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H. D. JAMES ET AL

SYSTEM OF CONTROL

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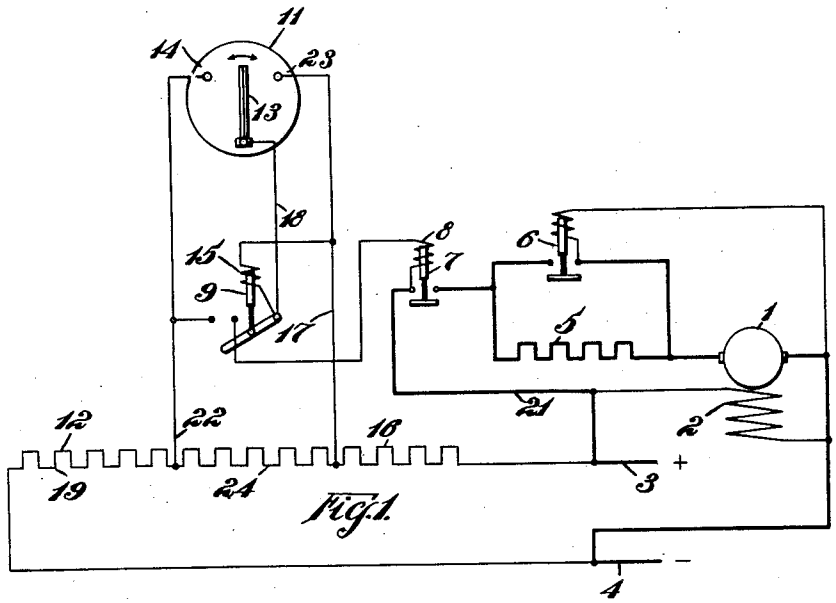


Fig. 1.

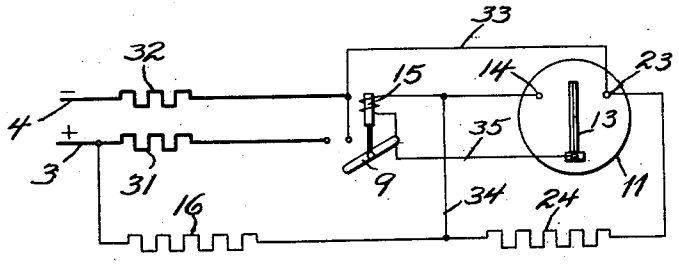


Fig. 2.

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UNITED STATES PATENT OFFICE.

HENRY D. JAMES, OF EDGEWOOD PARK, AND EDGAR M. BOUTON, OF EAST PITTSBURGH, PENNSYLVANIA, ASSIGNORS TO WESTINGHOUSE ELECTRIC AND MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA.

SYSTEM OF CONTROL.

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To all whom it may concern:

Be it known that we, HENRY D. JAMES, a citizen of the United States, and a resident of Edgewood Park, in the county of Allegheny and State of Pennsylvania, and EDGAR M. BOUTON, a citizen of the United States, and a resident of East Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Systems of Control, of which the following is a specification.

Our invention relates to control systems and particularly to such systems as are employed in connection with thermostats or pressure regulators.

One object of our invention is to provide means for limiting the voltage applied to a regulator and to the electric circuits controlled thereby.

The regulator is employed to control a relay and is commonly arranged to shunt the actuating coil of the relay under certain conditions. It is another object of this invention to limit the current traversing the contact members of the regulator when the actuating coil of the relay is shunted.

It has been found convenient to locate the relay within the regulator structure; that is, to combine them as a unit. It has been found difficult to properly insulate the operating members of this unit and to effect a shunt circuit for the relay coil which will insure the opening of the relay contact members.

Our invention will be described in connection with the accompanying drawings, in which Figures 1 and 2 are diagrammatic views of circuits and apparatus embodying our invention.

Referring particularly to Figure 1, a motor having an armature 1 and a field-magnet winding 2 is connected to a source of energy having positive and negative line conductors 3 and 4, respectively. An accelerating resistor 5 and its controlling contactor 6 are employed in a well-known manner, and the motor circuit is controlled by a line contactor 7. The actuating coil 8 of the line contactor 7 is controlled by a relay 9, the actuating coil of which is controlled by a pressure regulator 11.

A resistor 12, having, for convenience, three sections, is connected, in shunt relation, to the source of supply.

The motor which may be presumed as operating a pumping plant, is assumed to be at rest. The pressure regulator 11 operates in a manner which is well known in accordance with the pressure prevailing in the pumping system. When the pressure falls to a predetermined degree, the moving contact member 13 engages a stationary contact member 14, establishing a circuit for the actuating coil 15 of relay 9, extending from the positive line conductor 3, through resistor section 16, conductor 17, coil 15, conductor 18, contact members 13 and 14 and resistor section 19 to the negative line conductor 4. Relay 9 is thereupon closed, establishing a circuit from positive line conductor 3, through conductor 21, coil 8, relay 9, conductor 22 and resistor section 19, to negative line conductor 4.

Contactor 7 now closes to establish a circuit for the motor armature 1, extending from positive line conductor 3, through conductor 21, contactor 7, resistor 5 and armature 1, to negative line conductor 4. The motor field-magnet winding 2 is connected, in a usual manner, to the line conductors 3 and 4. Accelerating resistor 5 is shunted by contactor 6 in a well-known manner, in accordance with the counter-electromotive force of the motor.

A holding circuit is established for relay coil 15, extending from positive line conductor 3, through resistor 16, conductor 17, coil 15, relay 9, conductor 22 and resistor 19, to negative conductor 4. Therefore, as the pressure decreases, the contact member 13 moves out of engagement with contact member 14, the motor circuit is uninterrupted until the pressure falls to such degree that contact member 13 engages contact member 23, establishing a shunt circuit for relay coil 15, extending from the positive line conductor 3, through resistor 16, conductor 17, contact members 23 and 13, conductor 18, relay 9 and resistor 19, to the negative conductor 4. Relay 9 then opens and de-energizes the coil 8 of contactor 7, interrupting the motor circuit.

The voltage applied to the regulator 11 and relay coil 15 is determined by the value of the resistance in section 24 of the resistor 12. The current traversing contact members 13 and 23 is limited by resistor sections 19 and 16, thereby reducing the voltage ap-

plied to coil 15 and insuring the opening of relay 9; the current is also limited by the provision of a shunt circuit for the resistor section 24, through the coil 8, when the relay 9 is closed.

Fig. 2 illustrates a modification of our invention in which the heating elements 31 and 32 are connected to the positive and negative line conductors 3 and 4, respectively, through the relay 9. Resistors 16 and 24 are connected in a circuit comprising a thermostat 11.

Normally, a circuit is established from the positive line conductor 3, through resistors 16 and 24, conductor 33 and a heating element 32, to the negative line conductor 4.

Assuming that the apparatus described is used to control room temperature, and assuming that the temperature falls to a predetermined degree, contact member 13 of the thermostat 11 engages contact member 23, establishing a circuit extending from positive line conductor 3, through resistor 16, conductor 34, relay coil 15, conductor 35, contact members 13 and 23, conductor 33 and heating element 32, to negative conductor 4. Relay 9 now closes, establishing a circuit from positive line conductor 3, heating element 31, relay 9 and heating element 32 to negative line conductor 4.

Both heating elements are energized, the room temperature increases and contact member 13 is disengaged from contact member 23. A circuit for the coil 15 of relay 9 is maintained, however, extending from the positive line conductor 3, through resistor 16, conductor 34, coil 15, relay 9 and heating element 32, to the negative line conductor 4. This circuit is maintained until the room temperature reaches a predetermined degree, when contact member 13 engages contact member 14, establishing a shunt circuit for coil 15, extending from positive line conductor 3, through resistor 16, conductor 34, contact members 14 and 13, conductor 35, relay 9 and heating element 32, to the negative conductor 4. The voltage applied to coil 15 is, therefore, reduced to a negligible degree, causing the relay 9 to open and to disconnect the heating element 31.

Resistor 24 limits the voltage applied to the thermostat and to the relay coil 15. Also, the current traversing contact members 13 and 14 is limited by the resistor 16 and the heating element 32 and by the shunt circuit comprising heating elements 31 and 32, when relay 9 is closed.

The application of a thermostat or pressure regulator, as described, in general is old, but we provide auxiliary means for limiting the voltage applied to the regulator and, also, for limiting the current traversing the regulator contacts.

It will be recognizable that it would be of considerable advantage to employ a regulator designed for use on systems of normal voltage wherein the system reduces the voltage applied to the regulator to a considerable degree below the normal or line voltage of the system. Also, the reduction in current when the relay coil is shunted, minimizes the deterioration of the contact members and insures de-energization of the relay, since a very low current traversing the regulator members causes a minimum voltage to be applied to the actuating coil of the relay.

We claim as our invention:—

1. The combination with an electric heating device and a circuit-controlling device, of a thermostat, means for shunting the circuit-controlling device and means for limiting the current traversing the thermostat when said device is shunted.

2. The combination with a circuit-controlling device having a movable contact member actuated between two stationary contact members and a resistor connected between the stationary contact members, of a resistor for limiting the voltage between said stationary contact members and for completing a shunt circuit through said controlling device when said movable contact member engages one of said stationary contact members.

3. The combination with a thermostat having electrical contact members and a circuit-controlling device controlled by said contact members, of means comprising said members for shunting the operating coil of said circuit-controlling device, a resistor for limiting the current in said shunt circuit and a resistor for limiting the voltage between said contact members and for limiting the voltage applied to the coil of said circuit-controlling device.

4. The combination with an energy-regulating device having a plurality of electrical contact members and a resistor connected to a source of supply, of a circuit-controlling device having a coil for connection in shunt relation to a section of the resistor, means comprising the contact members for controlling the circuit-controlling device and means comprising said resistor for limiting the current applied to the regulating device.

5. The combination with a pressure gage and a relay, of a plurality of contact members within the gage for shunting the actuating coil of the relay, and means for limiting the voltage applied to said gage and for limiting the current traversing said current members when said coil is shunted.

6. The combination with a pressure gage having electrical contact members and a relay controlled by said contact members, of means comprising said members for shunting the operating coil of said relay, a re-

sistor for limiting the current in said shunt circuit, and a resistor for limiting the voltage between said contact members and for limiting the voltage applied to said relay coil.

7. The combination with an electrical translating device and a circuit-controlling device, of a regulator means for shunting the circuit-controlling device and means for limiting the current traversing the regulator when said device is shunted.

8. The combination with a circuit-controlling device and a regulator, of means for shunting the circuit-controlling device and means for limiting the current traversing the regulator when said coil is shunted.

9. In a control system, in combination, a supply circuit, a plurality of resistors connected in series-circuit relation to each other and to the supply circuit, a heating element, an electromagnetic switch for controlling the energization of said heating element from said supply circuit, and a thermostat for causing the energization of the coil of said switch by connecting it in parallel-circuit relation to one of said resistors, whereby the switch is caused to close to permit the energization of said heating element from said supply circuit, said switch being effective, in its closed position, to short circuit said thermostat.

10. In a control system, in combination, a supply circuit, a plurality of resistors connected to said supply circuit, a heating element, a plural contact electromagnetic switch for controlling the energization of said heating element from said supply circuit, thermally-controlled means for initially connecting the coil of said switch in parallel-circuit relation to one of said resistors to energize the same, and an additional contact on said switch for maintaining the parallel-circuit connection of said coil and said resistor.

11. In a control system, in combination, a supply circuit, a plurality of resistors connected to said supply circuit, a heating element, a plural contact electromagnetic switch for controlling the energization of said heating element from said supply circuit, thermally-controlled means for initally connecting the coil of said switch in parallel-circuit relation to one of said resistors to energize the same, and an additional contact on said switch for establishing a holding circuit through said coil independent of said thermally-controlled means.

12. In a control system in combination, a supply circuit, a plurality of resistors connected to said supply circuit, a heating element, a plural contact electromagnetic switch for controlling the energization of said heating element from said supply circuit, thermally-controlled means for initially connecting the coil of said switch in parallel-circuit relation to one of said resistors to energize the same, and an additional contact on said switch for establishing a holding circuit through said coil independent of said thermally-controlled means, said thermally-controlled means being operative to short-circuit said coil at a predetermined temperature, to effect the interruption of the circuit through said heating element.

13. In a control system, in combination, a supply circuit, a plurality of resistors connected to said supply circuit, a heating element, a plural contact electromagnetic switch for controlling the energization of said heating element from said supply circuit, thermally-controlled means for initially connecting the coil of said switch in parallel-circuit relation to one of said resistors to energize the same, and an additional contact on said switch for establishing a holding circuit through said coil independent of said thermally-controlled means, said thermally-controlled means being operative to short circuit said coil at a predetermined temperature, to effect the interruption of the circuit through said heating element and through said thermally-controlled means.

14. In a control system, in combination, a supply circuit, a plurality of resistors connected to said supply circuit, a heating element, an electromagnetic switch for controlling the energization of said heating element from said supply circuit, a plural-position thermostat for controlling the energization of the coil of sail electromagnetic switch by alternately connecting said coil in parallel-circuit relation to one of said resistors and by short-circuiting it in accordance with the temperature of the heating element.

In testimony whereof, we have hereunto subscribed our names this 5th day of January, 1921.

HENRY D. JAMES.
EDGAR M. BOUTON.