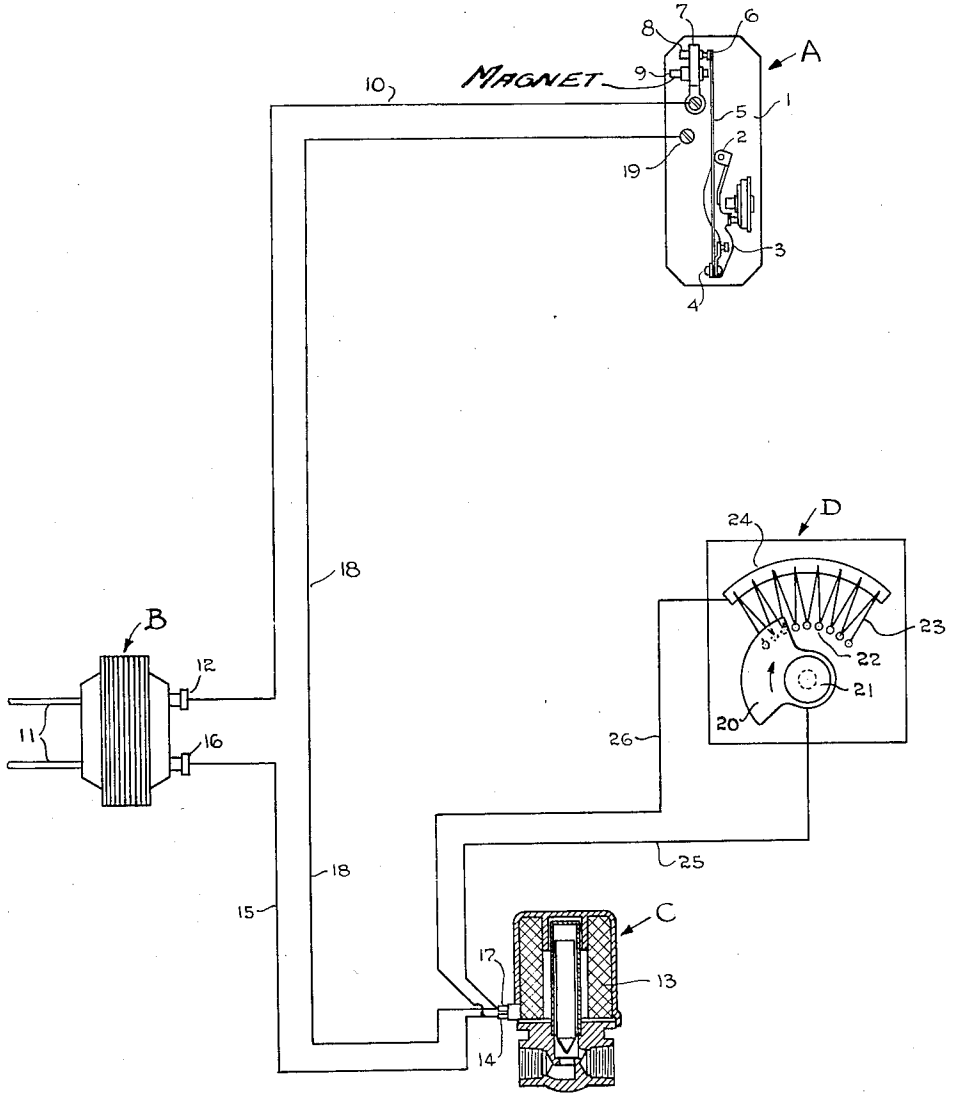
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ELECTRICAL CONTROL SYSTEM

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ELECTRICAL CONTROL SYSTEM

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3 Claims. (Cl. 175—335)

My invention relates to new and useful improvements in an electrical control system wherein a temperature responsive switch is employed to control the operation of an electrically operated means.

An object of my invention is to provide the system with means by which the set or predetermined differential of operation of the switch may be regulated or controlled.

Another object is to provide means by which the set or predetermined differential of operation of the switch may be maintained irrespective of variation or change in the resistance of the electrically operated means controlled by the switch.

The invention consists in the novel system and the controlling means for switch operation, to be more fully described hereinafter and the novelty of which will be particularly pointed out and distinctly claimed.

In the accompanying drawing, to be taken as a part of this specification, I have fully and clearly illustrated a preferred embodiment of my invention, in which drawing—

The figure is a diagrammatic view of a control system embodying my invention.

Referring to the drawing by characters of reference, A designates generally a temperature responsive or thermostatic switch having a base or supporting member of metal or other electric conducting material on which is pivotally mounted, as at 2, an adjustable supporting arm 3 by which the range of operation of the temperature responsive switch may be regulated. The arm 3 is electrically connected by its pivotal support to the base 1. Rigidly fixed at one end to the free end of the arm 3, as at 4, there is a bimetal switch blade 5 having its free end portion defining an armature and carrying a contact member 6. Mounted on the base 1 adjacent the free end of the blade 5 there is a supporting block 7 of metal or other electric conducting material which is electrically insulated from the base 1. The block 7 is provided with a contact member 8 cooperable with the contact member 6 to make and break an electric circuit to be described. The block 7 is also provided with a permanent bar magnet 9 which is adjustably supported therein and which is cooperable with the armature portion of the blade 5. Adjustment of the magnet 9 relative to the blade 5 to vary the air gap when contact is made determines the differential of operation of the switch and predetermines the maximum temperature differential of the blade at which contact will be made and broken. The switch A is electrically connected to a source of current supply B by a lead wire 10 connected to the block 7. The source B is shown as a transformer having its primary supplied by lead wires 11 and having one terminal 12 of its secondary connected to the lead wire 10. It is to be noted that the current may be supplied directly from a source of high potential without affecting the operation of my system which is shown as low voltage merely for illustration. The switch A means C may be a relay or any other electrically operated means C which is shown as a solenoid operated valve solely by way of example as the means C may be a relay or any other electrically energized or operated means. The means C is provided with an electrically energized operating coil 13 which has one terminal 14 connected by a lead wire 15 to the other post or terminal 16 of the transformer secondary. From the other terminal 17 of the coil 13 the lead wire 18 connects to the metal switch base 1, as at 19, so that the coil 13, the switch A and the transformer secondary are in series circuit. Also in series circuit with the switch A and in parallel circuit or multiple with the electrically operated means C, there is a variable electric resisting means or rheostat D. The rheostat D is provided with a segmental contact plate 20 having an operating knob 21 and cooperable with a row of spaced contact or terminal members 22. A continuous resistance wire or similar means 23, which is of zig-zag form, has the return bent portions along one side connected to the space members 22 and has the return bent portions along its other side electrically connected to a conductor bar 24 so that clockwise rotation of plate 20 in the direction of the arrow will cut out or decrease the electrical resistance of the rheostat. The plate 20 is electrically connected by a lead wire 25 to the lead wire 18 at terminal post 17 and the bar 24 is electrically connected by a lead wire 26 to the lead wire 15 at the terminal post 14 so that the coil 13 and the rheostat D are in parallel circuit with each other.

The operation of my system is as follows: Considering first the operation independent of rheostat D, the thermostatic switch A being in closed circuit position as shown, the coil 13 of the electrically operated means C will be energized and current will flow from the transformer secondary through the coil 13 and the switch blade 5 and thence back to the transformer secondary. Due to the electrical resistance of the blade 5, the blade will be heated by the current flowing therethrough to a temperature somewhat higher than the temperature of the air or

other medium surrounding the blade and to which it is subjected. The heating of the blade will be dependent upon the resistance of the blade which is a constant factor and upon the resistance offered by the coil 13. It will therefore be apparent that the movement of blade 5 to open circuit position is determined by the heat imparted to the blade from the surrounding air and from the current flow through the blade 5, and that closing movement of blade 5 is dependent solely on heat imparted to the blade from the surrounding air or other medium. Therefore for any given or predetermined resistance of the coil 13 the differential operation of the switch may be regulated by adjustment of the magnet 9. However, assuming that the magnet 9 has been adjusted to provide a desired differential of operation of the switch with a certain or determined circuit load, it will be apparent that change in the load or resistance of the coil 13 as by the use of a coil having a different resistance will result in a change in the current flowing through the blade 5 so that there will be a change in the heating of the blade. Any change in the current flow through the blade will result in a change in the differential of operation of the switch for a given setting or adjustment of the magnet 9. Any such variation in the circuit load may be compensated by means of the rheostat D which provides an additional path for current flow in series with the thermostatic switch so that the current flow through the blade 5 may be maintained constant for any variation in the resistance of the coil 13 within the limits of the variable resistance of the rheostat D. If, for example, the thermostatic switch is adjusted by the magnet 9 to provide a two degree differential of operation of the switch between the temperatures at which contact will be made and broken for a power consumption in the circuit comprising the switch and the means C controlled thereby of say 25 watts, then if the resistance of the coil 13 is changed or an electrically operated means C having a different resistance is employed such that the power consumption is less than 25 watts, less resistance may be put in parallel circuit with the means C and in series with the thermostatic switch by means of the rheostat D by adjusting knob 21 to provide additional current paths so that the current flow through the blade 5 may be maintained constant thereby maintaining constant the differential of operation of the switch A.

The system is also operable to regulate the operation of the switch A within the maximum differential, set or determined by the magnet 9. Assuming that the switch is adjusted by the magnet 9 to have a two degree differential of operation when the power consumption of the circuit including the means C is 25 watts, then by adjusting the rheostat D so that there will be a greater current flow through the blade 5 the heating of the blade by the current flowing therethrough will be increased with the result that the differential of operation of the switch A will be decreased. By increasing the current flow through the blade so that the temperature of the blade when the switch is closed is heated say two degrees above the temperature of the surrounding medium, which temperature differential is also the differential of operation determined by the magnet 9, then the operation of the switch A will be fully compensated so that contact will be broken upon any increase from a given temperature at which the switch is set to close. It will also be apparent that the switch may be overcompensated by increasing the current flow through the blade sufficiently so that the temperature rise of the blade due to electrical heating when the switch is closed will be greater than the maximum differential of operation determined by the setting of the magnet 9. With such an adjustment of the current flow through blade 5, the switch will intermittently open and close until the temperature of the medium surrounding the blade has decreased below the range setting of the switch by an amount equal to the difference between the differential of operation of the switch as determined by the magnet 9 in degrees of temperature and the number of degrees temperature to which the blade is heated by the current flow therethrough.

It will also be noted that when the switch operates to make circuit on increase of temperature of the surrounding medium as would occur in connection with control of refrigerating apparatus or the like, the differential of operation due to heating of the blade 5 by current flow therethrough will be added to the differential of operation determined by the setting or adjustment of the magnet 9. If therefore for a given current flow through the blade, the magnet 9 is adjusted to provide for breaking of circuit at a differential of operation of say two degrees below the temperature at which contact is made, then decreasing of the current flow through the blade by means of the rheostat D will decrease the differential of operation of the switch A. If the current flow through the blade is increased by adjustment of the rheostat D, the differential of operation will be increased to cause a greater differential of operation of the switch than was determined by the setting of the magnet 9, that is, will further lower the temperature point at which contact is broken without changing the degree of temperature at which contact is made.

From the foregoing description, it will be apparent that the rheostat D is also operable when the thermostatic switch A makes circuit on increase of temperature to maintain the differential of operation of the switch constant with changes in the resistance of the means C controlled by the switch.

What I claim and desire to secure by Letters Patent of the United States is:

1. In a temperature controlling system, a thermostat responsive to ambient temperature, means cooperable with said thermostat determining the temperature differential between opening and closing response of said thermostat to ambient temperature, an electrically operated means having a source of current supply and comprising the circuit load, said thermostat having switch contacts controlling current supply to said electrically operated means, said thermostat having a resistance to current flow acting to heat the thermostat when said contacts are closed, and electrical resistance means in parallel circuit with said load for regulating the heating of said thermostat thereby to vary the thermostat differential determined by said first-named means.

2. In a temperature controlling system, a thermostat responsive to ambient temperature and having switch contacts, an electrically operated means in circuit with said contacts and controlled by said thermostat, magnetic means cooperable with said thermostat and opposing separation of said contacts to provide quick contact breaking movement, said magnetic means establishing a temperature differential of operation, said thermostat having a resistance to cur-

rent flow acting to heat the thermostat in accordance with the resistance of said electrically operated means, and a regulatable resistance in parallel circuit with said electrically operated means and cooperable with said electrically operated means to regulate the differential of operation of said thermostat.

3. In a temperature controlling system, a thermostat having switch contacts, an electrically operated means in circuit with said contacts, said thermostat having an electrical resistance in circuit with said contacts and acting to heat the thermostat when said contacts are closed, means cooperable with said thermostat and opposing separation of said contacts, the heating of said thermostat by current flow through said resistance varying with change in resistance of said electrically operated means, and electrical resistance means in parallel circuit with said electrically operated means, said last-named means acting to compensate for variation in resistance of said electrically operated means thereby to maintain a constant differential of operation of said thermostat.

EARNEST J. DILLMAN.

CERTIFICATE OF CORRECTION.

Patent No. 2,061,536. November 17, 1936.

EARNEST J. DILLMAN.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 11, for the words "means C may be a relay or any other" read serves to control the operation of an; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 9th day of March, A. D. 1937.

Henry Van Arsdale
(Seal) Acting Commissioner of Patents.