

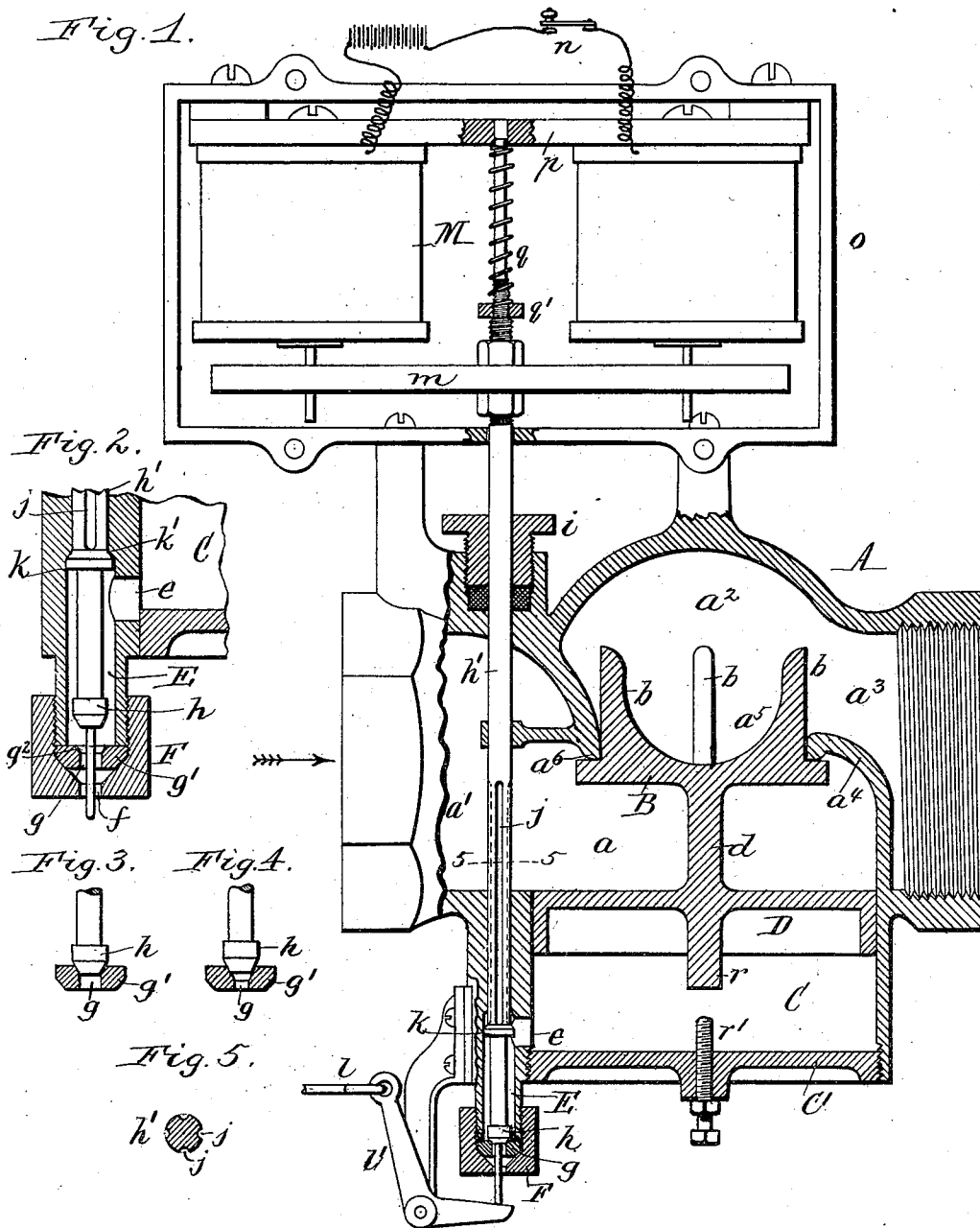
No. 620,829.

Patented Mar. 7, 1899.

J. F. BATCHELOR.  
VALVE.

(Application filed Aug. 11, 1898.)

(No Model.)



WITNESSES:  
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# UNITED STATES PATENT OFFICE.

JOSEPH F. BATCHELOR, OF NEW YORK, N. Y., ASSIGNOR TO ELIZA J. BOYDEN, OF NEWARK, NEW JERSEY.

## VALVE.

SPECIFICATION forming part of Letters Patent No. 620,829, dated March 7, 1899.

Application filed August 11, 1898. Serial No. 688,357. (No model.)

*To all whom it may concern:*

Be it known that I, JOSEPH F. BATCHELOR, a citizen of the United States, residing at New York, in the borough of Brooklyn, in the State of New York, have invented new and useful Improvements in Valves, of which the following is a specification.

This invention relates to valves for controlling the supply of steam or other fluid under pressure to a steam-cylinder, a signal-whistle, or other device, and more particularly to a valve of this kind which is controlled by an electromagnet, although my improvements are equally applicable to valves controlled by manual or other means. An electrically-controlled valve of this character is shown and described in Letters Patent of the United States No. 552,811, granted to me January 7, 1896. In the valve of this patent the main-valve head is connected with a piston operating in a cylinder which is provided in its closed front end with an opening in which said valve slides, the piston being of larger diameter than said opening, so that when the valve is open an annular space or pocket is left between the closed front end of the cylinder and the front side of the piston.

When the piston is moved forward to close the valve, the steam or other fluid leaks past the piston and fills this space or pocket, forming a cushion which checks the closure of the valve. In order to avoid this cushioning action, it is necessary to provide a vent in the cylinder in front of the piston for the escape of said fluid. This vent is objectionable, however, because when the valve is closed the steam or fluid which leaks past the piston escapes through the vent.

The principal objects of my invention are to provide a ventless valve of this type which is free from the above-described objection and to simplify and improve the construction of the auxiliary-valve mechanism which controls the main valve.

The invention has the further object to provide simple and convenient means for causing the main valve to open slowly or quickly, as may be desired, and for enabling the valve to be used with different pressures without

requiring the operating-magnet of the auxiliary valves to be changed.

In the accompanying drawings, Figure 1 is a sectional elevation of my improved valve, showing the same closed. Fig. 2 is a fragmentary sectional elevation of the auxiliary-valve mechanism, on an enlarged scale, showing the position of the parts when the main valve is open. Figs. 3 and 4 are vertical sections of the exhaust-valve and its removable seat. Fig. 5 is a cross-section of the valve-stem in line 5 5, Fig. 1.

Like letters of reference refer to like parts in the several figures.

A is the casing of the valve;  $a$ , its inlet-chamber, having the branch  $a'$ ;  $a^2$ , its outlet-chamber, having the branch  $a^3$ ;  $a^4$ , the usual diaphragm separating said chambers, and  $a^5$  the connecting-passage formed in said diaphragm and provided on the inlet side of the valve with a valve-seat  $a^6$ .

B is the main valve, adapted to close against the seat  $a^6$  and having suitable guides or wings  $b$ , which slide in the passage  $a^5$ .

C is a cylinder or cylindrical chamber preferably formed integrally with the valve-casing A and opening at its front or inner end into the inlet-chamber  $a$  of the valve-casing. The rear end of this cylinder is closed by a removable cap or head  $C'$ . In the preferred construction shown in the drawings the cylinder C projects from one side of the valve-casing and is arranged at right angles to the axis thereof.

D is a piston arranged in the cylinder C and rigidly connected with the main valve B by a stem  $d$ , the valve, piston, and connecting-stem being preferably formed in one piece, as shown. This piston is larger in diameter than the back of the main-valve head, as shown, so as to present a greater area to the fluid-pressure than the valve-head. As the front or inner end of the cylinder C is not separated from the inlet-chamber of the valve-casing A, but opens freely into the same, the back of the main valve and the front side of the piston D are exposed to the pressure in said inlet-chamber.

E is an auxiliary-valve chamber preferably

formed integral with the cylinder C and extending beyond the outer end thereof. The inner end of this auxiliary chamber communicates by a port *e* with the portion of the cylinder C in rear of the piston D, while its outer end opens into the atmosphere through a port or passage *f*, formed in a removable cap F, applied to the screw-threaded outer end of the chamber, and through a port *g*, formed in a removable disk *g'*, interposed between said cap and the outer end of the valve-chamber. The exhaust-port *g* is provided at its inner end with a valve-seat *g*<sup>2</sup>, against which an exhaust-valve *h* is adapted to close for shutting off communication between the auxiliary-valve chamber and the atmosphere. This valve is formed on or secured to a sliding stem *h'*, which extends centrally through the auxiliary-valve chamber, the adjacent wall of the cylinder C, the inlet-chamber of the valve-casing, and a stuffing-box *i*. Communication is normally established between the rear portion of the cylinder C and the inlet-chamber of the valve-casing by the port *e* and by longitudinal grooves or passages *j*, formed in the surface of the stem *h'* and extending from said inlet-chamber to said auxiliary-valve chamber.

*k* is a second or supply valve, also mounted on the valve-stem *h'* and adapted to close against a seat *k'*, formed at the inner end of the auxiliary-valve chamber around said stem, so as to prevent the steam or other fluid from passing from the grooves or passages *j* into the auxiliary-valve chamber and into the cylinder C, behind the piston D, when said valve is seated, while permitting the same to enter the cylinder behind the piston when said valve is open.

The supply and exhaust valves *h k* are so arranged on the valve-stem *h'* that the supply-valve is open when the exhaust-valve is closed, as shown in Fig. 1, and so that the supply-valve is closed when the exhaust-valve is open, as shown in Fig. 2. By this construction and arrangement when the parts are in the normal position (shown in Fig. 1) the steam or fluid under pressure is permitted to exert its pressure against both sides of the piston as well as against the back of the main valve B. The pressure on opposite sides of the piston is thus balanced and the main valve is held to its seat by the pressure against the back thereof. When it is desired to open the main valve, the supply and exhaust valves *h k* are shifted to the position shown in Fig. 2, whereby communication between the inlet-chamber of the valve-casing and the portion of the cylinder C behind the piston is interrupted and communication between the rear portion of the cylinder and the atmosphere is established. The steam behind the piston is now allowed to exhaust from the cylinder C through the auxiliary-valve chamber and its exhaust-port, and as the area of the piston exceeds that of the main valve the overpres-

sure against the front side of the piston forces the latter and the main valve B connected therewith toward the rear end of the cylinder C, thereby opening the main valve and allowing the steam or other fluid to pass to the whistle or other contrivance controlled by the valve. In order to close the main valve, the auxiliary valves *h k* are again shifted to the reverse position shown in Fig. 1, whereby the exhaust-port of the auxiliary-valve chamber is closed and the supply ports or passages *j* leading to the rear portion of the cylinder C are opened. The pressure on opposite sides of the piston is now again balanced and the main valve is closed and held to its seat by the pressure against its rear side.

By this improved construction no cushion can be formed in front of the piston and the necessity of providing a vent in the cylinder in front of the piston is therefore obviated, thus preventing the leakage of steam from the valve resulting from the presence of such a vent and obtaining a perfectly-steam-tight construction when the main valve is closed and also preventing freezing of the valve in winter.

The auxiliary valves may be operated manually, if desired, by means of a cord *l*, connected with an elbow-lever *l'*, which bears with its inner arm against the projecting end of the valve-stem or by other suitable means. These valves are, however, preferably operated by an electric magnet M, the armature *m* of which is secured to the valve-stem *h'* and which is included in an open circuit controlled by a suitable manual or automatic switch, an ordinary Morse key *n* being shown in the drawings for this purpose. The electromagnet is arranged in a suitable case *o*, secured to one side of the valve-casing A, and the valve-stem *h'* extends through an opening formed in the bottom of said case and through the connecting-bar *p* of the magnets. The auxiliary valves are normally held in their proper position for causing the seating of the main valve by a spring *q*, applied to the valve-stem between the connecting-bar, and a nut or adjustable collar *q'*, applied to a screw-threaded portion of said stem. When the circuit is open, the auxiliary valves are held in the normal position (shown in Fig. 1) by the spring *q*, while when the circuit is closed the armature is attracted by the energized magnet, shifting the auxiliary valves to the reverse position shown in Fig. 2 and opening the main valve.

The opening movement of the main valve is limited by a lug *r*, projecting from the rear side of the piston D and adapted to strike against an adjustable stop *r'* on the head of the cylinder C. This stop preferably consists of a screw or bolt arranged in a screw-threaded opening formed in said head, as shown. By this means the extent of the opening movement of the main valve B can be regulated in accordance with the size of the steam-pipe

connected with the valve, a small pipe requiring a greater shut-off of the passage controlled by said valve than a large pipe. For example, if a three-inch valve is used on a one-inch steam-pipe said passage must be throttled so that a one-inch volume of steam is allowed to pass through the valve in order to cause the steam to be diverted through the supply-passage *j* and port *e* into the rear portion of the cylinder C.

By changing the size of the exhaust-port of the auxiliary-valve chamber the main valve may be caused to open slowly or quickly, as desired, a small exhaust-port causing the same to open slowly and a larger one allowing it to open quickly. To facilitate this change in the size of the exhaust-port, the disk *g'*, containing the exhaust-port *g* and the valve-seat *g''*, is made removable, so that another similar disk having a larger or smaller exhaust-port can be readily substituted therefor. By employing such removable disks with different-sized valve-seats in connection with a conical exhaust-valve the important advantage is gained of enabling the valve to be used with a high or a low pressure of steam without requiring the magnet to be changed. When the valve-seat in the disk is of such a size that a portion of the beveled face of the valve is exposed above the seat in the closed position of the valve, as shown in the drawings, the pressure in the auxiliary-valve chamber impinges against said exposed portion and tends to lift and unseat the valve, thereby aiding the magnet in opening the valve when the circuit is closed. This lifting power or pressure increases in proportion to the area of the exposed portion of the beveled face, and by employing a disk with a valve-seat of greater or less diameter, as shown in Figs. 3 and 4, a correspondingly larger or smaller area of the beveled face is exposed and a corresponding lifting power obtained. The resistance to the movement of the valve-stem is greater under a high pressure than under a low pressure, and when the pressure is high a disk with a comparatively small valve-seat is employed for obtaining a correspondingly greater pressure to supplement the lifting power of the magnet, while when the pressure is low a smaller amount of additional power is sufficient to enable the magnet to open the valve and a disk with a larger valve-seat is therefore used. By thus utilizing the fluid-pressure against the exposed under side of the exhaust-valve to supplement the power of the magnet and varying this pressure by the use of different-sized interchangeable valve-seats the same magnet can be employed for adapting the valve to different pressures, and the magnet may therefore be a permanent part of the valve.

When the area of the back of the supply-valve exceeds that of the exhaust-valve, as shown in the drawings, the pressure in the

auxiliary-valve chamber has a tendency to close the supply-valve and open the exhaust-valve. To prevent this, the tension of the spring *q* is regulated to overcome the excess of pressure due to the differential areas of said valves.

By extending the valve-stem *h'* through the valve-case into the atmosphere, as shown, instead of terminating the same within the inlet-chamber *a'* the end of the valve-stem is relieved from the steam-pressure to which it would otherwise be subjected. The stem can therefore be shifted more easily and a smaller magnet and a correspondingly lighter current can be employed for operating the stem than would be required if the magnet had to overcome the resistance of steam-pressure against the end of the stem.

In my improved valve the auxiliary-valve chamber is formed integral with the valve-casing A or the cylinder C, producing a simple and economical construction and avoiding joints between these parts.

I claim as my invention—

1. The combination with a valve-casing having inlet and outlet chambers and a diaphragm separating said chambers and having a passage, of a main valve applied to said passage on the inlet side of the valve-case and having its rear side exposed to the pressure in said inlet-chamber, a cylinder closed at its rear end and opening at its front end into said inlet-chamber, a piston of larger diameter than said main valve arranged in said cylinder and connected with said valve, said cylinder being ventless on the front side of said piston, supply and exhaust passages leading from the rear portion of said cylinder to the inlet-chamber of the valve-casing and the atmosphere, respectively, and auxiliary-valve mechanism controlling said supply and exhaust passages and operating to open said supply-passage when the exhaust-passage is closed and to close said supply-passage when the exhaust-passage is open, substantially as set forth.

2. The combination with a valve-casing having inlet and outlet chambers and a diaphragm separating said chambers and having a passage, of a main valve applied to said passage on the inlet side of the valve-case and having its rear side exposed to the pressure in said inlet-chamber, a cylinder closed at its rear end and opening at its front end into said inlet-chamber, a piston of larger diameter than said main valve arranged in said cylinder and connected with said valve, an auxiliary-valve chamber communicating with the rear portion of said cylinder and provided with an exhaust-port, a supply-passage leading from the inlet-chamber of the valve-casing to said auxiliary-valve chamber, supply and exhaust valves controlling said supply-passage and said exhaust-port, respectively, and arranged to open said supply-passage when the exhaust-port is closed and to close said

passage when the exhaust-port is open, and means for operating said valves, substantially as set forth.

3. The combination with a valve-casing  
5 having inlet and outlet chambers and a diaphragm separating said chambers and having a passage, of a main valve applied to said passage on the inlet side of the valve-case and having its rear side exposed to the pressure in  
10 said inlet-chamber, a cylinder closed at its rear end and opening at its front end into said inlet-chamber, a piston of larger diameter than said main valve arranged in said cylinder and connected with said valve, an auxiliary-valve chamber communicating with the  
15 rear portion of said cylinder and provided at its inner end with a valve-seat and in its outer portion with an exhaust-port, a sliding valve-stem provided with a supply-passage extending  
20 from the inlet-chamber of the valve-casing to said auxiliary-valve chamber, a supply-valve applied to said stem and adapted to close against the seat at the inner end of the auxiliary-valve chamber, and an exhaust-valve also carried by said stem and controlling  
25 said exhaust-port, substantially as set forth.

4. The combination with a valve-casing having connected inlet and outlet chambers  
30 and a main valve controlling the passage of the fluid from the inlet to the outlet chamber, of a cylinder containing a piston connected with said main valve and having its rear portion normally in communication with  
35 the inlet-chamber of the valve-casing, an auxiliary-valve chamber connected with the rear portion of said cylinder and having a removable head or disk provided with an exhaust-port, and a valve applied to said port, substantially  
40 as set forth.

5. The combination with the inlet and outlet chambers of the valve-casing and the main valve, of a cylinder containing a piston which  
45 is connected with the main valve, an auxiliary-valve chamber connected with the rear portion of said cylinder and with said inlet-chamber, a removable disk arranged in said auxiliary-valve chamber and having a conical valve-seat and an exhaust-port leading  
50 from said seat to the atmosphere, said disk being adapted to be interchanged with a similar disk or disks having different-sized valve-seats, a conical exhaust-valve applied to said valve-seat and having a beveled face of  
55 greater depth than said seat, whereby a portion of said face is exposed to the pressure in said valve-chamber when the valve is seated, and an electromagnet included in a suitable

circuit and having its armature connected with said exhaust-valve, substantially as set forth. 60

6. The combination with a valve-casing and a main valve, of a cylinder having its rear portion normally in communication with the inlet-chamber of the valve-casing, and  
65 containing a piston which is connected with the main valve, an auxiliary-valve chamber formed integrally with said cylinder and communicating therewith and provided at its outer end with a removable head or cap having  
70 an exhaust-port, and a valve controlling said port, substantially as set forth.

7. The combination with a valve-casing having inlet and outlet chambers and a diaphragm separating said chambers and having  
75 a passage, of a main valve applied to said passage on the inlet side of the case and having its rear side exposed to the pressure in said inlet-chamber, a cylinder opening at its front end into said inlet-chamber, a piston of  
80 larger diameter than said main valve arranged in said cylinder and connected with said valve, an auxiliary-valve chamber communicating with the rear portion of said cylinder and provided with an exhaust-port, a  
85 supply-passage leading from the inlet-chamber of the valve-casing to said auxiliary-valve chamber, supply and exhaust valves controlling said supply-passage and said exhaust-port, a valve-stem carrying said valves  
90 and extending through said inlet-chamber into the atmosphere, and an electromagnet having its armature connected with said valve-stem, substantially as set forth.

8. The combination with a valve-casing  
95 having connected inlet and outlet chambers and a main valve controlling the passage of the fluid from the inlet to the outlet chamber, of a cylinder containing a piston which operates said main valve and which is larger in  
100 diameter than said valve, supply and exhaust passages leading from the rear portion of said cylinder to the inlet-chamber of the valve-casing and the atmosphere respectively, auxiliary-valve mechanism controlling said supply  
105 and exhaust passages, and an adjustable stop arranged to limit the opening movement of said main valve, substantially as set forth.

Witness my hand this 6th day of August, 110 1898.

JOSEPH F. BATCHELOR.

Witnesses:

CARL F. GEYER,  
E. R. DEAN.