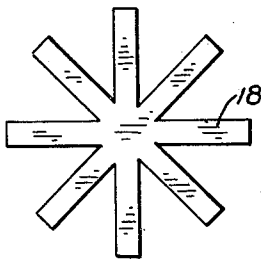
Aug. 7, 1945. O. W. HAHN 2,381,215

BURNER CONTROL APPARATUS

Filed Jan. 12, 1942

Fig. 4.



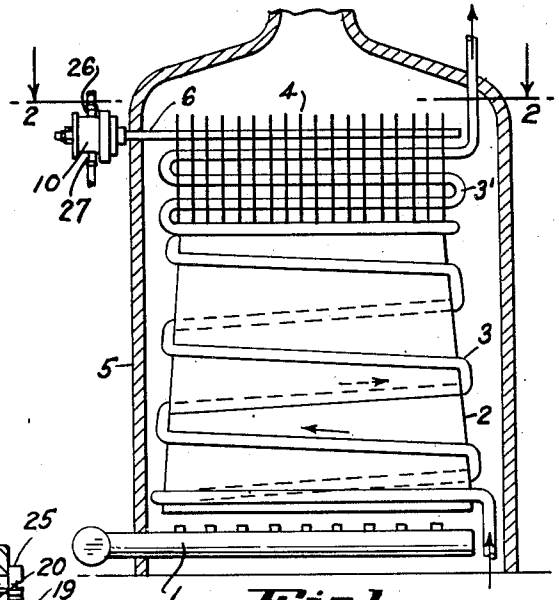


Fig. 1.

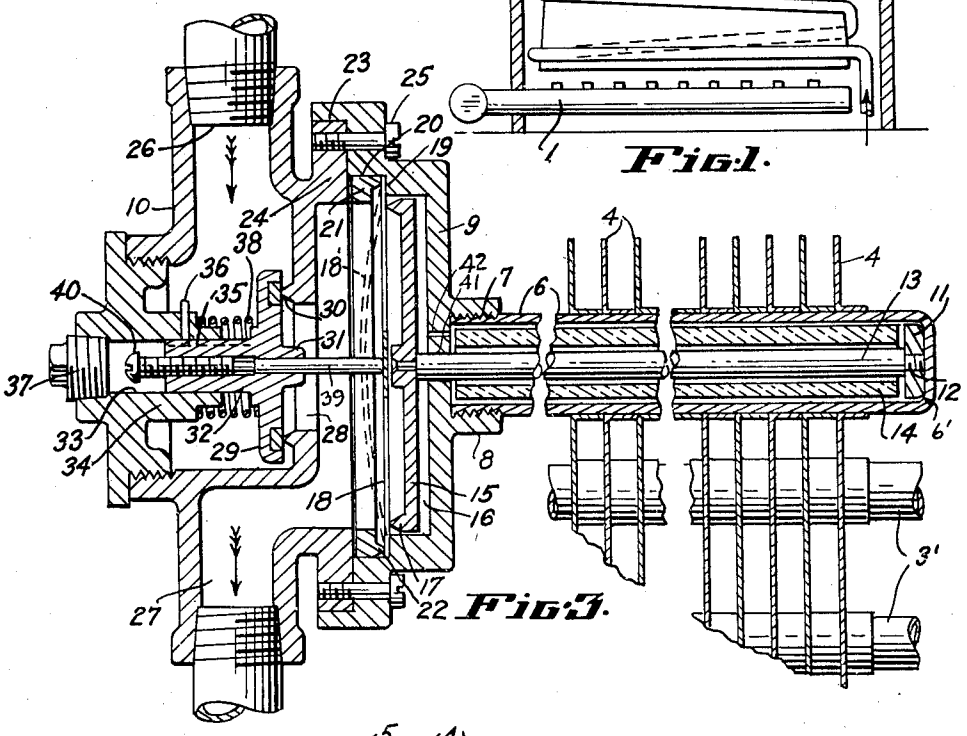


Fig. 3.

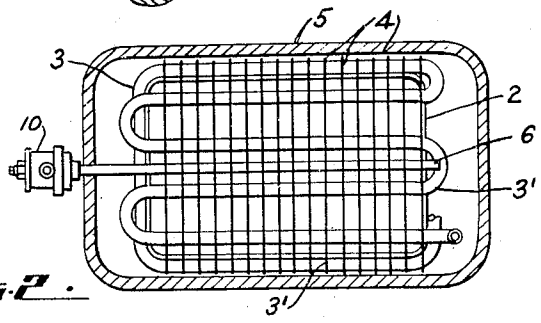


Fig. 2.

INVENTOR.
OTTO W. HAHN
BY
ATTORNEY.

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BURNER CONTROL APPARATUS

Otto W. Hahn, San Francisco, Calif., assignor to Industrial Research Laboratories, Ltd., San Francisco, Calif., a corporation of Nevada

Application January 12, 1942, Serial No. 426,410

4 Claims. (Cl. 236—33)

This invention relates to burner control apparatus of the type employing a thermostat in connection with pipe coils in which a fluid is heated, such for instance as gas water heaters, and the objects of the invention are to provide improvements in such apparatus which will greatly reduce the cost of construction and be more efficient and quicker in response to heat variations and prevent injurious overheating of the coils.

Other features and advantages of the invention will appear in the following description and accompanying drawing.

In the drawing

Fig. 1 is an elevation of a typical installation showing my improved control apparatus built in a pipe coil type gas water heater.

Fig. 2 is a plan of the top of the heater of Fig. 1, as seen from the line 2—2 thereof.

Fig. 3 is an enlarged longitudinal cross section of the thermostat valve and adjacent parts.

Fig. 4 is a front view of the star leverage disk.

Before describing the drawing in detail, it may be said that the present thermostatic apparatus is designed principally for use in connection with pipe heating coils, some of which are provided with heat receiving fins immersed in the hot gases above a heating burner or fire box of any type.

In the showing of the drawing (Fig. 1), the heating equipment includes a gas burner 1, a heat transmitting shell 2, above and embracing the burner, a tube or pipe coil 3 wrapped about the shell in good thermal contact therewith, and with the upper coils 3' passing directly over the upper end of the shell through a series of heat transmitting sheet metal fins 4 which are thereby suspended in the ascending hot gaseous products of combustion, and conduct the heat directly to the pipe coils and to the water or steam therein to be heated. Spaced outside of the pipe coils is an outer casing shell as indicated at 5.

The gas water heater shown is of well known construction and is only to illustrate the application of my invention, as it may take the form of any heater having any number of pipe coils or fluid carrying heating tubes arranged in any manner providing that some of them are equipped with fins immersed in the heating zone. In the heater illustrated, the flow of water in the coils is from the bottom of the coil upward, as denoted by the arrows, and the flow is controlled in any of the well known ways, not shown, as not being involved in the present invention.

Broadly, my invention comprises mounting an expansible thermostat directly through and in thermal contact with the fins and thereby making the heat changes in these fins the principal factor in operating the thermostat, and by it the fuel control valve supplying the burner.

Specifically, the thermostat and its valve embraces special construction to effectively carry out the invention, and details of my preferred construction are shown in Figs. 3 and 4.

In Fig. 2 the thermostatic element is indicated generally as a long pipe or tube 6 tightly embraced by the heater pipe fins 4 directly through which it passes. These fins are preferably of copper, as also is the tube 6, and they are preferably formed with flanges around the holes through which the tube 6 passes so as to form a tight thermal fit thereagainst, and may be brazed in place for better heat transfer, and of course the same fins extend to similarly embrace one or several of the heating coil tubes, or pipes 3' as indicated.

Tube 6 is secured at its inner end as by welding or threading as at 7 to the hub 8 of one portion 9 of a valve body 10, and at its outer end it is closed as by a common pipe cap screwed over it, or by drawing or welding the copper tube together as indicated at 6' in Fig. 3, and thickened inside as by a button 11 of metal welded in place and having a threaded hole 12 in its center, and into which hole is screwed the outer end of a metal rod 13 of less expansibility than the copper tube 6, preferably a metal of the nature of Invar, so that when heated the copper tube will elongate considerably, relative to the rod.

This rod 13 is spaced within the tube 6 and may have a loose filling of asbestos or a loose sleeve of asbestos 14 around it to further reduce the heat transferred to it from the tube when heated, although this feature may be dispensed with.

The inner end of the rod 13 is freely slidably supported at 41 in hub 8 and is preferably of reduced diameter at its extreme end secured to (or loosely positioned in), a hole formed centrally in the hub of a pressure disk 15 freely mounted in a chamber 16 in valve member 9. Disk 15 is formed at its outer margin with an annular V-shaped rim 17 projecting from its side remote from the thermostatic elements, and the substantially sharp edge of rim 17 bears against the outer side of a spring sheet metal spider 18 which spreads out in front of disk 15, and is supported at the outer ends of its arms on a shoulder 19 formed at the bottom of a counter-bore 20 in member 9, and within which counter-bore is a

ring 21 formed at its outer margin with a V-shaped rim 22 bearing against the inner side of the spider 18 along a circular line outward from the circular line of contact of the rim 17 of disk 15 at the opposite side of the spider. Ring 20 is touching but not tightly clamped against the spider 18.

The spring sheet metal spider may have any number of arms, and the form of the arms may be varied, but a spider of about 8 arms as shown in Fig. 4 has been found satisfactory.

Valve body member 9 is recessed as at 23 to receive the flange 24 of the main portion 10 of the valve body, and secured thereto as by screws 25. Body member 9 is provided with threaded inlet and outlet ports 26 and 27, and a valve passage 28 adapted to connect the two ports when not closed off by a valve disk 29 which closes on a seat 30 surrounding passage 28.

Valve disk 29 is formed with hubs on both sides 31, 32, with the latter being elongated and slidably supported in a bore 33 formed in a closure bonnet 34 screwed into the valve body member 10 as indicated. Hub 32 is formed with a groove 35 along one side into which the end of a pin 36 projects so that the hub cannot be revolved in the bore, although it is free to slide longitudinally. Bore 33 extends clear through the bonnet 34, and is closed by a threaded plug 37.

Valve disk 29 is urged toward its seat by a coiled compression spring 38, and its hub is drilled centrally, and slidably positioned in the hole is a rod 39 bearing at its outer end against the inner side of spider 18, and impinged at its inner end by a screw 40 threaded into the inner end of hub 32. Screw 40 is preferably a snug fit so that it will stay in adjusted position, and it is accessible with a screwdriver when plug 37 is removed. Screw 40 and rod 39 may be one piece if desired, as rod 39 only acts as an extension of the screw, and forms as it were, an extensible valve stem along which the position of the valve disk can be adjusted by turning the screw.

The valve disk shown seated in Fig. 3 presumes the thermostatic elements 6 to be over-heated and longitudinally expanded, for when cooler or cold it will shorten so as to urge the less expansible and cooler rod 13, and its disk 15, toward the spider 18 and arch it inwardly as indicated by the dotted line 18', and thereby hold the valve open. The degree of opening of the valve when the apparatus is cold, or rather the degree of heat which will be required to permit the valve disk to close when the thermostatic element is too hot, is determined by the position of the valve disk along the stem 39 as set by the adjustment of the screw.

In such apparatus wherein a linear expansible element is used mechanically, it generally operates directly on the valve stem, and therefore produces very little motion unless the element is extremely long, but by the use of the spring spider, the arms provide a radially arranged group of motion amplifying levers fulcrumed at their outer ends under annular rim 22, and with the operating force applied by annular rim 17 a very short distance from the fulcrum point, so that a slight linear motion or relative motion of rod 13 at once produces a greatly amplified motion of the valve and thus effects immediate and direct large main fuel valve control from minute temperature changes in the thermostatic element without the use of mechanical or electrical relays or pilot valves, although it is manifest that if desired the device may be made very small and with a small flow through its valve used to control a larger, or pilot valve, in the well known way. In the showing of the drawing, valve 29 may be directly on the gas or other fluid fuel passage for the burner. A vent 42 preferably connects the thermostat tube space to the valve space.

In considering the construction described, it will be seen to operate quite differently either from such a linear expanding thermostat placed within the hot water pipe or space of a water heater, for such thermostats would not quickly respond to an absence of water in the pipe until the pipe was overheated and destroyed, whereas with the present construction, the fins being in thermal contact with the water pipes or tubes correctly represent the temperature of the pipes as well as the relative temperature of the water in them under normal conditions of water heater operation, if however, the supply of water should cease and hot water were drawn off to leave the pipes empty, or partially, or steam were formed, so their temperature would rise very quickly and likewise that of the fins, the expansible thermostatic element 6 being directly connected to the fins would operate to at once shut off or turn down the burner flame, and vice versa, and therefore provides a much more sensitive apparatus yet of sufficient power to directly operate the fuel valve for the burner. In the drawing Fig. 2 shows for clarity the thermostat tube 6 as located between two runs of the water pipe 3', but is preferably close to and directly above one run of the water pipe so as to respond as quickly as possible to its varying temperature. While the drawing illustrates one way of carrying out the invention, it will be evident to anyone skilled in the art that changes in detail may readily be made without departing from the mode of operation above set out.

I therefore claim:

1. In a burner control apparatus for a fluid heater, a fuel burner arranged to create a heating zone passing upwardly above the burner, a heating tube through which the fluid passes positioned in said heating zone and provided with a plurality of spaced heat conducting sheet metal fins directly embracing and projecting therefrom, fuel feed controlling means for said burner comprising a thermostat arranged adjacent said heating tube also in thermal contact with a plurality of said sheet metal fins, and means operated by said thermostat operating said fuel feed controlling means, said heating tube extending transversely or crosswise of and within said heating zone, and said thermostat being substantially spaced from and above said tube.

2. In a burner control apparatus for a combustible fluid fired water heater, a fuel burner arranged to create a heating zone passing upwardly above the burner, a water heating tube through which the water passes provided with a plurality of spaced heat conducting sheet metal fins directly embracing and projecting therefrom arranged in the path of the hot gasous products of combustion of said heating zone, and fuel feed controlling means for said burner comprising a thermostat extending adjacent said water heating tube and also in thermal contact with a plurality of said sheet metal fins, and means operated by said thermostat operating said fuel feed controlling means, said heating tube extending transversely or crosswise of an within said heating zone, and said thermostat being substantially spaced from and above said tube.

3. In a burner control apparatus for a fluid heater, a fuel burner arranged to create a heating zone passing upwardly above the burner, a plu-

rality of parallel runs of spaced heating tubes through which the fluid to be heated passes positioned in said heating zone, a plurality of spaced sheet metal heat conducting fins extending transversely of and directly embracing said tubes and through which fins all of said tubes extend in thermal contact therewith, and fuel feed controlling means for said burner comprising a thermostat provided with a main heat expansible element in the form of an elongated linearly expansible tube extending transversely through snugly fitting openings in and in thermal contact with a plurality of said fins adjacent one of said heating tubes, and means operated by said thermostat operating said fuel feed controlling means, said heating tubes extending transversely or crosswise of and within said heating zone, and said thermostat being substantially spaced from and above said heating tubes.

4. In a burner control aparatus for a liquid heater, a fuel burner arranged to create a heating zone passing upwardly above the burner, a liquid circulating heating pipe positioned in said heating zone provided with a plurality of spaced sheet metal heat conducting fins extending transversely of and directly embracing the pipe for conducting heat thereto, a thermostatically operated valve for controlling fuel feed to the burner of the heater comprising an elongated thermostat made of two cooperative dissimilarly expansible members passing through aligned openings in a plurality of said sheet metal fins adjacent said pipe and with its most expansible element in direct thermal contact therewith, said heating pipe extending transversely or crosswise of and within said heating zone, and said thermostat being substantially spaced from and above said heating pipe.

OTTO W. HAHN.