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(54) **COMPRESSOR**

(57) A compressor, comprising: a housing (101) provided with a rotor accommodating cavity (105) and an exhaust cavity (180); and a pair of screw rotors (110) at least partially located in the rotor accommodating cavity (105), a compression accommodating cavity (150) being formed between teeth of the pair of screw rotors (110) and the housing (101), and the pair of screw rotors (110) having a suction end (112) and an exhaust end (113), wherein the housing (101) further comprises an unloading channel (208) and a connecting channel (308), the unloading channel (208) is provided with an unloading channel inlet (216) and an unloading channel outlet (217), the unloading channel inlet (216) can be communicated with the compression accommodating cavity (150) through the connecting channel (308), and the unloading channel outlet (217) is communicated with a suction side of the compressor; and an unloading device (109) configured to controllably open or close the connecting channel (308), such that the compression accommodating cavity (150) can be controllably communicated with or disconnected from the connecting channel (308). The compressor can reduce the load upon startup.

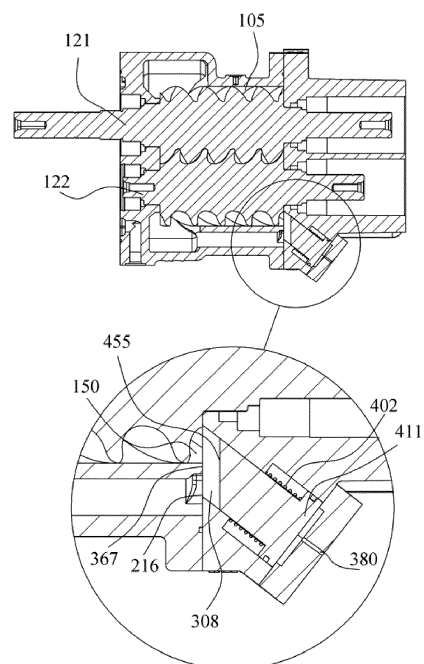


FIG. 5B

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Description

Technical Field

[0001] The present application relates to a compressor, and in particular, to a screw compressor having an unloading device.

Background Art

[0002] A screw compressor is a common component in a refrigeration unit. In the screw compressor, tooth space volumes of a pair of screw rotors mesh with each other, leading to changes in elementary volume composed of tooth-shaped space, thereby completing a process of gas suction, compression, and exhaust. The pair of screw rotors that are meshed with each other are arranged in parallel in a body of the screw compressor, wherein one end of the screw rotor is a suction end, which is communicated with a suction port of the body, and the other end is an exhaust end, which is communicated with an exhaust port of the body. As the screw rotor rotates, gas is sucked in from the suction end and exhausted from the exhaust end after being compressed.

[0003] It takes a certain amount of time for the screw compressor to run smoothly after being started; and during this process, the actual working condition of the screw compressor is quite different from the working condition during smooth operation. When the screw compressor is started, problems such as difficult startup, excessive starting torque, and motor overload are likely to occur; therefore, when the compressor is designed, a method of reducing the load during startup needs to be found.

Summary of the Invention

[0004] The present application provides a compressor comprising: a housing provided with a rotor accommodating cavity and an exhaust cavity; a pair of screw rotors at least partially located in the rotor accommodating cavity, a compression accommodating cavity being formed between teeth of the pair of screw rotors and the housing, and the pair of screw rotors having a suction end and an exhaust end, wherein the housing further comprises an unloading channel and a connecting channel, the unloading channel is provided with an unloading channel inlet and an unloading channel outlet, the unloading channel inlet can be communicated with the compression accommodating cavity through the connecting channel, and the unloading channel outlet is communicated with a suction side of the compressor; and an unloading device configured to controllably open or close the connecting channel, such that the compression accommodating cavity can be controllably communicated with or disconnected from the connecting channel.

[0005] In the compressor described above, the unloading device is configured that: when the compressor is started, the unloading device opens the connecting chan-

nel, thereby opening the inlet of the unloading channel, such that the compression accommodating cavity is communicated with a suction side of the compressor.

[0006] In the compressor described above, the housing further comprises an unloading device accommodating cavity and a cover, a proximal end of the unloading device accommodating cavity forms the connecting channel, and a distal end of the unloading device accommodating cavity is closed by the cover.

[0007] In the compressor described above, the unloading device accommodating cavity has an unloading device accommodating cavity opening, and an area of the unloading device accommodating cavity opening is larger than an area of the inlet of the unloading channel.

[0008] In the compressor described above, the exhaust end of the pair of screw rotors has an exhaust end surface, the unloading device accommodating cavity opening, the inlet of the unloading channel, and the exhaust end surface are on the same plane, and the unloading device accommodating cavity opening can simultaneously overlap at least a part of the inlet of the unloading channel and at least a part of the exhaust end surface.

[0009] In the compressor described above, the unloading device comprises a piston movable in the unloading device accommodating cavity and an elastic device capable of providing an elastic force, wherein the unloading device is configured that: when the pressure on the piston is less than the elastic force of the elastic device, the piston can move away from the inlet of the unloading channel, thereby opening the connecting channel; and when the pressure on the piston is greater than the elastic force of the elastic device, the piston can close the inlet of the unloading channel, thereby closing the connecting channel, wherein the pressure is provided by gas exhaust pressure of the compressor.

[0010] In the compressor described above, the piston has a head and a body, wherein a diameter of the head is greater than a diameter of the body; the unloading device accommodating cavity has a first section and a second section, wherein a diameter of the second section is smaller than a diameter of the first section, the first section is close to the cover, and the head is accommodated in the first section and forms a seal with an inner wall of the first section; and one end of the elastic device abuts against a step surface formed by the first section and the second section, and the other end abuts against the head of the piston, wherein the elastic device provides an elastic force, such that the piston can be away from the inlet of the unloading channel, thereby opening or closing the connecting channel, and the head of the piston can be subjected to a pressure, such that the piston moves towards the inlet of the unloading channel to close the connecting channel.

[0011] In the compressor described above, the unloading device accommodating cavity is communicated with the exhaust cavity of the compressor through a connecting passage, and a throttling element is disposed on the

connecting passage.

[0012] In the compressor described above, a buffer device is disposed on the connecting passage, and the buffer device is arranged between the unloading device accommodating cavity and the throttling element.

[0013] In the compressor described above, the cover is provided with a cover channel, and the cover channel forms the throttling element.

[0014] In the compressor described above, the throttling element and the buffer device are disposed in the housing.

[0015] In the compressor described above, the housing has a housing fitting surface disposed facing the exhaust end surface of the exhaust end of the pair of screw rotors, an exhaust port is disposed on the housing fitting surface, and in a radial direction, there is a distance between the unloading device accommodating cavity opening and the exhaust port.

[0016] The compressor in the present application has an unloading device, which can reduce the load of the compression upon startup of the compressor, and restore the load when the compressor runs smoothly. The unloading device in the present application can be adjusted according to a working state of the compressor.

Brief Description of the Drawings

[0017]

FIG. 1A is a partial perspective view of a screw compressor according to an embodiment of the present application;

FIG. 1B is an exploded view of the screw compressor shown in FIG. 1A;

FIG. 1C is an axial cross-sectional view of the screw compressor shown in FIG. 1A;

FIG. 2A is a perspective view of a rotor seat shown in FIG. 1B;

FIG. 2B is a side view of the rotor seat shown in FIG. 2A;

FIG. 2C is a cross-sectional view of the rotor seat shown in FIG. 2B sectioned along a line A-A;

FIG. 3A is a perspective view of an exhaust seat shown in FIG. 1B;

FIG. 3B is a side view of the exhaust seat shown in FIG. 3A;

FIG. 3C is a cross-sectional view of the exhaust seat shown in FIG. 3B sectioned along a line B-B;

FIG. 3D is a front view of the exhaust seat shown in FIG. 3A;

FIG. 4A is a perspective view of an unloading device; FIG. 4B is an exploded view of the unloading device shown in FIG. 4A;

FIG. 5A is a side view of the screw compressor shown in FIG. 1A;

FIG. 5B is a cross-sectional view of the screw compressor shown in FIG. 5A sectioned along a line C-C; FIG. 5C is another cross-sectional view of the screw

compressor shown in FIG. 5A sectioned along a line C-C;

FIG. 6 is a schematic view of a first embodiment of a connection relationship between an unloading device accommodating cavity of a compressor and an exhaust cavity of the compressor according to the present application;

FIG. 7 is a schematic view of a second embodiment of a connection relationship between an unloading device accommodating cavity of a compressor and an exhaust cavity of the compressor according to the present application; and

FIG. 8 is a schematic view of a third embodiment of a connection relationship between an unloading device accommodating cavity of a compressor and an exhaust cavity of the compressor according to the present application.

Detailed Description of Embodiments

[0018] Various embodiments of the present application will be described below with reference to the accompanying drawings that constitute a part of the specification. It should be understood that although terms such as "front (til)," "rear," "up," "down," "left," "right," "inside," "outside," "top," "bottom," "front (\overline{FE})," "back," "proximal," "distal," "horizontal," and "longitudinal" that represent directions are used in the present application to describe various example structural parts and elements of the present application, these terms used herein are determined based on example orientations shown in the accompanying drawings and for ease of illustration only. Since embodiments disclosed in the present application may be disposed in different directions, these terms that represent directions are for illustration only and should not be regarded as limiting.

[0019] FIG. 1A is a partial perspective view of a screw compressor according to an embodiment of the present application, FIG. 1B is an exploded view of the screw compressor shown in FIG. 1A, and FIG. 1C is an axial cross-sectional view of the screw compressor shown in FIG. 1A. FIGs. 1A-1C show some components of the screw compressor. As shown in FIGs. 1A-1C, the screw compressor comprises a housing 101, a pair of screw rotors 110, and unloading devices 109 and 119. The housing 101 comprises a rotor seat 131 and an exhaust seat 132.

[0020] The rotor seat 131 has a rotor accommodating cavity 105 for accommodating the pair of screw rotors 110. The rotor seat 131 has an exhaust cavity 180, and the exhaust cavity 180 is communicated with an exhaust port 181 of the compressor.

[0021] The pair of screw rotors 110 comprise a male rotor 121 and a female rotor 122 that are meshed with each other, and the male rotor 121 and the female rotor 122 can be driven to rotate. The pair of screw rotors 110 comprise a tooth portion 160 and shaft portions 161 and

162 that are connected to two ends of the tooth portion 160, respectively. At the tooth portion 160 of the pair of screw rotors 110, the male rotor 121 has a plurality of spiral teeth, and grooves are formed between adjacent teeth; and the female rotor 122 also has a plurality of spiral teeth, and grooves are also formed between adjacent teeth. The teeth and the corresponding grooves of the male rotor 121 and the female rotor 122 form an intermeshing structure, and form a compression accommodating cavity together with the housing 101 (refer to FIG. 5A).

[0022] In a direction of the axis of the pair of screw rotors 110, the tooth portion 160 of the pair of screw rotors 110 has a suction end 112 and an exhaust end 113. Gas is sucked into the compression accommodating cavity 150 at the suction end 112, and gradually moves towards the exhaust end 113 as the pair of screw rotors 110 rotate. At the same time, the volume of the compression accommodating cavity 150 gradually decreases as the pair of screw rotors 110 rotate, and the gas in the compression accommodating cavity 150 is gradually compressed. The compressed gas enters the exhaust cavity 180 of the compressor from the exhaust end 113, and then is exhausted from the exhaust port 181 of the compressor. The exhaust end 113 has an exhaust end surface 118.

[0023] FIG. 2A is a perspective view of the rotor seat shown in FIG. 1B, FIG. 2B is a side view of the rotor seat shown in FIG. 2A, and FIG. 2C is a cross-sectional view of the rotor seat shown in FIG. 2B sectioned along a line A-A. As shown in FIGs. 2A-2C, the rotor seat 131 comprises a front end 211 of the rotor seat and a rear end 212 of the rotor seat. The front end 211 of the rotor seat is close to the suction end 112 of the pair of screw rotors 110, and the rear end 212 of the rotor seat is close to the exhaust end 113 of the pair of screw rotors 110. The rear end 212 of the rotor seat is connected to the exhaust seat 132, and the rear end 212 of the rotor seat has a rear end surface 207. The rotor accommodating cavity 105 extends through the rear end surface 207 to form a rotor accommodating cavity opening 215. The rotor seat 131 has an unloading channel 208 and an unloading channel 209 that fit with the unloading device 109 and the unloading device 119, respectively. The unloading channel 208 and the unloading channel 209 are located on two sides of the rotor accommodating cavity 105 in the axial direction, respectively, so as to be close to the female rotor 122 and the male rotor 121, respectively. The unloading channel 208 and the unloading channel 209 have similar structures but different positions, and the unloading channel 208 is used as an example to introduce the structure of the unloading channel below. In other embodiments, one or more unloading channels may be disposed according to an actual requirement.

[0024] The unloading channel 208 extends in a direction from the front end 211 to the rear end of the rotor seat and is arranged side by side with the compression accommodating cavity 150. The unloading channel 208 is separated from the rotor accommodating cavity 105

by a partition wall 285. The unloading channel 208 has an unloading channel inlet 216 and an unloading channel outlet 217. The unloading channel inlet 216 is located on the rear end surface 207 and is disposed spaced from the rotor accommodating cavity opening 215. The unloading channel outlet 217 is close to the suction end 112 of the pair of screw rotors and is communicated with the rotor accommodating cavity 105. The unloading channel outlet 217 is disposed to be communicated with the suction side of the compressor. The unloading channel 208 is used to communicate the unloading channel inlet 216 located on the rear end surface 207 with the suction side of the compressor.

[0025] In another embodiment of the present application, the unloading channel 208 may extend in another direction within the rotor seat 131, and an inner cavity of the unloading channel 208 may have two or more sections with different shapes.

[0026] FIG. 3A is a perspective view of the exhaust seat shown in FIG. 1B, FIG. 3B is a side view of the exhaust seat shown in FIG. 3A, FIG. 3C is a cross-sectional view of the exhaust seat shown in FIG. 3B sectioned along a line B-B, and FIG. 3D is a front view of the exhaust seat shown in FIG. 3A.

[0027] As shown in FIGs. 3A-3D, the exhaust seat 132 has a first end 311 and a second end 312, and the first end 311 is connected to the rotor seat 131. An end surface of the first end 311 forms a housing fitting surface 341, and the housing fitting surface 341 fits with the rear end surface 207 of the rotor seat 131.

[0028] The exhaust seat 132 has rotor shaft accommodating cavities 361 and 362, an exhaust cavity 180, and unloading device accommodating cavities 310 and 320.

[0029] The rotor shaft accommodating cavities 361 and 362 are used to accommodate a shaft of the screw rotor 110, and the rotor shaft accommodating cavities 361 and 362 form rotor shaft openings 371 and 372 on the housing fitting surface 341. The exhaust cavity 180 forms an exhaust cavity opening 366 on the housing fitting surface 341. The unloading device accommodating cavities 310 and 320 form unloading device accommodating cavity openings 367 and 368 on the housing fitting surface 341. There is a distance between the exhaust cavity opening 366 and the unloading device accommodating cavity openings 367 and 368.

[0030] There is a rotor projection area 382 on the housing fitting surface 341, wherein the rotor projection area 382 is a projection area formed on the housing fitting surface 341 in the axial direction during rotation of the pair of screw rotors 110. The rotor projection area 382 is approximately of an "8" shape and is disposed around the rotor shaft openings 371 and 372.

[0031] During rotation of the pair of screw rotors 110, a range swept by the exhaust end surface 118 on the housing fitting surface 341 is within a range defined by the rotor projection area 382. The rotor projection area 382 has a sealing area 326, a first opening area 328, and

second opening areas 338 and 339. An overlapping portion of the exhaust cavity opening 366 with the rotor projection area 382 forms the first opening area 328, overlapping portions of the unloading device accommodating cavity openings 367 and 368 with the rotor projection area 382 form the second opening areas 338 and 339, and the remaining portion forms the sealing area 326. The second opening areas 338 and 339 are located, relative to the first opening area 328, downstream of the rotation direction of the corresponding screw rotor, respectively. In other words, during rotation, the screw rotor first passes through the second opening areas 338 and 339, and then reaches the first opening area 328.

[0032] The compression accommodating cavity 150 forms an end of the compression accommodating cavity 150 on a plane on which the exhaust end surface 118 of the pair of screw rotors is located. The sealing area 326 can seal the end of the compression accommodating cavity 150, such that the compression accommodating cavity 150 can form a sealed space. During rotation of the pair of screw rotors 110, when the end of the compression accommodating cavity 150 is aligned with the sealing area 326, the compression accommodating cavity 150 is disconnected from the exhaust cavity 180, and refrigerant gas in the compression accommodating cavity 150 can be compressed; when the end of the compression accommodating cavity 150 is aligned or partially aligned with the first opening area 328, the compression accommodating cavity 150 is communicated with the exhaust cavity 180, and the gas in the compression accommodating cavity 150 can be exhausted; and when the end of the compression accommodating cavity 150 is aligned or partially aligned with the second opening areas 338 and 339, the compression accommodating cavity 150 is selectively communicated with or disconnected from the unloading channel. A selective communicating relationship between the compression accommodating cavity 150 and the unloading channel will be described in detail below.

[0033] The exhaust seat 132 further comprises covers 315 and 316 for covering distal ends of the unloading device accommodating cavities 310 and 320, respectively. The unloading device accommodating cavities 310 and 320 have similar structures but different positions, and the unloading device accommodating cavity 310 is used as an example to introduce the structure thereof below.

[0034] As shown in FIG. 3C, the unloading device accommodating cavity 310 is formed by extending the unloading device accommodating cavity opening 367 towards the inside of the exhaust seat. The distal end (namely, an end away from the unloading device accommodating cavity opening 367) of the unloading device accommodating cavity 310 is closed by the cover 315. The unloading device accommodating cavity 310 has a first section 321 and a second section 322, the first section 321 is close to the unloading device accommodating cavity opening 367, and the second section 322 is close

to the cover 315. A diameter of the second section 322 is less than a diameter of the first section 321, such that a step surface 333 is formed at a joint of the first section 321 and the second section 322. A shape of the unloading device accommodating cavity 310 is configured to fit with the unloading device 109, such that the unloading device 109 can move within the unloading device accommodating cavity 310.

[0035] The unloading device accommodating cavity 310 has a connecting channel 308, wherein the connecting channel 308 is formed by a part of the first section 321 of the unloading device accommodating cavity 310 close to the unloading device accommodating cavity opening 367. That is, the connecting channel 308 is a portion of the first section 321.

[0036] The cover 315 is provided with a cover channel 380, wherein an extension direction of the cover channel 380 is substantially the same as an extension direction of the unloading device accommodating cavity 310. The cover channel 380 extends through the cover 315 to form a through hole on the cover 315. The cover channel 380 communicates the unloading device accommodating cavity 310 with a high-pressure side of the compressor. A diameter of the cover channel 380 is thin, such that the cover channel 380 can be used as a throttling element to control a flow of fluid into the unloading device accommodating cavity 310 through the cover channel 380.

[0037] FIG. 4A is a perspective view of the unloading device, FIG. 4B is an exploded view of the unloading device shown in FIG. 4A, and as shown in FIGs. 4A and 4B, the unloading device 109 comprises a piston 401 and an elastic device 402. The piston 401 has a head 411 and a body 412. A diameter of the head 411 is greater than a diameter of the body 412, wherein an outer diameter of the head 411 matches an inner diameter of the first section 321 of the unloading device accommodating cavity 310, an outer diameter of the body 412 matches an inner diameter of the second section 322 of the unloading device accommodating cavity 310, the head 411 is accommodated in the first section 321, and the body 412 is accommodated in the second section 322. In the axial direction, a length of the first section 321 of the unloading device accommodating cavity 310 is greater than a length of the head 411 of the piston 401, and a length of the second section 322 of the unloading device accommodating cavity 310 is greater than a length of the body 412 of the piston 401, such that the piston 401 can move within a range in the axial direction in the unloading device accommodating cavity 310. The head 411 has an inner surface 421 and an outer surface 422 that are disposed opposite to each other, and a side surface 423 connecting the inner surface 421 and the outer surface 422. The inner surface 421 faces the body 412 and the outer surface 422 is away from the body 412. The elastic device 402 is a spring, and the elastic device 402 is sleeved on the body 412 of the piston. One end of the elastic device 402 abuts against the inner surface 421 of the head 411 or is connected to the inner surface 421 of

the head 411. A seal ring can be provided on the side surface 423 of the head to enhance a seal between the head 411 and the inner wall of the first section 321. A distal end of the body 412 has a piston sealing end surface 455. A shape of the piston sealing end surface 455 matches a shape of the unloading device accommodating cavity opening 367, such that the piston sealing end surface 455 can seal the unloading device accommodating cavity opening 367.

[0038] FIG. 5A is a side view of the screw compressor shown in FIG. 1A, FIG. 5B is a cross-sectional view of the screw compressor shown in FIG. 5A sectioned along a line C-C, showing the piston in an opened position, and FIG. 5C is another cross-sectional view of the screw compressor shown in FIG. 5A sectioned along the line C-C, showing the piston in a closed position.

[0039] As shown in FIG. 5A, the unloading device accommodating cavity opening 367 is simultaneously aligned with at least a part of the unloading channel inlet 216 and a part of the screw rotor accommodating cavity opening 215. In other words, the unloading device accommodating cavity 310 can communicate the end of the compression accommodating cavity 150 with the unloading channel 208.

[0040] In the position shown in FIG. 5A, the piston 401 is in the opened position. One end of the elastic device 402 abuts against the inner surface 421 of the head 411 of the piston 401, and the other end abuts against the step surface 333 formed at the joint between the first section 321 and the second section 322. The elastic device 402 is in a compressed state, thereby providing the piston 401 with an elastic force in a direction away from the unloading device accommodating cavity opening 367. In this case, the piston 401 is not subjected to an external force opposite to the direction of the elastic force, or is subjected to an external force less than the elastic force of the elastic device, such that the piston 401 is in the farthest position relative to the unloading device accommodating cavity opening 367. In this case, the head of the piston 401 abuts against the cover 315 and cannot move further in a direction towards the unloading device accommodating cavity opening 367.

[0041] There is a distance between the piston sealing end surface 455 of the piston 401 and the unloading device accommodating cavity opening 367, such that a part between the piston sealing end surface 455 and the unloading device accommodating cavity opening 367 forms the connecting channel 308. That is, when the piston 401 is in the opened position, the piston is located outside the connecting channel 308. The connecting channel 308 has a cavity, such that the connecting channel 308 communicates the compression accommodating cavity 150 and the unloading channel 208. In this case, the compression accommodating cavity 150 is not yet communicated with the exhaust cavity opening 366, and a part of the compressed refrigerant gas in the compression accommodating cavity 150 is communicated with the suction side of the compressor through the unloading

channel 208, thereby reducing the load of the compressor.

[0042] In the position shown in FIG. 5B, the piston 401 is in the closed position. The piston 401 is subjected to a force opposite to the direction of the elastic force of the elastic device, which can overcome the elastic force of the elastic device, such that the piston 401 enters the connecting channel 308 and abuts against the rear end surface 207 of the rotor seat 131. In this case, the connecting channel 308 is filled by the body of the piston 401, such that the connecting channel 308 is closed. The piston sealing end surface 455 is flush with the unloading device accommodating cavity opening 367 and seals the unloading device accommodating cavity opening 367. The compression accommodating cavity 150 and the unloading channel 208 are blocked by the piston sealing end surface 455 and cannot communicate with each other. In the closed position of the piston, the refrigerant in the compression accommodating cavity 150 continues to be compressed before entering the exhaust cavity 180.

[0043] The cover channel 380 on the cover 315 is communicated with the exhaust side of the compressor, such that the pressure on the outer surface 422 of the head 411 of the piston 401 changes as the pressure on the exhaust side of the compressor changes. The piston in the present application can be automatically adjusted according to a working state of the compressor, wherein when the compressor is just started, the piston 401 is in the opened position, and when the compressor runs smoothly, the piston 401 is in the closed position. When the compressor needs to be started, a small load is conducive to reducing a starting torque, thereby facilitating quick startup of the compressor. When the compressor in the present application is just started, the pressure on the exhaust side of the compressor is small and cannot overcome the elastic force of the elastic device to cause the piston to seal the unloading device accommodating cavity opening 367. In this case, the connecting channel 308 is opened, and a part of gas entering the compression accommodating cavity 150 reaches the suction side of the compressor through the connecting channel 308 and the unloading channel 208, and is not subjected to compression, such that a suction volume of the compressor decreases, and in this case, the load of the compression is small. When the compressor operation reaches a stable state, the pressure on the exhaust side of the compressor increases, and the pressure on the exhaust side is exerted on the piston 401 through the cover channel 380, causing the piston 401 to move towards where the piston seals the unloading device accommodating cavity opening 367 and into the farthest position. In this case, the connecting channel 308 is filled by the piston 401 and thus is closed, and the compression accommodating cavity 150 is disconnected from the unloading channel 208. The compressor reaches a full load state. Opening and closing of the piston 401 is automatically associated with the working state of the compressor and does not require manual intervention.

[0044] In the present application, in a rotation direction of the rotor, there is a distance between the unloading device accommodating cavity openings 367 and 368 and the exhaust cavity opening 366, such that when the connecting channel is communicated, the refrigerant gas begins to be communicated with the suction side before reaching a maximum compression state. In other embodiments of the present application, positions of the unloading device accommodating cavity openings 367 and 368 can be set as required. In the rotation direction of the rotor, the distance between the unloading device accommodating cavity openings 367 and 368 and the exhaust cavity opening 366 can affect an unloading capability of the unloading device.

[0045] FIG. 6 is a schematic view of a first embodiment of a connection relationship between the unloading device accommodating cavity 310 of the compressor and the exhaust cavity of the compressor according to the present application. In the embodiment shown in FIG. 6, the cover channel 380 is communicated with the exhaust cavity of the compressor through a connecting passage 608. A throttling element 611 and a buffer device 612 are disposed on the connecting passage, wherein the buffer device 612 is disposed between the throttling element 611 and the cover 315. The throttling element 611 and the buffer device 612 are used to reduce the pressure of the refrigerant gas on the exhaust side of the compressor exerted on the unloading device 109, thereby preventing the unloading device 109 from being subjected to excessive impact. The buffer device 612 disposed on the throttling element 611 can be configured according to an actual requirement for the compressor, and in one embodiment, the throttling element 611 can meet the requirement, so the buffer device 612 does not need to be disposed. In another embodiment, a plurality of stages of throttling elements and buffer devices may be disposed. In yet another embodiment, the cover channel 380 is thin, such that the throttling element is formed from the cover channel 380 to further throttle the refrigerant gas.

[0046] In other embodiments, the cover channel 380 may be communicated with any place on a high-pressure side of the air conditioning system.

[0047] FIG. 7 is a schematic view of a second embodiment of the connection relationship between the unloading device accommodating cavity 310 of the compressor and the exhaust cavity of the compressor according to the present application. This embodiment is similar to the embodiment shown in FIG. 6, and a difference lies in that in the embodiment of FIG. 7, the connecting passage 708 is disposed in the housing 101 of the compressor. Compared with the embodiment shown in FIG. 6, the embodiment shown in FIG. 7 is more compact and can achieve the same technical effects.

[0048] FIG. 8 is a schematic view of a third embodiment of the connection relationship between the unloading device accommodating cavity 310 of the compressor and the exhaust cavity of the compressor according to the present application. In the embodiment shown in FIG. 8,

the buffer device is formed by a cover. As shown in FIG. 8, a cover 815 has a thickness in the axial direction, and there is a cover accommodating cavity 830 inside the cover, wherein the cover accommodating cavity 830 is communicated with the unloading device accommodating cavity 310. The cover accommodating cavity 830 has a volume and can provide a buffering effect, thereby forming the buffer device.

[0049] The compressor in the present application can automatically adjust a load state during startup and smooth running, such that the compressor is in a good working state.

[0050] While only some of the features of the present application have been illustrated and described herein, various modifications and changes will occur to those skilled in the art. It is therefore to be understood that the appended claims are intended to cover all such modifications and changes that fall within the true spirit of the present application.

Claims

1. A compressor, comprising:

a housing (101) having a rotor accommodating cavity (105) and an exhaust cavity (180), wherein the housing (101) further comprises an unloading channel (208) and a connecting channel (308), and the unloading channel (208) has an unloading channel inlet (216) and an unloading channel outlet (217);

a pair of screw rotors (110) at least partially located in the rotor accommodating cavity (105), wherein a compression accommodating cavity (150) can be formed between teeth of the pair of screw rotors (110) and the housing (101), the pair of screw rotors (110) have a suction end (112) and an exhaust end (113), the unloading channel inlet (216) can be communicated with the compression accommodating cavity (150) through the connecting channel (308), and the unloading channel outlet (217) is communicated with a suction side of the compressor; and
 an unloading device (109) configured to controllably open or close the connecting channel (308), such that the compression accommodating cavity (150) can be controllably communicated with or disconnected from the connecting channel (308).

2. The compressor of claim 1, wherein:

the unloading device (109) is configured that: when the compressor is started, the unloading device (109) opens the connecting channel (308), thereby opening the inlet (216) of the unloading channel (208), such that the compression accommodating cavity (150) is communicated with the suction side

of the compressor.

3. The compressor of claim 1, wherein:
the housing (101) further comprises an unloading
device accommodating cavity (310) and a cover
(315), a proximal end of the unloading device ac- 5
commodating cavity (310) forms the connecting
channel (308), and a distal end of the unloading de-
vice accommodating cavity (310) is closed by the
cover (315). 10
4. The compressor of claim 3, wherein:
the unloading device accommodating cavity (310)
has an unloading device accommodating cavity
opening (367), and an area of the unloading device
accommodating cavity opening (367) is larger than 15
an area of the inlet (216) of the unloading channel
(208).
5. The compressor of claim 4, wherein: 20
the exhaust end (113) of the pair of screw rotors (110)
has an exhaust end surface (118), the unloading de-
vice accommodating cavity opening (367), the inlet
(216) of the unloading channel (208), and the ex-
haust end surface (118) are on the same plane, and 25
the unloading device accommodating cavity opening
(367) can simultaneously overlap at least a part of
the inlet (216) of the unloading channel (208) and at
least a part of the exhaust end surface (118).
6. The compressor of claim 3, wherein:
the unloading device (109) comprises a piston (401)
movable in the unloading device accommodating
cavity (310) and an elastic device (402) capable of
providing an elastic force, wherein the unloading de- 30
vice (109) is configured that: when the pressure on
the piston (401) is less than the elastic force of the
elastic device (402), the piston (401) can move away
from the inlet (216) of the unloading channel (208),
thereby opening the connecting channel (308); and
when the pressure on the piston is greater than the
elastic force of the elastic device (402), the piston
(401) can close the inlet (216) of the unloading chan- 35
nel (208), thereby closing the connecting channel
(308), wherein the pressure is provided by gas ex-
haust pressure of the compressor. 40
7. The compressor of claim 6, wherein:
the piston (401) has a head (411) and a body 50
(412), wherein a diameter of the head (411) is
greater than a diameter of the body (412), the
unloading device accommodating cavity (310)
has a first section (321) and a second section
(322), wherein a diameter of the second section
(322) is less than a diameter of the first section
(321), the first section (321) is close to the cover
(315), and the head (411) is accommodated in 55
- the first section (321) and forms a seal with an
inner wall of the first section (321); and
one end of the elastic device (402) abuts against
a step surface (333) formed by the first section
(321) and the second section (322), the other
end abuts against the head (411) of the piston
(401), wherein the elastic device (402) provides
an elastic force, such that the piston (401) can
move away from the inlet (216) of the unloading
channel (208), thereby opening the connecting
channel (308), and the head (411) of the piston
(401) can be subjected to a pressure, such that
the piston (401) moves towards the inlet (216)
of the unloading channel (208) to close the con-
necting channel (308).
8. The compressor of claim 4, wherein:
the unloading device accommodating cavity (310) is
communicated with the exhaust cavity (180) of the
compressor through connecting passages (608,
708), and a throttling element is disposed on the con-
necting passage.
9. The compressor of claim 8, wherein:
a buffer device is disposed on the connecting pas-
sages (608, 708), and the buffer device is arranged
between the unloading device accommodating cav-
ity (310) and the throttling element.
10. The compressor of claim 8, wherein:
the cover (315) is provided with a cover channel
(380), and the cover channel forms the throttling el-
ement.
11. The compressor of claim 9, wherein:
the throttling element and the buffer device are dis-
posed in the housing (101).
12. The compressor of claim 4, wherein:
the housing (101) has a housing fitting surface (341)
disposed facing the exhaust end surface (118) of the
exhaust end of the pair of screw rotors, an exhaust
port (348) is disposed on the housing fitting surface
(341), and in a radial direction, there is a distance
between the unloading device accommodating cav-
ity opening (367) and the exhaust port (348).
13. A compressor, comprising any one of the technical
features or any combination of the technical features
in claims 1-12.

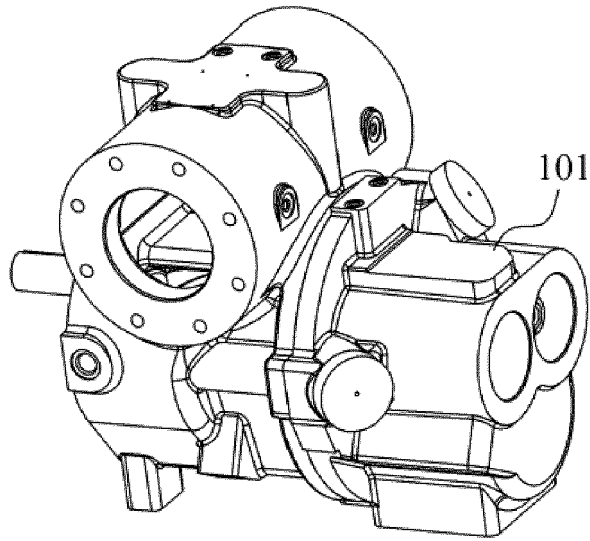


FIG. 1A

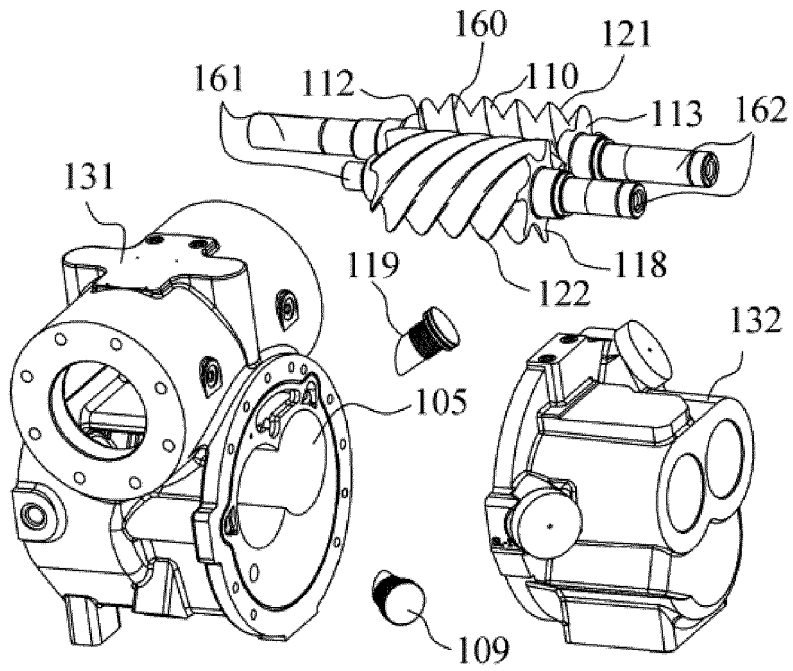


FIG. 1B

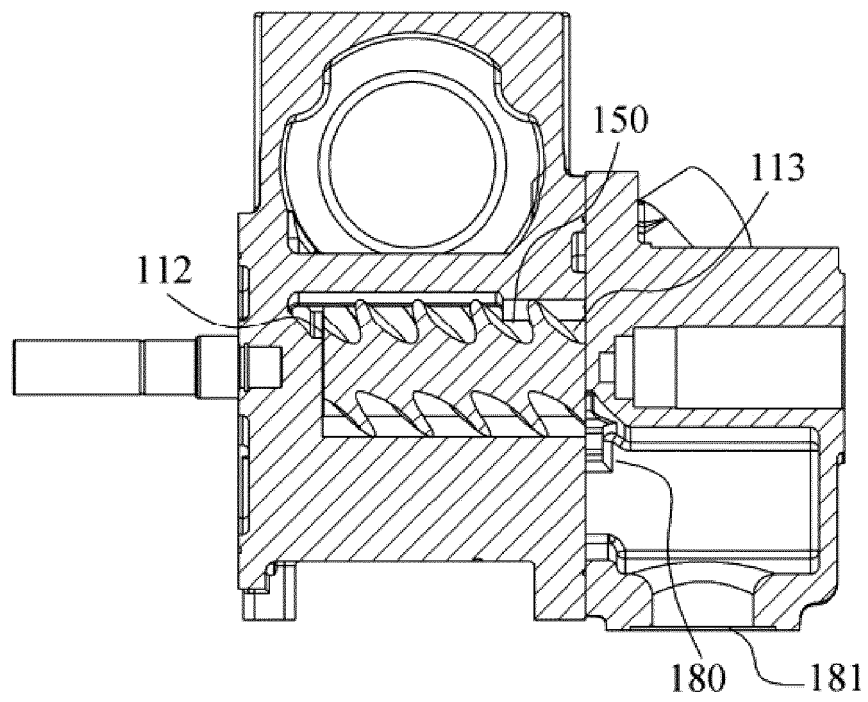
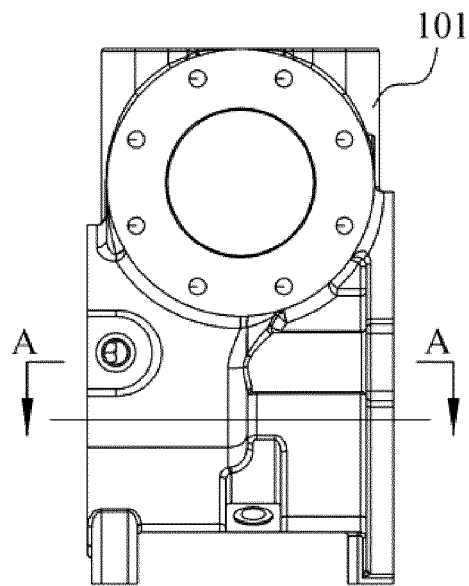
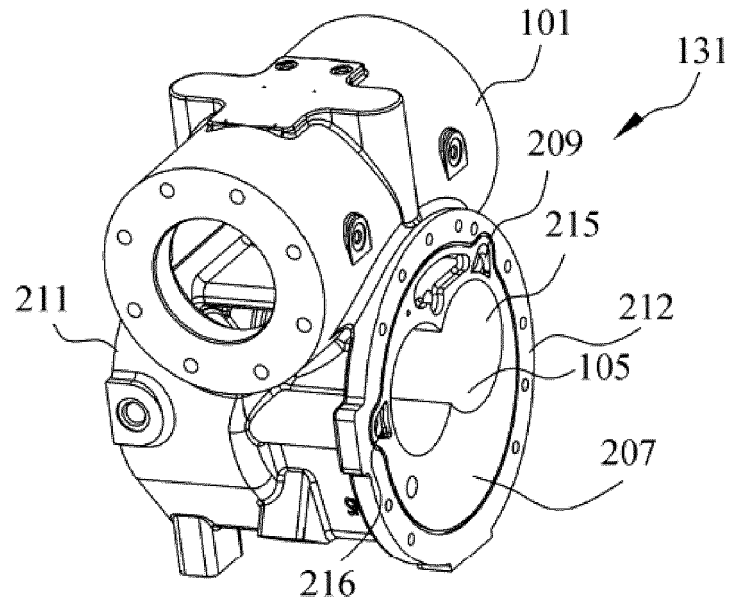


FIG. 1C



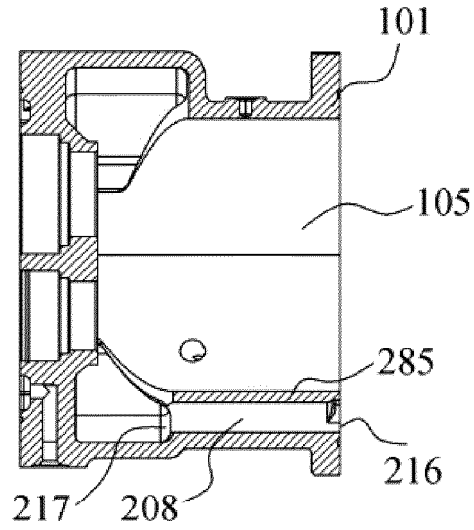


FIG. 2C

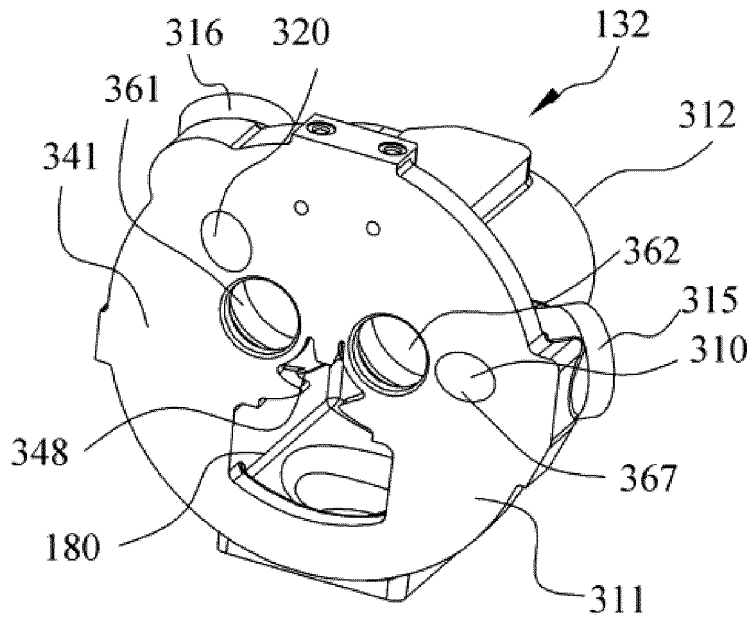
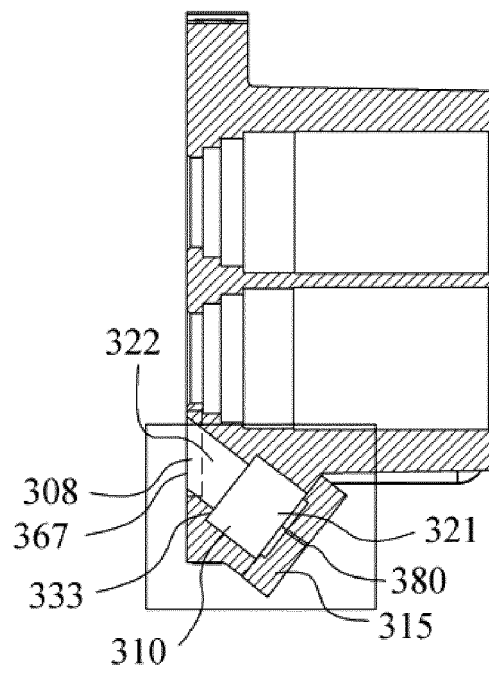
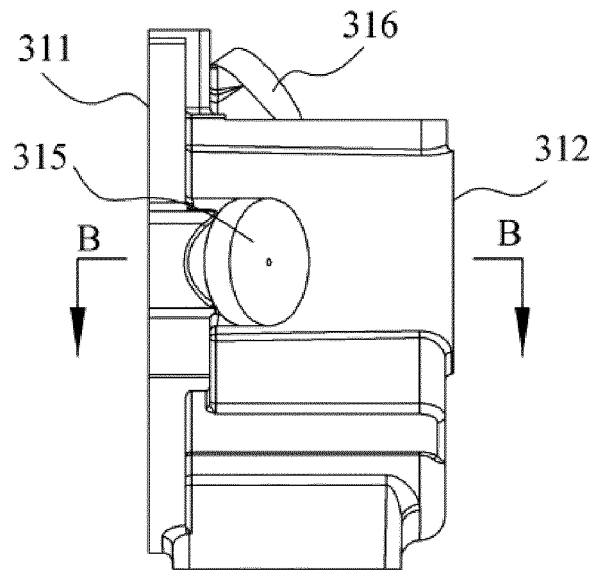


FIG. 3A



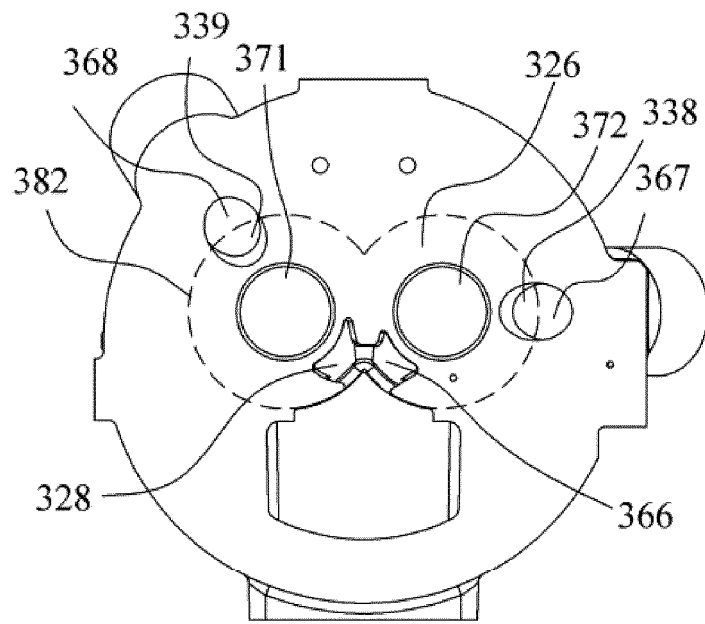


FIG. 3D

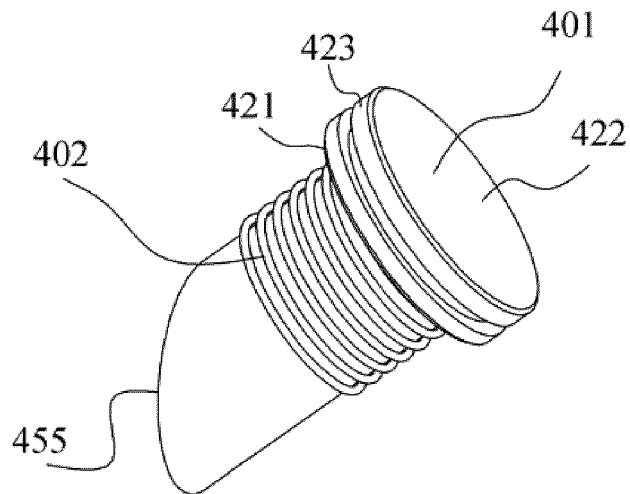


FIG. 4A

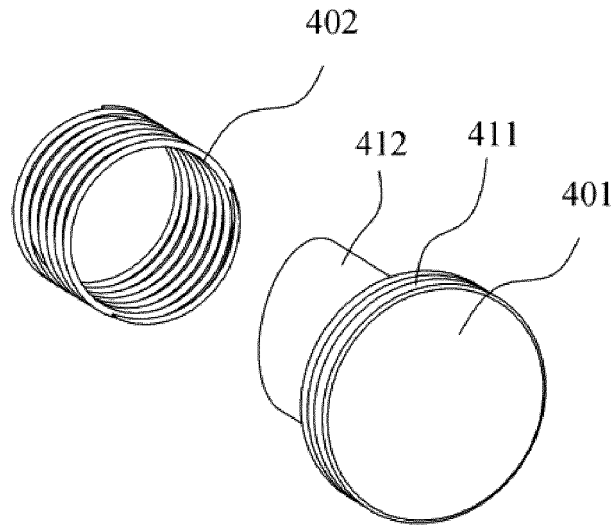


FIG. 4B

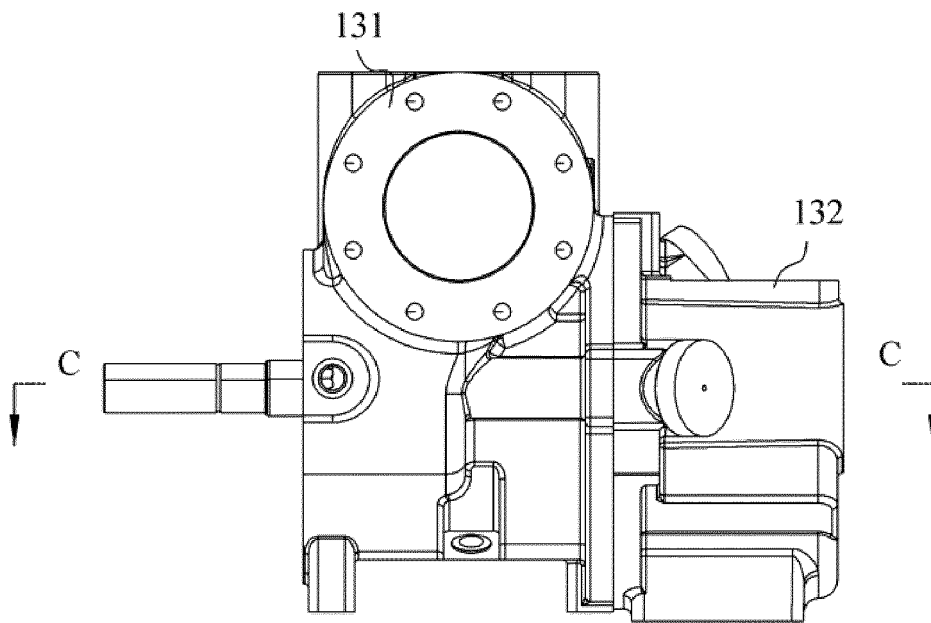


FIG. 5A

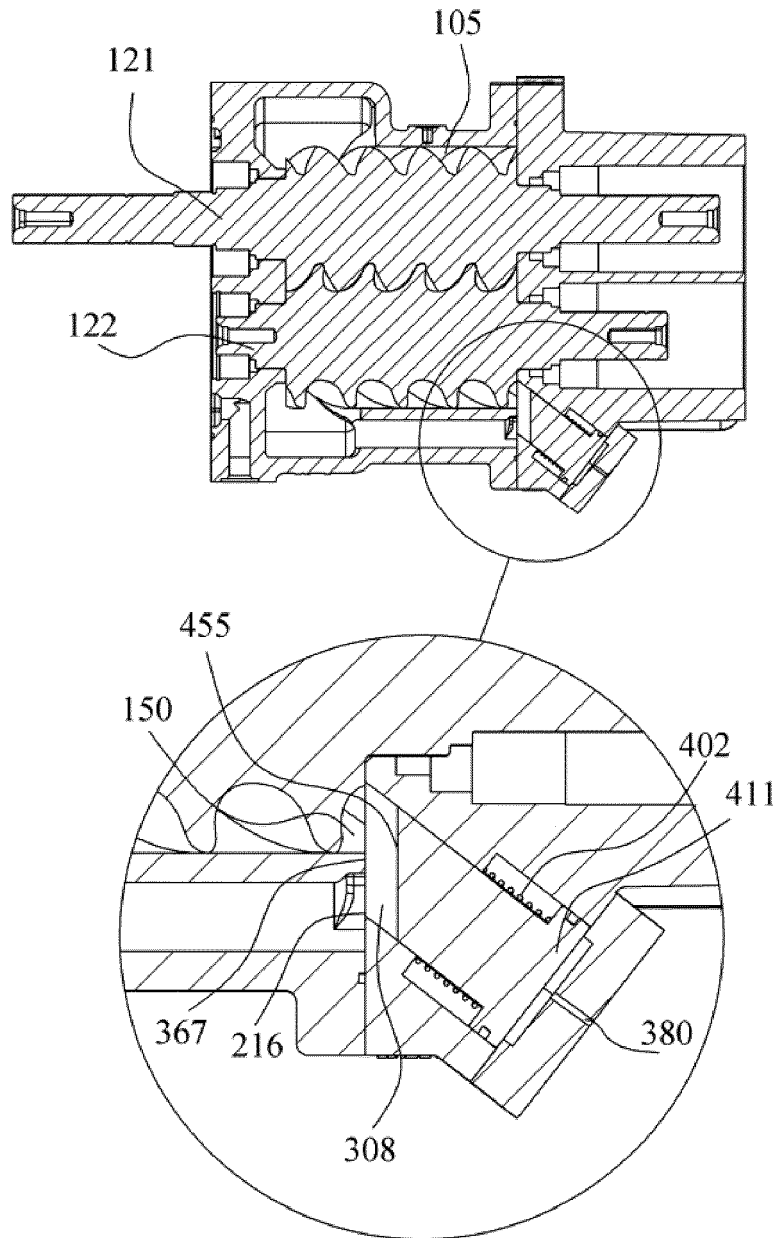


FIG. 5B

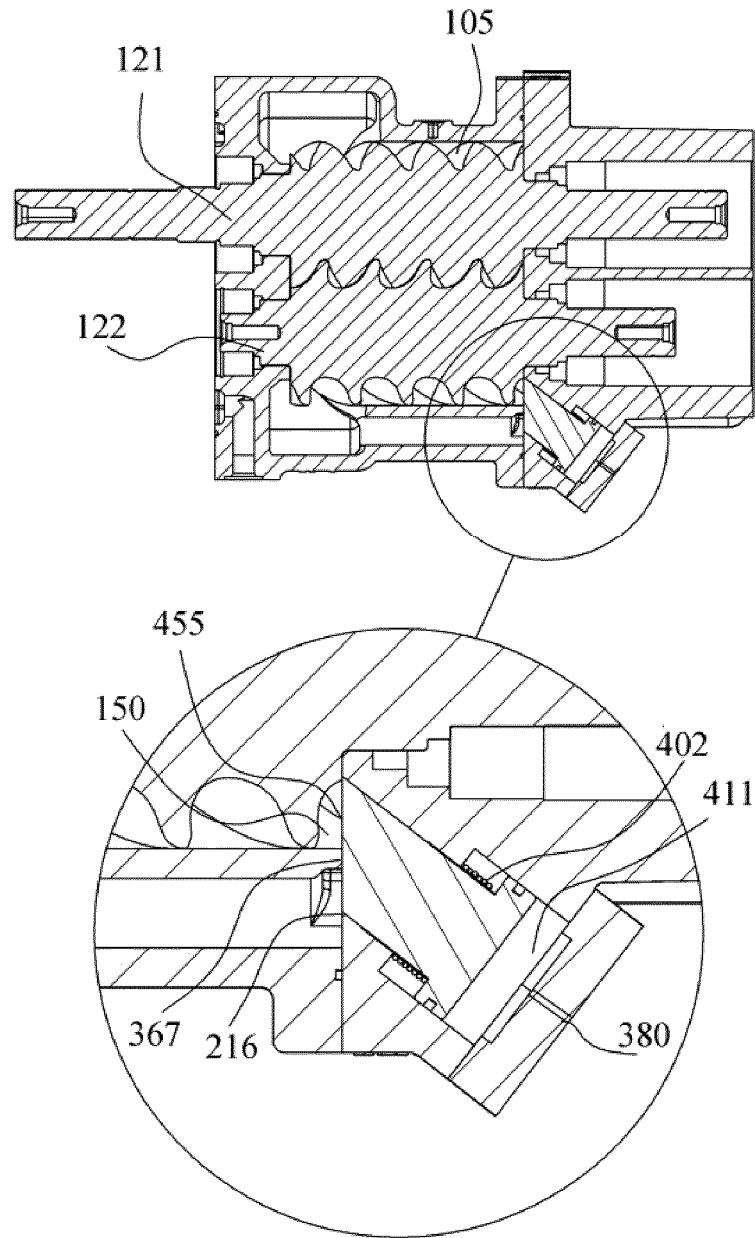
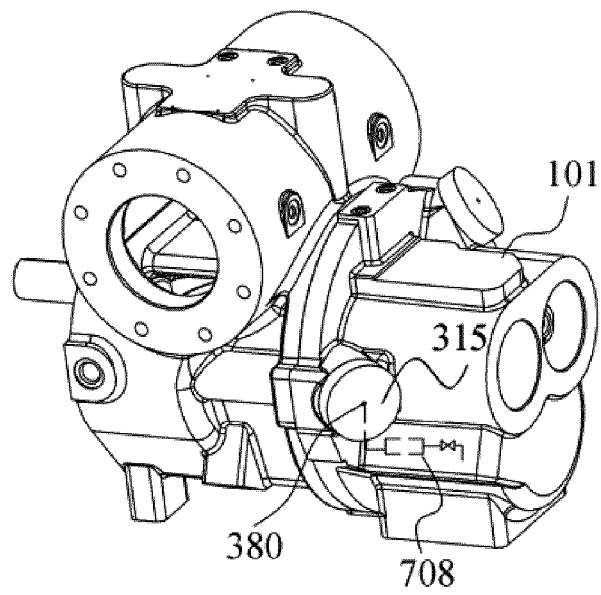
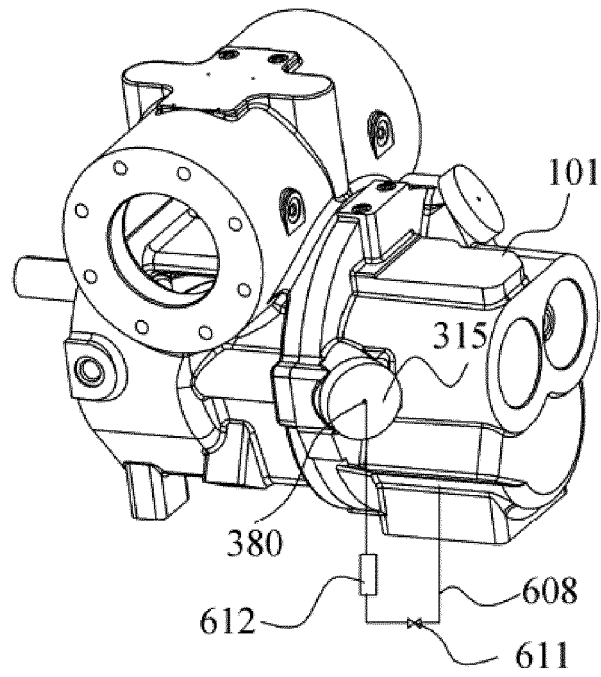


FIG. 5C



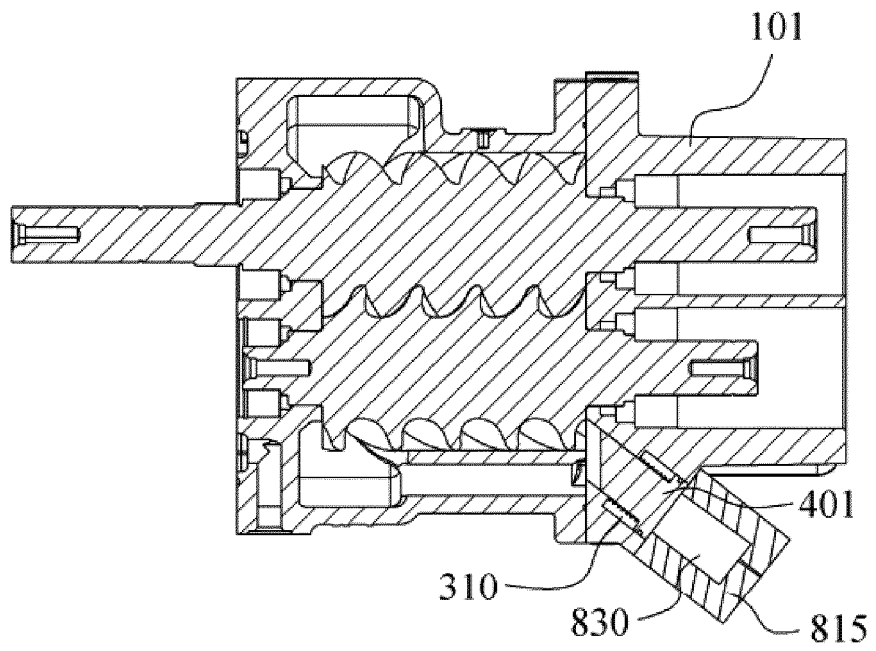


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/115501

5	A. CLASSIFICATION OF SUBJECT MATTER F04C 18/16(2006.01)i; F04C 29/12(2006.01)i According to International Patent Classification (IPC) or to both national classification and IPC	
10	B. FIELDS SEARCHED Minimum documentation searched (classification system followed by classification symbols) F04C Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched	
15	Electronic data base consulted during the international search (name of data base and, where practicable, search terms used) CNTXT, ENTXT, DWPI, CNKI: 压缩机, 螺杆, 转子, 壳体, 压缩腔, 通道, 卸载, 连通, 断开, compressor, screw, rotor, housing, chamber, cavity, channel, unload, connect, disconnect	
20	C. DOCUMENTS CONSIDERED TO BE RELEVANT	
25	Category*	Citation of document, with indication, where appropriate, of the relevant passages
30		Relevant to claim No.
35	PX	CN 113982916 A (JOHNSON CONTROLS AIR CONDITIONING AND REFRIGERATION (WUXI) CO., LTD. et al.) 28 January 2022 (2022-01-28) claims 1-12
40	X	CN 110578690 A (WUXI XIYA COMPRESSOR CO., LTD.) 17 December 2019 (2019-12-17) see description, paragraphs [0010]-[0011], and figures 1-3
45	X	CN 210769318 U (WUXI XIYA COMPRESSOR CO., LTD.) 16 June 2020 (2020-06-16) see description, paragraphs [0019]-[0020], and figures 1-3
50	X	US 4544333 A (MITSUBISHI HEAVY INDUSTRIES, LTD.) 01 October 1985 (1985-10-01) see description, column 3, line 38 to column 9, line 41, and figures 1-12
55	A	JP H03121291 A (HOKUETSU KOGYO CO.) 23 May 1991 (1991-05-23) see entire document
	A	JP 2008240579 A (HITACHI INDUSTRIAL EQUIPMENT SYSTEMS CO., LTD.) 09 October 2008 (2008-10-09) see entire document
	<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.	
	* Special categories of cited documents: “A” document defining the general state of the art which is not considered to be of particular relevance “E” earlier application or patent but published on or after the international filing date “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) “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	“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 “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 “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 “&” document member of the same patent family
	Date of the actual completion of the international search 11 November 2022	Date of mailing of the international search report 29 November 2022
	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 Facsimile No. (86-10)62019451	Authorized officer Telephone No.

Form PCT/ISA/210 (second sheet) (January 2015)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2022/115501

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Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
CN 113982916 A	28 January 2022	None	
CN 110578690 A	17 December 2019	None	
CN 210769318 U	16 June 2020	None	
US 4544333 A	01 October 1985	AU 7513281 A SE 8105394 L GB 2083868 A FR 2490749 A1 DE 3137918 A1 AU 550468 B2 FR 2490749 B1 SE 456264 B GB 2083868 B	25 March 1982 20 March 1982 31 March 1982 26 March 1982 27 May 1982 20 March 1986 02 October 1987 19 September 1988 03 October 1984
JP H03121291 A	23 May 1991	JP 2814272 B2	22 October 1998
JP 2008240579 A	09 October 2008	None	

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