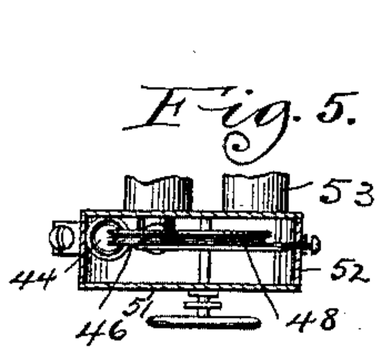
(No Model.)

W. P. POWERS.

THERMOSTAT.

No. 424,617. Patented Apr. 1, 1890.

Fig. 5.



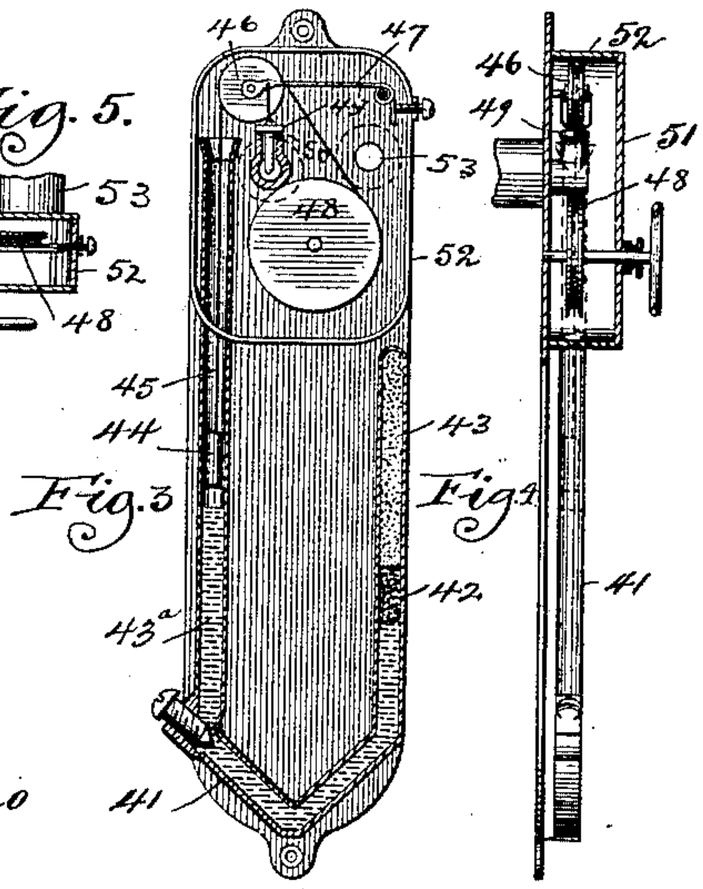
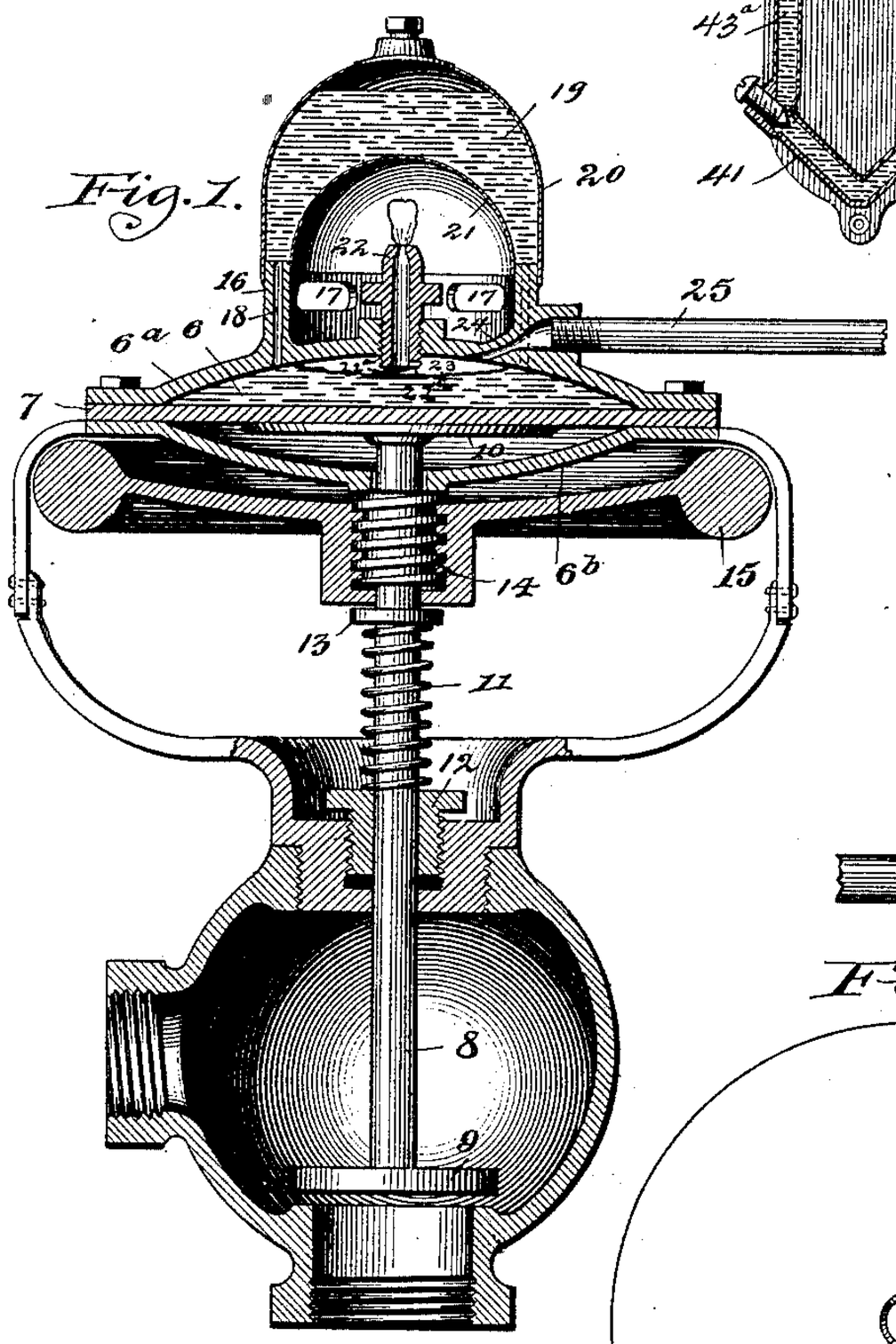


Fig. 3.

Fig. 4.

Fig. 1.



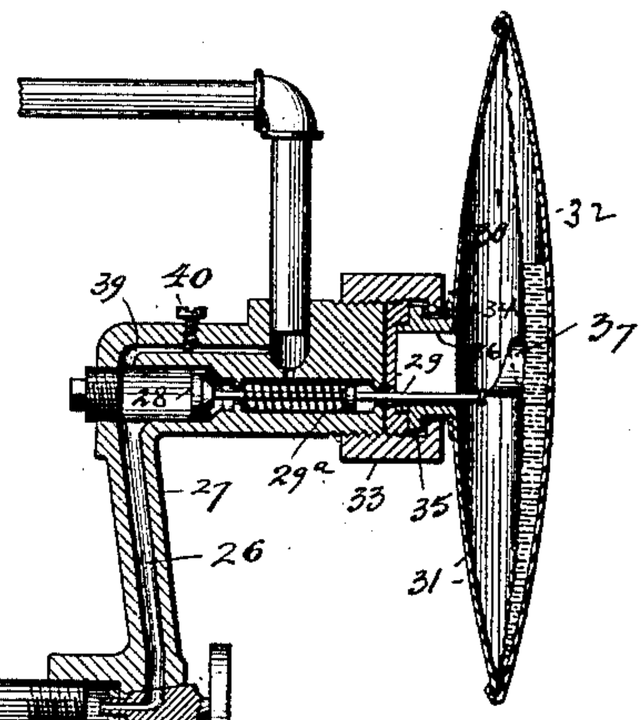
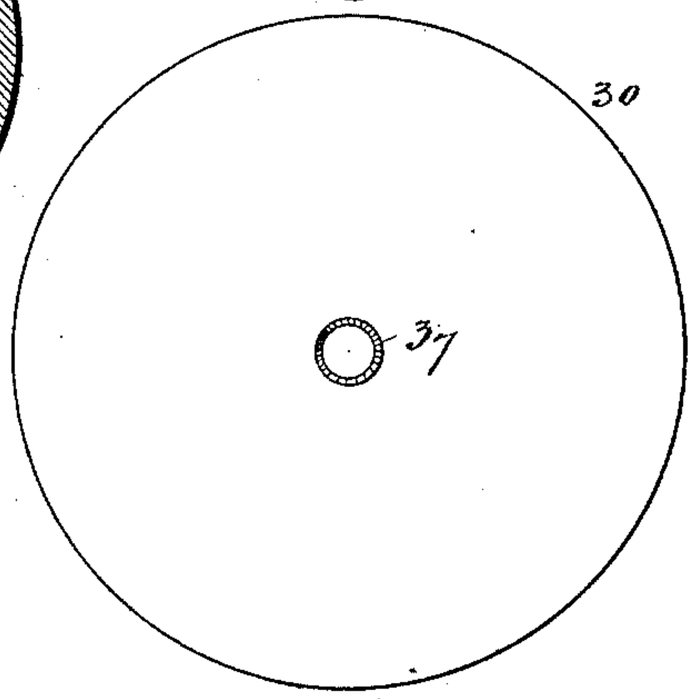


Fig. 2.



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UNITED STATES PATENT OFFICE.

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THERMOSTAT.

SPECIFICATION forming part of Letters Patent No. 424,617, dated April 1, 1890.

Application filed November 26, 1889. Serial No. 331,646. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM P. POWERS, a citizen of the United States, residing at La Crosse, in the county of La Crosse and State of Wisconsin, have invented certain new and useful Improvements in Thermostats, of which the following is a specification.

The object of this invention is to provide improved means whereby the temperature of an apartment is automatically controlled. These means comprise a steam-generating chamber and appliances for utilizing the expansive force of the steam to operate a valve or damper, a heating-flame to generate the steam, and a thermostat to control the supply of the flame-producing fluid or gas. These parts are so constructed and combined that a flame of inoperative heating capacity is constantly maintained, so that relighting is unnecessary, and when the generating of steam is necessary an increased flow of the gas or flame producing fluid is caused, thus increasing the flame to operative power.

In the preferred form of construction I make use of a pressure-chamber having secured therein a flexible diaphragm, the vibrations of which are adapted to impart motion to a valve or damper controlling rod. A water-space is provided above the diaphragm, which is in communication with the steam-generator, the latter consisting of a closed vessel having a heating-chamber beneath it, in which chamber is located a gas jet or other burner. A steam or vapor producing liquid fills the pressure-chamber, the communicating ports, and partially or wholly fills the generating-chamber. Gas is supplied to the burner through a pipe, the passage of which is controlled by a valve, and the movement of the valve is governed by a thermostat. The preferred form of thermostat consists of a chamber having a movable wall or diaphragm, the movement of which is effected by the vaporization of a volatile liquid confined against said wall. A liquid will be used which will vaporize at about the temperature it is desired to maintain, and the arrangement of parts is such that when this liquid vaporizes it will move said wall against which it is confined, thus opening the passage in the supply-pipe and permitting the gas or other flame producing fluid to flow to the burner, increasing the flame thereat, which flame generates steam in the steam-chamber, and the pressure of which, acting through the water upon the diaphragm of the pressure-chamber, moves the latter and actuates the rod to open a ventilator or close a damper or valve.

I have also provided a safety device for cutting off the supply of gas when more than the needed pressure is developed at the diaphragm.

In the accompanying drawings, Figure 1 is a sectional elevation, some of the parts shown entire, of a device embodying my invention applied to the closing of a valve in a steam-heating coil. Fig. 2 is a detail view of the thermostat construction illustrated in Fig. 1. Fig. 3 is a side elevation of a modified form of thermostat, partly in section. Fig. 4 is an edge view thereof, and Fig. 5 is a plan view.

In the drawings, 6 indicates a pressure-chamber, which is formed by an oval plate 6^a and a diaphragm 7, the edges of the diaphragm and said plate being secured together.

8 is an operating-rod, which in this case is the valve-stem of a steam-valve 9, said stem having on its upper end a disk 10, which is held normally in contact with the diaphragm 7 by means of a spring 11, seated at its lower end on a nut 12 and at its upper end against a shoulder 13 on the valve-stem. An extension on the lower plate 6^b is threaded at 14, and a threaded handle 15 is applied thereto, the bottom of which rests upon the collar on the rod, whereby the valve can be closed by hand by rotating the handle against the tension of the spring.

Rising from the plate 6^a is a flange 16, having apertures 17 for the admission of air to support combustion, and the body of the flange is also perforated to provide the passage 18 between the pressure-chamber and generating-chamber. The generating-chamber 19 is formed by the two inverted cup-shaped walls 20 21, whose lower edges may be secured, respectively, to the outer and inner sides of the flange 16. Communication is established between the generating-chamber and the pressure-chamber through the apertures in the flange. The space beneath the inner cup-shaped wall provides a heating-

chamber in which is secured the gas jet or burner 22. A small chamber is provided below the lower end of this jet or burner by means of a diaphragm 23, and a passage 24 is formed through the plate 6ª, communicating at its outer end with a pipe 25. The latter receives its supply of gas through a passage 26, formed in an elbow 27, and this passage is controlled by a valve 28, having a stem 29, projected by a spring 29ª into contact with a movable wall or diaphragm 30, the edge of which is secured between the margins of the curved plates 31 32, and the former has provision for rotatably connecting it with the gas-supply pipe. This provision comprises a threaded collar or coupling 33, having a flange 34, adapted to engage a flange 35 on a sleeve 36, connected with the exterior wall of the diaphragm.

37 is a cam which is secured to the movable wall of the diaphragm, and which cam bears against the end of the valve-stem, the center of rotation of the cam being so adjusted that the edge of the cam will impinge against the end of the valve-stem. The diaphragm being turned by means of its sleeve-connection, the cam, the face of which is helically cut, will be adjusted to different positions with relation to the valve-stem, and thereby the thermostat can be set to act upon the valve-stem at a higher or lower temperature, as desired. The same result would be accomplished by providing for extending or shortening the valve-stem, and the cam might be dispensed with.

38 is a plug-valve, by which the flow of gas may be entirely checked, and 39 is a by-passage, which will supply a limited amount of gas at all times through the pipe to the burner, the amount being gaged by the size of the passage or by the valve 40, and sufficient in quantity only to maintain a pilot light or flame, which can be increased to operative effect by the opening of the valve by reason of the action of the thermostat.

In Figs. 3, 4, and 5 I have shown another form of thermostat, which comprises an inverted-U-shaped tube 41, having one leg thereof closed. Mercury is placed in this U-shaped tube, and above it, at the closed end, is a volatile liquid, (indicated at 42,) and which, when volatilized, as indicated at 43, tends to raise the mercury (indicated at 43ª) in the other leg of the U-shaped tube. When the temperature is lower than the normal point of vaporization of the volatile liquid, the mercury will stand higher in the leg of the tube containing the volatile liquid than in the other leg, and so action may be secured at a temperature lower than the ordinary boiling-point of the liquid used by reason of the mercury standing higher in the leg containing this fluid than in the other. In such case the weight of the mercury tends to produce a vacuum in the chamber containing the fluid, and so lowers its point of vaporization. It is evident that the greater the heat applied the higher the mercury will rise in the leg having the open end. Within this open leg, above the mercury, is suspended a float 44 by means of a cord 45. This cord is carried over a sheave 46, hung on a frame or yoke 47, the arms of which are preferably of spring-wire, and the cord is then conducted to a drum 48, which is adapted to be rotated to raise or lower the weight. 49 is a drop-valve connected to the spring-frame, and which is adapted to close a passage 50, which passage corresponds to the one marked 26 in the elbow.

A closed chamber is formed by the plate 51 and a flanged plate 52, and from this chamber a pipe 53 delivers. This device is adapted to be secured to a gas-stub, through which the flow of gas is automatically controlled by the rise and fall of the mercury in the U-shaped tube, influenced by the variations in temperature, and which gas when permitted to flow may be conducted to the burner shown in Fig. 1. When the weight is lifted by the rising column of mercury, the valve is opened by the spring-frame above, and the same is closed by the weight when the mercury recedes.

The operation of the device illustrated in Fig. 1 is as follows: The thermostat being adjusted to the required temperature by the character of the liquid used therein or by the adjustment of the cam on its movable wall with relation to the valve-stem, if now the temperature rises so as to volatilize the liquid in the thermostat, the flexible partition or wall will be distended, and, acting through the cam upon the valve-stem, will open the valve and permit the flow of gas through the pipe and into the chamber below the burner, thus increasing the heat of the flame within the heating-chamber. This will act to heat the confined liquid in the generating-chamber and to generate steam or vapor therein, which will force the liquid below it into the pressure-chamber, flexing the diaphragm and moving the operating-rod. This rod, if the device be used as shown in Fig. 1, closes the valve and the supply of steam or other heating agent is cut off. The generation of steam or vapor will be continued until it has exerted sufficient force in the pressure-chamber to flex the diaphragm 23, which will be so adjusted by reason of its own elasticity or by suitable spring-pressure that more force will be required to move it than is required to operate the valve or damper. When this pressure is attained, the diaphragm 23 will be forced upwardly, thus sealing the lower end of the aperture in the burner; but in order to permit a supply of a limited quantity of gas in order to maintain the pilot-flame the side wall of the burner 22 has a minute aperture 22ª, through which a small quantity of gas will be admitted. In this way sufficient pressure will be maintained to keep the valve closed so long as the supply of gas is kept up by the thermostat. When the temperature

in the room shall have fallen to such an extent that the movable wall of the thermostat, receding, allows the valve to close and shut off the gas, (except the pilot-light,) then, the heat being thus reduced, the vapor in the pressure and steam-generating chambers will condense, diaphragm 7 will straighten out, and the operating-rod 8 will be returned to its first position under the influence of the spring 11.

The device may be set for any temperature desired, and is automatic throughout its working cycle.

I do not intend to limit my invention to any particular construction of device for controlling the flow of gas, except that a device must be employed which will respond to said variations in temperature and automatically control said flow. Neither do I intend to limit my invention to the use of water in the generating-chamber, as any vaporizable fluid may be used.

I claim—

1. In a heat-controlling device, the combination of a pressure-chamber having a movable diaphragm or piston, a generating-chamber communicating therewith to contain a vaporizable fluid, a gas-burner located in proximity to said chamber, a pipe connecting therewith for supplying gas, a valve in the pipe, and a thermostat adapted to actuate the valve, whereby to control the supply of gas to the burner.

2. In a heat-controlling device, the combination of a pressure-chamber having a movable diaphragm or piston to impart motion to an operating-rod, a generating-chamber in communication with the pressure-chamber to contain a vaporizable fluid, a gas-burner located in proximity to the generating-chamber, a gas-supply pipe and a valve in the pipe, a thermostat adapted to actuate the valve to control the main supply of gas, and a by-passage around the valve to admit a limited supply of gas to the burner to maintain a pilot-light, substantially as described.

3. In a heat-controlling device, the combination of a pressure-chamber having a movable diaphragm or piston to impart motion to an operating-rod, a generating-chamber to contain a vaporizable fluid and communicating with the pressure-chamber, a chamber below the burner having a movable side adapted to be flexed by the pressure in the pressure-chamber, whereby to seal the main aperture of the burner, a by-passage to the burner to admit a limited supply of gas, a valve in the gas-passage, a thermostat adapted to actuate the valve, whereby to control the main supply of gas, and a by-passage around the valve to supply a limited amount of gas to maintain a pilot-light, substantially as described.

4. In a heat-controlling device, the combination of a pressure-chamber having a movable diaphragm or piston to impart motion to an operating-rod, a generating-chamber, a gas-burner in proximity thereto, a valve in the gas-passage, a thermostat comprising curved plates, and a flexible diaphragm secured between them, providing a chamber to contain a volatile liquid in contact with the diaphragm, and a cam on the diaphragm to engage the valve-stem, said plates being adjustably secured with relation to the valve-stem, whereby to secure action thereon at varying temperatures, substantially as described.

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