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(54) ELASTIC BRACKET FOR SUPPORTING A PUMPING MEMBER OF A HERMETIC COMPRESSOR

(57) The present invention relates to an elastic bracket for supporting a pumping member (9) of a hermetic compressor. The elastic bracket (10) comprises an elastically deformable elongated arched portion (11) and a supporting and centering member (14) formed by a stem having at least two opposed flat faces which extends from a central region of the elongated arched portion (11) along an axis essentially perpendicular. The supporting and centering member (14) is adapted to accommodate and support the pumping member (9) in a freely axially sliding manner.

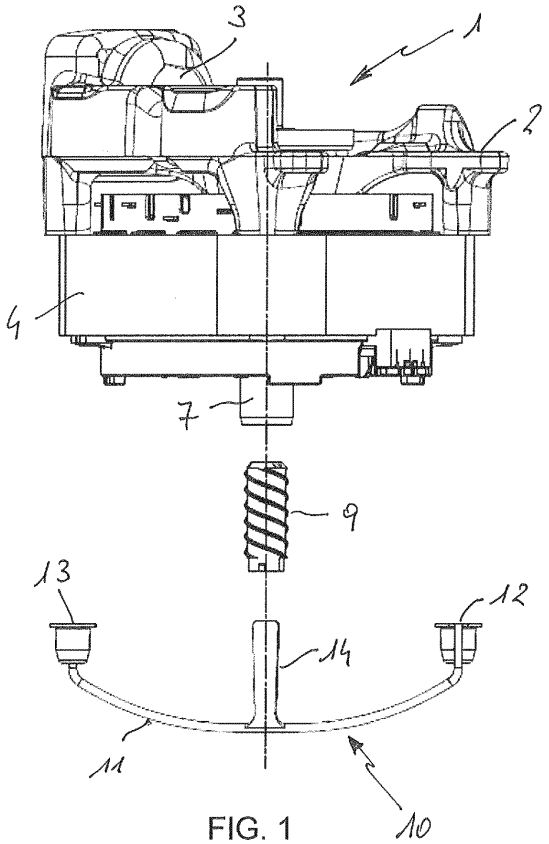

FIG. 1

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention relates to an elastic bracket for supporting a pumping member of a hermetic compressor, in particular used in refrigerating equipment. The elastic supporting bracket is associable with an oil pumping member for the lubrication of the compressor.

PRIOR ART

[0002] It is known that the hermetic compressors used in refrigerating equipment and the respective electric motor are enclosed in a sealed enclosure which does not allow performing any type of maintenance on the components contained within such an enclosure. A suitable lubrication of the moving mechanical parts should therefore be ensured for the entire operating life of the compressor.

[0003] To this end, an amount of oil sufficient to carry out an optimal lubrication is charged into the enclosure at the end of the production process and the compressor is generally provided with means capable of ensuring, during the operating periods, the correct and suitable circulation of oil both to lubricate the moving mechanical parts and to prevent overheating thereof.

[0004] A construction example of such a compressor is provided by WO 00/01949, in which an oil suction member provided with a helical groove is inserted in a bushing integrally rotatable with the rotor shaft. The oil suction member is elastically supported by an elastic bracket, anchored to the stator, by means of connecting means that allow the flotation of the suction member but prevent the rotation thereof with respect to the bushing; the assembly formed by the bushing, the suction member and the bracket is immersed in the oil sump. The rotation of the shaft imposes an integral rotation on the bushing and a rectilinear reciprocating flotation motion of the suction member in contrast to the elastic action exerted by the bracket. Such a reciprocating motion allows transferring, through the channel formed by the helical groove and the inner surface of the bushing, an oil flow from the oil sump towards the moving part of the compressor so as to carry out the lubrication and cooling of such parts.

[0005] Further similar solutions are described in US 6,716,001, WO 2012/062848 and EP 2724026.

[0006] A drawback found in the solutions disclosed by WO 00/01949 and US 6.716 .001 lies in that in order to center the suction member, essentially consisting of a worm screw, and to compensate for any misalignment with respect to the rotor shaft, it is necessary to provide at least one bushing arranged coaxially to the shaft, i.e. at least one additional member that complicates the construction of the compressor, thereby increasing the final production cost. Constructively more complex embodiments are also provided which have further components, such as an extension sleeve, in the solution disclosed by WO 00/01949, or a plurality of damping springs interposed between the bracket pins and the stator on the one hand, and the bottom of the oil sump, on the other hand, required to allow the floating movement of the worm screw since it is made in one piece with the bracket or otherwise integral thereto, as disclosed in US 6.716.001.

[0007] As a partial solution to these drawbacks, the solutions described in 2012/062848 and EP 2724026 provide for the direct insertion of the worm screw coaxially to the shaft, where the worm screw is made in one piece with the support bracket or freely associated therewith by means of a cushioning spring. While this construction is simplified, it introduces an additional drawback since the working tolerances for coupling between the screw and the shaft must be extremely precise to prevent any misalignments. The high machining precision therefore involves additional constructive and design costs.

SUMMARY OF THE INVENTION

[0008] The main task of the present invention is to overcome the drawbacks of the prior art by devising an elastic support bracket for a pumping member of a hermetic compressor able to simplify the construction of the compressor through a reduction of the components required to ensure optimum lubrication of the moving mechanical parts and consequently reducing the respective production costs.

[0009] Within the above task, an object of the present invention is to provide an elastic support bracket able to ensure the proper centering between the oil pumping member and the rotor shaft.

[0010] Another object is to provide an elastic bracket in which the coupling between the bracket and the pumping member is with clearance so as to allow the adaptation of the pumping member to the rotor shaft for proper centering.

[0011] A further object is to provide an elastic bracket which allows further working tolerances of the components, especially in the coupling between the pumping member and rotor shaft, so as to further reduce the production costs as precision machining is not required.

[0012] Yet another object is to significantly simplify the equipment, and in particular the moulds, for the production of the elastic bracket.

[0013] Another object is to devise an elastic bracket which allows reducing the diametrical bulk of the compressor.

[0014] Last but not least, an object is to devise an elastic support bracket for a pumping member of a hermetic compressor which achieves the task and the objects mentioned above at competitive costs and is obtainable with the usual and known plants, machinery and equipment.

[0015] The above task and objects as well as others that will better appear hereinafter in the description are

achieved by an elastic bracket for supporting a pumping member of a hermetic compressor as defined in claim 1.

BRIEF DESCRIPTION OF THE FIGURES

[0016] Further features and the advantages of the present invention will appear more clearly from the following description of some particular but non-exclusive embodiments thereof, made by way of a non-limiting example with reference to the accompanying figures, in which:

- figure 1 shows an exploded front view of a compressor unit provided with an elastic bracket for supporting a pumping member according to the present invention;
- figure 2 shows a section along a diametrical plane of figure 1;
- figures 3 and 4 show a front view similar to that in figure 1 and a sectional view similar to that in figure 2, respectively, of the compressor unit on which the elastic bracket of the preceding figures is mounted;
- figure 5 shows a perspective view of an elastic bracket according to the present invention;
- figure 6 shows a bottom view of the compressor unit of figure 1;
- figure 7 shows a perspective bottom view of the unit of figure 6.

DETAILED DESCRIPTION OF THE INVENTION

[0017] With reference to the above figures, reference numeral 1 generically indicates a compressor unit, typically used in refrigerating equipment, comprising an upper body 2 provided with a cylinder 23, to which a stator 4 and a rotor 6 are inferiorly associated.

[0018] Rotor 6 is placed in rotation about an axis defined by a shaft 7 which is internally hollow and integral with rotor 6.

[0019] The lower surface of stator 4, arranged on the side opposite to the upper body 2, is provided with two or more fastening means, such as screws or bolts, for the connection of stator 4 to the upper body 2, the heads 8 whereof protrude from stator 4.

[0020] The compressor unit 1 is enclosed by an outer sealed casing which forms, in its lower portion, the lubricating oil sump. The casing and the sump are not represented in the accompanying figures as they are widely known to those skilled in the art and not dissimilar from those described and represented in the prior art documents cited in the preamble of the present description relating to the prior art, in particular the casing denoted by reference numeral 12 in WO 00/01949, reference numeral 1 or 101 in US 6,716,001 or reference numeral 2 in WO 2012/062848 and EP 2724026.

[0021] A pumping member 9 is slidingly accommodated in a freely floating manner into shaft 7, externally provided with a helical groove and adapted to transfer the lubricating oil from the sump towards the moving mechanical parts through the channel formed by the helical groove cooperating with the inner wall of shaft 7.

[0022] The pumping member 9 comprises an axial cavity with polygonal section, preferably square, with at least two opposing flat surfaces for the reasons that are better explained hereinafter.

[0023] As is known, the flow of the lubricating oil from the sump to the moving parts occurs due to the rotation of shaft 7 with respect to the pumping member 9, immersed in the oil bath of the sump; this relative movement allows the oil transportation along the channel formed by the helical groove of the pumping member 9 cooperating with the inner wall of shaft 7. The smaller the clearance between the outer surface of the pumping member 9 and the inner surface of shaft 7, the better the oil flow, as the effectiveness of the oil suction effect improves the more reduced is such a clearance. As a result, optimal pumping performance can also be achieved at low rotation speeds of shaft 7 and/or at low viscosity of the lubricating oil the more reduced is the distance of the outer wall of the pumping member 9 from the inner wall of shaft 7, while the pumping performance decreases quickly, and a greater number of revolutions per minute of shaft 7 is required to maintain acceptable lubrication, as this distance increases.

[0024] According to the present invention, in order to slidingly support the pumping member 9 into shaft 7 there is provided an elastic bracket 10, commonly referred to as "oil drafting spring", comprising an elastically deformable arched portion 11 from the free ends whereof a first cup 12 and a second cup 13 extend, respectively, forming connection means of the elastic bracket 10 to the compressor unit 1; the first cup 12 and the second cup 13 are in fact adapted to engage by interlocking with the respective heads 8 of the fastening means protruding downwards from stator 4. Advantageously, the first and the second cup 12, 13 are arranged mutually offset, i.e. on opposite sides with respect to the diametrical plane defined by arched portion 11.

[0025] At the central region of arched portion 11, a supporting and centering member 14 extends according to an axis essentially perpendicular to the arched portion 11, consisting of a stem having with at least two opposing flat faces; advantageously, said stem has an essentially two-dimensional shape, preferably a tapered blade shape connected towards the connection point to the arched portion 11.

[0026] The supporting and centering member 14 is adapted to be inserted in a axially freely slidable manner into the cavity of the pumping member 9 for supporting the latter into shaft 7 in a freely floating manner; the coupling between the supporting and centering member 14 and the pumping member 9 takes place with clearance so as to compensate for any misalignment between shaft 7 and the pumping member 9, allowing the centering of the latter into shaft 7 without expensive precision processes with minimum tolerances in order to ensure such

a centering.

[0027] Moreover, the coupling between opposing flat faces of the supporting and centering member 14 with the inner cavity of the pumping member 9 with polygonal section, preferably square, prevents the rotation of the pumping member 9 with respect to shaft 7 while allowing the free flotation thereof with respect to the supporting and centering member 14 and to shaft 7. In other words, the supporting and centering member 14 has the further function of anti-rotation member for the pumping member 9.

[0028] The elastic bracket 10 is made of plastic in one piece, thus comprising the first and the second cup 12, 13 and the supporting and centering member 14 associated with the arched portion 11; alternatively, the arched portion 11 comprising the supporting and centering member 14 may be made of a metal material 14 on which the first and the second cup 12, 13 of plastic material are overinjected.

[0029] In any case, the construction of bracket 10 is significantly convenient cost-wise, since a single mould having a simplified shape combined with an injection press is sufficient; in this way, the production process can be automated, thereby significantly increasing the production capacity and, consequently, obtaining a considerable reduction in the production costs.

[0030] Bracket 10 further allows simplifying the compressor assembly steps. In fact, during the assembly steps, the compressor unit 1 travels on an assembly line oriented as shown in figure 1, i.e. with the upper body 2 up and stator 4 down.

[0031] Most of the known brackets require the overturning of the compressor unit 1 in order to be mounted; this operating step, and the subsequent replacing of the compressor unit after the bracket has been mounted, generally occur manually as they can hardly be automated. It is thus clear then that production capacity is limited, resulting in increased cost.

[0032] Bracket 10 according to the present invention instead allows being mounted on the compressor unit 1 without having to be overturned, according to the diagram shown in figures 1 and 2: with the compressor unit 1 in position not overturned, the pumping member 9 is inserted into the inner cavity of shaft 7 and then, the supporting and centering member 14 is inserted into the pumping member 9; once these operations have been completed, cups 12, 13 are fixed with interference, such as snappingly, to the respective heads 8 of the fastening means so as to complete the assembly. The assembly can therefore be fully automated with further reduction of the production costs.

[0033] According to another aspect of the present invention, the mutually offset arrangement of the first and second cup 12, 13 allows reducing the diametrical footprint of the compressor unit 1 since heads 8 of the fastening means, with which the cups 12, 13 are engaged, are located on a circumference with a smaller diameter than an arrangement in which the cups are aligned according to a diametrical axis.

[0034] From the foregoing, it is therefore apparent that the present invention achieves the tasks and the objects set forth: in fact, an elastic support bracket 10 for a pumping member 9 of a hermetic compressor has been devised which is able to simplify the construction of the compressor through a reduction of the components required to ensure optimum lubrication of the moving mechanical parts and consequently reducing the respective production costs.

[0035] In particular, bracket 10 according to the present invention allows greatly simplifying the equipment, and in particular the moulds for the production of the bracket itself, as well as automating all the assembly steps of the compressor without the need for manual interventions for the positioning of the compressor unit on the assembly line.

[0036] Moreover, the elastic support bracket 10 is able to ensure the proper centering between the oil pumping member 9 and the rotation rotor shaft 9 and the rotor shaft 7, due to the coupling with clearance between the supporting and centering member 14 and the pumping member 9 that allows compensating for any misalignment between the pumping member 9 and shaft 7 of rotor 6. In this way, the components can be made with greater working tolerances, thus further reducing the production costs as no precision machining is required.

[0037] The adaptation capacity provided by the centering and supporting member 14 to the pumping member 9 further allows having a minimum clearance between the pumping member 9 and shaft 7, so as to achieve optimal performance in oil circulation even at low rotation speeds of shaft 7 and/or at low viscosity of the lubricating oil.

[0038] A further advantageous aspect of the present invention is the possibility of reducing the diametrical footprint of the compressor due to the mutually offset arrangement of cups 12, 13 engageable with heads 8 of the fastening means of stator 4 to the upper body 2 of the compressor unit 1.

[0039] Of course, the present invention is susceptible of numerous applications, modifications or variants without departing from the scope of protection as defined in the independent claim 1.

[0040] Moreover, the materials and equipment used in implementing the present invention, as well as the shapes and sizes of the single components may be the most suitable ones depending on the needs.

Claims

1. Elastic bracket for supporting a pumping member (9) of a hermetic compressor, said elastic bracket (10) comprising an elastically deformable elongated arched portion (11), **characterized in that** a supporting and centering member (14) formed by a stem having at least two opposed flat faces extends from

a central region of said elongated arched portion (11) along an axis essentially perpendicular to said elongated arched portion (11), said supporting and centering member (14) being adapted to accommodate and support said pumping member (9) in a freely axially sliding manner.

2. Elastic bracket as in claim 1, wherein said at least two opposed flat faces of said supporting and centering member (14) being adapted to couple with corresponding flat faces of an axial cavity having a polygonal section provided inside said pumping member (9) so as to prevent rotation of said pumping member (9).

3. Elastic bracket as in claim 1, wherein said supporting and centering member (14) is configured with essentially bidimensional shape tapered and filleted to said arched portion (1).

4. Elastic bracket as in claim 1, wherein connecting means comprising a first cup (12) and a second cup (13) are provided to connect said elastic bracket (10) to said compressor, said first and second cup (12, 13) respectively extending from the free ends of said elongated arched portion (11) and being arranged mutually staggered in respect to a diametrical plane defined by said arched portion (11).

5. Elastic bracket as in claim 4, wherein said arched portion (11), said supporting and centering member (14) and said first and second cup (12, 13) are made integral in one piece.

6. Hermetic compressor comprising a compressor unit (1) including an upper body (2) provided with a cylinder (3), a stator (4) and a rotor (6) actuated in rotation by a hollow shaft (7) being associated to said upper body (2), said stator (4) being connected to said upper body (2) by fastening means (8) protruding from said stator (4) opposite said upper body (2), a pumping member (9) being slidingly accommodatable, in a freely floating manner, inside said hollow shaft (7), said pumping member (9) being provided on its outer surface with a helical groove adapted to cooperate with the inner wall of said hollow shaft (7) to form a channel adapted to convey a lubricant, **characterized in that** it comprises an elastic bracket as in claim 1 for supporting said pumping member (9).

7. Hermetic compressor as in claim 6, wherein said pumping member (9) is slidingly supported and centered inside said hollow shaft (7) by said supporting and centering member (14) extending perpendicular from said elastic bracket (10), coupling means between said supporting and centering member (14) and said pumping member (9) being provided to prevent rotation of said pumping member (9) in respect to said hollow shaft (7).

8. Hermetic compressor as in claim 7, wherein said pumping member (9) is adapted to be fitted with clearance to said supporting and centering member (14) so as to compensate any misalignment between said pumping member (9) and said hollow shaft (7).

9. Hermetic compressor as in claims 4 and 6, wherein said elastic bracket (10) is associable to said stator (4) by connecting means comprising said first and second cup (12, 13) adapted to engage said fastening means (8) fastening said stator (4) to said upper body (2).

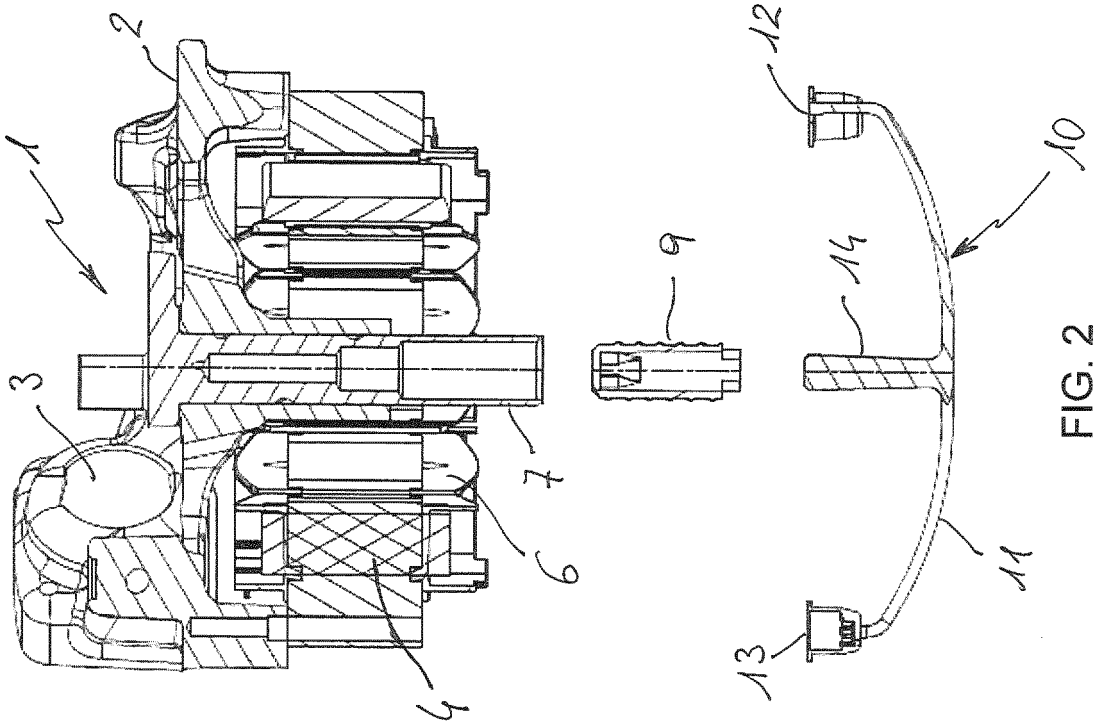

FIG. 2

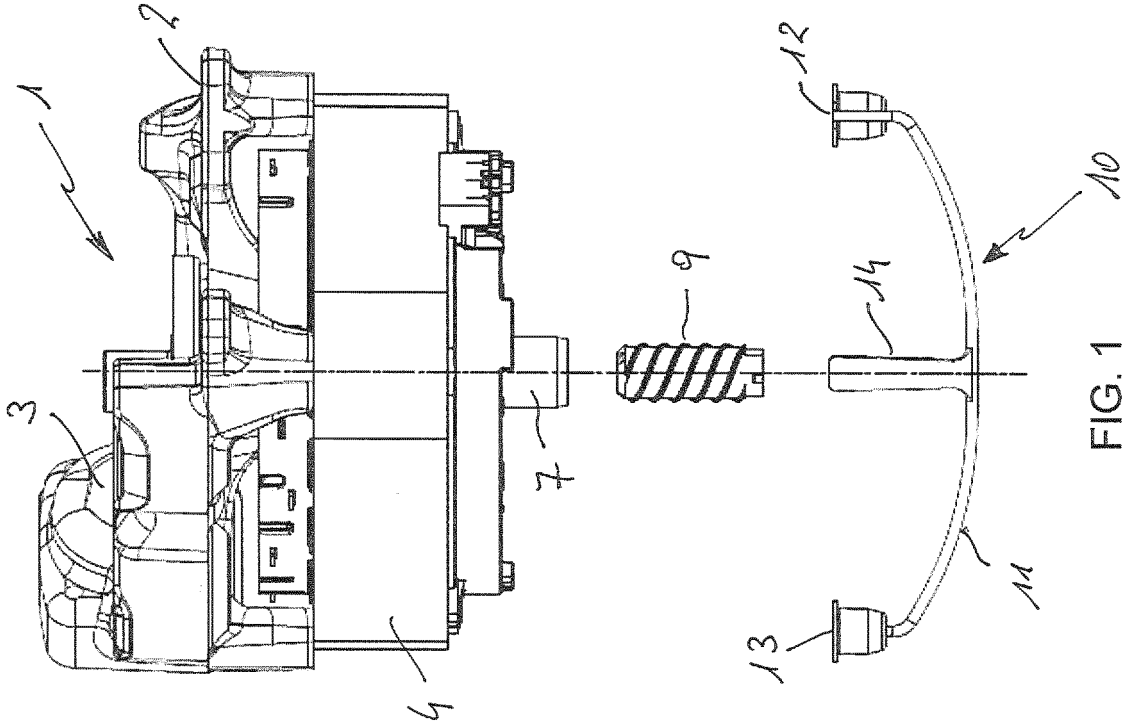

FIG. 1

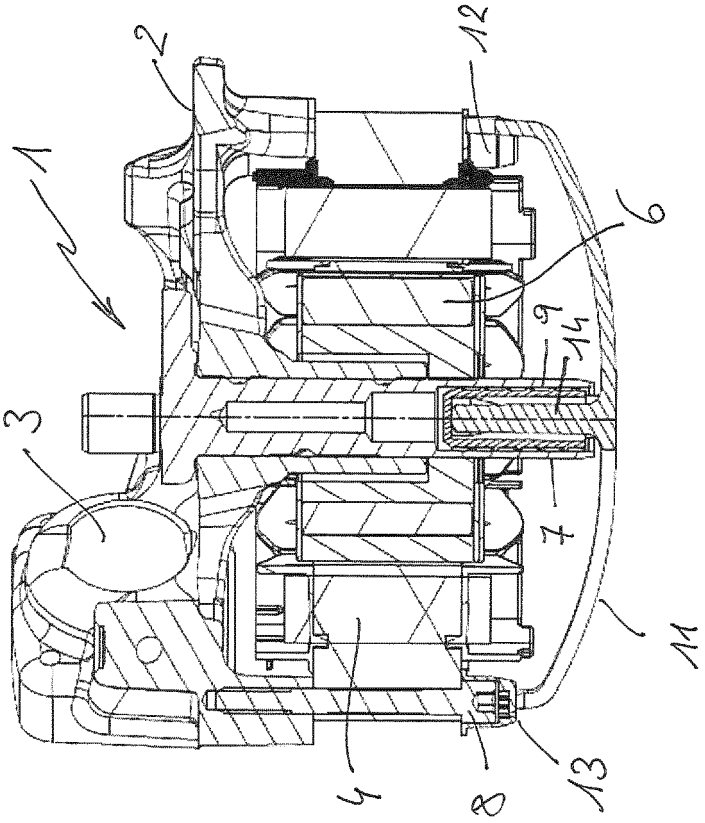

FIG. 4

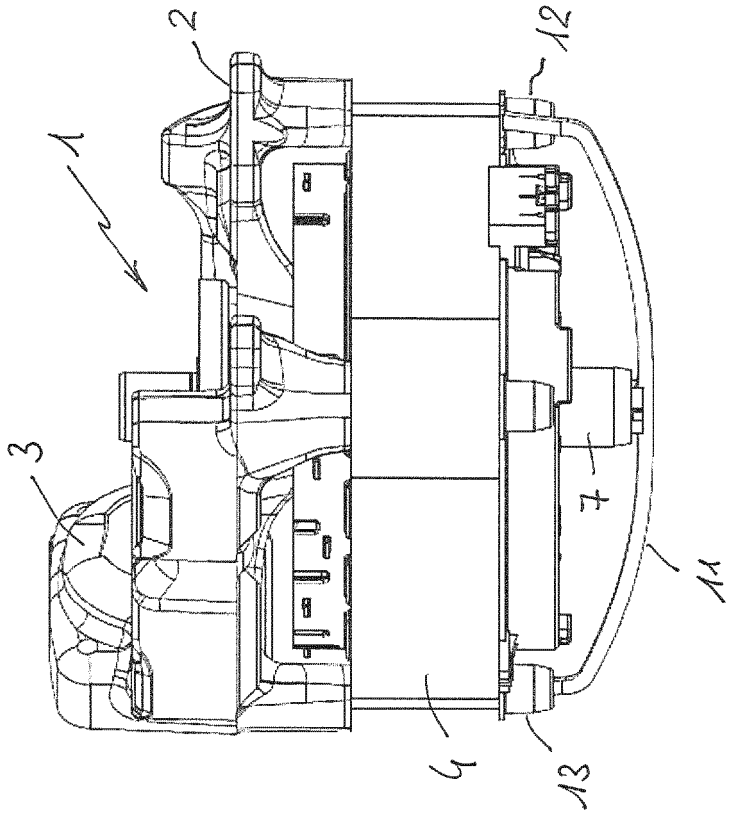

FIG. 3

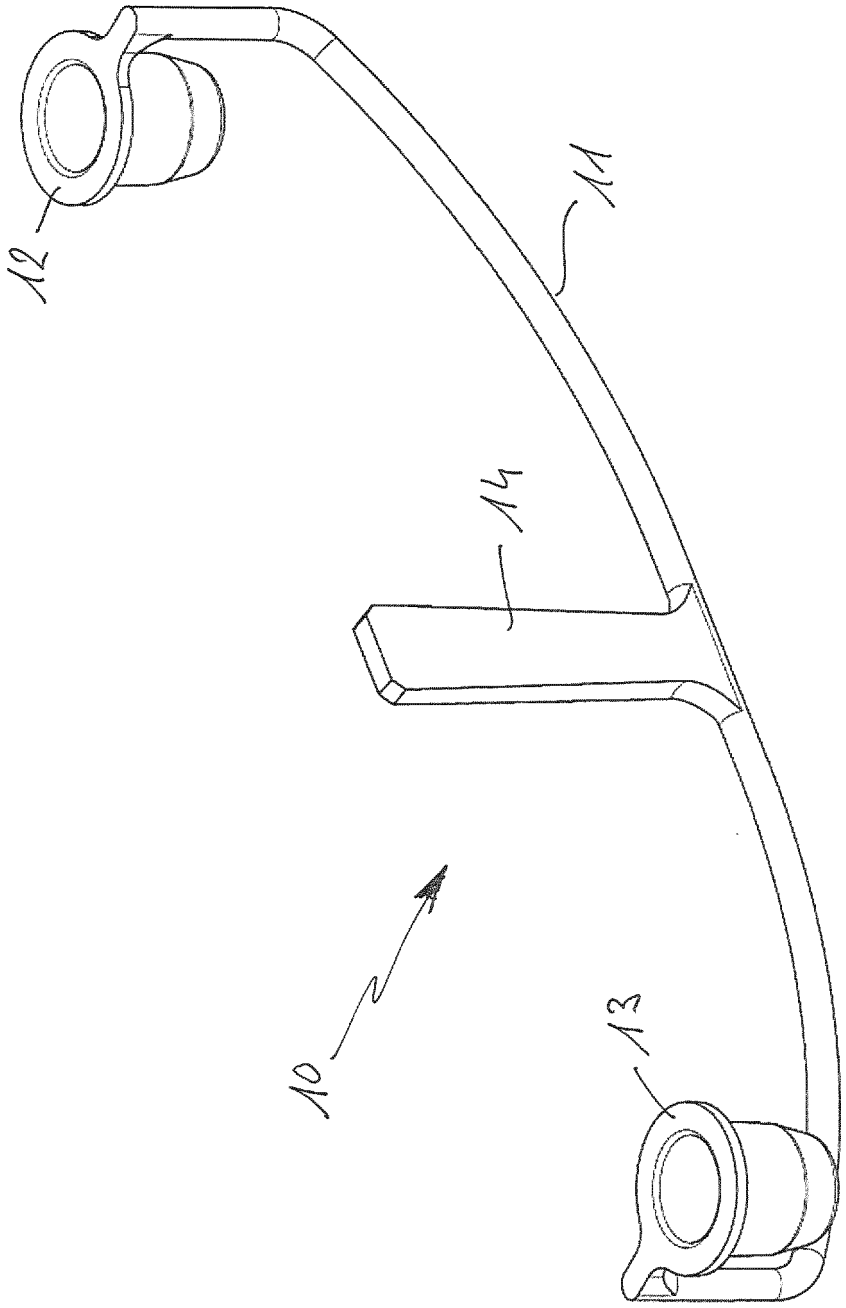

FIG. 5

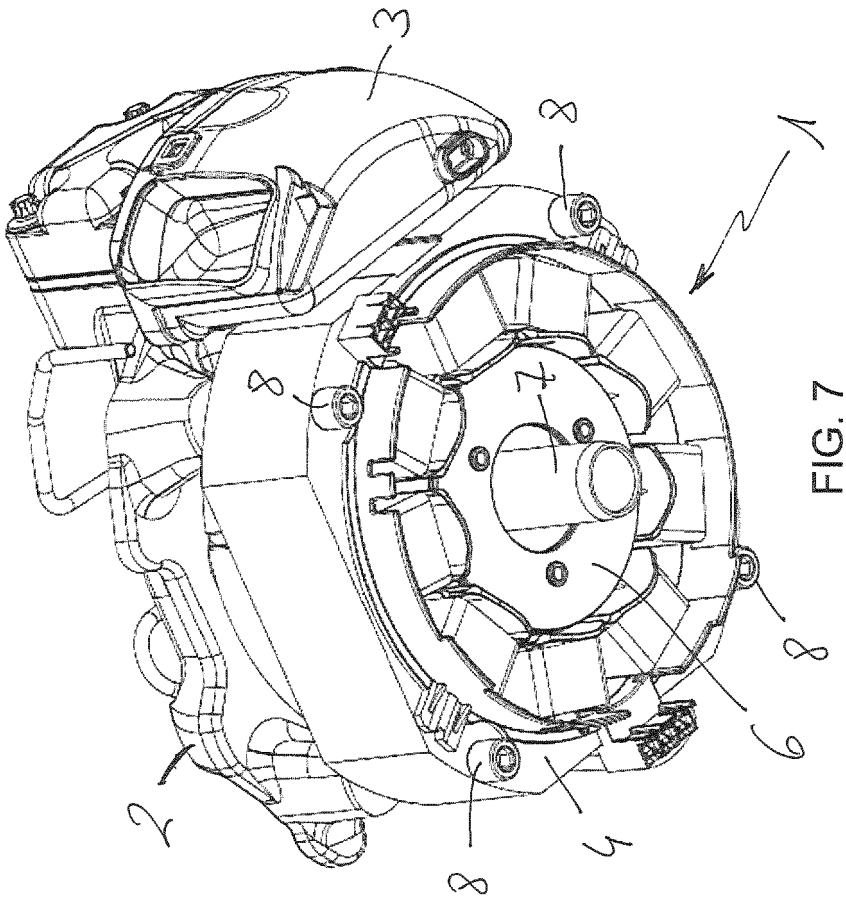

FIG. 7

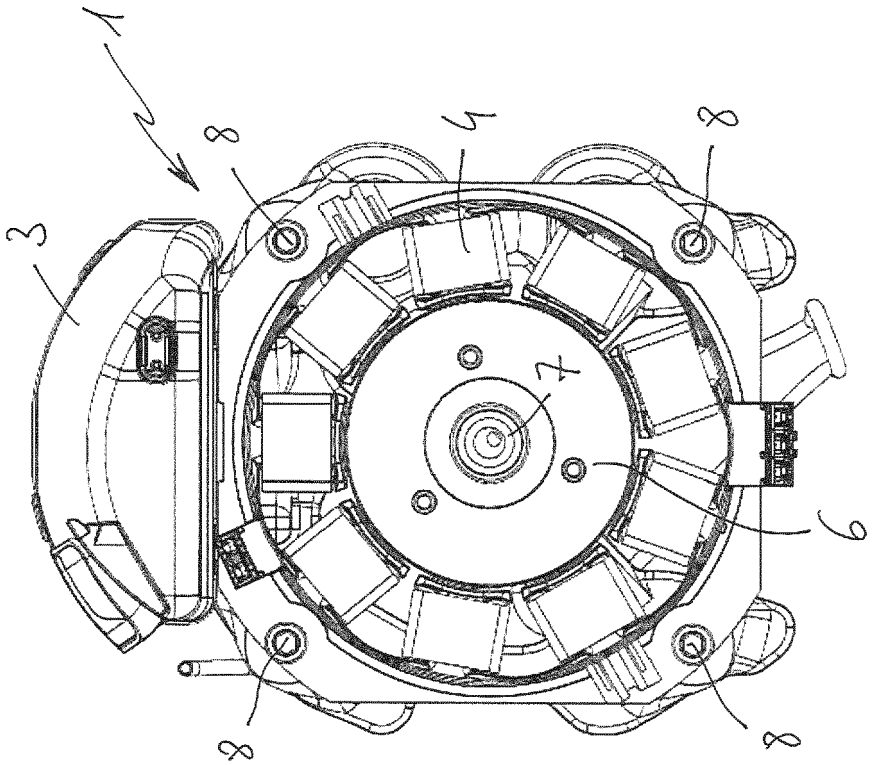

FIG. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 3484

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	25 January 2018	Ricci, Saverio

CATEGORY OF CITED DOCUMENTS

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