



(12) **EUROPEAN PATENT APPLICATION**
published in accordance with Art. 153(4) EPC

(43) Date of publication:
19.05.2021 Bulletin 2021/20

(51) Int Cl.:
F04B 39/12 (2006.01)

(21) Application number: **20838870.2**

(86) International application number:
PCT/CN2020/079234

(22) Date of filing: **13.03.2020**

(87) International publication number:
WO 2021/056979 (01.04.2021 Gazette 2021/13)

(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
Designated Extension States:
BA ME KH MA MD TN

(72) Inventors:
• **CHEN, Huiping**
Guangzhou, Guangdong 510470 (CN)
• **CHEN, Zhonghua**
Guangzhou, Guangdong 510470 (CN)
• **WU, Xiaoling**
Guangzhou, Guangdong 510470 (CN)
• **QUI, Shixue**
Guangzhou, Guangdong 510470 (CN)

(30) Priority: **23.09.2019 CN 201910898938**

(71) Applicant: **Wanbao Group Compressor Co., Ltd.**
Baiyun District
Guangzhou, Guangdong 510470 (CN)

(74) Representative: **LifeTech IP**
Spies & Behrndt Patentanwälte PartG mbB
Elsenheimerstraße 47a
80687 München (DE)

(54) **CYLINDER HEAD ASSEMBLY, COMPRESSOR AND REFRIGERATION DEVICE**

(57) The disclosure relates to a cylinder head assembly, a compressor and a refrigeration device. The cylinder head assembly includes a crankcase provided with a cylinder hole and an exhaust muffler cavity, wherein the crankcase is provided with an annular boss at an end of the cylinder hole, an end surface of the annular boss forms a first mounting surface, the first mounting surface is provided with a first exhaust throttle through-hole which is communicated with the exhaust muffler cavity, and an outer circular surface of the annular boss is not coaxial with the cylinder hole and is biased toward the first exhaust throttle through-hole; cylinder head components, an edge of each of the cylinder head components is provided with a protrusion, and each protrusion is provided with a second exhaust throttle through-hole corresponding to the first exhaust throttle through-hole; and a cylinder cover provided with a first cylindrical mounting groove and a second cylindrical mounting groove. The compressor includes the cylinder head assembly. The refrigeration device includes the compressor. The disclosure not only has the advantages of small size and low cost of a circular cylinder head, but also avoids the technical difficulty of exhausting gas from a cylinder cover in the traditional circular cylinder head design, and saves the material cost.

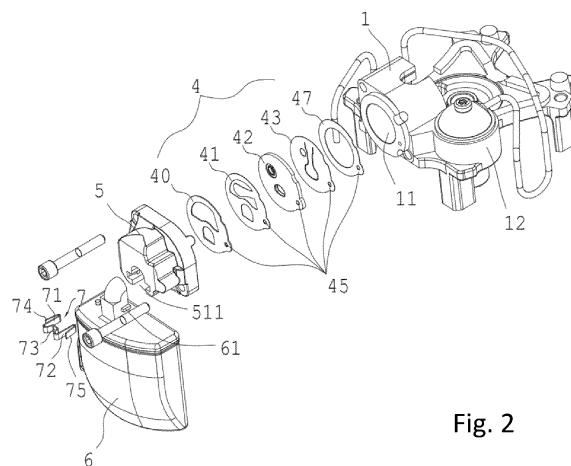


Fig. 2

Description

TECHNICAL FIELD

[0001] The disclosure is applied in the field of compressors, and particularly relates to a cylinder head assembly, a compressor and a refrigeration device.

BACKGROUND

[0002] Cylinder head components of a compressor include a cylinder cover, a cylinder cover gasket, a suction muffler, a valve plate component, a suction valve sheet, a valve plate gasket, cylinder cover screws, etc., wherein the amount of cylinder cover screws is four. The cylinder cover, the cylinder cover gasket, the valve plate component, the suction valve sheet and the valve plate gasket are designed to be square in appearance, and cylinder cover screw mounting holes are formed in four corners. Correspondingly, threaded holes are formed in a crankcase board (near the top end of a cylinder hole), and the four number of cylinder cover screws are matched with the threaded holes to fasten each cylinder head component.

[0003] Due to many shortcomings of the square cylinder head components, circular cylinder head components are generally used in the prior art. However, the cylinder head components in the prior art still have the following shortcomings.

1. An exhaust system is led out from a cylinder cover, and then introduced into a separate exhaust muffler, which results in a large number of overall structural parts, complex processes, and high production cost.
2. Cylinder head components are complicated in positioning and difficult in processing, positioning and assembling, high in process cost, long in production time, slow in pace, and prone to bad displacement in the assembling process.
3. The cylinder head components have poor gas tightness, and the material cost is high.

SUMMARY

[0004] An objective of the disclosure is to solve at least one of the technical problems existing in the prior art and provide a cylinder head assembly, a compressor and a refrigeration device, which not only have the advantages of small size and low cost of a circular cylinder head, but also avoid the technical difficulty of exhausting gas from a cylinder cover in the traditional circular cylinder head design, and save the material cost.

[0005] The technical solutions adopted by the disclosure to solve the technical problems are as follows.

[0006] According a first aspect, the cylinder head assembly includes:

a crankcase provided with a cylinder hole and an exhaust muffler cavity, wherein the crankcase is provided with an annular boss at an end of the cylinder hole, an end surface of the annular boss forms a first mounting surface provided with a first exhaust throttle through-hole communicated with the exhaust muffler cavity, and an outer circular surface of the annular boss is not coaxial with the cylinder hole and is biased toward the first exhaust throttle through-hole;

cylinder head components including an exhaust valve sheet, a valve plate and a suction valve sheet, wherein each of the cylinder head components has a circular shape, an edge of each of the cylinder head components is provided with a protrusion, and each protrusion is provided with a second exhaust throttle through-hole corresponding to the first exhaust throttle through-hole; and

a cylinder cover provided with a first cylindrical mounting groove and a second cylindrical mounting groove, wherein the first cylindrical mounting groove is coaxial with the cylinder hole, the second cylindrical mounting groove is coaxial with the outer circular surface of the annular boss, the cylinder cover is connected to the crankcase and clamps the cylinder head components between the bottom of the first cylindrical mounting groove and the first mounting surface, the second exhaust throttle through-hole is communicated with the first exhaust throttle through-hole to form an exhaust passage, and the second cylindrical mounting groove is matched with the outer circular surface of the annular boss.

[0007] In conjunction with the first aspect, in some embodiments of the first aspect, each of the cylinder head components can be fitted in the first cylindrical mounting groove and matched with a cylindrical surface of the first cylindrical mounting groove.

[0008] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylindrical surface of the first cylindrical mounting groove and a cylindrical surface of the second cylindrical mounting groove are inscribed.

[0009] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with a positioning groove that is matched with the protrusion; the cylinder cover is provided with a positioning post, and the edge of each of the cylinder head components is provided with a first groove that is matched with the positioning post; and the positioning post, the first groove and the inscribed position are distributed in a circumferential direction of the first cylindrical mounting groove.

[0010] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with a positioning boss, and the crankcase is provided with a recess that is matched with the positioning boss.

[0011] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the positioning boss is located at an end of the positioning post.

[0012] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder head components also include a cylinder cover gasket and a valve plate gasket, wherein the cylinder cover gasket is disposed between the cylinder cover and the exhaust valve sheet, and the valve plate gasket is disposed between the suction valve sheet and the crankcase.

[0013] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, a second mounting surface is formed on an end surface of the crankcase at an outer side of the annular boss; after all the cylinder head components are clamped, a first gap is left between the bottom of the second cylindrical mounting groove and the first mounting surface; and a second gap is left between the top of the second cylindrical mounting groove and the second mounting surface.

[0014] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the first gap and the second gap are not less than 0.1 mm, respectively.

[0015] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with a plurality of first connecting holes in the peripheries of the first cylindrical mounting groove and the second cylindrical mounting groove; the crankcase is provided with second connecting holes corresponding to the first connecting holes; and the cylinder cover and the crankcase are connected by connecting members that pass through the first connecting holes and the second connecting holes.

[0016] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, a part of a wall of at least one of the first connecting holes bulges toward the inside of the first cylindrical mounting groove, and the edge of each of the cylinder head components is provided with a second groove that is matched with the bulged wall.

[0017] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with a flange at one end that is matched with the crankcase, and the first connecting holes are provided in the flange.

[0018] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the first exhaust throttle through-hole in the first mounting surface is located in an extension line of a connecting line between a center of the outer circle of the annular boss and a center of the cylinder hole.

[0019] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, a minimum distance between the first exhaust throttle through-hole and the outer circular surface of the

annular boss is not less than 2 mm, and a minimum distance between the first exhaust throttle through-hole and the cylinder hole is not less than 2 mm.

[0020] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, each of the cylinder head components is formed from a square sheet by punching, and the protrusion of each cylinder head component is located at a corner of the square sheet.

[0021] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with an exhaust cavity at the bottom of the first cylindrical mounting groove, and a throttling component and an exhaust valve sheet limiting component are provided in the exhaust cavity.

[0022] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the cylinder cover is provided with a mounting hole, a suction muffler is further included, and a gas outlet end of the suction muffler is provided in the mounting hole and is tightly pressed against the cylinder head components by an elastic component.

[0023] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the elastic component includes a clamp spring formed by bending an elastic sheet and having a first clamping arm, a connecting portion and a second clamping arm, wherein an end of the first clamping arm is reversely everted to form a first clamping wing, and an end of the second clamping arm is reversely everted to form a second clamping wing; a clamp spring mounting groove is formed in the wall of the mounting hole; a clamping wing limiting boss is provided in the clamp spring mounting groove; the clamp spring is embedded into the clamp spring mounting groove and is clamped by the clamping wing limiting boss through the first clamping wing and the second clamping wing; and the connecting portion presses the suction muffler in the mounting hole.

[0024] In conjunction with the first aspect and the above embodiments, in some embodiments of the first aspect, the connecting portion has a bent pressing part for pressing the suction muffler.

[0025] According to a second aspect, the compressor includes the cylinder head assembly according to any of the embodiments in the first aspect.

[0026] According to a third aspect, a refrigeration device includes the compressor according to the second aspect.

[0027] One of the above technical solutions has at least one of the following advantages or beneficial effects:

1. Each of the cylinder head components is of a circular design, which saves the overall size of the cylinder head component, and reduces the weight and the cost.
2. The second exhaust throttle through-hole in each cylinder head component, the first exhaust throttle

through-hole in the annular boss and the exhaust muffler cavity in the cylinder head are communicated to form an exhaust passage, and the technical solution in the prior art that an exhaust system is led out from a cylinder cover and then introduced into a separate exhaust muffler is abandoned, so that the overall structure has fewer parts, simpler process and lower production cost.

3. The outer circular surface of the annular boss and the cylinder hole, the first cylindrical mounting groove and the second cylindrical mounting groove are all designed to be non-coaxial, which can ensure a good seal of the exhaust passage while greatly saving the amount of materials used for the crankcase and the cylinder cover, thereby greatly reducing the production cost. In addition, the structural form of being non-coaxial also plays a foolproof function for assembly-line operations.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The disclosure will be further described below in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic structural diagram of a compressor in one embodiment of the disclosure;

FIG. 2 is an exploded structural view of a cylinder head assembly of the compressor in one embodiment of the disclosure;

FIG. 3 is a schematic structural diagram of a crankcase in one embodiment as shown in FIG. 2;

FIG. 4 is a schematic diagram that the outer circular surface of an annular boss is not coaxial with a cylinder hole in one embodiment as shown in FIG. 2;

FIG. 5 is a schematic structural diagram that a cylinder head component is formed from a square sheet in one embodiment as shown in FIG. 2;

FIG. 6 is a schematic diagram of an internal structure of a cylinder cover in one embodiment as shown in FIG. 2;

FIG. 7 is a schematic structural diagram that the cylinder head component is provided in the cylinder cover in one embodiment as shown in FIG. 2;

FIG. 8 is a schematic structural diagram after the cylinder cover and the crankcase are connected in one embodiment as shown in FIG. 2;

FIG. 9A is a partially enlarged view at A in FIG. 8; and

FIG. 10 is a schematic structural diagram of the cylinder cover and a mounting hole in one embodiment

as shown in FIG. 2.

DETAILED DESCRIPTION

[0029] This section will describe specific embodiments of the disclosure in detail. The preferred embodiments of the disclosure are shown in the accompanying drawings. The accompanying drawings function to supplement the description of the text part of the description with graphics, so as to intuitively and vividly understand each technical feature and overall technical solution of the disclosure, but cannot be understood as a limitation for the protection scope of the disclosure.

[0030] In the disclosure, if there is a description of directions (up, down, left, right, front and back), it is only for the convenience of describing the technical solution of the disclosure, but not indicating or implying that the indicated technical features have to be specifically located, and structured and operated in a specific direction, and therefore, should not be understood as limitations to the disclosure.

[0031] In the disclosure, "several" means a number of one or more, and "a plurality of" means a number of two or more, and "greater than", "less than", "exceeding", etc., are understood as not including the number; and "above", "below", "within", etc., are understood to include the number. In the description of the disclosure, the terms "first" and "second" are, if any, used for only distinguishing the technical features, but cannot be understood as indicating or implying the relative importance or implicitly specifying the number of the indicated technical features or implicitly specifying the precedence relationship of the indicated technical features.

[0032] In the disclosure, unless otherwise definitely limited, the terms "provided", "mounted", "connected" and the like need to be broadly understood. For example, connection may be direct connection, or connection via an intermediation, or fixed connection, or detachable connection or integrated connection; or may be mechanical connection, or electrical connection or the ability to communicate with each other; or may be internal communication between two components or an interaction between two components. Those of ordinary skill in the art can understand the specific meanings of the above terms in the disclosure in accordance with specific content of the technical solutions.

[0033] An embodiment of the disclosure provides a compressor, and particularly relates to a reciprocating compressor. Referring to FIG. 1, the reciprocating compressor includes a cylinder head assembly, a driving assembly 2 and a casing 3. The cylinder head assembly and the driving assembly 2 are provided inside the casing 3. An exhaust pipe 31 and a suction pipe 32 are provided on the casing 3. When the reciprocating compressor works, a working fluid is continuously sucked by the suction pipe 32 and discharged from the exhaust pipe 31 after being compressed. The cylinder head assembly includes a crankcase 1, cylinder head components 4 and

a cylinder cover 5. The crankcase 1 is provided with a cylinder hole 11. The driving assembly 2 includes a motor, a crankshaft, a connecting rod and a piston. In operation, the motor drives the crankshaft to rotate, an eccentric portion of the crankshaft drives the connecting rod to move, the connecting rod drives the piston to reciprocate in the cylinder hole 11 of the crankcase 1, and meanwhile the working fluid is controlled by the cylinder head assembly to flow in and out to realize the compression of a refrigerant.

[0034] Referring to FIGs 2 and 3, the crankcase 1 is provided with the cylinder hole 11 and an exhaust muffler cavity 12. The exhaust muffler cavity 12 is cast on the crankcase 1. The crankcase 1 is provided with an annular boss 13 at an end of the cylinder hole 11, An end surface of the annular boss 13 forms a first mounting surface 14 which is closely fitted with each cylinder head component 4. The first mounting surface 14 is provided with a first exhaust throttle through-hole 15 which is communicated with the exhaust muffler cavity 12. According to the embodiment of the disclosure, an external exhaust muffler is replaced by the exhaust muffler cavity 12, which has a simple structure and lower process cost.

[0035] Referring to FIG. 3, the outer circular surface of the annular boss 13 is not coaxial with the cylinder hole 11, and is biased toward the first exhaust throttle through-hole 15, such that the annular boss 13 has a larger contact surface on the side where the first exhaust throttle through-hole 15 is located, for fitting with the cylinder head component 4, so as to ensure sealing and ensure that no leakage occurs around the first exhaust throttle through-hole 15 during the exhaust process. Meanwhile, the annular boss 13 has a smaller thickness on the side away from the first exhaust throttle through-hole 15, thereby greatly saving the material consumption of the crankcase 1 and greatly reducing the production cost. Referring to FIG. 4, compared with a coaxial structure design, the embodiment of the disclosure can save a material quota of a diagonally shaded area.

[0036] The cylinder head components 4 are used to control a flow direction of the working fluid when the compressor works. Referring to FIG. 2, the cylinder head components 4 include an exhaust valve sheet 41, a valve plate 42 and a suction valve sheet 43. The valve plate 42 is provided with a suction hole and an exhaust hole. The exhaust valve sheet 41 is attached to the outside of the valve plate 42. The exhaust valve sheet 41 is provided with an exhaust valve flap corresponding to the exhaust hole and a suction avoidance hole corresponding to the suction hole. The suction valve sheet 43 is attached to the inside of the valve plate 42, and the suction valve sheet 43 is provided with a suction valve flap corresponding to the suction hole and an exhaust avoidance hole corresponding to the exhaust hole. In some embodiments, the cylinder head components 4 also include a cylinder cover gasket 40 and a valve plate gasket 47. The cylinder cover gasket 40 is disposed between the cylinder cover 5 and the exhaust valve sheet 41, and the

valve plate gasket 47 is disposed between the suction valve sheet 43 and the crankcase 1.

[0037] Referring to FIG. 2 and FIG. 5, each of the cylinder head components 4 is of a circular design, which can save the overall size of the cylinder head component, and reduce the weight and the cost. An edge of each cylinder head component 4 is provided with a protrusion 44. The protrusion 44 is provided with a second exhaust throttle through-hole 45 corresponding to the first exhaust throttle through-hole 15. The respective cylinder head components 4 are stacked. The second exhaust throttle through-holes 45 of respective cylinder head components 4 are sequentially butted to form a duct through which the working fluid can flow. Each protrusion 44 can be set to be round, oval, square, specially-shaped, etc. Each protrusion 44 can keep a sufficient sealing width around the second exhaust throttle through-hole 45 of each cylinder head component 4 to ensure that no leakage occurs around the second exhaust throttle through-hole 45 during the exhaust process.

[0038] Referring to FIG. 2 and FIG. 6, the cylinder cover 5 is provided with a first cylindrical mounting groove 51 and a second cylindrical mounting groove 52. The first cylindrical mounting groove 51 has a diameter smaller than that of the second cylindrical mounting groove 52, and the first cylindrical mounting groove 51 is coaxial with the cylinder hole 11 and used to clamp each cylinder head component 4 at the end of the first cylinder hole 11. The second cylindrical mounting groove 52 is coaxial with an outer circular surface of the annular boss 13. After the cylinder cover 5 is connected to the crankcase 1, the second cylindrical mounting groove 52 is matched with the outer circular surface of the annular boss 13, and then mounted and positioned. The cylinder cover 5 is connected to the crankcase 1 and clamps the respective cylinder head component 4 between the bottom of the first cylindrical mounting groove 51 and the first mounting surface 14, and the second exhaust throttle through-hole 45 is communicated with the first exhaust throttle through-hole 15 to form an exhaust passage. The first cylindrical mounting groove 51 and the second cylindrical mounting groove 52 are both designed to be non-coaxial, which can greatly save the amount of materials used for the cylinder cover 5, thereby greatly reducing the production cost. In addition, the structural form of being non-coaxial also plays a foolproof function for assembly-line operations, which helps the cylinder cover 5 and the crankcase 1 to quickly and accurately realize the butt joint, and makes the process simpler and the production cost lower.

[0039] In some embodiments, referring to FIG. 7, each of the cylinder head components 4 can be assembled in the first cylindrical mounting groove 51 and matched with a cylindrical surface of the first cylindrical mounting groove 51. When assembling, the cylinder cover gasket 40, the exhaust valve sheet 41 and the valve plate 42 are positioned and assembled. That is, cylindrical outer circles of the cylinder cover gasket 40, the exhaust valve

sheet 41 and the valve plate 42 are directly mounted into the cylindrical surface of the first cylindrical mounting groove 51 to form radial positioning. The centrally-biased second cylindrical mounting groove 52 is provided at the same time. The suction valve sheet 43 and the valve plate gasket 47 are positioned and assembled, and the second cylindrical mounting groove 52 is then mounted and positioned on a circular outer wall surface of the annular boss 13 of the crankcase 1. After the cylinder head components 4 are assembled, the cylinder cover 5 is fastened to the crankcase 1 by connecting members, such as screws, to seal the cylinder hole 11. The assembly process is more orderly and the positioning accuracy is higher.

[0040] In order to maximally save the material quota, referring to FIG. 6 and FIG. 7, the cylindrical surface of the first cylindrical mounting groove 51 and the cylindrical surface of the second cylindrical mounting groove 52 are inscribed, which is the most material-saving solution geometrically. It can be understood that the structural design in which the cylindrical surface of the first cylindrical mounting groove 51 and the cylindrical surface of the second cylindrical mounting groove 52 are coaxial and inscribed can save materials.

[0041] In some embodiments, referring to FIG. 4, on the first mounting surface 14, the first exhaust throttle through-hole 15 is located in an extension line of a connecting line between the center of the outer circle of the annular boss 13 and the center of the cylinder hole 11. At this time, the first exhaust throttle through-hole 15 is located at the widest portion of the annular boss 13. In order to ensure a good contact seal, a minimum distance between the first exhaust throttle through-hole 15 and the outer circular surface of the annular boss 13 is not less than 2 mm, and a minimum distance between the first exhaust throttle through-hole 15 and the cylinder hole 11 is not less than 2 mm. By keeping a sufficient sealing width, it is ensured that no leakage occurs around the second exhaust throttle through-hole 45 during the exhaust process.

[0042] Further, referring to FIG. 7, the cylinder cover 5 is provided with a positioning groove 53 arranged in a depth direction of the first cylindrical mounting groove 51. The protrusion 44 of each cylinder head component 4 engages with the positioning groove 53 to form a first positioning point for positioning the cylinder head component 4. The cylinder cover 5 is provided with a positioning post 54 which is arranged in the depth direction of the first cylindrical mounting groove 51. Referring to FIG. 5, the edge of each cylinder head component 4 is provided with a first groove 46 which engages with the positioning post 54 to form a second positioning point for positioning the cylinder head component 4. A third positioning point for positioning the cylinder head component 4 is formed at a position where the cylindrical surface of the first cylindrical mounting groove 51 and the cylindrical surface of the second cylindrical mounting groove 52 are inscribed. The positioning post 54, the first groove 46 and

the inscribed position are distributed in a circumferential direction of the first cylindrical mounting groove 51, and are spaced a certain distance apart. The combined action of the first positioning point, the second positioning point and the third positioning point ensures the accuracy of the mounting and positioning of the cylinder head components 4, especially the accuracy of the mounting and positioning of the suction valve sheet 43 and the valve plate gasket 47 that cannot be positioned by the first cylindrical mounting groove 51, and ensures the normal operation of the suction and exhaust functions of the cylinder head components 4.

[0043] In some embodiments, referring to FIG. 3 and FIG. 6, a positioning boss 55 is provided on the cylinder cover 5, and a recess 10 is formed in the crankcase 1. After the cylinder cover 5 is connected to the crankcase 1, the positioning boss 55 is embedded in the recess for quick assembly and positioning, wherein the positioning boss 55 has a dome that can guide the positioning boss 55 to quickly fit into the recess.

[0044] Further, the positioning boss 55 and the positioning post 54 can be separated or butted. For example, in the embodiment shown in FIG. 6, the positioning boss 55 is located at the end of the positioning post 54, and the positioning boss 55 and the positioning post 54 are located at the same position, which is convenient for the design and molding of a mold of the cylinder cover 5. In addition, the positioning boss 55 also provides a guiding function for the cylinder head components 4, which makes the assembly of the cylinder head components 4 in the first cylindrical mounting groove 51 more convenient, and plays a foolproof role.

[0045] Referring to FIG. 3, a second mounting surface 16 is formed on the end surface of the crankcase 1 at an outer side of the annular boss 13. The second mounting surface 16 is formed by machining with a milling cutter, and the circular outer wall surface of the annular boss 13 of the crankcase 1 is formed by machining with the milling cutter at the same time. The circular outer wall surface of the annular boss 13 is not coaxial with the cylinder hole 11 of the crankcase 1, and the axis of the annular boss 13 is biased toward the first exhaust throttle through-hole 15.

[0046] Referring to FIG. 8 and FIG. 9, after all the cylinder head components 4 are clamped, a first gap is left between the bottom of the second cylindrical mounting groove 52 and the first mounting surface, and a second gap is left between the top of the second cylindrical mounting groove 52 and the second mounting surface 16. The first gap and the second gap are not less than 0.1 mm, that is, no direct contact occurs. Therefore, it is ensured that only the bottom of the first cylindrical mounting groove 51 of the cylinder cover 5 is supported by the cylinder head components 4 and the crankcase 1, and no two or more supporting surfaces will appear. A plurality of supporting surfaces may cause a bad phenomenon of over-positioning, while a single supporting surface can ensure that the cylinder head components 4 obtain suf-

ficient pressing force, to ensure the sealing performance of the cylinder. It can be ensured that no over-positioning phenomenon occurs, even if the cylinder head components 4 are tightened by the torque from cylinder cover 5 screws and the cylinder cover gasket 40 and the valve plate gasket 47 are compressed and deformed.

[0047] The cylinder cover 5 and the crankcase 1 may be connected and locked by screws, bolts, buckles, etc. Referring to FIG. 2, FIG. 3 and FIG. 6, in some embodiments, the cylinder cover 5 is provided with a plurality of first connecting holes 56 in the peripheries of the first cylindrical mounting groove 51 and the second cylindrical mounting groove 52. The crankcase 1 is provided with second connecting holes 17 corresponding to the first connecting holes 56. The cylinder cover 5 and the crankcase 1 are connected by connecting members that pass through the first connecting holes 56 and the second connecting holes 17. The connecting members may be screws or bolts. After the cylinder head components 4 are assembled, the cylinder cover 5 is fastened to the crankcase 1 by a plurality of connecting members to seal the cylinder hole 11. The plurality of connecting members are distributed on the periphery of the cylinder cover 5, which can provide a more uniform pressing force for the cylinder head components 4, achieve a better sealing effect, and avoid the leakage of the working fluid.

[0048] Further, in some embodiments, referring to FIG. 7, a part of a wall of at least one of the first connecting holes 56 bulges toward the inside of the first cylindrical mounting groove 51, and the edge of each of the cylinder head components 4 is provided with a second groove 48 that is matched with the bulged wall. That is, the second groove 48 of each cylinder head component 4 engages with the bulged wall to form a fourth positioning point. The combined action of the first positioning point, the second positioning point, the third positioning point and the fourth positioning point ensures the accuracy of the mounting and positioning of the cylinder head components 4, especially the accuracy of the mounting and positioning of the suction valve sheet and the valve plate gasket 47 that cannot be positioned by the first cylindrical mounting groove 51, and ensures the normal operation of the suction and exhaust functions of the cylinder head components 4.

[0049] The cylinder cover 5 is provided with a flange 57 at one end that is matched with the crankcase 1, and the first connecting holes 56 are provided in the flange 57. The cylinder head components 4 are embedded in the cylindrical mounting groove of the cylinder cover 5, and the connecting members of the cylinder cover 5 are located outside the circular contour of the cylinder head components 4 as a whole. By means of the strengthened design of the peripheral structure of the first connecting holes 56 of the cylinder cover 5, an acting force from the connecting members of the cylinder cover 5 is transmitted to the bottom of the first cylindrical mounting groove 51 of the cylinder cover 5 to press the cylinder head components 4. Therefore, the cylinder head components 4

and the cylinder cover 5 screws for fixing the cylinder cover 5 are not directly stacked in a thickness direction. Therefore, the cylinder cover 5 between the cylinder cover 5 screws and the cylinder head gasket 40 can have a smaller material thickness.

[0050] Therefore, the head of each cylinder head 5 screw can have a smaller distance from a first board of the crankcase 1. A safety distance between the head of each cylinder cover 5 screw and the casing is required to be greater than or equal to 4 mm. In the embodiment of the disclosure, since the head of each cylinder cover 5 screw is closer to the first board of the crankcase 1, the compressor can be made smaller in a long axis direction (that is, an axial direction of the cylinder hole 11), such that the compressor has a more compact structure and lower cost.

[0051] Referring to FIG. 5, the cylinder head components 4 provided with the protrusions 44 will not increase the material usage quota. That is, no real input cost will be produced in the production process. Because the cylinder head components 4 are formed by punching a whole sheet, the process quota is determined by a smallest square area corresponding to a projection profile. Because each protrusion 44 in the embodiment of the disclosure has a sufficiently small external dimension, the protrusion 44 of each cylinder head component 4 is located at a corner of the square sheet without increasing any additional material quota, thereby reducing the production cost.

[0052] Referring to FIG. 6, the cylinder cover 5 is provided with an exhaust cavity 58 at the bottom of the first cylindrical mounting groove 51. The exhaust cavity 58 is used to guide the working fluid discharged from the cylinder head components 4 into the second exhaust throttle through-hole 45. A throttling component 59 is provided in the exhaust cavity 58. The throttling component 59 includes an oblique baffle. The throttling component 59 can narrow a flow path of the working fluid and reduce the exhaust pulsation of the working fluid. An exhaust valve sheet limiting component 510 capable of limiting a stroke of the exhaust valve flap is provided in the exhaust cavity 58.

[0053] In some embodiments, referring to FIG. 2, FIG. 6 and FIG. 10, the cylinder cover 5 is provided with a mounting hole 511. The exhaust cavity 58 is divided by the wall of the mounting hole 511. A suction muffler 6 is further provided. A gas outlet end of the suction muffler 6 is provided in the mounting hole 511, and is pressed against the cylinder head components 4 by the elastic component 7. When the compressor works, the working fluid enters the suction muffler 6 through the suction pipe 32, and then enters the cylinder hole 11 after being muffled for noise reduction. The elastic component 7 can tightly press the suction muffler 6 against the cylinder head components 4, and at the same time, ensure that the suction muffler 6 are closely fitted with the cylinder head components 4 under vibration conditions, thereby avoiding the leakage of the working fluid.

[0054] Referring to FIG. 2, a limiting block 61 is arranged at the gas outlet end of the suction muffler 6. The cylinder cover is provided with a limiting groove 514. After the suction muffler 6 is assembled, the limiting block 61 is embedded in the limiting groove for positioning.

[0055] The elastic component 7 may be a compression spring, a clamp spring, an elastic pad, etc. Referring to FIG. 2, in some embodiments, the elastic component 7 includes a clamp spring formed by bending an elastic sheet and having a first clamping arm 71, a connecting portion 72 and a second clamping arm 73. The first clamping arm 71, the connecting portion 72 and the second clamping arm 73 are shaped like M. The connecting portion 72 has a bent pressing part for pressing the suction muffler 6. An end of the first clamping arm 71 is reversely everted to form a first clamping wing 74, and an end of the second clamping arm 73 is reversely everted to form a second clamping wing 75. The wall of the mounting hole 511 is provided with two clamp spring mounting grooves 512 which are arranged oppositely, and a clamping wing limiting boss 513 is provided in the clamp spring mounting grooves 512. Upon assembling, the gas outlet end of the suction muffler 6 is inserted into the mounting hole 511; the clamp spring is embedded into the clamp spring mounting groove 512; the first clamping wing 74 and the second clamping wing 75 pass over the clamping wing limiting boss 513 to be clamped with the clamping wing limit boss 513; and the connecting portion 72 tightly presses the suction muffler 6 in the mounting hole 511.

[0056] An embodiment of the disclosure further provides a refrigeration device which includes the compressor described in any one of the above embodiments. The structural features and advantages of the compressor have been described in detail above, and will not be repeated.

[0057] Of course, the disclosure is not limited to the above-mentioned embodiments. Those skilled in the art can make equivalent modifications or substitutions without departing from the spirit of the disclosure. These equivalent modifications or substitutions are all included in the scope defined by the claims of the present application.

Claims

1. A cylinder head assembly, comprising:

a crankcase provided with a cylinder hole and an exhaust muffler cavity, wherein the crankcase is provided with an annular boss at the end of the cylinder hole, an end surface of the annular boss forms a first mounting surface provided with a first exhaust throttle through-hole communicated with the exhaust muffler cavity, and an outer circular surface of the annular boss is not coaxial with the cylinder hole and the outer circular surface is biased toward the first exhaust

throttle through-hole;

cylinder head components comprising an exhaust valve sheet, a valve plate and a suction valve sheet, wherein each of the cylinder head components has a circular shape, an edge of each of the cylinder head components is provided with a protrusion, and each protrusion is provided with a second exhaust throttle through-hole corresponding to the first exhaust throttle through-hole; and

a cylinder cover provided with a first cylindrical mounting groove and a second cylindrical mounting groove, wherein the first cylindrical mounting groove is coaxial with the cylinder hole, the second cylindrical mounting groove is coaxial with the outer circular surface of the annular boss, the cylinder cover is connected to the crankcase and clamps the cylinder head components between the bottom of the first cylindrical mounting groove and the first mounting surface, the second exhaust throttle through-holes are communicated with the first exhaust throttle through-hole to form an exhaust passage, and the second cylindrical mounting groove is matched with the outer circular surface of the annular boss.

2. The cylinder head assembly according to claim 1, wherein each of the cylinder head components can be fitted in the first cylindrical mounting groove and matched with a cylindrical surface of the first cylindrical mounting groove.

3. The cylinder head assembly according to claim 1, wherein the cylindrical surface of the first cylindrical mounting groove and a cylindrical surface of the second cylindrical mounting groove are inscribed.

4. The cylinder head assembly according to claim 3, wherein the cylinder cover is provided with a positioning groove that is matched with the protrusion; the cylinder cover is provided with a positioning post, and the edge of each of the cylinder head components is provided with a first groove that is matched with the positioning post; and the positioning post, the first groove and the inscribed position are distributed in a circumferential direction of the first cylindrical mounting groove.

5. The cylinder head assembly according to claim 4, wherein the cylinder cover is provided with a positioning boss, and the crankcase is provided with a recess that is matched with the positioning boss.

6. The cylinder head assembly according to claim 5, wherein the positioning boss is located at an end of the positioning post.

7. The cylinder head assembly according to claim 1, wherein the cylinder head components further comprise a cylinder cover gasket and a valve plate gasket, the cylinder cover gasket being disposed between the cylinder cover and the exhaust valve sheet, and the valve plate gasket being disposed between the suction valve sheet and the crankcase.
8. The cylinder head assembly according to any one of claims 1 to 7, wherein a second mounting surface is formed on an end surface of the crankcase at an outer side of the annular boss; after all the cylinder head components are clamped, a first gap is left between the bottom of the second cylindrical mounting groove and the first mounting surface; and a second gap is left between the top of the second cylindrical mounting groove and the second mounting surface.
9. The cylinder head assembly according to claim 8, wherein the first gap and the second gap are not less than 0.1 mm, respectively.
10. The cylinder head assembly according to claim 1, wherein the cylinder cover is provided with a plurality of first connecting holes in the peripheries of the first cylindrical mounting groove and the second cylindrical mounting groove; the crankcase is provided with second connecting holes corresponding to the first connecting holes; and the cylinder cover and the crankcase are connected by connecting members that pass through the first connecting holes and the second connecting holes.
11. The cylinder head assembly according to claim 10, wherein a part of a wall of at least one of the first connecting holes bulges toward the inside of the first cylindrical mounting groove, and the edge of each of the cylinder head components is provided with a second groove that is matched with the bulged wall.
12. The cylinder head assembly according to claim 10 or 11, wherein the cylinder cover is provided with a flange at one end that is matched with the crankcase, and the first connecting holes are provided in the flange.
13. The cylinder head assembly according to claim 1, wherein the first exhaust throttle through-hole in the first mounting surface is located in an extension line of a connecting line between a center of the outer circle of the annular boss and a center of the cylinder hole
14. The cylinder head assembly according to claim 13, wherein a minimum distance between the first exhaust throttle through-hole and the outer circular surface of the annular boss is not less than 2 mm, and a minimum distance between the first exhaust throttle through-hole and the cylinder hole is not less than 2 mm.
15. The cylinder head assembly according to claim 1, wherein each of the cylinder head components is formed from a square sheet by punching, and the protrusion of each cylinder head component is located at a corner of the square sheet.
16. The cylinder head assembly according to claim 1, wherein the cylinder cover is provided with an exhaust cavity at the bottom of the first cylindrical mounting groove, and a throttling component and an exhaust valve sheet limiting component are provided in the exhaust cavity.
17. The cylinder head assembly according to claim 1, wherein the cylinder cover is provided with a mounting hole, a suction muffler is further comprised, and a gas outlet end of the suction muffler is provided in the mounting hole and is tightly pressed against the cylinder head components by an elastic component.
18. The cylinder head assembly according to claim 17, wherein the elastic component comprises a clamp spring formed by bending an elastic sheet and having a first clamping arm, a connecting portion and a second clamping arm, wherein an end of the first clamping arm is reversely everted to form a first clamping wing, and an end of the second clamping arm is reversely everted to form a second clamping wing; a clamp spring mounting groove is formed in a wall of the mounting hole; a clamping wing limiting boss is provided in the clamp spring mounting groove; the clamp spring is embedded into the clamp spring mounting groove and is clamped by the clamping wing limiting boss through the first clamping wing and the second clamping wing; and the connecting portion tightly presses the suction muffler in the mounting hole.
19. The cylinder head assembly according to claim 18, wherein the connecting portion has a bent pressing part for pressing the suction muffler.
20. A compressor, comprising the cylinder head assembly according to any one of claims 1 to 19.
21. A refrigeration device, comprising the compressor according to claim 20.

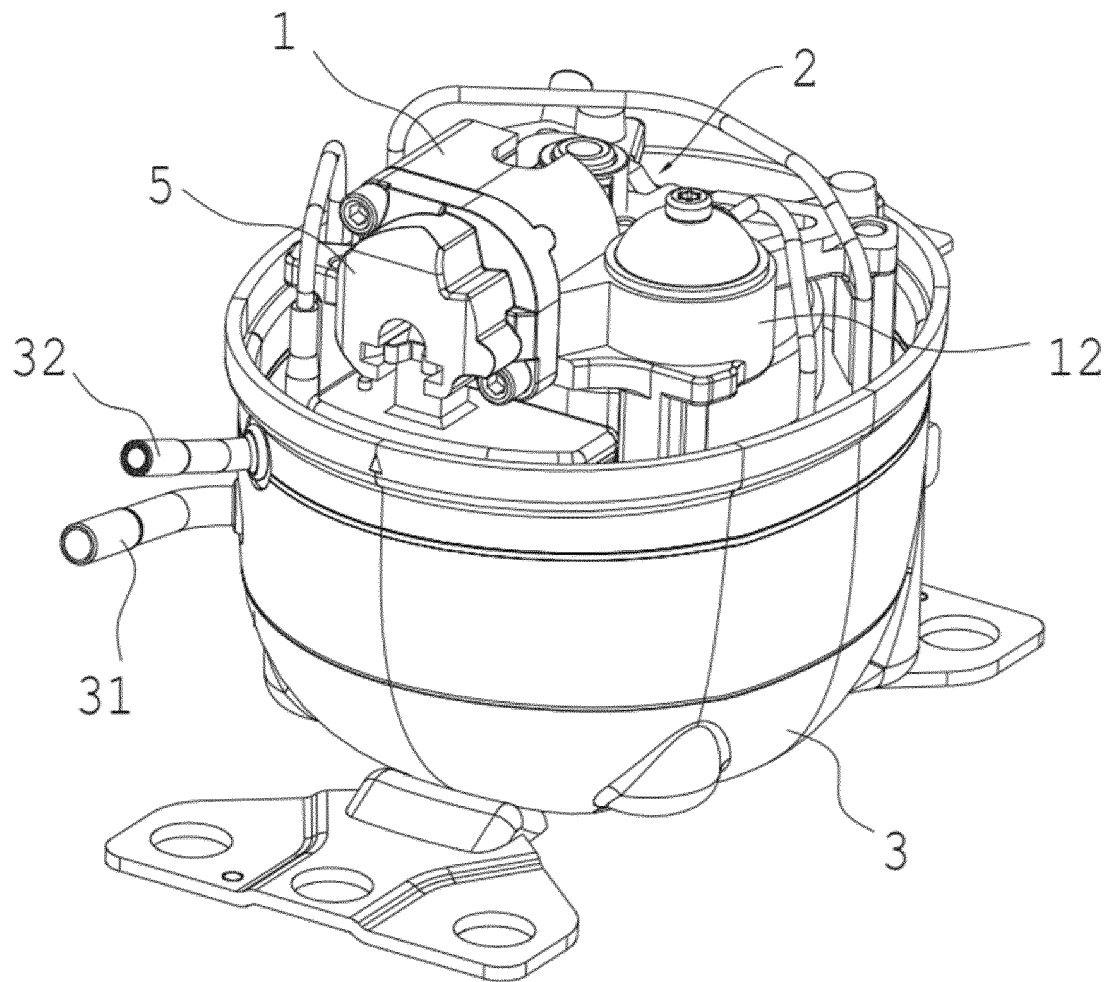


Fig. 1

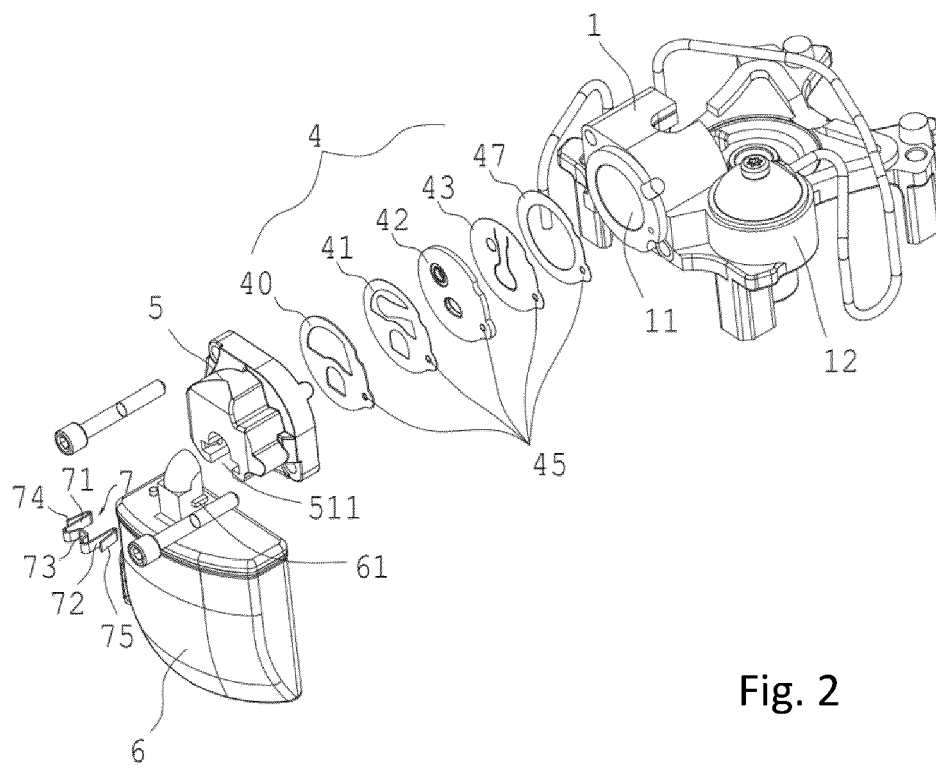


Fig. 2

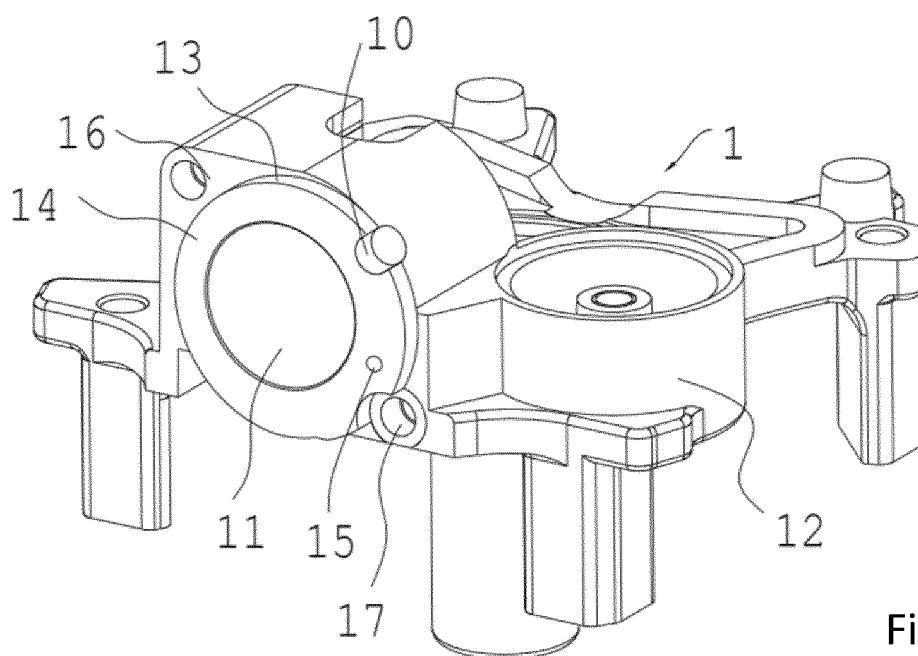
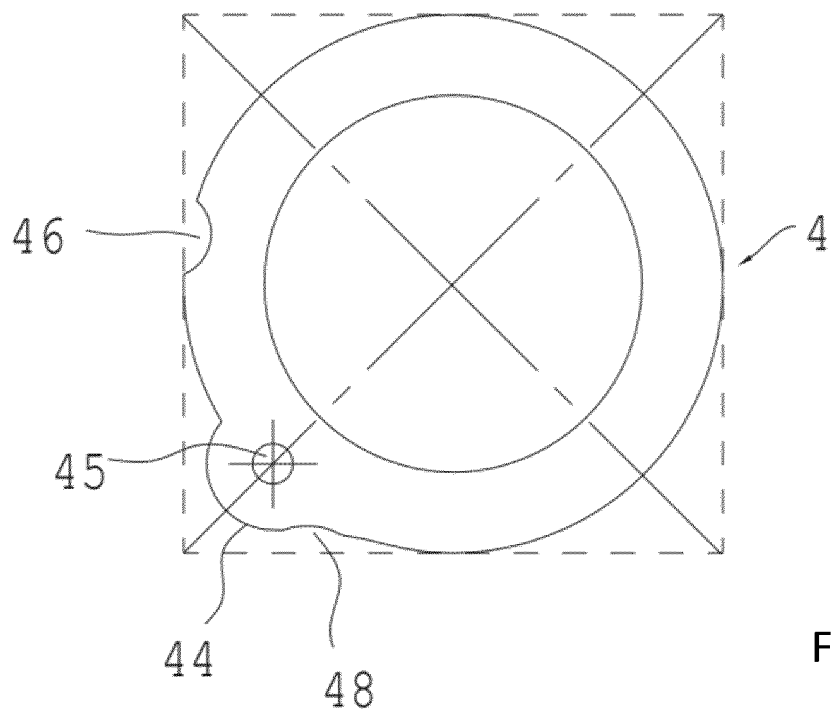
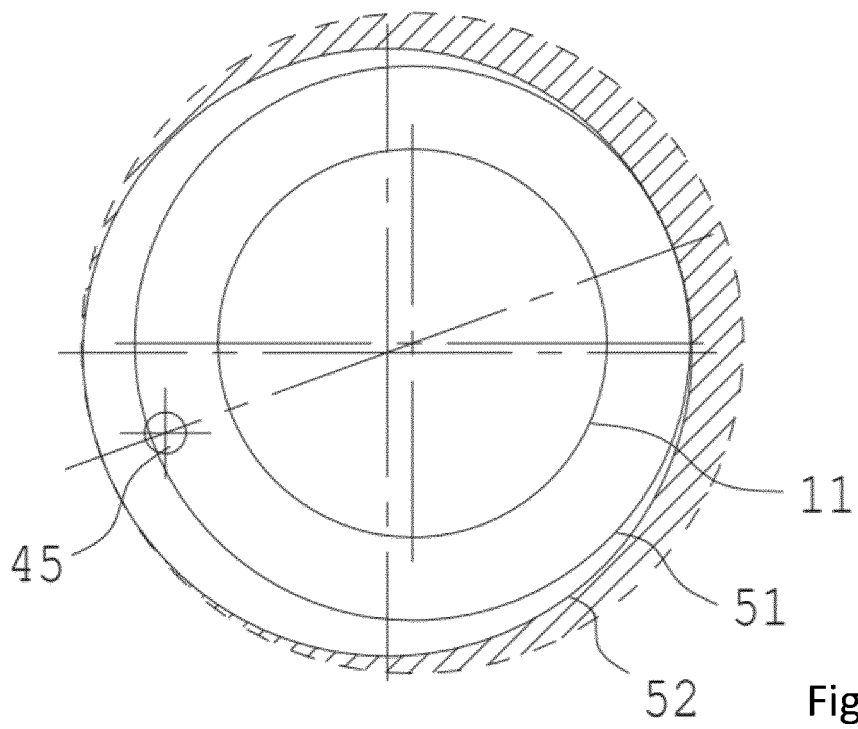
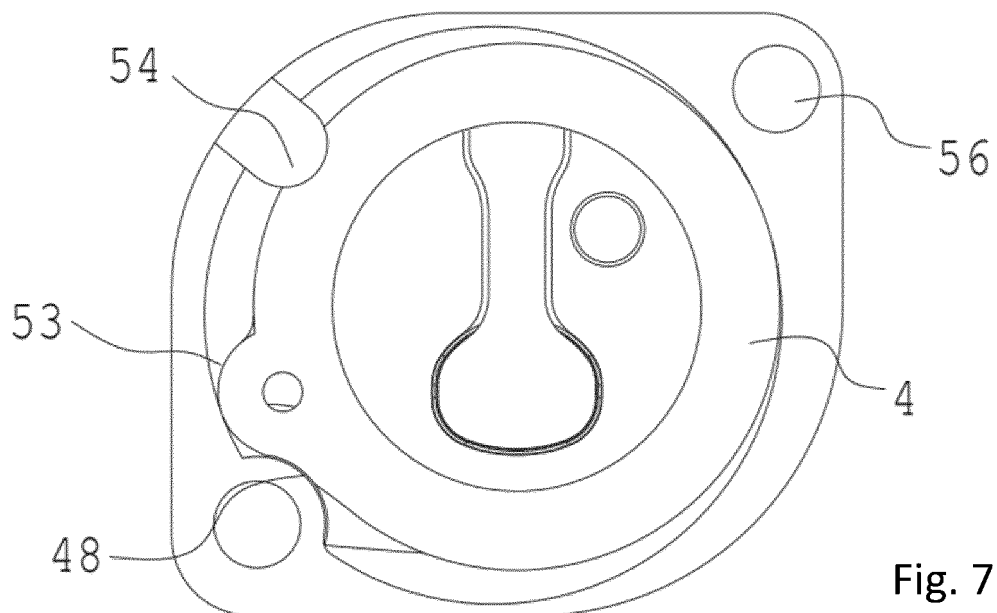
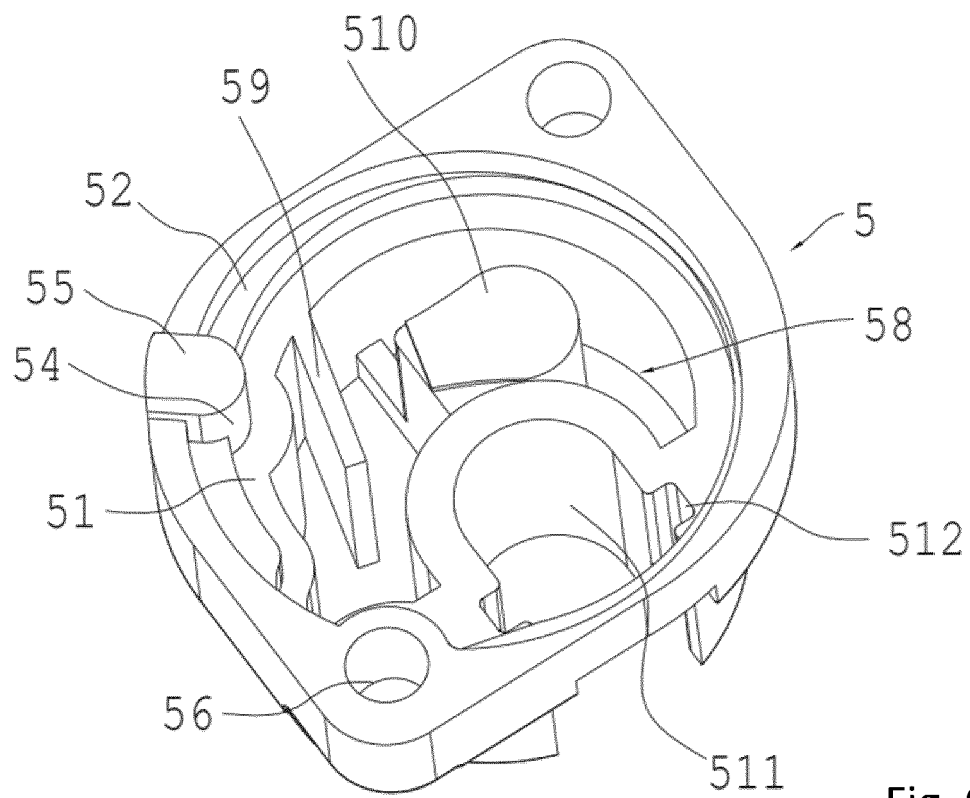


Fig. 3





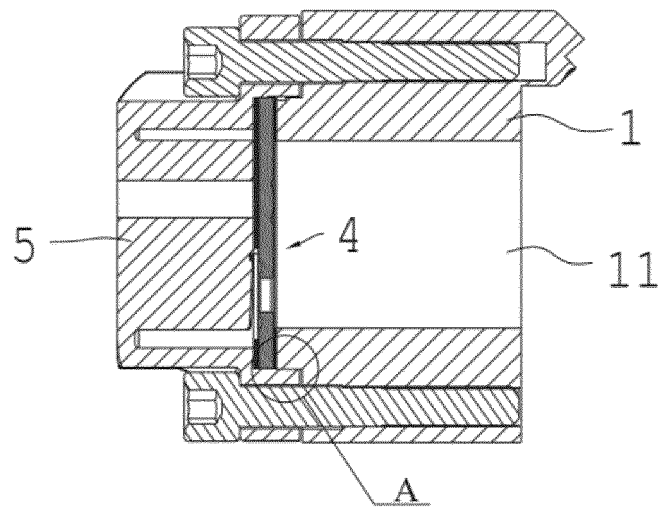


Fig. 8

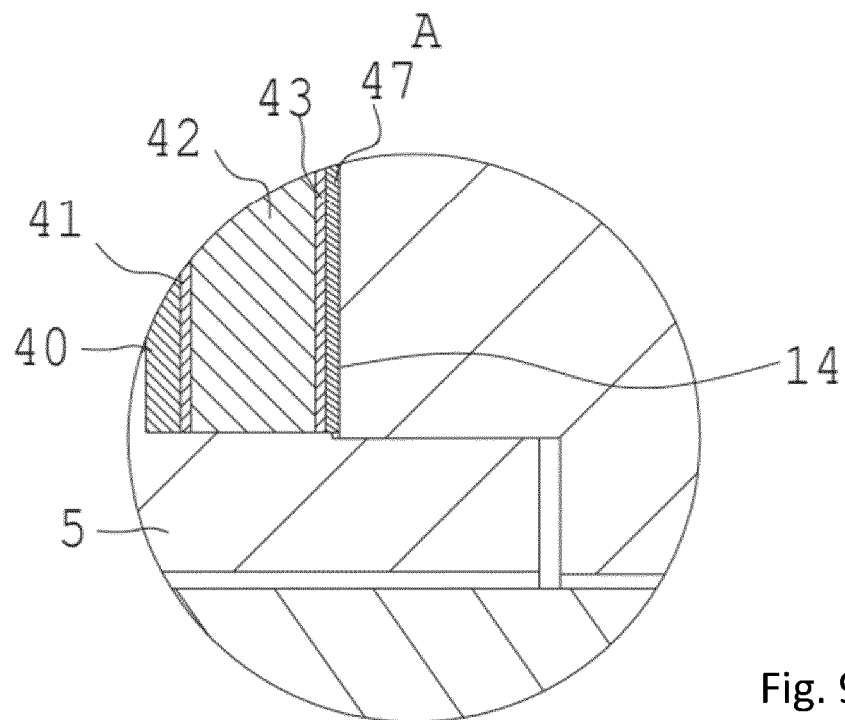


Fig. 9

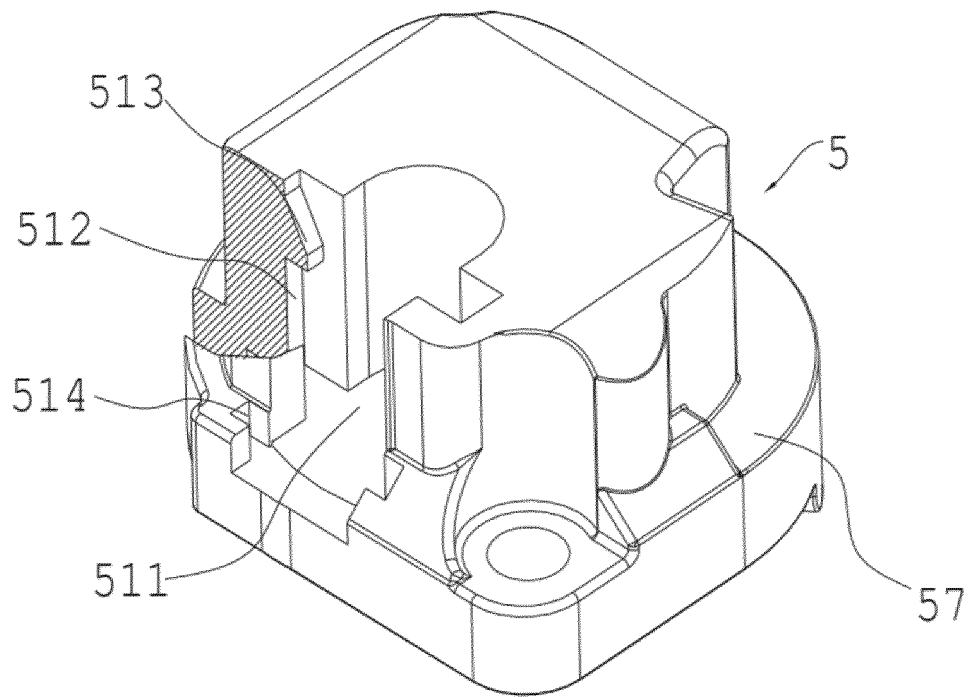


Fig. 10

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2020/079234

A. CLASSIFICATION OF SUBJECT MATTER

F04B 39/12(2006.01)i; F04B 39/10(2006.01)i; F04B 39/14(2006.01)i

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 practicable, search terms used)

CNABS, VEN, CNKI: 压缩机, 气缸盖, 气缸头, 排气, 消音, compressor, cylinder, head, cover, exhaust, silencing

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 110645165 A (GUANGZHOU WANBAO GROUP COMPRESSOR CO., LTD.) 03 January 2020 (2020-01-03) description paragraphs 52-74, figures 1-10	1-21
A	CN 108266350 A (GUANGZHOU WANBAO GROUP COMPRESSOR CO., LTD.) 10 July 2018 (2018-07-10) description paragraphs 44-58, figures 1-19	1-21
A	CN 206111487 U (HUAYI COMPRESSOR (JINGZHOU) CO., LTD.) 19 April 2017 (2017-04-19) entire document	1-21
A	CN 109488570 A (GUANGZHOU WANBAO GROUP COMPRESSOR CO., LTD.) 19 March 2019 (2019-03-19) entire document	1-21
A	CN 109654022 A (QINGDAO WANBAO COMPRESSOR CO., LTD.) 19 April 2019 (2019-04-19) entire document	1-21
A	JP 5885377 A (DAIKIN INDUSTRIES, LTD.) 21 May 1983 (1983-05-21) entire document	1-21

☐ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

27 May 2020

Date of mailing of the international search report

29 June 2020

Name and mailing address of the ISA/CN

**China National Intellectual Property Administration (ISA/
CN)
No. 6, Xitucheng Road, Jimenqiao Haidian District, Beijing
100088
China**

Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2020/079234

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 110645165 A	03 January 2020	None	
CN 108266350 A	10 July 2018	CN 108266350 B	04 June 2019
CN 206111487 U	19 April 2017	None	
CN 109488570 A	19 March 2019	None	
CN 109654022 A	19 April 2019	None	
JP 5885377 A	21 May 1983	JP S6244113 B2	18 September 1987

Form PCT/ISA/210 (patent family annex) (January 2015)