Aug. 20, 1935. J. J. JORGENSEN 2,011,899

THERMOSTATIC CONTROL FOR FUEL BURNERS

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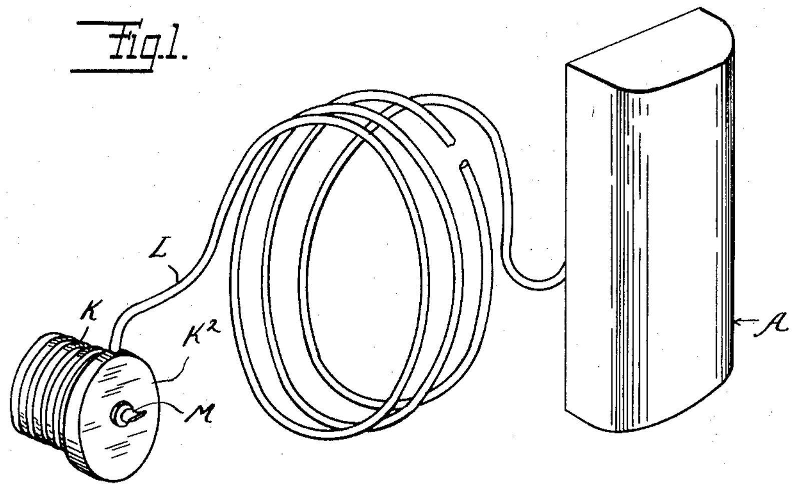
Fig. 1.



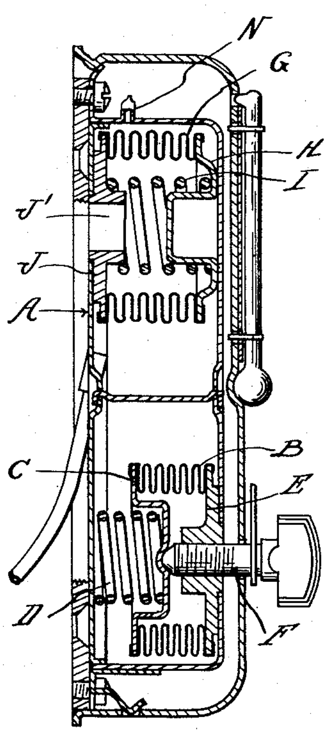


Fig. 2.

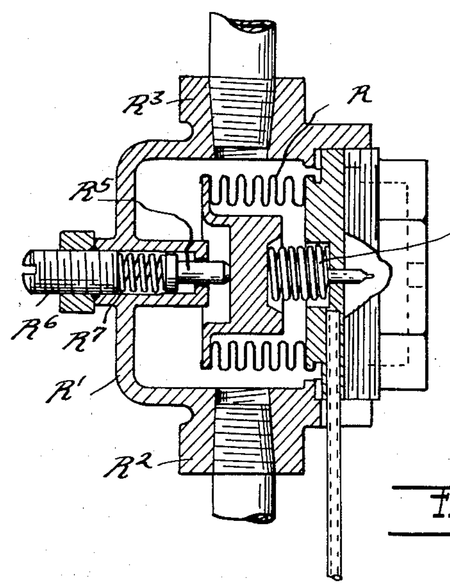


Fig. 6.

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THERMOSTATIC CONTROL FOR FUEL BURNERS

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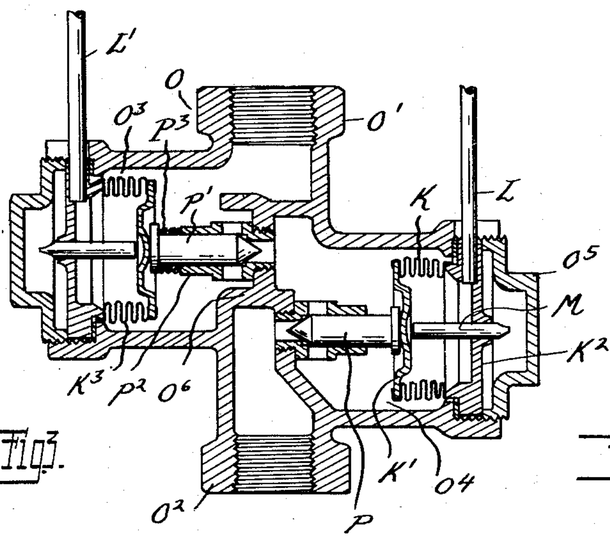


Fig.3.

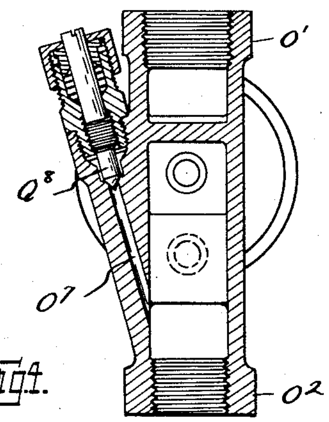


Fig.4.

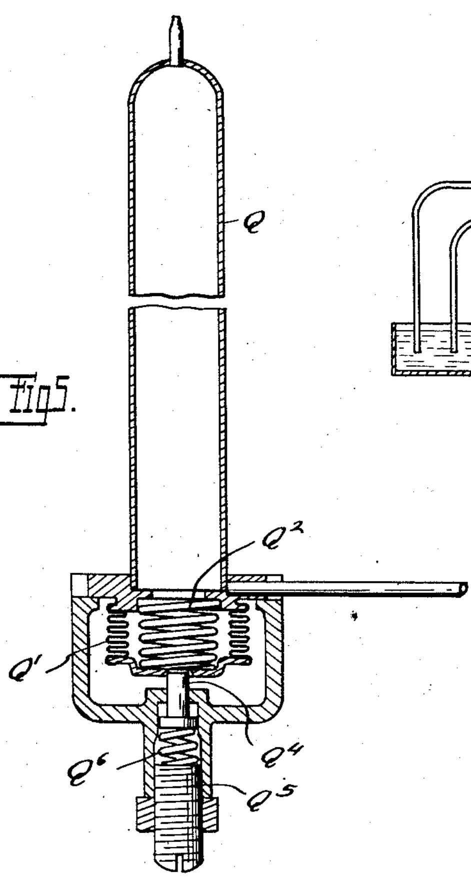
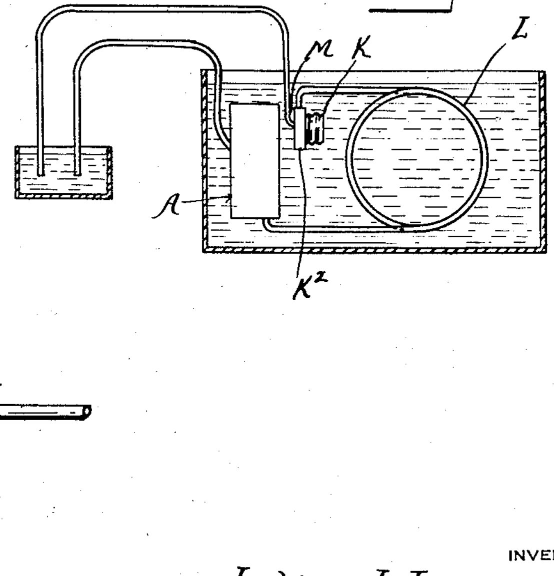


Fig.5.

Fig.7.



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THERMOSTATIC CONTROL FOR FUEL BURNERS

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Application November 27, 1931, Serial No. 577,616

7 Claims. (Cl. 297—5)

The invention relates to thermostatic control devices and has for its object the obtaining of a construction which is particularly adapted for use in effecting a variable control throughout a predetermined range of temperature changes. For instance, automatically controlled fuel burners are of two general types. In the one, the operation is intermittent, but during the operating period the burner is supplied with a full amount of fuel. With the other type, the supply of fuel is varied during continuous operation in accordance with the demand. My improved construction is particularly designed for use in controlling the latter type of fuel burners and for other uses of a similar character, and to this end the invention consists in the construction and method of forming the same as hereinafter set forth.

In the drawings:

Figure 1 is a perspective view of the thermostatic control unit prior to installation;

Figure 2 is a vertical central cross section through the container for the expansible fluid;

Figure 3 is a central section through the control valve;

Figure 4 is a transverse section thereof;

Figure 5 is a section through a container used in connection with the hot air furnace;

Figure 6 is a section through a unit used in connection with a steam plant and Figure 7 is a diagram illustrating the method of filling an adjusting unit.

Generally described, my improved control unit comprises a container for an expansible fluid which is located at the point of temperature control, a small flexible tube connected to this container and an expansible chamber connected to the opposite end of said conduit. It is one of the objects of the invention to obtain a construction of standard unit which is adapted for installation in any place where such control is desired. For instance in a private residence the fuel burner is usually placed in the basement while the point of temperature control is some place in the rooms above, which in different houses may vary in distance from the burner. I have therefore devised a construction provided with a standard length of conduit sufficient for most installations and where the distance is less than the length of the conduit, a portion of the latter may remain coiled.

The container, conduit and expansion chamber are filled with a suitable expansible fluid, such for instance as ethyl alcohol and after preliminary operations which insure the elimination of all air or gas from these parts, they are hermetically sealed. The tube or conduit used is one having a very small internal diameter and the volume in the expansion chamber is also relatively small so that the volume of the container is large relative thereto. This to a very great extent eliminates any fluctuations in volume due to different temperatures in the conduit or expansion chamber, so that the device will respond only to temperature variations in the fluid at point of control.

In detail, A is the container, preferably formed of pressed sheet metal with all joints soldered or otherwise hermetically sealed. Within the container is arranged a collapsible chamber B, preferably of the metallic bellows type. One end of this chamber is provided with a head C recessed to receive a spring D, the opposite end of which abuts against a wall of the container. At the opposite end of the collapsible chamber is a head E having a threaded aperture therein for receiving an adjusting screw F which bears against the head C. Thus by adjusting the screw F the chamber B can be expanded or contracted to alter the volume of the surrounding chamber within the container A. A second collapsible bellows G is arranged at another point within the container A, this being provided with a head H embossed to engage a spring I arranged within the chamber and tending to normally expand the same. The head J at the opposite end of the chamber is soldered or otherwise sealed to the wall of the container A and an aperture J′ through this head vents the interior of the chamber to the external atmosphere. Thus under normal conditions the chamber G is of fixed volume but in case of an abnormal pressure on the fluid surrounding this chamber and within the container A, the chamber G can collapse against the tension of the spring I, thereby relieving pressure.

The expansible chamber K is also preferably formed of a metallic bellows having at opposite ends thereof the heads K′, K^2. The head K^2 has connected thereto the conduit L preferably formed of copper tubing of very small internal diameter. This tubing is of some standard length, such for instance as fifty feet, and the opposite end is connected into the rear wall of the container A so as to establish communication between the interior of this container and the expansible chamber K.

To fill the parts with the fluid, the chamber K is provided with a tube M extending thereinto through the head K^2 and the container A is provided with a similar tube N. The parts may then be filled with alcohol by immersing one of these tubes in the supply of this fluid and applying a suction pump to the other tube. This filling operation may, however, not completely eliminate all air and I therefore heat the parts to a temperature above the boiling point of the fluid so as to vaporize the same, driving out all liquid and leaving only the vapor. This may be accomplished by immersing the parts with the exception of the tubes M and N in boiling water, the temperature of which is considerably above the boiling point of alcohol. During this process the ends of the tubes M and N are immersed beneath the surface of the volume of alcohol which condenses the vapor as it is driven out from the chamber and the tube. The device is then permitted to cool while the tubes are still immersed in the volume of alcohol so that upon condensation of the vapor within the chambers of the tubes they will be re-filled with the liquid alcohol. The apparatus is then heated, by for example immersing the parts in a fluid, to some standard temperature below the boiling point of the alcohol such for instance as 90° F. and after sufficient interval for temperature equalization the tubes M and N are cut off and the stub ends hermetically sealed by soldering.

During the process of manufacture as above described, the tube L is coiled to be confined within a small space as indicated in Figure 1. When the apparatus is to be installed the container A is mounted at the desired point for temperature control, the tube L is uncoiled and together with the expansible chamber K is strung preferably within the wall of the building to extend to the point of fuel control.

The fuel valve may be of any suitable construction but as shown in Figure 3 it is adapted for a double control, first, by room temperature, and second, by furnace conditions. It comprises a fitting O having the aligned nipples O′, O^2 for connecting into the fuel supply line. On opposite sides of the fitting O are the chambers O^3 and O^4 each adapted to receive a collapsible chamber such as K which is secured and sealed therein by a cap O^5. Within the fitting are partitions O^6 which are arranged to divide the same into three chambers with connected ports therebetween. The chamber O^3 which is connected to the nipple O′ is connected by a port, controlled by a valve P′, with the chamber O^4 and the latter chamber is connected by a port, controlled by the valve P, with the nipple O^2. The valves P and P′ are of any suitable construction but as shown are of the needle type slidably engaging a surrounding ported casing P^2 and actuated by a spring P^3 in the direction to open the port. The outer ends of the valves abut against the expansible chamber K and the construction is such that when said chamber is expanded by fluid passing thereinto from the conduit L, the valve will be closed while the contraction of said chamber will permit the valve under the actuation of the spring P^3 to open to vary the port area. Thus the amount of fuel passing between the nipples O′, O^2 is determined jointly by the valves P and P′ either one of which can variably restrict the passage between the nipple O′ and the nipple O^2.

As previously stated, the expansible chamber K is connected through the tube L to the container A which is located at the point of temperature control so that expansion or contraction of the fluid in said chamber under varying temperatures will correspondingly close or open the valve P. Thus the amount of fuel which can pass from the nipple O′ to the nipple O^2 is primarily dependent upon the position of the valve P. On the other hand, the valve P′ is actuated by a collapsible chamber K^3 similar to the chamber K which is connected by a conduit L′ to a container which is under direct influence of heat from the furnace. Where the control is applied to a warm air furnace a container such as Q is arranged in any suitable position to receive heat from the heated air so that increase in temperature thereof will expand the fluid and effect a closing movement of the valve P′ while a decrease in temperature will produce a corresponding contraction of the fluid resulting in the opening of the valve P′. Thus independent of the control by room temperature, the fuel burner will be controlled by the temperature of the hot air delivered from the furnace.

Where the heating plant is steam the conduit L′ is connected to a collapsible chamber R arranged within a chambered fitting R′ having nipples R^2 and R^3, one being connected to a steam line and the other to a gauge. The collapsible chamber R is preferably of the bellows type and is normally expanded by a spring R^4 of predetermined tension. When, however, the steam pressure within the chambered fitting R′ rises, it will overcome the tension of the spring R^4 contracting the chamber R and expelling fluid into the chamber K^3 which will move the valve P′ towards closed position. The device may be set to operate under any pressure conditions desired by means of an adjustable stop R^5 which may be shifted in position by an adjusting screw R^6 operable from outside the fitting. A spring R^7 arranged between the screw R^6 and stop R^5 cooperates with a spring R^4 in securing the desired balance of tension.

Where the burner is applied to a hot water heating plant, a construction similar to that described for the hot air plant may be used comprising essentially a container such as Q which is placed in heat conducting relation to the hot water conduit. With both of these constructions provision is made for adjustment and setting comprising a bellows Q′ normally expanded by a spring Q^2 and held from expansion by a stop Q^4 adjusted by a screw Q^5 with an intervening spring Q^6. These various control devices are all similar in construction in that they include a container for fluid exposed to variable temperature conditions, an expansible chamber in operative relation to the fuel control valve and a standard length of conduit of small capacity connecting the container and expansible chamber. Also the same method of filling and adjusting is used in the manufacture of each of these devices.

From the description given, the operation of the device will be obvious, but briefly is as follows. The apparatus having been installed is first adjusted by the turning of the screws F or Q^5 so as to respond to variations of temperature within predetermined limits to produce a corresponding opening or closing movement of the valves P and P′. When properly adjusted any rise in temperature at the point of control will cause a progressive restriction in the fuel passage from the nipple O′ to the nipple O^2 which in turn will progressively decrease the flame of the burner. On the other hand, if there is a fall in temperature at the point of control this will produce a progressive opening of the valve which will correspondingly increase the flame at the burner. Thus instead of operating solely by on or off intermittent action, the furnace will have a progressive increase or decrease in heat production which results in a much more uniform temperature at the point of control. However, the apparatus may be used in connection with the on or off intermittent type of operation and still have the advantage of a gradual change between certain limits below which the burner will be turned off by any suitable control means.

To avoid the necessity of extreme accuracy in construction and adjustment, the valve O is preferably provided with a by-pass for the passage of a minimum amount of fuel between the nipples O′ and O^2. This as shown in figure consists of a by-pass O^7 variably restricted by a needle valve O^8 which may be operated from outside the casing O.

What I claim as my invention is:

1. In a thermostatic unit for controlling heating apparatus, a container for an expansible fluid, an expansible bellows within a portion of said container, a spring engaging said bellows to contract the same, a screw operable from outside the container for adjusting said bellows to vary the fluid capacity of said container, a second bellows within a portion of said container internally connected with the external atmosphere and tension means for holding said bellows normally expanded, permitting the collapsing of the same under abnormal pressure of the fluid within said container.

2. A control device for fuel burners comprising a container for an expansible fluid located at the point of temperature variation, one wall of said container being flexible, means for adjustably varying the fluid capacity of the container including means for adjustably moving said flexible wall to a set position and means for increasing the capacity of the container including a second flexible wall movable outwardly in response to an abnormal pressure in the container for increasing the fluid capacity thereof.

3. A control device for fuel burners comprising a container for an expansible fluid located at the point of temperature variation, one wall of said container being flexible, means for adjustably varying the fluid capacity of the container including means for adjustably moving said flexible wall to a set position, a second flexible wall movable outwardly, and means maintaining said second wall in its inward position and yieldable only to excess pressure in the container for increasing the fluid capacity thereof.

4. In a thermostatic system employing a room thermostat designed to control a fuel burner at a considerable distance therefrom, comprising a container for an expansible fluid of predetermined capacity located at the point of temperature variation, an expansible chamber located at the point of fuel control and a flexible conduit of fixed standard length connecting said container and expansible chamber.

5. In a thermostatic system employing a room thermostat designed to control a fuel burner at a considerable distance therefrom, comprising a container for an expansible fluid of a predetermined capacity and located at a point of temperature variation, an expansible chamber located at the point of fuel control, a flexible conduit of fixed standard length connecting said container and expansible chamber, said expansible chamber and conduit having a fluid capacity which is relatively small to the capacity of said container.

6. In a thermostatic system employing a room thermostat designed to control a fuel burner at a considerable distance therefrom, comprising a container for an expansible fluid of a predetermined capacity, an expansible fluid of a predetermined capacity, an expansible chamber and a flexible coiled conduit of fixed standard length connecting said container and expansible chamber permitting of the location of said container and chamber at varying distances from each other without effect on the operation thereof.

7. In a thermostatic system employing a room thermostat designed to control a fuel burner at a considerable distance therefrom, comprising a container for an expansible fluid of predetermined capacity located at the point of temperature variation, an expansible chamber located at the point of fuel control and a flexible conduit of fixed standard length connecting said container and expansible chamber, said flexible conduit being of a length sufficient to extend to rooms adjacent to or remotely from the heating plant or the point of fuel control, and adapted normally to be arranged in a small compass between the container and expansion chamber, so that the container can be extended at will to various distances from the expansion chamber without affecting the resistance offered by the conduit.

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