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JP H08219043

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updated as appropriate

Additional Fields
Other: **SEARCH-PATENT**

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United Kingdom

GB 2612265 B

FIG. 1

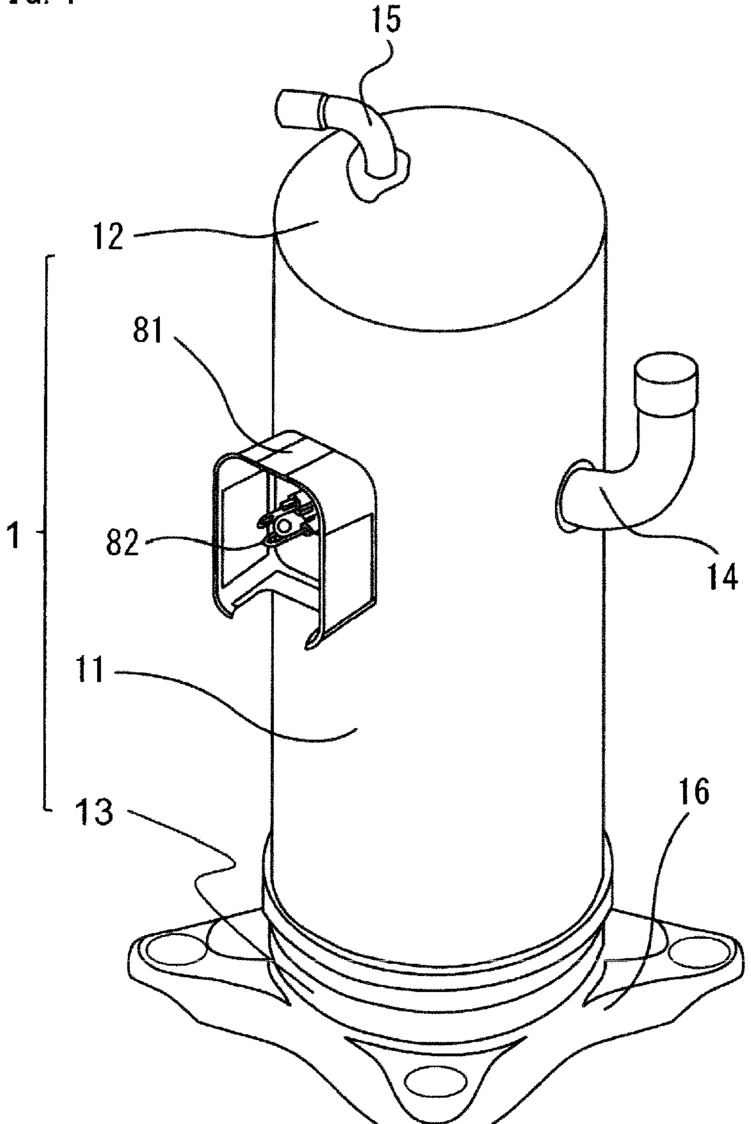


FIG. 2

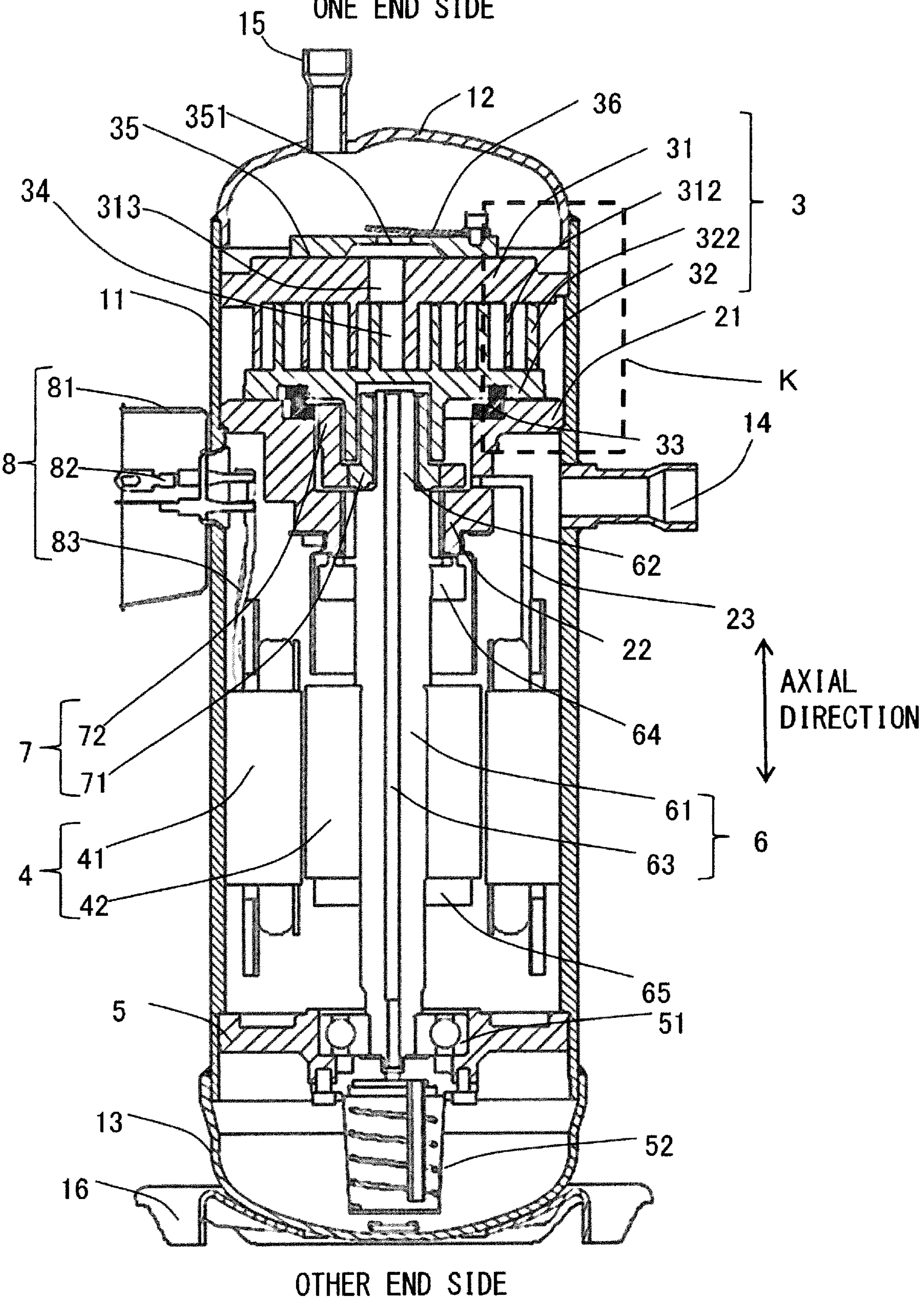

ONE END SIDE
15
12
36
351
35
31
34
313
312
3
322
32
11
21
81
K
8
82
33
14
83
62
23
22
AXIAL
DIRECTION
72
64
7
71
61
41
6
4
63
42
65
5
51
13
52
16
OTHER END SIDE

FIG. 3

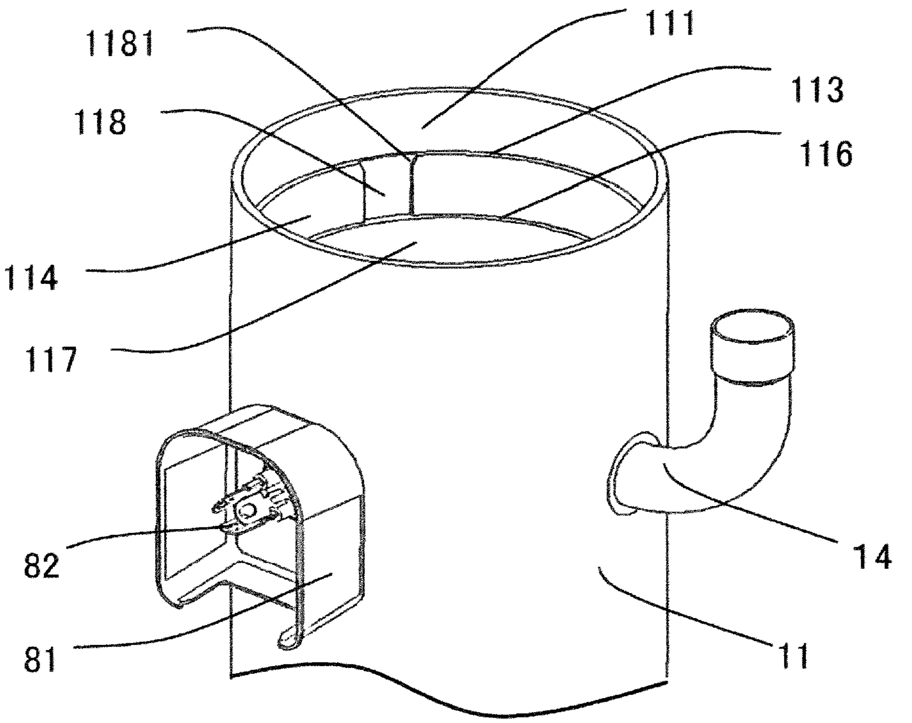


FIG. 4

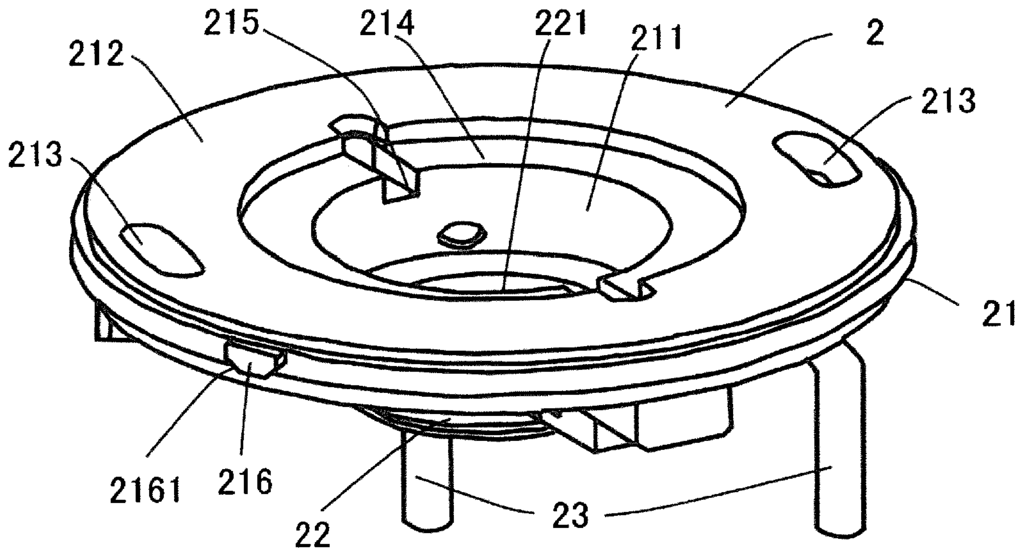


FIG. 5

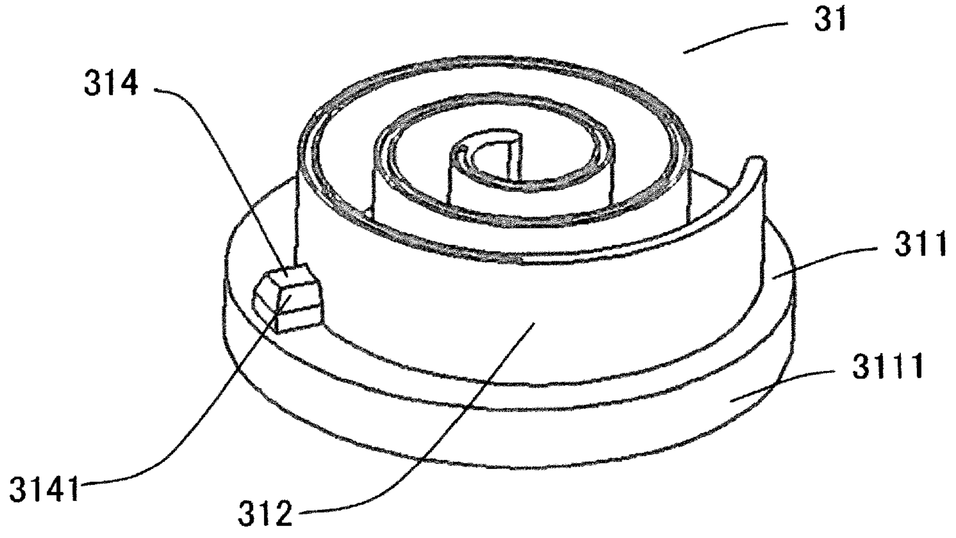


FIG. 6

FIG. 6A

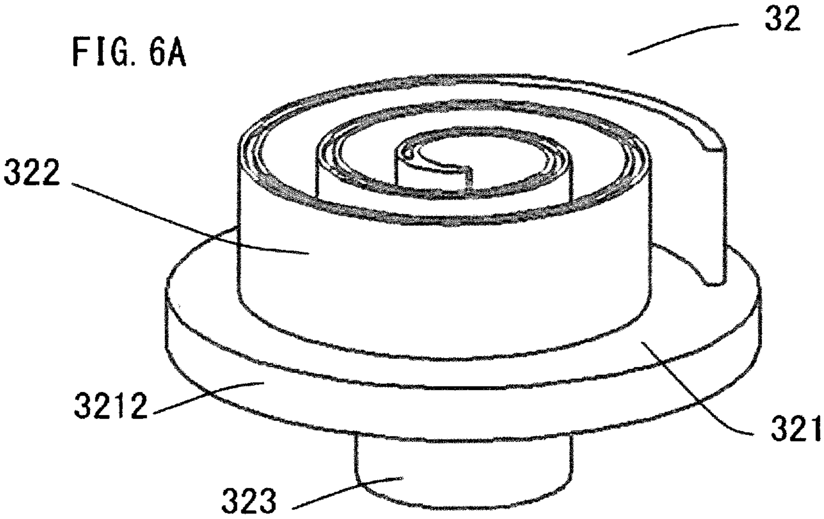


FIG. 6B

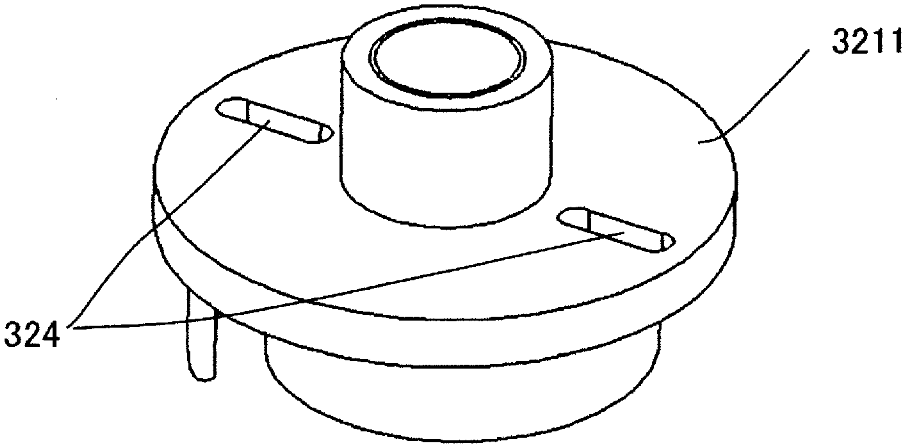


FIG. 7

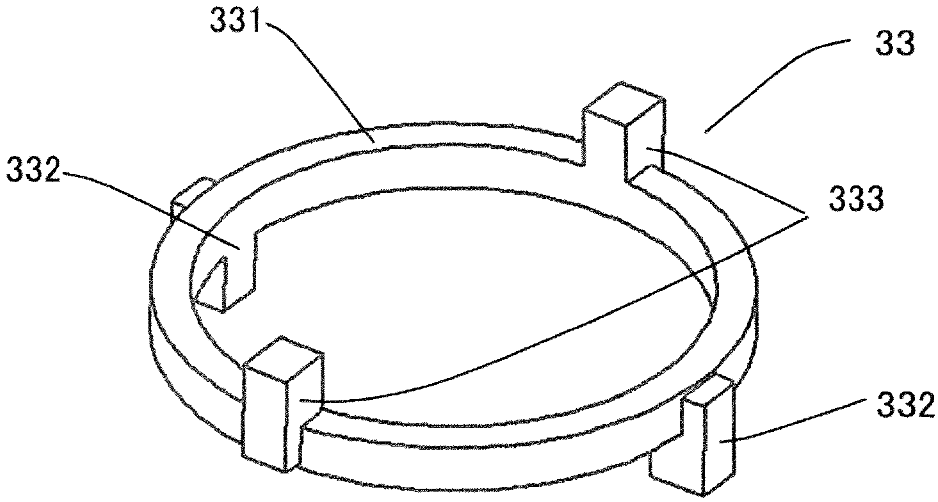


FIG. 8

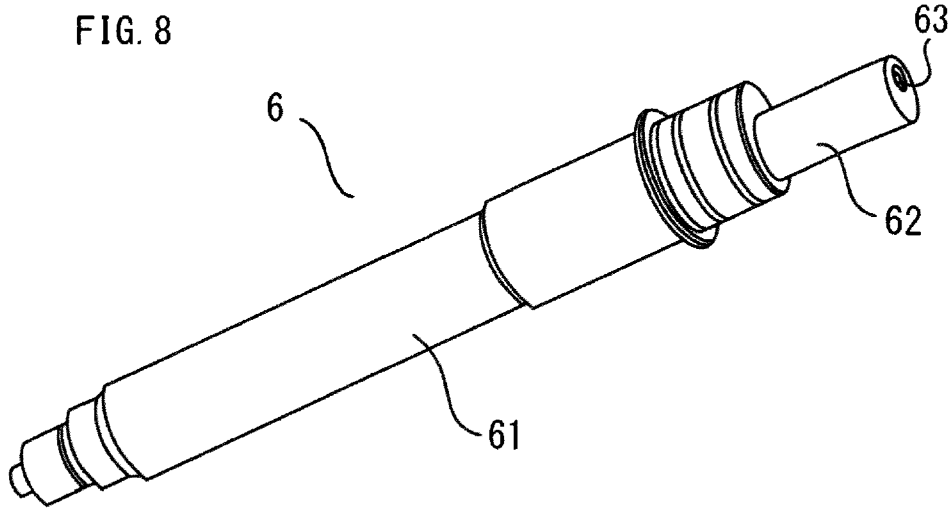


FIG. 9

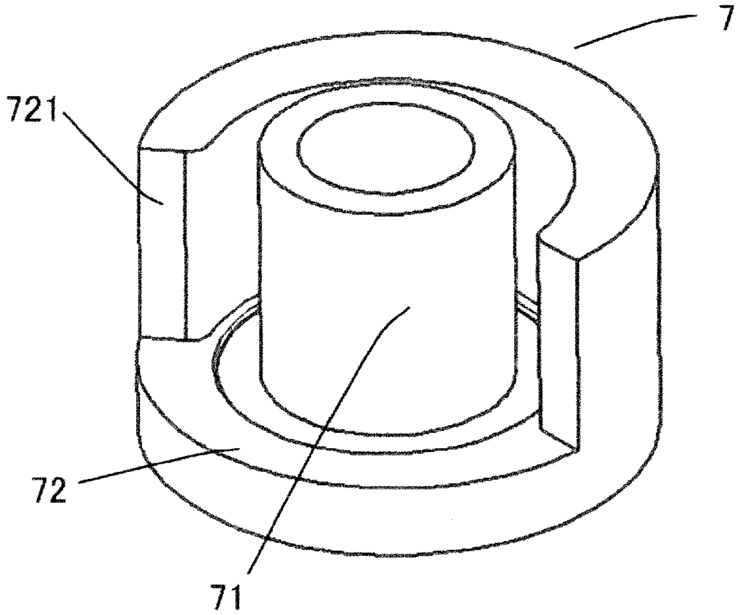


FIG. 10

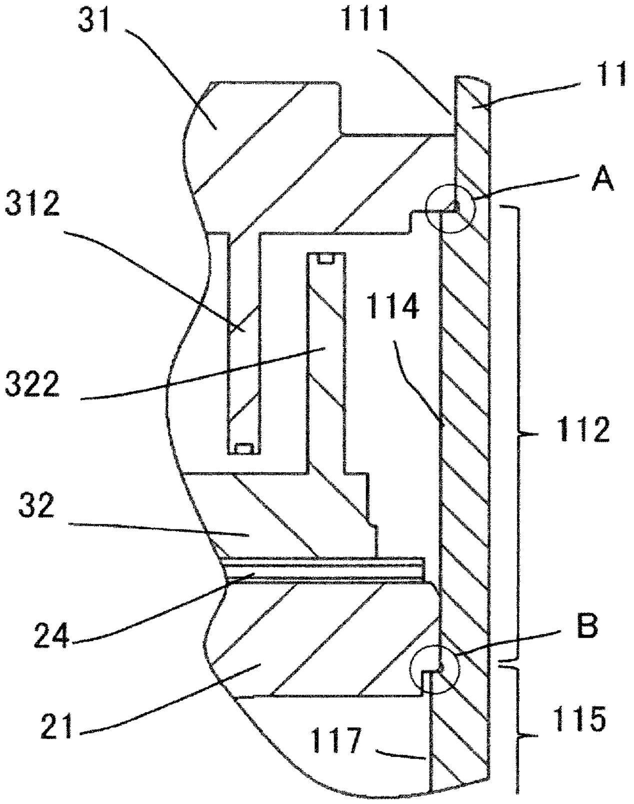


FIG. 11

PART A

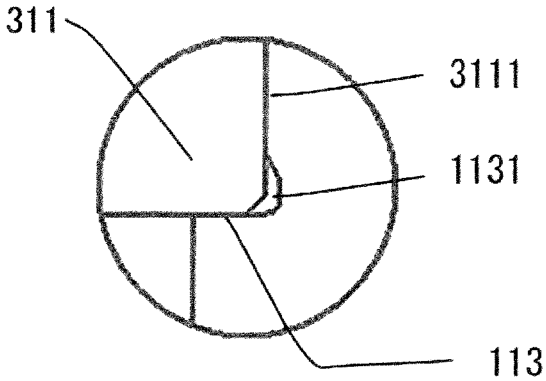


FIG. 12

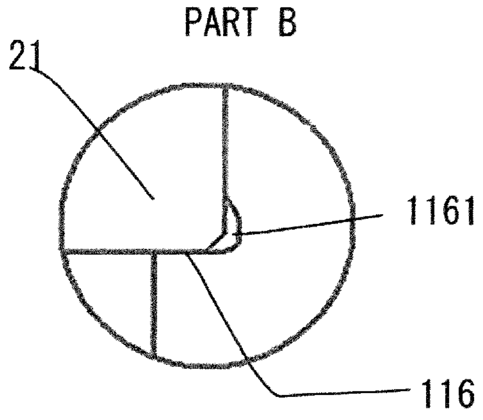


FIG. 13

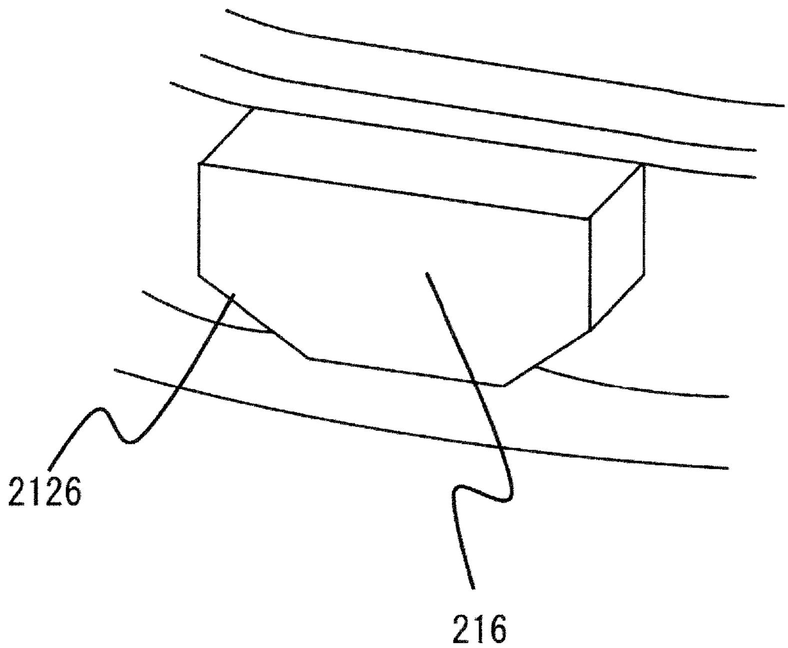


FIG. 14

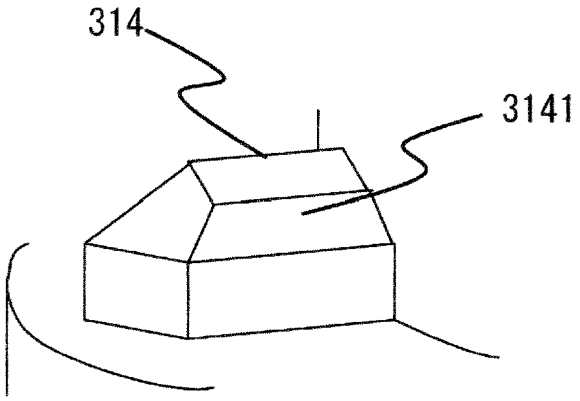


FIG. 15

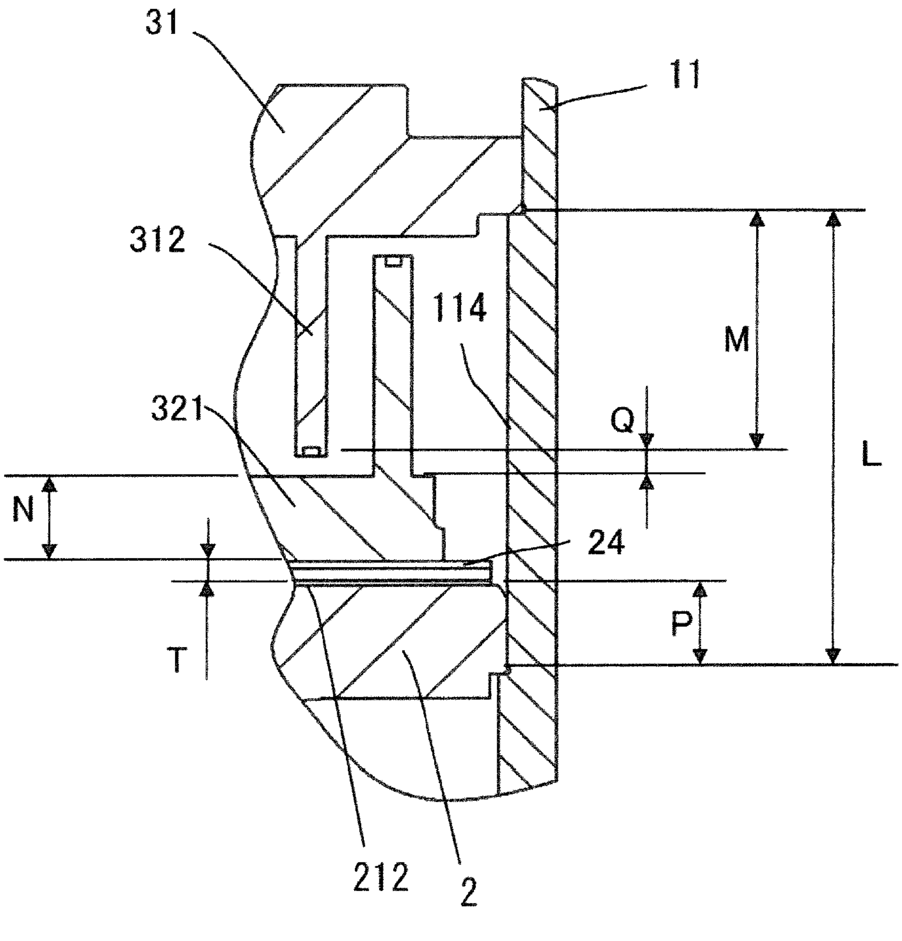


FIG. 16

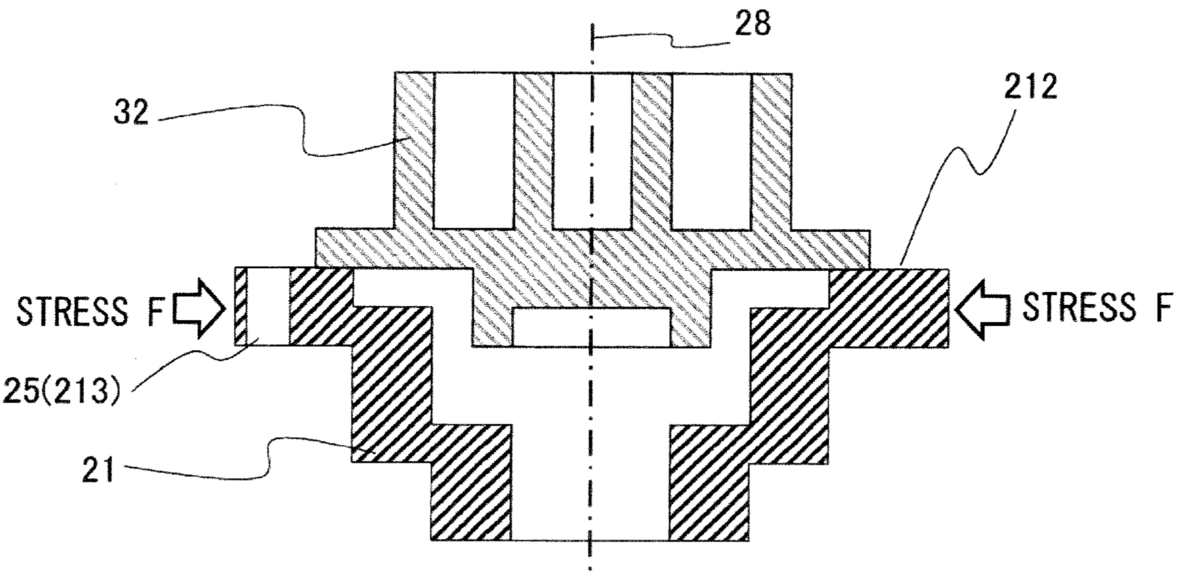


FIG. 17

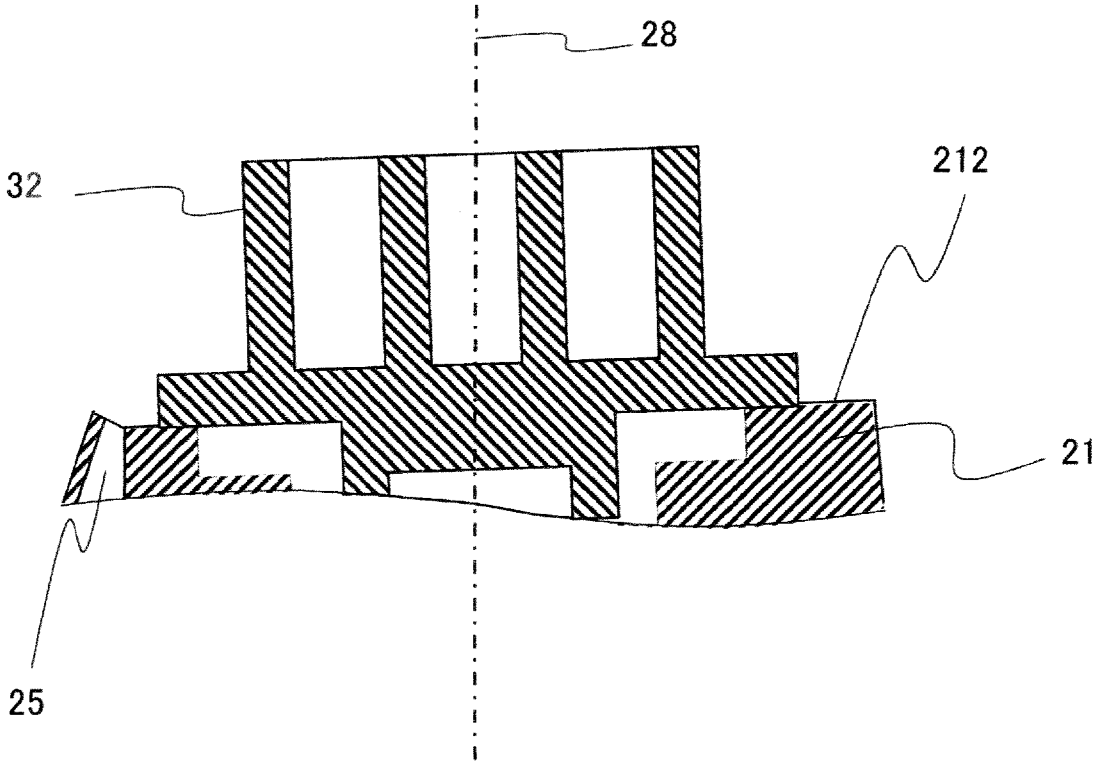


FIG. 18

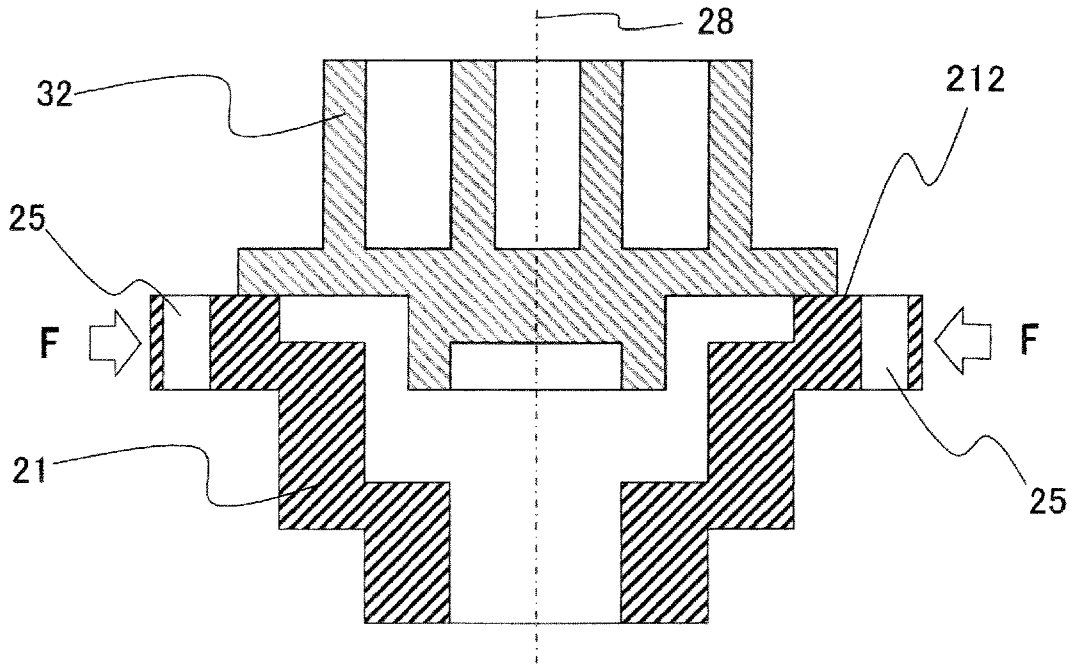


FIG. 19

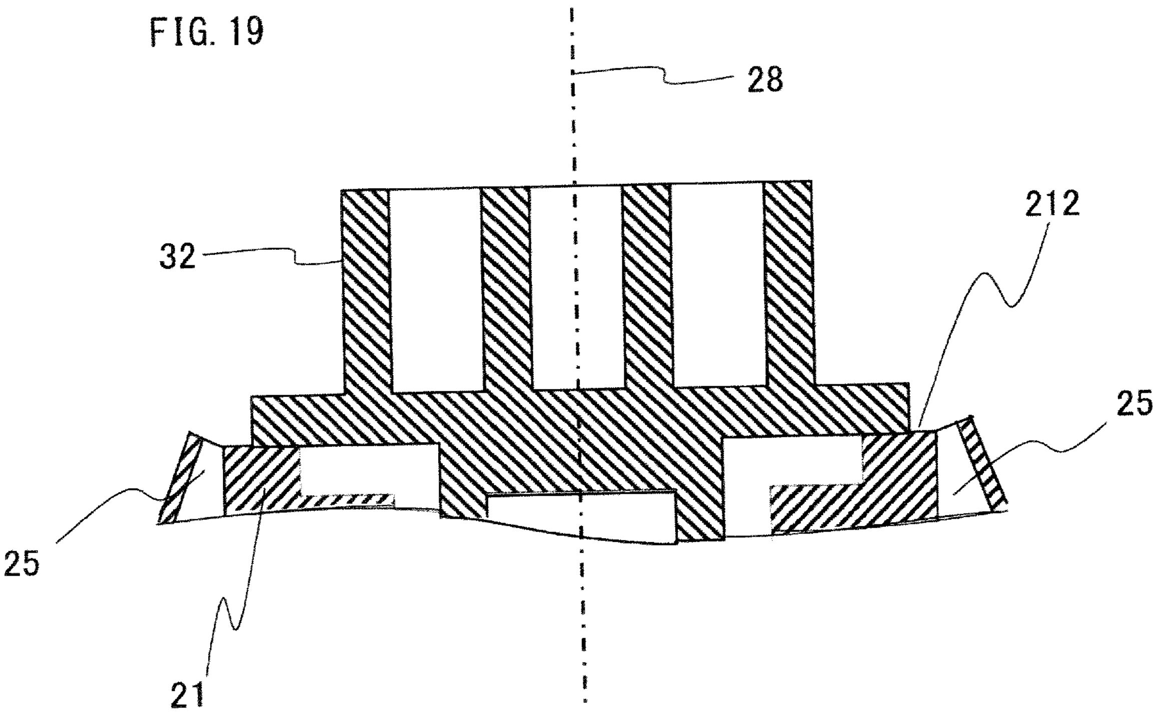


FIG. 20

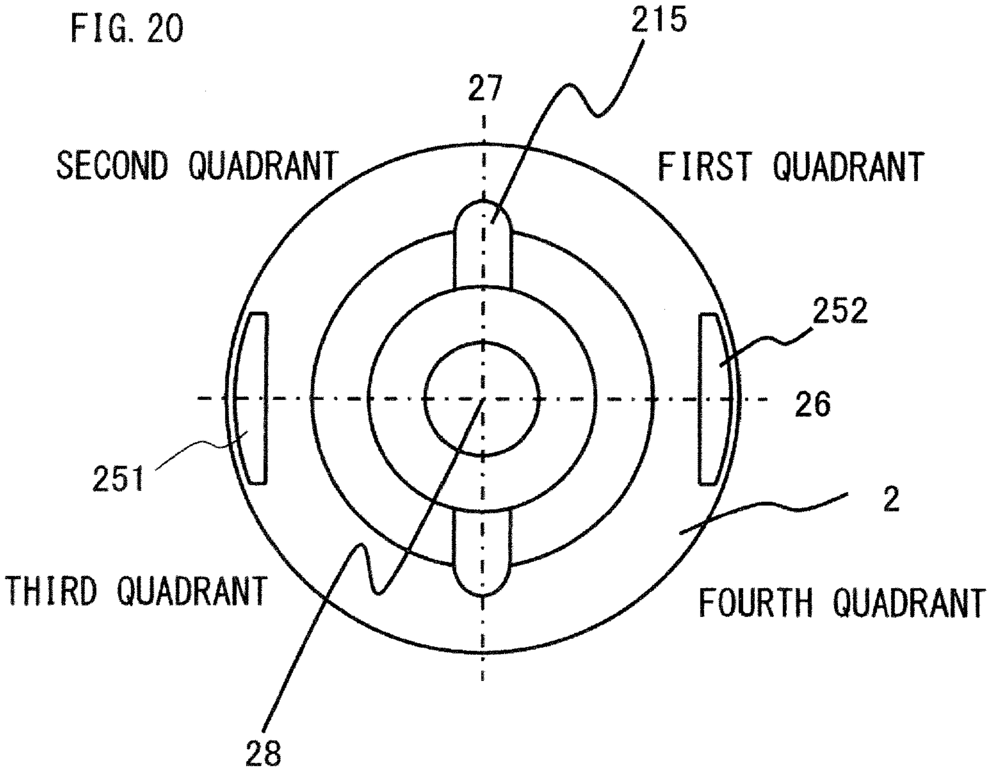

215
27
SECOND QUADRANT
FIRST QUADRANT
252
26
251
2
THIRD QUADRANT
FOURTH QUADRANT
28

FIG. 21

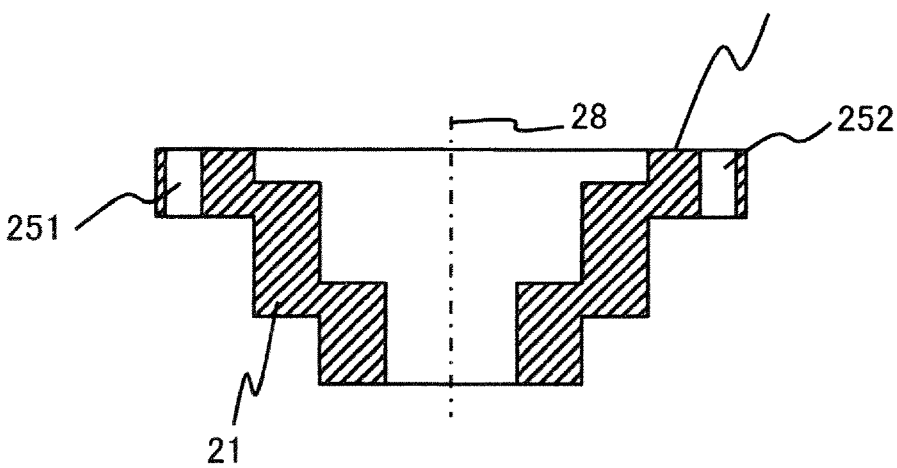


FIG. 22

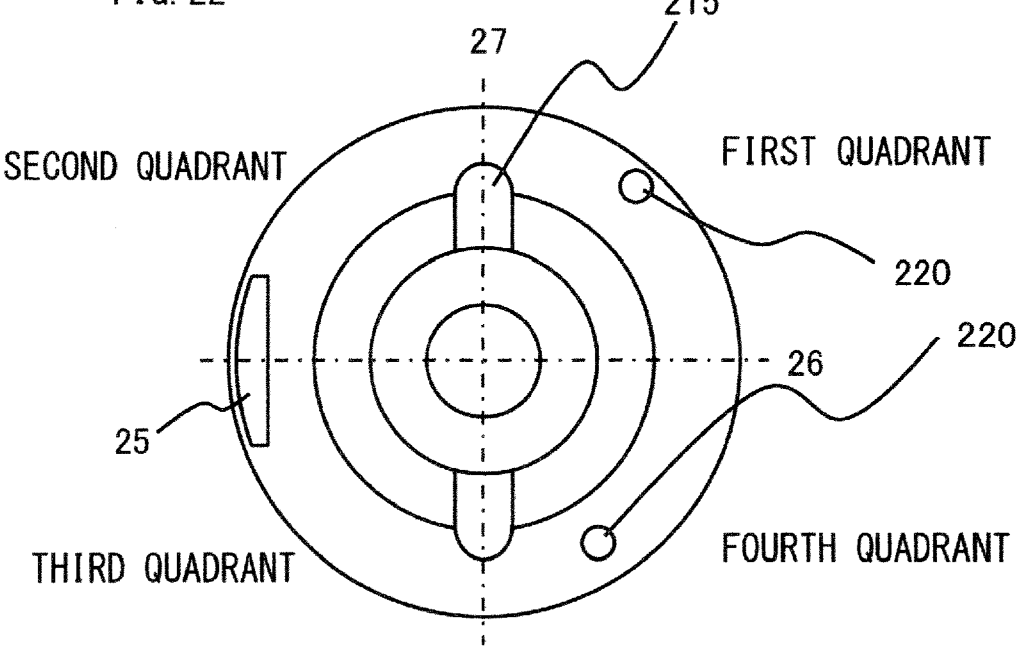

215
27
SECOND QUADRANT
FIRST QUADRANT
220
220
26
25
THIRD QUADRANT
FOURTH QUADRANT

FIG. 23

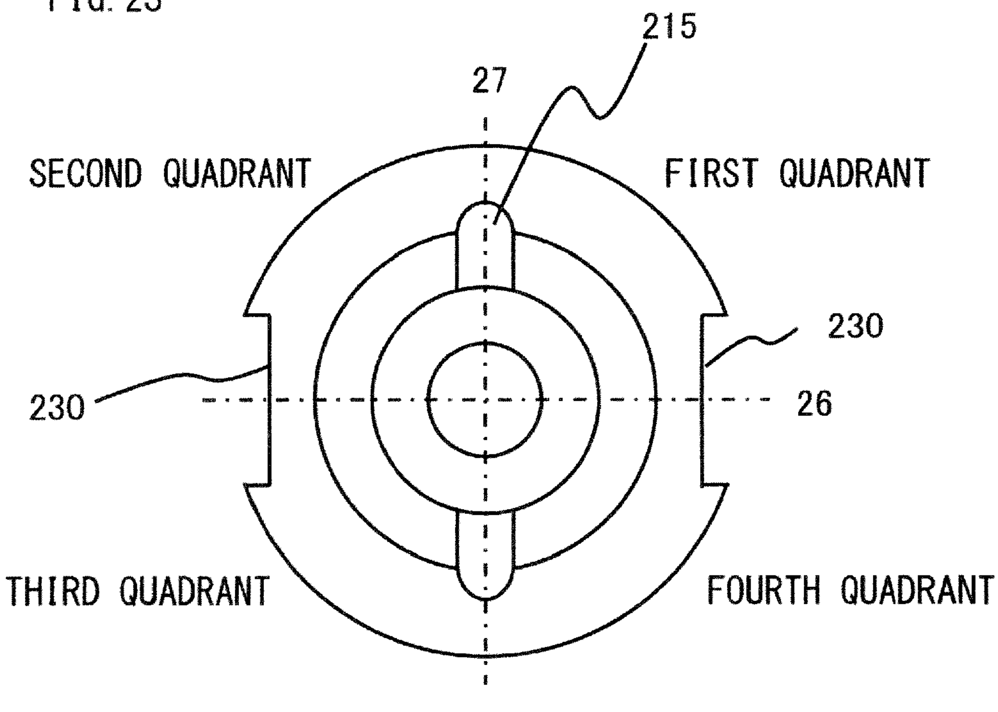

215
27
SECOND QUADRANT
FIRST QUADRANT
230
230
26
THIRD QUADRANT
FOURTH QUADRANT

FIG. 24

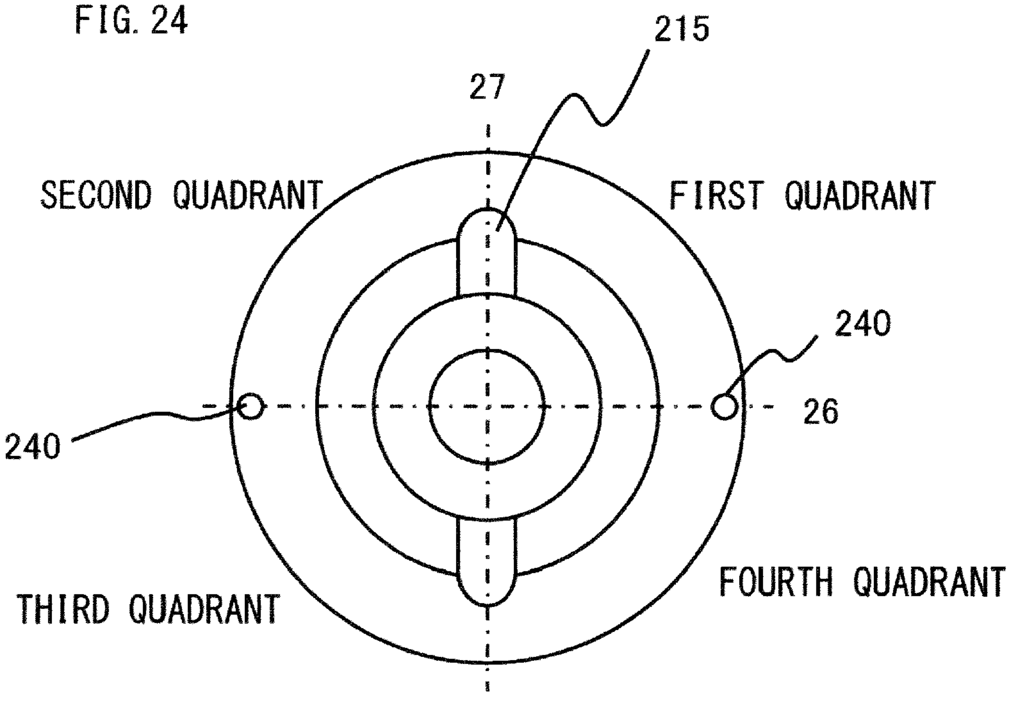

215
27
SECOND QUADRANT
FIRST QUADRANT
240
240
26
THIRD QUADRANT
FOURTH QUADRANT

FIG. 25

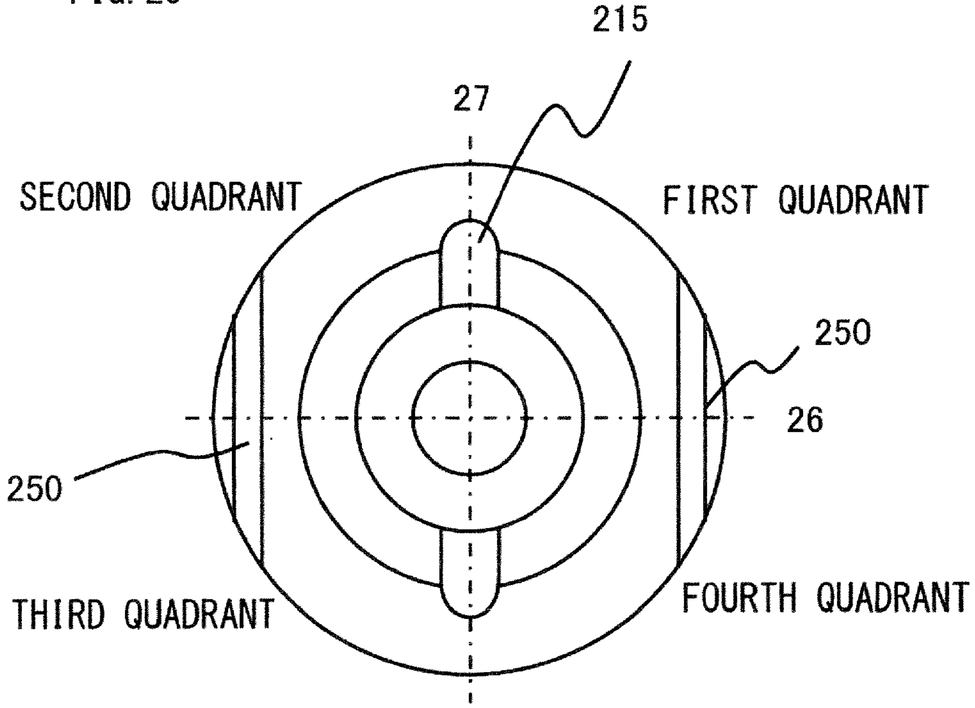

215
27
SECOND QUADRANT
FIRST QUADRANT
250
26
250
THIRD QUADRANT
FOURTH QUADRANT

FIG. 26

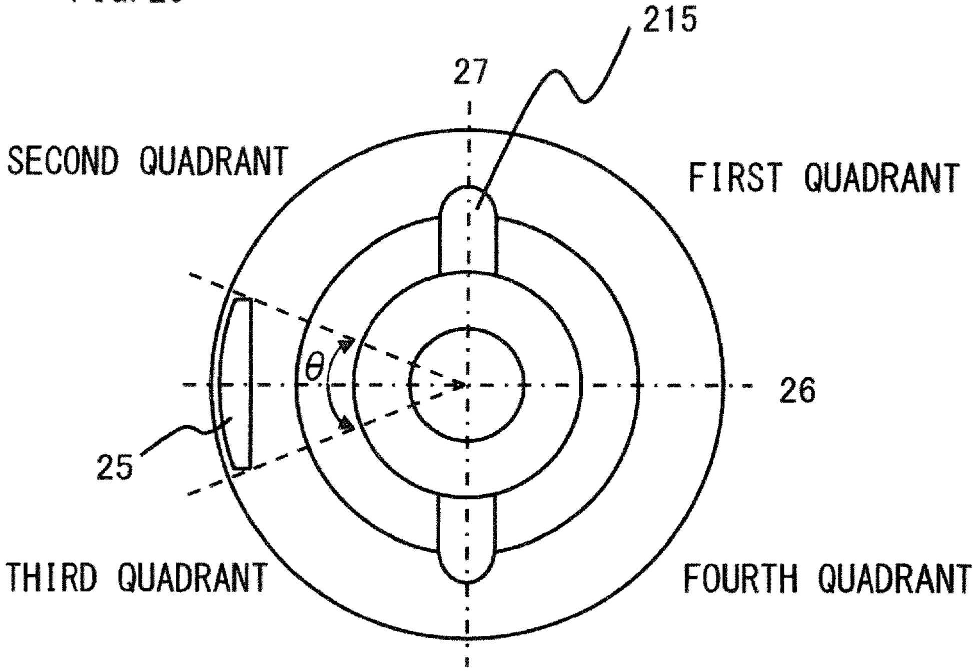

215
27
SECOND QUADRANT
FIRST QUADRANT
θ
26
25
THIRD QUADRANT
FOURTH QUADRANT

FIG. 27

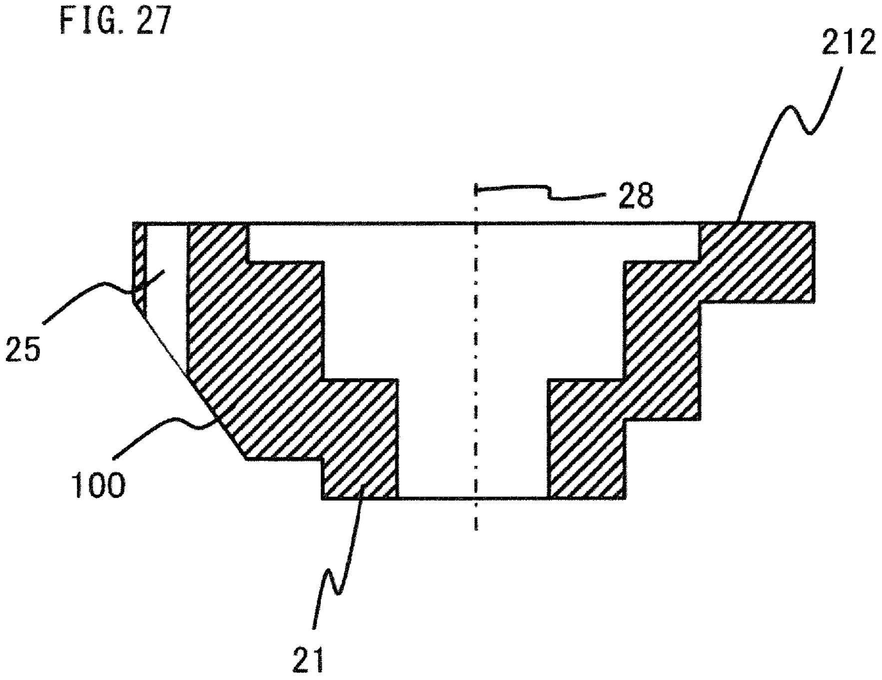


FIG. 28

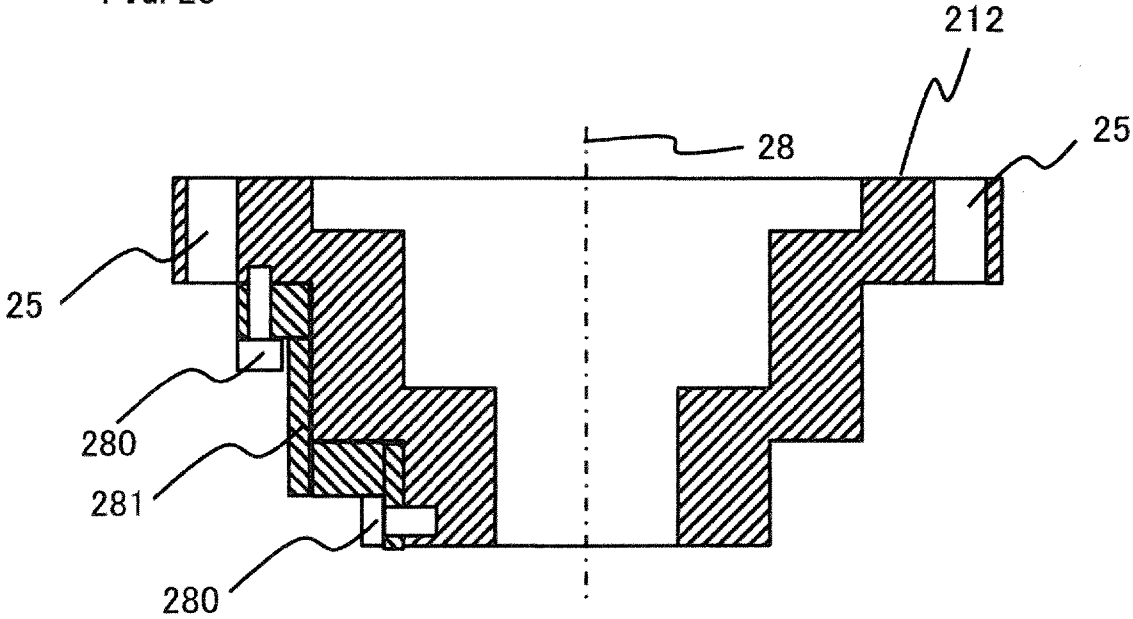


FIG. 29

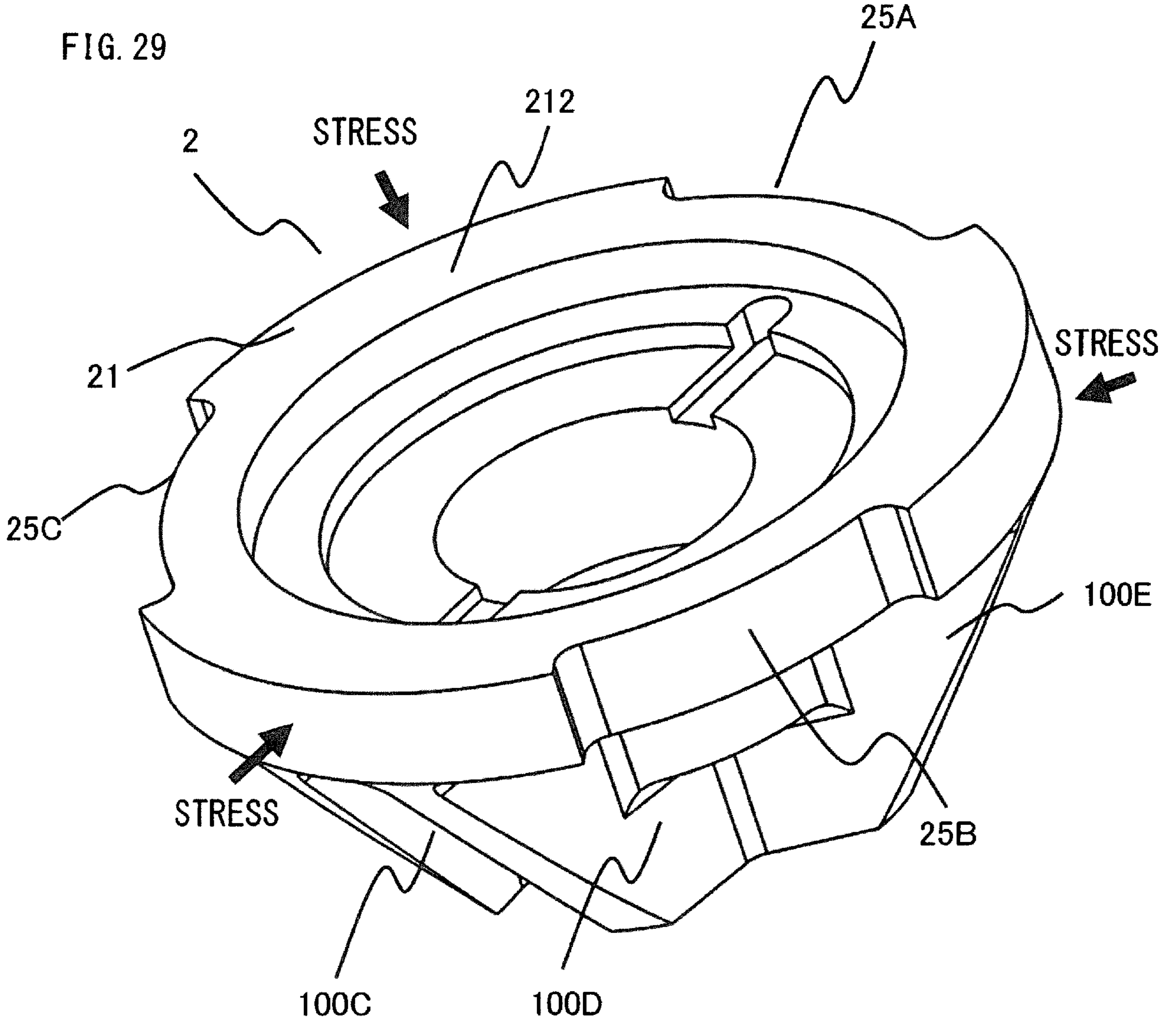


FIG. 30

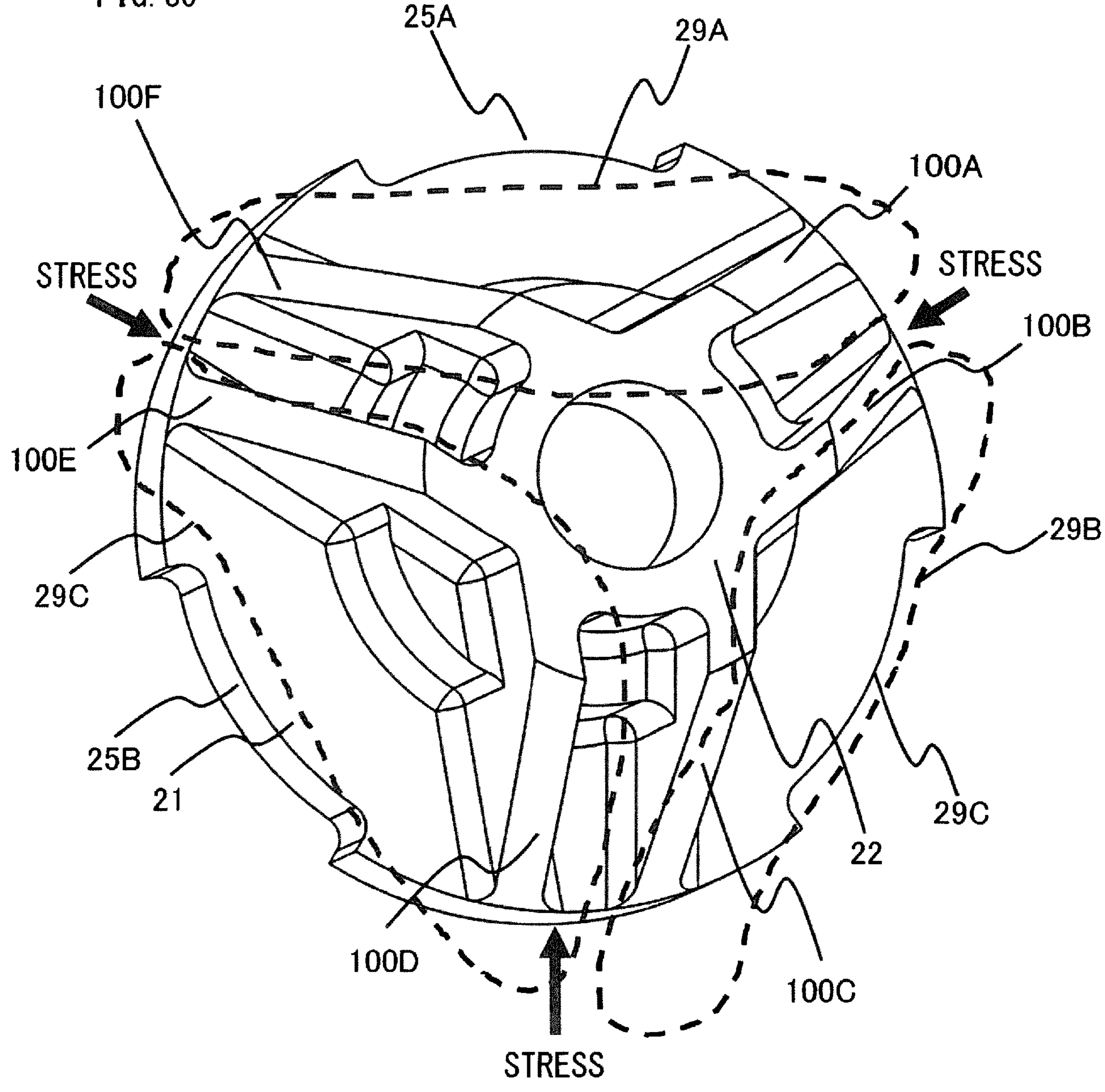
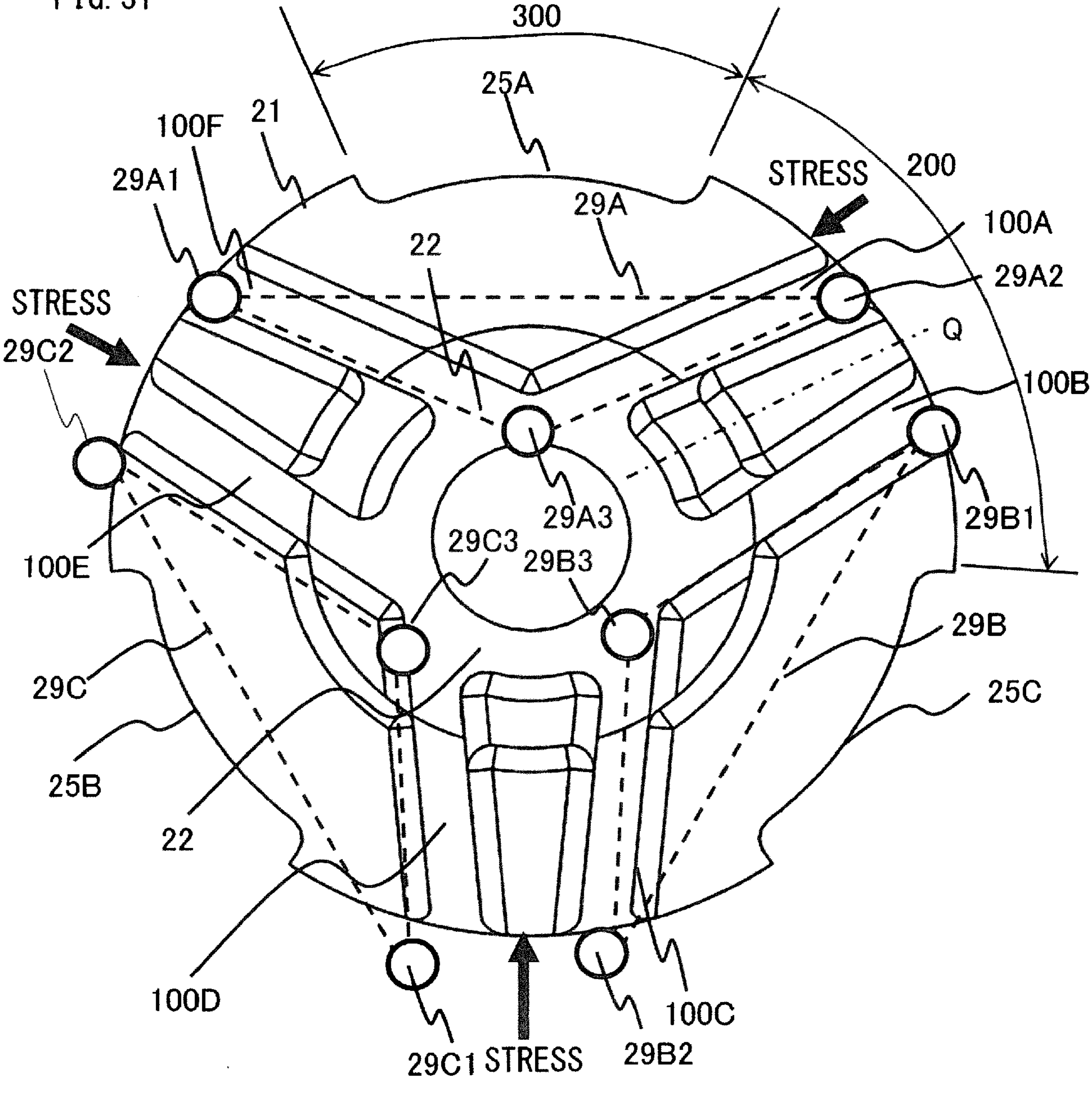

25A
29A
100F
100A
STRESS
STRESS
100B
100E
29B
29C
25B
21
29C
22
100D
100C
STRESS

FIG. 31



300
25A
21
100F
29A1
STRESS
200
29A
100A
29A2
22
Q
STRESS
29C2
100B
29A3
29B1
100E
29C3
29B3
29B
29C
25C
25B
22
100D
100C
29C1
STRESS
29B2

FIG. 32

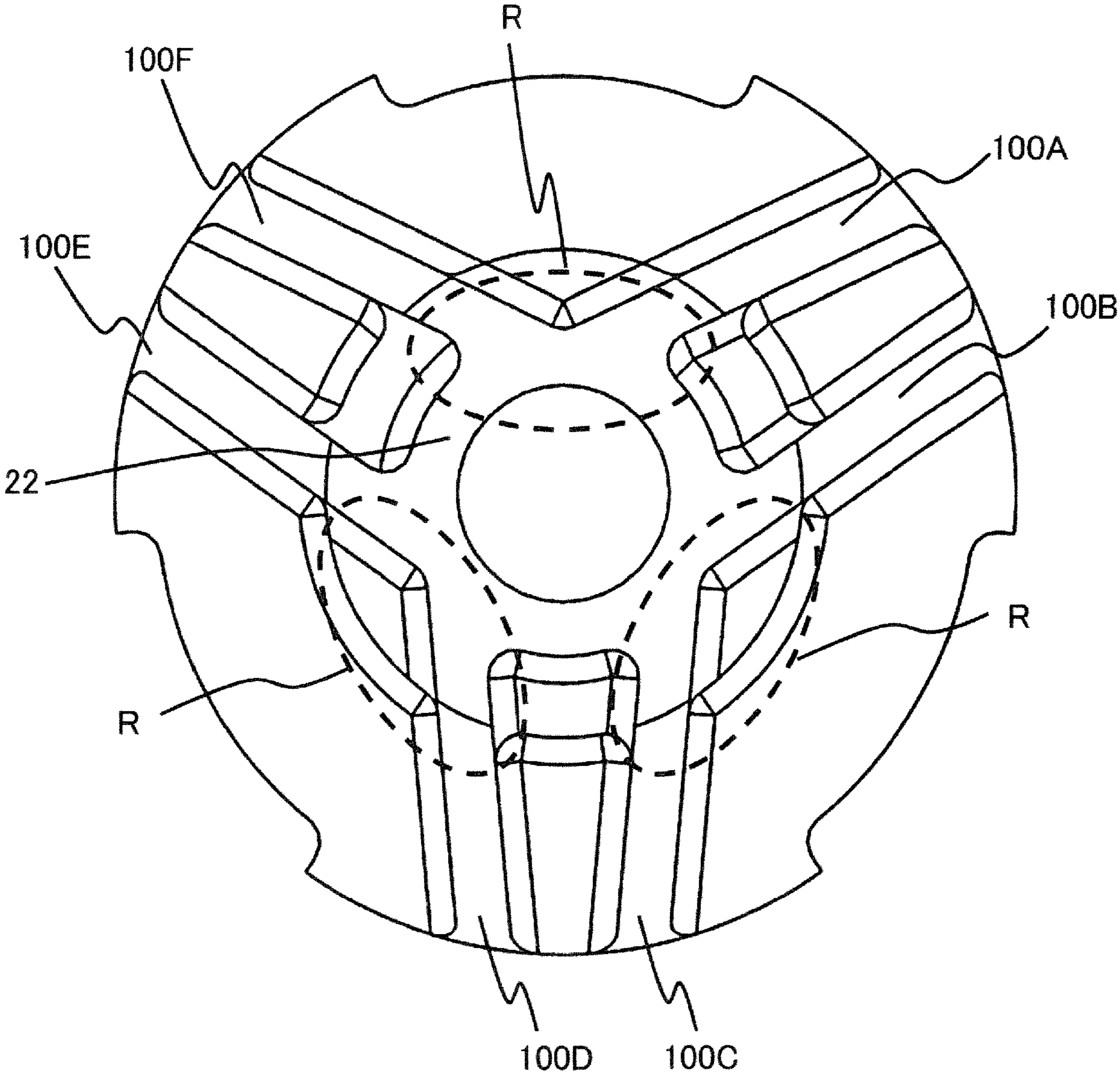


FIG. 33

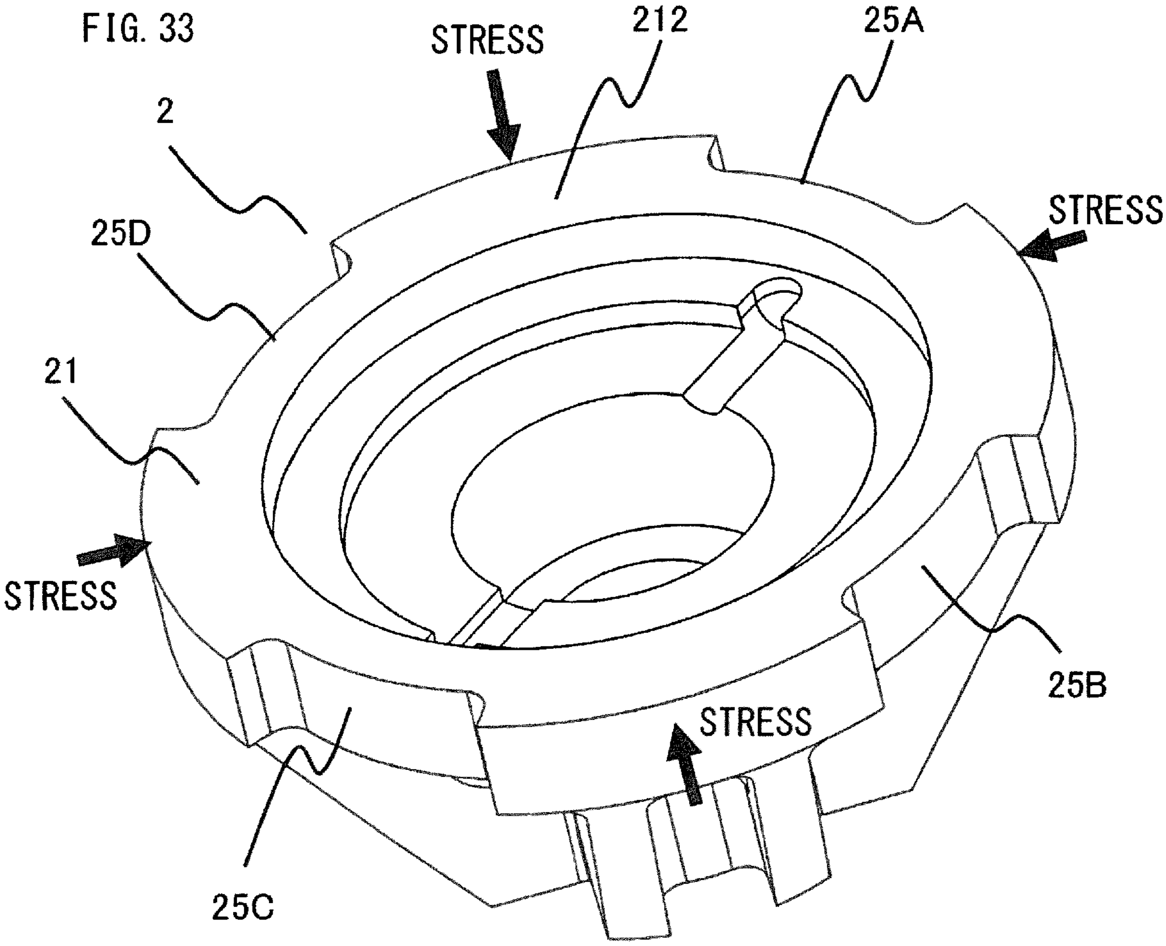


FIG. 34

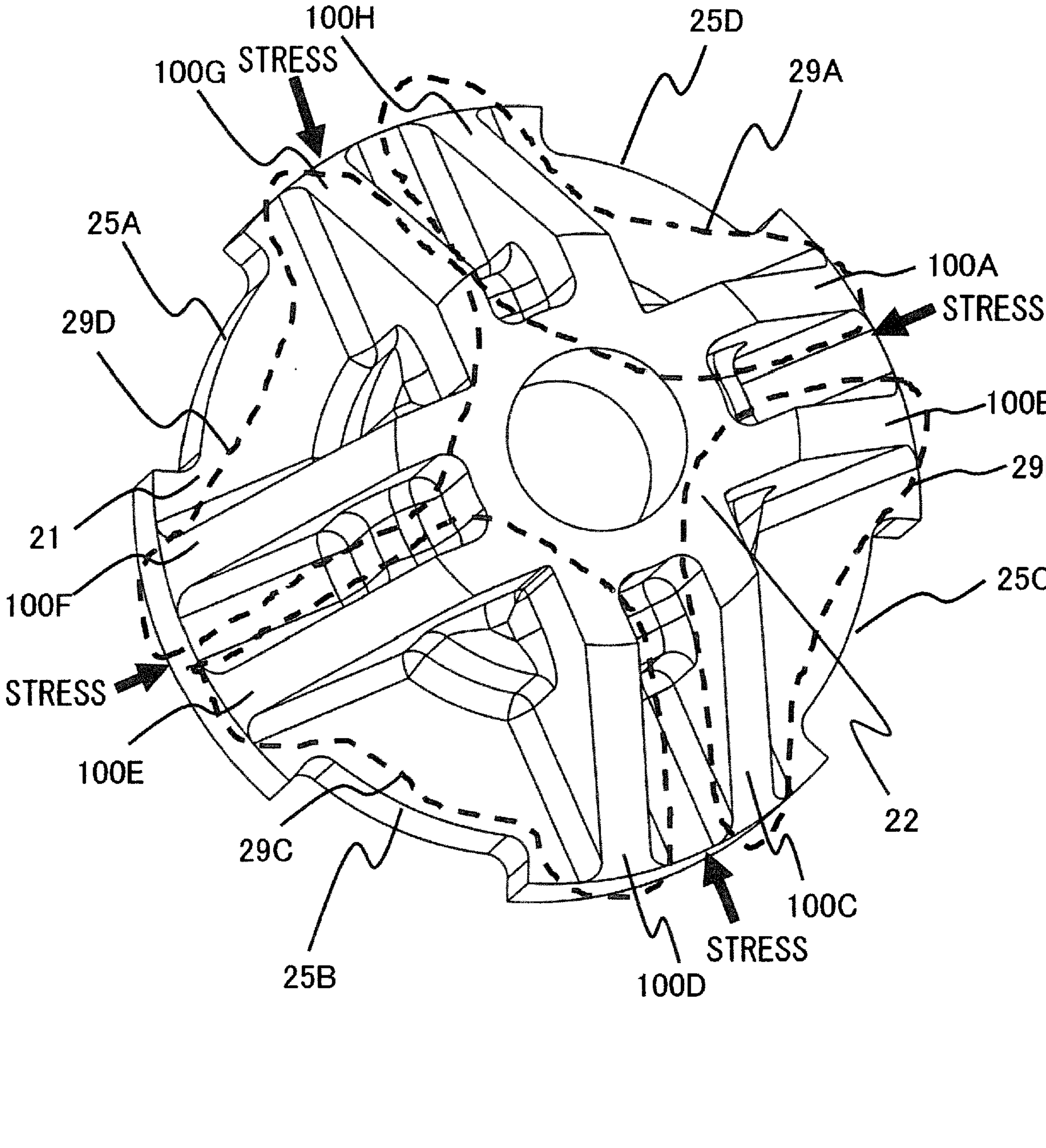
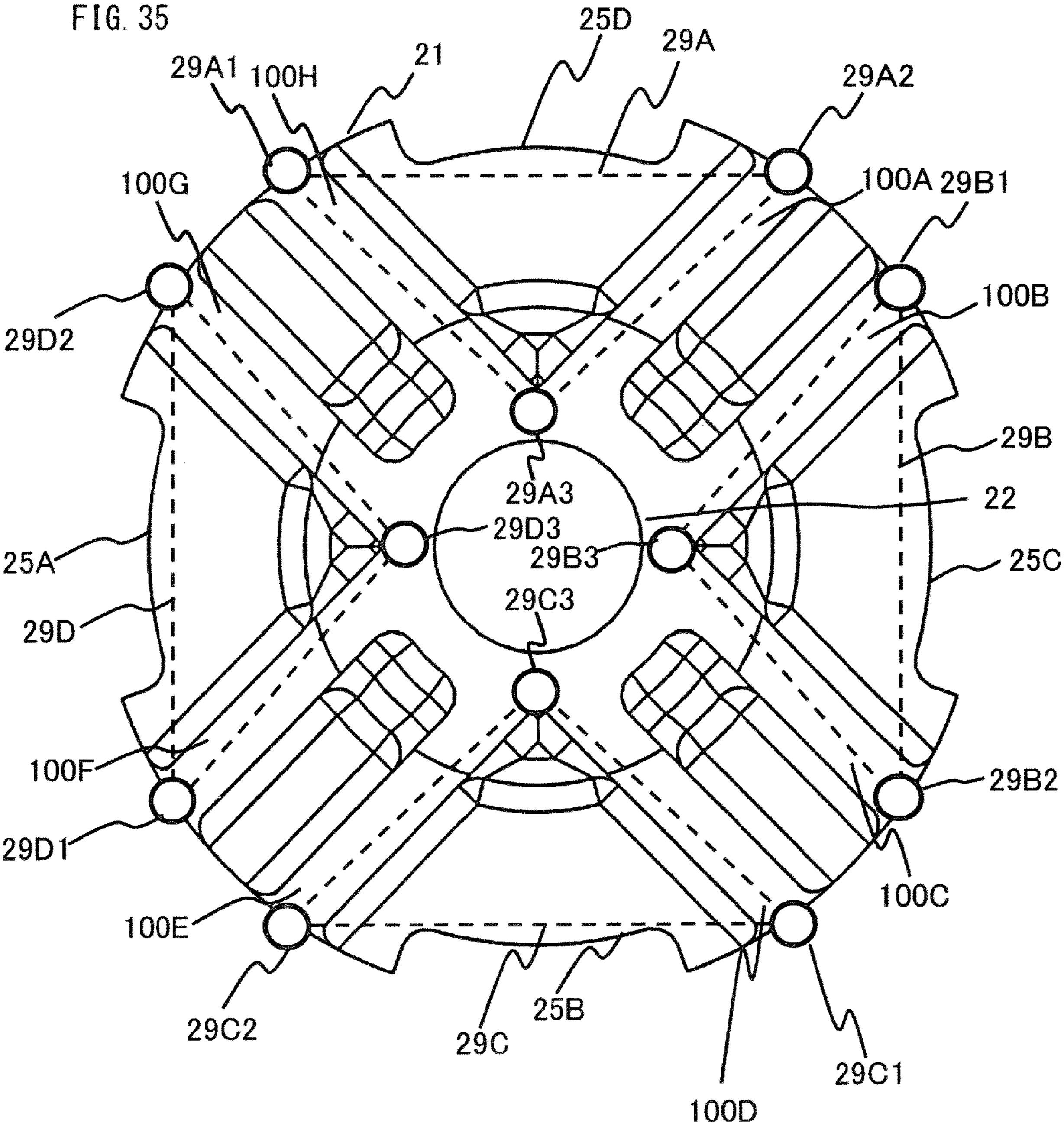

100H
25D
100G
STRESS
29A
25A
100A
STRESS
29D
100B
29B
21
25C
100F
STRESS
100E
22
29C
100C
25B
STRESS
100D

FIG. 35


25D
29A
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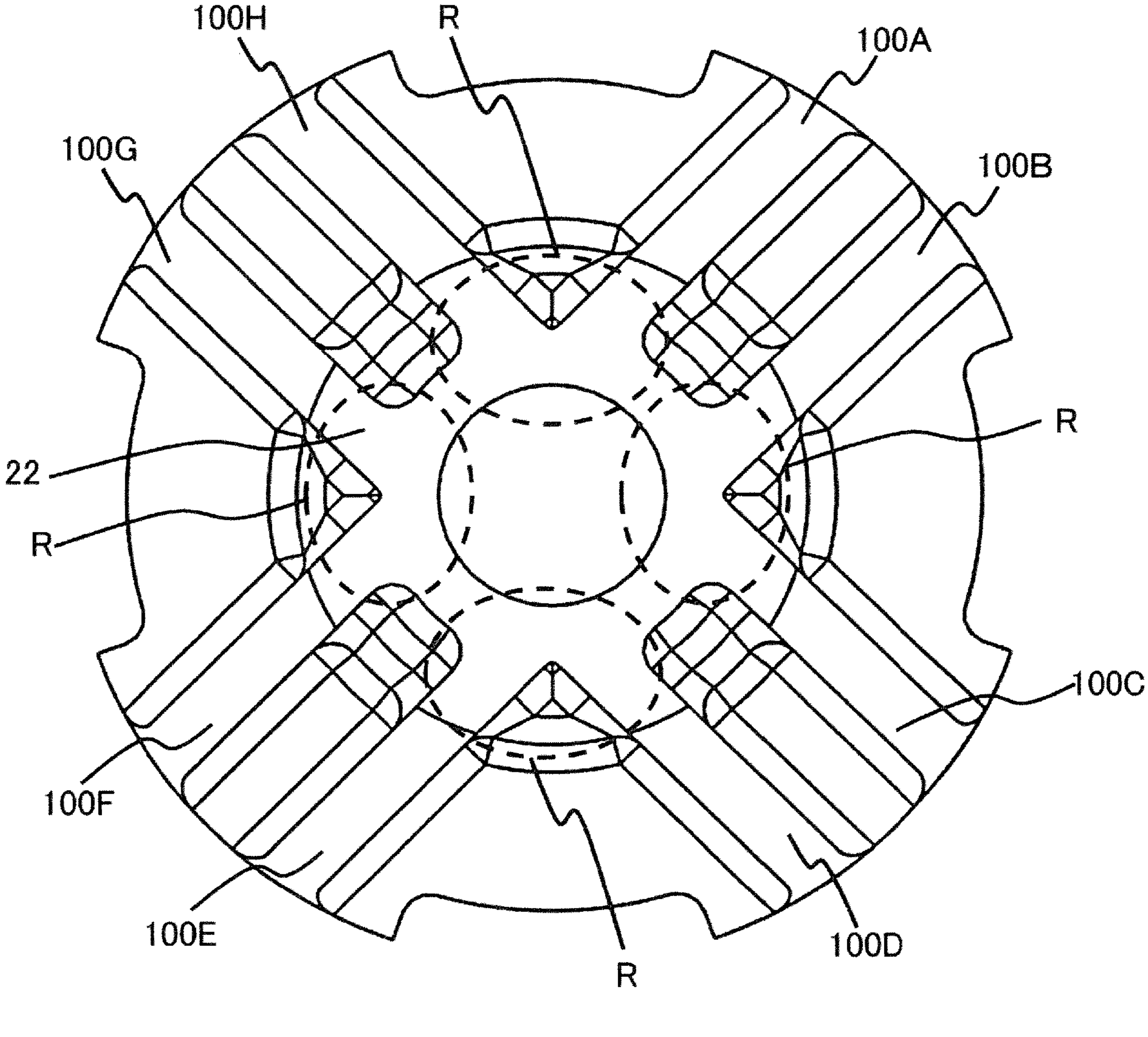
29A1
100H
29A2
100G
100A
29B1
29D2
100B
29B
29A3
22
29D3
25A
29B3
25C
29C3
29D
100F
29B2
29D1
100C
100E
29C2
29C
25B
29C1
100D

FIG. 36



DESCRIPTION

TITLE OF THE INVENTION:

SCROLL COMPRESSOR

TECHNICAL FIELD

[0001] The present disclosure relates to a scroll compressor.

BACKGROUND ART

[0002] One example of conventional scroll compressors has a stator fixed at a center part inside a shell, a main frame fixed at an upper part inside the shell, and a sub frame fixed at a lower part inside the shell. The scroll compressor further has a crankshaft supported by the main frame and a bearing fixed to the sub frame, a rotor fixed to the crankshaft, an orbiting scroll attached to an eccentric part at an end of the crankshaft, and a fixed scroll provided so as to be opposed to the orbiting scroll and fixed to the shell. By motive power of the stator and the rotor, the crankshaft is rotated, so that the orbiting scroll swings with respect to the fixed scroll, thereby a refrigerant in a compression chamber formed by the orbiting scroll and the fixed scroll is compressed (see Patent Document 1).

CITATION LIST

PATENT DOCUMENT

[0003] Patent Document 1: WO2018/078787

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0004] In the scroll compressor described in Patent Document 1, when the main frame is fixed to a second inner wall surface of a main shell by shrink fit or the like, load is applied to the radially outermost contact surface of the main frame. As a result, stress occurs in the main frame, so that the main frame is deformed. According to the position of a suction port provided to the main frame or the like, stress distribution is biased, so that the flat surface of the main frame is deformed and the flatness of the flat surface is deteriorated. Along with this, the orbiting scroll supported on the flat surface of the main frame tilts, so that parallelism and perpendicularity between spiral bodies of the orbiting scroll and the fixed scroll are deteriorated, thus a problem exists in that assembly cannot be performed by an accurate scroll tooth tip clearance. Thus problems exist in that the sliding resistance of the orbiting scroll, the fixed scroll, and the main frame increases, and airtightness is deteriorated, thereby performance of the compressor is deteriorated. Therefore, it is necessary to suppress deterioration in the flatness of the flat surface of the main frame.

[0005] The present disclosure has been made to solve the above problem, and an object of the present disclosure is to provide a scroll compressor that can suppress deterioration in the flatness of the flat surface of the main frame.

MEANS FOR SOLVING THE PROBLEMS

[0006] A scroll compressor according to the present disclosure is as set forth in claim 1.

[0007]

EFFECT OF THE INVENTION

[0008] The scroll compressor according to the present disclosure can suppress deterioration in the flatness of a flat surface of a main frame.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] [FIG. 1] FIG. 1 is a perspective view showing a scroll compressor according to example 1.

[FIG. 2] FIG. 2 is a vertical sectional view showing the scroll compressor according to example 1.

[FIG. 3] FIG. 3 is a perspective view showing a middle shell in the scroll compressor according to example 1.

[FIG. 4] FIG. 4 is a perspective view showing a main frame in the scroll compressor according to example 1.

[FIG. 5] FIG. 5 is a perspective view showing a fixed scroll in the scroll compressor according to example 1.

[FIG. 6] FIG. 6 is a perspective view showing an orbiting scroll in the scroll compressor according to example 1.

[FIG. 7] FIG. 7 is a perspective view showing an Oldham ring in the scroll compressor according to example 1.

[FIG. 8] FIG. 8 is a perspective view showing a crankshaft in the scroll compressor according to example 1.

[FIG. 9] FIG. 9 is a perspective view showing a bush in the scroll compressor according to example 1.

[FIG. 10] FIG. 10 is a sectional view showing part K in FIG. 2.

[FIG. 11] FIG. 11 is an enlarged view of part A in FIG. 10.

[FIG. 12] FIG. 12 is an enlarged view of part B in FIG. 10.

[FIG. 13] FIG. 13 is an enlarged perspective view showing a projection part.

[FIG. 14] FIG. 14 is an enlarged perspective view showing a projection part.

[FIG. 15] FIG. 15 is a sectional view showing part K in FIG. 2.

[FIG. 16] FIG. 16 is an enlarged sectional view showing a part about the main frame and the orbiting scroll.

[FIG. 17] FIG. 17 is an enlarged sectional view showing a part about the main frame and the orbiting scroll.

[FIG. 18] FIG. 18 is an enlarged sectional view showing a part about the main frame and the orbiting scroll.

[FIG. 19] FIG. 19 is an enlarged sectional view showing a part about the main frame and the orbiting scroll.

[FIG. 20] FIG. 20 is a plane view showing the main frame.

[FIG. 21] FIG. 21 is a sectional view taken along a plane passing X axis in FIG. 20.

[FIG. 22] FIG. 22 is a plane view showing the main frame.

[FIG. 23] FIG. 23 is a plane view showing the main frame.

[FIG. 24] FIG. 24 is a plane view showing the main frame.

[FIG. 25] FIG. 25 is a plane view showing the main frame.

[FIG. 26] FIG. 26 is a plane view showing a main frame in a scroll compressor according to embodiment 1.

[FIG. 27] FIG. 27 is a sectional view taken along a plane passing X axis in FIG. 26.

[FIG. 28] FIG. 28 is a sectional view showing the main frame.

[FIG. 29] FIG. 29 is a perspective view of the main frame as seen from one end side.

[FIG. 30] FIG. 30 is a perspective view of the main frame as seen from the other end side.

[FIG. 31] FIG. 31 is a plane view of the main frame as seen from the other end side.

[FIG. 32] FIG. 32 is a plane view of the main frame as seen from the other end side.

[FIG. 33] FIG. 33 is a perspective view of the main frame as seen from one end side.

[FIG. 34] FIG. 34 is a perspective view of the main frame as seen from the other end side.

[FIG. 35] FIG. 35 is a plane view of the main frame as seen from the other end side.

[FIG. 36] FIG. 36 is a plane view of the main frame as seen from the other end side.

EMBODIMENTS FOR CARRYING OUT THE INVENTION

[0010] Example 1

The present example relates to a scroll compressor, and in particular, relates to the structure of a main frame which is a component of the scroll compressor.

Hereinafter, example 1 will be described with reference to the drawings. FIG. 1 is a perspective view showing the scroll compressor, FIG. 2 is a vertical sectional view showing the scroll compressor, FIG. 3 is a perspective view showing a middle shell in the scroll compressor, FIG. 4 is a perspective view showing the main frame, and FIG. 5 is a perspective view showing a fixed scroll as seen from the lower side. FIG. 6 is a perspective view showing an orbiting scroll, FIG. 6A is a perspective view of the orbiting scroll as seen from the upper side and FIG. 6B is a perspective view of the orbiting scroll as seen from the lower side. FIG. 7 is a perspective view showing an Oldham ring, FIG. 8 is a perspective view showing a crankshaft, and FIG. 9 is a perspective view showing a bush. The compressor shown in FIG. 1 is a so-called vertical-type scroll compressor used in a state in which the center axis of the crankshaft is substantially perpendicular to the ground surface.

[0011] The scroll compressor includes a shell 1, a main frame 2, a compression mechanism portion 3, a drive mechanism portion 4, a sub frame 5, a crankshaft 6, a bush 7, and a power supply portion 8. In the following description, using the main frame 2 as a criterion, the side in which the compression mechanism portion 3 is provided (upper side) is defined as one end side, and the side in which the drive mechanism portion 4 is provided (lower side) is defined as another end side.

The shell 1 is a housing made of metal and closed at both ends, and is composed of a middle shell 11, an upper shell 12, and a lower shell 13. The middle shell 11 is formed into a cylindrical shape, and a suction pipe 14 is connected to the side wall thereof by welding or the like. The suction pipe 14 is a pipe for introducing a refrigerant into the shell 1, and communicates with the inside of the middle shell 11.

[0012] The upper shell 12 is formed into substantially a hemisphere shape, a part of the side wall thereof is connected to the upper end of the middle shell 11 by welding or the like, and the upper shell 12 covers the upper opening of the middle shell 11. A discharge pipe 15 is connected to an upper part of the upper shell 12 by welding or the like. The discharge pipe 15 is a pipe for discharging the refrigerant to the outside of the shell 1, and communicates with the internal space of the middle shell 11. The lower shell 13 is formed into substantially a hemisphere shape, a part of the side wall thereof is connected to the lower end of the middle shell 11 by welding or the like, and the lower shell 13 covers the lower opening of the middle shell 11. The shell 1 is supported by a stationary base 16 having a plurality of screw holes. In the stationary base 16, a plurality of screw holes are formed and screws are screwed into the screw holes, whereby the scroll compressor can be fixed to another member such as a housing of an outdoor unit.

[0013] As shown in FIG. 4, the main frame 2 is made of metal such as cast iron, and is formed as a hollow frame having a cavity therein. The main frame 2 is provided inside the shell 1. The main frame 2 includes a body portion 21, a main bearing portion 22, and an oil return pipe 23. The body portion 21 is fixed to the inner wall surface on the one end side of the middle shell 11, and has, at a center part, a storage space 211 formed along the longitudinal direction of the shell 1. The storage space 211 opens on the one end side and has a step shape so that the space is narrowed toward the other end side. The body portion 21 has, on the one end side, an annular flat surface 212 surrounding the storage space 211. On the flat surface 212, a ring-shaped thrust plate 24 (see FIG. 10) made of a steel-plate material such as valve steel is provided. Therefore, in the present example, the thrust plate 24 acts as a thrust bearing.

[0014] Since the thrust plate 24 acts as a thrust bearing, a rotation stopper for suppressing rotation is needed. Although not shown here, for example, the flat surface 212 of the main frame 2 may be provided with projections thinner than the thickness of the thrust plate 24, whereby rotation of the thrust plate 24 can be suppressed. Further, a structure in which the main frame 2 has grooves, the thrust plate 24 has projections, and both components are fitted to each other, may be adopted. At a position in which the thrust plate 24 does not overlap on the outer end side of the flat surface 212 of the main frame 2, a suction port 213 is formed. The suction port 213 is a space penetrating the body portion 21 in the up-down direction, i.e., between the upper shell 12 side and the lower shell 13 side. In FIG. 4, a case of providing two suction ports 213 and two oil return pipes 23 is shown, but the numbers thereof are not limited thereto. In addition, the suction ports 213 are shown as through holes, but they may be formed as cutouts in which the outer wall is partially removed.

[0015] The main frame 2 has an Oldham storage portion 214 at a step part on the other end side with respect to the flat surface 212. At the Oldham storage portion 214, a first Oldham groove 215 is formed. A part of the first Oldham groove 215 on the outer end side is formed such that the inner end side of the flat surface 212 is cut out. Thus, when the main frame 2 is seen from the one end side, the first Oldham groove 215 partially overlaps the thrust plate 24. Paired two first Oldham grooves 215 are formed so as to be opposed to each other. The main bearing portion 22 is continuously formed on the other end side of the body portion 21 and has a shaft hole 221 therein. The shaft hole 221 penetrates the main bearing portion 22 in the up-down direction, and the one end side thereof communicates with the storage space 211. The oil return pipe 23 is a pipe for returning lubricant oil stored in the storage space 211 to an oil reservoir provided inside the lower shell 13, and is inserted and fixed into an oil discharge hole formed so as to penetrate the main frame 2 between the inner side and the outer side.

[0016] The lubricant oil is refrigerant oil containing ester-based synthetic oil, for example. The lubricant oil is stored at the lower part of the shell 1, i.e., in the lower shell 13. The lubricant oil is sucked by an oil pump 52 described later and passes through an oil passage 63 provided in the crankshaft 6. And the lubricant oil reduces wear between mechanically contacting members of the compression mechanism portion 3 and the like, adjusts the temperatures of sliding parts, and improves sealing property. It is Preferable that the lubricant oil is high in lubrication property, electric insulation property, stability, refrigerant solubility, low-temperature fluidity, and the like, and has an appropriate viscosity.

[0017] The compression mechanism portion 3 is a compression mechanism for compressing the refrigerant. The compression mechanism portion 3 is a scroll compression mechanism including a fixed scroll 31 and an orbiting scroll 32. As shown in FIG. 2 and FIG. 5, the fixed scroll 31 is made of metal such as cast iron, and includes a first base plate 311 and a first spiral body 312. The first base plate 311 is formed into a disk shape, and has a discharge port 313 penetrating in the up-down direction at the center. The first spiral body 312 protrudes from the surface on the other end side of the first base plate 311 so as to form a spiral wall, and the tip of the spiral wall protrudes toward the other end side.

[0018] As shown in FIG. 6A and FIG. 6B, the orbiting scroll 32 is made of metal such as aluminum, and includes a second base plate 321, a second spiral body 322, a cylindrical portion 323, and a second Oldham groove 324. The second base plate 321 is formed into a disk shape having one surface on which the second spiral body 322 is formed, another surface whose outer circumferential area serves, at least partially, as a sliding surface 3211, and a side surface 3212 located at the radially outermost side and connecting the one surface and the another surface. The sliding surface 3211 on the another surface is slidable against the thrust plate 24, and is supported (borne) by the main frame 2.

[0019] The second spiral body 322 protrudes from the one surface of the second base plate 321 so as to form a spiral wall, and the tip of the spiral wall protrudes toward the one end side. At the tips of the first spiral body 312 of the fixed scroll 31 and the second spiral body 322 of the orbiting scroll 32, seal members for suppressing leakage of the refrigerant are provided. The cylindrical portion 323 is a cylindrical boss protruding from substantially the center of the other surface of the second base plate 321 toward the other end side. On the inner circumferential surface of the cylindrical portion 323, a swing bearing (so-called journal bearing) for rotatably supporting a slider 71 described later is provided such that the center axis of the bearing is parallel with the center axis of the crankshaft 6.

[0020] The second Oldham groove 324 is formed at the another surface of the second base plate 321, and is a rectangular-shaped groove with one surface formed into an arc shape. Paired two second Oldham grooves 324 are provided so as to be opposed to each other. A line connecting the paired two second Oldham grooves 324 is set to be perpendicular to a line connecting the paired two first Oldham grooves 215.

[0021] An Oldham ring 33 is disposed in the Oldham storage portion 214 provided in the main frame 2. As shown in FIG. 7, the Oldham ring 33 includes a ring portion 331, a first key portion 332, and a second key portion 333. The ring portion 331 is formed into a ring shape. On the surface on the other end side of the ring portion 331, paired two first key portions 332 are formed so as to be opposed to each other. And they are stored in the paired two first Oldham grooves 215 of the main frame 2. On the surface on the one end side of the ring portion 331, paired two second key portions 333 are formed so as to be opposed to each other. And they are stored in the paired two second Oldham grooves

324 of the orbiting scroll 32.

[0022] When the orbiting scroll 32 revolves and orbits along with rotation of the crankshaft 6, the first key portions 332 slide in the first Oldham grooves 215 and the second key portions 333 slide in the second Oldham grooves 324, whereby the Oldham ring 33 prevents the orbiting scroll 32 from rotating. The first spiral body 312 of the fixed scroll 31 and the second spiral body 322 of the orbiting scroll 32 are meshed with each other, whereby a compression chamber 34 is formed. The volume of the compression chamber 34 is reduced from the outer side toward the inner side in the radial direction, and thus the refrigerant is gradually compressed while moving to the center side after sucked from the outer side of the spiral body.

[0023] The compression chamber 34 communicates with the discharge port 313, at a center part of the fixed scroll 31. On the surface on the one end side of the fixed scroll 31, a muffler 35 having a discharge hole 351 is provided, and a discharge valve 36 which opens/closes the discharge hole 351 in a predetermined case in order to prevent reverse flow of the refrigerant is provided. Examples of the refrigerant are halogenated hydrocarbon having a double bond of carbon in the composition, halogenated hydrocarbon not having a double bond of carbon, hydrocarbon, and a mixture containing these. As the halogenated hydrocarbon having a double bond of carbon, there are a HFC refrigerant and a fluorocarbon-based low-GWP refrigerant whose the ozone depletion potential is zero, and an example thereof is tetrafluoropropene such as HFO1234yf, HFO1234ze, or HFO1243zf, represented by a chemical formula C3H2F4. Examples of the halogenated hydrocarbon not having a double bond of carbon are a refrigerant of R32 (difluoromethane) represented by CH2F2, and a refrigerant in which R41 and the like is mixed. Examples of the hydrocarbon are propane and propylene which are natural refrigerants. Examples of the mixture are mixed refrigerants obtained by mixing R32, R41, etc. in HFO1234yf, HFO1234ze, HFO1243zf, etc.

[0024] The drive mechanism portion 4 is provided on the other end side with respect to the main frame 2 inside the shell 1. The drive mechanism portion 4 includes a stator 41 and a rotor 42. For example, the stator 41 is formed by winding wires, with an insulating layer interposed, around a core composed of a plurality of stacked electromagnetic steel sheets, and is formed into a ring shape. The stator 41 is fixed and supported inside the middle shell 11 by shrink fit or the like. The rotor 42 is formed such that permanent magnets are provided inside a core composed of a plurality of stacked electromagnetic steel sheets, and is formed into a cylindrical shape having a through hole penetrating in the up-down direction at the center. The rotor 42 is provided in the internal space of the stator 41.

[0025] The sub frame 5 is a frame made of metal such as cast iron, and is provided on the other end side with respect to the drive mechanism portion 4 inside the shell 1. The sub frame 5 is fixed and supported on the inner circumferential surface on the other end side of the middle shell 11 by shrink fit, welding, or the like. The sub frame 5 includes a sub bearing portion 51 and the oil pump 52. The sub bearing portion 51 is a ball bearing provided on the upper side at a center part of the sub frame 5, and has a hole penetrating in the up-down direction at the center. The oil pump 52 is provided on the lower side at a center part of the sub frame 5, and is disposed so as to be at least partially immersed in the lubricant oil stored in the oil reservoir of the shell 1. In FIG. 2, a ball bearing is shown as the sub bearing portion 51. However, this may be a journal bearing, for example.

[0026] As shown in FIG. 8, the crankshaft 6 is a metal member having a long rod shape, and is provided inside the shell 1. The crankshaft 6 includes a main shaft portion 61, an eccentric shaft portion 62, and the oil passage 63. The main shaft portion 61 is a shaft forming a major part of the crankshaft 6, and is provided such that the center axis thereof coincides with the center axis of the middle shell 11. The rotor 42 is fixed in contact with the outer side surface of the main shaft portion 61. The eccentric shaft portion 62 is provided on the one end side of the main shaft portion 61 such that the center axis of the eccentric shaft portion 62 is eccentric with respect to the center axis of the main shaft portion 61. The oil passage 63 is provided so as to penetrate in the up-down direction inside the main shaft portion 61 and the eccentric shaft portion 62. Regarding the crankshaft 6, one end side of the main shaft portion 61 is inserted into the main bearing portion 22 of the main frame 2, and the other end side is inserted and fixed into the sub bearing portion 51 of the sub frame 5. Thus, the eccentric shaft portion 62 is provided in the cylinder of the cylindrical portion 323 of the orbiting scroll 32. The outer circumferential surface of the rotor 42 and the inner circumferential surface of the stator 41 are disposed with a predetermined gap therebetween. A first balancer 64 is provided on the one end side of the main shaft portion 61, and a second balancer 65 is provided on the other end side, in order to cancel out imbalance due to swing of the orbiting scroll 32.

[0027] As shown in FIG. 9, the bush 7 is made of metal such as iron, and is a connection member for connecting the orbiting scroll 32 and the crankshaft 6. The bush 7 is composed of two components in FIG. 9, i.e., includes a slider 71 and a balance weight 72. The slider 71 is a cylindrical member having a flange, and is fitted to each of the eccentric shaft portion 62 and the cylindrical portion 323. The balance weight 72 is a doughnut-shaped member having a weight portion 721 whose shape as seen from the one end side is substantially a C shape. The balance weight 72 is eccentrically provided with respect to the rotation center in order to cancel out the centrifugal force of the orbiting scroll 32. The balance weight 72 is, for example, fitted to the flange of the slider 71 by shrink fit or the like. The bush 7 may be formed as one component by being cut by mechanical working and the like such that the slider 71 and the balance weight 72 are integrally formed.

[0028] As shown in FIG. 2 and FIG. 3, the power supply portion 8 is a power supply member for supplying power to the scroll compressor, and is formed on the outer circumferential surface of the middle shell 11 of the shell 1. The power supply portion 8 includes a cover 81, a power supply terminal 82, and a wire 83. The cover 81 is a bottomed cover member having an opening. The power supply terminal 82 is a metal member, with one side provided inside the cover 81 and another side provided inside the shell 1. One side of the wire 83 is connected to the power supply terminal 82 and another side is connected to the stator 41.

[0029] FIG. 10 is a sectional view showing part K in FIG. 2. FIG. 11 is an enlarged view of part A in FIG. 10, and FIG. 12 is an enlarged view of part B in FIG. 10. In FIG.

10, the middle shell 11 has a first protrusion portion 112 protruding in the radial direction from a first inner wall surface 111. The middle shell 11 has a first positioning surface 113 which is an end surface facing the upper shell 12 side of the first protrusion portion 112 and comes in contact with the first base plate 311 of the fixed scroll 31 in order to determine the axial-direction position of the fixed scroll 31. The middle shell 11 has a second inner wall surface 114 which is the inner wall surface of the first protrusion portion 112, and a second protrusion portion 115 further protruding in the radial direction from the first protrusion portion 112. The middle shell 11 has a second positioning surface 116 which is an end surface facing the upper shell 12 side of the second protrusion portion 115 and comes in contact with the body portion 21 of the main frame 2 in order to determine the axial-direction position of the main frame 2. And the middle shell 11 has a third inner wall surface 117 which is the inner wall surface of the second protrusion portion 115.

[0030] That is, the middle shell 11 has a stepwise part such that the inner diameter is reduced toward the other end side. The first positioning surface 113 and the second positioning surface 116 are formed so as to be substantially perpendicular to the center axis of the crankshaft 6, and the normal vectors of both positioning surfaces are set so as to be directed in the same direction. As shown in FIG. 3, the first protrusion portion 112 has a groove 118 which is fitted to a projection 314 of the fixed scroll 31 and a projection 216 of the main frame 2 described later and determines the phases of both components. The end on the upper shell 12 side of the groove 118 has a chamfered part 1181 formed by C chamfering (cutting the corner in an isosceles right triangle shape) or R chamfering (chamfering in an arc shape), so that the width of the groove is gradually narrowed from the end. Thus, the chamfered part 1181 serves as a guide so that the projection 216 of the main frame 2 and the projection 314 of the fixed scroll 31 are easily guided. Whereby assembly can be easily performed and assemblability of the compressor is improved.

[0031] A recess 1131 is formed at a corner in which the first positioning surface 113 and the first inner wall surface 111 intersect each other, and a recess 1161 is formed at a corner in which the second positioning surface 116 and the second inner wall surface 114 intersect each other. Thus, the fixed scroll 31 and the main frame 2 can be assuredly brought into contact with the respective positioning surfaces. When manufacturing the middle shell 11 as a welded steel tube, a plate steel material is formed into a tube shape by rolling or pressing, thereafter the seam is connected by welding so as to become a steel tube. In this case, if the groove 118 is formed at a part other than the welded seam part, the groove can be formed without losing reliability of the middle shell 11.

[0032] As shown in FIG. 4, the main frame 2 has the projection 216 protruding in the radial direction from the outer circumference of the body portion 21. FIG. 13 is an enlarged perspective view showing a projection part. The end on the lower shell 13 side of the projection 216 has a chamfered portion 2161 formed by C chamfering or R chamfering, so that the projection width is gradually expanded from the end. The projection 216 is fitted to the groove 118 formed on the middle shell 11, thereby the phase of the main frame 2 is determined. In addition, the body portion 21 of the main frame 2 is brought into contact with the second positioning surface 116 formed on the middle shell 11, thereby the axial-direction position of the main frame 2 is determined. Further, in this state, the main frame 2 is fixed to the second inner wall surface 114 or the third inner wall surface 117 of the middle shell 11 by press fit or shrink fit, thereby the center position is determined. If a retention force is insufficient, arc spot welding or the like may be further performed. Thus, the main frame 2 can be retained in the middle shell 11 in the state in which the center position, the axial-direction height position, and the phase are determined with respect to the middle shell 11.

[0033] As shown in FIG. 5, the fixed scroll 31 has the projection 314 protruding toward the lower shell 13 side from the surface of the first base plate 311 on the side in which the first spiral body 312 is formed. FIG. 14 is an enlarged perspective view showing a projection part. The end on the lower shell 13 side of the projection 314 has a chamfered portion 3141 formed by C chamfering or R chamfering, so that the width of the projection is gradually expanded from the end. The projection 314 is fitted to the groove 118 formed in the middle shell 11, thereby the phase of the fixed scroll 31 is determined. In addition, as shown in FIG. 10, the surface of the first base plate 311 of the fixed scroll 31 on the side in which the first spiral body 312 is formed is brought into contact with the first positioning surface 113 formed in the middle shell 11, thereby the axial-direction position of the fixed scroll 31 is determined. Further, in this state, a side surface 3111 of the first base plate 311 is fixed to the first inner wall surface 111 of the middle shell 11 by shrink fit, thereby the center position is determined. Thus, the fixed scroll 31 can be retained in the middle shell 11 in the state in which the center position, the axial-direction height position, and the phase are determined with respect to the middle shell 11. In addition, a function of separating a high pressure and a low pressure inside the shell 1 is imparted to the fixed scroll 31.

Therefore, it is necessary to apply a pressure to the side surface 3111 of the first base plate 311 of the fixed scroll 31 and the first inner wall surface 111 of the middle shell 11 over the entire circumference by shrink fit, so that the refrigerant will not leak. Accordingly, the shrink-fit position exists in parts of the first inner wall surface 111 in which the groove 118 is not formed.

[0034] Next, a method for adjusting the clearance between each spiral body tip and each base plate of the fixed scroll 31 and the orbiting scroll 32 (teeth tip clearance) will be described with reference to FIG. 15. FIG. 15 is a sectional view showing part K in FIG. 2 that is the same as FIG. 10, and shows the dimensions of the respective parts. The dimensions of the respective parts are set as follows, and then a teeth tip clearance Q can be represented by the following expression.

L: the distance between the first positioning surface 113 and the second positioning surface 116

M: the distance between the first positioning surface 113 and the tip of the first spiral body 312

N: the thickness of the second base plate 321 of the orbiting scroll 32

T: the thickness of the thrust plate 24

P: the distance between the second positioning surface 116 and the flat surface 212

Q: the teeth tip clearance

L = M + Q + N + T + P

Thus, Q = L - M - N - T - P is obtained.

[0035] Here, if the dimensions of the respective parts are known by measuring, it is possible to obtain a desired teeth tip clearance Q by adjusting the thickness T of the thrust plate 24 for which most types of and a largest number of products can be produced. Here, the teeth tip clearance Q to be desired is approximately 71 ± 5 μm. However, this value is a value of a representative type, and the desired value varies among types.

By such adjustment, it is possible to prevent the refrigerant from passing through the clearance between each spiral body tip and each base plate, and leaking into an adjacent compression space. Thus loss of the scroll compressor can be reduced.

[0036] Next, a mechanism of deformation of the main frame 2 in fixing the middle shell 11 and the main frame 2 will be described with reference to FIG. 16 to FIG. 19. FIG. 16 to FIG. 19 are enlarged sectional views showing a part about the main frame 2 and the orbiting scroll 32. Z axis 28 shown in FIG. 16 to FIG. 19 is a straight line perpendicular to the flat surface 212 of the main frame 2 and passing the center of the outer circumferential part in which stress F occurs. In FIG. 16, the orbiting scroll 32 is disposed on the main frame 2. In this state, as shown in FIG. 16, stress F due to shrink fit of the middle shell 11 occurs in the surface of the outer circumferential part of the main frame 2, so that the flat surface 212 of the main frame 2 is deformed as shown in FIG. 17. FIG. 17 shows deformation of the main frame 2 in a case in which the suction port 213 as a part having low rigidity against a bending moment due to stress F generated by compressive load applied in the radial direction is present on one side of Z axis 28. Other than the suction port 213, an example of a part 25 having low rigidity in comparison with other constituent parts of the main frame 2 is a necessary pin hole for positioning in working, a hole for suppressing whirling in vibration, the Oldham groove, a hole for determining the phase of the fixed scroll, or the like.

[0037] FIG. 18 and FIG. 19 show deformation of the main frame 2 in a case in which parts 25 having low rigidity are present on both sides of Z axis 28. In comparison with the flatness of the flat surface 212 of the deformed main frame 2 in the case in which the part 25 having low rigidity is present on one side of Z axis 28 as shown in FIG. 17, the flatness of the flat surface 212 of the deformed main frame 2 in the case in which the parts 25 having low rigidity are present on both sides of Z axis 28 as shown in FIG. 19 is improved. Therefore, in the case in which the flat surface

212 of the main frame 2 is defined as a reference plane, the tilt of the orbiting scroll 32 with respect to the flat surface 212 when the orbiting scroll 32 is provided on the main frame 2 becomes smaller. Thus, assembly can be performed with an accurate teeth tip clearance Q, whereby leakage into an adjacent compressive space can be suppressed and loss of the scroll compressor can be reduced.

In addition, since deterioration in the flatness of the flat surface 212 of the main frame 2 can be suppressed, increase in the sliding resistance of the orbiting scroll 32 can be suppressed and deterioration in performance of the scroll compressor can be suppressed.

[0038] Next, arrangement of parts 25 having low rigidity of the main frame 2 in the structure of the main frame 2 will be described with reference to FIG. 20 and FIG. 21. FIG. 20 is a plane view showing the main frame, and FIG. 21 is a sectional view taken along a plane passing X axis 26 in FIG. 20. Z axis 28 is a straight line perpendicular to the flat surface 212 of the main frame 2 and passing the center of the outer circumferential surface of the main frame 2. Y axis 27 is a straight line passing the centers of the first Oldham grooves 215 and crossing Z axis 28. X axis 26 is a straight line perpendicular to Y axis 27 and crossing Z axis 28.

[0039] In a case in which a first part 251 having low rigidity of the main frame 2 is provided over the second quadrant and the third quadrant, a second part 252 having low rigidity is provided over the first quadrant and the fourth quadrant. In FIG. 20, a pair of parts 251, 252 having low rigidity are present at positions symmetric with respect to Y axis 27 and are opposed to each other on both sides of Z axis 28 which is the center axis of the main frame 2. That is, two parts having low rigidity, i.e., the first part 251 having low rigidity and the second part 252 having low rigidity are provided on both left and right sides with respect to Y axis (first axis line) which is the straight line passing the centers of the first Oldham grooves 215 and crossing Z axis 28. And when the straight line perpendicular to Y axis 27 and crossing Z axis 28 which is the straight line passing the center of the outer circumferential surface of the main frame 2 is defined as X axis 26 (second axis line), the first part 251 having low rigidity and the second part 252 having low rigidity are disposed across X axis 26.

In FIG. 20, the parts 251, 252 having low rigidity of the main frame 2 are shown in the same shape. However, they may be asymmetric with respect to X axis 26 and Y axis 27, the shape thereof may be different, and the number thereof may be different.

For example, as shown in FIG. 22, holes 220 may be provided. Further, they may be formed asymmetrically with respect to X axis 26 or Y axis 27, in contrast with the shape of the part 25 having low rigidity. Further, the shape or the number thereof may be set to be different.

[0040] The shape of the part 25 having low rigidity may be a hole, a notch, a groove, or the suction port 213. FIG. 23 is a plane view showing a case of providing notches 230. FIG. 24 is a plane view showing a case of providing holes 240. FIG. 25 is a plane view showing a case of providing grooves 250. These are provided in order to suppress deterioration in the flatness of the flat surface 212 of the main frame 2.

In a case in which the parts 25 having low rigidity are the suction ports 213, in order to allow the refrigerant to pass through the main frame 2, it is desirable that a part of each suction port 213 is located on the outer side of a trajectory of the orbiting scroll 32 during swinging. This is for preventing the second base plate 321 of the orbiting scroll 32 from closing the passage of the refrigerant. That is, in a case in which the suction port 213 corresponds to the part having low rigidity, the parts 25 having low rigidity are located on the radially outer side with respect to the orbiting scroll 32.

[0041] Embodiment 1

Hereinafter, embodiment 1 will be described with reference to the drawings. FIG. 26 is a plane view showing the main frame, and FIG. 27 is a sectional view taken along a plane passing X axis in FIG. 26. In the present embodiment, regarding the structure of the main frame 2, a part 100 having high rigidity of the main frame 2 is provided. Z axis 28 is a straight line perpendicular to the flat surface 212 of the main frame 2 and passing the center of the outer circumference. Y axis 27 is a straight line passing the centers of the first Oldham grooves 215 and crossing Z axis 28. X axis 26 is a straight line perpendicular to Y axis 27 and crossing Z axis 28.

[0042] In a case in which the part 25 having low rigidity of the main frame 2 is provided over the second quadrant and the third quadrant as shown in FIG. 26, the part 100 having high rigidity is provided over the second quadrant and the third quadrant as shown in FIG. 27. As shown in FIG. 27, the thick part 100 provided along the circumferential direction over the second and third quadrants is the part having high rigidity, and this part is a rib. That is, the part 100 having high rigidity is provided at a position corresponding to the circumferential-direction position of the part 25 having low rigidity of the main frame 2. Here, the position corresponding to the circumferential-direction position is an angle range θ in which the part 25 having low rigidity is provided in FIG. 26, and the part 100 having high rigidity is provided in the same angle range θ.

Regarding the moment of inertia of area with respect to a bending moment due to stress F generated by compressive load applied in the radial direction as shown in FIG. 16, the moment of inertia of area increases in comparison with the moment of inertia of area of the cross-section in the first and fourth quadrants, so that rigidity in the second and third quadrants increases in comparison with that in the first and fourth quadrants. The part 25 having low rigidity and the part 100 having high rigidity are located at the same phase (corresponding to the same circumferential-direction position). In this case, it is necessary that their positions are only the same phase, and therefore there is a degree of freedom in the radial direction. In addition, in the same manner as the case shown in FIG. 22, the part 100 having high rigidity may be asymmetric with respect to X axis 26 and Y axis 27, the shape thereof may be different, and the number thereof may be different.

[0043] In the above description, as the part having high rigidity of the main frame 2, the rib is integrally formed with the main frame 2. However, as shown in FIG. 28, a member separate from the main frame 2 may be provided instead of the rib. FIG. 28 shows a case in which, as a separate member, a bracket 281 is attached by screws 280. Thus, also in the case of providing the part having high rigidity at such a position as to compensate for the part having low rigidity, it is possible to suppress deterioration in the flatness of the flat surface 212 of the main frame 2 in the same manner as example 1. If the parts 25 having low rigidity are present left-right symmetrically, the part having high rigidity is not required.

[0044] Embodiment 2

Hereinafter, embodiment 2 will be described with reference to the drawings. FIG. 29 is a perspective view of the main frame as seen from the one end side (see FIG. 2), FIG. 30 is a perspective view of the main frame as seen from the other end side, and FIG. 31 and FIG. 32 are plane views of the main frame as seen from the other end side. In the drawings, the main frame 2 is provided with ribs 100A, 100B, 100C, 100D, 100E, 100F which are parts having high rigidity. In the present embodiment, regarding the structure of the main frame 2, truss structures 29A, 29B, 29C are formed by the body portion 21, the main bearing portion 22, and the ribs 100A, 100B, 100C, 100D, 100E, 100F which are the parts having high rigidity of the main frame 2, as indicated by dotted lines (see FIG. 30 and FIG. 31). For example, the truss structure 29A is formed by the rib 100A, the main bearing portion 22, the rib 100F, and the body portion 21. The rib 100F and the body portion 21 are rigidly joined at a connection point 29A1. The rib 100A and the body portion 21 are rigidly joined at a connection point 29A2. The main bearing portion 22 and each of the rib 100F and the rib 100A are rigidly joined at a connection point 29A3. The truss structures 29B, 29C are also formed in the same manner. In this structure, the respective parts are rigidly joined at connection points 29A1, 29A2, ..., 29C3, thus the truss structures 29A, 29B, 29C are formed.

[0045] As shown in FIG. 30 and FIG. 31, the ribs 100A, 100B, 100C, 100D, 100E, 100F which are the parts having high rigidity are formed from the body portion 21 toward the main bearing portion 22 of the main frame 2. That is, the axial-direction one end side of each rib 100A, 100B, 100C, 100D, 100E, 100F on the body portion 21 side, corresponding to the connection part between each rib 100A, 100B, 100C, 100D, 100E, 100F and the body portion 21 of the main frame 2, connects to the part in which the main frame 2 comes in contact with the shell 1. Here, the axial direction is the vertical direction in which the compressor is installed as shown in FIG. 2. Further, the circumferential-direction position of the axial-direction one end side of each rib 100A, 100B, 100C, 100D, 100E, 100F on the body portion 21 side is present in a circumferential-direction range of the body portion 21 to which stress is applied (in FIG. 31, for example, the axial-direction one end sides of the ribs 100A, 100B on the body portion 21 side are present in a circumferential-direction range 200). Meanwhile, as shown in

FIG. 31, the circumferential-direction position of the axial-direction other end side of each rib 100A, 100B, 100C, 100D, 100E, 100F on the main bearing portion 22 side, corresponding to the connection part between each rib 100A, 100B, 100C, 100D, 100E, 100F and the main bearing portion 22 of the main frame 2, is present in a circumferential-direction range of each part 25A, 25B, 25C having low rigidity (for example, the circumferential-direction position of the axial-direction other end side of the rib 100A on the main bearing portion 22 side is present in a circumferential-direction range 300 of the part 25A having low rigidity).

[0046] Thus, it is possible to suppress deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 when the main frame 2 is fixed to the shell 1 by shrink fit or the like. That is, since the truss structures 29A, 29B, 29C are used as described above, it is possible to prevent deterioration in the flatness of the flat surface 212 of the main frame 2 even when internal stress occurs in the main frame 2. In addition, the ribs 100A and 100B are provided left-right symmetrically with respect to a center Q of the surface of the body portion 21 contacting with the shell 1. The same applies to the ribs 100C and 100D, and the ribs 100E and 100F. Thus, when the main frame 2 is fixed to the shell 1 by shrink fit or the like, deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 becomes symmetric, so that deterioration in the flatness of the flat surface 212 of the main frame 2 can be suppressed.

[0047] In this case, the truss structure 29A is formed by the body portion 21, the parts 100A, 100F having high rigidity, and the main bearing portion 22 as indicated by dotted lines. In addition, the truss structure 29B is formed by the body portion 21, the parts 100B, 100C having high rigidity, and the main bearing portion 22 as indicated by dotted lines similarly to the truss structure 29A. In addition, the truss structure 29C is formed by the body portion 21, the parts 100D, 100E having high rigidity, and the main bearing portion 22 as indicated by dotted lines similarly to the truss structures 29A, 29B. As shown in FIG. 31 and FIG. 32, in the truss structure 29A, the axial-direction other end sides of the adjacent ribs 100A and 100F on the main bearing portion 22 side connect to each other. In addition, in the truss structure 29B, the axial-direction other end sides of the adjacent ribs 100B and 100C on the main bearing portion 22 side connect to each other. Further, in the truss structure 29C, the axial-direction other end sides of the adjacent ribs 100D and 100E on the main bearing portion 22 side connect to each other.

[0048] Thus, it is possible to suppress deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 when the main frame 2 is fixed to the shell 1 by shrink fit or the like. The truss structures 29A, 29B, 29C shown in FIG. 30 and FIG. 31 are structures that can suppress a bending moment generated by internal stress occurring in the body portion 21, the parts 100A, 100B, 100C, 100D, 100E, 100F having high rigidity, and the main bearing portion 22 when stress occurs in the body portion 21 of the main frame 2. Thus, deterioration in the flatness of the flat surface 212 of the main frame 2 can be suppressed. In addition, as shown in FIG. 32, the adjacent ribs 100A and 100F are provided so as to come in contact with each other at a dotted-line part R of the main bearing portion 22. The same applies to the relationship between the ribs 100B and 100C, and the relationship between the ribs 100D and 100E.

[0049] Embodiment 3

Hereinafter, embodiment 3 will be described with reference to the drawings. FIG. 33 is a perspective view of the main frame as seen from the one end side, FIG. 34 is a perspective view of the main frame as seen from the other end side, and FIG. 35 and FIG. 36 are plane views of the main frame as seen from the other end side. In the drawings, the main frame 2 is provided with parts 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H having high rigidity. In the present embodiment, regarding the structure of the main frame 2, truss structures 29A, 29B, 29C, 29D are formed by the body portion 21, the main bearing portion 22, and the ribs 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H which are parts having high rigidity of the main frame 2, as indicated by dotted lines (see FIG. 34 and FIG. 35). For example, the truss structure 29A is formed by the rib 100A, the main bearing portion 22, the rib 100H, and the body portion 21. The rib 100H and the body portion 21 are rigidly joined at the connection point 29A1. The rib 100A and the body portion 21 are rigidly joined at the connection point 29A2. The main bearing portion 22 and each of the rib 100H and the rib 100A are rigidly joined at the connection point 29A3. The truss structures 29B, 29C, 29D are also formed in the same manner. In this structure, the respective parts are rigidly joined at connection points 29A1, 29A2, ..., 29D3, thus the truss structures 29A, 29B, 29C, 29D are formed.

[0050] As shown in FIG. 34 and FIG. 35, the ribs 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H which are the parts having high rigidity are formed from the body portion 21 toward the main bearing portion 22 of the main frame 2. That is, the axial-direction one end side of each rib 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H on the body portion 21 side, corresponding to the connection part between each rib 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H and the body portion 21 of the main frame 2, connects to the part in which the main frame 2 comes in contact with the shell 1. Here, the axial direction is the vertical direction in which the compressor is installed as shown in FIG. 2. Further, in the same manner as embodiment 2, the circumferential-direction position of the axial-direction one end side of each rib 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H on the body portion 21 side is present in a circumferential-direction range of the body portion 21 to which stress is applied.

[0051] As shown in FIG. 35, the circumferential-direction position of the axial-direction other end side of each rib 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H on the main bearing portion 22 side, corresponding to the connection part between the main bearing portion 22 side of each rib 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H and the main bearing portion 22 of the main frame 2, is present in a circumferential-direction range of each part 25A, 25B, 25C, 25D having low rigidity. Thus, it is possible to suppress deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 when the main frame 2 is fixed to the shell 1 by shrink fit or the like. That is, since the truss structures 29A, 29B, 29C, 29D are used as described above, it is possible to prevent deterioration in the flatness of the flat surface 212 of the main frame 2 even when internal stress occurs in the main frame 2.

[0052] In addition, the ribs 100A and 100B are provided left-right symmetrically with respect to the center of the surface of the body portion 21 contacting with the shell 1. The same applies to the ribs 100C and 100D, the ribs 100E and 100F, and the ribs 100G and 100H. Thus, when the main frame 2 is fixed to the shell 1 by shrink fit or the like, deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 becomes symmetric, so that deterioration in the flatness of the flat surface 212 of the main frame 2 can be suppressed. In this case, the truss structure 29A is formed by the body portion 21, the parts 100A, 100H having high rigidity, and the main bearing portion 22 as indicated by dotted lines. In addition, the truss structure 29B is formed by the body portion 21, the parts 100B, 100C having high rigidity, and the main bearing portion 22 as indicated by dotted lines similarly to the truss structure 29A. In addition, the truss structure 29C is formed by the body portion 21, the parts 100D, 100E having high rigidity, and the main bearing portion 22 as indicated by dotted lines similarly to the truss structures 29A, 29B. In addition, the truss structure 29D is formed by the body portion 21, the parts 100F, 100G having high rigidity, and the main bearing portion 22 as indicated by dotted lines similarly to the truss structures 29A, 29B, 29C.

[0053] As shown in FIG. 35 and FIG. 36, in the truss structure 29A, the axial-direction other end sides of the adjacent ribs 100A and 100H on the main bearing portion 22 side connect to each other. In addition, in the truss structure 29B, the axial-direction other end sides of the adjacent ribs 100B and 100C on the main bearing portion 22 side connect to each other. In addition, in the truss structure 29C, the axial-direction other end sides of the adjacent ribs 100D and 100E on the main bearing portion 22 side connect to each other. In addition, in the truss structure 29D, the axial-direction other end sides of the adjacent ribs 100F and 100G on the main bearing portion 22 side connect to each other. Thus, it is possible to suppress deformation of the main frame 2 due to stress occurring at the contact part between the main frame 2 and the shell 1 when the main frame 2 is fixed to the shell 1 by shrink fit or the like. The truss structures 29A, 29B, 29C, 29D shown in FIG. 34 and FIG. 35 are structures that can suppress a bending moment generated by internal stress occurring in the body portion 21, the parts 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H having high rigidity, and the main bearing portion 22 when stress occurs in the body portion 21 of the main frame 2. Thus, deterioration in the flatness of the flat surface 212 of the main frame 2 can be suppressed. In addition, as shown in FIG. 36, the adjacent ribs 100A and 100H are provided so as to come in contact with each other at a dotted-line part R of the main bearing portion 22. The same applies to the relationship between the ribs 100B and 100C, the relationship between the ribs 100D and 100E, and the relationship between the ribs 100F and 100G.

[0054] Although the disclosure is described above in terms of various exemplary embodiments and implementations, it should be understood that the various features, aspects, and functionality described in one or more of the individual embodiments are not limited in their applicability to the particular embodiment with which they are described, but they can be applied, alone or in various combinations to one or more of the embodiments of the disclosure.

It is therefore understood that numerous modifications which have not been exemplified can be devised without departing from the scope of the present disclosure. For example, at least one of the constituent components may be modified, added, or eliminated. At least one of the constituent components mentioned in at least one of the preferred embodiments may be selected and combined with the constituent components mentioned in another preferred embodiment.

DESCRIPTION OF THE REFERENCE CHARACTERS

[0055] 1 shell

2 main frame

21 body portion

22 main bearing portion

215 first Oldham groove

25, 25A, 25B, 25C, 25D part having low rigidity

251 first part

252 second part

31 fixed scroll

312 first spiral body

32 orbiting scroll

322 second spiral body

324 second Oldham groove

33 Oldham ring

332 first key portion

333 second key portion

34 compression chamber

100, 100A, 100B, 100C, 100D, 100E, 100F, 100G, 100H part having high rigidity

CLAIMS

[1] A scroll compressor comprising:

a fixed scroll having a first spiral body;

an orbiting scroll having a second spiral body meshed with the first spiral body to form a compression chamber;

an Oldham ring provided with second key portions which are stored in a pair of second Oldham grooves provided in the orbiting scroll;

a main frame provided with a pair of first Oldham grooves for storing a pair of first key portions provided in the Oldham ring; and

a shell inside which the fixed scroll, the orbiting scroll, and the main frame are stored, wherein

at a position corresponding to a circumferential-direction position of a part having low rigidity against a bending moment due to compressive load applied in a radial direction in comparison with other constituent parts of the main frame, a part having high rigidity is provided,

the part having high rigidity is a rib,

an axial-direction one end side of the rib on a body portion side of the main frame, corresponding to a connection part between the rib and the body portion of the main frame, connects to a part in which the main frame comes in contact with the shell and which is located at a range other than circumferential-direction range of the part having low rigidity against the bending moment.

[2] The scroll compressor according to claim 1, wherein

a circumferential-direction position of an axial-direction other end side of the rib on a main bearing portion side of the main frame, corresponding to a connection part between the rib and the main bearing portion, is present in a circumferential-direction range of the part having low rigidity.

[3] A scroll compressor comprising:

a fixed scroll having a first spiral body;

an orbiting scroll having a second spiral body meshed with the first spiral body to form a compression chamber;

an Oldham ring provided with second key portions which are stored in a pair of second Oldham grooves provided in the orbiting scroll;

a main frame provided with a pair of first Oldham grooves for storing a pair of first key portions provided in the Oldham ring; and a shell inside which the fixed scroll, the orbiting scroll, and the main frame are stored, wherein

at a position corresponding to a circumferential-direction position of a part having low rigidity against a bending moment due to compressive load applied in a radial direction in comparison with other constituent parts of the main frame, a part having high rigidity is provided,

the part having high rigidity is a rib,

an axial-direction one end side of the rib on a body portion side of the main frame, corresponding to a connection part between the rib and the body portion of the main frame, connects to a part in which the main frame comes in contact with the shell,

a circumferential-direction position of an axial-direction other end side of the rib on a main bearing portion side of the main frame, corresponding to a connection part between the rib and the main bearing portion, is present in a circumferential-direction range of the part having low rigidity,

the axial-direction other end sides of the adjacent two ribs on the main bearing portion side connect to each other.

[4]

A scroll compressor comprising:

a fixed scroll having a first spiral body;

an orbiting scroll having a second spiral body meshed with the first spiral body to form a compression chamber;

an Oldham ring provided with second key portions which are stored in a pair of second Oldham grooves provided in the orbiting scroll;

a main frame provided with a pair of first Oldham grooves for storing a pair of first key portions provided in the Oldham ring; and

a shell inside which the fixed scroll, the orbiting scroll, and the main frame are stored, wherein

at a position corresponding to a circumferential-direction position of a part having low rigidity against a bending moment due to compressive load applied in a radial direction in comparison with other constituent parts of the main frame, a part having high rigidity is provided,

the part having high rigidity is a rib,

an axial-direction one end side of the rib on a body portion side of the main frame, corresponding to a connection part between the rib and the body portion of the main frame, connects to a part in which the main frame comes in contact with the shell,

a plurality of the ribs are provided, and two of the plurality of ribs are provided left-right symmetrically with respect to a center of a surface on which the main frame comes in contact with the shell.

[5]

A scroll compressor comprising:

a fixed scroll having a first spiral body;

an orbiting scroll having a second spiral body meshed with the first spiral body to form a compression chamber;

an Oldham ring provided with second key portions which are stored in a pair of second Oldham grooves provided in the orbiting scroll;

a main frame provided with a pair of first Oldham grooves for storing a pair of first key portions provided in the Oldham ring; and

a shell inside which the fixed scroll, the orbiting scroll, and the main frame are stored, wherein

at a position corresponding to a circumferential-direction position of a part having low rigidity against a bending moment due to compressive load applied in a radial direction in comparison with other constituent parts of the main frame, a part having high rigidity is provided,

the part having high rigidity is a member separate from the main frame.

[6] The scroll compressor according to any one of claims 1 to 5, wherein

the part having low rigidity is a hole, a groove, or a notch.

[7] The scroll compressor according to any one of claims 1 to 6, wherein

the part having low rigidity is located on a radially outer side with respect to the orbiting scroll.