

United States Patent

Holtkamp

[15] 3,639,726

[45] Feb. 1, 1972

[54] SELF-CLEANING OVEN OVERHEAT SAFETY CONTROL

[72] Inventor: Calvin J. Holtkamp, Mansfield, Ohio

[73] Assignee: Westinghouse Electric Corporation, Pittsburgh, Pa.

[22] Filed: May 26, 1970

[21] Appl. No.: 40,485

[52] U.S. Cl.: 219/413, 219/393, 219/398, 219/494

[51] Int. Cl.: F27d 11/02

[58] Field of Search: 219/413, 410, 411, 412, 393, 219/398, 494

[56] References Cited

UNITED STATES PATENTS

3,270,183 8/1966 Jordan 219/398

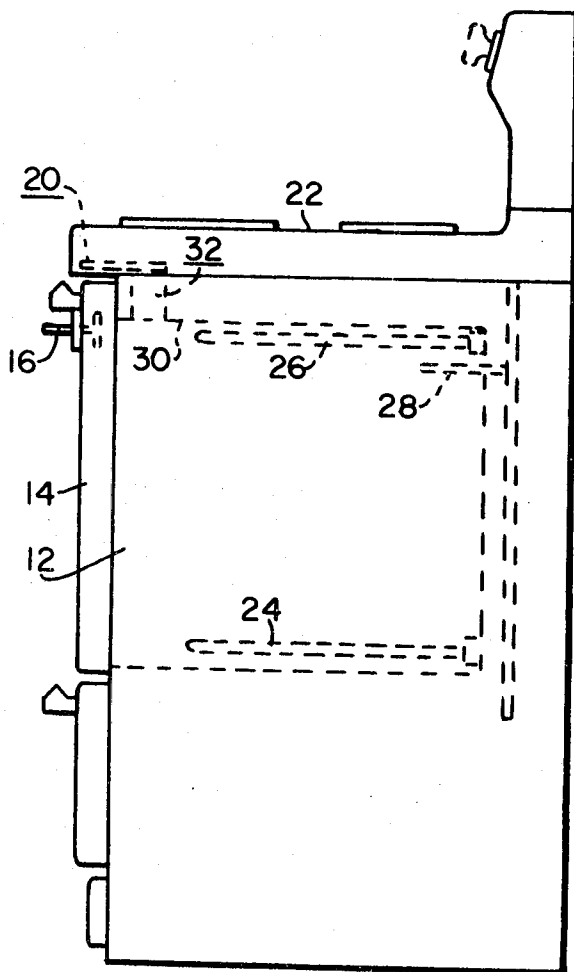
3,301,999 1/1967 Chisholm 219/393
3,122,626 2/1964 Welch 219/413
3,412,236 11/1968 Hild et al. 219/413

Primary Examiner—Volodymyr Y. Mayewsky
Attorney—F. H. Henson and E. C. Arenz

[57] ABSTRACT

An arrangement in which a switch responsive to oven temperatures is operable to cut off the heating in the oven when in a cooking operation the oven temperatures exceed the normal cooking temperatures from a failure such as a thermostat malfunction or failure, the safety switch being effectively recalibrated to an overheat limit for a self-cleaning temperature by operation of latching means for the oven door.

8 Claims, 9 Drawing Figures



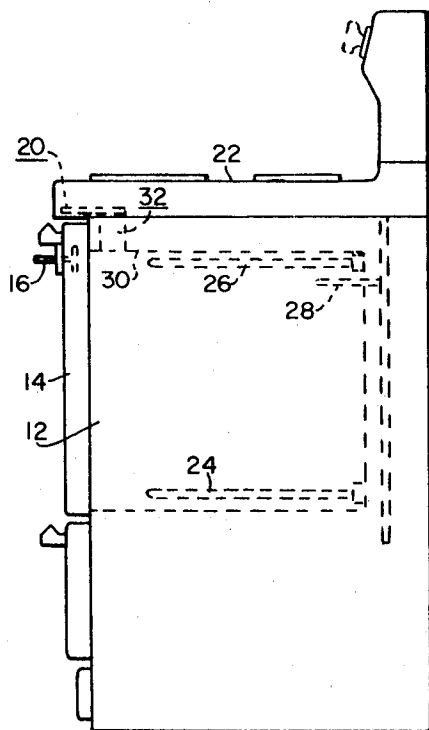


FIG. 1

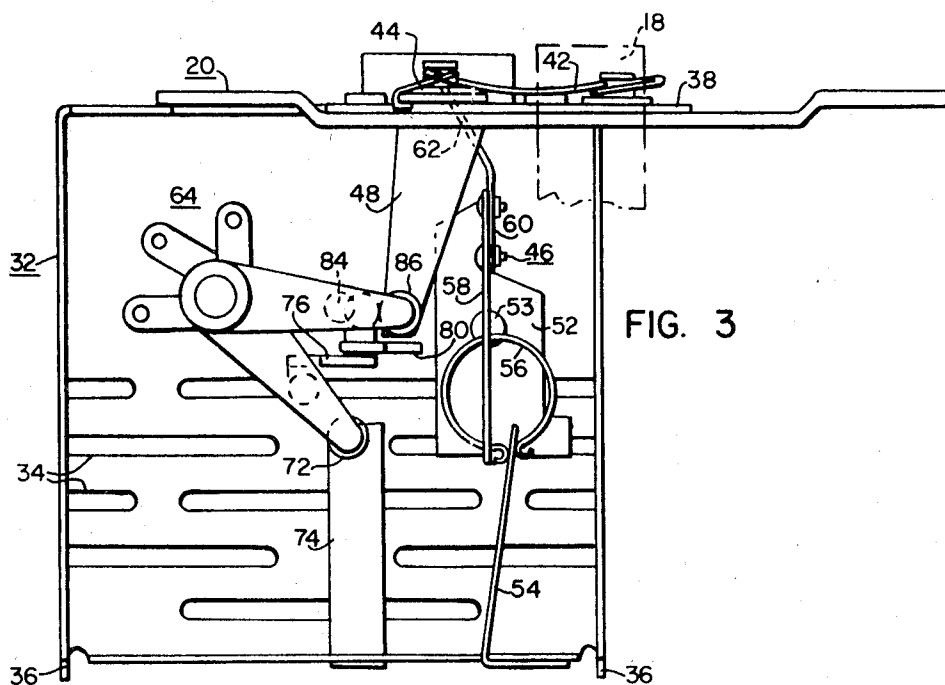


FIG. 3

WITNESSES

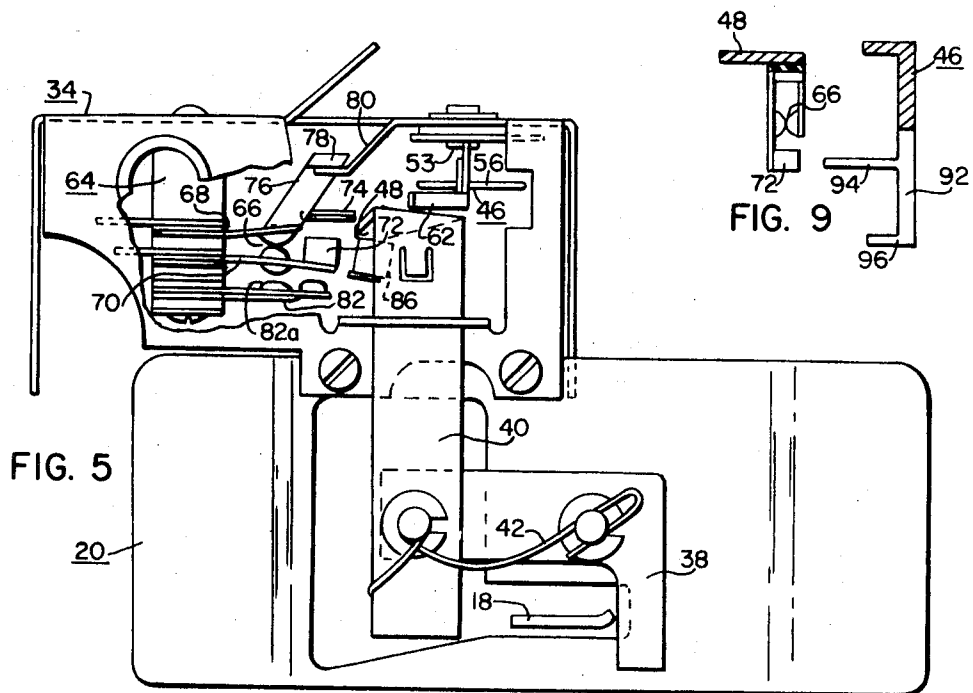
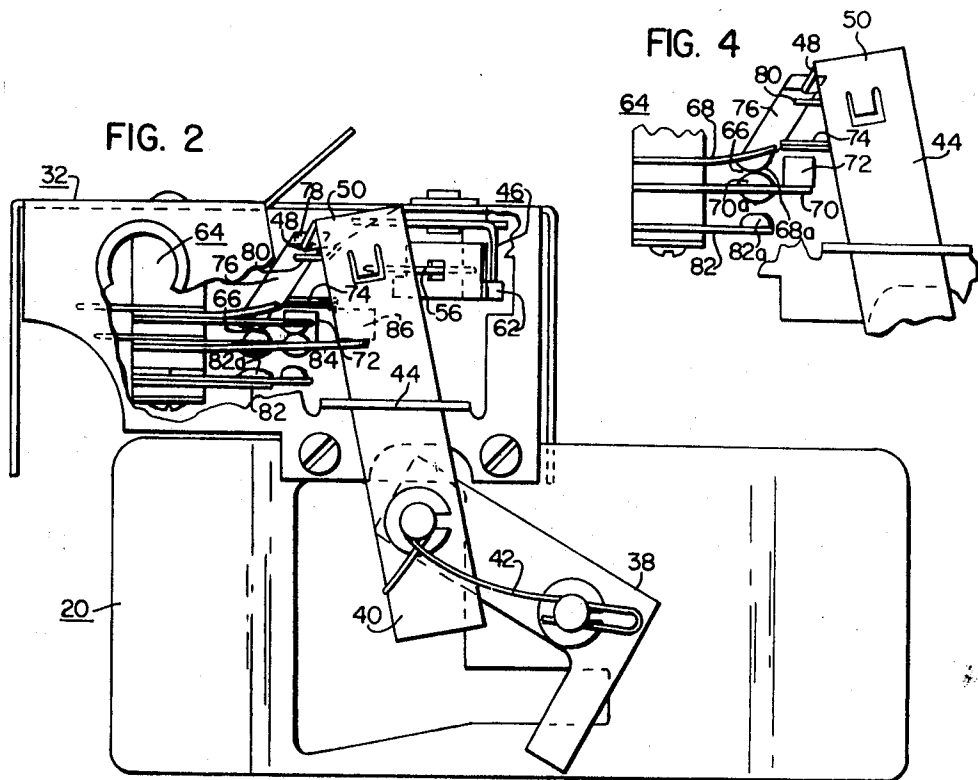
Alfred D. Colaizzi
James F. Young

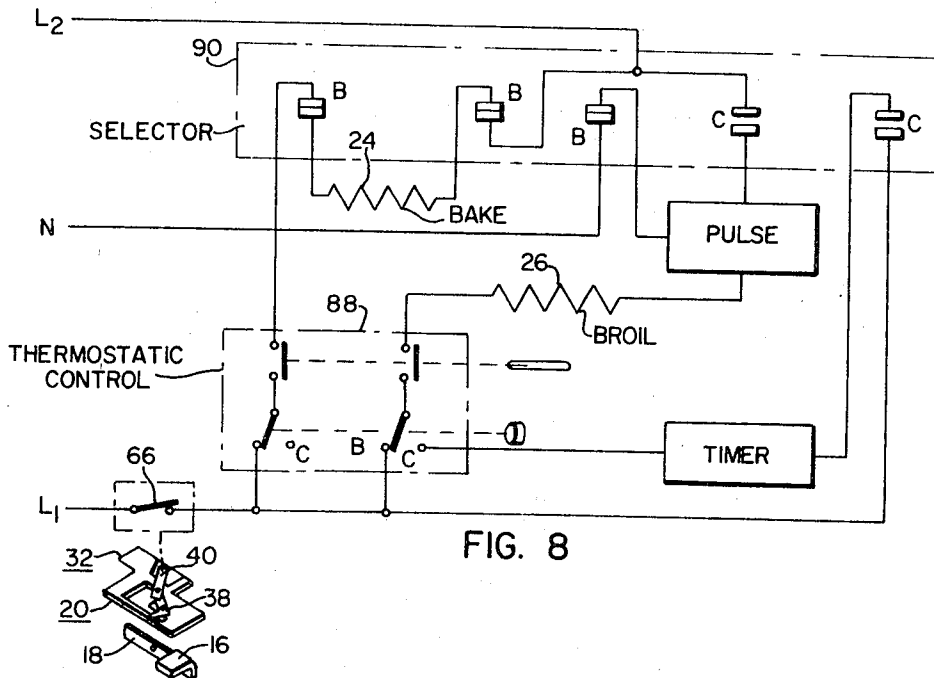
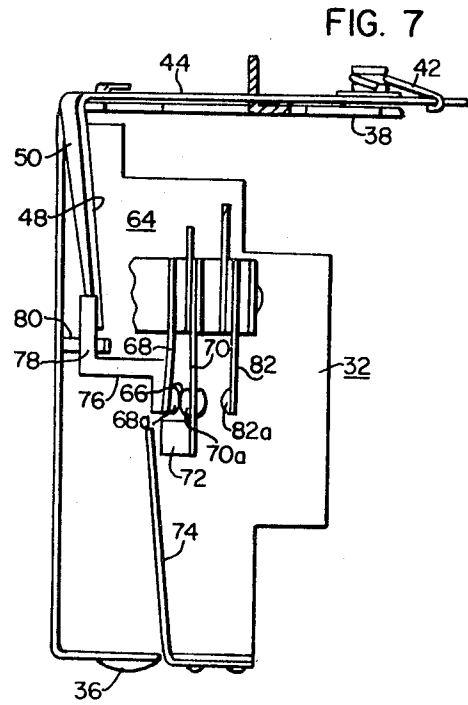
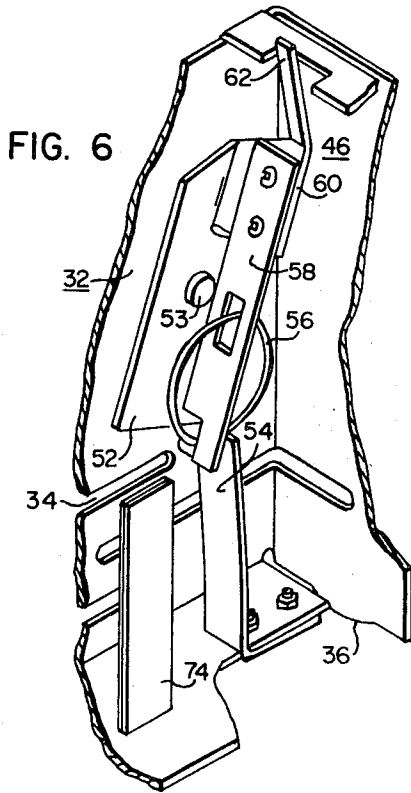
INVENTOR

Calvin J. Holtkamp

Edward C. Arny

ATTORNEY





SELF-CLEANING OVEN OVERHEAT SAFETY CONTROL

CROSS-REFERENCE TO RELATED APPLICATION

Phifer U.S. Pat. application Ser. No. 40,495, filed May 26, 1970, is related to this application.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to the art of controlling the operation of self-cleaning ovens, and in particular to the art of preventing a runaway oven temperature.

2. Description of the Prior Art

U.S. Pat. No. 3,484,858 is the closest prior art of which I am aware, in the sense that it provides means for preventing a runaway bake cycle. In that patent the invention is stated as comprising a fixed point, temperature limiting, thermal switch which during the cooking mode is connected in series with the oven heating means so as to deenergize the oven heating means if the oven temperature rises above a preset critical temperature of the thermal switch. As further stated, this thermal switch during a heat-cleaning mode is rearranged into a circuit for the electroresponsive means for opening the circuit whenever the oven temperature reaches a preset critical temperature of about 600° F. so as to prevent entrance into the oven cavity whenever the oven temperature is above about 600° F. While the arrangement according to the patent provides a result similar to my invention in the sense that an overheat condition during a cooking operation is controlled, there are other significant differences in result and in the manner of accomplishing the result according to my invention. As further background with respect to the problem that my invention is directed to, the following is noted.

Both standard cooking ovens, and self-cleaning cooking ovens use temperature control arrangements which occasionally (though fortunately infrequently) fail in a way which permits the oven to continue heating with no control over the temperature reached in the oven. Such a failure in a self-cleaning oven can result in very high temperatures being reached (e.g., high as 1,300° F.), because of the superior insulation used in self-cleaning ovens. Since such a failure can occur in a self-cleaning oven while it is set for a cooking operation and the oven door is in an unlatched and unlocked condition, a potentially dangerous condition can exist.

Accordingly, my invention is concerned with a control arrangement including a safety switch which limits the temperatures which can be reached in the oven, when the oven is set for a cooking operation, to not exceed that temperature at which Underwriters Laboratories requires the oven door to be locked, currently 600° F., and which also provides, if desired, a limiting temperature to which the oven can rise during a self-cleaning operation if the clean thermostat should fail to limit the temperature.

SUMMARY OF THE INVENTION

In accordance with my invention, an oven is provided having a control circuit with a safety switch therein having a first normal position permitting heating in the oven, and a second position interrupting heating in the oven, with means for operating the switch from the first to the second position in response to oven temperature exceeding the normal oven cooking temperatures by a predetermined degree when the door latching means is in an unlatched condition, and means for recalibrating the switch, by operation of the latch means to a latched condition, to remain in said first position with oven temperatures in a heat-cleaning range.

In the currently preferred embodiment the safety switch is arranged in series with the heating elements used during either a cooking operation or a cleaning operation and is disposed for operation, if such operation occurs, by bimetal means, or other differentially expandable material means, responsive to oven temperatures. During a cooking operation with the latch means in an unlatched position the switch occupies one physical location relative to the bimetal means. By operating the

latching means to a latched position, the switch is physically displaced to another position relative to the bimetal means.

DRAWING DESCRIPTION

FIG. 1 is a side elevational view of a range having a heat-cleaning oven incorporating the invention;

FIG. 2 is a partly broken top view of a lockbox and strike plate assembly with the draw bar in a rear, unlatched position;

FIG. 3 is a front elevational view of the assembly of FIG. 2 with the draw bar in a forward, latched position, and the locking means in a position obstructing the return of the draw bar;

FIG. 4 is a fragmentary top view corresponding to FIG. 2, with some parts omitted for clarity;

FIG. 5 is a top view similar to FIG. 2, but with the draw bar in the forward latching position, and again with some parts omitted for purposes of clarity;

FIG. 6 is an isometric view of the one form of locking means shown in FIGS. 2 and 3;

FIG. 7 is a fragmentary side view emphasizing the arrangement of the safety switch and cooperating parts;

FIG. 8 is a simplified schematic diagram of one circuit which may be used to carry out my invention; and

FIG. 9 is a diagrammatic view in the nature of a horizontal section illustrating another form which my invention may take.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, the range 10 includes an interior oven cavity 12 adapted to be closed by the swing-down door 14 which may be manually latched by turning handle 16 in a clockwise direction. By so turning the handle, a bolt 18 (not shown in FIG. 1) is turned up out of the top edge of the door to engage with a strike plate 20 located above the top edge of the door in the front nose portion of the surface unit platform 22. One mechanism suitable for carrying out this type of latching operation is described in Nagel U.S. Pat. No. 3,390,909, to which reference should be had for further detail.

The oven cavity 12 contains the usual bake-heating element 24, and broil element 26 which preferably is used for providing the heat for the self-cleaning operation in accordance with Kastovich U.S. Pat. application Ser. No. 552,663 now U.S. Pat. No. 3,504,161. The oven also contains temperature sensing means 28 which, through conventional thermostatic means, normally controls energization of whichever heating elements are used for carrying out cooking operations and heat-cleaning operations. The exact form which these heaters and the thermostatic control takes is not of significance in connection with the invention.

The top wall of the oven liner defining the oven cavity 12 is indicated by the numeral 30. A lockbox 32 has its lower portion seated upon the outer face of the wall 30 in limited heat-conducting relation and contains the safety switch means used in accordance with the invention.

Referring to FIGS. 2 and 3 in particular, the lockbox 32 takes the general form of an open front box provided with a number of horizontal slots 34 in the rear and sidewalls. Downwardly projecting tabs 36 at the lower ends of the sidewalls set on the top wall 30 of the oven liner to provide single-point contact at each side. The horizontal slots provide heat breaks which limit the rate of heat transfer through the box side and rear walls. The lockbox 32 is attached directly to the strike plate 20 which, in turn, is secured to the frame of the range in the nose of the platform 22. The single point contact by the tabs 36 to the oven liner is for the purpose of providing uniform and predictable heat transfer rates into the lockbox structure from the liner of one range as compared to the next range.

The latch and lock arrangement includes an L-shaped lever 38 pivotally carried on the strike plate and having one leg pivotally attached at its end to draw bar 40. The draw bar is biased to the rear, and the L-shaped lever in a clockwise

direction as shown in FIG. 2 by a torsion spring 42 which, because of the hook portion engaging the one edge of the draw bar 40, also tends to rotate the draw bar in a counterclockwise direction or to the left at its rear end. A slot 44 (FIG. 3) in a bentup tab portion of the lockbox cooperates with the pivotal connection between the draw bar and the L-lever to impose a translational motion to the draw bar as it is being moved forwardly so that in its forward position (FIG. 5) it is substantially perpendicular to the front edge of the strike plate 20.

When the oven door is to be latched, the latch handle 16 on the oven door is swung downwardly to move the bolt 18 up into the strike plate slot into engagement with the one leg of the L-lever 38 which pivots counterclockwise and accordingly draws the draw bar 40 forwardly to a position shown in FIG. 5. While the torsion spring 42 tends to urge the draw bar 40 rearwardly, the weight and spring of the latch handle prevents this from occurring. However, so long as the draw bar is not obstructed in movement in a rearward direction by the locking means generally designated 46, turning of the latch handle back toward an unlatched position releases the one leg of the L-lever which had been engaged by the bolt and permits the torsion spring 42 to move the draw bar rearwardly to its FIGS. 2 and 4 position. It is noted that the arrangement of the forward end of the draw bar and the L-lever accords in most respects with that of the noted Nagel patent.

The draw bar 40 has a depending portion 48 (FIGS. 2, 4 and 5) at its rear end which is used to control switch means in the forward path of movement of the depending portion. As contributed by another (Phifer), and as set forth in his noted patent application, the angle between the depending portion 48 and the main portion 40 of the draw bar is about 80°, and the bend line 50 between these portions forms a slight acute angle, such as 4°, relative to a line perpendicular to the longitudinal axis of the main portion 40 of the draw bar. The purpose of this arrangement is to insure that the engagement of the portion of the locking means 46 which contacts the draw bar engages the bend line 50 only, and that the movement of the locking means from a locked position to an unlocked position is facilitated if the user should have attempted to prematurely unlatch the still-locked oven door and then have left the door handle in that position at which lock interference was encountered, and the locking means is in the process of moving toward an unlocked position.

One form of locking means which may be conveniently used in carrying out the invention, and which has been contributed to in part by Phifer is perhaps best understood from FIGS. 3 and 6. The locking means includes a pivotal base member 52 pivotally carried by a stud 53 on the vertical rear wall of the lockbox, a main bimetal 54 which has its lower end fixed to the lower wall of the lockbox and its upper end coupled through a circular spring wire 56 (which serves in part as stress relief means), to the lower end of lag compensating bimetal 58. This compensating bimetal has its lower end coupled to one end of the spring wire circle, and its upper end fastened to a right-angle tab portion 60 at the base member. The right-angle tab portion has an upward extension 62 which is the part adapted to move into obstructing relationship with the rear end of the draw bar 40. Details of the manner in which the locking means operates to effect locking and unlocking of the door by moving into and out of obstructing relationship with the rear end of the draw bar at a desired temperature is explained in the noted Phifer patent application. For present purposes it will suffice to note that as the oven reaches a temperature at which it is required to have the door locked, the main bimetal 54 deflects to the right at its upper end and thereby pivots the base member 52 in a counterclockwise direction through its coupling with the lag compensator bimetal 58 and, accordingly, the locking extension 62 will be moved into the position shown in FIG. 5. With descending oven temperatures after the cleaning cycle has been completed, the base member 52 will pivot clockwise in accordance with the deflection to the left of the upper end of

the main bimetal 54 and thus move the lock extension 62 out of an obstructing position at the rear end of the draw bar.

The safety switch arrangement according to the invention will perhaps best be understood in connection with FIGS. 3-5 and FIG. 7. A stacked switch assembly generally designated 64 is mounted on the vertical rear wall of the lockbox 32 and carries a series of flexible conducting leaves having switch contacts at one end and being in electrical contact with terminal lugs at the opposite end. The safety switch 66 is comprised of leaves 68 and 70 (seen as the diagonally directed ones in FIG. 3) carrying opposed contacts, normally closed, 68a and 70a, respectively (FIGS. 4 and 7). Leaf 70 also carries an insulator 72 at its outboard end disposed to be engaged by the upper end of bimetal 74 which has its lower end rigidly secured to the bottom wall of the lockbox. An insulator member 76 which, as viewed in elevation as in FIG. 7, is of reverse Z-shape, has its downwardly extending portion attached to the rear surface of the switch leaf 68 and its upwardly projecting portion 78 disposed to be engaged by the lower end of the depending portion 48 of the draw bar when the draw bar is moved rearwardly to a position as shown in FIGS. 4 and 7. It is noted that the insulator 76 is not supported except from the switch leaf 68. The leaves 68 and 70 of the safety switch 66 are spaced apart less in their secured portions than they are at the ends carrying their respective contacts by virtue of a contact depth which exceeds the spacing. Thus, the contacts are biased toward each other and the switch 66 is accordingly normally closed regardless of whether the draw bar is in its rear position engaging the insulator 76 and pulling the rear leaf 68 rearwardly (as shown in FIGS. 4 and 7), or whether the draw bar is in the position shown in FIG. 5 in which the insulator 76 controlling the position of the rear leaf 68 has been released from the draw bar permitting the leaf 68 to assume a more forward position. A stop 80, which may take the form of a tab bent out of the rear wall of the lockbox 32, is located for engagement by the insulator 76 as it is pulled forwardly by the leaf spring 68. The stop 80 is adjustable and is positioned to cause the normally closed contacts of the switch 66 to be opened when the temperature during the heat-cleaning cycle in the oven exceeds what is considered to be a safe temperature, this occurring because the bimetal 74, reflecting oven temperature, deflects forwardly sufficiently at its upper end as to engage the insulator 72 at the end of leaf 70 and force the contact 70a away from the contact 68a.

During normal cooking operations the draw bar 40 is in its rearward position as shown in FIG. 4 and the leaf spring 68 is pulled rearwardly slightly by engagement of the draw bar depending extension 48 with the insulator 76. With a cold oven then, and as may be seen in FIG. 4 relative to FIG. 5, the upper end of the bimetal 74 is closer to engaging the insulator 72 carried by the leaf 70 than where the draw bar is forward to correspond to a latched door. Thus, if during a cooking operation an established excessive temperature of, say, 600° or 650° F., exists in the oven without the door being latched, the bimetal 74 pushes the insulator 72 sufficiently to open the contacts 68A and 70A. This interrupts the heating since the safety switch is in the power circuit to the heaters, as will be seen in connection with the circuit of FIG. 8.

However, if the door is latched and the oven is undergoing a heat-cleaning operation, the forward movement of the draw bar caused the switch 66 to be recalibrated, in effect, through being moved forwardly so that greater movement of the bimetal 74 is required before it engages the insulator 72. It is currently considered desirable that the spatial relationships between these parts be such that when an excessively high temperature is reached during a heat-cleaning operation, such as, say, 1,100-1,200° F., that the switch 66 be opened. At the same time it will be appreciated that the safety switch operation with respect to a cooking operation may be provided without necessarily providing the overheat safety for a heat-cleaning operation.

The switch contact 82a on leaf 82 (FIGS. 4 and 7) may be used for signalling purposes, as for example to indicate that an

overheat condition of the oven exists or, alternatively, for example, to control an indicator light related to the locked condition of the door.

The stack switch assembly 64 may also conveniently be used to carry a pair of switch contacts forming switch 84 (FIG. 2) at a physical level that the downward extension 48 of the draw bar will engage an insulator 86 carried by one of the leaves, this switch when being closed indicating that the door is latched at the start of the clean operation.

Referring to FIG. 8, a simplified schematic is provided illustrating how the arrangement according to the invention may be incorporated in a circuit for a heat-cleaning oven. The safety switch 66 is shown in the one side of the power line and a dash line leading to the latching means indicates only that the switch has its physical disposition or location established by the latching means, and is not intended to indicate that the latching means actually operates the switch 66 from a closed to an open position, this of course being effected by the bimetal 74 responsive to oven temperatures. However it will be noted that the switch 66 is in the line which feeds both the bake heater 24 and broil heater 26 through the thermostatic control 88, and that opening of the safety switch 66 interrupts the line L, and hence that circuit for energization of whichever heater is on. The oven selector switch 90 is of conventional nature and is operated to set up the type of oven operation such as baking, broiling or cleaning, which is to be carried out in the oven. Only those switch contacts relating to a bake or a clean operation are shown, with both the oven selector and the thermostatic control having switch elements shown in the bake position. The C contacts in each case are closed when a cleaning operation is to be carried out, in which case the B contacts will be opened. No further explanation of the circuit is considered to be necessary since it is believed to be self-explanatory to those versed in the art.

While the invention has been described in terms of the currently preferred embodiment, it is to be appreciated that the invention may be carried out with structure significantly different in detail. For example, FIG. 9 is a generally schematic illustration of a way in which the movement of the locking means may be utilized to also accomplish the function of the bimetal 74, which in the previously described embodiment operated the safety switch 66. In FIG. 9 the depending extension 48 of the draw bar is shown as carrying the safety switch 66 in insulated fashion from its front face. The locking means 46 is provided with a forwardly extending part 92 which has a first pusher member 94 and a second pusher member 96 spaced forwardly from the member 94 with both pushers at the level of the insulator 72. When the draw bar 48 is in its rearward or unlatched position, heating of the oven above the normal cooking temperatures will move the locking means 46 to the left at its upper end so that the pusher member 94 can engage with the insulator 72 to open the safety switch 66 at a predetermined excessive temperature with respect to a cooking operation. However, when the draw bar has been moved forwardly by latching of the oven door, the insulator 72 is then aligned with the shortened pusher 96 requiring a further movement to the left of the upper end of the locking means to effect engagement of the pusher 96 with the insulator 72. The length of the pusher 96 is established of course so that it will engage with the insulator 72 and open the safety switch at the predetermined excessive temperature for purposes of heat cleaning. It is to be appreciated that the illustration in FIG. 9 is principally schematic to illustrate an alternative embodiment of the invention. It is also noted that from a practical standpoint a number of difficulties which could arise in connection with a FIG. 9 type of arrangement can be avoided, and better control obtained, by using the preferred embodiment as described in connection with FIGS. 1 through 8.

It will also be appreciated that the invention is not limited to use with a lockbox which is located at the front of the oven as has been described, but rather that is equally applicable to a lockbox position near the rear of the oven as noted in the Nagel patent, so long as a bimetal reflecting oven temperature such as 74 is included.

An arrangement according to the invention provides safety means against an overheated oven condition for both a cooking and a cleaning operation although if desired it may be used for only one or the other of the operations. The arrangement does not require a solenoid or other electroresponsive means in the latching and locking arrangement, and the thermally responsive door locking means is of a relatively inexpensive nature. The system is adaptable for use with any type of oven thermostat. Finally, the door latch need not be in a latched position to energize heaters at the start of a cleaning cycle.

I claim:

1. A cooking oven of the pyrolytic self-cleaning type for carrying out both cooking operations and cleaning operations, including:

an oven cavity;
heating means for said oven cavity;
a door for said cavity;
latching and locking means for said door for effecting locking of said door during oven operations at temperatures exceeding the cooking temperature range;
a circuit for controlling said heating in both a cooking operation and in a cleaning operation;
thermostatically controlled switch means in said circuit responsive to oven temperatures for normally controlling said heating means in both said cooking and cleaning operations;
safety switch means in said circuit having a first normal position permitting heating in said oven, and a second position interrupting heating in said oven, said safety switch means being separate from, and operable independently of, said thermostatically controlled switch means;
means for operating said safety switch means from said first to said second position in response to oven temperatures exceeding normal oven cooking temperature by a predetermined degree, when said latching means is in an unlatched condition; and
means for recalibrating said safety switch means, by operation of said latching means to a latched condition, to remain in said first position with oven temperatures in a heat cleaning range.

2. An oven according to claim 1 wherein:

said heating means for said cavity comprises electrical heating elements;
said safety switch means is series connected to said heating means;
said first normal position is a closed condition of said safety switch means, and said second position is an open condition of said safety switch means.

3. An oven according to claim 1 wherein:

said means for recalibrating said safety switch means comprises means for physically displacing said safety switch means in accordance with operation of said latch means to a latched condition.

4. An oven according to claim 1 wherein:

said latching means includes a draw bar movable in accordance with operation of said latching means;
said locking means including first differentially expansible material means movable in response to changes in oven temperature, said locking means being moved to a position obstructing movement of said draw bar in response to oven temperature exceeding normal cooking temperature by a predetermined degree; and
independent differentially expansible material means for effecting the operation of said safety switch means.

5. An oven according to claim 1 wherein:

said first and said independent differentially expansible material means comprise bimetallic means.

6. An oven according to claim 1 wherein:

said means for recalibrating said safety switch means through operation of said latched means to a latch condition recalibrates said safety switch means to remain in said first position with oven temperatures in a heat-cleaning range and to be operated to a second position in response to oven temperatures exceeding the upper limit

of the heat-cleaning temperatures by a predetermined degree.

7. A cooking oven of the pyrolytic self-cleaning type for carrying out both cooking operations and cleaning operations, including:

an oven cavity;

heating means for said oven cavity;

a door for said cavity;

latching means for latching said door;

locking means for locking said door during oven operations at temperatures exceeding the cooking temperature range;

a circuit for controlling said heating means in both a cooking operation and a cleaning operation;

thermostatically controlled switch means in said circuit responsive to oven temperatures for normally controlling said heating means in both said cooking and cleaning operations;

normally closed safety switch means in said circuit, said safety switch means being separate from, and operable independently of, said thermostatically controlled switch means;

switch-operating means responsive to oven temperatures for opening said safety switch means, said safety switch

means and said switch-operating means having a first condition, corresponding to said latching means being in an unlatched condition, in which said safety switch means is opened in response to an oven temperature approximating that oven temperature at which a door-locked condition is required; and

means for changing the condition of said safety switch means relative to said switch-operating means, in accordance with operation of said latching means to a latched position, to maintain said safety switch means in a closed position with oven cavity temperatures exceeding those oven temperatures at which a door-locked condition is required.

8. An oven according to claim 7 wherein:

said means for changing the condition of said safety switch means relative to said switch-operating means, in accordance with operation of said latching means to a latched condition, is effective to condition said safety switch means and said switch-operating means for operation of said safety switch means to an open position with oven cavity temperatures exceeding a predetermined established upper limit of the heat-cleaning temperature range.

* * * * *

30

35

40

45

50

55

60

65

70

75