M. P. OSBOURN.

STEAM TRAP.

APPLICATION FILED JULY 27, 1909.

1,010,791. Patented Dec. 5, 1911.

FIG. 1

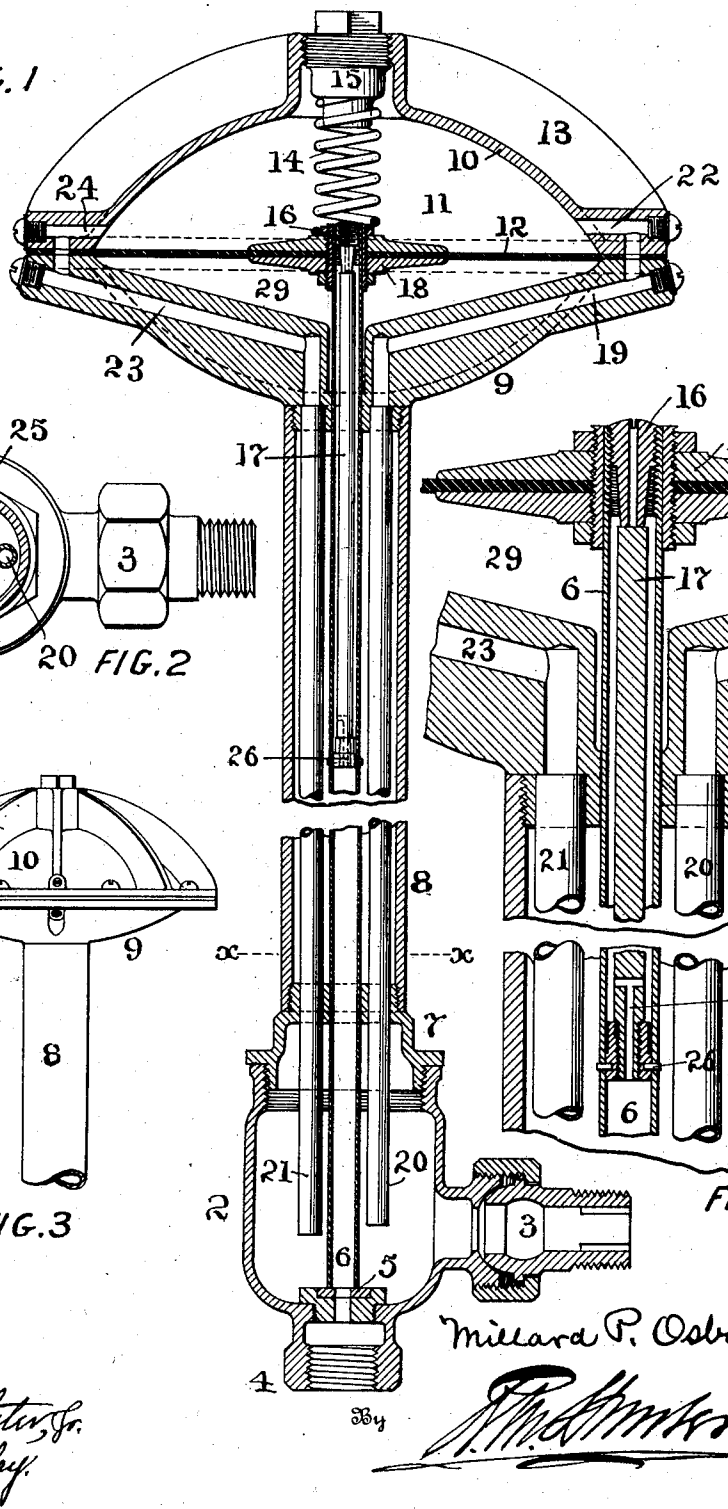

FIG. 2

FIG. 3

FIG. 4

Witnesses

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STEAM-TRAP.

1,010,791. Specification of Letters Patent. Patented Dec. 5, 1911.

Application filed July 27, 1909. Serial No. 509,869.

To all whom it may concern:

Be it known that I, MILLARD P. OSBOURN, a citizen of the United States, and a resident of the city of Merchantville, county of Camden, and State of New Jersey, have invented an Improvement in Steam-Traps, of which the following is a specification.

My invention has reference to steam traps, and consists of certain improvements which are fully set forth in the following specification and shown in the accompanying drawings which form a part thereof.

The object of my invention is to provide a form of automatic steam trap which is adapted more particularly for use in connection with steam heating systems preferably of the vacuum type, and arranged to perform the function of permitting the escape of the water and air from the radiator, but restricting or preventing the escape of steam therefrom whereby the heating may be done in an efficient manner and the full capacity of the radiator be always available for heating without material loss of steam.

My object is also to provide a construction of trap which may be employed on steam mains, or in any other connection where it is necessary to remove the water without permitting the escape of steam.

My invention also consists of certain improvements which are fully described both as to their construction and operation hereinafter in this specification, and more particularly defined in the claims.

My invention will be better understood by reference to the drawings, in which:

Figure 1 is a sectional elevation of a steam trap embodying my invention; Fig. 2 is a cross sectional plan of the same on line *x—x;* Fig. 3 is an elevation of the upper part of the steam trap; and Fig. 4 is a sectional view corresponding to portions of Fig. 1, but on a larger scale.

The trap consists essentially of a body part having inlets and outlets separated by a valve seat and from which body upwardly extends a motor device comprising a diaphragm which is operated upon under differential pressure made effective by variations in the level of the water in the valve body, and said motor device is caused to operate a valve piece extending down to and coöperating with the valve seat.

2 is the valve body and is provided with an inlet in its side at 3, and an outlet at its bottom at 4, said outlet being provided with a suitable valve seat 5.

6 is the valve piece, and in the particular form shown it is tubular and extends upward to a considerable distance and is connected to a diaphragm 12 by a suitable clamping head 18, and by which diaphragm it is raised and lowered.

7 is the bonnet of the valve body and upon the upper part of this bonnet is screwed a tubular case 8, and upon the top of this tubular case is screwed the lower part 9 of the motor device. The part 9 forms a lower chamber 29 which is closed above by the diaphragm 12 and may communicate with the case 8. Above the diaphragm and screwed to the lower part 9 is a head 10 forming within it a closed chamber 11 above the diaphragm 12. Screwed into the top of the head 10 is a plug 15 between which and the clamping head 18 of the diaphragm is placed a coil spring 14. By adjusting the plug 15 it is evident that the spring 14 may be made to put varying pressures upon the diaphragm and valve piece to vary the resistance to the raising of the valve piece under the motor action. Screwed into the upper end of the tubular valve 6 and opening into the chamber 11 is an adjustable valve seat bushing 16 through which the air may escape. Immediately below this valve seat bushing 16 and inclosed within the tubular valve piece is a thermostatic member 17 in the form of a rod of smaller diameter than the internal diameter of the valve piece 6 and having a coefficient of expansion greater than the coefficient of expansion of the tube forming the valve piece. The lower end of this thermostatic member 17 is screwed into a bushing secured within the valve piece 6, with provision for the escape of air from around the thermostatic member 17 through its lower part into the lower part of the valve piece, and thence through the valve seat 5 into the outlet 4. The point of connection between the thermostatic member 17 and the valve piece is indicated at 26, and the passage for the air through the thermostatic member is indicated at 27.

20 and 21 are two tubes having their lower ends opening into the body 2 at slightly different levels, the end of the tube 20 being slightly higher than the end of the tube 21. These tubes extend upwardly through the

bonnet 7 and are preferably housed within the tubular case 8. Their upper ends connect respectively with passages 19 and 23 in the lower part 9 of the motor device. The passage 19 communicates upwardly and inwardly through a port 22 into the chamber 11 at a small distance above the diaphragm 12. The passage 23 in a similar manner communicates upwardly and inwardly through a port 24 with the chamber 11 and slightly above the diaphragm 12, but the level of the port 24 is lower than the level of the port 22 just the same as the level of the bottom of the tube 21 was lower than the bottom of the tube 20.

I prefer to form the cap 10 of the motor device with a considerable amount of cooling surface, and as illustrative of this feature I provide the cap with ribs 13. In practice, there may be any number of these ribs, and they may be arranged in any suitable manner.

The operation of the device is as follows: Assuming that the water has been discharged to a level below the tube 21, the valve piece 6 will be closed upon its seat. If the air has been exhausted, then the action of the steam which may find its way through either or both of the tubes 20 and 21 will, upon passing through the valve seat bushing 16, heat the thermostatic member 17 and cause it to expand to close the port in the valve seat bushing 16. Should air be present in the system and be passing through the valve seat bushing, then because of its cooler condition, the thermostatic member 17 will not be expanded sufficient to prevent the passage of the air, and consequently the air will be driven or drawn through the valve seat bushing 16, thence into the valve piece 6 and out by the outlet port 4. The valve seat bushing 16 may be adjusted so as to insure responsive action by the thermostatic member the moment steam passes, whereby the said member will properly close the port in the valve seat bushing the moment any material quantity of steam passes. Assuming that the water of condensation flows into the body through the inlet 3 sufficiently to close the bottom of the tubes 20 and 21, we will then have the steam in the chamber 11 shut off from the inlet and it will condense because of the construction of the cap. When this condensation takes place, the water from the body 2 will be caused to rise in the tubes 21 and 20, and will, by providing columns of water coöperating with the vacuum produced in the chamber 11, cause the diaphragm 12 to be raised at its middle portion, and this will raise the valve piece 6 from the seat 5 and permit the discharge of the water from the body until the bottom of the tube 20 is uncovered. When this latter action takes place the steam rushes through the tube 20 and by passages 19 and 22 enters the chamber 11 to destroy the vacuum. Instantly the valve piece 6 is lowered, and further discharge of the water through the valve piece 5 is prevented. When the water again rises in the body 2 to seal the lower part of the tube 20, the steam in the chamber 11 again condenses, and the operation of lifting the valve piece 6 is again repeated. The outlet port 24 being closer to the diaphragm 12 than the port 22 permits the water of condensation above the diaphragm to flow from the chamber 11 through the port 24 and by passage 23 into the tube 21. The outlet port 24 should preferably be somewhat lower than the air vent port in the top of the valve seat bushing 16 so as to insure the water of condensation passing back into the body 2 instead of passing through the thermostatic controlled member. By having the lower ends of the tubes 20 and 21 at small differences in their levels, the discharge of the water from the trap is very perfect and each discharge is in small quantities, the apparatus being adapted to operate that the discharge might be considered as taking place with the regularity of the swinging of a pendulum. By having the tubes 20 and 21 of considerable height, it is evident that when the sealing of the tube 20 takes place a considerable suction will be produced by the vacuum within the chamber 11 before the water rises through the tubes into the said chamber, and the adjustment of the valve piece controlling spring 14 is such that the vacuum may be sufficient to operate the valve piece either before or just about the time that the water rises in the tubes 20 and 21 and discharges into the chamber 11, and thereby helps to condense the steam and make the motor diaphragm responsive. No matter how much water may rise in the tubes 20 and 21 and find its way through the ports 22 and 24, said water will instantly be discharged through the port 24, passage 23, and tube 21, the moment the lower end of the tube 20 is unsealed and the steam rushes through the said tube in the chamber 11. When the adjustment is such that the momentum of the water under the action of the steam pressure may cause some discharge into the chamber 11, the steam and air will always be caused to pass through the tube 20, whereas the tube 21 will always be filled with water, together with such air as may entrain with it during its discharge through the port 24 from the chamber 11. The tube 21 is in effect a drain tube for the chamber 11, whereas the tube 20 is the supply tube for steam and air to the chamber 11, and also acts as a counterbalance tube when the water is suddenly caused to rush up said tube under the vacuum in the chamber 11, whether by the condensation of the

steam therein, or by the partial vacuum caused by the sucking of the return pipe of a steam heating system upon the outlet port 4, or by the superior column of water which may be in the tube 21, due to the rushing down of the water of condensation, and this counterbalancing action in the tube 20 helps to make the motor action in the diaphragm 12 more responsive.

In the operation of the apparatus with a normal height between the body 2 and the chamber 11, there is more or less intermittent circulation of water up through the tube 20 into the chamber 11 alternating with steam and air, and a discharge of the water of condensation with or without entraining air downward through the tube 21. The surplus air passes off through the thermostatic member. In those cases where it is not essential to provide for taking care of the air, the thermostatic member may be omitted.

While I have shown the tubular valve piece 6 as forming a snug fit through the bottom of the lower part 9 of the motor device, it is to be understood that it is free to move vertically through said guiding part under the operation of the diaphragm, and it will also be understood that while there is no positive communication between the chamber below the diaphragm and within the part 9, nevertheless, this chamber 29 communicates with the steam space in casing 8 by the guide part 28 and would in effect be a steam chamber in which the pressure would be approximately equal to that in the casing 8 and the body 2. This guiding part 28 and the bonnet 7 act as vertical guides for the reciprocating valve piece 6 but is not steam tight.

While it is preferable that the difference between the levels of the ports 22 and 24 should approximately correspond to the difference in the levels of the bottoms of the tubes 20 and 21, and the colums of water which may exist in these two tubes practically balance each other when the water in them is in a state of rest, it is evident that the port 22 might be relatively higher up in the cap 10 than what is shown without changing the level in the bottom of the tubes 20 and 21. It is also evident that by materially changing the levels of the bottoms of the tubes 20 and 21, the operation of the device may be varied as to its intermittent time of action, that is to say, a greater discharge of water may be required to take place with each operation. It is more desirable, however, to employ only a slight difference in the levels of the bottoms of these tubes as the apparatus is more responsive and more regular in its action.

The bonnet 7 may be provided with holes 25 in its top, so that the same steam temperature which exists in the body and within the tube 20 may also exist within the casing 8 which incloses the said tubes 20 and 21 and the valve piece 6. In this manner the tubes 20 and 21 are prevented from acting as condensers, and consequently, the motor device is dependent upon the condenser action of the cap 10 coupled with the control thereof by the water sealing of the tube 20 in the body 2.

While I have shown a form of thermostatic member which is suitable for the purpose, and to enable the air to be discharged through the valve piece 6, it is evident that any other character of thermostatic member for permitting the escape of air while restricting the passage of steam, may be employed, and it will be self evident that it is not at all necessary that this thermostatic member shall be arranged in the valve piece itself, as it may be arranged in any other manner so long as the air within the chamber 11 is permitted to escape automatically or otherwise.

I have shown my apparatus in a form which I have found suitable for commercial operation of my invention, but I do not restrict myself to the details of construction shown, as it is evident that these may be modified in various ways without departing from the spirit or the essential features of the invention.

Having now described my invention what I claim as new and desire to secure by Letters Patent, is:—

1. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat opening into the outlet port, a valve piece controlling the outward flow of water through the valve seat, a diaphragm motor device for operating the valve piece, a drainage passage opening from the motor device close to the diaphragm and discharging into the body above the outlet port thereof, and a steam supply passage opening into the motor device above the diaphragm and also into the body at a higher level than the opening between the drainage passage and the body.

2. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat opening into the outlet port, a valve piece controlling the outward flow of water through the valve seat, a drainage passage opening from the motor device close to the diaphragm and discharging into the body above the outlet port thereof, and a steam supply passage opening into the motor device above the diaphragm at a higher level above the diaphragm than the level of the drainage passage above the diaphragm and also into the body at a higher level than the opening between the drainage passage and the body.

3. In a steam trap, the combination of a body having inlet and outlet ports and a

valve seat opening into the outlet port, a valve piece controlling the outward flow of water through the valve seat, a diaphragm motor device for operating the valve piece, a drainage passage opening from the motor device close to the diaphragm and discharging into the body above the outlet port thereof, a steam supply passage opening into the motor device above the diaphragm and also into the body at a higher level than the opening between the drainage passage and the body, a spring device to oppose the opening of the valve piece by the motor device, and means to adjust the tension of the spring.

4. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat opening into the outlet ports, a valve piece controlling the outward flow of water through the valve seat, a diaphragm motor device for operating the valve piece, a drainage passage opening from the motor device close to the diaphragm and discharging into the body above the outlet port thereof, a steam supply passage opening into the motor device above the diaphragm and also into the body at a higher level than the opening between the drainage passage and the body, and a thermostatically controlled air vent through the motor device and the valve piece for permitting the escape of air but restricting the passage of steam.

5. In a steam trap, the combination of a body having inlet and outlet ports, and a valve seat opening into the outlet port, a tubular valve piece controlling the outward flow of water through the valve seat, a diaphragm motor device for operating the valve piece, a drainage passage opening from the motor device close to the diaphragm and discharging into the body, a steam supply passage opening into the motor device above the diaphragm and also into the body at a higher level than the opening between the drainage passage and the body, and a thermostatically controlled air vent through the motor device and the valve piece for permitting the escape of air but restricting the passage of steam, said controlled air vent comprising a valve seat bushing arranged in the diaphragm of the motor device and a thermostatic member secured to and carried by the tubular valve piece for controlling the passage through the valve seat bushing.

6. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat and opening communicating with the outlet port, a valve piece for controlling the flow of water through the opening through the valve seat, a motor device arranged at a higher level than the body and connecting therewith and comprising a steam chamber, a diaphragm above the steam chamber and a condensing chamber above the diaphragm, connections between the diaphragm and the valve piece, and two tubular passages connecting the condensing chamber with the interior of the valve body at different levels above the outlet port thereof.

7. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat and opening communicating with the outlet port, a valve piece for controlling the flow of water through the opening through the valve seat, a motor device arranged at a higher level than the body and connecting therewith and comprising a steam chamber, a diaphragm above the steam chamber and a condensing chamber above the diaphragm, connections between the diaphragm and the valve piece, and two tubular passages connecting with the condensing chamber at different levels and also with the interior of the valve body at different levels above the outlet port thereof.

8. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat and opening communicating with the outlet port, a valve piece for controlling the flow of water through the opening through the valve seat, a motor device arranged at a higher level than the body and connecting therewith and comprising a steam chamber, a diaphragm above the steam chamber and a condensing chamber above the diaphragm, connections between the diaphragm and the valve piece, two tubular passages connecting the condensing chamber with the interior of the valve body at different levels above the outlet port thereof, and adjusting means for regulating the action of the motor device to vary its responsiveness.

9. In a steam trap, the combination of a body having inlet and outlet ports and a valve seat and opening communicating with the outlet port, a valve piece for controlling the flow of water through the opening through the valve seat, a motor device arranged at a higher level than the body and connecting therewith and comprising a steam chamber, a diaphragm above the steam chamber and a condensing chamber above the diaphragm, connections between the diaphragm and the valve piece, two tubular passages connecting the condensing chamber with the interior of the valve body at different levels above the outlet port thereof, and thermostatically controlled means for permitting the escape of air from the condensing chamber while preventing the passage of steam.

10. In a steam trap, a body in which the water of condensation collects, combined with a valve device for controlling the flow of water through the body, and a motor device for operating the valve device con-

sisting of a closed chamber, a movable part connecting with the valve device to operate it and moved by varying pressures in the closed chamber, and two tubular passages connecting the interior of the body at different levels above the outlet of the valve device with the closed chamber.

11. In a steam trap, a body in which the water of condensation collects, combined with a valve device for controlling the flow of water through the body, and a motor device for operating the valve device consisting of a closed chamber, a movable part connecting with the valve device to operate it and moved by varying pressures in the closed chamber, and two tubular passages connecting the interior of the body at different levels above the outlet of the valve device with the closed chamber at correspondingly different levels.

12. In a steam trap, a body in which the water of condensation collects, combined with a valve device for controlling the flow of water through the body, and a motor device for operating the valve device consisting of a closed chamber provided with cooling ribs whereby it acts as a condenser, a movable part connecting with the valve device to operate it and moved by varying pressures in the closed chamber, and two tubular passages connecting the interior of the body at different levels above the outlet of the valve device with the closed chamber.

In testimony of which invention, I hereunto set my hand.

MILLARD P. OSBOURN.

Witnesses:
R. M. KELLY,
J. M. CUNNINGHAM.