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

(11) **EP 2 235 378 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
18.05.2011 Bulletin 2011/20

(21) Application number: **08862665.0**

(22) Date of filing: **12.12.2008**

(51) Int Cl.:
F04D 29/42 *(2006.01)* ***F04D 29/44*** *(2006.01)*
F04D 17/16 *(2006.01)*

(86) International application number:
PCT/EP2008/067434

(87) International publication number:
WO 2009/077455 (25.06.2009 Gazette 2009/26)

(54) A FLUID-MECHANICAL MACHINE, IN PARTICULAR A CENTRIFUGAL FAN

FLUIDMECHANISCHE MASCHINE, INSBESONDERE ZENTRIFUGALGEBLÄSE

MACHINE MÉCANIQUE À FLUIDE, EN PARTICULIER VENTILATEUR CENTRIFUGE

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

(30) Priority: **19.12.2007 IT PD20070416**

(43) Date of publication of application:
06.10.2010 Bulletin 2010/40

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Description

Technical field

[0001] The present invention relates to a fluid-mechanical machine having the characteristics set out in the preamble to main Claim 1.

Technological background

[0002] A fluid-mechanical machine having the features outlined above is known from US 3289695 (closest prior art). FR-A-2422053 and DE-A-3842826 are also prior art to the present invention.

[0003] Fluid-mechanical machines of the type indicated, whether they be operative machines or power machines, are typically provided with a bladed rotor which is supported rotatably in a manifold in which an inlet section and an output section are defined for the operative fluid processed by the machine. Compressors, fans and pumps are given as examples of operative machines. These fluid-mechanical machines are distinguished by fluid intake and delivery sections that are far apart and in general are arranged in the region of the rotation axis of the rotor and in a radial position remote from the axis, respectively, according to whether they are operative or power machines.

Description of the invention

[0004] A principal object of the invention is to provide a fluid-mechanical machine which is devised structurally and functionally to achieve an improvement in functional capacity in terms of efficiency in the processing of the operative fluid output from or entering the machine, prior to the supply of the flow to other operative stages that are provided for downstream of the fluid-mechanical machine in specific applications.

[0005] This object is achieved by a fluid-mechanical machine constructed in accordance with the appended claims.

Brief description of the drawings

[0006] Further characteristics and advantages of the invention will become clearer from the following detailed description of a preferred embodiment thereof which is described by way of non-limiting example with reference to the appended drawings, in which:

Figures 1 and 2 are partially-sectioned, perspective views of a fluid-mechanical machine constructed in accordance with the present invention,

Figure 3 is an axial section through the machine of Figure 1, and

Figure 4 is a further partially-sectioned, perspective view of the invention.

Preferred embodiment of the invention

[0007] With reference to the drawings mentioned, an example of a fluid-mechanical machine according to the invention, generally indicated 1, is constructed as an operative machine and is designed, in particular, as a centrifugal fan arranged for processing an aeriform fluid. A typical application may be that of a centrifugal fan for the pre-mixing of an air-gas mixture to be supplied to a gas burner which is arranged downstream of the fan with respect to the direction of the flow.

[0008] The fan comprises a bladed rotor 2 with a rotor-housing manifold 3 in which an intake section 4 and a delivery section 5 of the fan are formed.

[0009] The rotor 2 can be rotated about a rotation axis X by a drive means (not shown), for example, an electric motor onto the drive shaft of which the rotor is keyed.

[0010] The intake section 4 is provided in the region of the axis X and comprises an opening 4a coaxial with the axis X. The delivery section 5, on the other hand, is defined in the region of a circumferential profile located downstream of the outside diameter of the rotor and can be approximated to a cylindrical lateral surface the circular base of which is defined by the above-mentioned circumferential profile.

[0011] According to the invention, the fan unit contains first diverter means, indicated 10, for diverting the fluid that is delivered through the delivery section 5 of the fan and second, separate and distinct diverter means, indicated 11, for diverting the flow of operative fluid drawn in from outside the fan towards the intake section 4.

[0012] Moreover, the diverter means 10, 11 are selected to have an extent and shape such that the flow at the delivery section 5 of the fan crosses the flow of fluid directed towards the intake section 4, as shown schematically in Figure 3, in which the flows are directed separately and distinctly from one another by the first and second diverter means.

[0013] In Figure 3, the directions of the above-mentioned flows, which cross in a region indicated M, are marked by white-filled arrows (intake flow) and by black arrows (delivery flow), respectively.

[0014] More particularly, the first diverter means 10 comprise a respective plurality of ducts, all indicated 12, which extend in the region of the delivery section 5 of the fan, beyond the outside diameter of the rotor 2, to connect the delivery section with the area outside the fan.

[0015] The ducts 12 are distributed circumferentially, downstream of the delivery section 5, at preselected angular intervals, in particular at regular angular intervals. Moreover, each duct 12 has, at one of its ends with respect to the direction of the flow, an inlet opening 12a for the fluid (supplied by the delivery section of the fan) in which the flow has a predominant radial component, and an output opening 12b at the opposite end, in which the flow has a predominant axial component.

[0016] The second diverter means 11 in turn comprise a respective plurality of ducts, all indicated 13, which are

positioned alternately with the ducts 12 so that, in the region M in which the flows cross, a duct 13 is interposed between a pair of adjacent ducts 12.

[0017] Moreover, with respect to the direction of the flow, each duct 13 has an inlet opening 13a which is open to the area outside the fan for the admission of the fluid thereto, and an opposed outlet opening 13b communicating with a chamber 15 which in turn is connected to the intake section 4 of the fan. Stator blades, indicated 20, are also formed in the chamber 15 for suitably diverting the flow of the operative fluid towards the intake section 4; optionally, the stator blades 20 can impart to the flow a pre-rotation component which is produced by the curved profiles of the stator blades.

[0018] The ducts 13 are also preferably distributed along a circumferential profile which is concentric with the rotor axis and is located downstream of the delivery section 5. Moreover, a distribution of ducts at regular angular intervals is preferred. The inlet opening 13a of each duct is such as to impart a predominant axial component to the flow which is subsequently deflected to reach the outlet opening 13b where it has a predominant radial component at the inlet to the chamber 15, through which it is conveyed to the intake section 4 of the fan. The intake section 4 advantageously comprises the opening 4a which is coaxial with the rotor axis X.

[0019] Figure 1 shows a preferred configuration of ducts 13 of which the openings 13a for the admission of the fluid to the fan are visible.

[0020] One of the main advantages of the invention lies in the fact that, the provision of diverter means in the fan for bringing about crossing of the intake and delivery flows permits further processing of the flow output from the fan, improving the efficiency thereof, that is, improving the fluid-mechanical characteristics prior to the supply of the flow to further operative stages of the preselected application. For example, the delivery flow can be cooled by virtue of the cross-over with the intake flow owing to the respective heat-exchange, which is particularly advantageous in air-air pre-heating devices.

[0021] Another advantage is that of improving the operative conditions at the intake in terms of a quieter flow by virtue of the presence of the stator flow-straightener device arranged upstream of the intake section.

[0022] Another advantage lies in the fact that, in a fluid-mechanical machine according to the invention, a flow-rate measurement can be obtained by providing a pressure sensor in the intake chamber.

[0023] Another advantage is that further possible silencing can be achieved by the provision of sound-absorbent material on the walls of the intake chamber.

[0024] Yet another advantage is connected with the greater compactness that can be achieved by the invention in comparison with machines with similar performance characteristics.

[0025] A further advantage lies in a lower cost in comparison with known solutions since the invention incorporates within it several functions for each component.

The invention thus achieves the objects proposed, affording the above-mentioned advantages over known solutions.

Claims

1. A fluid-mechanical machine comprising a bladed rotor (2) which can be rotated about a rotation axis (X) and which can be housed in a manifold (3) in which an inlet section (4) and a delivery section (5) are defined for the operative fluid processed by the machine, said machine further comprising first and second diverter means (10, 11) for diverting the flow at the inlet to the machine and the flow supplied at the output of the machine, respectively, the first and second diverter means (10, 11) having an extent and shape such that the flow of the fluid at the output of the machine crosses the flow of fluid directed towards the inlet section of the machine, the flows being directed separately and distinctly from one another by the first and second diverter means, **characterized in that**

   - the inlet section (4) comprises an axial intake section extending in the region of the rotation axis of the rotor, **in that**
   - the delivery section (5) is a radial delivery section, and **in that**
   - the first and second diverter means (10, 11) comprise, respectively, a first plurality of ducts (12) and a second plurality of ducts (13) which are arranged alternately so that, in the region (M) in which the flows cross, a duct of one of the pluralities is interposed between a pair of ducts of the other plurality, the ducts (12) of the first plurality being defined in a stator flow-straightener device in which the corresponding ducts are in flow communication with a chamber connecting the ducts to the intake section (4) and the ducts (13) of the second plurality put the delivery section into communication with a common output section extending downstream of the region of crossed flows.

2. A fluid-mechanical machine according to Claim 1, **characterized in that** it is a centrifugal machine.

3. A machine according to Claim 1 or Claim 2, **characterized in that** it is an operative centrifugal machine.

4. A machine according to Claim 3, **characterized in that** it is a fan.

5. A machine according to Claim 1, in which the ducts (13) of the second plurality are distributed along a circumferential profile which is concentric with the rotor axis (X) and is located downstream of the de-

livery section (5), with respect to the direction of the flow.

6. A machine according to Claim 5 in which the ducts (13) of the second plurality are arranged at regular angular intervals along the circumferential profile.

Patentansprüche

1. Fluidmechanische Maschine umfassend einen beschaufelten Rotor (2), der um eine Rotationsachse (X) gedreht werden kann und der in einem Verteiler (3) untergebracht sein kann, in dem ein Einlassabschnitt (4) und ein Auslassabschnitt (5) für das von der Maschine verarbeitete Betriebsfluid definiert sind, wobei die Maschine weiter ein erstes und ein zweites Umlenkmittel (10, 11) umfasst, um den Strom am Einlass zur Maschine bzw. den zum Ausgang der Maschine geführten Strom abzuleiten, wobei das erste und das zweite Umlenkmittel (10, 11) eine solche Ausdehnung und Gestalt aufweisen, dass der Fluidstrom am Ausgang der Maschine den zum Einlassabschnitt der Maschine gerichteten Fluidstrom kreuzt, wobei die Ströme durch das erste und zweite Umlenkmittel separat und getrennt voneinander geleitet werden, **dadurch gekennzeichnet, dass**

   - der Einlassabschnitt (4) einen axialen Einlaufabschnitt umfasst, der sich in den Bereich der Rotationsachse des Rotors erstreckt, dass
   - der Auslassabschnitt (5) ein radialer Auslassabschnitt ist, und dass
   - das erste und das zweite Umlenkmittel (10, 11) jeweils eine erste Mehrzahl von Kanälen (12) und eine zweite Mehrzahl von Kanälen (13) umfassen, die abwechselnd so angeordnet sind, dass im Bereich (M), in dem die Ströme sich kreuzen, ein Kanal von der einen Mehrzahl von Kanälen zwischen ein Paar Kanäle der anderen Mehrzahl eingesetzt ist, wobei die Kanäle (12) der ersten Mehrzahl in einem Stator-Strömungsgleichrichter definiert sind, in dem die zugehörigen Kanäle in Strömungsverbindung mit einer Kammer stehen, die die Kanäle mit dem Einlassabschnitt (4) verbindet, und die Kanäle (13) der zweiten Mehrzahl den Auslassabschnitt mit einem gemeinsamen Ausgabeabschnitt in Verbindung setzen, der sich stromabwärts des Bereichs der Strömungskreuzungen erstreckt.

2. Fluidmechanische Maschine nach Anspruch 1, **dadurch gekennzeichnet, dass** sie eine Zentrifugalmaschine ist.

3. Maschine nach Anspruch 1 oder Anspruch 2, **dadurch gekennzeichnet, dass** sie eine operative Zentrifugalmaschine ist.

4. Maschine nach Anspruch 3, **dadurch gekennzeichnet, dass** sie ein Gebläse ist.

5. Maschine nach Anspruch 1, in der die Kanäle (13) der zweiten Mehrzahl entlang eines Umfangsprofils verteilt sind, das zur Rotorachse (X) konzentrisch ist, und bezüglich der Strömungsrichtung stromabwärts des Auslassabschnitts (5) gelegen ist.

6. Maschine nach Anspruch 5, in der die Kanäle (13) der zweiten Mehrzahl in regelmäßigen Winkelintervallen entlang des Umfangsprofils angeordnet sind.

Revendications

1. Machine mécanique à fluide comprenant un rotor à aube (2) qui peut être entraîné en rotation autour d'un axe de rotation (X) et qui peut être logé dans un collecteur (3) dans lequel une section d'entrée (4) et une section de distribution (5) sont définies pour le fluide opérationnel traité par la machine, ladite machine comprenant en outre des premier et deuxième moyens de déviation (10, 11) pour dévier l'écoulement au niveau de l'entrée de la machine et l'écoulement alimenté à la sortie de la machine, respectivement, les premier et deuxième moyens de déviation (10, 11) ayant une étendue et une forme de sorte que l'écoulement du fluide à la sortie de la machine croise l'écoulement du fluide dirigé vers la section d'entrée de la machine, les écoulements étant dirigés séparément et distinctement l'un de l'autre par les premier et deuxième moyens de déviation, **caractérisée en ce que** :

   la section d'entrée (4) comprend une section d'admission axiale s'étendant dans la région de l'axe de rotation du rotor, **en ce que** :
   la section de distribution (5) est une section de distribution radiale, et **en ce que** :
   les premier et deuxième moyens de déviation (10, 11) comprennent, respectivement, une première pluralité de conduits (12) et une deuxième pluralité de conduits (13) qui sont agencées de manière alternée de sorte que, dans la région (M) dans laquelle les écoulements se croisent, un conduit de l'une des pluralités est intercalé entre une paire de conduits de l'autre pluralité, les conduits (12) de la première pluralité étant définis dans un dispositif redresseur d'écoulement de stator dans lequel les conduits correspondants sont en communication d'écoulement avec une chambre raccordant les conduits à la section d'admission (4) et les conduits (13) de la deuxième pluralité placent la section de distribution en communication avec une section de

sortie commune s'étendant en aval de la région des écoulements croisés.

2. Machine mécanique à fluide selon la revendication 1, **caractérisée en ce qu'**elle est une machine centrifuge.

3. Machine selon la revendication 1 ou la revendication 2, **caractérisée en ce qu'**elle est une machine centrifuge opérationnelle.

4. Machine selon la revendication 3, **caractérisée en ce qu'**elle est un ventilateur.

5. Machine selon la revendication 1, dans laquelle les conduits (13) de la deuxième pluralité sont répartis le long d'un profil circonférentiel qui est concentrique par rapport à l'axe de rotor (X) et est positionné en aval de la section de distribution (5), par rapport à la direction de l'écoulement.

6. Machine selon la revendication 5, dans laquelle les conduits (13) de la deuxième pluralité sont agencés à des intervalles angulaires réguliers le long du profil circonférentiel.

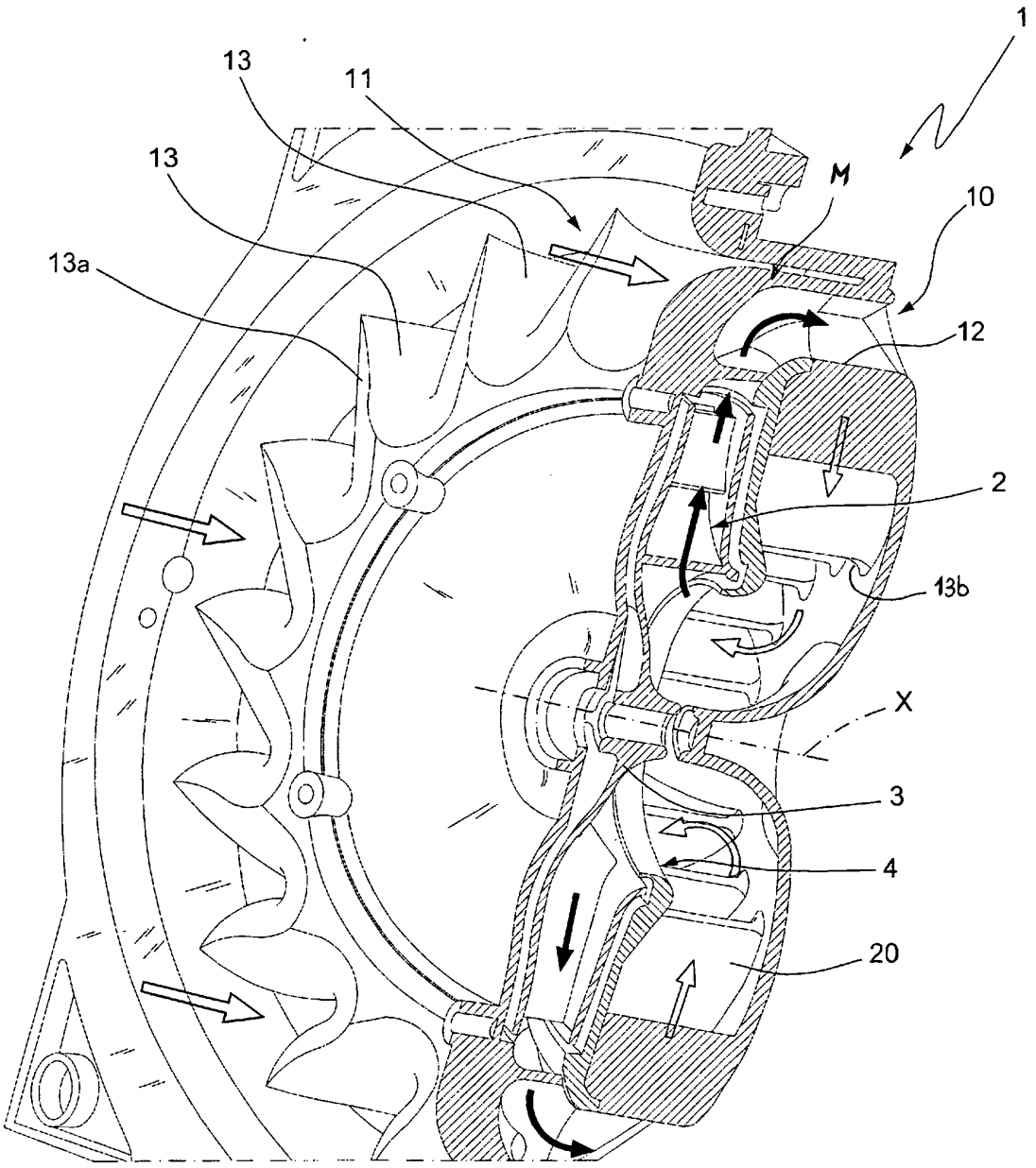

Fig.1

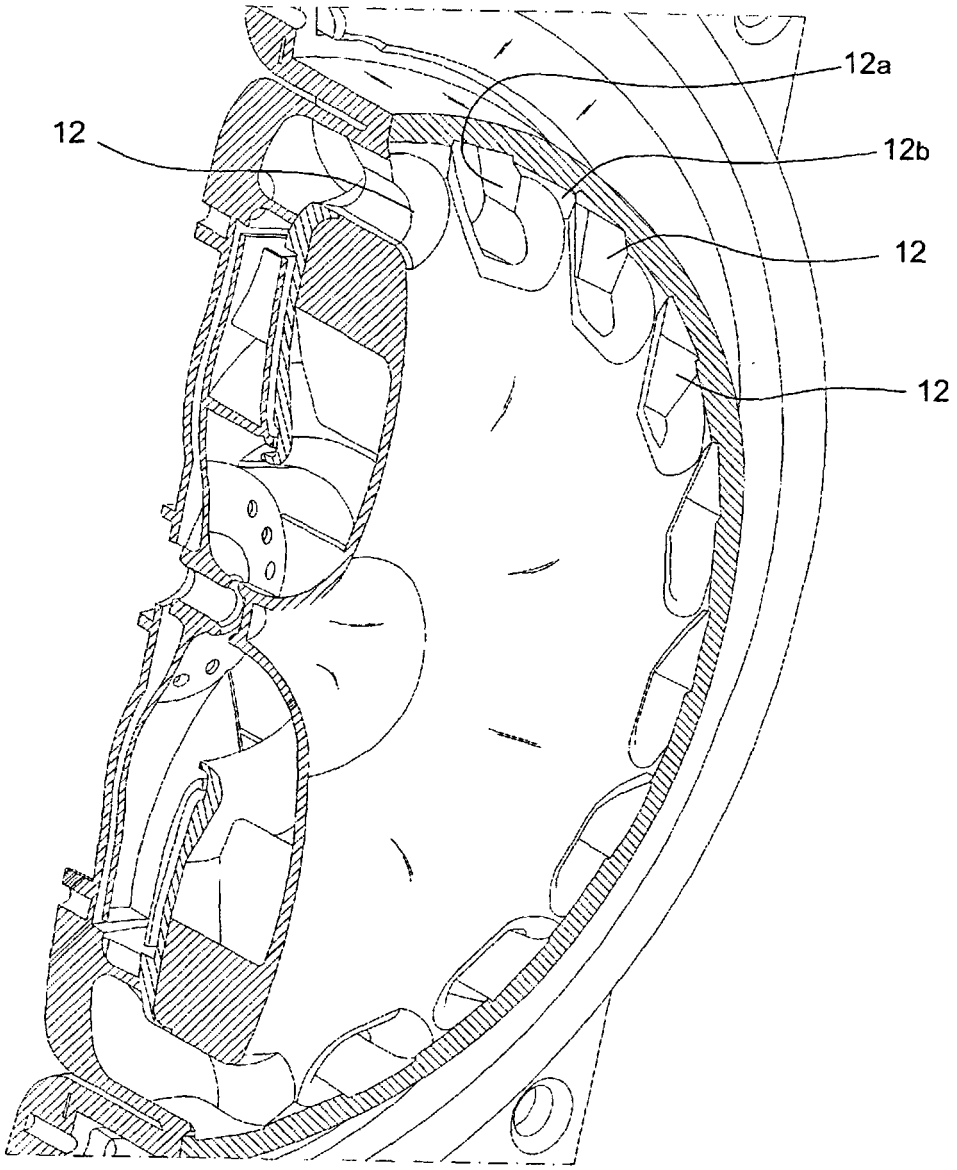

Fig. 2

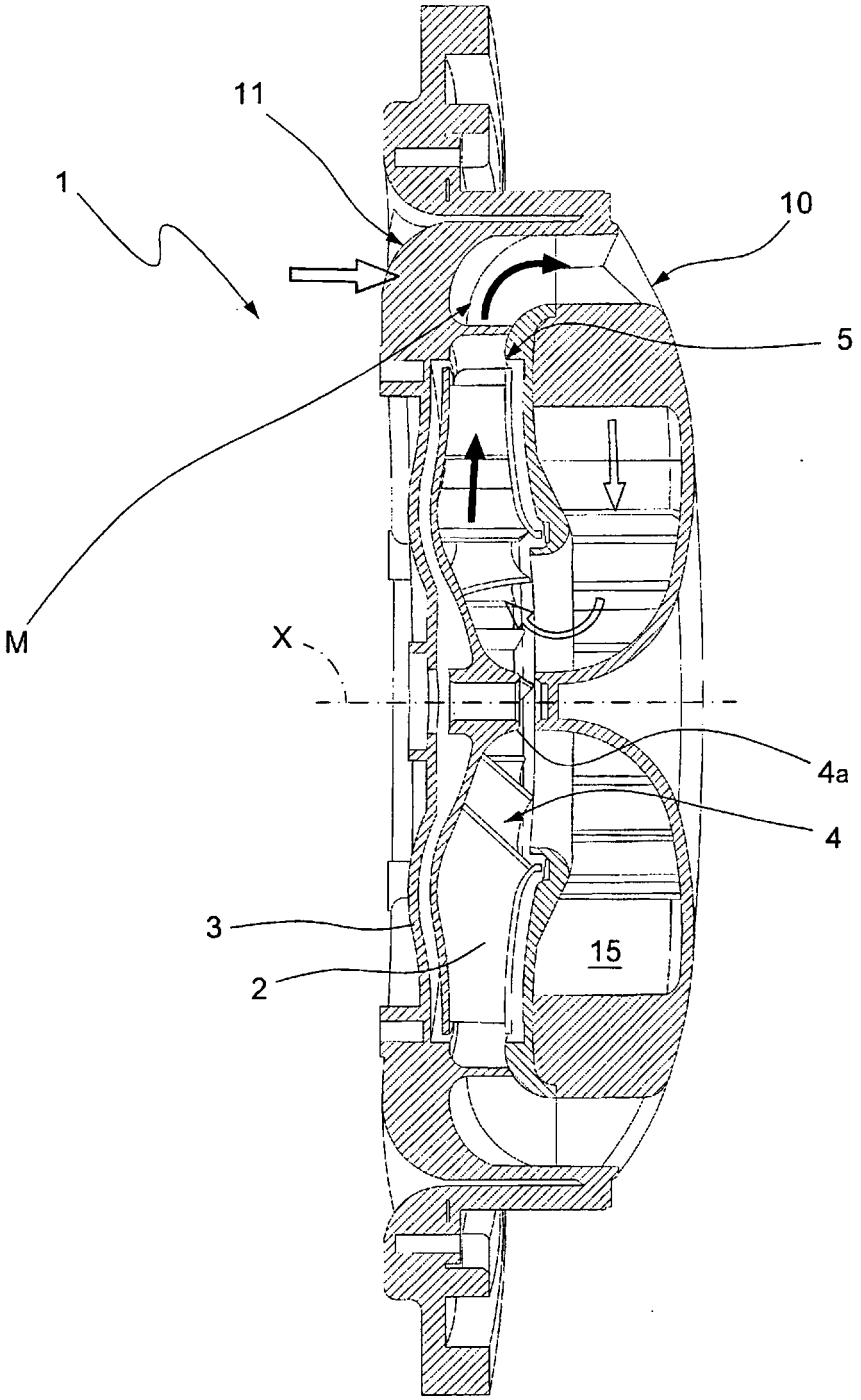

Fig. 3

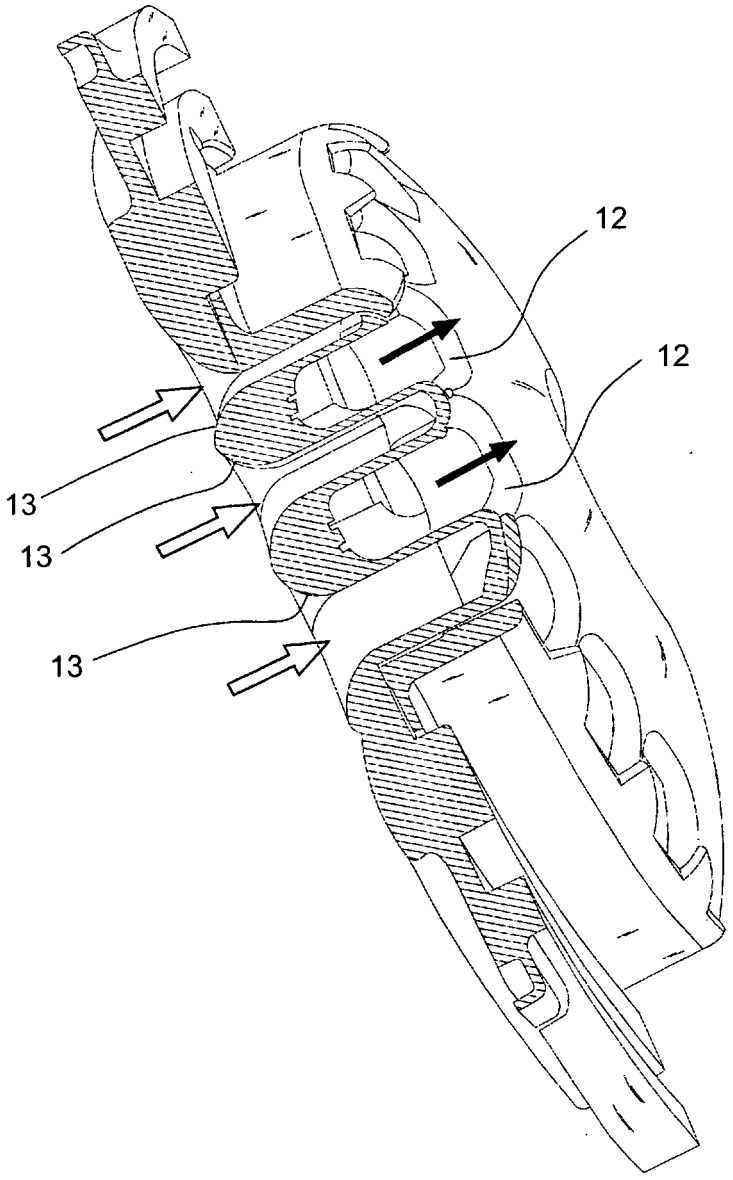

Fig. 4

REFERENCES CITED IN THE DESCRIPTION

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