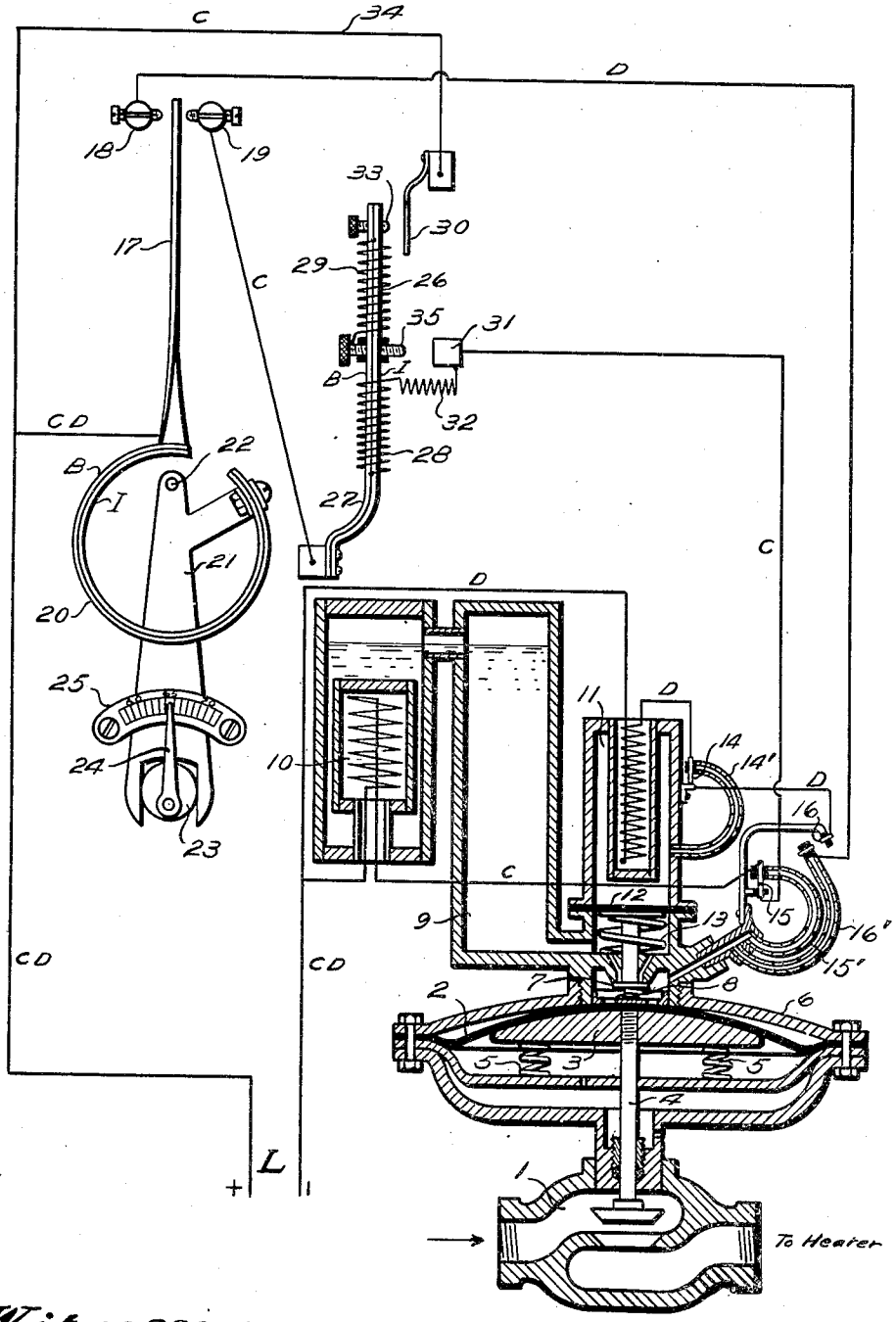
J. H. SWAN.

THERMOSTAT.

APPLICATION FILED JUNE 15, 1905.

921,308. Patented May 11, 1909.



Witnesses:
Andrew Rummler
Glen C. Stephens, by

Inventor,
John H. Swan,
Rummler & Rummler
Attorneys.

UNITED STATES PATENT OFFICE.

JOHN H. SWAN, OF CHICAGO, ILLINOIS.

THERMOSTAT.

No. 921,308. Specification of Letters Patent. Patented May 11, 1909.

Application filed June 15, 1905. Serial No. 265,369.

To all whom it may concern:

Be it known that I, JOHN H. SWAN, a citizen of the United States of America, and a resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Thermostats, of which the following is a specification.

This invention relates to electrical thermostats.

The main objects of this invention are to provide an improved form of electric switch adapted to operate in conjunction with a thermostat for closing an electric circuit, said switch being adapted to respond to an extremely delicate contact at the thermostat and to remain closed, until otherwise released, regardless of subsequent fluctuations of the thermostat; to provide means whereby excessive sparking, at the contact points of a thermostat, due to intermittent making and breaking of the circuit, is avoided.

Further objects of this invention are to provide means whereby at the time that the contact is made the strength of the electric current in said circuit will be reduced below its normal strength by resistance so as to avoid excessive sparking at the thermostat and will then be automatically increased by shunting said resistance so as to throw the full strength of current into the circuit.

I accomplish these objects by the device shown in the accompanying drawing which is a representation of a form of electrical mechanism for operating the steam valve of a radiator, together with a controlling thermostat constructed according to my invention. The valve operating mechanism is shown in section, and the electrical controlling devices are shown diagrammatically.

The particular form of valve operating mechanism which is shown in the drawing is not broadly claimed in this application but is more fully described and claimed in my co-pending application filed January 20, 1904, Serial No. 189,928.

In the construction shown in the drawings, the steam valve 1 is in the form of an ordinary globe valve arranged to be operated by means of a diaphragm 2. The diaphragm bears upon a head 3 at the upper end of the valve stem 4. The valve is normally urged to an open position by means of the springs 5. The diaphragm is inclosed in a casing 6 and said casing communicates at its upper end with a steam pressure device. The passage between the casing 6 and said steam pressure device is controlled by means of the check valve 7, which is normally urged to its closed position by means of the spring 8. The steam pressure device consists of a water reservoir 9 provided with an electrical heater 10 for heating the water contained therein. The steam pressure device is also provided with a second heater 11 separated from the main compartment by a flexible diaphragm 12 which is arranged to bear directly upon the upper end of the stem of the valve 7 for opening said valve. The diaphragm 12 is adapted to be forced downwardly by the steam pressure in the water compartment of the heater 11 and is normally urged by a spring 13 toward the position shown in the drawing. The valve 7 is also adapted to be opened by water pressure from the reservoir 9 under the action of steam formed in the upper part of said reservoir by the heater 10.

When the heater 10 is operating, the water from the reservoir 9 opens the valve 7 and forces the diaphragm 2 downward to close the steam valve 1. When the heater 11 is operating after the steam in the reservoir 9 has become cooled and condensed, the check valve 7 is opened by means of the diaphragm 12 and the water above the diaphragm 2 runs back into the reservoir 9 and permits the springs 5 to open the valve 1.

The circuits for operating the heaters, are controlled by thermostatic means which will be hereinafter described, and are also controlled by the water pressures of the valve operating mechanism. These water pressures make or break the circuits at the contact points 14, 15 and 16, through the action of Bourdon tubes 14′, 15′, and 16′. The tube 14′ communicates with the interior of the water chamber of the heater 11 and the tubes 15′ and 16′ communicate with the compartment above the diaphragm 2.

The conductors of the circuit which supplies current to the heater 10 are indicated by the reference letter C, and the conductors of the circuit which supplies current to the heater 11 are indicated by D. Where both reference letters are used the conductor forms a part of each circuit. The electrical circuits are connected at L with a source of electricity.

The thermostat which controls the circuits C and D consists of a movable member or arm 17, a pair of contact points 18 and 19;

which are connected respectively with the circuits C and D, and a curved strip 20 which is formed of adjacent laminations of two different metals I and B, which expand differentially under changes of temperature and thereby tend to increase or decrease the curvature of the strip 20 and shift the arm 17 between the contact points 18 and 19. The strip 20 is rigidly connected with a lever arm 21 which is pivoted at 22 and is adjustable about its pivotal axis by means of an eccentric 23. The eccentric 23 is provided with a pointer 24 which indicates on a dial 25 the temperature to which the thermostat is set. This mechanism for adjusting the arm 17 is well known in thermostats and need not be more fully described in this application. The metals which are commonly used in the construction of the strip 20 are iron and brass and their respective positions in the drawing are indicated by the initial letters I and B.

On account of the greater expansibility of brass under changes of temperature, the strip 20 will tend to straighten out and cause a contact between the arm 17 and the contact point 18 when the temperature falls below the temperature to which the indicator 24 is set, and a contact will be made with the contact point 19 when the temperature rises above such setting.

In order that a delicate contact between the arm 17 and the contact point 19 will cause a proper closure of the circuit C, the switch 26 is arranged to close automatically when a current flows over the circuit C and complete a shunt path for the current. This also avoids sparking between the arm 17 and the contact point 19, due to a delicate contact at that point and due to fluctuations of the arm 17 under slight variations of temperature, and to the small volume of current passing through the resistance. In the form of switch 26 which is shown in the drawings the switch arm 27 is constructed of laminations of brass and iron similarly to the strip 20. The arm 27 is provided with heating coils 28 and 29 which form parts of the circuit C and serve to cause the arm 27 to move into contact with the contact points 30 and 31. A resistance coil 32 is connected to one end of the coil 28 and the other end of the coil 28 is grounded on the arm 27. This furnishes a path of high resistance in series with the contact point 19 and the arm 17. As soon as a contact is made between the arm 17 and the contact point 19, an electric current will flow through the heating coil 28. This current will be reduced to such an extent by the resistance 32 that little or no sparking will take place at the contact point 19, even though the contact be uncertain. The arm 27 when heated by the heating coil 28 will be distorted and carry its contact point 33 into contact with the spring contact point 30. This closes a shunt of the circuit C which maintains a flow of current through the heating coil 28 on the arm 27 independent of any subsequent fluctuation of the arm 17 which might occur before the contact between 31 and 35 is completed. The current now flows through the conductor 34, the arm 27, the heating coil 28, and the resistance 32. The arm 27 continues to bend under the heating action of the coil 28 and closes the circuit C at the contact points 35 and 31. This shunts out the coils 28 and 32, but brings the heating coil 29 into the circuit. The greater part of the resistance being thus shunted out, the current in the circuit C is largely increased. A similar switch might be provided in the circuit D, but with the valve mechanism shown I do not consider this as necessary on account of the small amount of power which is required for operating the heater 11.

The operation of the device shown is as follows: Assume that the parts of the valve and its operating mechanism are in the positions shown in the drawing. The steam valve 1 is open and the radiator tends to raise the temperature of the room. This rise in temperature causes the brass lamination of the strip 20 to expand more rapidly than the iron lamination and moves the arm 17 into contact with the contact point 19 closing the circuit C. Sparking at 19 will be reduced to a minimum by the resistance 28 and 32. The current then flows over the circuit C, heats the coil 28 and moves the switch arm 27 into contact at 30. This brings the shunt 34 into the circuit C and said shunt takes care of the main volume of the current and prevents sparking at 19 or breaking of the circuit through subsequent fluctuations of the arm 17. The continued heating of the arm 27 causes the same to swing still farther to the right and make a contact at 35 and 31. This contact permits the current to divide, the greater part thereof passing through heating coil 29 and the lesser part continuing to pass through resistances 28 and 32. The resistance in circuit at this point is greatly reduced by this shunting in of the second heating coil 29. The heat developed within this coil insures a continued contact at 35 and 31. The completion of the circuit C causes a heating of the water in the heater 10 and as the pressure of the steam thus formed increases, water is forced through the check valve 7 into the compartment above the diaphragm 2, forcing said diaphragm down and closing the valve 1. The check valve 7 now returns to its seat. Continued increase in the pressure of the steam in the reservoir 9 is communicated through the check valve 7 to the compartment above the diaphragm 2 and causes the Bourdon tube 15′ to break the circuit C at 15. This pressure also causes the Bourdon tube 16′ to form a contact at 16. The valve 1 is now in its closed position and the water

above the diaphragm 2 is confined within the casing 6 by means of the check valve 7. The steam in the heater 10 and the reservoir 9, being no longer heated, cools off and condenses and since the supply of steam was also cut off from the radiator by the closing of the valve 1, the temperature of the room gradually falls. As soon as the circuit C has been broken, the heating effect of the coils 29 and 28 ceases and the switch arm 27 therefore swings away from its contact points and assumes its normal position as shown in the drawing. When the temperature of the room falls, the arm 17 of the thermostat swings into contact with the contact point 18 and completes the circuit D. This causes the heater 11 to generate steam which forces the diaphragm 12 down and opens the check valve 7, thus releasing the pressure of the water above the diaphragm 2 and permitting the springs 5 to open the valve 1. As soon as the valve 1 has opened reduction of pressure in the Bourdon tubes 15′ and 16′ breaks the circuit D and closes the circuit C at 15, so that the circuit C is again in condition for being completed through contact of the arm 17 with the contact point 19 as has been hereinbefore described.

What I claim as my invention and desire to secure by Letters Patent, is:—

1. In a thermostat, the combination of a member adapted to move through temperature changes, an electric circuit having one terminal connected with said member and having a contact point suitably located to be engaged by said member for closing said circuit at a certain predetermined temperature, a switch operated by the current in said circuit and adapted to shunt the current around said member and contact point, a relatively high resistance connected in series with said switch, and means for automatically reducing the resistance in series with said switch after an interval of time following the closing of said switch.

2. In a thermostat, the combination of a main circuit normally open, a contact point connected with one terminal of said main circuit, a member connected with the other terminal and adapted to be moved toward and away from said contact point through changes of temperature, a shunt circuit adapted to connect said terminals independently of the connection at said member and contact point, a switch controlling said shunt circuit, means operated by differential expansion of two substances under changes of temperature for controlling the opening and closing of said switch, a heating coil in series with said main circuit for operating said means when said member is in electrical connection with said contact point, and a second heating coil adapted to hold said switch in its closed position regardless of fluctuations of said member.

3. In a thermostat, the combination of a main circuit, normally open, a contact point connected with one terminal of said main circuit, a member connected with the other terminal and adapted to be moved toward and away from said contact point through changes of temperature, a shunt circuit adapted to connect said terminals independently of the connection of said member and contact point, a heat-operated switch controlling said shunt circuit, an electrical heater in series with said main circuit adapted to close said switch when said member is in electrical connection with said contact point, and an electrical heater in said shunt circuit adapted to hold said switch in the closed position after electrical connection between said member and contact point has been broken.

4. In a thermostat, the combination of a main circuit, normally open, a contact point connected with one terminal of said main circuit, a member connected with the other terminal and adapted to be moved toward and away from said contact point through changes of temperature, a shunt circuit adapted to connect said terminals independently of the connection of said member and contact point, a heat-operated switch controlling said shunt circuit, an electrical heater in series with said main circuit adapted to close said switch when said member is in electrical connection with said contact point, an electrical heater in said shunt circuit adapted to hold said switch in the closed position after electrical connection between said member and contact point has been broken, and a second heat-operated switch in said main circuit, adapted to break said circuit through a rise in temperature.

5. A device of the class described comprising a circuit, a thermostat arranged to open and close said circuit, resistance in series with said thermostat and adapted to prevent sparking at the contacts of said thermostat, a shunt in series with said resistance but bridging said thermostat contacts, a circuit closing device adapted to close the circuit through said shunt through the closing of said thermostat circuit, and means operated through the closing of said shunt circuit for thereafter shunting out a substantial part of said resistance.

6. A device of the class described, comprising a circuit normally open, a thermostat adapted to close said circuit when exposed to a certain temperature, resistance in series with the contacts of said thermostat, a normally open shunt in series with said resistance but bridging the thermostat contacts, and means actuated through the closing of the circuit through said thermostat and adapted to first close said shunt and afterward reduce the resistance of the circuit.

7. A device of the class described, com-

prising a circuit normally open, a thermostat adapted to close said circuit when exposed to a certain temperature, resistance in series with the contacts of said thermostat, a normally open shunt in series with said resistance but bridging the thermostat contacts, and means actuated through the closing of the circuit through said thermostat and adapted to first close said shunt so as to include said resistance in series therewith and to afterward connect the same in parallel for successively reducing the resistance of the circuit.

8. A device of the class described, comprising a circuit normally open, a thermostat adapted to close said circuit when exposed to a certain temperature, resistance in series with the contacts of said thermostat, a normally open shunt bridging the thermostat contacts, a heating coil connected in series with the contacts of said thermostat, and a heat operated switch controlled by said coil and being adapted through a certain movement to close said shunt and to maintain the circuit independently of said thermostat and being adapted through a further movement to shunt out said resistance.

9. In combination with a thermostat, an anti-sparking device comprising a thermostat arm, a contact point arranged to be engaged by said arm when the latter is flexed by heat, said arm and point being connected in parallel with said thermostat, a heating coil carried by said arm for heating the same, said coil being in the circuit controlled by said thermostat, a second heating coil also carried by said arm and being normally on open circuit, and means actuated by continued flexing of said arm for placing the second heating coil in parallel connection with the first heating coil and thus lowering the resistance in the circuit.

10. In combination with a thermostat, an anti-sparking device comprising a thermostat arm, a contact point arranged to be engaged by said arm when the latter is flexed by heat, said arm and point being connected in parallel with said thermostat, a heating coil carried by said arm for heating the same, said coil being in the circuit controlled by said thermostat, additional resistance in series with said heating coil, a second heating coil also carried by said arm and being normally on open circuit, and means actuated by continued flexing of said arm for placing the second heating coil in parallel connection with the first heating coil and said additional resistance, and thus lowering the resistance in the circuit.

Signed at Chicago this 12th day of June 1905.

JOHN H. SWAN.

Witnesses:
E. A. RUMMLER,
RUDOW RUMMLER.