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(54) Side channel blower

(57) The invention concerns a blower wherein a rotor (6) with peripheral blades (12) compresses air coming from a suction channel (29) and send it to a delivery channel (30); in each channel there is a tubular manifold (27, 28) to be connected thereto on one side and on the opposite side to another manifold.

In such a manner there can be obtained blowers with several compression stages with a high efficiency.

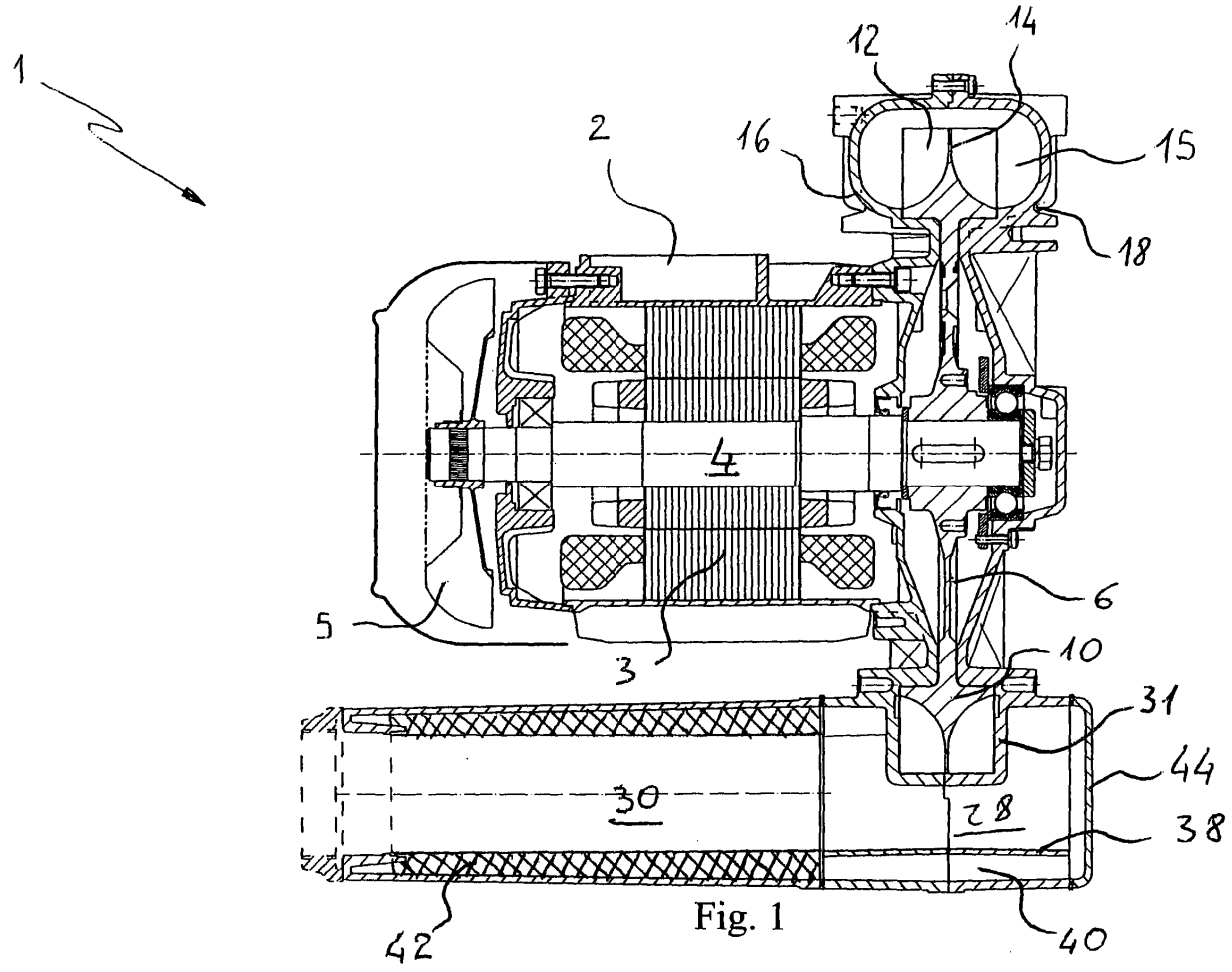

Fig. 1

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Description

[0001] The invention relates to centrifugal blowers, also known as regenerative blowers, used for supplying the airflow for furnaces or in other industrial applications.

[0002] Briefly, these blowers consist of a rotor caused to rotate by a motor, generally electric, having the form of a disc on the edge of which the blades are arranged.

[0003] The latter move inside a toroidal chamber formed in the stator, which communicates with a suction channel and a delivery channel situated on one side of the motor, parallel to the axis of rotation.

[0004] In the operation of side channel blowers, the blading imparts pressure to the air or other fluid processed, forcing it to circulate in a spiral path along the toroidal chamber.

[0005] The configuration of the blading significantly affects the performance of side channel blowers; however, there are also other factors having a decisive effect, especially if it is wished to increase the flow rate or the pressure of the fluid processed by the blower.

[0006] For this purpose, blowers are known which use two stages in parallel to have a higher flow rate, or in series to achieve greater delivery pressure; however, it does not follow that doubling the rotors also doubles the flow rate or pressure of the air, whereas it is certain that it does increase the complexity of the machine.

[0007] For this reason, machines have been devised with only one rotor in which the blading and the stator are designed to operate in more than one mode by changing the relative position of the suction and delivery apertures; a similar solution described in US patent 3,915,589 does not appear advantageous, however, since the (theoretical) benefits achieved do not compensate for the disadvantages because when the blower operates with stages in parallel, its flow rate is lower compared with that of a normal blower having the same dimensions.

[0008] In other words, the theoretical increase in delivery pressure resulting from connecting the stages in series is obtained to the detriment of the flow rate of the blower when it operates in normal conditions with stages in parallel.

[0009] The technical problem addressed by the present invention is therefore that of overcoming the disadvantages of currently known blowers; the concept for solving this problem consists in producing a machine with modular stages, that is stages which may be used singly, or connected in series or parallel.

[0010] According to a preferred form of the invention, the blower is characterised in that the suction and discharge of the air from each stage are obtained by means of manifolds which divide the flow of air so as to match the operation of the stages in series or in parallel.

[0011] Other characteristics of the invention and the effects deriving therefrom will become clear from the following description concerning a preferred and nonlimiting example of embodiment illustrated in the appended drawings, in which:

figure 1 is a longitudinal section of a blower according to the invention;

figures 2 and 3 are a front view and section view along the diameter of the rotor, of the blower in figure 1;

figures 4 and 5 show, respectively from the front and from the rear, half of the toroidal chamber of the blower in figure 1;

figure 6 is a section along the line VI-VI in figure 5;

figures 7 and 8 are respectively a front view partly in section and a side view of a blower according to the invention, with two stages in series;

figures 9 and 10 show sections of the preceding two-stage blower, viewed from the opposite side compared with that in figure 7;

figure in 11 is a section of a blower according to the invention, with two stages in parallel.

[0012] With reference to these drawings, in them the number 1 indicates as a whole a blower according to the invention, having an outer casing 2 in which an electric motor 3 of known type is housed.

[0013] The latter drives a shaft 4 to which are keyed a cooling fan 5 at one end and a rotor 6 for processing the air at the opposite end.

[0014] The rotor 6 is constituted by a central disc 8 which extends from the hub 9 to a peripheral ring 10, along which are located the blades 12; these have a convex spoon shape and are divided in the median plane by a baffle 14 constituted by a tapering elongation of the ring 10, which extends as far as the ends of the blades 12.

[0015] In the blower 1, the blades 12 of the rotor move in a toroidal chamber 15 formed between a body 16 attached with screws to the casing 2 and a cover 18 attached to the above-mentioned body; the body 16 and the cover 18 constitute respective shells of a casing which contains the rotor: given their substantially equal form, only the first of these will be described hereafter with reference to figures 4-6 and what will be stated shall be understood valid also for the second.

[0016] As can be seen, the body 16 is equipped externally with radial ribs 20 and peripheral ribs 21 , while internally it has an annular cavity 23 which forms the internal wall of the toroidal chamber 15.

[0017] In the bottom part of the cavity 23 with reference to figures 4 and 5, there are two ports 25, 26 communicating respectively with the manifolds 27 and 28 associated with the suction side channel 29 and the delivery side channel 30 of the blower (in figure 1, only channel 30 is shown).

[0018] According to a preferred embodiment, the manifolds 27 and 28 are constituted by respective walls 37 and 38 having a substantially semicircular shape (cf. figures 4 and 5) so that they are open at the top thereby facilitating the passage of the air towards the ports 25 and 26.

[0019] Each of the semicircular walls 37 and 38 is surrounded by a space 39 and 40, whose function will be-

come clearer in what follows when dealing with the blower with two stages in parallel; in the blower with only one stage of figure 1, the above-mentioned spaces are instead closed by the acoustic insulation 42 present in the side channels 29, 30 for suction and delivery.

[0020] At the opposite end the side channels 29, 30 and the manifolds 27, 28 are closed by a cover 44.

[0021] Finally, in the area 31 comprised between the ports 25 and 26, the cavity 23 has a shape matching that of the blades 12 (cf. figure 1); this is made to form a labyrinth seal between the two ports, enabling the air to be discharged through the above-mentioned ports during operation of the blower which takes place as follows.

[0022] The air coming from the outside enters the blower through the side suction channel 29 (not shown but parallel to the channel 30) and continuing through the manifold 27, reaches the toroidal chamber 23; it is just the case to point out that the same thing also happens on the other side of the toroidal chamber formed by the cover 18, on which there are ports similar to ports 25 and 26 present on the body 16 housing the rotor 6.

[0023] In other words, when it reaches the manifold 27, the flow of outside air running through the suction channel divides and enters the toroidal chamber 15 from two sides, one on the body side and the other on the cover side.

[0024] Inside the toroidal chamber, the blades 12 drive the air along opposite sides with respect to the baffle 14: the latter therefore acts as a dividing wall which prevents interference in the movement of the air that may cause pressure losses.

[0025] It will be observed that the baffle 14 and the blades 12 have the same radial height, thus creating uniform conditions both with respect to the median plane and with respect to the outer circumference of the rotor 6.

[0026] Advantageously, however, the radial height of the baffle and of the blades is smaller compared with that of the toroidal chamber 15, so as to maintain the same pressure on both sides of the rotor.

[0027] Air is sent to the delivery channel 30 at each revolution of the rotor, through the port 26; the latter is arranged to the side with respect to the blades 12, while the manifold 28 is in a tangential position relative to the path of the blades and is configured with a semicircular cross-section.

[0028] This provides for the discharge of the air from the toroidal chamber 15, because the side port 26 is adjacent to it and there are no obstacles to overcome or ducts to run through while the position and semicircular shape of the manifold 28 assist the centrifugal component of the velocity of the air, so as to make full use of the associated energy and not lose pressure.

[0029] The same advantageous effects are also obtained, mutatis mutandis, by the air being sucked in through the inlet port 25 and the manifold 27.

[0030] The most important point, however, is that these effects are also achieved in the case of a blower with two stages S, S' in series or in parallel.

[0031] The first of these is shown in figures 7-10, which give various views of a blower with two stages S, S' connected in series, the parts already seen in the previous example being indicated by the same reference numbers, while the new ones are distinguished by an apostrophe.

[0032] As can be seen, in this case the suction channel 29 is no longer arranged horizontally by the side of the electric motor 3, but is vertical and positioned at the end of the blower; the latter is equipped with an added compression stage, which comprises a rotor 6' keyed onto the shaft 4 next to the other rotor 6 and identical thereto.

[0033] The blower 6' is housed in a body 16' closed by a cover 18', identical to those of the adjacent rotor but rotated with respect to them by an angle α (figure 8) so as to line up the outlet manifold 28' of the first stage with the inlet manifold 27 of the other stage (cf. figure 10); in this way, the two stages are connected in series with each other.

[0034] It is just the case to point out that the manifold 28' of the first stage is closed by a plug 44' at the opposite end of the manifold relative to the one at which it is connected to the second stage, which in turn is closed by a plug 44 at the free end.

[0035] The operation of each stage S, S' of this blower is identical to that of the preceding case, so that for the sake of brevity reference may be made to what has already been said; it is in any case clear that at the delivery outlet of the blower there will be a pressure approximately double compared with that of a single stage blower.

[0036] What should however be pointed out here is the embodiment of the blower in modular form, obtained by using a longer shaft 4 so as to be able to fit the two identical rotors 6, 6', and adding, compared with the previous single stage blower, the cover 18 and the body 16' identical to each other and connected in series simply by rotating one relative to the other.

[0037] This simple and effective embodiment gives clear savings for the industrial production, since the differences between the blowers with one or two stages are reduced substantially to a few parts.

[0038] It should moreover be pointed out that the modular structure designed in this way is also suitable in principle for producing blowers with three or more stages; all that is required for this purpose is to add to the shaft 4 a rotor housed between a body and a cover like those described, offset angularly relative to the adjacent ones according to the description just given.

[0039] The same is true for the blower with two stages S, S' laid in parallel, shown in figure 11, though there is no angular offset between them.

[0040] The reason is that in this case the air inlet manifolds 27, 27' are lined up (and not offset) so as to be fed from the same flow of air sucked into the side channel 29; the same happens with the outlet manifolds 28, 28' (not shown in figure 11) through which the air blown by the rotors 6, 6' passes.

[0041] It is clear that in this case the volume of air proc-

essed by the blower is greater than the previous one; for this reason, the space 39, 39' which surrounds the manifolds 27, 27' is also used in order to increase the cross-section through which the air passes.

[0042] More particularly, the channel 29 advantageously has a cross-section equal to that of the manifold 37 with the associated space 39, to which it is joined by means of a coupling 47 (the latter might also not be needed if the channel 29 had a diameter such that it could be aligned with the manifold 27).

[0043] In this way the flow of air coming from the channel 29 is divided and one part goes into the manifold 27, while the other passes into the space 39 and 39'; the first part is then further reduced because a fraction of it is drawn off by the first stage S of the blower, while the other goes into the manifold 27' to be drawn off by the second stage S'.

[0044] By contrast, the flow of air which passes into the space 39 and 39' flows directly into the manifold 27' to be drawn off by the second stage S': this allows the latter to operate in uniform optimum conditions, since the flow which feeds it is substantially equal to that which reaches the first stage S.

[0045] This flow is given by the sum of that which passes into the manifold 27 and which is not drawn off by the first stage S, plus that which passes into the space 39, 39'.

[0046] Consequently, as can be seen, in this case too the modular embodiment of the blower provides a simple two-stage machine which differs from the previous ones only by a few parts.

[0047] Finally, it should be pointed out that although the blower according to the invention has been described in this example for blowing air, it can in any case be used with other gases and may also be used to generate vacuum; for this purpose, it is only necessary to connect its inlet channel to the volume in which the vacuum is to be produced.

Claims

1. A side channel blower, comprising:

a toroidal chamber (15) in which there are at least one inlet port (25) and one outlet port (26) for the air or other fluid processed,
a rotor (6) with a plurality of peripheral blades (12) which extend into the toroidal chamber (15),
a suction channel (29) and a delivery channel (30) communicating respectively with the inlet port (25) and outlet port (26) of the toroidal chamber (15),

characterised in that each of said ports (25, 26) is associated with a respective tubular manifold (27, 28) extending transversely to the median plane of the rotor, connected to one of said channels (29, 30) at one end and capable of being connected to another manifold (27', 28') at the other end.

2. A blower according to claim 1, wherein each manifold (27, 28) has an open cross-section at the end having the port (25, 26) associated with it.

3. A blower according to claims 1 and 2, wherein around each manifold (27, 28; 27', 28') there is a space (39, 40; 39', 40').

4. A blower according to the preceding claims, wherein the inlet and outlet ports (25, 26) are formed in the wall of the toroidal chamber (15) in a position beside the blades (12) of the rotor (6).

5. A blower according to the preceding claims, comprising a body (16; 16') and a cover (18, 18') placed side by side to form the toroidal chamber (15) between them.

6. A blower according to claim 5, wherein the manifold (27, 28; 27' 28') is constituted by parts formed as one piece respectively in said body (16, 16') and cover (18,18').

7. A blower according to claims 5 and 6, wherein a plurality of stages (S, S') each comprising a body (16, 16'), a cover (18, 18') and the associated rotor (6, 6'), are fitted to the same shaft (4) and are connected in series with each other by offsetting them angularly with respect to each other, so as to connect the respective outlet manifold (28') and inlet manifold (27).

8. A blower according to claims 5 and 6, wherein a plurality of stages (S, S') each comprising a body (16, 16'), a cover (18, 18') and the associated rotor (6, 6') are fitted to the same shaft (4) with the respective inlet manifolds (27, 27') and outlet manifolds (28, 28') connected to each other, and wherein the suction and delivery channels (29, 30) have a cross-section equal to that of said manifolds plus that of the spaces (39, 40; 39', 40') surrounding them.

9. A blower according to any one of the preceding claims, wherein between the blades (12, 12') of at least one rotor (6, 6') there is a baffle (14, 14') having the same radial height as the blades, which divides the surfaces of these in two and which extends in a plane transverse to the axis of rotation of the rotor.

10. A blade according to claim 9, wherein the baffle (14, 14') is constituted by the tapering prolongation of a ring (10,10') of the rotor (6, 6').

11. A blower according to claim 10, wherein the baffle (14, 14') lies in a median plane of the blades (12, 12').

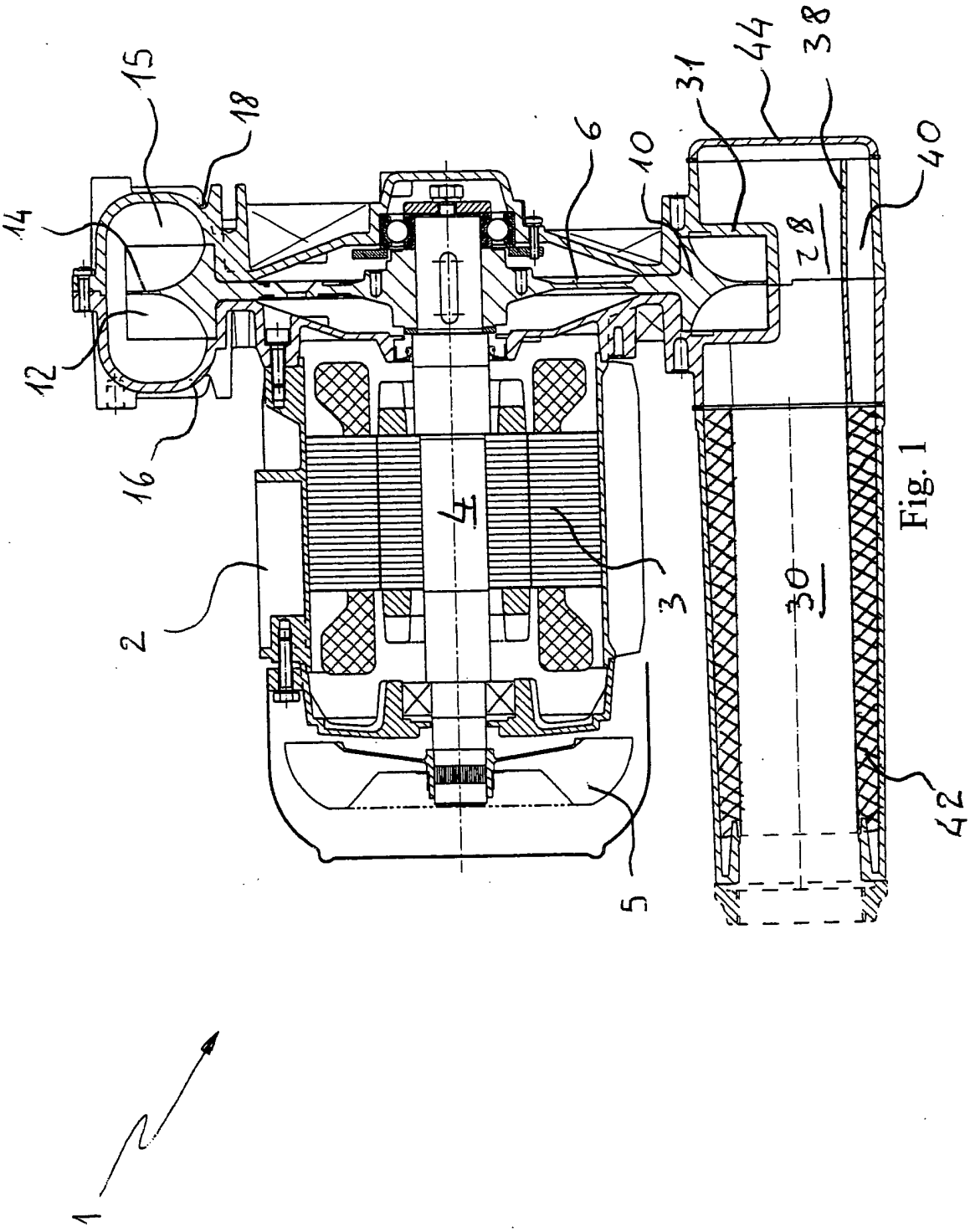


Fig. 1

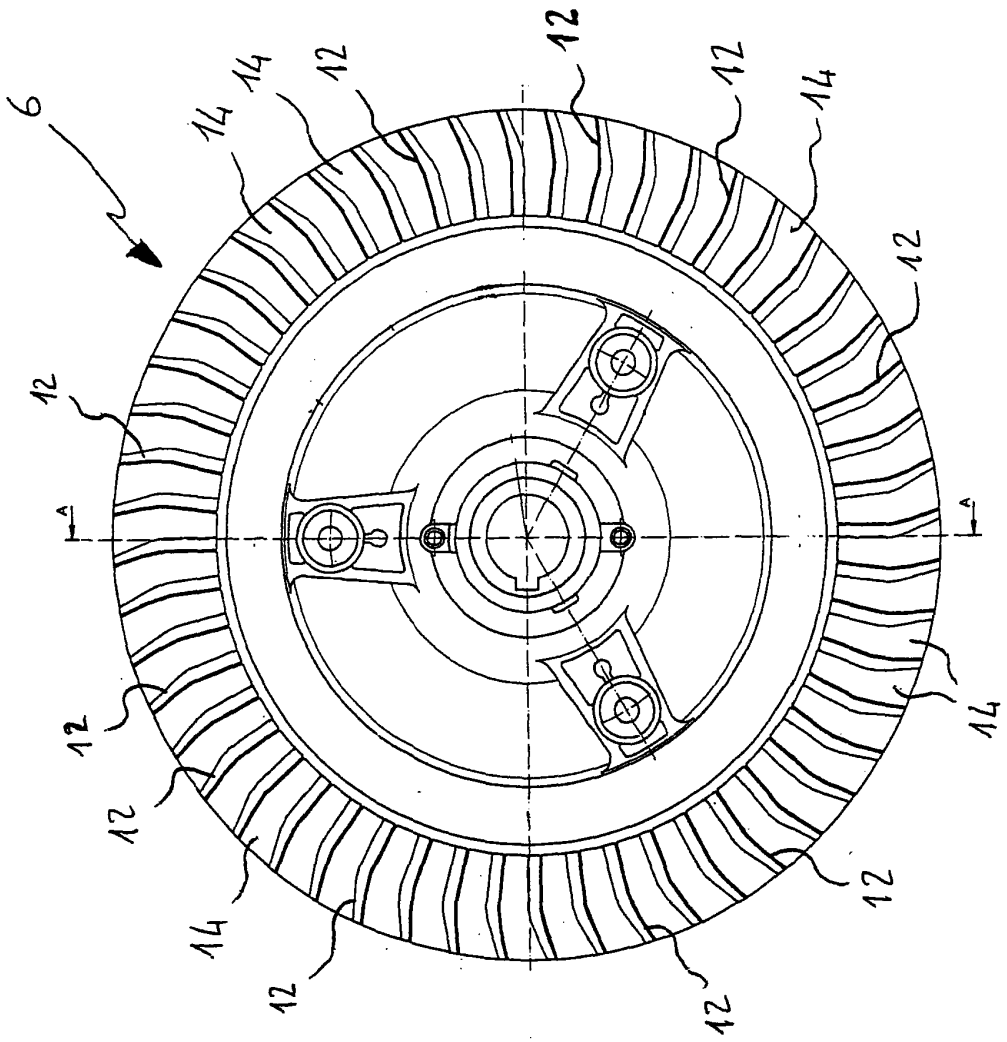


Fig. 2

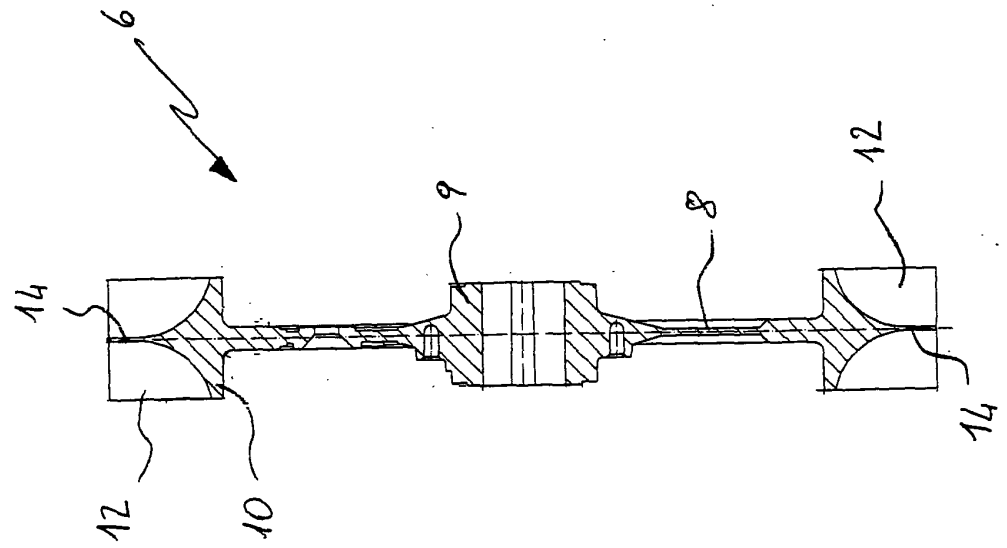


Fig. 3

Fig. 6

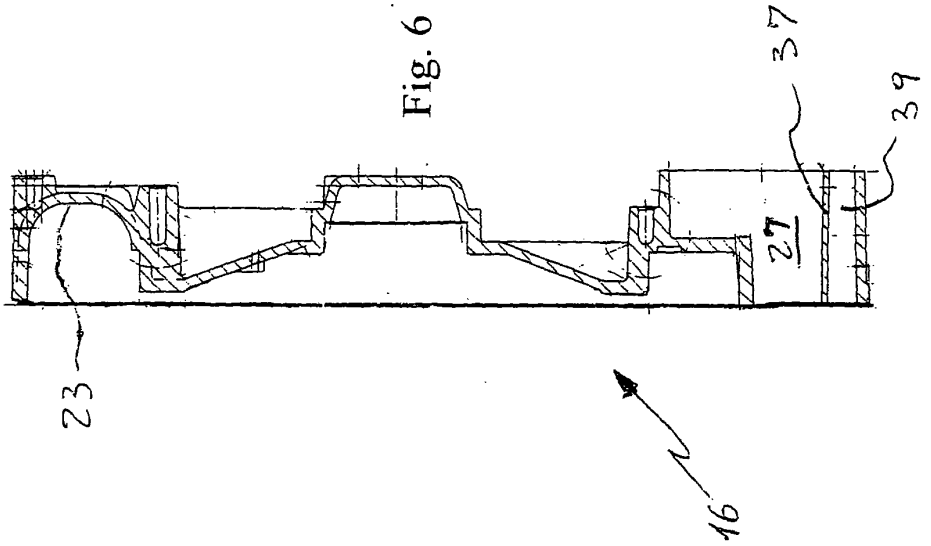
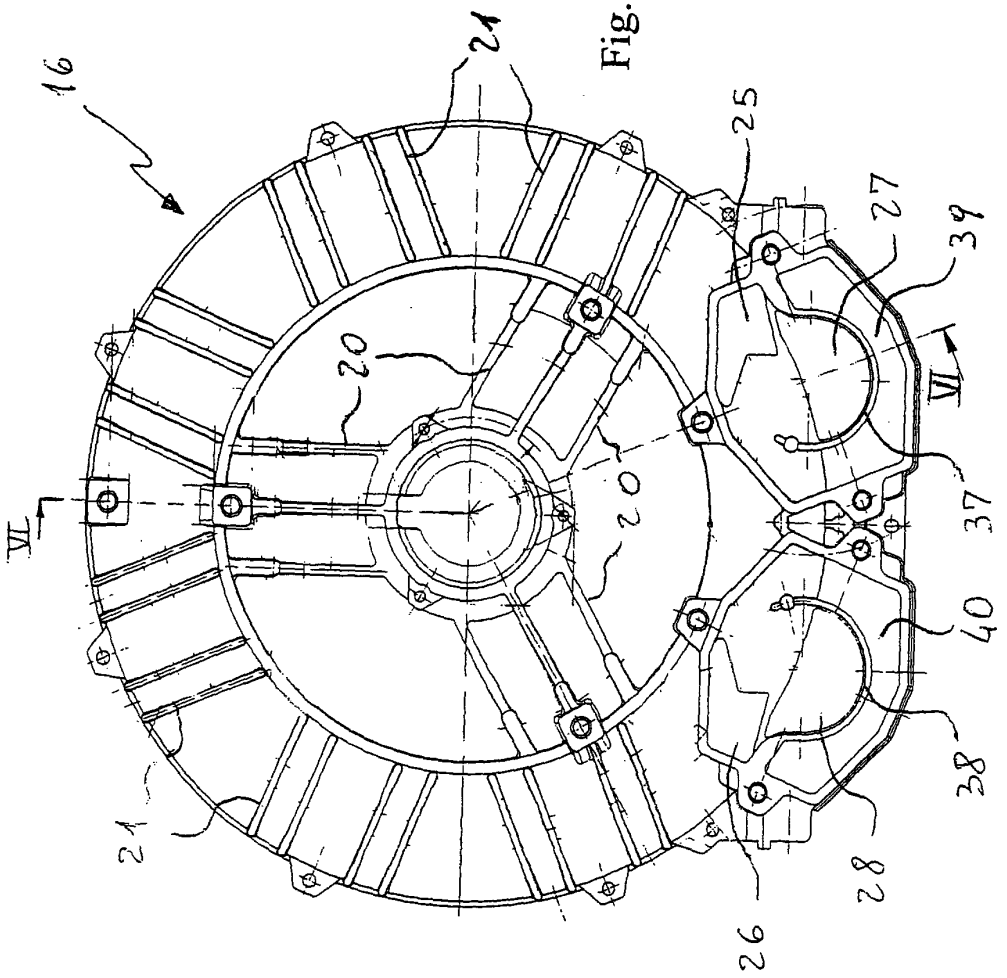


Fig. 4



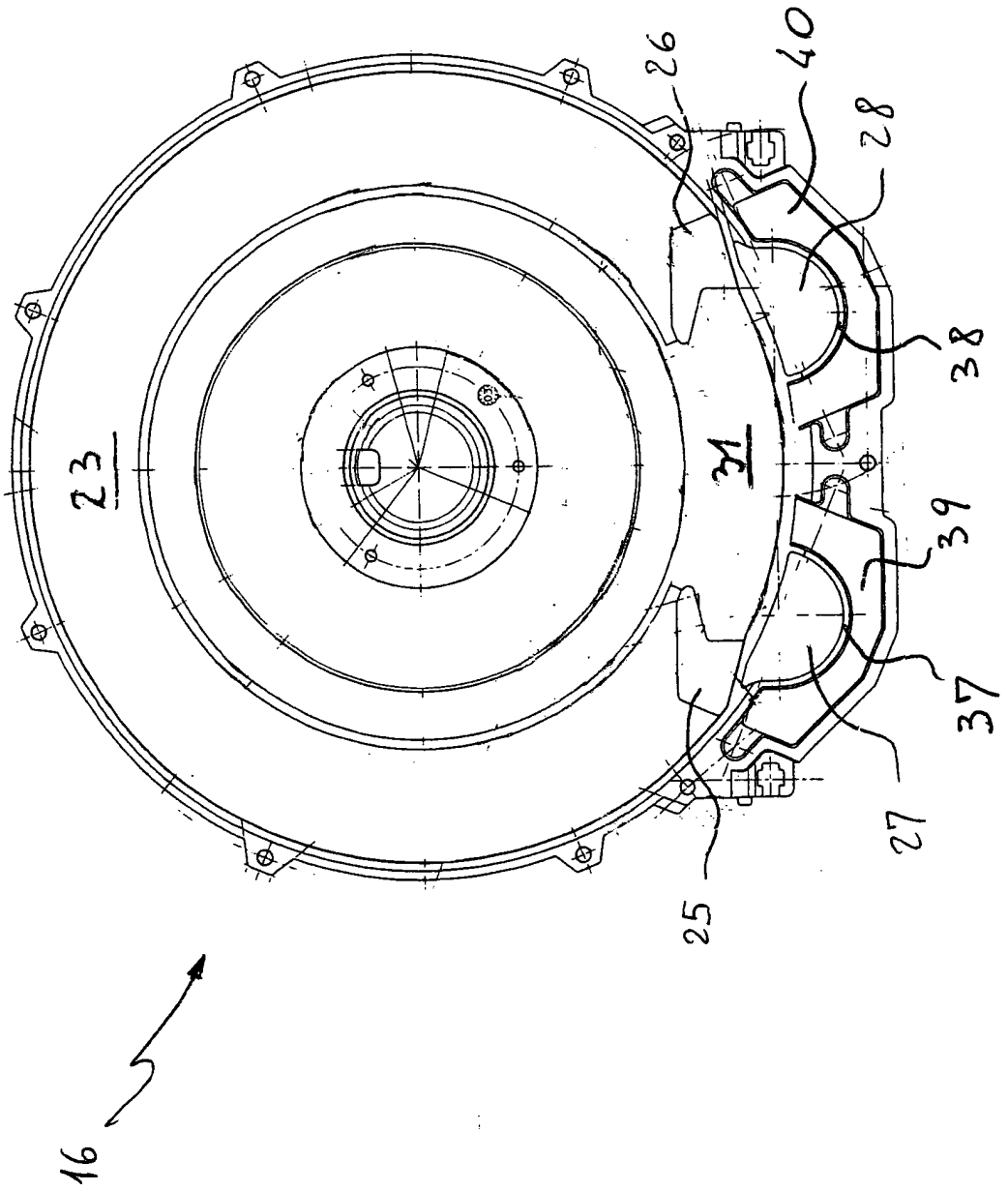


Fig. 5

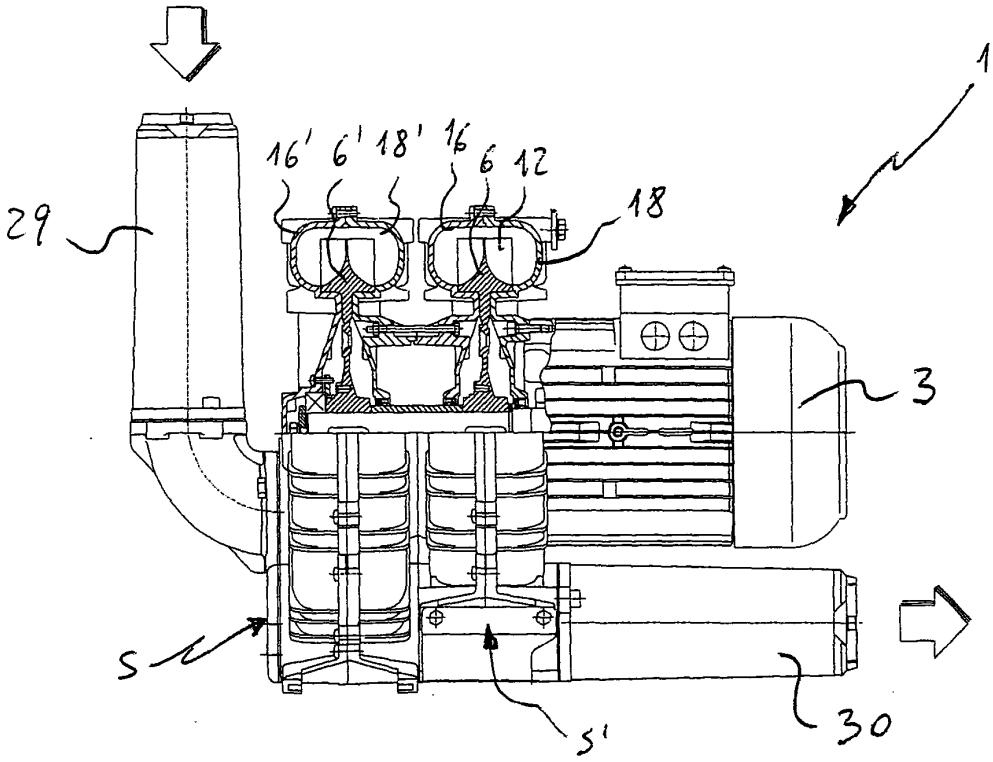


Fig. 7

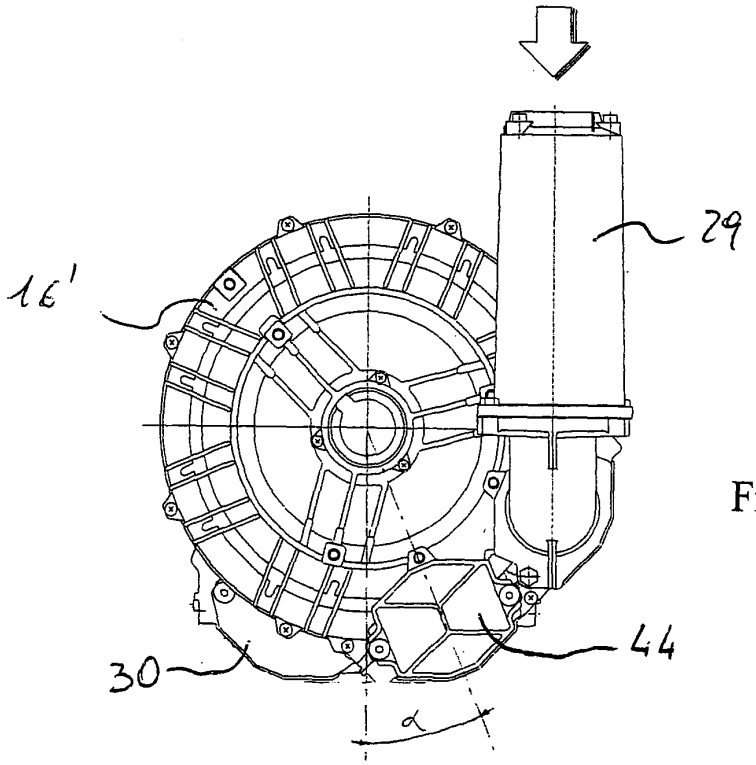


Fig. 8

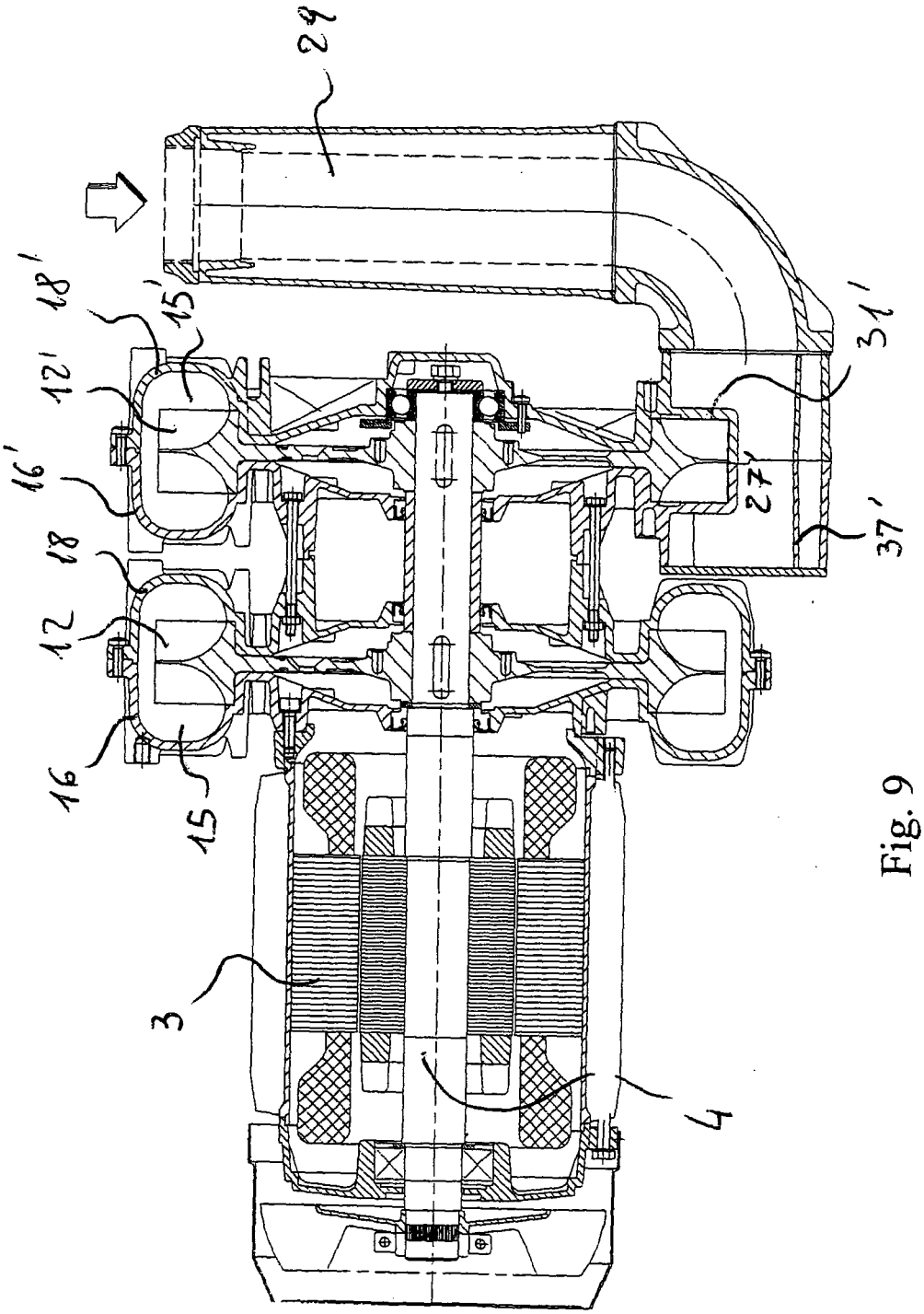


Fig. 9

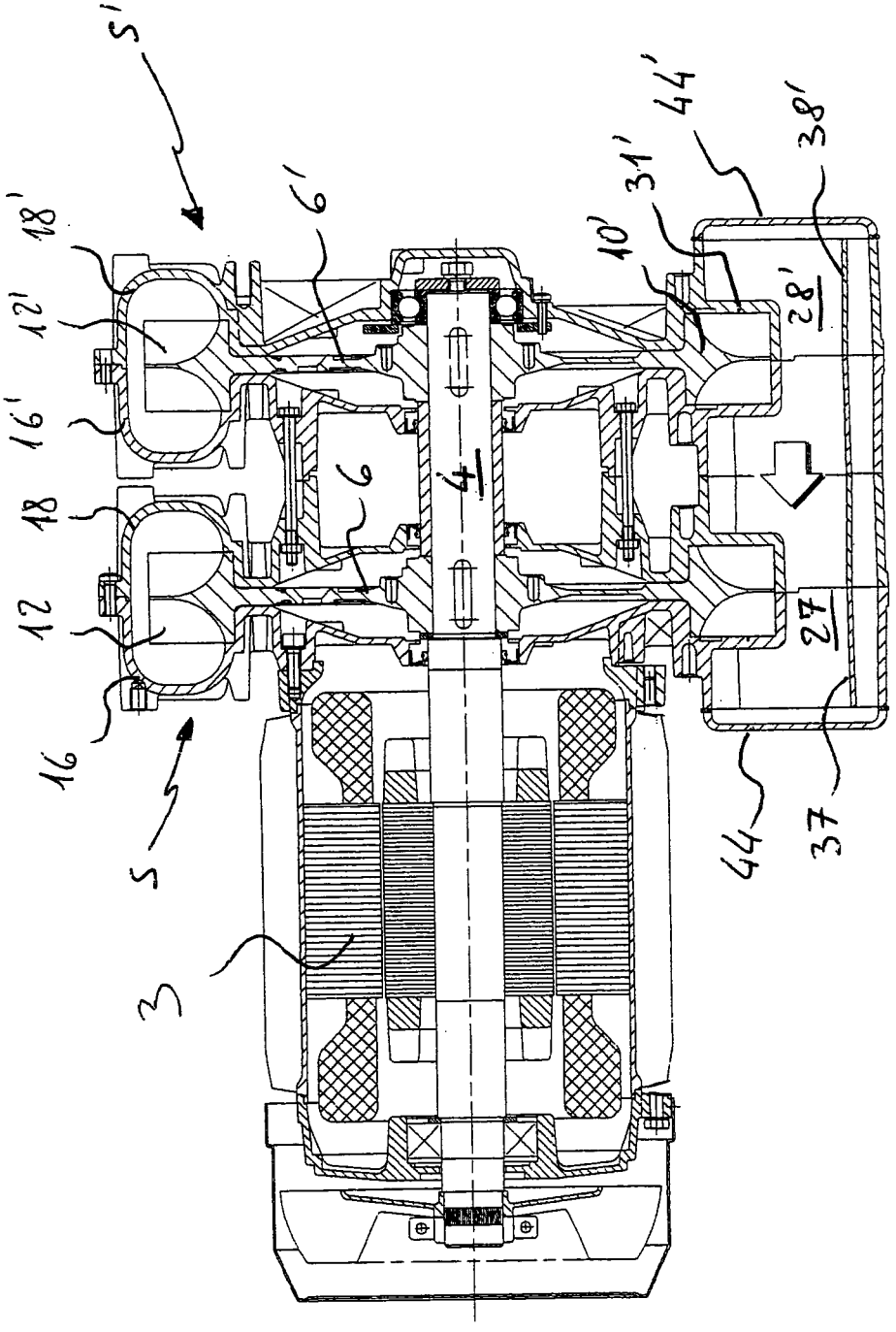


Fig. 10

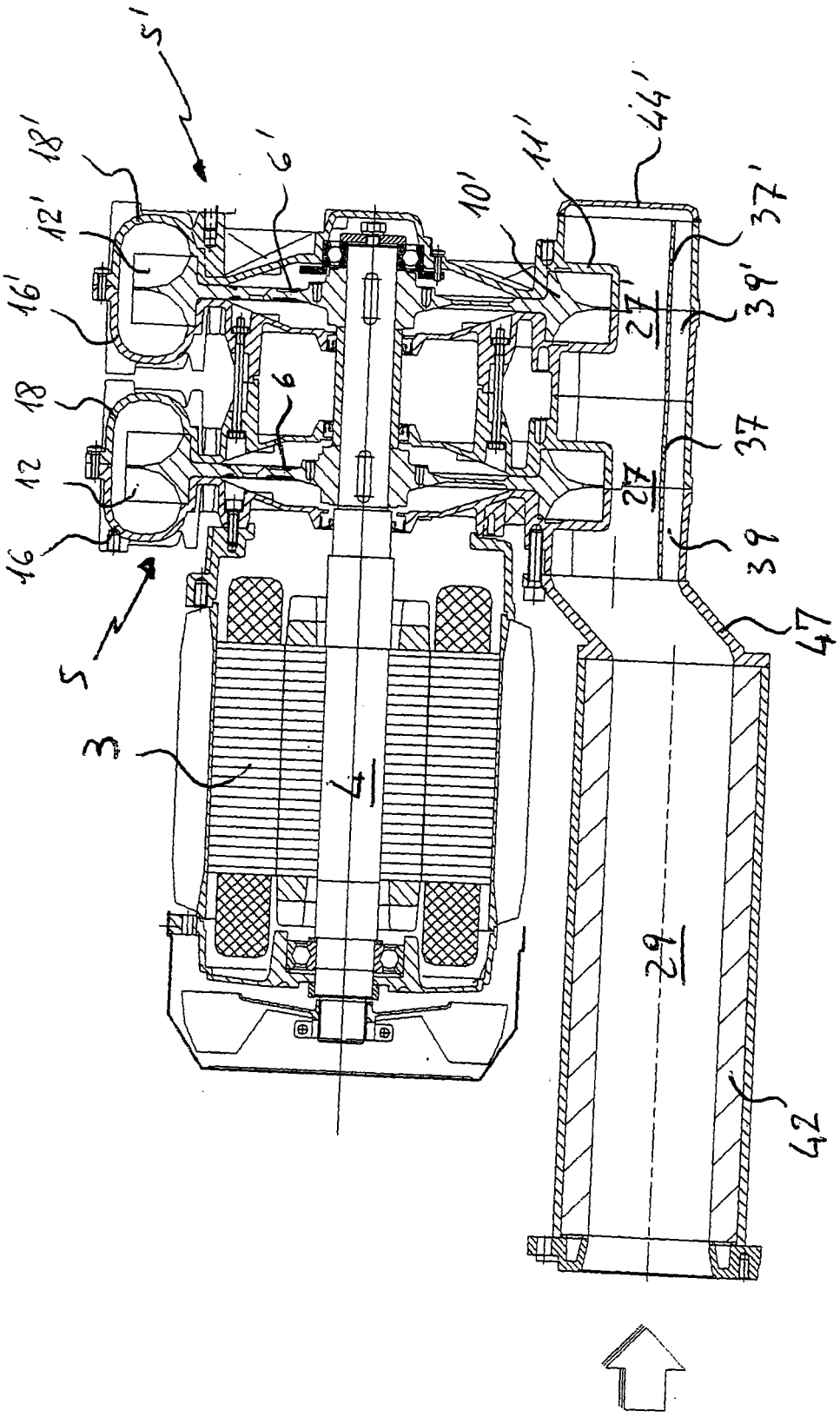


Fig. 11

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EUROPEAN SEARCH REPORT

Application Number
EP 04 42 5593

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	16 November 2004	Di Giorgio, F

CATEGORY OF CITED DOCUMENTS

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