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(54) **A MULTI-STAGE COMPRESSOR**

(57) The present application relates to a multi-stage compressor, including a housing provided with at least three compression chambers, a rotor set rotatably installed within the compression chambers, and a drive mechanism used as a power source for the rotor set. An outlet end of the rotor set is provided with a support bearing. An inlet end of the rotor set performing third-stage and above compression is also provided with a support bearing, and is further provided with a pressure transmission device and a pressure balancing device. The pressure balancing device is connected to the housing at an outlet end of the corresponding compression chamber. The pressure balancing device uses air pressure at the outlet end of the compression chamber to balance pressure transmitted by the pressure transmission device. By transmitting pressure from the outlet end of the rotor set to the pressure balancing device via the pressure transmission device, and then balancing the transmitted pressure through the pressure balancing device, unidirectional pressure borne by an inner ring of the support bearing at the outlet end of the rotor set is balanced, preventing an outer ring of the support bearing from rotating with the inner ring and causing wear.

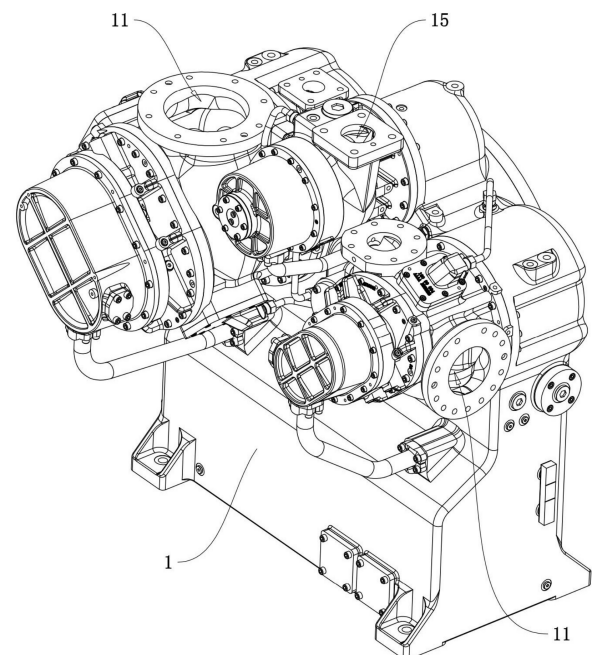


FIG. 1

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Description

TECHNICAL FIELD

[0001] The present application relates to the field of a compressor, and, in particular, to a multi-stage compressor.

BACKGROUND ART

[0002] A screw compressor is one type of positive displacement compressors. It compresses air through volume changes between the meshing tooth grooves of male and female rotors inside the compressor. It has high compression efficiency and low noise, and thus is often chosen as a compression tool in situations where gas needs to be compressed.

[0003] When high-pressure gas is required, a multi-stage compression is usually used to compress the gas, in which multiple compression chambers are designed on the compressor, and multiple pairs of male and female rotors are used to perform multi-stage compression to compress the gas to a high-pressure state.

[0004] In multi-stage compression, air first enters a first-stage compression chamber for primary compression by the male and female rotors. The compressed gas is then cooled by a cooling device and enters a second-stage compression chamber for secondary compression. After the secondary compression, the gas is cooled by a cooling device and enters a third-stage compression chamber for tertiary compression, and so on. The gas is multi-stage compressed in this manner until the required air pressure is reached, and then output to a load.

[0005] A support bearing is provided at the outlet ends of the male and female rotors to bear the pressure difference between the outlet end and the inlet end of the male and female rotors. A four-point contact ball bearing is usually adopted as the support bearing to withstand large axial loads under high-speed requirements.

[0006] However, when performing third-stage and above gas compression, due to the excessive pressure difference between the inlet end and the outlet end of the male and female rotors, after the inner ring of the support bearing of the male and female rotors bears a large pressure, due to the characteristics of the four-point contact ball bearing, the rollers of the support bearing will exert excessive pressure on the outer ring of the support bearing. This results in high friction between the rollers of the support bearing and the outer ring of the support bearing. Consequently, when the male and female rotors rotate, the inner ring of the support bearing drives the outer ring of the support bearing to rotate synchronously, leading to significant wear on the outer ring of the support bearing during operation, as well as significant wear on the abutting surface of the bearing seat used to install the support bearing and the outer ring of the support bearing. If the support bearing and the

bearing seat need to be replaced, the entire male and female rotor set must be disassembled first. Frequent disassembly and replacement are not only troublesome but also prone to damage the male and female rotors, reducing their service life.

SUMMARY

[0007] In order to solve the problem that the support bearing outer rings of the male and female rotors in the third or higher stage compression chambers of a screw compressor are prone to wear and require frequent replacement, the present application provides a multi-stage compressor.

[0008] A multi-stage compressor provided by the present application adopts the following technical solutions.

[0009] A multi-stage compressor includes a housing provided with at least three compression chambers, a rotor set rotatably installed within the compression chambers for compressing gas, and a drive mechanism serving as a power source for the rotor set. An outlet end of the rotor set is provided with a support bearing for bearing the pressure difference between the two ends of the rotor set. The inlet end of the rotor set used for compressing gas to a third or higher stage is also provided with a support bearing, and the inlet end of the rotor set is further provided with a pressure transmission device and a pressure balancing device. The pressure transmission device is used to transmit the pressure from the outlet end of the rotor set to the pressure balancing device. The pressure balancing device is connected to the housing at the outlet end of the corresponding compression chamber. The pressure balancing device uses the air pressure at the outlet end of the compression chamber to balance the pressure transmitted by the pressure transmission device.

[0010] Through the above technical solution, the pressure at the outlet end of the third-stage compression rotor set is transmitted to the pressure balancing device through the pressure transmission device, and then the transmitted pressure is balanced by the pressure balancing device. Thereby, the unidirectional pressure borne by the inner ring of the support bearing at the outlet end of the rotor set is balanced, preventing the inner ring of the support bearing from exerting excessive pressure on the rollers and the outer ring, which would cause the outer ring of the support bearing to rotate with the inner ring and lead to wear. At the same time, since the pressure source of the pressure balancing device is the air pressure of the gas output from the outlet end of the rotor set, the counterforce applied by the pressure balancing device to the pressure transmission device for balancing the pressure always forms a dynamic balance with the pressure applied by the rotor set to the pressure transmission device. This prevents the pressure balancing device from applying excessive counterforce to the rotor set, which would cause reverse pressure on the support bearing and make the outer ring of the support bearing

rotate due to excessive reverse friction with the rotation of the inner ring.

[0011] Optionally, the pressure transmission device includes:

a pressing block, abutting against the outer ring of the support bearing, provided therein with an accommodation chamber for accommodating an end portion of the rotor set, wherein an abutting surface abutting against the support bearing is defined with a clearance hole, the clearance hole is connected to the accommodation chamber, and the clearance hole is used for allowing the end portion of the rotor set to pass through into the accommodation chamber;
 a support plate, abutting against the pressing block; and
 a support column, having one end connected to the support plate and the other end abutting against the pressure balancing device, and located at the center between the support bearings.

[0012] Optionally, the housing at the end of the compression chamber is penetrated with a connection hole, and the support column is slidably installed in the connection hole.

[0013] Optionally, the pressure balancing device includes:

a push plate, slidably installed in the connection hole, with one surface abutting against the end face of the support column, and the other plate surface defined with an air pressure groove;
 a sealing plate, provided on the housing, sealing the connection hole, and provided with an air inlet hole connected to the air pressure groove.

[0014] Optionally, a sealing ring is provided between the sealing plate and the housing, and the sealing ring abuts against the outer side of the push plate to form a seal.

[0015] Optionally, the sealing plate is penetrated with a drainage hole, and the drainage hole is connected to the air pressure groove.

[0016] Optionally, the end face of the support column is penetrated with an exhaust hole, the exhaust hole penetrates through the support plate, the exhaust hole is connected to the accommodation chamber, a side wall of the pressing block is provided with a plurality of weight reduction holes, and the weight reduction holes are connected to the accommodation chamber.

[0017] Optionally, the push plate is defined with an exhaust groove, and the exhaust groove is connected to the exhaust hole.

[0018] Optionally, the end area of the exhaust hole connected to the exhaust groove is smaller than the area of the exhaust groove.

[0019] Optionally, the drive mechanism includes:

a drive gear, rotatably installed within the housing; and

a transmission gear set, provided with several sets corresponding one-to-one with the rotor set, for transmission connection between the drive gear and the male rotor; and

the outlet end of the rotor set used for compressing gas to a third or higher stage is transmission-connected to the transmission gear.

[0020] In summary, The present application, by providing support bearings, pressing blocks, support covers, push plates, and sealing plates on the housing at the inlet ends of the female and male rotors performing third-stage and above air compression, balances the pressure transmitted from the outlet ends of the male and female rotors. This makes the installation bearings of the male and female rotors less prone to excessive wear caused by the excessive pressure transmitted from the outlet ends during operation, thereby extending their service life. Furthermore, by connecting the air inlet hole of the sealing plate to the outlet end of the compression chamber via a pressure supply pipe, the output pressure from the outlet ends of the male and female rotors is used to balance the pressure received at their inlet ends. This keeps the pressure at both ends of the male and female rotors in a balanced state, so that the axial force borne by the installation bearings of the male and female rotors is theoretically zero, improving the service life of the installation bearings of the male and female rotors. Simultaneously, water accumulated in the air pressure groove is discharged through the drainage pipe, effectively preventing the push plate and the sealing plate from being corroded and rusting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021]

FIG. 1 is a perspective structural schematic diagram of the present application at a compression chamber side, wherein connection pipes between the compression chambers are not shown.

FIG. 2 is a perspective structural schematic diagram of the present application at a drive mechanism side. FIG. 3 is a cross-sectional view of the present application at a drive mechanism.

FIG. 4 is a cross-sectional view of the present application at a compression chamber performing primary air compression.

FIG. 5 is a cross-sectional view of the present application at a compression chamber performing third-stage and higher-stage air compression.

FIG. 6 is an enlarged schematic diagram of Portion A in FIG. 5.

FIG. 7 is an exploded schematic diagram at a third-stage compression chamber of the present application.

FIG. 8 is a perspective structural schematic diagram of an internal structure of a third-stage compression chamber of the present application, wherein a sealing plate and a support plate are not shown.

[0022] Those skilled in the art will understand that the elements in the drawings are shown for simplicity and clarity, not necessarily drawn to scale. For example, the dimensions and positions of some elements in the drawings may be exaggerated relative to other elements to help improve the understanding of the embodiments of the present application.

[0023] Listing of reference signs: 1, Housing; 11, Compression chamber; 12, Support bearing; 121, Bearing seat; 13, Connection hole; 14, Installation groove; 15, Third-stage compression chamber; 2, Rotor set; 21, Female rotor; 22, Male rotor; 3, Pressure transmission device; 31, Pressing block; 311, Clearance hole; 312, Accommodation chamber; 313, Weight reduction hole; 32, Support plate; 4, Support column; 41, Exhaust hole; 5, Pressure balancing device; 51, Push plate; 511, Air pressure groove; 512, Exhaust groove; 52, Sealing plate; 521, Air inlet hole; 522, Drainage hole; 6, Drive mechanism; 61, Drive gear; 611, Connection shaft; 62, Transmission gear set; 7, Sealing ring; 71, Sealing gasket; and 8, Plug.

DETAILED DESCRIPTION

[0024] The present application will be described in further detail with reference to FIGs. 1 to 8.

[0025] An embodiment of the present application discloses a multi-stage compressor. Referring to FIGs. 1, 2, and 4, it includes a housing 1 provided therein with three or more compression chambers 11. The number of compression chambers 11 is determined according to the required compression stages. In this embodiment, three-stage compression is adopted. According to the compression stages, the housing 1 is provided therein with three compression chambers 11. Each of the three compression chambers 11 is provided with a rotor set 2. The rotor set 2 includes a pair of a male rotor 22 and a female rotor 21. The male rotor 22 and the female rotor 21 mesh with each other for compressing gas.

[0026] Referring to FIGs. 2, 3, and 4, the housing 1 is provided with a drive mechanism 6. The drive mechanism 6 includes a drive gear 61 rotatably installed within the housing 1 and three sets of transmission gear sets 62. In this embodiment, the transmission gear sets 62 use single gears with different numbers of teeth. The drive gear 61 is coaxially and fixedly installed with a connection shaft 611, which is connected to a motor. The three sets of transmission gear sets 62 are all rotatably installed within the housing 1. The three male rotors 22 are respectively transmission-connected to the drive gear 61 through the three sets of transmission gear sets 62. During operation, the motor drives the drive gear 61 to rotate via the connection shaft 611. The drive gear 61 synchronously

drives the three male rotors 22 to rotate through the three sets of transmission gear sets 62. The rotation of the male rotor 22 drives the female rotor 21 to rotate to compress the gas.

[0027] Referring to FIGs. 1 and 2, the compression chambers 11 are provided on one side of the housing 1, and the drive mechanism 6 is provided on the other side of the housing 1. Defining the side of the housing 1 with the compression chambers 11 as the front view, the leftmost one in the front view direction is the first-stage compression chamber 11, the rightmost one is the second-stage compression chamber 11, and the middle one is the third-stage compression chamber 15. The compression chambers 11 are all provided with an air inlet passage and an air outlet passage. The cross-sectional area of the air inlet passage is larger than that of the air outlet passage. The third-stage compression chamber 15 is named the third-stage compression chamber 15.

[0028] Air enters the first-stage compression chamber 11 from its air inlet passage, is compressed by the rotor set 2, and then is output from the air outlet passage of the first-stage compression chamber 11.

[0029] The output compressed air is transported along a pipeline to a cooler for cooling, then enters the second-stage compression chamber 11 from its air inlet passage along a pipeline. After being compressed by the rotor set 2 in the second-stage compression chamber 11, it is output from the air outlet passage of the second-stage compression chamber 11.

[0030] The output compressed air is transported along a pipeline to a cooler for cooling, then enters the third-stage compression chamber 15 from its air inlet passage along a pipeline. After being compressed by the rotor set 2 in the third-stage compression chamber 15, it is output from the air outlet passage of the third-stage compression chamber 15. The output compressed air is supplied to the load via a pipeline.

[0031] Referring to FIGs. 4 and 5, the outlet ends of the male rotor 22 and the female rotor 21 are coaxially and fixedly installed with a support bearing 12 for bearing axial pressure. The support bearing 12 is a four-point contact ball bearing.

[0032] Referring to FIGs. 4 and 5, the inlet ends of the male rotors 22 in the first-stage compression chamber 11 and the second-stage compression chamber 11 are transmission-connected to the drive gear 61 through the transmission gear set 62. The outlet end of the male rotor 22 in the third-stage compression chamber 15 is transmission-connected to the drive gear 61 via the transmission gear set 62.

[0033] Since the air out of the third stage of compression has high pressure, the pressure difference between the inlet end and the outlet end of the male rotor 22 and the female rotor 21 in the third-stage compression chamber 15 is high.

[0034] After the inner ring of the support bearing 12 at the outlet end bears a large pressure, due to the characteristics of the four-point contact ball bearing, the roll-

ers of the support bearing 12 will exert excessive pressure on the outer ring of the support bearing 12. This results in high friction between the rollers of the support bearing 12 and the outer ring of the support bearing 12. Consequently, when the female rotor 21 and the male rotor 22 rotate, the inner ring of the support bearing 12 drives the outer ring of the support bearing 12 to rotate synchronously, leading to significant wear on the outer ring of the support bearing 12 during operation.

[0035] Therefore, a support bearing 12 is also coaxially and fixedly installed at the inlet ends of the rotor set 2 performing the third-stage compression. In addition, a pressure balancing device 5 and a pressure transmission device 3 are provided at the inlet ends of the rotor set 2 performing the third-stage compression. The support bearings 12 transmit the pressure difference between the outlet end and the inlet end of the rotor set 2 to the pressure transmission device 3. The pressure transmission device 3 then transmits the pressure to the pressure balancing device 5. The pressure is balanced at the pressure balancing device 5, so that the pressure on the inner ring of the support bearing 12 at the outlet end of the rotor set 2 is balanced. The pressure exerted by the inner ring on the rollers and the outer ring is reduced, thereby preventing the outer ring from rotating with the inner ring.

[0036] Referring to FIGs. 6, 7, and 8, the pressure transmission device 3 includes a pressing block 31, a support plate 32, and a support column 4 integrally provided on the support plate 32.

[0037] The pressing block 31 is slidably installed on the bearing seat 121 of the support bearing 12 via a positioning pin. The pressing block 31 is also threadedly installed with a blocking bolt for preventing the positioning pin from sliding out.

[0038] The pressing block 31 is defined with two clearance holes 311 respectively coaxial with the male rotor 22 and the female rotor 21. In addition, an accommodation chamber 312 for accommodating the end portions of the male rotor 22 and the female rotor 21 is provided inside the pressing block 31. One end of the accommodation chamber 312 is open, penetrating the pressing block 31. The side wall of the accommodation chamber 312 is provided with a number of weight reduction holes 313, which penetrate the pressing block 31. By providing the weight reduction holes 313, the weight of the pressing block 31 is reduced, and the internal condition of the accommodation chamber 312 becomes easier to observe.

[0039] The inlet end portions of the male rotor 22 and the female rotor 21 respectively pass through the two clearance holes 311 coaxially and are located within the accommodation chamber 312. The surface of the pressing block 31 facing away from its open end abuts tightly against the outer rings of the support bearings 12 at the inlet ends of the male rotor 22 and the female rotor 21.

[0040] Referring to FIGs. 6, 7, and 8, the surface of the support plate 32 facing away from the support column 4

abuts tightly against the end face of the open end of the pressing block 31. The housing 1 at one end of the third-stage compression chamber 15 is penetrated with a connection hole 13. The support column 4 is slidably installed in the connection hole 13. The support plate 32 is radially limited by the connection hole 13. At this time, the support column 4 is located at the center between the two support bearings 12, making the supporting force exerted by the support plate 32 and the pressing block 31 on the two support bearings 12 relatively even.

[0041] Referring to FIGs. 6, 7, and 8, the pressure balancing device 5 includes a circular push plate 51, a circular sealing plate 52, and a sealing ring 7.

[0042] Referring to FIGs. 6, 7, and 8, the push plate 51 is slidably installed in the connection hole 13. One end face of the support column 4 abuts tightly against the plate surface of the push plate 51. The outer wall of the housing 1 is coaxially provided with a circular installation groove 14. The connection hole 13 is connected to the installation groove 14. The sealing ring 7 is fittingly inserted in the installation groove 14. The sealing plate 52 is fixedly installed on the housing 1 by a bolt and seals both the installation groove 14 and the connection hole 13. The sealing ring 7 forms a seal with the sealing plate 52 via a sealing gasket 71, forms a seal with the push plate 51 via a sealing gasket 71, and forms a seal with the bottom of the installation groove 14 via a sealing gasket 71.

[0043] Referring to FIGs. 6, 7, and 8, the surface of the push plate 51 facing away from the support column 4 is coaxially provided with a circular air pressure groove 511. The surface of the push plate 51 abutting against the support column 4 is provided with a circular exhaust groove 512.

[0044] Referring to FIGs. 6, 7, and 8, the sealing plate 52 is penetrated with an air inlet hole 521 and a drainage hole 522. The air inlet hole 521 is directly above the drainage hole 522. Both the air inlet hole 521 and the drainage hole 522 are connected to the air pressure groove 511. Under normal conditions, both the air inlet hole 521 and the drainage hole 522 are sealed with a plug 8 to prevent external dust from entering.

[0045] Referring to FIGs. 6, 7, and 8, the air inlet hole 521 is connected via a pipeline to the outlet end of the third-stage compression chamber 15, so that the air pressure at the outlet end of the third-stage compression chamber 15 is transmitted to the air pressure groove 511 to support the push plate 51. The pressure generated by the air pressure is transmitted sequentially along the push plate 51, the support column 4, the support plate 32, and the pressing block 31 to the outer rings of the support bearings 12 at the inlet end of the rotor set 2. Since the support bearing 12 is a four-point contact ball bearing, the pressure on the bearing outer ring is transmitted along the rollers to the bearing inner ring, and then to the rotor set 2. The pressure continues along the rotor set 2 to the inner rings of the support bearings 12 at the outlet end of the rotor set 2, balancing the pressure borne

by the inner rings of the support bearings 12 at the outlet end of the rotor set 2. This reduces the pressure exerted by the inner rings of the support bearings 12 on the rollers and the outer rings, thereby reducing the friction between the inner rings and the rollers and the outer rings. This prevents the outer rings from rotating with the inner rings when the inner rings of the support bearings 12 at the outlet end of the rotor set 2 rotate, thus preventing wear on the outer rings.

[0046] Referring to FIGs. 6, 7, and 8, the length of the support column 4 plus the thickness of the push plate 51 is greater than the length of the connection hole 13, ensuring that the support column 4 and the support plate 32 do not abut against the inner wall of the housing 1, avoiding support failure when supporting the pressing block 31. Additionally, a gap is provided between the push plate 51 and the sealing plate 52, preventing the push plate 51 from abutting against the sealing plate 52, which, otherwise, would cause support failure.

[0047] Referring to FIGs. 6, 7, and 8, the drainage hole 522 of the sealing plate 52 is sealingly connected via a pipeline to the housing 1 at the inlet end of the third-stage compression chamber 15. Compressed gas enters the air pressure groove 511 through the air inlet hole 521 to provide pressure to the push plate 51, then flows out along the drainage hole 522 to the inlet end of the third-stage compression chamber 15 for reuse. While flowing, the air stream carries out moisture from the air pressure groove 511, preventing water from accumulating in the air pressure groove 511 and causing corrosion of the push plate 51 and the sealing plate 52.

[0048] Referring to FIG. 7, the support column 4 is coaxially penetrated with an exhaust hole 41. The exhaust hole 41 is connected to the accommodation chamber 312, and the exhaust groove 512 is connected to the exhaust hole 41. Due to the high degree of sealing between the push plate 51, the sealing ring 7, and the support column 4, during the installation of the push plate 51, some air can easily be compressed and trapped between the push plate 51, the sealing ring 7, and the support column 4, preventing the push plate 51 from closely abutting the end face of the support column 4, thereby affecting the support effect on the support column 4.

[0049] Referring to FIG. 7, by providing the exhaust hole 41, the air between the push plate 51, the sealing ring 7, and the support column 4 is discharged, allowing the push plate 51 to closely abut against the end face of the support column 4. This makes the support of the push plate 51 on the support column 4 more stable while having higher positional accuracy. Simultaneously, by providing the exhaust groove 512, during the installation of the push plate 51, air can flow out more easily from between the push plate 51, the sealing ring 7, and the support column 4, minimizing the amount of air trapped between them. This greatly improves the support effect of the push plate 51 on the support column 4, thereby effectively reducing the wear of the installation bearings

of the rotor set 2 during operation.

[0050] The above are all preferred embodiments of the present application, not intended to limit the scope of protection of the present application. Therefore, all equivalent changes made to the structure, shape, and principles of the present application shall fall within the scope of protection of The present application.

Claims

1. A multi-stage compressor, **characterized by** comprising: a housing (1) provided with at least three compression chambers (11), a rotor set (2) rotatably installed within the compression chambers (11) for compressing gas, and a drive mechanism (6) serving as a power source for the rotor set (2), wherein an outlet end of the rotor set (2) is provided with a support bearing (12) for bearing a pressure difference between two ends of the rotor set (2), an inlet end of the rotor set (2) used for compressing gas to a third or higher stage is also provided with a support bearing (12), and the inlet end of the rotor set (2) is further provided with a pressure transmission device (3) and a pressure balancing device (5), a pressure balancing device (5) is connected to the housing (1) at an outlet end of a corresponding compression chamber (11), and the pressure balancing device (5) uses air pressure at the outlet end of the compression chamber (11) to balance a pressure transmitted by the pressure transmission device (3).
2. The multi-stage compressor according to claim 1, **characterized in that**, the pressure transmission device (3) comprises:

a pressing block (31), abutting against the outer ring of the support bearing (12), and provided therein with an accommodation chamber (312) for accommodating an end portion of the rotor set (2), wherein an abutting surface abutting against the support bearing (12) is provided with a clearance hole (311), the clearance hole (311) is connected to the accommodation chamber (312), and the clearance hole (311) is configured for allowing the end portion of the rotor set (2) to pass through into the accommodation chamber (312);
 a support plate (32), abutting against the pressing block (31); and
 a support column (4), having one end connected to the support plate (32) and the other end abutting against the pressure balancing device (5), and located at a center between the support bearings (12).

3. The multi-stage compressor according to claim 2, **characterized in that**, the housing (1) at the end of

the compression chamber (11) is penetrated with a connection hole (13), and the support column (4) is slidably installed in the connection hole (13).

4. The multi-stage compressor according to claim 3, **characterized in that**, the pressure balancing device (5) comprises:

a push plate (51), slidably installed in the connection hole (13), with one surface abutting against an end face of the support column (4), and the other plate surface provided with an air pressure groove (511); and
a sealing plate (52), provided on the housing (1), sealing the connection hole (13), and provided with an air inlet hole (521) connected to the air pressure groove (511), wherein the sealing plate (52) is connected via a pipeline to the outlet end of the compression chamber (11) where it is located.

5. The multi-stage compressor according to claim 4, **characterized in that**, a sealing ring (7) is provided between the sealing plate (52) and the housing (1), and the sealing ring (7) abuts against the outer side of the push plate (51) to form a seal.

6. The multi-stage compressor according to claim 4, **characterized in that**, the sealing plate (52) is penetrated with a drainage hole (522), and the drainage hole (522) is connected to the air pressure groove (511).

7. The multi-stage compressor according to claim 4, **characterized in that**, the end face of the support column (4) is penetrated with an exhaust hole (41), the exhaust hole (41) penetrates through the support plate (32), the exhaust hole (41) is connected to the accommodation chamber (312), a side wall of the pressing block (31) is provided with a plurality of weight reduction holes (313), and the weight reduction holes (313) are connected to the accommodation chamber (312).

8. The multi-stage compressor according to claim 7, **characterized in that**, the push plate (51) is defined with an exhaust groove (512), and the exhaust groove (512) is connected to the exhaust hole (41).

9. The multi-stage compressor according to claim 8, **characterized in that**, the end area of the exhaust hole (41) connected to the exhaust groove (512) is smaller than the area of the exhaust groove (512).

10. The multi-stage compressor according to claim 1, **characterized in that**, the drive mechanism (6) comprises:

a drive gear (61), rotatably installed within the housing (1); and

a transmission gear set (62), provided with several sets corresponding one-to-one with the rotor set (2), for achieving transmission connection between the drive gear (61) and the male rotor (22);

wherein the outlet end of the rotor set (2) used for compressing gas to a third or higher stage is transmission-connected to the transmission gear.

Amended claims in accordance with Rule 137(2) EPC.

1. A multi-stage screw compressor comprising: a housing (1) provided with at least three compression chambers (11), a rotor set (2) rotatably installed within the compression chambers (11) for compressing gas, and a drive mechanism (6) serving as a power source for the rotor set (2), wherein an outlet end of the rotor set (2) is provided with a support bearing (12) for bearing a pressure difference between two ends of the rotor set (2), an inlet end of the rotor set (2) used for compressing gas to a third or higher stage is also provided with a support bearing (12), and the inlet end of the rotor set (2) is further provided with a pressure transmission device (3) and a pressure balancing device (5), wherein said pressure balancing device (5) is connected to the housing (1) at an outlet end of the corresponding compression chamber (11), and the pressure balancing device (5) uses air pressure at the outlet end of the compression chamber (11) to balance a pressure transmitted by the pressure transmission device (3), **characterized in that**, the pressure transmission device (3) comprises:

a pressing block (31), abutting against the outer ring of the support bearing (12), and provided therein with an accommodation chamber (312) for accommodating an end portion of the rotor set (2), wherein an abutting surface abutting against the support bearing (12) is provided with a clearance hole (311), the clearance hole (311) is connected to the accommodation chamber (312), and the clearance hole (311) is configured for allowing the end portion of the rotor set (2) to pass through into the accommodation chamber (312);

a support plate (32), abutting against the pressing block (31); and

a support column (4), having one end connected to the support plate (32) and the other end abutting against the pressure balancing device (5), and located at a center between the support bearings (12), the housing (1) at the end of the compression

chamber (11) is penetrated with a connection hole (13), and the support column (4) is slidably installed in the connection hole (13),
the pressure balancing device (5) comprises:

a push plate (51), slidably installed in the connection hole (13), with one surface abutting against an end face of the support column (4), and the other plate surface provided with an air pressure groove (511); and
a sealing plate (52), provided on the housing (1), sealing the connection hole (13), and provided with an air inlet hole (521) connected to the air pressure groove (511), wherein the sealing plate (52) is connected via a pipeline to the outlet end of the compression chamber (11) where it is located.

2. The multi-stage compressor according to claim 1, **characterized in that**, a sealing ring (7) is provided between the sealing plate (52) and the housing (1), and the sealing ring (7) abuts against the outer side of the push plate (51) to form a seal.
3. The multi-stage compressor according to claim 1, **characterized in that**, the sealing plate (52) is penetrated with a drainage hole (522), and the drainage hole (522) is connected to the air pressure groove (511).
4. The multi-stage compressor according to claim 1, **characterized in that**, the end face of the support column (4) is penetrated with an exhaust hole (41), the exhaust hole (41) penetrates through the support plate (32), the exhaust hole (41) is connected to the accommodation chamber (312), a side wall of the pressing block (31) is provided with a plurality of weight reduction holes (313), and the weight reduction holes (313) are connected to the accommodation chamber (312).
5. The multi-stage compressor according to claim 4, **characterized in that**, the push plate (51) is defined with an exhaust groove (512), and the exhaust groove (512) is connected to the exhaust hole (41).
6. The multi-stage compressor according to claim 5, **characterized in that**, the end area of the exhaust hole (41) connected to the exhaust groove (512) is smaller than the area of the exhaust groove (512).
7. The multi-stage compressor according to claim 1, **characterized in that**, the drive mechanism (6) comprises:

a drive gear (61), rotatably installed within the housing (1); and

a transmission gear set (62), provided with several sets corresponding one-to-one with the rotor set (2), for achieving transmission connection between the drive gear (61) and the male rotor (22);
wherein the outlet end of the rotor set (2) used for compressing gas to a third or higher stage is transmission-connected to the transmission gear.

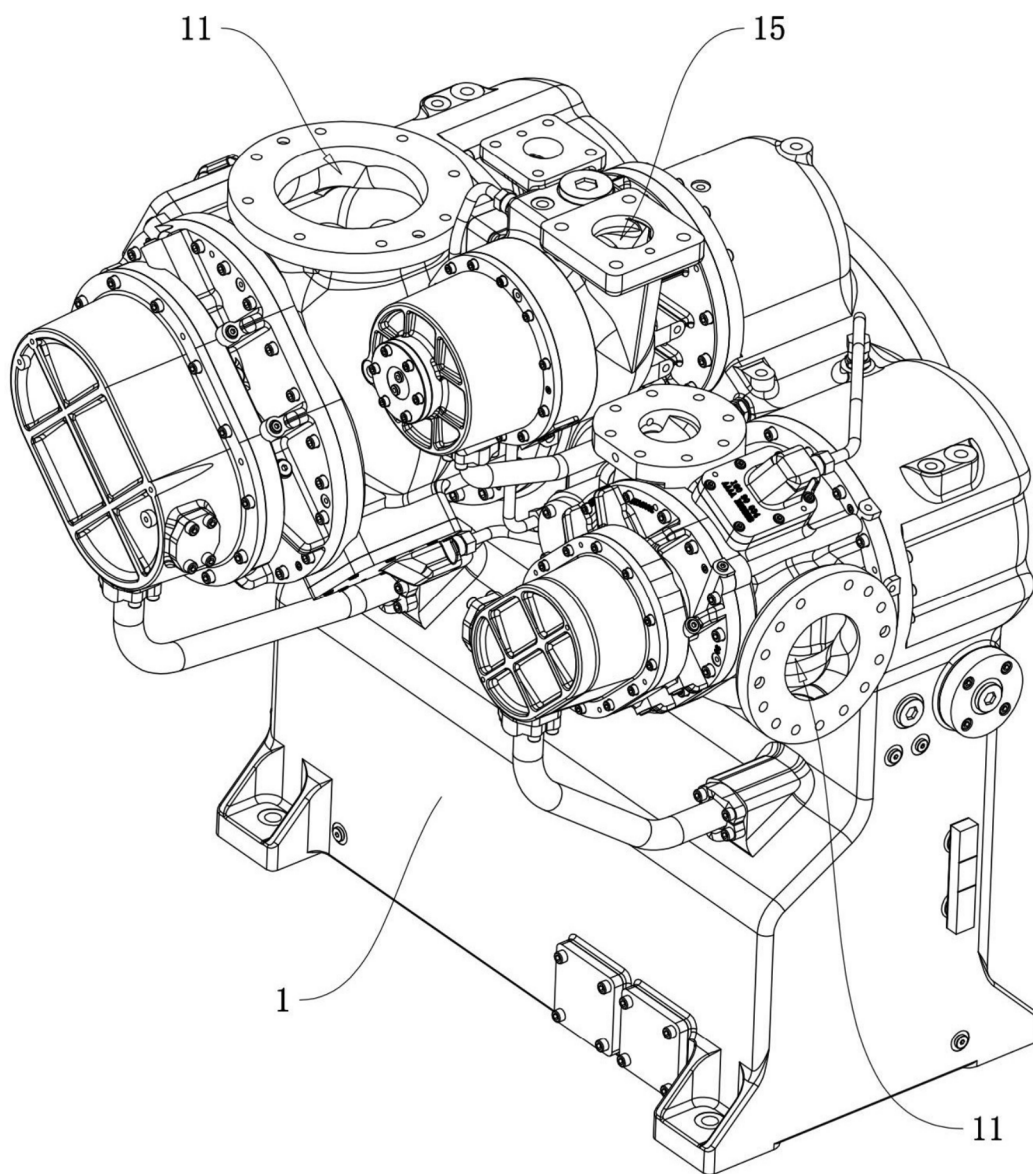


FIG. 1

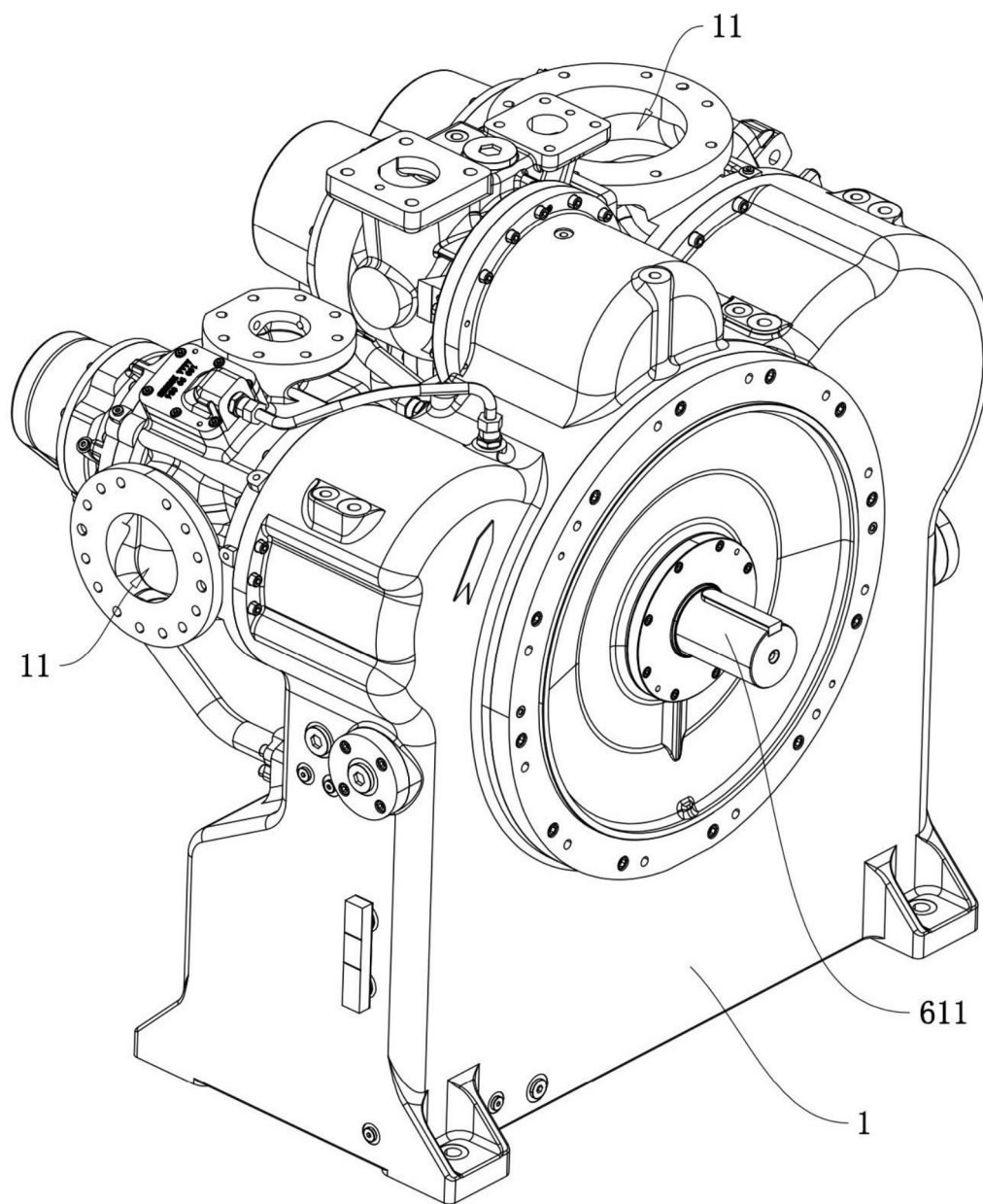


FIG. 2

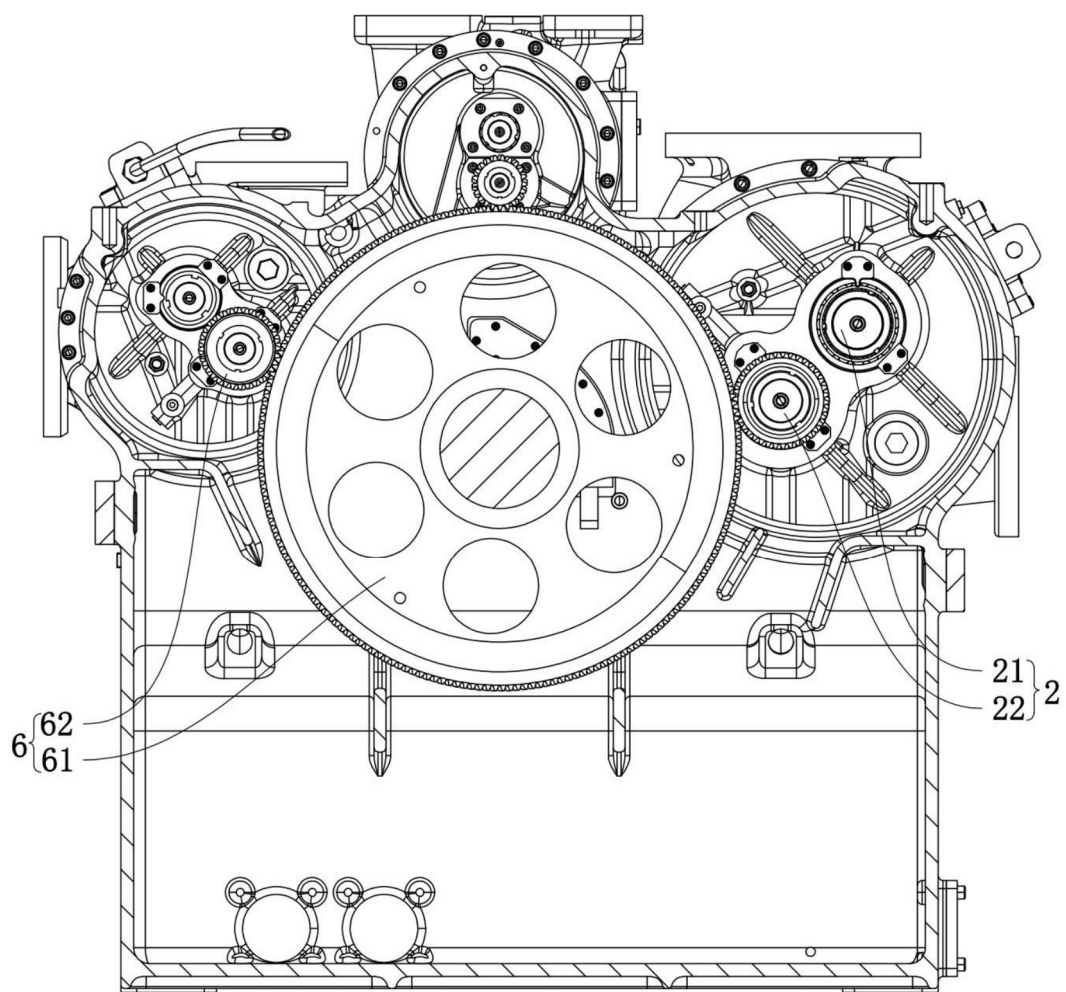


FIG. 3

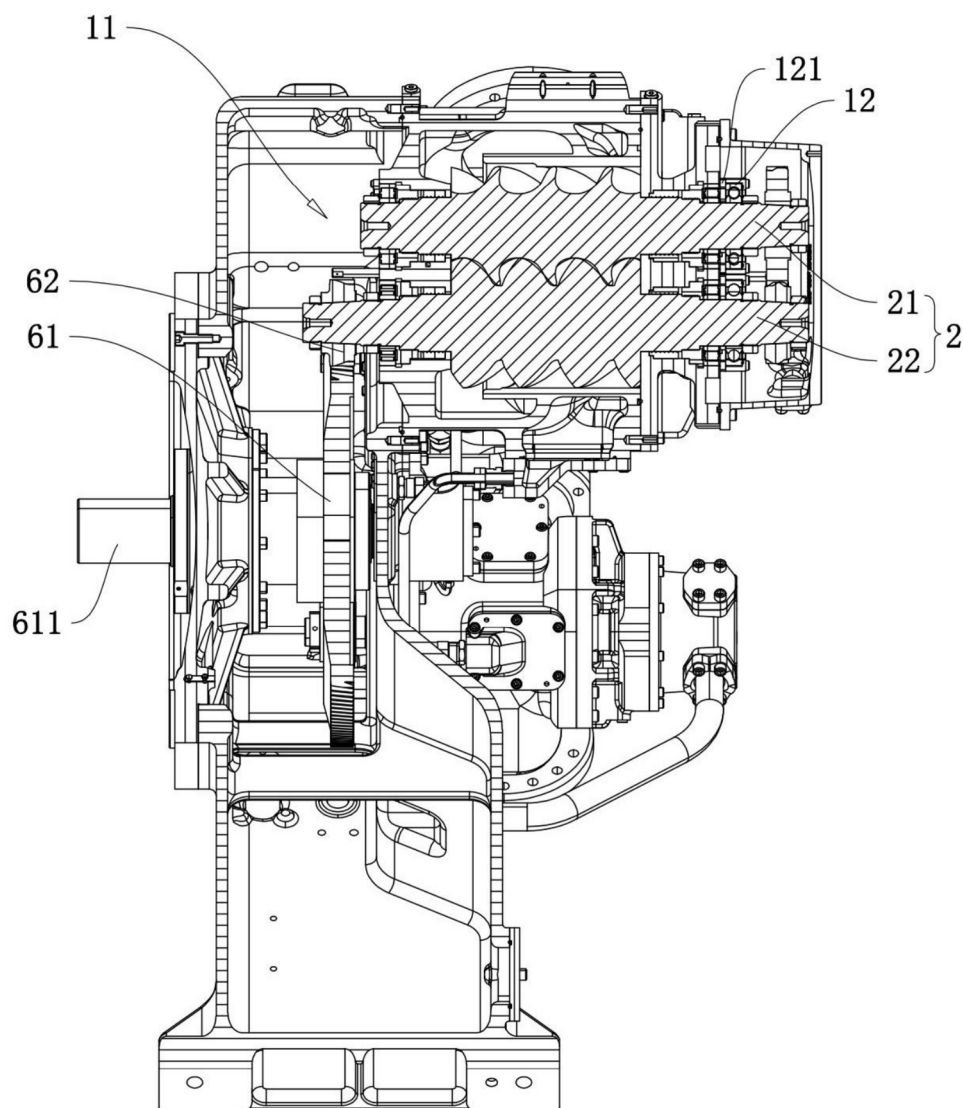


FIG. 4

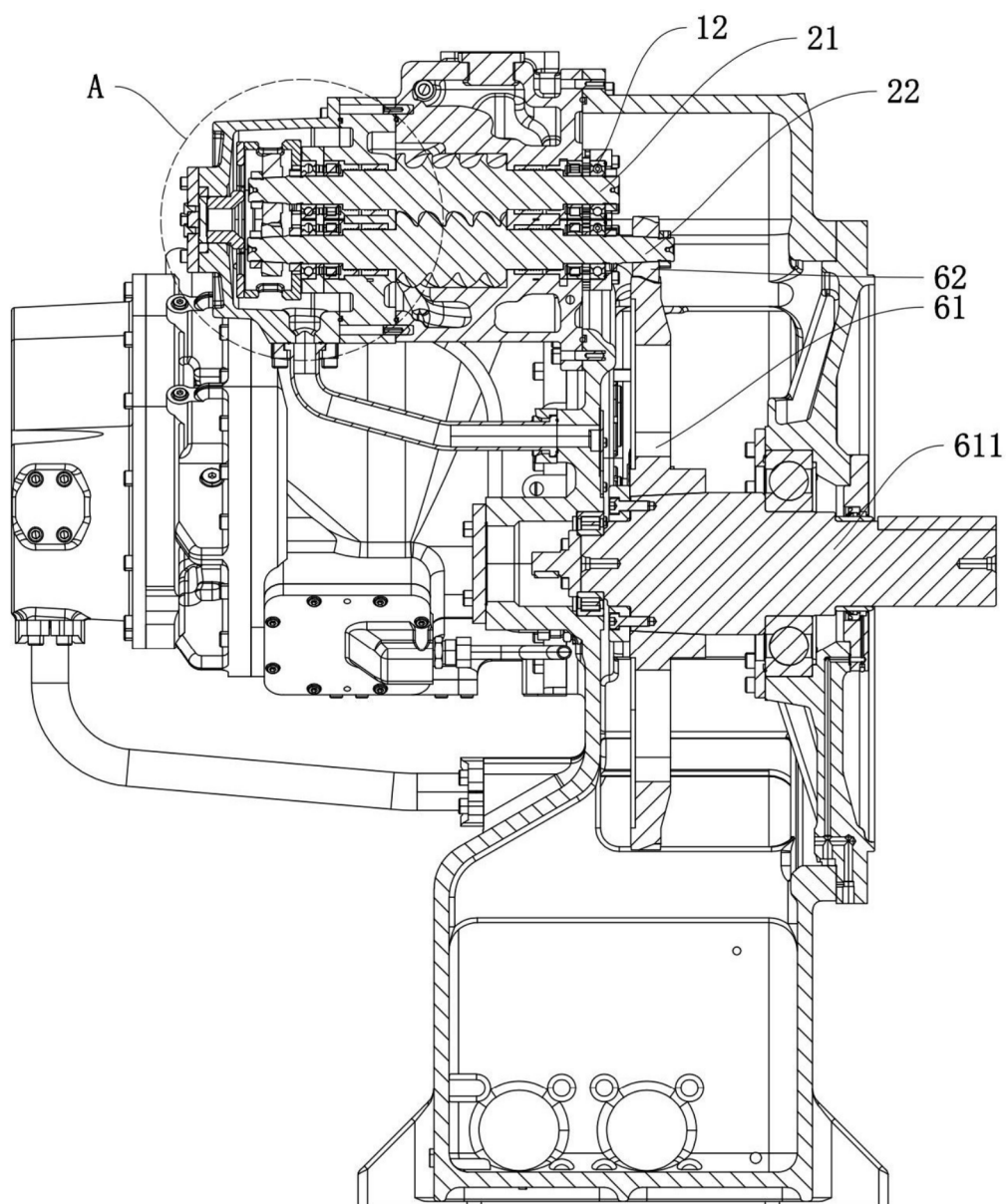
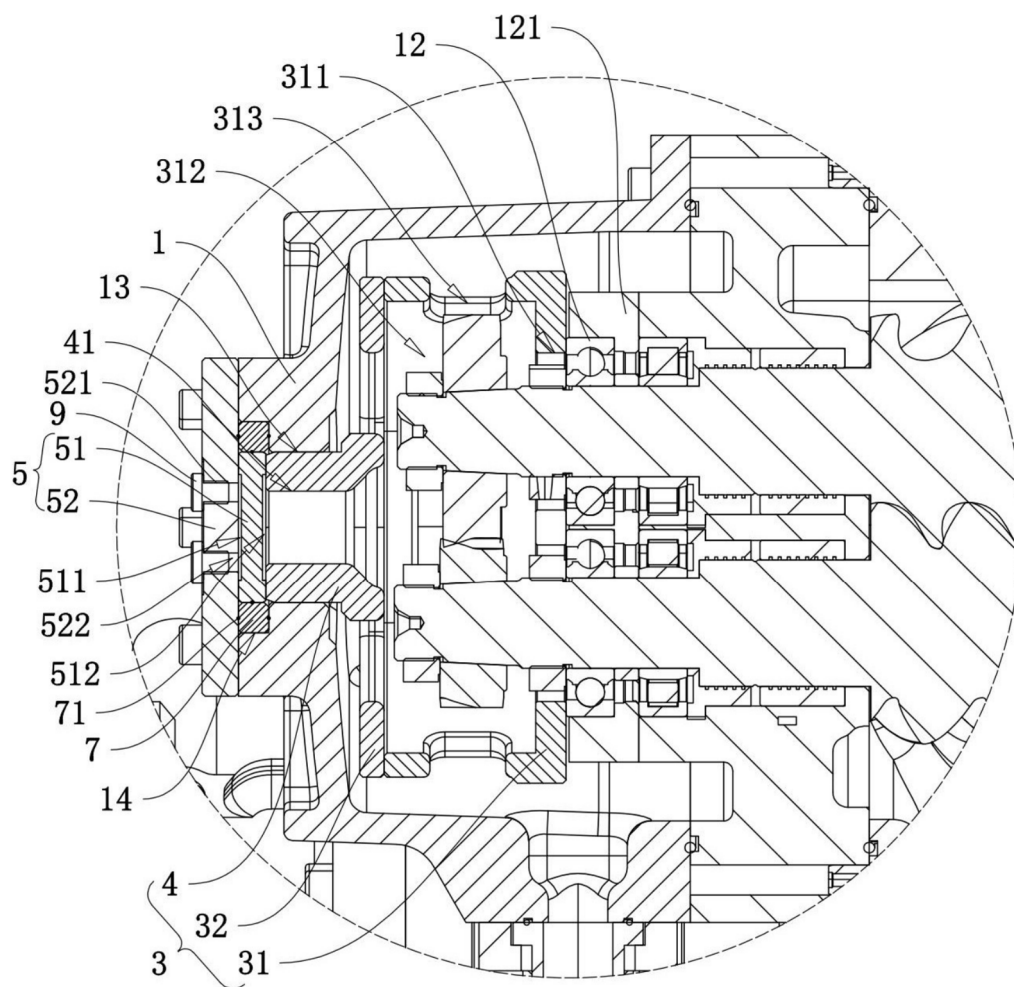


FIG. 5



A

FIG. 6

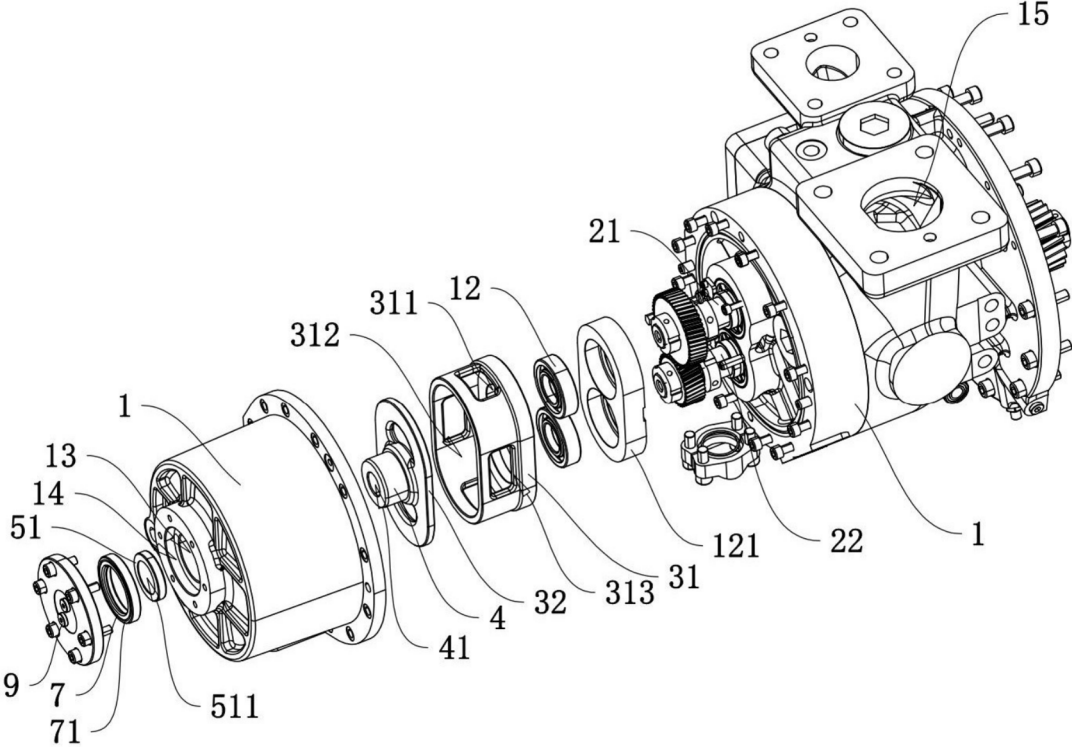


FIG. 7

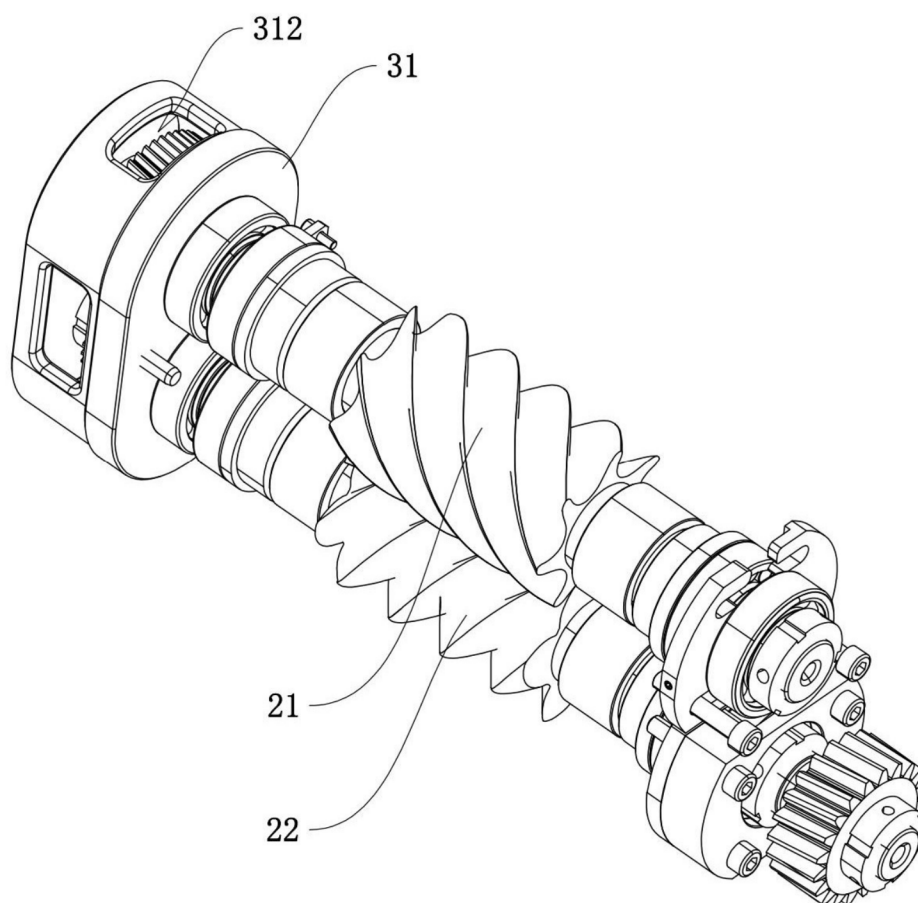


FIG. 8



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O : non-written disclosure			
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