

DUAL FUNCTIONAL VALVE WITH V-SHAPE DOUBLE DISCHARGE AND SPRING REED

Field of the Invention

[0001] The present invention relates to the technology fields of compressor, and more specifically to a dual functional valve with V-shape double discharge and spring reed, where the dual functional valve can be employed in a compressor.

Background of the Invention

[0002] A compressor generally contains a motor part for generating a rotational driving force, and a compression part for sucking and compressing a gaseous medium by receiving the rotational driving force. The compression part usually contains a cylinder as a chamber for retaining the gaseous medium, a piston reciprocatingly inserted into the cylinder, a suction valve and a discharge valve for alternately opening and closing the inner space of the cylinder in response to the pressure differences between the cylinder's internal and external pressures caused by the linear reciprocation of the piston.

[0003] The valves are with diverse shapes and configurations. For example, US Patent 2725183 discloses a suction valve containing a three-beam reed with two fixed secure points for increasing efficiency due to increased valve area and reducing noise due to lower lift required. US Patent 4764091 discloses a suction valve containing multiple reed for reducing vibration and noise. US Patent 7850437 discloses a single beam reed by minimizing the distance between 2 passing through channels for reducing bending stress. It is evident that a smaller valve plate is unable to fit into current discharge reed designs. It is imperative to have a new valve that is suitable for a valve with a small valve plate.

Summary of the Invention

[0004] One aspect of the present invention provides a compressor valve. In one embodiment, the compressor valve comprise a suction valve plate having a suction reed,

and two discharge holes, wherein the suction reed allows for one-way flow of refrigerant, and the two discharge holes allow discharge of compressed refrigerant; a discharge valve plate having a recess formed on a surface away from the suction valve plate, two discharge holes located within the recess, and a suction hole; wherein when the compressor valve is assembled, these two discharge holes are aligned with the two discharge holes from the suction valve plate, and the suction hole is aligned with the suction reed; a V-shape double discharge spring reed with two reed arms, wherein the two reed arms form a V-shape configuration; a stopper with two stop arms; a spacer disposed between the stopper and V-shape double discharge spring reed; a limiter with two limit arms; wherein both the stopper and limiter have a V-shape configuration similar to the one formed by the V-shape double discharge spring reed; and wherein the V-shape double discharge spring reed, spacer, stopper, and limiter are disposed within the recess in this sequential order; and a cylinder head for directing the refrigerant into the respective chambers of a compressor; wherein the suction valve plate, discharge valve plate, V-shape double discharge spring reed, spacer, stopper, limiter, and cylinder head are assembled into the compressor valve.

[0005] In another embodiment of the compressor valve, the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the lower limit of the angle is to avoid stress concentration.

[0006] In another embodiment of the compressor valve, the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the upper limit of the angle is to avoid making the valves too far apart causing larger turbulence.

[0007] In another embodiment of the compressor valve, the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the angle is in the range of 15 to 150 degrees. In another embodiment, the angle is in the range of 20 to 135 degrees. In yet another embodiment, the angle is in the range of 25-90 degrees.

[0008] In another embodiment of the compressor valve, the V-shape double discharge spring reed, spacer, stopper, and limiter are fastened together by a screw through their fastening holes located at the middle of their joint sections.

[0009] In another embodiment of the compressor valve, further comprising a gasket valve plate disposed between the discharge valve plate and cylinder head.

[0010] In another embodiment of the compressor valve, the V-shape double discharge spring reed, spacer, stopper, and limiter are fastened together in this sequential order by press fit.

[0011] In another embodiment of the compressor valve, the V-shape double discharge spring reed is only joined with the valve plate at the middle of the V-shape.

[0012] The objectives and advantages of the invention will become apparent from the following detailed description of preferred embodiments thereof in connection with the accompanying drawings.

Brief Description of the Drawings

[0013] Preferred embodiments according to the present invention will now be described with reference to the Figures, in which like reference numerals denote like elements.

[0014] FIG 1 shows an exploded view of a compressor valve in accordance with one embodiment of the present invention, where the view is from the cylinder head to the suction valve plate.

[0015] FIG 2 shows an exploded view of the compressor valve shown in FIG 1, except that the view is from the suction valve plate to the cylinder head.

[0016] FIG 3 shows the front plain view (a), side view (b), top view (c) and side view (d) of the cylinder head shown in FIG 1.

[0017] FIG 4 shows the front plain view (a), side view (b), and side view (c) of the optional gasket valve plate shown in FIG 1.

[0018] FIG 5 shows the front plain view (a), side view (b), and side view (c) of the limiter shown in FIG 1.

[0019] FIG 6 shows the front plain view (a), side view (b), and side view (c) of the stopper shown in FIG 1.

[0020] FIG 7 shows the front plain view (a), side view (b), and side view (c) of the spacer shown in FIG 1.

[0021] FIG 8 shows the front plain view (a), side view (b), and side view (c) of the spring reed shown in FIG 1.

[0022] FIG 9 shows the front plain view (a), side view (b), and side view (c) of the discharge valve plate shown in FIG 1.

[0023] FIG 10 shows the front plain view (a), side view (b), and side view (c) of the suction valve plate shown in FIG 1.

[0024] FIG 11 shows an exploded view of a compressor valve in accordance with one embodiment of the present invention.

Detailed Description of the Invention

[0025] The present invention may be understood more readily by reference to the following detailed description of certain embodiments of the invention.

[0026] Throughout this application, where publications are referenced, the disclosures of these publications are hereby incorporated by reference, in their entireties, into this application in order to more fully describe the state of art to which this invention pertains.

[0027] Referring now to FIGS 1 and 2, there is provided an exploded view of a compressor valve in accordance with one embodiment of the present invention.

[0028] The compressor valve **1** comprises:

[0029] a suction valve plate **10** used to house a suction reed **13**, which allows for one-way flow of refrigerant. The suction valve plate **10** have a plurality of assembling holes **11** (four corner holes shown here) for assembling the compressor valve, a plurality of tightening holes **14** (2 holes shown here), and two discharge holes **12** allowing the passing of any discharged compressed refrigerant.

[0030] a discharge valve plate **20** having a recess **25** formed on a surface away from the suction valve plate **10**, where two discharge holes **22** are located within the recess **22**; when the compressor valve is assembled, the two discharge holes **22** are aligned with the two discharge holes **12** from the suction valve plate. The discharge valve plate **20** has a suction hole **23**; when the compressor valve is assembled, the suction hole **23** is aligned with the suction reed **13**. The discharge valve plate **20** also has a plurality of assembling holes **21** (four corner holes shown here) for assembling the compressor valve and a plurality of tightening holes **24** (2 holes shown here); when the compressor valve **1** is

assembled, the assembling holes **21** and tightening holes **24** are aligned with the assembling holes **11** and tightening holes **14** from the suction valve plate **10** respectively.

[0031] a V-shape double discharge spring reed **30** with two reed arms **31**. The V-shape double discharge spring reed **30** is disposed within the recess **22**; when the compressor valve **1** is assembled, each of the two reed arms **31** is able to be aligned with each of the two discharge holes **22**. The V-shape double discharge spring reed **30** is able to be bent outward when the pressure within a cylinder chamber is higher than the one in a discharging house, so that refrigerant can be discharged. The two reed arms **31** have a V-shape configuration, where the central lines of the two reed arms **31** form an angle. The lower limit is to avoid stress concentration while the upper limit to avoid making the valves too far apart causing larger turbulence. In certain embodiments, the V-shape configuration has an angle ranging from 15-150 degrees, preferably 20-135 degrees, and more preferably 25-90 degrees. In addition, the angle can vary according to the relative positions of the two reed arms **31** and two discharging holes **25**; for example, when the positions of the two discharging holes **25** are fixed, the angle varies depending on the length of the reed arms **31**.

[0032] a stopper **50** with two stop arms **51** for controlling the flexibility of the reed arms **31**; disposed between the stopper **50** and V-shape double discharge spring reed **30** is a spacer **40**. A limiter **60** with two limit arms **61** for limiting the opening of the two discharge reed arms **31**. Both the stopper **50** and limiter **60** have a V-shape configuration similar to the one used for the V-shape double discharge spring reed **30**. The V-shape double discharge spring reed **30**, spacer **40**, stopper **50**, and limiter **60** are disposed within the recess **22**, and assembled by for example press fit.

[0033] a gasket valve plate **70** for making up any manufacturing differences in thickness. The gasket valve plate **70** has a plurality of assembling holes **71** (four such holes shown), a through area **72** corresponding to the recess **22** of the discharge valve plate **20**, and a suction hole **73** being aligned with the suction hole **23** of the discharge valve plate **20**.

[0034] a cylinder head **80** for directing the refrigerant into the respective chambers of a compressor. The cylinder head **80** has a plurality of assembling holes **81**, and a suction hole **82**. The cylinder head **80** can be any suitable one known in the art.

[0035] During assembly, the suction valve plate **10**, discharge valve plate **20**, V-shape double discharge spring reed **30**, spacer **40**, stopper **50**, and limiter **60** are usually assembled first to form a valve module. The exemplary ways to assemble them include locking by screws and press fit. The valve module, the optional gasket valve plate **70**, and cylinder head **80** are assembled in such a sequential order to the compressor valve **1**.

[0036] FIGS 3-10 shows front plain and side views of the cylinder head **80**, gasket valve plate **70**, limiter **60**, stopper **50**, spacer **40**, spring reed **30**, discharge valve plate **20**, and suction valve plate **10** respectively.

[0037] Referring now to FIG 11, there is provided an exploded view of the compressor valve in accordance with another embodiment of the present invention. The compressor valve **1a** is similar to one shown in FIG 1, except that the suction valve plate **10a**, discharge valve plate **20a**, V-shape double discharge spring reed **30a**, spacer **40a**, stopper **50a**, and limiter **60a** have one fastening hole (**15**, **26**, **32**, **41**, **52**, **62**, respectively) for being able to be fastened by for example a screw.

[0038] The compressor valve **1** can be assembled to a block plate for a compressor; it is well known in the art; no details will be provided herein in order not to obscure the principles of the present invention.

[0039] The benefits of the present invention include:

[0040] (i) The present invention involves less parts (1 less caulking pin, 1 less discharge reed), hence reducing assembly time and reject rate.

[0041] (ii) The resting surface is reduced from 2 locations to 1. As the resting surface is sintered and not machined, 2 resting surfaces will have a larger tolerance. Therefore, reducing to 1 resting surface allows for better sealing, better stability and less back flow. The resting surface refers to the part of the valve plate where the discharge reed is joined. In the prior art, 2 discharge reeds would be joined with the valve plate at 2 separate locations. In our invention, the “v-shaped” discharge reed is only joined with the valve plate at the middle of the “v-shape”. Hence there is only 1 resting surface. As the flatness of the valve plate will affect the sealing of the discharge hole, reducing the number of resting surfaces will allow for better sealing of the valve hence allowing for better performance.

[0042] (iii) The present invention is able to fit onto a smaller valve plate while using the same length of the discharge reed as the prior art hence maintaining a similar rigidity and properties as the prior art.

[0043] (iv) The present invention allows for the distance between the 2 discharge holes to be increased. This allows the design to maximise the distance between 2 discharge holes, hence reducing turbulence caused during the discharge process which in turn leads to better performance.

[0044] While the present invention has been described with reference to particular embodiments, it will be understood that the embodiments are illustrative and that the invention scope is not so limited. Alternative embodiments of the present invention will become apparent to those having ordinary skill in the art to which the present invention pertains. Such alternate embodiments are considered to be encompassed within the scope of the present invention. Accordingly, the scope of the present invention is defined by the appended claims and is supported by the foregoing description.

CLAIMS

What is claimed is:

1. A compressor valve, comprising:

a suction valve plate having a suction reed, and two discharge holes, wherein the suction reed allows for one-way flow of refrigerant, and the two discharge holes allow discharge of compressed refrigerant;

a discharge valve plate having a recess formed on a surface away from the suction valve plate, two discharge holes located within the recess, and a suction hole; wherein when the compressor valve is assembled, these two discharge holes are aligned with the two discharge holes from the suction valve plate, and the suction hole is aligned with the suction reed;

a V-shape double discharge spring reed with two reed arms, wherein the two reed arms form a V-shape configuration.

a stopper with two stop arms;

a spacer disposed between the stopper and V-shape double discharge spring reed;

a limiter with two limit arms; wherein both the stopper and limiter have a V-shape configuration similar to the one formed by the V-shape double discharge spring reed; and wherein the V-shape double discharge spring reed, spacer, stopper, and limiter are disposed within the recess in this sequential order; and

a cylinder head for directing the refrigerant into the respective chambers of a compressor;

wherein the suction valve plate, discharge valve plate, V-shape double discharge spring reed, spacer, stopper, limiter, and cylinder head are assembled into the compressor valve.

2. The compressor valve of claim 1, wherein the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the lower limit of the angle is to avoid stress concentration.

3. The compressor valve of claim 1, wherein the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the upper limit of the angle is to avoid making the valves too far apart causing larger turbulence.
4. The compressor valve of claim 1, wherein the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the angle is in the range of 15 to 150 degrees.
5. The compressor valve of claim 1, wherein the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the angle is in the range of 20 to 135 degrees.
6. The compressor valve of claim 1, wherein the central lines of the two reed arms of the V-shape double discharge spring reed form an angle, and wherein the angle is in the range of 25-90 degrees.
7. The compressor valve of claim 1, wherein the V-shape double discharge spring reed, spacer, stopper, and limiter are fastened together by a screw through their fastening holes located at the middle of their joint sections.
8. The compressor valve of claim 1, further comprising a gasket valve plate disposed between the discharge valve plate and cylinder head.
9. The compressor valve of claim 1, wherein the V-shape double discharge spring reed, spacer, stopper, and limiter are fastened together in this sequential order by press fit.
10. The compressor valve of claim 1, wherein the V-shape double discharge spring reed is only joined with the valve plate at the middle of the V-shape.