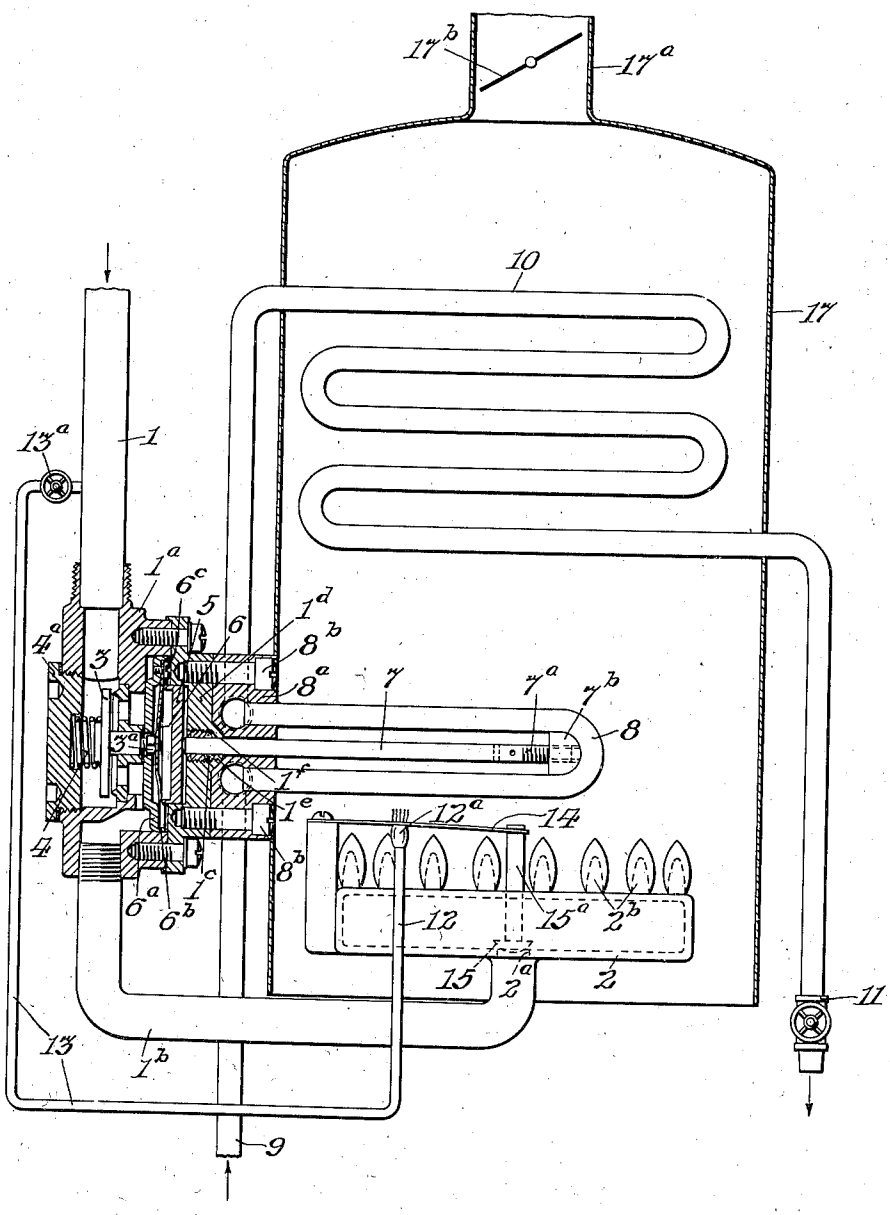
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FLOW CONTROLLED WATER HEATER

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FLOW CONTROLLED WATER HEATER

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My invention is applicable to control a main burner which is part of a water heater, by location of a thermostatic couple in such position that it is directly heated by the products of combustion from the burner. One member of that couple is a tube of copper or other metal having a high coefficient of expansion and which is a conduit through which the water flows to a main heating coil in the heater. It is characteristic of my invention that operation of the burner is controlled by the flow of water through that thermostatic tube. The flow of cold water through said thermostatic tube contracts the latter and causes the main burner to operate. The heating effect of the burner is stopped when the water in said thermostatic tube is heated to a predetermined temperature by said burner.

In the form of my invention chosen for illustration, said thermostatic tube is U-shaped and has both of its ends rigidly connected with the casing of a valve which is mounted exterior to the heater casing and controls the flow of fluid to said burner. The other member of the thermostatic couple is a rod which is substantially invariable in length under the temperatures to which it is subjected, but is rigidly connected at one end with the bight of said tubular member of the couple and has its other end arranged to reciprocate in said valve casing in operative relation with said valve, which is continually stressed toward its closed position by a spring in said casing, but arranged to be opened by the thrust of said rod when the tubular member of the thermostatic couple is contracted by the flow of cold water therethrough at a predetermined temperature lower than that at which the valve is permitted to be automatically closed by its spring. Said thermostatic couple is so positioned in the heater casing that it is continually subjected to the heat from the burner when the latter is ignited, so that when water is not flowing through the tubular thermostatic member, it is expanded by the heat from the burner so as to permit the valve to remain closed by its spring.

In the form of my invention chosen for illustration, I have found it convenient to provide a pilot burner in lighting relation to the main burner in the heater so that a small flame may be continually afforded at the pilot burner to light the main burner when said valve is opened by the aforesaid operation of the thermostatic couple. Moreover, I find it convenient to associate with said burners in position to be heated by either, a thermostatic element, conveniently a bi-metal strip in operative relation with an auxiliary valve controlling the supply of fluid fuel to the main burner, at the burner, so that while either burner is lit, said strip is expanded by heat and thereby flexed to open the auxiliary valve but, when the burner flames are extinguished that strip contracts and closes said auxiliary valve.

My invention includes the various novel features of construction and arrangement hereinafter more definitely specified.

The drawing is a fragmentary vertical sectional view of a water heater casing and its appurtenances showing, somewhat diagrammatically, a convenient embodiment of my invention.

In the drawing; gas or other fluid is supplied through the conduit 1, the valve casing 1a, and conduit 1b to the main burner 2 under control of the thermostatic valve 3 which is continually pressed by the spring 4 toward its closed position. Said valve is arranged to be opened by thrust of the disk 5, left, against the snap spring 6 which is operatively connected with the valve 3 by the adjustable screw 3a. Such thrust is effected by the thermostatic couple member 7 which is substantially invariable in length under the temperatures to which it is subjected and mounted to reciprocate toward and away from said valve casing 1a. Said rod is screw threaded at its end 7a, for adjustment in the nut 7b which is fixed in the bight of the U-shaped expansion tube 8 forming the other member of the thermostatic couple and which is expansible and contractible in accordance with variations in the temperatures to which the couple is subjected.

The ends of said expansion tube 8 are rigidly mounted in the fitting 8a which is detachably rigidly connected with said valve casing 1a by any convenient means. The cold water supply conduit 9 is in communication with one end of said expansion tube 8 through said fitting 8a. The other end of said expansion tube 8 is in communication with the heating coil 10 through said fitting 8a and leads to means for dispensing hot water exemplified by the spigot 11.

The pilot burner 12 is supplied with the fluid fuel through the conduit 13 which is conveniently branched from the main supply conduit 1 and controlled by the manually operative valve 13a. When the fuel from the pilot burner 12 is lighted, its flame 12a is in heating relation with the bi-metal thermostatic element 14 which is operatively connected by the stem 15a with the valve 15 controlling the inlet port 2a in the main burner 2. When thus heated, the unequal expansion of the bi-metal components of the ther-

mostatic strip 14 flexes it to lift and open the valve 15 as shown, and it is maintained open as long as said element 14 is subjected to either the heat from the pilot burner flame 12a or the heat from the flames 2b of the jets of the main burner 2. Said burners 2 and 12, tube 8, and the heating coil 10, are preferably inclosed by the heater casing 17, leaving the valve casing 1a exterior thereto. The products of combustion from said burners, thus directed in maximum heating relation with said expansion tube 8 and coil 10, may be directed from said casing through the flue 17a under control of the damper valve 17b and said flue is preferably connected to a suitable chimney vent.

Said snap spring 6 is formed of initially plane sheet metal which is pressed to concavo-convex form and normally set with its convex surface toward the thermostatic couple. Its perimeter is fixed in the circular frame 6a, within the annular rim 6b on said frame, which is removably positioned in the valve casing 1a as shown. Said snap spring is so formed that it continually tends to return to its initial position and is only displaced to the opposite convexity shown when under pressure of the disk 5 when the latter is thrust to the left by the thermostatic couple member 7 as above described. I prefer to make that snap spring assembly as described and claimed in my co-pending application Serial No. 232,136 filed September 28, 1938, for Letters Patent of the United States for Improvement in thermostatic controls. Said application has matured into Patent #2,215,384, dated Sept. 17, 1940. As thus made, the spring has three radial arms disposed in symmetrical relation with the axis of the saucer shaped frame 6a and the end of each of said arms is rigidly connected with said frame by respective screws 6c. After the spring 6 is thus secured in its frame 6a the annular rim 6b is slightly distorted, by being bent inwardly at the ends of two of said arms, whereby the spring 6 is subjected to compression edgewise toward its axial region and convexed outwardly from said frame toward the right as shown, with its axis in slightly eccentric relation to said frame. Said spring 6 is thus arranged to snap alternately, in opposite directions, transversely to its plane, in accordance with the pressure to which it is subjected on its side thus convexed. The spring 4 continually stressing said valve 3 toward said snap spring 6 facilitates the snap action of said spring to its initially convexed position, when relieved of the pressure of the thermostatic member 7. However, any other suitable form of snap spring which is capable of the desired reversal under the described conditions of pressure upon the right hand face thereof shown may be employed.

The differential temperatures at which said valve 3 may be opened and closed may be variably predetermined by the position to which the thermostatic rod 7 is axially adjusted by rotation of its screw threaded end 7a in the nut 7b. The extent to which the valve 2 is opened by the thermostatic couple is also variably determinable by the position to which the set screw 3a is axially adjusted by its rotation in the stem of the valve 3.

I find it convenient to provide the valve casing 1a with the removable screw plug 4a as an abutment for the spring 4 and to provide the opposite side of said valve casing 1a with the removable cover plate 1d, containing the stuffing box 1c and to provide said cover plate with the truncated conical projection 1e in coaxial relation with the bearing 1f for the rod 7 to facilitate the precise location of the fluid conduit fitting 8a, and to rigidly connect said fitting with said cover plate by two screws 8b, as shown in the drawing. However, other suitable means may be employed to support the thermostatic couple in cooperative relation with the valve controlling the supply of fuel to the burner 2.

Therefore, I do not desire to limit myself to the precise details of construction, arrangement, or method of operation herein set forth, as it is obvious that various modifications may be made therein without departing from the essential features of my invention as defined in the appended claims.

I claim:

1. In a water heater controlled by the flow of water from it; the combination with a fluid fuel burner; of a valve casing; a fuel supply conduit, leading to the burner through the casing; a valve in the casing, controlling that conduit; a spring continually stressing the valve toward its closed position; a thermostatic couple including a rod member substantially invariable in axial length by the temperatures to which the couple is subjected and mounted to reciprocate axially toward and away from the valve, respectively to open the valve and permit it to be closed by its spring, and having a screw thread at its end remote from the valve; a nut engaging that thread; a water conducting expansion tube, bent to U-shape, forming the other member of the couple, and longitudinally expansible and contractible by the temperatures to which it is subjected, and having both of its end regions extending parallel with the rod, from a bight region between those ends which is rigidly fixed to the nut; means securing both ends of the expansion tube in rigid relation with the casing, with that tube in position to be expanded by heat from the burner; a water supply conduit leading to one end of the expansion tube; a water discharge outlet leading from the other end of the expansion tube; and means for controlling the flow of water from the heater, through the expansion tube; whereby, differential temperatures at which the valve is respectively opened and permitted to close, may be variably determined by turning the rod in the nut, and the fuel valve is opened at the lower temperature, by contraction of the expansion tube, by cool water therein, and consequent thrust of the rod toward the valve, and closed at the higher temperature, by its spring, when the rod is withdrawn from the valve by expansion of the expansion tube, by heat from the burner.

2. In a water heater controlled by the flow of water from it; the combination with a fluid fuel burner; of a valve casing; a fuel supply conduit, leading to the burner through the casing; a valve in the casing, controlling that conduit; a spring continually stressing the valve toward its closed position; a thermostatic couple including a rod member substantially invariable in axial length by the temperatures to which the couple is subjected and mounted to reciprocate axially toward and away from the valve, respectively to open the valve and permit it to be closed by its spring, and having a screw thread at its end remote from the valve; a nut engaging that thread; a water conducting expansion tube, bent to U-shape, forming the other member of the couple, and longitudinally expansible and contractible by the temperatures to which it is subjected, and having both of its end regions extending parallel with the rod, from a bight region between those

ends which is rigidly fixed to the nut; means securing both ends of the expansion tube in rigid relation with the casing, with that tube in position to be expanded by heat from the burner; a water supply conduit leading to one end of the expansion tube; a water discharge outlet leading from the other end of the expansion tube; and means for controlling the flow of water from the heater, through the expansion tube; a water receiving element connected with said outlet and in position to be heated by the burner; whereby, differential temperatures at which the valve is respectively opened and permitted to close, may be variably determined by turning the rod in the nut, and the fuel valve is opened at the lower temperature, by contraction of the expansion tube, by cool water therein, and consequent thrust of the rod toward the valve, and closed at the higher temperature, by its spring, when the rod is withdrawn from the valve by expansion of the expansion tube, by heat from the burner.

HARRY W. WILKINSON.