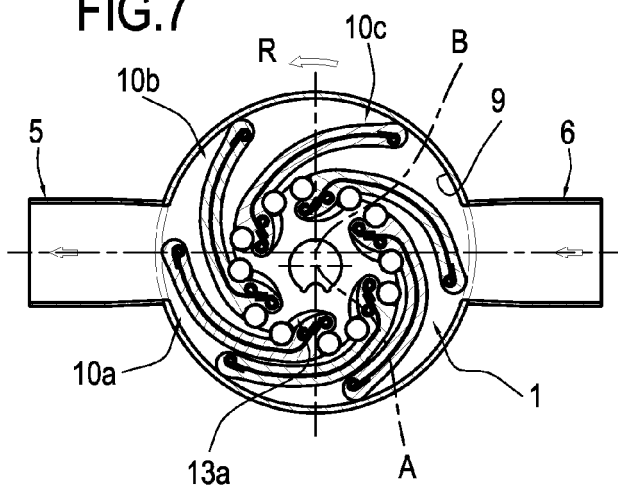
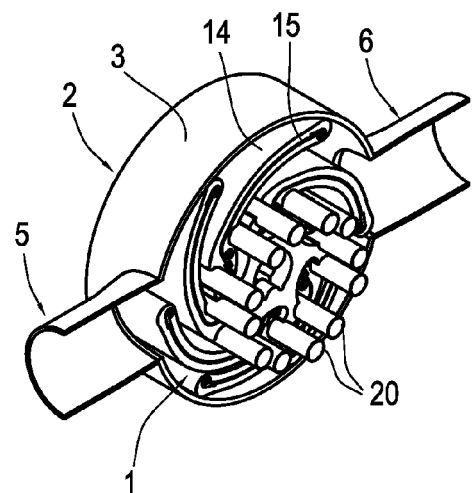


FIG.10





EUROPEAN SEARCH REPORT

Application Number
EP 10 19 1138

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	GB 786 999 A (JABSCO PUMP COMPANY) 27 November 1957 (1957-11-27) * the whole document * * The claims in the set of claims as filed are referred to as successively numbered in the sequence of their appearance. *	1-10	INV. F01C5/02 F01C21/08 F04C2/44 F04C5/00
X	GB 249 587 A (ERNEST FEUERHEERD; PAUL SHISHKOFF; FREDERICK WALTER HALLEWELL) 29 March 1926 (1926-03-29) * the whole document *	1-6,8-10	
A		7	
X	JP 11 324940 A (WORLD CHEM KK) 26 November 1999 (1999-11-26) * figures 1-7 * * abstract * * claims 1-3,5 * * paragraphs [0020], [0034] *	1-4,10	
A		5-9	
X	US 2 203 974 A (WEINHARDT ROBERT A) 11 June 1940 (1940-06-11) * figures 2,3,5 * * page 1, column 2, line 21 - line 36 * * page 2, column 1, line 3 - line 13 *	1-4,10	TECHNICAL FIELDS SEARCHED (IPC)
A		5-7	F04C F01C
A	US 4 702 205 A (DAVID CONSTANT V [US]) 27 October 1987 (1987-10-27) * figures 5,16,18,19,42 * * column 9, line 35 - column 10, line 24 * * column 29, line 64 - column 30, line 7 * * column 31, line 34 - line 50 * * column 34, line 1 - line 4 *	1,2,5-10	
A	US 5 163 825 A (OETTING ROY E [US]) 17 November 1992 (1992-11-17) * the whole document *	5,6,8,9	
		-/--	
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 March 2011	Examiner Sbresny, Heiko
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			

 1
EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 10 19 1138

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	DE 78 37 159 U1 (ROTH, GÜNTHER-PAUL) 22 May 1980 (1980-05-22) * the whole document *	5,6,8,9	
A	EP 1 788 249 A2 (MANZINI ROBERTO [IT]) 23 May 2007 (2007-05-23) * the whole document *	1,3,4,10	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 28 March 2011	Examiner Sbresny, Heiko
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			

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 10 19 1138

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

28-03-2011

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
GB 786999	A	27-11-1957	NONE	
GB 249587	A	29-03-1926	NONE	
JP 11324940	A	26-11-1999	NONE	
US 2203974	A	11-06-1940	NONE	
US 4702205	A	27-10-1987	NONE	
US 5163825	A	17-11-1992	NONE	
DE 7837159	U1	22-05-1980	NONE	
EP 1788249	A2	23-05-2007	NONE	