

May 3, 1960

P. R. LEE

2,935,591

ELECTRIC OVEN CONTROL

Filed June 23, 1958

FIG.1.

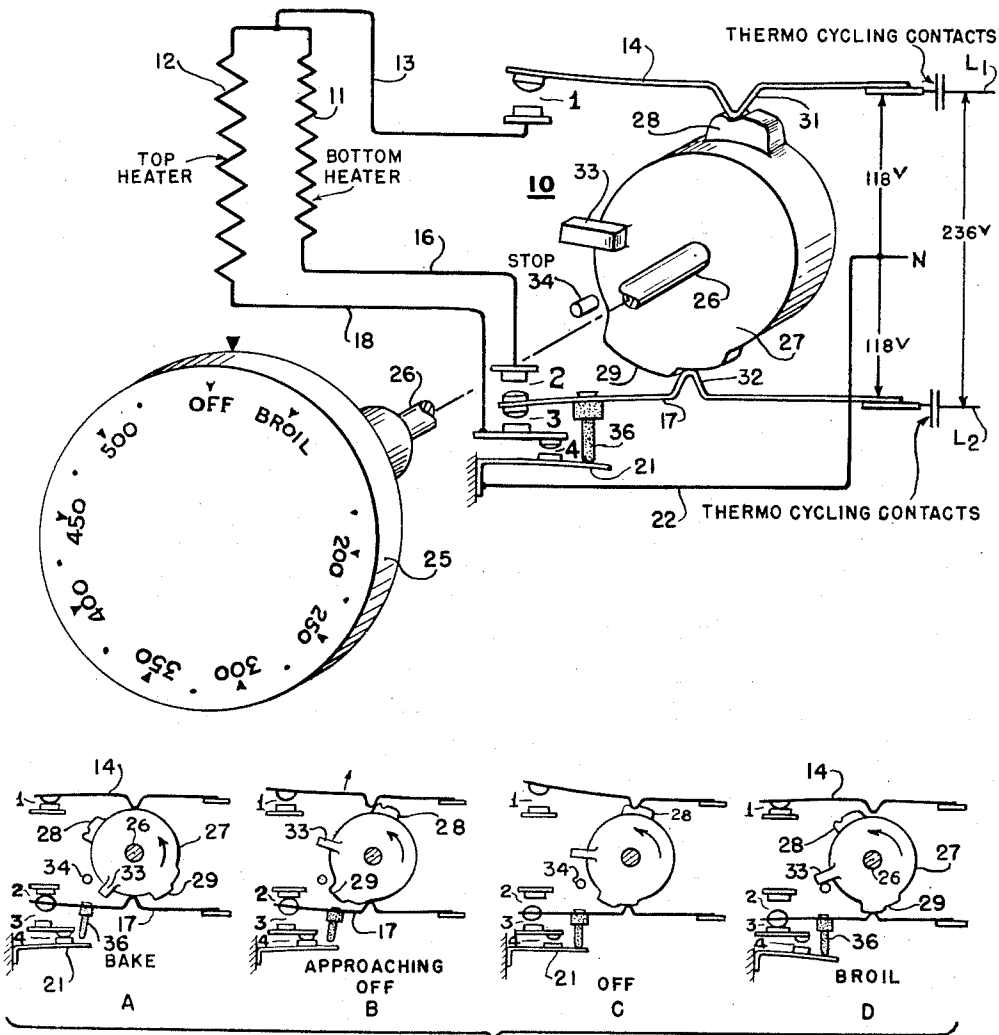


FIG.2.

INVENTOR
PAUL R. LEE

BY Ralph T. French
ATTORNEY

1

2,935,591

ELECTRIC OVEN CONTROL

Paul R. Lee, Mansfield, Ohio, assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application June 23, 1958, Serial No. 743,534

5 Claims. (Cl. 219—20)

This invention relates to controls for electrical heating apparatus, more particularly to electrical heaters capable of operating on both high voltage and low voltage, and may find particular application in the control of heaters for electric ovens of the domestic type.

Where domestic ovens are equipped with a high voltage bottom heater for use in baking operations and a top heater to which either low voltage for baking or high voltage for broiling may be applied, a flash-over or short circuiting problem in the top heater may exist when changing from bake to broil.

Such a short circuit may develop if, in opening the circuit on one voltage, an arc hangs on until a circuit is established on the other voltage. This might happen if the operator manually turned the control knob at a fast rate or oscillated it rapidly between the two voltage positions.

The present invention eliminates this flash-over or short circuit problem by provision of a control which interposes sufficient delay in the change from one voltage of the heater to the other voltage to insure that all arcs from the first voltage circuit are extinguished before the second voltage circuit is established.

In the control of the present invention the "off" position of the control knob and of the contact-operating cam positioned thereby is located between the "bake" position and the "broil" position, with mechanical stops for the cam so located that movement of the knob and cam from "bake" position to "broil" position can take place only by first passing through the "off" position. Further, the cam is so designed and constructed that a special and novel sequence of opening and closing of contacts occurs which insures elimination of flash-over or short circuiting.

These and other features of the invention will be apparent from the following description and claims taken in connection with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a wiring diagram of an oven heating system utilizing the present invention, with the control knob and cam shown in perspective; and,

Fig. 2 is a diagrammatic view of the cam and the switches operated thereby, in four different positions.

Referring now to the drawing in greater detail, particularly to Fig. 1, the reference character 10 indicates, in its entirety, a control for an oven bottom heater 11 and top heater 12. Both heaters are connected through line 13, switch 1 and lever 14, with the live wire L¹ of a three-wire power source.

The bottom heater 11 is also connected, through line 16, switch 2 and lever 17, with the other live wire L² of the power source. Similarly, top heater 12 is connected through line 18, switch 3 and lever 17 with the live wire L² of the power source.

The top heater may be alternately connected through line 19, lever 19, switch 4, lever 21 and line 22, to the neutral or intermediate wire of the three-wire power source.

Manually operable control knob 25 is secured in driving relation to shaft 26 which carries cam 27 having operating projections 28 and 29. The working surface of projection 28 engages follower 31 of the lever 14 while projection 29 has a working surface engaging the

2

follower 32 of the lever 17. The cam 27 also carries an arm 33 projecting therefrom and adapted to engage a stop 34, serving to limit rotational movement of the cam 27 in both clockwise and counterclockwise directions.

The lever 17 is provided with an abutment 36 of insulating material adapted, in certain positions of the lever 17, to engage and move the free end of the lever 21 to open the normally closed switch 4.

As best shown in Fig. 2, the cam projections 28 and 29 have their operating surfaces so designed and constructed as to produce the hereinafter described movements of the levers 14, 17 and 21 to produce the desired sequences of switch openings and closings.

At A—Fig. 2 the cam is shown in its extreme position of clockwise rotation in which position the heaters will be connected for baking operation. In this position of the control knob and cam the switches 1, 2 and 4 are closed, thereby providing for high voltage heating of the bottom heater and low voltage heating of the top heater.

When it is desired to change the control setting from that for baking to that for broiling, the control knob 25 and its associated cam 27 are rotated counterclockwise to the extreme counterclockwise position. In passing from the "bake" position (A—Fig. 2) to the "broil" position (D—Fig. 2), the cam will pass through the positions B and C of Fig. 2. In B of Fig. 2 the cam is shown just entering the "off" position and as it enters this position the cam projection 28 engages the follower 31 of the lever 14 before the projection 29 engages the follower 32 of the lever 17 with the result that the switch 1 is opened first, thereby absorbing most of the arc blast at this switch. As the cam is rotated further in the counterclockwise direction the switch 2 opens, completely extinguishing the arc due to the bottom heater. While switch 2 is moving to open position the projection 28 is acting upon the follower 31 of the lever 14 to move the switch 1 to still wider open position.

As the cam 27 is rotated still further clockwise to full "off" position (shown at C of Fig. 2), the switch 1 will be opened to its maximum width, switches 2 and 3 will both have opened due to the positioning of lever 19 by the cam projections 29, and the switch 4 will be opened due to the pressure applied to the free end of lever 21 by the abutment 36 carried by the lever 17. Opening of the switch 4 extinguishes the small arc due to the low voltage of the top heater 12.

In the "off" position of the cam 27 both of the lever followers 31 and 32 are positioned in slight recesses in the cam projection surfaces 28 and 29, respectively, to effect a slowing down or retardation of the cam movement from "bake" to "broil" positions. As the cam continues to move counterclockwise from the "off" position to the "broil" position shown at D in Fig. 2, the cam projection 28 moves out of engagement with the follower 31 of the lever 14, thereby permitting contact 1 to close. By the time the cam has reached "broil" position its projection 29 will have moved lever 17 to its maximum position in which the switch 3 is closed and the switch 4 opened even farther than in the "off" position shown at C in Fig. 2.

It will be obvious that, as the control is turned to change from "broil" position to a "bake" position, the sequence of switch opening and closing movements, described above, will be reversed.

By the novel arrangement herein described, with the "off" position of the control knob and its cam located between the series of "bake" positions and the "broil" position, together with the stop arrangement necessitating passing through "off" position to switch from "bake" to

"broil" or vice versa, there is provided a control system wherein flash-over or short circuiting is effectively prevented.

The usual thermocycling contacts may be provided at any suitable location in the circuit and in the arrangement herein illustrated as shown as positioned in the lines L¹ and L².

While the invention has been shown in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof.

What is claimed is:

1. In an electric circuit for an oven having a top heater and a bottom heater and a three-wire power source including two live wires and an intermediate wire providing high and low voltages: a first pair of contacts for connecting both of said heaters to one of the live wires; a second pair of contacts for connecting the bottom heater to the other live wire; a third pair of contacts for connecting the top heater to said other live wire; a fourth pair of contacts for connecting the top heater to the intermediate wire; a manually operable cam for controlling said pairs of contacts; said cam having a series of "bake" positions in which the first, second and fourth pairs of contacts are closed and the third pair is open, whereby high voltage is applied to the bottom heater and low voltage is applied to the top heater, a "broil" position in which the first and third pairs of contacts are closed and the second and fourth pairs are open, whereby high voltage is applied to the top heater, and an "off" position located between the "bake" positions and the "broil" position and wherein all of the pairs of contacts are opened; and stop means associated with said cam for so limiting its movement that to reach "broil" position from "bake" position, it must pass through the "off" position.

2. In an electric circuit for an oven having a top heater and a bottom heater and a three-wire power source including two live wires and an intermediate wire providing high and low voltages: a first pair of contacts for connecting both of said heaters to one of the live wires; a second pair of contacts for connecting the bottom heater to the other live wire; a third pair of contacts for connecting the top heater to said other live wire; a fourth pair of contacts for connecting the top heater to the intermediate wire; a manually operable cam for controlling said pairs of contacts; said cam having a series of "bake" positions in which the first, second and fourth pairs of contacts are closed and the third pair is open, whereby high voltage is applied to the bottom heater and low voltage is applied to the top heater, a "broil" position in which the first and third pairs of contacts are closed and the second and fourth pairs are open, whereby high voltage is applied to the top heater, and an "off" position located between the "bake" positions and the "broil" position, and wherein all of the pairs of contacts are opened; and stop means associated with said cam for so limiting its movement that to reach "broil" position from "bake" position it must pass through the "off" position, said cam being so designed and constructed that in moving from "bake" position to "broil" position via "off" position, the first pair of contacts is the first to open, thereby absorbing most of the arc blast, the second pair of contacts is next to open, completely extinguishing arc due to the bottom heater, the fourth pair of contacts is next to open, extinguishing the small arc due to the low voltage of the top heater, and the third pair of contacts is last to open.

3. In an electric circuit for an oven having a top heater and a bottom heater and a three-wire power source including two live wires and an intermediate wire providing high and low voltages; a first pair of contacts for connecting both of said heaters to one of the live wires; a second pair of contacts for connecting the bottom heater to the other live wire; a third pair of contacts for con-

necting the top heater to said other live wire; a fourth pair of contacts for connecting the top heater to the intermediate wire; a manually operable cam for controlling said pairs of contacts; said cam having a series of "bake" positions in which the first, second and fourth pairs of contacts are closed and the third pair is open, whereby high voltage is applied to the bottom heater and low voltage is applied to the top heater, a "broil" position in which the first and third pair of contacts are closed and the second and fourth pairs are open, whereby high voltage is applied to the top heater, and an "off" position located between the "bake" positions and the "broil" position and wherein all of the pairs of contacts are opened; and stop means associated with said cam and so limiting its movement that to shift from "bake" to "broil" it must pass through "off"; said cam being so constructed that in moving from "bake" into "off" the first pair of contacts opens first, thereby absorbing most of arc blast, the second pair of contacts opens next, completely extinguishing arc due to the bottom heater, the fourth pair of contacts opens next, extinguishing the arc due to the low voltage of the top heater, and the spacing of the contacts of said first pair is materially greater than the spacing of the contacts of the other pairs, in "off" position.

4. In an electric circuit for a heater having a three-wire power source including two live wires and an intermediate wire providing high and low voltages: a first pair of contacts for connecting the heater to one of the live wires, a second pair of contacts for connecting the heater to the other live wire, and a third pair of contacts for connecting the heater to the intermediate wire, a manually operable cam for controlling said pairs of contacts, said cam having a low voltage position in which the first and third pairs of contacts are closed and the second pair is open, a high voltage position in which the first and second pairs of contacts are closed and the third pair is open, and an "off" position located between the low voltage and the high voltage positions and wherein all of the pairs of contacts are open, and stop means for said cam for so limiting its movement that to reach the high voltage position from the low voltage position it must pass through the "off" position.

5. In an electric circuit for an oven having a top heater and a bottom heater and a three-wire power source including two live wires and an intermediate wire providing high and low voltages: a first pair of contacts for connecting both of said heaters to one of the live wires; a second pair of contacts for connecting the bottom heater to the other live wire; a third pair of contacts for connecting the top heater to said other live wire; a fourth pair of contacts for connecting the top heater to the intermediate wire; and a manually operable cam for controlling said pairs of contacts; said cam having a series of "bake" positions in which the first, second and fourth pairs of contacts are closed and the third pair is open, whereby high voltage is applied to the bottom heater and low voltage is applied to the top heater, a "broil" position in which the first and third pairs of contacts are closed and the second and fourth pairs are open, whereby high voltage is applied to the top heater, and at least one "off" position located between the "bake" positions and the "broil" position and wherein all of the pairs of contacts are opened, said cam being movable from a "bake" position to "broil" position, or vice versa, only by passing through an "off" position.

References Cited in the file of this patent

UNITED STATES PATENTS

2,303,460	Hodgkins	Dec. 1, 1940
2,483,831	Illian	Oct. 4, 1949
2,675,455	Richardson	Apr. 13, 1954
2,710,323	Andrews	June 7, 1955
2,747,073	Welch et al.	May 22, 1956
2,753,432	Long et al.	July 3, 1956