

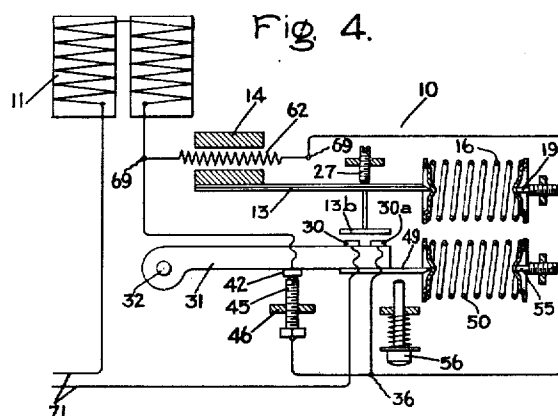
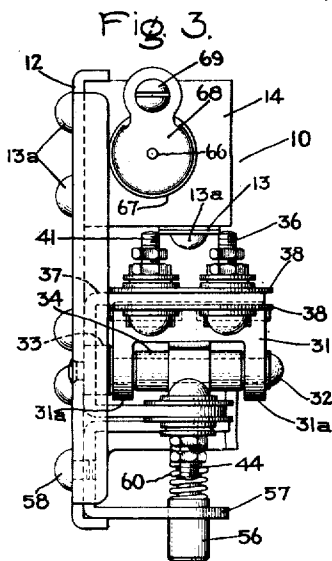
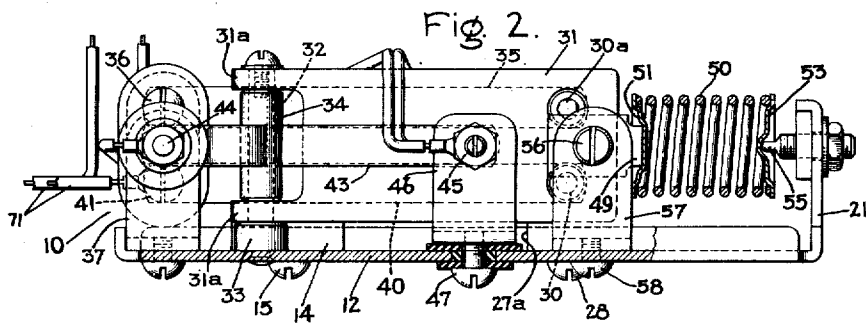
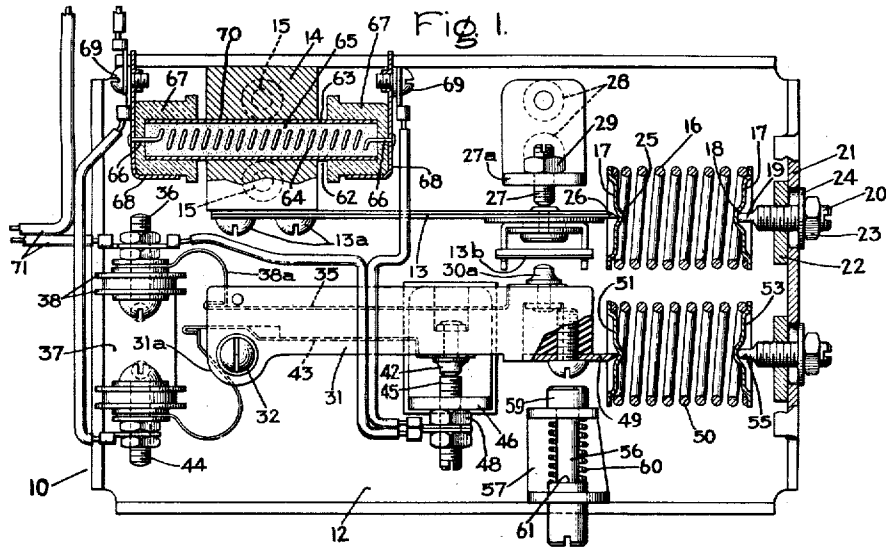
July 29, 1941.

R. A. WINBORNE

2,250,979

TIMING DEVICE

Filed March 11, 1938



Inventor:
 Russell A. Winborne,
 by *Harry E. Dunham*
 His Attorney.

UNITED STATES PATENT OFFICE

2,250,979

TIMING DEVICE

Russell A. Winborne, Oak Park, Ill., assignor to
Edison General Electric Appliance Company,
Incorporated, Chicago, Ill., a corporation of
New York

Application March 11, 1938, Serial No. 195,347

13 Claims. (Cl. 161-16)

This invention relates to timing devices, more particularly to thermal timing devices for controlling the heating periods of appliances and the like, such as a bread toaster, and it has for its object the provision of an improved timing device of this character.

More specifically this invention relates to improvements in thermal timing devices having a temperature responsive member that is heated and cooled during the heating period of the controlled device. That is, at the end of the heating period of the controlled device, the temperature responsive member is restored substantially to its initial temperature condition so that it can then be immediately reoperated to measure another heating period for the controlled device.

For a more complete understanding of this invention, reference should be had to the accompanying drawing in which Fig. 1 is a plan view of a timing device embodying this invention, parts being shown in section so as to illustrate certain details of construction; Fig. 2 is an elevation of the timing device of Fig. 1, parts being shown in section so as to illustrate certain details of construction; Fig. 3 is an end elevation of the timing device of Fig. 1; and Fig. 4 is a diagrammatic representation of the timing device of Figs. 1, 2 and 3 and illustrating it as applied to the control of the heating means of an electric toaster.

Referring to the drawing, this invention has been shown in one form as applied to a timing device 10 for controlling the toasting period of an electric toaster that is not shown in detail, but which is provided with electrical heating means 11 shown diagrammatically in Fig. 4.

As shown in Figs. 1 to 3, the timing device 10 comprises a base or supporting panel 12 formed of any suitable material, such as steel. Mounted upon the base 12 is a temperature responsive element 13, which preferably is of the bimetallic bar type, the element being formed of two metals having dissimilar temperature coefficients of expansion secured together lengthwise from end to end. Any two suitable metals, such as invar and steel, may be used. One end of the bimetal bar 13, the left-hand end as viewed in Fig. 1, is rigidly secured to a metallic supporting block 14 so as to be mounted edgewise to the base, as shown. The block 14 is secured to the base 12 in any suitable manner, as by means of screw fastening means 15, and the bar 13 is secured to the block 14 by means of screw fastening means 13a. The major portion of the bar, as shown, is free to move laterally in response to temperature changes. Bearing on the free end of the bar 13 is a snap action, over-center compression spring 16 having its opposite ends resting on bearing members 17. One bearing member, the right-hand member as viewed in Fig. 1, has a seat 18

which receives a pivot bearing 19 carried by an adjusting screw 20. The screw 20 is mounted in an upright end wall 21 on the base 12. A plate 22 on the inside of the wall 21 is threaded on the screw 20 while a nut 23 is threaded on the outside of the wall 21, the nut bearing on a seat or washer 24. The plate 22 and nut 23 serve to hold the screw 20 in its adjusted positions relative to the wall 21. The opposite bearing member 17 is provided with a seat 25 which receives a knife-edge bearing 26 provided for it on the free end of the bimetallic bar 13.

It will be understood that the spring 16 constitutes an over-center or snap acting spring for the thermostatic member 13. That is, it causes the bimetal bar to move quickly between its controlling positions. The first of these positions is defined by a stop 27 which, as shown, is in the form of a screw. The screw is threaded in a standard 27a provided for it on the base, the standard being secured to the base in any suitable manner, as by screw fastening means 28. The screw 27 is held in its adjusted position on the standard by means of a nut 29. The other controlling position of the bimetal bar is defined by a pair of spaced contacts 30 and 30a mounted on a switch arm 31, the bimetal bar carrying on its free end a bridging contact 32b arranged to engage and bridge the contacts 30 and 30a. The switch arm 31 is formed of any suitable electrically insulating material, such as a suitable phenol condensation product, and the contacts 30 and 30a may be secured to it in any suitable manner as by riveting.

The bimetal bar 13 is arranged to move downwardly, as viewed in Fig. 1, from its upper controlling position to its lower in response to an increase in temperature and upwardly to return to its upper position when cooled. The spring 16 is arranged to hold the bar in each of its positions and resists movement of the bar from each to a neutral position and then assists the bar to move to its other controlling position in the manner set forth in the U. S. patent to A. Lewerenz, Reissue No. 16,654, dated June 14, 1927. This operation of the spring results in a quick snap action of the thermostat bar.

The switch arm 31, as shown, is mounted on the base 12 for pivotal movement on an upright standard or stud 32 riveted at its lower end to the base 12, as shown in Figs. 2 and 3. The switch arm 31 has two spaced arms 31a pivoted to the stud 32. Preferably, the lower of these arms rests on an insulating spacing collar 33 on the stud, and preferably, a second insulation spacing collar 34 is mounted between the arms.

A conducting lead or strip 35 on the switch arm is secured at one end to the switch contact 30a and at its opposite end it is connected to a stationary binding post 36 mounted on one leg

of a U-shaped supporting bracket 37 secured to the base 12, the binding post being insulated from the bracket by means of mica-insulating washers 38. The strip 35 preferably is embedded in the material of which the arm is made, and at its end where it leaves the switch arm for connection with the binding post, it has a flexible section 38a which permits the switch arm to move on its pivot 32. The contact 30 is connected by a similarly arranged conducting lead 40 with a binding post 41 (Figs. 2 and 3) also supported by the bracket 37 in the same manner that the post 36 is supported by it. There is still a third contact 42 carried by the switch arm 31, but on its side opposite the contacts 30 and 30a. The contact 42 is connected by means of a lead 43, similar to the leads 35 and 40, with a binding post 44 mounted on the leg of the U-shaped bracket 37 opposite to that on which the posts 36 and 41 are secured. The contact 42 is arranged to bear against a fixed contact 45, shown as a screw, mounted in a bracket 46 which is insulated from and secured to the base 12 in any suitable manner; as shown a screw fastening means 47 is used to secure the bracket to the base. The contact 45 is adjustable in the bracket and is secured in its adjusted position by means of a nut 48. The contact 45, therefore, defines one position, the lower position, of the switch arm 31, and thereby, the second or lower controlling position of the bimetal bar 13.

Carried by the free or movable end of the switch arm 31 is a knife-edge bearing 49 with which a snap action compression spring 50 cooperates. This spring is similar to the spring 16, and has a bearing cup 51 at one end that rests on the knife-edge bearing 49, and another cup or seat 52 that is received in an adjustable normally fixed bearing member 55, similar to bearing 19, 20. The over-center or snap spring 50 is arranged to hold the switch arm in its first or lower controlling position against the stop 45, as shown in Fig. 1, or to hold it in a second or upper controlling position defined by the bridging contact 13b of the thermostatic member 13 when the member 13 is in its upper position of Fig. 1, and it effects movement of the switch arm between these positions with a snap action.

The switch arm 31 may be moved from its lower controlling position against the stop 45 to its upper by means of a plunger 56 mounted in a U-shaped supporting bracket 57 secured to the base 12 in any suitable manner, as by means of a screw 58. The plunger at its upper or inner end carries a head 59 that is arranged to engage the switch arm to move it from its lower to its upper controlling position. The head 59 normally rests against the upper leg of the U-shaped bracket 57, as shown in Fig. 1, and is held against this leg by means of a compression spring 60 mounted on a reduced section of the plunger 56 between the two legs of the bracket, as shown, and having its upper end bearing against the upper leg of the bracket and its lower against an abutment 61 provided for it on the plunger. The plunger may be depressed or pushed inwardly to move the switch arm from its first to its second controlling position, and when released, the plunger is moved to its outer or retracted position by means of the spring 60.

The thermostat is heated to move away from its stop 27 by a heating element 62 that is mounted in the metallic supporting block 14

for the thermostatic bar. The heating element 62 may be of any suitable type, but preferably will be of the sheathed type such as described and claimed in the U. S. patent to C. C. Abbott No. 1,367,341, dated February 1, 1921. Briefly, this heating element comprises a metallic sheath 63 in which is mounted a helical resistance conductor 64. This conductor 64 is supported in spaced relation with reference to the sheath by a compacted mass 65 of an electrically insulating heat conducting material, such as compressed powdered magnesium oxide. The terminals 66 of the resistance conductor project outwardly from the ends of the sheath. As shown, the terminals pass out of the sheath through electrically insulating cups 67 that enclose the ends of the sheath. These terminals are electrically connected with conducting leads 68 into which binding screws 69 are threaded. As shown, the metallic block 14 is provided with an aperture 70 in which the sheath 63 is mounted.

As shown diagrammatically in Fig. 4, the binding post 36 of the contact 30a is electrically connected with the binding post or fixed contact 45 of the contact 42, and also is electrically connected with one of the binding screws 69 of the heater 62. The opposite terminal or binding screw 69 of this heater is connected to one terminal of the toaster heating means 11 and also with the binding post 44 of switch contact 42. The opposite terminal of the toaster is connected with the electrical supply source 71. The other terminal of this supply source is electrically connected with the binding post 41 of the switch contact 30.

With the connections established in this manner and with the parts in their operative positions shown in the drawing, no current will flow through the heating element 11 of the toaster or the heating element 62 of the timing device. However, if the plunger 56 is depressed so as to snap the switch arm 31 from its position shown in Fig. 4 to its upper or second controlling position wherein the contacts 30 and 30a are bridged by the bridging contact 13b of the thermostatic member 13, an energizing circuit will be established for both heating elements 11 and 62 from the lower conductor of the supply source 71 through the closed contacts 30 and 30a, through the heating element 62 and the heating element 11 and thence to the other side of the supply source 71. Thus, the toaster will be energized and heat will be imparted to the thermostatic member 13. The thermostatic member 13 when its temperature attains a predetermined maximum will move downwardly from its first controlling position against the stop 27 and will carry with it the switch arm 31. When the thermostatic member 13 and the switch arm 31 pass through their neutral positions the springs 16 and 50 will snap the thermostatic bar and the switch arm downwardly until the contact 42 engages the stop contact 45.

When this happens, it will be observed that the energizing circuit for the toaster heater 11 will be completed, as before, through the closed contacts 30 and 30a, but the contacts 42 and 45 will now be closed so as to short out the heating element 62 from the energizing circuit. Thereupon, the thermostatic bar 13 begins to cool and when it cools to a predetermined low temperature it will snap back to its first controlling position against the stop 27. This operation deenergizes the toaster element 11, because the bridging con-

tact 13b will be carried away from the contacts 30 and 30a. The switch arm 31 cannot follow the thermostatic bar 13 in its upward movement, because it is held against the stop 45 by the compression spring 50.

Thus, the timing interval of the timing device is measured by two periods, the first which is the time required to heat up the bar 13 to move downwardly to carry the switch arm against the stop 45 and which operation deenergizes the heating element 62, and the second time required for it to cool to the low temperature at which it snaps against the stop 27 to open the contacts 30 and 30a. When the bar has returned to its initial position, it has substantially its initial low temperature so that it is ready for an immediate successive operation. The spring 16 may be adjusted such variations also change the amplitude between the maximum temperature at which it leaves the stop 27 and the minimum temperature at which it returns and thereby varies the toasting interval. The spring 50 may also be adjusted to vary its holding effect on the arm 31. Variations in the compression of this spring also will influence the timing interval because in moving downwardly to cut off the heater 62, the thermostat bar 13 must overcome the resistance of both springs 16 and 50. The basic time setting may be influenced and controlled by changing the relative positions of the stops 27 and 45, as such variations also change the amplitude between the above mentioned maximum and minimum temperatures. For example, if the stop 27 be moved outwardly this will increase the amplitude and thereby the time interval. On the other hand, if it be moved inwardly, the time interval will be reduced because the amplitude will be reduced. It will also be understood that the bimetal bar 13 is preformed so as to operate at a desired average temperature. This combined with the adjustment in amplitude governs the basic time setting of the control device.

The thermal mass 14, that is associated with the fixed end of the thermostatic blade 13 and which serves to impart heat to it, is so related to the thermal mass of the toaster or other appliance controlled that it compensates for the stored heat in the toaster, thereby insuring that successive slices will be cooked to substantially the same color. That is, the stored heat capacity of the thermal mass is such that it will not cool down so as to return to its normal or room temperature at the end of the first toasting cycle, but will have heat stored in it so that the second cycle will be shorter than the first, because in the second it will require less time to heat the thermostat to its maximum temperature at which the heater 62 is cut off. The third cycle is shorter than the second and so the time interval of each succeeding cycle is reduced until the toaster has attained its effective or maximum operating temperature, when the cycles will have the same length of time. In other words, the thermal mass 14 acts as a miniature of the toaster in so far as the thermal mass of the toaster is concerned.

Moreover, the thermal mass functions to control the rate of heating of the bimetallic bar 13 by introducing a thermal lag so that the maximum timing period can be obtained conveniently and in a practical thermostatic construction; the thermostat functions on a much smaller temperature amplitude between the maximum temperature at which it leaves the stop 27 and the minimum temperature at which it returns to it

than if the mass were not present. By thus reducing this amplitude, a much wider range of timing is possible and with a smaller temperature rise in the thermostatic bar 13. Also, the effect of the ambient temperature rise on the operation of the timing device is substantially eliminated.

The sheathed heater 63 itself has a thermal mass which is combined with and functions as a part of the mass 14. A heater of relatively small thermal mass may be used, and in such cases, the thermal mass of the block 14 should be increased accordingly.

While I have shown a particular embodiment of my invention, it will be understood, of course, that I do not wish to be limited thereto since many modifications may be made and I, therefore, contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A thermal timing device for a heating appliance and the like comprising a temperature responsive member, heating means for heating said member, switching means having a control member arranged in one position to energize said heating appliance and said heating means simultaneously and when moved from said one to another position to deenergize said heating means, over-center resilient means for holding said control member in each of said positions, means for moving said control member to said one position, and said temperature response member when heated to substantially a predetermined high temperature moving said control member to the other of said positions, and the temperature responsive member operating to deenergize said heating appliance when cooling in response to the deenergization of said heating means by said control member.

2. A thermal timing device for a heating appliance and the like comprising a control arm and a thermostatic bar, each operable between a pair of controlling positions and each having an over-center spring acting on it to move it with a snap action between said positions, a heating element for applying heat to said thermostatic bar, switching elements controlled by said thermostatic bar and control arm arranged when the control arm is moved to one of its positions and said thermostatic bar is in one of its positions to close the energizing circuit for said heating appliance and said heating element, the thermostatic bar thereupon being heated and when attaining a predetermined maximum temperature snapping from said one to its other controlling position to snap the control arm to its other position, and said switching element arranged when the thermostatic bar and control arm are in said other positions to deenergize said heating element to remove heat from the bar, and the bar when cooling to a predetermined degree snapping back to its first position, the switch elements being operated thereby to open the energizing circuit of said heating appliance.

3. A thermal timer for an electrically heated appliance comprising a control arm, three contacts on said arm, a heating element, a temperature responsive element in thermal relation with said heating element and carrying a bridging contact arranged to bridge a pair of said three contacts, one of said pair being adapted for connection with a supply source, and the other with a terminal of said heating element, the other terminal of which is connected with the third con-

tact of said three on said control arm, this third contact also adapted to be connected with one terminal of said appliance, a fixed contact co-operating with said third contact connected with said other of said pair of contacts, means for moving said control arm to open said third contact from its fixed contact and to move said pair into bridged relation with said bridging contact to complete an energizing circuit from said terminal of said supply source through said heating element and appliance to the other terminal of the supply source, the heating element applying heat to said thermostatic element to heat it to a predetermined maximum temperature, whereupon said thermostatic element moves said control element to close said third contact with said fixed contact to thereby deenergize said heating element, and the temperature responsive element when cooling moving its bridging contact away from said pair to deenergize said appliance.

4. A thermal timer for electrically heated appliances and the like comprising a switch arm, a thermostatic bar cooperating with it, both the switch arm and thermostatic bar movable between a pair of controlling positions, a heater in thermal relation with said bar, contacts carried by said thermostatic bar and switch arm arranged when the switch arm and bar each are in one of their controlling positions to energize said appliance and said heater, the thermostatic bar thereupon heating and when attaining a predetermined high temperature moving to its other controlling position and cooperating with the switch arm to move it at the same time to its other controlling position, the contacts thereby being operated to deenergize said heater, whereupon the thermostatic bar cools and when attaining a predetermined low temperature returns to its said one controlling position independently of the switch arm, means for manually moving said switch arm to its said one controlling position, and yieldable means for holding both said switch arm and said thermostat bar in each of their controlling positions.

5. A thermal timer for an electrically heated appliance and the like comprising a base, a switch arm and thermostatic bar mounted opposite each other on said base movable between a pair of spaced stops and the stops being sufficiently spaced to provide for limited freedom of movement of said members between said stops, over-center springs acting on said switch arm and thermostatic bar to hold them against said stops respectively, a heater in thermal relation with said thermostat bar, cooperating switch contacts in the circuit of said appliance and heater carried by said switch arm and thermostatic bar separated when said members are against said stops, means for moving said switch arm away from its stop to said thermostat bar to close said contacts and thereby energize said appliance and heater, the thermostat bar when attaining a predetermined maximum temperature moving away from its stop toward the other and returning said switch arm to its stop while maintaining said contacts closed, switch contacts in the circuit of said heater operated by the return of said switch arm to its stop for deenergizing said heater, the thermostat bar thereupon cooling to return to its stop and open said first-mentioned contacts to deenergize said appliance.

6. A thermal timer for an electrically heated device and the like comprising a base, a thermal storage mass on said base, means for heating said mass, a bimetallic thermostat bar supported

at one end by said thermal mass, a bridging contact carried by the other end of said bar which end is free to move in response to temperature changes, a switch arm pivoted to said base in substantially parallel relation with said bar and carrying a set of contacts in the energizing circuits of said device and said heating means and adapted to be closed by said bridging contact, a manually depressible member for moving said arm toward said thermostat bar to one controlling position to cause its contacts to be closed by said bridging contact to thereby energize said heated device and heating means, the bar thereupon being heated and when attaining a predetermined high temperature moving said switch arm to another controlling position, switching means operated by said arm in said second position to deenergize said heating means whereby heat is removed from said thermostat bar, the bar then cooling to move away from said switch arm and thereby open said set of contacts to deenergize said heated device.

7. A thermal timing device for controlling the timing operation of a cooking appliance having heating means comprising a temperature responsive member constructed and arranged to expand and contract in response to heating and cooling, a thermal mass in thermal relation with said temperature responsive member, a heating element for heating said thermal mass to heat the temperature responsive member and cause it to expand, means controlled by the expansion of said temperature responsive member controlling the heating of said cooking appliance and said heating element so that the heating element applies heat to said thermal mass while said cooking appliance is heating until said temperature responsive element is heated to a predetermined high temperature whereupon said means is controlled by the expansion of said element to shut off the heat from said thermal mass, thereby permitting said temperature responsive member to cool and contract, means controlled by the contraction of said temperature responsive member for shutting off the heat from said cooking appliance, and the heating and cooling of said thermal mass being so related to the heating and cooling of the cooking appliance during cooking operations and the intervals between cooking operations that the thermal mass controls the temperature of said temperature responsive element to compensate for stored heat in the cooking appliance thereby insuring that edibles will be cooked to substantially the same degree in successive cooking operations.

8. A thermal timing device for controlling the timing operation of an electrically heated toaster comprising a bimetallic temperature responsive member having one end fixed and its other end free to move in response to temperature changes, a thermal mass in direct heat conducting relation with said fixed end, a heating element arranged to apply heat to said thermal mass, control means controlled by the movement of said free end controlling said toaster and heating element so that the heating element applies heat to said thermal mass while said toaster is heating until said bimetallic member is heated to a predetermined high temperature at which it moves to control said control means to deenergize said heating element, thereby permitting said bimetallic member to cool, and means controlled by the cooling of said bimetallic member for shutting off the heat from said toaster, and

the heating and cooling of said thermal mass being so related to the heating and cooling of said toaster during toasting operations and the intervals between toasting operations that the thermal mass controls the temperature of said bimetallic blade to compensate for stored heat of the toaster thereby insuring that bread slices will be cooked to substantially the same degree in successive cooking operations.

9. A timing device for an electric appliance and the like including heating means, comprising a temperature responsive member, a fixed support for one end of said member, the other end of said member being free to move between a pair of controlling positions responsively to temperature changes, and controlling said heating means to heat said appliance for the period of time that said member is initially in the first of said positions and moves from the first position to the other and returns to the first, an over-center spring acting on the free end of said temperature responsive member to control its movement between said positions, a second heating means for heating said member to cause it to move against the force of said spring from said first position to the other position in a predetermined interval of time, means controlled by the movement of said member to said other position controlling said second heating means to shut off the heat from said member when it reaches said other position, whereby it is permitted to cool, the member then cooling and returning to the first position against the force of said spring in a predetermined interval of time, and means for adjusting the tension in said spring to vary said periods of time.

10. A timing device for an electric appliance and the like comprising a temperature responsive member movable between a pair of controlling positions and controlling said appliance to heat for the period of time that said member moves from the first position to the other and returns to the first, an over-center spring acting on said temperature responsive member to control its movement between said positions, heating means for heating said member to cause it to move from said first to the other position, means controlled by the movement of said member to said other position controlling said heating means to shut off the heat from said member when it reaches said other position, whereby it is permitted to cool, the member then cooling and returning to the first position, and means for varying the distance between said positions and for regulating the tension of said spring so as to vary the timing period.

11. A thermal timing device for a heating appliance and the like comprising a temperature responsive member, heating means for heating said member, switching means having a control member arranged in one position to energize said heating appliance and said heating means simultaneously and when moved from said one to another position to deenergize said heating means, over-center resilient means for holding said control member in each of said positions, means for moving said control member to said one position, and said temperature responsive member when heated to substantially a predetermined high temperature moving said con-

trol member to the other of said positions, and the temperature responsive member operating to deenergize said heating appliance when cooling in response to the deenergization of said heating means by said control member, and means for adjusting the tension of said resilient means to vary the timing period of said timing device.

12. A thermal timing device for a heating appliance and the like having an energizing circuit comprising a control arm and a thermostatic bar, each operable between a pair of controlling positions and each having an over-center spring acting on it to move it with a snap action between said positions, a heating element for applying heat to said thermostatic bar, an energizing circuit for said heating element, switching elements controlling said energizing circuits controlled by said thermostatic bar and control arm so that when the control arm is moved to one of its positions and said thermostatic bar is in one of its positions said energizing circuits for said heating appliance and said heating element are energized, the thermostatic bar thereupon being heated and when attaining a predetermined maximum temperature snapping from said one to its other controlling position to snap the control arm to its other position, and said switching elements further controlled by said thermostatic bar and control arm so that when they are in said other positions said energizing circuit for said heating element is deenergized to remove heat from the bar, and the bar when cooling to a predetermined degree snapping back to its first position, the switch elements thereupon being operated thereby to open the energizing circuit of said heating appliance, and means for adjusting the tension of both of said springs to vary the timing period of said timing device.

13. A thermal timer for an electrically heated appliance and the like having an energizing circuit comprising, a pair of spaced stops, a switch arm and thermostatic bar movable between said pair of spaced stops and the stops being sufficiently spaced to provide for limited freedom of movement of said switch arm and thermostat bar between said stops, over-center springs acting on said switch arm and thermostatic bar to hold them against said stops respectively, a heater in thermal relation with said thermostat bar, cooperating switch contacts in the circuit of said appliance and heater carried by said switch arm and thermostatic bar separated when said members are against said stops respectively, means for moving said switch arm away from its stop to said thermostat bar to close said contacts and thereby energize said appliance and heater, the thermostat bar when attaining a predetermined maximum temperature moving away from its stop toward the other and returning said switch arm to its stop while maintaining said contacts closed, switch contacts controlling the circuit of said heater operated by the return of said switch arm to its stop to deenergize said heater, the thermostat bar thereupon cooling to return to its stop and open said first-mentioned contacts to deenergize said appliance, and means for adjusting the positions of said stops to control the timing interval.

RUSSELL A. WINBORNE.

CERTIFICATE OF CORRECTION.

Patent No. 2,250,979.

July 29, 1941.

RUSSELL A. WINBORNE.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 2, first column, line 7, for the word "building" read --binding--; line 74, for "be" read --by--; page 3, first column, line 18, strike out "such variations also change" and insert instead the syllable and words --justed by the screw 20 to vary--; line 31, for "ampltiude" read --amplitude--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 30th day of September, A. D. 1941.

(Seal)

Henry Van Arsdale,
Acting Commissioner of Patents.