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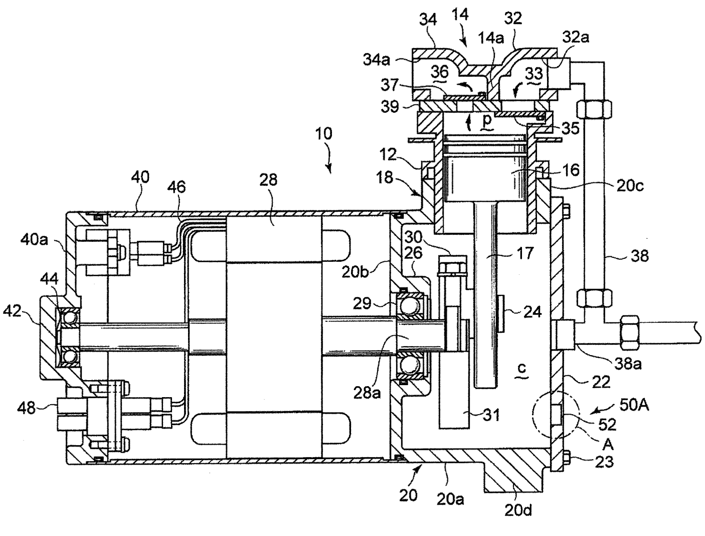
(54) PRESSURE BOOSTER COMPRESSOR

(57) The present invention realizes a simple method for preventing a pressure in a crank chamber from excessively increasing without leading to an increase in a weight and an escalation of cost and causing damage of a structure forming a pressurizing booster compressor. A compression chamber p is formed by a cylinder 12, a cylinder head 14, and a piston 16 reciprocable inside the cylinder 12. A rotation of an output shaft 28a of an electric motor 28 causes the piston 16 to reciprocate via a crank shaft 24. A sealed crank chamber c is defined inside a crank case 18. Further, a pressurized gas supply tube 38, which supplies pressurized gas to be compressed into each of the compression chamber p and the crank chamber c, is provided. The crank case 18 is formed from a hollow cylindrical body 20 and an end plate 22 facing the outside. A low-strength wall 50A (a partition wall having a lower strength than another partition wall), which is configure to be broken under an allowable maximum pressure of the crank chamber c, is formed on the end plate 22.

Fig. 1



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Description

TECHNICAL FIELD

[0001] The present invention relates to a pressurizing booster compressor configured to be able to prevent a pressure in a crank chamber from increasing to an allowable maximum pressure or higher with a simple structure.

BACKGROUND ART

[0002] A booster compressor is a compressor that, upon introduction of compressed gas with a pressure thereof raised in advance from an external pressurized gas supply apparatus, further raises the pressure of this introduced compressed gas to then supply it to a demander. This type of compressor includes a cylinder, and a crank case disposed below the cylinder. A crank chamber is formed inside the crank case. Then, this compressor is configured in such a manner that the pressurized gas is supplied only into a compression chamber formed inside the cylinder. Therefore, the compression chamber and the crank chamber are prone to have a large pressure difference therebetween, which likely necessitates high power when the piston is displaced upward, or easily leads to an increase in a change of a torque to unbalance a rotation of a crank shaft.

[0003] Therefore, to solve this drawback, there has been conventionally proposed a pressurizing booster compressor that supplies the pressurized gas into not only the compression chamber but also the crank chamber. Reducing the pressure difference between the compression chamber and the crank chamber in this manner can, for example, bring down the driving torque of the crank shaft, and also prevent the crank shaft from rotating unevenly, which otherwise would be caused by the increase in the change of the torque. Patent Literature 1 discloses a pressurizing booster compressor configured in this manner.

[0004] However, the pressurizing booster compressor involves such a risk that a structure forming the crank case may be damaged when the pressure in the crank chamber increases to an excessive pressure. Therefore, the conventional pressurizing booster compressor is arranged in such a manner that the crank case has a strength high enough to keep the crank case undamaged even when the pressure in the crank chamber increases to the excessive pressure, or a safety valve is provided to the crank case so as to release the pressurized gas in the crank chamber outward by this safety valve when the pressure in the crank chamber increases to the excessive pressure.

[0005] The pressurizing booster compressor disclosed in Patent Literature 1 includes the safety valve provided to the crank case, thereby succeeding in preventing the inner pressure in the crank chamber from excessively increasing.

CITATION LIST

PATENT LITERATURE

[0006] [PTL 1] Japanese Patent Application Public Disclosure No. 2010-059889

SUMMARY OF INVENTION

TECHNICAL PROBLEM

[0007] However, the measures of providing the crank case with the strength high enough to keep the crank case undamaged even when the pressure in the crank chamber increases to the excessive pressure raises such a drawback that this arrangement leads to an increase in a weight and an escalation of cost of the booster compressor.

[0008] Further, the measures of providing the crank case with the safety valve raises the following drawback. When the pressure in the crank chamber reduces due to actuation of the safety valve, the safety valve is automatically returned to the closed position, and the pressure in the crank chamber increases again due to the return of the safety valve. The pressure reduces and then increases repeatedly in this manner, which results in damage of the structure forming the booster compressor.

[0009] The present invention has been contrived in consideration of the above-described drawbacks, and an object thereof is to propose a simple arrangement that does not lead to the increase in the weight and the escalation of the cost, and also does not cause the damage of the structure forming the pressurizing booster compressor, as a apparatus for preventing the pressure in the crank chamber of the pressurizing booster compressor from excessively increasing.

SOLUTION TO PROBLEM

[0010] To achieve the foregoing object, a pressurizing booster compressor according to the present invention comprises a cylinder, a cylinder head provided on the cylinder, a piston reciprocatable inside the cylinder and defining a compression chamber together with the cylinder head and the cylinder, a driving shaft configured to rotate a crank shaft coupled with the piston via a connecting rod, a crank case containing the crank shaft and defining a crank chamber isolated from an outside, and a pressurized gas supply tube configured to supply pressurized gas to be compressed to each of the compression chamber and the crank chamber. A partition wall facing the outside, which is included in a partition wall of the crank case, is partially formed from a low-strength wall configured to be broken under an allowable maximum pressure of the crank chamber (in other words, a partition wall having a lower strength than another partition wall).

[0011] According to the present invention, when the pressure in the crank chamber reaches the allowable maximum pressure, the low-strength wall is broken, so that the pressure in the crank chamber returns to a low pressure without increasing to the allowable maximum pressure or higher. Then, the pressure in the crank chamber is kept prevented from increasing until removal of a cause of the increase in the pressure in the crank chamber to the allowable maximum pressure or higher, and a recovery of the crank chamber into an original state thereof. Therefore, this configuration does not cause the crank chamber to automatically recover and the pressure in the crank chamber to reach the allowable maximum pressure repeatedly, unlike the safety valve, and thus does not lead to the damage of the structure forming the booster compressor.

[0012] Further, this configuration only requires the formation of the low-strength wall at the end wall of the crank case, and thus does not lead to an escalation of cost.

[0013] According to one aspect of the present invention, the partition wall of the crank case may be configured to comprise a hollow cylindrical body including an outer peripheral wall and an end wall forming one end surface with an opposite end surface open to the outside, and an end plate fixed to this hollow cylindrical body and closing the opened opposite end surface. The pressurized gas supply tube may be connected to the end plate, and the low-strength wall may be formed at a different position of the end plate from a position to which the pressurized gas supply tube is connected.

[0014] In this manner, the low-strength wall is formed on the end plate that is prepared as a different member from the hollow cylindrical body and faces the outside, which facilitates the formation of the low-strength wall.

[0015] According to one aspect of the present invention, the low-strength wall may be formed from a thinned portion formed on a partition wall facing the outside of the crank case or on the end plate. This configuration allows the thinned portion to be formed at the same time as when the crank case or the end plate is processed, which facilitates the formation of the low-strength wall.

[0016] According to one aspect of the present invention, a through-hole may be formed through a partition wall facing an outside of the crank case or through the end plate. The low-strength wall may comprise a low-strength plate and a fixation member. The low-strength plate may be configured to have a strength that allows the low-strength wall to be broken under the allowable maximum pressure of the crank chamber. The low-strength plate may be disposed in abutment with an outer surface of the partition wall or the end plate around the through-hole so as to shield the through-hole. The fixation member may be fixed to the outer surface of the partition wall or the end plate around the through-hole to fix the low-strength plate at a position that allows the low-strength plate to shield the through-hole.

[0017] Therefore, when the pressure in the crank chamber increases to the allowable maximum pressure or higher and the low-strength plate is broken, this configuration only requires replacement of the broken low-strength plate with another member to restart the operation. Further, replacing the low-strength plate, which is a low-cost member in the first plate, with another member does not lead to an escalation of cost.

[0018] In addition to the configuration of the above-described aspect of the present invention, the fixation member can be fixed in an attachable and detachable manner to the outer surface of the partition wall or the end plate around the through-hole. This configuration facilitates the replacement of the broken low-strength wall.

[0019] Alternatively, in addition to the configuration of the above-described aspect of the present invention, a space may be formed between the outer surface of the partition wall or the end plate around the through-hole, and the fixation member. The low-strength plate may be configured to have a wedge-like shape in cross-section, and may be press fitted in the space to be fixed at the position that allows the low-strength plate to shield the through-hole. This configuration can simplify the shape and achieve cost saving with respect to the low-strength plate and the fixation member, and also facilitate the installation of the low-strength wall.

ADVANTAGEOUS EFFECTS OF INVENTION

[0020] According to the present invention, the structure forming the booster compressor can be effectively prevented from being damaged without leading to the increase in the weight and the escalation of the cost, with a simple and low-cost configuration that forms a part of the partition wall of the crank case from the low-strength wall.

BRIEF DESCRIPTION OF DRAWINGS

[0021]

Fig. 1 is a vertical cross-sectional view of a pressurizing booster compressor according to a first embodiment of the present invention.

Fig. 2 is an enlarged view of a portion labeled A in Fig. 1.

Fig. 3 is a cross-sectional view of a low-strength wall forming portion according to a second embodiment of the present invention.

Fig. 4 is a cross-sectional view of a low-strength wall forming portion according to a third embodiment of the present invention.

Fig. 5 is a front view of the low-strength wall forming portion according to the third embodiment.

Fig. 6 is a side view of a low-strength plate according to the third embodiment.

DESCRIPTION OF EMBODIMENTS

[0022] In the following description, the present invention will be described in detail based on illustrated embodiments thereof. However, dimensions, materials, shapes, a relative layout, and the like of component parts that will be described in these embodiments are not intended to limit the scope of the present invention only thereto, unless otherwise specified especially.

(First Embodiment)

[0023] Next, a first embodiment of the present invention will be described with reference to Figs. 1 and 2. Fig. 1 illustrates a configuration of a pressurizing booster compressor 10 according to the present embodiment. As illustrated in Fig. 1, the pressurizing booster compressor 10 includes a cylinder 12, and a cylinder head 14 disposed on the cylinder 12 via a valve spacer 39. A piston 16 is reciprocatably contained inside the cylinder 12. A crank case 18 is coupled with a lower portion of the cylinder 12. A compression chamber P is formed by the cylinder 12, the valve spacer 39, the cylinder head 14, and the piston 16.

[0024] The crank case 18 includes a partition wall, and this partition wall includes a hollow cylindrical body 20 and a flat circular end plate 22. The hollow cylindrical body 20 includes a cylindrical outer peripheral wall 20a, and a flat circular end wall 20b provided integrally with the outer peripheral wall 20a and forming one end surface. The hollow cylindrical body 20 is open on an opposite end surface. The circular end plate 22 is joined to the outer peripheral wall 20a by a joining method, such as a bolt, in an attachable and detachable manner, and closes the open end surface of the hollow cylindrical body 20. As illustrated in Fig. 1, the end plate 22 is disposed on a position facing the outside of the pressurizing booster compressor 10, and is fixed to the hollow cylindrical body 20 with use of a joining member, such as a bolt 23, in the attachable and detachable manner. A crank chamber c, which is defined so as to be isolated from the outside of the pressurizing booster compressor 10, is formed inside the crank case 18. The hollow cylindrical body 20 and the end plate 22 are made of a metal or a resin having a strength set according to a pressure generated in the crank chamber c in such a manner that the hollow cylindrical body 20 and the end plate 22 can bear or tolerate this pressure.

[0025] A circular opening is formed through a part of the outer peripheral wall 20a, and a circular flange 20c is also formed around this opening. The lower portion of the cylinder 12 is fitted in this opening. A top surface and a down surface of the piston 16 face the compression chamber p and the crank chamber c, respectively. A connecting rod 17 extends into the crank chamber c, and is coupled with a crank shaft 24 disposed in a direction perpendicular to the connecting rod 17 in the crank chamber c. A leg portion 20d is formed at a lower portion of the outer peripheral wall 20a.

[0026] A circular opening is formed through a center of the end wall 20b, and a cylindrical housing 26 is formed integrally with the end wall 20b so as to surround this opening. An output shaft 28a of an electric motor 28 is inserted in this opening. The output shaft 28a is rotatably supported by a rolling bearing 29 disposed inside the housing 26.

[0027] The crank shaft 24 is disposed so as to extend in parallel with the output shaft 28a and be located at a position eccentric to a rotational axis of the output shaft 28a, and is coupled with the output shaft 28a via a coupling member 30. A rotation of the output shaft 28a causes the crank shaft 24 to revolve around the rotational axis of the output shaft 28a, and the revolving motion of the crank shaft 24 causes the piston 16 to reciprocate. A counter weight 31 is integrally formed at the crank shaft 24 at a position out of phase by 180 degrees from the position where the crank shaft 24 is located eccentrically to the output shaft 28a.

[0028] Next, a configuration of the cylinder head 14 will be described. The cylinder head 14 is divided into an intake portion 32 and a discharge portion 34 by a central partition wall 14a. An intake port 32a for gas to be compressed in the compressor 10 is formed at the intake portion 32. An intake path 33 for the gas to be compressed, which is in communication with the intake port 32a, is formed inside the intake portion 32. An intake hole is formed through a valve spacer 39, which separates the intake path 33 and the compression chamber p from each other. A plate-like intake valve 35, which opens and closes this intake hole, is disposed at the valve spacer 39. The intake valve 35 is normally maintained in a closed state. Then, when the piston 16 is displaced downward inside the cylinder 12, a differential pressure between the intake path 33 and the compression chamber p causes the intake valve 35 to operate from the closed state to an opened state to thereby establish communication between the intake path 33 and the compression chamber p, thus allowing the gas to be supplied into the compression chamber p.

[0029] A pressurized gas supply tube 38, which supplies the pressurized gas to be compressed, is connected to the intake port 32a. The pressurized gas to be compressed is supplied from a pressurized gas supply apparatus (not illustrated) to the intake port 32a via the pressurized gas supply tube 38. A branch tube 38a branches off from the pressurized gas supply tube 38, and is connected to a central portion of the end wall 22. When the pressurizing booster compressor 10 is in operation, the pressurized gas to be compressed is supplied into the compression chamber via the intake valve 35, and is also supplied into the crank chamber c via the branch tube 38a simultaneously.

[0030] A discharge path 36, from which the gas compressed in the compression chamber p is discharged, is formed in the discharge portion 34. A discharge port 34a is formed at an exit of the discharge path 36. A discharge hole is formed through the valve spacer 39, which separates the compression chamber p and the discharge path 36 from each other. A plate-like discharge valve 37, which opens and closes this discharge hole, is disposed at the valve spacer 39. This discharge valve 37 is normally maintained in a closed state. Then, when the piston 16 is displaced upward to raise the pressure in the compression chamber p, a differential pressure between the compression chamber p and the discharge path 36 causes the discharge valve 37 to operate from the closed state to an opened state, thereby establishing communication between the compression chamber p and the discharge path 36.

[0031] A motor case 40 is horizontally coupled with the crank case 18. The electric motor 28, which rotates the output shaft 28a, is contained inside the motor case 40. A support portion 42, which forms a recess containing a rolling bearing 44, is provided on an end surface 40a of the motor case 40. An opposite end of the output shaft 28a is rotatably supported by the rolling bearing 44 contained in the support portion 42. Further, a power supply cable 46, which supplies a current to the electric motor 28, is disposed inside the motor case 40. A terminal 48, which is connected to the power supply cable 46, is disposed on an outer surface of the end surface 40a. Power is supplied from an external commercial power supply (not illustrated) to the electric motor 28 via the terminal 48.

[0032] In this configuration, when the pressurizing booster compressor 10 is in operation, the electric motor 28 is driven to rotate the output shaft 28a thereof. The rotation of the output shaft 28a is transmitted to the crank shaft 24 to thereby cause the crank shaft 24 to revolve and also cause the piston 16 to reciprocate.

[0033] Further, the pressurized gas to be compressed is supplied from the pressurized gas supply tube 38 into the intake portion 32. The gas to be compressed is supplied into the compression chamber p via the intake valve 35, and its pressure is raised in the compression chamber p. The gas to be compressed with its pressure raised is transmitted via the discharge valve 37, and is delivered from the discharge port 34a to a demander. At the same time, the gas to be compressed is also supplied into the crank chamber c via the branch tube 38a. This supply reduces a pressure difference between the compression chamber p and the crank chamber c, thereby cutting down a driving torque of the crank shaft 24 to realize energy saving, and also preventing an increase in a change of the torque, a vibration, and the like, which otherwise would be caused due to unevenness of the rotation of the crank shaft.

[0034] As illustrated in Fig. 2, a low-strength wall 50A is formed on the end plate 22. As illustrated in Fig. 2, in the low-strength wall 50A, a cutout 22a, which is circular and rectangular in cross-section, is formed at a part of the end plate 22, thereby forming a circular thinned portion 52 constant in thickness. A strength by which the thinned portion 52 is broken matches an allowable maximum pressure of the crank chamber c. The shape of the thinned portion 52 does not necessarily have to be circular, and a shape, such as a polygon and an oval, can be arbitrarily selected therefor according to an intended purpose.

[0035] The thinned portion 52 does not necessarily have to be constant in thickness. A groove may be partially formed at the thinned portion 52, and a strength of a portion where this groove is formed may be set so as to match the allowable maximum pressure, in order to facilitate the breakage of the thinned portion 52 and make it easier to identify the breakage portion.

[0036] As a result, when the pressure in the crank chamber c reaches the allowable maximum pressure, the thinned portion 52 is broken, so that the pressure in the crank chamber c is prevented from exceeding the allowable maximum pressure and is allowed to return to a low pressure. Then, the pressure in the crank chamber c is kept prevented from increasing until removal of a cause of the increase in the pressure in the crank chamber c to exceed the allowable maximum pressure, and a recovery of the crank chamber c into an original state thereof.

[0037] Therefore, this configuration does not cause the crank chamber c to automatically recover and the pressure in the crank chamber c to reach the allowable maximum pressure repeatedly, unlike the pressurizing booster compressor provided with the safety valve, and thus does not lead to the damage of the structure forming the pressurizing booster compressor 10. Further, this configuration only requires the formation of the thinned portion 52 at the end plate 22 to form the low-strength wall 50A, and thus does not lead to an escalation of cost.

[0038] Further, the end plate 22 is located so as to face the outside, which facilitates installation of the branch tube 34a. In addition, the end wall 22 is provided so as to be attachable to and detachable from the hollow cylindrical body 20, which also facilitates the formation of the low-strength wall 50A.

[0039] Further, the low-strength wall 50A is formed from the thinned portion 52, which allows the thinned portion 52 to be formed at the same time as when the end plate 22 is processed. This can reduce the number of processes that should be performed on the low-strength wall 50A, thereby achieving cost saving.

(Second Embodiment)

[0040] Next, a second embodiment of the present invention will be described with reference to Fig. 3. In Fig. 3, a low-strength wall 50B according to the present embodiment forms a circular through-hole 22b through the end plate 22. Then, a circular low-strength plate 54, which is larger in diameter than the through-hole 22b and is configured as a thin plate, is brought into abutment with the through-hole 22b from outside the end plate 22, thereby shielding the through-hole 22b. A fixation member 56, which fixes the low-strength plate 54, is provided outside the low-strength plate 54. The fixation member 56 has a circular shape larger in diameter than the low-strength plate 54. A circular recess 56a, which is large and deep enough to be able to contain the low-strength plate 54 therein, is formed at a center of the fixation member 56.

[0041] The fixation member 56 is fixed to an outer surface of the end plate 22 by a joining member, such as a bolt 58, in an attachable and detachable manner. A strength of the low-strength plate 54 is determined so as to allow the low-strength plate 54 to be broken under the allowable maximum pressure of the crank chamber c. The low-strength wall 50B may be provided at a position similar to the low-strength wall 50A according to the first embodiment, or a different position on the end plate 22. Further, the through-hole 22b, the low-strength plate 54, and the fixation member 56 do not have to be circular, and may have another shape, such as a polygon and a trapezoid.

[0042] Forming the low-strength wall 50B configured in this manner allows the low-strength wall 50B to be broken when the pressure in the crank chamber c exceeds the allowable maximum pressure, thereby preventing the pressure in the crank chamber c from increasing to the pressure higher than the allowable maximum pressure. Then, this configuration only requires removal of the fixation member 56 from the end plate 22 and replacement of the broken low-strength plate 54 with another member to restart the operation, thereby achieving cost saving. Further, the low-strength plate 54 is a low-cost member in the first place, and therefore can be replaced with another member while still keeping cost low.

[0043] Further, the fixation member 56 is fixed to the end plate 22 in the attachable and detachable manner, which facilitates the replacement of the low-strength plate 54.

(Third Embodiment)

[0044] Next, a configuration of a low-strength wall 50C according to a third embodiment of the present invention will be described with reference to Figs. 4 to 6. In Figs. 4 to 6, a quadrilateral through-hole 22c is formed through the end plate 22. A quadrilateral fixation member 62, which is sufficiently larger in area than an opening area of the through-hole 22c, is disposed on the outer surface of the end plate 22 so as to cover the through-hole 22c. The fixation member 62 is fixedly attached to the outer surface of the end plate 22 by a method such as welding. A recess 62a, which is deep enough to allow a low-strength plate 60 to be press fitted therein, is formed on an inner surface of the fixation member 62. As illustrated in Fig. 5, the recess 62a is larger in area than the opening area of the through-hole 22c, and is formed across an entire length of a horizontal side 62b of the fixation member 62. An opening (not illustrated), which is used to expose the low-strength plate 60 to the outside, is formed on an outer surface of the fixation member 62. Preferably, this opening is formed at a position in alignment with the through-hole 22c. When the pressure in the crank chamber c exceeds the allowable maximum pressure, the low-strength wall 60 is broken, which can prevent the pressure in the crank chamber c from increasing to the pressure higher than the allowable maximum pressure.

[0045] The low-strength plate 60 has a rectangular shape, and has a wedge-like shape in cross-section as illustrated in Fig. 6. Further, the low-strength plate 60 is formed in such a manner that a length hi of a long side 60a thereof is longer than a length h2 of the horizontal side 62b of the fixation member 62. The low-strength plate 60 is press fitted into the recess 62a in such a manner that a tapered tip 60b thereof is inserted first, and is fixed at a position that allows the low-strength plate 60 to cover the through-hole 22b. In other words, the tapered tip 60b and a thick end 60c of the low-strength plate 60 are fixed while being located outside beyond the fixation member 62.

[0046] The low-strength wall 50C according to the present embodiment can simplify the shape and achieve cost saving with respect to the low-strength plate 60 and the fixation member 62 forming the low-strength wall 50C, and also facilitate the installation of the low-strength plate 60. Further, this low-strength wall 50C can bring about such an advantage that the low-strength plate 60 can be securely fixed by being press fitted in the fixation member 62.

INDUSTRIAL APPLICABILITY

[0047] According to the present invention, it is possible to achieve the simple prevention arrangement that does not lead to the increase in the weight and the escalation of the cost, and also does not cause the damage of the structure forming the pressurizing booster compressor, as the apparatus for preventing the pressure in the crank chamber of the pressurizing booster compressor from excessively increasing.

[0048] Having described the present invention based on the embodiments, needless to say, the technical scope of the present invention shall not be limited to the range described in the above-described embodiments. It is apparent to those skilled in the art that the above-described embodiments can be changed or improved in various manners. Further, it is apparent from the recitation of the scope of the claims that such embodiments changed or improved in various manners can be also contained in the technical scope of the present invention.

[0049] This application claims priority under the Paris Convention to Japanese Patent Application No. 2013-202013 filed on September 27, 2013. The entire disclosure of Japanese Patent Application No. 2013-202013 filed on September 27, 2013 including the specification, the claims, the drawings, and the summary is incorporated herein by reference in its entirety.

[0050] The entire disclosure of Japanese Patent Application Publication No. 2010-059889 (Patent Literature 1) including the specification, the claims, the drawings, and the summary is incorporated herein by reference in its entirety.

REFERENCE SIGNS LIST

[0051]

10	pressurizing booster compressor
12	cylinder
14	cylinder head
14a	partition wall
16	piston
17	connecting rod
18	crank case
20	hollow cylindrical body
20a	outer peripheral wall
20b	end wall
20c	flange
20d	leg portion
22	end plate
22a	cutout
22b and 22c	through-hole
23	bolt
24	crank shaft
26	housing
28	electric motor
28a	output shaft
29 and 44	rolling bearing
30	coupling member
31	counter weight
32	intake portion
32a	intake port
33	intake path
34	discharge portion
34a	discharge port
36	discharge path
35	intake valve
37	discharge valve
38	pressurized gas supply tube
38a	branch tube
39	valve spacer
40	motor case
40a	end surface
42	support portion
46	power supply cable
48	terminal
50A, 50B, and 50C	low-strength wall

52	thinned portion
54 and 60	low-strength plate
60a	long side
60b	tapered tip
60c	thick end
56 and 62	fixation member
56a and 62a	recess
62b	horizontal side
c	crank chamber
p	compression chamber

Claims

1. A pressurizing booster compressor comprising:

    a cylinder;
    a cylinder head provided on the cylinder;
    a piston reciprocatable inside the cylinder, the piston defining a compression chamber together with the cylinder head and the cylinder;
    a crank shaft coupled with the piston;
    a driving shaft configured to rotationally drive the crank shaft;
    a crank case containing the crank shaft and defining a crank chamber isolated from an outside; and
    a pressurized gas supply tube configured to supply pressurized gas to be compressed to each of the compression chamber and the crank chamber,

    wherein the crank case includes a partition wall, and the partition wall includes a low-strength wall at a part thereof facing the outside, the low strength wall being configured to be broken under an allowable maximum pressure of the crank chamber.

2. The pressurizing booster compressor according to claim 1, wherein the partition wall of the crank case comprises a hollow cylindrical body including an outer peripheral wall and an end wall forming one end surface with an opposite end surface open to the outside, and
    an end plate fixed to the hollow cylindrical body and closing the opposite end surface, and
    wherein the pressurized gas supply tube is connected to the end plate, and the end plate includes the low-strength wall formed at a different position from a position to which the pressurized gas supply tube is connected.

3. The pressurizing booster compressor according to claim 1 or 2, wherein the low-strength wall includes a thinned portion, the thinned portion being formed on at least one of the partition wall facing an outside of the crank case and the end plate.

4. The pressurizing booster compressor according to claim 1 or 2, wherein a through-hole is formed through at least one of the partition wall facing an outside of the crank case and the end plate, and
    wherein the low-strength wall includes
    a low-strength plate having a strength that allows the low-strength plate to be broken under the allowable maximum pressure of the crank chamber, the low-strength plate being disposed in abutment with at least one of an outer surface of the partition wall and the end plate around the through-hole so as to shield the through-hole, and
    a fixation member fixed to at least one of the outer surface of the partition wall and the end plate around the through-hole to fix the low-strength plate at a position that allows the low-strength plate to shield the through-hole.

5. The pressurizing booster compressor according to claim 4, wherein the fixation member is fixed in an attachable and detachable manner to at least one of the outer surface of the partition wall and the end plate around the through-hole.

6. The pressurizing booster compressor according to claim 4, wherein a space is formed between at least one of the outer surface of the partition wall and the end plate around the through-hole, and the fixation member, and
    wherein the low-strength plate has a wedge-like shape in cross-section, and is press fitted in the space to be fixed at the position that allows the low-strength plate to shield the through-hole.

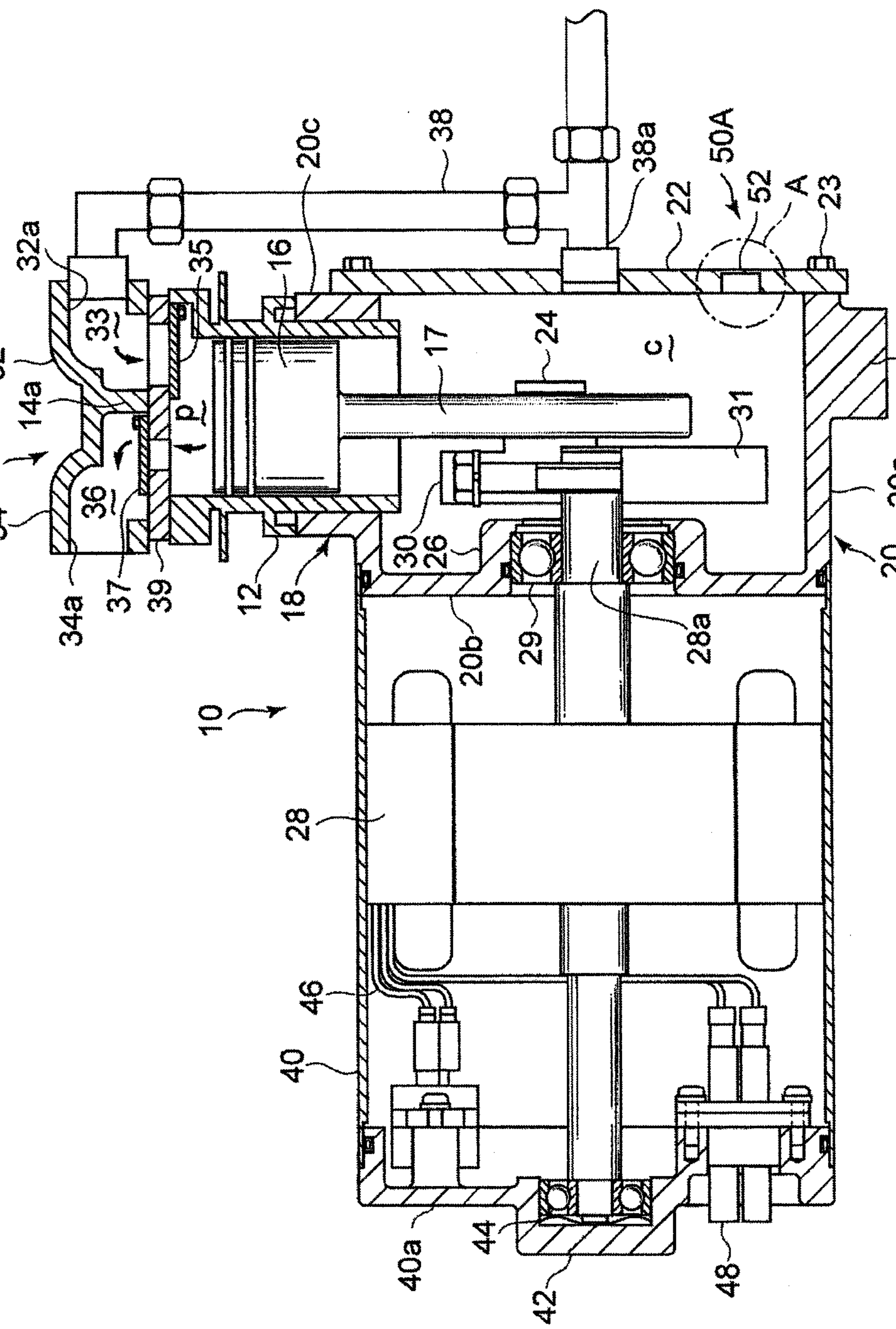
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Fig. 1

Fig. 2

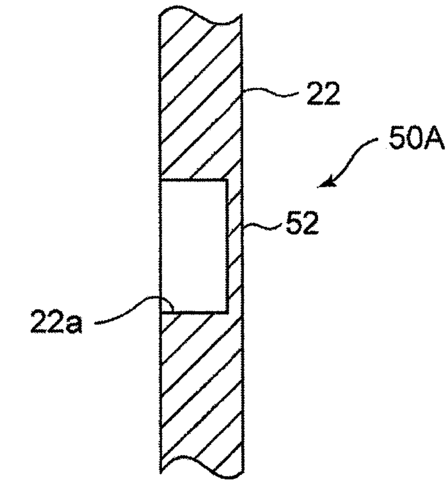


Fig. 3

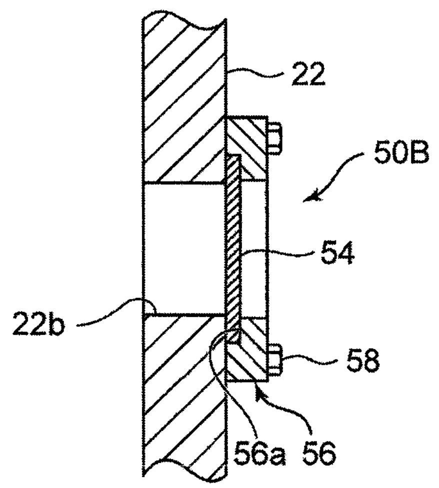


Fig. 4

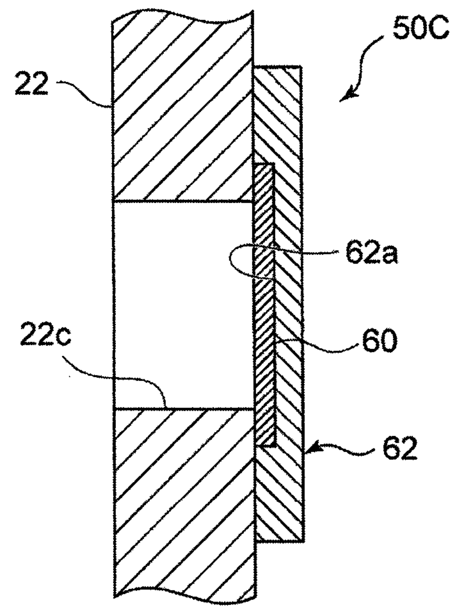


Fig. 5

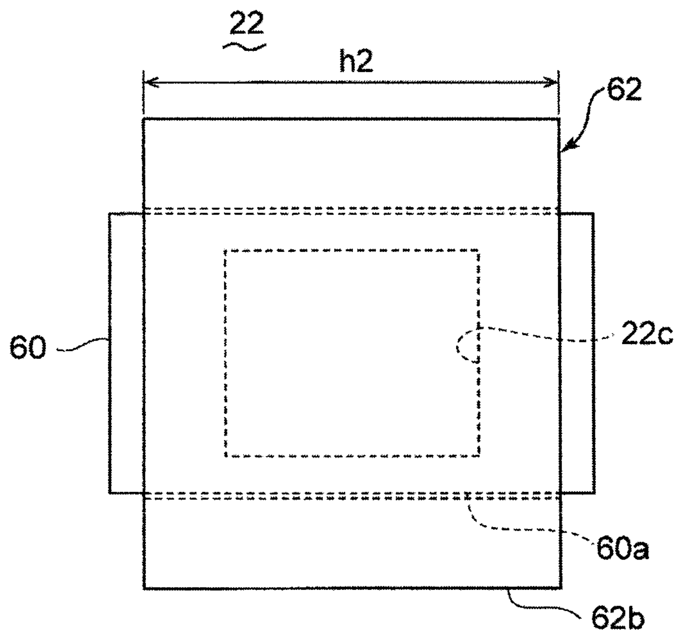
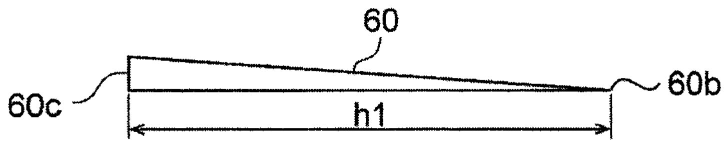


Fig. 6



INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/074634

A. CLASSIFICATION OF SUBJECT MATTER
F04B39/12(2006.01)i, *F04B37/12*(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
F04B39/12, F04B37/12

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Jitsuyo Shinan Koho	1922-1996	Jitsuyo Shinan Toroku Koho	1996-2014
Kokai Jitsuyo Shinan Koho	1971-2014	Toroku Jitsuyo Shinan Koho	1994-2014

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 84687/1979(Laid-open No. 4690/1981) (Tokico, Ltd.), 16 January 1981 (16.01.1981), fig. 2 (Family: none)	1-6
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 41450/1981(Laid-open No. 153788/1982) (Kayaba Industry Co., Ltd.), 27 September 1982 (27.09.1982), fig. 1 (Family: none)	1-6

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
15 December, 2014 (15.12.14)	22 December, 2014 (22.12.14)

Name and mailing address of the ISA/	Authorized officer
Japanese Patent Office	
Facsimile No.	Telephone No.

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP2014/074634

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	JP 2006-233869 A (NGK Spark Plug Co., Ltd.), 07 September 2006 (07.09.2006), fig. 10 (Family: none)	1-6
A	Microfilm of the specification and drawings annexed to the request of Japanese Utility Model Application No. 23811/1986(Laid-open No. 135878/1987) (Tokico, Ltd.), 26 August 1987 (26.08.1987), fig. 4 (Family: none)	1-6

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010059889 A **[0006] [0050]**
- JP 2013202013 A **[0049]**