B. F. SILLIMAN.

VALVE.

APPLICATION FILED FEB. 24, 1909.

976,222.

Patented Nov. 22, 1910.

3 SHEETS—SHEET 1.

Fig. 1

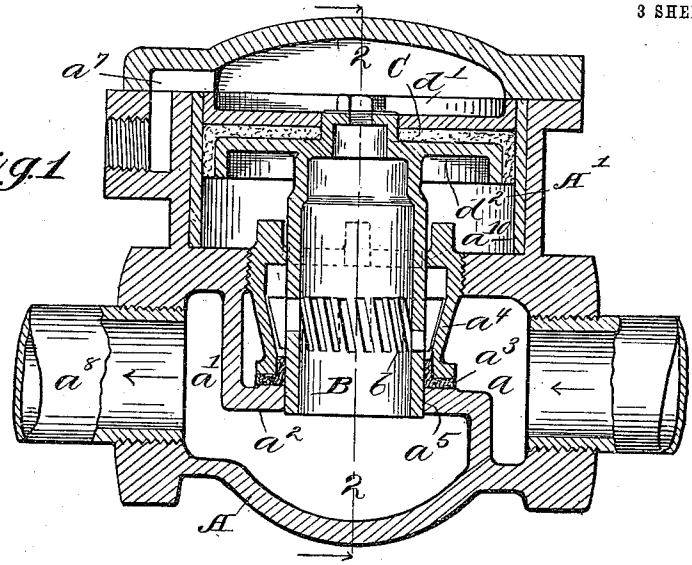


Fig. 2

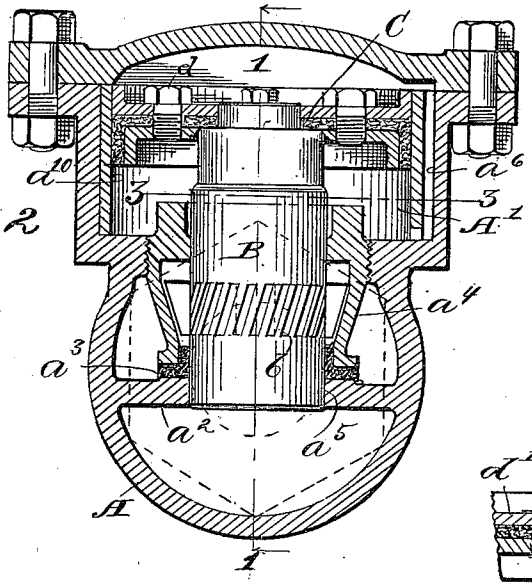


Fig. 4.

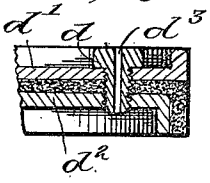
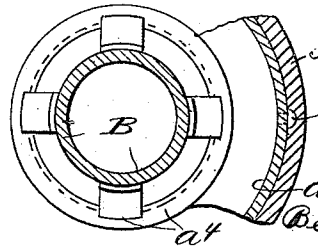


Fig. 3



Witnesses.

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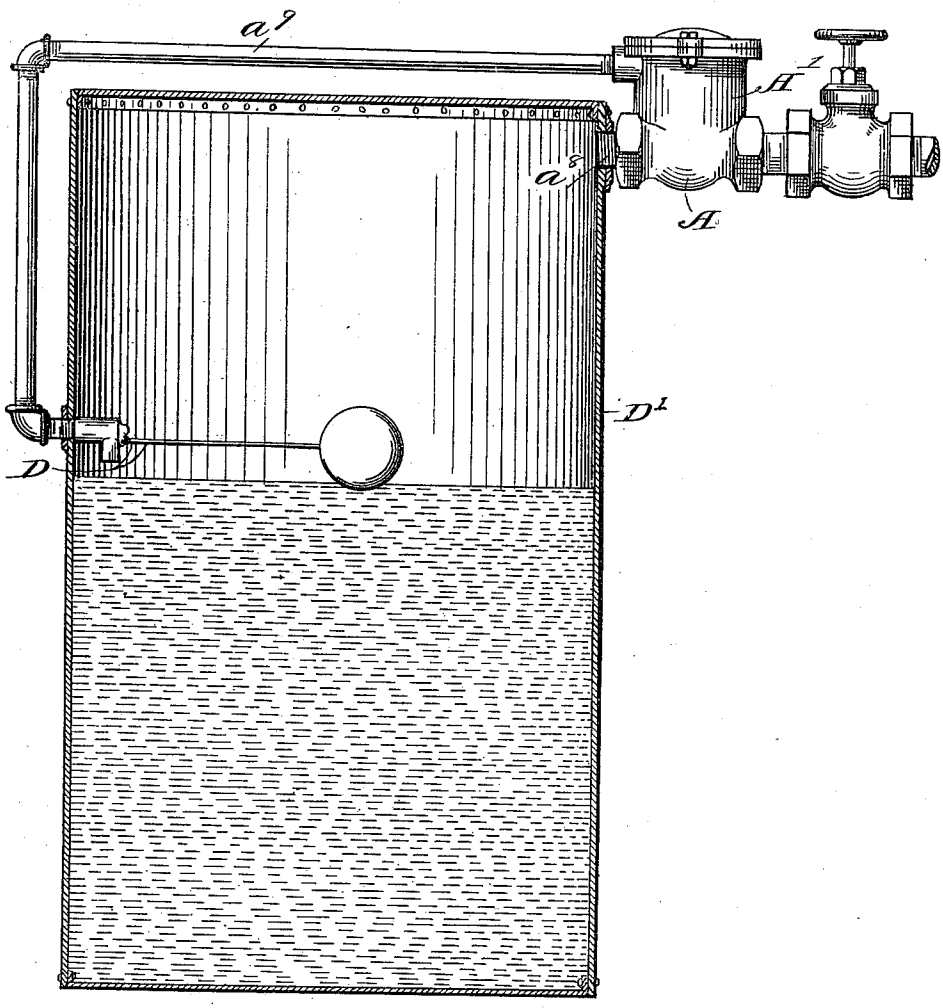
3 SHEETS—SHEET 2.

Fig. 5



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3 SHEETS—SHEET 3.

Fig. 6

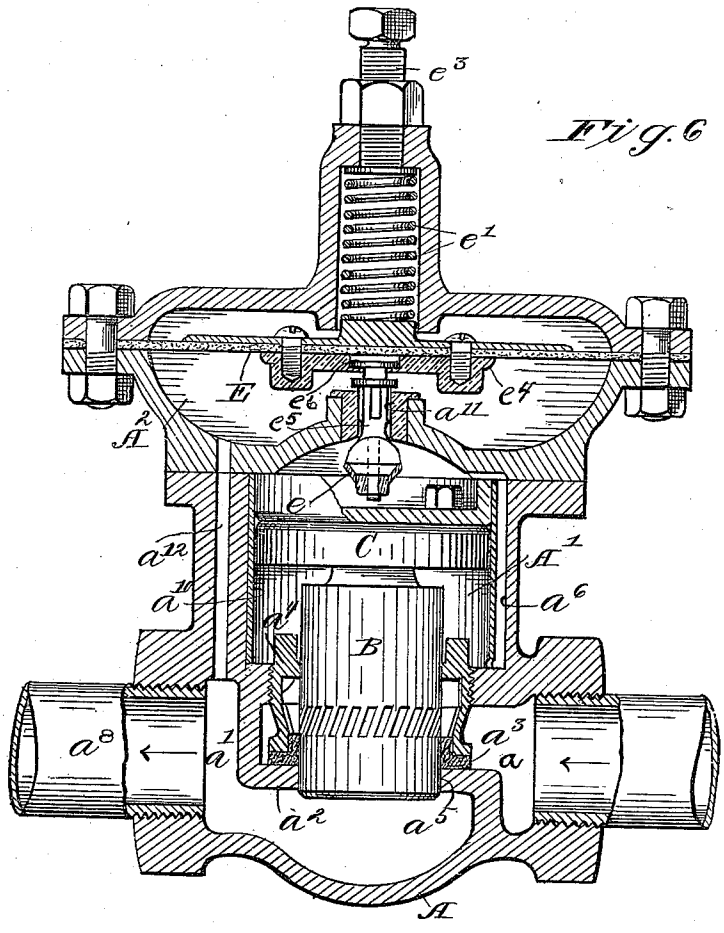
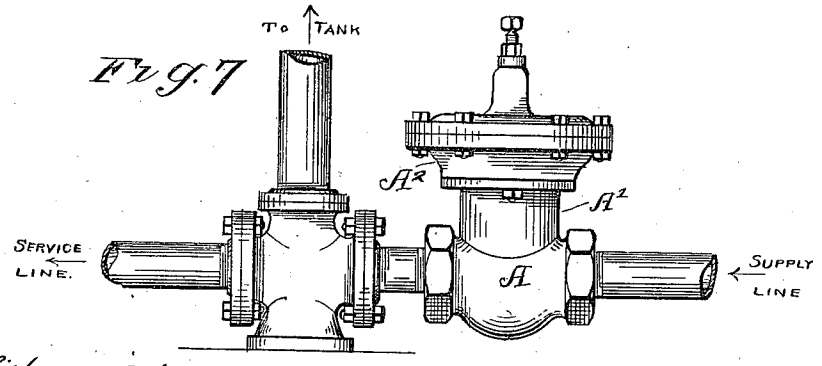


Fig. 7



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UNITED STATES PATENT OFFICE.

BENJAMIN F. SILLIMAN, OF CLEVELAND, OHIO, ASSIGNOR TO THE CLEVELAND STEEL TOOL COMPANY, OF CLEVELAND, OHIO, A CORPORATION OF OHIO.

VALVE.

976,222. Specification of Letters Patent. Patented Nov. 22, 1910.

Application filed February 24, 1909. Serial No. 479,726.

To all whom it may concern:

Be it known that I, BENJAMIN F. SILLIMAN, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Valves, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

The present invention, relating as indicated to valves, has regard more particularly to valves designed for automatically controlling the supply of a fluid under pressure, as for example, the supply of water to a heater, reservoir, or the like.

Said invention consists more specifically in certain improvements in a valve of this general type forming the subject matter of a co-pending application of Charles F. Siegrist, filed January 23, 1908, Serial No. 412,254, the object of the improvements being the further simplification of the valve's construction, and the incorporation therewith of additional operative means adapting the same for use in various connections.

To the accomplishment of the above and related objects, said invention, then, consists of the means hereinafter fully described and particularly pointed out in claims.

The annexed drawings and the following description set forth in detail certain mechanism embodying the invention, such disclosed means constituting, however, but several of the various mechanical forms in which the principle of the invention may be used.

In said annexed drawings:—Figure 1 is a central vertical section of one such form of my improved valve; Fig. 2 is a similar section of such valve taken at right angles to the section of Fig. 1; Fig. 3 is a detailed sectional view of said valve taken on a transverse plane indicated by the line 3—3, Fig. 2; Fig. 4 is another detailed sectional view, showing a modification in the construction of the piston that controls operation of the valve; Fig. 5 is a view, partly in elevation and partly in section, illustrating an installation of said valve; Fig. 6 is a central vertical section of a modified form of the valve; and Fig. 7 is an illustrative installation of said modified form of the valve.

Referring first to the form of construction illustrated in Figs. 1, 2 and 3, the valve will be seen to comprise a casing A within which the several operative elements of the device are contained. Such casing is provided with inlet and outlet openings a a' for the passage therethrough of the fluid to be controlled, being formed with this object in view, with a transverse ported partition a^2 intermediate between such openings. A washer a^3 clamped in place on the upper face of said partition by an open sleeve a^4 threaded in the casing, surrounds the port a^5 in said partition, so as to permit a tubular valve B to form a closure of said port when depressed sufficiently to bring the perforations b, that encircle the same, below said partition. When in its raised position, on the contrary, said valve permits the free passage of fluid from the inlet opening a through the perforations b in the valve and the port a^5 in the partition, to the outlet opening a', as will be obvious. Movement of the valve to thus variously position the same, is effected and controlled by a piston C in a suitable piston chamber A′ formed in the upper portion of the casing A. The tubular valve is mounted directly on the under face of said piston, thereby correspondingly diminishing the area of said face, so that in effect a differential piston is secured. The lower portion of the piston chamber A′ communicates freely with the inlet opening of the casing, so that the normal position of the valve is the raised one illustrated in Figs. 1 and 2, the action of such pressure fluid being to move the piston outwardly. Pressure fluid is supplied against the outer face of the piston, by a passage a^6, preferably formed, as shown in Fig. 2, in the wall of the piston chamber, so as to permit the pressure fluid to flow from below to above the piston unhindered, save by the relatively small bore of such passage. Normally, however, such pressure fluid on the upper face is ineffective, owing to the passage a^7 provided for the escape of fluid therefrom being normally open. This escape may obviously be variously controlled, and in the installation illustrated in Fig. 5, a float device D operated by the level of fluid in the receiving tank D′, wherewith the discharge pipe a^8, leading from the casing is connected, serves to close the end of

the pipe a^9 leading from said escape whenever such level rises to a pre-determined height. To further simplify the construction of the valve which is thus seen to consist of relatively few parts, requiring practically no machining, I do not finish the interior of that part of the casing constituting the piston chamber A′, but insert instead therein a bushing a^{10} that forms a suitable bearing for the piston C. This enables the passage for effecting communication between the two parts of the chamber to be provided by simply recessing the wall of the cylinder as clearly appears in Fig. 2, without any need for coring. If desired, moreover, communication between such chamber portions may be had directly through the piston, a convenient mode of securing such connection (shown in Fig. 4) consisting in forming the set screw d, whereby the portions d' d^2 of the piston are clamped together, with perforations d^3.

Where it is desired to control the escape opening from the upper side of the piston chamber by pressure of a fluid column, instead of by a float, as in the installation just described, I modify the construction of the valve by adding above such piston chamber, a diaphragm chamber A^2, Fig. 6, with which the escape opening a^{11} from the piston chamber, now disposed centrally, communicates. Such communication is adapted to be shut off by a valve e carried by a diaphragm E in said chamber, but normally held off its seat by a spring e' that presses against the opposite face of said diaphragm. A passage a^{12} is cored in the casing so as to afford free connection between such diaphragm chamber and the outlet opening of the casing. As a result it will be seen that while such opening a^{11} affords free escape, in the normal condition of the valve, for the pressure fluid that is supplied against the upper face of the piston, as soon as a sufficient pressure is built up on the outlet side of the casing, this pressure will back up through passage a^{12} against the under face of the diaphragm, so as to raise valve e against its seat and close the escape from the upper end of the piston chamber. The piston will thereupon, of course, be moved downwardly, owing to the unequal areas of its faces, the valve B will be closed, and further passage of fluid through the casing prevented until the pressure against the under face of the diaphragm is again reduced. A set screw e^3 as usual provides means for adjusting the tension of the spring e' against the upper face of the diaphragm. I have found that where valve e is rigidly attached to the diaphragm, it does not close down, or open, as the case may be, as promptly under all conditions as might be desired. I have accordingly provided for its attachment to the diaphragm in such fashion that a slight relative movement of the valve is possible; such attachment being conveniently secured by making the plate e^4 on the under side of the diaphragm independent of the valve stem and forming it with a recessed opening in which a head e^6 on said stem is loosely held so as to permit said stem and the valve carried thereby a small amount of play. To unseat the valve accordingly, it is merely necessary for the spring, operating the diaphragm downwardly, to open the valve a trifle, whereupon the excess pressure in the piston chamber will throw it full open. When the valve, on the contrary, is once drawn to its seat in the closing operation, this same pressure will hold it there despite a slight weakening of the pull of the diaphragm thereon. The limits within which actuation of the valve will occur are thus rendered much more definite and the sensitiveness of the device is correspondingly increased. It will be seen from the foregoing description of this second form of my valve, that such valve is wholly self-contained, and simple and compact in construction, as will be obvious by reference to Fig. 7, illustrating the manner of installing it when in use. For this purpose it is simply necessary to insert the casing in the supply line leading to the reservoir or tank wherein a desired level of liquid is desired to be maintained. As soon as such level is reached, the valve will automatically shut off the supply until withdrawal through the service line connected with said reservoir again lowers the level therein.

Other modes of applying the principle of my invention may be employed instead of the one explained, change being made as regards the mechanism herein disclosed, provided the means stated by any one of the following claims or the equivalent of such stated means be employed.

I therefore particularly point out and distinctly claim as my invention:—

1. In a device of the character described, the combination of a casing having inlet and outlet openings; a ported partition intermediate between such openings; a washer on the upper face of said partition surrounding the port therein; an open sleeve threaded in said casing and adapted to clamp said washer in place; and a tubular valve fitting the port in said partition, said valve being provided with a series of perforations encircling the same between its ends so as to lie above said partition in the upper, and below said partition in the lower position of said valve, thereby affording communication between such inlet and outlet openings and cutting off such communication, respectively.

2. In a device of the character described, the combination of a casing having inlet and outlet openings; a differential piston

movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open passage in said casing extending from below to above said piston to supply pressure fluid against the outer face of said piston; an opening in the casing wall adjacent to the outer face of said member for the escape of the fluid thus supplied; and fluid pressure actuated means for closing said escape.

3. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with such openings, respectively, said discharge pipe leading to said tank; a differential piston reciprocable in said casing, said piston having its face of smaller area directed inwardly and being operable outwardly by the pressure of fluid in said casing against such face; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open passage in said casing extending from below to above said piston to supply pressure fluid against the outer face of said piston; an opening in the casing wall adjacent to the outer face of said member for the escape of the fluid thus supplied; and fluid pressure actuated means for closing said escape, operation of said means being dependent on the pressure of fluid in said receiving tank.

4. In a device of the character described, the combination of a casing having inlet and outlet openings and a piston chamber freely communicating with such inlet opening; a differential piston reciprocable in said chamber, said piston having its face of smaller area directed inwardly and being operable outwardly by the pressure of fluid in said chamber against such face, the wall of said chamber being recessed to form a passage extending from below to above said piston to supply pressure fluid against the outer face of the latter; a valve, carried by said piston, controlling connection between such inlet and outlet openings; and a normally open escape for the fluid supplied against the outer face of said piston.

5. In a device of the character described, the combination of a casing having inlet and outlet openings and a piston chamber freely communicating with such inlet opening; a differential piston reciprocable in said chamber, said piston having its face of smaller area directed inwardly and being operable outwardly by the pressure of fluid in said chamber against such face; a bushing fitted in said chamber to provide a bearing for said piston, the wall of said chamber being recessed to form a passage behind said bushing extending from below to above said piston to supply pressure fluid against the outer face of the latter; and a normally open escape for the fluid supplied against the outer face of said piston.

6. In a device of the character described, the combination of a casing having inlet and outlet openings; a differential piston movably secured in said casing, said piston being operated outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open connection for supplying pressure fluid against the outer face of said piston; an opening in the casing wall adjacent to the outer face of said member for the escape of the fluid thus supplied; and fluid pressure actuated means for closing said escape.

7. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with said openings, respectively, said discharge pipe leading to said tank; a differential piston movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open connection for supplying pressure fluid against the outer face of said piston; an opening in the casing wall adjacent to the outer face of said member for the escape of the fluid thus supplied; and fluid pressure actuated means for closing said escape, operation of said means being dependent on the pressure of fluid in said receiving tank.

8. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with said openings, respectively, said discharge pipe leading to said tank; a differential piston movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open connection for supplying pressure fluid against the outer face of said piston; an outlet for the fluid thus supplied; a valve for closing said outlet; resilient means normally holding said valve open; and diaphragm means connected to be operated by the pressure of fluid in said tank and adapted to close said valve.

9. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with said openings, respectively, said discharge pipe leading to said tank; a differential piston movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open con-

nection for supplying pressure fluid against the outer face of said piston; an outlet for the fluid thus supplied; a valve for closing said outlet; a diaphragm connected with said valve; a spring pressing against one face of said diaphragm to normally hold said valve open; and connections for supplying fluid from said tank against the other face of said diaphragm to close the same when the fluid reaches a predetermined level in said tank.

10. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with said openings, respectively, said discharge pipe leading to said tank; a differential piston movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open connection for supplying pressure fluid against the outer face of said piston; an outlet for the fluid thus supplied; a valve for closing said outlet; resilient means normally holding said valve open; and diaphragm means connected to be operated by the pressure of fluid in said tank and adapted to close said valve, said valve having a limited movement with respect to said diaphragm.

11. In a device of the character described, the combination with a receiving tank; of a casing having inlet and outlet openings; supply and discharge pipes connected with said openings, respectively, said discharge pipe leading to said tank; a differential piston movably secured in said casing, said piston being operable outwardly by the pressure of fluid in said casing; a valve, carried by said piston, controlling connection between such inlet and outlet openings; an open connection for supplying pressure fluid against the outer face of said piston; an outlet for the fluid thus supplied; a valve for closing said outlet; a diaphragm connected with said valve; a spring pressing against one face of said diaphragm to normally hold said valve open; and connections for supplying fluid from said tank against the other face of said diaphragm to close the same when the fluid reaches a predetermined level in said tank, the connections between said valve and diaphragm permitting the former a limited movement with respect to the latter.

Signed by me, this 18th day of February, 1909.

BENJAMIN F. SILLIMAN.

Attested by—
ANNA L. GILL,
JNO. F. OBERLIN.