May 16, 1961 A. J. NICHOLAS 2,984,408

VALVE SERVICE FOR COMPRESSORS

Filed Oct. 6, 1960

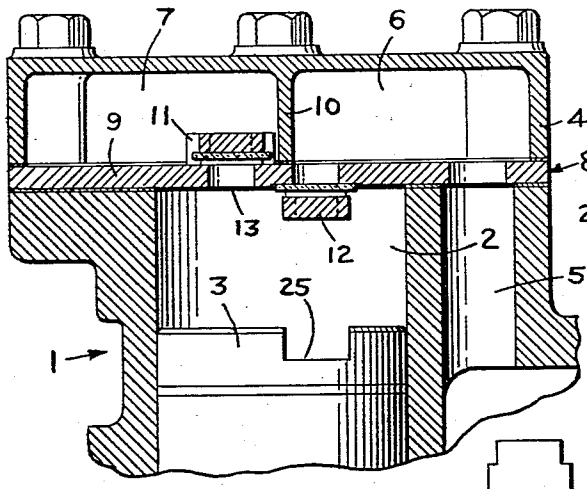

FIG. 1

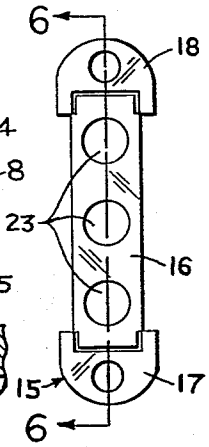

FIG. 5

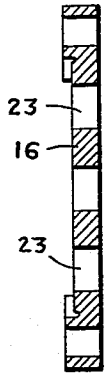

FIG. 6

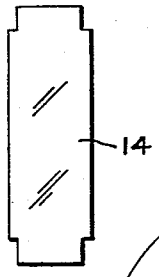

FIG. 7

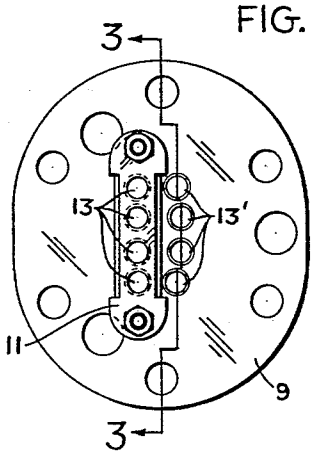

FIG. 2

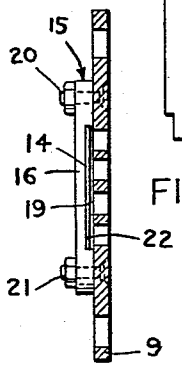

FIG. 3

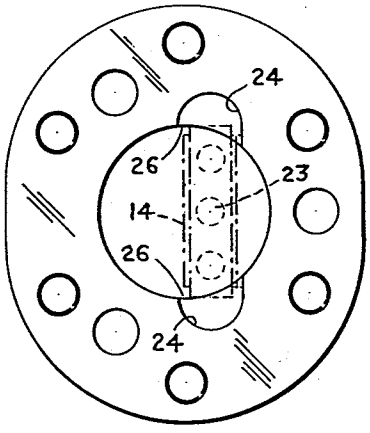

FIG. 8

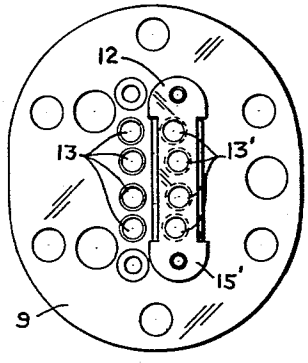

FIG. 4

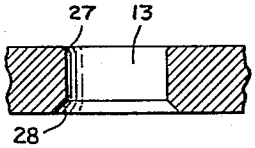

FIG. 9

ANDREW J. NICHOLAS
INVENTOR.

BY Daniel A Bobis
atty

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VALVE SERVICE FOR COMPRESSORS

Andrew J. Nicholas, Suffield, Conn., assignor to Worthington Corporation, Harrison, N.J., a corporation of Delaware

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2 Claims. (Cl. 230—231)

This invention is a continuation in part of my United States application Serial No. 796,108 filed February 27, 1959 now abandoned and relates to refrigeration compressors and more particularly to an improved valve service for such refrigeration compressors.

The refrigeration compressor valve service must perform the duties of controlling the introduction and discharge of the system fluid. For best operation it is desirable that the design of the valve service conform to the following requisites: stability of design for efficient performance, long life and quietness during operation. There are a number of valve services currently employed in the art to accomplish the above objectives which together with the present invention are rather generally based on the same fundamental conception. Thus, they comprise inlet and discharge valves located in association with the cylinder to control the introduction and discharge of the fluid being compressed. These valves are actuated by variations in pressure in the cylinder.

Within the broad limits just defined, and with the advent of the high speed refrigeration compressor there is room for improvement in the compressor valve service. From a practical standpoint many of the services employed embody devices which are complex and expensive to manufacture and the foregoing objection is amplified by the advent of the high speed machine.

From a standpoint of engineering the services now used seem to embody one or more of the following disadvantages which are not found in a compressor utilizing a service according to the present invention: leakage of fluid being compressed, undue noise, high cost, and low volumetric efficiency.

The present invention meets the problems mentioned above with the provision of a tetrafluoroethylene glass laminate strip including guiding means associated therewith to control the flexing of the strip to a degree that is required to accomplish the adaptation of this service to a high speed refrigeration compressor.

More particularly leakage of fluid being compressed is substantially reduced as cup-like deformations are formed on the valve strip which act to guide the strip to seals exactly over the inlet and outlet ports of the valve plate.

In this connection pressure exerted on the strips by the fluid being compressed forms the cup-like means. The size of the cup-like means being a function of the strip thickness and diameter of the port which are both variables assessable by one skilled in the art familiar with the capacity and speed of the unit including the valve service contemplated herein.

Noise reduction would follow as the strip contemplated herein does not present the usual valve clatter caused by steel and the like strips.

Accordingly, it is one object of this invention to provide a valve service for a high speed refrigeration compressor that remedies the foregoing objectives.

It is a further object to adapt this service in a refrigeration compressor and accomplish an increase in volumetric efficiency by providing this service in such fashion to obtain minimum clearances between piston and cylinder head.

The above and other objects are effected by my invention as will be apparent from the following description and claims taken in connection with the accompanying drawings, in which:

Figure 1 is a fragmentary section of a refrigeration compressor showing the valve service in operating position.

Figure 2 is a top view showing the discharge valve mounted on a plate.

Figure 3 is a section taken on line 2—2 of Figure 2.

Figure 4 shows the suction valve mounted on the plate.

Figure 5 is a top view showing the guide means.

Figure 6 is a section taken on line 5—5 of Figure 5.

Figure 7 is a top view showing the strip of tetrafluoroethylene.

Figure 8 is a top view of the cylinder showing the guard and strip mounted thereon.

Figure 9 is a fragmentary view showing the port configuration preferred.

Referring now to the drawings more in detail, Figure 1 shows a portion of a high speed reciprocating machine in which the novel valve service is embodied. The compressor generally designated **1** includes a cylinder **2** in which a piston **3** operates. A cylinder head **4** is secured to the cylinder **2** by any well known means and is provided with an inlet **5**, an inlet chamber **6**, an outlet or discharge means not shown, a discharge chamber **7**, and a partition **10** between the inlet and discharge chambers. A valve service generally designated **8** and including a plate means **9** having both discharge and suction valves **11** and **12** associated therewith is disposed between the cylinder and cylinder head as is shown in the drawings.

The valve service **8** is shown as including a disc or circular valve plate **9** which has fashioned therein a plurality of openings shown as circular ports **13** to provide for communication between the cylinder **2** and the discharge chamber **7**. These ports **13** are plain and differ from the standard in that they are not trepanned, and have no sharp edges on the seat portion thereof. The edges thereof as at **27** in abutment with the valve strip **14** are rounded and a greater number of smaller sized holes is provided all having their bottom portions chamfered as at **28** to provide for efficient egress of the fluid being compressed.

The size of the ports is easily assessable by one skilled in the art and is of course a function of the capacity of the machine containing the novel valve service.

Furthermore the ports are offset from the long centerline of the valve plate to provide for sufficient space between the holes in order that the strip **14** may properly seat over each hole and thusly blend into the slightly cup-shaped form of the port **23** in Figure 8 over the ports which act to guide the strip **14** to always seat tightly over these ports.

Provisions such as the above and utilizing a wider strip **14** to overlap the ports substantially preclude a pushing of the strip **14** into the holes to adversely effect the operation of the compressor.

In addition such a pushing effect in conjunction with the rounded ports tends to limit fluid leakage to a minimum.

Discharging of compressed fluid from the cylinder into the discharge chamber is controlled by mounting a tetrafluoroethylene glass laminate strip **14** in association with the foregoing ports.

The flexible nature of the strip **14** must be controlled

in order to accomplish the desired type of compressor operation. This is accomplished by providing guiding means therefor taking the form of a valve guard **15** which comprises a body portion **16** in the form of a strip of a predetermined dimension and including end portions **17** and **18** of greater thickness than the body portion to provide a space **19** wherein the strip **14** may move.

It is preferred that the movement of the strip be constrained to a flat surface. The strip contemplated herein will not withstand flexing. Accordingly space **17** is fashioned to provide a space wherein the strip **14** can move and yet without any harmful flexing.

The guard **15** is connected as by bolt means **20** and **21** to the plate **9**; the strip **14** inserted between the face **22** of the guard and the plate **9** to regulate the flow of fluid through the ports **13** in the plate and the ports **23** in the guard **15**.

The suction side of the valve service **8** is provided for on the opposite side and face of the valve plates **9**. As is the case with the discharge portion **11** similar holes **13'** are fashioned in plate **9** to provide communication between the cylinder **2** and the suction or inlet chamber **6**. In this assembly the guard **15'** fashioned along the lines of the discharge guard **15** for the discharge valve is mounted into a flush recess **24** formed in the cylinder flange **26**. The strip **14** and guard are adapted to function in same fashion on the suction side as was described above in connection with the discharge service. The portions of the guard as at **26** are cut to facilitate the disposition of the guard in recess **25** as later described.

With the provision and location of the inlet service as above the guard acting as a guide functions to prevent any undue flexing of the strip **14** which would render it inoperative in its controlling function and in addition cause a premature breaking.

To accomplish the necessary minimum clearance between the piston **3** and cylinder head **4** the piston **3** is provided with a recess **25** which is adapted to fit about the suction valve **12** which extends into cylinder **2** to thereby provide a high volumetric efficiency for the compressor.

The operation of the compressor is as follows: as the piston **3** moves downwardly on its suction stroke, the fluid entering through the inlet **5** and the inlet chamber **6** passes downwardly through the ports **13'** deflects the strip downwardly and then passes through the ports in the suction guard **15'** to the cylinder. It is evident that on the suction phase the guide means **15'** prevents the extreme deflection of the strip **14** to preclude the objection indicated above.

Upon the upward movement of the piston in its compression stroke, the fluid contained in the cylinder passes upwardly through the ports **13**, deflects the strip **14** upwardly as it passes through the ports **23** into the outlet chamber **7** to the compressor outlet. During the discharge stroke the strips **14** assume their normal flat position to prevent any leakage of fluid to the suction side of the compressor. The strip is of course held down by the higher pressure in cylinder **2**, and during the suction stroke the strips in the discharge portion are held down by the pressure differential existing in chamber **7** and cylinder **2**.

It will be understood that the invention is not to be limited to the specific construction or arrangement of parts shown but that they may be widely modified within the invention defined by the claims.

What is claimed is:

1. A valve service for a high speed refrigeration compressor including a piston slidably disposed therein, cylinder head means for the cylinder and providing an inlet compartment and a discharge compartment therefor, said valve service including a plate means disposed between said cylinder head and said cylinder, a first passage means in the plate means and comprising a plurality of ports all being of lesser dimension than prior type ports and said ports being spaced a predetermined distance from the centerline of said plate means, said first passage means to operatively interconnect said cylinder and said discharge compartment, a second passage means in the plate means comprising a plurality of ports spaced a predetermined distance from the centerline of said plate means, said second passage means to operatively interconnect said cylinder and said inlet compartment, a first rectangular like valve strip consisting of tetrafluoroethylene glass laminate disposed over said first passage means, a second rectangular like valve strip consisting of tetrafluoroethylene glass laminate disposed over said second passage means, and both of said valve strips disposed on opposite faces of said plate means and operating respectively to regulate passage of fluid out of and into said cylinder, and said ports forming the first and second passage means having rounded edges on the end thereof coacting with the valve strips and a chamber at the opposite end to provide for efficient egress and ingress of fluid passing out of and into said cylinder, and guiding means for each of the valve strips comprising a body portion including ends connected to the plate means whereby said body portion and said ends provide a space to permit said valve strips to move a predetermined amount, said ports defining a diameter of a size which permits deforming said strip into cups which project into said ports by pressure exerted by gas during compressor operation, and said cups engaging said ports to form the seal on said valve plate.

2. A valve service for a high speed refrigeration compressor including a piston slidably disposed therein, cylinder head means for the cylinder and providing an inlet compartment and a discharge compartment therefor, said valve service including a plate means disposed between said cylinder head and said cylinder, a first passage means in the plate means and comprising a plurality of ports all being of lesser dimension than prior type ports and said ports being spaced a predetermined distance from the centerline of said plate means, said first passage means to operatively interconnect said cylinder and said discharge compartment, a second passage means in the plate means comprising a plurality of ports spaced a predetermined distance from the centerline of said plate means, said second passage means to operatively interconnect said cylinder and said inlet compartment, a first rectangular like valve strip consisting of tetrafluoroethylene glass laminate disposed over said first passage means, a second rectangular like valve strip consisting of tetrafluoroethylene glass laminate disposed over said second passage means, and both of said valve strips disposed on opposite faces of said plate means and operating respectively to regulate passage of fluid out of and into said cylinder, and said ports forming the first and second passage means having rounded edges on the end thereof coacting with the valve strips and a chamber at the opposite end to provide for efficient egress and ingress of fluid passing out of and into said cylinder, a first rectangular like guide means for the first valve strip and comprising a body portion including ends connected to the plate means and being of greater thickness than said body portion to provide a rectangular like flat space between the body portion and the plate means to permit said valve strip to move a predetermined amount, a second guide rectangular like means for said second valve strip comprising a body portion including ends connected to the plate means and being of greater thickness than said body portion to provide a flat space between the body portion and the plate means to permit said valve strip to move a predetermined amount, and a recess in said piston adapted to receive the second guide means on upward movement thereof in said cylinder, said ports defining a diameter of a size which permits deforming said strip into cups which project into said ports by pressure exerted by

has during compressor operation, and said cups engaging said ports to form the seal on said valve plate.

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