Aug. 25, 1931. C. H. HODGKINS 1,820,702

ELECTROMAGNETIC SWITCH

Filed Aug. 25, 1925

Fig. 1.

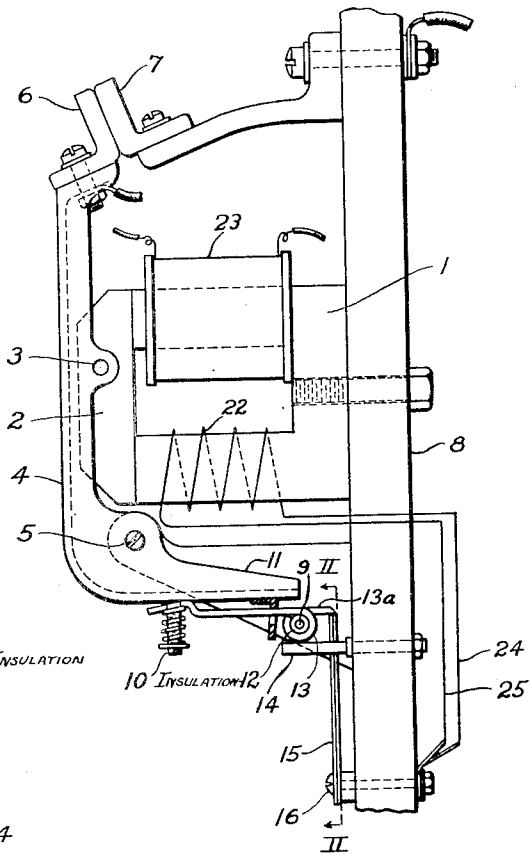


Fig. 2.

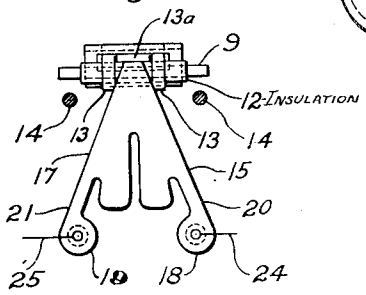
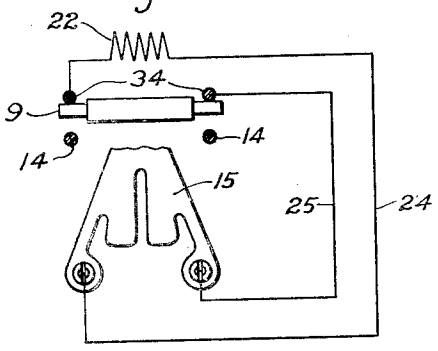


Fig. 3.



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UNITED STATES PATENT OFFICE

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ELECTROMAGNETIC SWITCH

Application filed August 25, 1925. Serial No. 52,267.

My invention relates to electromagnetic switches and it has particular relation to switches employed for controlling electric motors and other translating devices.

One object of my invention is to provide an improved switching device having a thermally controlled time-element operation.

Another object of my invention is to provide means inductively related to the operating coil of an electromagnetic switch for controlling the operation of a thermal element.

Many types of time-element controlling devices, have been employed in connection with motor-control systems and the like, but few of such devices are dependable and satisfactory in operation. In employing a thermally controlled device, it is necessary to provide a thermal element having a suitable characteristic such that, when subjected to heat, the element cools rapidly at intervals between successive switching operations. Another difficulty encountered in connection with switching devices of this character is in the provision of suitable means for heating the thermal element without undue waste of energy.

In accordance with my invention, I provide an electromagnetic switch having main contact members and an operating magnet of a familiar character, together with an auxiliary switch, commonly termed an electrical interlock, that is controlled by means of a bimetallic thermal element. The thermal element is heated by means of a secondary coil that is inductively related to the operating coil of the switch and, therefore, is heated without undue waste of energy. I also have devised a bimetallic element that operates efficiently and with a desirable short time-element, when heated, and cools rapidly when de-energized.

My invention will be best understood by reference to the accompanying drawings in which,

Figure 1 is a view, partially in side elevation and partially in section, of apparatus embodying my invention,

Fig. 2 is a view in front elevation of the auxiliary contact members and thermal element, and

Fig. 3 is a diagrammatic view of a modification of the apparatus illustrated in Fig. 2.

Referring to the drawings, I have illustrated my invention as applied to an alternating-current electromagnetic switch of a conventional design, comprising a stationary U-shape core member 1 and an armature member 2 that is pivotally supported on an intermediate bearing 3, which is carried by a movable switch arm 4 that is also pivotally mounted upon a lower shaft or bearing 5. Movable and stationary main switch members or contact tips 6 and 7 are provided, and the entire switching mechanism is supported upon an insulating base 8 in accordance with a familiar practice.

An auxiliary movable switch member 9 is secured to a punching 13 that is pivotally and yieldingly mounted upon a pin or bearing 10 that is attached to the rearwardly-projecting tail piece 11 of the switch. The movable switch member 9 is preferably insulated from punching 13 carried by the tail piece 11 of the switch arm 4 in any suitable manner, such as by means of the illustrated insulating tube 12, which is secured to the metal punching or saddle 13, through one end of which the pin 10 projects. The switch member 9 is adapted to bridge across a pair of stationary contact members 14, which are utilized to govern another switch, or to close any other desired circuit.

A bimetallic thermal element 15, triangular in outline, is secured to the base 8 by means of terminal bolts 16 passing through the two lower corners. The thermal element comprises an upper portion 17 having a relatively large radiating surface, the top end of which engages the under side of a rearwardly-projecting arm 13*a* of punching 13 and thereby normally biases the switch element 9 to an inoperative position. Portions 18 and 19 having relatively large radiating surfaces are also provided at the two lower terminals of the thermal element 15. Current enters and leaves the element through these terminal portions and I have,

therefore, found it desirable to provide relatively large radiating surfaces at these points. Adjacent to the terminal portions 18 and 19, I provide restricted or narrow portions 20 and 21 that in operation become what are familiarly termed "hot spots". The thermal element when heated warps from its normal position, the warping effect being greatly increased on account of the location of the "hot spots". The element is cooled quickly because of its large radiating surfaces or portions of heat storage capacity adjacent to the "hot spots", whereby heat from the constricted portions 20 and 21 is rapidly dissipated.

A secondary or heating coil 22 is mounted on one leg of the magnet core 1 and the switch-operating coil 23 is preferably mounted on the other leg. When current is supplied to the operating coil 23, the coil 22, being inductively related to the operating coil, is energized by transformer action and current flows from coil 22 through conductors 24 and 25 to heat the thermal element 15.

When the operating coil 23 is energized, the armature 2 is attracted to its illustrated position, whereupon main contact members 6 and 7 are brought into engagement. The auxiliary contact member 9, however, remains in its illustrated and inoperative position momentarily. The thermal element 15 is now being heated from the secondary coil 22 and, after a predetermined time interval, the element 15 warps to the right of its illustrated position to release contact member 9, which thereupon bridges stationary contact members 14.

When operating coil 23 is de-energized, and the armature 2 is restored to its inoperative position, both the main and the auxiliary circuits are thereby interrupted through main contact members 6 and 7 and auxiliary members 9 and 14, respectively. The secondary coil 22, being deenergized, the thermal element 15 is rapidly cooled and restored to its illustrated initial position.

By varying the "section" of the constricted portions 20 and 21, I am able to vary the operating characteristics of the thermal element 15. The element itself may be readily removed and a new element, having a different section and time characteristic substituted therefor, in order to meet various requirements of switching operations.

Referring to Fig. 3, I have illustrated means comprising upper terminal members 34 that cooperate in the interruption of the circuit of coil 22 when movable member 9 is released by the operation of thermal element 15. The element is thereby permitted to cool and coil 22 is protected against undue heating. Element 15 then engages the end of saddle 13 and snaps into place when armature 14 returns to its inoperative position.

Various modifications of my invention will naturally occur to one skilled in the art and I desire, therefore, that my invention shall be limited only in accordance with the scope of the appended claims.

I claim as my invention:—

1. In a switch, the combination with a movable switch member and a thermal element for biasing said member, said element comprising bimetallic material provided with a pair of fixed terminals of relatively large thermal capacity and a constricted portion adjacent to each terminal to control the operation of said element.

2. A thermal element comprising a bimetallic strip having a pair of current-carrying terminal members of relatively large thermal capacity and a constricted portion of relatively low thermal capacity adjacent to each terminal.

3. In a switch, the combination with a movable switch member and a thermal element for biasing the switch member, the thermal element comprising a terminal member for connecting the element to a source of electrical energy, a body member provided with a large surface area for quickly dissipating heat, and a connecting member between the terminal member and body member which has a relatively small surface area, as compared with the body member, thereby to provide for causing the connecting member to respond quickly to the application of heat caused by the flow of electrical energy to actuate the switch member in one direction, said body member serving to dissipate the heat quickly when the application of heat is discontinued to effect the operation of the switch in the other direction.

4. In a switch, the combination with a movable switch member and a thermal element for biasing the switch member, the thermal element comprising a terminal member for connecting the element to a source of electrical energy, a body member provided with a large surface area for dissipating heat quickly, a constricted member interposed between the terminal member and the body member, said constricted member being disposed to respond quickly to the flow of electrical energy to effect the operation of the switch member in one direction, said body member serving to dissipate the heat quickly when the flow of electrical energy is discontinued to effect the operation of the switch member in the opposite direction.

In testimony whereof I have hereunto subscribed my name this 7th day of August, 1925.

CHARLES H. HODGKINS.