W. M. FULTON.

DAMPER REGULATOR.

APPLICATION FILED JUNE 27, 1905.

900,511. Patented Oct. 6, 1908.

FIG. 1.

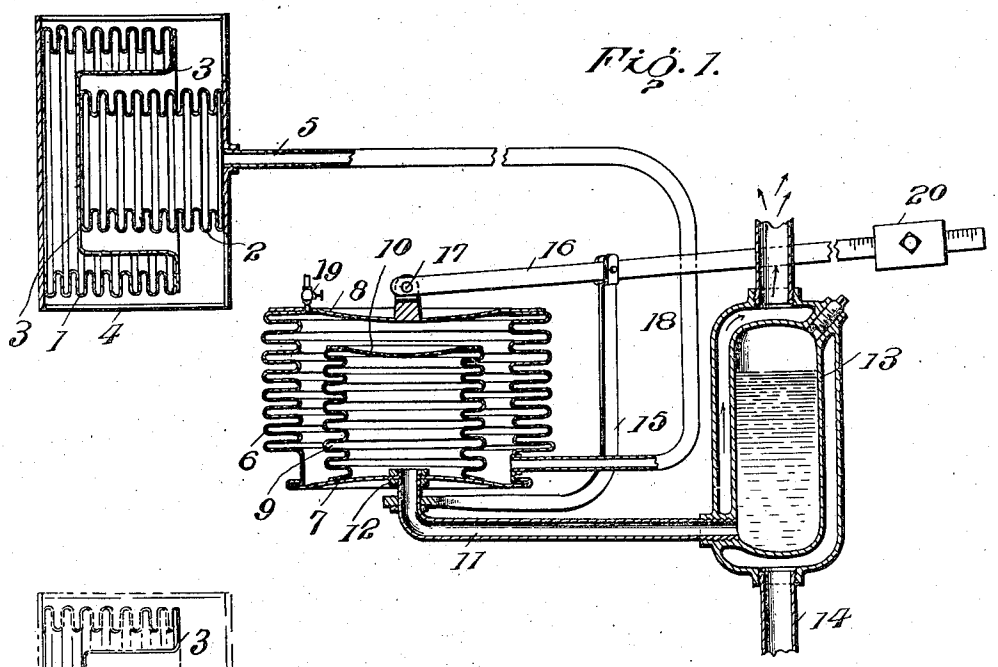
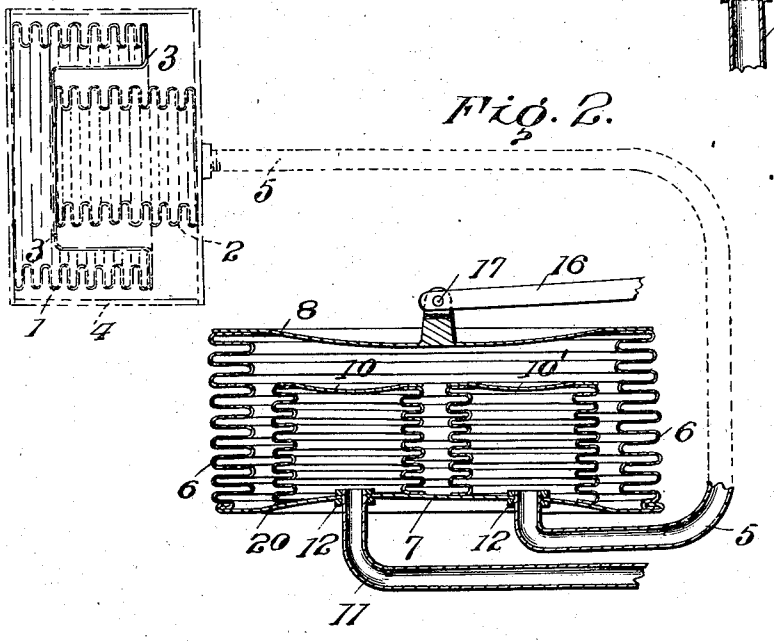


FIG. 2.



Witnesses

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DAMPER-REGULATOR.

No. 900,511. Specification of Letters Patent. Patented Oct. 6, 1908.

Application filed June 27, 1905. Serial No. 267,255.

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 Damper-Regulators, which invention is fully set forth in the following specification.

This invention relates to damper regulators and particularly to those in which a fluid pressure motor is employed the operation of which is dependent on the temperature of the space to be heated and also on the temperature of the heating medium such as steam or hot water in the heating system.

In damper regulators which are subject to the direct action of steam or hot water some form of flexible diaphragm is usually employed, such as leather or rubber, for imparting its motion to the damper through some form of connecting means such as a lever or chain. Diaphragms of this character soon become brittle and crack under the action of high temperatures, even where provision is made to keep them always moist. When flexible metal diaphragms are employed to obviate the disadvantages of rubber and leather, like the latter, they have a short path through which they can vibrate and require special provisions, such as a system of levers, to multiply their motion. Again in the thermostat, which is subject only to the room temperature and which also controls the fluid motor, a diaphragm is usually employed, and, though it is not subject to the same deteriorating heat influences as those in the motor, it requires to be of an unwieldy size to secure the necessary transfer of fluid to the distant damper-operating motor, and it is also required to develop considerable pressure on the fluid operating the motor. Power multiplying devices have also been used in connection with these diaphragms, but they add to the expense of construction and detract from simplicity of structure.

It is the object of this invention to overcome the above objections by doing away with the flat flexible form of diaphragm both in the thermostat and also in the motor. To this end I construct the thermostat with a rigid movable diaphragm subject to yielding pressure on its opposite sides and support it by collapsible and expansible walls fixed at their outer ends and I provide the motor with a rigid movable end wall and support the same by a collapsible and expansible wall. By this construction the thermostat consists of a collapsible and expansible vessel divided by a rigid movable partition into two compartments, the outer end walls of the vessel being held fixed. One of the compartments is filled with a gaseous body sealed therein and the other compartment communicates with the motor and contains a fluid for transmitting the movement of the rigid diaphragm of the thermostat to the movable end walls of the motor. By reason of this construction the thermostat diaphragm is enabled to move back and forth over a much longer path than is possible with a flexible diaphragm of the same diameter, and the same is true with the movements of the motor wall. The diameter of the thermo-sensitive compartment is preferably larger than that of its companion compartment whereby the effective pressure on the diaphragm is increased without the use of levers or multiplying gearing, and enables a greater transfer of fluid to the motor for a given rise of temperature than in the case of a flexible diaphragm.

To enable the motor to be operated by changes of temperature in the steam or hot water, provision is also made for acting directly on a rigid movable wall supported by a collapsible and expansible wall.

The invention further consists and resides in the construction and combination of cooperating elements hereinafter to be fully described and pointed out in the claims.

Referring to the accompanying drawings:—Figure 1 is a vertical sectional view through the damper regulating apparatus; Fig. 2 is a sectional view showing a modification of the fluid motor.

Referring to Fig. 1, the thermostat comprises a two chambered corrugated sheet metal collapsible and expansible vessel, the chambers of which are designated 1 and 2 and are separated by a rigid impervious diaphragm 3. The outer end walls of the vessel are held in a fixed relation to each other by a rigid frame 4. The chambers 1 and 2 are preferably of unequal diameter, the larger chamber being filled with an expansible fluid, which, when it expands, exerts a pressure on diaphragm 3 proportional to the cross-sectional area of the larger chamber,

thereby magnifying the power of the thermostat. The diaphragm 3 is preferably made reëntering to receive chamber 2 and secure compactness of structure.

5 is a pipe having rigid walls which connect the thermostat with the fluid motor.

6 is a corrugated sheet metal wall which has a rigid bottom closure 7, held from movement by any suitable means, and 8 is a movable rigid top closure for the same. Within the chamber thus formed is a second collapsible and expansible fluid displacing vessel 9, similarly constructed and having a movable top wall 10. A pipe 11, enters the bottom wall 7 and makes a tight joint therewith by means of couplings 12. The other end of pipe 11 communicates with a vapor generator or receptacle 13 for holding a volatile fluid subject to the heat of the hot water or steam in pipe 14. As here shown, the generator is located at one side of the displacing vessel 9, and, though this is the preferred arrangement yet it is manifest that it may be located within the vessel 9 and the latter will operate in like manner.

15 is a supporting arm for the power transmitting means which, as shown, consists of a lever 16, having a pivot connection 17 with the movable end 8 of the fluid motor. The pipe 5 connects with the motor through the non-corrugated portion 18 of the wall 6.

The operation of the device is as follows:—The motor is located in proximity to the dampers or valves to be actuated and the inner vessel 9 of the motor connected with the receptacle 13 in the heating conduit. The thermostat is placed in the room or space in which the temperature is to be regulated and is connected by means of pipe 5 with the motor.

In setting up the device the lever 16 is approximately balanced by the weight 20 for the purpose of relieving the motor vessel 6 from unnecessary outside pressure and the outer end of the lever connected with the dampers or valves to be turned. Fluid, preferably under pressure and at the standard temperature to be maintained, is introduced into vessels 1, 2 and 6, the pressure in vessels 2 and 6 being adjusted by means of valve 19 to bring the diaphragm 3 of the thermostat into a normal position or where the pressure on the diaphragm will not collapse or expand the walls of either vessel 1 or 2 and the final adjustment of the weight 20 and dampers are made. The receptale 13 is partly filled with a liquid which will be vaporized at the maximum temperature at which the steam or hot water in the system is to be maintained, and is connected with the displacing vessel 9.

From the foregoing, it will be evident that a rise of temperature will cause the diaphragm 3 to move to the right, the excess of pressure being in that direction, and will force out and forward a volume of fluid to act in forcing wall 8 of vessel 6 upward and thereby raising lever 16 and closing the damper. A lowering of temperature at the thermostat causes a reverse movement.

The inner vessel 9 is not responsive to the variations of room temperatures, but responds when the steam or hot water in the system reaches a temperature which is that of the boiling point of liquid in receptacle 13 whereupon vessel 9 expands and transmits its motion through the fluid in vessel 6 to wall 8 and the power transmitting means.

In Fig. 2 is shown a plurality of fluid displacing vessels 10, 10′, within the outer vessel 6, each of which connects with a source of fluid pressure resulting from heat applied to the thermostat or from the heating medium in the hot water or steam pipes.

From the foregoing it will be seen that the number of elements in the device are extremely few; that it is sensitive in a marked degree by reason of the extent of the exposed surface of the thermosensitive element, and by reason of the use of a rigid movable diaphragm in connection with corrugated expansible and collapsible walls, extensive movement can be imparted thereto, and thereby enables a transfer of a greater volume of fluid to the motor for a given rise of temperature. Further, by the use of the metallic expansible displacing vessel within the motor the use of rubber and leather diaphragms is avoided and the deleterious action of steam and hot water on the structure overcome.

What is claimed is:—

1. In a damper regulator of the character described, the combination of a thermo-sensitive element comprising a collapsible and expansible corrugated sheet metal vessel having stationary end walls and a rigid movable diaphragm dividing the vessel into two compartments of unequal cross-sectional areas in one of which is sealed an expansible medium; a motor vessel for actuating a damper, comprising a collapsible and expansible corrugated sheet metal vessel having a stationary end wall; and a fluid containing conduit in open communication with one of said compartments and said motor vessel, for transmitting power from said thermo-sensitive element to the motor to actuate the latter for controlling a damper.

2. In a damper regulator of the character described, the combination of a thermo-sensitive element comprising a collapsible and expansible corrugated sheet metal vessel having fixed end walls and a rigid movable diaphragm dividing the vessel into compartments of unequal cross-sectional areas in one of which is sealed an expansible medium; a motor vessel comprising a collapsible and expansible annular walled vessel having a stationary end wall and movable

end walls; and power transmitting means for transmitting movements of said diaphragm to one of said end walls and means operative at a predetermined elevated temperature for imparting movements to the other of said walls.

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

WESTON M. FULTON.

Witnesses:
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