A. A. CRYER.

VALVE DEVICE.

APPLICATION FILED APR. 29, 1904.

929,398. **Patented July 27, 1909.**

Fig. 1.

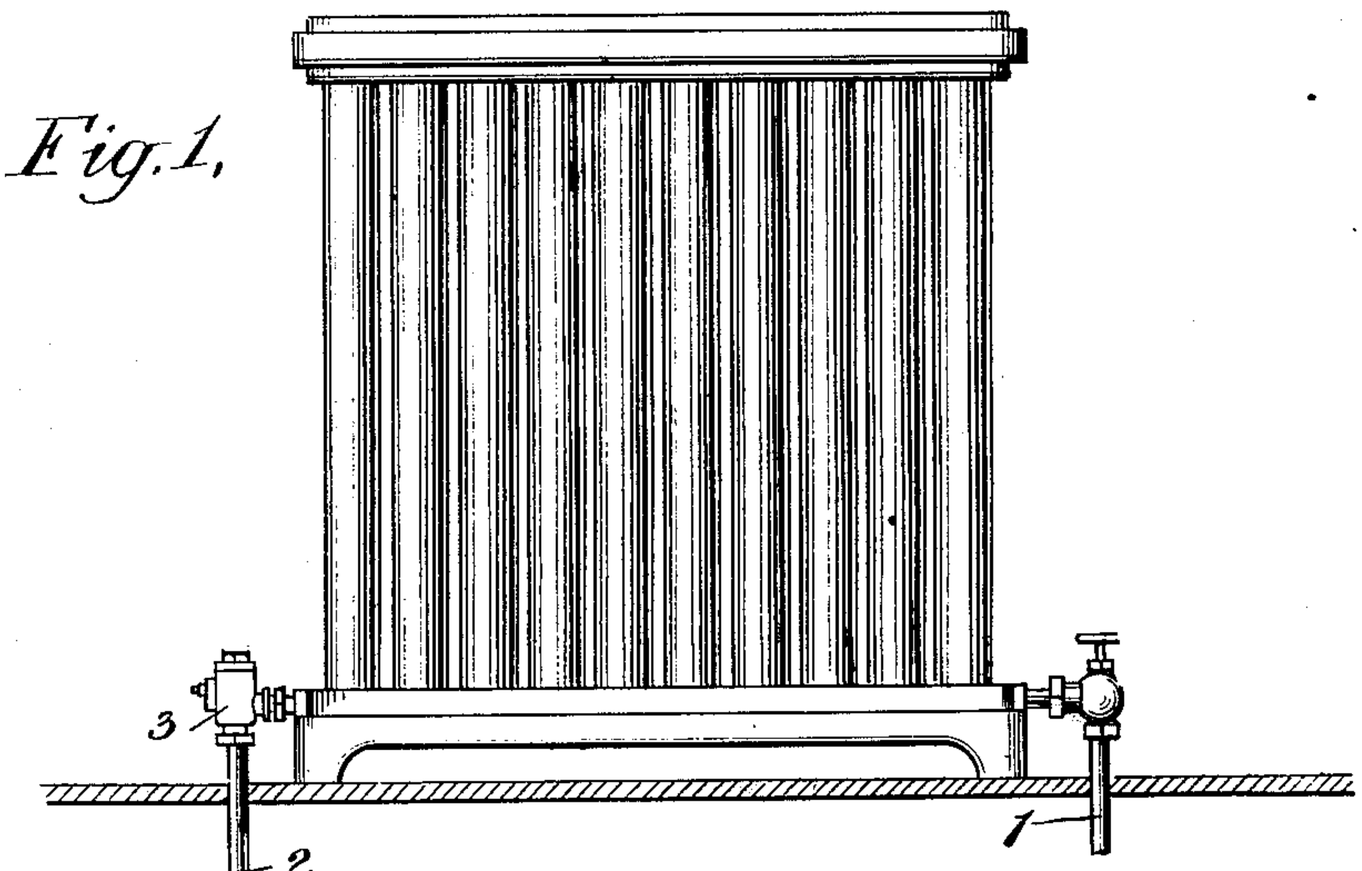

Fig. 2.

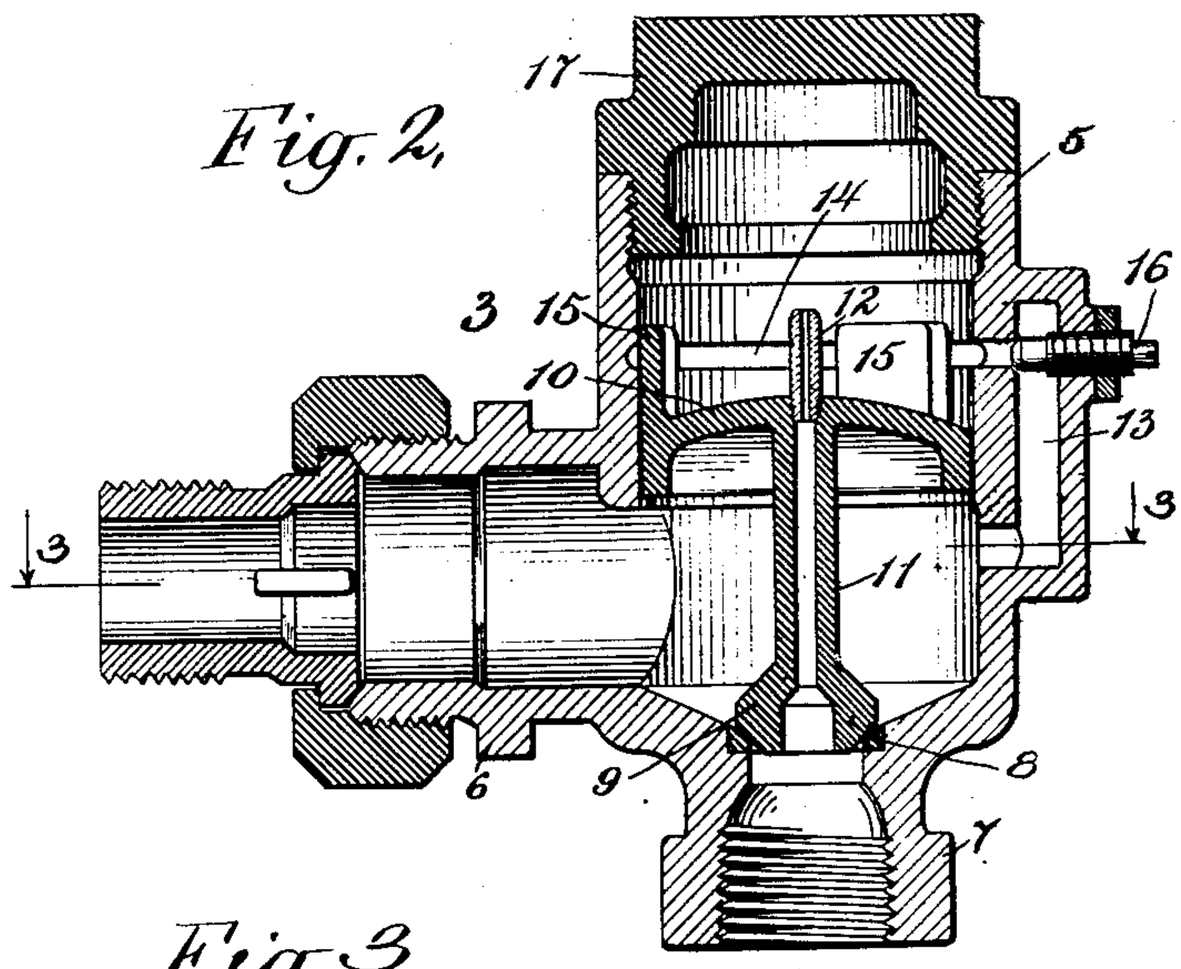

Fig. 4.

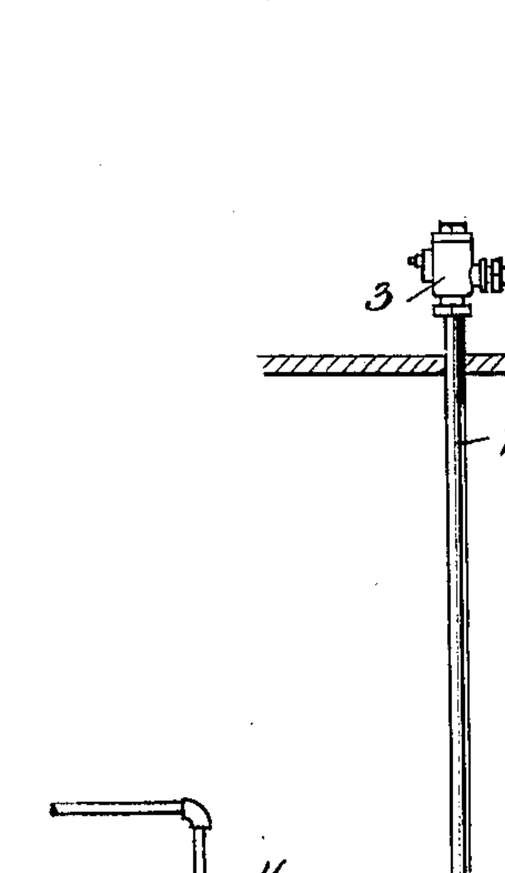

Fig. 3.

WITNESSES:

Harry P. Goss.

Edw. J. Blair.

INVENTOR

Albert A. Cryer

BY

Nicholas M. Goodlett Jr.

His ATTORNEY

UNITED STATES PATENT OFFICE.

ALBERT A. CRYER, OF NEW YORK, N. Y.

VALVE DEVICE.

No. 929,398. Specification of Letters Patent. Patented July 27, 1909.

Application filed April 29, 1904. Serial No. 205,507.

To all whom it may concern:

Be it known that I, ALBERT A. CRYER, a citizen of the United States, and a resident of New York city, in the county and State of New York, have invented certain new and useful Improvements in Valve Devices, of which the following is a specification.

This invention relates to valve devices adapted for use in connection with steam heating systems and in the combination of such devices with the other parts of the system.

The invention seeks to provide an efficient and reliable device whereby the air and the water of condensation may be automatically removed.

The invention also seeks to accomplish its result by economical means and by means so arranged as to insure the reliability and effective operation of the device, notwithstanding the collection of dirt, sediment, rust or other foreign matter, such as ordinarily collects in the conduits of a heating system.

The invention is applicable to a steam heating system or apparatus of any character such, for example, as one employing ordinary radiators or one employing drying cylinders such as those of a paper-drying machine.

In the accompanying drawings forming part of this specification and in which like reference numerals designate corresponding parts in the several figures, there is shown the preferred embodiment of the invention and modification thereof.

Figure 1 of the drawings is an elevation of a radiator forming part of the steam heating system and provided with a valve device. Fig. 2 is a central vertical elevation of the valve device. Fig. 3 is a plan sectional view on the line 3—3 of Fig. 2. Fig. 4 is an elevation partly in section showing a modification of the valve.

Referring now more particularly to the specific construction as shown in the drawings:—The radiator has a supply pipe 1 and a return pipe 2.

3 is a valve device connected with the radiator and the return pipe.

4 is an exhauster which may be of any suitable construction and designed to maintain a lower pressure in the return pipe than the pressure in the radiator or other heating body when the system is in operation.

The valve device 3 has a valve casing 5 provided with an inlet 6 and an outlet 7. The thoroughfare of the valve casing has a seat 8 for a valve 9. The seat 8 has a beveled edge, and the face of the valve is correspondingly beveled so as to form a conical passage when the valve is lifted from the seat. The valve is provided with a piston 10 which divides the valve casing into compartments or chambers. The lower side of the piston communicates with the system on the inlet side of the valve 9, and the upper side of the piston communicates with the system on the outlet side of the valve 9, this valve being actuated by the piston. The valve 9 is carried on a hollow stem 11 which is provided with a duct or passage opening at one end on the outlet side of the valve 9 and at its other end into the compartment or fluid pressure chamber above the piston. This duct, as shown, includes a removable nipple 12 having a narrow or capillary passage. The duct or passage in the stem 11 is enlarged below the nipple 12 so as to aid the jet or ejector effect of the air or water escaping through the discharge port as hereinafter explained. The piston is capable of moving bodily in the valve casing in which it closely fits.

13 is an air duct connecting both sides of the pressure motor. This duct, it will be seen, is formed in the side of the valve casing. Its lower end is above the level to which the water of condensation rises in the normal operation of the device. In Fig. 2 the duct 13 opens into the compartment above the piston through an inner circumferential channel 14 cut in the valve casing. In Fig. 2 the piston is provided with wings 15 on its upper side designed to secure the accurate movement of the piston without binding. It will be seen that the channel 14 prevents the duct 13 from being closed by one of the wings 15 in case the piston turns so as to bring one of the wings 15 opposite the opening of the duct 13.

16 is a valve for regulating the mouth of the duct 13. By means of this valve the size of the upper opening of the duct 13 can be properly adjusted with reference to the size of the passage in the nipple 12.

17 is a screw cap forming the top of the valve casing 5 and by means of which ready access to the interior of the valve casing is afforded, as may be required from time to time.

The operation of the device is as follows. The valve 16 is adjusted so as to make the

upper opening of the air duct 13 of proper size relatively to the opening through the nipple 12. I have found in practice that the best results will ordinarily be secured by making the upper opening of the duct 13 from four to six times as large in cross-sectional area as the opening in the nipple 12. The system being put into operation, the exhauster exhausts air from the outlet 7, and thereby reduces the pressure at that point. This produces a flow of air from the fluid pressure chamber above the piston 10 through the nipple 12 and the hollow stem 11, and thereby reduces the pressure in the fluid pressure chamber. This causes a flow of air from the chamber below the piston through the duct 13 into the upper chamber, but this flow is not sufficient to prevent the decrease of pressure in the upper chamber, and as a result of the differential pressures in the two chambers, the piston 10 rises, lifting the valve 9. Air is then drawn out from the lower chamber through the conical opening between the valve 9 and the valve seat 8. This air, escaping through the discharge port, operates as a jet and tends to maintain, if not to increase, the flow of air through the nipple 12 and the hollow stem 11, as a result of which the pressures in the two chambers are prevented from equalizing, and the valve 9 is held away from its seat and in a balanced position, although air only is escaping from the valve. I have found by actual test that the effect of the jet of air escaping between the valve 9 and the seat 8, is such that the pressure in the wider part of the hollow stem 11 immediately below the nipple 12, is less than the pressure in the outlet 7.

If there is an inrush of air into the lower chamber from any cause, the effect is to increase the pressure in that chamber, and to correspondingly lift the piston 10 and the valve 9. As the valve is opened wider a larger volume of air escapes through the discharge port, and this reduces the pressure in the lower chamber to the normal point, which causes the piston 10 to fall until it reaches its normal or balanced position, thereby shutting off to that extent the discharge port. When the water of condensation enters the lower chamber, it surrounds the valve 9 and begins to flow through the discharge port. This water, passing between the valve 9 and the seat 8, forms a water jet which acts in the same manner as the air jet but with even greater force, drawing air through the hollow stem 11 and the nipple 12, and maintaining a less pressure in the upper chamber than in the lower chamber. As water will not flow as readily through an opening of a given size as air does, the discharge from the lower chamber through the discharge port is decreased in volume, as a result of which the pressure in the lower chamber is slowly increased, causing the piston 10 to rise somewhat and thereby to open wider the discharge port. This increases the outflow from the lower chamber through the discharge port until the pressure in the lower chamber again becomes normal, when the piston 10 and the valve 9 fall to their normal or balanced position. I have found by actual test that in the normal operation of this device the valve never closes, but that the piston and the valve are held during most of the time in a balanced position, being raised or lowered according to the increase or decrease of the pressure in the lower chamber, as already explained.

In Fig. 4 the piston which carries the stem 11 and valve 9 is made somewhat different from that shown in Fig. 2. In Fig. 4 the piston consists of a lower disk 19 and an upper ring 20 connected by ribs 21. The peripheries of the disk 19 and ring 20 constitute the bearing surface of the piston and insure the accurate movement of the piston without binding. It will be seen that the ribs 21 are set in from the bearing surface of the piston so that in this case the turning of the piston in the valve casing would not close the mouth of the duct 13. Hence, the circumferential channel 14 may be omitted, if desired, when the piston shown in Fig. 4 is used.

What I claim and desire to secure by Letters Patent, is:

1. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

2. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, the upper end of said passage being capillary in character and the lower end thereof being enlarged, an air duct formed in the valve casing and connecting the cham-

bers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

3. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a conical valve seat, a conical valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, the upper end of said passage being capillary in character and the lower end thereof being enlarged, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

4. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the lower end of the duct being above the level to which the water of condensation rises in the normal operation of the device, and the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

5. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, and means in said duct for so regulating the size of its opening with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

6. In an automatic valve device for heating systems, the combination of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston 10 having one side in communication with the system on the inlet side of said valve, a hollow stem 11 connecting the piston and the valve, provided with a capillary passage at its upper end with an enlarged passage at its lower end, the air duct 13 formed in the valve casing connecting the chambers on opposite sides of said piston and opening at its lower end above the level to which the water of condensation rises in the normal operation of the device, the valve 16 for regulating the size of the opening in the duct 13 with reference to the size of the passage in the stem 11 so as to maintain the valve normally in an open balanced position.

7. In an automatic valve device, the combination of a valve casing having a thoroughfare, a conical valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

8. In a heating system, the combination of a supply pipe, a radiator, a discharge pipe, an exhauster connected with the discharge pipe and an automatic valve on the discharge pipe consisting of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

9. In a heating system, the combination of a supply pipe, a radiator, a discharge pipe, an exhauster connected with discharge pipe and an automatic valve on the discharge pipe consisting of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, the upper end of said passage being capillary in character and the lower end thereof be-

ing enlarged, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

10. In a heating system, the combination of a supply pipe, a radiator, a discharge pipe, an exhauster connected with the discharge pipe and an automatic valve on the discharge pipe consisting of a valve casing having a thoroughfare, a conical valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

11. In a heating system, the combination of a supply pipe, a radiator, a discharge pipe, an exhauster connected with the discharge pipe and an automatic valve on the discharge pipe consisting of a valve casing having a thoroughfare, a valve controlling said thoroughfare, a piston to actuate said valve having one side in communication with the system on the inlet side of said valve, a hollow stem connecting the piston and the valve, the passage in said stem connecting the chamber on the outer side of said piston with the system on the outlet side of the valve, an air duct formed in the valve casing and connecting the chambers on opposite sides of said piston, the lower end of the duct being above the level to which the water of condensation rises in the normal operation of the device, and the size of said duct being so proportioned with reference to the size of the passage in the stem as to maintain the valve normally in an open balanced position.

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

ALBERT A. CRYER.

Witnesses:

NICHOLAS M. GOODLETT, Jr.,
FRANCIS J. MCBARRON.