United States Patent

Hild et al.

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[54] THERMOSTATIC CONTROL DEVICE AND SYSTEM UTILIZING THE SAME

[72] Inventors: **Henry F. Hild; Siegfried E. Manecke; James L. Shaw,** all of Indiana, Pa.

[73] Assignee: **Robertshaw Controls Company,** Richmond, Va.

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[52] **U.S. Cl.**.....**337/322,** 337/309, 337/323

[51] **Int. Cl.**.....**H01h 37/28,** H01h 37/42

[58] **Field of Search**.....236/30; 73/368.6; 219/496, 219/513, 412; 337/306, 309, 310, 311, 312, 316, 317, 321, 322, 323, 330, 119

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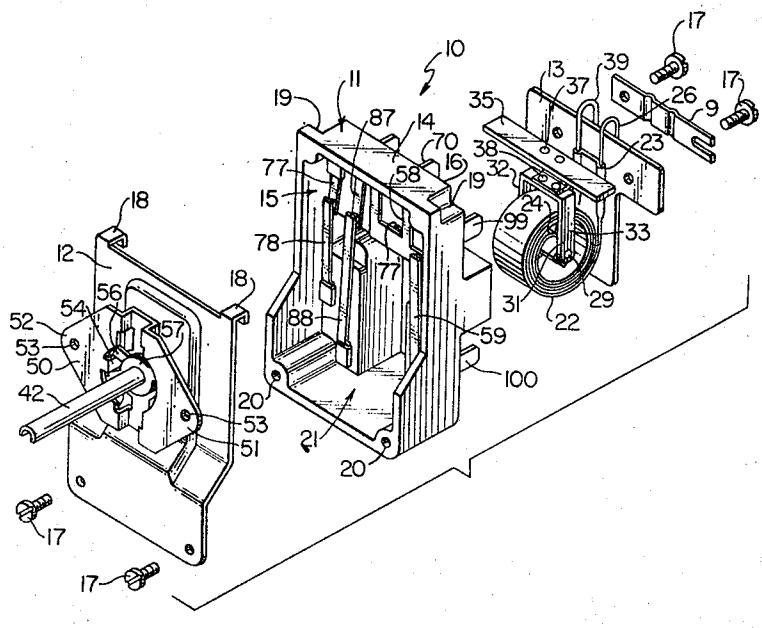
Primary Examiner—Bernard A. Gilheany
Assistant Examiner—Dewitt M. Morgan
Attorney—Auzville Jackson, Jr., Robert L. Marben and Candor, Candor & Tassone

[57] **ABSTRACT**

A coiled tube having opposed ends one of which being interconnected to a frame means and the other being movable relative thereto and being interconnected to a temperature sensing bulb whereby expansion and contraction of the fluid in the bulb causes movement of the other end of the tube relative to the frame means. A pair of switch blades are carried by the frame means and normally are moved toward each other for electrical contact therebetween. Control means is carried by the frame means for selectively adjusting the position of one of the switch blades relative to the frame means. The other end of the tube carries means for engaging against the other of the blades to cause movement thereof in a direction away from the one blade when a certain temperature is sensed by the bulb whereby the setting of the control means determines the sensed temperature that will cause the tube to open the switch blades.

26 Claims, 8 Drawing Figures



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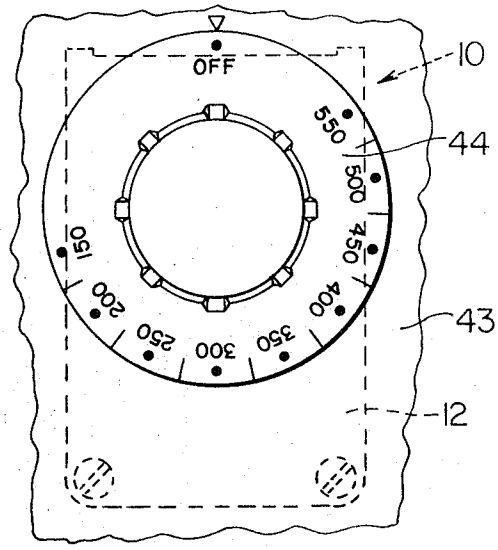

FIG. 1

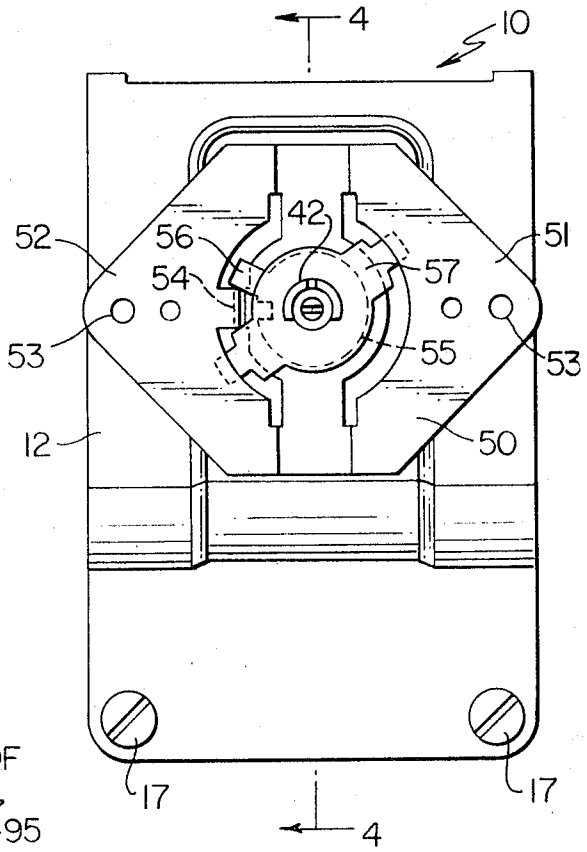

FIG. 2

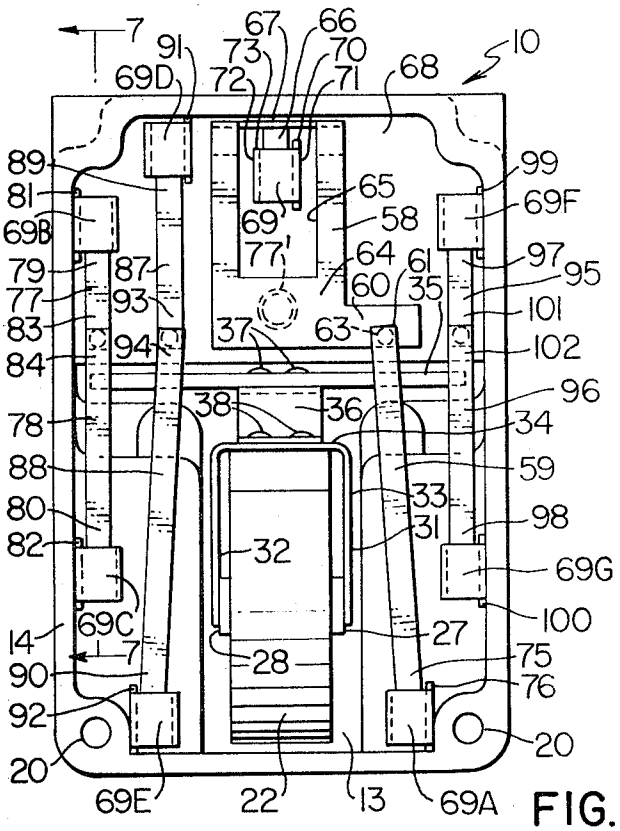

FIG. 3

INVENTORS.
HENRY F. HILD
SIEGFRIED E. MANECKE
BY JAMES L. SHAW

Cauder, Cauder & Tassone
THEIR ATTORNEYS

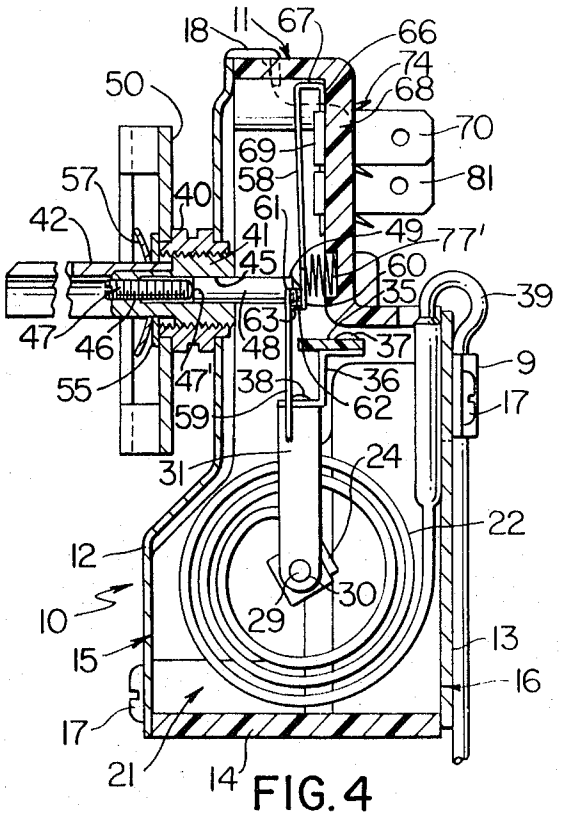

FIG. 4

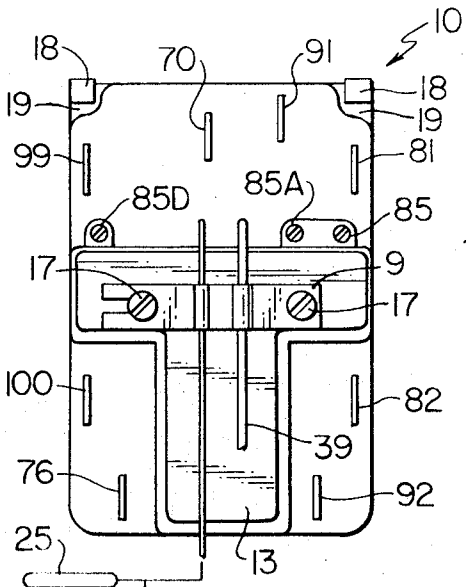

FIG. 5

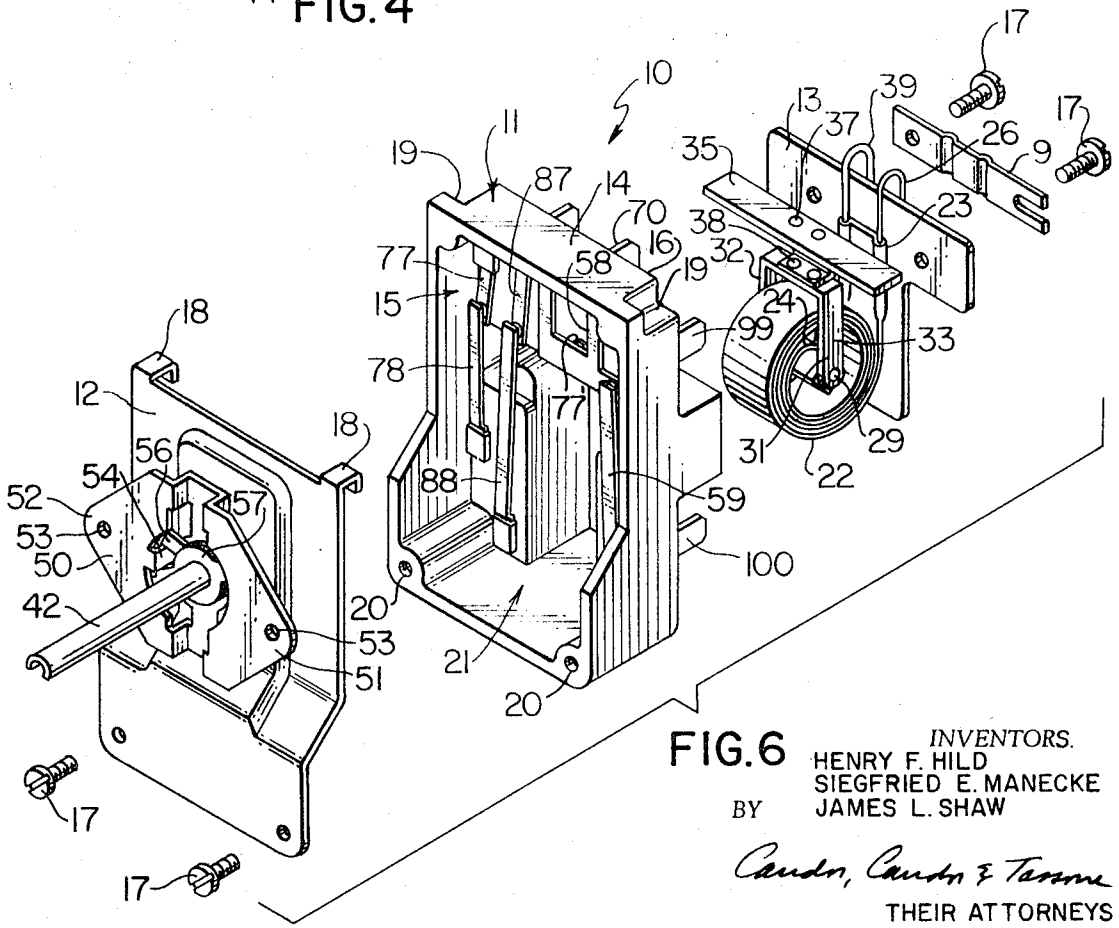

FIG. 6

INVENTORS.
HENRY F. HILD
SIEGFRIED E. MANECKE
BY JAMES L. SHAW

Cauldon, Cauldon & Tassone
THEIR ATTORNEYS

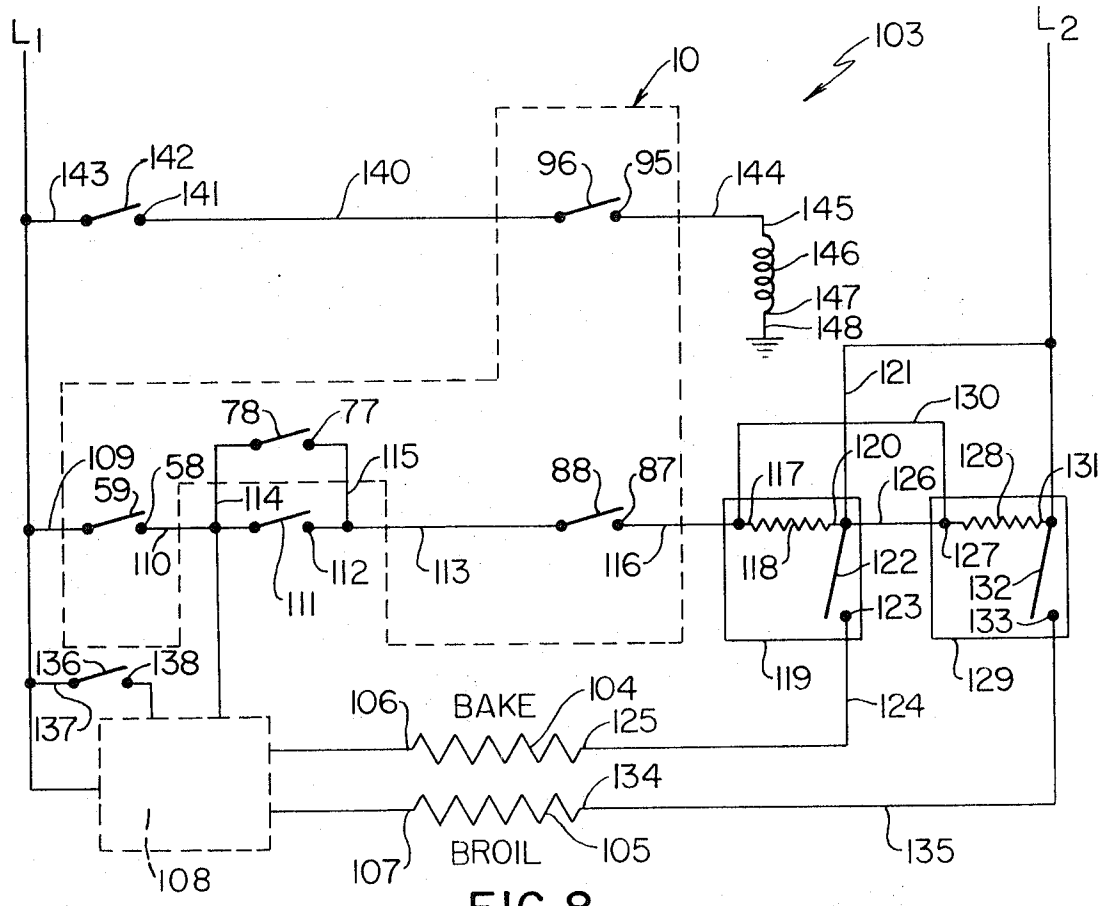

FIG. 8

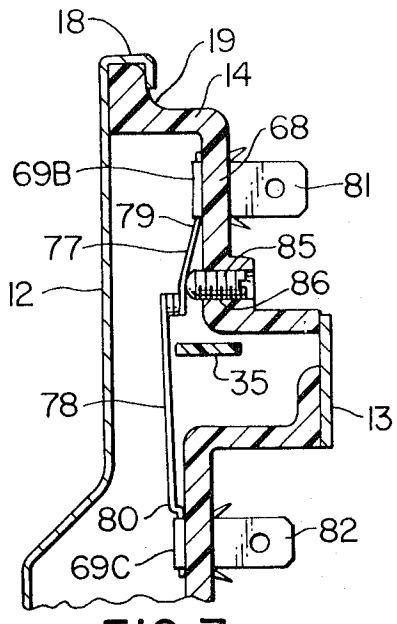

FIG. 7

INVENTORS.
HENRY F. HILD
SIEGFRIED E. MANECKE
JAMES L. SHAW

BY

Cowdon, Cowdon & Tassone

THEIR ATTORNEYS

THERMOSTATIC CONTROL DEVICE AND SYSTEM UTILIZING THE SAME

This invention relates to a thermostatic control device for an oven or the like as well as to an improved control system utilizing such a thermostatic control device or the like.

It is well known that various thermostatic control devices have been provided for ovens to permit the user to select a desired cooking temperature as well as a high temperature burn-off cleaning operating. However, such prior known thermostatic devices usually utilize two different temperature responsive means respectively for controlling the normal cooking operation and the high temperature burn-off cleaning operation.

One of the features of this invention is to provide a thermostatic control device that can be utilized for controlling both the normal cooking operations of a domestic oven or the like as well as the high temperature burn-off cleaning operations thereof with such control device utilizing only one temperature responsive means for controlling both operations.

Another feature of this invention is to provide such a thermostatic control device which can be utilized for any number of desired purposes, such as for only a normal cooking operation and the like.

In particular, one embodiment of the thermostatic control device of this invention comprises a frame means carrying a coiled tube that has opposed ends one of which is interconnected to the frame means and the other is movable relative thereto, the coiled tube having a temperature sensing bulb interconnected thereto whereby expansion and contraction of fluid in the bulb causes movement of the other end of the tube relative to the frame means. A pair of switch blades are carried by the frame means and normally are moved toward each other for electrical contact therebetween for interconnecting an electrical power source to electrical heating means of a domestic oven or the like. Control means are carried by the frame means for selectively adjusting the position of one of the switch blades relative to the frame means for selecting a cooking operation of the heating means. The other end of the tube carries means for engaging against the other of the blades to cause movement thereof in a direction away from the one blade when a certain temperature is sensed by the bulb whereby the setting of the control means determines the sensed temperature that will cause the tube to open the switch blades and, thus, maintain the output temperature effect of the heating means in the oven at the temperature effect selected by the control means.

Such a thermostatic device can be utilized in an oven control system wherein other switch blades thereof control other operations of the oven, such as a high temperature burn-off cleaning operation, door lock construction, low temperature operations, etc., with the tube controlling such other pairs of switch blades in the manner previously described.

Accordingly, it is an object of this invention to provide an improved thermostatic control device having one or more of the novel features of this invention as set forth above or hereinafter shown or described.

Another object of this invention is to provide an improved control system utilizing such a thermostatic device or the like.

Other objects, uses or advantages of this invention are apparent from a reading of this description which proceeds with reference to the accompanying drawings forming a part thereof and wherein:

FIG. 1 is a fragmentary, front view of a cooking apparatus carrying the thermostatic control device of this invention.

FIG. 2 is an enlarged view of the thermostatic control device of FIG. 1 with the control knob thereof removed.

FIG. 3 is a view similar to FIG. 2 of the control device of this invention with the cover thereof removed.

FIG. 4 is a cross-sectional view of the thermostatic device of FIG. 2 and is taken on line 4—4 thereof.

FIG. 5 is a reduced view of the rear of the thermostatic device of FIG. 2.

FIG. 6 is an exploded perspective view of the various parts of the thermostatic device of FIG. 2.

FIG. 7 is a fragmentary cross-sectional view taken substantially on line 7—7 of FIG. 3.

FIG. 8 is a schematic view illustrating the improved oven control system of this invention.

While the various features of this invention are hereinafter described and illustrated as being particularly adapted to control the cooking and high temperature burn-off cleaning operations of a domestic oven or the like, it is to be understood that the various features of this invention can be utilized singly or in any combination thereof to provide control means for other apparatus as desired.

Therefore, this invention is not to be limited to only the embodiment illustrated in the drawings, because the drawings are merely utilized to illustrate one of the wide variety of uses of this invention.

Referring now to FIGS. 1–7, the improved thermostatic control device of this invention is generally indicated by the reference numeral **10** and comprises a housing or frame means **11** formed from a front plate **12**, a rear plate **13** and a central housing member **14** having opposed open ends **15** and **16** respectively closed by the plates **12** and **13** that are adapted to be secured thereto by threaded fastening members **17** as illustrated. The front plate **12** has a pair of ears or tangs **18** adapted to extend over the central member **14** at corner recesses **19** thereof to secure the upper portion of the front plate **12** to the central member **14** while the lower end of the front plate **12** is secured to the central member **14** by the threaded fastening members **17** being received in threaded openings **20** of the central member **14**. The rear plate **13** is secured to the central member **14** by the two threaded fastening members **17** likewise being received in threaded openings (not shown) in the central member **14**.

The plates **12** and **13** cooperate with the central member **14** to define a chamber **21** in the frame means or housing means **11** which is adapted to receive a coiled tube **22** of this invention.

The coiled tube **22** has an outer end **23** adapted to be secured to the rear plate **13**, such as by spot welding thereto, and has an inner end **24** disposed within the spiral or coil and being adapted to be moved relative to the frame means **11** upon the expansion and contraction of fluid contained within the tube **22** and interconnected to a temperature sensing bulb **25** by a capillary tube **26**. Since the control device **10** of this invention is adapted to control a high temperature burn-off cleaning operation which takes place with the temperature being around **1,000°** F., the bulb **26** and tube **22** are filled with helium so that the same can withstand and accurately control the high temperature operation as well as the low temperature cooking operation as will be apparent hereinafter.

The movable end or inner end **24** of the tube **22** has opposed sides **27** and **28** respectively provided with outwardly directed pivot pins **29** that are respectively secured in suitable openings **30** of a pair of legs **31** and **32** of a U-shaped member **33** that has the legs **31** and **32** thereof completely straddling the coiled tube **22** with the cross member **34** thereof extending across the top of the coiled tube **22** in spaced relation relative thereto whereby expansion and contraction of the fluid in the bulb **25** and tube **22** causes the coiled tube **22** to tend to unwind or to wind up and thereby cause a back and forth rocking motion of the U-shaped member **33** relative to the frame means **11**.

An electrically insulating cross bar **35** is secured to the cross member **34** of the U member **33** by an S-shaped member **36** suitably riveted to the cross bar member **35** by rivets **37** and to the cross member **34** of the U member **33** by rivets **38**. The S-shaped member **36** is made from a bimetal and serves to provide ambient compensation for the coil tube **22**.

In order to initially fill the temperature sensing bulb **25** and tube **22** with the aforementioned helium, a fill conduit means **39** is disposed in fluid communication with the tube **22** in parallel relation to the capillary tube **26** as illustrated in FIG. **6** whereby helium can be forced into the tube **22** and, thus, into the bulb **25** until the same have been filled to the desired

degree whereby the filled tube 39 can be subsequently sealed closed in any desired manner.

The capillary tube 26 and the fill conduit means 39 are held in place against the outer surface of plate 13 by the clamp means 9. The clamp means 9 is held in place by the threaded fastening members 17 used to secure plate 13 to member 14.

The front plate 12 of the thermostatic device 10 carries an internally threaded bushing 40 which threadedly receives an externally threaded member 41 that is secured to a C-shaped control shaft 42 that is adapted to project through a suitable opening in the oven frame structure 43 as illustrated in FIG. 1 so as to receive a control knob 44 thereon for rotating the shaft 42 and, thus, rotating the externally threaded member 41 relative to the frame means 11 so as to cause axial movement of the threaded member 41 within the stationary threaded bushing 40. The externally threaded member 41 has an opening 45 passing axially therethrough with the left hand portion 46 thereof being internally threaded to threadedly receive an adjusting screw 47 that has an end 47' disposed within the right hand unthreaded portion of the bore 45 to abut against an electrically insulating pin or rod 48 that has the position of its free end 49 in the chamber 21 of the frame means 11 adjusted by the axial adjustment of the threaded member 41 within the stationary threaded portion 40 as will be apparent hereinafter.

A bracket member 50 is secured to the internally threaded bushing 40 and has opposed ears 51 and 52 provided with openings 53 for fastening the control device 10 to the desired structure, such as the frame structure 43 of a domestic oven or the like, such as the control panel thereof as illustrated in FIG. 1. The bracket 50 has inwardly bent tangs 54 utilized as a stop means for the rotation of the control shaft 42 because the control shaft 42 carries a disc 55 having an outwardly directed tang 56 which engages against the top side of the tang 54 of the bracket 50 in the manner illustrated in FIGS. 2 and 6 when the control shaft 42 is disposed in its "off" position and against the under side of the tang 54 when the control shaft 42 is set in its highest temperature position.

Thus, it can be seen that when the control shaft 42 is disposed in its "off" position as illustrated in FIGS. 2 and 6, the rod or pin 48 controlled thereby projects into the chamber 21 of the housing means 11 to its greater extent and when the control knob 44 as illustrated in FIG. 1 is rotated in a clockwise direction from its "off" position as illustrated to its higher temperature position, the threaded member 41 is axially moved to the left in FIG. 4 whereby the pin 48 will be in its least projected condition into the chamber 21 of the housing means 11 for a purpose hereinafter described.

In order to provide tension or "feel" for the location of the shaft 42 relative to the control device 10, a bowed leaf spring 57 is disposed between the bracket member 50 and the plate 55 of the control shaft 42 whereby rotation of the control shaft 42 relative to the frame means 11 is opposed by the friction provided by the bowed leaf spring 57 to provide the aforementioned "feel" for the rotation of the control knob 44 relative to the control panel 43.

A pair of switch blades 58 and 59 are carried by the frame means 11 and are adapted to cooperate together at free ends 60 and 61 thereof, where suitable contact means 62 and 63 are secured, for completing an electrical circuit therebetween. The upper switch blade 58 is best illustrated in FIG. 3 and comprises a substantially rectangular portion 64 having a rectangular cutout 65 therein and carrying a bent tang 66 extending rearwardly from a top portion 67 thereof to be inserted between a back wall 68 of the central housing member 14 and a U-shaped sleeve portion 69 of a terminal 70 to secure the end 66 of the switch blade 58 to the frame means 11 while the lower end 60 thereof is adapted to move relative to the frame means 11 about the hinge portion 67 of the switch blade 58 in a manner hereinafter described. The terminal 70 is adapted to project through a slot 71 in the rear wall 68 of the central housing member 14 to extend outwardly from the same to be interconnected to a suitable electrical lead in a manner hereinafter described while the U-shaped portion 69 thereof has an inner portion 72 received in a suitable slot 73 formed in the rear wall 68 of the central housing member 14, the terminal 70 being staked in place in the slot 71 of the wall 68 by suitable staking 74 as illustrated in FIG. 4. Thus, when the tang 66 of the switch blade 58 is assembled into the slot means formed between the U-shaped portion 69 of the terminal 70 and the rear wall 68 of the frame means 11 as illustrated in FIG. 3, the same can be spot welded together so as to provide positive securement and positive electrical connection between the terminal 70 and the switch blade 58.

The contact portion 62 of the switch blade 58 is offset to the right as illustrated in FIG. 3 to cooperate with the free end 61 of the switch blade 59 which also has its lower end 75 secured to the housing means 11 by a U-shaped portion 69A of another terminal 76 of the control device 10 in a manner similar to the terminal 70.

The switch blade 59 has a natural resiliency or bias that tends to move the movable end 61 thereof toward the switch blade 58 as illustrated in FIG. 4 and a compression spring 77' is disposed between the rear wall 68 of the central housing member 14 and the switch blade 58 to tend to move the switch blade 58 toward the switch blade 59 whereby the switch blade 58 and 59 are normally placing the electrical contacts 62 and 63 thereof together.

The cross bar 35 of the tube 22 of the control device 10 is disposed in such a position that the same is adapted to engage against the switch blade 59 below the switch blade 58 to move the same in a direction away from the switch blade 58 to tend to separate the switch blades 59 and 58 upon an increase in temperature sensed by the bulb 25 as the expansion of fluid in the tube 22 tends to unwind the same. However, the switch blade 58 tends to follow such movement of the switch blade 59 because the force of the compression spring 77' is tending to move the switch blade 58 to the left in FIG. 4.

However, the position of the pin 48 under the influence of the setting of the control knob 44 limits the amount of movement of the switch blade 58 to the left in FIG. 4 as the end 49 of the pin 48 is in the path of movement of the switch blade 58. Therefore, it can be seen that the setting of the control knob 44 to a desired temperature setting will cause the switch blades 58 and 59 to remain in electrical contact with each other as long as the temperature sensed by the bulb 25 is below the set temperature of the knob 44 and will cause opening of the switch blades 58 and 59 when the temperature sensing bulb 25 senses a temperature above the temperature set by the control knob 44. In this manner, the pair of switch blades 58 and 59 are adapted to control the normal cooking operation of a domestic oven or the like as will be apparent hereinafter.

Another pair of switch blades 77 and 78 are carried by the frame means 11 by respectively having opposed ends 79 and 80 thereof secured to U-shaped portions 69B and 69C of terminals 81 and 82 so that free ends 83 and 84 thereof are adapted to cooperate together to provide an electrical circuit between the terminals 81 and 82 when the blades 77 and 78 are in electrical contact with each other at the free ends 83 and 84 thereof. However, the lower blade 78 is in the path of movement of the cross bar 35 of the tube 22 so that at a certain sensed temperature, the cross bar 35 will move the switch blade 78 away from the switch blade 77 because the natural bias of the switch blade 78 is toward the switch blade 77 and the position of the switch blade 77 relative to the housing means 14 is controlled by a set screw 85 disposed in a threaded bore 86 in the rear wall 68 of the central housing member 14 with the natural bias of the switch blade 77 being toward the rear wall 68 of the housing member 14. Thus, depending upon the setting of the set screw 85, the opening and closing of the switch blades 77 and 78 will take place at a certain sensed temperature whereby such pair of switch blades 77 and 78 are adapted to control a non-cooking and warmth-retaining temperature operation for the oven of the cooking apparatus 43 in a manner hereinafter described.

Another pair of switch blades 87 and 88 are carried by the frame means 11 with the switch blades 87 and 88 respectively having ends 89 and 90 secured to the frame means 11 by the U-shaped portions 69D and 69E of terminals 91 and 92 whereby the free ends 93 and 94 of the switch blades 87 and 88 are adapted to cooperate together to provide electrical circuit between the terminals 91 and 92. However, the switch blade 88 is disposed in the path of movement of the cross bar 35 of the tube 22 so that the natural bias of the switch blade 88 toward the switch blade 87 can be overcome by movement of the cross bar 35 away from the switch blade 87 to open the circuit between the switch blades 87 and 88 when a certain temperature is sensed by the temperature sensing bulb 25, the switch blade 87 having a natural bias toward the end wall 68 and having its position set by the set screw 85A in the same manner as the set screw 85 previously described. The switch blades 87 and 88 are adapted to control a high temperature burn-off cleaning operation of the cooking apparatus 43 in a manner hereinafter described.

Another pair of switch blades 95 and 96 are carried by the frame means 11 by having the ends 97 and 98 thereof respectively secured to the rear wall 68 of the central housing member 14 by the U portions 69F and 69G of terminals 99 and 100 whereby the free ends 101 and 102 of the switch blades 95 and 96 are adapted to cooperate together to provide an electrical circuit between the terminals 99 and 100. However, the cross bar 35 is disposed to engage the switch blade 96 and move the same away from the switch blade 95 upon a temperature sensed by the bulb 25 reaching a certain temperature to overcome the natural bias of the switch blade 96 toward the switch blade 95, the switch blade 95 having a natural bias toward the rear wall 68 of the central housing member 14 and having its position adjusted thereto by the set screw 85D, FIG. 5, in a manner similar to the set screw 85. The switch blades 95 and 96 are adapted to provide a door locking function during a cleaning operation of the cooking apparatus 43 as will be apparent hereinafter.

Therefore, it can be seen that the tube 22, through its insulating contact bar 35, is adapted to control the operation of the four pairs of switch blades 58, 59; 77, 78; 87, 88; and 95, 96 with each pair of switch blades being opened and closed at different temperatures sensed by the sensing bulb 25 to provide an automatic control system for the cooking apparatus 43 now to be described.

As illustrated in FIG. 8, an improved control system of this invention is generally indicated by the reference numeral 103 and comprises a pair of power source leads L_1 and L_2 for operating a bake heating element 104 and a broil heating element 105 of the cooking apparatus 43. The power source lead L_1 is adapted to be interconnected to the side 106 of the bake element 104 or the side 107 of the broil element 105 by suitable selector switching means 108 depending upon whether the switching means 108 is set for a baking operation or a broiling operation. Likewise, the power source lead L_1 is adapted to be interconnected to both the bake element 104 and the broil element 105 when the switching means 108 sets forth a burn-off cleaning operation.

The control device 10 of this invention is schematically illustrated by dash lines in FIG. 8 and comprises the main cycling or moving switch blade 59 and its cooperable and adjustable switch blade 58, the movable switch blade 78 and its cooperable and adjustable switch blade 77, the movable switch blade 88 and its cooperable and adjustable switch blade 87 and the movable switch blade 96 and its cooperable and adjustable switch blade 95 interconnected into the control system 103 as illustrated in FIG. 8.

In particular, the movable switch blade 59 is electrically interconnected by its terminal 76 to a lead 109 that is interconnected to the power source lead L_1, the adjustable switch blade 58 being interconnected through its terminal 70 to a lead 110 that is interconnected to a timer operated switch blade 111. The timer operated switch blade 111 is adapted to be closed against a fixed contact 112 which is interconnected by a lead 113 to the terminal 100 of the movable switch blade 88.

The lead 110 is also interconnected by a lead 114 to the terminal 82 of the movable switch blade 78 while the adjustable switch blade 77 is interconnected by its terminal 81 to a lead 115 that is interconnected to the lead 113.

The adjustable switch blade 87 is interconnected by its terminal 91 to a lead 116 that is interconnected to one side 117 of a small heater element 118 of a thermal relay switch 119. The other side 120 of the heater element 118 is interconnected by a lead 121 to the power source lead L_2. The thermal relay switch 119 has a movable switch blade 122 formed by bimetallic material which is adapted to close against a fixed contact 123 when the heater element 118 is operating so as to interconnect the lead 121 to a lead 124 interconnected to the fixed contact 123 at one end thereof and to the side 125 of the bake element 104 at the other end thereof.

The side 120 of the heating element 118 of the thermal relay switch 119 is also interconnected by a lead 126 to one side 127 of a heating element 128 of another thermal relay switch 129, the side 127 of the heating element 128 also being interconnected to the side 117 of the heating element 118 by a lead 130. The other side 131 of the heating element 128 is interconnected to the power source lead L_2. The thermal relay switch 129 has its bimetal switch blade 132 movable against a fixed contact 133 that is interconnected to the side 134 of the broil element 105 by a lead 135, the switch blade 132 only closing against the contact 133 when the heating element 128 is energized.

The cooking apparatus 103 is provided with a movable switch blade 136 which is interconnected to the lead L_1 by a lead 137 and is normally disposed in an open condition relative to a fixed contact 138 as long as the manual latch member for the oven door is in its unlatched or unlocked position. However, when such oven door latch member is moved to its latching position, the same closes the switch blade 136 against the fixed contact 138 which is interconnected to the selector switching means 108. The selector switch 108, when positioned in the "clean" position for the burn-off cleaning cycles connects the fixed contact 138 to lead 110.

The movable blade 96 of the thermostatic device 10 is interconnected by its terminal 100 to a lead 140 which is interconnected to a fixed contact 141 that cooperates with a normally opened switch blade 142 that is interconnected to the power source lead L_1 by a lead 143. The adjustable switch blade 95 of the thermostatic device 10 is interconnected by its terminal 99 to a lead 144 that is interconnected to one side 145 of a solenoid coil 146 that has its other side 147 interconnected by a lead 148 to ground. The solenoid coil 146 when energized is adapted to move a latching pin out of latching engagement with the manual door latch lever so that the door latch lever can be moved from its unlatching position to its locking position or can be moved from its locking position to its unlatching position, both operations of the door latch member only taking place when the coil 146 is energized as will be apparent hereinafter.

The operation of the control system 103 will now be described.

Assuming that the housewife or the like desires to utilize the control system 103 for a conventional baking operation of the cooking apparatus 43, the selector means 108 is set for a baking operation so that the power source lead L_1 is only interconnected to the side 106 of the bake element 104. Since the timer is in a "manual position thereof" the switch blade 111 is disposed in its closed position against the contact 112. The housewife sets the control knob 44 at the desired cooking temperature whereby as long as the temperature in the oven is below the set cooking temperature of a knob 44, the switch blade 59 will be disposed against the switch blade 58 and since the switch blade 88 for the high temperature burn-off cleaning operation is always disposed against the switch blade 87 until the oven temperature exceeds the burn-off cleaning temperature, the power source lead L_1 is interconnected to the heater

118 of the thermal relay switch 119 so that the heater 118 is placed across the power source leads l_1 and L_2. The thus operating heating element 118 heats the bimetal switch blade 122 to move the same to a closed position against the contact 123 to interconnect the power source lead L_2 to the side 125 of the bake element 104 so that the bake element 104 is placed across the power source leads L_1 and L_2 to heat the oven to the desired baking temperature at which time the switch blade 59 is moved away from the switch blade 58 to disconnect the heater 118 from across the power source leads L_1 and L_2 and, thus, cause the switch blade 122 to move to its open position to disconnect the element 104 from across the power source leads L_1 and L_2.

In this manner, the switch blade 59 is cycled between its open and closed positions to tend to maintain the temperature in the oven at the baking temperature selected by the selector knob 44.

Such a baking operation could be an automatically timed baking operation whereby after the lapse of a selected baking time period, the control device 10 will maintain the oven at a low, non-cooking and warmth-retaining temperature until the housewife or the like desires to remove the food from the oven.

In particular, after the previously described baking operation has taken place from the predetermined time period, the timer clock causes the switch blade 111 to move away from the fixed contact 112 to its open position as illustrated in FIG. 8 whereby the only time the power source lead L_1 can be interconnected to the lead 113 to operate the thermal switch 119 is when the switch blade 78 is disposed against the switch blade 77 and the switch blade 78 is only moved against the switch blade 77 when the temperature in the oven has fallen just below a non-cooking and warmth-retaining temperature, such as a 170° F., and, of course, at such low temperature, the switch blade 59 is disposed against the switch blade 58 whereby the cycling of the switch blade 78 between its open and closed positions will maintain the temperature in the oven at a low temperature as set by the set screw 85.

When the system 103 is utilized for a broiling operation, the selector switch 108 is moved to a "broil" position thereof with the control knob 44 also being moved to its broiling position (approximately 625° F.) so that the broil element 105 will be placed across the power source leads L_1 and L_2 when the switch blade 132 of the thermal relay 129 is moved to its closed position by the heater element 128 being placed across the power source leads L_1 and L_2 in the same manner as the heating element 118 for the thermal relay switch 119 for the bake element 104 as previously described, the switch blade 59 cycling between its open and closed positions to maintain the broiling temperature in the oven in the same manner as the previously described baking operation.

When the housewife or the like desires to utilize the control system 103 for a high temperature burn-off cleaning operation, the selector switch 108 is placed in the "clean" position, the control knob 44 turned to the oven "clean" position thereof, and the timer (not shown) for controlling switch blade 111 is set so blade 111 is in contact with contact 112 for the desired burn-off period. The housewife or the like must also momentarily close the switch 142 which energizes the solenoid 146 by placing the same across the power source leads L_1 and ground since the switch blade 96 is normally maintained against the switch blade 95 until the temperature of the oven exceeds 550° F. or the like. Energizing of the solenoid coil 146 will move the locking pin so that the housewife can now move the oven door latch member from its unlocked position to its locked position. With the oven door latch member now being disposed in its locked position, the switch blade 136 is closed against the fixed contact 138 connecting the power source lead L_1 to the selector switch means 108. The oven door is therefore locked before the selector switch 108 when placed in the "clean" position is effective to connect the power source lead L_1 to the timer operated switch blade 111. The housewife releases the button 142 after the door latch member has been moved to its locked position which will cause deenergizing of the coil 146 so that the latch pin now drops into place to hold the door latch member in its locked position until the coil 146 is again energized which, of course, cannot take place unless the oven temperature is below 550° F. because when the oven temperature is above 550° F., the contact bar 35 of the tube 22 has moved the switch blade 96 away from the switch blade 95 so that the coil 146 cannot be energized at any time when the oven is above 550° F.

With the switch blade 136 now disposed against contact 138 with the oven latch member in its locked position, the switch blade 88 remains against the contact 87 to interconnect the power source lead L_1 to the heaters 118 and 128 of the thermal relay switches 119 and 129 to cause the heating elements 104 and 105 to be placed across power source leads L_1 and L_2 to heat the oven to the high temperature for burn-off purposes which temperature when reached in the oven will cause the contact bar 35 to move against the switch blade 88 and move the same away from the fixed blade 87 to turn off the elements 104 and 105 until the oven again falls below such high temperature setting of the set screw 85A. Thus, the switch blade 88 will be cycled between its open and closed position by the tube 22 to maintain the temperature at the high burn-off cleaning temperature.

The cleaning operation is terminated when the switch 111 opens upon completion of the selected burn-off time or by operation of the selector switch 108 to the "off" position which prevents the elements 104 and 105 from having the sides 106 and 107 thereof interconnected to the power source leads L_1, the temperature in the oven begins to drop and when the same falls below 550° F., the switch blade 96 is again permitted to close against the switch blade 95 by the contacting tube 22 so that the housewife or the like can again close the switch 142 to energize the coil 146 and retract the latching pin so that the oven door latch member can be moved from its locked position to its unlocked which will open the switch blade 136 away from the contact 138.

Therefore, it can be seen that the coiled tube 22 of the thermostatic device 10 of this invention is adapted to control the various pairs of switches in the control device 10 for not only the normal cooking operation of the cooking apparatus 43, but also for the cleaning operation thereof.

However, it is to be understood that if it is desired to utilize the thermostatic device 10 for an oven that does not provide for a cleaning operation thereof, only the pair of switch blades 59 and 58 of the device 10 need be utilized. Alternatively, the switch blades 59, 58 and 78, 77 can be utilized without the oven door latch means 96, 95 and high temperature clean-off operations 88, 87, as desired.

Accordingly, it can be seen that this invention not only provides an improved thermostatic control device having many novel and unobvious features, but also this invention provides an improved control system for an oven or the like.

While the form of the invention now preferred has been disclosed as required by the statutes, other forms may be used, all coming within the scope of the claims which follow.

What is claimed is:

1. A thermostatic device comprising frame means, a coiled tube having opposed ends one of which is interconnected to said frame means and the other being movable relative thereto, a temperature sensing bulb interconnected to said tube whereby expansion and contraction of fluid in said bulb causes movement of said other end of said tube relative to said frame means, a pair of switch blades carried by said frame means and normally being moved toward each other for electrical contact therebetween, control means carried by said frame means for selectively adjusting the position of one of said switch blades relative to said frame means, and means carried by said other end of said tube for engaging against the other of said blades to cause movement thereof in a direction away from said one blade when a certain temperature is sensed by said bulb whereby the setting of said control means

determines the sensed temperature that will cause said tube to open said switch blades, said tube being ribbon-like with opposed side edges and being coiled into a spiral with said other end thereof being an inner end of said spiral, said means carried by said other end of said tube comprising a U-shaped member having the legs thereof interconnected to said opposed side edge of said other end of said tube.

2. A thermostatic device as set forth in claim 1 wherein an engagement bar is carried by the cross member of said U-shaped member for engaging against said other switch blade.

3. A thermostatic device as set forth in claim 2 wherein said engagement bar is formed of electrical insulating material.

4. A thermostatic device as set forth in claim 1 wherein said one switch blade has opposed ends, one of said ends of said one switch blade being secured to said frame means and the other end thereof being movable relative to said frame means and carrying contact means for electrically contacting said other switch blade.

5. A thermostatic device as set forth in claim 4 wherein a compression spring is disposed between said frame means and said one switch blade to tend to move said other end thereof toward said other switch blade.

6. A thermostatic device as set forth in claim 5 wherein said control means comprises an axially movable member carried by said frame means and engageable with said one switch blade on the side thereof opposite to the compression spring engaged side thereof to set the position of said one blade relative to said frame means.

7. A thermostatic device as set forth in claim 6 wherein said control means comprises a rotatable member threaded to said frame means, said axially movable member being disposed between said rotatable member and said one switch blade.

8. A thermostatic device as set forth in claim 7 wherein said axially movable member comprises a pin formed of electrically insulating material.

9. A thermostatic device as set forth in claim 1 wherein another pair of switch blades is carried by said frame means and normally being moved toward each other for electrical contact therebetween, said means carried by said other end of said tube being adapted to engage against one of said blades of said other pair thereof and move the same away from the other blade of said pair thereof when a certain temperature is sensed by said bulb.

10. A thermostatic device as set forth in claim 9 wherein said frame means carries an adjusting member to adjust the position of said one blade of said other pair thereof relative to said frame means to change the temperature that must be sensed by said bulb before said other pair of switch blades will open.

11. A thermostatic device as set forth in claim 10 wherein said switch blades of said other pair thereof each has opposed ends one of which is secured to said frame means and the other being movable relative thereof for cooperating with the movable end of the other blade of said pair.

12. A thermostatic device as set forth in claim 11 wherein said frame means carries a pair of slot means respectively receiving said one ends of said switch blades of said other pair to secure the same to said frame means.

13. A thermostatic device as set forth in claim 1 wherein a plurality of other pairs of switch blades are carried by said frame means and are normally being moved toward each other for electrical contact therebetween, said means carried by said other end of said tube being adapted to engage against one of said blades of each other pair thereof and move the same away from the other blade of said pair thereof when a certain temperature is sensed by said bulb.

14. In an oven control system having a heating means, the improvement comprising a thermostatic device having frame means, a coiled tube having opposed ends one of which is interconnected to said frame means and the other being movable relative thereto, a temperature sensing bulb disposed to sense the temperature effect in said oven and being interconnected to said tube whereby expansion and contraction of fluid in said bulb causes movement of said other end of said tube relative to said frame means, a pair of switch blades carried by said frame means and normally being moved toward each other for electrical contact therebetween, said switch blades being operatively interconnected with said heating means for operating said heating means when said switch blades are in contact with each other, control means carried by said frame means for selectively adjusting the position of one of said switch blades relative to said frame means, and means carried by said other end of said tube for engaging against the other of said blades to cause movement thereof in a direction away from said one blade when a certain temperature is sensed by said bulb whereby the setting of said control means determines the sensed temperature that will cause said tube to open said switch blades and, thus, the temperature of said oven, said tube being ribbon-like with opposed side edges and being coiled into a spiral with said other end thereof being an inner end of said spiral, said means carried by said other end of said tube comprising a U-shaped member having the legs thereof interconnected to said opposed side edges of said other end of said tube.

15. In an oven control system as set forth in claim 14 the further improvement wherein an engagement bar is carried by the cross member of said U-shaped member for engaging against said other switch blade.

16. In an oven control system as set forth in claim 15 the further improvement wherein said engagement bar is formed of electrical insulating material.

17. In an oven control system as set forth in claim 14 the further improvement wherein said one switch blade has opposed ends, one of said ends of said one switch blade being secured to said frame means and the other end thereof being movable relative to said frame means and carrying contact means for electrically contacting said other switch blade.

18. In an oven control system as set forth in claim 17 the further improvement wherein a compression spring is disposed between said frame means and said one switch blade to tend to move said other end thereof toward said other switch blade.

19. In an oven control system as set forth in claim 18 the further improvement wherein said control means comprises an axially movable member carried by said frame means and engageable with said one switch blade on the side thereof opposite to the compression spring engaged side thereof to set the position of said one blade relative to said frame means.

20. In an oven control system as set forth in claim 19 the further improvement wherein said control means comprises a rotatable member threaded to said frame means, said axially movable member being disposed between said rotatable member and said one switch blade.

21. In an oven control system as set forth in claim 20 the further improvement wherein said axially movable member comprises a pin formed of electrically insulating material.

22. In an oven control system as set forth in claim 14 the further improvement wherein another pair of switch blades is carried by said frame means and are normally being moved toward each other for electrical contact therebetween, said means carried by said other end of said tube being adapted to engage against one of said blades of said other pair thereof and move the same away from the other blade of said pair thereof when a certain temperature is sensed by said bulb.

23. In an oven control system as set forth in claim 22 the further improvement wherein said frame means carries an adjusting member to adjust the position of said one blade of said other pair thereof relative to said frame means to change the temperature that must be sensed by said bulb before said other pair of switch blades will open.

24. In an oven control system as set forth in claim 23 the further improvement wherein said switch blades of said other pair thereof each has opposed ends one of which is secured to said frame means and the other being movable relative thereof for cooperating with the movable end of the other blade of said pair.

25. In an oven control system as set forth in claim 24 the further improvement wherein said frame means carries a pair of slot means respectively receiving said one ends of said switch blades of said other pair to secure the same to said frame means.

26. In an oven control system as set forth in claim 14 the further improvement wherein a plurality of other pairs of switch blades are carried by said frame means and are normally being moved toward each other for electrical contact therebetween, said means carried by said other end of said tube being adapted to engage against one of said blades of each other pair thereof and move the same away from the other blade of said pair thereof when a certain temperature is sensed by said bulb.

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