

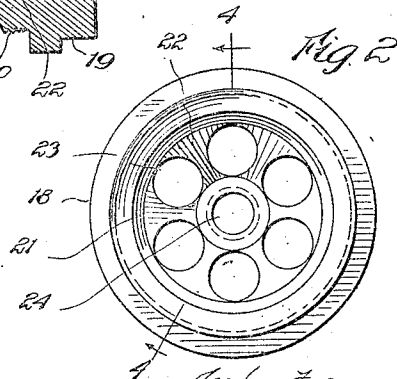
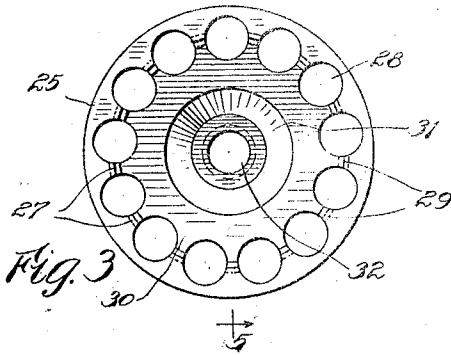
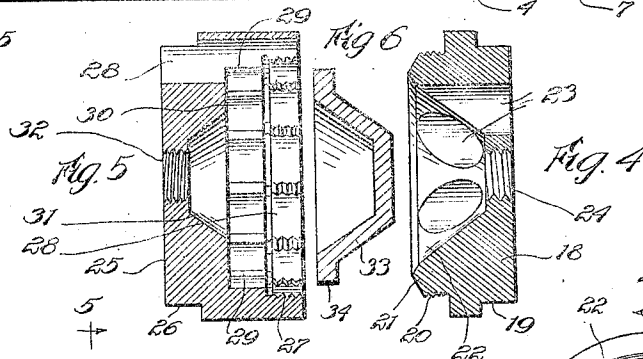
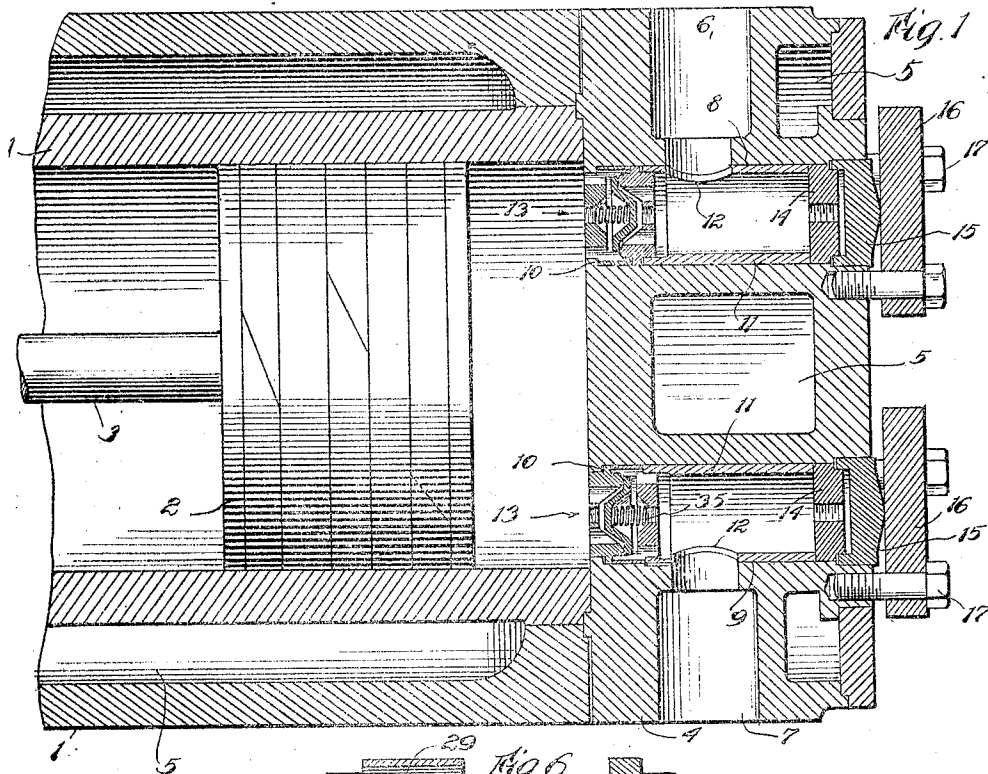
Oct. 26, 1926.

1,604,487

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COMPRESSOR

Filed March 31, 1924



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UNITED STATES PATENT OFFICE.

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COMPRESSOR.

Application filed March 31, 1924. Serial No. 703,057.

The invention relates to fluid compressors, and more particularly to the construction and arrangement of the suction and discharge valves in compressors of the reciprocating piston type.

In compressors of this type it is common to position both suction and discharge valves in detachable heads mounted at the ends of the cylinder, frequently employing the latter in double-acting capacity. It will be obvious that the space available for the location of the valves immediately adjacent the cylinder chamber is limited, and that highly efficient valves of large capacity in comparison to their lateral dimensions are desirable, especially when employed in compressors for the volatile refrigerant gases. The quick acting free disc type of valve possesses advantages of efficiency in operation, but has been objectionable in its lack of durability and tendency to chatter, as heretofore constructed.

It is the object of this invention to provide a compressor valve of the disc type having great durability, high efficiency and large capacity, which is positive and noiseless in its operation, and which is constructed in a reversible structure adapted for interchangeable use as a suction valve or as a discharge valve.

Other objects and advantages will be apparent in the following detailed description of a preferred embodiment of the invention which I have chosen for illustration in the accompanying drawings, and which shows an application of the invention to a compressor adapted for use with refrigeration apparatus.

In the drawings, Fig. 1 represents a sectional elevation of a compressor cylinder and piston with a detachable head embodying the invention. Fig. 2 is an inner plan view of one section of the valve case. Fig. 3 is an inner plan view of the associated section of the valve case. Fig. 4 is a sectional view of the section shown in Fig. 2 taken on the plane of the line 4—4. Fig. 5 is a sectional view of the section shown in Fig. 3 taken along the line 5—5. Fig. 6 is a sectional view of the valve member.

Referring to Fig. 1, the numeral 1 indicates a compression cylinder in which is positioned a piston 2 operable by a piston rod 3. A detachable head 4 is suitably secured at the end of the cylinder, effecting

a closure of the compression chamber. Both the cylinder and head are provided with chambers 5 for the circulation of cooling water.

The head 4 is provided with a suction inlet 6 and a discharge outlet 7, having suitable pipe connections (not shown) and leading respectively into the valve chambers 8 and 9, the latter preferably being cylindrical bores extending through the head, and each being constructed at the end communicating with the compression cylinder to form an annular abutment 10.

An outwardly removable tube 11 is positioned in each of the chambers 8 and 9, the tubes having lateral openings 12 communicating respectively with the suction inlet and discharge outlet. Between the inner ends of the tubes 11 and the abutments 10 are secured the reversible valve cases 13, the latter being removably fitted to the chambers 8 and 9 and having like peripheral end channels to receive the abutments 10 and the end portions of the tubes 11. By removing the tubes and valve cases from the chambers 8 and 9 the valve cases may be reversed endwardly and employed either as suction valves or discharge valves.

The tubes 11 are each outwardly secured by abutment with a head 14, over which is a cap 15 held in position by a bridge plate 16, secured to the cylinder head by bolts 17.

Describing now the construction and arrangements of the valves, Figs. 2 and 4 illustrate the intake or seat section 18 of the valve case. The latter is provided with an outer circumferential end channel 19 to receive the abutting end of the tube 11, and with an inner screw threaded portion 20 of decreased diameter adapted to receive the other section of the valve casing. An annular valve seat 21 is formed on the inner face of the section 18, preferably being of pyramidal cross section. Within the annular seat 21 is a conical recess 22, into which open a concentric series of intake passage 23 extending through the outer face of the section. A center passage 24 may be provided, and preferably screw threaded for the engagement of a tool for removing the valve casing from the valve chamber.

Figs. 3 and 5 illustrate the outlet or cage section 25 of the valve case. The cage section is provided with an outer circumferential end channel 26 similar to the channel

19. It is inwardly recessed and screw-threaded in the portion 27 to engage the portion 20 of the opposite section and secure the two parts together, the outer diameters of the two sections being similar. A concentric series of outlet passages 28 extend longitudinally through the section 25, their inner openings being in greater part radially outward of the seat 21, when the sections are assembled. As herein illustrated, convenience of construction and minimum outside dimensions are served by carrying the passages through the section and cutting the screw threads 27 upon the portions of the structure remaining between the passages.

A central recess is provided in the section 25 for the accommodation of the valve member, and is laterally defined by the cylindrical arrangement of the concentric faces 29 of the portions of the structure between the passages 28. The end wall 30 of the central recess is provided with a conical pocket 31 out of which opens a central passage 32, preferably screw threaded for the accommodation of a case removing tool.

The valve member 33, illustrated in Fig. 6, is of truncated cone formation having a lateral annular flange 34 at its base, and centrally recessed. The flat face of the flange 34 co-operatively engages the seat 21 for effecting the closure of the valve, and is freely movable away from its seat through the central recess in the section 25, the spaced faces 29 serving as lateral guides for the flange 34, and the wall 30 limiting the opening movement of the valve member. A spring 35 (see Fig. 1) is positioned in the recess 31 and the opposite recess in the member 33, bearing centrally upon the latter and resiliently holding it in normal engagement with its seat.

In operation, the valve member 33 freely oscillates between the seat 21 and the stop wall 30, the narrow laterally supporting spaced guide faces 29 causing a minimum of friction and accurately guiding the valve member to centered position on its seat. The cup shaped form of the valve member permits the use of a comparatively long spring with the force of the latter applied well in advance of the seat engaging face of the valve member, thus assuring a firm seating of the member and a simultaneous closure of the entire aperture, and thereby preventing chatter of the valve upon its seat. The conical form of the member 33 also provides a rigid structure of very light weight without danger of warping of the outer seat-engaging flange. A further characteristic of the shape of the valve member is that the entire area of the valve face is exposed when opening to the pressure of the inflowing gas, thus assuring a positive quick and complete opening, and

the tapered sides divert the gas flow toward the lateral aperture without interfering eddies in the flow.

The aggregate capacity of the intake passages 23 is less than that of the valve aperture when opened, and in consequence the pressure at the valve aperture is reduced at the instant of opening, thereby materially reducing the force with which the valve member 33 is thrown against the stop 30 and preventing objectionable hammering. Also, the greater aggregate flow capacity of the discharge passages, in comparison with the capacity of the valve aperture, prevents any back pressures on the reverse side of the valve member when open which would tend to relieve the member from the stop wall 30 and cause chattering in that position.

I claim as my invention:

1. In a compressor, a removable valve structure comprising, in combination, a cylindrical seat section having an annular valve seat formed on one end thereof and having a recess within said seat with inlet passages opening therefrom through the opposite end of said section, a cylindrical cage section attached to said seat section having a recess enclosing said annular seat and outlet passages arranged radially outward of said seat extending longitudinally through said cage section, a cup shaped valve member reciprocally positioned in said recesses having an annular flange operatively engaging said seat, the central portion of said valve member extending into the recess in said seat section, spaced guides in said cage section laterally supporting said valve member, and a spring in said cage section bearing within the cupped portion of said valve member and tensioned to normally hold said flange in engagement with said annular seat.

2. In a compressor, a valve seat structure having a central recess and inlet passages communicating with said recess, an annular valve seat formed on said structure marginally outward of said recess, a valve member having an annular flange operatively engageable with said valve seat and having a conical center portion extending into said recess, and a stop limiting the movement of said valve member away from said valve seat, the capacity of the aperture between said seat and said valve member in open position being greater than the aggregate capacity of said inlet passages for the flow of fluid therethrough.

3. In a compressor, a reversible valve structure comprising, in combination, an end section having an annular valve seat and having inlet passages opening inwardly thereof, an opposite end section removably attached to said first mentioned end section having a central chamber enclosing said seat and having outlet passages communi-

ating with said chamber substantially outward of said valve seat, and a valve member positioned in said central chamber having a conical center portion opposed to said inlet passages and having a marginal flange portion in operative association with said annular seat.

4. In a compressor, a valve structure comprising, in combination, an end section having an annular valve seat and having inlet passages opening inwardly of said seat, an opposite end section having a central chamber enclosing said seat and having outlet passages communicating with said chamber substantially outward of said seat, and a valve member positioned in said central chamber in operative association with said valve seat and adapted to open into abutment with the outer wall of said chamber, the relative capacities for a flow of fluid through said inlet passages, the aperture between said seat and said valve member in

open position, and said outlet passages respectively being in progressively increased ratio.

5. In a compressor, a valve structure comprising, in combination, a seat section having an annular valve seat and having a recess within said seat with inlet passages opening therein, a cage section attached to said seat section having a recess enclosing said annular seat and having outlet passages opening therefrom radially outward of said seat, a valve member operatively positioned in the chamber formed by said recesses having a conical center portion extending into the recess in said seat section and having an annular flange adapted to engage said seat, and resilient means normally retaining said valve member in engagement with said seat.

In witness whereof I have hereunto attached my signature.

JOHN C. SCOVEL, JR.