W. F. RUWELL.

VALVE.

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1,029,464. Patented June 11, 1912.

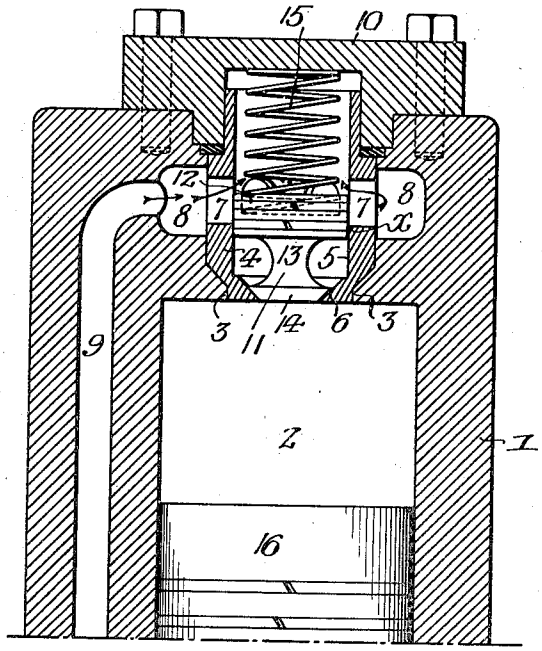


Fig. 1.

Fig. 3.

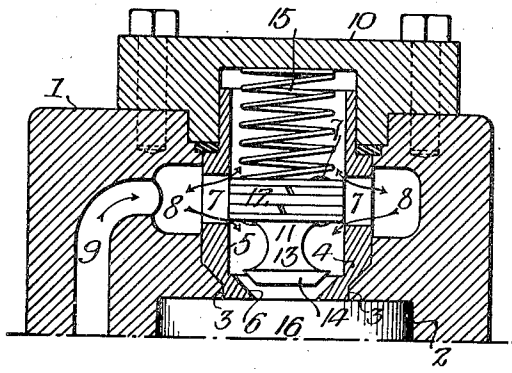


Fig. 2.

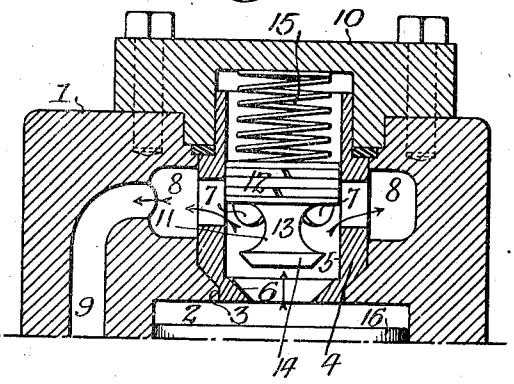
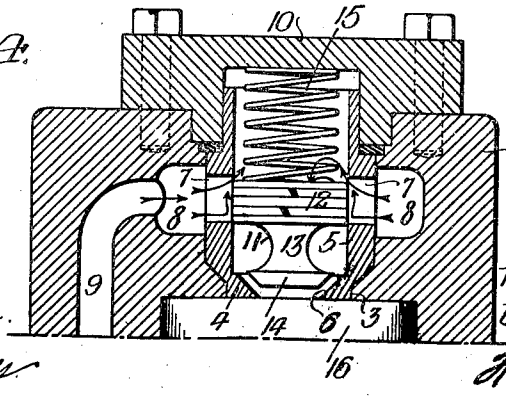


Fig. 4.



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VALVE.

1,029,464. Specification of Letters Patent. Patented June 11, 1912.

Application filed November 7, 1911. Serial No. 659,037.

To all whom it may concern:

Be it known that I, WILLIAM F. RUWELL, a citizen of the United States, residing in Philadelphia, Pennsylvania, have invented certain Improvements in Valves, of which the following is a specification.

My invention relates to valve construction and consists of a valve which is particularly adapted for use as a discharge valve for refrigerating compressor pumps or the like.

The chief object of my invention is to make a valve which will be of simple construction, effective and which can be easily inserted or removed from a compressor cylinder. These objects and other advantages I attain in the following manner, reference being had to the accompanying drawing in which—

Figure 1, is a sectional elevation of my improved valve mechanism applied to the discharge portion of a compression cylinder of a compressor pump. Figs. 2, 3, and 4, are similar sections showing different positions of the valve during a discharge.

Referring to the drawing, 1 is a cylinder having a piston bore 2 serving as a compression chamber. An aperture 3 leads from the compression chamber 2 to form a seat for the valve casing 4. The valve casing 4 has a cylindrical valve-chamber 5 terminating at one end in a frusto-conical valve seat 6 and leading to the compression chamber 2. Apertures 7 are formed in the valve casing 4 and lead to a discharge port 8 formed in the cylinder 1. A channel 9 leads from the discharge port 8 to condensing coils or other mechanism not shown in the drawings. The position and size of the apertures 7 form important features of my invention and will be more fully considered hereinafter. A cap plate 10 is fixed to the cylinder 1 and forms a retainer and a closure for the valve casing.

Mounted within the valve-chamber 5 is a valve 11 having a piston head 12, and a stem 13. The stem 13 terminates in a frusto-conical shaped end 14 which is designed to contact with the valve seat 6 and stop communication between the compression chamber 2 and of the valve chamber 5. A compression spring 15 is mounted so as to bear against the piston head 12 and the cap 10.

Any form of compression element may be employed within the chamber 2 but in the present instance I show a plunger 16 which is reciprocated within the chamber by mechanism not shown.

My invention as illustrated is designed to perform the functions of a discharge and back pressure valve; first, to allow the compressed or high pressure ammonia gas from the chamber 2 to be forced into the condensing tubes and, second, to prevent a back leak of the gas from the condensers while low pressure gas is being admitted to the chamber 2 through suction or inlet valves (not shown).

In the construction of the valve the thickness of the piston head 12 is made less than the diameter of the apertures 7, and the length of the valve 11 is such that when the stem 14 is in contact with the seat 6 the apertures 7 will be open to the valve-chamber 5 at a point between the piston head 12 and cap plate 10. Also, in this latter position, the piston head 12 forms a back pressure cut off and prevents a leakage of the back pressure into the valve chamber between the valve seat 6 and the piston head 12 (see Fig. 1). The lift of the valve is dependent upon the intensity of the discharge of the cylinder but in all cases lifts to a point sufficient to close the ports to the portion of the valve chamber between the piston head 12 and the cap plate 10, and to open the apertures 7 to the portion of the casing between the piston head 12 and the compression chamber 2. (See Fig. 2.)

One of the important features of my invention is to have the apertures 7 disposed with respect to the piston head 12 that they are closed to the compression chamber 2 and opened to the cushion chamber by the piston head 12 when the valve is closed, and opened to the compression chamber 2 and closed to the cushion chamber by the piston head 12 when the valve is opened. The advantages of this construction will be more fully set forth in the following description of the operation.

In the normal position shown in Fig. 1, the valve end 14 is seated and the piston head 12 aids the end in forming a cut off against leakage of the back pressure. Also in this position the back pressure, aided by the spring 15, is acting to keep the valve seated.

The operation is as follows: The plunger 16 moves toward the valve thereby compressing the gas in the chamber 2. When

the pressure in the chamber 2 exceeds the back pressure and that of the spring 15, the valve is forced off its seat and the gas is forced through the apertures 7. Also, the piston head 12 being moved to a point between the apertures 7 and the cap plate 10, will cushion and compress the gas between itself and the cap plate 10 (see Fig. 2). When the plunger has completed its compression stroke and is at the end of the compression chamber 2, as shown in Fig. 2, the spring 15 and the compressed gas between the piston head 12 and cap plate 10 expand and force the valve toward its seat because the compressed gas and the spring pressure are greater than the back pressure. As soon as the piston head 12 in its return movement reaches the position shown in Fig. 3 the gas pressure is equalized. In other words, as the apertures 7 are opened to the portion of the valve chamber 5 between the piston head and the cap plate the back pressure gas that had been cushioned becomes common with the back pressure. This would practically form a balance for the valve at this time if it were not for the action of the spring 15 because the back pressure acts on all faces of the piston head 12. At this point, however, the spring 15 acts as an auxiliary member and continues the movement of the valve toward its seat until the face of the piston head which is adjacent the valve stem passes the apertures 7 and cuts off the back pressure to the chamber 2 as shown in Fig. 4. When the piston head reaches this position the entire back pressure acts on the spring-pressed end of the piston head 12 and tends to quickly seat the valve. However, the gas between the piston head 12 and the plunger 16 will form a slight temporary cushion and retard the movement of the valve thereby preventing the valve from pounding. This temporary cushioning takes place owing to the fact that the seat 6, being smaller in diameter than the piston head 12 and partially cut off by the stem 14 (Fig. 4), is unable to carry off the gas necessary for the displacement of the quick moving piston head. Therefore the piston head is retarded just before the seating of the valve. Also, by having the apertures 7 larger than the thickness of the piston head 12 the cut off of the valve is prevented until the back pressure has started to act on the outer end of the said piston head 12. This prevents pocketing of the hot gas by allowing a discharge opening until the back of the piston head cuts off the back pressure to the compression cylinder. Another advantage of having the apertures 7 larger than the thickness of the piston head 12 is that the discharge passages will be wide open before the cushioning of the valve and thereby permit a free outlet of the gas from the compression chamber. Thus the compression plunger is not compelled to compress the gas in the cushion chamber before the gas in the compression chamber can be discharged. This construction, therefore, prevents unnecessary resistance to the movement of the compression plunger and to the gas that is being discharged. Thus the piston head 12 and the apertures 7 are specifically arranged and coöperate to perform the following functions: First, they permit the discharge of the gas; second, they permit a cushion to be formed for the valve and thereby do away with a cushion spring; third, they serve to cut off the back pressure to the compression chamber; fourth, they effect a rapid closure of the valve; fifth, they effect a slight cushioning of the valve to prevent pounding; and sixth, they form a second seat for the valve to prevent a leakage of the back pressure into the compression chamber 2 (see *x* Fig. 1).

In the use of my invention it is preferable that the parts be so proportioned that the pressure of the gas in the compression cylinder is sufficient to move the piston head of the valve far enough to expose a part of the area of the aperture 7 which is at least equal to the area of the valve seat opening into the compression cylinder. By having this arrangement, there is an even passage of the gas from the time that it leaves the compression cylinder until the time that it reaches the discharge port and channel 9.

Up to the time of my invention valves of this nature were constructed with double cased auxiliary valves, by passes and cushion springs all of which formed a complicated mechanism in need of constant repair. Attempts have been made to form air or gas cushions in separate casings from the main valve and run by-passes or ports from the main and auxiliary valve chamber into the discharge chamber, but, owing to the number of parts and delicate adjustment, none of these have been practical. In my invention the valve proper contains only three parts namely, a piston-headed valve, an auxiliary spring, and a valve casing of simple construction and which has but one row of apertures. Also by having the construction shown in the several views of drawing, the valve stem is flush with the end of the compression chamber 2 so that all the gas is forced through the valve casing on each stroke of the piston and, as the valve closes just as soon as the plunger has finished its compression stroke, there is no chance of hot, compressed gas remaining between the plunger and valve stem because the plunger can move to the end of the compression chamber 2 as clearly shown in Figs. 3 and 4.

I claim:

1. The combination in a compressor pump of a valve casing, having a valve seat and

lateral passages, a valve arranged to close against said seat, said valve having a portion arranged to move past the passages, said valve portion being of such thickness as to never entirely close the passages.

2. The combination in a compressor pump of a valve casing having a valve seat and lateral passages, a piston headed valve arranged to close against said seat, said piston head being arranged to move past the passages and being of such thickness as to never entirely close the passages.

3. The combination in a compressor pump of a valve casing having a valve seat and lateral passages, a piston headed valve arranged to close against said seat, a spring bearing on said piston head, said piston head being arranged to move past the passages and being of such thickness as to never entirely close the passages.

4. The combination in a compressor pump having a compression chamber and a passage, of means providing an aperture between the compression chamber and the passage, and a valve intermediate the aperture and the compression chamber, said valve being movable to either side of and never entirely covering the aperture.

5. The combination in a compressor pump having a passage, a compression chamber, and a valve chamber communicating with the compression chamber, of means providing an aperture between the valve chamber and the said passage, said aperture being between the compression chamber and the end of the valve chamber; and a valve fitting and movable within the valve chamber to points on either side of the aperture, said valve never covering the entire aperture.

6. The combination in a compressor pump having a compression chamber, and a passage formed therein of a valve casing opening into the compression chamber; an aperture in said valve casing and forming communication between the said passage and the compression chamber; a valve seat formed in the valve casing; a valve fitting and movable within the valve casing to points on either side of the aperture, said valve never covering the entire aperture.

7. The combination in a compressor pump having a compression chamber, and a passage formed therein of a valve casing at one end of the compression chamber, a plurality of apertures in said valve casing and forming communication between the said passage and the compression chamber, a valve seat formed in the valve casing, a valve fitting and movable within the valve casing to points on either side of the aperture, said valve never covering the entire aperture.

8. The combination in a compressor pump having a passage and a compression chamber mounted therein of the valve casing having apertures formed therein and forming a communication between the passage and the compression chamber, said apertures being positioned in a common plane at right angles to the center of the valve casing, and between the end of the compression chamber and the outer end of the valve casing, a valve fitting and movable to points on either side of the apertures, said valve never covering the entire apertures.

9. The combination in a compressor pump having a compression chamber and a passage, a valve mounted at one end and opening into the compression chamber, a valve movable in the valve chamber, said valve having a piston head and a stem projecting from the piston head, a valve seat formed in the valve casing and with which the valve stem contacts, a series of apertures leading from the valve casing to the passage, said apertures being in a common plane at right angles to the axis of the piston head, the thickness of the said piston head, being less than the width of any of the apertures.

10. The combination in a compressor pump having a passage and a compression chamber, a valve casing opening into the compression chamber, a frusto-conical valve seat formed within the valve casing and a piston headed valve in the valve casing, a frusto-conical valve stem projecting from the valve, a spring for moving the valve stem in contact with the valve seat, an aperture forming communication between the said passage and the valve casing, the thickness of the said piston head being less than the width of the aperture, a closure for the outer end of the valve chamber, said piston head being movable within the valve chamber to points on either side of the said aperture.

11. The combination in a compressor pump having a passage and a compression chamber, a valve casing opening into the compression chamber and closed at the end opposite the compression chamber, a valve seat formed in said casing, a piston headed valve mounted within the valve casing, a spring for moving the valve toward the valve seat, said valve casing having an aperture forming communication with the passage and the interior of the valve casing, said aperture forming communication between the passage, and the portion of the valve casing between the piston head and the closed end of the valve casing when the valve is seated and forming communication between the passage and the compression chamber when the outer face of the piston is raised to a point beyond the aperture.

12. The combination in a compressor pump having a passage and a compression chamber, a valve casing having a valve chamber opening into the compression chamber and closed at the end opposite the com-

pression chamber, a seat formed in the valve casing, a piston headed valve mounted within the valve chamber, means between the piston head and the closed end of the valve chamber for normally holding the valve in contact with the valve seat, an aperture forming a communication between the said passage and the valve chamber the thickness of the said piston head being less than the width of the said aperture, the distance from the outer edge of the said aperture to the compression chamber being greater than the distance of the outer surface of the piston head to the compression chamber when the valve is in its closed position.

13. The combination in a compressor pump having a passage and a compression chamber, a valve casing having a valve chamber opening into the compression chamber and closed at the end opposite the compression chamber, a seat formed in the valve casing, a piston headed valve mounted within the valve chamber, a spring between the piston head and the closed end of the valve chamber for normally holding the valve in contact with the valve seat, an aperture forming a communication between the said passage and the valve chamber, the thickness of the said piston head being less than the width of the said aperture, the distance from the outer edge of the said aperture to the compression chamber being greater than the distance of the outer surface of the piston head to the compression chamber when the valve is seated.

14. The combination in a compressor pump having a passage and a compression chamber, a casing providing a valve chamber, said valve chamber opening into the compression chamber and being closed at its outer end, a frusto-conical valve seat formed in said casing, a piston-headed valve mounted within the valve casing and having a frusto-conical valve stem adapted to contact with the valve seat, said casing having a series of apertures formed therein and leading from the valve chamber to the said passage, the piston head being movable within the valve chamber to points on either side of the aperture.

15. A valve casing closed at one end and having an aperture and a valve seat formed therein; a valve fitting the casing, said valve closing the aperture to the valve seat when the valve is seated; said valve, when open, closing the aperture to the closed end portion of the valve casing.

16. The combination, in a compressor pump having a passage and a compression chamber, of a valve casing having an aperture and being closed at one end; a valve fitting the casing, said casing having a valve seat formed therein; a stem on the valve and fitting the seat, said valve being movable by the gas in the compression chamber to a point between the aperture and the closed end to cushion and to allow the discharge of the said gas through the aperture; and means for returning the valve to a point between the aperture and the valve seat to be acted upon by the back pressure of the dischargd gas to seat the valve.

17. The combination, in a compressor pump having a passage and a compression chamber, of a valve casing having an aperture and being closed at one end; a valve fitting said casing, said casing having a valve seat formed therein and smaller in diameter than the valve; a stem on the valve and fitting the seat, said valve being movable by the gas in the compression chamber to a point between the aperture and the closed end to cushion and to allow the discharge of the said gas through the aperture; and means for returning the valve to a point between the aperture and the valve seat to be acted upon by the back pressure of the discharged gas to seat the valve.

18. The combination, in a compressor pump having a passage and a compression chamber, of a valve casing having an aperture and being closed at one end; a valve fitting said casing; said casing having a frusto-conical valve seat formed therein and smaller in diameter than the valve; a frusto-conical stem on the valve and fitting the seat, said valve being movable by the gas in the compression chamber to a point between the aperture and the closed end to cushion and allow the discharge of the said gas through the aperture; and means for returning the valve to a point between the aperture and the frusto-conical valve seat to be acted upon by the back pressure of the discharged gas to seat the valve.

19. The combination, in a compressor pump having a passage and compression chamber, of a valve casing opening into the compression chamber and closed at one end; a piston valve mounted within the valve casing, said casing having a frusto-conical valve seat formed therein and smaller in diameter than the valve, said piston valve having a frusto-conical stem thereon and fitting the valve seat; a spring for moving the valve toward the valve seat, said valve casing having an aperture forming communication with the passage and the interior of the valve casing, said aperture forming communication between the passage and the portion of the valve casing between the piston head and the closed end of the valve casing when the valve is seated, and forming communication between the passage and the compression chamber when the outer face of the piston valve is moved to a point beyond the aperture.

20. The combination, in a compressor pump having a passage and a compression chamber, of a valve casing closed at one

end, a valve seat in said casing and opening into the compression chamber; a valve fitting said casing; means for moving said valve toward the valve seat, said valve casing having an aperture; said aperture at all times forming communication with the passage and the interior of the valve casing, said aperture forming communication between the passage and the portion of the valve casing between the valve and the closed end of the valve casing when the valve is seated and forming communication between the passage and the compression chamber when the outer face of the valve is moved to a point beyond the aperture by the discharge of the gas from the compression chamber.

In testimony whereof, I have signed my name to this specification, in the presence of two subscribing witnesses.

WILLIAM F. RUWELL.

Witnesses:
AUGUSTUS B. COPPES,
JOS. H. KLEIN.