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AUTOMATIC SWITCHING MECHANISM

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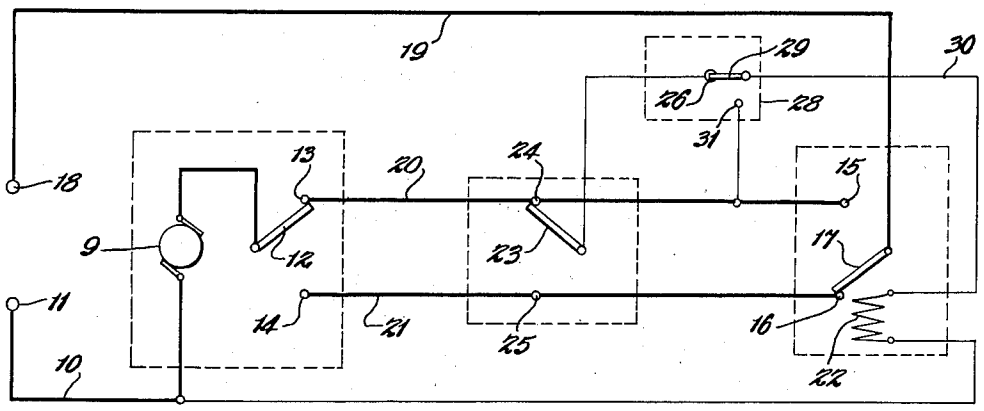

Fig 1

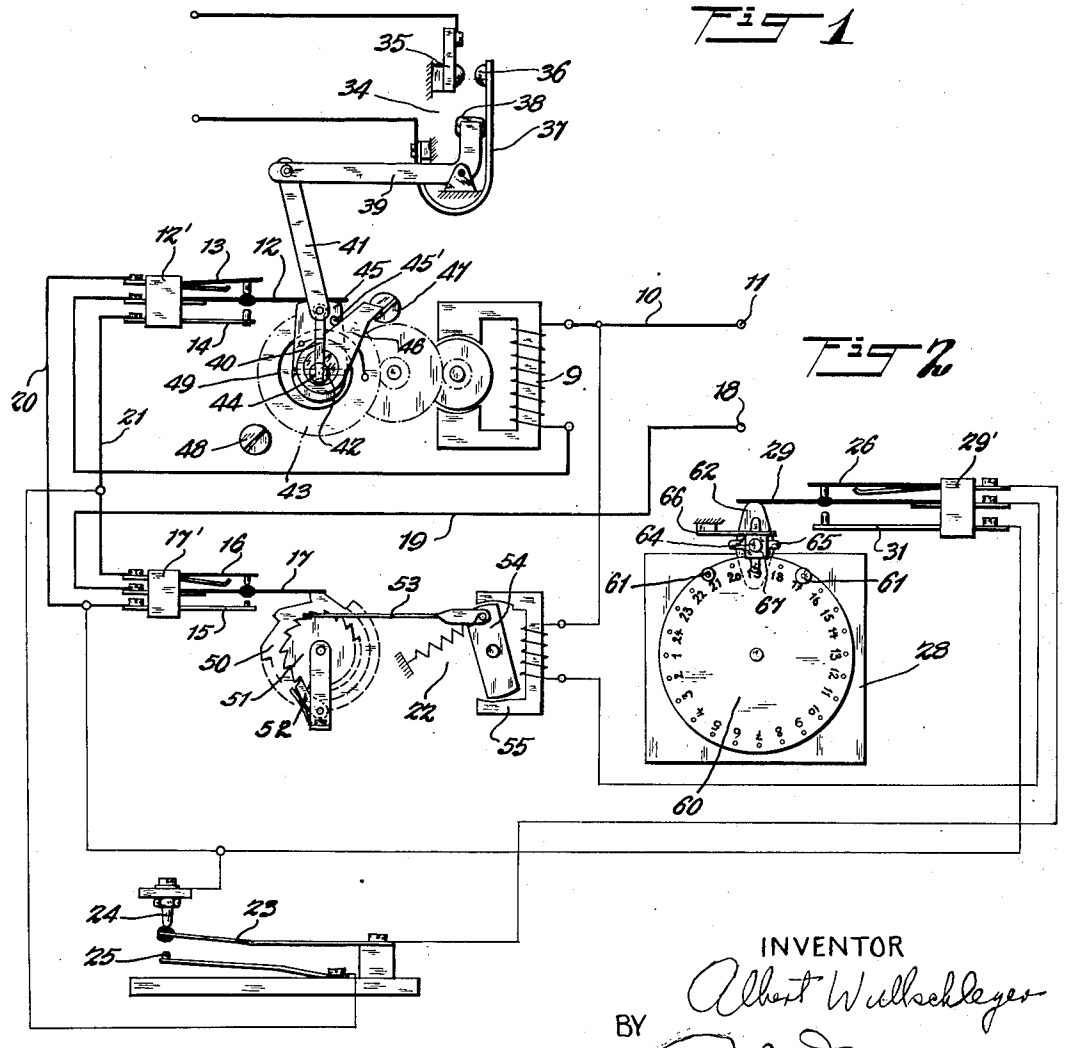

Fig 2

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AUTOMATIC SWITCHING MECHANISM

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10 Claims. (Cl. 175—375)

The present invention relates to automatic switching mechanism and more particularly to an automatic motor-actuated switching mechanism adapted to be controlled by temperature or other changes.

Objects and advantages of the invention will be set forth in part hereinafter and in part will be obvious herefrom, or may be learned by practice with the invention, the same being realized and attained by means of the instrumentalities and combinations pointed out in the appended claims.

The invention consists in the novel parts, constructions, arrangements, combinations and improvements herein shown and described.

The accompanying drawing, referred to herein and constituting a part hereof, illustrates one embodiment of the invention, and together with the description, serve to explain the principles of the invention.

Of the drawing:

Fig. 1 is a diagrammatic view illustrating the controlling circuit for the automatic switching mechanism; and

Fig. 2 is a diagrammatic view illustrating the present preferred and illustrative embodiment of the invention.

The present invention has for its object the provision of an automatic switching mechanism in which the relays controlling the switching operations remain energized only for a very short period of time, thereby reducing the danger of overloading the relays. A further object is the provision of an automatic switching mechanism in which the relays are operative only during the beginning of the switching period. Still another object of the invention is the provision of a switching mechanism in which each switching operation automatically sets the mechanism in reverse switching position ready to operate as soon as the controlling conditions change in a predetermined manner.

Figure 1 of the drawing illustrates diagrammatically the principal circuits employed in the present preferred and illustrative embodiment of the invention, and, as there shown, a motor 9 is provided to actuate the switching mechanism for the main circuit. The motor controlling circuit comprises the conductor 10, leading from one side of the main 11, to the motor 9, and thence to a double throw switch arm 12 which can be moved to contact with either of the contacts 13 or 14. Contacts 13 and 14 are connected by conductors 20 and 21 with other contacts 15 and 16 respectively which cooperate with a second double throw switch arm 17 to connect the switch with the main 18 through conductor 19.

Motor 9 is mechanically connected with the switching arm 12 to move the arm from one of the contacts 13 or 14 to the other each time the motor is energized, and other electromagnetic motive means 22 is provided to similarly move the switch arm 17 between its contacts 15 and 16.

For controlling the circuits previously described and causing a switching operation at predetermined times and upon predetermined changes in temperature, a temperature responsive switching mechanism is provided. This comprises the temperature controlled switching arm 23 which contacts with either of its contacts 24 or 25. Contact 24 is connected with contacts 13 and 15, and contact 25 is connected with contacts 14 and 16, while the switching arm 23 is connected with one contact 26 of a double-throw time switch 28. The switch arm 29 of the time switch 28 is connected with the motive means 22 through conductor 30 and the other contact 31 of switch 28 is connected with conductor 20.

Figure 2 of the drawing shows the circuits more in detail together with the mechanical parts causing the successive operations to be performed in accordance with the changes in temperature or with time. As embodied, the main switch 34, which is to be controlled by the remainder of the mechanism, comprises stationary contacts 35, and movable contacts 36 which are connected in the circuit of the mechanism or heater to be controlled in the usual manner. The contacts 36 are normally held in contact with the stationary contacts 35 by the resiliency of the spring supports 37 carrying the movable contacts, and contacts 36 are moved to circuit breaking position out of contact with contacts 35 by movement of the insulated bar 38 supported on pivoted bell cranks 39.

Switch 34 is opened and closed by means of a small motor 9, which is connected to crank 40 through reduction gearing, and crank 40 is connected with bell-crank 39 by pitman 41. For insuring quick opening and closing of switch 34, crank 40 is supported on shaft 42 on which is rotatable gear 43 of the reduction gearing. Shaft 42 also carries an eccentric 44 loosely mounted thereon, the eccentric being fast with respect to the switch-actuating shoe 45 and carrying the loosely mounted stop arm 46 which contacts with stops 47 and 48, and abuts against pin 45′ mounted on shoe 45. Shoe 45 and crank 40 are connected with gear 43 by means of the spiral spring 49, so that as gear 43 rotates, eccentric 44 is rotated until stop arm 46 is withdrawn from contact with

one of the stops 47 or 48, thereby permitting spring 49 to rotate the crank 40 and shoe 45 until stop arm 46 comes in contact with the other stop. This half-revolution of crank 40 opens or closes switch 34.

Shoe 45 moves arm 12 of switch 12' into contact with contact 13 and permits it to be resiliently moved into engagement with contact 14 on alternate half-revolutions of the shoe.

In this embodiment, the electromagnetic motive means 22, for the switch 17' comprises a toothed wheel 50 rotatably mounted and fast with respect to a ratchet wheel 51, held against retrograde movement by means of dog 52, and moved by means of the pawl 53 which is drawn forwardly by oscillation of the movable armature 54 each time electromagnet 55 is energized. Toothed wheel 50 is positioned with respect to the switch 17' that the teeth lift arm 17 into contact with contact 16, and on a single actuation of the armature 54, the arm resiliently moves into contact with the contact 15.

The temperature responsive means preferably comprises a bimetallic member 23 forming the movable switch arm and supported between the contacts 24 and 25 so that on being heated beyond a predetermined temperature it moves to close the circuit through contact 24, and on cooling below a predetermined temperature moves to close the circuit through contact 25.

The time controlled means preferably comprises a clock driven disc 60 which rotates in accordance with time, and carries a plurality of switch actuating pins 61 which alternately close and open the switch 29'. As embodied, there is provided a rotatable cam 62 having alternate high and low surfaces which cooperate with the switch arm 29 to alternately close and open the switch, and this cam is rotatably mounted by means of shaft 64 which also carries a star wheel 65 adapted to be moved a quarter revolution each time it comes in engagement with a pin 61. A spring 66 is provided cooperating with the squared member 67 mounted on the shaft for holding the cam and star wheel in one of their four positions.

As shown in this figure, the parts are connected in circuit the same as in Figure 1, contacts 13, 15, 24 and 31 being connected together, as are contacts 14, 16 and 25. Contact 26 is connected with switch arm 23, and the electromagnetic motive means is connected between switch arm 29 and main 11.

Figure 2 shows the parts in the position they assumed after the main switch 34 was opened by an increase in temperature beyond the predetermined limit.

As the temperature falls, bimetal strip 23 contacts with contact 25 to close this switch, establishing a circuit, as follows: from main 11, through the coil of magnet 22, through arm 29, contact 26, bimetal strip 23, contact 25, contact 16, arm 17 and through conductor 19 to main 18. This energizes the electromotive means 22, causing arm 17 to contact with contact 15, which closes the circuit to energize motor 9 which continues to rotate until switch 34 is closed and arm 12 is simultaneously moved to contact with contact 14, interrupting the motor circuit.

In case the time switch moves arm 29 next, this arm contacts with contact 31, the electromagnet 22 is energized, which moves arm 17 to contact with contact 16, thereby energizing motor 9 and causing switch 34 to be opened.

If the temperature rose beyond the predetermined limit before the time switch opened the circuit, the magnet 22 would be actuated by contact of arm 23 and contact 24, which would shift arm 17 to contact with contact 16 thereby establishing the circuit as follows: from main 11, through motor 9, arm 12, contact 14, contact 16, arm 17, conductor 19 and out to main 18. The motor 9 then continues to drive until the switch is opened and arm 12 is moved into engagement with contact 13, restoring the parts to the position shown in Figure 2.

The invention in its broader aspects is not limited to the specific mechanisms shown and described but departures may be made therefrom within the scope of the accompanying claims without departing from the principles of the invention and without sacrificing its chief advantages.

What I claim is:

1. Automatic switching mechanism including in combination a main switch and motive means for opening and closing the switch, a temperature responsive switch controlling the supply of energy to the motive means, and means set in operation by the temperature responsive switch for interrupting the flow of current through said temperature responsive switch while continuing the supply of energy to the motive means until the main switch has been fully operated.

2. Automatic switching mechanism including in combination a main switch and motive means for opening and closing the switch, a periodically actuated switch controlling the supply of energy to the motive means, and means set in operation by the periodically actuated switch for interrupting the flow of current through said periodically actuated switch while continuing the supply of energy to the motive means until the main switch has been fully operated.

3. Automatic switching mechanism including in combination a main switch and motive means for opening and closing said switch, means for supplying energy to said motive means to complete the switching operation once it is initiated, a controlling means for supplying energy to the motive means and means for interrupting the supply of energy through the controlling means immediately after the motive means are started without interrupting the supply of energy to the motive means and means for thereafter interrupting the supply of energy to the motive means on completion of the switching operation.

4. Automatic switching mechanism including in combination a main switch and motive means for opening and closing said switch, means for intermittently supplying the motive means with energy, means for thereafter interrupting the flow of current through the second means and for interrupting the supply of energy to the motive means as soon as it completes operation of the main switch.

5. Automatic switching mechanism including in combination a main switch and motor actuating means therefor, a switch in the motor circuit and driven thereby, a second motor switch, a temperature controlled switch, a time switch, means for disconnecting the temperature controlled switch and time switch immediately after they have operated and means for continuing the current supply to the motor until it has completed its switching operation.

6. Automatic switching mechanism including in combination a main switch and motor actuating means therefor, a time switch in the motor circuit preventing closure of the main switch during predetermined periods, a temperature

controlled switch operative to open and close the main switch in accordance with temperature changes subject to control of the time switch, means for interrupting the flow of current through the time and temperature controlled switches immediately after one of their switching operations and means rendered operative by such interruption to continue supply of current to the motor until completion of the switching operation.

7. Automatic switching mechanism including in combination a main switch and motor actuating means therefor, a time switch in the motor circuit preventing closure of the main switch during predetermined periods, a temperature-controlled switch operative to open and close the main switch in accordance with temperature changes subject to control of the time switch and means for interrupting the flow of current through the time and temperature controlled switches immediately after one of their switching operations.

8. Automatic switching mechanism including in combination a main switch, electric motor means for actuating the switch, two double throw switches in the motor circuit, one having its movable member moved from one position to the other by operation of the motor to complete a main switching operation, a second motor for moving the movable member of the second switch between its two positions and a time switch and a temperature controlled switch in series with said second motor.

9. Automatic switching mechanism including in combination a main switch, electric motor means for actuating the switch, two double throw switches in the motor circuit, one having its movable member moved from one position to the other by operation of the motor to complete a main switching operation, a second motor for moving the movable member of the second switch between its two positions, a time controlled double throw switch and a temperature controlled double throw switch both in circuit with said second motor and operative to energize the second motor momentarily to cause said second switch to be operated when an actuation of the main switch is called for by the temperature between predetermined periods of time.

10. Automatic switching mechanism including in combination a main switch, electric motor means for actuating the switch, two double throw switches in the motor circuit, one having its movable member moved from one position to the other by operation of the motor to complete a main switching operation, a second motor for moving the movable member of the second switch between its two positions, a pair of switches in circuit with said second motor and adapted to be intermittently actuated independently of each other, said switches being so connected in the motor circuit that one causes motors to be energized only while the other of said last mentioned switches is in one of its positions while said other switch affects the motor circuits only when the main switch is closed.

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