April 4, 1967 T. BRANDIN ETAL 3,312,388

DEVICE FOR SUCTION VALVES FOR RECIPROCATING MACHINERY

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Fig. 1

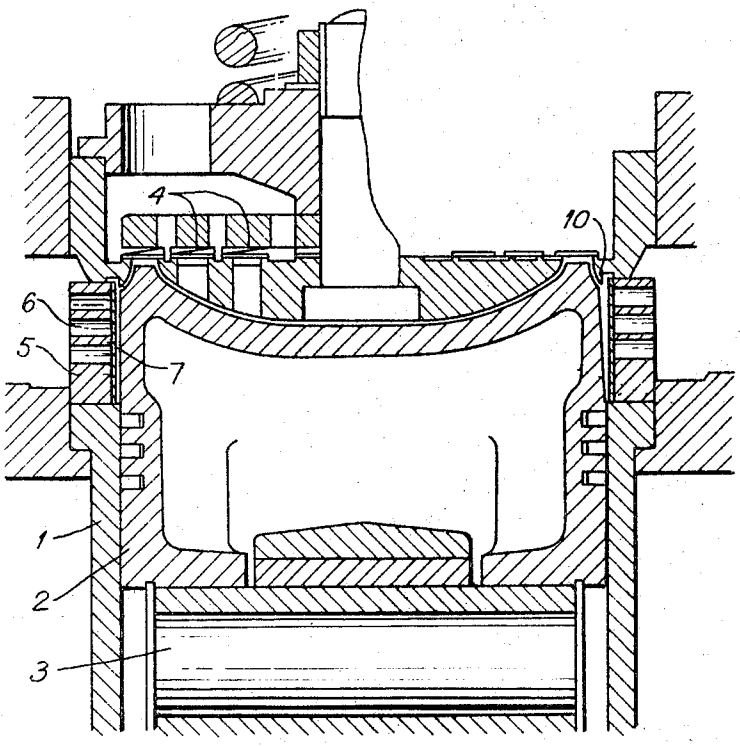


Fig. 2

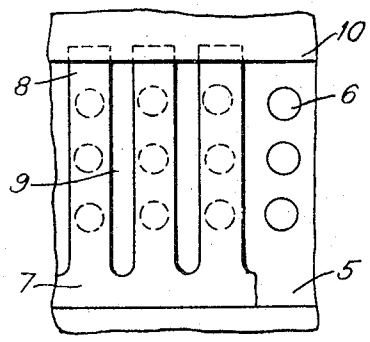
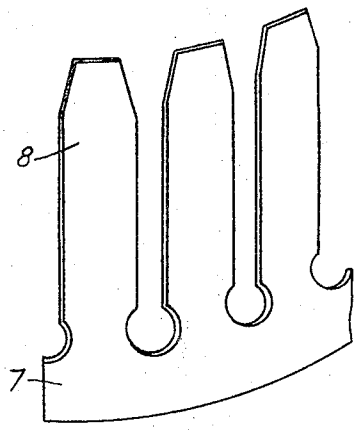


Fig. 3



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Fig. 4

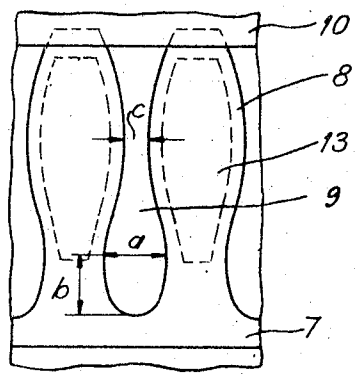
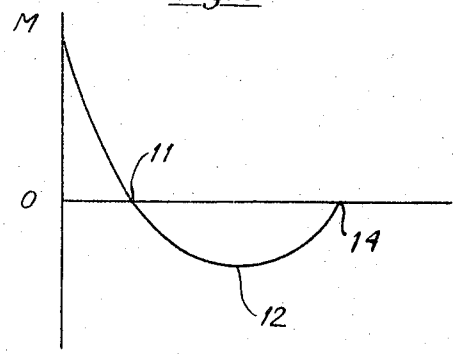


Fig. 5



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DEVICE FOR SUCTION VALVES FOR RECIPROCATING MACHINERY

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This invention relates to a device for suction valves for a reciprocating machine such as a compressor and it is an object of the invention to provide an improved arrangement by means of which efficiency in operation of the machine will be materially improved.

More particularly, the invention contemplates the provision of a cylinder in which a piston is reciprocated, the cylinder being provided at the top with an annular, apertured valve seat behind which is positioned a ring-shaped band. The band is disposed in contact with the inside face of the valve seat and is formed with a plurality of integral, elongated flexible tongues or tabs which normally cover the apertures in the valve seat. When the piston desecends in the cylinder the tabs are flexed inwardly which uncovers the apertures in the valve seat and permits the working medium to pass through these apertures as well as through slot-like spaces between the tabs and admits the working medium into the cylinder. Means are provided for limiting the inward flexure of the tabs. An important feature of the invention resides in the shape of the tabs and the spacing between them. Preferably, the tabs have a spindle or spool-shaped center area or are of ellipsoidal shape having convex side edges for the greater portion of their length and are arranged to form pear-shaped spaces whenever adjacent to their points of joinder to the band. This arrangement results in many advantages which will be more clearly disclosed hereinafter.

With these and other objects to be hereinafter set forth in view, we have devised the arrangement of parts to be described and more particularly pointed out in the claims appended hereto.

In the accompanying drawings wherein an illustrative embodiment of the invention is disclosed,

FIG. 1 is an axial cross-sectional view of the top portion of a compressor cylinder provided with a piston and with a construction according to the present invention;

FIG. 2 shows a part of the valve ring or hoop as seen from the inside of the cylinder;

FIG. 3 shows the part of the ring or hoop in perspective and as seen from the outside;

FIG. 4 shows a side view of the valves, and

FIG. 5 shows a curve of the bending torque on a valve tab bent toward the shoulder which constitutes a stop to limit its bending movement.

Referring to the drawings, and particularly to FIG. 1, a cylinder wall is shown at **1**. A portion of the piston arrangement located within the cylinder is shown at **2** and the piston pin is shown at **3**. At **4** are shown spring-loaded exhaust valves.

For admitting the working medium into the cylinder, the top of the cylinder wall is provided with an annular or ring-shaped valve seat **5** having a plurality of radially arranged openings **6** as shown in FIG. 2. These openings may be in the form of round holes, oval openings or openings of other shapes, such as shown for example at **13** in FIG. 4.

On the inside of the valve seat **5** is inserted a ring-shaped band or hoop **7** out of which tabs or tongues **8** have been stamped. These tabs normally cover the openings **6** as shown in FIG. 2, but are adapted to flex or

bend inwardly toward the interior of the cylinder, by the action of the descending piston **2** and the resultant reduced pressure in the cylinder thus providing a passage into the cylinder for the working medium.

Located between the tabs **8** are spaces **9** through which the working medium flows when the tabs are flexed inwardly as above described. To limit the inward flexing or bending of the tabs, the cylinder wall is provided with an edge or shoulder **10** acting as an abutment against which the ends of the tabs contact when they are flexed inwardly. It will be understood that the tabs are of a springy nature to permit of the flexing described.

In FIG. 4 the tabs **8** are shown as being of a shape different from the tabs shown in FIGS. 2 and 3. That is to say, the tabs shown in FIG. 4 are ellipsoidal and have convex edges for the greater portion of their length. The tabs are thus designed with a spool-shaped or spindle-shaped center section and with pear or droplet spaces between the bottom portions of the tabs. The maximum distance a between the bases of the tabs at a distance b from the base of each tab is less than $2 \times b$ and in addition, the distance c defining the spacing between the spool-shaped parts of the tabs is less than the distance a constituting the spacing between the pear-shaped parts of the tabs.

Referring to FIG. 5, the distance indicated at b is approximately the equivalent of the distance between the base or root of a tab, in other words from the line along which a tab is stamped out from the ring or hoop at o and the flexing point **11**. The shortest distance c between the tabs is spaced a distance from the base of the tab which is substantially equal to the distance from the point of origin o to the point **12** on the torque curve. Point **14** in FIG. 5 represents the edge or shoulder **10** on the cylinder wall. It will be seen, therefore, that shape and spacing of the tabs has been selected so that their narrowest portion is adjacent to the location where the bending torque is zero and their widest portion where the bending torque is greatest.

The valve ring or hoop **7** may be composed of a plurality of section. Moreover, the pear-shaped section can, for a short distance, have parallel boundary surfaces on each side of the distance a. Gas passages substantially similar in shape to the tabs, are designated at **13** in the valve seat shown in FIG. 4.

The valve tabs shown in FIG. 4 are designed so as to keep the strains exerted thereon to a minimum. The spool-shape design of the valve tabs provides a wide and substantially large gas passage **13** in the valve seat, with consequent lower gas velocities and pressure drops. The total drop in pressure, when gas flows through a valve system, is the sum of the pressure drop resulting from the velocity through the gas passage in the valve seat, pressure drop caused by bending torque, and the pressure drop resulting from the velocity in the space between two adjacent valve tabs.

The lowest total pressure is obtained when there is an optimal relationship between the area of the gas passage **13** and the area between two adjacent valve tabs, whereby the force of the gas exerted on the valve tab is reduced, and thus keeps the strains on the valve tabs to a minimum.

It should be clear from the foregoing explanation that it is important to impart to the tabs such shape as to provide a re-inforced streamlined transition contour and thereby avoid localized concentration of stress.

Having thus described a single embodiment of the invention, it is obvious that the same is not to be restricted thereto, but is broad enough to cover all structures coming within the scope of the annexed claims.

What we claim is:

1. A device for suction valves for reciprocating machines such as compressors comprising, a cylinder, a piston therein, an annular valve seat arranged as an extension of the cylinder, said seat having a plurality of passages extending through it for the passage of working medium, a ring-shaped valve band disposed on the side of the valve seat and in contact therewith, the valve band being provided with a plurality of elongated tabs that are flexed inwardly upon the descent of the piston, each of said tabs, apart from its base portion located adjacent to the band, having a configuration corresponding to a longitudinal section through a spindle, the side edges of each tab being convex from a point just above its base portion to its extremity, the convex edges near such base portion extending into a concavity, the tabs defining spaces between them which spaces increase in width in two directions from the approximate transverse center line of the tabs, the spacing between the tabs between their approximate centers and the band being droplet shape, the valve seat openings corresponding in shape substantially to the spindle-shaped portions of the tabs.

2. A device according to claim 1, wherein the lower edge of each of the valve openings is located approximately opposite to the point on the tabs whereat the curvature of the edges of the tab starts its transition in shape from convex to concave.

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