June 30, 1936. R. S. AUSTIN 2,045,821

CONTROL MECHANISM

Original Filed April 20, 1931 2 Sheets-Sheet 1

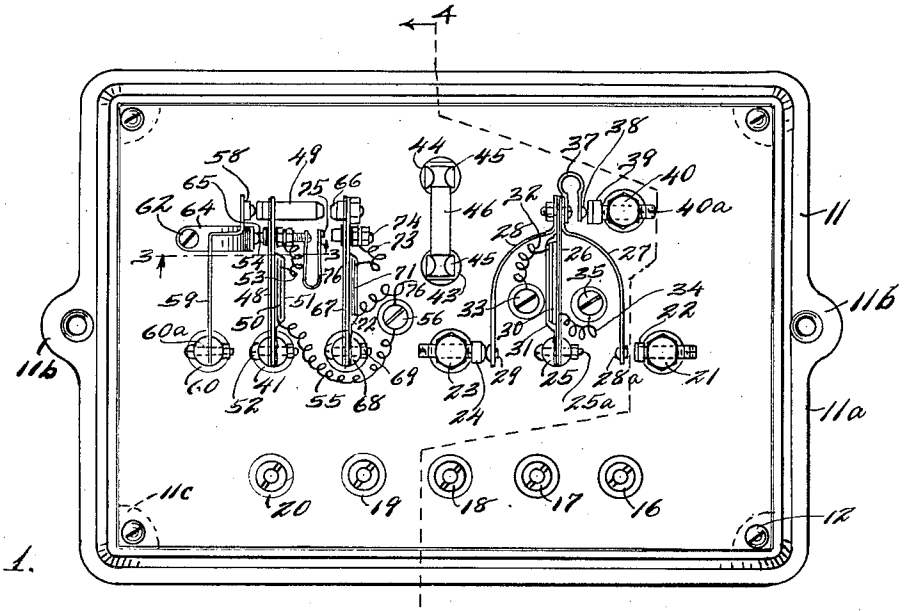


Fig. 1.

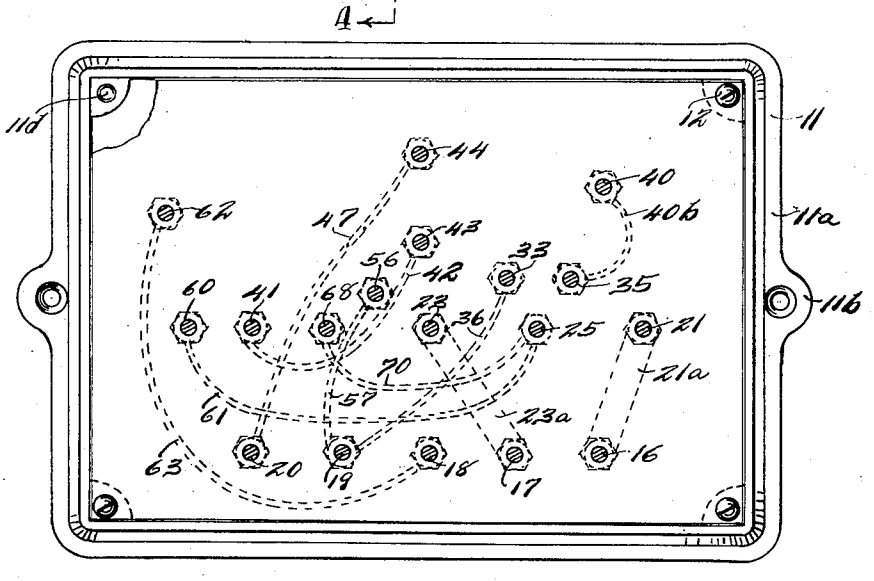


Fig. 2.

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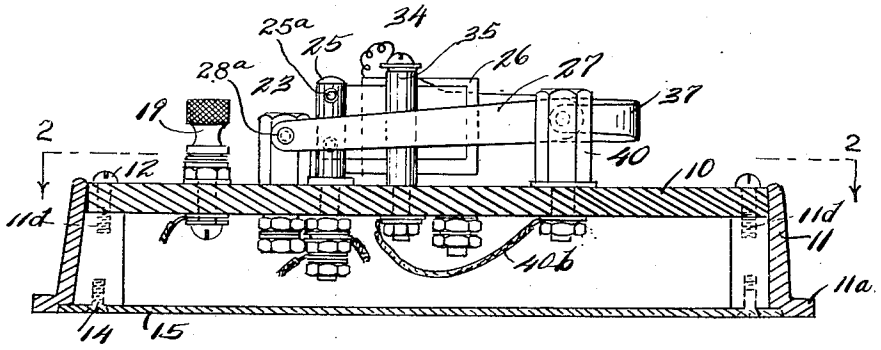


Fig. 4.

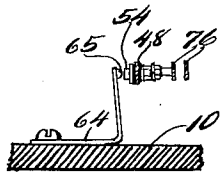


Fig. 3.

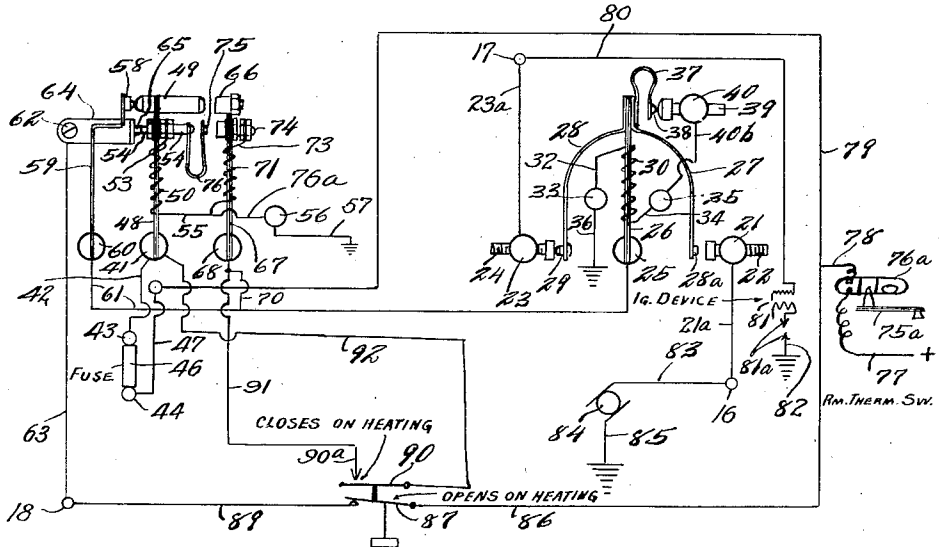


Fig. 5.

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2,045,821

CONTROL MECHANISM

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Application April 20, 1931, Serial No. 531,384
Renewed June 12, 1935

14 Claims. (Cl. 175—320)

This invention relates to a device adapted to control an apparatus through which current is supplied, and while the invention might be applicable to various sorts of apparatus, it particularly is designed for use in connection with an oil burner. Oil burners are now extensively used in furnaces, and as commonly constructed, comprise an ignition device operated by an ignition circuit, and an electric motor which usually operates a pump supplying fuel, and a fan for supplying air to the burner. The ignition is usually operated and after a short interval, the motor is started to supply the combustible mixture. It is also a common practice to supply some means for stopping the operation of the circuit and motor, should the burner fail to ignite. This is usually done by a protectostat or other device placed adjacent the burner or in the stack, which is operated by heat and controls an electrical circuit which will operate apparatus to break the ignition and motor circuits. It is desirable to have a mechanism which will operate if the burner fails to ignite and stop the ignition and motor apparatus, and after a certain period, to again operate the ignition and motor device in a further attempt to start the burner.

It is an object of this invention, therefore, to provide a control mechanism for an electrical apparatus which will stop the operation of the apparatus under certain conditions, and which will subsequently again supply current to the apparatus, but will again cease to supply current under certain conditions.

It is a further object of the invention to provide a mechanism through which current is supplied to the ignition and motor circuits of an oil burner, and which will be actuated by the protectostat or stack device of the burner to stop the supply of current to the ignition and motor circuit should the burner fail to ignite, but which will, after a certain period, again supply current to the ignition and motor circuits in a further attempt to start the burner, but will cease to supply said current should the burner a second time fail to ignite.

It is more specifically an object of the invention to provide a mechanism for controlling an oil burner, comprising a thermostatic bar comprising a pair of contacts to which current is supplied to the ignition and motor circuits of the oil burner, means for heating said thermostatic bar, a circuit for said heating means controlled by the protectostat or stack device whereby if the burner fails to ignite, said thermostatic bar will separate said contacts and stop the supply of current to the ignition and motor circuits, but which will, after a further movement of the thermostatic bar due to the heating means, engage other contacts to again supply current to the ignition and motor circuits of the burner.

It is also an object of the invention to provide such a device as set forth in the preceding paragraph, together with a second thermostatic bar, heating means for the same controlled by the protectostat or stack device, which second thermostatic bar will move to separate said second pair of contacts and again cut off the supply of current to the ignition and motor circuits should the burner fail to ignite.

These and other objects and advantages of the invention will be fully set forth in the following description made in connection with the accompanying drawings, in which like reference characters refer to similar parts throughout the several views and in which:—

Fig. 1 is a plan view of one embodiment of the invention;

Fig. 2 is a horizontal section taken substantially on line 2—2 of Fig. 3;

Fig. 3 is a vertical section taken on line 3—3 of Fig. 1 as indicated by the arrows;

Fig. 4 is a view in vertical section taken substantially on line 4—4 of Fig. 1; and

Fig. 5 is a wiring diagram of the device.

Referring to the drawings, a mechanism is shown comprising a plate 10 which preferably will be made of insulating material. Said plate may be mounted in a casing 11 having a flange 11*a* about its lower edge, which flange is provided with a plurality of apertured bosses 11*b* adapted to receive screws for attaching the casing to some support. Said casing also has a plurality of lugs 11*c* having tapped holes 11*d* therein adapted to receive attaching screws 12 for a plate 10 and also attaching screws 14 for a bottom plate 15 closing the bottom of casing 11. Binding posts 16, 17, 18, 19 and 20 are secured in plate 10, as shown in Figs. 1 and 2. Binding post 16 is adapted to have attached thereto a conductor 83 leading to the motor circuit of an oil burner. Post 17 is adapted to have a conductor 80 attached thereto leading to the ignition circuit of the burner; post 18 is adapted to have a conductor attached thereto leading from the stack device or protectostat used with the burner; post 19 is adapted to have a ground conductor attached thereto and post 20 receives the live wire supplying current to the device.

The control means for the ignition and motor circuits is shown comprising a post 21 secured in

plate 10 and carrying an adjustable contact member 22. Post 21 is secured to post 16 by a metal strip 21a disposed beneath plate 10. Another post 23 is secured in plate 10 some distance from post 21 and carries an adjustable contact member 24. Post 23 is connected to post 17 by a metal strip 23a disposed beneath plate 10. Contacts 22 and 24 preferably are substantially in axial alinement and comprise headed and threaded members, the members having slots in one end adapted to receive a screw driver or adjusting implement. A post 25 is secured in plate 10 between posts 21 and 23 and the same has secured thereto a thermostatic bar 26 illustrated as a bi-metallic bar. Bar 26 has secured thereto and in electrical contact therewith a pair of flexible resilient comparatively thin strips 27 and 28. While these strips may be made of various materials, in practice it has been found suitable to make the same of sheet copper. Strip 27 curves away from bar 26 and then extends substantially parallel thereto at its terminal portion, the same carrying a contact 28a adapted to engage contact 22. Strip 28 also curves away from bar 26 in a direction opposite to strip 27 and also extends substantially parallel to said bar at its terminal portion, and carries a contact 29 adapted to engage contact 24. Bar 26 is provided with heating means comprising a heating element 30 held thereon by a thin plate 31, which heating element may be of any suitable form, such as thin sheets of mica wound with very fine high resistance wire. Bars 26 and 31 are inserted in the split top of post 25 and held therein by a small headed and nutted bolt 25a.

Heating element 26 has one terminal conductor 32 extending from one end of its winding to a post 33 and the other terminal of the heating element has a conductor 34 extending to a post 35. Post 33 is connected by a conductor 36 beneath plate 10 to the post 19. Plate 26 has secured thereto a flexible resilient conductor in the form of a metal strip 37, the same being reversely bent and having thereon a contact 38 adapted to engage one end of an adjustable contact member 39 threaded into post 40 secured in plate 10 and having a slot 40a in its end adapted to receive an adjusting tool such as a screw driver. Post 40 is secured in plate 10 and is connected by a conductor 40b disposed beneath plate 10 to post 35.

The parts so far described constitute one form of regulator for the ignition and motor circuits of the burner and per se form no part of the present invention.

A post 41 is also secured in plate 10 and the same is connected by a conductor 42 beneath plate 10 to a post 43 also secured in plate 10. Another post 44 is secured in plate 10 a short distance from post 43 and said posts 43 and 44 are provided at their tops with spring contact clips 45 adapted to receive the ends of a fuse 46 which is provided to prevent too large a current being supplied. Post 44 is connected by a conductor 47 disposed below plate 10 to the post 20 through which current is supplied. The post 41 has secured therein a thermostatic bar 48, such as a bi-metallic bar, having secured at its other end a rather long cylindrical contact member 49. Bar 48 also has secured thereto a heating element 50 held on said bar by a plate 51. Plates 48 and 51 are inserted in the split top of post 41 and clamped by the small headed and nutted bolt 52. Heating element 50 may be similar to the heating element 30 and has one terminal of its coil connected by conductor 53 to a contact member 54 carried by and insulated from bar 48, said contact being formed at one side of said bar as a binding post for receiving conductor 53. The other terminal of heating member 50 is connected by conductor 55 to the binding post 56 secured in plate 10 and which is connected by a conductor 57 disposed beneath plate 10 to the binding post 19. Contact member 49 engages at one end with a contact member 58 carried adjacent the end of a flexible resilient conductor in the form of a sheet metal strip 59, said strip being inserted in the split top of post 60 and held therein by a headed and nutted bolt 60a, said post being secured in plate 10. Post 60 is connected by conductor 61 disposed beneath plate 10 to the post 25. A post 62 is secured in plate 10 and is connected by conductor 63 disposed beneath plate 10 to post 18. A conductor clip or contact 64 is held in place by and in contact with post 62 and has a vertically extending side carrying a contact 65 engaging contact 54. Contact member 49 is engageable at its other end with a contact member 66 carried at one end of the thermostatic bar 67, which bar is disposed in the split top of post 68 and clamped therein by a small headed and nutted bolt 69. Post 68 is connected beneath plate 10 by a conductor 70 to post 25. Bar 67 carries a heating element 71 held thereon by a bar 72 also held in post 68 by screw 69. Heating element 71 has one terminal connected by conductor 73 to a contact 74 secured in and insulated from bar 67 and projecting at one side thereof, said contact being adapted to engage a contact 75 carried at the end of a resilient metal strip 76 secured to contact 54. The other end of the heating element 71 is connected by conductor 76 to a post 56.

In Fig. 5 a wiring diagram for the device is shown. A thermostat 75a is provided, illustrated as in the form of a thermostatic bar mounted on a suitable support and having a bracket thereon in which is carried a mercury tube 76a. Said tube has a pair of electrodes at one end adapted to be connected by the mercury in the tube when the tube is tilted, and one of these electrodes is connected to a conductor 77 through which current is supplied. The other electrode is connected by conductor 78 to a conductor 79 and conductor 79 extends to and is connected to post 20 which is in turn connected to post 44 by a conductor 47. The fuse 46 extends between posts 43 and 44 to limit the amount of current supplied and post 43 is connected by conductor 42 to post 41. Post 41 has connected thereto as already described, the bar 48 carrying a heating element 50, one end of which is connected to post 56 by conductor 55 and the other end of which is connected by conductor 53 to contact 54 carried by bar 48. Bar 48 also carries contact 49, one end of which engages contact 58 carried on the strip 59 secured in post 60. Post 60 is connected by conductor 61 to a post 25. Post 25 as already described, carries bar 26 having thereon the heating element 30, the ends of which are connected to the posts 33 and 35 by conductors 32 and 34 respectively, post 33 being connected to ground by conductor 36. Bar 26 carries the strips 27 and 28 having thereon the contacts 28a and 29 engaging respectively contacts 22 and 24 carried in posts 21 and 23 respectively. Post 23 is connected by conductor 23a to post 17 and the latter is connected by conductor 80 to ignition device 81 of the burner,

comprising the transformer having spaced electrodes 81*a*, one of which is connected to ground by conductor 82. In operation a series of sparks pass between the electrodes 81*a*. Post 21 is connected by conductor 21*a* to post 16 and the latter is connected by conductor 83 to the motor 84 supplying oil and air to the burner, one side of said motor being shown as connected to ground by conductor 85. Bar 26 also carries a strip contact 37 having thereon contact 38 engaging contact 39 carried in post 40. Post 40 is connected by a conductor 40*b* to post 35. The conductor 86 also extends from conductor 78 to a switch 87 which will be opened upon heat being applied to the protectostat or stack device 88 used with the burner. Switch 87 is connected by conductor 89 to the post 18 and the latter is connected by conductor 63 to post 62 carrying the clip 64 having a contact 65 engaging contact 54. Member 88 will also close a switch 90 connected to post 41 by conductor 92. A conductor 91 connects the open contact 90*a* of switch 90 to post 68. The conductor strip 76 is shown having the contact 75 which engages contact 74 on bar 67 secured in post 68. Bar 67 carries the heating element 71, one end of which is connected to post 56 by conductor 76*a* and the latter is connected to ground by conductor 57. The other end of heating element 71 is connected to contact 74 by conductor 73. Bar 67 also carries the contact 66 engageable with contact 49. Conductor 70 is shown connecting post 68 and wire 61 or post 25.

The operation of the device is as follows: When the temperature in the room drops sufficiently, thermostat bar 75*a* will flex, tilting tube 76*a* and causing the mercury therein to connect the electrodes thereof. Current will then flow from conductor 77 through the electrodes and conductor 78 to conductor 79, thence to posts 20, 43 and 44 to post 41 through said post, bar 48 and contact 49 to contact 58 to strip 59 and post 60 and through conductor 61 to post 25. Current then flows through post 25 and strips 26 and 28 through contacts 29 and 24 which are normally in contact to post 23 and then through conductor 23*a*, post 17 and conductor 80, to the ignition device 81 and to ground. The ignition is now operated. Current is supplied to heating element 30 through bar 26 and strip 37 to post 40 and then through conductor 40*b* to post 35 and through conductor 34 to said element. Current passes from said element through conductor 32, post 33 and conductor 36 to ground. Bar 26 flexes toward the left shown in Figs. 1 and 5. As bar 26 flexes toward the left, contact 28*a* moves toward and eventually engages contact 22, thus closing the motor circuit through conductor 21*a*, post 16 and conductors 83 and 85, or through strip 21*a* and post 16 as shown in Fig. 2. The motor now starts and oil and air are supplied to the burner. After a short time, upon further flexing of the free end of bar 26 to the left contacts 24 and 29 separate and the ignition is cut off. The burner should now be ignited. If the burner ignites properly, protectostat or stack device 88 will open switch 87. However, should the burner not ignite, current will be supplied from conductor 78 through conductors 86 to switch 87, then through conductor 89 to post 18, conductor 63 and post 62 and strip 64, through contacts 65 and 54 which are normally engaged and conductor 53 to heating element 50. Heating element 50 will heat bar 48 and cause the same to flex to the right as seen in Figs. 1 and 5 and after it has moved slightly, contacts 49 and 58 which are normally in engagement will be separated. This will cut off the current supplied through posts 41 and 60 to post 25 and both the ignition and motor circuits will be broken. The ignition and motor of the burner will then be stopped and bar 26 with strips 27 and 28 will resume normal position. However, bar 48 will continue to flex as current is still supplied to heating element 50 and after it flexes to a certain degree, contact 49 will be brought into engagement with contact 66 carried by bar 67 members 58 and 49 being now separated. When this occurs, current can again flow to post 25 through post 41, bar 48, contacts 49 and 66, bar 67, post 68 and conductor 70. Current is again then supplied to the ignition circuit through strips 26 and 28 and contacts 24 and 29 as already described. Current is again supplied to heating element 30 and bar 26 flexes as already described and the motor circuit is again closed in a short time by engagement with contacts 22 and 28. The burner motor 84 is thus again started, ignition device 81 operated and another opportunity given for ignition. When bar 48 was flexed, strip 76 and contact 75 engaged contact 74 and heat was supplied to the heating element 71 on bar 67, current passing through conductor 73, the heating element 71, conductor 76*a* and to ground through post 56 and conductor 57. It may be mentioned that strip 64 carrying the contact 65 is under considerable tension and moves over with bar 48 as the latter flexes, so that contacts 65 and 54 remain engaged when contacts 74 and 75 engage. Bar 67 is thus heated and flexes toward the right as seen in Figs. 1 and 5. When bar 67 thus flexes, it separates contacts 49 and 66 and the circuit furnishing current to post 25 is thus broken and the ignition and motor circuits are broken and the burner is again stopped. If the burner ignites properly upon the second attempt, protectostat 88 would open switch 87 and thus the circuit furnishing the heating current to heating elements 50 and 71 would be broken and the burner would continue to operate. Should the bar 48 be excessively heated and flexed too far toward the right, contacts 54 and 65 would be broken and said bar would cool slightly and flex back sufficiently to reengage said contacts 65 and 54. It is thus heated to a point to retain it in its proper position with contacts 49 and 66 and 75 and 74 engaged. Should the burner not ignite, the trouble will soon be discovered and the apparatus can be brought to normal position by manipulating the thermostat 75*a* and the mercury tube 76. If this is set at a point below the temperature of the room in which it is disposed, the circuit will be broken through conductor 86 and no current will be furnished to the heating devices 50 and 71 and the parts will thus assume their normal positions. The burner would then be investigated to see why the same did not ignite.

Should the burner ignite on the second attempt, protectostat 88 will, as stated, open switch 87, thus breaking the heating circuits for heating elements 50 and 71. At the same time, switch 90 will be closed and current will be supplied to post 68. This is to prevent the ignition and motor circuits being broken and the motor stopped, when the contact 49 moves away from contact 66 and back to contact 58. When the burner cools, switch 87 is closed and switch 90 opened.

From the above description it is seen that applicant has provided a simple and efficient control mechanism for an oil burner or other apparatus and one which not only acts to stop operation of the burner upon an ignition failure, but which will again repeat the starting operation by oper-

ating the ignition and motor of the burner and will again stop the operation thereof should the burner fail to ignite. The device is simple in structure and can be inexpensively made and marketed. The device has been amply demonstrated in actual practice and found to be very successful and efficient.

It will, of course, be understood that various changes may be made in the form, details, arrangement and proportions of the parts, without departing from the scope of the applicant's invention, which generally stated, consists in a device capable of carrying out the objects above set forth in the parts and combinations of parts disclosed and defined in the appended claims.

What is claimed is:—

1. A switching device for controlling a plurality of electrical circuits, each circuit having a controlling contact therein having in combination a thermostatic member, a heating means therefor, a contact carried by said thermostatic member, a second thermostatic member, a heating means for said latter member, a contact carried by said second thermostatic member, means for supplying heat to said first mentioned heating means including a resilient member having a contact thereon and a contact on said first thermostatic member engaged by said latter contact, said first thermostatic member being adapted to flex upon being heated and move said first mentioned contact to cut off the current to said controlling contacts and upon further flexing movement, to engage said first mentioned contact with the contact of said second thermostatic member and again supply current to said controlling contacts, and means for supplying heat to said second mentioned heating means.

2. The structure set forth in claim 1, said last mentioned means including a contact carried by said first thermostatic member and a contact carried by said second thermostatic member, which contacts are brought into engagement by movement of said first thermostatic member, said contact on said flexible member and the first thermostatic member remaining in engagement until said last mentioned pair of contacts are engaged.

3. A switching device for controlling the supply of current to a plurality of electrical circuits, which circuits have therein respectively fixed adjustable contacts having in combination, a pair of movable members having contacts thereon adapted respectively to engage said first mentioned contacts, a thermostatic member through which current is supplied to said movable members, a safety and repeating means for said regulator comprising a plurality of thermostatic members, a plurality of pairs of contacts controlled respectively by said thermostatic members through which current may be supplied to said first mentioned movable members, heating means for each of said thermostatic members, and means for supplying current to each of said heating means including a pair of contacts constructed and arranged to be separated if said thermostatic member is excessively heated and cut off current to said heating means.

4. A switching device for controlling the supply of current to a plurality of electrical circuits having in combination means for supplying current to said circuits, a pair of thermostatically operated members, heating means for each of said members, means for supplying current to one of said heating means for moving one of said members to render said first mentioned means inoperative after a time period and to subsequently render such means again operative after a certain period, and means for supplying current to said other heating element to cause said other thermostatically operated member to again render said first mentioned means inoperative after a certain second period, after a second time period.

5. The structure set forth in claim 4, said means for supplying current to said heating means for said last mentioned thermostatically operated member including a circuit closed by movement of said first mentioned thermostatically operated member.

6. A switching device for controlling the supply of current to a plurality of circuits, having in combination, a thermostatic member, a pair of contacts, one of which is carried by said thermostatic member through which current is supplied to said circuits, a second pair of contacts controlled by said thermostatic member and through which current is supplied to said circuits, means for heating said thermostatic member after a time period to flex said thermostatic member and separate said second pair of contacts and cut off current from said circuits, another pair of contacts controlled by said thermostatic member and subsequently closed by further flexing of said thermostatic member to again supply current to said circuits.

7. A switching device for controlling a plurality of circuits having in combination, a current supply circuit, a temperature responsive means having contacts normally closing one of said plurality of circuits and having a contact adapted to close a second of said circuits when said means is heated, a heating circuit for said means, a second temperature responsive means arranged to act subsequently to said first mentioned temperature responsive means having a contact adapted to break said current supply circuit when said second temperature responsive means is heated, a heating circuit for said second temperature responsive means, a third temperature responsive means arranged to act subsequently to said second temperature responsive means and having a contact adapted to break said current supply circuit a second time when said third temperature responsive means is heated and a heating circuit for said third temperature responsive means closed after said second period of time.

8. The structure set forth in claim 7, said last mentioned heating circuit being closed by a contact moved by said second temperature responsive means when heated.

9. The structure set forth in claim 7 and means responsive to heat for breaking either the heating circuit for said second temperature responsive means or the circuit for said third temperature responsive means whereby said current supply circuit will not be broken and said second of said plurality of circuits will remain closed.

10. A switching device for controlling the supply of current to a plurality of circuits having in combination, a pair of contacts through which current is supplied to said circuits, a thermostatic member controlling one of said pair of contacts and adapted to be flexed to separate said contacts, an electrical heating means for said member, a circuit through which current is supplied to said heating means including a pair of contacts, a resilient member on which one of said last mentioned contacts is carried normally under tension to move with the other of said pair

of contacts for a certain distance when said thermostatic member is flexed, said thermostatic member being constructed and arranged to flex sufficiently to separate said last mentioned pair of contacts whereby said last mentioned circuit will be broken and current cut off from said heating means.

11. A switching device for controlling the supply of current to a plurality of circuits having in combination, a thermostatic member, a pair of contacts controlled by said member through which current is supplied to said circuits, a heating means for said thermostatic member operated after a time period for flexing said thermostatic member and separating said contacts to cut off the supply of said current to said circuits at said contacts and a second pair of contacts closed by the further movement of said thermostatic member to supply current to said circuits.

12. The structure set forth in claim 11, a second thermostatic member, one of said second pair of contacts being carried by said second thermostatic member, an electrical heating means for said second thermostatic member and means for supplying current to said last mentioned heating means to move said last mentioned thermostatic member and separate said second pair of contacts to again cut off current from said circuits at said second pair of contacts.

13. A switching device for controlling the supply of current to a plurality of circuits having in combination, means through which current is supplied to said circuits including a pair of contacts, a thermostatic member controlling one of said contacts to separate the same when heated, electrical means for heating said thermostatic member to cause it subsequently to separate said pair of contacts, a second pair of contacts, one of which is carried by said thermostatic member, which second pair is engaged after a further heating and flexing of said thermostatic member and a circuit closed by said last mentioned pair of contacts.

14. The structure set forth in claim 13, a second thermostatic member, means for heating said second thermostatic member to flex the same and separate said last mentioned pair of contacts after a certain period, whereby current is again cut off from said circuits.

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