

Description

The present invention relates to a piston type compressor, and more particularly to a multicylinder compressor in which a plurality of cylinders are arranged around an axis.

In conventional multicylinder compressors used for, for example, air conditioners, a plurality of discharge valves, provided in correspondence with the respective outlet ports of a plurality of cylinders, are integrally formed as a single plate. Each valve guard for restricting the motion of each discharge valve and protecting the discharge valve is formed usually in the same shape as that of the discharge valve.

FIGS. 4A and 4B illustrate a part of a conventional multicylinder compressor. FIG. 4B depicts a vertical section of a valve guard. In FIG. 4B, valve plate 110 having outlet ports 113 is provided on an end of a cylinder block (not shown).

Inlet valve member 114 is provided on the cylinder block side of valve plate 110. Discharge valve member 111 is provided on the cylinder head side of valve plate 110. Discharge valve member 111 has discharge valves 111a for opening and closing the respective outlet ports 113. Each discharge valve 111a is restricted in opening motion by valve guard 116a. Valve guard member 116 has a plurality of valve guards 116a by the number corresponding to the number of discharge valves 111a (outlet ports 113). Valve guard member 116 is provided in discharge chamber 122 defined by the cylinder head, particularly by inside partition plate 123 of the cylinder head. Valve guard member 116 has center hole 126 for fixing the valve guard member to valve plate 110 via a bolt (not shown). Gasket 115 seals between valve plate 110 and inside partition plate 123.

As shown in FIG. 4A inside partition plate 123 of the cylinder head is formed as a shape having a wave line. The interior of waved inside partition plate 123 is formed as discharge chamber 122. Each of valve guards 116a of valve guard member 116 radially extends from the center of the member toward each of inner side surfaces 123a of projecting portions 123b of waved inside partition plate 123. Discharge valve member 111 has substantially the same shape as that of valve guard member 116. Each valve guard 116a extends straightly from the central portion of valve guard member 116, and only the tip portion of the valve guard 116a is shaped along each inner side surface 123a of projecting portion 123b of waved inside partition plate 123 with a substantially constant distance. Therefore, the distance between each constriction portion 116b of valve guard member 116 and the inner side surface of waved inside partition plate 123 is greater than the distance between the tip

portion of each valve guard 116a and each inner side surface 123a of projecting portion 123b.

As shown in FIG. 4B valve guard 116a is curved such that the separation distance of the valve guard from valve plate 110 becomes larger as the valve guard extends outwardly.

In such a conventional multicylinder compressor, the shape of discharge valve member 111 is designed in consideration of the rigidity of delivery valves 111a so as to decrease fluid loss therethrough. Valve guard 116a is curved in vertical section to restrict the motion of discharge valve 111a and for the relaxation of stress of the restricted discharge valve 111a and consequently valve guard member 116 is star-shaped. Therefore, valve guard 116a is relatively flexible in a similar manner to the discharge valve 111a. To increase the rigidity of valve guard 116a, each valve guard 116a and valve guard member 116 must be made thicker. However, the total weight and cost of such a compressor is thus increased.

It would be desirable to provide a multicylinder compressor with discharge valves which have a high rigidity but which are not thick, and which can be light and inexpensive.

DE-A-3839172 discloses a multicylinder compressor which comprises a cylinder block having a plurality of cylinders arranged parallel to each other, a valve plate provided on an end of the cylinder block, the valve plate including a plurality of outlet ports for discharging a compressed fluid from the plurality of cylinders, a cylinder head provided on the valve plate, the cylinder head having a partition wall which surrounds and defines a discharge chamber, and which has, in section parallel to the valve plate, a wavy shape, presenting to the discharge chamber alternate convex and concave portions, a plurality of discharge valves provided on the valve plate and a valve guard member provided in the discharge chamber; and according to the present invention such a multicylinder compressor is characterised in that an outline of a fringe of the valve guard member has first portions spaced by a substantially constant distance from respective concave portions of the partition wall and, between the first portions, second portions spaced from respective convex portions of the partition wall by no more than the constant distance.

The plurality of discharge valves may comprise a discharge valve member.

Each of the plurality of discharge valves may cover one of the plurality of outlet ports to open and close each of the plurality of outlet ports.

The outline of the fringe of the valve guard member may maintain throughout its full length a substantially constant distance from the partition wall.

The rigidity of each valve guard within the valve guard member is increased without making the valve guard member thicker, because more support is provided on each side of each valve guard than in a conventional multicylinder compressor. As a result, the valve guard member need not be excessively thick and the multicylinder compressor can be made light-weight and produced inexpensively.

In the accompanying drawings:-

FIG. 1A is a vertical sectional view of a part of a multicylinder compressor according to an embodiment of the present invention.

FIG. 1B is a schematic cross-sectional view of the multicylinder compressor shown in FIG. 1A, taken along 1B-1B line of FIG. 1A.

FIG. 2A is a schematic cross-sectional view of a part of the multicylinder compressor shown in FIG. 1A, showing the structure of a valve guard member of the compressor.

FIG. 2B is a partial vertical sectional view of the multicylinder compressor shown in FIG. 2A, showing the structure of a vertical section of the valve guard member of the compressor.

FIG. 3 is a schematic cross-sectional view of a part of a multicylinder compressor according to another embodiment of the present invention, showing the structure of a valve guard member of the compressor.

FIG. 4A is a schematic cross-sectional view of a part of a conventional multicylinder compressor, showing the structure of a valve guard member of the compressor.

FIG. 4B is a partial vertical sectional view of the multicylinder compressor shown in FIG. 4A, showing the structure of the vertical section of the valve guard member of the compressor.

FIGS. 1A to 2B illustrate a multicylinder compressor according to an embodiment of the present invention. FIGS. 1A and 1B illustrate the end portion of cylinder block 100 and cylinder head 120.

Cylinder block 100 has a plurality of cylinders 101 (in this embodiment; seven cylinders) arranged parallel to each other around a center axis 100a. Valve plate 110 is provided on an end of cylinder block 100. Valve plate 110 has a plurality of inlet ports 112 through which a fluid is introduced into the respective cylinders 101 and a plurality of outlet ports 113 through which the fluid compressed in the respective cylinders 101 is discharged from the respective cylinders. Inlet valve member 114 is provided between the end of cylinder block 100 and valve plate 110. Cylinder head 120 is mounted on valve plate 110 via gasket 115. Cylinder head 120 is fixed to cylinder block 100 by bolts 130 screwed into tapped holes 131 of the cylinder block via valve plate 110 and gasket 115. The through holes for bolts 130 are defined in boss

portions 125 formed on outer partition wall 124 of cylinder head 120 at the respective portions between adjacent cylinders 101. Suction chamber 121 and discharge chamber 122 are formed in cylinder head 120. Suction chamber 121 is defined by outer partition wall 124 and inner partition wall 123 of cylinder head 120. Discharge chamber 122 is defined by inner partition wall 123 of cylinder head 120. Discharge valve member 111 is provided on valve plate 110 in discharge chamber 122. Valve guard member 1 is provided on discharge valve member 111 in discharge chamber 122. Valve guard member 1 is fixed to valve plate 110 by bolt 132 inserted through center hole 2 of the valve guard member.

Piston 102 is slidably inserted into each cylinder 101. Piston rings 103 and 104 are fitted on the periphery of piston 102. Connecting rod 105 is pivotably connected to boss portion 106 of piston 102. Inlet valve member 114 has inlet valves 114a radially extending which open and close the respective inlet ports 112, and through holes 114b at the positions corresponding to the respective outlet ports 113. Groove 101a is formed on the periphery of each cylinder 101 at the radially outermost position and at the end of cylinder block 100. Groove 101a restricts the opening motion of inlet valve 114a by engaging the tip portion of the inlet valve.

FIGS. 2A and 2B illustrate discharge valve member 111, valve guard member 1 and inner side wall 123 of cylinder head 120. Discharge valve member 111 has discharge valves 111a radially extending which open and close the respective outlet ports 113. Valve guard member 1 has a plurality of valve guards 1a radially extending by the number corresponding to the number of discharge valves (seven valve guards). Each valve guard 1a is curved in vertical section so as to be separated from valve plate 110 as radially extended. Each valve guard 1a restricts the separation distance (opening motion) of corresponding delivery valve 111a from valve plate 110. Inner partition wall 123 is formed in plane as a waved shape as shown in FIG. 2A. Respective curved projection portions 123b are formed on inner partition wall 123 at the positions corresponding to those of cylinders 101 (outlet ports 113). The outline of the fringe of valve guard member 1 is formed along waved inner side surface 123a of inner partition wall 123. In this embodiment, the outline of the fringe of valve guard member 1 is formed along, or follows, the waved inner side surface 123a of inner partition wall 123 such that the distance between the outline of the fringe and the inner side surface is maintained as a constant distance. The outline of the fringe of valve guard member 1 may be formed analogous to the shape defined by waved inner side surface 123a of inner

partition wall 123, or substantially parallel to the inner side surface 123a.

In the multicylinder compressor constructed above, piston 102 is reciprocally driven. A fluid is sucked from suction chamber 121 into cylinder 101 through inlet port 112 and opened inlet valve 114a when piston 102 is moved toward right side of FIG. 1A. The fluid introduced into cylinder 101 is compressed in cylinder 101 by piston 102 moving toward left side of FIG. 1A. The compressed fluid is discharged from cylinder 101 to discharge chamber 122 through outlet port 113 and opened discharge valve 111a when piston 102 is moved toward left side of FIG. 1A, as shown by arrow 150 in FIG. 1A.

As shown in FIG. 2A, the outline of the fringe of valve guard member 1 extends along waved inner side surface 123a of inner partition wall 123, maintaining a constant distance between the outline of the fringe and the inner side surface. Therefore, even in constriction portion 1b between adjacent valve guards 1a, the constant distance is maintained. As a result, the degree of the constriction of constriction portion 1b is small as compared with the constriction portion 116b in the conventional multicylinder compressor, as shown in FIG. 3A.

Thus, the length of the minimum radius of the valve guard member 1 is greater than one-half of the length of the maximum radius of the valve guard member 1. Any angle formed by the outline of the fringe of the valve guard member is greater than 90 degrees. Accordingly, the rigidity of each valve guard 1a can be maintained sufficiently high even if the thickness of the valve guard 1a is less than that in the conventional multicylinder compressor. The compressor according to the present invention can be made to be light-weight and can be produced inexpensively as compared with conventional multicylinder compressors.

FIG. 3 illustrates another embodiment of the present invention. In this embodiment, each constriction portion 1b of valve guard member 1 is closer to waved inner side surface 123a of inner partition wall 123, as compared with the above embodiment. Thus, constriction portion 1b of valve guard member 1 may be close to the inner side surface 123a of inner partition wall 123, unless the constriction portion 1b comes into contact with the inner side surface 123a. Since the degree of the constriction of constriction portion 1b can be smaller, the rigidity of each valve guard 1a can be more increased.

Claims

1. A multicylinder compressor comprising a cylinder block (100) having a plurality of cylinders (101) arranged parallel to each other, a valve

plate (110) provided on an end of the cylinder block (100), the valve plate (110) including a plurality of outlet ports (113) for discharging a compressed fluid from the plurality of cylinders (101), a cylinder head (120) provided on the valve plate (110), the cylinder head (120) having a partition wall (123) which surrounds and defines a discharge chamber (122), and which has, in section parallel to the valve plate (110), a wavy shape, presenting to the discharge chamber alternate convex and concave portions, a plurality of discharge valves (111a) provided on the valve plate (110) and a valve guard member (1) provided in the discharge chamber (122); characterised in that an outline of a fringe of the valve guard member (1) has first portions spaced by a substantially constant distance from respective concave portions of the partition wall (123) and, between the first portions, second portions spaced from respective convex portions of the partition wall by no more than the constant distance.

2. A multicylinder compressor according to claim 1, wherein the plurality of discharge valves (111a) comprise a discharge valve member (111).

3. A multicylinder compressor according to claim 1 or claim 2, wherein each of the plurality of discharge valves (111a) covers one of the plurality of outlet ports (113) to open and close each of the plurality of outlet ports (113).

4. A multicylinder compressor according to any one of the preceding claims, wherein the outline of the fringe of the valve guard member (1) maintains throughout its full length a substantially constant distance from the partition wall (123).

5. A multicylinder compressor according to any one of the preceding claims, wherein the valve guard member (1) is attached to the valve plate (110) in the discharge chamber (122).

6. A multicylinder compressor according to claim 5, wherein the valve guard member (1) has a center hole (2) for fixing the valve guard member (1) to the valve plate (110).

7. A multicylinder compressor according to any one of the preceding claims, wherein the cylinder head (120) is mounted on the cylinder block (100) via a gasket (115).

8. A multicylinder compressor according to any one of the preceding claims, wherein the

partition wall 123, or substantially parallel to the inner side surface 123a.

In the multicylinder compressor constructed above, piston 102 is reciprocally driven. A fluid is sucked from suction chamber 121 into cylinder 101 through inlet port 112 and opened inlet valve 114a when piston 102 is moved toward right side of FIG. 1A. The fluid introduced into cylinder 101 is compressed in cylinder 101 by piston 102 moving toward left side of FIG. 1A. The compressed fluid is discharged from cylinder 101 to discharge chamber 122 through outlet port 113 and opened discharge valve 111a when piston 102 is moved toward left side of FIG. 1A, as shown by arrow 150 in FIG. 1A.

As shown in FIG. 2A, the outline of the fringe of valve guard member 1 extends along waved inner side surface 123a of inner partition wall 123, maintaining a constant distance between the outline of the fringe and the inner side surface. Therefore, even in constriction portion 1b between adjacent valve guards 1a, the constant distance is maintained. As a result, the degree of the constriction of constriction portion 1b is small as compared with the constriction portion 116b in the conventional multicylinder compressor, as shown in FIG. 3A.

Thus, the length of the minimum radius of the valve guard member 1 is greater than one-half of the length of the maximum radius of the valve guard member 1. Any angle formed by the outline of the fringe of the valve guard member is greater than 90 degrees. Accordingly, the rigidity of each valve guard 1a can be maintained sufficiently high even if the thickness of the valve guard 1a is less than that in the conventional multicylinder compressor. The compressor according to the present invention can be made to be light-weight and can be produced inexpensively as compared with conventional multicylinder compressors.

FIG. 3 illustrates another embodiment of the present invention. In this embodiment, each constriction portion 1b of valve guard member 1 is closer to waved inner side surface 123a of inner partition wall 123, as compared with the above embodiment. Thus, constriction portion 1b of valve guard member 1 may be close to the inner side surface 123a of inner partition wall 123, unless the constriction portion 1b comes into contact with the inner side surface 123a. Since the degree of the constriction of constriction portion 1b can be smaller, the rigidity of each valve guard 1a can be more increased.

Claims

1. A multicylinder compressor comprising a cylinder block (100) having a plurality of cylinders (101) arranged parallel to each other, a valve

plate (110) provided on an end of the cylinder block (100), the valve plate (110) including a plurality of outlet ports (113) for discharging a compressed fluid from the plurality of cylinders (101), a cylinder head (120) provided on the valve plate (110), the cylinder head (120) having a partition wall (123) which surrounds and defines a discharge chamber (122), and which has, in section parallel to the valve plate (110), a wavy shape, presenting to the discharge chamber alternate convex and concave portions, a plurality of discharge valves (111a) provided on the valve plate (110) and a valve guard member (1) provided in the discharge chamber (122); characterised in that an outline of a fringe of the valve guard member (1) has first portions spaced by a substantially constant distance from respective concave portions of the partition wall (123) and, between the first portions, second portions spaced from respective convex portions of the partition wall by no more than the constant distance.

2. A multicylinder compressor according to claim 1, wherein the plurality of discharge valves (111a) comprise a discharge valve member (111).
3. A multicylinder compressor according to claim 1 or claim 2, wherein each of the plurality of discharge valves (111a) covers one of the plurality of outlet ports (113) to open and close each of the plurality of outlet ports (113).
4. A multicylinder compressor according to any one of the preceding claims, wherein the outline of the fringe of the valve guard member (1) maintains throughout its full length a substantially constant distance from the partition wall (123).
5. A multicylinder compressor according to any one of the preceding claims, wherein the valve guard member (1) is attached to the valve plate (110) in the discharge chamber (122).
6. A multicylinder compressor according to claim 5, wherein the valve guard member (1) has a center hole (2) for fixing the valve guard member (1) to the valve plate (110).
7. A multicylinder compressor according to any one of the preceding claims, wherein the cylinder head (120) is mounted on the cylinder block (100) via a gasket (115).
8. A multicylinder compressor according to any one of the preceding claims, wherein the

length of the shortest distance between a centre of the valve guard member (1) and its fringe is greater than half of the length of the greatest distance between the centre of the valve guard member (1) and its fringe.

Patentansprüche

1. Mehrzylinderkompressor mit einem Zylinderblock (100) mit einer Mehrzahl von Zylindern (101), die parallel zueinander angeordnet sind, einer Ventilplatte (110), die an einem Ende des Zylinderblockes (100) vorgesehen ist, wobei die Ventilplatte (110) eine Mehrzahl von Auslaßöffnungen (113) zum Ausgeben eines komprimierten Fluids aus der Mehrzahl von Zylindern (101) enthält, einem Zylinderkopf (120), der auf der Ventilplatte (110) vorgesehen ist, wobei der Zylinderkopf (120) eine Unterteilungswand (123) aufweist, die eine Auslaßkammer (122) umgibt und definiert und die in einem Abschnitt parallel zu der Ventilplatte (110) eine wellige Form aufweist, die der Auslaßkammer abwechselnd konvexe und konkave Abschnitte zeigt, einer Mehrzahl von Auslaßventilen (111a), die auf der Ventilplatte (110) vorgesehen sind, einem Ventilschutzteil (1), das in der Auslaßkammer (122) vorgesehen ist; dadurch gekennzeichnet, daß eine Außenlinie einer Einfassung des Ventilschutzteiles (1) aufweist erste Abschnitte, die in einem im wesentlichen konstanten Abstand von den entsprechenden konkaven Abschnitten der Unterteilungswand (123) angeordnet sind, und zwischen den ersten Abschnitten zweite Abschnitte, die von den entsprechenden konvexen Abschnitten der Unterteilungswand in nicht mehr als den konstanten Abstand entfernt angeordnet sind.
2. Mehrzylinderkompressor nach Anspruch 1, bei dem die Mehrzahl von Auslaßventilen (111a) ein Auslaßventilteil (111) aufweist.
3. Mehrzylinderkompressor nach Anspruch 1 oder 2, bei dem jedes der Mehrzahl von Auslaßventilen eine der Mehrzahl von Auslaßöffnungen (113) zum Öffnen und Schließen von jedem der Mehrzahl von Auslaßöffnungen (113) bedeckt.
4. Mehrzylinderkompressor nach einem der vorhergehenden Ansprüche, bei dem die Außenlinie der Einfassung des Ventilschutzteiles (1) über seine gesamte Länge einen im wesentli-

chen konstanten Abstand von der Unterteilungswand (123) aufrechterhält.

5. Mehrzylinderkompressor nach einem der vorhergehenden Ansprüche, bei dem das Ventilschutzteil (1) an der Ventilplatte (110) in der Auslaßkammer (122) angebracht ist.
6. Mehrzylinderkompressor nach Anspruch 5, bei dem das Ventilschutzteil (1) ein Mittenloch (2) zum Befestigen des Ventilschutzteiles (1) an der Ventilplatte (110) aufweist.
7. Mehrzylinderkompressor nach einem der vorhergehenden Ansprüche, bei dem der Zylinderkopf (120) auf dem Zylinderblock (100) über eine Dichtung (115) angebracht ist.
8. Mehrzylinderkompressor nach einem der vorhergehenden Ansprüche, bei dem die Länge des kürzesten Abstandes zwischen einer Mitte des Ventilschutzteiles (1) und seiner Einfassung größer als die Hälfte der Länge des größten Abstandes zwischen der Mitte des Ventilschutzteiles (1) und seiner Einfassung ist.

Revendications

1. Compresseur multicylindre qui comprend un bloc de cylindres (100) comportant une pluralité de cylindres (101) disposés parallèlement les uns aux autres, une plaque à soupapes (110) montée sur une extrémité du bloc de cylindres (100), la plaque à soupapes (110) comprenant une pluralité d'orifices de sortie (113) pour décharger un fluide comprimé de la pluralité de cylindres (101), une culasse (120) montée sur la plaque à soupapes (110), la culasse (120) comportant une paroi de séparation (123) qui entoure et définit une chambre de décharge (122) et qui comporte, dans une section parallèle à la plaque à soupapes (110), une forme ondulée présentant à la chambre de décharge des parties alternativement convexes et concaves, une pluralité de soupapes d'échappement (111a) montées sur la plaque à soupapes (110), et un élément de garde de soupapes (1) placé dans la chambre de décharge (122); caractérisé en ce que le contour du bord de l'élément de garde de soupapes (1) comporte des premières parties espacées d'une distance parfaitement constante des parties concaves respectives de la paroi de séparation (123) et, entre les premières parties, des secondes parties espacées des parties convexes respectives de la paroi de séparation par une distance ne dépassant pas la distance constante.

2. Compresseur multicylindre selon la revendication 1, caractérisé en ce que la pluralité de soupapes d'échappement (111a) comprend un élément de soupapes d'échappement (111).
3. Compresseur multicylindre selon la revendication 1 ou la revendication 2, caractérisé en ce que chaque soupape d'échappement de la pluralité de soupapes d'échappement (111a) recouvre un orifice de sortie de la pluralité d'orifices de sortie (113) pour ouvrir et fermer chaque orifice de sortie de cette pluralité d'orifices de sortie (113).
4. Compresseur multicylindre selon l'une quelconque des revendications précédentes, caractérisé en ce que le contour du bord de l'élément de garde de soupapes (1) maintient, sur toute sa longueur, une distance parfaitement constante par rapport à la paroi de séparation (123).
5. Compresseur multicylindre selon l'une quelconque des revendications précédentes, caractérisé en ce que l'élément de garde de soupapes (1) est attaché à la plaque à soupapes (110) dans la chambre de décharge (122).
6. Compresseur multicylindre selon la revendication 5 caractérisé en ce que l'élément de garde de soupapes (1) comporte un trou central (2) pour fixer l'élément de garde de soupapes (1) à la plaque à soupapes (110).
7. Compresseur multicylindre selon l'une quelconque des revendications précédentes, caractérisé en ce que la culasse (120) est montée sur le bloc de cylindres (100) par l'intermédiaire d'un joint d'étanchéité (115).
8. Compresseur multicylindre selon l'une quelconque des revendications précédentes, caractérisé en ce que la longueur de la distance la plus courte entre le centre de l'élément de garde de soupapes (1) et son bord, est supérieure à la moitié de la longueur de la distance la plus grande entre le centre de l'élément de garde de soupapes (1) et son bord.

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