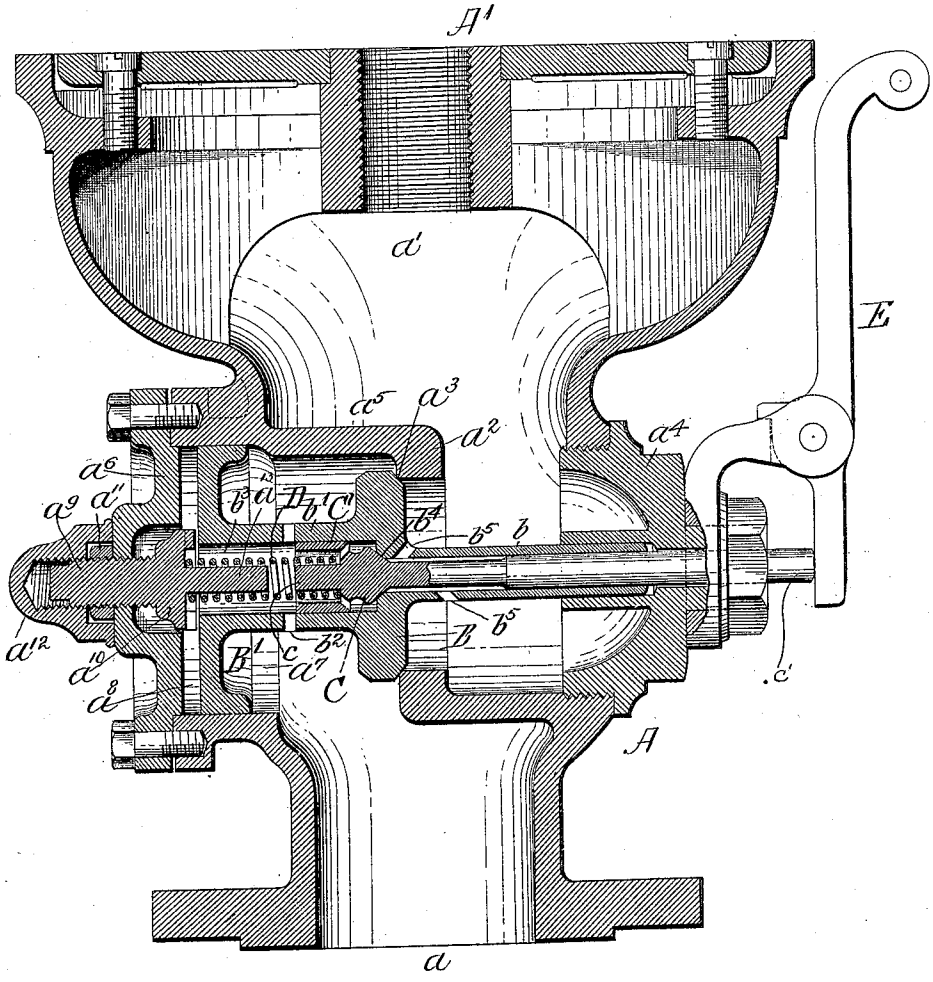
C. F. FERNALD.

VALVE.

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922,686. Patented May 25, 1909.



WITNESSES:

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VALVE.

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To all whom it may concern:

Be it known that I, CHARLES F. FERNALD, of Boston, in the county of Suffolk and State of Massachusetts, a citizen of the United States, have invented a new and useful Improvement in Valves, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification, in explaining its nature.

My invention relates to an improvement in that type of valve which is operated by an overbalanced piston, or in other words, that type of valve controlling pressure inlet and outlet passages which has connected with it a piston normally held by the fluid pressure acting on both sides thereof in a state of equilibrium, until by exhausting or eliminating the pressure from the chamber on one side of the piston it may be actuated by the pressure in the chamber on the other side thereof to operate the valve.

Heretofore the usual mode of constructing the valve in order that the pressure might enter the chambers on both sides of the piston was to have the chamber located on the front side of the piston in direct connection or communication with the inlet passage, while the chamber in the rear of the piston was reached by passages extending through the same. Though this was a very simple and convenient mode of connection and had the advantage also of being within the main casing, as distinguished from that type of valve in which the connection between the inlet passage and the chamber back of the piston was formed by auxiliary or by-passages outside the casing, there was one difficulty and this arose from the fact that the pressure continued to enter the chamber in the rear of the piston during the time of its exhaustion and was not cut off. The effect was that the chamber exhausted very slowly. In other words, pressure continuing to enter it acted as a check upon the piston and so caused it and the main valve to act tardily and not with that quick responsive action which is so desirable in a valve of this kind and which is absolutely necessary when the valve is used for certain kinds of work.

It is accordingly the object of my invention to provide such an arrangement that passages entirely within the main valve casing, as distinguished from auxiliary or by-passages outside the same, may directly connect the chambers on the opposite sides of the piston with the inlet passage by which the piston may become properly balanced, and with this arrangement of passages to provide means by which those of the passages connecting with the chamber in the rear of the piston may become closed and the pressure shut off at the time of, and during the exhaustion of said chamber, with the effect that the piston and main valve will operate with a quick responsive action.

My improvement can best be seen and understood by reference to the drawing in which the figure shows the valve mainly in vertical cross section.

In the drawings:—A represents the main valve casing having an inlet passage a and outlet passage a^1 through which the fluid is adapted to pass. I have shown the valve as attached to or combined with a whistle A^1, a portion of which only is shown. Inside the casing A, separating the inlet and outlet passages, is a partition a^2 in which is a port or opening. Around this port or opening is formed a valve seat a^3 against which the main valve B is adapted to close. This main valve is arranged upon forward and rear extending members b and b^1, respectively. The member b which forms the stem of the valve extends forward and has bearing in the side of the valve casing, or rather in a detachable plug a^4 forming a part thereof. The member b^1 comprises a rod extending backward from the main valve to where it is fitted with a piston B^1. This piston is contained within a cylinder a^5 forming a part of the valve casing and the end of which is closed by a head a^6 which is bolted or otherwise fastened to the end of the cylinder.

The piston B^1 in area is larger than the valve B with which it connects and its location inside the cylinder a^5 is such that there are formed therein the chambers a^7, a^8, respectively, on opposite sides of the piston. The pressure from the inlet passage communicates directly with the chamber a^7 forward of the piston. The pressure also connects with the chamber a^8 in the rear of the piston by the ports or passages b^2 which enter from the chamber a^7 through the side of the piston rod b^1 into the chambered interior b^3 thereof and thence by this chambered passage out through the piston into said chamber a^8.

Before referring to the mode of operating the piston I will call attention to the thread-

ed plug a^9 which extends through the cylinder head a^6 in line with the piston. This threaded plug carries upon its end a stop a^{10} which by encountering the piston on its backward movement, when the chamber a^8 is exhausted, acts to define or limit such movement and consequently the degree of opening of the main valve. By means of the threaded connection of the plug with the cylinder head, as aforesaid, this stop is adjustable, by which the movement of the piston and opening of the valve can be adjustably defined. The plug a^9 is held in place at any point of adjusted position by means of a locking nut a^{11}, while the end of the plug outside the cylinder is covered and protected by a cap a^{12} screwing onto the plug.

With reference now to the mode of overbalancing the piston. From the chambered passage b^3 there extends forward through the main valve an exhaust port or passage b^4 which communicates with the outlet passage a^1 forward of the main valve through by-passages b^5. Contained in the chambered passage b^3 is an auxiliary exhaust-controlling valve C which is adapted to close upon a valve seat formed at the entrance to the exhaust port or passage b^4. This auxiliary valve is so made and adapted that when placed upon its valve seat it closes the exhaust passage b^3 and so cuts off all communication between the chamber a^8 and the outlet passage a^1. When the valve is open, however, and moved away from its valve seat communication between said chamber and the outlet passage is open so that the fluid pressure in said chamber may be exhausted therefrom and pass directly into the outlet passage. There is also contained in the chambered passage b^3 what may be termed a sliding gate C^1 movable by and with the auxiliary valve C. This gate is in the nature of a sleeve which fits snugly within the passage b^3 and acts to guide the auxiliary valve onto and off its valve seat. It is also made hollow and connects with the auxiliary valve C in such manner as not to prevent the passage of the exhaust through it and around the head of the valve C to the passage b^4 when the chamber a^8 is exhausting. The gate also is so adapted that when the auxiliary valve is closed upon its valve seat, shutting off the exhaust, it will not interfere with the flow of the fluid pressure through the ports or passages b^2 into the chambered passage b^3 and chamber a^8, as before described, but when the auxiliary valve is opened the gate is moved back thereby and simultaneously with the opening of said valve is adapted to close said ports b^2 thereby shutting off the fluid pressure from the chamber a^8.

The auxiliary valve C is normally held closed upon its valve seat by means of a compression spring D which is contained within the chambered passage b^3 and arranged partly upon a stem c projecting from said valve and partly upon a stem a^{13} extending from the stop a^{10}.

For extraneously opening the auxiliary valve C it is provided with a long stem c^1 which extends forward from the valve through the valve stem b and thence straight out to project through and have bearing in the plug a^4 forming a part of the valve casing. Engaging with this projecting end of the stem is the arm of a lever E so mounted upon the side of the valve casing or plug a^4 that upon operating the lever its arm will press against the projecting end of the stem and through it will unseat or open the auxiliary valve.

The adaptability and operation of the parts are as follows:—The pressure will enter through the inlet passage a and act upon the back of the main valve. The pressure will at the same time enter the chambers on the front and rear sides of the piston, entrance into the chamber a^8 back of the piston being made through the ports or openings b^2 and the chambered passage b^3. The auxiliary valve C controlling the exhaust passage b^4 leading through the main valve from the passage b^3 and communicating with the outlet passage through the by-passages b^5, will at this time be closed both by the fluid pressure and by the compression spring D, so the effect is, with the parts thus normally arranged, for the piston to be held in a state of equilibrium and the main valve closed upon its valve seat. Now upon operating the lever E its lever arm will press against the stem c^1 of the auxiliary valve projecting through the wall of the casing, thereupon opening it against the pressure and compression of its seating spring. Simultaneously with such opening or movement of the valve the gate C^1 carried by it will be made to slide back, closing the ports or openings b^2 through which the pressure normally passes from the inlet passage to the chamber a^8 back of the piston. Said chamber a^8 will then exhaust. The exhaust pressure will pass out through the passage b^3 through the gate C^1, around the auxiliary valve and thence out through the exhaust passage b^4 and by-passage b^5 into the outlet passage. By thus exhausting the chamber a^8 pressure is relieved on the back side of the piston. The pressure will continue to press on the front side of the piston as well as upon the main valve, but inasmuch as the area of the piston is larger than said valve, the pressure will act to press back the piston, overbalancing the same as it were, and consequently the main valve will be automatically drawn open. Upon relieving the stress of the lever upon the auxiliary valve the valve will become seated by the compression spring D, thereby shutting off the exhaust. Simultaneously with the closing of the auxiliary

valve the gate C^1 will slide forward opening the ports b^2 when the pressure will again flow into the chamber a^8 in the rear of the piston and the parts made to assume their aforesaid normal position with the main valve closed upon its valve seat.

Having thus fully described my invention, I claim and desire to secure by Letters Patent of the United States:—

1. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a piston within said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage communicating directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, an auxiliary valve for controlling the connection between said chambered passage and the outlet passage of the valve, means for controlling said auxiliary valve from the forward end thereof, and a member attached to said auxiliary valve operable therewith for controlling said by-passage.

2. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a piston within said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage communicating directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, a valve seat at the entrance to said port or opening through the main valve, an auxiliary valve adapted to become seated upon said valve seat, said auxiliary valve being smaller than said chambered passage, a member sliding within said chambered passage and connecting with said auxiliary valve and operable therewith for controlling said by-passage, said member acting also to guide said auxiliary valve onto and off its valve seat, and means passing through said main valve by which said auxiliary valve is controlled from outside the valve casing.

3. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a piston within said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage communicating directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, an auxiliary valve for controlling the connection between said chambered passage and the outlet passage of the valve, a member connecting with said auxiliary valve and operable therewith for controlling said by-passage, said member comprising a hollow sleeve fitting snugly to slide within said chambered passage.

4. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a piston within said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage communicating directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, a auxiliary valve located inside said chambered passage for controlling the connection between the same and the outlet passage of the valve, yielding means for keeping the auxiliary valve normally seated, and means operable with said auxiliary valve for controlling said by-passage.

5. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a hollow stem extending forward from said main valve, a member forming a part of the casing providing a bearing for said hollow stem, a piston inside said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage connecting directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, an auxiliary valve for controlling the connection between the said chambered passage and the outlet passage of the valve, a stem extending forward from said auxiliary valve through the hollow stem of said main valve and through the side of the casing, and means operable with said auxiliary valve for controlling said by-passage.

6. A valve of the character specified having a casing and inside the same a main valve controlling a port between inlet and outlet passages, a piston within said casing in direct communication with the inlet passage and which piston is arranged also whereby a chamber is formed in the rear thereof, a piston rod connecting said main valve and piston, said piston and rod having formed therein a chambered passage communicating directly with the chamber in the rear of the piston and with the outlet passage by a port or opening through said main valve, said piston rod having also a by-passage leading into the interior thereof from said inlet passage, an auxiliary valve contained within said chambered passage for controlling the connection between the same and the outlet passage of the valve, means for operating said auxiliary valve from outside the valve casing, a member carried by said auxiliary valve for controlling said by-passage, a stop for said piston, and a spring contained within said chambered passage and arranged upon said auxiliary valve and stop for holding said auxiliary valve in a normally closed position.

CHARLES F. FERNALD.

Witnesses:
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MARTIN V. FOLEY.