C. R. BALLARD.

VALVE.

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**1,003,412.**

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Fig 1

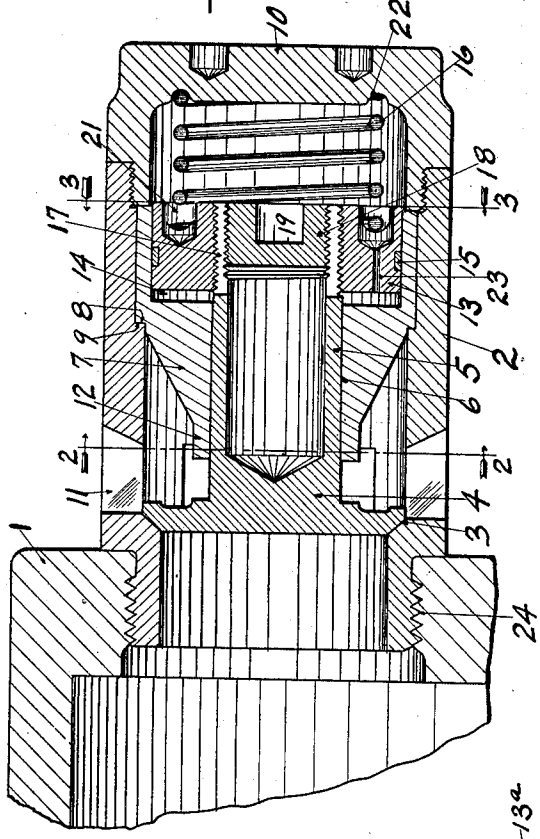
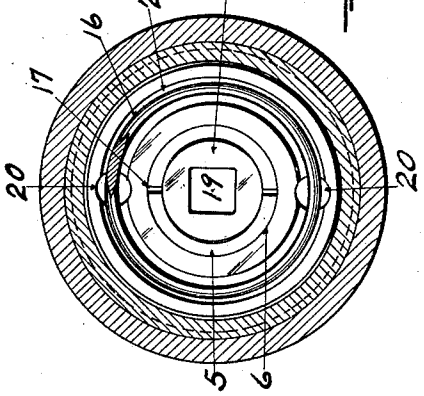



Fig 3



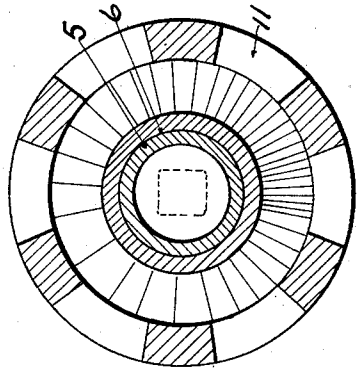




Fig 2

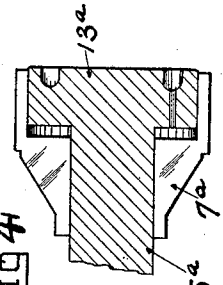



Fig 4

WITNESSES

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# UNITED STATES PATENT OFFICE.

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## VALVE.

1,003,412. Specification of Letters Patent. **Patented Sept. 19, 1911.**

Application filed January 13, 1911. Serial No. 602,469.

*To all whom it may concern:*

Be it known that I, CHARLES R. BALLARD, a resident of Midway, in the county of Washington and State of Pennsylvania, have invented a new and useful Improvement in Valves, of which the following is a specification.

This invention relates to valves for compressors, pumps and the like, and more particularly to outlet valves therefor, although the main features are also applicable to inlet valves.

The object of the invention is to provide for the purposes stated a valve of simple and durable construction, one which is noiseless in its action, one in which the extent of opening can be varied, which is so constructed that it can be easily attached to and removed from the cylinder head, and which is provided with adjustable renewable means for taking up the wear.

The invention comprises a valve constructed and arranged as hereinafter described and claimed.

In the accompanying drawing Figure 1 is a longitudinal sectional view through the valve showing it attached to the cylinder head; Figs. 2 and 3 are transverse sections taken respectively on the lines 2—2 and 3—3, Fig. 1; and Fig. 4 is a central longitudinal section of a portion of the valve showing a modification of the piston and bushing.

In the drawing 1 indicates a portion of the head of a cylinder of an air compressor, pump or similar apparatus. The valve is shown as an outlet valve and comprises a casing 2 which at its inner end is open to the pump or compressor cylinder and is provided with a seat 3 with which coöperates a valve 4 provided with a stem 5 projecting outwardly and slidably mounted in an axial bore 6 in a bushing member 7. The latter is rotatably adjustable in the casing and is adapted to be clamped to the casing so that it cannot accidentally rotate therein by being provided with an external shoulder 8 contacting with an internal shoulder 9 in the casing and arranged to be contacted at its outer end by the inner edge of cap 10 which has a threaded engagement in the outer end of the casing and serves the twofold purpose of clamping the bushing between its inner end and the shoulder 9 in the casing and serving as a closure for the outer end of the casing.

In the valve illustrated the wear is almost entirely confined to the reciprocation of the valve stem 5 in the axial bore of the bushing 7, and since these valves, whether used as inlet or discharge valves, are usually placed in a horizontal position the wear is greater on the lower side of the valve stem and of the bushing bore. After the wear becomes excessive it is merely necessary to remove the cap 10 and give the bushing 7 and valve a half turn, that is, through 180 degrees, and then replace the cap. This simple adjustment brings the valve and valve stem back into alinement with the valve seat. When the wear again becomes excessive the worn bushing is replaced by a new one, when the valve will be practically as good as new. The bushing rotatably adjustable in the valve body provides simple means for keeping the valve in proper working order and for renewing the wearable part at a reasonable cost, without discarding the main parts of the valve.

The discharge orifices 11 are through the side walls of the casing, and the inner end of the bushing 7 is tapered to a comparatively small sleeve 12 which surrounds the valve stem in fairly close proximity to the valve seat. As a consequence the valve stem is protected to a very considerable extent from dirt or grit in the fluid being compressed or pumped. The cap 10 closes the outer end of the casing substantially hermetically so that there is no tendency of the fluid being compressed to pass outwardly between the valve stem and the walls of the bore in which said stem reciprocates, so that there is a minimum amount of wear of the valve stem in the bushing due to dirt or grit in the fluid being compressed.

The outer end of the valve system is threaded to receive a head or piston 13 which has a fairly close fit in the chamber 14 formed in the outer end of the bushing 7, so that said chamber and piston form a dashpot to steady and cushion the movements of the valve and prevent the same from closing so suddenly as to cause a disagreeable noise. If desired, the piston may be provided with a suitable packing ring shown at 15, to give a tight fit in the dashpot chamber. Between said piston and the outer end of the cap is a spiral spring 16 which serves to hold the valve to its seat, and which is compressed during the opening movement of the valve. The threaded

connection of the piston 13 with the valve stem serves to adjust the position of said piston on said stem and therefore determines the extent of opening movement of the valve, it being obvious that when the piston is adjusted outwardly the spring 16 becomes compressed sooner than when said piston is adjusted inwardly on the stem. In order to lock the piston in its adjusted position on the valve stem, the outer end of said stem is split, as indicated at 17, and is made hollow and internally threaded to receive a tapered threaded plug 18 which serves to spread the end of the stem and thus lock the piston against accidental rotation. This plug is provided with a recess 19 of square or other irregular shape in cross section to receive a suitable key by means of which it may be loosened or tightened in the hollow valve stem. The piston 13 is also preferably provided in its outer face with a pair of recesses 20 for receiving a spanner wrench or other tool for turning the same on the valve stem. Preferably the outer face of said piston is provided with an annular groove 21 forming a seat for the inner end of the spring 16, and the cap 10 may also be provided with a similar groove 22 to form a seat for the outer end of said spring. Also, if desired, the piston may be provided at its outer end with a small leak port 23.

The valve casing at its inner end is externally threaded, as at 24 and is secured to the cylinder head 1 by merely screwing the same into a tapped opening therein. Consequently the valve can be very readily attached to and removed from the cylinder head without disturbing other parts, and permits of the use of a very simple cylinder head.

Fig. 4 shows a modification in which the piston $13^a$ is integral with the valve stem $5^a$, and the bushing $7^a$ is split longitudinally, (as indicated by the absence of section lines on said bushing) to permit the same to be assembled with the piston and valve stem. In other particulars the construction and operation is the same as in the main form.

The valve is of solid compact construction and is supported entirely at its inner end, thereby dispensing with the usual complicated arrangement for fastening the valve to or in the cylinder head. The ports and internal sleeve are so located that the grit and dirt in the fluid being compressed cannot work into the axial bore in which the valve stem slides and wear the valve stem and its bearing.

The sealing of the outer end of the casing prevents the fluid being compressed from escaping through the axial bore and around the valve stem. The rotatably adjustable bushing separate from the casing and forming a bearing for the valve stem provides a simple means for bringing the valve back into alinement with its seat when the bearing becomes worn, and also is an inexpensive renewable means when worn excessively. This renewable rotatably adjustable bushing forming a bearing for the sliding valve stem is adapted equally as well for an inlet valve as for an outlet valve as shown in the drawing.

What I claim is:

1. A self contained valve for compressors, pumps and the like, comprising a casing provided at its inner end with a valve seat and with means for attachment to the cylinder and having ports in its side walls and provided with an internal shoulder, a valve coöperating with the valve seat and provided with an outwardly extending stem, a bushing rotatably adjustable in said casing and provided with an axial bore in which the valve stem is slidable and with an enlarged part contacting directly with the shoulder in the casing, a valve cap threaded into and closing the outer end of said casing and bearing directly against the bushing and clamping the latter against the internal shoulder in the casing, and a spring arranged to hold said valve to its seat.

2. A self-contained valve for compressors, pumps and the like, comprising a casing closed at its outer end and provided at its inner end with a valve seat and with external threads for attachment to a cylinder head and having ports through its side walls, a valve coöperating with the valve seat and provided with an outwardly extending stem, a bushing rotatably adjustable in said casing and provided with an axial bore in which the valve stem is slidable and projecting toward the valve seat to protect the valve stem from the fluid being compressed, a cap threaded into the outer end of the casing and directly engaging said bushing and holding the same against rotation, and a spring arranged to hold said valve to its seat.

3. A self-contained valve for compressors, pumps and the like, comprising a casing provided at its inner end with a valve seat and with means for attachment to a cylinder head and having ports through its side walls, a valve coöperating with the valve seat and provided with an outwardly extending stem, a bushing rotatably adjustable in said casing and provided with an axial bore in which the valve stem is slidable, means for securing said bushing against rotation, a cap secured to and closing the outer end of said casing, the bushing and cap being formed to provide a chamber, a piston secured to the outer end of the valve stem and having a close fit in said chamber and forming therewith a dashpot, and a spring in said chamber and bearing against said piston and arranged to close the valve.

4. A self-contained valve for compressors, pumps and the like, comprising a casing provided at its inner end with a valve seat and with means for attachment to a cylinder head and having ports through its side walls and having an internal shoulder, a valve coöperating with the valve seat and provided with an outwardly extending stem, a bushing rotatably adjustable in said casing and provided with an axial bore in which the valve stem is slidable and with an enlarged portion contacting directly with the shoulder in the casing, a cap having a threaded connection into the outer end of the casing and closing the same and directly engaging and clamping said bushing between its inner end and the internal shoulder in the casing, and a spring arranged to hold said valve to its seat.

In testimony whereof, I have hereunto set my hand.

CHARLES R. BALLARD.

Witnesses:
O. A. ROEHLING,
MARY E. CAHOON.