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CONTROL MEANS

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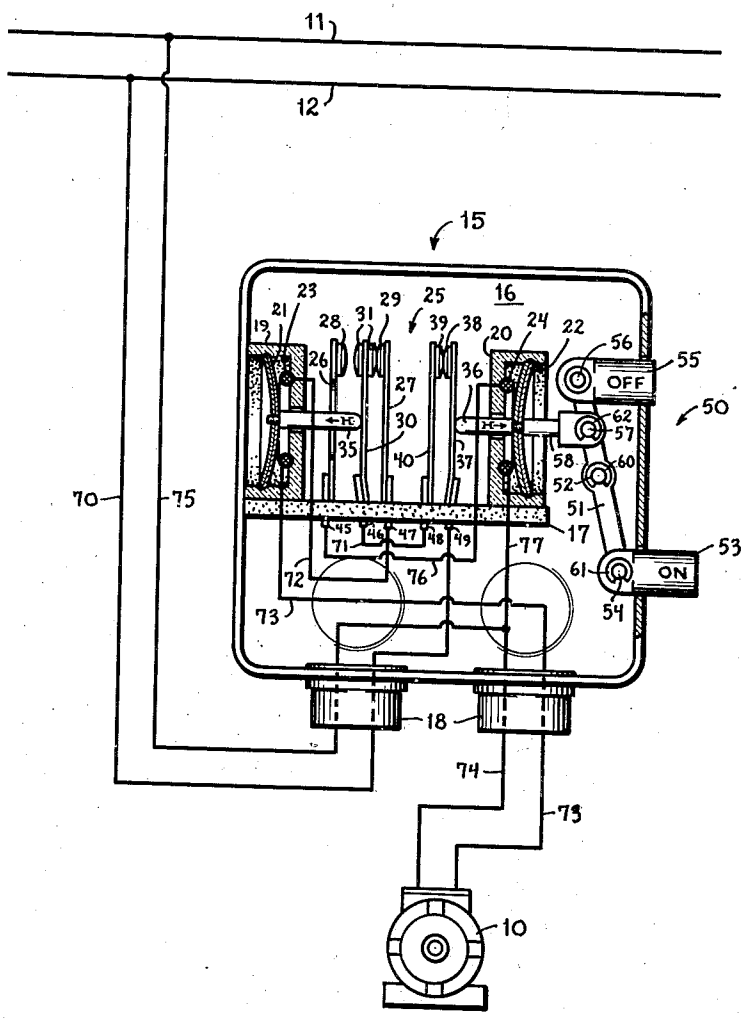

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CONTROL MEANS

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The present invention relates to a condition responsive control means, and more particularly to an electrical overload cutout.

The instant control means is adapted to be incorporated into a motor or into a motor circuit, or into circuit with or adjacent to any other energy using devices which generate heat when in use or use a substantially increased amount of electricity when operating under overloaded conditions. The control means is adapted to perform its protective function in a very simplified manner, and comprises but very few relatively simple and inexpensive parts.

A difficulty which has heretofore given great trouble in plural try overload responsive devices has been the failure of the devices to always give a plurality of cutout tries before finally rendering the controlled device inoperative. Many devices which provide a plurality of cutout tries merely notch around a tripping member. This member usually has no returning means so that if the device is made to give three tries, and two have been given on some previous overload condition, only one will remain for a later overload. Such devices obviously do not give satisfactory results in many applications such as a refrigerant compressor, wherein due to cold lubricant, sticky bearings or cylinder, the intial load is often very high and an overload cutout try will follow. However, after a brief loosening up period such conditions usually disappear and it is desirable to have the motor remain in operation after an initial cutout and a short elapse of time to permit the motor windings to cool. Other time devices give a clock-work timed cutout period. Such devices are satisfactory in their operation and solve the above difficulty, but all such comprise many intricate parts needing careful construction and assembly, thus raising the cost of production to a high level.

An object of the present invention is to provide a simplified overload cutout for always giving a predetermined number of overload cutout tries before shutting down the controlled device permanently.

Another object is to combine such an overload cutout with a manual switch which cooperates with an operating part of the cutout mechanism.

A further object is to provide a thermally responsive overload cutout with a thermal timer which will provide a plurality of overload cutout tries for said cutout before the controlled device is finally positively shut down by said timer.

The above and other objects will be in part apparent or pointed out in the accompanying specification and claims when read with consideration of the accompanying drawing, in which the single figure of the drawing is partly in detail and partly diagrammatic, and shows the overload cutout incorporated into a motor circuit.

Referring more particularly to the drawing, a motor 10 is supplied with electrical energy from line conductors 11 and 12. The motor 10 may be used to operate any desired device, such as, for example, a refrigeration compressor, a burner motor, or some other device.

The motor 10 is controlled by an overload cutout device generally indicated by the reference character 15. The overload cutout device 15 comprises a casing 16 and a switch mounting ledge 17 therein suitably secured to the casing 16. The casing 16 is provided with suitable electrical lead in connections 18. Mounted upon the insulating ledge 17 are two overload cutout housings 19 and 20 respectively constructed of some suitable insulating material, such as a ceramic which may be molded. Within the housings 19 and 20 are the thermostatic discs 21 and 22 respectively. The thermostatic disc 21 is designed to be more sensitive than the thermostatic disc 22 for reasons to be hereinafter more fully disclosed. Associated with the thermostatic discs 21 and 22 are a pair of heaters 23 and 24, respectively. The heater 23 is adapted to heat the disc 21 which will actuate a double throw switch generally indicated by the reference character 25. The switch 25 comprises a pair of fixed switch arms 26 and 27 carrying stationary contacts 28 and 29, respectively. A flexible switch arm 30 carries at its end a contact 31 which is adapted to cooperate with the stationary contacts 28 and 29. The thermostat 21 acts upon the flexible switch arm 30 through a rod 35. The thermostatic element 22 is adapted to act upon a rod 36 to move a flexible switch arm 37 having a contact 38 carried at the upper end thereof. A stationary contact 39 is carried upon a relatively rigid contact arm 40. The contact arms 26, 30, 27, 40 and 36 are all secured to the insulating shelf 17 by means of brackets 45, 46, 47, 48 and 49.

An on and off switch mechanism is generally indicated by the reference character 50. The switch mechanism comprises a link 51 suitably secured to a pivot 52. The link 51 is connected at its lower end to an "on" button 53 which is connected to the link by a pin 54. An "off" button 55 is connected by a pin 56 to the upper end of the link 51. The thermostatic disc 22 is con-

nected to the link by the pivot 57 and a connecting rod 58. The pins 52, 54 and 57 are secured to the link 51 by means of clip washers 60, 61 and 62. The purpose of using the clip washers is so that the various parts of the switch may be removed to cause the on and off switch to be rendered merely a manual reset switch, or to remove the entire switch mechanism to render the device entirely automatic and requiring opening of the switch housing in order to reset the device after it has been tripped upon the occurrence of an overload condition.

Operation

When the motor 10 is operating normally, current is supplied thereto from the line conductor 12 by the conductor 70, contact blade 37, contacts 38 and 39, switch arm 40, conductor 71, contact blade 30, contacts 31 and 29, switch arm 27, conductor 72, the heater 23 for the thermostatic disc 21, conductor 73, motor 10, and conductors 74 and 75 back to the line conductor 11. With the above traced circuit the motor 10 will be energized and operating. If the motor operates normally and no overload condition arises the switches mentioned will remain in the positions recited in tracing the above circuit.

Upon the occurrence of an overload at the motor 10 the heater 23 will supply an increased amount of heat to the thermostatic disc 21 thus causing it to snap toward the left. When the disc snaps to the left, the contacts 31 and 29 will be opened and the contacts 28 and 31 will be closed. With the contacts in this position the following circuit may be traced; from the line conductor 12 through the conductor 70, the switch arm 37, contacts 38 and 39, switch arm 40, conductor 71, switch arm 30, contacts 31 and 28, switch arm 26, conductor 76, the heater 24 for the thermal element 22, conductor 77, and conductor 75 back to the other line wire 11. It will be noted that when the above circuit is closed the motor 10 is deenergized. At this time the motor 10 may cool off. It will also be noted that in the above traced circuit the heater 24 for the thermal element 22 is energized. However, the electric circuit for the thermal element 23 will be opened at this time. Under such conditions the thermostatic element 21 will be cooling and the thermostatic element 22 will be heated by the heater 24.

The thermostatic discs 21 and 22 are so selected that the time of cooling to cause the thermostatic disc 21 to snap back to the position shown in the drawing will be less than the time required for the thermostatic element 22 to heat up sufficiently to snap from the position shown to its right hand position. However, a certain amount of heat will be supplied to the thermostatic disc 22 which will be stored in the closed chamber defined by the thermostatic disc 22 and the interior portion of the housing member 20.

After the thermostatic disc 21 has cooled and snapped back, the contacts 29 and 31 will be again closed and the circuit to the heater 24 will be opened. At this time the motor 10 will be reenergized. If the overload condition at the motor 10 still exists the thermostatic disc 21 will be heated up and again snapped to its left hand position. When this occurs the heater 24 for the thermostatic disc 22 will again be energized and the motor 10 will again be deenergized. The thermostatic disc may be so selected that upon this second successive reheating the disc will snap from the position shown in the drawing to its right-hand position. By proper selection the disc 22 might require three or four or more successive heatings before it will snap to its cutout position.

With the thermostatic disc 22 in its cutout position the contacts 38 and 39 will be broken. These contacts control the main circuit and therefore the motor 10 and the overload switch itself will be entirely deenergized until the overload cutout is manually reset by means of the manual switch 50.

It will be noted from the above disclosure that the thermostatic disc 21 is of the self-returning type when cooled, whereas the thermostatic disc 22 is of the type which must be manually reset after it has snapped because of being overheated. In other words, the thermostatic disc 22 is not of the self-return type.

After the thermostatic disc 22 is snapped to its right hand position because of a continued overload condition, the "off" button 55 will extend through the casing so that the word "off" may be read. To reset the overload cutout device 15 the operator need only press the "off" button bracket in the casing which will force the rod 58 toward the left and thus cause the thermostat disc 22 to be snapped back to the position shown. Also if the motor 10 is operating normally and an operator desires to shut the motor off, the "on" button may be pressed into the case which will force the bimetallic disc 22 toward the right in which position the contacts 38 and 39 will be opened. Therefore it is seen that an "on" and "off" type switch button mechanism is incorporated with an overload cutout in a novel manner.

If it is desired that the overload cutout be not actuable as an "on" and "off" switch, the "on" button thereof can be removed by merely removin the clip washer 61 and withdrawing the pin 54. With such an arrangement, the "off" button under normal operating conditions will be pressed into the casing in the position shown and will only extend out of the casing when the device has been shut down because of the occurrence of a continued overload condition. Likewise, if it is desired that the device be not resettable by an ordinary operator but require attention from a skilled mechanic who will at the same time service the entire system to discover the cause of the overload, the "off" button may be removed. To remove the "off" button 55 the clip washers 60 and 62 are removed and the pins 52 and 57 slipped out of the lever 51. When the pins 52 and 57 are removed the "off" button and link 51 may be removed from the actuating rod 58.

In many instances it is desired to have the overload cutout adjacent the windings of the motor. The present device is adapted to such mounting by placing the thermostatic housing 19 and the thermostatic disc 21 retained therein adjacent the left hand wall of the casing 16. With such a location of the cutout device the heater 23 may be eliminated and the heat of the motor winding itself be adapted to effect the thermostatic disc 22. In this case the conductors 72 and 73 would merely be connected together. Such installations with the overload cutout mounted adjacent the motor winding are conventional and well-known and hence have not been illustrated.

It is anticipated that many different structures and different arrangements of parts may occur to those skilled in the art. One obvious change would be to have the heaters respond to voltage

changes rather than to the actual existence of an overload. For the above reasons it is desired that applicant be not limited to that form shown and described but by the scope of the appended claims and the prior art.

I claim as my invention:

1. In combination, a device capable of using electrical energy, an electrical supply therefor, first and second cooperable switch means for controlling said supply, first and second timed actuators respectively for said switch means, and electrical circuit means connecting said switch means and said device, said first and second switch means being cooperable simultaneously to energize said device and said first actuator, and cooperable to energize said second actuator while deenergizing said device and said first actuator.

2. In combination, a motor, a circuit therefor, a plurality of switch means in said circuit, a load responsive means for actuating one of said switch means to control said motor responsive to an overload condition therein, and a thermal timer also controlled by said load responsive means, said thermal timer opening said other of said switch means so as to provide a predetermined number of overload cutout attempts by said load responsive means, said thermal timer being inoperative to reclose said other switch means automatically.

3. An overload cutout control switch for an electric motor supplied with electricity by a plurality of conductors, comprising in combination, a first double pole switch, a first heat actuated means responsive to the quantity of current used by said motor for moving said first switch, said first switch being in circuit with said motor when in one of its positions, a second single pole switch, a time delayed second heat actuated means for moving said second switch, and a heater for said second heat actuated means, said heater being in circuit when said first switch is in the other of its positions because of the occurrence of an overload condition in said motor, said second switch being in circuit with said first switch for either of its positions and adapted to deenergize it to render said motor inoperative when the overload condition exists for a predetermined period of time.

4. An overload cutout control switch for an electric motor supplied with electricity by a plurality of conductors, comprising in combination, a first double pole switch, a first heat actuated means responsive to the quantity of current used by said motor for moving said first switch, said first switch being in circuit with said motor when in one of its positions, a second single pole switch, a time delayed second heat actuated means for moving said second switch, a heater for said second heat actuated means, said heater being in circuit when said first switch is in the other of its positions because of the occurrence of an overload condition in said motor, said second switch being in circuit with said first switch for either of its positions and adapted to deenergize it to render said motor inoperative when the overload condition exists for a predetermined period of time, and manual means to reset said second switch to render said motor operative after it has been rendered inoperative by the continued existence of an overload condition.

5. An overload cutout control switch for an electric motor supplied with electricity by a plurality of conductors, comprising in combination, a first double pole switch, a first heat actuated means responsive to the quantity of current used by said motor for moving said first switch, said first switch being in circuit with said motor when in one of its positions, a second single pole switch, a time delayed second heat actuated means for moving said second switch, a heater for said second heat actuated means, said heater being in circuit when said first switch is in the other of its positions because of the occurrence of an overload condition in said motor, said second switch being in circuit with said first switch for either of its positions and adapted to deenergize it to render said motor inoperative when the overload condition exists for a predetermined period of time, and on and off manual switch actuating means also associated with said switch for rendering said motor operative and inoperative.

6. A control switch comprising, in combination, a casing adapted to be mounted adjacent a motor or other utilizer of electrical current and responsive to the temperature thereof, a thermostat housing mounted against an inside wall of said casing so as to respond to the heat of said motor, a snap acting first thermostat within said housing adapted to move responsively to temperature variations of said motor, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled and a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits.

7. A control switch comprising, in combination, a casing adapted to be mounted adjacent a motor or other utilizer of electrical current and responsive to the temperature thereof, a thermostat housing mounted against an inside wall of said casing so as to respond to the heat of said motor, a snap acting first thermostat within said housing adapted to move responsively to temperature variations of said motor, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled, a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits, a rod connected to said second thermostat, a rockable lever pivotally connected to said rod, and a manual reset button connected to said lever for forcing said second thermostat from its heated position to its cooled position.

8. A control switch comprising, in combination, a casing adapted to be mounted adjacent a motor or other utilizer of electrical current and responsive to the temperature thereof, a thermostat housing mounted against an inside

wall of said casing so as to respond to the heat of said motor, a snap acting first thermostat within said housing adapted to move responsively to temperature variations of said motor, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled, a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits, a rod connected to said second thermostat, a rockable lever pivotally connected to said rod, and on and off manual actuating means connected to said lever for moving said second thermostat between its heated and its cooled positions.

9. A control switch comprising, in combination, a snap acting first thermostat, an electric heater adjacent thereto for heating the same to a degree corresponding to the variations in an electrical load, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled, and a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits.

10. A control switch comprising, in combination, a snap acting first thermostat, an electric heater adjacent thereto for heating the same to a degree corresponding to the variations in an electrical load, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled, a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits, a rod connected to said second thermostat, a rockable lever pivotally connected to said rod, and a manual reset button connected to said lever for forcing said second thermostat from its heated position to its cooled position.

11. A control switch comprising, in combination, a snap acting first thermostat, an electric heater adjacent thereto for heating the same to a degree corresponding to the variations in an electrical load, said first thermostat moving in one direction when heated to a predetermined degree and returning in the opposite direction when cooled, a movable contact moved by said first thermostat, a pair of stationary contacts cooperably arranged therewith for opening and closing a pair of electrical circuits, one of said circuits being to said motor, a snap acting second thermostat, an electric heater in said second circuit and located adjacent said second thermostat, said second thermostat moving in one direction when heated but being incapable of returning in the opposite direction when cooled, a pair of cooperating contacts held closed by said second thermostat when cool, said last contacts being in control of said pair of circuits, a rod connected to said second thermostat, a rockable lever pivotally connected to said rod, and on and off manual actuating means connected to said lever for moving said second thermostat between its heated and its cooled positions.

12. An overload cut-out comprising in combination, an electric current consuming device, a circuit therefor, a first switch in said circuit, a timer of the self-return type for opening said switch in response to an overload in said circuit and reclosing said switch a predetermined time thereafter, a second electrically operated timer of the non-return type, said first timer including means for delivering electrical energy to said second timer each time said first switch is opened, and a second switch in said circuit opened by said second timer after said first switch has been opened a number of times.

13. An overload cut-out comprising in combination, an electric current consuming device, a circuit therefor, a first switch in said circuit, first thermal means responsive to the heat produced by an overload in said circuit for opening said switch to deenergize said circuit at one temperature and reclosing said switch to reenergize said circuit at another lower temperature, second thermal means, said first thermal means including means for heating said second thermal means each time said first switch is opened, and means operated by said second thermal means for deenergizing said circuit after said first switch has been opened a number of times, said second thermal means being inoperative to reenergize said circuit automatically.

14. An overload cut-out comprising in combination, an electric current consuming device, a circuit therefor, a first switch in said circuit, a timer of the self-return type for opening said switch in response to an overload in said circuit and reclosing said switch a predetermined time thereafter, a second electrically operated timer of the non-return type, means for energizing said second timer including a shunt around said first switch and current consuming device, said first timer including means for closing said shunt circuit as it opens said switch and opening said circuit as it closes said switch, and means operated by said second timer for opening said first named circuit after said switch has been opened a number of times, said second timer being inoperative to reclose said first circuit automatically.

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