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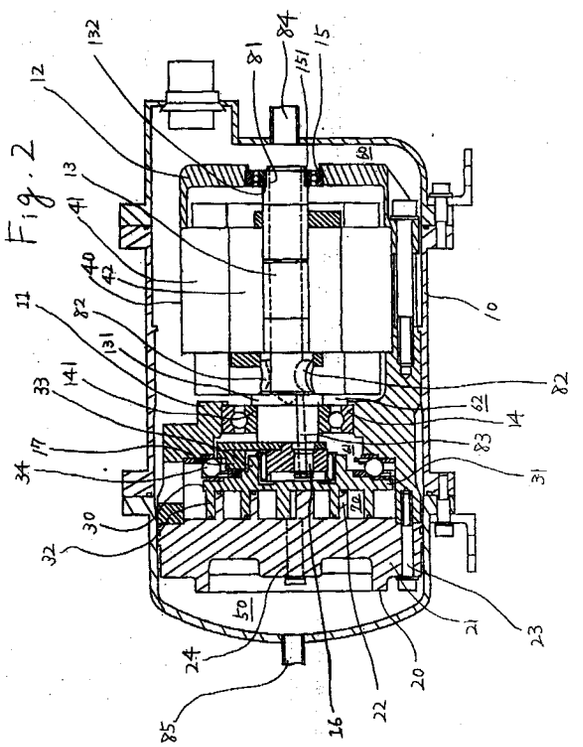
(54) Motor driven fluid compressor.

(57) This invention discloses a preventing mechanism of the axial movement of a drive shaft in a hermetically sealed scroll type compressor so as to protect the members disposed within a hermetically healed housing from the abrasion and breakage by the vibration. The compressor includes a drive mechanism operatively connected to an orbiting scroll which orbits within a stationary scroll. The drive mechanism includes a drive shaft of which the both ends penetrate the center of a pair of inner blocks and are rotatably supported by a pair bearings, respectively. The pair of bearings are fixedly supported by the pair of inner blocks, respectively. Each of the bearings includes an inner race, an outer race and a plurality of rolling elements rollingly disposed between the inner and outer races. The drive shaft engages with the inner race of the bearings so as to prevent the axial movement thereof. Accordingly, the collision between the drive shaft and the internal component parts of the compressor is effectively prevented so that the internal component parts of the compressor are protested from the abrasion or breakage due to the offensive vibration.



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BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to a fluid compressor, and more particularly, to a motor driven fluid compressor having the compression and drive mechanisms within a hermetically sealed container.

Description of the Prior Art

Motor driven fluid compressors having the compression and drive mechanisms within a hermetically sealed housing are known in the art. For example, Japanese Patent Application Publication No. 1-110891 discloses a compressor including a hermetically sealed housing which contains a compression mechanism, such as a scroll type fluid compression mechanism and a drive mechanism therein as shown In FIG. 1.

With reference to FIG.1, the compressor includes a hermetically sealed casing 1, drive shaft 2, fixed and orbiting scrolls 3 and 4. The drive shaft 2 axially penetrates the center of inner block 5 and is rotatably at the center of inner block 5 by hearing 6. The forward end of drive shaft 2 forms a balance weight 7. A hole 8 is axially formed on the balance weight 7. An annular projection 9 is formed on the rearward end surface of a circular end plate 10 of orbiting scroll 4 and is inserted within hole 8. The bearing 11 is disposed along the circumference of the inner surface of hole 8 and support annular projection 9 within hole 8. As the rearward end of balance weight 7 is spaced from bearing 6. The space 12 is formed between the rearward end surface of balance weight 7 and the forward end surface of bearings 6. And as the rearward end surface of annular projection 9 is spaced from the bottom end surface of hole 8. The space 13 is formed between the rearward end surface of annular projection 9 and the bottom end surface of hole 8.

According to the above construction of the compressor, during operation of the compressor, pressure of the refrigerant gas in the fluid pockets 14 which are defined by fixed and orbiting scrolls 3 and 4 periodically fluctuates so that orbiting scroll 4 periodically moves forwardly and rearwardly. Furthermore, the periodic vibration propagating from the automobile engine compartment also causes a periodic axial movement of orbiting scroll 4.

Therefore, the annular projection 9 periodically moves forwardly and rearwardly within space 13, and the balance weight 7 periodically moves forwardly and rearwardly within spaces 12 and 13. This periodic axial movement of balance weight 7 causes balance weight 7 to repeat the collision with bearings 6. Therefore, the friction between balance weight 7 and bearings 6 occurs, and balance weight 7 and bearings 6 abrades or breaks. As well as, the friction between the rearward end surface of annular projection 9 and the bottom surface of hole 8 occurs, as a result, balance weight 7 and annular projection 9 abrades or breaks.

SUMMARY OF THE INVENTION

It is an object of this invention to provide an effective and simplified preventing mechanism of a drive shaft in a hermetically sealed scroll type compressor in which the members disposed within the hermetically sealed housing is protected from the abrasion and the breakage by the vibration.

A compressor according to this invention includes a fixed and a orbiting scrolls disposed within a hermetically housing. The fixed scroll includes an end plate from which a first wrap or spiral element extends into the interior of the housing. The end plate of fixed scroll divides the housing into a discharge chamber and a suction chamber. The first spiral element is located in suction chamber. The orbiting scroll includes an end plate from which a second wrap or spiral element extends. The first and second spiral elements interfit angular and radial offset to form a plurality of line contacts which define at least one pair of sealed off fluid pockets.

A drive mechanism includes a motor supported in the housing. The drive mechanism is operatively connected to orbiting scroll to effect orbital motion thereof. A rotation device prevents the rotation of orbital scroll during orbital motion so that the volume of the fluid pockets changes to compress the fluid in pockets inwardly from the outermost pocket towards the central pockets. The compressed gas flows out of the central pocket through a channel in the end plate of the fixed scroll and into a discharge chamber.

The drive mechanism includes a drive shaft of which the both ends penetrates the center of an inner block and are supported at the center of inner block by bearings. The drive shaft radially forms the projections being in contact with the forward and the rearward ends of the bearings.

In this construction, as the axial movement of drive shaft is prevented by projections of drive shaft, the drive shaft doesn't axially move by the vibration within compressor. Therefore, as the projections of drive shaft prevent the collision between drive shaft and other members disposed within compressor, these members don't abrade or break.

In a second embodiment, the drive shaft radially forms the projection being in contact with the rearward end of bearing which supports the forward end of the drive shaft in the inner block.And the ring made of metal is set in the circumference of

drive shaft so as to be in contact ring with the forward end of bearing which supports the forward end of drive shaft in inner block. In this construction, the projection prevents drive shaft moving forward, the ring prevents drive shaft moving rearward.

In a third embodiment, the drive shaft radially forms projection being in contact with the forward end of bearing which supports the forward end of drive shaft in inner block. And the ring made of metal is set in drive shaft so as to be in contact ring with the rearward end of bearing which supports the forward end of drive shaft in inner block. In this construction, the projection prevents drive shaft moving rearward,the ring prevents drive shaft moving forward.

In a fourth embodiment, the drive shaft radially forms projection being in contact with the forward end of bearing which supports the forward end of drive shaft in inner block. And the ring made of metal is set in drive shaft so as to be in contact ring with the rearward end of bearing which supports the rearward end of drive shaft in inner block. In this construction, the projection prevents drive shaft moving rearward, the ring prevents drive shaft moving forward.

In a fifth embodiment, the drive shaft radially forms projection being in contact with forward end of the bearing which supports the rearward end of drive shaft in inner block. And the ring made of metal is set in drive shaft so as to be in contact ring with the hearing which supports the forward and of drive shaft in inner block. In this construction, the projection prevents drive shaft moving rearward, the ring prevents drive shaft moving forward.

In a sixth embodiment, the drive shaft radially forms projection being in contact with the forward end of bearing which supports the rearward end of drive shaft. And the ring made of metal is set in drive shaft so as to be in contact ring with the rearward end of bearing which supports the rearward end of drive shaft in inner block. In this construction, the projection prevents drive shaft moving rearward, the ring prevents drive shaft moving forward.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG.1 is a vertical longitudinal sectional view of a scroll type compressor in accordance with one prior art.

FIG.2 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a first embodiment of this invention.

FIG.3 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a second embodiment of this invention.

FIG.4 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a third embodiment of this invention.

FIG.5 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a fourth embodiment of this invention.

FIG.6 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a fifth embodiment of this invention.

cc FIG.7 is a vertical longitudinal sectional view of a hermetically sealed scroll type compressor in accordance with a sixth embodiment of this invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG.2, a hermetically sealed scroll type compressor in accordance with a first embodiment of the present invention is shown. For purpose of explanation only, the left side of the figure will be referenced as the forward end or front of the compressor and the right side of the figure will be referenced as the rearward end or rear of the compressor.

The compressor includes hermetically sealed casing 10, fixed and orbiting scrolls 20 and 30, and motor 40. Fixed scroll 20 includes circular end plate 21 and spiral element or wrap 22 extending from rearward end surface thereof. Fixed scroll 20 is fixedly disposed within a front end portion of casing 10 by a plurality of screws 23. Circular end plate 21 of fixed scroll 20 partitions an inner chamber of casing 10 into discharge chamber 50 and suction chamber 60.

Orbiting scroll 30 is disposed within suction chamber 60, and includes circular end plate 31 and spiral element or wrap 32 extending from forward end surface of circular end plate 31. Spiral element 22 of fixed scroll 20 and spiral element 32 of orbiting scroll 30 interfit at an angular and radial offset to form a plurality of linear contacts which define at least one pair of sealed off fluid pockets 70. Annular projection 33 is formed at the rearward end surface of circular, end plate 31 opposite spiral element 32. Rotation prevention device 34 is disposed on circumferential surface of annular projection 33 to prevent rotation of orbiting scroll 30 during orbital motion of orbiting scroll 30.

First and second inner blocks 11 and 12 secure stator 41 of motor 40 and are fixedly disposed near opposite ends within suction chamber 60. Drive shaft 13 axially penetrates the centers of

inner blocks 11 and 12. Both ends of drive shaft 13 are rotatably supported by inner blocks 11 and 12 through bearings 14 and 15, respectively. Motor 40 includes stator 41 and rotor 42 which is fixedly secured to an exterior surface of drive shaft 13. Pin member 16 is integral with and axially projects from the forward end surface of drive shaft 13 and is radially offset from the axis of drive shaft 13. Balance weight 17 is disposed within a hollow space 61 defined by inner block 11 and the circular end plate 31 of orbiting scroll 30, and is fixedly connected to pin member 16. Radial projection 131 is formed at the exterior surface of drive shaft 13 at a position which is rear to bearing 14 so as to continuously contact a rear end surface of inner race 141 of bearing 14 with a front side surface of radial projection 131. Annular ridge 132 is formed at the exterior surface of drive shaft 13 at a position which is front of bearing 15 so as to continuously contact the side surface of annular ridge 132 with the front end surface of inner race 151 of bearing 15.

Drive shaft 13 is provided with axial bore 81 and a plurality of radial bores 82. Axial bore 81 extends from an opening at rearward end of drive shaft 13, that is, the end opposite pin member 16, to a closed end rearward of pin member 16. Narrow passage 83 links the forward closed end of axial bore 81 to an open end surface of pin member 16 adjacent orbiting scroll 30. The plurality of radial bores 82 link axial bore 81 near its closed end to cavity 62 located between motor 40 and hearing 14. Suction gas inlet pipe 84 is inserted through the rearward end of casing 10 and faces the opening of axial bore 81. Discharge gas outlet pipe attached to a side wall of casing 10 and links discharge chamber 50 to an external element.

In operation, stator 41 generates a magnetic field causing rotation of rotor 42, thereby rotating drive shaft 13. This rotation is connected to orbital motion of orbiting scroll 30 through balance weight 17. Rotational motion of orbiting scroll 30 is prevented by rotation prevention drive 34. Refrigerant gas introduced into suction chamber 60 through suction gas inlet pipe 84 is taken into the outer sealed fluid pockets 70 between fixed scroll 20 and orbiting scroll 30, and moves inwardly towards the center of spiral elements 22 and 32 due to the orbital motion of orbiting scroll 30. As the refrigerant moves towards the central pockets, it undergoes a resultant volume reduction and compressor, and is discharged to discharge chamber 50 through valved discharge port 24. Discharge gas in discharge chamber 50 then flows to an external fluid circuit (not shown) through discharge gas outlet pipe 85.

The preventing mechanism for preventing the axial movement of drive shaft 13 of this embodiment operates as follows. When the compressor drives, for example, the pressure of refrigerant gas within fluid pockets 70 causes the vibration within compressor. And the vibrations caused out of compressor, such as the mechanical vibration caused within the automobile engine room, and like, propagate the inside of compressor.

The above vibrations propagate the members disposed within compressor, the members also vibrate. The vibration propagating drive shaft 13 add the axial power to drive shaft 13 so as to reciprocate. However, the forward movement of drive shaft 13 is prevented by being in contact projection 131 with the rearward end of inner race 141, and rearward movement of drive shaft 13 is prevented by being in contact projection 132 with the forward end of inner race 151. As a result, as the reciprocation of drive shaft 13 is prevented and the collision between drive shaft 13 and the other members disposed within compressor, particularly, balance weight 17 and the forward end of hearing 14, or circular end plate 31 doesn't occur, abrasion and breakage of the members disposed within compressor is prevented.

Referring to FIG.3, a hermetically sealed scroll type compressor in accordance with a second embodiment of the present invention is shown. The same construction is accorded like numerals as shown with respect to FIG.2 and the explanation of part of the identical elements is substantially omitted.

Ring 91 made of metal is set in the circumference of the forward end of drive shaft 13. Projection 131 is in contact with the rearward end of inner race 141 of bearing 14, and ring 91 is in contact with the forward end of inner race 141 of bearing 14.

In this construction, when the vibration propagating drive shaft 13 add the axial power to drive shaft 13 so as to reciprocate, the forward movement of drive shaft 13 is prevented by being in contact projection 131 with the rearward end of inner race 141, and the rearward movement of drive shaft 13 is prevented by being in contact ring 91 with the forward end of inner race 141. As a result, the axial movement of drive shaft 13 is prevented.

Referring to FIG.4, a hermetically sealed scroll type compressor in accordance with a third embodiment of the present invention is shown. The same construction is accorded like numerals as shown with respect to FIG.2 and the explanation of part of the identical elements is substantially omitted.

Radial projection 133 radially extends from the exterior surface of the forward end of drive shaft 13. Ring 92 made of metal is set in the circumference of the forward end of drive end of drive

shaft 13. Projection 133 is in contact with the forward end of inner race 141 of bearing 14, and ring 92 is in contact with the rearward end of inner race 141 of bearing 14.

In this construction, when the vibration propagating drive shaft 13 add the axial power to drive shaft 13 so as to reciprocate, the forward movement of drive shaft 13 is prevented by being in contact ring 92 with the rearward end of inner race 141 and the rearward movement of drive shaft 13 is prevented by being in contact projection 133 with the forward end of inner race 141. As a result, the reciprocation of drive shaft 13 is also prevented.

Referring to FIG.5, a hermetically sealed scroll compressor in accordance with a fourth embodiment of the present invention is shown. The same construction is accorded like numerals as shown with respect to FIG.2 and the explanation of part of the identical elements is substantially omitted.

Ring 93 made of metal is set in the circumference of the rearward end drive shaft 13. Projection 133 is in contact with the forward end of inner race 141 of bearing 14, and ring 93 is in contact with the rearward end of inner race 151 of bearing 15.

In this construction, when the vibration propagating drive shaft 13 add the axial power to drive shaft 13 so as to reciprocate, the forward movement of drive shaft 13 is prevented by being in contact ring 93 with the rearward end of inner race 151 and the rearward movement of drive shaft 13 is prevented by being in contact projection 133 with the forward end of inner race 141. As a result, the reciprocation of drive shaft 13 is also prevented.

Referring to FIG.6, a hermetically sealed scroll type compressor in accordance with a fifth embodiment of the present invention is shown. The same construction is accorded like numerals as shown with respect to FIG.2 and the explanation of part of the identical elements is substantially omitted.

Ring 92 is in contact with the rearward end of inner race 141 of bearing 14, and the side surface of annular ridge 132 is in contact with the forward end of inner race 151 of bearing 15.

In this construction, when the vibration propagating drive shaft 13 add the axial power to drive shaft 13 so as to reciprocate, the forward movement of drive shaft 13 is prevented by being in contact ring 92 with the rearward end of inner race 141, and the rearward movement of drive shaft 13 is prevented by being contact the side surface of annular ridge 132 with the forward end of inner race 151. As a result, the reciprocation of drive shaft 13 is also prevented.

Referring to FIG.7, a hermetically sealed scroll type compressor in accordance with a sixth embodiment of the present invention is shown. The same construction is accorded like numerals as shown with respect to FIG.2 and the explanation of part of the identical elements is substantially omitted.

The side surface of annular ridge 132 is in contact with the forward end of inner race 151 of bearing 15, and ring 132 is in contact rearward end of inner race 151 of bearing 15.

In this construction, when the vibration propagating drive shaft 13 adds the axial power to drive shaft 13 so as to reciprocate, the forward movement of drive shaft 13 is prevented by being in contact ring 93 with the rearward end of inner race 151, and the rearward movement of drive shaft 13 is prevented by being in contact the side surface of annular ridge 132 with the forward end of inner race 151.

As a result, the reciprocation of drive shaft 13 is prevented.

The above explanation of a hermetically sealed scroll type compressor in accordance with the second through sixth embodiments of the present invention is omitted about the same as explanation of operation of the first embodiment.

Claims

1. In a motor driven fluid compressor:

said compressor comprising a compressing mechanism for compressing a gaseous fluid;

a driving mechanism for driving said compressing mechanism, said driving mechanism including a drive shaft operatively connected to said driving mechanism;

a housing containing said compressing mechanism and said driving mechanism;

a first and second inner blocks rotatably supporting both ends of said drive shaft by first and second bearings means, respectively:

axial movement preventing means for preventing the axial movement of said drive shaft.

2. The motor driven fluid compressor of claim 1, said preventing movement means comprising a first bearing means supporting the forward end of said drive shaft, a second bearing means supporting the rearward end of said drive shaft, a preventing movement members which are in contact with the rearward end of said first bearing means and the forward end of said second bearing means, respectively.

3. The motor driven fluid compressor of claim 1 or 2, said preventing movement means comprising a first bearing means supporting the forward end of said drive shaft, a preventing

movement members which are in contact with the forward and rearward end of said first bearing means, respectively.

4. The motor driven fluid compressor of one of claims 1 to 3, said preventing movement means comprising a first bearing means supporting the forward end of said drive shaft, a second bearing means supporting the rearward end of said drive shaft, a preventing movement members which are in contact with the forward end of said first hearing means and the rearward end of said second bearing means, respectively.

5. The motor driven fluid compressor of one of claims 1 to 4, said preventing movement means comprising a second bearing means supporting

the rearward end of said drive shaft, a preventing movement members which are in contact with the forward and rearward end of said second bearing means,respectively.

6. The motor driven fluid compressor of claims 2-5, said preventing movement member comprising a projection member formed radially on the circumference of said drive shaft, or a ring member set in the circumference of said drive shaft.

Fig 1 (Prior Art)

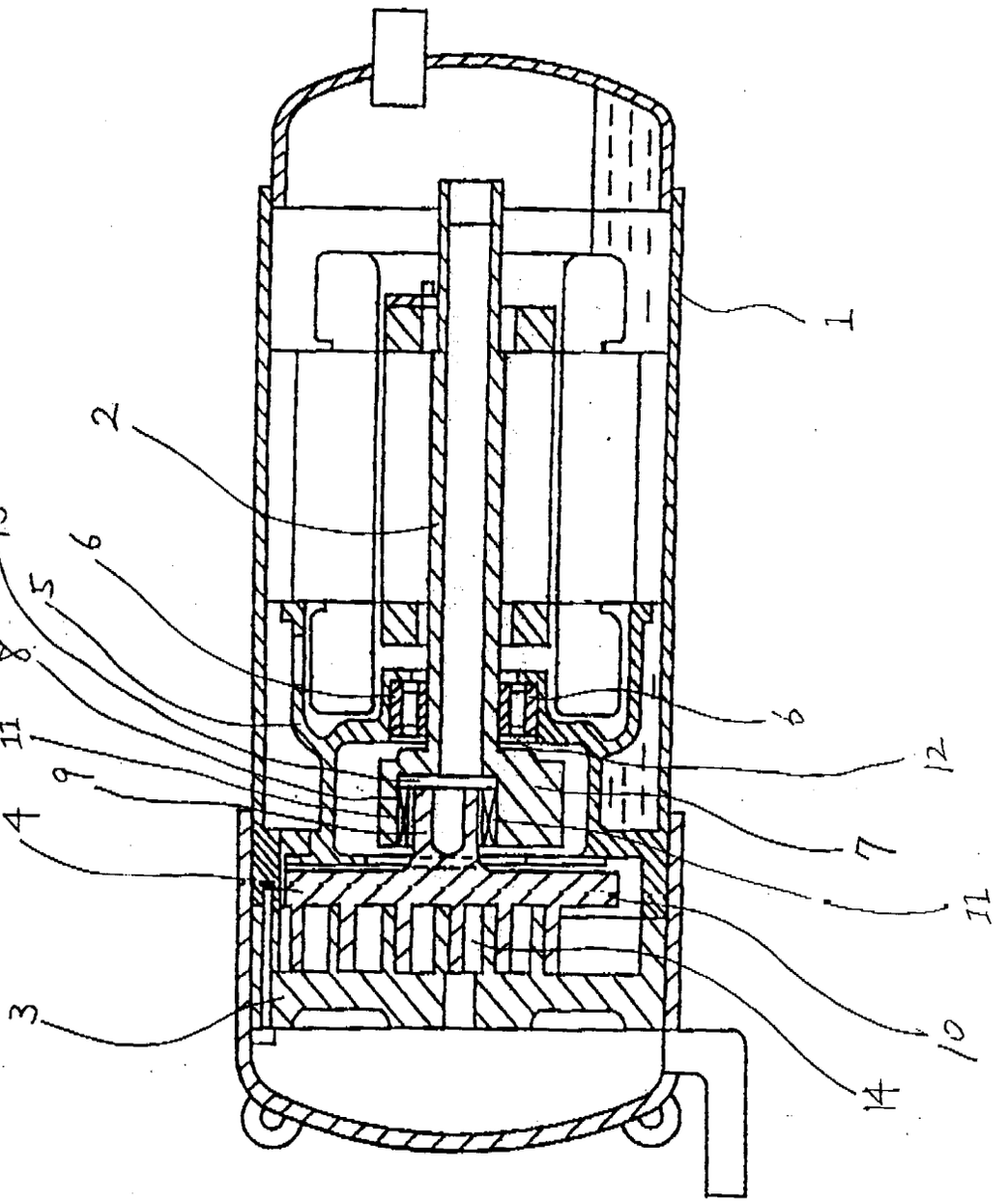

Fig. 2

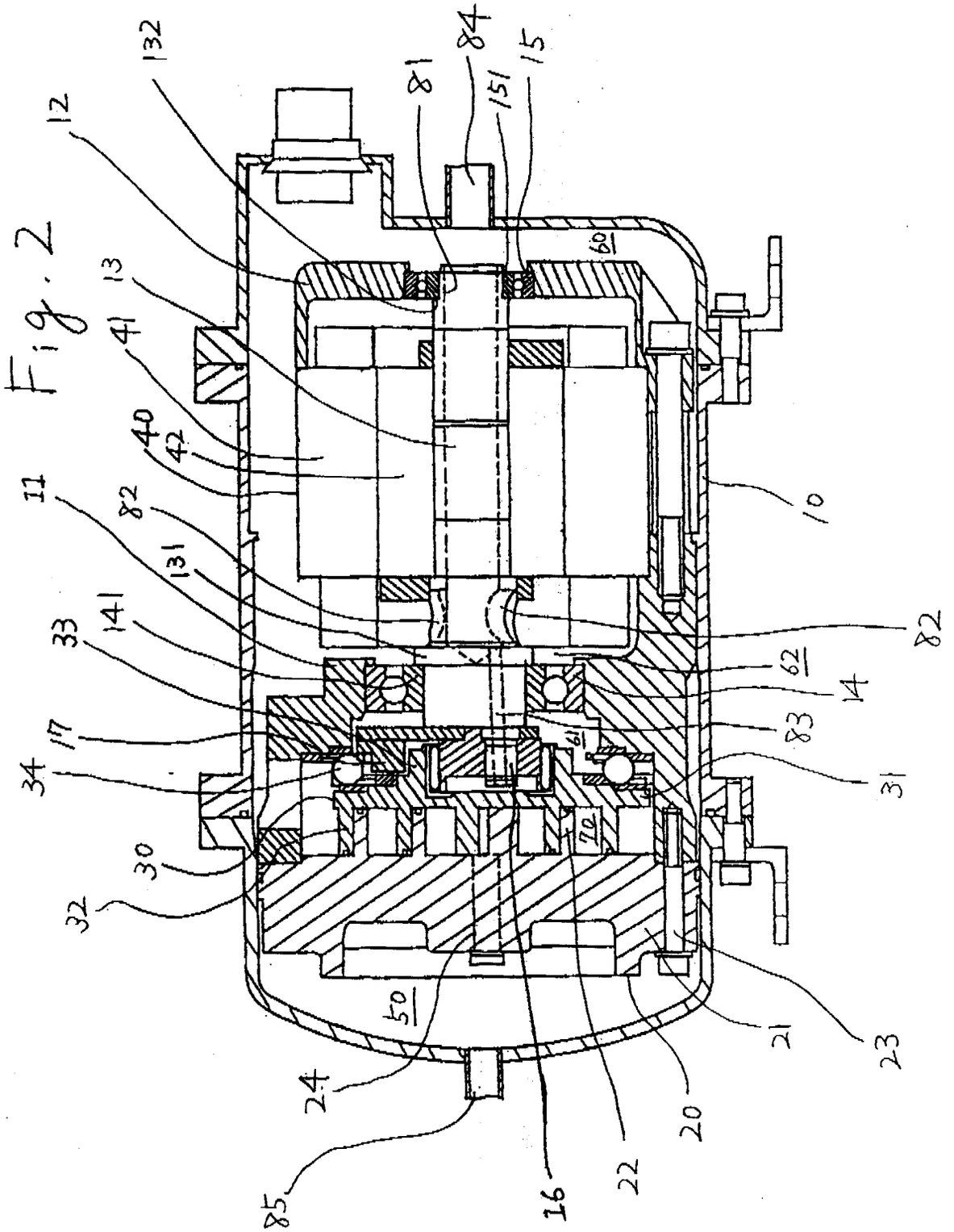
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Fig. 3

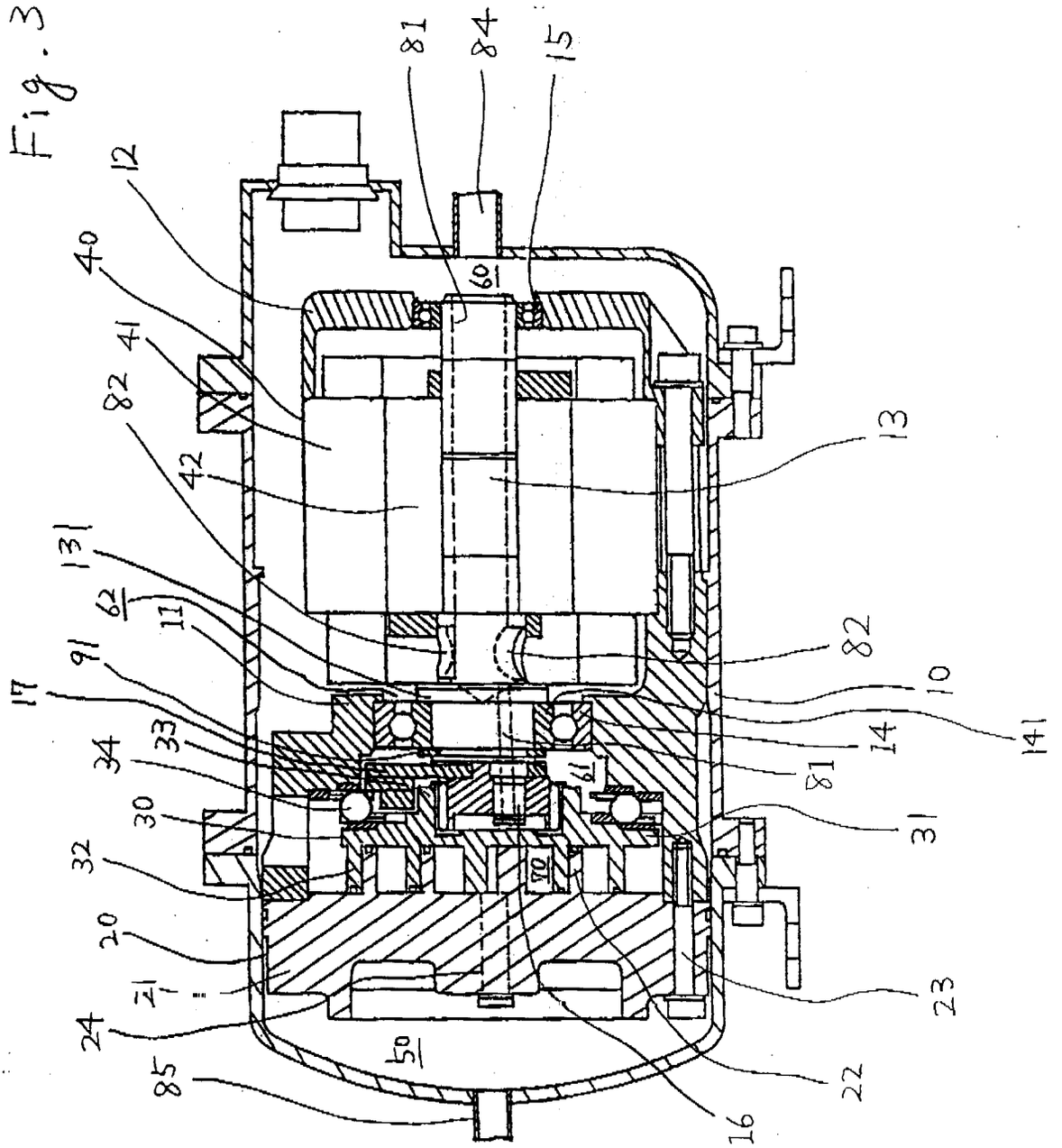
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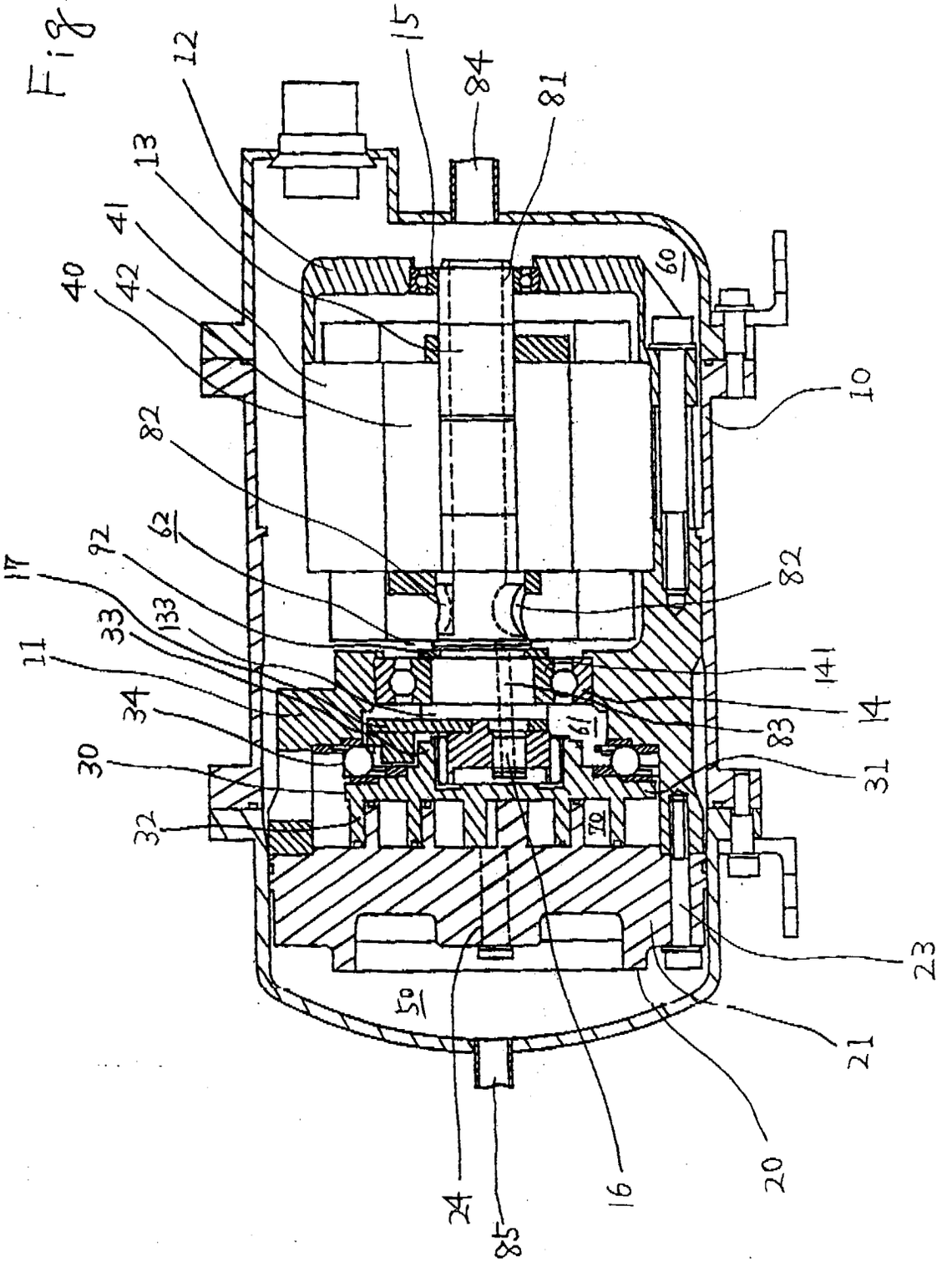
Fig. 4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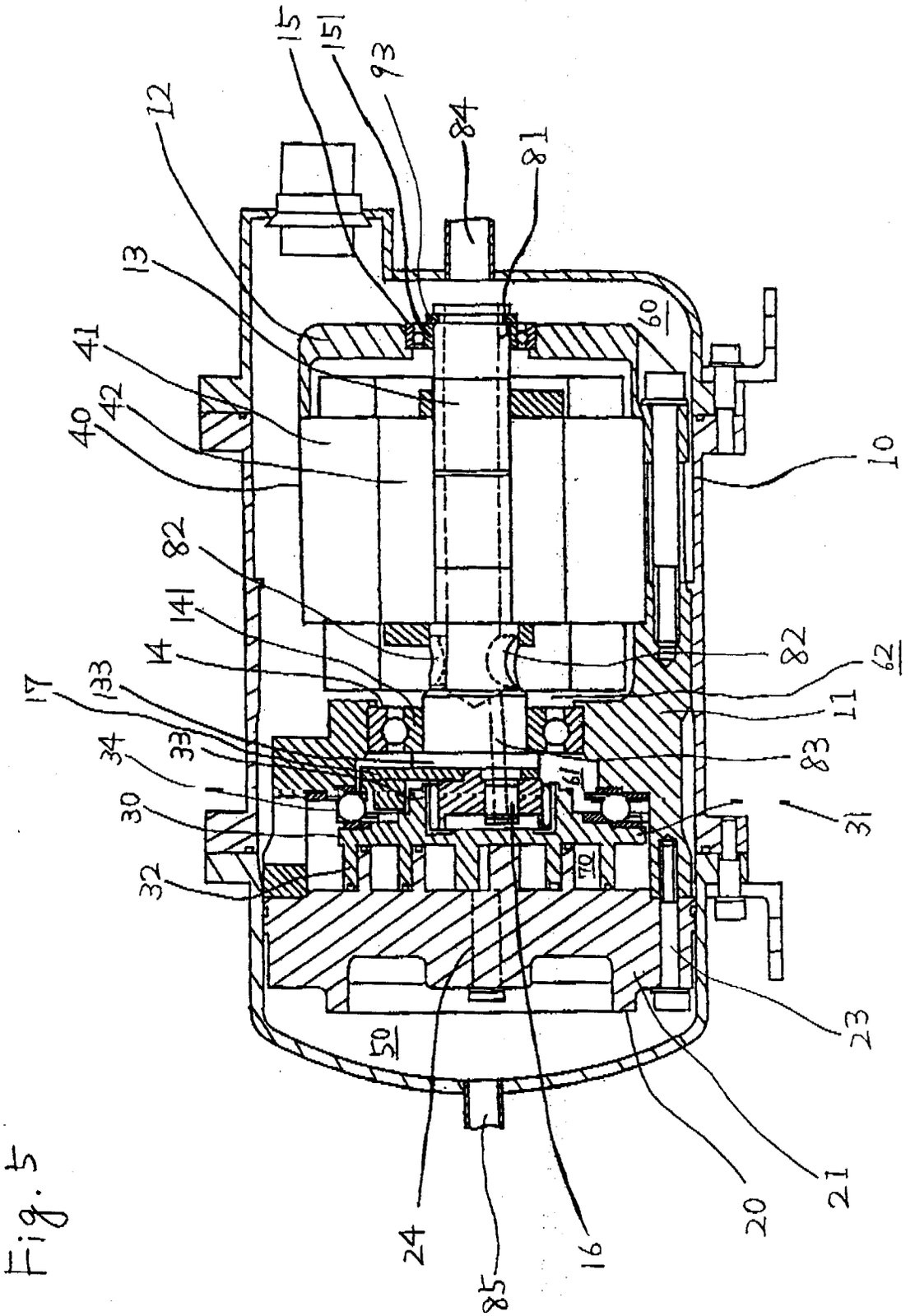
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Fig. 5

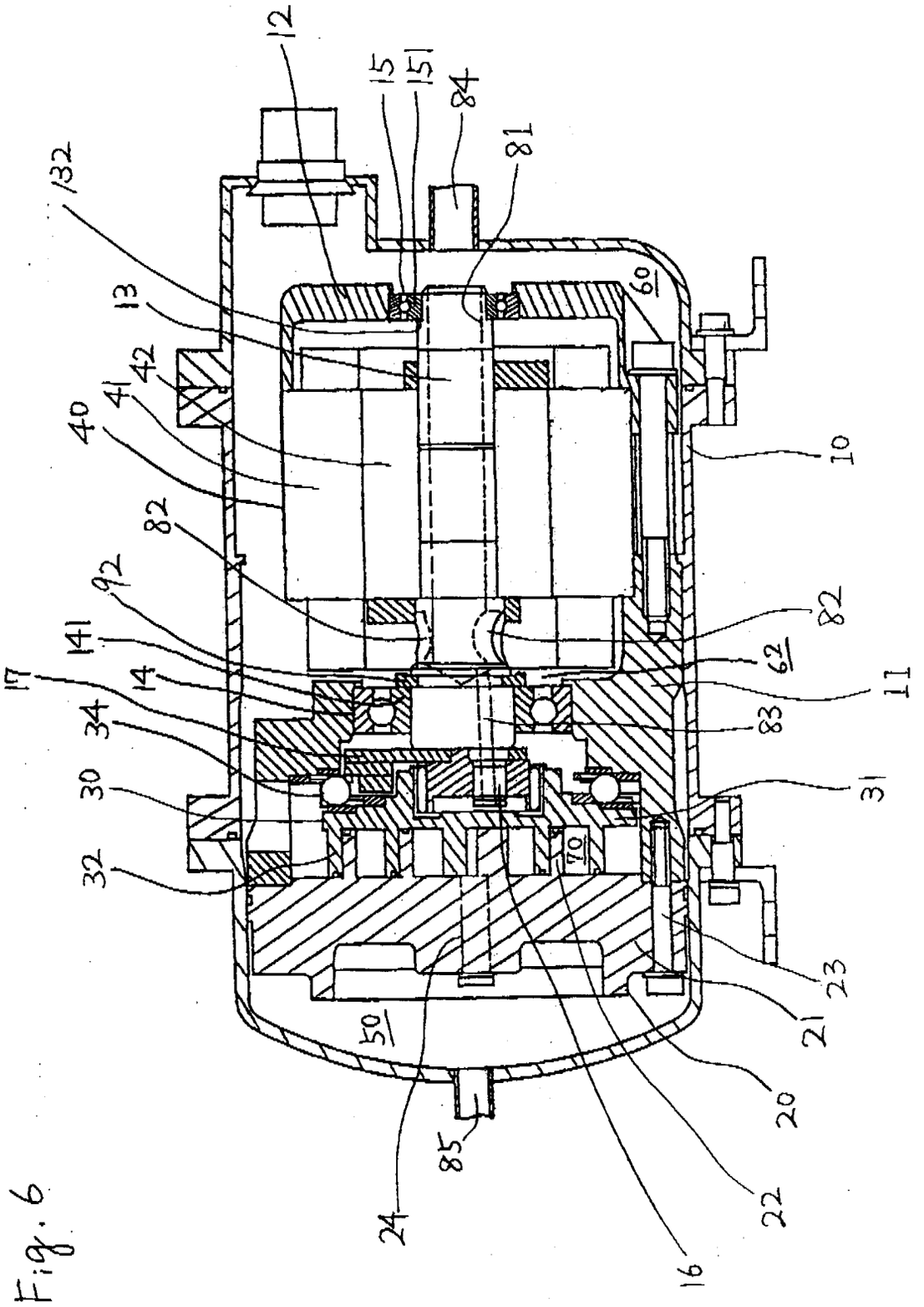
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Fig. 6

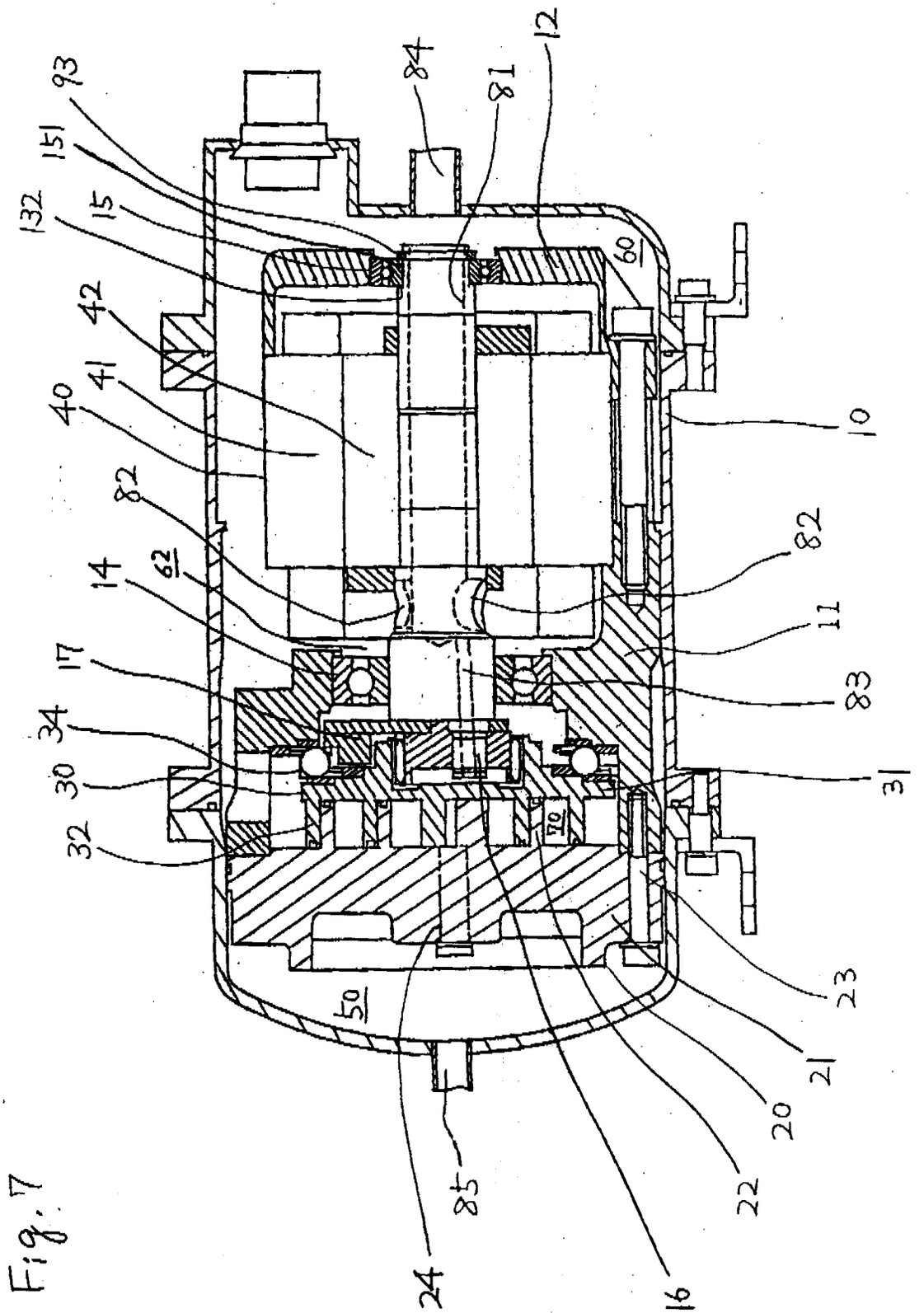
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Fig. 7

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 11 8209

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	EP-A-0 283 045 (SANDEN CO.) * column 2, line 44 - column 3, line 10; figure 1 *	1-6	F04C18/02 F04C23/00
A	PATENT ABSTRACTS OF JAPAN vol. 14, no. 71 (M-933)(4014) 9 February 1990 & JP-A-12 90 983 (DIESEL KIKI CO. LTD.) 22 November 1989 * abstract *	1-6	
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 1 (M-550)(2448) 6 January 1987 & JP-A-61 182 482 (SHIN MEIWA IND. CO. LTD.) 15 August 1986 * abstract *	1-6	
A	PATENT ABSTRACTS OF JAPAN vol. 10, no. 333 (M-534)(2389) 12 November 1986 & JP-A-61 138 895 (SHIN MEIWA IND. CO. LTD.) 26 June 1986 * abstract *	1-6	TECHNICAL FIELDS SEARCHED (Int. Cl.5) F04C F01C
A	PATENT ABSTRACTS OF JAPAN vol. 11, no. 347 (M-641)(2794) 13 November 1987 & JP-A-62 126 284 (DAIKIN IND. LTD.) 8 June 1987 * abstract *	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 JANUARY 1993	DIMITROULAS P.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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