W. W. CURTIS.

TEMPERATURE REGULATING DEVICE.

APPLICATION FILED FEB. 3, 1908.

912,293.

Patented Feb. 16, 1909.

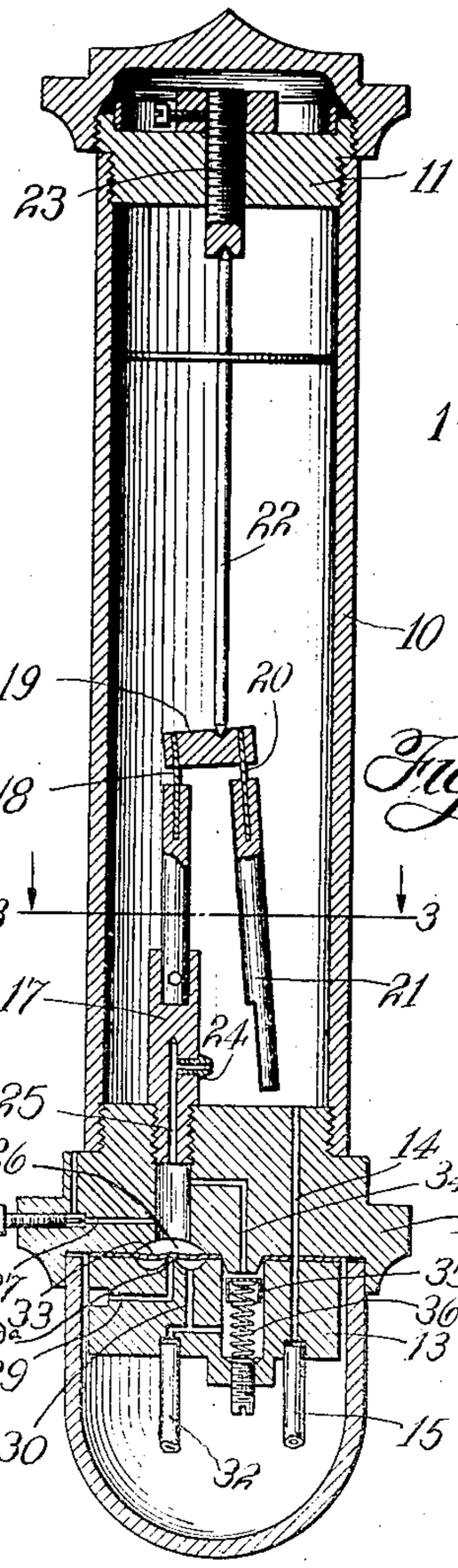

Fig. 1.

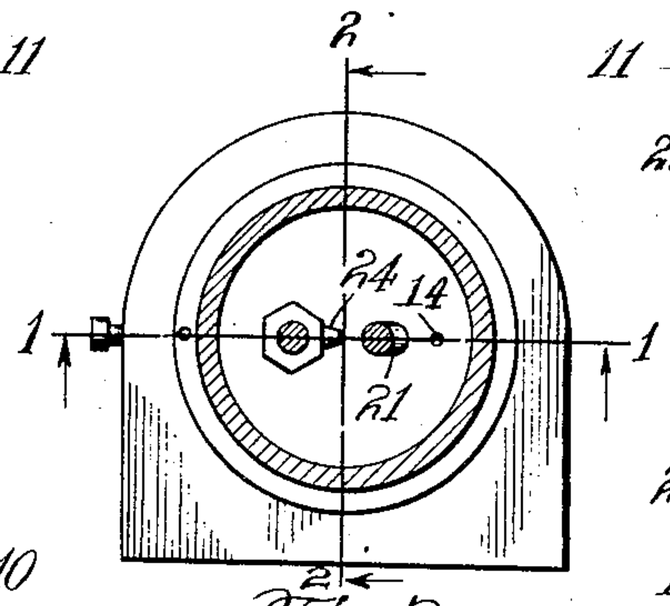

Fig. 3.

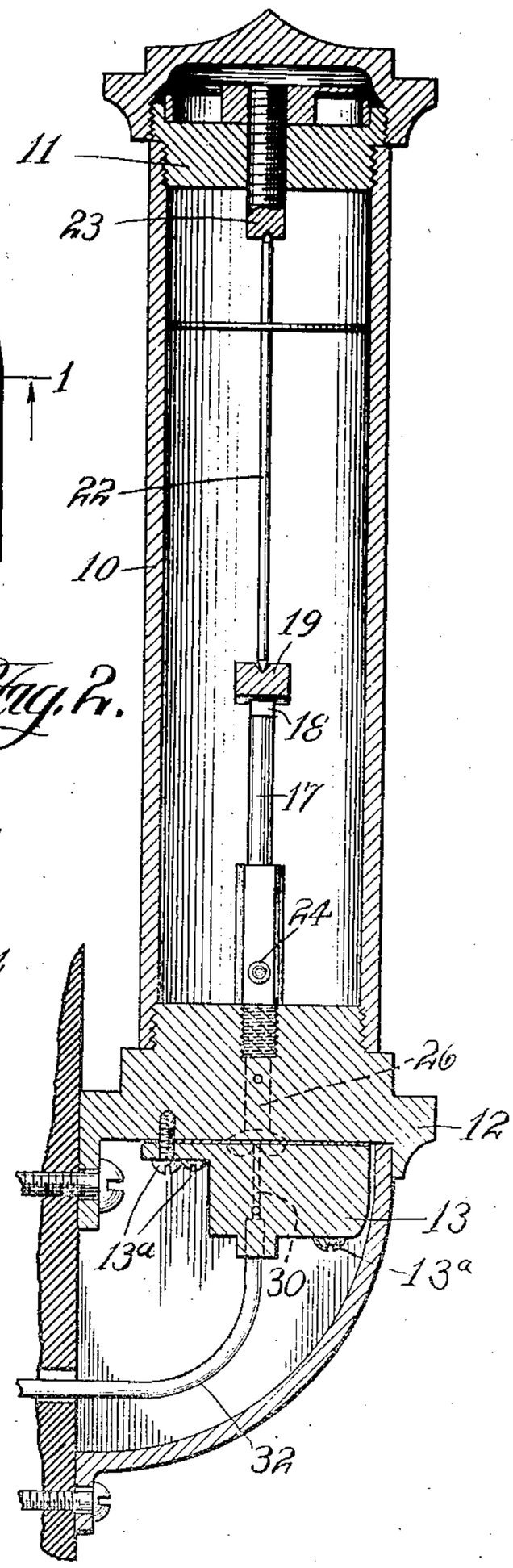

Fig. 2.

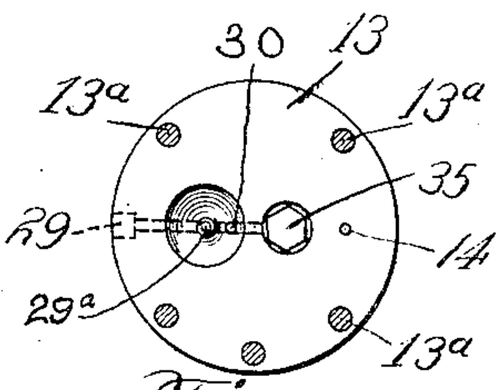

Fig. 4.

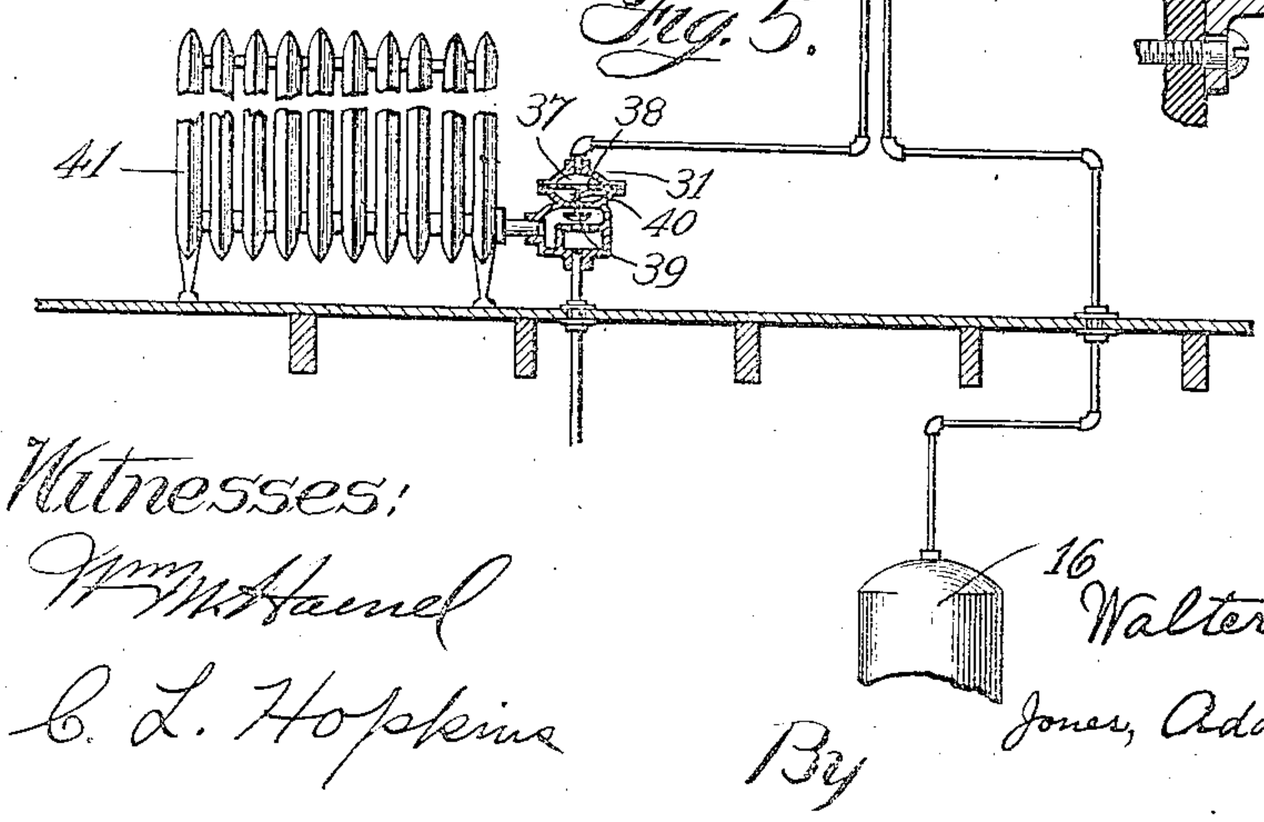

Fig. 5.

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UNITED STATES PATENT OFFICE.

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TEMPERATURE-REGULATING DEVICE.

No. 912,293. Specification of Letters Patent. Patented Feb. 16, 1909.

Application filed February 3, 1908. Serial No. 414,046.

To all whom it may concern:

Be it known that I, WALTER W. CURTIS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Temperature-Regulating Devices, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to improvements in thermostatic devices for controlling the flow of a fluid such as air under pressure, to or from a motor actuated thereby and arranged to operate valves, dampers and the like in the regulation of heating apparatus. In some cases, as for instance where the motor controls the flow of steam to a radiator, it is desirable that the motor may be made to act positively, that is, so that the steam shall be turned off or on completely before the motor stops or begins to move in the opposite direction. It is also important that the steam be admitted quickly to the radiator, and in some cases it should be turned off quickly also.

The object of the present invention is to provide a device which is controlled by changes in temperature conditions and which admits a large volume of air under pressure to the motor to operate it quickly and fully in one direction and which, upon a temperature change of the opposite kind, will shut off the flow of fluid to the motor and quickly and positively open a large exhaust port to permit the fluid stored in the motor to be discharged to the atmosphere.

In the accompanying drawings, in which I have illustrated an embodiment of my invention, Figure 1 shows a vertical longitudinal section of my improved thermostat, this section being taken on the line 1—1 of Fig. 3, looking in the direction of the arrows; Fig. 2 is a vertical sectional view taken on a plane at right angles with the plane of Fig. 1; Fig. 3 is a cross sectional view of the device, the section being taken on the line 3—3 of Fig. 1, looking in the direction indicated by the arrows; Fig. 4 is a plan view of one of the parts of the device disassociated from the other parts; and Fig. 5 illustrates a steam radiator, a thermostat, a source of fluid under pressure, a fluid-operated motor for controlling the valve leading to the steam radiator, and a system of piping connecting the thermostat with the source of fluid supply and the motor.

In these drawings 10 is a tube of hard rubber or other material adapted to expand and contract under changes in temperature conditions. A plug 11 screws into the upper end of the thermostatic tube 10 and a second plug 12 screws into the lower end of the same, this plug forming, with the block 13 (shown by itself in plan in Fig. 4) the base of the device and having passages leading therethrough for the admission of fluid to the chamber within the tube 10 and therefrom. The block 13 is secured to the plug 12 by means of screws 13ª passing therethrough into the plug. The passage 14 communicates, by means of a pipe 15, with a tank 16 containing compressed air or the like. In the chamber within the tube 10 is arranged a standard 17 provided at its upper end with a flat spring 18 secured at one of its ends to the standard 17 and at its opposite end to a block 19. A second flat spring 20 connects the opposite end of the block 19 with a valve piece 21. A thrust-rod 22 bears upon the upper side of the block 19 and extends upwardly to an adjusting screw 23 passing through the plug 11. When the thermostatic tube 10 is contracted by the lowering of the temperature of the room this rod 22 will thrust the block 19 downward, swinging the valve piece 21 into engagement with its seat 24. From this point leads a passage 25 to a chamber 26 in the base of the device. This chamber has a diaphragm 33 extending thereacross. Leading from this chamber 26, above the diaphragm is a restricted passage 27 leading to the atmosphere, a screw 28 being provided for regulating the extent of the restriction. Leading from that part of the chamber which is below the diaphragm 33 are two passages, one of which, designated 29, leads to the atmosphere and the other of which, designated 30, leads to the motor 31 through a pipe 32. The passage 29 terminates in a valve seat 29ª covered by the diaphragm 33, the center of which constitutes a valve for the port, closing said port when a state of pressure exists in the chamber 26 on the upper side of the diaphragm. A by-pass 34 is provided which leads around the cham-

ber 26 from the passage 25 to the passage 30 and thence to the motor. In this by-pass is located a check valve 35 pressed toward its seat by a spring 36. The motor 31 is provided with an air chamber 37 and a diaphragm 38. The diaphragm 38 is mechanically connected with a valve 39 and is pressed upwardly by a spring 40 which tends to move the valve away from its seat and permit steam to flow to the radiator 41. When air is allowed to flow through the pipe 32 to the air chamber 37 of the motor the diaphragm 38 is flexed and the valve 39 is moved to its seat against the tendency of the spring 40 to move it away from the same.

The operation of the system is as follows: The chamber within the thermostatic tube 10 is in communication with the air supply tank 16 through the pipe 15 and passage 14. With the parts in the positions shown in Fig. 1, air under pressure passes from the chamber within the thermostatic tube through the passage 25 to the chamber 26 in the base, holding down the diaphragm 33 upon the exhaust port 29. When sufficient pressure has been attained in the chambers of the device the check valve 35 is unseated thereby and air flows through the pipe 32 to the motor 31, flexing the diaphragm of the motor and closing the steam valve, thereby shutting off the steam from the radiator. The room thereupon begins to cool and the thermostatic element 10 to contract. This contraction finally seats the valve 21, closing the passage 25 and shutting off the flow of air to the motor. The check valve 35 now closes to prevent air from the motor flowing around to the chamber 26. The pressure in the chamber 26, which has heretofore held down the diaphragm 33 upon the exhaust port 29, is now relieved through the relief port 27, allowing the back pressure from the motor to raise the diaphragm 33, and thus permitting the air to flow back from the motor through the pipe 32, passage 30 and exhaust port 29 to the atmosphere. The motor is thus permitted to discharge the air from its chamber rapidly and the steam valve is quickly opened by the spring 40. Steam is now admitted to the radiator and the temperature of the room begins to rise. This rise in temperature causes the thermostatic tube to lengthen, relieving the pressure of the thrust-rod 20 on the valve 21. This valve is, however, held to its seat for a time until the thermostatic tube 10 has so far expanded that the block 19, under the influence of the spring 18, has risen sufficiently to store considerable energy in the spring 20, whereupon the air pressure tending to hold the valve against its seat is overcome and the valve suddenly opens. Air flows down the passage 25 and encounters the check valve 35, which is closed, and fills the chamber 26, holding the diaphragm 33 down over the exhaust port 29 and shutting off the exhaust. Pressure now rapidly increases in the chamber 26 and passage 34, and when sufficient pressure has been attained the check valve 35 is forced open and air finds its way through the pipe 32 to the motor, moving the steam valve to closed position against the tendency of the spring 40 to hold the same open. This action takes place quickly as the valve 21 is wide open and permits the air to flow rapidly through the pipe 32 into the air chamber of the motor and speedily fill the same. The check valve 35 does not offer sufficient resistance to the flow of air toward the motor to appreciably retard the action of the motor in closing the steam valve 39.

What I claim as new and desire to secure by Letters Patent is:

1. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a thermostatically controlled valve for closing said passage, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust from said motor, and a valve located in said secondary chamber and subjected to the pressure therein for closing said exhaust.

2. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a thermostatically controlled valve for closing said passage, a secondary chamber communicating with said first-named chamber when said valve is opened, a relief port for said secondary chamber, an exhaust from said motor, a valve in said secondary chamber for controlling said exhaust, said exhaust-controlling valve being arranged to be seated by the pressure within said secondary chamber when said thermostatically controlled valve is opened.

3. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve permitting the flow of fluid through said passage in one direction only, a thermostatically controlled valve for closing said passage, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust from said motor, and a valve in said secondary chamber for controlling said exhaust, said valve being subjected to pres-

sure from said first-named chamber when said thermostatically controlled valve is opened and being seated by such pressure.

4. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve arranged to close said passage and tending to unseat itself against the pressure in said chamber, thermostatically responsive means for closing said valve, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust for said motor, and a valve in said secondary chamber for closing said exhaust, said valve being seated by pressure in said secondary chamber and opening when said thermostatically controlled valve is closed.

5. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve for closing said passage, said valve being subjected to the pressure within said chamber and opening against such pressure, thermostatically responsive means for controlling said valve, an exhaust from said motor, a valve for controlling said exhaust, said valve being held to its seat by pressure from said chamber when said first-named valve is opened, and a relief port for releasing the pressure behind said pressure-operated valve.

6. The combination with a motor operated by fluid pressure, means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a thermostatically controlled valve for closing said passage, said valve being arranged to open against the pressure within said chamber, a check valve in said passage, a second valve subjected to pressure from said chamber when said thermostatically controlled valve is opened, a relief port for releasing the pressure upon said second valve when said thermostatically controlled valve is closed and an exhaust from said motor controlled by said last-named valve.

7. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to the motor, a thermostatically controlled valve for closing said passage, said valve opening against the pressure within said chamber, a check valve in said passage, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust from the motor, a diaphragm in said secondary chamber constituting a valve for closing said exhaust when subjected to pressure by the opening of said thermostatically controlled valve.

8. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a thermostat having a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a thermostatically controlled valve in said chamber for closing said passage, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust for said motor, and a valve located in said secondary chamber and subjected to the pressure therein for closing said exhaust.

9. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a thermostat having a chamber communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a thermostatically controlled valve in said chamber for closing said passage, a secondary chamber communicating with said passage, a relief port for said secondary chamber, an exhaust from said motor, and a valve located in said secondary chamber and subjected to the pressure the rein, for closing said exhaust when said thermostatically controlled valve is open.

10. The combination with a motor operated by fluid pressure, of means for controlling said motor comprising a hollow thermostat communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve in said thermostat for closing said passage, said valve being operated by expansion and contraction of said thermostat, a secondary chamber communicating with said hollow thermostat when said valve is open, and having a relief port, an exhaust from said motor, and a valve in said secondary chamber for controlling said exhaust, said exhaust-controlling valve being arranged to be held to its seat by the pressure within said secondary chamber when said first-named valve is opened.

11. The combination with a motor operated by fluid pressure, of a hollow thermostat communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve arranged to permit the flow of fluid through said passage in one direction only, a valve closing said passage, said valve being controlled by expansion and contraction of said thermostat, a secondary chamber communicating with said passage and having a re-

stricted relief port, an exhaust from said motor, and a valve in said secondary chamber for controlling said exhaust, said valve being subjected to pressure from said first-named chamber when said first-named valve is opened and being seated by such pressure.

12. The combination with a motor operated by fluid pressure, of a hollow thermostat communicating with a source of supply of fluid under pressure, a passage leading from said thermostat to said motor, a valve arranged to control said passage and tending to unseat itself against the pressure in said chamber, said valve being moved by expansion and contraction of said thermostat, a secondary chamber communicating with said passage and having a restricted relief port, an exhaust for said motor, and a valve in said secondary chamber for closing said exhaust, said valve being seated by pressure in said secondary chamber when said first-named valve is open and opening when said thermostatically controlled valve is closed.

13. The combination with a motor operated by fluid pressure, of a hollow thermostat communicating with a source of supply of fluid under pressure, a passage leading from said thermostat to said motor, a valve within said thermostat operated by expansion and contraction of said thermostat for controlling said passage, said valve being subjected to the pressure within said thermostat and opening against such pressure, an exhaust from said motor, a valve for controlling said exhaust and arranged to be held to its seat by pressure from the chamber within said thermostat when said first-named valve is opened and a relief port for releasing the pressure behind said pressure operated valve.

14. The combination with a motor operated by fluid pressure, of a thermostat having a chamber therein communicating with a source of supply of fluid under pressure, a passage leading from said chamber to said motor, a valve for closing said passage operated by expansion and contraction of said thermostat, said valve being arranged to open against the pressure within said chamber, a check valve in said passage, an exhaust-controlling valve operated by pressure from said chamber when said first-named valve is opened, and a relief port for releasing the pressure upon said exhaust-controlling valve when said first-named valve is closed.

15. The combination with a motor operated by fluid pressure, of a thermostat having a chamber therein communicating with a source of supply of fluid under pressure, a passage leading from said chamber to the motor, a thermostatically controlled valve for closing said passage, said valve opening against the pressure within said chamber, a check valve in said passage, a secondary chamber communicating with said passage between said check valve and said thermostatically controlled valve, said secondary chamber having a restricted relief port, and a diaphragm in said secondary chamber constituting a valve for closing the exhaust from said motor when subjected to pressure by the opening of said thermostatically controlled valve.

16. The combination with a motor, of a source of supply of fluid under pressure for operating said motor, and an apparatus arranged to establish communication between said source of supply and said motor and thereafter to close said communication and open said motor to the atmosphere, said apparatus having a passage leading from said source of supply to said motor, a check valve in said passage, a chamber having a restricted vent, a passage leading from said source of supply to said chamber, a thermostatically controlled valve for controlling the flow of liquid through both of said passages, an exhaust passage leading from said motor to the atmosphere, and means within said chamber for controlling said exhaust passage, said means being subjected to pressure when said thermostatically controlled valve is open and thereby operating to close said exhaust passage and arranged to open said exhaust passage when said thermostatically controlled valve is closed.

17. The combination with a motor, of a source of supply of fluid under pressure for operating said motor, and an apparatus arranged to establish communication between said source of supply and said motor and thereafter to close said communication and open said motor to the atmosphere, said apparatus having a passage leading from said source of supply to said motor, a check valve in said passage, a chamber having a restricted vent, a thermostatically controlled valve for controlling the flow of fluid to said passage and to said chamber, an exhaust port leading from said motor to the atmosphere, and a diaphragm in said chamber arranged to close said exhaust port when said thermostatically controlled valve is open and permitting said exhaust port to be opened when said thermostatically controlled valve is closed.

18. The combination with a motor, of a source of supply of fluid under pressure for operating said motor, and an apparatus arranged to establish communication between said source of supply and said motor and thereafter to close said communication and open said motor to the atmosphere, said apparatus having a passage leading from said source of supply to said motor, a check valve in said passage, a chamber having a restricted vent, a thermostatically controlled

valve for controlling the flow of fluid to said passage and to said chamber, an exhaust port leading from said motor to the atmosphere, and means within said chamber arranged to be subjected to pressure on one side when said thermostatically controlled valve is open and thereby caused to close said exhaust port and to be subjected to pressure from said motor when said thermostatically controlled valve is closed and thereby to permit said motor to exhaust the atmosphere.

In witness whereof, I have hereunto subscribed my name in the presence of two witnesses.

WALTER W. CURTIS.

Witnesses:
M. L. FARRAR,
C. L. HOPKINS.