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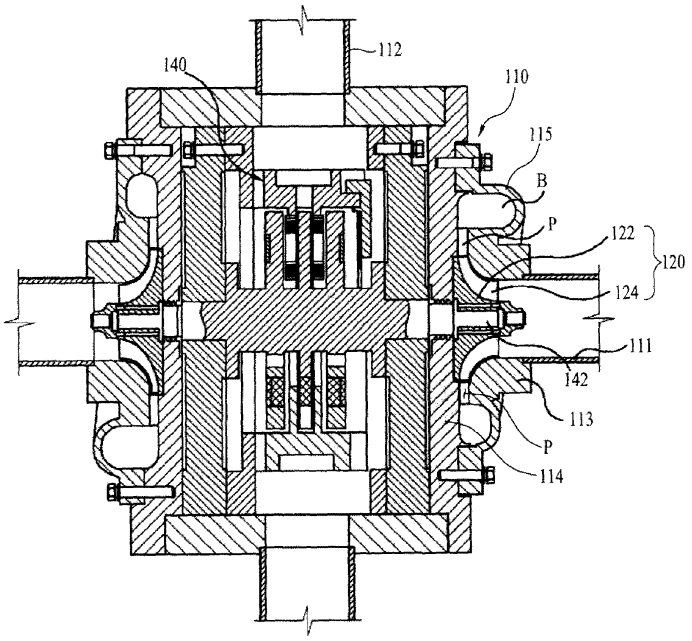
(54) Centrifugal compressor

(57) The present invention relates to a centrifugal compressor including a case (110), an impeller (120) for accelerating refrigerant introduced to an inside of the case, a variable diffuser (130) on a flow passage of the refrigerant for regulating opening of the flow passage, a rotating member mounted to move the variable diffuser up/down and to rotate the variable diffuser, and a drive motor (150) for providing rotating power to the rotating member. The variable diffuser is screw coupled to an inside of the case to regulate the opening of the flow passage as the variable diffuser moves up/down by rotation, thereby permitting precise regulation of opening of the flow passage.

FIG. 1



EP 2 626 573 A1

Description

[0001] The present invention relates to centrifugal compressors, and more particularly to a centrifugal compressor in which regulating accuracy of flow passage opening of a variable diffuser is enhanced.

[0002] An air conditioner is a machine for cooling/heating or cleaning air of a room. The air conditioner has a cycle in which refrigerant therein circulates in an order of compression, condensation, expansion, and evaporation to transfer heat.

[0003] A compressor in the air conditioner provided on a refrigerant flow passage serves to compress the refrigerant to a high temperature and a high pressure. In the compressor, there are rotary compressors, scroll compressors, and centrifugal compressors depending on a compression type.

[0004] The centrifugal compressor, a machine for compressing the refrigerant introduced thereto by centrifugal force of an impeller rotating at a high speed, has high compression efficiency. The centrifugal compressor is provided with the impeller for rotating fluid introduced thereto, and a variable diffuser for regulating opening of a fluid flow passage to compress the fluid.

[0005] The centrifugal compressor is also provided with a power transmission member connected between the variable diffuser and a motor which is a driving source of the variable diffuser for transmission of driving power from the motor to the variable diffuser. The power transmission member serves, not only a function of the transmission of the driving power from the motor, but also a function of converting a rotation motion of the motor to a linear motion or another direction rotation motion. As the power transmission member, a combination of plain gears, a cam, or a link is used.

[0006] However, since the power transmission member has a low rotation torque (N·m) to require a large movement in regulating flow passage opening of the variable diffuser by operation of the motor, the related art variable diffuser has difficulty in controlling accurate flow passage opening. And, in regulating the flow passage opening of the variable diffuser, calculation of a distance of movement of the power transmission member in relation to the rotation of the motor has been complicate.

[0007] Accordingly, the present invention is directed to a centrifugal compressor.

[0008] An object of the present invention is to provide a centrifugal compressor which can make precise control of flow passage opening regulation of a variable diffuser.

[0009] Additional advantages, objects, and features of the disclosure will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0010] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a centrifugal compressor includes a case, an impeller for accelerating refrigerant introduced to an inside of the case, a variable diffuser on a flow passage of the refrigerant for regulating opening of the flow passage, a rotating member mounted to move the variable diffuser up/down and to rotate the variable diffuser, and a drive motor for providing rotating power to the rotating member, wherein the variable diffuser is screw coupled to an inside of the case to regulate the opening of the flow passage as the variable diffuser moves up/down by rotation.

[0011] In this instance, the rotating member has a helix formed on a side thereof, and the drive motor has a gear engaged with the side of the rotating member.

[0012] And, the rotating member is a worm wheel and the gear is a worm.

[0013] And, the worm and the worm wheel have a reduction ratio (A ratio of rotation speeds between the worm and the worm wheel) of over 50:1 therebetween.

[0014] And, the variable diffuser has a side with a plurality of pins, and the rotating member has a plurality of inserting holes for inserting the plurality of pins therein, respectively.

[0015] And, the rotating member has a side with a plurality of pins, and the variable diffuser has a plurality of inserting holes for inserting the plurality of pins therein, respectively.

[0016] And, the pin has a length longer than a moving up/down distance of the variable diffuser.

[0017] And, the plurality of pins rotate in one body with the rotating member, and moves up/down within the inserting hole following moving up/down of the variable diffuser.

[0018] And, the rotation member has a rotation direction perpendicular to the rotation direction of the drive motor.

[0019] And, the variable diffuser has a shape of a ring which surrounds an outside circumference of the impeller.

[0020] And, the case includes a shroud having a refrigerant inlet formed therein, and a supporting member arranged spaced from the shroud to form a space for housing the impeller and forming a flow passage of compressed refrigerant on an outside circumference of the impeller, wherein the supporting member has a ring shaped inserting portion screw coupled to the variable diffuser.

[0021] And, the drive motor is a step motor.

[0022] In another aspect of the present invention, a centrifugal compressor includes a case, an impeller for accelerating refrigerant introduced to an inside of the case, a variable diffuser provided on a flow passage of the refrigerant to have a plurality of pins on one side thereof, a worm wheel positioned to face the one side of the variable diffuser to have a plurality of inserting holes for inserting the pins therein respectively, and a drive motor

having a worm engaged with the worm wheel, wherein the variable diffuser is screw coupled to an inside of the case to regulate opening of the flow passage as the variable diffuser moves up/down by rotation.

[0023] In this instance, the plurality of pins rotate in one body with the worm wheel, and moves up/down within the inserting hole following moving up/down of the variable diffuser.

[0024] And, the pin has a length longer than a moving up/down distance of the variable diffuser.

[0025] And, the worm and the worm wheel have a reduction ratio (A ratio of rotation speed between the worm and the worm wheel) of over 50:1 therebetween.

[0026] And, the variable diffuser has a shape of a ring which surrounds an outside circumference of the impeller.

[0027] And, the case includes a shroud having a refrigerant inlet formed therein, and a supporting member arranged spaced from the shroud to form a space for housing the impeller and forming a flow passage of compressed refrigerant on an outside circumference of the impeller, wherein the supporting member has a ring shaped inserting portion screw coupled to the variable diffuser.

[0028] As has been described, the centrifugal compressor of the present invention has the following advantages.

[0029] The up/down movement of the variable diffuser screw coupled to the case while rotating in one body with the worm wheel by operation of the drive motor having the worm provided thereto permits regulation of opening of the flow passage of the refrigerant.

[0030] And, the use of the worm and the worm wheel having a large reduction ratio as a power transmission member permits precise regulation of opening of the flow passage according to operation of the drive motor.

[0031] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0032] The accompanying drawings, which are included to provide a further understanding of the disclosure and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the disclosure and together with the description serve to explain the principle of the disclosure. In the drawings:

[0033] FIG. 1 illustrates a section of a centrifugal compressor in accordance with a preferred embodiment of the present invention.

[0034] FIG. 2 illustrates a partial enlarged view of a centrifugal compressor having a variable diffuser in accordance with a preferred embodiment of the present invention.

[0035] FIG. 3 illustrates a perspective view showing an impeller, a variable diffuser, and a supporting member in accordance with a preferred embodiment of the present invention.

[0036] FIG. 4 illustrates a perspective view showing an operation state of a variable diffuser in relation to operation of a drive motor in accordance with a preferred embodiment of the present invention.

[0037] FIG. 5 illustrates a partial enlarged view of a compressor showing a state in which a variable diffuser closes a flow passage in accordance with a preferred embodiment of the present invention.

[0038] A centrifugal compressor in accordance with a preferred embodiment of the present invention will be described with reference to the attached drawings, in detail. The attached drawings illustrate exemplary modes of the present invention, provided for describing the present invention in more detail, but not for limiting technical scopes of the present invention.

[0039] And, regardless of drawing numbers, identical or corresponding elements will be given the same reference numbers, and repetitive description of which will be omitted. For convenience of description, a size or a shape of an element may be exaggerated or reduced.

[0040] FIG. 1 illustrates a section of a centrifugal compressor in accordance with a preferred embodiment of the present invention, and FIG. 2 illustrates a partial enlarged view of a variable diffuser and an impeller in accordance with a preferred embodiment of the present invention.

[0041] There is a case 110 which serves to form an exterior of the centrifugal compressor and to support components therein. The case 110 has a refrigerant inlet 111 for introduction of refrigerant thereto and a refrigerant outlet 112 for discharging compressed refrigerant therefrom.

[0042] The case 110 includes a shroud 113 which is an extension from the refrigerant inlet 111 for guiding the refrigerant introduced thus to an impeller 120. The shroud 113 has a streamlined inside for reducing resistance to the refrigerant being introduced thereto thus.

[0043] And, the case 110 includes a supporting member 114 spaced a predetermined distance from the shroud 113. The supporting member 114 has the impeller 120 and the variable diffuser 130 fixedly secured thereto. The supporting member 114 is positioned spaced from the shroud 113 to form a space for housing the impeller 120 between the shroud 113 and the supporting member 114. In detail, a space for housing the impeller 120 is formed at a center portion between the shroud 113 and the supporting member 114, and a flow passage P is formed on an outside circumference of the center portion for flow of the refrigerant accelerated by the impeller 120.

[0044] Along with this, the case 110 includes a volute member 115 which forms a volute B space between the case 110 and the supporting member 114. The volute B formed between the volute member 115 and the supporting member 114 is a space the refrigerant compressed thus passes. The refrigerant passed through the volute

B is discharged to an outside of the centrifugal compressor through the refrigerant outlet 112.

[0045] Next, the impeller 120 rotates to accelerate the refrigerant introduced thereto to a high speed. The impeller 120 is arranged between the shroud 113 and the supporting member 114 connected to a driving shaft 142 of a compression motor 140 positioned in the case 110. The impeller 120 includes a hub 122 coupled to the driving shaft 142, and an impeller vane 122 provided to a surface of the hub 122.

[0046] Next, the variable diffuser 130 regulates opening of the flow passage P for increasing a pressure of the refrigerant. That is, the variable diffuser 130 reduces the opening of the flow passage P to increase flow resistance of the refrigerant for converting kinetic energy of the refrigerant accelerated by the impeller 120 thus to pressure energy. The variable diffuser 130 is provided on the refrigerant flow passage P, and as an embodiment, may be arranged at a region which surrounds an outside circumference of the impeller 120 in a space between the shroud 113 and the supporting member 114.

[0047] The variable diffuser 130 moves up/down in the case 110 to regulate the opening of the flow passage P. That is, as the variable diffuser 130 moves up on the refrigerant flow passage P, the opening of the flow passage P is reduced, or as the variable diffuser 130 moves down on the refrigerant flow passage P, the opening of the flow passage P is increased.

[0048] In this instance, the variable diffuser 130 may be screw coupled to the case 110. In detail, the supporting member 114 may have an inserting portion formed therein for screw coupling to the variable diffuser 130, for enabling to insert the variable diffuser 130 or draw out the variable diffuser 130 in/from the insert portion. As described later, as the variable diffuser 130 is screw coupled to the case 110, the variable diffuser 130 can move up/down by rotation of the variable diffuser 130.

[0049] Next, there is a rotating member mounted to make the variable diffuser 130 to move up/down, and has a function of rotating the variable diffuser 130. The rotating member, being a power transmission member, not only transmits rotating power from the driving motor 150 to the variable diffuser 130, but also changes a direction of rotating movement of the drive motor 150.

[0050] As an embodiment, the variable diffuser 130 has one side with a plurality of pins, and the rotating member may have a plurality of inserting holes for inserting the plurality of pins therein, respectively. That is, since the pins of the variable diffuser 130 are respectively inserted in the inserting holes in the rotating member, transmitting the rotating power from the rotating member to the variable diffuser 130 through the pins, the rotating member and the variable diffuser 130 rotate in one unit. In this instance, since the variable diffuser 130 is screw coupled to the case 110, the variable diffuser 130 moves up or down by the rotation of the variable diffuser 130.

[0051] In the meantime, since the variable diffuser 130 can move up/down, without having the pins secured to, but having the pins inserted in, the inserting holes in the rotating member, the variable diffuser 130 can be mounted to the rotating member to be movable up/down by the rotation of the variable diffuser 130. And, by forming the pin to have a length longer than a distance of the up/down movement of the variable diffuser 130, the rotating power can be transmitted from the rotating member to the variable diffuser 130 within a move up/down range while preventing the pin from breaking away from the inserting hole.

[0052] However, the present invention in not limited to this, but the rotating member may have one side with a plurality of pins and the variable diffuser 130 may have a plurality of inserting holes for inserting the plurality of the pins therein, respectively. That is, the pins may transmit the rotating power from the rotating member to the variable diffuser 130 while the pins are fixedly secured to the rotating member, and the variable diffuser 130 may move up/down while rotating.

[0053] And, the drive motor 150 provides the driving power to the rotating member. The drive motor 150 is connected to the rotating member to serve as a driving source for rotating the rotating member.

[0054] As an embodiment, the rotating member may have a side with a helix formed thereon, and the drive motor 150 may have a gear engaged with the side of the rotating member. According to this, at the same time with the rotation of the gear following operation of the drive motor 150, the rotating member engaged with the gear may rotate.

[0055] Preferably, the rotating member may be a worm wheel, and the gear provided to the drive motor 150 may be a worm. The present invention may use the worm and the worm wheel for precise control of a distance of the up/down movement of the variable diffuser 130 by the rotation of the drive motor 150, and has an effect of production cost saving as an expensive motor can be dispensed with, which will be described in detail, later.

[0056] And, the rotating member may have a rotation direction perpendicular to a rotation direction of the drive motor 150. Since the rotation direction of the rotating member is perpendicular to the rotation direction of the drive motor 150, enabling to arrange the drive motor 150 on a side of the rotating member, a space can be used effectively, thereby permitting to fabricate the compressor smaller.

[0057] And, the drive motor 150 may be a step motor. The step motor enables to control a number of revolutions per unit time period, a rotation angle, and a rotation direction, enabling to control the operation of the rotating member according to a preset algorithm.

[0058] The variable diffuser 130 in accordance with a preferred embodiment of the present invention will be described with reference to the attached drawings, in detail.

[0059] FIG. 3 illustrates a perspective view showing a coupled structure of a variable diffuser and a supporting member in accordance with a preferred embodiment of

the present invention, and FIG. 4 illustrates a perspective view showing an operation state of a variable diffuser by using a worm gear in accordance with a preferred embodiment of the present invention.

[0060] Referring to FIGS. 3 and 4, the variable diffuser 130 has a ring shape surrounding an outside circumference of the impeller 120 within the case 110. In detail, the variable diffuser 130 may be inserted in, or drawn out of, an inserting portion 114a in the supporting member 114 of the case 110. That is, the variable diffuser 130 may be inserted in the inserting portion 114a to open the flow passage P fully, or the variable diffuser 130 may be moved up to be drawn out of the inserting portion 114a to reduce the opening of the flow passage P.

[0061] In this instance, the variable diffuser 130 is screw coupled to the supporting member 114. The variable diffuser 130 has one side having threads formed thereon, and the inserting portion 114a of the supporting member 114 also has threads formed on an inside thereof in conformity therewith. According to this, the variable diffuser 130 moves up or down while rotating in a forward direction or a reverse direction.

[0062] And, the variable diffuser 130 has one side with a plurality of pins 132. As described later, the pin 132 serves to transmit the rotating power from the worm wheel 160 to the variable diffuser 130. Though it is preferable that a number of the pins 132 are plural for effective transmission of the rotating power of the worm wheel 160, but the number of the pins 132 is not limited to this, and one or more than one pin 132 may be provided to the one side of the variable diffuser 130. The plurality of pins 132 may be provided to the one side of the variable diffuser 130 in a circumferential direction thereof.

[0063] In the meantime, a worm 152 is provided to the drive motor 150 of the variable diffuser 130. The worm 152 is engaged with the worm wheel 160 to rotate the worm wheel 160 as the drive motor 150 is operated. The worm wheel 160 is positioned to face the one side of the variable diffuser 130, and provided with a plurality of inserting holes 162 for inserting the pins 132 of the variable diffuser 130 therein, respectively.

[0064] That is, since the pins 132 of the variable diffuser 130 are in the inserting holes 162 of the worm wheel 160, the drive motor 150 rotates the variable diffuser 130 together with the worm wheel 160. Therefore, as the variable diffuser 130 screw coupled to the supporting member 114 is moved up/down while rotating by the drive motor 150, opening of the flow passage P can be regulated.

[0065] The present invention can make precise regulation of the opening of the flow passage according to the rotation of the drive motor 150 by using the worm 152 and the worm wheel 160 as a power transmission member from the driving motor 150, in which the worm wheel 160 is made to rotate in one body with the variable diffuser 130 and the variable diffuser 130 is made to move up/down to regulate the opening of the flow passage P.

[0066] In detail, since the worm 152 and the worm wheel 160 have a large reduction ratio (A ratio of rotation speeds of the worm and the worm wheel), a number of rotation of the worm wheel 160 is smaller than a number of rotation of the drive motor 150. Eventually, a rotation angle of the worm wheel 160 can be regulated within a small range precisely by rotating the drive motor 150. Along with this, since variation of a number of rotations of the worm wheel 160 is not large in comparison to a number of rotations of the drive motor 160, not to require precise control of the drive motor 150, a low priced motor or a small sized motor may be used.

[0067] And, since the variable diffuser 130 screw coupled thus moves up/down while the worm wheel 160 and the variable diffuser 130 rotate in one body, a mechanism of transmission of the rotating power from the drive motor 150 is simple. That is, if it is known that a number of rotation of the worm wheel according to a number of rotation of the drive motor 150, and a distance of the up/down movement of the variable diffuser 130 according to a number of rotation of the worm wheel 160, the opening of the flow passage P of the variable diffuser 130 can be regulated by controlling the drive motor 150.

[0068] In this instance, a reduction ratio of the worm 152 to the worm wheel 160 may be over 50:1. If the reduction ratio of the worm 152 to the worm wheel 160 is over 50:1, an error of moved distance of the variable diffuser 130 caused by backlash of the worm 152 and the worm wheel 160 is within 1% of a total distance of the up/down movement, which is negligible.

[0069] In the meantime, the pins 132 of the variable diffuser 130 move up/down within the inserting holes 162 in the worm wheel 160 by the up/down movement of the variable diffuser 130. Therefore, the pin 132 of the variable diffuser 130 is designed to have a diameter with a cross sectional area smaller than a cross sectional area of the inserting hole 162 of the worm wheel 160 so that the pin 132 can move up/down in the inserting hole 162.

[0070] And, referring to FIG. 5, the pin 132 has a length L longer than a distance H of the up/down movement of the variable diffuser 130. In this instance, the distance H of the up/down movement means a distance forming a largest space between the variable diffuser 130 and the supporting member 114. Therefore, even in a state the variable diffuser 130 is spaced a largest distance from the supporting member 114 as the variable diffuser 130 moves up, since the pin 132 is kept inserted in the inserting hole 162 in the worm wheel 160, the variable diffuser 130 can rotate in one body with the worm wheel 160.

[0071] As embodied and broadly described herein, a centrifugal compressor may include a case, an impeller for accelerating refrigerant introduced to an inside of the case, a variable diffuser on a flow passage of the refrigerant for regulating opening of the flow passage, a rotating member to rotate the variable diffuser and a drive motor for providing rotating power to the rotating member, wherein the variable diffuser is mounted movably to the rotating member in up/down direction and the variable diffuser is screw coupled to an inside of the case to reg-

ulate the opening of the flow passage as the variable diffuser moves up/down by rotation.

[0072] The rotating member may have a helix formed on a side thereof, and the drive motor may have a gear engaged with the side of the rotating member.

[0073] The rotating member may be a worm wheel and the gear may be a worm.

[0074] The variable diffuser may have a side with a plurality of pins, and the rotating member may have a plurality of inserting holes for inserting the plurality of pins therein, respectively.

[0075] The rotating member may have a side with a plurality of pins, and the variable diffuser may have a plurality of inserting holes for inserting the plurality of pins therein, respectively.

[0076] The plurality of pins may be configured to rotate in one body with the rotating member, and be configured to move up/down within the inserting hole following moving up/down of the variable diffuser.

[0077] The rotation member may have a rotation direction perpendicular to the rotation direction of the drive motor.

[0078] The drive motor may be a step motor.

[0079] As embodied and broadly described herein, a centrifugal compressor may include a case, an impeller for accelerating refrigerant introduced to an inside of the case, a variable diffuser provided on a flow passage of the refrigerant to have a plurality of pins on one side thereof, a worm wheel positioned to face the one side of the variable diffuser, the worm wheel has a plurality of inserting holes for inserting the pins therein, respectively and a drive motor having a worm engaged with the worm wheel. And, the variable diffuser may be screw coupled to an inside of the case to regulate opening of the flow passage as the variable diffuser moves up/down by rotation.

[0080] The plurality of pins may be configured to rotate in one body with the worm wheel, and be configured to move up/down within the inserting hole following moving up/down of the variable diffuser.

[0081] The plurality of pins may have a length longer than a moving up/down distance of the variable diffuser.

[0082] Between the worm and the worm wheel may be a reduction ratio of over 50:1.

[0083] The variable diffuser may have a shape of a ring which surrounds an outside circumference of the impeller.

[0084] The case may include a shroud having a refrigerant inlet formed therein, and a supporting member arranged spaced from the shroud to form a space for housing the impeller and forming a flow passage of compressed refrigerant on an outside circumference of the impeller. And, the supporting member may have a ring shaped inserting portion screw coupled to the variable diffuser.

[0085] As embodied and broadly described herein, a method for operating a centrifugal compressor according to any of the preceding centrifugal compressors is available.

[0086] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

Claims

1. A centrifugal compressor comprising:

a case;
an impeller for accelerating refrigerant introduced to an inside of the case;
a variable diffuser on a flow passage of the refrigerant for regulating opening of the flow passage;
a rotating member to rotate the variable diffuser; and
a drive motor for providing rotating power to the rotating member,
wherein the variable diffuser is mounted movably to the rotating member in up/down direction and the variable diffuser is screw coupled to an inside of the case to regulate the opening of the flow passage as the variable diffuser moves up/down by rotation.

2. The centrifugal compressor as claimed in claim 1, wherein the rotating member has a helix formed on a side thereof, and
the drive motor has a gear engaged with the side of the rotating member.

3. The centrifugal compressor as claimed in claim 2, wherein the rotating member is a worm wheel and the gear is a worm.

4. The centrifugal compressor as claimed in any of claims 1 to 3, wherein the variable diffuser has a side with a plurality of pins, and
the rotating member has a plurality of inserting holes for inserting the plurality of pins therein, respectively.

5. The centrifugal compressor as claimed in any of claims 1 to 4, wherein the rotating member has a side with a plurality of pins, and
the variable diffuser has a plurality of inserting holes for inserting the plurality of pins therein, respectively.

6. The centrifugal compressor as claimed in claim 5, wherein the plurality of pins are configured to rotate in one body with the rotating member, and are configured to move up/down within the inserting hole following moving up/down of the variable diffuser.

7. The centrifugal compressor as claimed in any of claims 1 to 6, wherein the rotation member has a rotation direction perpendicular to the rotation direction of the drive motor.

8. The centrifugal compressor as claimed in any of claims 1 to 7, wherein the drive motor is a step motor.

9. A centrifugal compressor comprising:

a case;
an impeller for accelerating refrigerant introduced to an inside of the case;
a variable diffuser provided on a flow passage of the refrigerant to have a plurality of pins on one side thereof;
a worm wheel positioned to face the one side of the variable diffuser, the worm wheel 1 has a plurality of inserting holes for inserting the pins therein, respectively; and
a drive motor having a worm engaged with the worm wheel,
wherein the variable diffuser is screw coupled to an inside of the case to regulate opening of the flow passage as the variable diffuser moves up/down by rotation.

10. The centrifugal compressor as claimed in claim 13, wherein the plurality of pins are configured to rotate in one body with the worm wheel, and are configured to move up/down within the inserting hole following moving up/down of the variable diffuser.

11. The centrifugal compressor as claimed in any of claims 4 to 10, wherein the plurality of pins have a length longer than a moving up/down distance of the variable diffuser.

12. The centrifugal compressor as claimed in any of claims 3 to 11, wherein between the worm and the worm wheel is a reduction ratio of over 50:1.

13. The centrifugal compressor as claimed in any of claims 1 to 12, wherein the variable diffuser has a shape of a ring which surrounds an outside circumference of the impeller.

14. The centrifugal compressor as claimed in claim 13, wherein the case includes;
a shroud having a refrigerant inlet formed therein, and a supporting member arranged spaced from the shroud to form a space for housing the impeller and forming a flow passage of compressed refrigerant on an outside circumference of the impeller,
wherein the supporting member has a ring shaped inserting portion screw coupled to the variable diffuser.

15. A method for operating a centrifugal compressor according to any of the preceding claims.

FIG. 1

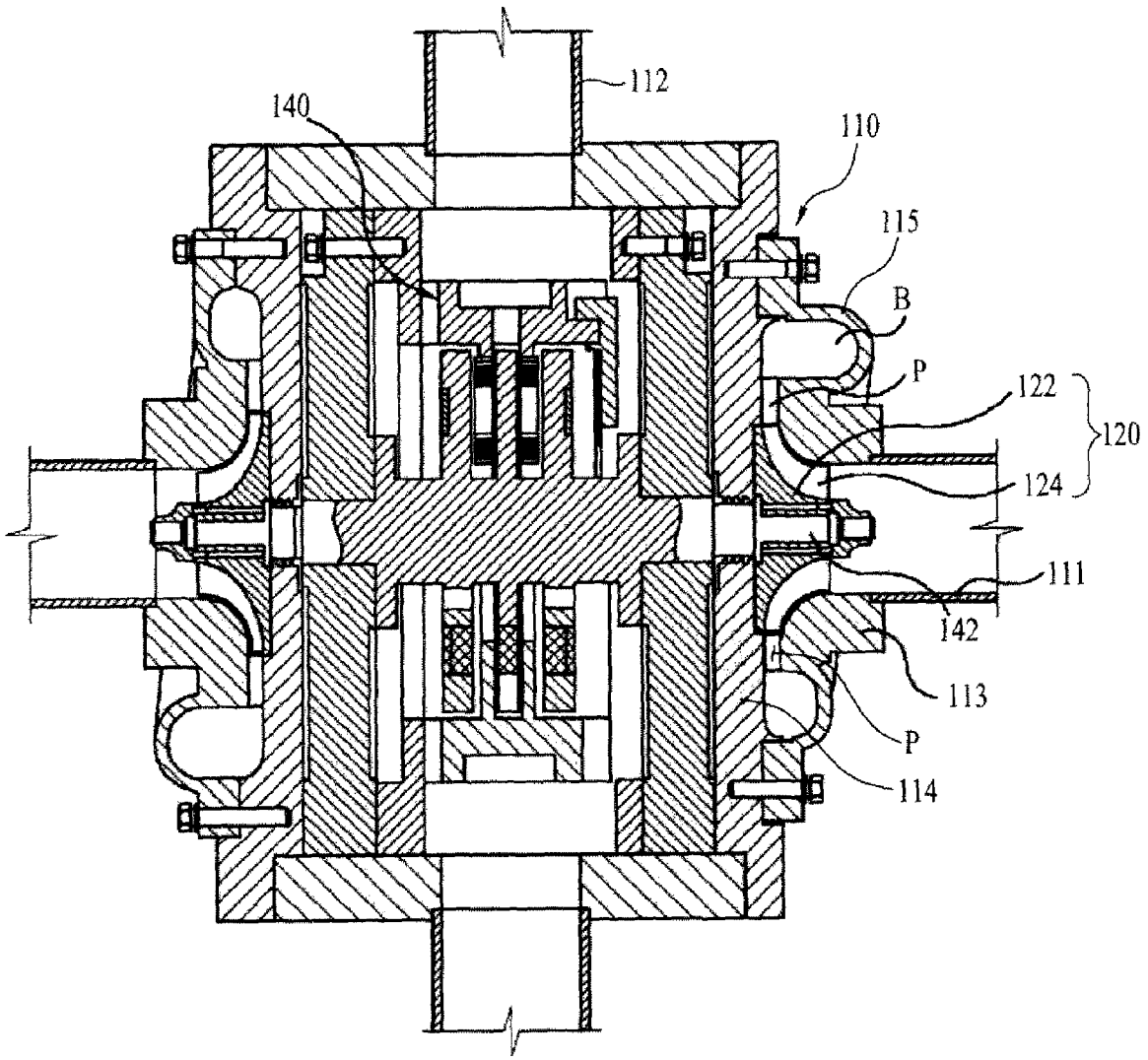


FIG. 2

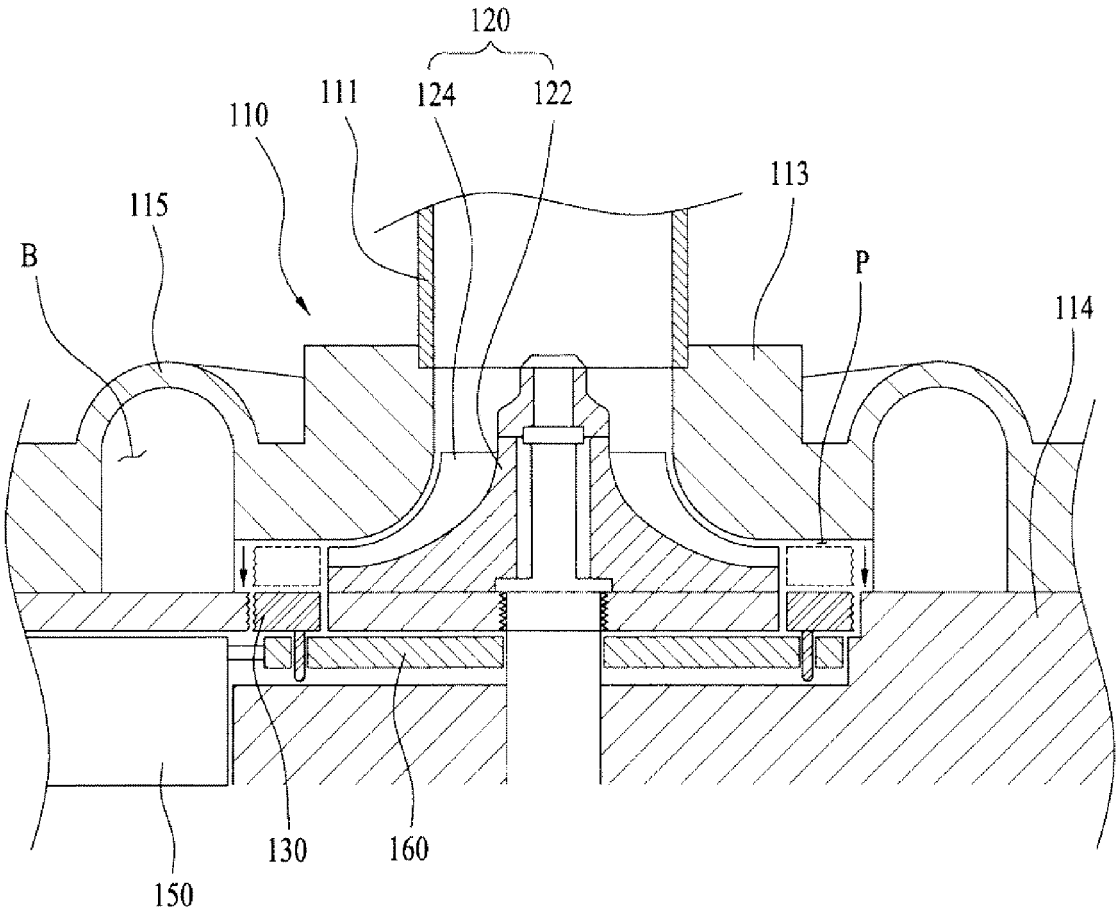


FIG. 3

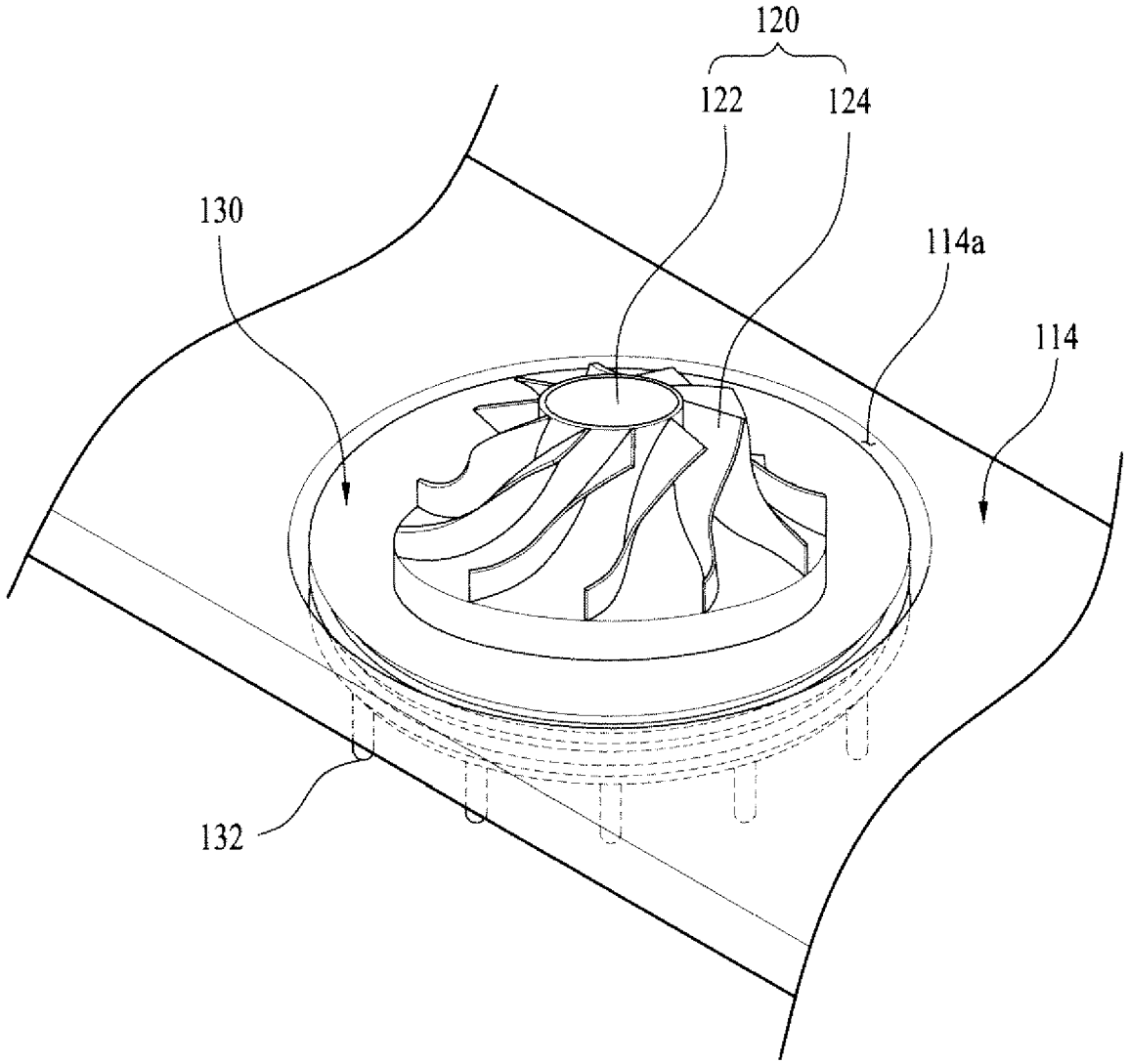


FIG. 4

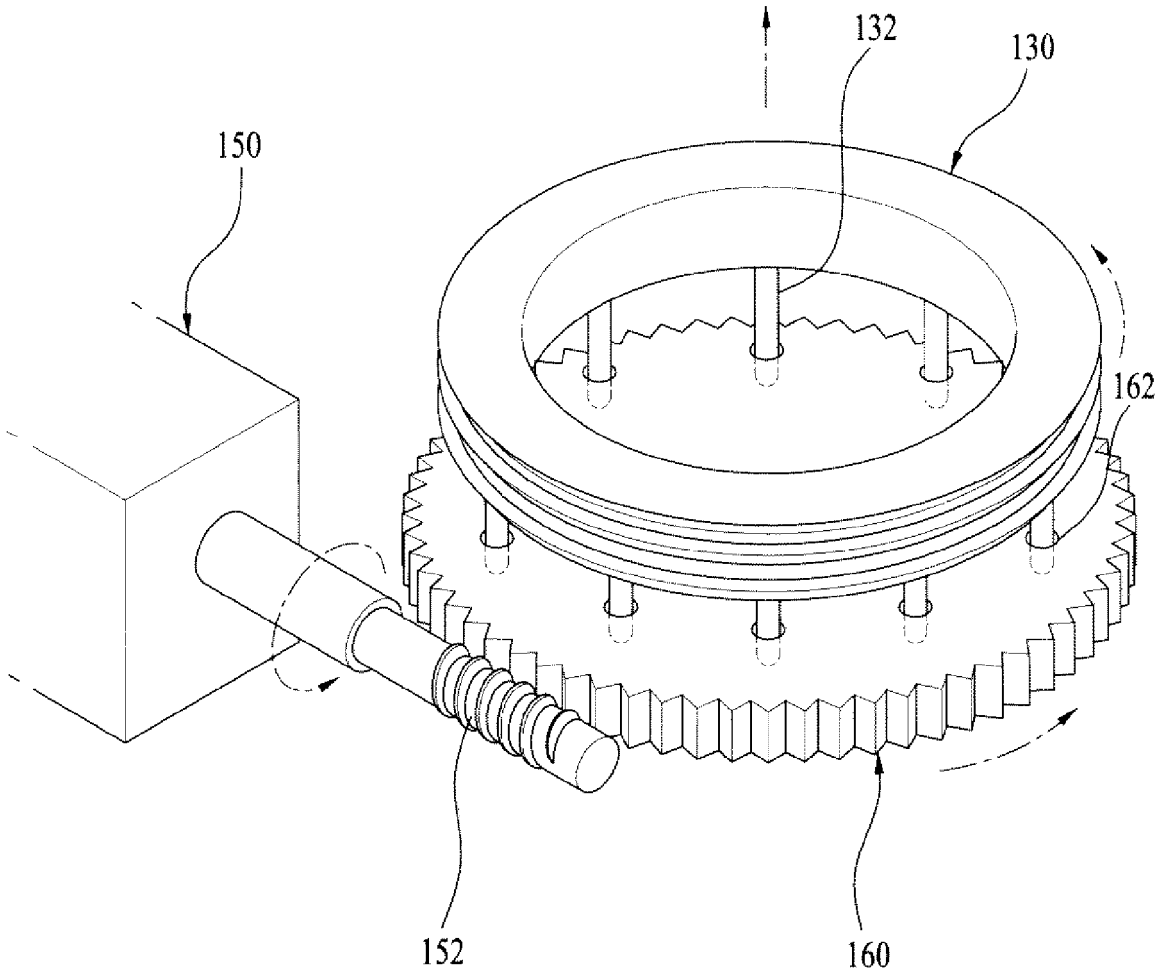
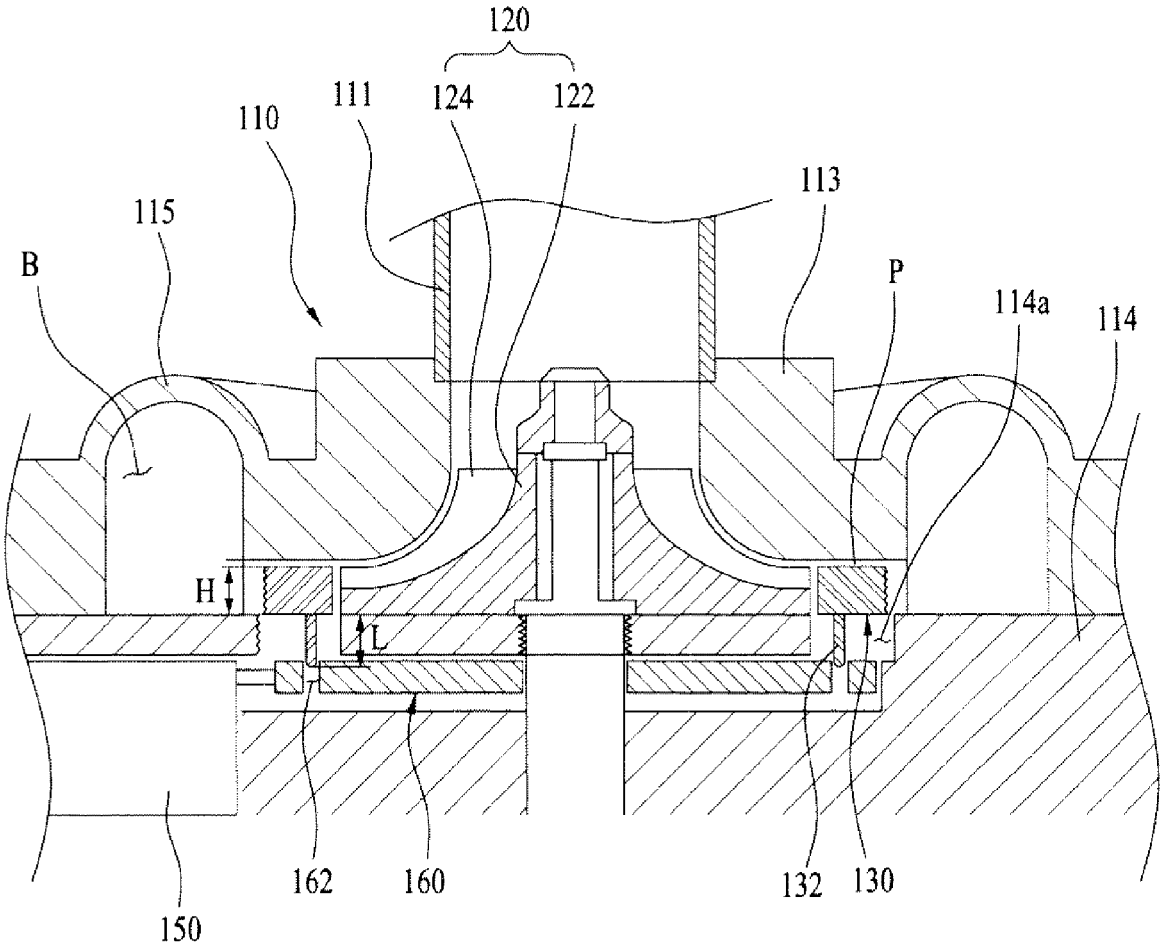


FIG. 5



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EUROPEAN SEARCH REPORT

Application Number
EP 12 18 5119

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 2005/017321 A1 (HONEYWELL INT INC [US]; MCARDLE NATHAN JOHN [GB]; ASPEY PETER [GB]; CH) 24 February 2005 (2005-02-24) * page 1, lines 9-11; figure 19 *	1-8,15	INV. F04D29/46
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A	US 3 588 270 A (BOELCS ALBIN) 28 June 1971 (1971-06-28) * abstract; figure 2 *	1,9,15	
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