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

(11) EP 0 695 855 A1

(12) EUROPEAN PATENT APPLICATION

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

(51) Int. Cl.[6]: **F01C 21/10**, F01C 1/344

(21) Application number: **95202028.7**

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

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

(30) Priority: **29.07.1994 IT MI941639**

(71) Applicant: **Valentini, Guido**
I-20100 Milano (IT)

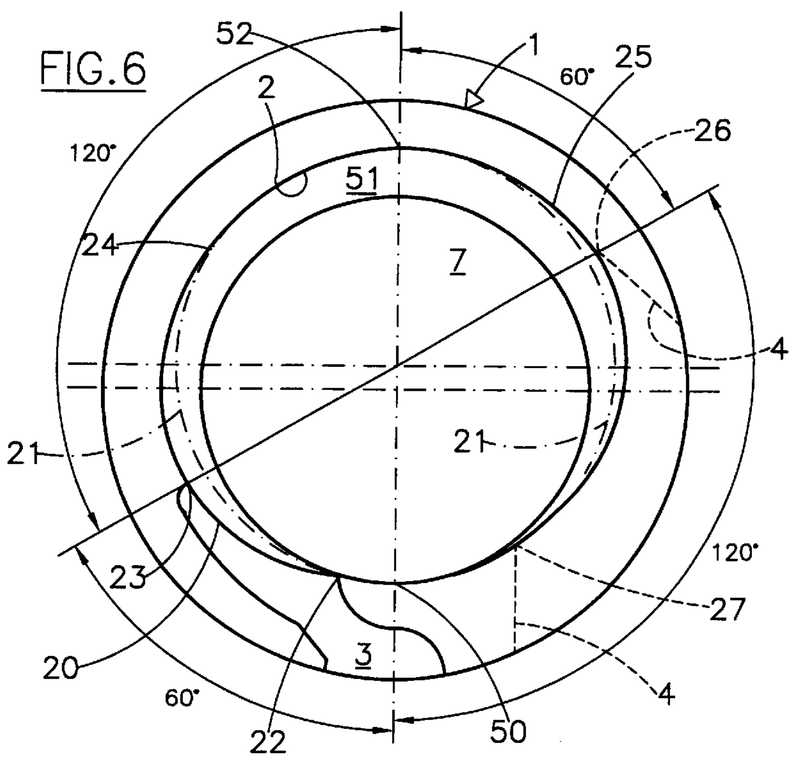
(72) Inventor: **Valentini, Guido**
I-20100 Milano (IT)

(74) Representative: **Mittler, Enrico et al**
I-20131 Milano (IT)

(54) Stator for pneumatic motor

(57) A stator for pneumatic motor comprises a fixed body (1) inside whereof a substantially cylindrical stator cavity (2) is formed wherein a rotor (5) is rotatably housed in an eccentric position to form with the stator cavity (2) an interspace (51) having a length with increasing section from a point of minimum eccentricity (50) to a point of maximum eccentricity (52), and a length with decreasing section from the point of maximum eccentricity (52) to the point of minimum eccentricity (50); the stator comprises an inlet passage (3) for a pressurised fluid, leading into the stator cavity (2) in the increasing section length of said interspace (51), and an outlet passage (4) for the pressurised fluid leading into the stator cavity (2) in the decreasing section length of said interspace (51); the substantially cylindrical stator cavity (2) is provided with a first ovalisation (20) in the increasing section length of the interspace (51) at the inlet passage (3) of the fluid, in order to increase the section of said interspace (51) in relation to a perfectly cylindrical profile (21).

FIG.6



EP 0 695 855 A1

Printed by Rank Xerox (UK) Business Services
2.9.9/3.4

Description

The present invention relates to a stator 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 itself. 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 (or point of minimum eccentricity) up to a diametrically opposed point of maximum eccentricity, and then decreasing from the point of maximum eccentricity to the point of minimum eccentricity. 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 increasing section length 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 decreasing section length of said interspace, between the point of maximum eccentricity and the point of minimum eccentricity. 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 project from the cylindrical body of the rotor to an extent which varies according to the section of said interspace.

It is clear that, in the point wherein the inlet passage of the pressurised fluid leads into the stator cavity, the section of the interspace being still small in said point, the active surface of the blades (i.e. the surface of the length of blade between the cylindrical body of the rotor and the internal surface of the stator cavity) is small, and therefore is not able to exploit to the full the pressure of the fluid, which is maximum in that point. This causes a reduction in the efficiency of the motor, on a par with other conditions.

In view of the state of the art described, the object of the present invention is that of providing a stator for a pneumatic motor which overcomes the above mentioned disadvantage.

In accordance with the present invention, this object is achieved by means of a stator for pneumatic motor comprising a fixed body wherein a substantially cylindrical stator cavity is formed wherein a rotor is rotatably housed in an eccentric position to form with the stator cavity an interspace having a length with increasing section from a point of minimum eccentricity to a point of maximum eccentricity, and a length with decreasing section from the point of maximum eccentricity to the point of minimum eccentricity, said stator comprising an inlet passage for a pressurised fluid, leading into the stator cavity in the length with increasing section of said interspace, and an outlet passage for the pressurised fluid leading into the stator cavity in the length with decreasing section of said interspace, characterised in that said substantially cylindrical stator cavity is provided with a first ovalisation, in the length with increasing section of the interspace at the fluid inlet passage, in order to increase the section of said interspace in relation to a perfectly cylindrical profile.

Thanks to the present invention, the section of said interspace near the inlet of the pressurised fluid is increased in relation to the case of a perfectly cylindrical stator cavity. The active surface of the blades of the rotor is thus increased and as a result the efficiency of the pneumatic rotor increases.

In accordance with a preferred solution, the stator cavity also comprises a second ovalisation in the length with decreasing section of said interspace, to maintain the section of said interspace constant in a length between the point of maximum eccentricity and a mouth of the outlet passage of the pressurised fluid.

In this way the fluid is prevented from compressing due to the decrease in the section of the interspace between the point of maximum eccentricity and the outlet passage, compression which occurs however in the case of a cylindrical stator cavity, thus causing a braking action by the fluid on the blades of the rotor.

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;

Figure 5 is a similar view to Figure 1, with the rotor rotated;

Figure 6 is a schematic view of a stator according to the present invention.

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. 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, or point of minimum eccentricity. 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 minimum eccentricity 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 minimum eccentricity 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. As described in a contemporary patent application for industrial invention in the name of the same applicant, for each notch 8 two grooves 11 are provided, formed on the two opposite head faces of the cylindrical body 7, which have a substantially "L" shape and which start from the external surface of the cylindrical body 7, extending 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 radial notches 8 in the direction of rotation of the rotor 5.

The stator cavity 2 which, as mentioned, has a substantially cylindrical shape, nevertheless comprises a first ovalisation 20, seen more clearly in Figure 6 where the displacement of the profile of the stator cavity 2 in relation to a cylindrical profile 21 is shown as a dotted and dashed line, in order to increase the section of the interspace 51 in a more marked manner than in the case of an exactly cylindrical cavity. The ovalisation 20 starts substantially at the upstream edge 22 of the inlet passage 3 for compressed air and reaches peak value at the downstream edge 23 of the inlet passage 3, placed at 60° in relation to the point of minimum eccentricity 50. The ovalisation 20 then decreases gradually until the profile of the stator cavity 2 joins up again with the cylindrical profile 21, in a point 24 placed between the downstream edge 23 of the inlet passage 3 and the point of maximum eccentricity 52. In this way the section of the interspace 51 at the inlet passage 3 for compressed air and in the immediately subsequent section is greater than if the stator cavity 2 were perfectly cylindrical. This causes an increase in the active surface of the blades 9 at the inlet passage 3 for compressed air, where the pressure of the air is greater, and hence better efficiency of the motor.

The stator cavity 2 also has a second ovalisation 25 which allows the section of the interspace 51 to be maintained substantially constant in the length from the point of maximum eccentricity 52 to the upstream edge 26 of the air outlet 4, placed at an angle of 60° in relation to the point of maximum eccentricity 52. In this way the section of the interspace 51 is prevented from starting to decrease from the point of maximum eccentricity 52, as in the case of a perfectly cylindrical cavity, causing a reduction in the available volume of air and hence a gradual compression of the latter in an area wherein it is however appropriate for the air to expand as freely as possible to then be discharged. The increase in pressure in the length of the interspace 51 between the point 52 and the outlet 4 slows down the motion of the rotor 5, causing a loss of power. Having exceeded the point 26, the ovalisation 25 decreases gradually until the profile of the stator chamber 2 joins up again with the cylindrical profile 21, approximately near the downstream edge 27 of the outlet 4.

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.

Claims

1. Stator for pneumatic motor comprising a fixed body (1) inside whereof a substantially cylindrical stator cavity (2) is formed wherein a rotor (5) is rotatably housed in an eccentric position, forming with the stator cavity (2) an interspace (51) having a length with increasing section from a point of minimum eccentricity (50) to a point of maximum eccentricity (52), and a length with decreasing section from the point of maximum eccentricity (52) to the point of minimum eccentricity (50), said stator comprising an inlet passage (3) for a pressurised fluid, leading into the stator cavity (2) in the length with increasing section of said interspace (51), and an outlet passage (4) for the pressurised fluid leading into the stator cavity (2) in the length with decreasing section of said interspace (51), characterised in that said substantially cylindrical stator cavity (2) is provided with a first ovalisation (20) in the length with increasing

section of the interspace (51) at the inlet passage (3) for the fluid, in order to increase the section of said interspace (51) in relation to a perfectly cylindrical profile (21).

2. Stator for pneumatic motor according to claim 1, characterised in that the stator cavity (2) moreoever comprises a second ovalisation (25) in the length with decreasing secton of said interspace (51), in order to maintain the section of said interspace (51) substantially constant in a length between the point of maximum eccentricity (52) and a mouth (26) of the outlet passage (4) of the pressurised fluid.

3. Stator for pneumatic motor according to claim 1, characterised in that said rotor (5) 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), means (11) being provided for maintaining said radial blades (9) in conditions of forced engagement with an internal surface of said stator cavity (2).

4. Stator for pneumatic motor according to claim 3, characterised in that said means (11) comprise a pair of grooves (11) for each radial notch (8), said grooves (11) being formed in two end faces of said cylindrical body in order to be positioned further forward in relation to said notch (8) in the direction of rotation of the rotor (5) and leading into the base of said radial notch (8) to allow the pressurised fluid to penetrate said notches (8) to force said blades (9) into conditions of forced engagement against the internal surface of the stator cavity (2).

FIG.1

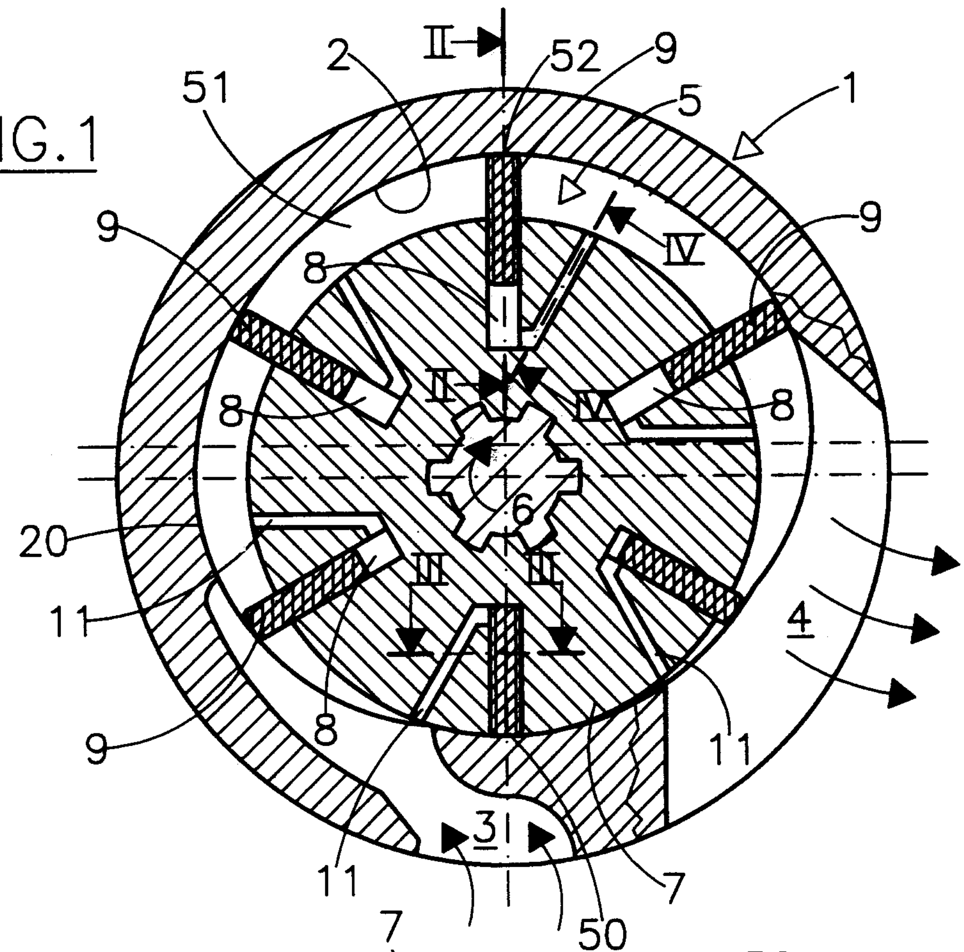

II
2
52
9
51
5
1
9
IV
9
8
8
II
IV
8
6
20
11
II
II
4
9
8
11
11
3
7
50

FIG.5

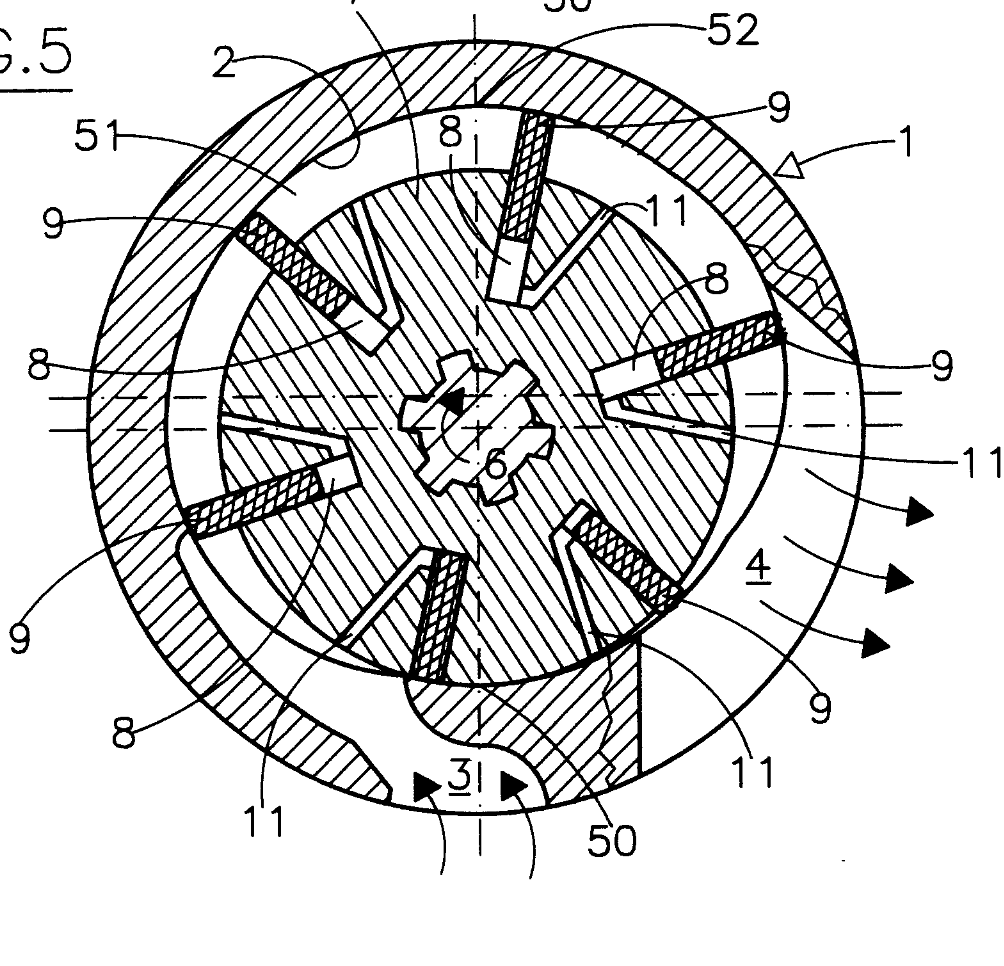

7
52
2
9
51
8
1
9
11
8
8
9
6
11
4
9
9
8
11
11
3
50

FIG.6

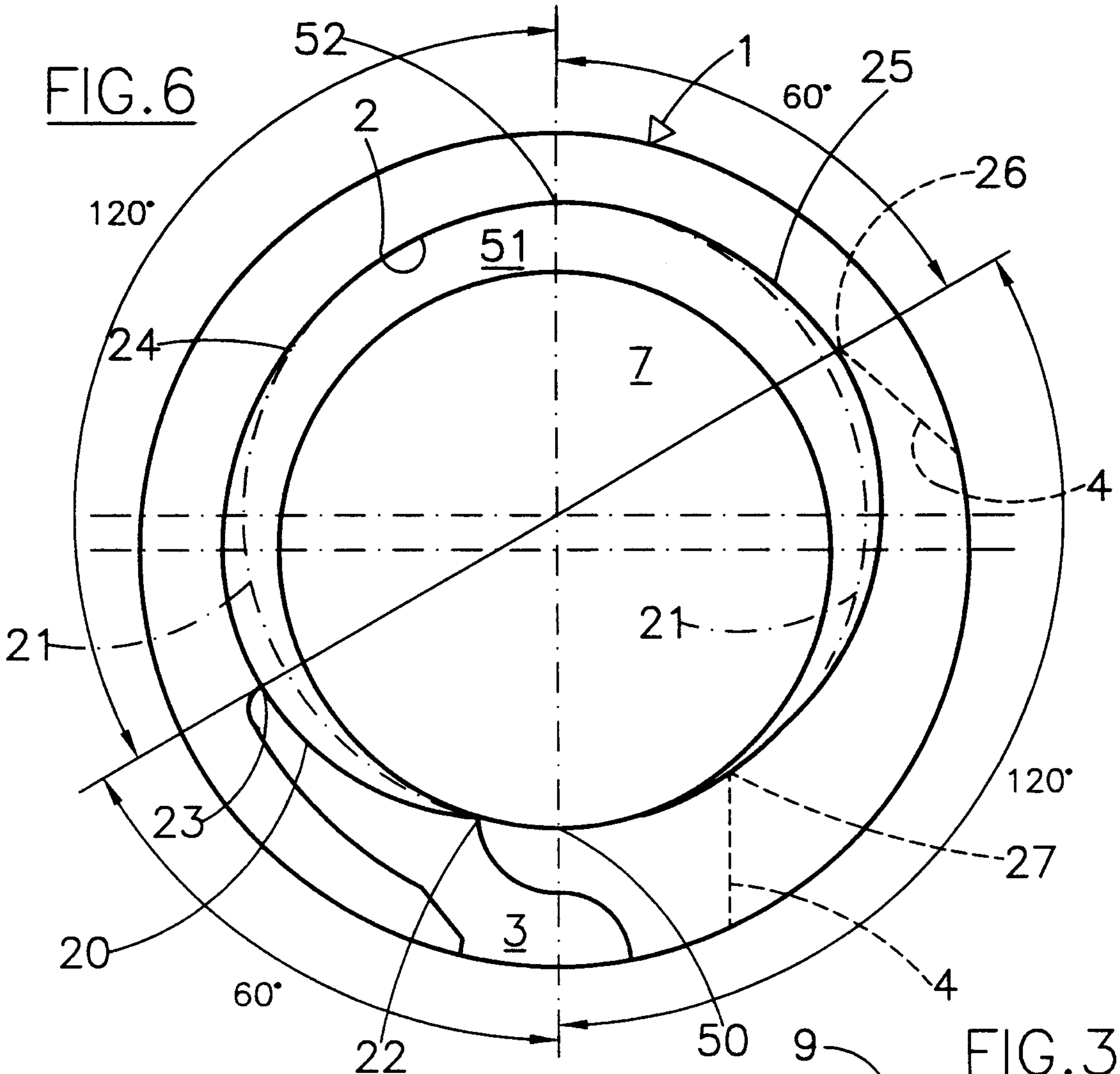
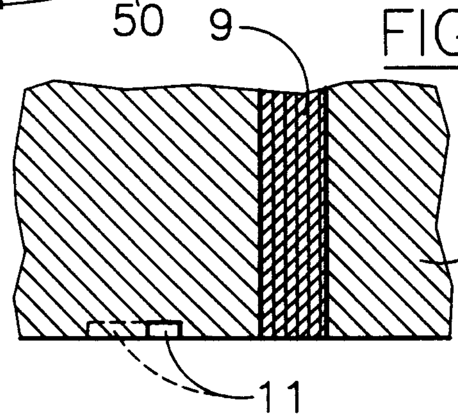


FIG.3



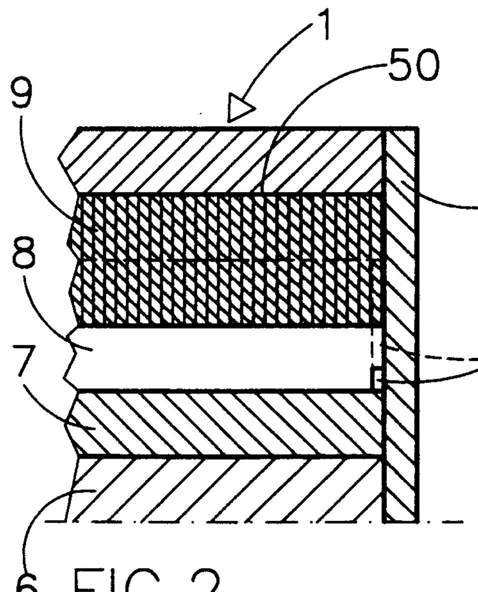


FIG.2

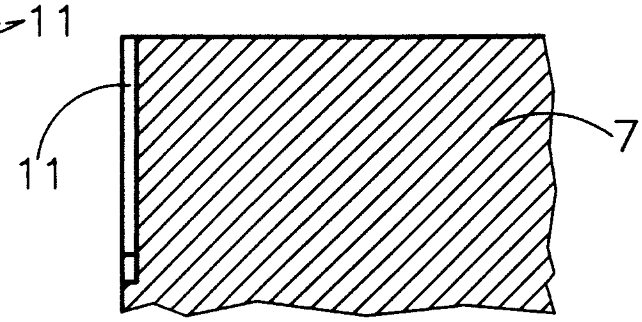


FIG.4

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 20 2028

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 Y	US-A-5 310 326 (GUI ET AL.) * the whole document *	1-3 4	F01C21/10 F01C1/344
Y	FR-A-2 095 507 (A. PIERBURG AUTO- UND LUFTFAHRT-GERÄTEBAU KG) * the whole document *	4	
A	US-A-2 347 944 (FOWLER) * the whole document *	1	
A	US-A-3 499 600 (MCGREGOR) * the whole document *	1	
A	US-A-3 452 725 (KELLY) * the whole document *	1	
A	GB-A-1 605 285 (SECRETARY OF STATE FOR DEFENCE) * the whole document *	4	
A	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 *	4	TECHNICAL FIELDS SEARCHED (Int.Cl.6) F01C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	27 October 1995	Dimitroulas, P

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)