Nov. 14, 1933. W. PRELLWITZ 1,935,376

VALVE MECHANISM

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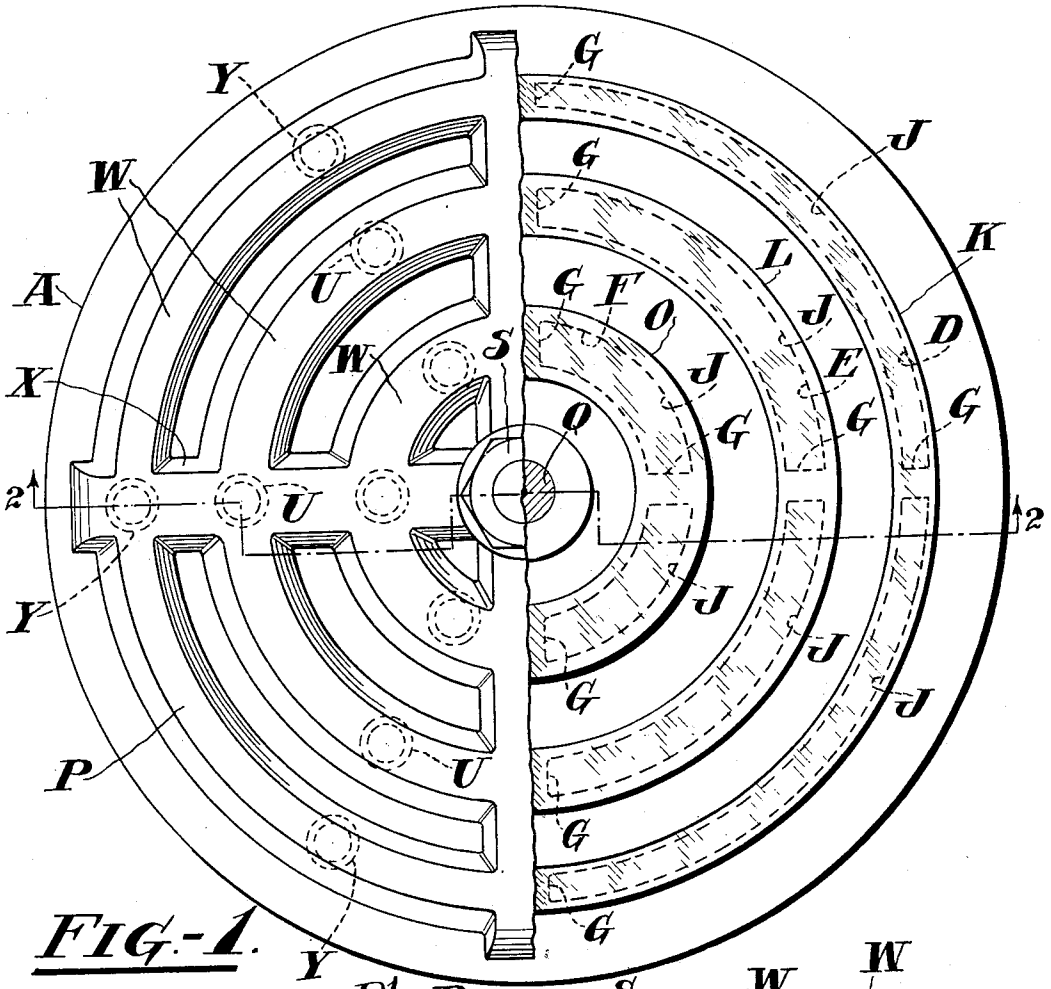


FIG.-1.

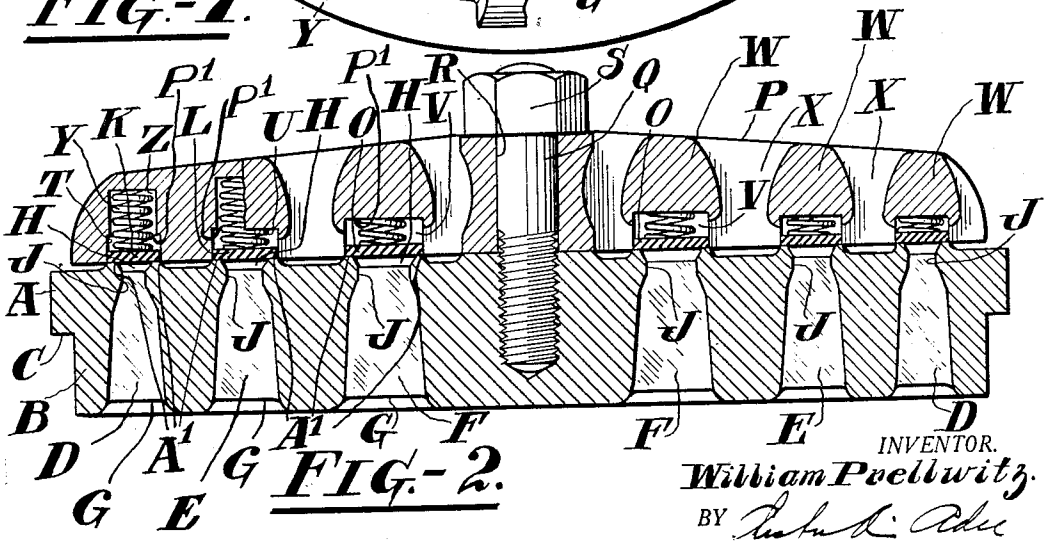


FIG.-2.

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VALVE MECHANISM

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9 Claims. (Cl. 277—46)

This invention relates to valve mechanisms, but more particularly to valve mechanisms for pumps, blowing engines, compressors, and the like for either controlling the admission of air and gases into the compressor or the exhaust of the compressed fluid from the compressor, depending upon whether the valve mechanism is intended to serve as an inlet valve or as a discharge valve.

More particularly, the invention relates to valve mechanisms of the multi-plate type in which each of a series of concentrically arranged ports is individually controlled by a separate valve plate. The valve plates are suitably guided by the stop plate and may be provided with individual spring means for pressing them to the valve seat.

As now constructed, valve mechanisms of the multi-plate type are usually provided with ports of substantially equal width, the valve plates which control them are of equal width and the stop element which controls the lift of the valve plates is so arranged that the valve plates lift or move from the valve seat in substantially an equal degree. Obviously, when thus constructed the lift of the valve plates is determined by that which the weaker of a series of plates is capable of withstanding.

In the case of concentrically arranged valve plates the weaker member is, of course, the outermost valve plate which, due to its greater area, weight and consequent flexibility, is less capable of withstanding repeated forceful impact against the stop elements than are the innermost plates or valve plates of smaller diameter.

It will be at once apparent to those skilled in the art that the lift area, that is, that space or area between the valve plates, when lifted, and the valve seat also determines the area of the ports through which the fluid is intended to pass to or from the machine to which the valve mechanism may be applied, depending upon whether the valve is being used as an inlet or an exhaust valve. There would obviously be no advantage in providing the valve mechanism with ports capable of accommodating a greater flow of fluid than may be accommodated by the lift area of the valve plates. Due to these limitations, whenever a valve mechanism is required for machines of large output volume it becomes necessary to employ valves of extremely large diameter. These may be applied only to machines operating at comparatively slow piston speed. When otherwise operated serious and usually costly delays result because of injury to or breakage of the valve plates.

One serious drawback, apart from that stated, to the use of valve mechanisms of large diameter is that as the diameter of the valve mechanisms is increased only a small number of separate mechanisms may be arranged in the space usually available for their accommodation, as for instance, around the end of a cylinder and, as in other cases, in the head or heads forming closures for the cylinders.

It is an object of the present invention to obviate the aforesaid limitations and therefore to enable each of a series of valve plates of a unitary structure to be operated at lifts at which they may be safely operated and to assure total port and lift areas commensurate with the requirements of the machine to which the valve mechanism may be applied without resorting to the use of valve mechanisms of impractical overall dimensions.

Other objects will be in part obvious and in part pointed out hereinafter.

In the accompanying drawing and in which similar reference characters refer to similar parts,

Figure 1 is a plan view, partly broken away, of a valve mechanism constructed in accordance with the practice of the invention, and

Figure 2 is a sectional elevation taken through Figure 1 on the line 2—2 looking in the direction indicated by the arrows.

Referring more particularly to the drawing, a valve mechanism constructed in accordance with the practice of the invention and designated generally by A is shown, for the purpose of illustration, as a discharge valve, and comprises a valve seat B having a shoulder C which is adapted to engage a corresponding shoulder or wall of a machine, such as a compressor, to which the valve mechanism A may be applied.

The valve seat B is provided with a series of annular ports, three such being shown in the present instance, and designated as D, E and F. The ports are preferably arranged concentrically with respect to each other and the walls thereof may taper gradually from the inlet ends G in the direction of their outlet ends H. Although, as shown, restricted throat portions J may be formed at points near the outlet ends of the ports.

The outlet openings of the ports D, E and F are controlled by valve plates K, L and O respectively. The valves seat against seating surfaces A' on the end of the valve seat A and which seating surfaces lie in a common transverse plane.

The valve plates are preferably in the form of flat ring-like plates and are held in substantially the correct operative position by a stop plate P which is superimposed upon the valve seat B and may be secured thereto in any suitable manner. One convenient means of accomplishing this is shown in the form of a bolt Q which extends through an aperture R in the stop plate and is threaded with one end into the valve seat B. On the opposite end of the bolt is threaded a nut S which serves to clamp the stop plate P securely to the valve seat B.

In the inner end surface of the stop plate P are formed a plurality of grooves T, U and V to guide the valve plates K, L and O respectively. The groves T, U and V are formed in annular ribs W which are so spaced with respect to each other as to form therebetween annular ports X through which the fluid issuing from the ports D, E and F may flow to a receiving chamber. The ports X are, of course, staggered with respect to the ports D, E and F and the fluid flowing from the ports D, E and F is deflected by the plates K, L and O and by the ribs W into the ports X.

The valve plates may be conveniently pressed to the seat B by means of coil springs Y which are disposed in sockets Z in the stop plate P and seat against the valve plates. Any suitable number of springs Y may be employed for this purpose depending upon the individual characteristics of the valve plates.

Constructed in accordance with the practice of the invention, the grooves T, U and V are of different depth so that the respective valve plates operating therein will be capable of lifting or opening in different degrees with respect to each other. Where, as in the present instance, the ports D, E and F are of different widths, thus necessitating valve plates of different widths, the grooves T, U and V are, of course, also of suitable widths to accommodate the respective valve plates for which they are intended.

As will be observed, the ports D, E and F, as well as the grooves T, U and V, decrease progressively in width in the direction of the outermost port. Likewise, the grooves T, U and V decrease progressively in depth with respect to each other in the direction of the outermost groove so that the bottom of the groove T, and which groove constitutes a seating surface P' for the valve plate K, lies nearer the valve plate K than do the seating surfaces P' of the grooves U and V with respect to the valve plates L and O, respectively. Due to this arrangement all the valve plates may be operated at high speeds since the lift of the outermost valve plate may be maintained within safe limits without a resulting decrease in the overall port and lift areas of the valve mechanism. Any decrease of the lift area of the outer plate K will be compensated for by the innermost and intermediate valve plates which, due to their smaller diameters and consequent greater rigidity and strength, are fully capable of withstanding the strains and jars incident to fast operation at high lifts.

From the foregoing, it will be apparent that a valve mechanism constructed in the manner described, is capable of being operated at a greatly increased speed over that of the usual type of multi-plate valve mechanism and, due to the gradation of the lift areas in accordance with the differences in the diameters of the valve plates, large total port and lift areas may be obtained without resorting to the use of valve mechanisms of large overall dimensions, as has been customary heretofore.

I claim:

1. A valve mechanism comprising a valve seat having a plurality of concentrically arranged annular ports, a plurality of separate valve plates to control the ports, a stop plate having seating surfaces for the valve plates and said seating surfaces being spaced at progressively decreasing distances from the valve plates in the direction of the outermost valve plate to cause the valve plates to operate at different lifts, and spring means to press the valve plates to the valve seat.

2. A valve mechanism comprising a valve seat having a plurality of concentrically arranged annular ports decreasing successively in width in the direction of the outermost port, valve plates to control the ports, a stop plate having a plurality of annular seating surfaces for the valve plates and said seating surfaces being spaced at progressively decreasing distances from the valve plates in the direction of the outermost valve plate to cause the valve plates to operate at different lifts, and spring means to press the valve plates to the valve seat.

3. A valve mechanism comprising a valve seat having a plurality of concentrically arranged annular ports decreasing successively in width in the direction of the outermost port, valve plates in the form of separate rings to control the ports, a stop plate having a plurality of annular seating surfaces for the valve plates and said seating surfaces being spaced at progressively decreasing distances from the valve plates in the direction of the outermost valve plate to cause the valve plates to operate at different lifts, and spring means to press the valve plates to the valve seat.

4. A valve mechanism comprising a valve seat having a plurality of concentrically arranged annular ports decreasing successively in width in the direction of the outermost port and lying in the same transverse plane, valve plates in the form of rings to control the ports, a stop plate having a plurality of annular seating surfaces for the valve plates and said seating surfaces being spaced at progressively decreasing distances from the valve plates in the direction of the outermost valve plate to cause the valve plates to operate at different lifts, and spring means to press the valve plates to the valve seat.

5. A valve mechanism comprising a valve seat having a plurality of ports, a plurality of seating surfaces on the valve seat and lying in a common transverse plane, valve plates cooperating with the seating surfaces to control the ports, a stop plate having relatively stepped surfaces to form stops for the valve plates, and spring means to press the valve plates to the valve seat.

6. A valve mechanism comprising a valve seat having a plurality of concentrically arranged ports of different widths, valve plates in the form of rings to control the ports, a stop plate having seating surfaces to form stops for the valve plates, said seating surfaces lying in different planes to permit the valve plates to lift in different degrees, and spring means to press the valve plates to the valve seat.

7. A valve mechanism comprising a valve seat having a plurality of concentrically arranged ports decreasing successively in width in the direction of the outermost port, valve plates to control the ports, a stop plate having relatively stepped seating surfaces for the valve plates to

permit of different degrees of lift of the valve plates, and spring means to press the valve plates to the valve seats.

8. A valve mechanism comprising a valve seat having a plurality of concentrically arranged ports decreasing successively in width in the direction of the outermost ports, valve plates to control the ports, a stop plate having seating surfaces for the valve plates, said seating surfaces being spaced at decreasing distances from the valve seat in the direction of the outermost seating surface to permit of different degrees of lift of the valve plates, and spring means to press the valve plates to the valve seat.

9. A valve mechanism comprising a valve seat having inner and outer annular ports, said inner port being of greater width than the outer port, inner and outer valve plates in the form of rings to control the ports, a stop plate having inner and outer seating surfaces for the valve plates, said inner seating surface being spaced a greater distance from the valve seat than the outer seating surface to permit of a greater degree of lift of the inner valve plate than the outer valve plate, and spring means for pressing the valve plates to the valve seat.

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