Nov. 11, 1958 R. H. SWART ET AL 2,859,912

CRESCENT SHAPED REED VALVE

Filed April 23, 1953

FIG. 1.

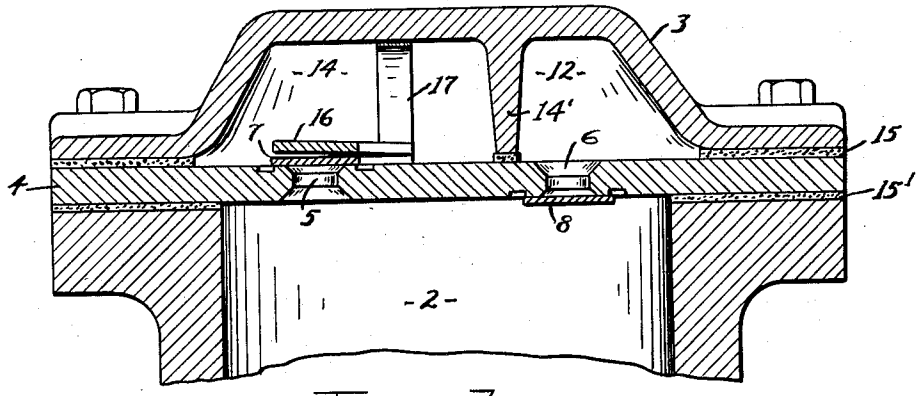


FIG. 7.

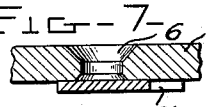


FIG. 2.

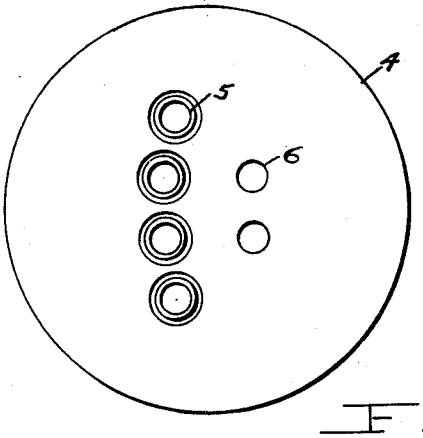


FIG. 3.

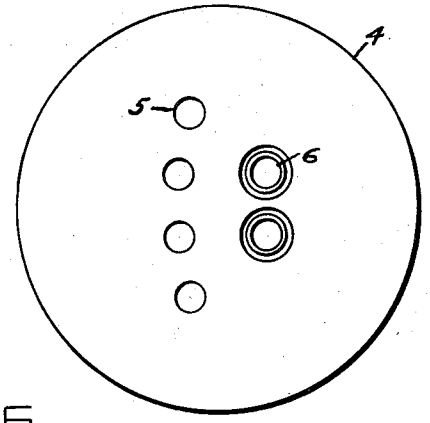


FIG. 6.

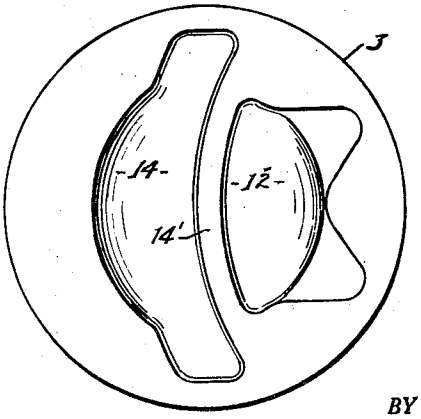
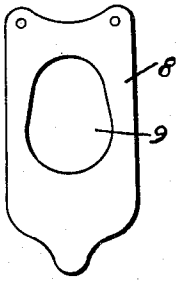


FIG. 5.



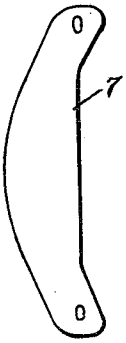


FIG. 4.

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CRESCENT SHAPED REED VALVE

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6 Claims. (Cl. 230—172)

This invention relates to compressors and, more particularly, to reciprocating hermetic compressors employed in refrigerating systems having a cylinder head whose discharge gas volume is substantially increased without substantially changing the height of the head.

The efficiency of a reciprocating compressor depends to some extent on the head pressure. In reciprocating compressors, at the start of the suction stroke, there remains in the piston cylinder a small volume of the compressed fluid from the prior compression stroke. This left-over fluid is due to the fact that there must be a slight clearance between the top of the piston at the end of its stroke and the valve plate.

The ratio of the volume of this left-over fluid to the volume of incoming suction fluid will depend on the ratio of the pressure in the head, which is the pressure of the left-over fluid, to the suction pressure. Thus, the higher the head pressure in comparison to the suction pressure, the greater volume the left-over fluid occupies at suction pressure. It is, of course, desirable to keep the volume of the left-over fluid at suction pressure as low as possible since it is not desired to recompress any more fluid than necessary.

If the head pressure can be reduced, then the efficiency of the compressor will be increased. Since the compressor will be operating more efficiently, it will have a greater capacity with the same amount of power consumption.

The head pressure is reduced if the volume of the discharge chamber in the head is increased since this will permit the compressed gas to expand more rapidly and therefore have a lower pressure, which is closer to the condenser pressure.

However, in hermetic type compressors, the casing limits the height of the head so that it is not possible to increase the height of the head to increase the volume of the discharge chamber without increasing the over-all size of the compressor, and this is not desirable. Our invention permits an increase in head volume without increasing the height of the head to provide a more efficient compressor with the same size casing and compressor.

We have satisfactorily solved this problem by tremendously increasing the head volume for the discharge gas. By disposing the discharge ports on an arc of a circle, we have been able to dispose the discharge chamber over a greater portion of the head than previously. This increase in head volume for the discharge gas results in the pressure of the head gas being closer to the condenser pressure and the volume of left-over fluid in the cylinder at the end of the suction stroke being decreased.

It also will be noted that the increase in the discharge gas chamber in the head results in a quieter compressor. This is due to the fact that the compressed fluid has more volume into which to expand. Since the discharge gas enters the head approximately thirty times a second, it will be understood that a decrease in this noise will be a large factor in quieter operation of the compressor.

The chief object of this invention is to provide a compressor having an increased capacity without increasing the size of the compressor.

An object of the invention is to provide a cylinder head of a compressor with an increased volume for discharge gas without substantially increasing the thickness of the head.

Another object of this invention is to provide a compressor that operates more efficiently than present compressors.

A further object is to provide a compressor valve reed of novel design. Other objects of our invention will be readily perceived from the following description.

This invention relates to a reciprocating compressor including, in combination, a compression cylinder, a cylinder head disposed above the cylinder, a valve plate disposed between the cylinder and the head, said valve plate including suction and discharge ports to provide communication between the head and the cylinder, said head cooperating with said valve plate to form two chambers in the head, one of said chambers being above the suction ports, the other of said chambers being above the discharge ports, said second chamber being of a greater volume than said first chamber, a valve reed disposed above the ports, means disposed above the reed in the second chamber to permit the reed to lift to permit gases to flow through the discharge ports when the gas pressure in the cylinder reaches a predetermined amount, and means to cover the suction ports to permit gas to enter the cylinder and to prevent discharge gases from entering the first chamber.

This invention also relates to a valve assembly comprising a valve plate, said plate having suction ports and discharge ports therein, said discharge ports being disposed about the arc of a circle, a crescent shaped valve reed adapted to close the discharge ports, means to permit the reed to lift when the pressure in the cylinder reaches a predetermined amount, and means to prevent flow of discharge gas through the suction ports.

The attached drawings illustrate a preferred embodiment of our invention, in which

Figure 1 is a sectional view of the compression cylinder of the present invention;

Figure 2 is a plan view of the valve plate taken from the head side;

Figure 3 is a plan view of the valve plate taken from the compression cylinder side;

Figure 4 is a plan view of the discharge valve reed;

Figure 5 is a plan view of the suction valve reed;

Figure 6 is a bottom plan view of the cylinder head of the present invention; and

Figure 7 is a fragmentary view in section illustrating a crescent-shaped suction valve reed disposed on the valve plate.

Referring to the drawings, and particularly to Figure 1, there is shown a compression cylinder **2** within which a piston, not shown, is mounted for reciprocatory movement in the well-known manner and above which is disposed a cylinder head **3**. A valve plate **4** serves to separate the cylinder head **3** from the cylinder **2**. This valve plate preferably has a plurality of discharge ports **5** therein. These discharge ports are arranged along the arc of a circle as clearly shown in Figure 2. It will be understood that a single slot or opening forming the arc of a circle could be used, if desired. The valve plate also has suction ports **6** therein. Flow of gas through the discharge ports **5** is regulated by a crescent shaped valve reed **7**, shown in Figure 4. A suction valve reed **8**, shown in Figure 5, regulates the flow of gas through the suction ports **6**. Note that the suction valve reed has an opening **9** therein. This opening permits mounting of the suction valve reed without blocking the discharge ports. It will

be understood, as shown in Figure 7, that the suction ports 6 could be arranged on the arc of a circle in the same manner as the discharge ports and the suction valve reed 8' could be crescent shaped similar to discharge valve reed 7.

Referring to Figures 1 and 6, the head 3 has a suction chamber 12 and a discharge chamber 14 separated by an arcuate partition 14'. The suction chamber is disposed above the suction ports, while the discharge chamber is disposed above the discharge ports. The discharge chamber 14 is of a larger volume than the suction chamber 12.

As clearly shown in Figures 1 and 6, the discharge chamber 14 extends beyond the center of the head. The discharge chamber extends nearly the complete diameter of the head and is shaped to be disposed over the discharge ports 5 in the valve plate 4. While the discharge chamber is narrow in width at its ends, note Figure 6, it increases substantially and quickly in width in the center portion.

The suction chamber 12 is disposed on one side of the center of the head. This chamber extends across only a portion of the head. Its greatest depth is adjacent the discharge chamber while it is shallow in depth at the points nearest the outer edge of the head.

Suction gas flows by suitable means into the suction chamber 12 and then through the suction ports 6 and past the suction valve reed 8 into the compression cylinder 2. Discharge gas flows from the cylinder 2 into the discharge ports 5 and past the discharge valve reed 7 to the discharge chamber 14 of the head 3. From the head, the gas flows to the condenser, not shown.

Means must be provided to insure that the suction gas does not flow into the discharge chamber or vice versa. A gasket 15 is disposed between the valve plate 4 and the cylinder head 3 to seal the suction chamber from the discharge chamber. This gasket is preferably made of a mixture of polymerized polychloroprene and asbestos fibers but other suitable similar materials may be employed, if desired. To insure that the gasket performs its function satisfactorily, a groove may be provided in the space between the chambers 12 and 14 on the valve plate 4. If desired, instead of a groove, a crown may be provided on the valve plate. While a groove or crown may be used, it is not necessary that such means be employed to insure the sealing. A gasket 15', preferably made of the same material as the gasket 15, is disposed between the valve plate 4 and the top of cylinder 2 to prevent leakage.

The valve reed must be prevented from uncovering the discharge ports until the gas has been compressed in the cylinder 2. To prevent the reed from lifting until the desired time, a crescent shaped stop 16 is disposed above the reed. A spring 17 is disposed between the stop 16 and the head 3 to apply the desired force to the stop 16 to prevent the reed from lifting until a desired pressure exists in the cylinder 2. While the reed and the stop are crescent shaped, it is preferred to make the spring straight. Of course, if desired, the spring may be crescent shaped.

By making the reed crescent shaped, the distance between the ends of the reed along a centerline is greater than th distance along the centerline of a straight valve reed, and this permits the reed to uncover the ports with less strain. This construction also permits the reed to lift obliquely when it uncovers the ports. This results in a relatively low resonant reed frequency thereby causing the opening and closing action to be less noisy. The greater length of the reed along its centerline has the advantage of permitting more discharge ports to be disposed beneath it. The tendency of the discharge gas to enter the head rapidly is reduced by the present invention; thus, the performance of the compressor is improved.

A further advantage of the present invention is to provide a compressor with an increased number of discharge ports to lower the gas velocity passing therethrough.

Still another advantage of the invention is the provision of a compressor valve plate with discharge ports disposed on the arc of a circle.

While we have described a preferred embodiment of our invention, it will be understood that our invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

We claim:

1. In a reciprocating compressor including a compressor cylinder; a piston mounted within the cylinder for reciprocating movement therein; a cylinder head, including a suction chamber and a discharge chamber disposed above the cylinder; a valve plate interposed between said head and cylinder, said plate including a plurality of arcuately disposed discharge passages permitting communication between the discharge chamber in the head and the cylinder, and a plurality of suction passages permitting communication between the suction chamber in the head and the cylinder; a valve comprising substantially a crescent-shaped reed overlying said discharge passages, said reed being secured at its extremities to the upper surface of the valve plate; and means secured to the underside of the valve plate adapted to permit flow of gas into the cylinder as the piston is retracted from the valve plate and to prevent the flow of gas into the cylinder when the piston is moved toward the valve plate, said last mentioned means including a second crescent-shaped reed.

2. In a reciprocating compressor including a compressor cylinder; a piston mounted within the cylinder for reciprocating movement therein; a cylinder head, including a suction chamber and a discharge chamber disposed adjacent the cylinder; a valve plate interposed between said head and cylinder, said plate including a series of arcuately disposed discharge passages permitting communication between the discharge chamber in the head and the cylinder, and at least one suction passage permitting communication between the suction chamber in the head and the cylinder; a valve comprising substantially a crescent-shaped reed overlying said discharge passages, said reed being secured at its extremities to the upper surface of the valve plate, means positioned above the reed in the discharge chamber of the head for preventing movement of the reed in the absence of a predetermined pressure within the cylinder; and means secured to the underside of the valve plate adapted to permit flow of gas into the cylinder as the piston is retracted from the valve plate and to prevent the flow of gas into the cylinder when the piston is moved toward the valve plate.

3. In a reciprocating compressor including a compressor cylinder; a piston mounted within the cylinder for reciprocating movement therein; a cylinder head including a suction chamber and a discharge chamber; a valve plate interposed between said head and cylinder, said plate including a series of arcuately disposed discharge passages permitting communication between the discharge chamber in the head and the cylinder, and at least one suction passage permitting communication between the suction chamber in the head and the cylinder; a valve comprising substantially a crescent-shaped reed overlying said discharge passages, said reed being secured proximate its extremities to the surface of the valve plate which forms a part of the discharge chamber; and means secured to the other side of the valve plate adapted to permit flow of gas into the cylinder from the suction chamber as the piston is retracted from the valve plate and to prevent the flow of gas from the cylinder into the suction chamber when the piston is moved toward the valve plate.

4. A reciprocating compressor as set forth in claim 3 wherein said discharge chamber is generally of substantially crescent-shaped configuration to provide a maximum volume discharge chamber in a cylinder head having a limited height.

5. In a reciprocating compressor including a compressor cylinder; a piston mounted within the cylinder for reciprocating movement therein; a cylinder head, includ-

ing a suction chamber and a discharge chamber disposed adjacent the cylinder, said cylinder head being provided with a partition separating the suction chamber from the discharge chamber, at least a portion of said partition being arcuate; a valve plate interposed between said head and cylinder, said plate including at least one discharge passage permitting communication between the discharge chamber in the head and the cylinder, and at least one suction passage permitting communication between the suction chamber in the head and the cylinder; a valve comprising substantially a crescent-shaped reed overlying said discharge passage, said reed being secured at its extremities to the upper surface of the valve plate; and means secured to the other side of the valve plate adapted to permit flow of gas into the cylinder as the piston is retracted from the valve plate and to prevent the flow of gas into the cylinder when the piston is moved toward the valve plate.

6. In a reciprocating compressor including a compressor cylinder; a piston mounted within the cylinder for reciprocating movement therein; a cylinder head including a suction chamber and a discharge chamber; a valve plate interposed between said head and cylinder, said plate including means formed therein having a configuration serving to cooperate with a crescent-shaped reed permitting communication between the discharge chamber in the head and the cylinder, and at least one suction passage permitting communication between the suction chamber in the head and the cylinder; a valve comprising substantially a crescent-shaped reed overlying said means, said reed being secured proximate its extremities to the surface of the valve plate which forms a part of the discharge chamber; and means secured to the other side of the valve plate adapted to permit flow of gas into the cylinder from the suction chamber as the piston is retracted from the valve plate and to prevent the flow of gas from the cylinder into the suction chamber when the piston is moved toward the valve plate.

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