W. M. FULTON.

HEAT CONTROLLING DEVICE.

APPLICATION FILED MAR. 24, 1905.

906,700. Patented Dec. 15, 1908.

Fig. 1.

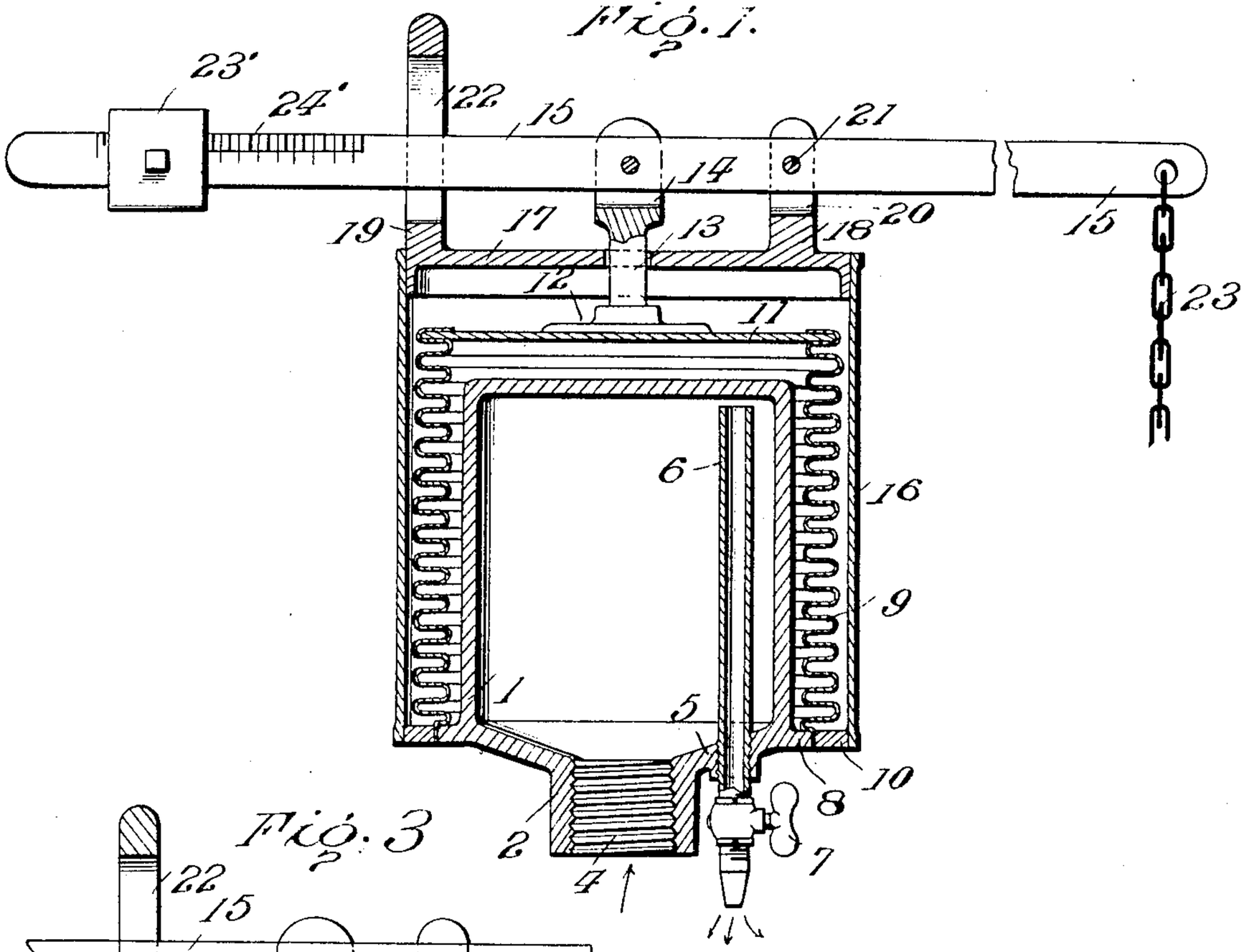


Fig. 3

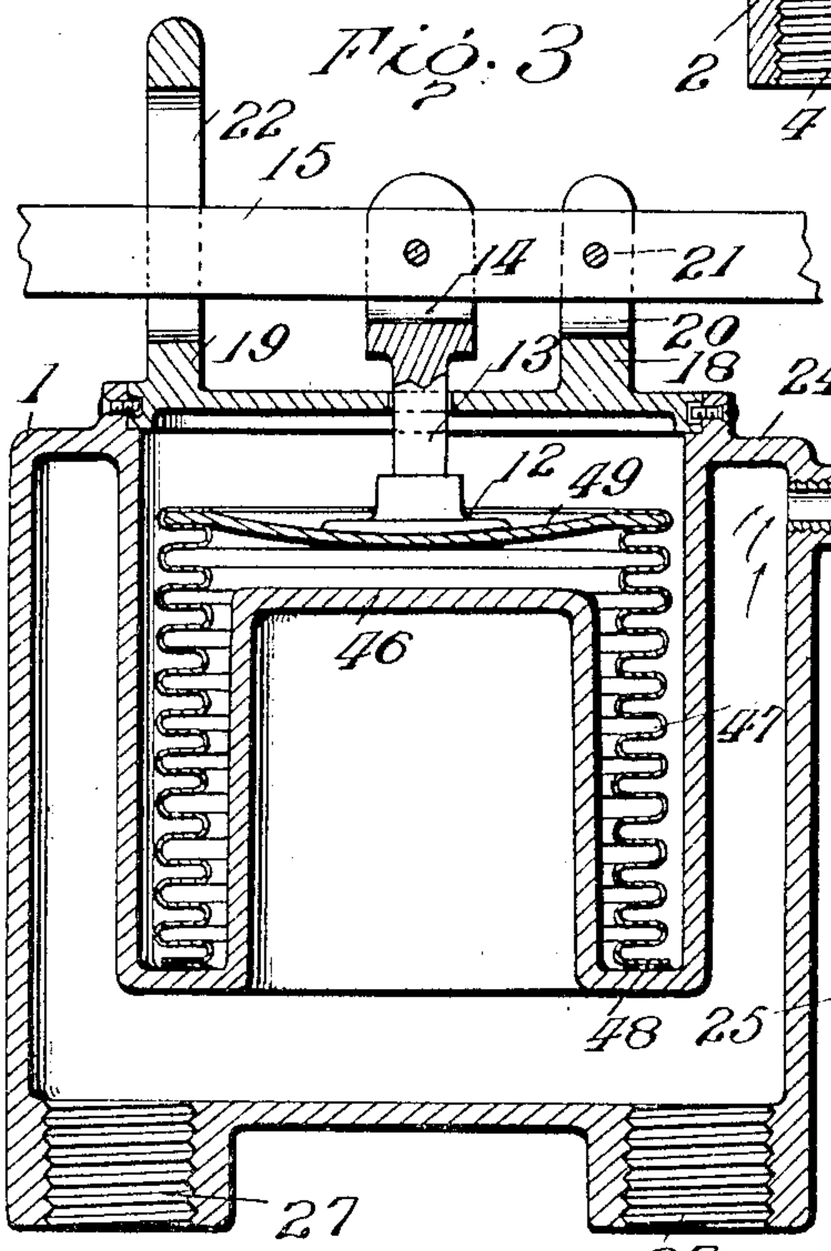
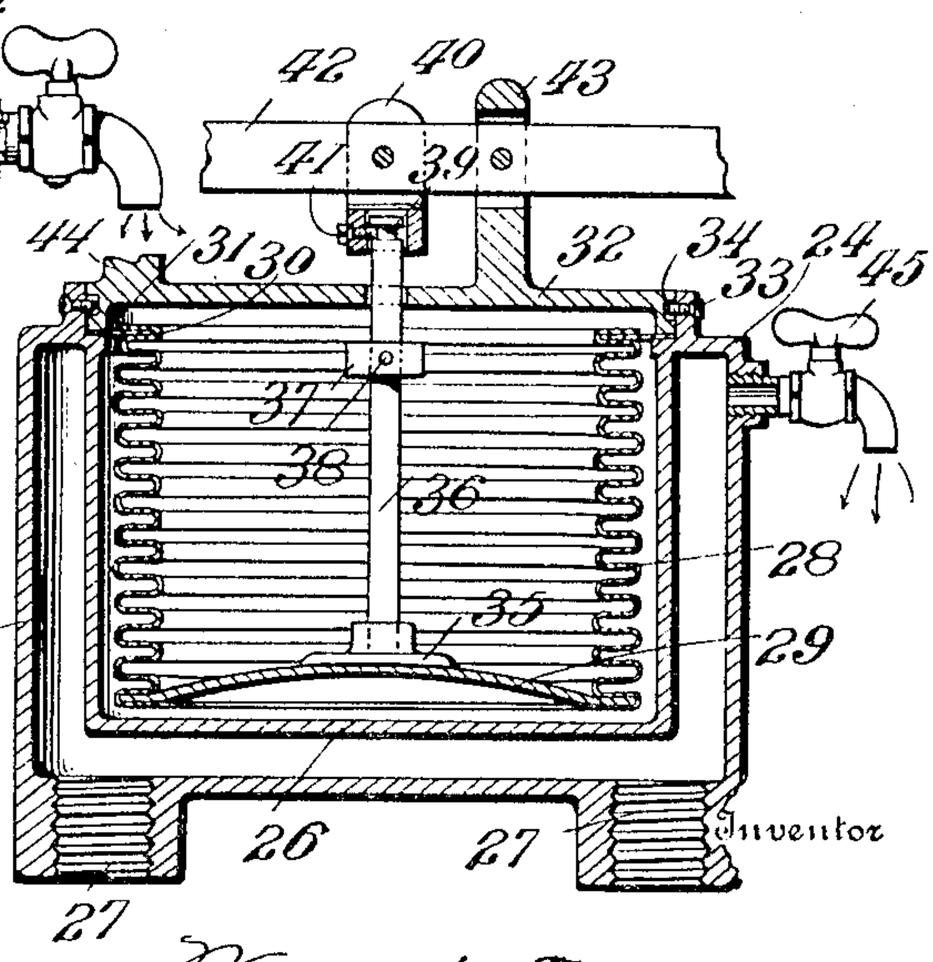


Fig. 2.



Witnesses

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UNITED STATES PATENT OFFICE.

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HEAT-CONTROLLING DEVICE.

No. 906,700. Specification of Letters Patent. Patented Dec. 15, 1908.

Application filed March 24, 1905. Serial No. 251,913.

To all whom it may concern:

Be it known that I, WESTON M. FULTON, of Knoxville, Tennessee, have invented a new and useful Improvement in Heat-Controlling Devices, which invention is fully set forth in the following specification.

This invention relates to heat regulators and especially those for use in connection with furnaces for raising high pressure steam or for heating water for hot-water systems, and particularly to regulators in which an expansible and collapsible wall is actuated by the expansion and contraction of a gaseous body subjected to the fluctuations in temperature of the steam or hot water to control the draft of a furnace and thereby controlling the temperature of the steam or hot water.

In this class of regulators in which a collapsible and expansible metal wall is used, it would be impractical to expose such thin walls to actual contact with the steam or hot water, for the reason that the walls would not be strong enough to withstand the necessary pressure, and to thicken such walls would greatly lessen their flexibility and detract from the sensitiveness of the device. To overcome such objections and secure the advantages of using a collapsible and expansible metal wall, I interpose a rigid heat-conducting wall between the corrugated wall and the heated fluid under pressure, thereby protecting the latter from fluid pressure while permitting the fluctuations of temperature of the steam or hot water to act on the confined gaseous body to lengthen or contract the corrugated wall.

Certain mechanical expressions of the inventive idea involved are shown in the accompanying drawings, which are designed merely as illustrations, and not as defining the limits thereof.

In the accompanying drawings, Figure 1 is a vertical central section of one form of regulator designed for use with high-pressure steam; Fig. 2 is a similar view of a form of the invention useful in connection with hot water heaters; and Fig. 3 is a modification of the form shown in Fig. 2.

Referring to Fig. 1, 1 is a dome, preferably of cast iron and cylindrical in shape, 2 is a hub, at its lower end, having a screw-threaded opening 4 for connecting the dome directly to a boiler. 5 is a screw-threaded opening in the bottom of the dome for receiving an air-escape pipe 6, opening near the top of the dome and provided at its opposite end with a cock 7 for permitting the escape of air from the dome when the steam enters inlet 4 from the boiler for the first time. From the bottom of the dome extends a flange 8 for receiving the end of a corrugated sheet-metal wall 9, which is secured to flange 8, by means of a metal ring 10, shrunk on over the sheet metal, thereby forming a steam-tight joint between the dome and corrugated metal wall. 11 is a rigid end wall made fast to the end of vessel 9, as by welding or brazing. For transmitting the movements of the corrugated wall, translating means or devices are employed. To this end a plate 12 is made fast to end 11 and carries a rod 13, provided at its end with a slot 14, for receiving a pivotally-supported lever 15. A casing 16, made fast at its bottom to ring 10, surrounds vessel 9 forming a protecting jacket therefor, and supports at its upper end a plate 17, provided with lugs 18, 19, preferably integral therewith. Lug 18 receives lever 15 in a slot 20, and supports the same by a pivot pin 21. Slot 22 in lug 19 serves to guide and limit the extent of movement of the lever 15. One end of the lever 15 is provided with a damper chain 23, and the other with an adjustable weight 23′ and a scale 24′.

The space inclosed by the corrugated walls of the collapsible vessel and the steam dome is charged with a gaseous body, preferably the saturated vapor of some liquid whose boiling point corresponds with the temperature of steam at the desired pressure. For example, it is desired to maintain a steam pressure of 75 pounds per square inch, the temperature of which is 320 degrees F. The space within the collapsible vessel 1, is exhausted of air and then turpentine introduced which has a boiling point of substantially 320 degrees F. and the vessel hermetically sealed.

The device thus described operates as follows: The dome 1 is coupled to the steam boiler, not shown, and the chain 23 connected to the damper or dampers to be operated. The cock 7 is opened to permit the escape of air and then closed. As long as the temperature of the steam remains below that of the boiling point of the turpentine, there will be no motion of the wall 11, since the tension of the vapor of the turpentine

is below atmospheric pressure for all temperatures below 320 degrees F. Above this temperature its tension exceeds atmospheric pressure, thereby forcing wall 11 upwards together with rod 13, and shifting lever arm 15 which, acting through chain 23, effects the closing of the draft damper. When the temperature falls the reverse of this action results and the chain 23 opens the draft damper.

It will be noted that the range of motion of the wall 11 is limited by wall 17 of the casing, and the top wall of the dome 1 so that it cannot exceed these limits which determine the range within which the vessel and other parts may move without danger of injuring the walls of the vessel or other parts. When it is desired to set the device to become operative at a higher temperature, the weight 23′ is slid outward on the arm 15 increasing the pressure to be overcome by the vapor in the chamber, and therefore the temperature to secure this pressure.

Fig. 2 shows a form of the regulator particularly applicable to the control of temperature in hot water systems, but it is also applicable to steam boilers. 24 is a cylindrical shell, preferably of cast iron, having parallel walls 25, 26, forming between them a space for receiving hot water. 27, 27, are screw-threaded members for connecting the shell 24 with a hot water boiler. 28 is a corrugated sheet metal wall, having a rigid end plate 29, brazed or welded thereto and its upper end 30 made fast to a ledge 31 on the top of shell 24. 32 is a plate loosely resting on ledge 31 and held in position by set screws 33, passing through extensions on shell 24 and entering a groove or slot 34 in the periphery of plate 32. Brazed or otherwise secured to the rigid wall 29 is a plate 35, receiving a rod 36, carrying a collar 37, made fast thereto by a pin 38. The end of rod 36 is provided with a slot 39, and supports a cap 40, secured to the rod by a set screw 41. This cap is provided with a U-shaped standard for pivotally supporting a lever 42 connected at one end to the damper to be operated, the other end carrying an adjustable weight, as shown in Fig. 1. On top plate 32 are lugs 43 and 44, the former constituting a bearing for lever 42, and the other serving to limit its play, as shown in Figs. 1 and 3. 45 is a cock for escape of air.

The space within the walls 28 of the collapsible vessel and wall 26 of the shell 24 is charged with a suitable fluid sensitive to changes of temperature. In case the regulator is to be attached to a hot water boiler whose contents are to be kept at from 180 degrees F. to 200 degrees F., the fluid employed is preferably carbon-tetra-chlorid whose boiling point is about the same as the lowest temperature at which the regulator is to operate. This fluid is introduced into the collapsible vessel as described in connection with Fig. 1 above.

In operation the device having been connected to the hot-water boiler, by means of connections 27, 27, the air is permitted to escape from the shell 24 by opening cock 45, the hot water entering the shell through connections 27, 27 and filling the same. When its temperature reaches the boiling point of carbon-tetra-chlorid, the pressure within the collapsible and expansible vessel exceeds that of the atmosphere, and end plate 29 rises and forces lever 42 upward, closing the damper as above described in connection with Fig. 1. In this case, however, the motion of end wall 29 is limited in an upward direction by stop 37 meeting cover 32, and in a downward direction by wall 29 meeting wall 26 of the shell 24. For all temperatures below the boiling point of the heat-sensitive fluid, the atmospheric pressure tends to force wall 29 towards wall 26, and for temperatures above its boiling point the pressure within the vessel 28 tends to collapse the vessel. Undue extension and contraction are provided for, however, by limiting the range of motion as above explained.

The space inclosed by plates 32, 35 and wall 28, which is open to the atmosphere, may be filled with a lagging material such as mineral wool, but preferably it is left vacant to form a dead-air-space which serves the same purpose. By loosening set screws 34 and 41, plate 32 may be rotated in either direction to adjust the lever 42 with respect to the dampers. A weight is also provided for arm 42 by moving which in one direction or the other the temperature at which the regulator will begin to act may be made to vary.

Fig. 3 is a further modification of the invention in which the bottom wall 26 of Fig. 2 is indented upward, forming the reentering bottom wall 46 of the collapsible and expansible vessel of Fig. 3. In this modification the end of the corrugated wall 47 is made fast at 48 to the wall of the casing or shell 24, and its upper end secured to end wall 49 which, with walls 46 and 47, constitute the space for receiving the heat-sensitive agent. This form of construction enables a greater heating surface to exert its influence on the collapsible and expansible vessel, by reason of greater amount of hot water space, and enables the regulator to more quickly respond to variations of temperature of the water in the boiler. Its operation in other respects is like the other forms previously described.

Although this invention has been described as applicable to operating dampers for furnaces for raising steam and heating water, it may be used in other relations where it is desired to control valves, switches

or similar devices by variations of temperature in steam or hot water.

Instead of using volatile liquids which will exert a tension only at a predetermined temperature, I may use certain solids which pass directly from the solid state into that of vapor, such as naphthalene and like bodies.

What is claimed is:

1. In a heat-controlling device, the combination of a flexible corrugated metal wall having a rigid end closure, a rigid metal wall concentric with said corrugated wall and forming therewith a closed chamber and confining therein an expansible fluid, a second rigid metal wall forming with the first-named rigid metal wall a heating chamber in heat-interchanging relation for its full length with said first-named chamber, and power-transmitting means associated with said movable end closure.

2. In a heat-controlling device, the combination of a flexible corrugated metal wall having a rigid end closure, a plurality of rigid metal walls concentric with said corrugated wall, one of said rigid walls forming with said corrugated wall a closed chamber and confining therein an expansible fluid, said rigid walls forming with each other a heating chamber in heat-interchanging relation for its full length with said first-named-chamber, and power-transmitting means associated with said movable end closure.

3. In a heat-controlling device, the combination of a flexible corrugated metal wall having a movable rigid end closure, a rigid metal wall concentric with said corrugated wall exterior thereto, and forming with the same a closed chamber and confining therein an expansible fluid, a second rigid metal wall forming with the first-named rigid wall a heating chamber in heat-interchanging relation for its full length with said first-named chamber, and power-transmitting means associated with said end closure.

4. In a heat-controlling device, the combination of a flexible corrugated metal wall having a movable rigid end closure, a rigid metal wall concentric with said corrugated wall and forming therewith a closed chamber and confining therein an expansible fluid, a second rigid metal wall forming with the first-named rigid metal wall a heating chamber in heat-interchanging relation for its full length with said first-named chamber, a power-transmitting rod for engaging said movable end closure, a damper lever engaging said rod, and supporting means for said lever angularly adjustable about said rod.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

WESTON M. FULTON.

Witnesses:
W. W. BERRY,
E. J. S. HYATT.