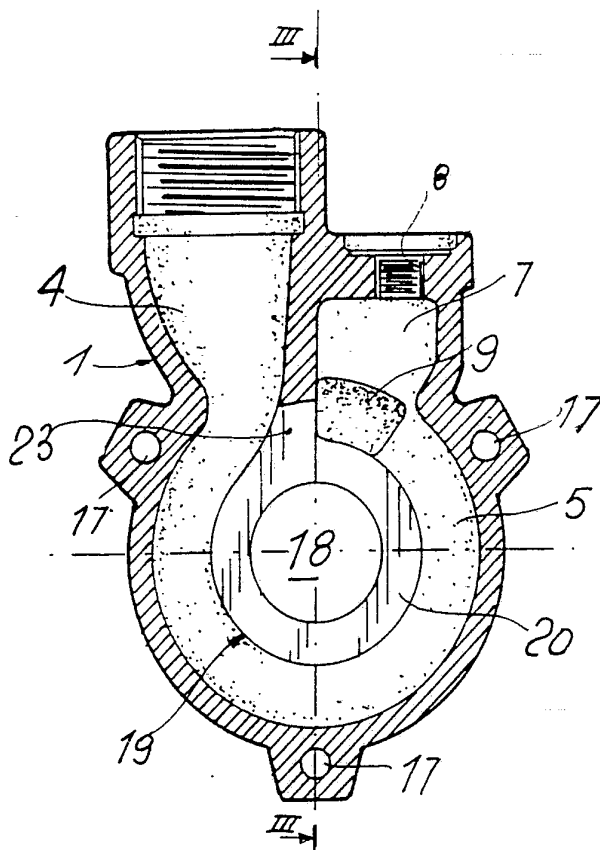




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(21) International Application Number: PCT/EP92/02211 (22) International Filing Date: 24 September 1992 (24.09.92) (30) Priority data: VI91A000154 27 September 1991 (27.09.91) IT (71) Applicants (for all designated States except US): FORAS PUMPS S.R.L. [IT/IT]; Via Mazzini, 2, I-36040 Brendola (IT). F.I.P. FABBRICA ITALIANA POMPE S.R.L. [IT/IT]; Piazza Alcide De Gasperi, 1, I-36100 Vicenza (IT). (72) Inventor; and (75) Inventor/Applicant (for US only) : CAODURO, Bruno [IT/IT]; Via Tecchio, 76, I-36075 Montecchio Maggiore (IT).		(74) Agent: FORATTINI, A.; Internazionale Brevetti Ingg. Zini, Maranesi & C. S.R.L., Piazza Castello, 1, I-20121 Milano (IT). (81) Designated States: AU, BB, BG, BR, CA, CS, FI, HU, JP, KP, KR, LK, MG, MN, MW, NO, PL, RO, RU, SD, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, ML, MR, SN, TD, TG). Published <i>With international search report.</i>
(54) Title: IMPROVED PUMP CASING FOR CENTRIFUGAL PUMP AND METHOD FOR PRODUCING SAID CASING (57) Abstract A pump casing for centrifugal pumps which can be obtained by casting, pressure die-casting or by means of another process for forming a metallic material, comprises an axial suction inlet (3; 3') connected to a pressure chamber (5; 5') shaped as an annular volute. A centrifugal impeller (6; 6') is arranged in the pressure chamber which is provided with a radial discharge outlet (4; 4'). The suction inlet (3; 3') has a substantially radial peripheral passage (9; 9') and an axial channel (18; 18'), at the region where it blends with the pressure chamber (5; 5'). The peripheral passage and the axial channel are connected to the pressure chamber and are obtained by means of a single core (F) which forms both the suction inlet and the pressure chamber. An annular ridge (19; 19') is formed along the edge of the axial opening (18) and forms an axial skimming surface (20; 20') for the non-bladed part of the impeller (6). Together with the impeller the ridge forms an element for separating the suction inlet (3) from the pressure chamber (5). The annular ridge (19') is interrupted by a radial groove (25) to avoid sticking and reduce friction during pickup.		



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IMPROVED PUMP CASING FOR CENTRIFUGAL PUMP AND METHOD FOR
PRODUCING SAID CASING

The present invention relates to an improved pump casing for
5 centrifugal pumps with a particularly simplified structure,
which can be obtained by casting, pressure die-casting or by
other processes for forming metallic materials such as cast
iron, steel, brass, bronze and the like.

10 As known, centrifugal or liquid-ring pumps are normally used
to raise liquids from shallow wells or to circulate them in
small-capacity household systems. Such pumps generally have a
casing which is defined by a main portion, provided with an
axial suction inlet, an approximately radial discharge outlet
15 and a pressure chamber or volute accommodating an impeller
with peripheral blades, which is coupled to a secondary
portion for the closure of the pressure chamber and
connection to an electric motor or the like.

20 In a known pump casing of this type, schematically
illustrated in Figure 1, an accumulation pre-chamber R is
defined proximate to the inner end of the suction inlet B;
the pre-chamber has a slightly conical toroidal shape and is
adjacent to a substantially annular pressure chamber or
25 volute P.

The accumulation chamber R has a front wall, or partition
S at its inner end. Partition S separates chamber R from the
pressure chamber P. A channel C extends between the upper
30 region of the accumulation chamber, externally with respect

to the partition, and the pressure chamber or volute, and ensures the continuous filling of the volute.

In this pump casing, two distinct and separate cores A_1 and A_2 must be prepared in order to form the cavities which define both the portion provided with the suction inlet and the accumulation chamber and the portion provided with the pressure chamber and the discharge outlet; this entails a considerable expenditure of time and labor for the execution of the cores and for their positioning in the forming dies.

In another known pump casing there is a suction inlet which is axially offset with respect to the rotation axis of the impeller and is not provided with a suction pre-chamber. This type of pump has solved some technical problems in casting or pressure die-casting, and has however led to the onset of other problems, especially in installation, because it is not interchangeable with other pumps provided with an axial suction inlet.

20

It must be furthermore noted that in all these pumps the casing has, in the pressure chamber, annular ridges which define front skimming surfaces for the impeller, with axial plays on the order of a few hundredths of a millimeter. This entails the risk of sticking of the impeller during idle periods, considerable initial separation friction, shorter impeller life and a certain noise.

Furthermore, dirt, sand or other matter can penetrate between the skimming surfaces, causing their progressive wear and/or

30

damage.

The aim of the present invention is to eliminate, or at least considerably limit, the above described problems by providing
5 a pump casing with simplified structure, obtainable by pressure die-casting or by means of other methods for forming metallic materials, which allows to considerably reduce its manufacturing costs.

- 10 An object of the present invention is to provide a centrifugal pump casing which is lighter and more compact than conventional ones.

Another object is to provide a pump casing which has less
15 risk of impeller sticking and lower initial separation friction and furthermore has a self-cleaning effect on the impeller.

Not least object of the present invention is to provide a
20 method for the simplified manufacture of the above described pump casing.

This aim, these objects and others which will become apparent hereinafter are achieved by a pump casing for centrifugal
25 pumps which can be obtained by casting, pressure die-casting or by another process for the forming of a metallic material, comprising an axial suction inlet connected to a pressure chamber shaped as an annular volute, a centrifugal impeller being arranged in said pressure chamber, said pressure
30 chamber being provided with a radial discharge outlet,

characterized in that said suction inlet has a substantially radial peripheral passage and an axial channel at the region where it is connected to the pressure chamber, both said peripheral passage and said axial channel being connected to the pressure chamber and being obtained by means of a single core (F) which forms both said suction inlet and said chamber.

In this manner the casing can be produced by using a single forming core instead of two as in the prior art.

Preferably, the casing has, along the edge of the axial channel, a first axial ridge which forms a front skimming surface for the impeller and defines, together with the non-bladed surface of the impeller, an element for separating the axial channel from the volute.

Said casing furthermore has, on the portion for connection to the motor, a second axial ridge which forms a further front skimming surface for the impeller, at least one of said ridges being interrupted by a radial groove which forms a passage between the suction inlet and the volute.

In a further aspect of the invention, a method is provided for the production of castings or pressure die-castings of casings for centrifugal pumps wherein a single core is adapted to define both the suction inlet and the pressure chamber which are mutually connected by means of a substantially radial peripheral passage and an axial channel.

The manufacture of semifinished items of the above indicated type requires considerably less equipment and a reduced time for preparations with respect to the prior art, with evident economic and production advantages.

5

For a better understanding of the invention, a few embodiments of the pump casing, according to the invention, are described in detail hereinafter and are illustrated only by way of non-limitative example in the accompanying

10 drawings, wherein:

Figure 1 is a partially sectional side view of a pump casing of the prior art, taken along an axial vertical plane;

15 Figure 2 is a partially sectional front view of a first embodiment of the pump casing according to the invention, taken along the transverse plane II-II of figure 3;

Figure 3 is a sectional side view of the casing of Figure 2,
20 taken along the axial plane III-III;

Figure 4 is a partially sectional front view of a second embodiment of the pump casing according to the invention, taken along a transverse plane IV-IV of Figure 5;

25

Figure 5 is a partially sectional side view of the casing of Figure 4, taken along the axial plane V-V;

Figure 6 is a partially sectional general side view of a
30 centrifugal pump which includes the casing of Figures 2 and

3;

Figure 7 is a partially sectional general side view of a centrifugal pump which includes the casing of Figures 4 and 5 5.

With reference to Figures 2, 3 and 6, a pump casing, according to the invention, has a main portion 1 and a secondary portion 2.

10

The main portion 1 has a suction inlet 3, which is substantially tubular and coaxial to the axis O of the pump, and a discharge outlet 4, whose axis is substantially radial and slightly offset with respect to the axis O of the pump.

15

Both the suction inlet 3 and the discharge outlet are internally partially threaded to allow coupling to pipes, respectively for feed and discharge, which are not illustrated in the drawings.

20

The suction inlet 3 and the discharge outlet 4 are both connected to a pressure chamber which is shaped as an annular volute 5, defined inside the main portion 1 and closed by the secondary portion 2. An impeller 6 with peripheral blades is 25 accommodated in the volute 5.

25

The pressure chamber 5 is also connected to a secondary chamber 7. Sensors for measuring flow parameters are arranged in chamber 7 which is provided with a passage 8. Passage 8 30 is internally threaded and open outwardly.

The suction inlet 3 is connected to the pressure chamber 5 through an approximately radial passage 9. Passage 9 is slightly inclined toward the discharge outlet and is suitable to convey the fluid toward the impeller 6.

5

The secondary portion 2 is fixed to a motor 10 by means of bolts 11 and is provided with seats for a mechanical seal 14 and a bearing 12 of the motor shaft 13. The impeller 6 is keyed to shaft 13 and the mechanical seal 14 is arranged within the main portion 1 of the casing. The main portion 1 is connected to the secondary portion 2 by inserting the peripheral edge of main portion 1 in an annular seat 15 of the secondary portion 2, and by means of connecting bolts 16 which are inserted in through holes 17 of the two portions.

15

According to the invention, the suction inlet 3 is provided with an axial channel 18 which is connected to the pressure chamber 5. In this configuration, the radial passage 9 and the axial channel 18 can be obtained by means of a single core F which extends uninterruptedly from the pressure chamber to the suction inlet and to the discharge outlet and is schematically indicated in broken lines in Figure 3.

20

An annular ridge 19 is provided along the edge of the opening 18 and has a front surface 20. Front surface 20 forms an axial skimming surface for the impeller and cooperates with the non-bladed part thereof to separate the axial channel from the volute-shaped pressure chamber 5.

25

30 On the opposite side, the connecting portion 2 of the pump

body has a similar annular ridge 21. The front surface 22 of ridge 21 also forms a radial skimming surface for the impeller. The coupling between the non-bladed part of the impeller and the two front surfaces 20 and 22 of the ridges 19 and 21, with a play of a few hundredths of a millimeter, forms the pressure chamber 5. Two partially radial curved wings 23 and 24 also extend from both ridges.

With respect to pump casings of the prior art, which is shown in Figure 1, the partition S which separates the accumulation pre-chamber R from the pressure chamber is thus eliminated, with a consequent saving in material and lower weight of the casting.

The absence of the accumulation pre-chamber R furthermore makes the shape more compact in an axial direction, with an evident advantage in terms of assembly and overall bulk.

A further aspect of the invention is illustrated in the embodiment shown in Figures 4, 5 and 7. For the sake of simplicity, components which are identical or similar to those of the preceding embodiment are designated by the same reference numerals provided with a prime.

According to the invention, the two annular ridges 19' and 21' are interrupted by respective radial grooves 25 and 26 which define corresponding passages between the suction duct 3' and the pressure chamber 5'.

In practice, the skimming surface 20' and 22' of each ridge

19' and 21' is interrupted at the side of the corresponding wing 23' and 24' which interrupts the continuity of the volute 5.

5 The fluid is then redirected from an axial direction to a radial direction until it enters the volute and is centrifuged by the set of blades until it exits through the discharge duct 4'.

10 The interruption of the skimming surfaces 20' and 22' reduces, in percentage terms, the region of possible impeller sticking. The motor is thus less stressed during startup, and initial separation friction is also smaller. Longer impeller life is thus also obtained.

15

Any particles of dirt, sand or other matter which are drawn inside the pump and become interposed between the impeller and the skimming surfaces 20' and 22' are discharged, at every turn, at the grooves 25 and 26. The pump is thus also
20 self-cleaning.

Practical tests have also shown that it is quieter than the pumps of the prior art.

25 In both cases, in order to perform a casting or pressure die-casting of the above described pump casing, and in particular of the main portion 1, it is thus sufficient to insert and coordinate a single core in the die which reproduces the outer surface of said portion. This entails a considerable
30 cost reduction both for the manufacture of the cores and for

their positioning inside the dies.

Furthermore, since only one core must be provided for each part, the costs for the related forming equipment are
5 correspondingly halved.

In the case of the manufacture of the body by casting, because of the simplicity and compactness of the body, it is possible to use a single casting channel for a cluster of
10 castings which comprises for example at least four parts. A plurality of clusters can furthermore be arranged in the same casting box, for example four clusters arranged uniformly so as to optimize the process and reduce preparation and casting times.

15

In practice it has been observed that the pump casing according to the invention achieves the intended aim and objects, and in particular the considerable constructive simplification of the semifinished parts, the significant
20 reduction in the costs for the production of the semifinished parts and of the cores and the better operation and longer life of the pump are stressed.

Where technical features mentioned in any claim are followed
25 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 scope of each element identified by way of example by such reference signs.

CLAIMS

1. Pump casing for centrifugal pumps which can be obtained by casting, pressure die-casting or by another process for the forming of a metallic material, comprising an axial suction
5 inlet (3; 3') connected to a pressure chamber (5; 5') shaped as an annular volute, a centrifugal impeller (6; 6') being arranged in said pressure chamber, said pressure chamber being provided with a radial discharge outlet (4; 4'), characterized in that said suction inlet (3; 3') has a
10 substantially radial peripheral passage (9; 9') and an axial channel (18; 18'), at the region where it is connected to the pressure chamber (5; 5'), both said peripheral passage and said axial channel being connected to the pressure chamber (5; 5') and being obtained by means of a single core
15 (F) which forms both said suction inlet (3; 3') and said chamber (5; 5').

2. Pump casing according to claim 1, characterized in that a first annular ridge (19) is provided along the edge of said
20 axial opening (18) and forms an axial skimming surface (20) for the non-bladed part of the impeller (6) and forms, together with said impeller, an element for separating the suction inlet (3) from the pressure chamber (5).

25 3. Pump casing according to claim 2, characterized in that a second annular ridge (21) is provided on the opposite side with respect to said first annular ridge (19) and forms an axial skimming surface (22) for the impeller, said surface being opposite to the first one.

4. Pump casing according to claims 2 and 3, characterized in that the two opposite annular ridges (19; 21) have respective wings (23; 24) which are slightly curved and partially radial.

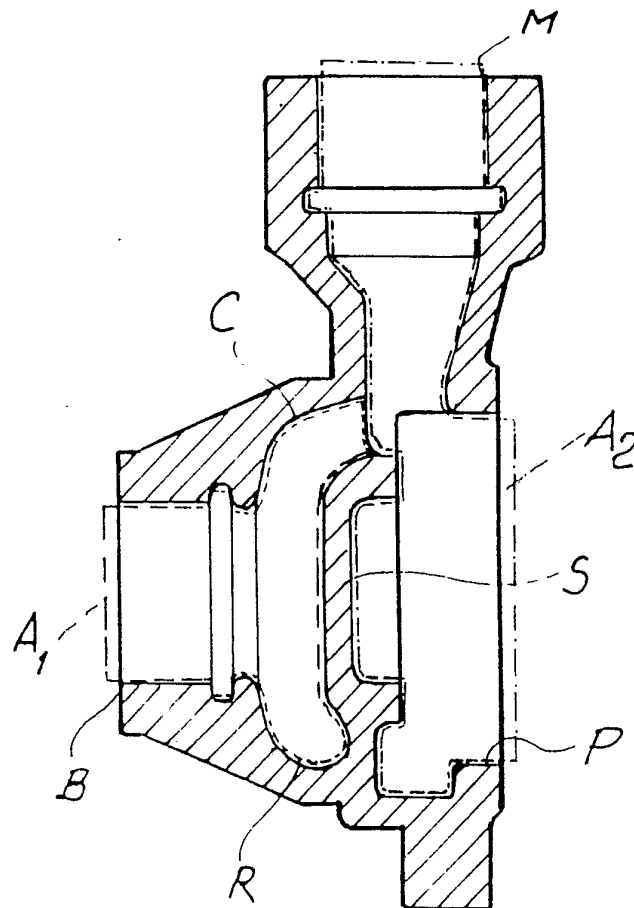
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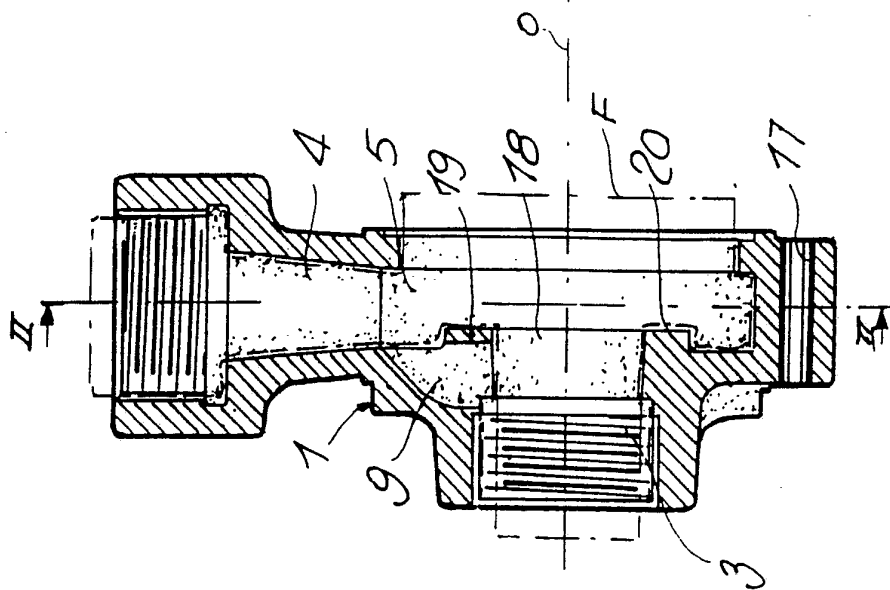
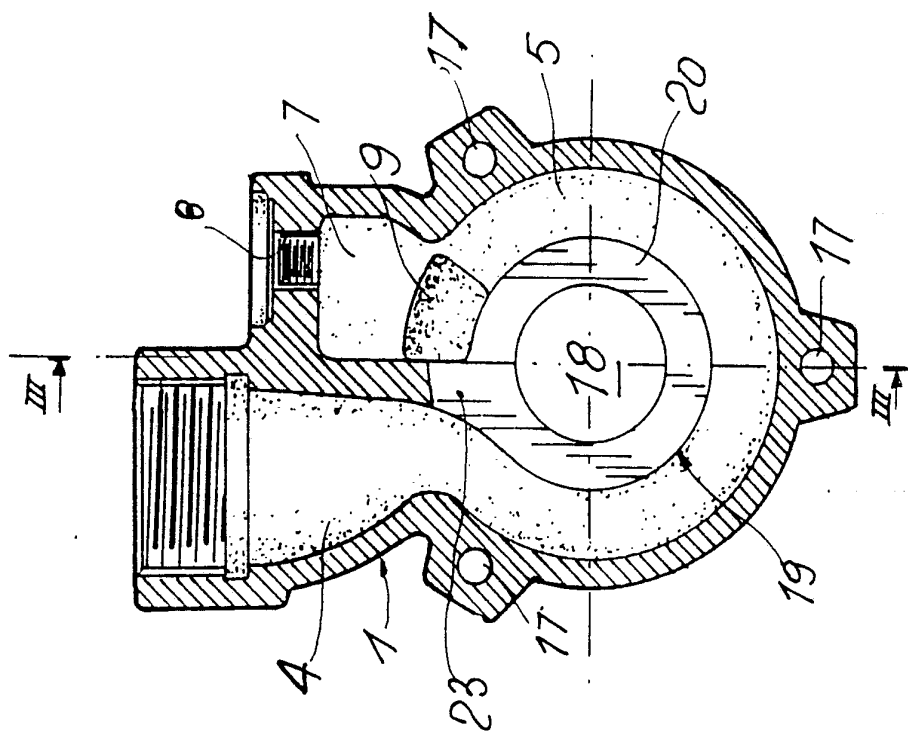
5. Pump casing according to claims 2 and 3, characterized in that at least one of said two annular ridges (19'; 21') is interrupted by a substantially radial groove (25; 26) which is adjacent to the respective wing (23'; 24').

10

6. Pump casing according to claim 5, characterized in that the radial groove on the side of the suction inlet (3) is aligned with said substantially radial passage (9').

15 7. Method for forming, by casting, pressure die-casting or by another equivalent method, a pump casing for centrifugal pumps according to one or more of the preceding claims, characterized in that it comprises the use of a single core to form, both the suction inlet (3) and the pressure chamber
20 (5), in a main portion of the body (1) said inlet and chamber being mutually connected by means of a substantially radial peripheral channel (9) and a substantially axial opening (18).

PRIOR ARTFig. 1



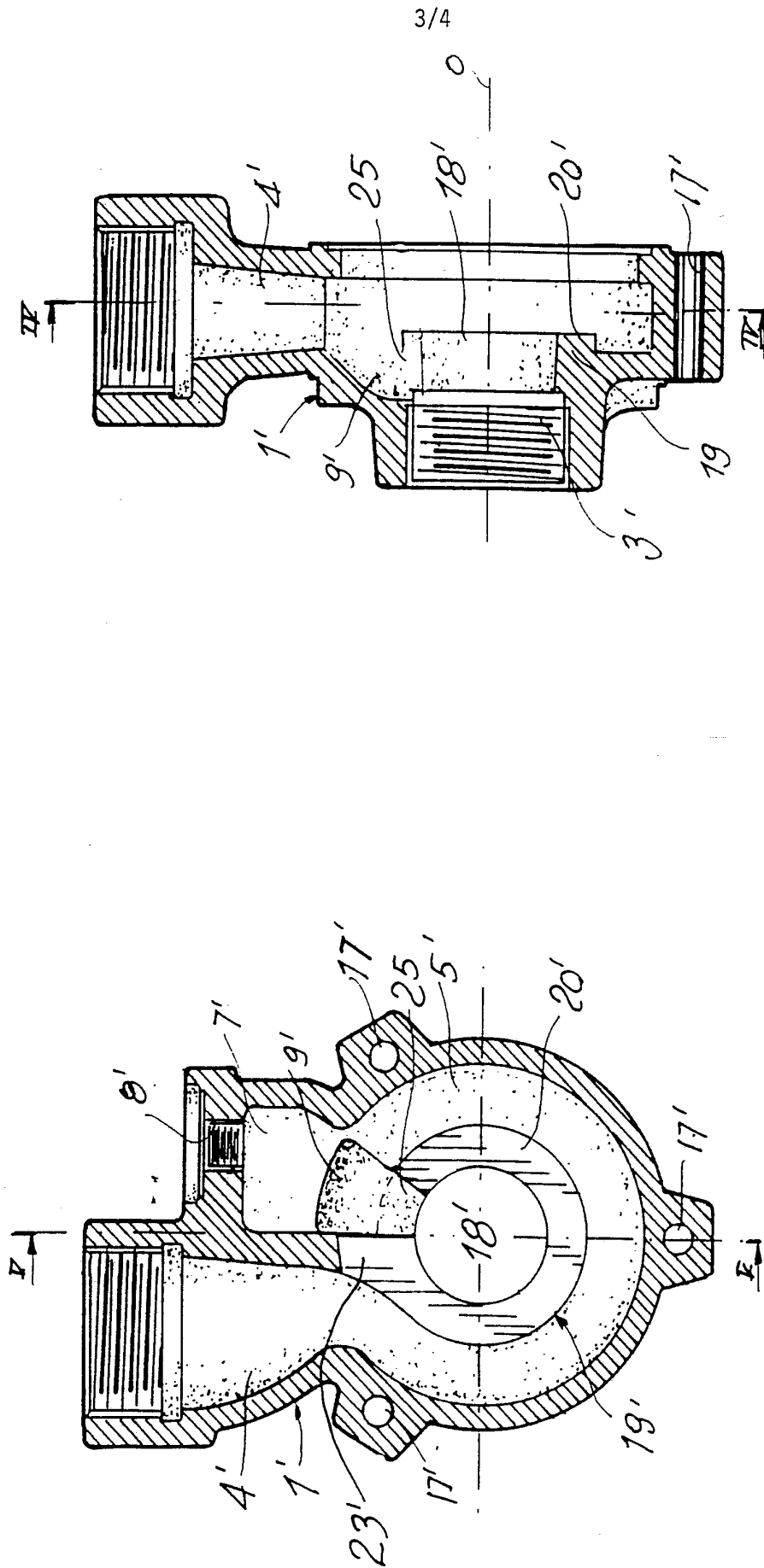
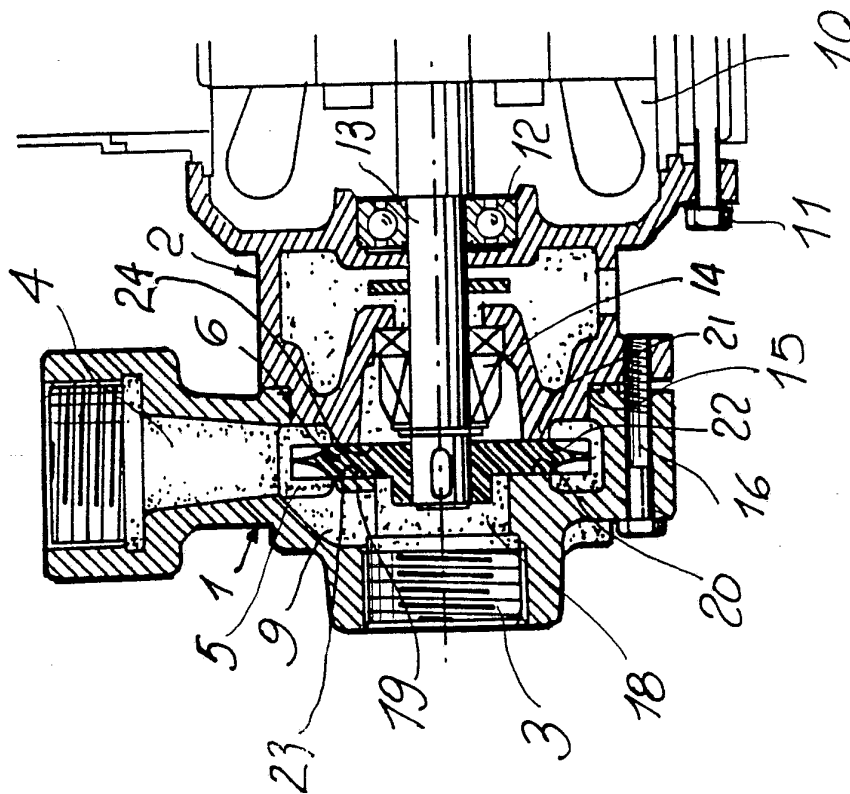
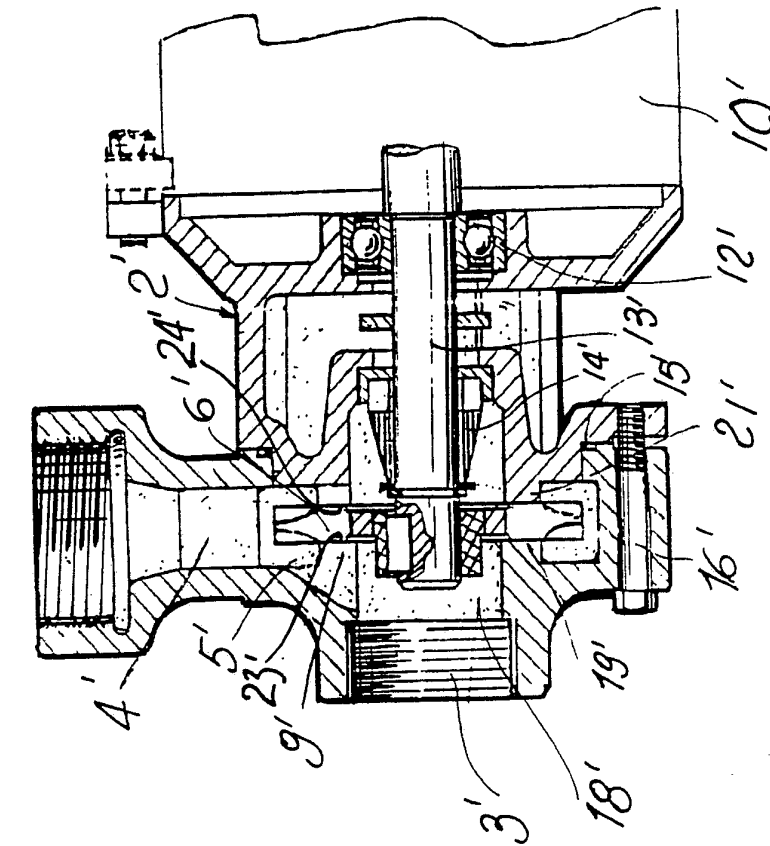


Fig. 5

Fig. 4



INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 92/02211

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
Int.Cl. 5 F04D5/00; F04D29/42		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	F04D	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	US,A,3 973 867 (LEE) 10 August 1976 see column 1, line 4 - line 5 see column 1, line 44 - column 2, line 18; figures ---	1-3
A	EP,A,0 201 377 (POMPES SALMSON) 17 December 1986 see column 1, line 1 - line 4 see column 3, line 25 - line 10 see column 5, line 10 - line 11; figures 1,2 ---	1,7
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 268 (M-424)(1991) 25 October 1985 & JP,A,60 113 088 (NIPPON DENSO) 19 June 1985 see abstract -----	1
¹⁰ Special categories of cited documents : "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier document but published on or after the international filing date "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) "O" document referring to an oral disclosure, use, exhibition or other means "P" document published prior to the international filing date but later than the priority date claimed "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art. "&" document member of the same patent family		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search 04 DECEMBER 1992		Date of Mailing of this International Search Report 09.12.92
International Searching Authority EUROPEAN PATENT OFFICE		Signature of Authorized Officer ZIDI K.

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO. EP 9202211
SA 65588**

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-3973867	10-08-76	None	
EP-A-0201377	17-12-86	FR-A- 2580036	10-10-86