

[54] OVEN CONTROL

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[51] Int. Cl. A21b 1/00, H05b 1/00

[58] Field of Search 337/41, 45, 85, 86,
337/114, 306; 219/413, 494, 496, 513, 412

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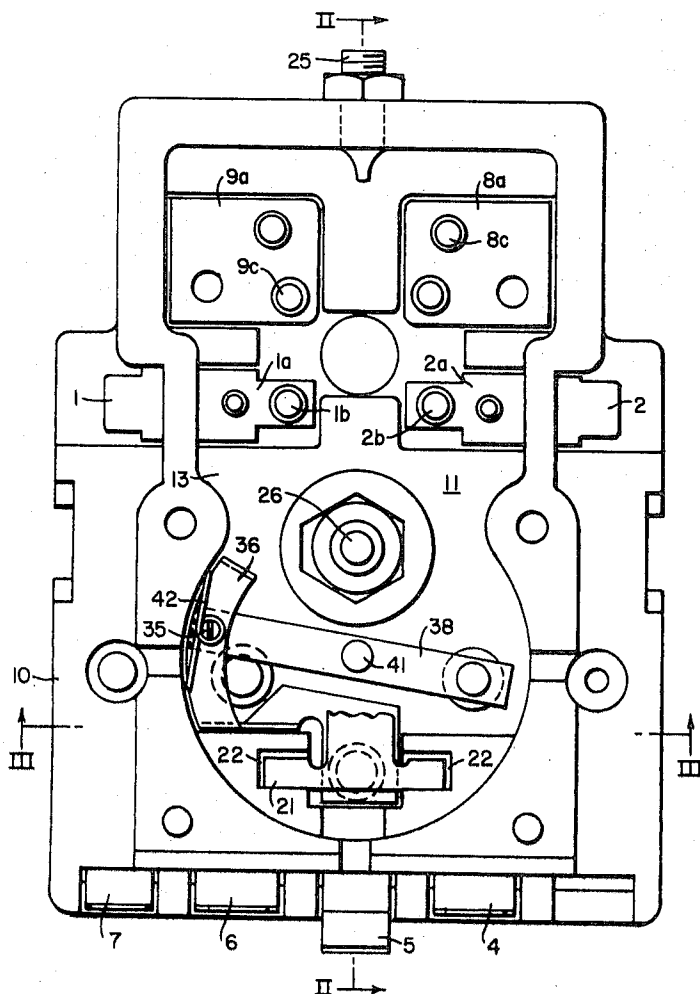
Attorney—F. H. Henson et al.

[57]

ABSTRACT

An oven control of the type having a bistable mechanism operable in accordance with oven temperature variations to effect opening and closing of snap-acting switch means series connected to directly control energization of the oven heating means is provided with a second creep action switch means which is operated between open and closed positions in accordance with the movement of the bistable mechanism, with the second switch means being connected in circuit means to provide control of any of various functions other than the main oven heating. The second switch means may control a door locking arrangement when the oven is of the self-cleaning pyrolytic type, or may be used to provide control of a safety signal for the oven, or to control auxiliary heating means in the oven whenever the temperature in the oven is below a predetermined level.

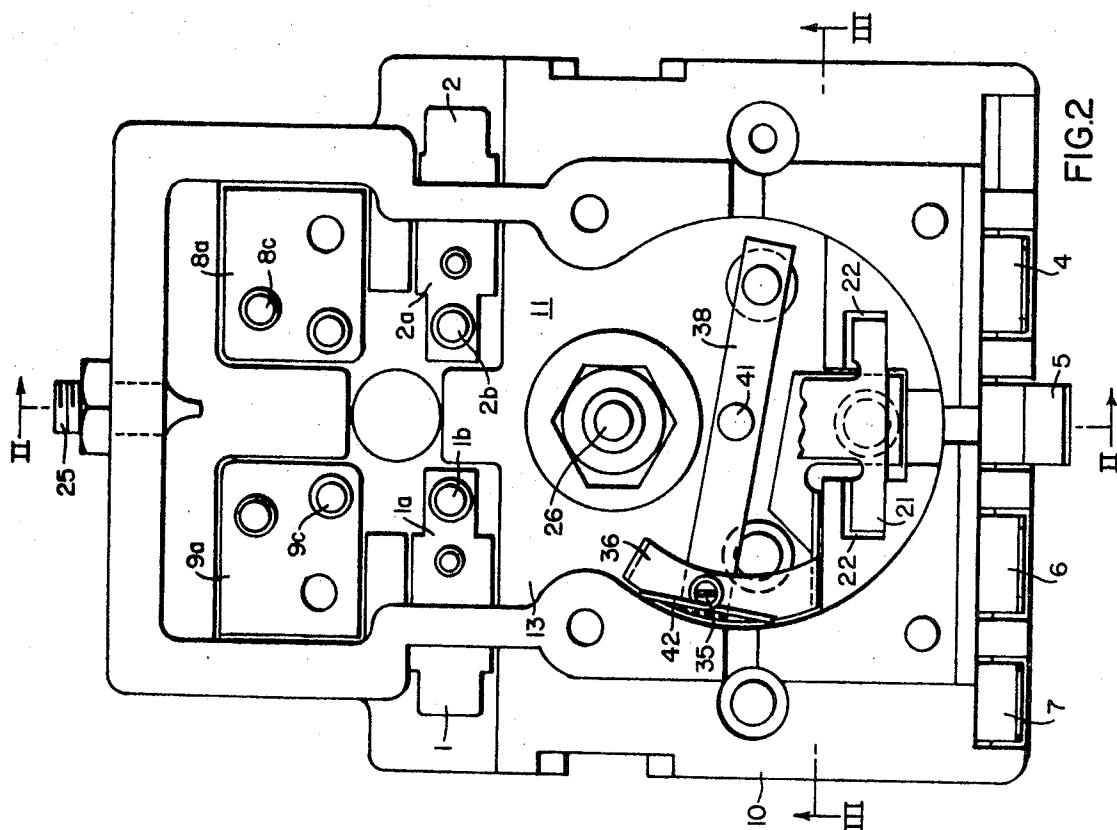
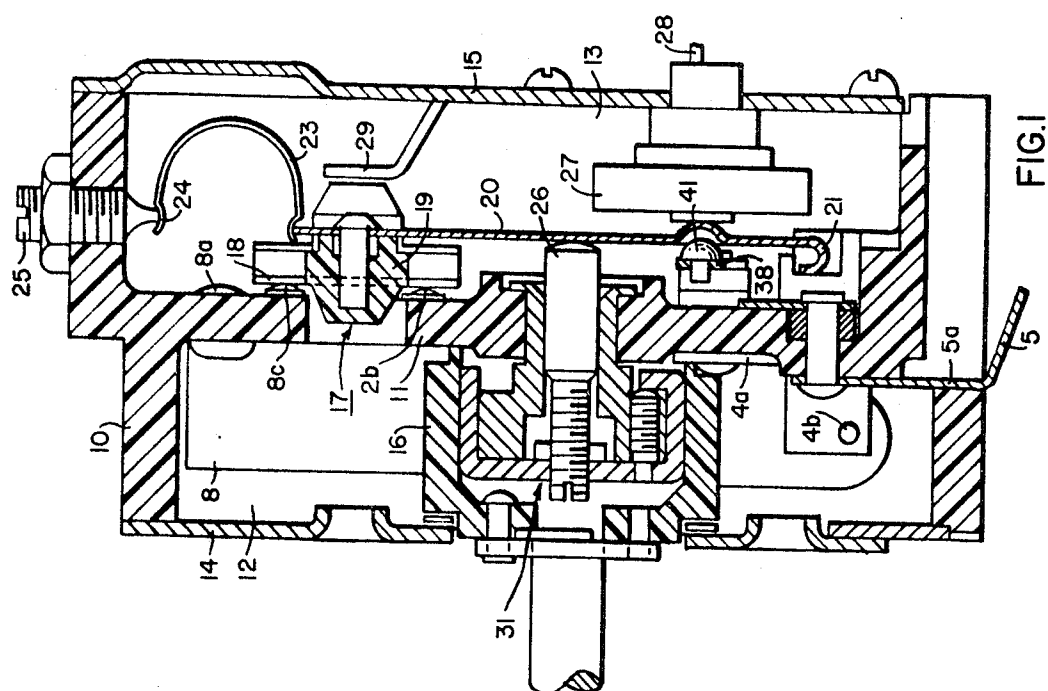
7 Claims, 7 Drawing Figures



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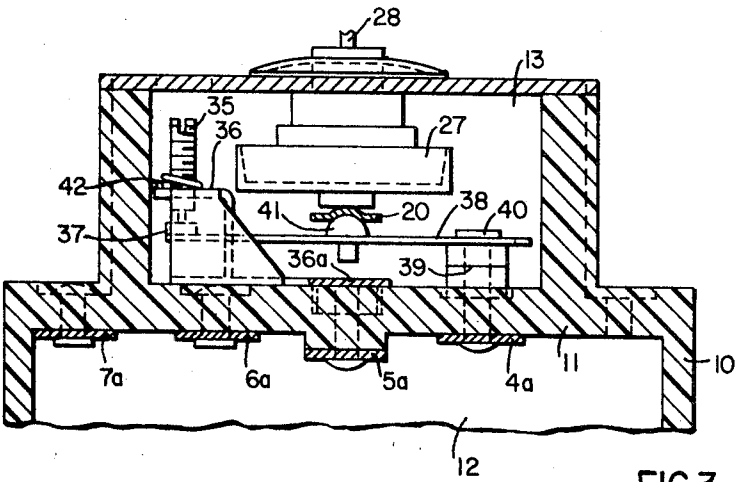


FIG. 3

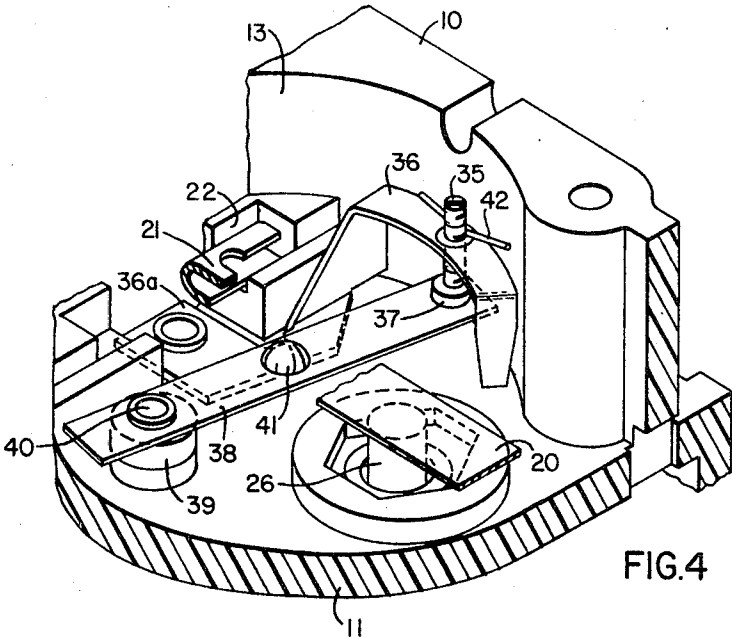


FIG. 4

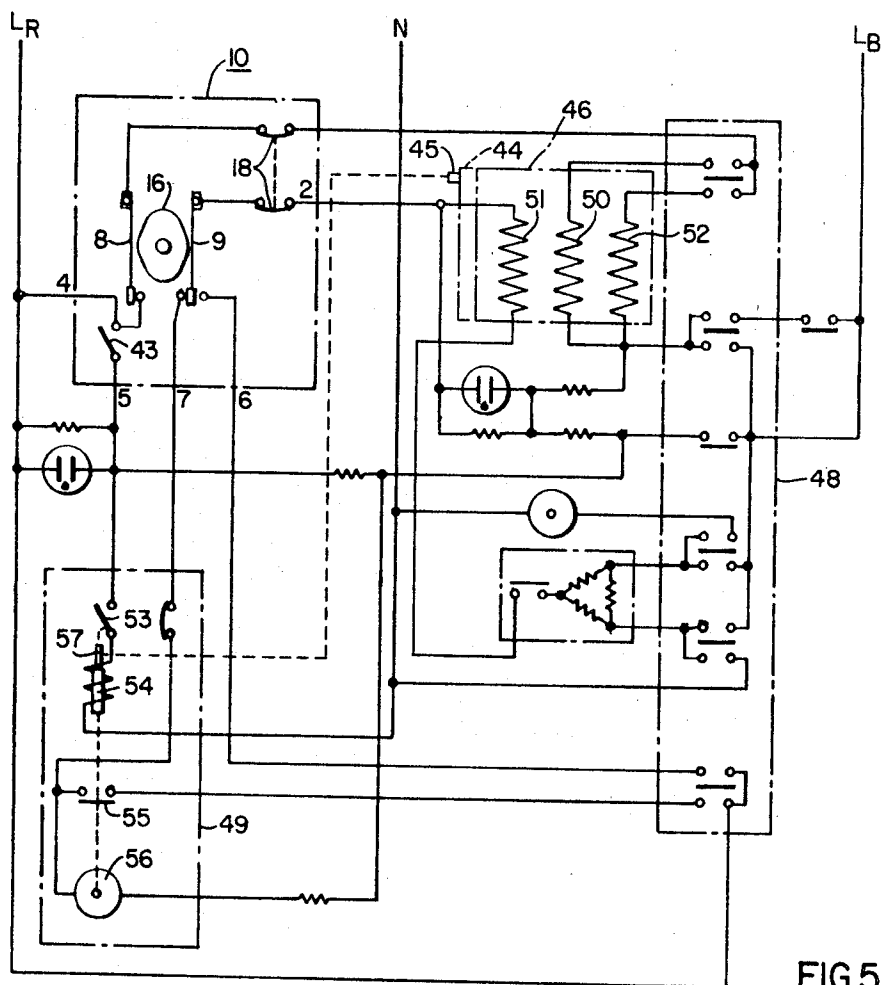


FIG. 5

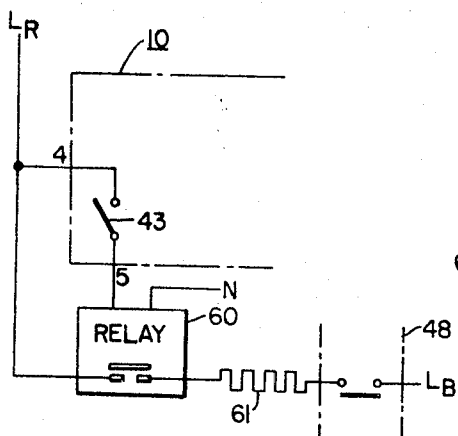


FIG. 6

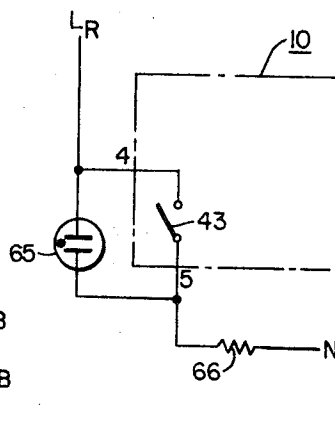


FIG. 7

OVEN CONTROL

CROSS REFERENCE TO RELATED APPLICATIONS

My U.S. application Ser. No. 103,098, filed Dec. 31, 1970 now U.S. Pat. No. 3,648,012, is considered to be a related application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to the art of oven controls and oven control systems for domestic cooking ovens.

2. Description of the Prior Art

Hydraulic type oven controls which use a bistable mechanism subject to adjustment by the oven user to obtain a given oven temperature range, and operated in accordance with sensed oven temperatures to control snap-acting switch means which may be series connected to directly control energization of the oven heaters, are conventional in this art. However, so far as I know, no one has incorporated in such an oven control a second switch means which is controlled in accordance with movement of the bistable mechanism and which may be factory adjusted to operate at a predetermined incremental movement of the bistable mechanism, corresponding to a selected oven temperature to control a function other than the main oven heating means.

SUMMARY OF THE INVENTION

In accordance with my invention, I incorporate a second switch with the oven control for operation in accordance with movement of the bistable mechanism for performing a control function other than control of the main heating means of the oven. Such a separate function may be control of a door locking arrangement for a self-cleaning pyrolytic oven; the principal example herein described being for an oven control of this character.

DRAWING DESCRIPTION

FIG. 1 is a rear face view of a thermostatic oven control according to the invention with the rear cover omitted and with a part of the bistable mechanism omitted for purposes of clarity;

FIG. 2 is a vertical section corresponding to one taken along the line II—II of FIG. 1 but with the rear cover and bistable mechanism included;

FIG. 3 is a sectional view corresponding to one taken along the line III—III of FIG. 1;

FIG. 4 is a fragmentary isometric view of the second switch arrangement within the rear chamber of the oven control;

FIG. 5 is a schematic view of a circuit for a control system for a self-cleaning pyrolytic oven and in which the second switch is used to control a door locking arrangement;

FIG. 6 is a schematic of a circuit illustrating how the second switch may be used to control the application of heat at low temperatures in the oven; and

FIG. 7 is a schematic of a circuit illustrating how the second switch may be used to control safety signal means to indicate excessive temperatures in the oven.

BRIEF DESCRIPTION OF THE PREFERRED EMBODIMENTS

The main parts of the oven control are shown in

FIGS. 1 and 2. The casing 10 for the control is a molded plastic, generally box-shaped member with an intermediate wall 11 separating the interior into opposite, outwardly-open front and rear chambers 12 and 13, with front and rear removable covers 14 and 15 being provided for the open faces of the chambers. The front chamber 12 basically contains the circuit switching arms and contacts and the operable mechanism for setting the thermostat, while the rear chamber 13 basically contains the bistable mechanism which operates the main switch means for the oven heaters, the second switch, and the hydraulic wafer which exerts the force upon the bistable mechanism in accordance with oven temperature variations.

The locations of the contact terminals on the exterior of the casing by which the control is connected into circuits in which it functions are best seen in FIG. 1, these terminals being identified as 1, 2, 4, 5, 6 and 7 to correspond with the terminal indicia to be provided on proposed commercial controls, and to correspond with the corresponding numerals shown in FIG. 5. These numerals also correspond to the numerals used on the same parts shown and described in more detail in my noted copending U.S. patent application, to which reference should be had for a more detailed discussion of various parts of the control, which will not be fully described herein.

Electrically conductive strips which terminate in the exterior terminals are riveted to the casing and are provided with the same numeral as the terminal plus a suffix letter *a* to indicate an electrically common connection. As an example, in FIG. 2 the strip 5*a* is seen, and in FIG. 1 strips 1*a*, 2*a*, 8*a* and 9*a* are seen.

A pair of contact spring arms 8 and 9 (only 8 being seen in FIG. 2) are located in the front chamber 12. The spring arm 8 is anchored at its right end as seen in FIGS. 1 and 2 by extending through a slot in the intermediate wall into the rear chamber 13 and being riveted to the intermediate wall and carrying a contact 8*c* thereon. The spring arms 8 and 9 serve to effect circuit selections in accordance with the particular oven operation that is to be carried out by rotating cam 16 (FIG. 2).

The main or cycling switch arrangement generally designated 17 (FIG. 2) includes a pair of electrically conductive bridging strips 18 (only one as seen in FIG. 2) carried in spaced apart electrically insulated relation by the plastic carrier 19 upon which they are secured in loosely held relation to accommodate proper seating upon the contacts which they bridge. When the cycling switch is closed, the one strip 18 bridges from contact 2*b* (FIG. 1) to 8*c*, while the other bridges from 1*b* to 9*c*. The carrier 19 is attached to a spring arm or leaf 20 which has (at its left end as seen in FIGS. 1 and 2) a T-shaped end 21 which seats in a niche 22 formed in the casing material. The right end of the arm 20 is received in an indent at one end of a curved over-center spring 23 which has a dimple 24 at its opposite end seating on the point of an adjusting screw 25 turned into the right end wall of the casing. The arm 20 is fulcrumed at an intermediate location against the end of movable pin 26. The pressure wafer 27 is connected by capillary tube 28 to an oven temperature sensitive bulb (not shown). The wafer bears against the spring arm 20 at a location between the pin 26 fulcrum location and the left T-shaped end 21.

The general way in which the main or cycling switch 17 works is as follows as viewed in FIG. 2. With an increase in oven temperature the pressure wafer 27 exerts a correspondingly increasing force leftwardly on arm 20 at the bearing location between the arm and wafer. When the force and lever arm product provided by the pressure wafer exceeds the force exerted by the over-center spring 23 urging the carrier 19 leftwardly, the over-center spring snaps the cycling switch carrier rightwardly until stopped by the inwardly-projecting prongs 29 carried by the cover 15. Thus, the main switch to the oven heaters is opened. As the temperature in the oven decreases below a given temperature, the pressure wafer retreats with the slightly bowed spring arm 20 following so that at a given point it will cause the carrier to snap back to close the cycling switch. Thus, the mechanism is a bistable mechanism in that it remains in either of two positions until external forces derived from a temperature change in the oven cause it to change positions. It will be appreciated that by moving the pin 26 in an axial direction, the temperature setting of the control may be changed.

As noted in my copending application, the general arrangement of the cycling switch with an overcenter snap action, with its operation being controlled by the relationship between user operated positionable means as shaft 26, and pressure wafer 27, is not new. Nor is it new to provide the circuit selecting arrangements with the spring arms 8 and 9 and the contact terminal arrangement as previously described. The main thrust of my copending application deals with the arrangement by which most of the rotation of the user shaft 30 controls the selection of temperatures in the cooking range, while a relatively minor part of the rotation moves the pin 26 axially a sufficient distance to set up a selected cleaning operation temperature. The structure generally indicated as 31 accomplishes this and may be best understood by referring to the noted copending application.

In accordance with the present invention, a second, creep action switch is incorporated with the oven control to be operated in accordance with movement of the bistable mechanism to effect operation of the second switch at an oven temperature which is selected independently of the oven temperature to which the user sets the control for operation of the main or cycling switch. It is believed the arrangement will be best understood in connection with FIG. 4 in which the arrangement is shown as being readily accommodated in space available in the rear chamber 13 of the oven control adjacent the end of the bistable mechanism which includes the T-shaped end 21. One of the second switch contacts comprises the bottom end of a threaded, silver core, brass rod 35 which is screwed into a threaded hole provided in the support bracket 36. The bracket has the general shape of a bridge, is electrically conductive and includes a conductive leg 36a which extends over to the rivet which passes through the intermediate wall 11 and connects the bridge and screw 35 electrically to the exterior terminal 5. The other contact 37 of the second switch is carried on the electrically conductive relatively thin leaf spring 38 which is supported at its other end on spacers 39. The spring is electrically connected to the exterior terminal 4 through the rivet 40 holding the spring on the spacer and to the wall 11. The spring 38 carries an insulating

button 41 through which movement of leaf 20 of the bistable mechanism is applied to the spring 38.

The second switch is set to a particular oven temperature by moving the threaded rod 35 axially relative to the bracket 36. This may be conveniently accomplished by providing a slot in the upper end of the threaded rod. An opening permitting the insertion of a tool through the rear cover of the control is also provided. The threaded rod is held in position after adjustment by a friction lock in the form of a one-turn locking spring 42. It will be appreciated from an examination of FIGS. 2 and 3 that the force for operating the second switch means, namely the movement of the pressure wafer upon the bistable mechanism arm 20, is derived from a location which is generally aligned with the line of application of force of the pressure wafer upon the bistable mechanism. This is the preferred arrangement, although depending upon the relative difference in stiffness of the spring 20 and the spring 38 (in the preferred form the leaf spring 38 is substantially more flexible than the leaf spring 20) the force exerted upon the button 41 could be obtained from a location other than in direct alignment with the center of the pressure wafer.

It is currently contemplated that the second switch will be incorporated with an oven control used to control a self-cleaning pyrolytic oven, with the second switch (designated 43 in FIG. 5) being used to control an oven door locking system used when the oven is undergoing a cleaning cycle. In FIG. 5, the major components of the control system, in addition to the control 10, are shown. These include the oven operation selector switch 48, a lock assembly 49 for the purpose of insuring that a cleaning operation cannot occur without the oven door 44 being locked during the high temperature operation at latch 45, bake heating element 50, broil heating element 51, and an optional auxiliary broil heating element 52, all of the heating elements of course being located within the oven 46 which is schematically illustrated.

For purposes of understanding the invention, it is considered unnecessary to detail the particular circuits which are energized and all of the various cooking operations and the cleaning operation. For those who wish to examine which switches are closed for various operations, reference should be had to my copending noted application which provides this information. It is noted, however, that the cycling switch contacts which control the main heating elements in the oven for the various operations are connected in series between the opposite sides of the line for direct control of energization of the main heating means, as distinguished from controlling the main heating means through a relay operated switch.

To understand the operation of the second switch 43, shown as incorporated in the oven control 10, attention will be directed first to the lock assembly 49. When a cleaning cycle is to be initiated, the manually operated latch 45 is operated to a position to mechanically latch the door. This closes the latch operated switch 53 in the lock assembly through moving the flexible pin 57 on the solenoid and completes a circuit from one side of the line through the then closed second switch 43, the latch switch 53, and the solenoid 54 to neutral. However, as is described in my U.S. Pat. No. 3,387,874, the solenoid 54 is only momentarily energized by virtue of the pin 57 releasing switch 53, and the pin falls in place

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to close interlock switch 55 so that the cleaning cycle is able to proceed. The interlock switch 55 is also under the control of a timing motor 56 which is adapted to open the interlock switch 55, but not move pin 57 out of a locking position, at the end of a predetermined cleaning period. During the warm-up period until the oven temperature reaches the predetermined temperature of about 550°, the cleaning cycle may be terminated and the door opened by manipulating the latch 45 to effect closure of switch 53, re-energize the solenoid, and open the oven door. The second switch 43 is adjusted so that it responds to movement of the bistable mechanism, specifically the leaf spring 20, to open when the oven reaches a temperature of about 550°F. When this occurs, it is no longer possible to complete a circuit through the solenoid 54 and the door is locked shut until the temperature subsequently drops to below the predetermined temperature at which the second switch 43 is again permitted to close.

The second switch is also adapted to be employed in other circuits to perform functions other than controlling locking of an oven door for a self-cleaning oven. In FIG. 6, the second switch 43 is connected to control energization of a relay 60 which includes switch contacts in turn controlling energization of an auxiliary heater 61 which is utilized in the oven to provide fast preheat for the oven whenever the temperature is below a value such as 140°F, and also to apply heat during a keep warm operation whenever the oven temperature drops to below 140°. In this case, the second switch is adjusted so that it will be closed whenever the temperature is below 140°F. A set of contacts in the selector switch 48 is also included in the circuit in which the auxiliary heater 61 is provided. Thus, with the selector switch set so that the preheat is to be obtained whenever the oven temperature is below 140°, the auxiliary heater 61 is energized.

In the FIG. 7 arrangement, the second switch 43 is used to provide a signal to indicate that the oven temperature is above some minimum safety level. In this case the neon signal light 65 is in parallel with the normally closed second switch 43, with both the light and the switch in series together with a dropping resistor 66. In this case, if the minimum temperature is exceeded, the second switch 43 will open so that the light 65 is energized. With this arrangement, the safety signal can be energized irrespective of whether the oven control is on or off.

What is claimed is:

1. An oven control comprising:
 - a casing including an intermediate wall separating said oven control into a forward chamber and a rear chamber;
 - circuit selector switch means in said front chamber for making selected connections to oven heating means;
 - snap action switch means in said rear chamber adapted to be series connected to oven heating means for directly controlling the energization of

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said oven heating means;
 a bistable mechanism in said rear chamber for controlling said snap-action switch means;
 user adjustable means for setting different oven temperatures by shifting the operating point of said bistable mechanism;
 oven temperature responsive means acting upon said bistable mechanism to effect opening and closing of said snap-action switch means in accordance with oven temperature variations; and
 a second switch means in said rear chamber disposed to be operated between open and closed positions in accordance with positioning of said bistable mechanism.

2. An oven control according to claim 8, wherein: said oven control is connected to control said oven heating means for a self-cleaning pyrolytic oven adapted for both cooking and a cleaning operation, and includes oven door locking means; and said second switch is connected to control said locking means.
3. An oven control according to claim 1, wherein: said oven temperature responsive means applies force to said bistable mechanism in accordance with said oven temperature variations; and said force for operating said second switch means upon movement of said bistable mechanism is derived from a location generally aligned with the line of application of force of said oven temperature responsive means.
4. An oven control according to claim 1, wherein: said second switch means is of the creep-action character.
5. In an oven control according to claim 1: said bistable mechanism includes a relatively stiff but flexible leaf spring fulcrumed on said user adjustable means; and said second switch means includes a relatively more flexible leaf spring disposed transversely to said first leaf spring.
6. In combination with an oven control according to claim 1: an oven including auxiliary heating means for providing additional heat when said oven is below a predetermined relatively low temperature; and said second switch means of said oven control means is connected in circuit means for controlling operation of said auxiliary heating means.
7. In combination with an oven control according to claim 1: an oven including an electrically energized safety signal for said oven for indicating when the temperature of said oven is above a predetermined level; and said second switch means is connected in circuit means for controlling operation of said safety signal.

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