May 15, 1928. 1,669,889

F. W. ANDREWS ET AL

COMPRESSOR VALVE

Filed April 17, 1922

Fig. 1

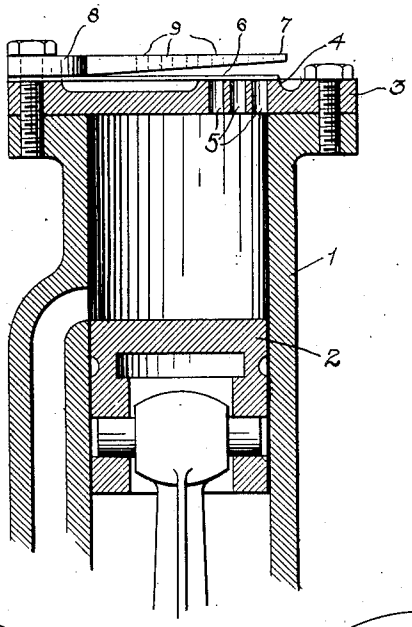


Fig. 3

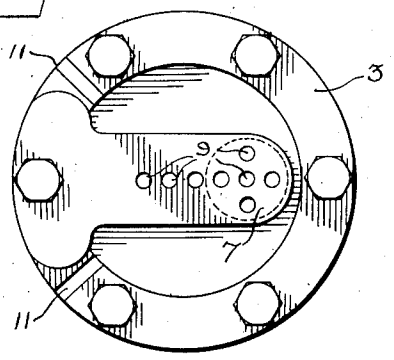
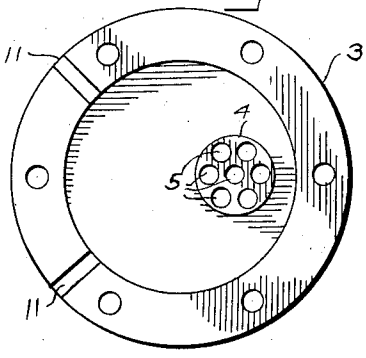


Fig. 2



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UNITED STATES PATENT OFFICE.

FRANK W. ANDREWS, OF WAPAKONETA, AND RAYMOND C. MITCHELL, OF SPRINGFIELD, OHIO, ASSIGNORS, BY MESNE ASSIGNMENTS, TO COUZENS ICE MACHINE COMPANY, OF DETROIT, MICHIGAN, A CORPORATION OF MICHIGAN.

COMPRESSOR VALVE.

Application filed April 17, 1922. Serial No. 554,016.

Our invention relates to improvements in pumps or compressors and more particularly to an improvement in valves therefor. The present invention is a continuation and amplification of the compressor valve structure set forth and described in co-pending application of Frank W. Andrews Serial No. 521,181, filed Dec. 9, 1921.

The present invention contemplates the employment of a thin sheet metal valve which is moved to and from its seat by the alternate suction and compression stroke of the pump or compressor piston. The movement of the valve away from the port, is limited by an overhanging stop member. It has been found in practice that if the port is of comparatively large size, there is a tendency for the thin sheet metal valve member to buckle or warp under the influence of the piston stroke, whereby it is drawn or forced into the mouth of the port, causing it to assume a substantially concavo-convex form, and inducing leakage. In the present instance, this difficulty is overcome by providing a plurality of ports or vents, all controlled by the single valve member and having a combined area of the desired size, but each being sufficiently small, that there will be no tendency for the valve itself to buckle within the mouth of the port. The invention further contemplates the placement of ports or air vents in the stop member, against which the valve abuts, when unseated to prevent any tendency of the valve being retarded in its movement by fluid pressure.

The object of the invention is to simplify the structure as well as the means and mode of operation of flutter valves, whereby they will not only be cheapened in construction, but will be more efficient in use, positive in operation, uniform in action, automatic, quickly responsive and unlikely to get out of repair.

A further object of the invention is to provide an improved form of flexible yielding flutter valve and a seat therefor, which will resist any warping or buckling tendency of the valve.

A further object of the invention is to provide means for eliminating any cohesion of the movable valve and its stop member.

A further object of the invention is to provide a form of valve and cylinder head mounting therefor, particularly applicable to compressors for refrigerating apparatus.

With the above primary and other incidental objects in view as will more fully appear in the specification, the invention consists of the features of construction, the parts and combinations thereof and the mode of operation, or their equivalents as hereinafter described and set forth in the claims.

Referring to the accompanying drawing, wherein are shown the preferred, but obviously not necessarily the only forms of embodiment of the invention, Fig. 1 is a vertical sectional view of a portion of a pump or compressor to which the present invention has been applied. Fig. 2 is a top plan view of the cylinder head, illustrating the valve seat therein, with the valve and its limiting stop removed. Fig. 3 is a top plan view of the pump or compressor cylinder with the valve and valve stop member assembled thereon.

Like parts are indicated by similar characters of reference throughout the several views.

Referring to the drawings, 1 is the pump or compressor cylinder and 2 the piston therein. Located upon the end of the cylinder 1 is a head 3, having thereon a slightly raised boss 4 in which are located a group of ports 5. In the present instance these ports are the outlet or discharge ports from the pump or compressor cylinder 1. The group of ports may comprise any desired number. The ports 5 comprising the group are controlled in unison by a common valve 6, comprising a thin flat flexible blade of sheet metal. The valve 6 is attached at one end to the head of the cylinder, with its free end bearing upon the valve seat 4, and covering the outlet ports 5. The valve is preferably of thin steel, and tin coated with a deeper deposit of tin or hard solder immediately overlying the ports. However, the solder coating and deposit may be omitted if desired. The face of the valve seat 4 and the contacting portions of the thin flexible valve member 6 are ground to smooth surfaces, which bear uniformly upon one another. The thin valve blade 6 is preferably mounted so as to be under slight tension, and exerts a slight pressure upon the valve seat 4, about the ports 5 thereby closing all of the ports. Overlying the yielding sheet metal

valve 6 is a limiting stop finger 7, having an enlarged head portion 8, secured to the cylinder head 3, and serving to clamp the end of the spring valve finger 6. The under side of the limiting stop finger 7 or that side adjacent to the spring blade valve is slightly beveled or tapered throughout its length, thereby permitting the spring blade valve a limited degree of fluctuation to and from the valve seat 4. The clearance of the tapered finger and range of vibration of the spring blade valve is quite small. In practice this range has been limited to approximately four or five thousandths of an inch. This range is mentioned for illustrative purposes and not as a limitation. The strain upon the flexible blade is therefore very slight and the movement so short that the valve will withstand long periods of use without showing wear or destroying the resiliency of the valve member. In the construction shown in the drawing, upon the upstroke of the piston the spring valve blade 6 is forced upward against its inherent tension, thereby opening the port 5 for the passage of compressed gas or other fluid. Upon the downward stroke of the piston this valve is tightly closed both under its own inherent resiliency and the pressure of the discharged gas or fluid. If the outlet ports 5 are of large size, or a single port is employed in lieu of the groups of smaller ports, there has been found in practice a tendency for the flexible valve to sink within such enlarged port, or to be buckled or warped centrally over the port, which tends to raise the edges of the valve out of contact with the seat 4, and permit leakage. If the valve is made of sufficient thickness to resist this buckling or warping tendency, then its efficiency is materially reduced, its flexibility destroyed, and its ease of operation and rapidity of movement retarded. These difficulties have been overcome and the employment of a flexible valve member of extremely thin character made possible by the use of grouped ports 5 of comparatively small size in lieu of a single large port.

The range of movement of the valve member being quite small, and it being pressed tightly against its overhanging stop finger upon its opening movement under the influence of the piston pressure, it tends to make a close contact with the stop finger when in open position, expelling any intermediate stratum of air gas or other fluid. There is thus induced a tendency for the valve to cling to the stop finger, momentarily, thus retarding its closing action. In the present instance, this difficulty has been overcome by providing a plurality of vents or ports 9 in the overhanging stop finger 7, by which fluid pressure is admitted to the opposite side of the valve member, thereby equalizing the pressure, and permitting the valve to leave its stop finger without a clinging tendency.

Grooves or drains 11 are provided in the periphery of the cylinder head 3 at spaced intervals to insure the drainage from the head of the cylinder of any moisture, condensed gas, oil or other fluid, which might otherwise overflow the valve seat 4, and interfere with the close seating of the valve thereon.

The characteristic flexibility of the spring member and its capability for distortion, insures a perfect contact between the valve and the valve seat at all times when the valve is closed. This capability for distortion or warping movement enables the valve member to accommodate itself to the seat surface about the ports. It is this characteristic that insures perfect seating by the warping or flexing of the valve, which in the event that a single port of large size is employed, defeats the purpose of the valve by permitting the warping to such extent as to depress the valve within the enlarged port, and causes its margins to be raised off the seat. This difficulty is overcome and the favorable and advantageous characteristic of the flexible valve is retained.

From the above description it will be apparent that there is thus provided a device of the character described possessing the particular features of advantage before enumerated as desirable, but which obviously is susceptible of modification in its form, proportions, detail construction and arrangement of parts without departing from the principle involved or sacrificing any of its advantages.

While in order to comply with the statute the invention has been described in language more or less specific as to structural features, it is to be understood that the invention is not limited to the specific details shown, but that the means and construction herein disclosed comprises the preferred form of several modes of putting the invention into effect and the invention is therefore claimed in any of its forms or modifications within the legitimate and valid scope of the appended claims.

Having thus described our invention, we claim:

1. In a flap valve construction, a body having thereon a boss forming a valve seat, a group of comparatively small ports formed in the valve seat, an imperforate spring blade bearing upon the raised seat to close the perforations therein, a supporting seat for the spring blade in spaced relation with the perforated valve seat, between which seats the spring blade is free to vibrate on a radius materially greater than the extent of the valve seat, thereby enabling the spring blade to lift clear of the valve seat on all sides thereof to an approximately

uniform extent with minimum angular extension of the blade, and a perforated stop finger overlying the spring blade and fixedly connected with the raised supporting seat to clamp one end of the spring blade fixedly therebetween, the perforated portion of the stop finger extending in spaced relation with the spring blade and serving to limit the vibratory movement thereof.

2. In a flap valve construction, a main body having two spaced elevated areas and a depressed area therebetween, one of the elevated areas having therein a group of perforations and forming a valve seat, a vibratory spring blade fixedly secured to the other elevated area as the center of its vibratory movement and extending in bridging relation across the intermediate depressed area into overlapping relation with the perforated valve seat and normally tending to close the plurality of perforations therein under influence of the inherent tension of the blade, the length of the vibratory portion of the blade being materially greater than the extent of the valve seat to afford an approximately uniform lift of the blade over all portions of the valve seat, and a perforated stop finger extending in divergent relation with the spring blade and limiting the vibratory movement of the spring blade away from the perforated valve seat.

In testimony whereof, we have hereunto set out hands this 11 day of April, 1922.

FRANK W. ANDREWS.
RAYMOND C. MITCHELL.