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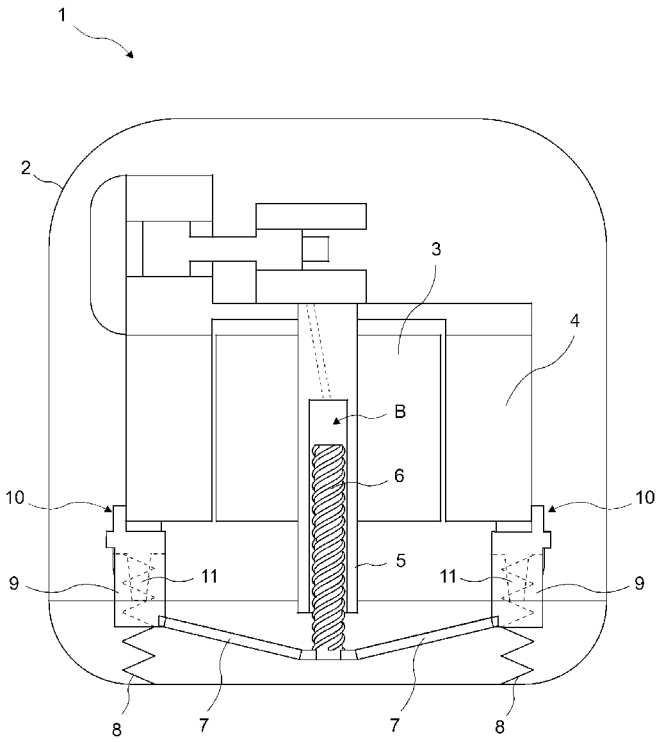
(54) **Title**: HERMETIC COMPRESSOR WITH OIL SUCKING MEMBER

Figure 1



(57) **Abstract**: The present invention relates to a hermetic compressor (1) comprising a casing (2), a motor having a rotor (3) and a stator (4), a crankshaft (5) that is snap-fittingly mounted to the core of the rotor (3) in the direction of the rotation axis thereof and that provides the rotational motion of the rotor (3) to be transmitted to the piston, the lower end of which is immersed into the oil in the casing (2), a gap (B) formed by punching the crankshaft (5) body in the axial direction starting from the lower end of the crankshaft (5), an oil sucking member (6) disposed through the lower end of the crankshaft (5) into the interior thereof and concentrically with the crankshaft (5), that is stationary during the rotation of the rotor (3) and the crankshaft (5), and at the outer circumference of which a helical groove that transports the oil in the casing (2) to the crankshaft (5) is disposed.

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RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

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Description

HERMETIC COMPRESSOR WITH OIL SUCKING MEMBER

[0001] The present invention relates to a hermetic compressor comprising an oil sucking member, the lubrication conditions of the movable members of which are improved.

[0002] In the reciprocating hermetic compressors used in refrigerators, the sliding bearings wherein the crankshaft operates and the other movable members are lubricated with the oil disposed in the compressor casing. In compressors, lubrication provides friction losses of the movable members to be decreased, abrasion to be prevented and heat to be removed by decreasing the temperature of the compressor members. In the compressor lubrication system, the oil at the base of the casing is sucked to be delivered to the bearings and compressor members that are to be lubricated. Generally, the centrifugal force that acts on the oil as a result of the rotation of the crankshaft is utilized for delivering the oil at the base of the casing to the bearings. In variable capacity compressors used in refrigerators, the refrigeration capacity that changes depending on the operating conditions is provided by changing the compressor rotational speed. Since the compressor motor operates at low speed in cases where low capacity is to be met, abrasion may occur in bearings operating in hydrodynamic lubrication conditions. In order to deliver the oil required in cases where the compressor motor operates at low speed, a cylindrical oil sucking member having helical oil transportation grooves is concentrically disposed at the lower end of the crankshaft immersed into oil in the rotation axis of the crankshaft. The vibrations of the compressor motor during operation affects the concentric position of the oil sucking member and this may cause the oil sucking capacity thereof to decrease and the pumping of insufficient oil to the bearings.

[0003] In the state of the art United States Patents No. US6716001 and US6450785, and European Patents No. EP0815360 and EP1412640, a cylindrical oil supply apparatus with helical grooves that is used in hermetic compressors, disposed at the lower end of the crankshaft and that is stationary during the operation of the motor is explained.

[0004] The aim of the present invention is the realization of a hermetic compressor comprising an oil sucking member the concentric position in the crankshaft of which is maintained during the operation of the motor.

[0005] The hermetic compressor realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof comprises a crankshaft mounted to the rotor core and the lower end of which is immersed into the oil in the outer casing, an oil sucking member disposed through the lower end of the crankshaft into the interior thereof and concentrically with the crankshaft and at the outer circumference of which a helical groove is disposed. The oil sucking member is secured to the stator by means of the support arms extending from the lower surface thereof sideways. A supporting block strengthening the support arms by increasing the rigidity is disposed at the end of the support arms from which they are secured to the stator. The support arms are produced from plastic material in terms of cost advantages and ease of assembly, and the rigidity thereof is increased by means of the supporting block again produced from plastic material. Furthermore, centering extensions are disposed on the supporting block, that extend upwards with respect to the circular lateral surface of the stator or the circular inner surface surrounding the rotor, thus the oil sucking member is concentrically disposed into the crankshaft.

[0006] In an embodiment of the present invention, more than one supporting block is fixed on the lower surface of the stator, along the edge thereof and arc-shaped centering extensions are disposed on each supporting block, that support onto the lateral surface by extending towards the circular lateral surface of the stator.

[0007] In another embodiment of the present invention, a rectangular stator with rounded corners is used and centering extensions bearing against the rounded portions of the lateral surface of the stator are disposed.

[0008] In another embodiment of the present invention, the supporting block is in closed curve form corresponding to the contour of the stator used in the hermetic compressor and is placed in the vicinity of the periphery of the lower surface of the stator.

[0009] In another embodiment of the present invention, the supporting block is in ring form and is seated in the vicinity of the inner edge of the lower surface of the stator surrounding the rotor, and a circular centering extension extending upwards and bearing against the inner surface of the stator is disposed on the supporting block.

[0010] In another embodiment of the present invention, more than one rod-shaped centering extension extending into the coil cavities of the stator is disposed on the ring-shaped supporting block.

[0011] In another embodiment of the present invention, the vibrations of the motor in the hermetic compressor are absorbed by springs placed between the lower surface of the stator and the casing, and legs mounted to the springs extending downwards are disposed on the supporting block.

[0012] In another embodiment of the present invention, the oil sucking member, support arms, supporting block, centering extensions and legs are produced from plastic material as a single piece.

[0013] In the hermetic compressor of the present invention, the oil sucking member providing oil to be delivered to the movable members and the sliding bearings for lubrication is rigidly secured into the crankshaft by means of the supporting block and the centering extensions disposed at the support arm ends to which the stator is secured, and prevent the oil sucking member from hitting the inner walls of the crankshaft while the motor continuously operates concentrically with the crankshaft or during transportation by the motor and the crankshaft oscillating together. The support arms, the supporting block and the oil sucking member are produced from plastic material as a single piece, thus ease of assembly and cost advantage are provided.

[0014] The hermetic compressor realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

[0015] Figure 1 - is the schematic view of a hermetic compressor comprising an oil sucking member.

[0016] Figure 2 - is the perspective view of an oil sucking member, support arms and supporting blocks.

[0017] Figure 3 - is the perspective view of an oil sucking member and a

ring-shaped supporting block with a circular centering extension thereon.

[0018] Figure 4 - is the perspective view of an oil sucking member and a supporting block with rod-shaped centering extensions thereon.

[0019] Figure 5 - is the schematic view of a hermetic compressor comprising an oil sucking member in another embodiment of the present invention.

[0020] Figure 6 - is the schematic view of a stator and a rotor, and a supporting block matching with the stator shape.

[0021] The elements illustrated in the figures are numbered as follows:

1. Hermetic compressor
2. Casing
3. Rotor
4. Stator
5. Crankshaft
6. Oil sucking member
7. Support arm
8. Spring
9. Supporting block
10. Centering extension
11. Leg

[0022] The hermetic compressor (1) comprises a casing (2) supporting the members and oil lubricating the movable members is filled wherein, a variable speed motor having a rotor (3) and a stator (4), a piston providing the refrigerant fluid to be delivered to the cooling system in a pressurized state, a cylinder wherein the piston operates, a crankshaft (5) that is snap-fittingly mounted to the core of the rotor (3) in the direction of the rotation axis of the rotor (3) and that provides the rotational motion of the rotor (3) to be transmitted to the piston, the lower end of which is immersed into the oil in the casing (2) and wherein a gap (B) opening into the body of the crankshaft (5) in the axial direction starting from the lower end of the crankshaft (5) is disposed, an oil sucking member (6) in cylindrical form, disposed through the lower end of the crankshaft (5) into the interior thereof and concentrically with the crankshaft (5), produced from plastic material, having a helical groove that transports the oil in the

casing (2) to the crankshaft (5) disposed at the outer circumference of the oil sucking member (6), more than one support arm (7) produced from plastic material, securing the oil sucking member (6) to the stator (4), one end of which is connected to the lower surface of the oil sucking member (6) and the other end of which is connected to the stator (4) by extending from the oil sucking member (6) sideways in the radial direction and more than one spring (8) that is placed between the lower surface of the stator (4) and the casing (2) and that absorbs the vibrations of the motor in the axial direction.

[0023] The hermetic compressor (1) of the present invention comprises one or more than one supporting block (9) to which the ends of the support arms (7) extending to the stator (4) are connected and that is seated onto the planar lower surface of the stator (4) and one or more than one centering extension (10) connected to the supporting block (9), bearing onto the circular lateral surface of the stator (4) or onto the circular inner surface of the stator ($) surrounding the rotor (3) by extending upwards from the lower surface of the stator (4) (Figure 1, Figure 5).

[0024] The oil sucking member (6) is stationary in the gap (B) in the crankshaft (5) during the operation of the motor, since it is fixed to the stator (4) by means of the support arms (7). The lower end of the crankshaft (5) is in a position to be immersed into the oil in the casing (2) and the oil in the casing (2) is sucked into the crankshaft (5). Oil sucked is carried upwards to the gap (B) inside the crankshaft (5) and from here to the movable elements on the motor such as cylinder, piston, piston rod and sliding bearings by means of the helical groove on the oil sucking member (6) placed into the crankshaft (5) concentrically. The oil sucking member (6) and the support arms (7) connecting the oil sucking member (6) to the stator (4) are produced from plastic material due to ease of production and assembly, low heat transmission and cost advantages. Since the oil sucking member (6) is secured to the stator (4), motor vibrations generated during the operation of the hermetic compressor (1) affect the stator (4) and thus the oil sucking member (6) and the oil sucking member (6) oscillates together with the motor. The continuation of effective oil

transmission of the oil sucking member (6) during the operation of the motor depends on the continuation of the concentricity between the oil sucking member (6) and the crankshaft (5). The supporting block (9) increases the rigidity of the support arms (7) produced from plastic material, thus the oil sucking member (6) is provided to oscillate together with the motor and not to hit the inner wall of the crankshaft (5) by minimizing the relative motions that the oil sucking member (6) makes with respect to the motor. The centering extensions (10) provide the oil sucking member (6) to be concentrically placed into the crankshaft (5) while the support arms (7) are mounted to the stator (4) and maintains the concentricity of the oil sucking member (6) and the crankshaft (5) during the operation of the motor.

[0025] In an embodiment of the present invention, the hermetic compressor (1) comprises more than one supporting block (9) mounted to the edge of the lower surface of the stator (4) and more than one arc-shaped centering extensions (10) bearing against the lateral surface of the stator (4) by extending from each supporting block (9) thereto (Figure 2)

[0026] In another embodiment of the present invention, the hermetic compressor (1) has the rectangular stator (4) with rounded corners and the centering extensions (10) bear against the rounded portions of the lateral surface of the stator (4) (Figure 6).

[0027] In another embodiment of the present invention, the hermetic compressor (1) comprises a single supporting block (9) that is in closed curve form corresponding to the periphery of the lower surface of the stator (4) with rounded corners and that is seated in the vicinity of the periphery of the lower surface of the stator (4) (Figure 6). The supporting block (9) in closed curve form creates a rigid connection between the ends of the support arms (7) extending from the oil sucking member (6) sideways in the radial direction and provides the distance between the ends of the support arms (7), in other words angles between the support arms (7) to be constant.

[0028] In another embodiment of the present invention, the supporting block (9) is in ring form and is seated in the vicinity of the inner edge of the lower

surface of the stator (4) surrounding the rotor (3) (Figure 3, Figure 5). The supporting block (9) in ring form creates a rigid connection between the ends of the support arms (7) extending from the oil sucking member (6) sideways in the radial direction and provides the distance between the ends of the support arms (7), in other words angles between the support arms (7) to be constant.

[0029] In a version of this embodiment, the centering extension (10) is in circular form and bears against the inner surface of the stator (4) surrounding the rotor (3) by extending upwards from the ring-shaped supporting block (9) (Figure 3, Figure 5).

[0030] In another version of this embodiment, the hermetic compressor (1) comprises more than one rod-shaped centering extension (10) disposed on the ring-shaped supporting block (9), extending into the winding slots of the stator (4) and preferably in a number as many as the number of the winding slots of the stator (4) (Figure 4). A narrow air gap required for the desired motor performance is disposed between the stator (4) and the rotor (3) and the centering extensions (10) mentioned in this embodiment are placed into the winding slots of the stator (4), into the gaps that are not filled by the stator (4) windings and do not violate the said air gap between the stator (4) and the rotor (3), thus the rotor (3) is prevented from rubbing against the centering extensions (10).

[0031] In another embodiment of the present invention, the hermetic compressor (1) comprises more than one leg (11) extending downwards from the supporting block (9) and mounted to the spring (8), and the oil sucking member (6), the support arms (7), the supporting block (9), the centering extensions (10) and the legs (11) are produced from plastic material as a single piece (Figure 1, Figure 2).

[0032] In the hermetic compressor (1), the oil sucking member (6) providing oil to be delivered from inside the casing (2) to the crankshaft (5) is secured to the stator (4) by means of the support arms (7) the rigidity of which is increased by means of the supporting block (9) and the centering extensions (10). The support arms (7) and the oil sucking member (6) are produced from plastic material as a single piece, thus ease of assembly

and cost advantage are provided.

[0033] It is to be understood that the present invention is not limited by the embodiments disclosed above and a person skilled in the art can easily introduce different embodiments. These should be considered within the scope of the protection postulated by the claims of the present invention.

Claims

1. A hermetic compressor (1) **comprising** a casing (2) supporting the members and oil lubricating the movable members is filled wherein, a motor having a rotor (3) and a stator (4), a crankshaft (5) that is snap-fittingly mounted to the core of the rotor (3) in the direction of the rotation axis of the rotor (3), the lower end of which is immersed into the oil in the casing (2) and wherein a gap (B) opening into the body of the crankshaft (5) in the axial direction starting from the lower end of the crankshaft (5) is disposed, an oil sucking member (6) in cylindrical form, disposed through the lower end of the crankshaft (5) into the interior thereof and concentrically with the crankshaft (5), produced from plastic material, having a helical groove disposed at the outer circumference of the oil sucking member (6), more than one support arm (7) produced from plastic material, one end of which is connected to the lower surface of the oil sucking member (6) and the other end of which is connected to the stator (4) by extending from the oil sucking member (6) sideways in the radial direction, **characterized by** one or more than one supporting block (9) to which the ends of the support arms (7) extending to the stator (4) are connected and onto which the planar lower surface of the stator (4) is seated and one or more than one centering extension (10) connected to the supporting block (9), bearing onto the circular lateral surface of the stator (4) or onto the circular inner surface of the stator (4) surrounding the rotor (3) by extending upwards from the lower surface of the stator (4).
2. A hermetic compressor (1) as in Claim 1, **characterized by** more than one supporting block (9) mounted to the edge of the lower surface of the stator (4) and more than one arc-shaped centering extensions (10) bearing against the lateral surface of the stator (4) by extending from each supporting block (9).
3. A hermetic compressor (1) as in Claim 1 or 2, **characterized by** the rectangular stator (4) with rounded corners and the centering extensions (10) that are disposed on the supporting block (9) and that bear against the rounded portions of the lateral surface of the stator (4).
4. A hermetic compressor (1) as in any one of the above claims, **characterized by** the supporting block (9) that is in closed curve form corresponding to the periphery of the lower surface of the stator (4) and that is seated in the vicinity

of the periphery of the lower surface of the stator (4).

5. A hermetic compressor (1) as in any one of the Claims 1 to 3, **characterized by** the supporting block (9) that is in ring form and that is seated in the vicinity of the inner edge of the lower surface of the stator (4) surrounding the rotor (3).
6. A hermetic compressor (1) as in Claim 5, **characterized by** the circular centering extension (10) that bears against the inner surface of the stator (4) surrounding the rotor (3) by extending upwards from the ring-shaped supporting block (9).
7. A hermetic compressor (1) as in Claim 5, **characterized by** more than one rod-shaped centering extension (10) that is disposed on the ring-shaped supporting block (9) and that extends into the winding slots of the stator (4).
8. A hermetic compressor (1) as in any one of the above claims, **characterized by** more than one spring (8) that is placed between the lower surface of the stator (4) and the casing (2) and that absorbs the vibrations of the motor in the axial direction and more than one leg (11) extending downwards from the supporting block (9) and mounted to the spring (8).
9. A hermetic compressor (1) as in Claim 8, **characterized by** the oil sucking member (6), the support arms (7), the supporting block (9), the centering extensions (10) and the legs (11) produced as a single piece.

Figure 1

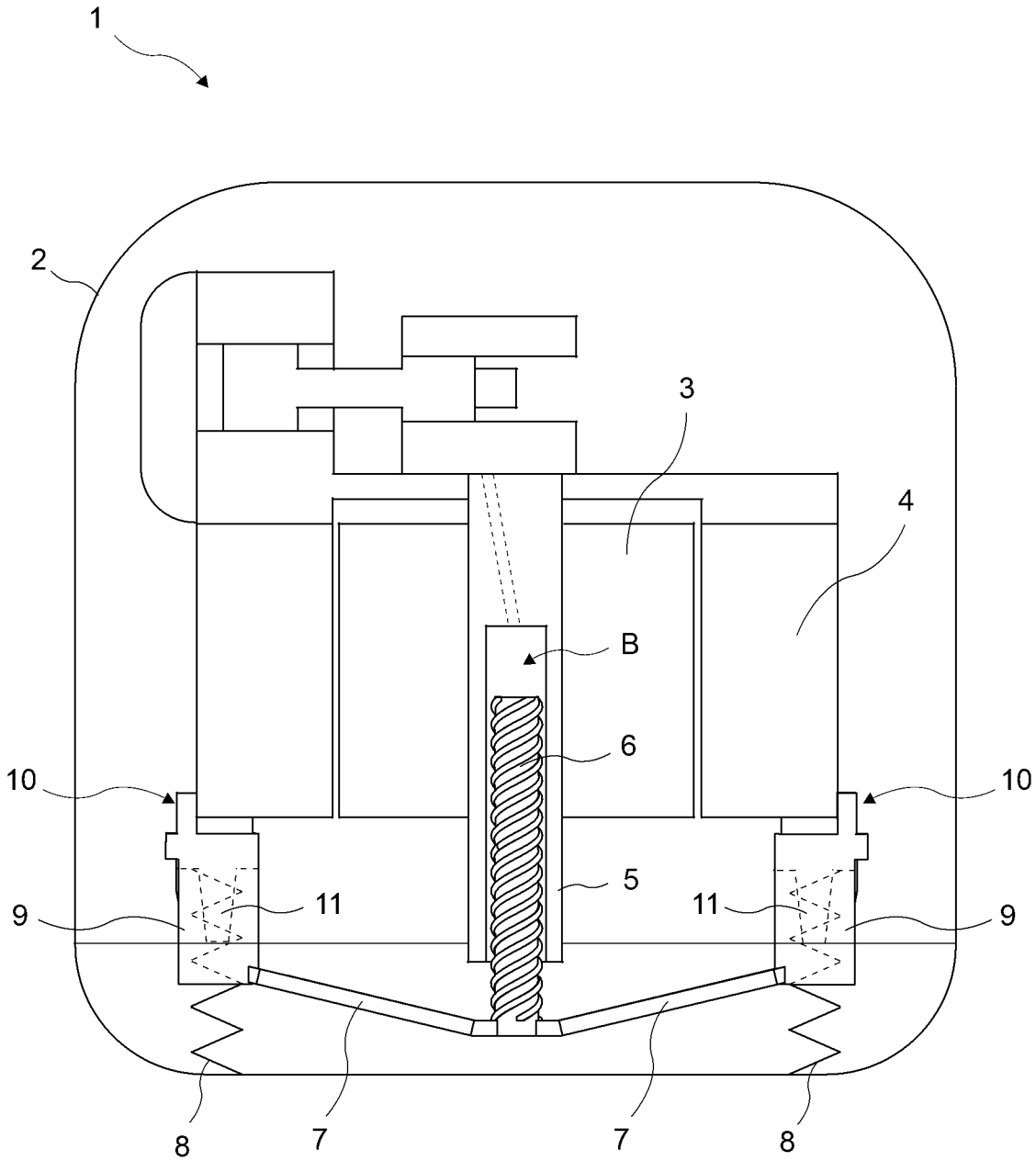


Figure 2

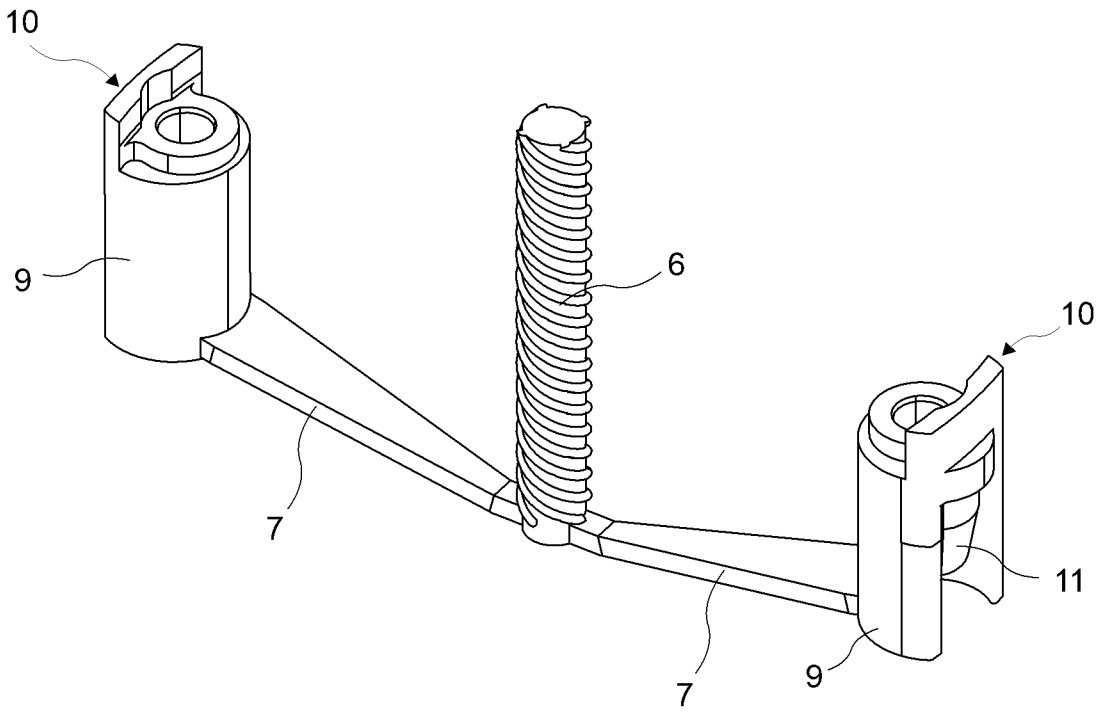


Figure 3

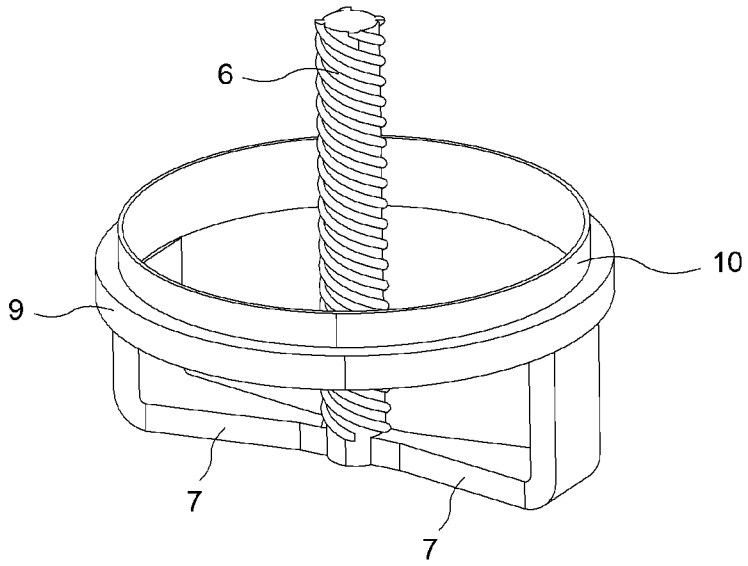


Figure 4

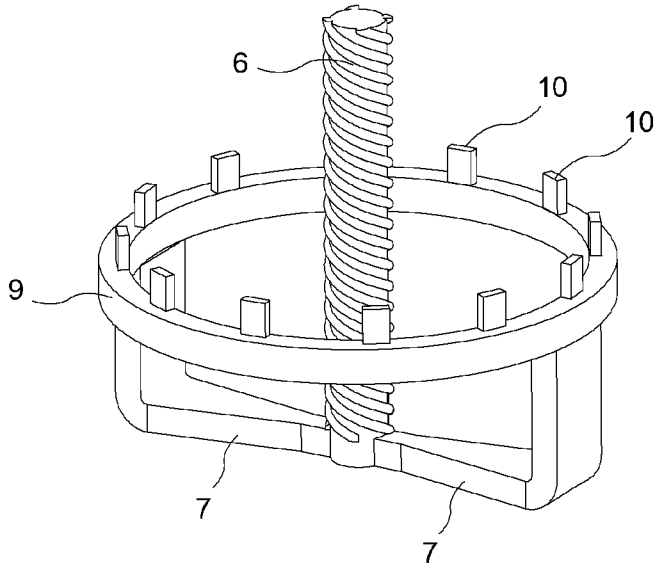


Figure 5

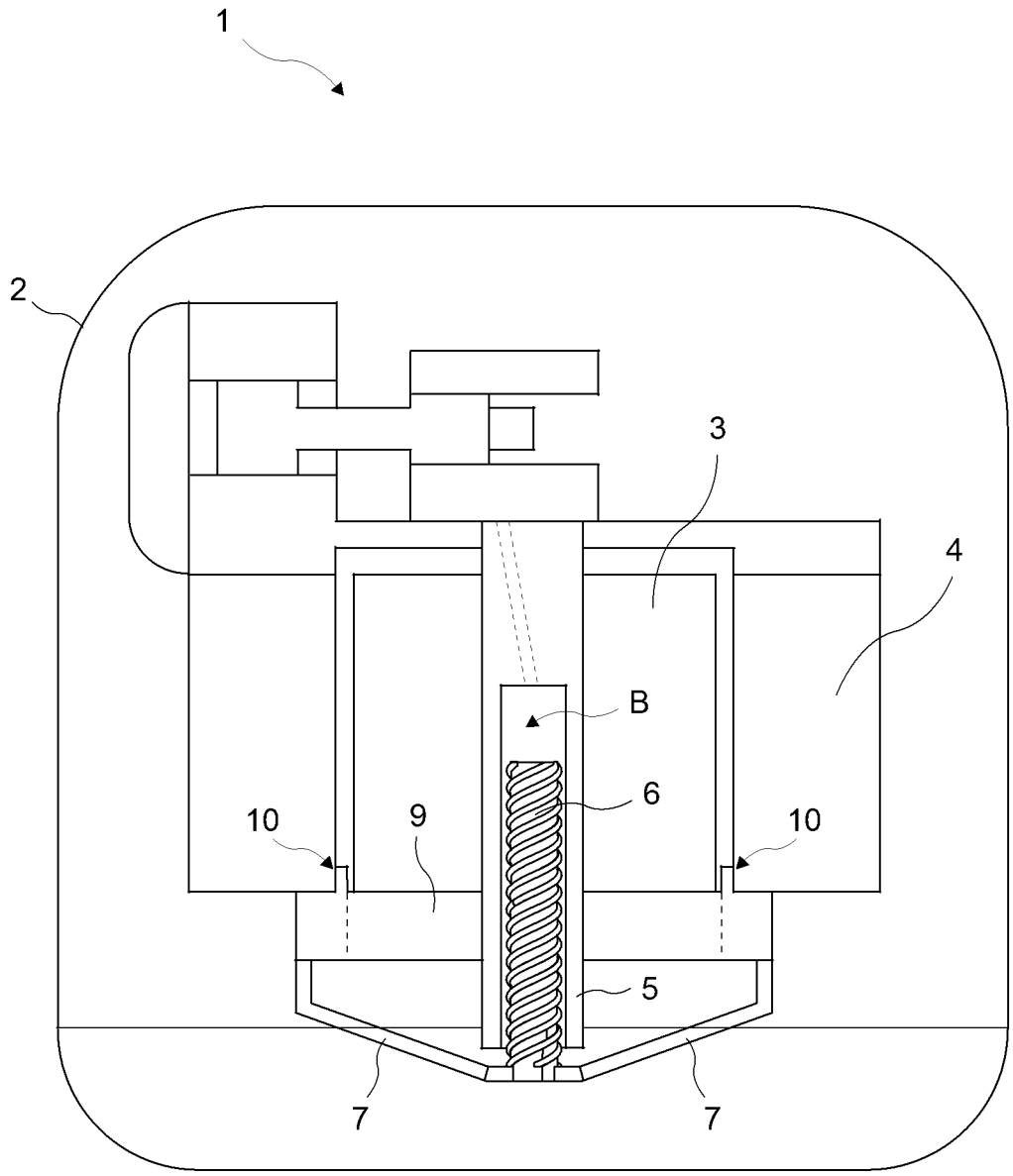
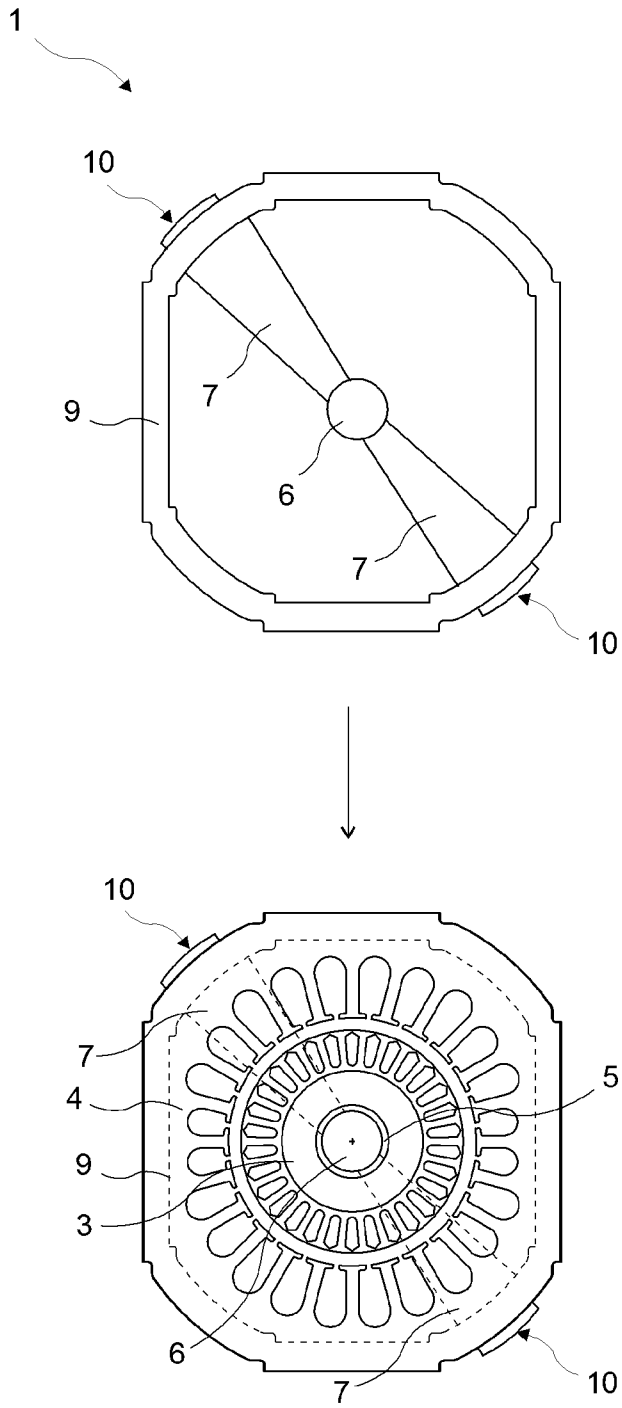


Figure 6



INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2011/069825

A. CLASSIFICATION OF SUBJECT MATTER
INV. F04B39/02 F04B53/22
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 605 163 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]) 14 December 2005 (2005-12-14) paragraph [0006]; figure 34 abstract	1-9
X	WO 00/01949 A1 (ZANUSSI ELETTROMECC [IT]; DELLBY FREDRIK [SE]; ZONTA CARLO [IT]) 13 January 2000 (2000-01-13)	1
A	abstract; figure 1	2-9
A	US 2002/172607 A1 (KIM TAE-MIN [KR]) 21 November 2002 (2002-11-21) abstract; figures	1-9
A	WO 2005/047699 A1 (MATSUSHITA ELECTRIC IND CO LTD [JP]; NISHIHARA HIDETOSHI) 26 May 2005 (2005-05-26) abstract; claims; figures	1-9

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
24 January 2012	08/02/2012

Name and mailing address of the ISA/	Authorized officer
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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2011/069825

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1605163 A1	14-12-2005	EP 1605163 A1	14-12-2005
		JP 4380630 B2	09-12-2009
		KR 20050083696 A	26-08-2005
		KR 20060108780 A	18-10-2006
		KR 20060110010 A	23-10-2006
		US 2006013706 A1	19-01-2006
		WO 2004081383 A1	23-09-2004
WO 0001949 A1	13-01-2000	BR 9907107 A	24-10-2000
		CN 1300347 A	20-06-2001
		DE 69905572 D1	03-04-2003
		DE 69905572 T2	25-09-2003
		DK 1092092 T3	02-06-2003
		EP 1092092 A1	18-04-2001
		ES 2193715 T3	01-11-2003
		IT PN980036 U1	03-01-2000
		JP 2002519589 A	02-07-2002
		US 6450785 B1	17-09-2002
		WO 0001949 A1	13-01-2000
US 2002172607 A1	21-11-2002	JP 3699419 B2	28-09-2005
		JP 2003013855 A	15-01-2003
		KR 20020088626 A	29-11-2002
		US 2002172607 A1	21-11-2002
WO 2005047699 A1	26-05-2005	CN 1878960 A	13-12-2006
		EP 1687533 A1	09-08-2006
		JP 2007510836 A	26-04-2007
		KR 20060120119 A	24-11-2006
		US 2007081908 A1	12-04-2007
		WO 2005047699 A1	26-05-2005