March 12, 1929. G. R. O'NEAL 1,704,807

AUTOMATIC WATER HEATER

Filed March 16, 1927 3 Sheets-Sheet 1

Fig. 1.

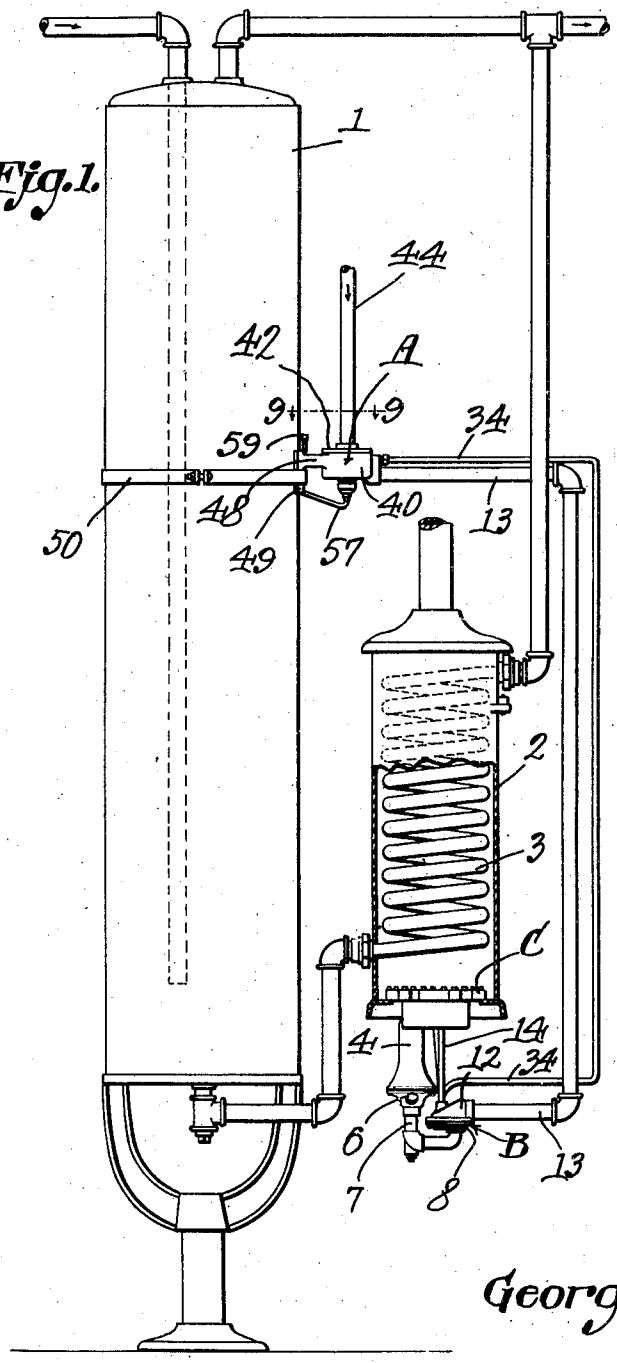


Fig. 7.

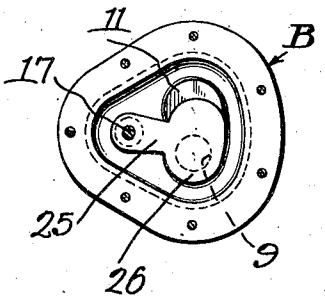
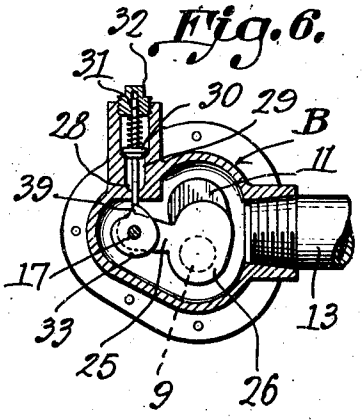


Fig. 6.



George R. O'Neal Inventor

By C. A. Snow & Co.

Attorneys

March 12, 1929. G. R. O'NEAL 1,704,807

AUTOMATIC WATER HEATER

Filed March 16, 1927 3 Sheets-Sheet 2

Fig. 2.

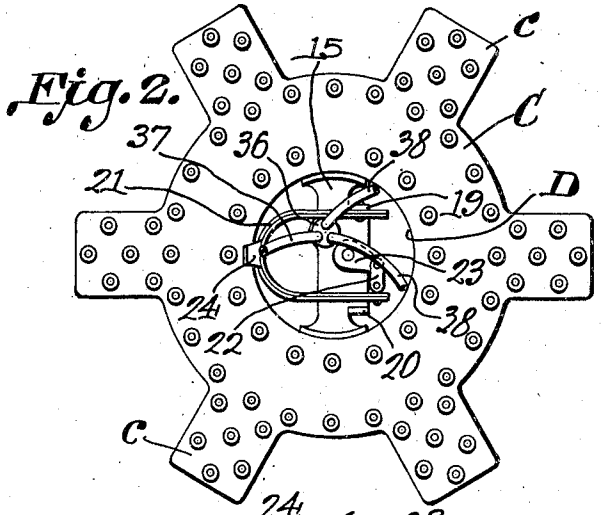


Fig. 5.

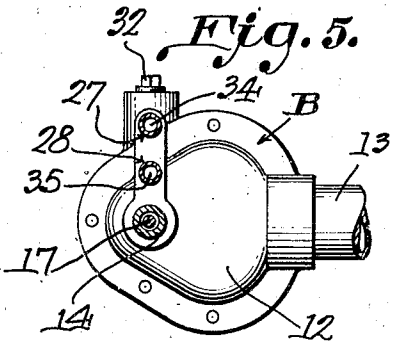


Fig. 3.

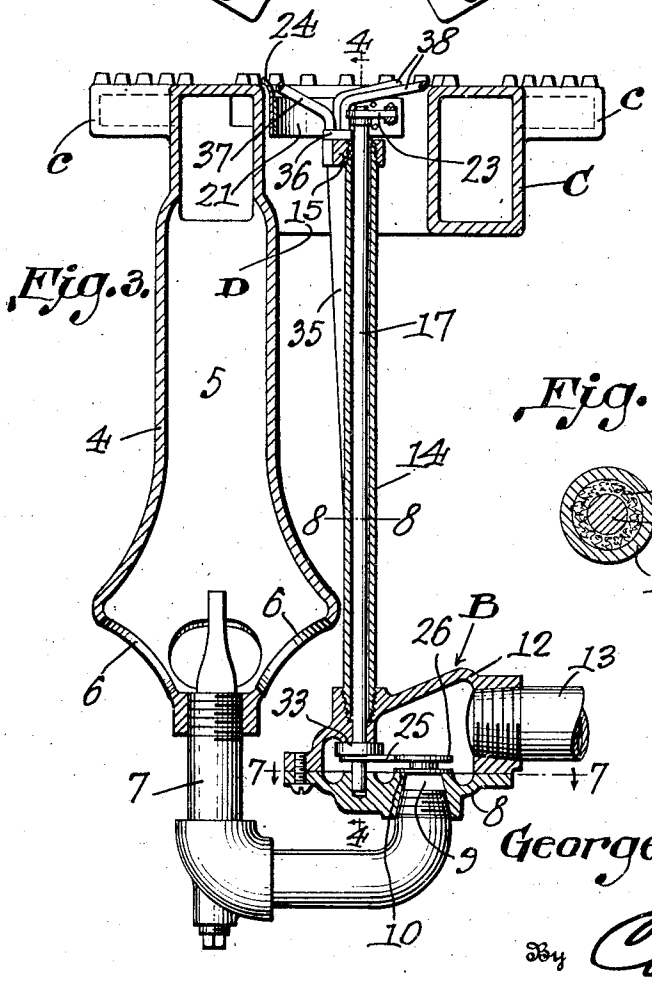


Fig. 4.

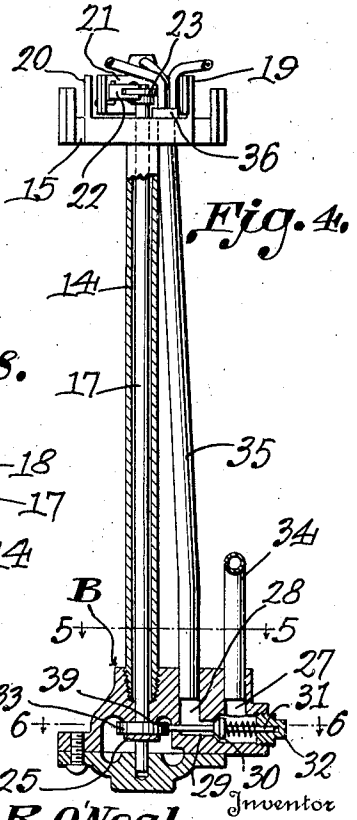


Fig. 8.

Inventor

George R. O'Neal

By C. A. Snow & Co.

Attorneys

March 12, 1929. G. R. O'NEAL 1,704,807

AUTOMATIC WATER HEATER

Filed March 16, 1927 3 Sheets-Sheet 3

Fig. 9.

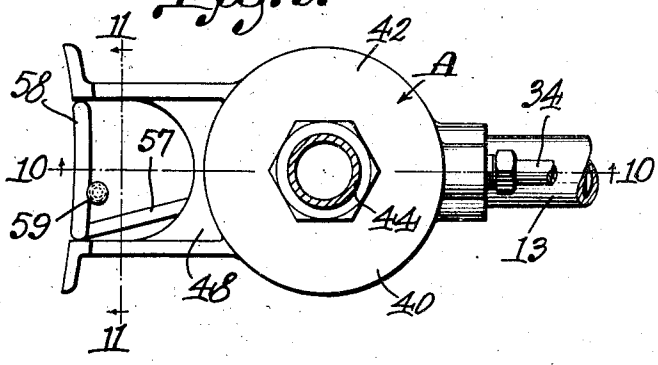


Fig. 11.

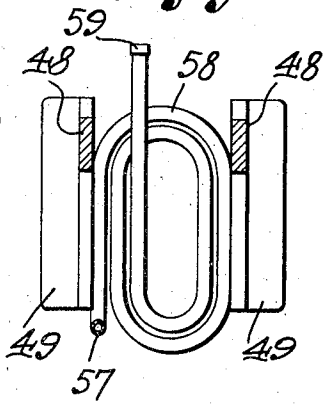


Fig. 10.

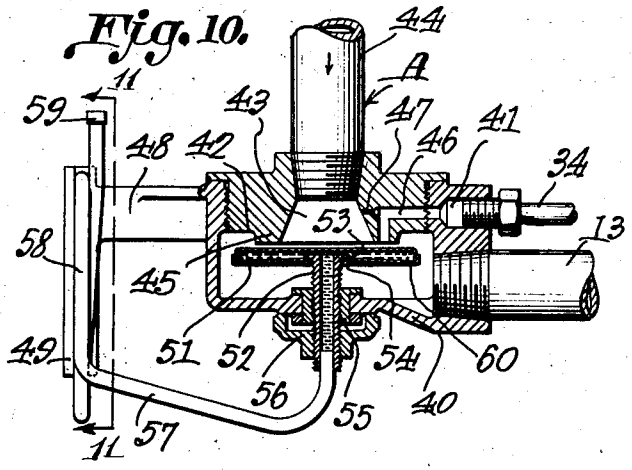


Fig. 12.

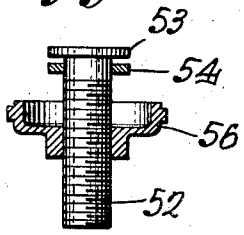


Fig. 14.

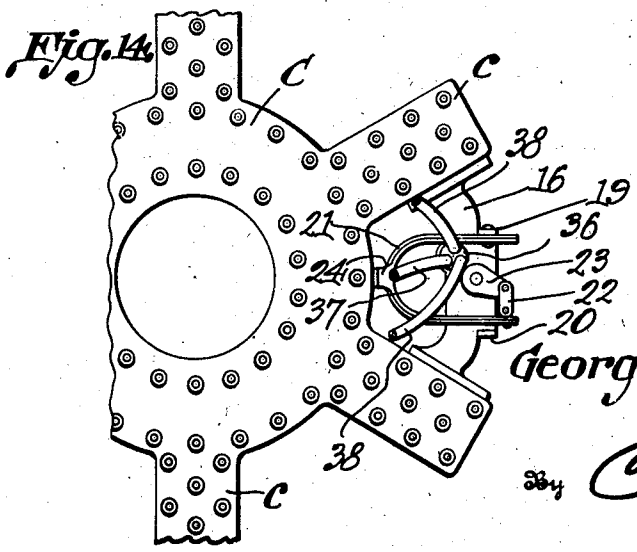
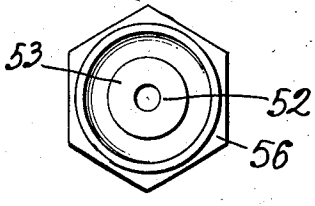


Fig. 13.



George R. O'Neal Inventor

By C. A. Snow & Co.

Attorneys

Patented Mar. 12, 1929. 1,704,807

UNITED STATES PATENT OFFICE.

GEORGE ROBERT O'NEAL, OF WASHINGTON, DISTRICT OF COLUMBIA.

AUTOMATIC WATER HEATER.

Application filed March 16, 1927. Serial No. 175,786.

This invention relates to an automatic water heater, one of the objects being to provide an inexpensive apparatus which can be applied readily to a domestic boiler of the standard type, said apparatus, while in operation, acting to maintain the temperature of the water in said boiler substantially at a predetermined degree.

A further object is to employ a novel arrangement of thermostatic controls for regulating the flow of gas at the pilot and at the main burner, the action of the controlling means being such that, should the pilot flame become extinguished, the flow of gas to the pilot burner would be completely cut-off.

A still further object is to provide control means for use in connection with the pilot which is so sensitive that the mere application of a burning match to the pilot burner will be sufficient to turn on the flow of gas to said burner so that the gas will become ignited by the match.

Another and very important object of the invention is to provide apparatus of this character which can be combined with the ordinary hot water heater of the gas type commonly connected to a domestic boiler so that the same can be changed to an automatic heater.

With the foregoing and other objects in view which will appear as the description proceeds, the invention resides in the combination and arrangement of parts and in the details of construction hereinafter described and claimed, it being understood that changes in the precise embodiment of the invention herein disclosed may be made within the scope of what is claimed, without departing from the spirit of the invention.

In the accompanying drawings the preferred forms of the invention have been shown.

In said drawings,

Figure 1 is a view partly in elevation and partly in section of a domestic boiler and a standard type of gas heater combined therewith, the same being equipped with the apparatus constituting the present invention and which renders the heater automatic in operation.

Figure 2 is a plan view of the burner forming a part of the apparatus.

Figure 3 is a section through the burner and through the pilot controlled thermostat and parts associated therewith.

Figure 4 is a section on line 4—4, Figure 3.

Figure 5 is a section on line 5—5, Figure 4.

Figure 6 is a section on line 6—6, Figure 4.

Figure 7 is a section on line 7—7, Figure 3.

Figure 8 is an enlarged section on line 8—8, Figure 3 showing the use of a packing around the cam operating shaft.

Figure 9 is a plan view of the master controlling mechanism adapted to be mounted on the boiler, said figure being more especially an enlarged section on line 9—9, Figure 1.

Figure 10 is a section on line 10—10, Figure 9, the mercury containing tube of the thermostat being shown in elevation.

Figure 11 is a section on line 11—11, Figure 10.

Figure 12 is a view partly in section and partly in elevation of the means employed for adjustably connecting the expansible valve forming a part of the master control.

Figure 13 is a plan view of the structure shown in Figure 12.

Figure 14 is a plan view of a part of the gas burner showing the pilot and its thermostat located between two of the arms of the burner.

Referring to the figures by characters of reference 1 designates a domestic boiler or tank such as commonly used in domestic water heating systems. A water heater in the form of a casing 2 with a water conducting coil 3 therein, is assembled with the tank or boiler in the usual way.

The apparatus constituting the present invention is adapted to be assembled with the tank or boiler and the heater and includes, in addition to the burner, a master controlling valve indicated generally at A and a thermostat controlled pilot valve indicated generally at B. The burner C which can be of the ring type having radial arms *c* is supported by a tubular standard 4 providing a mixing chamber 5, this standard being enlarged near its lower end to provide air inlet ports 6. A gas supply pipe 7 opens into the bottom of the standard and connects with the bottom plate 8 of the casing of valve B, there being a port 9 in the bottom of said casing opening into the pipe 7. The

port 9 is surrounded by a flat valve seat 10 flush with a flat valve support 11 formed on the plate 8.

A cap 12 constitutes the upper section of the casing of valve B and opening into this cap is a gas feed pipe 13, constituting the main source of gas supply to the valve B.

Engaging and upstanding from cap 12 is a tubular standard 14 the upper end of which is connected to a cross head 15 which, in the structure illustrated in Figures 2 and 3, is extended across the central opening or air passage D in the burner C, although it is to be understood that, if preferred, a similar cross head 16 can be mounted between two of the arms of the burner as shown in Figure 14.

A shaft 17 is journaled in the tubular standard 14 and, if desired and as shown in Figure 8, a suitable packing 18 of cotton or the like can be interposed between this shaft and the standard so as to seal the structure against leakage of gas along the shaft.

Upstanding from the cross head 15 are spaced ears 19 and 20 and to the ear 19 is secured one end of a laminated thermostat 21 preferably bent to U-shape, the other end of the thermostat being normally spaced inwardly from the ear 20 as shown particularly in Figure 2. This thermostat is formed of metals having different coefficients of expansion so positioned relative to each other that, when heated, the movable end of the thermostat will move toward the fixed end. The movable end of the thermostat is connected by a link 22 to a crank arm 23 secured to and movable with the upper end of the shaft 17.

The thermostat 21 is located within the air passage D slightly below the top of the burner C and extending from the middle portion of the thermostat is a tongue 24 which slightly laps the upper surface of the burner C. This tongue constitutes means for conducting heat to the thermostat as hereinafter explained.

The lower end of the shaft 17 is journaled in the bottom plate 8 of the casing of valve B and secured to this shaft is a radial arm 25 provided, at its free end, with a flat valve 26 one end portion of which normally rests upon the seat 10 so as to close port 9 while the other end portion constantly rests on the support 11. When the valve is moved from its normal or closed position it will pass partly or entirely from the port 9 so as to place said port in communication with the pipe 13, the valve at this time resting snugly on its support 11.

Formed within the cap 12 are spaced ports 27 and 28 having a connecting passage 29 adapted to be closed by a spring pressed valve 30. One end of the stem 31 of this valve is slidably mounted in a screw plug 32 closing the outer end of the passage 29 while the other end of the stem 31 extends through the inner end wall of passage 29 and bears against a cam 33 secured to and rotatable with shaft 17. A gas supply pipe 34 opens into the port 27 while a gas distributing pipe 35 extends from the port 28 and opens into a cap or head 36 at the upper end thereof. From this cap or head 36 are extended small tubular burners 37 and 38, the burner 37 having its outlet end close to the tongue 24 while the burners 38 are extended to points remote from the burner 37 but close to the top surface of the burner C. These burners 37 and 38 are at such angles that when a jet of flame is projected from each of them it will extend along an inclined line above but close to the top of the burner C, the jet from the burner 37 flowing against and past the tongue 24. Ordinarily, however, when only a small flame is provided at the outer ends of the burners 37 and 38, the flame from the burner 37 will just touch tongue 24 so that the thermostat will be mildly heated by conduction from the tongue and thus maintained in the normal working position illustrated in Figures 2 and 3.

The cam 33 carried by shaft 17 is provided with a marginal peak or nose 39 one side of which merges gradually into the concentric peripheral portion of the cam while the other side of the peak or nose is inclined abruptly relative to the margin of the cam. When the thermostat 21 is in its normal or intermediate position the cam 33 is held thereby with the outermost portion of peak 39 thereof in contact with valve stem 31 so that valve 30 is thus held unseated against the action of its spring. Consequently gas entering the port 27 is normally free to flow past the valve 30 to the port 28 and thence through the pipe 35 and cap 36 to the pilot burners 37 and 38. The orifices in these burners are so small that very little gas will be consumed under normal conditions. As before explained, however, the gas burning at the end of the burner 37 will be sufficient to mildly heat the thermostat 21 so as to maintain it in its normal intermediate or working position. Likewise, under normal conditions the cut-off valve 26 will be mounted on the seat 10 so that gas cannot flow to the burner standard 4.

For the purpose of controlling the supply of gas to the valve B there is provided the master valve structure indicated generally at A, this structure including a hollow base member 40 to which is connected one end of the pipe 13. One end of the pipe 34 is also connected to this member 40, said pipe 34 opening into a port 41 extending through the wall of the member. The top of the casing of the master valve can be in the form of a screw plug 42 provided with a port 43 into which opens the main supply pipe 44 for directing gas into the apparatus. The

inner end of the port 43 is surrounded by a seat 45. Another port 46 opens through the seat 45 and communicates with the port 41 while a by-pass 47 provides a direct connection between the ports 43 and 46. This by-pass is quite small so that only enough gas can flow therethrough to maintain very small flames at the ends of the pilot burners 37 and 38. The casing of the master valve A has a bracket 48 which can be integral therewith and can include spaced arms adapted to bear against the tank or boiler 1, these arms being provided with depending portions 49. These depending portions can be clamped firmly to the tank or boiler 1 by an adjustable band 50 or the like. Thus the structure can be easily applied to a tank or boiler already in use.

The master valve per se is in the form of a hollow disk indicated at 51, this disk being formed of relatively thin metal and being supported close to the seat 45. The valve is of sufficient area to simultaneously close both ports 43 and 46 and to simultaneously open them. Seated in the center portion of the bottom of the hollow disk is a threaded tubular stem 52 having an annular flange 53 at one end adapted to lap the bottom of the valve disk and to be held firmly in engagement therewith by a retaining ring or washer 54 shrunk onto the stem or fixedly connected thereto in any other preferred manner. The stem is supported by a threaded bushing 55 mounted in the bottom member of the valve casing and by rotating the stem within this bushing the valve can be adjusted toward or from the seat 45. A lock nut 56 can be mounted on the lower or projecting end of the stem 52, this nut being so shaped as to bridge the end of the bushing 55 and frictionally engage the bottom of the valve casing. Thus it will be seem that the valve can be readily adjusted and fastened.

Opening into the bottom of the stem 52 is one end of a tube 57, the other end portion of this tube being bent to provide a coil between the sides of the bracket 48 and where the coil can directly contact with the surface of the tank or boiler 1. This coil has been indicated at 58 and the free end thereof is closed by a cap 59 as shown. The disk 57, stem 52 and all portions of the tube 57 are filled with mercury indicated generally at 60. The amount of mercury used will be such that when it is expanded by heat conducted thereto from the wall of the tank or boiler 1 through the wall of the coil 58, the upper portion of the disk 51 will be caused to snap upwardly against the valve seat 45 to close the ports 43 and 46. This is the normal position of the valve when the water contained within the tank is at or above a predetermined temperature. Consequently at his time the only gas that can flow past the master valve will be that escaping through the by-pass 37 to pipe 34 and thence past valve 30 to pipe 35 and the pilot burners.

Should the temperature of the water fall below a predetermined degree the contracting mercury will cause the top surface of the disk 31 to abruptly snap downwardly away from the seat 45, thereby permitting gas to flow from port 43 to the pipe 13 and at the same time open port 46 and allow an increased amount of gas to flow into the pipe 34. This will result in the projection of strong flames from the pilot burners with the result that the tongue 24 will be subjected to greater heat and the thermostat 21 will be caused to contract. Consequently shaft 17 will be rotated to swing valve 26 away from the port 9, thereby opening communication between pipe 13 and the port 9 so that the gas will flow into the mixing chamber 5 and thence to the main burner from which it will issue and be ignited by the pilots. During this actuation of valve 26 the peak 39 of the cam 33 will move away from the valve stem 31 so that valve 30 will be seated gradually but not until the flame at the main burner has been produced. During the operation of the burner cold air will flow through the passage D, this air tending to prevent the thermostat 21 from becoming overheated. After the temperature of the water in the tank has been raised above a predetermined degree, the expanded mercury will cause the top surface of the master valve 51 to snap against seat 45, thereby cutting off the supply of gas to the main burner and reducing the pressure of gas to the pilot burners. The thermostat 21 being thus subjected to the reduced heat given off by the very small flame from the burner 37 will partly expand until it reaches its normal working position, this action moving valve 26 onto the seat 10 so as to close port 9 and at the same time return the peak 39 of the cam 33 so as to open valve 30. It is to be understood of course that the opening of this valve takes place immediately prior to the closing of port 9 so that gas will become ignited at the pilot burners before the flame is extinguished at the main burner. Under some conditions it might be found desirable to leave the valve 30 open during the operation of the main burner, this being made possible by increasing the movement of the valve 30 necessary to bring it to its seat from the position shown, for example, in Figure 6.

The operation of the mercury controlled master valve will be fully understood by any one acquainted with the art, it is believed. One surface of the valve is slightly buckled. Thus when a suction is set up by contraction of the mercury the valve will be snapped away from its seat whereas when

expansion of the mercury is produced the valve will be snapped outwardly against the seat. By using a valve of this construction the gas is turned off and on with an abrupt motion which is very desirable.

Should the pilot flame from the burner 37 be extinguished from any cause while the main burner is not use, the mechanism constituting this invention will act automatically to shut off the supply of gas to the pilot burners. As before explained the normal working position of the thermostat 21 is maintained by the mild heat conducted to the thermostat from the small flame at the burner 37. Should this flame be extinguished the thermostat would be relieved of the mild heat and would expand or open out so that the free end of the thermostat would move toward the stop ear 20 and pull through the link 22 upon the arm 23. This would result in the movement of the peak 39 of cam 33 to the right in Figure 6 with the result that the end of valve stem 31 would travel along the abruptly inclined side of the peak and allow the valve 30 to move to its seat. There would be a slight movement of the valve 26 but this would not open the port 9 as will be obvious. With valve 30 seated, the gas is cut off from all of the burners. Should it then be desired to re-light the pilot it becomes necessary merely to hold a burning match against the tongue 24. This will restore the thermostat 21 to its normal working condition with the result that the cam 33 will be turned back to the position shown in Figure 6 thereby opening the valve 30 and allowing gas to issue from the pilot burner where it will be ignited. Thereafter the apparatus will work as heretofore explained.

Attention is called to the fact that the apparatus constituting this invention can be combined readily with a standard water tank and gas heater, it merely being necessary to attach the casing of the master valve to the tank, substitute the burner C for the ordinary burner, and make the necessary pipe connections. It is also desirable when installing this burner in connection with standard equipment, to cover the tank with suitable insulating material without, however, interposing this insulating between the tank and the mercury coil.

Another important feature of this invention resides in the fact that the amount of hot water to be stored normally in the tank can be controlled by the location of the master valve. The hot water in the tank rises. Therefore by placing the master valve near the top the mercury column of the mercurial thermostat will be expanded when a comparatively small volume of water is heated to a predetermined temperature. However by placing the master valve nearer the bottom of the tank the mercurial thermostat will not be actuated except by variations in temperature at said lower point.

Although mercury has been mentioned for use in the thermostat of the master valve it is to be understood that any other suitable material or combinations of materials can be used in addition thereto or in lieu thereof.

What is claimed is:

1. In an automatic burner attachment for use with a water storage tank, a gas heater including a main burner and a pilot burner, means for supplying gas to the burners, separate valves for controlling the flow of gas to the main and pilot burners respectively, a thermostat normally heated by a low pressure flame from the pilot burner, means operatively connected to the thermostat for maintaining the pilot valve normally open and the valve of the main burner normally closed, said thermostat being shiftable when subjected to a high pressure flame from the pilot burner to open the valve of the main burner, a master valve for controlling the gas flow, said valve being normally closed, a by-pass for maintaining a continuous low pressure supply of gas to the pilot burner while the master valve is closed, and a thermostat controlled by the heat of the contents of the tank for actuating the master valve to unseat and to seat the same, said master valve when unseated constituting means for admitting gas under high pressure to the pilot and main burner controlling valves.

2. In an automatic burner attachment for use with a water storage tank, a gas heater including a main burner and a pilot burner, means for supplying gas to the burners, separate valves for controlling the flow of gas to the main and pilot burners, the pilot burner valve being normally open and the main burner valve being normally closed, a thermostat normally heated by a low pressure flame at the pilot burner to maintain said valves in normal positions, valve actuating means operatively connected to the thermostat, said thermostat when subjected to the heat of a high pressure flame from the pilot burner, being shiftable from normal position to open the controlling valve of the main burner and, when deprived of the heat of the pilot burner, being shiftable to close the valve of the pilot burner, and thermostatically controlled means for attachment to the tank for increasing and reducing the gas pressure to the pilot burner and for controlling the flow of gas to the valve of the main burner.

3. An automatic burner attachment for use with a water storage tank and a gas heater, including a main burner and a pilot burner, a thermostat carried by the main burner normally heated by a flame from the pilot burner to maintain the thermostat in an intermediate position, a valve casing hav-

ing a gas inlet, means for conducting gas from said casing to the main and pilot burners respectively, a valve for controlling the flow of gas to the pilot burner, a shaft mounted for rotation, means operated by the thermostat for rotating the shaft, a valve movable with the shaft for controlling the flow of gas to the main burner, said valve being normally closed, a cam rotatable with the shaft and maintaining the pilot valve normally open, said thermostat when heated by a high pressure flame from the pilot, being shiftable to open the valve controlling the main burner and, when deprived of the heat of the pilot burner being shiftable from intermediate position to maintain the valve of the main burner in closed position and to permit closing of the pilot valve, a master valve shiftable to open and to closed positions by variations in the temperature of the contents of the tank, said master valve when closed, maintaining a constant low pressure of gas to the pilot burner and shutting off the supply of gas to the valve of the main burner but, when open, supplying gas at a high pressure to the pilot burner and turning on the flow of gas to the valve of the main burner.

4. In an automoatic water heater a main burner, a pilot burner adjacent thereto, a thermostat adapted to be shifted by variations in the heat from the pilot burner, a valve casing communicating with the main burner, a valve therein for controlling the flow of gas to the main burner, an operative connection between said valve and the thermostat, means for supplying gas to the casing, a cam movable with the valve means for supplying gas to the pilot burner, a valve controlled by the cam for regulating the flow of gas to the pilot burner, and a thermostatically controlled master valve for varying the gas pressure to the pilot burner and controlling the flow of gas to the valve casing, variations in the gas pressure to the pilot burner producing variations in heat.

5. In an automatic water heater a main burner and a pilot burner, a thermostat controlled by the pilot burner, a shaft operatively connected to the thermostat, a cam rotatable with the shaft having an abruptly inclined surface and a gradually inclined surface, said surfaces cooperating to provide a peak, means for supplying gas to the pilot burner, and a spring controlled valve for controlling the flow of gas to the pilot burner, said valve having a stem engaging and actuated by the cam, the peak of said cam being positioned, when the thermostat is in intermediate position, to hold the valve entirely open, movement of the cam resulting from actuation of the thermostat when deprived of heat resulting in release of the valve stem by the movement of the abruptly inclined surface of the peak into the path of the stem thereby to close the valve, the movement of the thermostat under increased heat operating to bring the gradually inclined surface of the peak into the path of the valve stem thereby to partly or entirely close the valve, and means operated by the thermostat during the gradual closing of said valve for placing the main burner in communication with a gas supply.

6. In an automatic water heater the combination with a valve casing having a seat, of a tubular stem adjustable longitudinally relative to the seat, an expansible and contractable hollow disk valve including a buckled seat engaging surface, said valve being supported by and adjustable with the stem, and a thermostat communicating with the stem and the interior of the valve and operating to snap said buckled surface inwardly and outwardly to contract and expand the valve and to move the valve away from and into contact with the seat.

7. In an automatic water heater the combination with a structure having a valve seat, of an expansible and contractible hollow valve adjustably supported within said structure and a thermostat communicating with the interior of the valve and operating to contract and expand the same and to move a surface of the valve into and out of contact with the seat.

In testimony that I claim the foregoing as my own, I have hereto affixed my signature.

GEORGE ROBERT O'NEAL.