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[54] **SELF-CLEANING OVEN WITH DOOR LOCK LIGHT**
8 Claims, 2 Drawing Figs.

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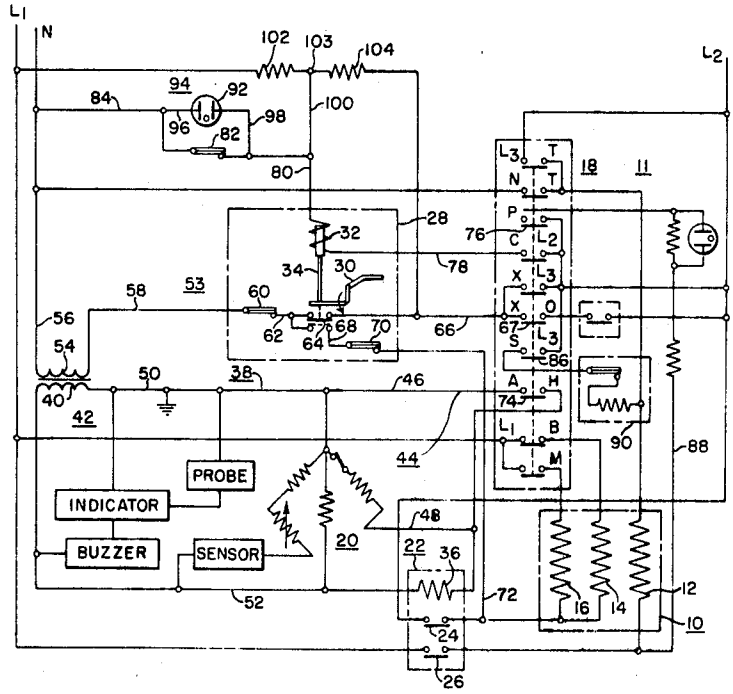
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ABSTRACT: A heat-cleaning oven circuit is disclosed having a door lock thermostat which opens above a predetermined minimum temperature such as 550° to ensure that the latching assembly for the oven cannot be unlocked until the temperature within the oven has again dropped below 600°. A door lock indicating light is provided connected directly across the normally closed contacts of the door lock thermostat so the door lock thermostat shorts out the door lock indicating light at all temperatures below door-locking temperatures, while the door lock light provides a positive indication when the locking assembly is in an unlockable condition and the contacts of the door lock thermostat are open. Nuisance lighting during operation other than heat cleaning is prevented by a circuit arrangement which connects opposite sides of the light to neutral.



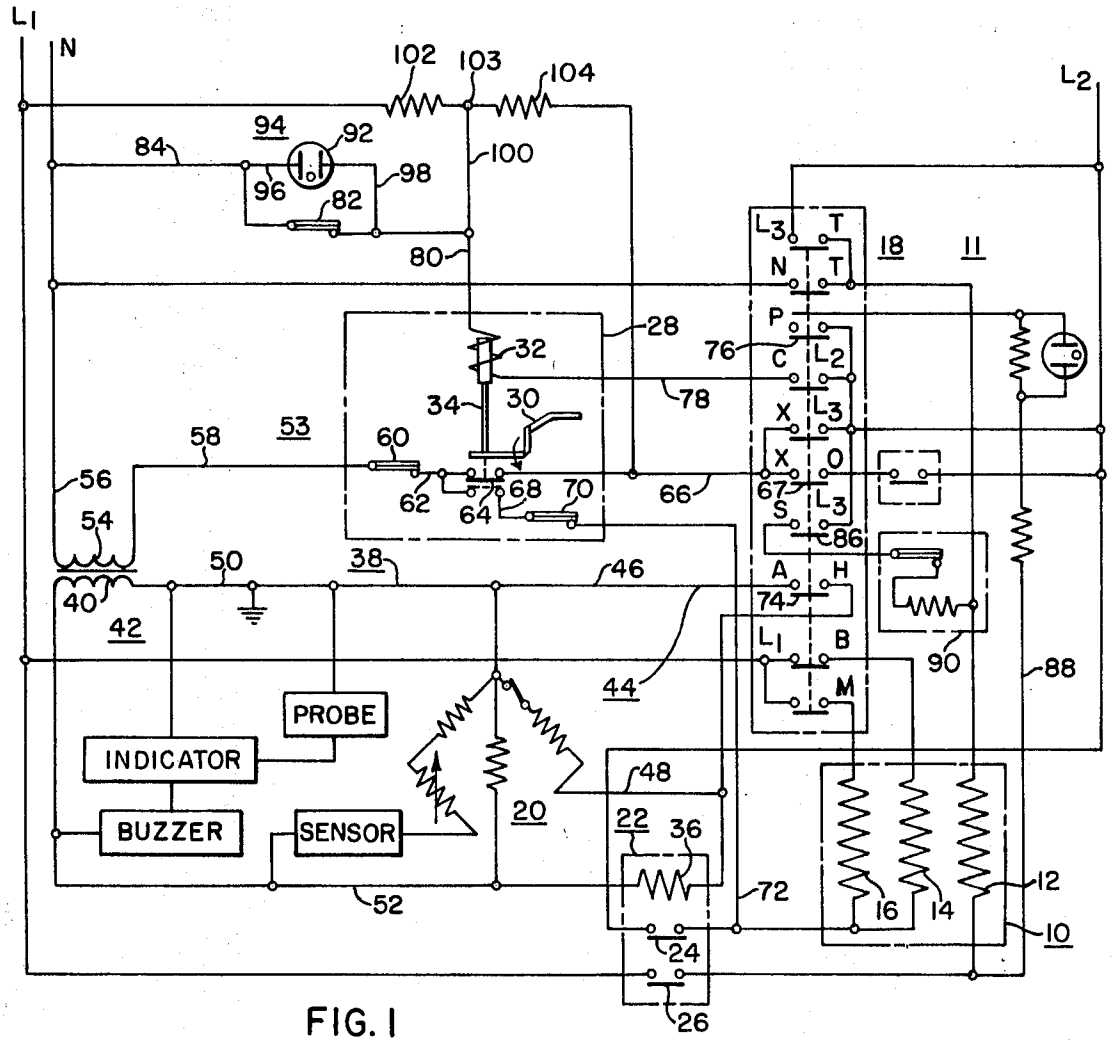


FIG. 1

	P L_2	L_2 C	L_3 T	T N	L_3 S	L_3 X	X O	A H	B L_1	L_1 M
OFF										
BAKE	X			X		X			X	
T. BAKE	X						X		X	
LATCH		X				X		X		
CLEAN	X				X			X		
BROIL	X		X			X				
S. BROIL	X		X			X				X

FIG. 2

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SELF-CLEANING OVEN WITH DOOR LOCK LIGHT

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to oven systems and, more particularly, relates to a heat-cleaning oven circuit which includes a positive door indicating light.

2. Description of the Prior Art

The use of a door lock indicating light is not new in the oven circuit art, with the same being shown, for example, in U.S. Pat. No. 3,116,398 issued Dec. 31, 1963. However, the use of such an indicating light in an oven circuit that controls the cleaning operation through a single temperature peak has heretofore generally required the use of a substantially high-priced arrangement to provide a functioning door lock indicating light. Various switching arrangements have been devised in the past in a single peak circuit to provide a door lock indicating light but in each case the cost of the lock indicating light features outweighed the somewhat minor (by comparison) advantages over a single peak circuit without such a feature.

Accordingly, while the invention is useful in systems other than a single peak control system, it will be described mainly in connection therewith.

SUMMARY OF THE INVENTION

In accordance with the principles of the invention, a heat-cleaning oven system is provided that includes an oven door latching arrangement, a thermostatic switch for preventing operation of the latching means in an unlatching direction in response to oven temperatures above normal oven cooking temperatures.

To this generally conventional arrangement, as shown, for example, in U.S. Pat. application Ser. No. 773,539, filed on Nov. 5, 1968 and now U.S. Pat. No. 3,549,862, and owned by a common assignee, a door lock light is placed in parallel with the thermostatic switch and a circuit means is added connecting the light between neutral and an artificial neutral when the oven is set for certain cooking operations which might effect opening of the switch and which removes the artificial neutral when the oven is set for heat cleaning so that the light can be energized during the appropriate time. This is preferably accomplished by connecting one side of the door lock light to the neutral side of the power supply for the oven circuit while the other side of the door lock light is connected to the center point of two voltage-dividing resistors which are connected in series between the L_1 side of the power supply and a terminal of the selector switch that places the oven circuitry in its various modes of operation. During the baking and broiling operations, this terminal of the selector switch means is connected to the L_2 side of the power supply which places the full 236 volts across the two resistors, thus making the center point to which one side of the door lock indicating light is connected an artificial neutral. With this arrangement for the door lock light, even if the oven cavity becomes hot enough to open the door lock thermostat, the door lock indicating light cannot be energized because both sides of it are connected to neutral potential.

During the cleaning operation, the selector switch contact is opened to the L_2 supply side of the electrical potential so that the artificial neutral is removed. A circuit is thereby completed through one of the resistors and the door lock indicating light (with the door lock thermostat open) to the neutral side of the power supply thereby energizing the light so that it indicates that the oven is in the clean mode at a temperature which prevents operation of the door latch from its locked condition.

DRAWING DESCRIPTION

For a better understanding of the invention, reference may be had to the preferred embodiment, exemplary of the invention, shown in the accompany drawings in which:

FIG. 1 is a partly diagrammatic and schematic view of the electric circuit arrangement according to the invention; and

FIG. 2 is a table which identifies those contacts of the selector switch means that are closed for particular settings of the selector switch means.

PREFERRED EMBODIMENT OF THE INVENTION

In FIG. 1 the oven cavity for an oven circuit means 11 is generally indicated by the dash-dot line rectangle 10. Only those parts which are physically located in the cavity which are necessary for the heating will now be described as included therein. The oven means includes a broil heater 12, a bake heater 14 and an auxiliary broil heater 16 which is used in conjunction with the regular broil heater 12 to obtain simultaneous broiling of the opposite faces of a food article. The oven broil heater 12 is also utilized as the heating element for the oven circuitry during the clean mode of operation.

An oven selector switch means 18, schematically indicated by a dash-rectangle, includes a plurality of fixed and movable contacts by which connections are made to energize various circuits of the oven circuit 11. A series of 14 external terminals are provided for the selector switch means 18, with these external terminals indicated by letter reference in FIG. 1 which correspond to the letter references given across the top of the table of FIG. 2. The "X" designation in any of the columns of the Table of FIG. 2 indicates that those contacts in that column are in electrical current-carrying capacity for that particular mode of operation of the oven.

A temperature controller 20 of a general bridge character is provided for the oven circuit 11, with this temperature controller including an auxiliary relay 22 in one of its legs which actuates relay switch means 24 and 26. Upon a sufficient difference in potential across the temperature sensor 20 and thereby a flow of current in auxiliary relay 22 there is a consequent generation of heat in it to move the aforementioned relay switch means 24 and 26 to closed position. Temperature controller 20, as will be explained later, controls the temperature within the oven for all heating modes of oven save for the cleaning mode.

A latching arrangement 28 to ensure that latching of the oven door (not shown) occurs prior to the heat-cleaning cycle being initiated is shown fragmentarily. The mechanism by which latching occurs and places the oven circuit 11 in a condition for locking is of the same general character as the latching arrangement disclosed in U.S. Pat. No. 3,387,874 issued on June 11, 1968, and owned by a common assignee. Reference may now be had to teat patent for a fuller understanding of the operation of the locking and latch assembly of the oven utilizing the oven circuit 11. Essentially, the latch assembly includes (schematically shown) a pivoted latching element 30 which is pivotally movable during actuation of the latch assembly to locked condition in the direction indicated by the arrow and a solenoid 32 that actuates a locking pin 34 in an upward direction away from the pivoting latch element 30. Upon placing the selector switch means 18 in the latch mode, the solenoid 32 is energized drawing the locking pin 34 upwardly. Mechanical manipulation of the latching arrangement then moves the pivoted latch element 30 in the direction of the arrow. Movement of the selector switch means 18 to the clean mode, at this time, causes the solenoid 32 to be disengaged and the locking pin 34 to drop downwardly behind the pivoting latch element 30 preventing its swinging return which is required for unlatching so that the oven door (not shown) is effectively locked in the heat-cleaning mode.

For a fuller understanding of the operation of some of the other elements of the oven circuit 11 reference should be made to the following U.S. Pat. applications: Kastovich, application Ser. No. 552,663 and now U.S. Pat. No. 3,504,161, relating to the manner in which heat is applied to the oven for a high-temperature quick-cleaning cycle and Holtkamp, U.S. Pat. No. 3,440,402, relating to the pulsing of the oven heating means and both owned by a common assignee.

The source of electrical power for the oven control system 11 is a conventional source, comprising a tree-line system in which a nominal 240 volt alternating current potential exists

between power connections denoted L_1 and L_2 and with 120 volts alternating current potential existing between either hot lines and a neutral designated N.

The temperature controller **20**, described above, may be of the general type described in U.S. Pat. 2,962,575 issued Nov. 29, 1960 and owned by a common assignee, with it operating during cooking to energize and deenergize the auxiliary relay **22** in accordance with whether the sensed temperature in the oven is above or below the temperature to which the temperature controller has been set. The relay switch means **24** and **26**, of course, close whenever the hot wire actuating means **36** of the relay **22** is energized. After deenergization, the hot wire **36** gradually cools and after a slight moment in time the relay switch means **24** and **26** open. This delay provides time for a holding circuit to be established when the relay switch means **24** and **26** are closed.

The temperature controller **20** is connected in a temperature controller circuit **38** which includes a secondary **40** of a transformer **42**. A temperature controller bypass circuit **44** is also provided which includes a pair of leads **46** and **48** leading to the terminals A and H of the selector switch means **18**. This bypass circuit means is inoperative in the cooking mode for the oven circuit **11** since the terminals A and H are not in a current-carrying condition. During cooking operation, the temperature controller **20** is energized by the aforementioned temperature controller circuit **38** that includes a pair of leads **50** and **52** connected to the secondary of the transformer **42** and to the temperature controller **20**. Temperature controller circuit **38** is thereby formed with a closed loop and normally operated at a very low voltage such as **11** volts for example, although this circuit may be operated at a higher voltage if required merely by altering the number of turns in a primary and secondary of the transformer **42**.

An energizing circuit **53** for the transformer **48** and, accordingly, for the temperature controller **38**, includes a transformer primary **54** connected to neutral through a lead **56** and a lead **58** extending to one side of a clean thermostat switch **60** which, by opening, when a preset predetermined temperature (say 1,050°) has been reached, terminates the cleaning cycle.

The opposite side of the clean thermostat **60** is electrically connected to a lead **62** which extends to an interlock switch **64** that is moved between two positions by the lock pin **34**. More specifically, the interlock switch **64** assumes the full line position illustrated when the latching assembly **28** is in an unlatched position and moves to the dotted line position shown in FIG. **1** when the locking pin **34** engages behind the pivoting latch element **30**, this locking pin abutting the interlock switch during this movement to thereby physically move the interlock switch **64** to the dotted line position. In its upper position, interlock switch **64** is in electrical contact with a lead **66** which extends to the terminal X of a first switch **67** of selector switch **18** and in its lower, dotted line position, interlock switch **64** is in electrical connection with a lead **68** which extends to an ambient thermostat **70** that opens in the event the ambient temperature outside the oven assumes an upper limit which makes continued operation of the oven unsafe. This thermostat can be set, for example, at 200° F. The opposite side of the ambient thermostat **70** is electrically connected to a lead **72** which extends to the electrical supply on the L_2 side of the circuitry. The energizing circuit **53**, then, is comprised of the primary **54** of the transformer **40**, the lead **58**, clean thermostat **70**, interlock switch **64** and lead **66** extending to terminal X and the first switch **67**. The holding branch comprises the lead **72** extending from the L_2 side of the current supply, ambient thermostat **70**, interlock switch **64**, clean thermostat **60**, lead **58** and primary **54** of the transformer **40**.

In a normal baking operation, the temperature controller **20** is energized through the energizing branch including the primary **54** of a transformer **40** which provides a low voltage to the upper and lower corners of the bridge arrangement for the temperature sensor **20** so that energization of the hot-wire relay element **36** is in accordance with the difference between the oven temperature and the temperature sensing of the bridge. For heat-cleaning operation, the temperature controller **20** is bypassed or disabled by closure of a second switch **74** which places the A and H terminals in a current-carrying condition in the selector switch means **18** to complete the temperature control bypass circuitry **44** that includes the leads **46** and **48** and the second switch **74**. This action shorts out the side of the bridge which includes the internal switch which normally opens and closes in accordance with the differential between the sensed temperature of the temperature controller **20** and the oven temperature. Thus, a low voltage is applied directly across the thermal relay elements **36** so that the relay switch means **24** and **26** are maintained in a closed current-carrying condition.

In order to actuate the solenoid **32** during the latching operation of the oven, a third switch **76**, in the selector switch means **18**, has a closed position in the latch mode of operation in which terminals C and L_2 are placed in a current-carrying condition. This provides a flow of current to the solenoid **32** since a circuit is completed from the power supply side L_2 to neutral N, through the third switch **76**, a lead **78** attached to the C terminal, the solenoid **32** and a lead **80** extending from the opposite side of the solenoid **32** and electrically connected to a door lock thermostat **82**. A lead **84** extends to neutral N from this door lock thermostat. The door lock thermostat **82** serves as a blocking switch to prevent reactivation of a solenoid **32** once a temperature above normal cooking temperature, say 650° F., has been reached. At this time, the door lock thermostat **82** opens and further closing of the third switch **76** to place L_2 and C terminals in a current carrying condition does not provide a completely closed circuit through the solenoid **32**.

A fourth switch **86** of the selector switch means **18** is closed only in the clean mode and connects the L_3 terminal to the S terminal to connect the L_2 side of the electrical supply source to the L_1 side of the electric supply through a lead **88** which extends to and is in electrical connection with the broil element **12**. A pulse switch **90** is also disposed in this circuit arrangement so as to provide a pulsing current flow through the broil element **12** in order to prevent its actuation at all times during the heat-cleaning cycle and to thereby provide a pulsing energy flow to it.

The manner in which the oven is operated to carry out a heat-cleaning cycle is as follows. Assume the oven door (not shown) is closed but not latched. The selector switch means **18** is turned from an off position to a latch position. This closes the first, second and third switches **67**, **74** and **76** of the selector switch means **18** and places, through the closure of switch **67**, the energizing branch of the energizing circuit **57** in a current-carrying condition to energize the primary **54** of the transformer **40**. Closure of the second switch **74** also affords energization to the temperature control bypass circuit **44** so that the voltage applied to the hot wire relay element **36** causes the relay switch means **24** and **26** to close and remain closed independent of the temperature controller **20**. The relay switch means **26** is in circuit with the broil element **12** but this element is not yet actuated since the fourth switch **86** has not yet been closed. Closure of the relay switch means **24**, however, does complete a portion of a holding circuit for the temperature sensor **20**. This circuit will be completed when the interlock switch **64** has been moved to its lower dotted line position, upon completion of the latching of the latching assembly **28** for the oven.

In the embodiment illustrated, the solenoid **32** emits a buzzing noise which indicates to the user of the oven that the latch means may now be manipulated to a latched position. In so doing, the pivoting latch element **30** swings out of the way of the solenoid locking pin **34** so that when the solenoid is subsequently deenergized the locking pin **34** can drop and thereby move interlock switch **64** to its lower dotted position. The aforementioned movement of the solenoid takes place after the latching of the door and when the user turns the selector switch means **18** from a latch to a clean position. The terminals across the third switch means **76** open, at this time,

disabling energization to the solenoid **32** so that the locking pin is free to move to its lower position. At this same time, the second switch **74** closes to control the bypass circuit and the fourth switch **86** of the selector switch means **18** is closed to complete the broil element heater circuit. Thus, after the selector switch means **18** has been operated to a clean position, the primary **54** of the transformer **42** remains energized through the holding branch of the energizatng circuit. The temperature controller circuit **38** is energized from the secondary **40** of the transformer and the temperature sensor **30** is shorted out by the bypass circuit so that the switches **24** and **26** remain closed independent of the temperature reached in the oven cavity. As a result, the oven temperature continues to increase through energization of the broil heater element **12** through energization of the broil heater element **12** through the pulse switch **90**.

As the oven temperature rises above the normal cooking temperature, door lock thermostat **82** opens to prevent energization of the solenoid **32** through operation of the selector switch means **18** from a clean to a latch position. This thermostat remains open until the temperature in the oven cavity again assumes the normal cooking temperature. Upon attaining the maximum heat-cleaning temperature set on the clean thermostat **60**, this normally closed thermostat opens thereby removing current from the primary **54** of transformer **42**. The loss of power through temperature controller circuit and the temperature controller bypass circuit results in deenergization of the relay switch means **24** and **26** so that these switches will open after a short delay for cooling of the hot wire **36**. Opening of relay switch means **26** results in a deenergization of the broil element **12**, while opening of relay switch means **24** prevents reenergization of the temperature controller circuit through the temperature controller **20**. The clean thermostat **60** again closes when a lower temperature is reached by the oven cavity. At the time when the temperature in the oven cavity has reached the normal cooking range, the door lock thermostat **82** again closes which permits operation of the latching assembly **28** to an unlocked condition so that the oven door (not shown) may be opened and the remaining residue contained in the oven cavity may be wiped from its interior periphery by use of a dry cleaning cloth. The oven circuit means **11** is now again ready to be placed in any of the desired cooking or cleaning modes.

The cleaning mode may be terminated at any time after it has started by turning the selector switch means **18** from a clean position to a latch position if the oven has not yet assumed a temperature above that which actuates the door lock thermostat **82** to an open condition. The solenoid **32** will be energized and a loud buzzing sound will indicate to the user of the oven that the latching assembly **28** may be moved to an unlocked condition. If the temperature in the oven cavity has risen above that temperature at which the door lock thermostat **82** opens, setting of the selector switch **18** to the latch position will not result in the solenoid again being energized. However, this action does deenergize the broil element **12** so that once the temperature is reached where the door lock thermostat **82** again closes, the latching assembly **28** may again be actuated to an unlocked condition.

The oven circuit **11** so far related is generally shown and described in U.S. Patent Application 773,539 filed Nov. 5, 1968 and now U.S. Pat. No. 3,549,862, and owned by a common assignee. The improvement to this circuit arrangement includes the provision of a door lock light **92** which indicates that time period during the cleaning cycle when the latching assembly **28** cannot be manipulated to an unlatched position.

Door lock light **92** is situated in a door lock and light circuit **94** that includes a pair of leads **96** and **98**. Lead **96** is connected to one side of the lock switch and to neutral throughlead **84**, and lead **98** is connected to the other side of the switch. Thus, the door lock light **92** is placed directly across the door lock thermostat **82**, so that the door lock thermostat, when closed, shorts out the light and thereby eliminates actuation of the indicating light at all temperatures below door locking temperatures. A lead **100** extends from electrical connection with the lead **98** to a center point **103** between two voltage dividing resistors **102** and **104** that are connected in series between terminal X of the selector switch and the L_1 side of the power supply.

During baking and broiling operation, the contacts L_3 and X are closed since the first switch **67** is closed and thus the terminal X is at the L_2 potential. This places **240** volts across the two resistors, making the center point **103** to which lead **100** is connected an artificial neutral. Thereby, door lock indicating light **92** cannot be energized. However, during the cleaning operation, selector switch contacts L_3 and X are open so that no potential is received from the L_2 side of the supply arrangement to the resistor **104** and the potential at junction **103** is no longer at neutral N. A 120 volt circuit is thereby completed through the resistor **102** and the door lock light **92** from L_1 to neutral. The door lock light **92** then operates as a true lock light indicating that the door lock thermostat **82** is open and the oven is in a cleaning mode with the temperature above the normal cooking range and with the latching-arrangement in a nonunlocking condition.

It should be clear to those skilled in the art that a door lock light feature has been provided for a cleaning oven system which is inexpensive to include in such a system and yet satisfies all the requirements of a true indicating light for door-locking conditions. It should also be clear to one skilled in the art that other obvious arrangements within the purview of this invention could be utilized to provide a door lock light for an oven-cleaning circuit.

What is claimed is:

1. An oven circuit having cooking and self-cleaning cycles including:

a. heating element means,

b. selector switch means for energizing at least one of said heating element means,

c. an electrical energy three-line source including a neutral, an L_1 side and an L_2 side,

d. door lock thermostat means in a series relationship with said neutral source,

e. door lock light indicating means connected in parallel with said door lock thermostat means,

f. an artificial neutral adapted to be formed between two relatively high resistances,

g. one of said resistances being connected to said L_1 side of said electrical energy source, and the other of said resistances being connectable to said L_2 side of said electrical energy source through said selector switch means when in a cooking position, and

h. said door lock light indicating means connected between said neutral and artificial neutral.

2. The combination set out in claim **1** wherein:

a. said selector switch means includes a switch connectable between the L_2 side of said electrical energy source and its respective resistance,

b. said switch is opened in said self-cleaning cycle position of said selector switch.

3. The combination set out in claim **2** wherein:

a. said door lock thermostat means opens to effect energization of said door lock light, when said switch is in said self-cleaning cycle.

4. In a pyrolytic heat-cleaning oven including a selector switch selectively settable for a heat-cleaning operation, and for cooking operations capable of heating the oven to temperatures at which the door of said oven is to be locked, a circuit arrangement for eliminating nuisance lighting of an oven door lock light, comprising:

a three-wire electrical supply including a neutral, one side, and the other side of the line;

a lock light;

normally closed switch means in parallel with said lock light for shunting said lock light when said oven is below a temperature at which said door is to be locked;

circuit means connecting one side of said light and said normally closed switch means to neutral, and the other side to a circuit location between said one side of the line and said selector switch;

circuit means connecting said selector switch to the said other side of the line;

said selector switch, when set to a cooking operation capable of elevating the oven to a locking temperature, imposing an electrical neutral upon said circuit location, and when set to a heat-cleaning operation disconnecting said circuit location from said other side of said line;

so that said light is effectively between neutral when said selector switch is set for those higher temperature cooking operations, and is between neutral and said one side of the line when said selector switch is set for a heat-cleaning operation.

5. The combination set out in claim 4 wherein:

a high-value resistance is disposed between said circuit location and said one side of the line, and

a high-value resistance is disposed between said circuit location and said other side of said line.

6. The combination set out in claim 4 wherein:

said normally closed switch is open when said oven is at a temperature when said door of said oven is locked.

7. In a pyrolytic heat-cleaning oven including a selector switch selectively settable for a heat-cleaning operation, and for cooking operations capable of heating the oven to temperatures at which the door of said oven is to be locked, a circuit arrangement for eliminating nuisance lighting of an oven door lock light comprising:

a light and lock circuit including said lock light, and a normally closed thermostatic switch operable to an open position in response to oven temperatures at which said door is to be locked, said thermostatic switch being in parallel with said light in said circuit to shunt said light and prevent its energization while said switch is closed;

a three-wire electrical supply including a neutral, and one side, and the other side of the line;

voltage divider means;

circuit means connecting one side of said voltage divider means to said one side of said line, and the other side of said voltage divider means to said other side of said line through said selector switch means when said selector switch is set for those higher temperature cooking operations capable of heating said oven to temperatures effecting said opening of said thermostatic switch, said other side of said voltage divider means being disconnected from said other side of said line when said selector switch means is set for heating cleaning operation;

said lock and light circuit having one side connected to said neutral, and the other side connected to the approximate electrical center of said voltage divider means so that said lock and light circuit is effectively between neutral when said selector switch is set for those higher temperature cooking operations, and is between neutral and said one side of the line when said selector switch is set for a heat-cleaning operation.

8. The combination set out in claim 7 wherein:

said voltage divider means includes a relatively high-value impedance means.