

COMPRESSOR PISTON HEAD WITH NOISE-ATTENUATING RECESS

FIELD OF THE INVENTION

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The present invention relates to the field of compressors, and particularly to a compressor piston head with a noise-attenuating recess for hermetically sealed compressors.

10 BACKGROUND OF THE INVENTION

The function of sealed compressors for cooling fluids, and particularly the role of the compressor piston head, is well known in the art. Typically, an electric motor drive is built into a sealed housing or shell, and has a stator or
15 electric armature affixed therein and a rotor assembly assembled into the cylindrical passage of the stator. This rotor assembly includes a rotor and a crankshaft which is inserted into the cylindrical passage of the rotor by interference fit. The reciprocating motion of the rotor and the piston in the compression chamber compresses low pressure gas into high pressure gas.
20 The gas comprises typically freon or substitutes thereof. The low pressure gas comes from the closed loop system and enters a suction chamber through a piston head-suction muffler assembly. At the suction chamber, the low pressure gas is drawn into a compression chamber during the suction stroke of the reciprocating machine. A negative vacuum pressure is created. At the
25 same time, lubricating fluid is also drawn into the suction chamber from a sump at the base of the crankshaft through a capillary tube for mixing with inert gas and lubricating the compression chamber. The compressed gas in the

compression chamber is directed to the condenser of the system through a discharge valve, a discharge muffler, discharge line and tube discharge.

These and other motions produce noise when the compressor is in operation. Noise is generally considered undesirable in the industry as the
5 compressors are often used in refrigerators and air conditioners where excessive noise can be a source of irritation for the end users. Hence, the industry in general has continuously sought to produce compressor designs which minimize noise without compromising the overall efficiency and performance.

10 There are many sources of noise in a compressor, and some noise is unavoidable. One source of significant noise is valve noise. Valve noise is a noise produced when the suction valve impacts against the compressor piston head during the gas intake. So far, the industry has not found a solution to noticeably reduce this impact, and thus the noise, and especially in a manner
15 which would avoid major alterations in the manufacturing process. A simple solution is important and highly desirable since each design modification imposes burden on the manufacturer, and it is necessary that the modification yield high return in value relative to the cost of implementing the change.

Hence, it would highly desirable to have a compressor head design
20 which would reduce the impact of the suction valve to significantly reduce valve noise without imposing burdensome level of additional resources in the manufacturing process.

25 OBJECT OF THE INVENTION

It is therefore the primary object of the present invention to reduce the impact of the suction valve to the compressor head to significantly reduce

valve noise without imposing burdensome level of additional resources in the manufacturing process.

5 SUMMARY OF THE INVENTION

The present invention reduces the metallic impact of the suction valve reed to the piston head, and hence the noise, by providing a recess on top of the piston head as a way of buffering the impact. The recess is located such
10 that it can receive the tongue of the valve reed when the tongue overshoots towards the piston head. Because the tongue approaches the recess in a slanted plane relative to the top, the recess should preferably have a sloping bottom to match the angle of the tongue as it enters the recess. The depth of the recess is preferably approximately equal to the amount of deflection of the
15 tongue. Generally a depth of about 1 to 3 mm at the deepest end is sufficient.

BRIEF DESCRIPTION OF THE DRAWINGS

20 FIG. 1 is a sectional side view of the compressor piston head with the noise-attenuating recess and the suction valve reed.

FIG. 2 is an isolated top view of the piston head with the noise-attenuating recess.

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FIG. 3 is an isolated bottom view of the suction valve reed.

DETAILED DESCRIPTION OF THE INVENTION

In the refrigeration compressor industry where the systems are usually hermetically sealed, valve noise is a type of noise whose oscillatory energy is transmitted to the outside pipe and shell. Hence, it can be heard readily from the outside, and is one of the major contributors to the overall noise produced by the compressor. The present invention significantly reduces this noise in a manner which is easily to implement and is highly adaptable for mass production.

Although the workings of a compressor is well known to those skilled in the art, to better understand the invention, some discussion of the mechanics of a compressor as it relates to noise production is warranted. During an operation cycle of a hermetic compressor, the suction valve reed opens on the downstroke of the piston because cylinder pressure is less than the vapour pressure in the suction line. On the upstroke of the piston, the suction valve closes and the pressure within the cylinder causes the discharge valve to open. When the piston is at the top of its stroke, known as the top dead centre position, both the suction and discharge valves are closed. The high pressure of the vapour is trapped in the clearance space. The volume of this clearance space is called the clearance volume. The trapped gas in the clearance volume expands after the discharge process is completed and thus reducing the volume available for fresh gas intake to enter the cylinder. Therefore, the actual volume of suction vapour at the suction line conditions which is drawn into the cylinder of the compressor is always less than the piston displacement of the compressor, and the refrigeration capacity of the compressor is reduced. The tightening control of the clearance volume and the rapidly changing pressure cause the tongue of the reed to overshoot towards the piston head after opening and impacting the piston head. Consequently, the valve noise is

produced by flow oscillations and the metallic impact of the valve reed with the top of the piston head.

The present invention reduces this valve noise by providing a recess to buffer the impact. As illustrated in FIGS. 1 through 3, a recess 3 is provided for on the top 2 of the piston head 1. The recess 3 should be located on the top 2 such that it can receive the tongue 4 of the valve reed 5 when it overshoots towards the piston head 1. Because the tongue 4 of the valve reed 5 approaches the recess on a slanted plane relative to the top 2 of the piston head 1, the bottom 6 of the recess 2 should preferably be sloping to match the angle of the tongue 4 as it enters the recess 2. However, the bottom 6 may also be flat without completely losing its effectiveness. The depth of the recess 3 should preferably be approximately equal to the amount of deflection of the tongue 4. Although the optimal depth could vary from compressor to compressor, generally a depth of about 0.5 to 1.0 mm at the deepest end 7 is sufficient. One can easily experiment with both the depth and the angle of the sloping bottom for maximum performance.

There are of course various ways to produce the recess. For instance, the recess can be produced by including this feature during the fabrication process of the piston head. However, this may not be possible or inefficient. Hence, in the alternative, a grinder be used to grind away a portion of the piston head.

Various other modifications, additions and substitutions not mentioned herein are possible for the invention described above, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

CLAIMS



We Claim:

- 1 1. A piston head with noise-attenuating recess for a hermetic compressor,
2 said piston being impacted by a tongue of a suction valve reed during a gas
3 intake, said piston head comprising:
4 a top,
5 a recess strategically located on said top to receive the tongue of said
6 suction valve reed to reduce the impact of said tongue to the top of the piston
7 head.
- 1 2. The piston head as recited in claim 1 wherein said recess has a sloping
2 bottom.
- 1 3. The piston head as recited in claim 2 wherein said recess with a
2 sloping bottom is about 0.5 to 1 mm deep at an end.