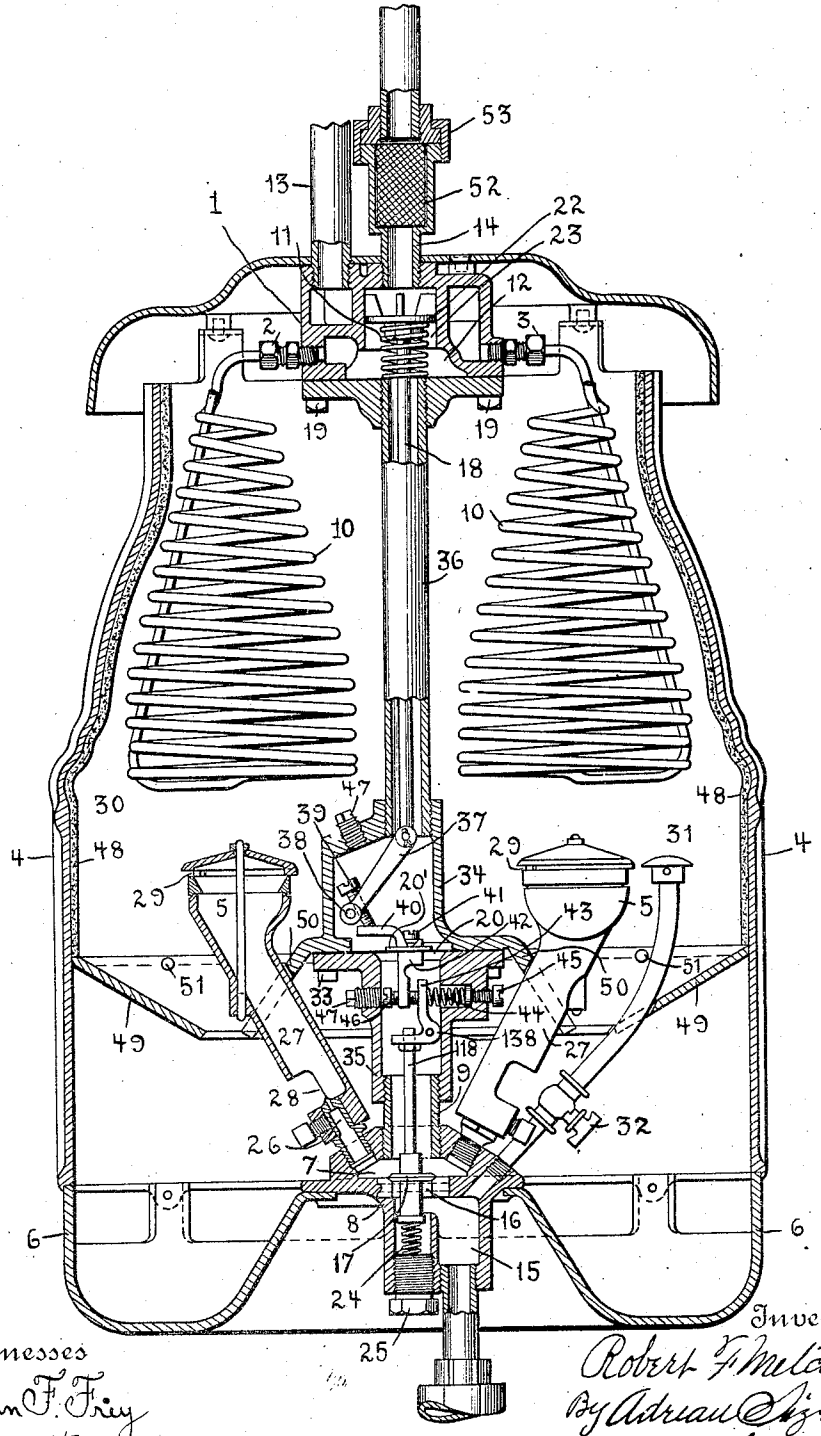
R. F. METCALFE.

WATER HEATER.

APPLICATION FILED FEB. 25, 1913.

1,140,910.

Patented May 25, 1915.



Witnesses

Edwin F. Frey

H. Thornett

Inventor

Robert F. Metcalfe

By Adrian Sizer

his Attorney

UNITED STATES PATENT OFFICE.

ROBERT F. METCALFE, OF ERIE, PENNSYLVANIA.

WATER-HEATER.

1,140,910. Specification of Letters Patent. Patented May 25, 1915.

Application filed February 25, 1913. Serial No. 750,484.

To all whom it may concern:

Be it known that I, ROBERT F. METCALFE, a citizen of the United States, residing in the city of Erie, in the county of Erie and State of Pennsylvania, have invented certain new and useful Improvements in Water-Heaters, of which the following is a specification.

This invention relates to an improvement in automatic water heaters, generally known as instantaneous heaters, and one in which the drawing off of hot water governs and controls the gas fuel used in the generation of heat, this being effected automatically and in proportions to the quantity of hot water drawn off by the operation of my improved valve mechanism.

My invention further aims to provide regulating means, which while remaining sufficiently sensitive to automatically place into operation the heat generating means upon the discharge of hot water from the apparatus, and yet be positive in its action in shutting off the gas supply when the hot water ceases to flow from the heater.

I attain these results by means of a reciprocally disposed water actuated valve piston, operatively connected with a gas valve plunger, in a manner which provides a proportionately shorter movement or lift to the gas valve than to the water actuated plunger.

With these and other objects hereinafter referred to, my invention consists of certain novel and peculiar features of construction and combination of parts as hereinafter described, and claimed, and for the purposes of describing my invention there is illustrated in the accompanying drawings the preferred embodiment of my apparatus wherein, the figure is a longitudinal section through the heater.

Referring to the drawings, 1 is a casting formed preferably of some non-corrosive metal, comprising a water container header, having two separate compartments therein, the one compartment located in the center thereof is adapted to receive the cold water from the mains, and to distribute the same into the several water heating tubes 10, the receiving end of each water heating tube being connected to the cold water compartment of the heater by the duct 2, and the discharging end of each water heating tube being connected to the hot water compartment of the heater by the duct 3. The water heating tubes are composed of soft drawn copper tubing formed into coils and arranged in the form of a cone, with that end of the cone forming the greatest circumference, placed directly over the fuel gas burner 5. As the coil extends upward each convolution is successively reduced in diameter to provide for each succeeding layer to be placed in better position to come in contact with the products of combustion from the burners 5.

Surrounding the water heating tubes 10, and the burners 5, is an exterior shell or casing 4, which rests upon a suitable base 6, constituting the foundation of the heater. Resting upon the base 6, is base casting 8, into which are screwed a plurality of burners 5, in such manner as to communicate with a central gas reservoir 7. Located within the base casting 8, is a gas inlet 15, which leads from any source of fuel gas supply, and communicates with gas chamber 7, through the gas port 16. Located within the gas chamber 7, and operating to open and close the gas port 16, is a puppet valve 17. Located under the valve stem of the puppet valve 17, is a coil spring 24, with a tension screw plug 25. By means of the tension screw plug 25 any desired adjustment can be made to facilitate the operation of the gas valve 17.

Extending upward from the casting 8, is a nipple 9, which is suitably attached to the base casting at its lower extremity, and at its upper extremity is screw threaded into the casting 35, which forms the lower section of the housing in which is located the gas valve operating mechanism. Resting on the casting 35, and suitably attached thereto by the bolts 33, is the casting 34 forming the upper part of the housing of the gas valve mechanism. Extending upward from the casting 34 is the tube 36, which is suitably attached to the casting 34, at its lower extremity and at its upper extremity is screw threaded into the flange 21, which is attached to the top header 1, by bolts 19.

Located between the inlet duct 14, and the water chamber 12, is the valve chamber 23, is which is located a reciprocally disposed valve piston 22. The valve piston and the

valve chamber 23, in which the valve piston 22 operates, are so designed that when the valve piston 22 has reached its upward most position, it substantially closes the valve chamber 23, to the free passage of water therethrough. As the valve piston 22 is forced into its downward most position, the water is free to pass from the inlet duct 14, to the water chamber 12, and be placed in direct communication with the water heating tubes 10, by the ducts 2.

Formed integrally with the valve piston 22, is the valve stem 18, which is centrally disposed within the tubes 36, extending downward therein, and is operatively connected at its lower extremity to the lever 37, which is fulcrumed at the pinion 38. Passing through the lever 37, is the set screw 39, which is suitably extended so as to provide a bearing contact on the finger 40. The finger 40 rests upon, and is suitably fastened to the diaphragm 20, and the diaphragm reinforcing disk 20′, by the screw 41 which passes through the disk 20′ and the diaphragm 20 and is screw threaded into the projecting finger 42 located on the underside of the diaphragm 20.

Placed in contact with the finger 42, is the gas valve lifting lever 43, which is pivoted on the stud 138. The horizontal finger of the lever 43 being operatively connected with the valve stem 118 of the gas valve 17. The lever 43 is maintained in contact with the projecting finger 42, by the tension spring 44, which is regulated by the tension screw 45. To provide for suitable adjustment between the lever 43 and the diaphragm projecting finger 42, an adjustment screw 46 is placed in the lower end of the projecting finger 42. Suitable openings are provided for in the housing for making adjustment of the valve mechanism, which are closed by dummy screws 47—47. Located within the top header 1, and exerting sufficient pressure to normally hold the valve plunger 22 in its upper most position is the spring 11. The castings 34 and 35 forming the housing of the gas valve operating mechanism is preferably composed of non-corrosive metal and by virtue of the lower casting 35 being readily detached from the upper casting 34, any of the working parts are accessible, and may be reached without dismantling the entire machine.

The reciprocally disposed valve piston 22 will by virtue of the tension of the spring 11 normally remain in the uppermost part of the valve chamber 23, as long as there is a suitable equilibrium between the water pressure within the chamber 12, and the inlet duct 14. When this equilibrium is established the spring 11 is free to exert its upward pressure without the counteracting influences of the water pressure against the upper side of the valve piston 22, thereby effectively closing the passage way against the incoming water from the inlet duct 14, until such time as the equilibrium established between the pressure within the cold water reservoir and the hot water chamber has been disturbed by a reduction of the pressure in the hot water mains due to a draft therefrom. Upon the opening of any passage leading from the hot water discharge 13, the water within the chamber 12, will be relieved of static pressure to such an extent as to attract the incoming water from the cold water supply duct 14, carrying down with it in its onward movement the valve piston 22. This downward movement of the valve piston 22 will exert a downward movement to the lever 37, which will communicate through the bearing of the screw 39, against the diaphragm finger 40, causing an oscillating movement of the center of the flexible diaphragm 20, thereby causing a lateral movement to the projecting finger 42, which movement is communicated to the gas valve operating lever 43, thereby causing a lift to the gas valve 17, and opening the valve passage way 16 to the free passage of gas from the passage way 15, to the gas chamber 7, supplying the burners 5 with gas.

The tension of the spring 44, is adjustable by the turning of the tension screw 45, thus providing means for proportioning the quantity of fuel gas that passes through the gas valve port 16, directly in ratio to the effort that is exerted on the plunger 22 by the quantity of water that is being drawn through the heater. This provides an absolute and reliable means of control, assuring that when it is set to supply the correct amount of fuel gas on a small discharge of water, and with the plunger 22 set at the right height to give a full opening on a full discharge of water, the mechanism will proportion the gas, to the amount of water discharged from a complete shut off to a full opening. As the water is being drawn from the chamber 12, the movement of the water through the inlet duct 14, will be sufficient to move the valve piston 22 against the spring 11, to a sufficient degree to cause a by-pass around the valve piston 22, to the free passage of water from the inlet duct 14, to the water chamber 12. The position of the valve piston 22 will remain open to the free passage of water as long as hot water is being drawn from the discharge pipe to such an extent as to cause a movement of the water to flow from the inlet duct 14, and the chamber 12. During the closing of the hot water discharge openings, there will be a gradual stoppage of the flow of water from the inlet duct 14, and as the flow of water ceases, the pressure of the spring 11 will cause the valve piston 22 to pass upward, until the valve chamber 23 has been closed to the free

passage of water and will remain closed until the flow of water through the inlet duct 14 again occurs by reason of the opening of one or more faucets in the hot water discharge line.

Under the adjustment provided the heating means is controlled through the velocity of water passing the plunger 22, and the effect on the operating mechanism by the variations in pressure due to the drafts from other communicating mains do not effect the operation of the heater, and the capacity of the heater being known, the supply can be regulated from either the inlet or the outlet side of the water connections.

Attached to the base casting 8, and screw threaded therein are a plurality of gas burners 5, each one of which constitutes a complete unit in itself, and communicates with one source of gas supply by the gas chamber 7. Fuel gas having been admitted to the passage way 15, from any source of gas fuel supply, it passes into the gas port 16 and remains in readiness to pass into chamber 7, upon the movement of the gas valve 17, when it passes through the gas chamber 7, and into the burner opening 26, of the burner 5, causing a jet to enter the mixing chamber 27, where it becomes commingled with atmospheric air drawn in through aperture 28, and passes upward through the mixing chamber 27, through the openings 29, and into the combustion chamber 30. Located within the combustion chamber 30, and placed in direct communication with the gas passage way 15, is the pilot burner 31, through which the gas is constantly admitted during such periods as the heater is in operation, by the opening of the cock 32. As the gas emerges from the burner 5, through the aperture 29, it becomes ignited from contact with the constant flame from the pilot burner 31.

The shell 4, surrounding the combustion chamber is preferably composed of sheet iron formed of suitable shape at the point where it encircles the heating tubes to provide for the most efficient application of heat within the combustion chamber to the heating tubes 10. To further provide for more efficient heating, as well as to retain the heat within the chamber, and to insulate the interior part of the shell 4, from the heat therein a suitable lining of asbestos felt 48, is placed within the shell 4, extending downward to a point below the level of the burners 5. Located within the shell 4, is a disk shaped baffle plate 49, surrounding the burner group, which forms the bottom of the combustion chamber 30. The casting 34 forming the upper half of the valve operating housing, is provided with projecting arms 50 which pass downward between each burner at an angle toward the lower circumference of the baffle plate 49 and serve the purpose of limiting the aperture by partially closing the space between the several burners, thus providing a suitable space between the circumference of the arms 50 and the inner diameter of the baffle plate 49 to constitute the required opening for the passage of air to the combustion chamber 30, the quantity admitted being pre-determined by the extent of these openings, thereby cutting off the rush of air directly into the combustion chamber, and forcing the burners to draw the maximum amount of free air into the burner mixing chamber 27, at the opening 28.

The baffle plate 49 is suitably attached to the shell 4, by bolts 51, and is readily removable to grant access to the burners or to the valve operating mechanism. The baffle plate 49 also serves the purpose of taking care of all dripping water caused by condensation, which coming in contact therewith is vaporized due to the heat absorbed by the baffle plate, owing to its close proximity to the burners. For the purpose of facilitating the manufacture as well as making all parts of the interior of the heater readily accessible, the shell 4 is composed of four pieces, the front and back sections having large doors (not shown). To provide for taking care of any sediment or other foreign matter that may be found in the water coming from the street mains, there is provided a suitable strainer 52 located above the inlet duct 14, which is suitably attached to the line communicating with the water mains by the union 53 which also admits of a detachment thereof being readily made to allow for the cleaning of the strainer 52.

Having thus described my invention and illustrated its use what I claim as new and desire to secure by Letters Patent is the following:

1. A water heater of the character described, comprising a water container having two separate compartments therein, a series of water heating tubes connecting said compartments, water heating means, a water actuated plunger located within one of said compartments, a gas valve, actuating means located between said water plunger and the gas valve comprising a flexible diaphragm having protruding fingers placed in operative contact with said water actuated plunger and the gas valve.

2. A water heater of the character described, comprising a series of waterheating tubes, a plurality of gas burners adjacent thereto, a gas valve, a valve stem connected to said gas valve, a flexible diaphragm having a projecting finger on each face, a water operated valve piston, an actuating lever placed in contact with the projecting finger on the upper face of the diaphragm operatively connected to said valve piston, a bell

crank lever engaging the finger on the lower face of said diaphragm and operatively connected to said gas valve stem.

3. A water heater of the character described, comprising a water container having two separate compartments therein, a series of water heating coils placed in communication between said compartments, heating means adjacent to said water heating coils, heat controlling means, a flexible diaphragm having fingers projecting therefrom, a water operated valve piston, a lever engaging the upper finger of said diaphragm operatively connected to said valve piston, a second lever engaging the lower finger of said diaphragm, and operating to actuate the heat controlling means.

4. A water heater of the character described, comprising a water container having two separate compartments therein, a series of water heating coils connecting said compartments, a gas valve, a flexible diaphragm having fingers projecting from its upper and lower faces, a water actuated valve piston, a lever pivoted at its lower end operatively connected to said valve piston and engaging the upper finger of said diaphragm, a bell crank lever engaging the lower finger of said diaphragm, operating to actuate the gas valve substantially as described.

5. A water heater of the character described, comprising a water container having two separate compartments therein, water conductors connecting said compartments comprising a series of water heating coils, a plurality of gas burners adjacent to said water heating coils, a gas passage leading to said burners, a gas valve located in said passage, a flexible diaphragm having fingers projecting from its upper and lower faces, a water actuated valve piston, a lever pivoted at its lower end operatively connected to said valve piston and engaging the upper finger of said diaphragm, a bell crank lever engaging the lower finger of said diaphragm, and operating to actuate the gas valve, substantially as described.

6. A water heater of the character described, comprising a water container having two separate compartments, a series of waterheating tubes connecting said compartments, a plurality of gas burners adjacent thereto, a gas valve, a water actuated plunger located in one of said compartments, gas valve actuating means comprising a flexible diaphragm with protruding fingers placed in operative contact with said water actuated plunger and the gas valve.

7. A water heater of the character described, comprising an exterior casing and an inner casing disposed therein, having an upper and a lower compartment, a flexible diaphragm separating said compartments, a vertically disposed gas valve in said lower compartment, water heating means located between said casings, a water actuated plunger located in the upper compartment, means for conveying an oscillating movement to said diaphragm and means for conveying movement to the gas valve from said oscillating movement of the diaphragm.

8. A water heater of the character described, comprising an exterior casing, an inner casing disposed therein having an upper and a lower compartment, a flexible diaphragm separating said compartments, a gas valve located in said lower compartment, water heating means located between said casings, a water actuated plunger having vertical movement located in the upper compartment, means for conveying an oscillating movement to said diaphragm by said water actuated plunger, and means for conveying vertical movement to the gas valve from the oscillating movement of said diaphragm.

9. A water heater of the character described, comprising an exterior casing, an inner casing disposed therein having an upper and a lower compartment, a flexible diaphragm separating said compartments, water heating means located between said casing, a gas valve, a water actuated plunger located in the upper compartment, means for conveying movement from the water actuated plunger through an oscillating movement of said diaphragm to the gas valve, substantially as described.

10. In a water heater of the character described, the combination of a series of water heating tubes, a plurality of gas burners adjacent thereto, a gas valve, a water container having two separate compartments in communication through said water heating tubes, a water actuated plunger located in one of said compartments, with gas valve actuating means comprising a flexible diaphragm having protruding fingers placed in operative contact with said water actuated plunger and the gas valve substantially as described.

11. In a water heater of the character described, the combination of an exterior casing, an inner casing disposed therein having an upper and a lower compartment, a flexible diaphragm separating said compartments, water heating means located between said casings, a water actuated plunger located in the upper compartment, with means for conveying an oscillating movement to said diaphragm, and means for conveying movement to a gas valve from said oscillating movement of the diaphragm.

12. In a water heater of the character described, the combination of a water container having two separate compartments therein, a series of water heating tubes connecting said compartments, an exterior casing, an inner casing disposed therein hav-

ing an upper and a lower compartment, a flexible diaphragm separating said compartments, water heating means located between said casings, a gas valve, a water actuated plunger having vertical movement located in the upper compartment, with means for conveying an oscillating movement to said diaphragm by said water actuated plunger, and means for conveying vertical movement to the gas valve from the oscillating movement of the diaphragm.

13. A water heater of the character described, comprising an exterior casing, a water container having two separate compartments located therein, a series of water heating coils, ducts leading from one of such compartments through said coils into the other of such compartments, a combustion chamber within said exterior casing, heating means within said chamber, an inner casing having an upper and a lower compartment, a flexible diaphragm separating such last-named compartments, a gas valve located in such lower compartment, water heating means located between the exterior and inner casing, a water actuated plunger having vertical movement located in the upper compartment, and means for conveying movement to the gas valve through an oscillating movement of said diaphragm, substantially as described.

14. In a water heater of the character described, the combination of an outer and an inner casing, a water container having two separate compartments located therein, outlet ducts leading from one compartment through a series of water heating coils into the other compartment, a combustion chamber between said casings, heating means within said combustion chamber, an upper and a lower compartment in said inner casing, a flexible diaphragm separating said compartments, a gas valve located in said lower compartment, a water actuated plunger having vertical movement located in the upper compartment, with means for conveying movement to the gas valve from said water actuated plunger through an oscillating movement of said diaphragm substantially as described.

15. A water heater of the character described, comprising a water container having a receiving and a discharging reservoir located therein, an inlet duct entering said receiving reservoir a water strainer located in said inlet duct, a plurality of outlet ducts leading from said receiving reservoir comprising a series of water heating coils and entering the discharge reservoir, water heating means adjacent to said water heating coils, heat controlling means, a water operated valve piston, a gas valve and actuating means comprising a flexible diaphragm having protruding fingers placed in operative contact with said water actuated plunger and a gas valve, substantially as described.

16. A water heater comprising water heating means, a plunger operable by movement of the water through said water heating means, fuel supply means for said heating means, and actuating means operatively connecting said plunger to said fuel supply means, said actuating means including a tilting diaphragm and connections between the same and said plunger and said fuel supply means, whereby the last-named means are controlled by movement of said plunger.

17. A water heater comprising water heating means, a water chamber connected thereto, a tilting diaphragm closing the bottom of said chamber, a plunger disposed in said chamber and actuated by the velocity of the water flowing through said chamber, fuel supply means disposed below said chamber, and means connecting said plunger, said diaphragm and said fuel supply means, whereby movement of said plunger tilts said diaphragm and controls said fuel supply.

In testimony whereof I have affixed my signature in presence of two witnesses.

ROBERT F. METCALFE.

Witnesses:

ROBERT L. ROBERTS,

JNO. F. BERKENHAMP.