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

(11) EP 0 695 854 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.02.1996 Bulletin 1996/06

(51) Int. Cl.[6]: **F01C 21/08**, F01C 1/344

(21) Application number: **95202027.9**

(22) Date of filing: **22.07.1995**

(84) Designated Contracting States:
DE ES FR GB IT SE

(30) Priority: **29.07.1994 IT MI941638**

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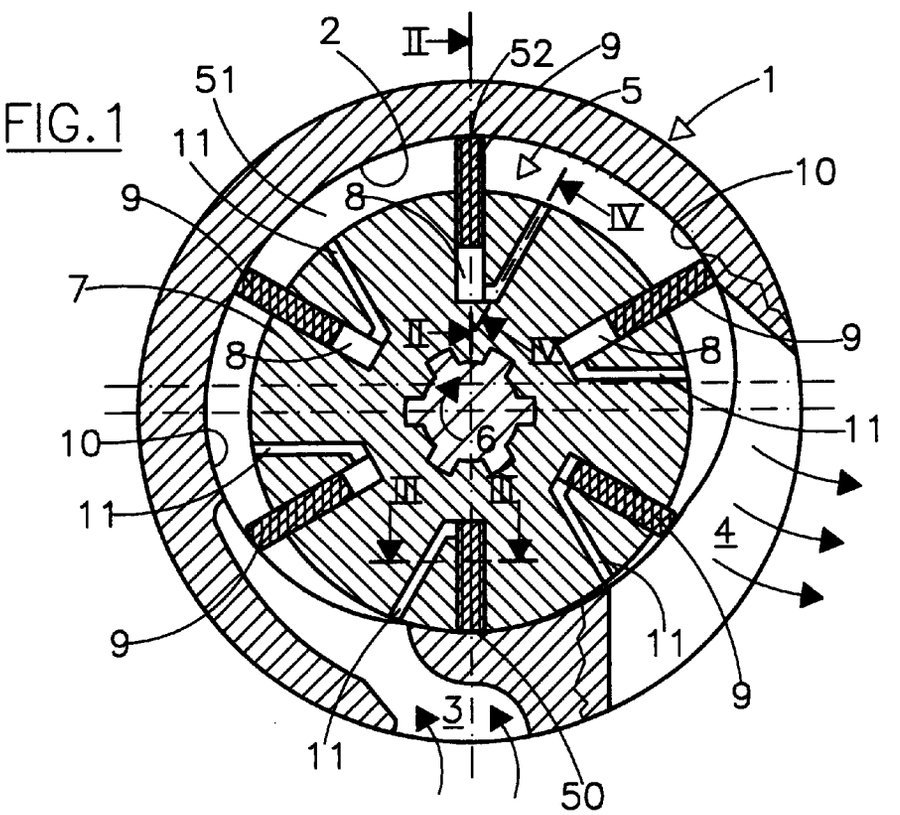
(54) Rotor for pneumatic motor

(57) A rotor for pneumatic motor comprising a stator cavity (2) wherein the rotor (5) is rotatably housed, comprises a substantially cylindrical body (7) wherein a circumferential series of radial notches (8) is formed, said notches extending along the whole length of the cylindrical body (7) itself and forming the same number of seats for respective radial blades (9) slidingly inserted in said notches (8); each of said notches (8) is related to at least one respective conduit (11) formed in said cylindrical body (7) separately and further forward in relation to said notch (8) in the direction of rotation of the rotor (5) and leading into the stator cavity (2) and into the base of the respective notch (8), to allow a pressurised fluid to penetrate the base of said notches (8) to force said blades (9) into a condition of forced engagement with an internal surface of said stator cavity (2).

FIG.1



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Description

The present invention relates to a rotor for pneumatic motor.

Pneumatic motors comprise a fixed body or stator inside whereof a cylindrical cavity, known as the stator cavity, is formed, wherein a rotor is rotatably inserted, comprising a cylindrical body of smaller diameter, integral with a motion transmission shaft. The rotor is provided with a circumferential series of radial blades extending along the whole length of the cylindrical body of the rotor. The longitudinal axis of the cylindrical body of the rotor (coinciding with the axis of rotation of the shaft) is parallel but misaligned in relation to the longitudinal axis of the stator cavity for a length sufficient for the cylindrical body of the rotor and the stator cavity to have a point of contact, and in the stator cavity an interspace is formed with an increasing section from said point of contact up to a diametrically opposed point of maximum eccentricity, and a decreasing section from the point of maximum eccentricity to the point of contact. The stator cavity is also provided with an inlet passage for a pressurised aeriform fluid (typically air) which leads into the stator cavity itself in the length with increasing section of said interspace, near the point of contact with the cylindrical body of the rotor, and a passage for discharge of said aeriform fluid, which leads into the stator cavity in the length with decreasing section of said interspace, between the point of maximum eccentricity and said point of contact. The pressurised fluid entering the stator cavity through the inlet passage exerts a thrust action on the radial blades, causing rotation of the rotor and hence of the transmission shaft, and leaves the stator cavity through the outlet passage.

The radial blades are substantially laminae slidingly inserted in respective radial seats formed by housing notches made in the cylindrical body of the rotor and which extend longitudinally along the whole length of the latter. Means are also provided for maintaining the blades in conditions of forced engagement with the internal surface of the stator cavity. The blades therefore have to project from the cylindrical body of the rotor to an extent which varies according to the section of said interspace: at the point of contact between the cylindrical body of the rotor and stator cavity, the blades are fully withdrawn into the housing notches; on moving in the direction of rotation of the rotor, the blades project to an increasing extent until they reach maximum extension at the point of maximum eccentricity.

For this purpose, pneumatic motors are known in which the pressurised fluid itself is used to press the radial blades against the internal surface of the stator cavity. This is obtained for example by means of a plurality of radial grooves formed in the two closure covers of the open ends of the stator cavity, which grooves, when the housing notches of the blades transit in front thereof, allow the pressurised fluid to penetrate the notches themselves so as to push the blades radially towards the outside.

In this way however it is not possible to ensure constant thrust on the blades, in that between one groove and the next of the closure covers the pressurised fluid cannot penetrate the housing notches.

Another known solution however provides for the formation of radial grooves along the blades themselves, so as to allow the pressurised fluid to penetrate the respective housing notches in order to push the blades radially towards the outside.

This solution has the disadvantage of not allowing the pressurised fluid to penetrate the housing notch of the blade, and hence to push the latter against the internal surface of the stator cavity, until after the blade itself, in its motion of revolution around the axis of rotation of the rotor, has exceeded the point of contact and is already in the length with increasing section of the interspace. Considering also the inertias, it is clear how there is an initial length starting from the point of contact in which the blade is not forced with the necessary pressure against the internal surface of the pressure chamber, and tightness is not therefore guaranteed. A similar, yet opposite problem, however occurs during the phase of discharging of the pressurised fluid, after the blade has transited from the point of maximum eccentricity: the blade continues to be forced against the internal surface of the stator cavity until it is positioned in front of the outlet passage, while it would be preferable for, after having exceeded the point of maximum eccentricity, the pressure of the blade against the surface of the stator cavity to decrease gradually, so as to allow better expansion of the fluid.

Furthermore, both the previous solutions are disadvantageous from the point of view of production in that they require machining not only of the rotor (to make the houses of the blades), but also of the covers or of the blades themselves, in order to form the aforementioned grooves for passage of the pressurised fluid.

In view of the state of the art described, the object of the present invention is that of providing a rotor for a pneumatic motor which overcomes the disadvantages of known rotors.

In accordance with the present invention, this object is achieved by means of a rotor for pneumatic motor comprising a stator cavity wherein the rotor is rotatably inserted, said rotor comprising a substantially cylindrical body wherein a circumferential series of radial notches is formed, extending along the whole length of the cylindrical body itself, and forming the same number of seats for respective radial blades slidingly inserted in said notches, characterised in that each of said notches is related to at least one respective conduit formed in said cylindrical body separately and further forward in relation to said notch in the direction of rotation of the rotor and leading into the stator cavity and the base of the respective notch, to allow a pressurised fluid to penetrate the base of said notches in order to force said blades into a condition of forced engagement with an internal surface of said stator cavity.

Thanks to the present invention, when, during its motion of turning around the axis of rotation of the rotor, the blade transits at the point of contact between the cylindrical body of the rotor and stator cavity, it may already receive the thrust of the pressurised fluid penetrating the base of the housing notch through the conduit placed further forward, which is already in the length with increasing section of the interspace of the stator cavity. In this way, when the blade enters the length with increasing section of the interspace, it is already effectively pushed against the internal surface of the stator cavity by the pressurised fluid. Similarly, after the blade has exceeded the point of maximum eccentricity (therefore during discharge of the pressurised fluid), since said conduit placed further forward is positioned in front of the outlet passage before the blade itself, the fluid present in the housing notch of the blade is discharged in advance in relation to the moment wherein the blade is positioned in front of the outlet passage. In this way the blade is no longer pushed against the internal surface of the stator cavity, the tightness is eliminated, and the expansion of the fluid during discharge is facilitated.

Another advantage consists of the fact that it is no longer necessary to machine the blades or other parts of the pneumatic motor other than the cylindrical body of the rotor, which has in any case to be machined to make the seats of the radial blades. The rotor according to the present invention simplifies the process of manufacture of the pneumatic motor, at the same time guaranteeing the same functional characteristics of known pneumatic motors.

The features of the present invention will be made clearer by the following detailed description of one of its embodiments, illustrated by way of a non-limiting example in the accompanying drawings, in which:

Figure 1 is a sectioned view along a transverse plane of a pneumatic motor comprising a rotor according to the invention;

Figure 2 is a partial section along plane II-II of Figure 1;

Figure 3 is a partial section along plane III-III of Figure 1;

Figure 4 is a partial section along plane IV-IV of Figure 1.

With reference to Figure 1, a pneumatic motor comprises, in a manner in itself known, a stator 1 formed substantially by a cylindrical body, wherein a stator cavity 2 with a substantially cylindrical shape is formed, having ovalisations or convexings 10 (indicated by the displacement of the profile of the stator cavity in relation to an ideal cylindrical profile which can be seen as a dotted and dashed line in Figure 1) as described in a contemporary patent application for industrial invention in the name of the same applicant. Two passages 3 and 4 are also provided in the stator 1, for inflow into the stator cavity 2 and for discharge respectively from the same of a pressurised aeriform fluid, typically compressed air. The two passages lead into the stator cavity 2 in separate points along a longitudinal axis (perpendicular to the plane of the drawing) of the stator cavity 2 itself. The stator cavity is closed at the two ends by two respective sealed covers 12 (one of which can be seen in Figure 2).

Inside of the stator cavity 2 a rotor 5 is rotatably inserted, comprising a cylindrical body 7 integral with a motion transmission shaft 6, which is coupled to the rotor 5 by means of a cogged coupling. The longitudinal axis of the rotor 5, coinciding with its axis of rotation, is parallel but misaligned in relation to the longitudinal axis of the stator cavity 2. The misalignment is such that the cylindrical body 7 and the stator cavity 2 have a common point of contact 50. Thus an interspace 51 is formed between the wall of the stator cavity 2 and the external surface of the cylindrical body 7, the interspace having a length with increasing section between the point of contact 50 and a point of maximum eccentricity 52, diametrically opposed, and a length with decreasing section between the point of maximum eccentricity 52 and the point of contact 50.

In the cylindrical body 7 a circumferential series of radial notches 8 is also formed and which extend along the entire length of the cylindrical body 7 (Fig. 2), and in each of which a respective radial blade 9 is slidingly housed. For each notch 8 two grooves 11 are provided, formed on the two opposite head faces of the cylindrical body 7, having a substantially "L" shape, and which start from the external surface of the cylindrical body 7, extend radially towards the axis of the cylindrical body 7 (Fig. 4), and bend in an "L" shape to end on the base of the respective notch 8 (Figs. 1 and 2). The grooves 11 are further forward in relation to the respective radial notch 8 in the direction of rotation of the rotor inside the stator cavity 2.

During operation of the pneumatic motor, the compressed air entering the stator cavity through the inlet passage 3 disperses clockwise and exerts a thrust action on the blades 9, causing rotation of the rotor 5. The compressed air in the stator cavity 2 moreover, passing through the grooves 11, penetrates the base of the notches 8, thus causing the centrifugal radial thrust of the blades 9, which are in this way maintained in a condition of forced engagement with the internal surface of the stator cavity 2.

Thanks to the fact that the grooves 11 are further forward in relation to the respective radial notch 8 whereto they are related in the direction of rotation of the rotor inside the stator cavity 2, when a blade 9 is positioned at the point of minimum eccentricity 50, the grooves 11 are already in the length with increasing section of the interspace 51, and the compressed air can therefore penetrate through them into the base of the notch 8. The blade 9 is thus pushed beforehand against the internal surface of the stator cavity 2, and when, after having passed beyond the point 50, it enters the length with increasing section of the interspace 51, tightness is guaranteed.

Similarly, when a blade 9 is in the length with decreasing section of the interspace 51 but has not yet reached the outlet passage 4, the grooves 11 related to the notch 8 wherein the blade is housed are already opposite the outlet passage 4. The compressed air in the notch 8 is thus discharged before the blade 9 reaches the outlet passage 4, so that the same blade 9 is no longer pushed against the internal surface of the stator cavity 2. This encourages expansion of air in the length downstream of the point of maximum eccentricity 52 (Fig. 1).

Claims

1. Rotor for pneumatic motor comprising a stator cavity (2) wherein the rotor (5) is rotatably housed, said rotor (5) comprising a substantially cylindrical body (7) wherein a circumferential series of radial notches (8) is formed, which notches extend for the entire length of the cylindrical body (7) itself, forming the same number of seats for respective radial blades (9) slidingly inserted in said notches (8), characterised in that each of said notches (8) is related to at least one respective conduit (11) formed in said cylindrical body (7), separately and further forward in relation to said notch (8) in the direction of rotation of the rotor (5) and leading into the stator cavity (2) and the base of the respective notch (8) to allow a pressurised fluid to penetrate the base of said notches (8) in order to force said blades (9) into a condition of forced engagement with an internal surface of said stator cavity (2).

2. Rotor for pneumatic motor according to claim 1, characterised in that said conduit, at least one, comprises a groove (11) formed in an end face of said cylindrical body (7).

3. Rotor for pneumatic motor according to claim 1, characterised in that said conduit, at least one, comprises a pair of grooves (11) formed in two opposite end faces of said cylindrical body (7).

4. Rotor for pneumatic motor according to claim 3, characterised in that each of said grooves (11) comprises a substantially radial length extending from the external surface of said cylindrical body (7) for a length substantially equal to the depth of said notches (8), and a transverse length connected to the base of a respective notch (8).

FIG.1

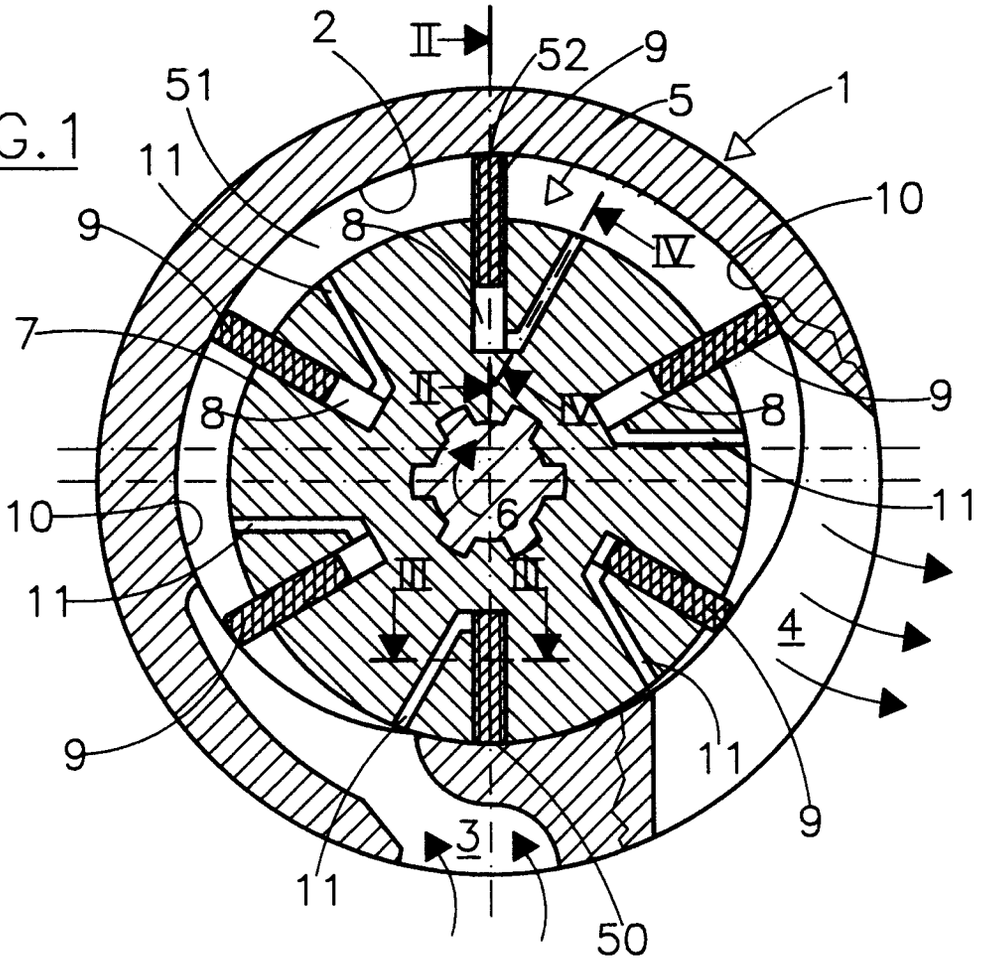
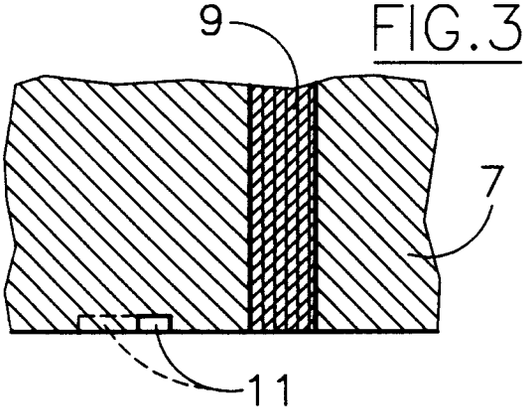


FIG.3



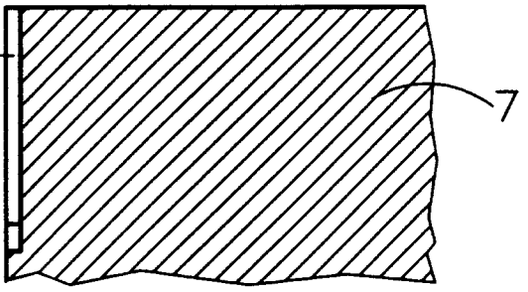


FIG.4

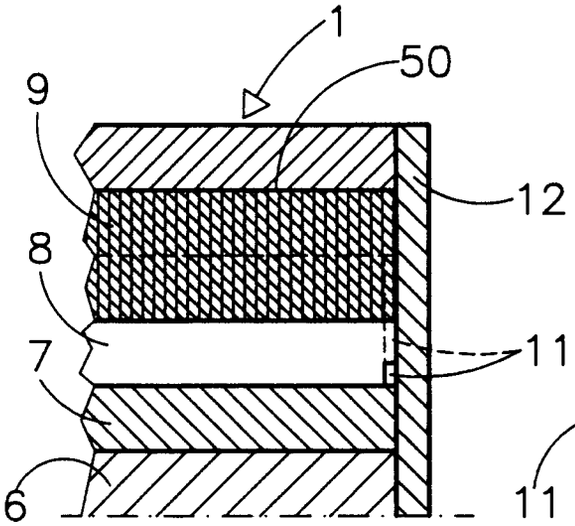


FIG.2

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EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2027

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	FR-A-2 095 507 (A. PIERBURG AUTO- UND LUFTFAHRT-GERÄTEBAU KG) * the whole document *	1-4	F01C21/08 F01C1/344
X	GB-A-1 605 285 (SECRETERY OF STATE FOR DEFENCE) * the whole document *	1,2	
X	PATENT ABSTRACTS OF JAPAN vol. 7 no. 223 (M-247) [1368] ,4 October 1983 & JP-A-58 117382 (MATSUSHITA DENKI SANGYO K.K.) 12 July 1983, * abstract *	1,2	
A	US-A-3 869 231 (ADAMS) * the whole document *	1	
A	FR-A-590 085 (PLANCHE) * the whole document *	1	
A	FR-A-1 078 008 (LLOUBÈS) * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F01C
A	FR-A-2 467 970 (USHIO KOGYO CO. LTD.) * the whole document *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 October 1995	Dimitroulas, P

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