



(11) **EP 3 196 462 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention
of the grant of the patent:
14.08.2019 Bulletin 2019/33

(51) Int Cl.:
F04B 39/02 ^(2006.01) **F04B 39/06** ^(2006.01)

(21) Application number: **17151956.4**

(22) Date of filing: **18.01.2017**

(54) **OIL PUMP ASSEMBLY ARRANGEMENT IN COOLING COMPRESSOR**

ÖLPUMPENANORDNUNG IN KÄLTEKOMPRESSOR

DISPOSITIF D'ASSEMBLAGE DE POMPE À HUILE DANS UN COMPRESSEUR DE
REFROIDISSEMENT

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

(30) Priority: **19.01.2016 CN 201610254910**

(43) Date of publication of application:
26.07.2017 Bulletin 2017/30

(73) Proprietor: **Whirlpool S.A.
04578-000 São Paulo - SP (BR)**

(72) Inventors:
• **MANKE, Adilson Luiz
89221-103 Joinville (BR)**
• **SACOMORI, Diego
89223-340 Joinville (BR)**

(74) Representative: **Soldatini, Andrea et al
Società Italiana Brevetti S.p.A.
Corso dei Tintori, 25
50122 Firenze (IT)**

(56) References cited:
**EP-A1- 1 605 163 WO-A1-2010/040195
WO-A1-2013/097973**

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

Field of the Invention

[0001] The present application refers to an oil pump assembly arrangement for cooling compressors. Such invention aims to provide said compressor with a better use of the inner space defined by the housing thereof, in order to allow its miniaturization.

Background of the Invention

[0002] According to the general knowledge available in the state of the art, most of the cooling compressors comprise an outer housing that package several functional components, such as a compression mechanism basically formed by a piston/cylinder set, being the piston moved by a connecting rod which is connected to an eccentric shaft which is defined and extends from a driving shaft that rotates together with the rotor of an electric engine, as well as the electric engine itself, basically defined by said rotor and a stator.

[0003] It is known that an essential aspect for the proper operation of these compressors consists of the lubrication of the moving parts (piston, connecting rod, eccentric shaft, etc.) and/or the surfaces with which they cooperate. This lubrication is commonly given by pumping lubricant oil provided in oil reservoir (crankcase) defined within the housing, in the lower portion thereof. This oil is pumped to achieve the proper components and, subsequently, returns to the crankcase by gravity.

[0004] It is also within the knowledge of the state of the art that these oil pumps (centrifugal or helical) are formed by the own driving shaft of the compressor or coupled to the same, in the lower end thereof and partially immersed in the lubricating oil contained in the reservoir. Additionally, it is quite common for driving shafts to comprise grooves on the outer surface thereof able to assist in the oil pumping to the other moving components of the compressor.

[0005] More specifically, the oil pumps of some current cooling compressors models comprise helical pump, formed by the interaction between a stationary pin and a hollow lower portion integrated or coupled to said driving shaft of the compressor electric engine, given by the concentric and slightly loose assembly thereof, being that in at least one of these a helical groove is provided. Quite didactic examples of this constructiveness are highlighted in documents BRP19201761, WO2005/047699, US6450785 and WO96/29516.

[0006] This type of pump allows raising a large oil flow rate, even when the compressor operates at low revolutions, which is desirable, mainly, when the cooling compressor is of the variable speed type.

[0007] In order to provide support of the pin, there are known several arrangements that use fastening rods, with a substantially similar "U" format, which overpass said pin in one of the ends thereof and anchor them to-

gether with a fixed portion of the cylinder block or the electric engine, such as the stator or a protective cover attached in the bottom to said stator.

[0008] Such fastening rods are easily identified in documents US6450785, JP20055337158 and BRPI0804302, as well as documents WO2005/047699 and WO96/29516.

[0009] However, all these documents have a common drawback, namely, said similar "U" format of the fastening rods. Due to this geometric configuration, such fastening rods tend to take up too much space inside the housing.

[0010] In particular, the fastening rod disclosed by document BRPI0804302 is arranged so that it bypasses the protective cover of the engine and/or heads of the electric coils thereof, having the ends thereof housed in substantially horizontal cribs in order to define a geometric pivot shaft, perpendicular and coplanar to the rotor spin shaft.

[0011] As inconvenient consequence of these types of prior art arrangements (rod with similar "U" format), it is mentioned the possibility of the fixing rod to collide with the housing of the compressor, especially during transportation or during startups (power up) and shut downs (power down) of the compressor. The incidence of these collisions is even greater when the distance between this fastening rod and the housing is reduced, what tends to happen due to the constant and current miniaturization of the cooling compressors.

[0012] In an even more critical situation, considering the different models of compressors, it is possible that such a distance is so small that even prevent these type of solution.

[0013] In addition, the "exposure" of such fastening rods, given the curvature thereof, may lead to an increased likelihood of assembly mistakes arising from possible shocks of said fastening rod against assembly devices or against other inner components of the compressor during the mechanical process of insertion of the kit inside said housing. Such problem seems to be even more critical in the case of the arrangement described by document BRPI0804302, because the contour of the rod takes place around the protective cover of the engine and/or the head of the coils.

[0014] In this regard, document EP1605163 already provides for a assembly arrangement of fastening rods of helical pump pin, wherein said rod comprises a format similar to two consecutive "S" curves, in each one of the right and left sides of the pump pin (see figures 1 and/or 3 of this document), being mounted so as not to be projected out of the circumference (the vertical projection) of the stator. It should be noted that some of the fastening rods of the documents mentioned above do not protrude either out of the circumference of the stator, regardless the format thereof.

[0015] Thus, and despite some helical oil pump assembly arrangements in cooling compressors have proved themselves, in a way, functional to this day, it is observed that all of them lack simple constructive solutions that can optimize the space occupied by the fas-

tening rod within the compressor housing, ensuring proper assembly of the set and protective operation of the electric engine and, at the same time, consisting of an easy and inexpensive manufacturing solution, also keeping the concept defined in document BRPI0804302, wherein the fastening rod has an portion joined to one of the portions of cylinder block and stator, according to an pivot geometric shaft, perpendicular and coplanar to the geometric shaft of rotor spin.

Objects of the Invention

[0016] Therefore, in view of all the above, it is the main objective of the present application to disclose an oil pump assembly arrangement in cooling compressor able to provide the compressor with a better use of the inner space defined by the housing thereof, in order to enable its miniaturization.

[0017] It is also an objective of the present application that the oil pump assembly arrangement in cooling compressor allows a good precision in the construction thereof, an easy and reliable assembly and easy and inexpensive manufacture, ensuring the proper lubricating of the portions of the compressors, even in low rotation speed.

[0018] Furthermore, it is an objective of the present application that the oil pump assembly arrangement in cooling compressor precisely defines, in the anchorage thereof, a pivot geometric shaft, perpendicular and coplanar to the geometric shaft of rotor spin.

Summary of Invention

[0019] Thus, in order to achieve the objectives and the technical effects reported above, the present application refers to an oil pump assembly arrangement in cooling compressor, which comprises a housing within which it is arranged an electric engine including a stator which carries a plurality of circumferentially spaced apart coils and a rotor connected to a driving shaft and an inner pin concentrically arranged with respect to said driving shaft, wherein the driving shaft cooperates with the pin so as to define helical channels that delineate the path of lubricating oil when it is pumped due to relative revolution between said driving shaft and the pin. It is also provided a fastening rod able to anchor said pin in a fixed portion of the electric engine.

[0020] According to the present invention, said fastening rod is supported, in the median portion thereof, to the pin and, at the ends thereof, in respective cribs defined in the fixed portion of the electric engine, wherein said fastening rod extends through free spaces longitudinally aligned with gaps defined between adjacent coils. The ends of the fastening rod are housed in cribs by the inner sides thereof.

[0021] Preferably, the cribs are defined by projections, diametrically opposite to each other, extending radially outwardly from an outer surface of a protective cover of the electric engine. The protective cover is polymeric and

manufactured by injection molding, and the projections are formed from at least two adjacent and opposed half-rounds.

[0022] Even preferably, the length of the fastening rod is entirely arranged within the circumference defined by the protective cover and the projections thereof.

Brief Description of the Drawings

[0023] The features, advantages and technical effects of the present application, as outlined above, will be best understood by one skilled in the art, from the following detailed description, made by way of mere example, and not limitation, of preferred embodiments of the invention, and with reference to the appended schematic figures, which:

Figure 1 illustrates a schematic front sectional view of a cooling compressor according to the prior art.

Figure 2 illustrates a schematic front sectional view of a cooling compressor according to the preferred embodiment of the present invention.

Figure 3 illustrates in detail the oil pump pin mounted in the fastening rod.

Figure 4 illustrates a bottom view of the oil pump assembly arrangement of cooling compressor near the electric engine stator, according to the present invention.

Figure 5 illustrates a front view of the oil pump assembly arrangement of cooling compressor in the protective cover, according to preferred embodiment of the invention.

Figure 6 illustrates a detailed enlarged view of the cribs that define the housing of the fastening rod ends of the oil pump pin, according to preferred embodiment of the assembly arrangement of the present invention.

Detailed Description of the Invention

[0024] According to the schematic figures mentioned above, some examples of possible embodiments of the oil pump assembly arrangement in cooling compressor, object of the present invention, will be described in more details below, but merely illustratively, not limiting. This is because the present invention may comprise different details and technical, constructive, structural and dimensional aspects without thereby affecting the present scope of protection.

[0025] Thus, as illustrated, the oil pump assembly arrangement in cooling compressor applies, preferably, to variable speed compressors and of reduced size, wherein this type of compressor comprises a housing 10 within which it is arranged an electric engine 20 including a stator 30 bearing a plurality of coils 31 circumferentially spaced from each other and a rotor 40 associated to a driving shaft 50 and a pin 51 internally and concentrically arranged with respect to said driving shaft 50.

[0026] Driving shaft 50 cooperates with pin 51, so as to define helical channels 52 that delineate the lubricating oil path when it is pumped due to relative revolution between driving shaft 50 and pin 51.

[0027] Such helical channels 52 are defined due to the provision of grooves arranged on the inner surface of the lower portion of driving shaft 50 or the outer surface of pin 51.

[0028] In order to anchor said pin 51 in a fixed portion 80 of electric engine 20, it is provided a fastening rod 70, wherein said fastening rod 70 is supported, in the median portion thereof, in a hole 53 provided next to pin 51 and, in the ends thereof 71, in respective cribs 81 defined in the fixed portion 80 of electric engine 20, said ends 71 being aligned with the geometric shaft defined by said cribs 81.

[0029] Such hole 53 may be a through hole relative to pin 51 itself or, preferably, may be defined by a handle 54 extending from the end of pin 51.

[0030] It should be noted that coils 31, as within the common knowledge of the skilled in the subject matter, can be rolled in accommodation portions 32 circumferentially spaced from each other, defined in the metal frame which conforms stator core 30.

[0031] Thus, it is worth noting that between coils 31 adjacent to each other there are defined gaps 34 to which free spaces 33 are longitudinally aligned, as shown in Figure 4.

[0032] Here, it is worth noting that the longitudinal direction refers to the main direction of the driving shaft 50 and, also, that free spaces 33 may be contained with the own gaps 34, depending on the size of coils 31.

[0033] Particularly, according to the present invention, fastening rod 70 of pin 51 extends through coils 31, overpassing free spaces 33 in order to enable that ends 71 of fastening rod 70 are housed in cribs 81 by means of the insertion thereof through inner sides 82 of this cribs 81. In other words, ends 71 of fastening rod 70 extend radially inwardly, projecting towards housing in cribs 81.

[0034] These two characteristics, relating to the arrangement of fastening rod 70, namely, the length of fastening rod 70 through free spaces 33 and having the ends thereof 71 inserted by inner sides of cribs 81, show themselves different from the state of the art, and carry technical advantages, since they allow optimizing the spatial arrangement of the inner components to the compressor housing, guaranteeing the minimum electrical distances required by rules, since fastening rod 70 do not need to bypass the lower end of protective cover 90.

[0035] Still preferably, fixing portion 80 of electric engine 20 refers specifically to a protective cover 90, wherein cribs 81 are defined by projections 92, diametrically opposite to each other, extending radially outwardly from an outer surface 91 of this protective cover 90.

[0036] Accordingly, it is dominant that the length of fastening rod 70 lies entirely arranged within the circumference (or vertical projection of the contour) defined by protective cover 90 and the projections thereof 92, so as

to reduce the "exposure" of fastening rod 70.

[0037] More particularly, it is highly desirable that ends 71 of fastening rod 70 do not extend beyond projections 92, so as to avoid an eventual contact of these ends 71 with housing 10 of the compressor or with any other element during the assembly process, said contact could "push" fastening rod 70 radially inwardly and cause decoupling / disengagement of these ends 71 of cribs 81.

[0038] Hence, fastening rod 70 has a curvilinear geometry, wherein each of the halves thereof resembles the word "S". Therefore, it is clearly noted a lower projection/"exposure" of fastening rod 70 towards/regarding housing 10 of the compressor, which allows approximating electric engine 20 to the latter.

[0039] In this particular construction, even if it happens an eventual contact/collision of pin 51 with the bottom of housing 10 of the compressor, whether during the operation thereof or during the assembly thereof, ends 71 of fastening rod 70 will be driven in the radial direction from the inside to the outside, so that they insert themselves even more in cribs 81, minimizing any risk of disengagement, unlike what happens in the prior art solutions, in which ends 71 of fastening rod 70 are housed in cribs 81 from the insertion thereof by the outer sides thereof, such as in the object of document BRPI0804302.

[0040] Protective cover 90, also widely known by the skilled technicians in the art, is polymeric and manufactured by injection molding due to the inherent advantages of this process with regard to the dimensional accuracy and cost.

[0041] Optionally, brackets specific for these cribs 81 may be coupled to stator 30 of electric engine 20, with the same functionalities described above.

[0042] When considering a polymer injection process for the manufacture of said protective cover 90, and so that cribs 81 are defined by projections 92 as proposed by the invention, it is usually necessary the use of mobile drawers in the injection mold.

[0043] Taking into account that the use of these drawers substantially raise the final price of the product, and in order to eliminate this problem, it is preferred that projections 92 are formed from at least two adjacent and opposing half-rounds, regarding the concavity thereof.

[0044] This set of half-rounds allows to precisely define, to cribs 81, a longitudinal geometric shaft having diameter equivalent to the one of a continuous tubular hole.

[0045] Thus, and according to one of the objectives of this invention, it is achieved a fixed portion 80 (protective cover 90) easy to manufacture and of low cost that, yet, guarantees the existence of a well-defined pivot geometric shaft, to fastening rod 70, perpendicular and coplanar to the shat of rotor spin.

[0046] In view of the above, it is noted that the invention now proposed discloses a solution that provides a better use of the inner space defined by the housing thereof, in order to allow its miniaturization, as well as an easy and reliable assembly and an easy and inexpensive manu-

facturing, further ensuring the proper lubrication of moving components of the compressor, even when it operates at low revolutions.

[0047] Finally, it is important to highlight that the present disclosure is for the sole purpose of describing exemplarily one embodiment of the oil pump assembly arrangement in cooling compressor, according to the present invention. Therefore, it should be evident to those skilled in the art that several constructive modifications, variations and combinations of the elements that perform the same function in substantially the same way are possible to achieve the same results, which are within the scope of protection defined by the appended claims.

Claims

1. A cooling compressor comprising an oil pump assembly, which comprises a housing (10) within which it is arranged an electric engine (20) which includes a stator (30) carrying a plurality of coils (31) circumferentially spaced apart from each other and a rotor (40) associated to a driving shaft (50) and a pin (51) internally and concentrically arranged with respect to said driving shaft (50);
the driving shaft (50) cooperating with the pin (51), so as to define helical channels (52) which delineate the lubricating oil path (60), when it is pumped due to the relative revolution between the driving shaft (50) and the pin (51); and
a fastening rod (70) able to anchor said pin (51) in a fixed portion (80) of the electric engine (20);
wherein said fastening rod (70) is supported, in the median portion thereof, to the pin (51) and, in the ends thereof (71), in respective cribs (81) defined in the fixed portion (80) of the electric engine (20);
said compressor being **CHARACTERIZED by** the fact that:

the fastening rod (70) extends through free spaces (33) arranged in the fixed portion (80) of the electric engine (20), longitudinally aligned with gaps (34) defined between adjacent coils (31); and
ends (71) of the fastening rod (70) are housed in the cribs (81) by the inner sides thereof (82).
2. Cooling compressor according to claim 1, **CHARACTERIZED by** the fact that the cribs (81) are defined by projections (92), diametrically opposite to each other, extending radially outwardly from an outer surface (91) of a protective cover (90) of the electric engine (20).
3. Cooling compressor according to claim 2, **CHARACTERIZED by** the fact that the length of the fastening rod (70) is entirely arranged within the circumference defined by the protective cover (90) and the

projections thereof (92).

4. Cooling compressor according to claim 2, **CHARACTERIZED by** the fact that the protective cover (90) is polymeric and manufactured by injection molding.
5. Cooling compressor according to claim 2, **CHARACTERIZED by** the fact that the projections (92) are formed from at least two adjacent and opposite half-rounds.

Patentansprüche

1. Kühlkompressor, der eine Ölpumpenanordnung enthält, die enthält ein Gehäuse (10), innerhalb dem ein elektrischer Antrieb (20) angeordnet ist, der einen Stator (30), der eine Mehrzahl von Spulen (31) trägt, die umfangsmäßig voneinander beabstandet sind, und einen Rotor (40) enthält, der mit einer Antriebswelle (50) und einem Stift (51) verbunden ist, der intern und konzentrisch bezüglich der Antriebswelle (50) angeordnet ist;
wobei die Antriebswelle (50) mit dem Stift (51) kooperiert, um spiralförmige Kanäle (52) zu definieren, die den Pfad (60) des schmierenden Öls darstellen, wenn es aufgrund der relativen Drehung zwischen der Antriebswelle (50) und dem Stift (51) gepumpt wird; und
einen Befestigungsstab (70), der in der Lage ist, den Stift (51) in einem fixierten Teil (80) des elektrischen Antriebs (20) zu verankern;
wobei der Befestigungsstab (70) im mittleren Teil davon an dem Stift (51) und an den Enden (71) davon in jeweiligen Schenkeln (81) abgestützt ist, die in dem fixierten Teil (80) des elektrischen Antriebs (20) definiert sind;
wobei der Kompressor durch die Tatsache **GEKENNZEICHNET** ist, dass
der Befestigungsstab (70) durch freie Räume (33), die in dem fixierten Teil (80) des elektrischen Antriebs (20) angeordnet sind, in Längsrichtung ausgerichtet mit Spalten (34) verläuft, die zwischen benachbarten Spulen (31) definiert sind; und
Enden (71) des Befestigungsstabs (70) in den Schenkeln (81) durch die Innenseiten (82) davon untergebracht sind.
2. Kühlkompressor nach Anspruch 1, **GEKENNZEICHNET durch** die Tatsache, dass die Schenkel (81) durch zueinander diametral entgegengesetzte Vorsprünge (92) definiert sind, die sich von einer äußeren Oberfläche (91) einer Schutzabdeckung (90) des elektrischen Antriebs (20) erstrecken.
3. Kühlkompressor nach Anspruch 2, **GEKENN-**

ZEICHNET durch die Tatsache, dass die Länge des Befestigungsstabes (70) vollständig innerhalb des Umfangs angeordnet ist, der durch die Schutzabdeckung (90) und die Vorsprünge (92) davon definiert ist.

4. Kühlkompressor nach Anspruch 2, **GEKENN-
ZEICHNET** durch die Tatsache, dass die Schutzabdeckung (90) polymer und durch Spritzgießen hergestellt ist.
5. Kühlkompressor nach Anspruch 2, **GEKENN-
ZEICHNET** durch die Tatsache, dass die Vorsprünge (92) aus wenigstens zwei benachbarten und entgegengesetzten Halbrundteilen gebildet sind.

Revendications

1. Un compresseur de refroidissement comprenant un ensemble pompe à huile, qui comprend un carter (10) dans lequel est agencé un moteur électrique (20) comprenant un stator (30) portant une pluralité de bobines (31) espacées de manière circconférentielle les unes des autres et un rotor (40) associé à un arbre d'entraînement (50) et à une goupille (51) agencée de façon interne et concentrique par rapport audit arbre d'entraînement (50) ;
 - l'arbre d'entraînement (50) coopérant avec la goupille (51), de façon à obtenir des canaux hélicoïdaux (52) qui définissent le trajet de l'huile de lubrification (60) lorsqu'il est pompé à cause de la rotation relative entre l'arbre d'entraînement (50) et la goupille (51) ; et
 - une tige de fixation (70) apte à ancrer ladite goupille (51) dans une partie fixe (80) du moteur électrique (20) ;
 - dans lequel ladite tige de fixation (70) est liée, dans sa partie médiane, à la goupille (51) et logée, à ses extrémités (71), dans des berceaux respectifs (81) définis dans la partie fixe (80) du moteur électrique (20) ;
 - ledit compresseur étant **caractérisé par le fait que** :
 - la tige de fixation (70) s'étend à travers des espaces libres (33) agencés dans la partie fixe (80) du moteur électrique (20), alignés longitudinalement avec des espaces (34) définis entre des bobines adjacentes (31); et
 - les extrémités (71) de la tige de fixation (70) sont logées dans les berceaux (81) par leurs côtés intérieurs (82).
2. Compresseur de refroidissement selon la revendication 1, **caractérisé en ce que** les berceaux (81) sont définis par des saillies (92) diamétralement opposées l'une à l'autre, s'étendant radialement vers

l'extérieur depuis une surface extérieure (91) d'un capot de protection (90) du moteur électrique (20).

3. Compresseur de refroidissement selon la revendication 2, **caractérisé en ce que** la longueur de la tige de fixation (70) est entièrement comprise dans la circonférence définie par le capot de protection (90) et ses saillies (92).
4. Compresseur de refroidissement selon la revendication 2, **caractérisé en ce que** le capot de protection (90) est en polymère et réalisé par moulage par injection.
5. Compresseur de refroidissement selon la revendication 2, **caractérisé en ce que** les saillies (92) sont réalisées à partir d'au moins deux demi-ronds adjacents et opposés.

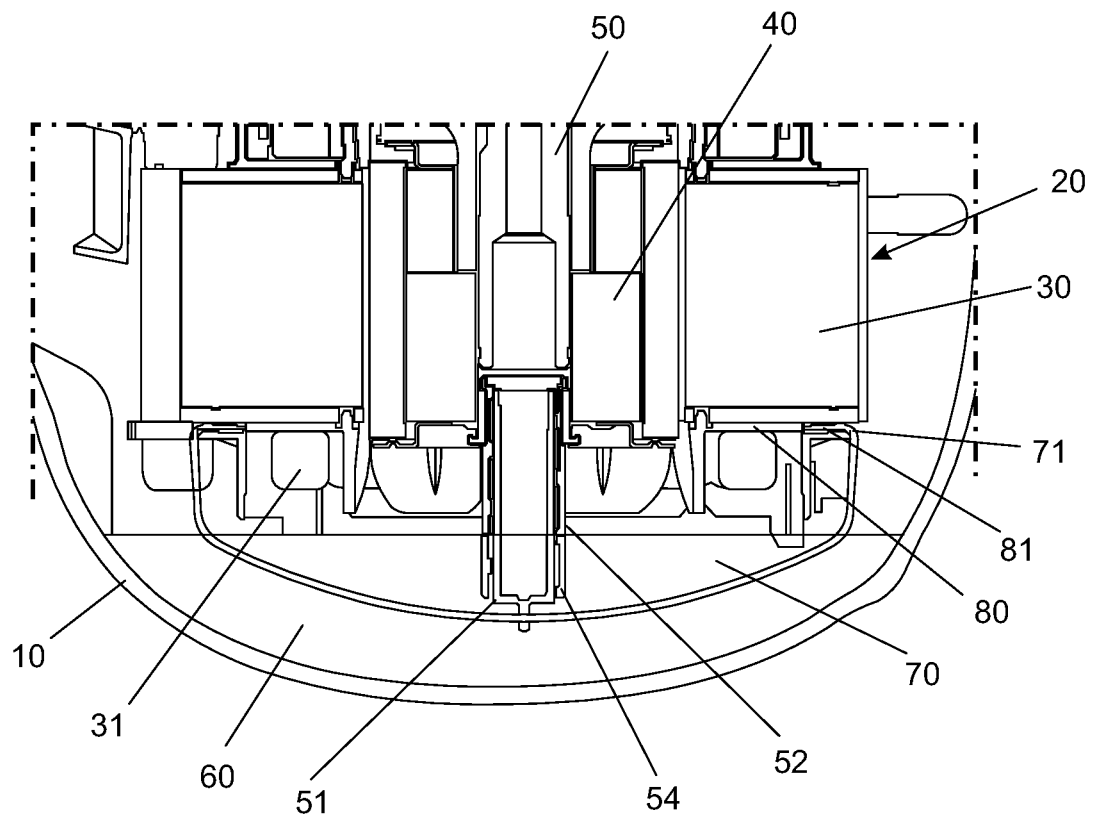


FIG.1

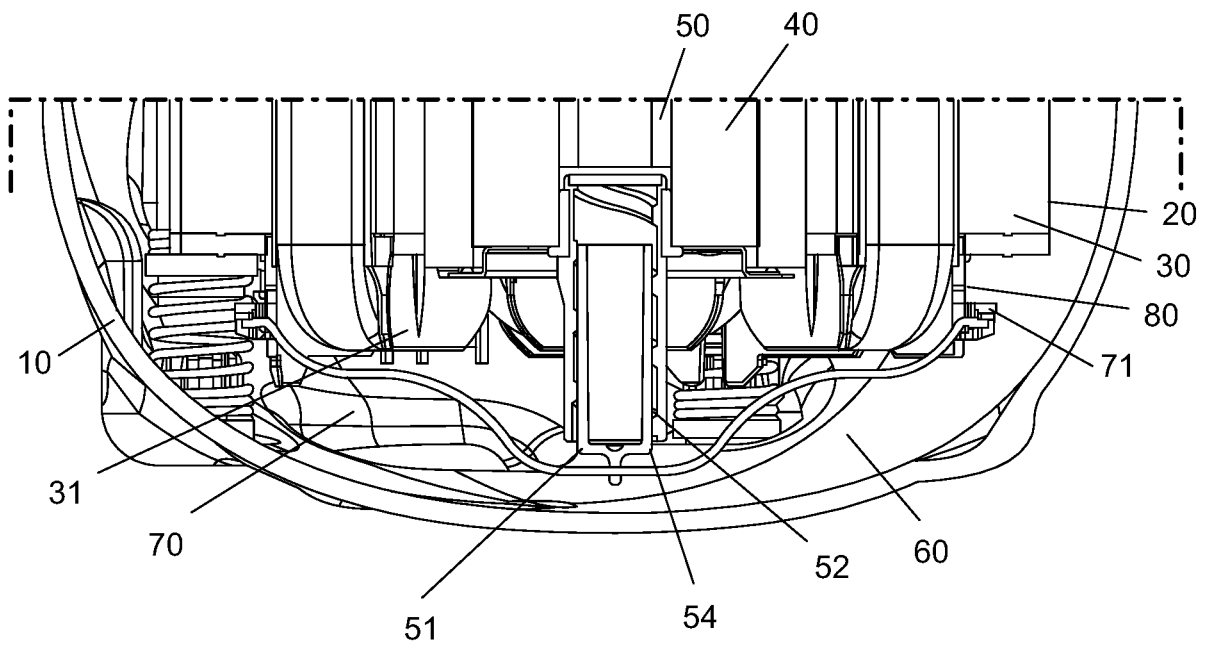


FIG.2

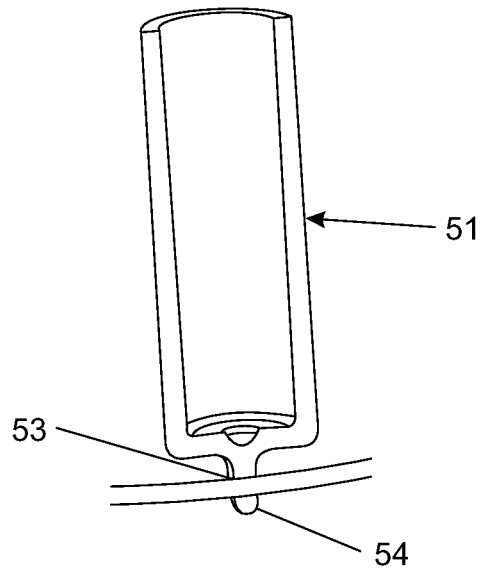


FIG.3

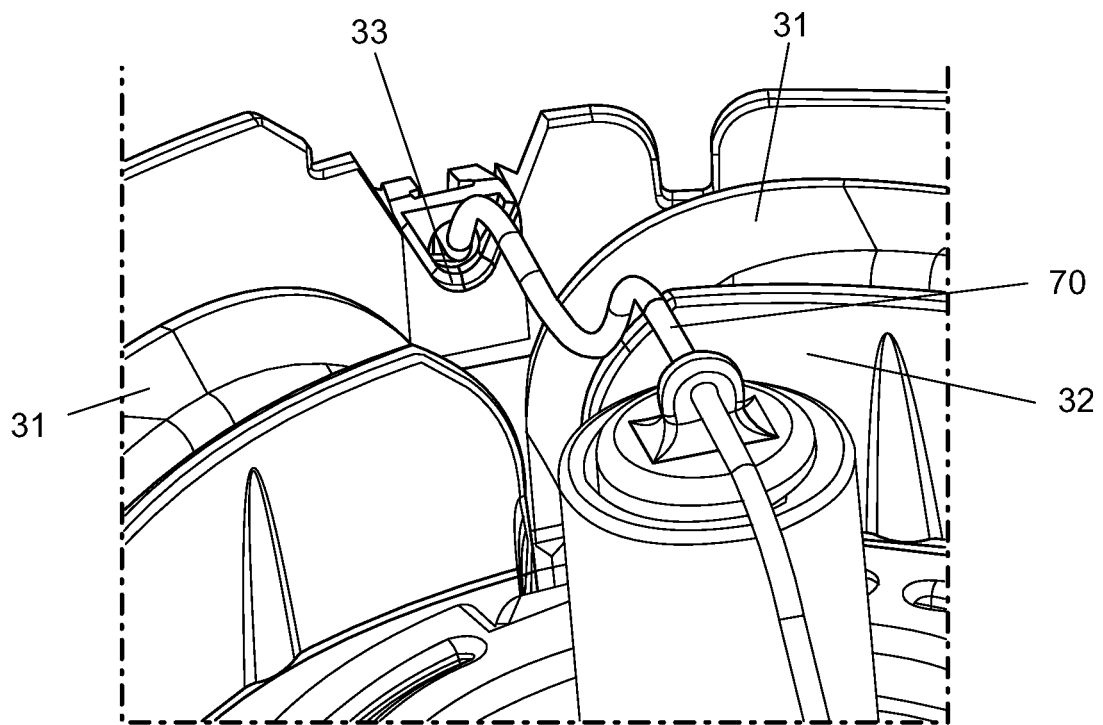


FIG.4

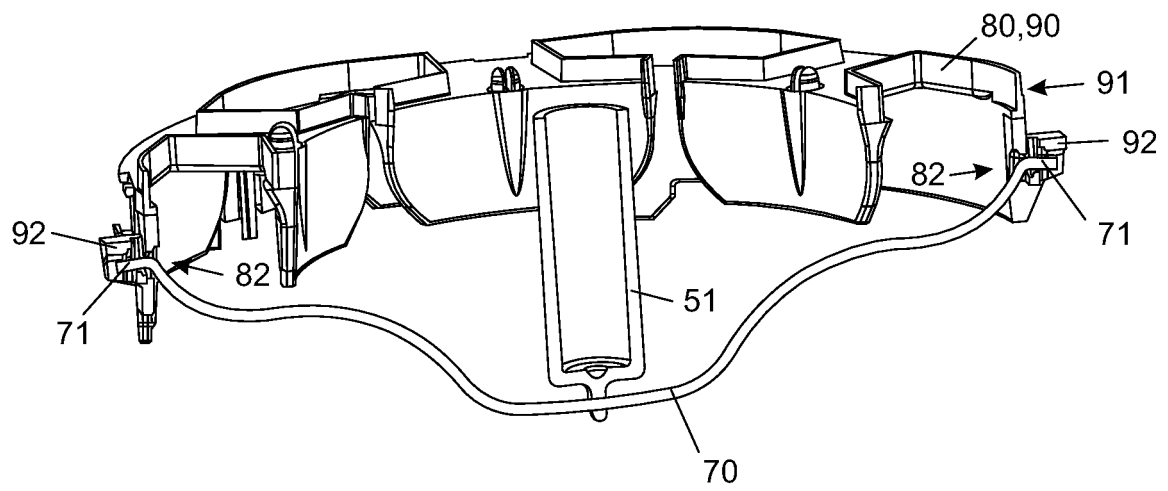


FIG.5

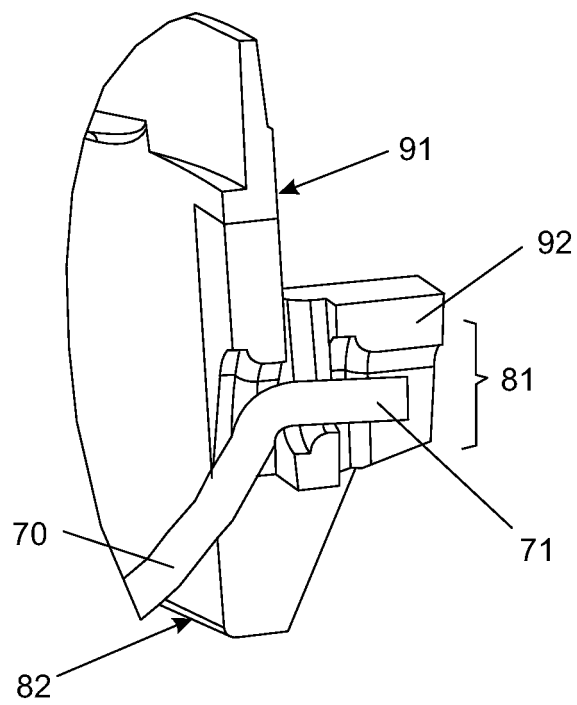


FIG.6

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- BR P19201761 [0005]
- WO 2005047699 A [0005] [0008]
- US 6450785 B [0005] [0008]
- WO 9629516 A [0005] [0008]
- JP 20055337158 B [0008]
- WO 0804302 A [0013] [0039]
- EP 1605163 A [0014]