Nov. 13, 1945. M. E. FRY 2,388,839

DOMESTIC APPLIANCE

Filed April 9, 1943 2 Sheets-Sheet 1

Fig 1

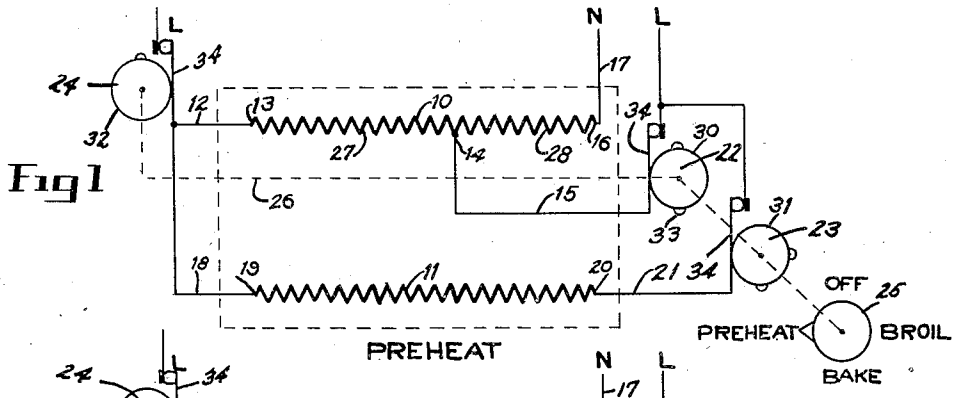


Fig 2

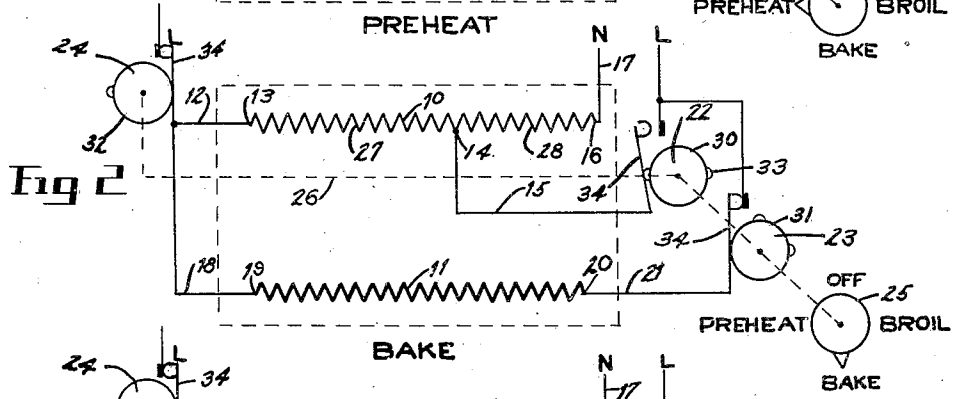


Fig 3

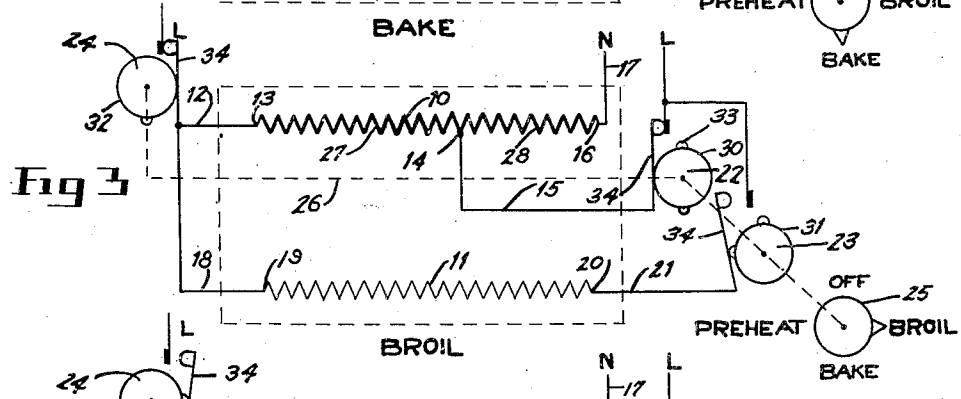
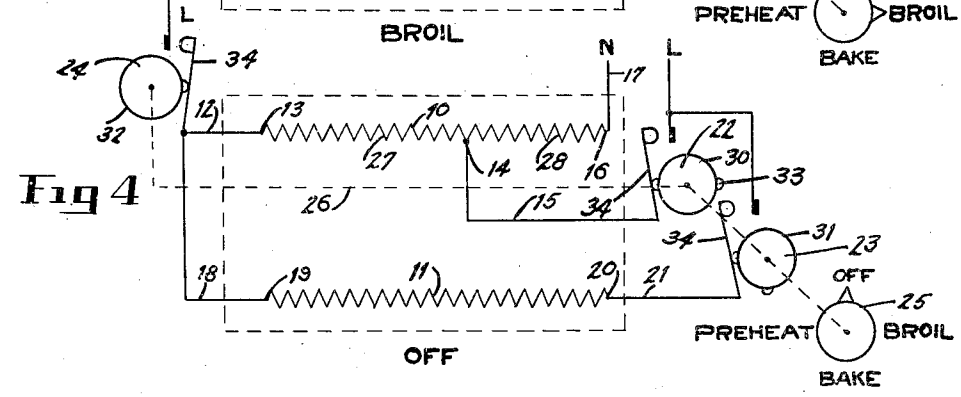


Fig 4



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DOMESTIC APPLIANCE

Filed April 9, 1943 2 Sheets-Sheet 2

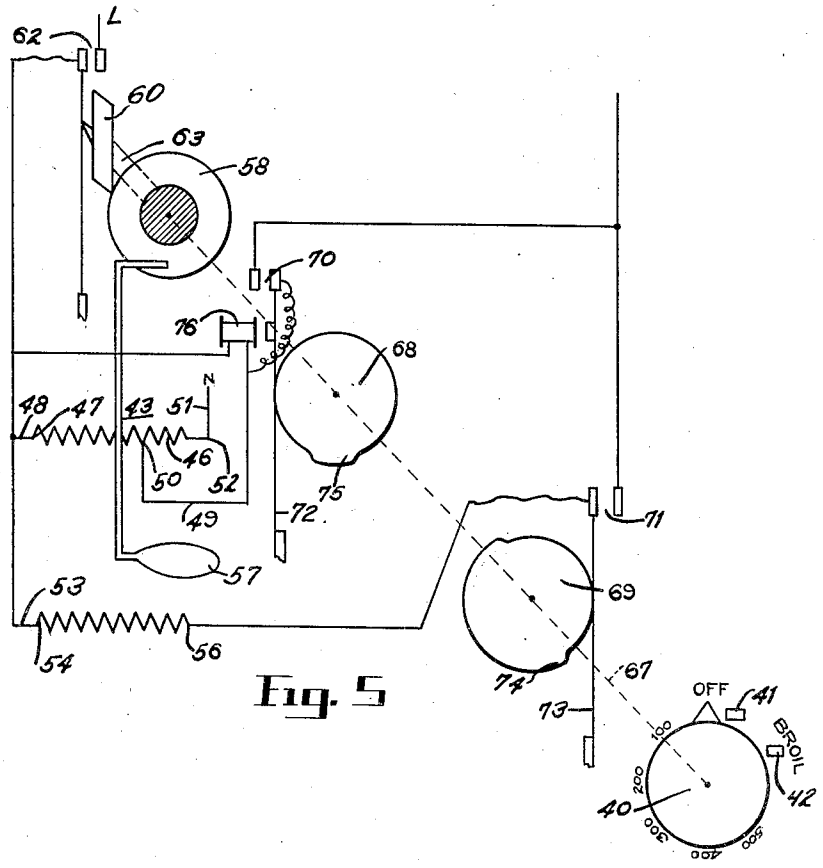


Fig. 5

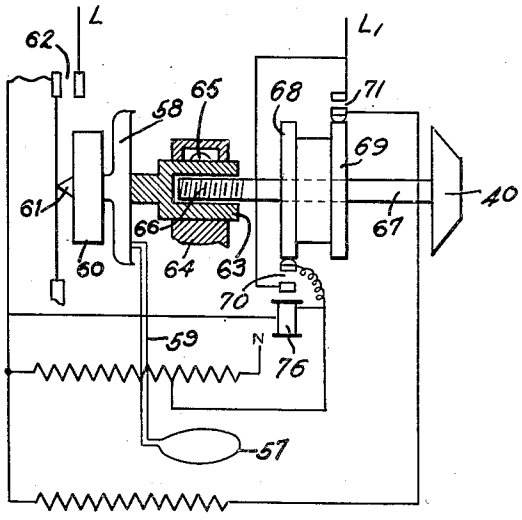


Fig. 6

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UNITED STATES PATENT OFFICE

2,388,839

DOMESTIC APPLIANCE

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Application April 9, 1943, Serial No. 482,393

9 Claims. (Cl. 219—20)

This invention relates to domestic appliances, and more particularly to electric ranges.

An object of this invention is to provide an electric heating arrangement for ovens which is capable of providing several different cooking conditions with relatively few switch connections.

Another object of this invention is to provide an electric heating arrangement for ovens, which provides a plurality of different cooking conditions with relatively few switches, and in which the polarity of the switch contacts is not reversed when shifting from one cooking condition to another.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a diagrammatic representation of one modification of my invention, in which the electric circuit is placed in a preheat position;

Fig. 2 is a view similar to Fig. 1, in which the circuit is placed in a bake position;

Fig. 3 is a view similar to Fig. 1, with the circuit in a broil position;

Fig. 4 is a view similar to Fig. 1, with the circuit in the "off" condition;

Fig. 5 is a diagrammatic representation, in perspective, of a modified form of the invention; and

Fig. 6 is a diagrammatic representation, somewhat in cross section, of the form shown in Fig. 5.

In my improved circuit, an oven is provided with an electrical upper heater 10, and an electrical lower heater 11, these heaters being placed in the oven with a cooking space between the heaters for baking and broiling articles to be cooked. These heaters are adapted to be connected and disconnected with two relatively high potential leads L and L1 and a relatively low potential lead N, these leads being adapted to be connected respectively to the lines of a source of power, such as a three-wire single phase source, in which there are two relatively high potential lines and a relatively low potential line, the arrangement being such that a high potential is adapted to be provided between the leads L and L1 and a relatively low potential between either of the leads L and L1 and the low potential, grounded or neutral lead N.

The upper heater 10 has a relatively high potential connection 12 between one of its ends 13 and the lead L. It also has an intermediate tap 14. Another relatively high potential connection 15 is provided between the tap 14 and the lead L1. The other end 16 of the heater 10 has a relatively low potential connection 17 with the lead N.

The lower heater 11 is provided with a relatively high potential connection 18 between one of its ends 19 and the lead L. Its other end 20 has a relatively high potential connection 21 with the lead L1.

Switch means are provided for energizing the heaters to provide a preheat condition, a plurality of cooking conditions, such as bake and broil conditions, and "off" condition. To this end, an upper heater switch 22 is provided for opening and closing one of the high potential connections, such as 15, of the upper heater. A lower heater switch 23 is provided for opening and closing one of the high potential connections, such as 21, of the lower heater 11. Another switch 24 is provided to cooperate with switches 22 and 23 to open all of the high potential connections in the "off" condition. The switches 22, 23 and 24 may be operated by a common manual actuator 25 which moves the shaft 26, or other mechanical connection, for operating the switches. This switch means may be of the type which is generally known as a "selector" switch, which has an actuator or knob 25 to be operated along with a separate thermostat knob, the thermostat being responsive to temperatures in the oven and opening and closing either or both of the leads L and L1. However, as hereinafter more fully described, these switches may be combined with the thermostat structure, so that the entire switch means and thermostat may be operated by a single knob.

In Fig. 1 the knob 25 is turned to the preheat position. Under these conditions, all of the switches 22, 23 and 24 are closed and all of the high potential connections 12, 15, 18 and 21 are connected with the lines L and L1 and the connection 17 is connected with the lead N. This places the lower heater 11 and the section 27 of the upper heater 10 across the high potential leads L and L1 and the section 28 of the upper heater 10 across the low potential between N and L. Preferably the upper heater 10 is made of a resistance wire of substantially uniform thickness, or resistance, throughout its length, and the tap 14 is so located intermediate the ends 13 and 16 so that substantially the same amount of current flows through the sections 27 and 28. For example, if the potential between the leads L and L1 is 235 volts and the potential between L1

and N is 117½ volts, then the tap 14 is placed so that section 27 is two-thirds of the length of the heater 10 and section 28 is one-third of the length of heater 10. Under these conditions the heater 10 is heated uniformly to the same temperature throughout its length under all of the conditions herein described.

In the bake position, shown in Fig. 2, the lower heater 11 is connected between the leads L and L_1. The upper heater 10 is connected between leads L and N; but is disconnected from the lead L_1. Under these conditions the heater 11 is energized at its full wattage and the heater 10 is energized at a reduced wattage, because the sections 27 and 28 are in series between the relatively low potential existing between the leads L and N.

In the broil position shown in Fig. 3, the connections 12, 15 and 17 of the upper heater 10 are connected to their respective leads L, L_1 and N. Under these conditions the upper heater is energized at its full wattage. The connection 21 of the lower heater 11 is opened, so that the lower heater 11 is not energized in the broil position.

In the "off" position shown in Fig. 4 the switches 22, 23 and 24 are opened and the high potential connections 12, 15, 18 and 21 are disconnnected from their respective leads L and L_1, so that neither heaters 10 nor 11 can be energized. Since the low potential lead N is ordinarily grounded, the connection 17 may remain permanently connected to the lead N.

Merely as an example, with a 235 volt, single phase, three-wire circuit, section 27 may have a wattage of 2000–W, section 28 may have 1000–W, thus giving heater 10 a wattage of 3000, in the preheat position. Heater 11 may have 2000–W, when in the preheat position. In the bake position heater 10 then will have a wattage substantially equal to 335 watts and heater 11 a wattage of 2000 watts. In the broil position, heater 10 has a wattage of 3000–W.

In the modification shown in Figs. 1 and 4 inclusive, the switches 22, 23 and 24 diagrammatically show rotary disks actuating reciprocating switches; but it is to be understood that any type of switch may be used. In the form of switch shown, the disks 30, 31 and 32 are illustrated with ridges 33 which come in contact with the swinging or reciprocating arms 34 to open the switch. In this modification arms 34 are spring biased towards the disks, to maintain the switches closed until opened by the action of ridges 33.

Figs. 5 and 6 illustrate a modification in which the thermostat structure is combined with the switches, and the resulting structure is actuated by a single knob. Fig. 5 shows the structure diagrammatically and somewhat in perspective, while Fig. 6 shows it diagrammatically but somewhat in cross section.

In this modification the knob 40 is shown in the "off" position, and may be rotated counterclockwise from the stop 41 past bake positions marked 100, 200, 300, 400, 500 to a broil position where another stop 42 is provided. The numerals 100, etc., are intended to designate degrees of temperature to be maintained in the oven by the adjustment of the thermostat in the bake position. In the broil position, the thermostat is adjusted to approximately 600° F. In order to preheat the oven, the user may rotate the knob 40 counterclockwise to the broil position and then rotate it clockwise to a selected bake position, such as 400. As hereinafter described, such an actuation of the knob 40 causes the switch structure to energize the upper oven heater 43 and the lower oven heater 44 at their maximum wattage until the oven reaches the selected temperature (400), at which time the circuit is changed automatically by the thermostat, with the upper heater 43 energized at reduced wattage and the lower heater 44 at maximum wattage.

The upper heater 43 is divided into sections 45 and 46. One end 47 of the heater 43 is provided with a connection 48 to the high potential lead L. A high potential connection 49 connects the tap 50 with the high potential lead L_1. The low potential connection 51 connects the end 52 of the heater 43 with the low potential lead N.

A high potential lead 53 connects the end 54 of the heater 44 with the lead L. The high potential connection 55 connects the other end 56 of the heater 44 with the lead L_1.

The heaters 43 and 44, and the sections 45 and 46 may have the same wattage as given by way of example for corresponding heaters and sections of Figs. 1 to 4.

The thermostat may include a bulb 57, placed in the oven, and connected to a diaphragm 58, in the switch structure. The bulb 57 and diaphragm 58, together with the connecting tube 59 may be filled with a thermostatic liquid, such as to cause the diaphragm 58 to expand with a rise in temperature in the oven and to contract with a fall in temperature. A snap-acting mechanism 60, if desired, may be used, and is diagrammatically indicated by a rectangle and may be of any well-known construction to cause the pusher 61 to snap the switch 62 into open and closed positions. The diaphragm 58 may be carried by internally threaded sleeve 63 which is axially free to move in the support 64; but is keyed against rotation by key 65. The internal threads of 63 cooperate with the external threads 66 on the shaft 67, so that rotation of the knob 40 counterclockwise moves the diaphragm 58 axially to the right, in Fig. 6, thus to adjust the diaphragm for the selected temperature setting, as is well-known. The movement of diaphragm 58, in the "off" position, may be sufficiently far to the left, in Fig. 6, so that the diaphragm 58 cannot collapse sufficiently to close the switch 62, regardless of any temperature in the oven. This prevents energization of the heaters in the "off" position.

The shaft 67 also rotates disks 68 and 69 which operate the switches 70 and 71. The arm 72, in Fig. 5 is spring biased to the right, while the arm 73, in Fig. 5, is spring biased to the left. In the "off" position, the disks 68 and 69 allow the arms 72 and 73 to move, under spring action, to open position, as illustrated in Fig. 5. The disk 69 is provided with a ridge 74, which comes into contact with the arm 73 as the knob 41 is turned counterclockwise and closes the switch 71, thus energizing the lower heater 44 between the leads L and L_1 throughout the baking temperature range of adjustment. In the baking range of adjustment, the disk 68 has no ridge, so that the switch 70 remains open, thus causing the upper heater 43 to be energized between the leads L and N, under a relatively low potential. Therefore, throughout the range of adjustment for bake conditions, the lower heater 44 is energized at maximum wattage and the upper heater 43 is energized at relatively low wattage.

In the broil position of knob 40, the ridge 75, on the disk 68, reaches a position to move the arm 72 to the left, in Fig. 5, thus closing switch 70. At that time, the ridge 74, on disk 69, is moved beyond contact with the arm 73, thus allowing the

switch 71 to open. Under these conditions, the section 45 of heater 43 is energized between leads L and L_1 while the section 46 is energized between the leads L_1 and N. This energizes the upper heater at its maximum wattage. The lower heater 44 is deenergized in this broil position by the opening of switch 71.

When it is desired to preheat, the knob 40 is first turned to broil and then back to 400 (for example). The ridge 75, when the knob 40 is in broil position, moves the arm 72 to close switch 70. This energizes a holding solenoid 76 across the lines L and L_1 and thus holds the switch 70 closed as long as thermostatic switch 62 remains closed. Since the oven is below the selected temperature at this time, the switch 62 remains closed, so that after the knob is turned back to 400, the switches 62 and 70 remain closed. The turning of the knob 40 to 400 causes the ridge 74 to close the switch 71. Therefore, under this preheat actuating, the heaters 43 and 44 are energized at maximum wattage until the oven reaches the selected temperature of 400°. At this time, the diaphragm 58, acting through the snap-acting mechanisms 60, opens the switch 62 and deenergizes the solenoid 76. This in turn opens the switch 70. As soon as the oven is cooled slightly, the switch 62 is again closed by the thermostatic diaphragm 58 but the solenoid 76 is not re-energized and the switch 70 remains open. The heater 43 is therefore energized between the leads L and N at reduced wattage while the heater 44 is energized between the leads L and L_1 at maximum wattage. The heaters will continue to be energized and deenergized by the thermostat thereafter with the upper heater at reduced wattage and the lower heater at maximum wattage until the knob 40 is turned to the "off" or broil positions.

If the user should desire to stop the use of a preheat cycle after having actuated the knob 40 for preheat, the knob 40 may be turned back to the "off" position, thus opening the switch 62 and deenergizing the holding coil 76. Thereafter the knob 40 may be turned to any selected bake position without the use of the preheat circuit.

While I have shown a single pole thermostat controlling only the connections to lead L, it is to be understood that I may use a double pole thermostat to control the connections to both leads L and L_1.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, an upper heater switch opening and closing one of said high potential connections of said upper heater, a lower heater switch opening and closing one of said high potential connections of said lower heater, and another switch cooperating with said switches to open all of said high potential connections in the "off" condition.

2. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, and switch means having a plurality of cooking positions and an "off" condition and opening and closing one of said high potential connections of said upper heater in different cooking positions, opening and closing one of said high potential connections of said lower heater in different cooking positions, and opening all of said high potential connections in the "off" condition.

3. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, and switch means having bake and broil positions and an "off" condition, and opening one of said high potential connections of said upper heater in said bake position and closing said last named connection in said broil position, and opening one of said high potential connections of said lower heater in said broil position and closing said last named connection in said bake position, and opening all of said high potential connections in the "off" condition.

4. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, and switch means having preheat, bake and broil positions and an "off" condition and opening one of said high potential connections of said upper heater in the bake position and closing said last named connection in the preheat and broil positions, opening one of said high potential connections of said lower heater in the broil position and closing said last named connection in the preheat and bake positions and opening all of said high potential connections in the "off" condition.

5. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, an upper heater switch opening and closing one of said high potential connections of said upper heater, a lower heater switch opening and closing one of said high potential connec-

tions of said lower heater, another switch cooperating with said switches to open all of said high potential connections in the "off" condition, and thermostatic means cooperating with said switches to control the energization of said heaters in accordance with temperature conditions in said oven.

6. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, an upper heater switch opening and closing one of said high potential connections of said upper heater, a lower heater switch opening and closing one of said high potential connections of said lower heater, another switch cooperating with said switches to open all of said high potential connections in the "off" condition, and thermostatic means opening and closing one of said switches in response to oven temperatures to maintain a predetermined temperature in said oven.

7. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, an upper heater switch opening and closing one of said high potential connections of said upper heater, a lower heater switch opening and closing one of said high potential connections of said lower heater, another switch cooperating with said switches to open all of said high potential connections in the "off" condition, thermostatic means cooperating with said switches to control the energization of said heaters in accordance with temperature conditions in said oven, temperature adjusting means for said thermostatic means, and a common manual actuator for said switches and adjusting means.

8. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, switch means having bake and broil positions and an "off" condition, and opening one of said high potential connections of said upper heater in said bake position and closing said last named connection in said broil position, and opening one of said high potential connections of said lower heater in said broil position and closing said last named connection in said bake position, and opening all of said high potential connections in the "off" condition, thermostatic means cooperating with said switch means to energize and deenergize said heaters in response to oven temperatures, temperature adjusting means for said thermostatic means, and a common manual actuator for said switch means and temperature adjusting means.

9. In combination, an oven, an electrical upper heater in said oven, an electrical lower heater in said oven, two relatively high potential leads, a relatively low potential lead, said upper heater having one end and an intermediate tap with high potential connections to said high potential leads respectively and its other end with a low potential connection to said low potential lead, said lower heater having its ends with high potential connections to said high potential leads respectively, switch means having preheat, bake and broil positions and an "off" condition and opening one of said high potential connections of said upper heater in the bake position and closing said last named connection in the preheat and broil positions, opening one of said high potential connections of said lower heater in the broil position and closing said last named connection in the preheat and bake positions and opening all of said high potential connections in the "off" condition, thermostatic means cooperating with said switch means to energize and deenergize said heaters in response to oven temperatures, temperature adjusting means for said thermostatic means, means controlled by said thermostatic means when said oven has been heated to a predetermined temperature while said heaters are energized in said preheat position for automatically changing said switch means from said preheat position to said bake position, and a common manual actuator for said switch means and temperature adjusting means.

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