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Remarks:
Amended claims in accordance with Rule 86 (2) EPC.

(54) Multistage motor-compressor for the compression of a fluid, for motor vehicles for example

(57) The motor-compressor (5) comprises a first compression stage (6) having a primary impeller (8) and at least one delivery duct (16), a second compression stage (7) having a secondary impeller (21) spinning in a predetermined direction of rotation, and at least one transfer duct (44) placed so as to put the delivery duct (16) in communication with a fluid conveyor (39) for the second stage (7). The transfer duct (44) is shaped in a way to create a fluid flow entering the conveyor (39) with a substantially helical course and a direction of rotation opposite to the direction of rotation of the secondary impeller (21).

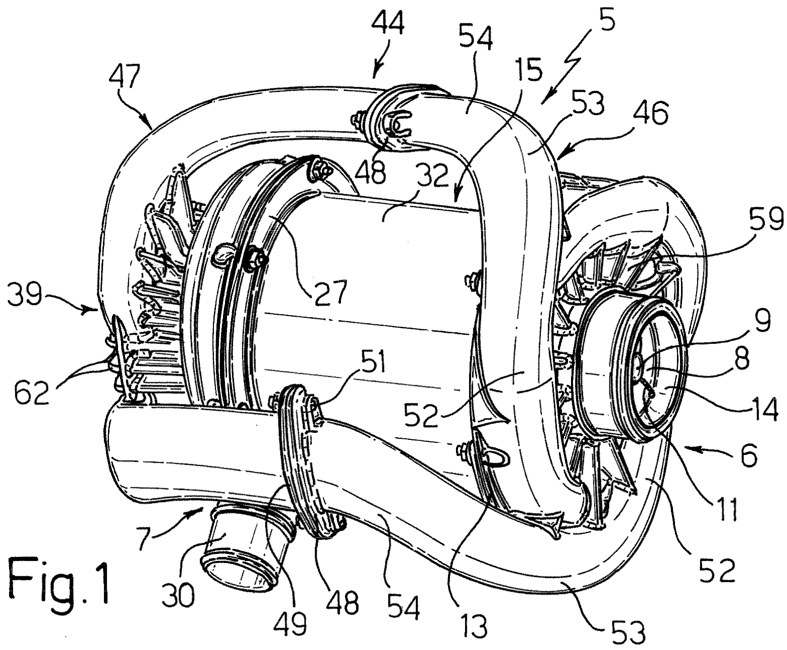

Fig.1

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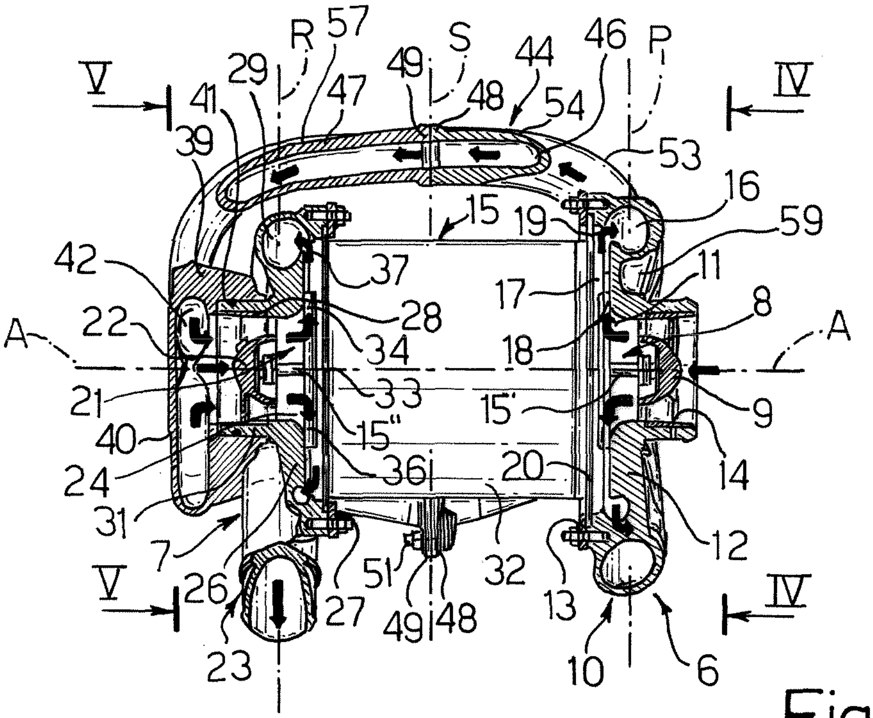
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Fig.3

Description

[0001] This invention refers to a multistage motor-compressor for the compression of a fluid, for motor vehicles for example. In particular, the invention refers to a two-stage motor-compressor for the supply of pressurized air to fuel cell systems.

[0002] Motor-compressors of the above-stated type are well known, in which the first-stage scroll is connected to a tangential first section of a transfer duct, while a second axial or radial section of the transfer duct is connected to a fluid conveyor for the second-stage scroll. In the case where the second section is axial, the fluid flow entering the conveyor undergoes abrupt changes of direction, giving rise to a drop in flow pressure, high operational power consumption and reduced efficiency for the motor-compressor.

[0003] In the case in which the second section of the transfer duct is radial, it is normally shaped to create a helical flow with the same direction of rotation as that of the second-stage impeller. This radial connection has the drawback of reduced efficiency and a low compression ratio at high flow rates.

[0004] Multistage motor-compressors are also known, in which the impellers are arranged in series on the same output side of the driving electric motor's shaft. Since the two impellers are cantilever mounted on the shaft, the latter is subject to stress, which reduces the operating speed.

[0005] The object of the invention is that of embodying a two-stage motor-compressor, which is highly reliable, eliminating the drawbacks and increasing the performance of motor-compressors of known art.

[0006] According to the invention, this object is achieved by a multistage motor-compressor for the compression of a fluid, as defined in claim 1.

[0007] According to a variant of the invention, the impellers of the two stages are fixed on two opposite ends of the shaft of a common driving electric motor, for which the motor-compressor is able to operate at high speeds.

[0008] For a better understanding of the invention, a preferred embodiment is described herein, provided by way of example with the aid of the enclosed drawings, in which:

Figure 1 is a right-hand perspective view of a two-stage motor-compressor according to a first variant of the invention,
Figure 2 is a left-hand perspective view of the motor-compressor in Figure 1,
Figure 3 is a diametrical section of the motor-compressor in Figure 1,
Figure 4 is a view along line IV-IV in Figure 3,
Figure 5 is a view along line V-V in Figure 3,
Figure 6 is a left-hand perspective view of part of the motor-compressor in Figure 1,
Figure 7 is a left-hand perspective view of another part of the motor-compressor in Figure 1,
Figure 8 is a right-hand perspective view of a further part of the motor-compressor in Figure 1,
Figures 9 and 10 are two due perspective views similar to that in Figure 2, regarding two variants of the motor-compressor, and
Figure 11 is a graph of the motor-compressor's compression ratio.

[0009] With reference to Figures 1 and 2, reference 5 generically indicates a multistage motor-compressor for the compression of a fluid, for motor vehicles for example. In particular, the motor-compressor 5 is of the type with two stages 6 and 7, low pressure and high pressure respectively, and is suitable for the supply of pressurized air in a fuel cell system or for supplying air to internal combustion engines, or for any system in which compressed air is required.

[0010] The low-pressure stage 6 comprises a low-pressure impeller, which henceforth will be called the primary impeller 8 (Figure 3). The primary impeller 8 rotates around an axis A and is preceded by a fixed ogival portion 9, placed inside a low-pressure scroll, which henceforth will be called the primary scroll 10. The primary impeller 8 is fixed on one end 15' of a shaft of an electric motor 15. The primary impeller 8 also comprises a series of substantially radial, shaped blades 11, of known type.

[0011] The primary scroll 10 is composed of a shaped casing 12, connected in a removable manner, via bolts and at least one half-ring 13, to a fixed plate 20 carried on an external casing 32 of the motor 15, which has a substantially cylindrical shape. The shaped casing 12 has a central air-inlet opening 14 to the low-pressure stage 6. The primary scroll 10 also has at least one curved, fluid-delivery duct 16, which has a substantially spiral shape placed substantially on plane P perpendicular to axis A.

[0012] According to the variant in Figures 1-8, the primary scroll 10 is equipped with three curved ducts 16 arranged at 120° to each other, for the purpose of having a balanced load on the primary scroll 10. The fixed plate 20 of the motor 15, together with the shaped casing 12 of the primary scroll 10, form an annular chamber 17 in communication with the curved ducts 16. On one side, the annular chamber 17 is in communication with the central opening 14, through an annular inlet opening 18 facing towards axis A, while on the other side it is in communication with the curved ducts 16 through corresponding outlet openings 19, facing towards the outside of the annular chamber 17.

[0013] The shaped blades 11 of the impeller 8 are suitable for conveying incoming air from the central opening 14 to the curved ducts 16. The axial direction of the airflow to be compressed is optimized by the ogival portion 9. In order to convey compressed air from the impeller 8, each curved duct 16 has an increasing section from the outlet opening 19 of the annular chamber 17 to the outlet opening 25, which is defined by the terminal radial section of the curved duct 16. The spiral shape of the curved duct

16 induces a fluid flow that turns in the same direction of rotation as the impeller 8.

[0014] The high-pressure stage 7 of the motor-compressor 5 comprises a high-pressure impeller, which henceforth will be called the secondary impeller 21 (Figure 3), rotating around its axis. This axis can advantageously coincide with axis A of the primary impeller 8. The secondary impeller 21 is fixed on the end 15" of the shaft of the motor 15 opposite from that of the primary impeller 8, thereby providing a balanced load on the shaft of the motor 15 such that the group of impellers 8 and 21 can be spun at high speed.

[0015] The secondary impeller 21 is equipped with its own ogival portion 22, suitable for optimizing the direction of the axial flow. The ogival portion 22 is placed inside a high-pressure scroll, which henceforth will be called the secondary scroll 23. The secondary impeller 21 also comprises a series of substantially radial, shaped blades 24.

[0016] The secondary scroll 23 is composed of a shaped casing 26 connected in a removable manner, via bolts and at least one half-ring 27, to another fixed plate 33, carried on the external casing 32 of the motor 15. The shaped casing 26 of the secondary scroll 23 has a sleeve 31 with a central air-inlet opening 28 to the high-pressure stage 7.

[0017] In addition, the secondary scroll 23 has at least one curved duct 29, substantially placed on another plane R perpendicular to axis A. The secondary scroll 23 (see also Figure 7) advantageously has just one curved duct 29, which also has a substantially spiral course and terminates with a straight section 30. The spiral of the curved duct 29 is such as to generate a fluid flow that also turns in the same direction as the secondary impeller 21.

[0018] The fixed plate 33 together with the shaped casing 26 forms an annular chamber 34, one side of which is in communication with the central opening 28, through an annular inlet opening 36 facing towards axis A. On the other side, the annular chamber 34 is in communication with the curved duct 29, through an opening 37 facing towards the outside, which forms the inlet opening of the curved duct 29. The shaped blades 24 of the impeller 21 are suitable for conveying incoming air from the central opening 28 to the annular chamber 34.

[0019] In order to convey compressed air entering through the central opening 28 in the annular chamber 34, the curved duct 29 has an increasing section from the portion adjacent to its inlet opening 37 to a corresponding outlet opening 38 (Figure 5) defined by the terminal radial section of the curved duct 29, which is equal to that of the straight section 30.

[0020] The motor-compressor 5 also comprises a conveyor 39 with an outer wall 40 and a central opening 41 (Figure 3), in which the sleeve 31 of the secondary scroll 23 engages in a sealed manner. The conveyor 39 is also provided with three inlet openings 42 associated with the three outlet openings 25 of the curved ducts 16 of the primary scroll 10. The three inlet openings 42 are also arranged at 120° to each other. A corresponding transfer duct, generically indicated by reference 44, is placed between each outlet opening 25 of the primary scroll 10 and the corresponding inlet opening 42 of the conveyor 39.

[0021] According to the invention, each transfer duct 44 is shaped so as to create a flow entering the conveyor 39 with a substantially helical course and a direction of rotation opposite to the direction of rotation of the secondary impeller 21. In particular, each transfer duct 44 comprises a first section 52 (Figures 1, 4 and 6) connected to the corresponding curved duct 16 and substantially tangential to the primary impeller 8, a second section 56 (Figures 2, 5 and 8) connected to the corresponding opening 42 of the conveyor 39 and substantially tangential to the secondary impeller 21, and a longitudinal intermediate section 54 and 57.

[0022] The second tangential section 56 of the transfer duct 44 and the corresponding opening 42 of the conveyor 39 are positioned in a manner to generate the said helical course of the flow, with an opposite direction of rotation to that of the impeller 21. Furthermore, each transfer duct 44 comprises a first connector section 53, substantially helical in form and placed between the first tangential section 52 and the intermediate section 54 and 57. Each transfer duct also comprises a second curved connector section 58 placed between the second tangential section 56 and the intermediate section 54 and 57.

[0023] The transfer ducts 44 are advantageously placed on the outside of the casing 32 and are each formed by two segments 46 and 47 (Figures 1 and 2), connected in a removable manner to the primary scroll 10 and the conveyor 39 respectively. The two segments 46 and 47 terminate with corresponding flanges 48 and 49, which mate together on a plane S (Figure 3) perpendicular to axis A, and are connected to each other in a sealed and removable manner, for example by bolts 51.

[0024] The segment 46 of each transfer duct 44 comprises the said first section 52, the corresponding substantially helical connection section 53, and a straight portion 54, which forms a portion 54 of the intermediate section 54 and 57. In turn, the segment 47 of each transfer duct 44 comprises the said second section 56, the curved connection section 58 and another straight portion 57 of the intermediate section 54 and 57.

[0025] All of the ducts 16, 29 and 44 of the motor-compressor 5 are outwardly sealed to support the pressurized fluid, via toroidal gaskets for example, pastes or in any other known manner. The shaped casing 12 of the primary scroll 10 is provided with a series of cooling ribs or fins 59. Similarly, the shaped casing 26 of the secondary scroll 23 and the conveyor 39 are provided with corresponding series of cooling ribs or fins 61 and 62. The fins 59, 61 and 62 serve to increase the heat-exchange surface area with the external environment, to cool the compressed fluid efficiently, increasing the density and therefore increasing the efficiency of the motor-compressor 5. The transfer ducts 44 have an elliptic section to contain the radial bulk of the motor-compressor 5.

[0026] In the illustrated embodiment, the two impellers 8 and 21 are coaxial and are driven by a single electric motor 15. In Figures 4 and 5, the arrows 63 and 64 represent the direction of rotation of the motor 15, while the black arrows on the transfer ducts 44 represent the flow of fluid. Figure 4 clearly shows that the direction of rotation of the flow in the segments 46 is consistent with that of the motor 15 (arrow 63), while Figure 5 shows that the direction of rotation of the flow in the sections 57 of the segments 47 is opposite to that of the motor 15 (arrow 64).

[0027] According to the variant in Figure 9, the motor-compressor 5 comprises just one delivery duct 16 and just one transfer duct 44 to the conveyor 39. According to the variant in Figure 10, the motor-compressor 5 comprises two delivery ducts 16 and two transfer ducts 44, placed diametrically opposite each other. Thus, the two variants have a number of outlets 25 for the scroll 10 and inlets 42 to the conveyor 39 equal to the number of transfer ducts 44. The shape of the transfer ducts 44 in Figures 9 and 10 is identical to that of the transfer ducts 44 in Figure 2. In Figures 9 and 10 parts that are the same or similar to those in Figure 2 are indicated with the same reference numbers, and so the two variants will not be described any further.

[0028] Figure 11 shows a curve 66 of the compression ratio β as a function of flow Q of the motor-compressor 5. In the case of transfer ducts 44 able to generate a helical flow that is totally consistent with the rotation of the motor 15, a predetermined compression curve 66 is obtained. If instead the second section 56 of each transfer duct 44 provokes an opposite helical flow to that of the motor 15, the outcome is a displacement of the curve 66 to the right in Figure 11, which indicates that a greater compression ratio is achieved at high flow-rates.

[0029] The functioning of the motor-compressor 5 is as follows.

[0030] By making the two impellers 8 and 21 rotate in the direction of the arrows 63 and 64 (Figures 4 and 5), the fluid entering from the central opening 14 of the casing 12 (see also Figure 3) is propelled by the blades 11 into the curved ducts 16 of the scroll 10, undergoing a first compression. Exiting from the outlet openings 25 of the curved ducts 16, the fluid flow, indicated in Figures 3-5 by black arrows on the various ducts, is channelled into the transfer ducts 44 and is introduced, through the inlet openings 42, into the conveyor 39 with a helical motion that turns in the opposite direction to the direction of rotation of the motor 15. The conveyor 39 then channels the fluid flow, via the central opening 28 of the sleeve 31, to the inlet opening 37 of the secondary scroll 23, where it undergoes a second compression imparted by the secondary impeller 21 and then passes into the curved duct 29 of the secondary scroll 23. Finally, the pressurized fluid is conveyed to where utilized by the straight section 30.

[0031] From what has been seen above, the advantages of the motor-compressor 5 according to the invention with respect to motor-compressors of known art are evident. In particular, the transfer ducts 44 avoid energy loss in the flow and improve the efficiency of the motor-compressor 5. Furthermore, the fixing of the two impellers 8 and 21 on the two ends 15' and 15" of the shaft of the common motor 15 renders operation of the impellers 8 and 21 well balanced, avoiding the generation of vibration and thereby allowing an increase in the speed of rotation.

[0032] It is intended that various modifications and refinements can be made to the above-described motor-compressor 5 without departing from the scope of the claims. For example, each transfer duct 44 could be in a single piece, and be connected to the scroll 10 and to the conveyor 39 in a removable manner, via a bolted flange for example. In addition, the two impellers 8 and 21 could be spun by independent electric motors and the respective axes A could be parallel, oblique or coplanar, but with a predetermined angle formed between them. In this case as well, the two impellers 8 and 21 are preferably rotated by a common electric motor, possibly via at least one drive transmission group, of known type.

Claims

1. Multistage motor-compressor for the compression of a fluid, comprising a first compression stage (6) having a primary impeller (8) and at least one delivery duct (16), a second compression stage (7) having a secondary impeller (21) spinning in a predetermined direction of rotation, and at least one transfer duct (44) placed so as to put said delivery duct (16) in communication with a fluid conveyor (39) of said second stage (7), **characterized in that** said transfer duct (44) is shaped in a way to create a fluid flow entering said conveyor (39) with a substantially helical course and with a direction of rotation opposite to the direction of rotation of said secondary impeller (21).

2. Motor-compressor according to claim 1, **characterized in that** said second stage (7) is fitted with at least one axial inlet duct (28) for said flow, said conveyor (39) including its own inlet opening (42) for said flow in communication with said transfer duct (44) and with the inlet opening (28) of said second stage (7).

3. Motor-compressor according to claim 2, **characterized in that** said first stage (6) comprises a pair of diametrically opposite delivery ducts (16), said conveyor (39) comprising a corresponding pair of inlet openings (42), also diametrically opposed, said inlet openings (42) being in communication with said delivery ducts (16) through a corresponding pair of mutually-alike transfer ducts (44).

4. Motor-compressor according to claim 2, **characterized in that** said first stage (6) comprises three delivery ducts (16) set at 120° to each other, said conveyor (39) comprising three corresponding inlet openings (42), also set at 120° to each other, said inlet openings (42) being in communication with said delivery ducts (16) via three mutually-alike transfer ducts (44).

5. Motor-compressor according to claims 3 or 4, **characterized in that** said impellers (8 and 21) are driven by drive means (15) placed inside a casing (32), said transfer ducts (44) being placed on the outside of said casing (15).

6. Motor-compressor according to any of the previous claims, **characterized in that** each of said transfer ducts (44) comprises a first section (52) connected to said delivery duct (16) and substantially tangential to said primary impeller (8), a second section (56) connected to said conveyor (39) and substantially tangential to said secondary impeller (21), and a longitudinal intermediate section (54 and 57).

7. Motor-compressor according to claim 6, **characterized in that** each of said transfer ducts (44) also comprises a substantially helical section (53) placed between said first tangential section (52) and said intermediate section (54 and 57), and a curved section (58) placed between said second tangential section (56) and said intermediate section (54 and 57).

8. Motor-compressor according to claim 7, **characterized in that** each of said transfer ducts (44) is subdivided into two segments (46 and 47), each comprising a portion (54 and 57) of said intermediate section, each of said segments (46 and 47) being fitted with a flange (48 and 49) for connection with the other segment (46 and 47).

9. Motor-compressor according to one of the claims 3 to 8, **characterized in that** said transfer ducts (44) are shaped in a way to create a fluid flow exiting from said delivery ducts 16 with a substantially helical course and with a direction of rotation concordant with the direction of rotation of the primary impeller (8).

10. Motor-compressor according to one of the previous claims, **characterized in that** said drive means (15) comprise two distinct electric motors for driving said two impellers (8 and 21).

11. Motor-compressor according to one of the claims 1 to 9, **characterized in that** said drive means (15) comprise a common electric motor for said two impellers (8 and 21).

12. Motor-compressor according to claim 11, **characterized in that** said impellers (8 and 21) are coaxial and are fixed on two opposite ends (15' and 15") of a shaft of said electric motor (15).

13. Motor-compressor according to claim 11, **characterized in that** said impellers (8 and 21) are coaxial or spin around two axes that are coplanar and which form a predetermined angle.

14. Motor-compressor according to one of the claims 11 to 13, **characterized in that** a drive transmission group is placed between said electric motor (15) and at least one of said impellers (8 and 21).

Amended claims in accordance with Rule 86(2) EPC.

1. Multistage motor-compressor for the compression of a fluid, comprising a first compression stage (6) having a primary impeller (8) and at least one delivery duct (16), a second compression stage (7) having a secondary impeller (21) spinning in a predetermined direction of rotation, and at least one transfer duct (44) placed so as to put said delivery duct (16) in communication with a fluid conveyor (39) of said second stage (7), **characterized in that** said transfer duct (44) includes a portion (56) substantially tangential to said secondary impeller (21) and is connected to a corresponding opening (42) of said conveyor (39) in a way to create a fluid flow entering said conveyor (39) with a substantially helical course and with a direction of rotation opposite to the direction of rotation of said secondary impeller (21).

2. Motor-compressor according to claim 1, **characterized in that** said second stage (7) is fitted with at least one axial inlet opening (28) for said flow, said inlet opening (42) being also in communication with said axial inlet opening (28) of said second stage (7).

3. Motor-compressor according to claim 2, **characterized in that** said first stage (6) comprises a pair of diametrically opposite delivery ducts (16), said conveyor (39) comprising a corresponding pair of inlet openings (42), also diametrically opposed, said inlet openings (42) being in communication with said delivery ducts (16) through a corresponding pair of mutually-alike transfer ducts (44).

4. Motor-compressor according to claim 2, **characterized in that** said first stage (6) comprises three delivery ducts (16) set at 120° to each other, said conveyor (39) comprising three corresponding inlet openings (42), also set at 120° to each other, said inlet openings (42) being in communication with

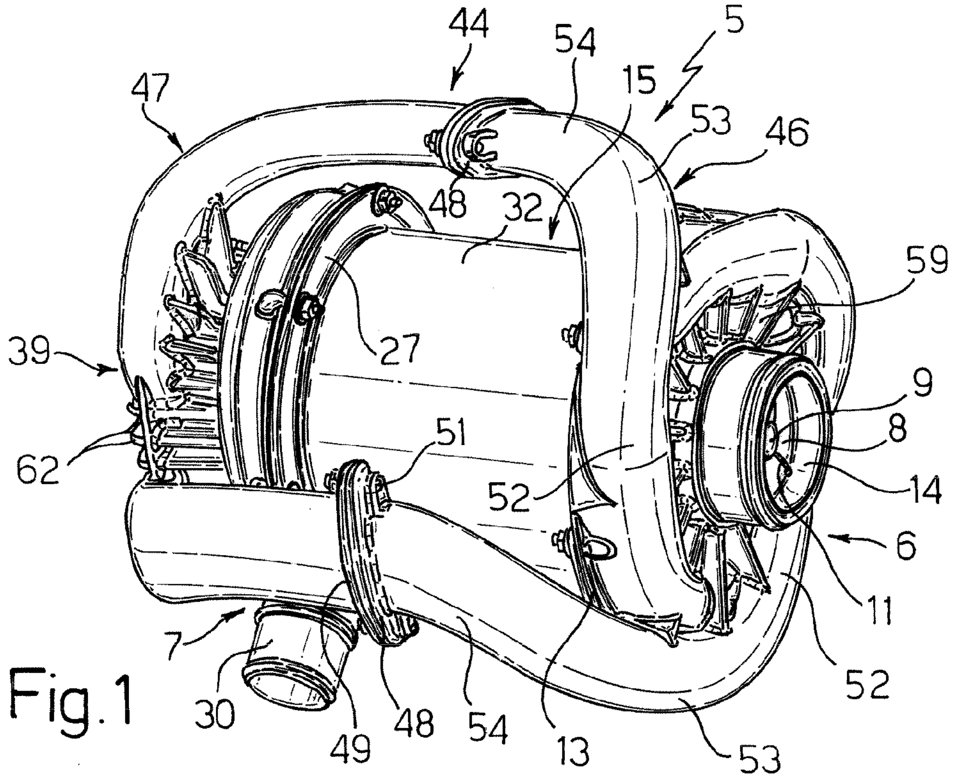
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Fig.1

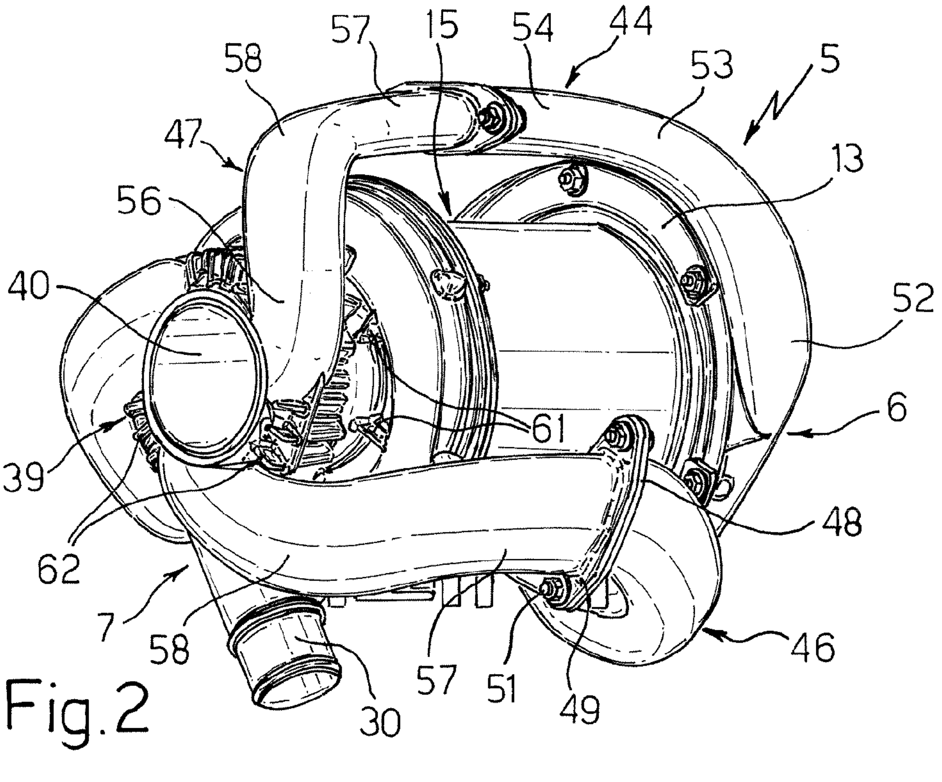
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Fig.2

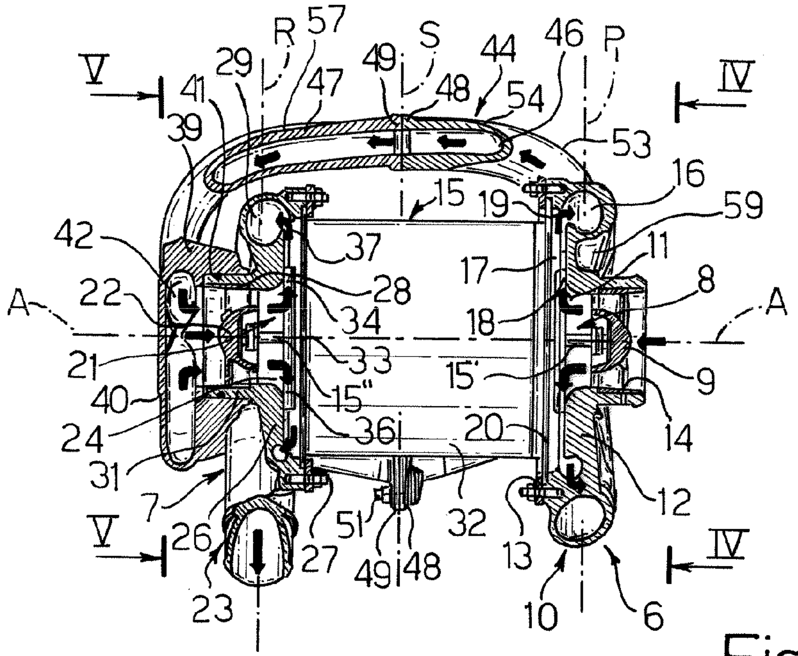

Fig.3

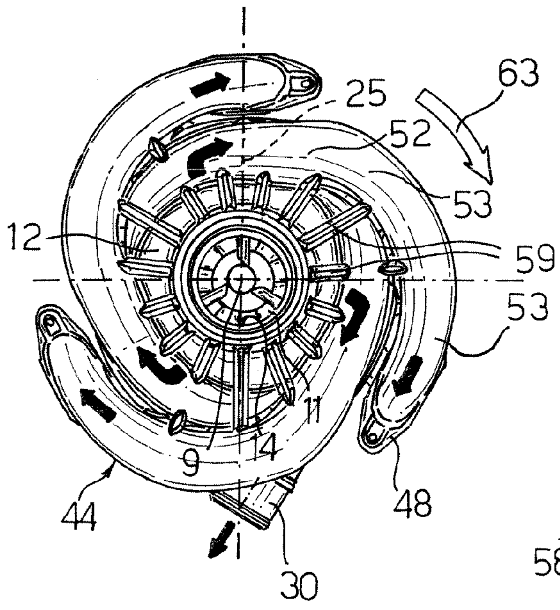

Fig.4

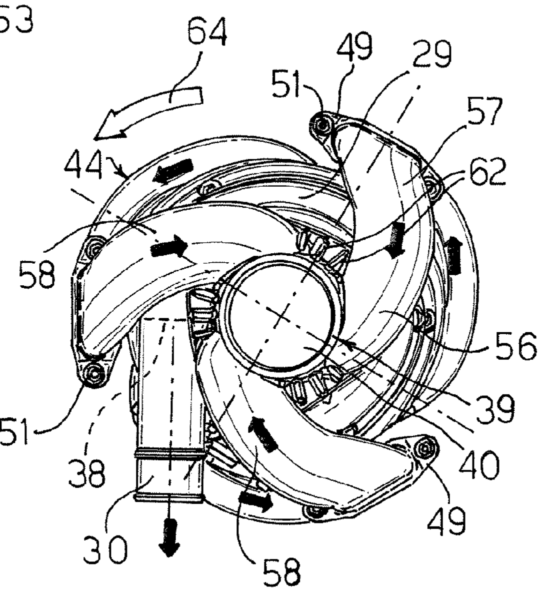

Fig.5

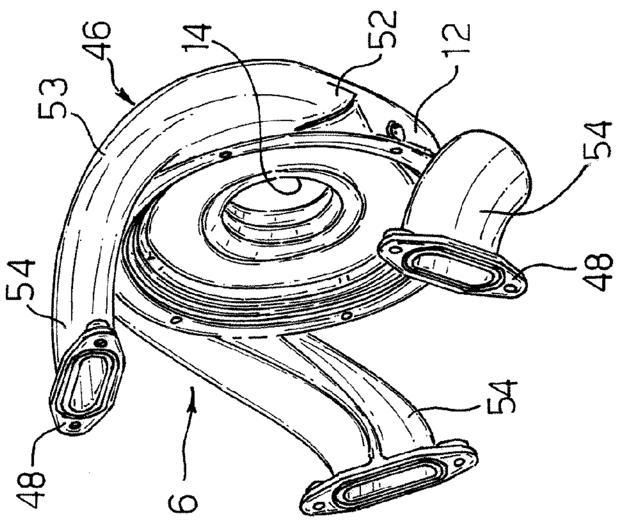

Fig.6

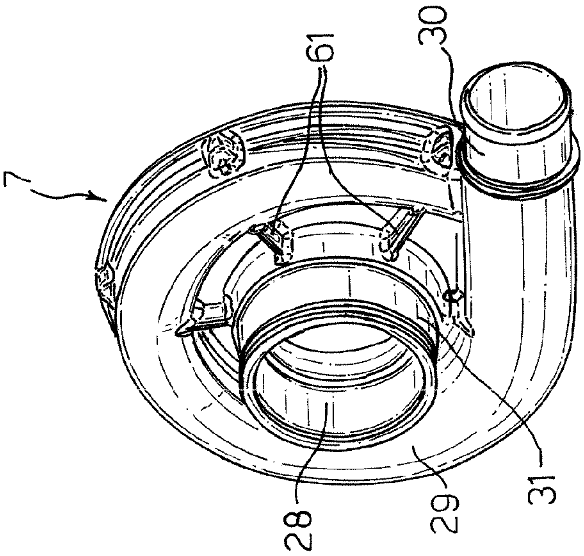

Fig.7

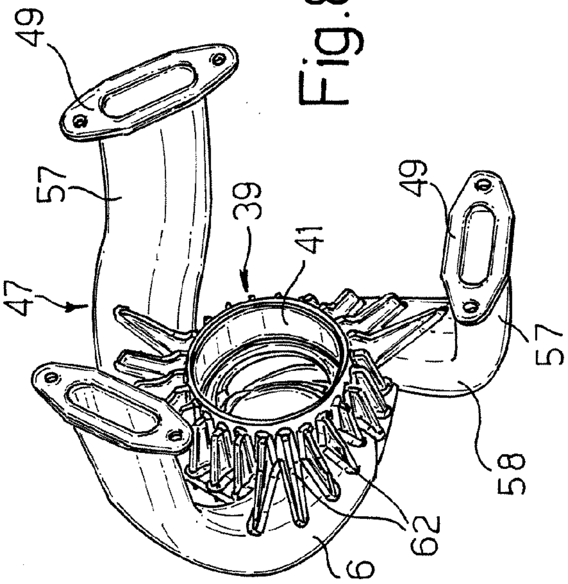

Fig.8

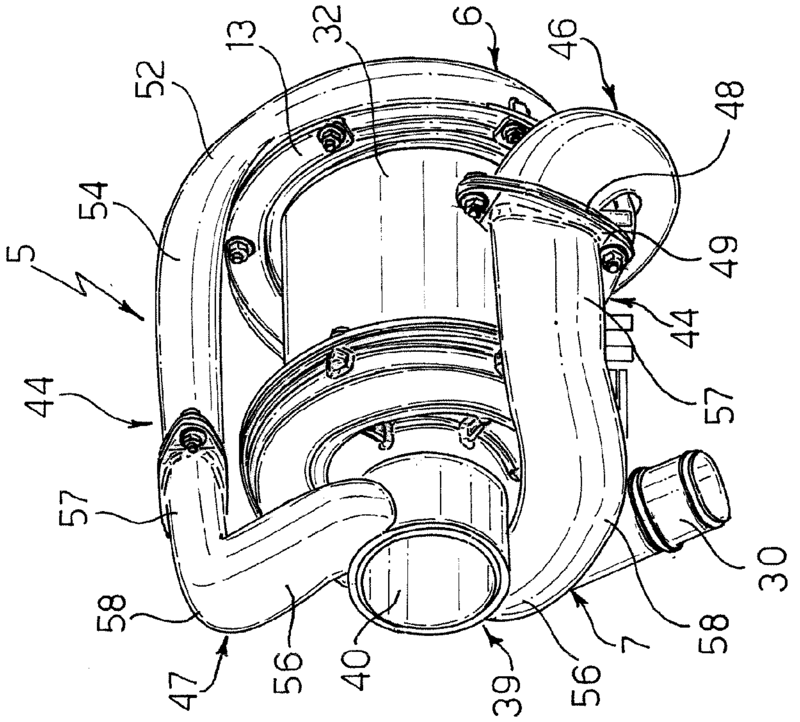

Fig.10

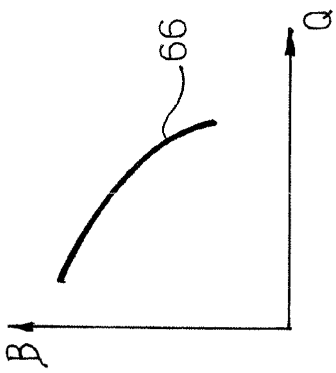

Fig.11

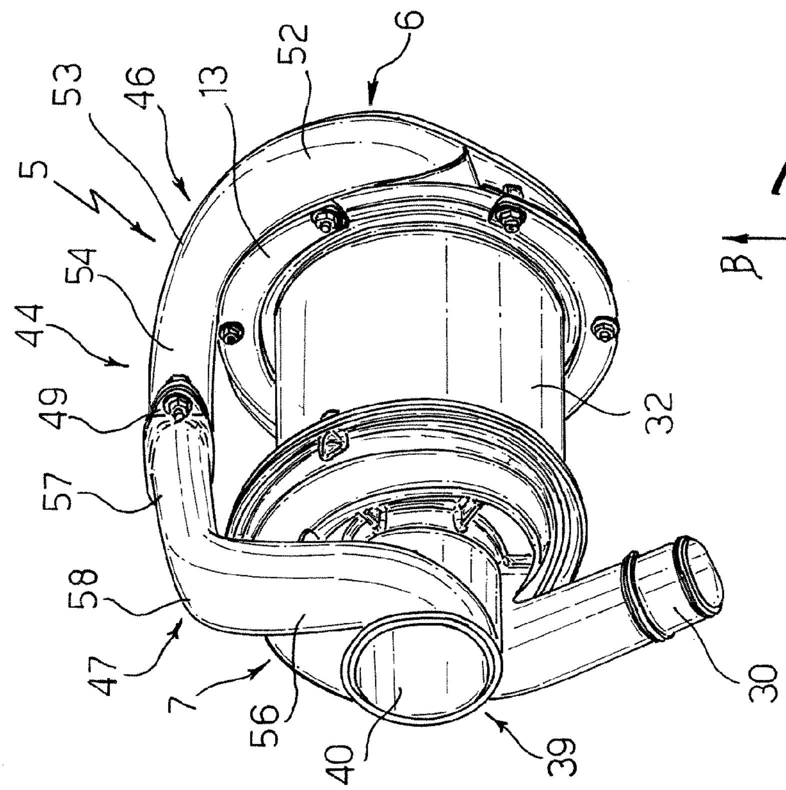

Fig. 9

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 10 1557

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	US 2004/247461 A1 (PFLUEGER FRANK ET AL) 9 December 2004 (2004-12-09) * paragraph [0039] - paragraph [0042]; figure 2 *	1-14	INV. F02B39/10 F02B33/40 F04D17/08 F04D17/12 F25B31/02 F04D25/06
A	US 3 171 353 A (MCMAHAN KENTON D) 2 March 1965 (1965-03-02) * column 4, line 17 - line 46; figures 1-3 *	1-14	
A	EP 1 041 289 A (COOPER CAMERON CORPORATION) 4 October 2000 (2000-10-04) * paragraph [0027]; figure 1 *	1-14	
A	US 2004/179947 A1 (AGRAWAL GIRIDHARI L ET AL) 16 September 2004 (2004-09-16) * paragraphs [0040] - [0046]; figure 1 *	1-14	
A	US 4 969 803 A (TURANSKYJ ET AL) 13 November 1990 (1990-11-13) * column 3, line 23 - line 55; figures 1-3 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) F02B F04D F25B

The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
Munich	2 June 2006	Tietje, K

CATEGORY OF CITED DOCUMENTS

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02-06-2006

Patent document cited in search report		Publication date	Patent family member(s)			Publication date
US 2004247461	A1	09-12-2004	NONE			
US 3171353	A	02-03-1965	DE	1528762	A1	06-05-1970
			GB	1024584	A	30-03-1966
EP 1041289	A	04-10-2000	US	6193473	B1	27-02-2001
US 2004179947	A1	16-09-2004	NONE			
US 4969803	A	13-11-1990	DE	3729486	C1	15-12-1988
			EP	0305700	A2	08-03-1989
			JP	1080799	A	27-03-1989
			JP	2794178	B2	03-09-1998
			NO	883910	A	06-03-1989

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82