F. H. WALKER.

AUTOMATIC WATER HEATER.

APPLICATION FILED JAN. 27, 1917.

1,326,237.

Patented Dec. 30, 1919.

Fig. 1

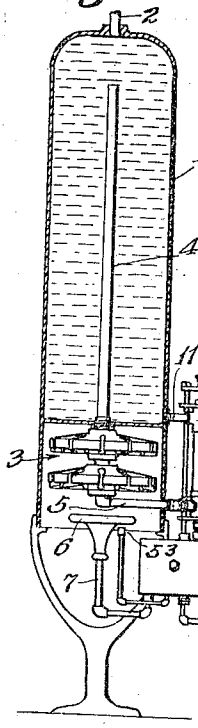


Fig. 2

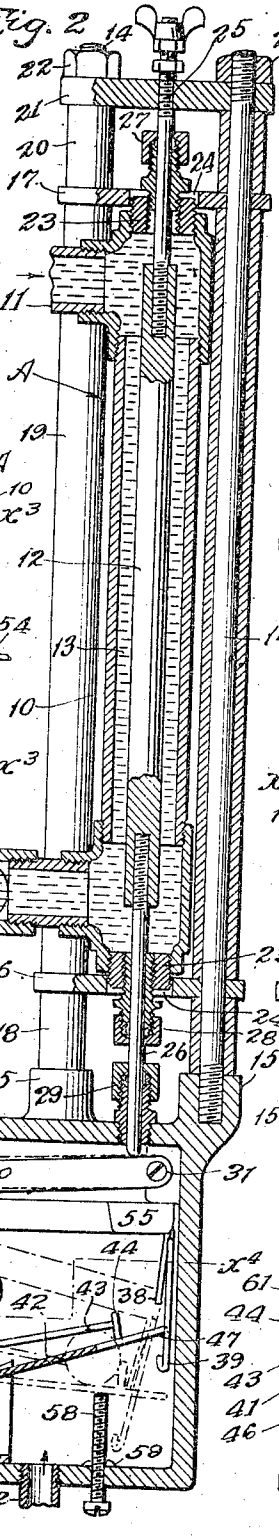


Fig. 3

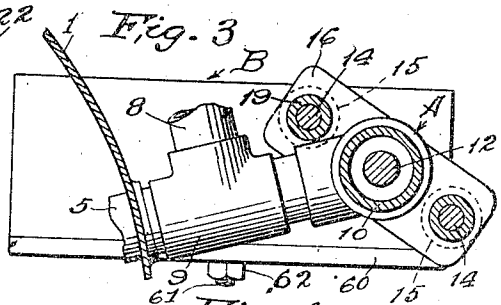


Fig. 4

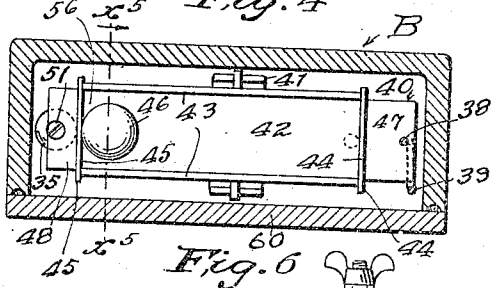


Fig. 6

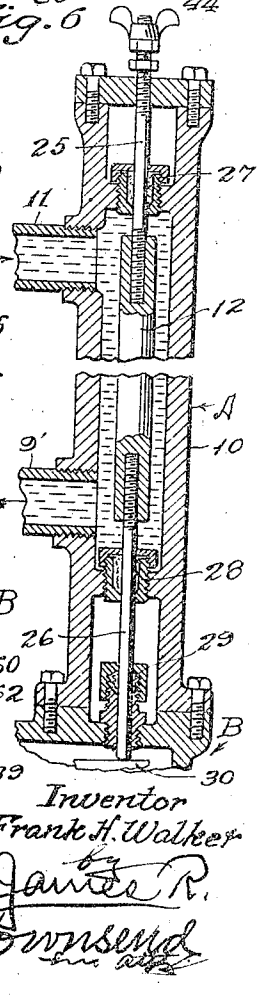
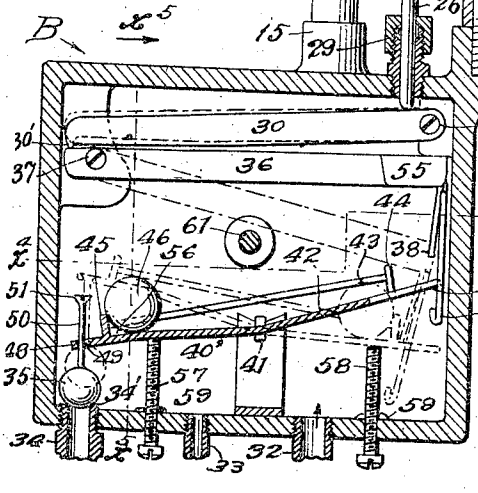


Fig. 5



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UNITED STATES PATENT OFFICE.

FRANK HARVEY WALKER, OF ALHAMBRA, CALIFORNIA.

AUTOMATIC WATER-HEATER.

1,326,237. Specification of Letters Patent. Patented Dec. 30, 1919.

Application filed January 27, 1917. Serial No. 148,902.

To all whom it may concern:

Be it known that I, FRANK HARVEY WALKER, a citizen of the United States, residing at Alhambra, in the county of Los Angeles and State of California, have invented a new and useful Automatic Water-Heater, of which the following is a specification.

This invention relates to a water heater having a valve operated by thermostatic means for automatically controlling the supply of gas to the lighted burner of a range boiler or hot water tank so as to keep the same constantly filled with hot water.

An object of the invention is to provide a thermostatically controlled water heater in which the supply of gas will be turned on full force at the moment it is required, as by the opening of a hot water cock, and to cut off the supply of gas at the moment the demand therefor has ceased, as when such cock is closed; so that when the gas is turned off there will be no following or popping back of the flame from the burner to the burner supplying gas orifice. An object is to conveniently apply to use a thermostatic rod that is extended and contracted by direct contact of the water, the temperature of which is to be controlled by the thermostatic valve action.

A further object is to produce results in an effective and practical manner, by direct application of the rod expansion caused by the hot water, and to avoid the use of springs, and in this relation durability and freedom from getting out of order are further objects.

A further object is to provide apparatus of this character which may be readily applied to range boilers of common construction.

Further objects are compactness, cheapness, simplicity of construction, avoidance of loose parts, easy adjustment to different temperatures with delicacy and positiveness of action combined with certainty of operation.

The invention may be variously constructed and I do not limit the same to specific construction, although the invention includes specific parts and combinations as will more fully appear by reference to the drawings and the subjoined detail description and appended claims.

The principles of my invention may be applied to any circulating boiler set up by placing the thermostat in the circulating line leading the cold water to the heater.

The accompanying drawings illustrate the invention.

Figure 1 is an elevation, partly in section, of an automatic water heater constructed in accordance with this invention.

Fig. 2 is a fragmental axial sectional elevation of part of the water heater shown in Fig. 1.

Fig. 3 is a fragmental plan section on line x^3, Figs. 1 and 2.

Fig. 4 is a plan section on irregular line x^4—x^4, Fig. 2.

Fig. 5 is a fragmental elevation partly in section on line x^5, Fig. 2.

Fig. 6 is a fragmental axial sectional elevation of a form of the invention that is cheaper than that shown in Figs. 1 and 2.

The boiler or tank 1 with hot water outlet pipe 2, heating element 3 with its discharge pipe 4 opening into the boiler, water pressure supply pipe 5, gas burner 6 and gas burner supply pipe 7, may be of any well-known construction. Said discharge pipe 4 terminates in the usual way at the top of the tank 1 from which the hot water pipe 2 leads to faucets not shown. Water is supplied to the heater supply pipe 5 from the service pipe 8 through a connection 9 communicating with the supply pipe 5 and, through nipple 9′, with the lower end of the thermostat water jacket 10, which is shown as a tube extending up above the level of the pipes 5 and 8 and connected at its upper end to the lower end of the tank or boiler by the return circulating pipe 11. The thermostat jacket may be a piece of pipe as in Figs. 1 and 2 and may be supported by the horizontal pipes 5 and 11 that are preferably at about the levels respectively, of the bottom and top of the heating element 3; the pipe 5 being shown below the level of the bottom, and the pipe 11 above the level of the top of such element. These pipes constitute the water line of the thermostat device. In the bore of said jacket 10, a thermostat element, shown as a rod 12 is arranged to be affected by the temperatures of the liquid 13 in the tube and is connected to control the gas supply for the heating element 3.

The automatic moment valve consists of two principal parts which are known, respectively, as the thermostat A and the stationary gas valve-box B.

The thermostat is in the form of a column external to the water tank and consists of two main parts: the water jacket 10 and a controlling element shown as the thermostat rod 12 within same.

The water jacket 10 stands perpendicularly above the valve-box B and is held in proper alinement with said valve-box by two anchor standards 14 firmly screwed into two studs 15 rising from one end of the valve-box B, the two standards holding in proper position lower and upper cradle bars 16, 17 at bottom and top respectively, of the water jacket; the two cradle bars being properly spaced by spacers 18, 19, 20 of tubing that incase the two anchor standards mentioned above and that are surmounted by an anchor plate 21, the whole being kept tight by nuts 22 which screw onto the tops of the two anchor standards and against the anchor bar. The intermediate spacers 19 which separate the cradle bars are of a length that permits a very slight play of the water jacket ends formed by bushings 23 to take care of expansion of said water jacket which the flexibility of pipes 5 and 11 allows. The bushings move freely through holes 24 in the cradle bars 16, 17.

Within the water jacket is the substantially vertical, controlling element 12 made of a metal of high expansibility, for the purpose of controlling the supply of the heat producing medium, as gas, to the heater. At each end of this element are projecting rods 25, 26, which pass through terminal stuffing boxes 27, 28 respectively supported by end bushings 23 of the water jacket 10. The upper rod 25 passes to the anchor bar 21 into which it threads to provide a purchase in fixed relation to the valve box for adjusting the thermostat relative to the mechanism in the valve box. This anchor bar is held firmly in place by the two anchor standards 14 and nuts 22. The lower projecting rod 26 of the controlling element has a free end and passes through the stuffing box 28 at the lower part of the water jacket, and through a stuffing box 29 that is fixed to the valve box, B, and terminates in said valve-box at a point where said rod bears upon a valve closing lever 30, one end of which is pivoted by pivot 31 to the valve-box and the other end of which lever is arranged to transmit force exerted by said rod to operate valve-closing means. Said free end of rod 26 constitutes means operable by expansion and contraction of the thermostat element 12, to actuate snap action means to control the supplying of heat producing medium to the water heating means.

The gas valve-box B in the form shown comprises a small cast metal gas-tight case connected to gas supply pipe 32, pilot light pipe 33 and burner pipe 34 and containing a valve 35 that is adapted to close the outlet seat 34′ and that is controlled by the thermostatically-operated rod 26 through a valve-shifting device comprising the motion increasing upper lever 30 of the third class acting through its knife edge fulcrum 30′ upon a lower motion increasing lever 36, of the first-class, greatly multiplying the action of the thermostat. The lower lever 36 is pivoted to the case by pivot 37 near one end and its end of greater motion has two lugs 38, 39 spaced apart to act with lost motion upon the end of a rocker 40 to rock the same on a central fulcrum 41 upon which the rocker is about or perfectly balanced.

The companion lever lost motion system thus provided by the levers 30, and 36, the lugs 38, 39, and the rocker admits of continued expansion or contraction of the thermostat construction in the water line, to a certain point without moving the rocker.

The rocker constitutes an important element in the snap action device or means of the moment valve, and is provided with a runway having a track or floor 42 bent upward from the fulcrum at a certain angle. Said runway comprises side rails 43 and end stops 44, 45 above the floor and consists of an inclosure in which a steel ball 46 rolls freely from stop to stop according to action of the rocker. The ends of the rocker form projections 47, 48 beyond the ends of the runway.

At the end projection 48 outside of the ball-way is a small hole 49 through which moves freely a stem 50 at the upper end of which is a small head 51 to be engaged by the rocker end when stop 45 is elevated. Below the rocker and at the lower end of the stem 50 is a bronze ball which forms the valve 35 and seats in a brass outlet seat 34′, through which passes gas to the burner through pipe 7, the gas entering the gas valve-box by way of the inlet 32 connected with a service pipe 52 and gas flowing uninterruptedly to the pilot light 53 whenever valve 54 is open. The intermittent mechanical movement for operating the valve 35 is claimed in my co-pending application Serial No. 233,182 filed May 6, 1918.

The operation is as follows: When the water in the tank controlled by the moment valve, and the water in the water jacket of the thermostat is cold, the controlling element in the thermostat is also cold, and hence contracted, thus allowing the long arm of the upper lever 30 to be raised by the weight of the long arm of the lower lever 36, and thus also allowing the long end of the lower lever to be in low position through force of gravity. A small weight 55 attached to the end of the long arm of the lower lever increases the tendency of the lever 36 to reach the position shown in broken lines in Fig. 2. The lugs 38, 39 on the lower lever intermittently and alternately engage the rocker and

cause the rocker to shift position as the lever shifts. When that end of the rocker which carries the valve is high, as shown in broken lines, the stem holding the bronze ball is held in high position, and thus the bronze valve ball is held free from the gas outlet seat, and as a consequence gas is being supplied to the burner and the flame from same ignited by the pilot light heats the water in the tank both by direct contact with the bottom of tank and also by heating the water in the heating elements at the bottom of tank and causing this heated water to rise through the tube 4 and to be discharged inside the tank near the top thereof.

Since the upper part of the water jacket of the thermostat is connected by pipe 11 with the side of the tank near the bottom thereof and the lower part of the water jacket is connected with the heating element 3, from which the tube 4 discharges the hot water into the top of the tank, the hot water displaces the cold water in the tank until the hot water reaches pipe 11.

The cold water in the meanwhile has gradually descended through the water jacket and by the disturbance of equilibrium caused by heating the water in the heating element has become heated by elements 3, and passed as hot water into the top of the tank until the tank and pipe are full of hot water, and the hot water passes into the water jacket and the controlling element 12 in said jacket becomes heated and thereby expands; whereupon, its upper end being anchored and its lower end rod free to travel downward, such lower end rod pressing upon the upper lever in the gas box operates the upper lever to in turn act upon the lower lever and thereby cause its long arm to rise, thereby bringing the lower lug 39 to lift the depressed end of the rocker, which up to this moment has held the free steel ball. Such ball is thus caused to roll to the other end of the way thus tilting the rocker beyond the point to which it would have been tilted by the lug 39. This action is made possible by reason of the lost motion device provided by the widely-spaced lugs 38, 39 above and below the free end of the rocker.

The thermostat has previously been adjusted to a point that will give the desired temperature of water, according to the purposes of the user. When water of this temperature has reached the controlling element in the thermostat and brought it to the predetermined temperature, said element will have expanded to a point where it will affect the two levers so that the bottom one will have raised the right end of rocker to a point high enough to allow the free ball to be moved by gravity, and it will suddenly leave the right end of rocker in Fig. 2 and will travel swiftly toward the center of the rocker. The weight of the free ball being relieved from the right end of rocker, the right end instantly rises still farther, the left end descending, and the free ball rolling on without stop to the left end of the runway drives that end down. During this action of the rocker, which is extremely rapid, the bronze valve ball has been dropped from its suspended position with an action almost instantaneous, to its valve seat, thus shutting off the gas supply to the burner; as a consequence of the operation of the snap action device just described including the ball 46 and the rocker 40, the heating flame instantly ceases, and there is left burning only the small pilot flame which is fed by the small independent tube 33 running from the valve-box.

The moment valve remains shut off until hot water is drawn from the tank which allows in-coming cold water from cold water supply pipe 8 at bottom of thermostat to act upon the controlling element; or, if no water is drawn from the tank the moment valve remains shut off until the water has cooled to a point low enough to contract the controlling element to relieve the pressure of rod 26 on lever 30 whereupon the upper lug 38 depresses the free end of the rocker until the ball rolls back to the stop 44. The weight of the ball 46 is sufficient to cause the rocker to lift the bronze valve ball instantly from its seat and thus the gas in full flow will be fed to the burner which will light up instantly from the pilot flame, and the water in the tank will then be heated to the predetermined temperature as before, when the gas will again be shut off as described above.

The action of the moment valve under the gradual cooling of water may be understood by reference to Fig. 2. The water cooling in the tank and in the water jacket gradually cools the controlling thermostat element 12 and the element contracts, thus moving operating rod 26 upward, relieving pressure on the end of the upper lever in valve-box, and allowing the long arm of lever 30 to rise responsive to action 36 of lower lever, the long arm of which will descend by force of gravity exerted on the weighted end. In descending, the upper lug gradually forces down the right hand end of rocker 40, thus raising the left end of rocker which contains the free ball in a slight pocket 56 made by the slight bending of the rocker near its left end. The purpose of this pocket is to hold the operating ball 46 at the left end until this end has risen to a certain point and the right end descended to a certain point where, when the ball finally rolls out of the pocket, it will roll down the left limb of the rocker with a rush and by momentum be carried up the right limb of the rocker to a point where its weight will be sufficient to depress

the right side to lift the left side of rocker quickly and suddenly unseat the bronze valve ball 35, the free steel ball 46 continuing on the right end of the ball inclosure and the rocker 40 assuming position of right end low and left end high, with bronze valve suspended.

In the construction of the rocker it is bent in the middle at a certain angle and a pocket is formed at the left end by a slight bend so that the action of the ends of the rocker will be as follows during the operation of same: As the left end of rocker rises, the angle of pocket and the middle angle of rocker must have been so formed that the free ball 46 will leave the pocket before left end of rocker rises high enough to engage head of stem attached to bronze valve head 35. This is so that the free ball 46 will leave pocket before valve ball 35 is unseated. At the same time the free ball must leave this pocket and the motion of rocker unseat the valve ball before the right end of rocker has descended to a point at which, when the operation of rocker is reversed and right end is rising, the free ball will have left the right end and, rolling toward the left, have allowed the motion of the rocker to have seated the valve ball. It will be seen that the object of the above is that the sudden action of the rocker (caused by movement of free ball toward the fulcrum) from left to right will begin before the valve ball is unseated, and vice versa, when action of the rocker is from right to left, before the valve ball is seated.

Thus I have produced means including an overbalanced quick-acting thermostatically controlled valve which will turn on the gas full force at one and shut it off the same way, as required to keep the burner from back-firing, and as required to operate the burner at its best, that is under full gas pressure.

Adjustable stops are provided in the form of screws 57, 58 screwed up through the bottom of the valve box B. These are designed to stop the rocker at such inclinations as may be deemed most desirable for perfect operation.

In setting up the heater these screws may be adjusted to the proper height and then a drop of shellac 59 be applied to each screw thus making the valve box gas tight at these points. The removable side 60 of the valve box is secured tightly in place by the stud 61 and nut 62; said stud being screwed into the reinforced opposite side of the valve box.

I claim:

1. The combination with a water line, a heater arranged to heat water in the water line, and means to supply the heater with heat producing medium; of a column outside the water line and connected at one end to said means; a thermostat element in the water within the water line and adapted to expand and contract according to the temperature of the water within the water line; a connection fixed to the thermostat element within the water line and movable relative to the water line, and fixed to the other end of the column outside the water line; snap action means to control the supplying of heat producing medium to the heater; and operative means freely movable with relation to the water line and operable by expansion and contraction of the thermostat element in the water line, and arranged to operate the snap action means to control the supplying of heat producing medium to the heater.

2. The combination with a water line, a heater arranged to heat water in the water line, and means to supply the heater with heat producing medium; of a column outside the water line and connected at one end to said means; a thermostat element in the water within the water line and adapted to expand and contract according to the temperature of the water in the water line; a connection fixed to the thermostat element inside the water line and fixed to the other end of the column outside the water line; means to adjust said connection relative to the water line; snap action means to control the supplying of heat producing medium to the heater; and operative means freely movable with relation to the water line and operable by expansion and contraction of the thermostat element inside the water line, and arranged to operate the snap action means to control the supplying of heat producing medium to the heater.

3. In a water heater the combination with cut-off means, of an oscillating gravity-operated means slidably connected at one end to and above the cut-off means to actuate the cut-off means, lost motion means at the other end of the oscillating means to actuate the oscillating means, thermostatic means comprising a substantially vertical rod secured above the oscillating means, and compound lever means located between the oscillating means and the thermostatic means and actuated by the thermostatic means to actuate the lost motion means.

4. In a circulating water heater construction, a substantially vertical thermostat rod in the line leading from the bottom of the boiler through the heating element, a stationary gas box in the gas line and below the thermostat rod, a gravity valve in the gas box for controlling the flow of gas, a rocker connected at one end to and above the valve for operating the valve, a traveling ball for overbalancing the rocker, and means intermittently connected with the rocker whereby the thermostat rod starts

the ball to over-balance the rocker to open or close the valve instantly.

5. In a water heater, a gas box in the gas line, a single plunger valve construction for controlling the flow of gas, a rocker connected at one end to and above the plunger valve for carrying the plunger, a ball traveling in the rocker from end to end for overbalancing the rocker, a lever combination with lost motion for starting the rocker, and a substantially vertical thermostat rod located in the water line and above the gas box for operating the gas line.

6. In a water heater, a gas box in the gas line, a single plunger valve for controlling the flow of gas, a rocker connected at one end to and above the plunger valve for carrying the plunger, an overbalancing and operating ball carried by the rocker, a compound lever system with lost motion for starting the rocker, and a substantially vertical thermostat rod located in the water line and above the gas box and having a projection at its lower end for operating the lever system.

7. In a gas water heater, the combination with a stationary chamber in the gas supply system, of a substantially vertical thermostat rod located in the water circulating system and secured at its upper end above the gas chamber and having a lower projection extending into the chamber; a valve in the bottom of the chamber; a rocker fulcrumed above the level of the valve and provided with a track bent upwardly from the fulcrum and having end stops; a ball adapted to run on the track; a compound lever construction above the rocker in the gas chamber and adapted to be actuated by contact with the lower projection of the thermostat rod; means slidably connecting the rocker at one of its ends and outside of the stop with the valve; and means intermittently connecting the rocker at its other end and outside of the stop with the compound lever to move the rocker and start the ball for suddenly tilting the rocker before the valve is unseated or seated, and thus quickly opening or closing the valve consequent upon the expansion or contraction of the thermostat rod.

8. In a gas water heater, the combination with a stationary chamber in the gas supply system, of a substantially vertical thermostat rod located in the water circulating system and secured at its upper end above the gas chamber and having a lower projection extending into the chamber; a valve in the bottom of the chamber; a rocker fulcrumed above the level of the valve and provided with a track bent upwardly from the fulcrum and having end stops, the track having a pocket therein at one of the end stops; a ball adapted to run on the track; a compound lever construction above the rocker in the gas chamber and adapted to be actuated by contact with the lower projection of the thermostat rod; means slidably connecting the end of the rocker at the pocket and outside of the stop with the valve; and means intermittently connecting the rocker at its other end and outside of the stop with the compound lever to move the rocker and start the ball for suddenly tilting the rocker before the valve is unseated or seated, and thus quickly opening or closing the valve consequent upon the expansion or contraction of the thermostat rod.

9. In a gas water heater, the combination with a stationary chamber in the gas supply system, of a substantially vertical thermostat rod located in the water circulating system and secured at its upper end above the gas chamber and having a lower projection extending into the chamber; a valve in the bottom of the chamber; a rocker fulcrumed above the level of the valve and provided with a track bent upwardly from the fulcrum and having end stops; a ball adapted to run on the track; a compound lever construction comprising an upper and a lower lever above the rocker in the gas chamber and adapted to be actuated by the upper lever's contact with the lower projection of the thermostat rod; means slidably connecting the rocker at one of its ends and outside of the stop with the valve; and lugs at the end of the long arm of the lower lever, the lugs being adapted intermittently and alternately to engage the rocker at its other end and outside of the stop to move the rocker and start the ball for suddenly tilting the rocker before the valve is unseated or seated, and thus quickly opening or closing the valve consequent upon the expansion or contraction of the thermostat valve.

In testimony whereof, I have hereunto set my hand at Los Angeles, California, this 19th day of January, 1917.

FRANK HARVEY WALKER.

Witness:

JAMES R. TOWNSEND.