No. 761,402. PATENTED MAY 31, 1904.

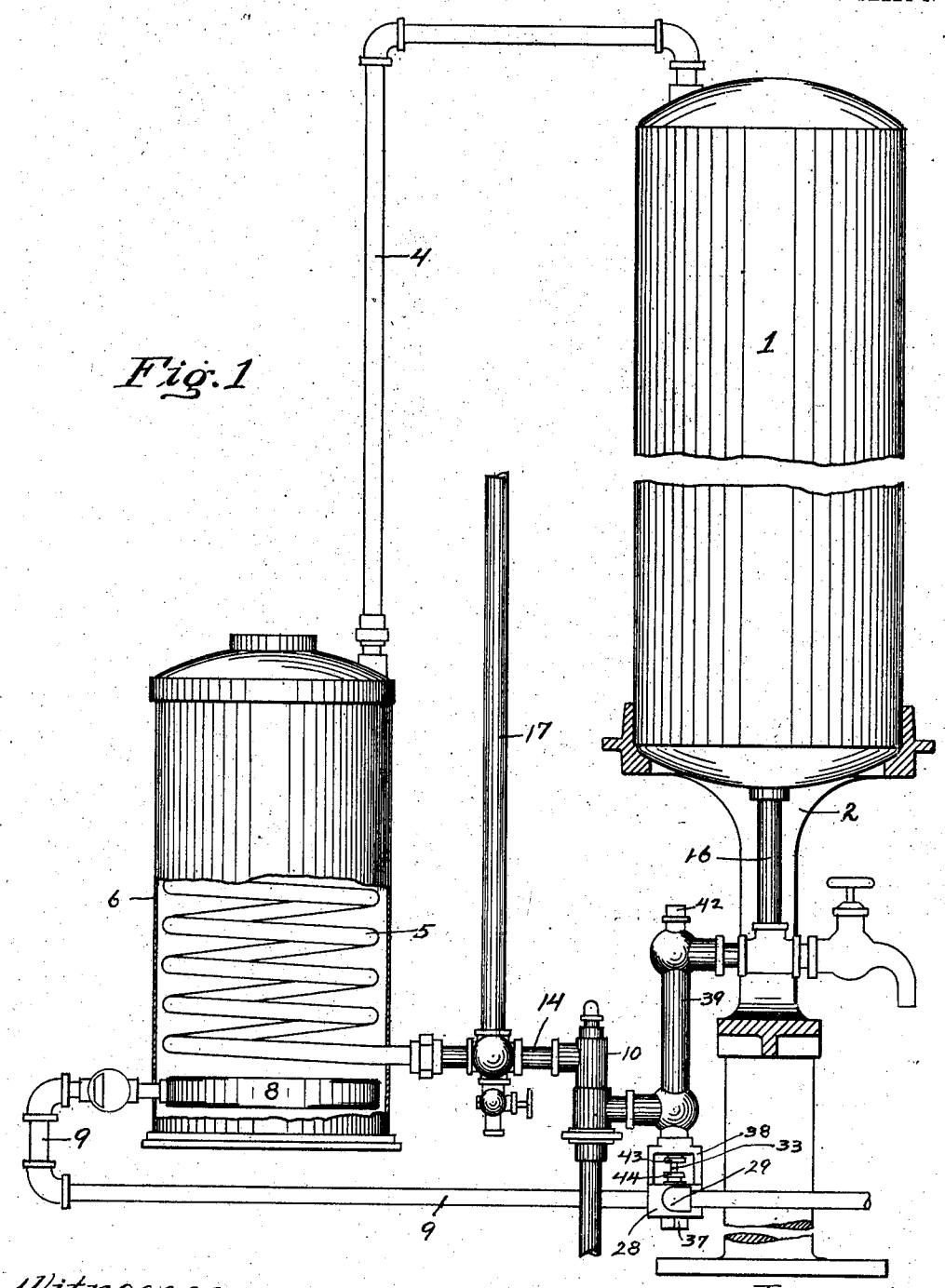
F. W. ROBERTSHAW.

THERMOSTAT AND REVERSING VALVE.

APPLICATION FILED JAN. 13, 1903.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1



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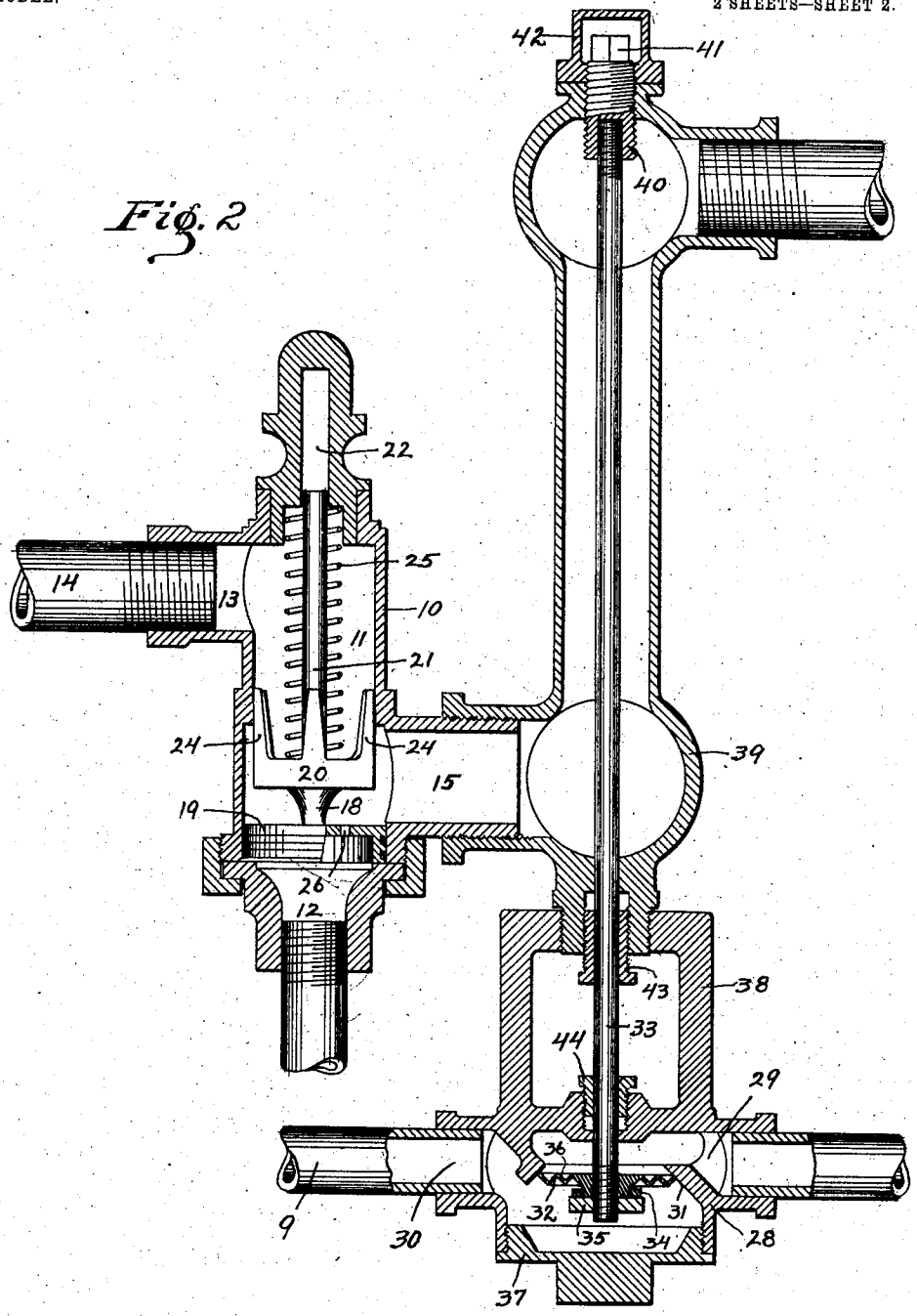
NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2



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No. 761,402. Patented May 31, 1904.

UNITED STATES PATENT OFFICE.

FREDERICK W. ROBERTSHAW, OF PITTSBURG, PENNSYLVANIA.

THERMOSTAT AND REVERSING-VALVE.

SPECIFICATION forming part of Letters Patent No. 761,402, dated May 31, 1904.

Application filed January 13, 1903. Serial No. 138,864. (No model.)

To all whom it may concern:

Be it known that I, FREDERICK W. ROBERTSHAW, a resident of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Thermostats and Reversing-Valves; and I do hereby declare the following to be a full, clear, and exact description thereof.

My invention relates to water-heaters, and more especially to automatic water-heaters wherein the water is heated by gas, the flow of which is automatically increased whenever a faucet is opened in any part of the system and is automatically decreased when all of the faucets are closed.

One of the objects of my invention is to provide a simple and efficient combined thermostat and gas-valve for controlling the flow of gas to the burners of the heater according to the temperature of the water in the system and which will bring on the gas as soon as a little hot water is drawn.

A further object of my invention is to provide a reversing-valve, thermostat, and gas-valve all combined in a single fitting, so that these parts can be accurately put together and adjusted in the factory, and said fitting can then be attached to the system without change by an ordinary plumber, thus dispensing with one of the sources of annoyance in apparatus of this kind resulting from a lack of skill on the part of the plumber in properly adjusting the valves and thermostat.

In the accompanying drawings, Figure 1 is a side elevation, partly in section, of a water system showing my improvement applied thereto; and Fig. 2 is a vertical section through the reversing-valve, thermostat, and gas-valve.

My invention may be employed in connection with water-heating systems of any kind, such as the ordinary domestic systems found in houses, or even for hot-water heating systems. I have shown the invention used in connection with an ordinary water reservoir or boiler 1, supported upon a suitable stand or bracket 2 and having its top end connected by the pipe 4 with the upper end of a heater-pipe 5, which may be of any desired form, such as a straight pipe or a coil or in any other known form. This pipe is shown inclosed in a casing 6, in the lower end of which is the gas-burner 8, supplied through the pipe 9. This form of heater has been selected for purposes of illustration merely, and the invention is not limited thereto, as in place thereof any form of heater may be employed, such as the ordinary coil located in the water-back of a range or a heater-pipe of any known form and heated in any known manner, it only being necessary that whatever form of heater-pipe is employed some form of burner using fluid fuel, such as gas or oil, be employed.

The lower end of the heater-pipe is connected to the water-supply and lower end of the boiler or reservoir, and in this connection I place a suitable reversing-valve, that shown in the drawings being a valve described and claimed in my patent, reissued October 21, 1902, No. 12,046. This valve comprises a suitable casing 10, having a cylindrical chamber 11, in which the valve mechanism works. The casing has a feed-port 12, to which at its lower end the cold-water pipe is connected, and two circulation-ports at different heights, one of which, 13, is the main circulation-port and is connected to the lower end of the heater-pipe 5 by means of a pipe 14, while the other port, 15, is connected to the lower end of the boiler by means of a pipe 16 projecting into the boiler through or into close proximity to the lower head of said boiler, so that the cold water is discharged near the bottom of the boiler. The hot-water or service pipe 17 will be connected at any suitable place so as to draw the water from the lower end of the heater-pipe without causing it to pass through the reversing-valve, this connection preferably being made to the pipe 14 between the valve 10 and the heater-pipe 5.

In the valve-chamber 11 works a double-piston valve 18, comprising a lower motor-piston 19 and upper piston or valve 20, which preferably are of different diameters, so as to form a differential valve. The piston-valve has a guide-stem 21 projecting upwardly into an opening 22 in the cap of the casing, and the piston 20 is provided with guiding arms or projections 24. A spiral spring 25 surrounds the stem 21 and acts normally to hold the pis-

ton-valve in its lowermost position, as shown in Fig. 2. The lower piston 19 is provided with a safety or leak port 26.

The gas-pipe 9, leading to the burner 8, is connected to a suitable gas-valve 28, which comprises a casing having an inlet 29 and outlet 30, to which the pipe 9 is connected, and provided with a valve-seat 31, against which bears a disk valve 32. This disk valve is connected to a stem or rod 33, so as to be adjustable thereon—such, for instance, as by screwing the same on the stem, as shown. In order to adjust the valve on the stem, the former is provided with opposite projections or wings 34, whereby the disk can be turned. A lock-nut 35 holds the disk in its adjusted position. The lower end of the valve-casing is provided with the screw-cap 37, by means of which access can be had to the interior thereof in order to adjust the disk 32 at the factory. The disk 32 is made thin at its center, preferably by having annular corrugations 36 formed therein, so that it will yield or spring, so as to relieve the threaded connection with the rod 33 of excessive strain as might otherwise occur if the fitting 39 overheated or if there is any obstruction to the closing of the valve.

The valve 28 is provided with a yoke 38, whereby it is secured to a fitting 39, which is in the form of a pipe-section placed in vertical position. Any connecting means may be used for securing the yoke 38 to the pipe-section 39; but preferably they are formed with screw-threaded connections, as shown. The pipe-section 39 communicates at its lower end with the circulation-port 15 of the reversing-valve and at its upper end with the pipe 16, leading to the lower end of the boiler. The valve-stem 33 extends upwardly into the pipe-section 39 and is secured to a plug 40, threaded through the upper end of the pipe-section 39. The plug 40 is provided with a squared end 41 or the like for receiving a wrench for turning the same in order to adjust the valve 32 without interrupting the flow of gas. A cap 42 protects the upper end of the plug 40.

The rod 33 and pipe-section 39 are formed of metals having different coefficients of expansion under the influence of heat, and preferably the pipe-section is formed of brass, copper composition, or other metal having a high coefficient of expansion, while the rod 33 is formed of high-grade steel or the like having a low coefficient of expansion. I prefer high-grade steel to iron, as it expands uniformly at all temperatures, whereas iron expands very little at low temperatures and relatively very much at high temperatures. The steel rod, therefore, insures an equal amount of valve-opening for relative variations of temperature. Suitable stuffing-boxes 43 and 44 are provided around the rod 33 where the same enters the pipe-section 39 and the gas-valve 28.

The heater will preferably be placed as shown in the drawings—that is, mostly below the bottom of the boiler—in order that the circulation will not be retarded, as would occur if the heater were placed at a higher level. By extending the thermostat elements downwardly below the boiler, as shown, and said elements being acted on by the water said elements will be kept cool as long as there is any cold water in the boiler, thus insuring the flow of gas to the burner until all the water in the boiler is heated. By making the thermostat, gas-valve, and reversing-valve as a single fitting and extending the thermostat below the boiler with the attaching connections, as shown, it is impossible for the plumber to place the heater so high that it will retard the circulation.

The operation of my reversing-valve and thermostat devices is as follows: When the faucets in the hot-water service-pipe are closed, the reversing-valve will be held by the spring 25 in the position shown in Fig. 2, with the motor-piston 19 closing the feed-port 12 and the circulation-ports 13 and 15 open. In this position the cold water from the bottom of the reservoir 1 will pass into the pipe 16, through the pipe-section 39, and through the port 15 into the valve-chamber 11 and from thence through the port 13 and pipe 14 into the heating-pipe 5, from which the hot water passes through the pipe 4 into the upper end of the reservoir. As long as there is cold water in the boiler this circulation will continue and the cold water will pass through the thermostatic pipe-section 39, thus chilling both the pipe-section 39 and rod 33. This will cause a relative shortening of the pipe-section 39 as compared with the rod 33 and keep the disk valve 32 off the seat 31 and permit gas to flow to the burner 8. When all of the water in the boiler has been heated, hot water will begin to flow through the pipe-section 39 and reversing-valve to the heater. This will heat both the pipe-section 39 and rod 33, causing them to expand; but by reason of the different coefficients of expansion of these parts the pipe-section 39 will expand more than the rod 33, thus causing the disk valve 32 to be brought into contact or close proximity with the seat in the gas-valve, either entirely cutting off or at least diminishing the flow of the gas to the burner. By means of this thermostatic device, therefore, the quantity of gas flowing to the burner will be regulated according to the temperature of the water flowing through the pipe-section 39, so that overheating of the water cannot occur. As soon as the faucet in the hot-water service-pipe is opened the pressure above the motor-piston 19 will be reduced, thereby permitting the pressure in the cold-water pipe 12 to raise the valve against the tension of the spring 25. In this movement the piston 19 opens the feed-port 12, while the piston-valve 20 closes the passage through the valve-casing, thus cutting off the flow of water from the circulation-port

15 to the circulation-port 13, and the closing of this passage takes place, as described in my patent aforesaid, before the piston 19 opens the feed-port 12. In this position of the valve the cold water passes through the valve-casing, through the circulation-port 15, pipe-section 39, and pipe 16 into the lower end of the boiler. This will drive the hot water upwardly in the boiler, and said hot water will pass through the pipe 4, down through the heating-pipe 5, and thence to the hot-water service-pipe, thus being reheated and passing through the heater-pipe in a direction opposite to its original course, thus cleaning out any sediment that may have been deposited therein. The cold water from the feed-pipe begins to pass through the pipe-section 39 almost as soon as the hot-water faucet is opened, and it chills said pipe-section and the rod 33 and these parts will contract; but by reason of their different coefficients of expansion the pipe-section 39 will contract more than the rod 33, thus, in effect, drawing the valve-seat away from the disk valve 32 and permitting more gas to flow to the burner 8, so that a high degree of heat is given the water flowing out of the service-pipe. As soon as the hot-water faucet is again closed the reversing-valve 19 returns to the position shown in Fig. 2, thus again reversing the flow of water through the system and establishing the circulation first above described. The gas will continue to flow in undiminished quantity to the burner 8 until the temperature of the water flowing through the pipe-section 39 increases so as to cause the variable expansion of the thermostatic elements, as above described, and this will not occur until all the water in the boiler has been heated.

It will thus be observed that by means of my improvements the circulation of the water through the boiler and heater is periodically reversed, and the quantity of gas flowing to the burners is automatically regulated according to the temperature of the water in the system. The reversing-valve, thermostatic elements, and gas-valve are arranged in juxtaposition and directly connected to each other, so that they can be assembled and properly adjusted at the factory. In applying them to the system the plumber need only connect the pipe 14 and cold-water pipe to the reversing-valve, the pipe 16 to the fitting 39, and the gas-pipes to the inlet and outlet of the gas-valve. It will not be necessary for him to disturb any part of the combined reversing and gas valves and thermostatic elements, so that a lack of skill on the part of the plumber will not get these parts out of adjustment and he cannot place the heater at the wrong elevation. The gas-valve and pipe-section 39 preferably will be formed as a single casting; but for convenience in making and fitting these parts they may be made in several parts, as shown. The reversing-valve will always be separate and attached to the thermostat. In place of the gas-valve shown I may substitute an oil-valve or a valve for any other form of fluid fuel.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a water-heater, the combination with a reservoir, of a heater and heater-pipe, a connection between said reservoir and heater-pipe, a reversing-valve constructed and adapted to automatically close the connection leading therefrom to the heater-pipe upon the withdrawal of water from the system, a feed-pipe connected thereto, connections between said reversing-valve and the heater-pipe and between said reversing-valve and the reservoir, a thermostatic device located in said last-named connection, and a fuel-supply valve for the heater controlled by said thermostatic device.

2. In a water-heater, the combination with a reservoir, of a heater and heater-pipe, a connection between said reservoir and heater-pipe, a reversing-valve constructed and adapted to automatically close the connection leading therefrom to the heater-pipe upon the withdrawal of water from the system, a feed-pipe connected thereto, connections between said reversing-valve and the heater-pipe, and between said reversing-valve and the reservoir, said last-named connection comprising a pipe-section, a rod in said pipe-section and projecting outside the same, said pipe-section and rod being made of metals having different coefficients of expansion, a fuel-supply-valve casing connected to said pipe-section, and a valve in said casing connected to said rod.

3. In a water-heater, the combination with a reservoir, of a heater and heater-pipe, a connection between said reservoir and heater-pipe, a reversing-valve comprising a valve-casing having a feed-port and two circulation-ports, a piston-valve in said casing controlling said ports and arranged to close the feed-port in one position and when moved to the other position to close one of the circulation-ports in advance of opening the feed-port, connections between one of said circulation-ports and the heater-pipe and between the other circulation-port and the reservoir, a thermostatic device located in said last-named connection, and a fuel-supply valve for the heater controlled by said thermostatic device.

4. As a new article of manufacture, a fitting for water-heaters comprising a valve-casing having a chamber provided with three ports, a valve in said chamber controlling one of said ports and adapted to be controlled in accordance with the flow of fluid through a second port, a fuel-supply valve, a pipe-section connected to the third port, and a thermostatic device in said pipe-section and controlling said fuel-supply valve.

5. As a new article of manufacture, a fitting for water-heaters comprising a valve-casing having a chamber provided with three ports, a valve in said chamber controlling one of said ports and adapted to be controlled in accordance with the flow of fluid through a second port, a pipe-section connected to the third port, a rod connected to said pipe-section and extending through and projecting outside the same, said pipe-section and rod being made of metals having different coefficients of expansion, a fuel-supply-valve casing connected to said pipe-section, and a valve in said casing connected to said rod, all said parts being combined as a single vendible article.

6. As a new article of manufacture, a fitting for water-heaters comprising a valve-casing having a chamber provided with two circulation-ports and a feed-port, a valve in said chamber controlling one of the circulation-ports and adapted to be controlled in accordance with the flow of fluid through the feed-port, a pipe-section connected to the other of said circulation-ports and having a reservoir connection, a fuel-supply-valve casing attached to said pipe-section, a valve in said fuel-supply-valve casing, and a thermostatic device in said pipe-section and connected to said fuel-supply valve for controlling the same.

7. As a new article of manufacture, a fitting for water-heaters comprising a valve-casing having a chamber provided with two circulation-ports and a feed-port, a valve in said chamber controlling one of the circulation-ports and adapted to be controlled in accordance with the flow of fluid through the feed-port, a pipe-section connected to the other of said circulation-ports and having a reservoir connection, a fuel-supply-valve casing attached to said pipe-section and provided with a valve-seat and inlet and outlet ports, a rod secured to said pipe-section and extending through and projecting outside of the same into the fuel-supply-valve casing, said pipe-section and rod being made of metals having different coefficients of expansion, and a valve connected to said rod and coöperating with a valve-seat in said fuel-supply-valve casing.

In testimony whereof I, the said FREDERICK W. ROBERTSHAW, have hereunto set my hand.

FREDERICK W. ROBERTSHAW.

Witnesses:
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ROBT. D. TOTTEN.