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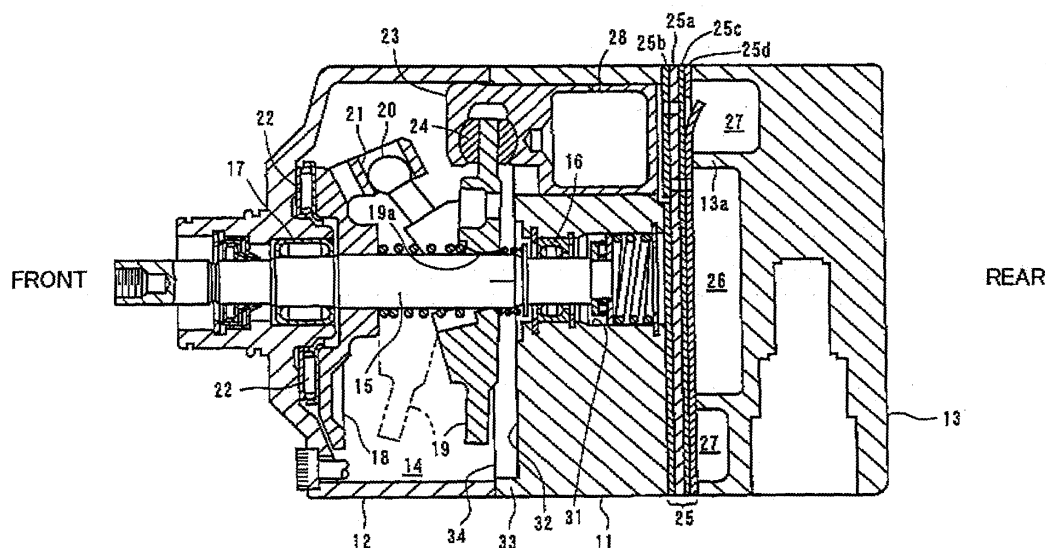
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(54) **Variable displacement compressor**

(57) A variable displacement compressor comprising a cylinder block having a plurality of cylinder bores. The cylinder block has an extension which extends from an outer periphery of an end surface of the cylinder block which faces a swash plate. The extension has an extension surface which forms a part of a bore surface of each cylinder bore and first and second wall surfaces which extend continuously from opposite ends of the extension

surface in a circumferential direction of the extension surface, A part of each extension surface which is connected to the first wall surface which is located on a preceding side of rotation of the swash plate corresponds to a high-load area which is locally subjected to loads from a single-headed piston during a compression stroke. The high-load area has a chamfered region which is formed into a curved surface by chamfering.

FIG. 2



Description

BACKGROUND OF THE INVENTION

[0001] The present invention relates to a variable displacement compressor, and more particularly to a variable displacement compressor having a single-headed piston.

[0002] Japanese Patent Application Publication No. 2000-120533 discloses a swash plate type variable displacement compressor which includes a cylinder block having formed therein a plurality of cylinder bores, a rotary shaft rotatably supported by the cylinder block at its center, a swash plate provided on the rotary shaft for rotation therewith and single-headed pistons engaged with the swash plate for reciprocation in the respective cylinder bores, wherein the openings of the cylinder bores which face the swash plate are chamfered so as to extend the diameter of the openings. A front housing is joined to the front of the cylinder block, and a rear housing is joined to the rear of the cylinder block through a valve plate.

[0003] In such a variable displacement compressor, the end surface of the cylinder block on the side of the swash plate is a plane which extends perpendicularly to the axial direction of the rotary shaft without any step. The chamfered surface is formed into a curved surface at the opening of the cylinder bore on the side of the swash plate for facilitating insertion of a piston into the cylinder bore. It is noted that the chamfered surface is formed along the entire circumference of the cylinder bore or along a part of the circumference of the cylinder bore.

[0004] According to the variable displacement compressor having the chamfered surface, a pressing force of a piston in radial direction which is generated when the piston moves from its bottom dead center toward its top dead center is reduced, so that the coating of the piston is prevented from a damage.

[0005] There has existed another variable displacement compressor having a cylinder block which has formed in the end surface thereof a step which faces the swash plate. For example, as shown in Fig.1, Japanese Patent Application Publication No. 7-180658 discloses a variable displacement compressor having a cylinder block 61 which has an extension 63 formed on the end surface of the cylinder block 61 on the side adjacent to the swash plate along the peripheral edge of the cylinder block 61. The extension 63 has extension surfaces 64 each forming a part of the bore surface of each cylinder bore 62 and wall surfaces 65 and 66 extending from the opposite ends of each extension surface 64 in the circumferential direction of the extension surface 64. In this arrangement, the extension surfaces 64 serve as slide surfaces for supporting the pistons in the cylinder bores 62.

[0006] As compared with the cylinder block disclosed in Japanese Patent Application Publication No.

2000-120533, the cylinder block 61 of Fig. 1 having the extension surfaces 64 of the extension 63 stabilizes the reciprocating movement of the pistons relative to the cylinder block 61. The cylinder block 61 having the extension 63 has a step in the end surface thereof on the side adjacent to the swash plate. Thus, edges a1 and a2 are formed between the extension surfaces 64 and the wall surfaces 65 and 66. Beveled surfaces 67 are formed at the periphery of the extension surfaces 64 on the side adjacent to the swash plate for facilitating insertion of pistons into the cylinder bores 62. Edges b are formed between the extension surfaces 64 and the beveled surfaces 67.

[0007] When the chamfered surface of cylinder bore of Japanese Patent Application Publication No. 2000-120533 is applied to the variable displacement compressor of Japanese Patent Application Publication No. 7-180658, however, the coating of the piston is not necessarily prevented from being damaged. This is because the contact surface pressure between the edge and the piston is excessively large due to the presence of the edge between the extension surface and the beveled surface in the variable displacement compressor of Japanese Patent Application Publication No. 7-180658. Especially, the piston during its compression stroke receives a pressure in the cylinder bore and the extension receives a high load from the piston. Therefore, part of the extension tends to receive a large contact surface pressure. In addition, since the swash plate is rotated in one direction, a pressing force of the piston which is caused by the rotation of the swash plate is applied to the edge between the extension surface and the wall surface. Therefore, there is a fear that the contact surface pressure at the edge in the extension is significantly large.

[0008] The present invention which has been made in view of the above problems is directed to a variable displacement compressor having an extension which extends from the end surface of the cylinder block on the side adjacent to the swash plate, which prevents generation of an excessive contact surface pressure at a part of the extension surface of the extension.

SUMMARY OF THE INVENTION

[0009] In one aspect of the present invention, there is provided a variable displacement compressor comprising a cylinder block, a rotary shaft, a swash plate and a plurality of pistons. The cylinder block has a plurality of cylinder bores. The rotary shaft is rotatably supported by the cylinder block. The swash plate is provided on the rotary shaft for rotation therewith. The plurality of single-headed pistons are engaged with the swash plate for reciprocation in the cylinder bores. A diameter expansion surface is formed at an edge of a bore surface of each cylinder bore which faces the swash plate so that a diameter of an opening of the cylinder bore are extended. The cylinder block has an extension which extends from an outer periphery of an end surface of the cylinder block

which faces the swash plate. The extension has an extension surface which forms a part of the bore surface of each cylinder bore and first and second wall surfaces which extend continuously from opposite ends of the extension surface in a circumferential direction of the extension surface. A part of each extension surface which is connected to the first wall surface which is located on a preceding side of rotation of the swash plate corresponds to a high-load area which is locally subjected to loads from the piston during a compression stroke. The high-load area has a chamfered region which is formed into a curved surface by chamfering.

[0010] Other aspects and advantages of the invention will become apparent from the following description, taken in conjunction with the accompanying drawings, illustrating by way of example the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The features of the present invention that are believed to be novel are set forth with particularity in the appended claims. The invention together with objects and advantages thereof, may best be understood by reference to the following description of the presently preferred embodiments together with the accompanying drawings in which:

Fig. 1 is a perspective view of the cylinder block of a variable displacement compressor according to the background art.

Fig. 2 is a longitudinal cross-sectional view of a variable displacement compressor of a preferred embodiment according to the present invention;

Fig. 3 is a front view of a cylinder block of the variable displacement compressor as viewed from the side of a swash plate;

Fig. 4 is a partially enlarged perspective view of the cylinder block;

Fig. 5 is a partially enlarged front view of the cylinder block;

Fig. 6 is a cross-sectional view taken along the line A-A in Fig. 5;

Fig. 7 is a partially enlarged perspective view of the cylinder block showing a high-load area and a chamfered region; and

Figs. 8A through 8C are views explaining the procedure of forming the chamfered region.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0012] The following will describe a variable displacement compressor of a preferred embodiment according to the present invention with reference to Figs. 2 through 8C. Fig. 2 is a longitudinal cross-sectional view of the variable displacement compressor of a preferred embodiment according to the present invention, Fig. 3 is a front view of a cylinder block of the variable displacement compressor as viewed from the side of a swash plate, and Fig. 4 is a partially enlarged perspective view of the cylinder block. In Fig. 2, the left and right sides of the compressor on the drawing correspond to the front and rear sides, respectively.

[0013] Referring to Fig. 2, the compressor has a cylinder block 11, a front housing 12 joined to the front end surface 32 of the cylinder block 11, and a rear housing 13 joined to the rear end surface of the cylinder block 11 through a valve forming assembly 25. The cylinder block 11 and the front housing 12 cooperate to define therebetween a crank chamber 14.

[0014] A rotary shaft 15 which extends through the crank chamber 14 is rotatably supported by the cylinder block 11 and the front housing 12 through radial bearings 16 and 17. The front end of the rotary shaft 15 extends out of the front housing 12 and is connected to a mechanism (not shown) which receives power from an engine or a motor of vehicle (not shown).

[0015] In the crank chamber 14, a lug plate 18 is secured on the rotary shaft 15, and a swash plate 19 is provided on the rotary shaft 15. The swash plate 19 has at the center thereof a hole 19a through which the rotary shaft 15 is inserted. The swash plate 19 has guide pins 20 which are slidably inserted in guide holes 21 formed in the lug plate 18 so that the swash plate 19 is connected to the lug plate 18 for rotation with the rotary shaft 15.

[0016] Sliding motion of the guide pins 20 in the guide holes 21 allows the swash plate 19 to slide in the axial direction of the rotary shaft 15 and to be inclined relative to the rotary shaft 15. A thrust bearing 22 is provided between the lug plate 18 and the front inner wall of the front housing 12, thus the lug plate 18 being rotatable relative to the front housing 12 through the thrust bearing 22.

[0017] The cylinder block 11 has formed therein a plurality of cylinder bores 28 (only one cylinder bore being shown in Fig. 2) which are arranged around the rotary shaft 15. Each cylinder bore 28 receives therein a single-headed piston 23 for reciprocation. Though not shown specifically in the drawing, the sliding surface of the piston 23 is coated with hardwearing material. The piston 23 is engaged at the front thereof with the outer peripheral portion of the swash plate 19 through a pair of shoes 24. As the swash plate 19 is driven to rotate by the rotary shaft 15, each piston 23 is moved reciprocally in its associated cylinder bore 28 by way of the shoes 24.

[0018] A suction chamber 26 is defined in the center

region of the rear housing 13 in facing relation to the valve forming assembly 25. A discharge chamber 27 is defined in the rear housing 13 radially outward of the suction chamber 26. As shown in Fig. 2, these chambers 26 and 27 are separated by a partition wall 13a formed in the rear housing 13. The suction chamber 26 and the discharge chamber 27 are connected to an external refrigerant circuit (not shown). In the preferred embodiment, the valve forming assembly 25 includes a valve plate 25a, a suction valve plate 25b, a discharge valve plate 25c, and a retainer plate 25d,

[0019] The following will describe more in detail the cylinder block 11 of the compressor with reference to Figs. 3 through 7. Referring to Fig. 3, the cylinder block 11 has formed therein a hole 31 which extends through the center of the cylinder block 11. The plurality of cylinder bores 28 are arranged around the hole 31 at equiangular intervals. The cylinder block 11 has formed therethrough between any two adjacent cylinder bores 28 a plurality of holes 29 for receiving therein bolts at positions adjacent to the outer periphery of the cylinder block 11.

[0020] The cylinder block 11 has the front end surface 32 from which an annular extension 33 extends toward the swash plate 19, so that a step is formed in axial direction of the cylinder block 11 between the end surface 34 of the extension 33 which faces the swash plate 19 and the front end surface 32.

[0021] The extension 33 of the cylinder block 11 is formed such that it has on the inner side thereof an extension surface 36 which forms a part of the bore surface of each cylinder bore 28, as best seen in Fig. 4. The extension 33 further has on the inner side thereof first and second wall surfaces 37 and 38 which extend continuously from the opposite ends of each extension surface 36 in the circumferential direction of the extension surfaces 36. The extension 33 has an inner wall surface 39 which extends continuously from the first wall surface 37 and also forms a part of the inner surface of each hole 29. The second wall surface 38 extends continuously from its adjacent inner wall surfaces 39 in the circumferential direction of the cylinder block 11. Thus, the first wall surface 37, the inner wall surface 39, and the second wall surface 38 are located in this order between the extension surfaces 36 of any two adjacent cylinder bores 28. As shown in Fig. 4, a curved surface is provided between the first wall surface 37 and the front end surface 32.

[0022] Fig. 5 is a partially enlarged front view of the cylinder block 11 as viewed from the swash plate 19. A beveled surface 40 is formed between the extension surface 36 and the end surface 34 of the extension 33 along the front edge of the extension surface 36, as shown in Figs. 4 and 5, so that the diameter of the opening of the cylinder bore 28 is extended toward the end surface 34 of the extension 33. Similarly, a beveled surface 41 is formed between the front end surface 32 and the bore surface along the front edge of the bore surface. The beveled surfaces 40 and 41 correspond to the diameter

expansion surface of the present invention for increasing the diameter of the opening of the cylinder bore 28 which faces the swash plate 19. The beveled surfaces 40 and 41 facilitate insertion of the piston 23 into the cylinder bore 28. Further, in the preferred embodiment, a beveled surface 42 is formed between the end surface 34 and the first wall surface 37, and a beveled surface 43 is formed between the end surface 34 and the second wall surface 38 as shown in Fig. 5.

[0023] In the preferred embodiment, a chamfered surface 44 is formed between the extension surface 36 and the first wall surface 37 so as to be inclined relative to the extension surface 36. The chamfered surface 44 are contiguous with the end surface 34, the extension surface 36, the first wall surface 37, the beveled surface 40, and the beveled surface 42.

[0024] Of the first and second wall surfaces 37 and 38 located on opposite sides of the cylinder bore 28, the first wall surface 37 is located on the preceding side of the rotation of the swash plate 19 with respect to the cylinder bore 28. The first wall surface 37 and a part of the extension surface 36 adjacent to the chamfered surface 44 provide a high-load area S indicated by shaded area in Fig. 4 which is subjected to high loads from the piston 23 due to the rotation of the swash plate 19. The high-load area S is locally subjected to high loads from the piston 23 during the compression stroke or when the piston 23 moves from its bottom dead center toward its top dead center in a state where the slide contact area between the cylinder bore 28 and the piston 23 is small. The high-load area S is also subjected to loads due to the pressing force of the piston 23 during the rotation of the swash plate 19.

[0025] Referring to Fig. 6 showing a cross-sectional view taken along the line A-A in Fig. 5 and also Fig. 7 showing the high-load area S of the cylinder block, in the preferred embodiment, the high-load area S includes a chamfered region D which is formed into a curved surface by chamfering. More specifically, the chamfered region D includes a first region D1 which is formed the edge between the extension surface 36 and the beveled surface 40 in the high-load area S into a curved surface by chamfering. As shown in Fig. 7, the chamfered region D further includes a second region D2 which is formed the edge between the chamfered surface 44 and the beveled surface 40 into a curved surface by chamfering, a third region D3 which is formed the edge between the extension surface 36 and the chamfered surface 44 into a curved surface by chamfering, and a fourth region D4 which is formed the edge between the extension surface 36 and the first wall surface 37 into a curved surface by chamfering.

[0026] The first through fourth regions D1 through D4 are indicated by the hatching in Fig. 7. The second and third regions D2 and D3 include chamfers in the vertical direction in Fig. 7 (the longitudinal direction of the cylinder bore 28) along the bore surface and in the circumferential direction of the cylinder bore 28, and the fourth region

D4 include a chamfer in the circumferential direction of the cylinder bore 28.

[0027] As mentioned earlier, the chamfered region D in the high-load area S is formed by removing or chamfering edges which had been present between the surfaces 36, 37, 40, 40 and 44 before the chamfering. Thus, the high-load area S receiving a high load from the piston 23 is not subjected an excessively high contact surface pressure.

[0028] It can be verified by a calculation method for contact surface pressure using Herz formula that an excessively high contact surface pressure is not generated at the high-load area S having the chamfered region D in comparison with the case where the aforementioned edges in a high-load area are not chamfered. Using the calculation method for the contact surface pressure, the radius of curvature of the curved surface for each of the regions D1 through D4 in the chamfered region D may be determined so as to prevent the piston coating from being damaged. Generally, the contact surface pressure in the high-load area S is decreased with an increase of the radius of curvature.

[0029] The following will describe a procedure of forming the chamfered region D in the high-load area S in the cylinder block 11 of the preferred embodiment. Figs. 8A through 8C are illustrative views showing the procedure of forming the chamfered region D. Fig. 8A shows a part of the cylinder block 11 before chamfering to form the region D. In this state of the cylinder block 11, the extension surface 36, the beveled surface 40, the beveled surface 41, the beveled surface 42, and the first wall surface 37 have been formed in the cylinder block 11 in advance. There exist edges which are defined clearly at the borders between any two surfaces.

[0030] The chamfered surface 44 is formed with a grinding tool 51 as shown in Fig. 8B. The grinding tool 51 has a shaft 53 and a grinding surface 52 which is tapered for forming the chamfered surface 44. The grinding tool 51 is driven to rotate about the shaft 53. The grinding tool 51 being driven to rotate in arrow direction is inserted into the cylinder bore 28, and the grinding surface 52 is brought into contact with the appropriate portion of the cylinder block 11 to chamfer the edge between the beveled surface 40 and the beveled surface 42, the edge between the extension surface 36 and the first wall surface 37, thereby forming the chamfered surface 44. Thus, the edges are formed at the borders between the chamfered surface 44 and the respective surfaces 36, 37, 40 and 42.

[0031] Such edges in the high-load area S are chamfered with a polishing brush 54, as shown in Fig. 8C. More specifically, the edge between the extension surface 36 and the beveled surface 40, the edge between the chamfered surface 44 and the beveled surface 40, the edge between the extension surface 36 and the chamfered surface 44, and the edge between the extension surface 36 and the first wall surface 37 are chamfered into curved surfaces. The polishing brush 54 in-

cludes a cylindrical-shaped elastic brush 55 having a polishing surface and a shaft 56 which is fitted into the center of the elastic brush 55. The polishing brush 54 is driven to rotate about the shaft 56. The polishing surface of the elastic brush 55 is elastic. Thus, the polishing surface is hollowed by a force applied to the polishing surface and returns to its original shape when the force is released.

[0032] The polishing brush 54 being driven to rotate is inserted into the cylinder bore 28 from the side of the end surface 34 in facing relation to the high-load area S. The polishing brush 54 is brought into contact with the cylinder block 11 to chamfer the edges in the high-load area S. With the polishing brush 54 kept in contact with the cylinder block 11, the polishing brush 54 is moved relative to the cylinder bore 28 reciprocally in the vertical direction in Fig. 8C and also in the circumferential direction of the extension surface 36, as indicated by arrows, for forming the chamfered region D.

[0033] The chamfered region D shown in Fig. 8C includes the first through fourth regions D1 through D4 formed by removing the above edges. Since the elastic brush 55 is used, a curved hollow is formed in the elastic brush 55 when it is pressed against the edges in the first through fourth regions D1 through D4. Thus, chamfering using the hollowed portion of the elastic brush 55 is performed on the first through fourth regions D1 through D4 corresponding to the above edges. The radius of curvature of the curved chamfered surface of each of the regions D1 through D4 is increased with an increase of time during which the polishing brush 54 is kept in contact with the regions D1 through D4.

[0034] According to the variable displacement compressor of the preferred embodiment of the present invention, the following advantageous effects are obtained.

(1) In the cylinder bore 28, the high-load area S includes the chamfered region D which is chamfered into curved surfaces. Thus, the contact surface pressure between the piston 23 and the cylinder block 11 in the high-load area S is reduced in comparison with the case where a high-load area does not include a chamfered region, so that the coating of the piston is substantially prevented from being damaged.

(2) The edges in the region other than the high-load area S remains between the extension surface 36 and the beveled surface 40, so that the length of the extension surface 36 as a guide surface is not shortened in comparison with the case where the chamfered region is formed along the entire circumference of the cylinder bore 28, thus the piston 23 being stably supported in the cylinder bore 28.

(3) In the high-load area S, the chamfered surface 44 is formed before the formation of the chamfered region D. Thus, the radius of curvature of the curved surface for the chamfered region D may be easily

set larger in comparison with the case where the chamfered surface 44 is not formed in the high-load area S. Larger radius of curvature contributes to reduction of the contact surface pressure in the high-load area S.

(4) In the extension surface 36 of the cylinder bore 28, there exist both chamfered and non-chamfered regions. The use of the polishing brush 54 makes possible chamfering only those portions which need to be chamfered. This method of chamfering in the preferred embodiment increases reliability and reduces the time of chamfering operation, as compared with chamfering by other methods such as shot blasting.

[0035] The present invention is not limited to the above-described preferred embodiment and may be practiced in various other ways as exemplified below.

[0036] One example of the chamfered surface 44 is shown in the above-described preferred embodiment, but the configuration of the chamfered surface 44 is not limited to that of the above-described preferred embodiment. The chamfered surface 44 may be formed in such a range that adjoins with the extension surface 36, the first wall surface 37, the beveled surface 40, and the beveled surface 42 so that it does not exist in the bore surface other than the extension surface 36.

[0037] In the above-described preferred embodiment, the chamfered surface 44 is formed before the formation of the chamfered region D. However, the chamfered region D may be formed without forming the chamfered surface 44. In this case, it is preferable that the edges in the high-load area S should be chamfered or beveled to form curved surfaces with a large radius of curvature, and the procedure of forming the chamfered surface 44 can be omitted.

[0038] In the above-described preferred embodiment, the grinding tool 51 and the polishing brush 54 are used to form the chamfered surface 44 and the chamfered region D in the high-load area S. Other means for chamfering may be used as required instead of the combination of the grinding tool 51 and the polishing brush 54.

[0039] In the above-described preferred embodiment, the beveled surface 40 is formed along the front end of the extension surface 36 so as to extend the diameter of the opening of the cylinder bore 28, and the beveled surface 41 is formed between the front end surface 32 and the bore surface along the front end of the bore surface. However, any surface may be formed as long as it extends the diameter of the opening of the cylinder bore 28. For example, chamfering for a curved surface may be done as in the chamfered for the region D.

[0040] Therefore, the present examples and embodiments are to be considered as illustrative and not restrictive, and the invention is not to be limited to the details given herein but may be modified within the scope of the appended claims.

[0041] A variable displacement compressor comprising a cylinder block having a plurality of cylinder bores. The cylinder block has an extension which extends from an outer periphery of an end surface of the cylinder block which faces a swash plate. The extension has an extension surface which forms a part of a bore surface of each cylinder bore and first and second wall surfaces which extend continuously from opposite ends of the extension surface in a circumferential direction of the extension surface. A part of each extension surface which is connected to the first wall surface which is located on a preceding side of rotation of the swash plate corresponds to a high-load area which is locally subjected to loads from a single-headed piston during a compression stroke. The high-load area has a chamfered region which is formed into a curved surface by chamfering.

Claims

1. A variable displacement compressor comprising:

a cylinder block (11) having a plurality of cylinder bores (28);
a rotary shaft (15) rotatably supported by the cylinder block (11);
a swash plate (19) provided on the rotary shaft (15) for rotation therewith;
a plurality of single-headed pistons engaged with the swash plate (19) for reciprocation in the cylinder bores (28); and
a diameter expansion surface (40, 41) formed at an edge of a bore surface of each cylinder bore (28) which faces the swash plate (19) so that a diameter of an opening of the cylinder bore (28) are extended,

wherein the cylinder block (11) has an extension (33) which extends from an outer periphery of an end surface (32) of the cylinder block (11) which faces the swash plate (19), and

wherein the extension (33) has an extension surface (36) which forms a part of the bore surface of each cylinder bore (28) and first and second wall surfaces (37, 38) which extend continuously from opposite ends of the extension surface (36) in a circumferential direction of the extension surface (36),

characterized in that a part of each extension surface (36) which is connected to the first wall surface (37) which is located on a preceding side of rotation of the swash plate (19) corresponds to a high-load area (S) which is locally subjected to loads from the piston during a compression stroke, and
in that the high-load area (S) has a chamfered region (D) which is formed into a curved surface by chamfering.

2. The variable displacement compressor according to

claim 1, wherein the chamfered region (D) has a curved surface which is formed in a circumferential direction and a longitudinal direction of the cylinder bore (28).

3. The variable displacement compressor according to any one of claims 1 and 2, wherein the chamfered region (D) has a part of the diameter expansion surface (40,41) which is located in the high-load area (S). 5
4. The variable displacement compressor according to any one of claims 1 through 3, wherein the chamfered region (D) includes a first region (D1) which is formed an edge between the extension surface (36) and the diameter expansion surface (40) in the high-load area (S) into a curved surface by chamfering. 10
5. The variable displacement compressor according to any one of claims 1 through 4, wherein a chamfered surface (44) is formed between the extension surface (36) and the first wall surface (37) so as to be inclined relative to the extension surface (36). 15
6. The variable displacement compressor according to claim 5, wherein the chamfered region (D) includes a second region (D2) which is formed an edge between the diameter expansion surface (40) and the chamfered surface (44) into a curved surface by chamfering. 20
7. The variable displacement compressor according to any one of claims 5 and 6, wherein the chamfered region (D) includes a third region (D3) which is formed an edge between the extension surface (36) and the chamfered surface (44) into a curved surface by chamfering. 25
8. The variable displacement compressor according to any one of claims 1 through 7, wherein the chamfered region (D) includes a fourth region (D4) which is formed an edge between the extension surface (36) and the first wall surface (37) into a curved surface by chamfering. 30
9. The variable displacement compressor according to any one of claims 1 through 8, wherein a beveled surface (42) is formed between the first wall surface (37) and an end surface (34) of the extension (33) which faces the swash plate (19). 35
10. The variable displacement compressor according to any one of claims 1 through 9, wherein a beveled surface (43) is formed between the second wall surface (38) and an end surface (34) of the extension (33) which faces the swash plate (19). 40
11. The variable displacement compressor according to 45

any one of claims 1 through 10, wherein the diameter expansion surface (40, 41) includes a beveled surface (40) which is formed between the extension surface (36) and an end surface (34) of the extension (33) which faces the swash plate (19). 50

12. The variable displacement compressor according to claim 11, wherein the diameter expansion surface (40, 41) includes a beveled surface (41) which is formed between the end surface (32) of the cylinder block (11) and the bore surface of the cylinder bore (28). 55

FIG. 1
(Background Art)

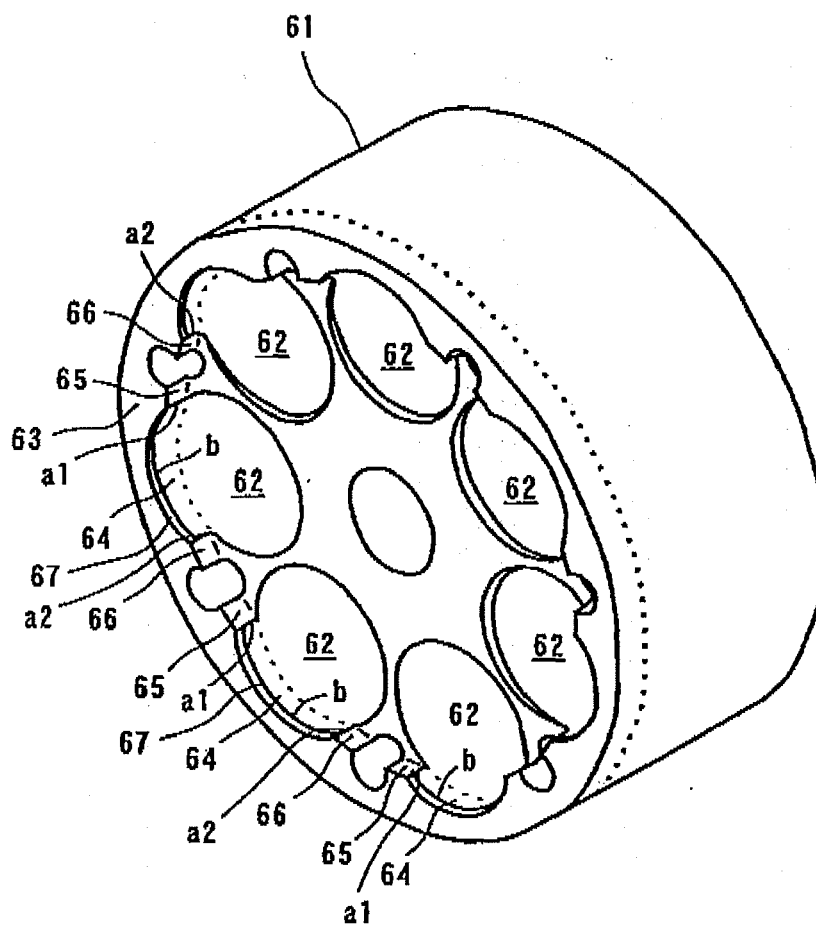


FIG. 2

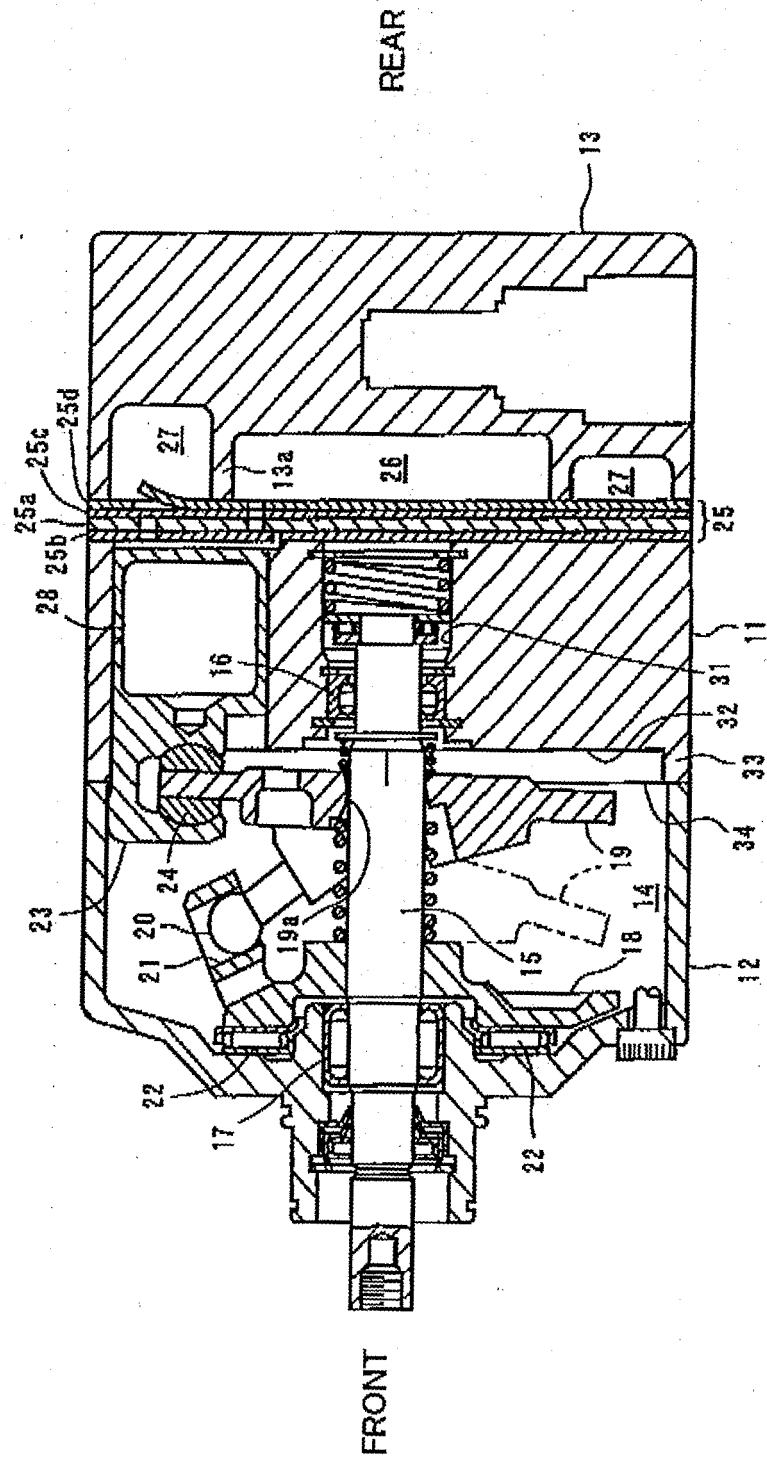


FIG. 3

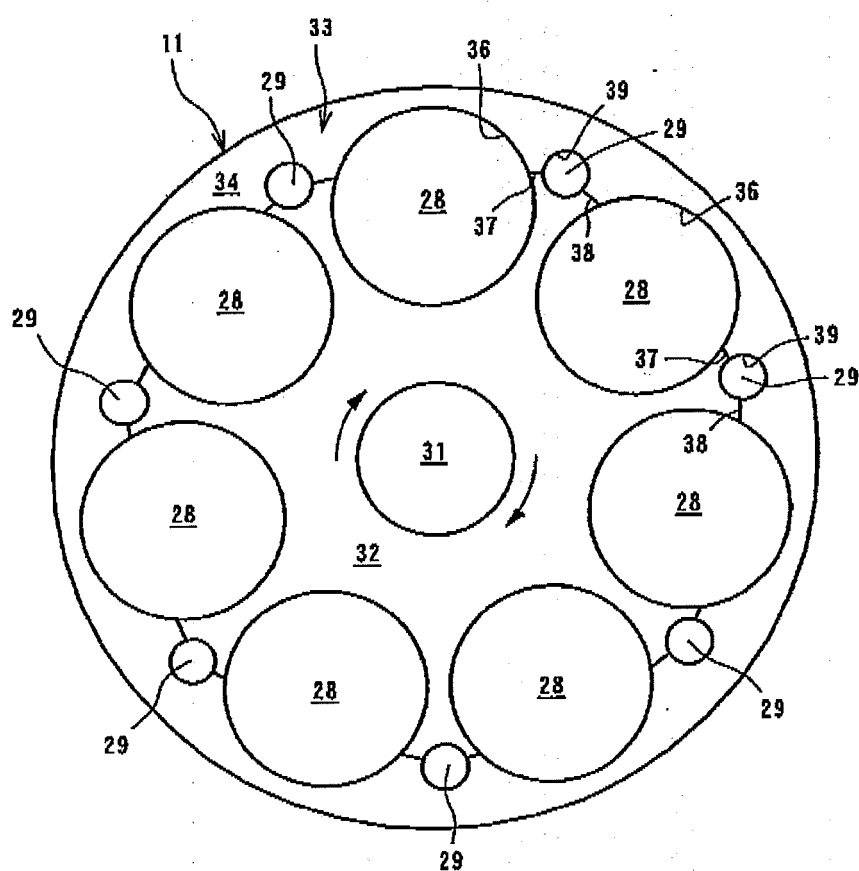


FIG. 4

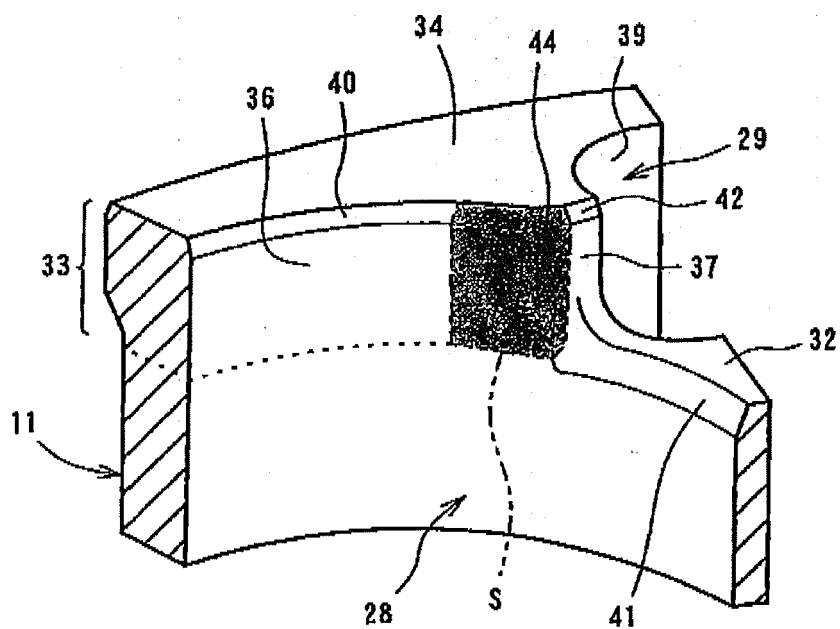


FIG. 5

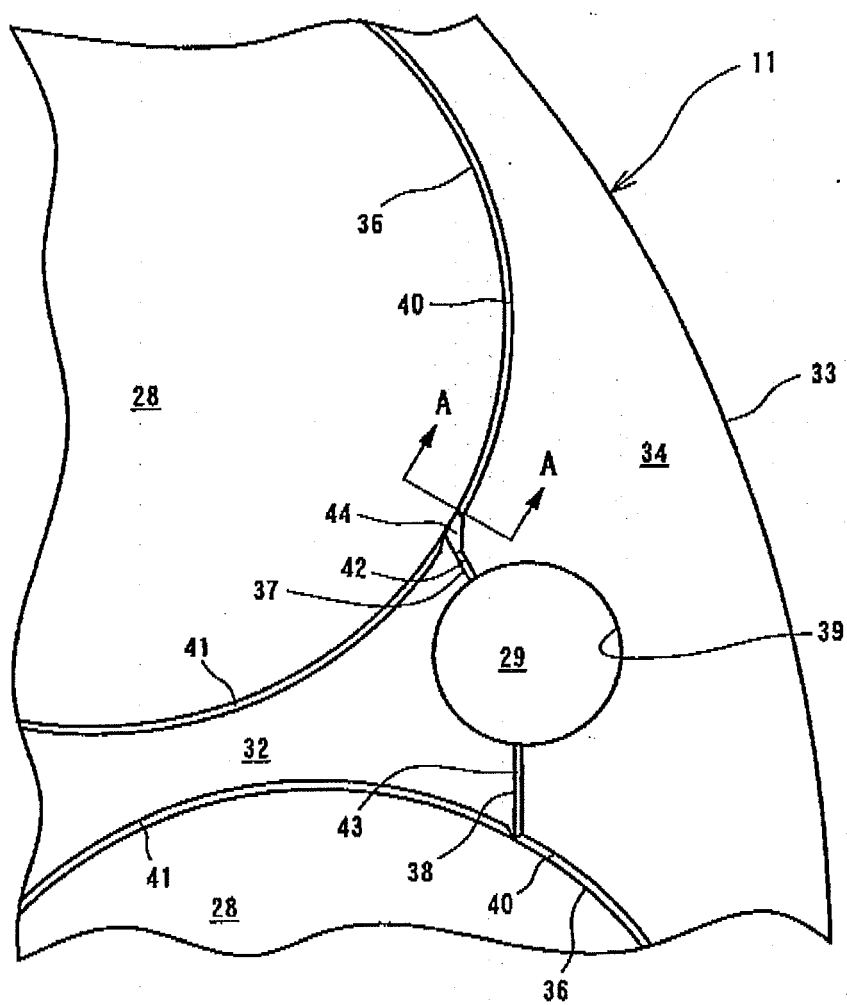


FIG. 6

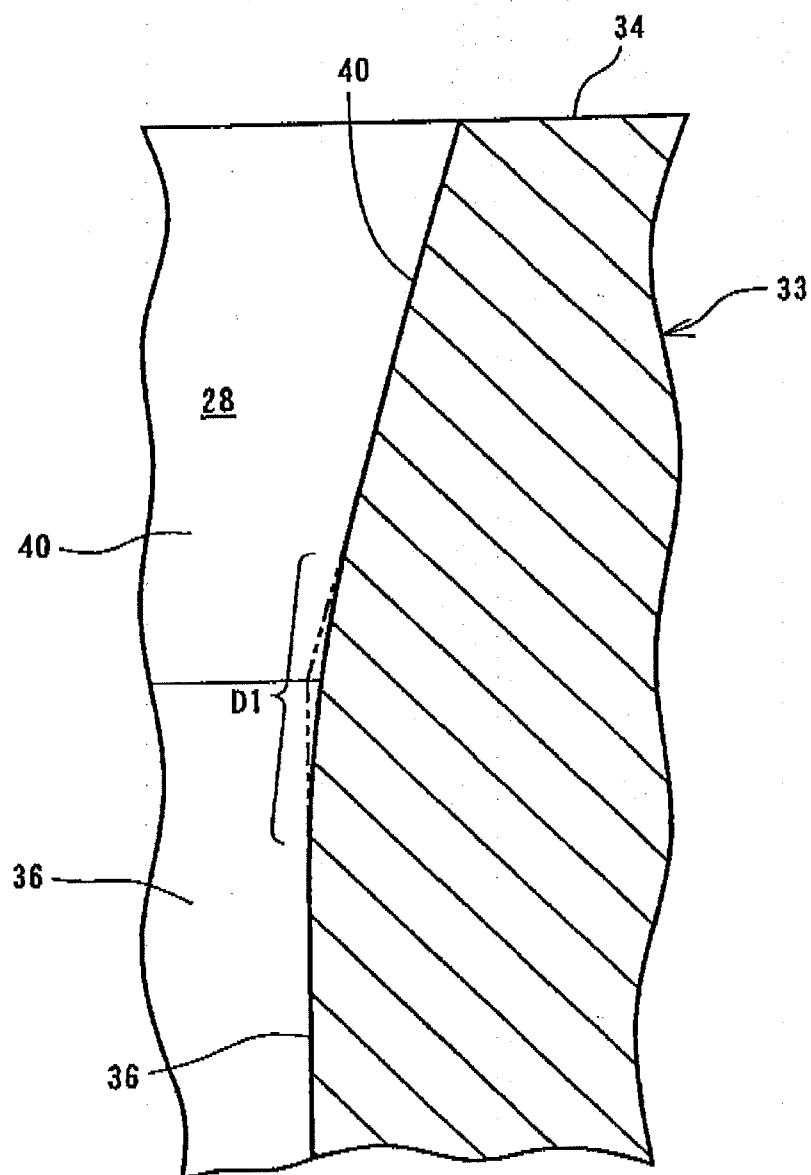


FIG. 7

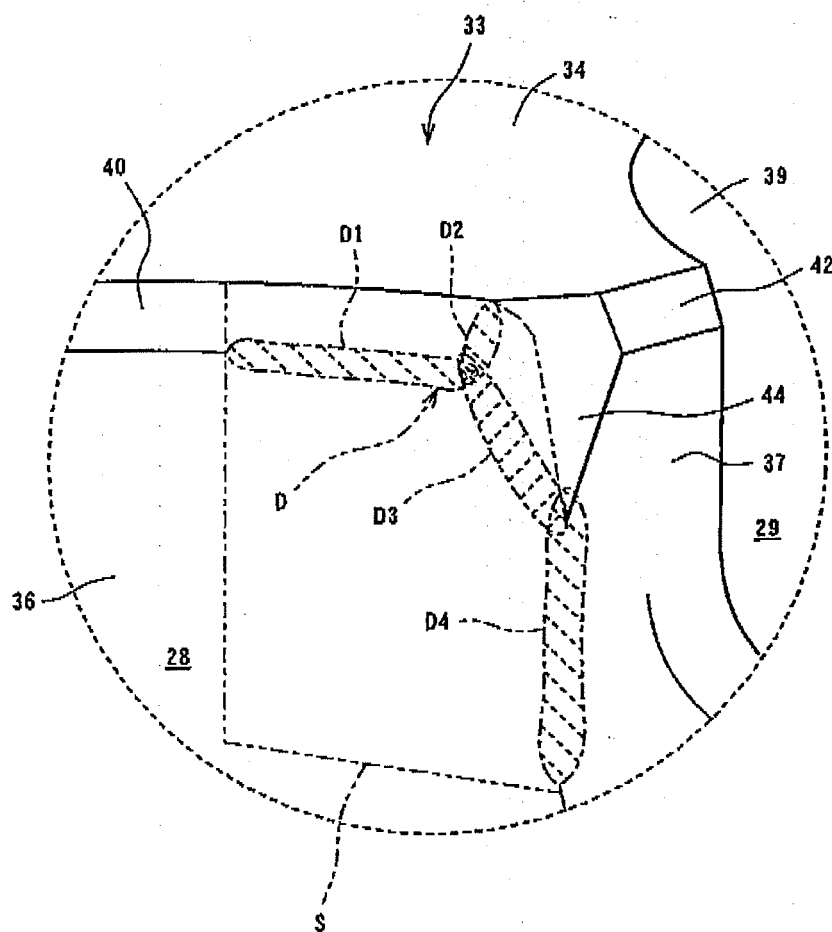


FIG. 8A

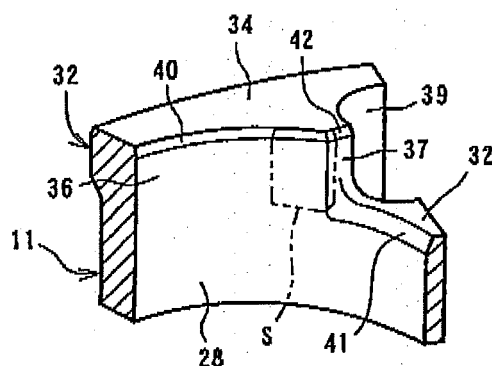


FIG. 8B

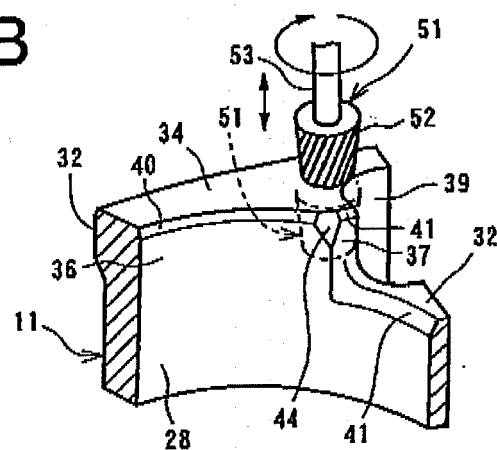
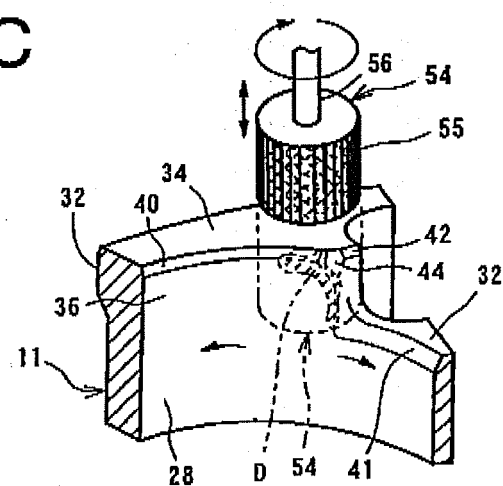


FIG. 8C



REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

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