SELF-CLEANING OVEN

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ABSTRACT OF THE DISCLOSURE

A self-cleaning gas oven is provided wherein during a controlled self-cleaning cycle, ambient air supports the burner combustion and the convected gases therefrom continuously pass through the cooking chamber elevating the chamber temperature to a predetermined range and purging the chamber of any gases caused by the oxidation of the food soils deposited on the interior surfaces of the chamber.

Background of the invention

Various self-cleaning ovens, as they are commonly identified, have heretofore been produced however, for practical and economic reasons the self-cleaning feature has only been incorporated in electric type ovens. The inclusion of the self-cleaning feature in electric ovens has however resulted in substantial cost increases because of the numerous complex and delicate devices and structural details required to do an effective and safe self-cleaning operation. Because of the high temperatures created within the cooking chamber of prior self-cleaning ovens during the cleaning cycle, substantially thicker layers of heat insulating material are required to envelop the cooking chamber with the result that the volumetric size of the cooking chamber must be reduced in order to compensate for such additional insulating material while maintaining conventional, uniform exterior dimensions for the oven.

In prior electric self-cleaning ovens it is customary as a safety feature, to have the oven door locked in a closed position during the self-cleaning cycle so as to avoid the possibility of an explosion of accumulated volatile gases occurring within the cooking chamber if the door was accidentally opened manually prior to completion of the cycle. Furthermore, with prior self-cleaning ovens, the self-cleaning cycle was normally a prolonged operation involving several hours which oftentimes caused an inconvenience for the oven user. Lastly, with electric ovens generally, and particularly those embodying a self-cleaning feature, it was necessary that the electrical wiring for the household be of adequate capacity to handle the increased load demands of such a unit.

Summary of the invention

Thus, it is an object of this invention to provide a gas type self-cleaning oven which overcomes the aforesaid shortcomings that have beset electric self-cleaning ovens. It is a further object of this invention to provide a gas oven embodying a self-cleaning feature which is of simple, practical and inexpensive construction and yet is efficient in operation.

Further and additional objects will appear from the description, accompanying drawings, and appended claims.

In accordance with one embodiment of this invention a self-cleaning gas type oven is provided which includes an outer frame and an inner structure disposed therein. The inner structure comprises upright side and back walls, a substantially horizontal top wall, and a removable substantially horizontal bottom wall; all of said walls cooperating to form a cooking chamber or oven cavity open at the front side thereof to permit access thereto. Enveloping the exterior surfaces of the chamber-forming walls is heat insulating means spaced from the frame and cooperating therewith to form wall cavities through which air is caused to circulate to produce a cooling effect. Adjustably mounted on the frame is a heat insulated door which, when in one position of adjustment, is adapted to close the open front side of the cooking chamber. Disposed in spaced relation beneath the removable bottom wall of the cooking chamber is a gas heating means. Spaced beneath the heating means are vertically spaced, horizontally disposed, apertured partitions through which air circulates and is heated prior to being circulated past the bottom wall and through the cooking chamber. A vent system is provided which incudes a first section communicating with said cooking chamber for exhausting gases therefrom, a second section through which outside cool air is circulated, and a third section communicating with said first and second sections and in which the hot exhaust gases and outside cool air intermingling are then discharged from said oven at a location remote from the cooking chamber. The vent system also includes a blower which cooperates with the sections to effect discharge of the intermingled exhaust gases and outside air from the third section. A control means is mounted on the frame and is operatively connected to the heating means to effect actuation thereof and thus the temperature within the cooking chamber.

Description

For a more complete understanding of the invention reference should be made to the drawings, wherein:

FIG. 1 is a perspective front view of one form of the self-cleaning gas oven;
FIG. 2 is a fragmentary enlarged view partially in section taken along line 2—2 of FIG. 1;
FIG. 3 is a fragmentary sectional view taken along line 3—3 of FIG. 2;
FIG. 4 is a fragmentary enlarged vertical sectional view of the insulated door for the front side of the cooking chamber;
FIG. 5 is a fragmentary diagrammatic view of the control means and circuit therefor for effecting actuation of the heating means for the cooking chamber; and
FIG. 6 is a fragmentary sectional view taken along line 6—6 of FIG. 3.

Referring now to the drawings and more particularly to FIG. 1, one form of an improved domestic gas type oven 10 embodying a self-cleaning feature is shown. The oven 10 in the illustrated embodiment, commonly referred to as an eye-level double oven, comprises a lower section A, which embodies a cooking chamber 11, see FIG. 2; an upper section B spaced vertically above section A and also including a similar cooking chamber; and a middle section C, normally referred to as the cook top burner section, which is provided with a plurality of individually controlled, spaced gas burners 12. The number and arrangements of the burners 12 may be varied as desired.
3,422,809 3 In oven 10, the size of the cooking chamber of section B is less than the size of the cooking chamber of section A. This size differential is due to a control panel 13 being disposed on one side of the front face of section B, see FIG. 1.

Mounted on the upper side of section B is a filter unit D through which the exhaust gases and outside air mingled therewith are caused to flow prior to being discharged to the atmosphere. In some installations the combustion gases and air are discharged directly to the outside of the house or dwelling. The arrangement of the sections A-C and filter unit D, as shown in FIG. 1, is common in eye-level type ovens and therefore such arrangement forms no part of the instant invention. The self-cleaning feature to be hereinafter described may be incorporated in the cooking chambers of either or both sections A and B. In the description to follow only the self-cleaning feature will be described with relation to the cooking chamber 11 of lower section A.

The principle of self-cleaning oven interior wall surfaces by the application of intermittent heat for predetermined periods of time is not basically new but has been described in considerable detail in earlier U.S. patents such as 2,224,945 and 3,121,158. Notwithstanding the knowledge of this principle, extreme difficulty has been encountered in perfecting a domestic type gas oven embodying such principle. Such difficulties have evolved about obtaining effective yet compact heat insulating materials, incorporating adequate safety features, reducing the time required for completing the cleaning cycle, and obtaining a simple and inexpensive construction which requires but a minimum of maintenance.

Oven 10, as seen in FIG. 2, comprises an upright frame 14 and an inner structure 15 which is disposed therein and secured thereto. Structure 15 includes a pair of opposed upright side walls 16 and a back wall 17, a horizontally disposed top wall 18, and a removable horizontally disposed bottom wall 20 (commonly referred to as a bottom plate). All of the walls cooperate with one another to define the cooking chamber or oven cavity 11 which has an open front side to permit access thereto.

The walls are formed of sheet metal of suitable gauge which has the surfaces thereof adjacent the chamber 11 lined or coated with a material such as porcelain enamel or the like which resists stains and prevents corrosion. As is conventional in most ovens, the side walls 16 are provided with a plurality of elongated horizontally extending protuberances 21 which are arranged in vertically spaced relation. Corresponding protuberances are adapted to accommodate and support marginal portions of a removable rack or grill, not shown, and thus enables the housewife to locate the product being cooked at different levels within the chamber. The top wall 18, in the illustrated embodiment, includes a recessed portion 18c in which is disposed a gas burner or heating element 22.

The burner 22 facilitates broiling within the chamber, when desired. A control for regulating the operation of burner 22 may be provided on control panel 13.

Bottom wall 20, as heretofore noted, is removable and is normally supported in a horizontal position by a plurality of brackets 23, see FIG. 3. The periphery of the bottom wall is provided with a plurality of slots or recesses 24 which cooperate with the side and back walls 16 and 17 to form ports through which the heated air passes into the chamber 11.

Formed in the upper portion of the back wall 17 is an exhaust port 25 through which the exhaust gases are continually purged from the chamber regardless of whether it is being heated from approximately 150° F. to approximately 650° F. for conventional cooking, baking or broiling or whether it is being heated from approximately 1100° F. during the self-cleaning cycle to be described more fully hereinafter. By reason of the continuous purging or exhausting of gases from within the chamber 11 through port 25 there is no accumulation of volatile gases therein and thus, a potential hazard has been eliminated. In certain of the prior electric self-cleaning ovens, evaporation of volatile gases within the cooking chamber, particularly during the self-cleaning cycle, presents a real problem and as a result the door for the cooking chamber is locked in a closed position during such cycle. The manner in which continuous purging of the gases from the chamber is maintained in an instant oven 10 will be discussed more fully hereinafter.

Positioned in spaced relation beneath bottom wall 20 is the heating means, which in the illustrated embodiment, comprises a pair of elongated tubular burners 26. Each burner extends from front to rear and may be formed from metallic tubing (aluminized or stainless steel) which is provided with a plurality of laterally disposed apertures 26a through which the combustible gaseous fluid passes.

Ignition of burners 26 is controlled through an automatic flame sensing switch 27, normally referred to in the art as a flame switch, see FIG. 5, which is actuated in a manner to be described more fully hereinafter. Where dual burners are utilized, each should have a capacity of from about 13,000 to about 16,000 B.t.u. If desired, however, the dual burners may be replaced by a single burner or by more than the two burners shown.

Positioned immediately beneath burners 26 is a horizontally disposed plate 28 (commonly referred to as the main oven bottom) which is provided with a plurality of elongated slots 30 arranged in spaced parallel relation to each other and to the burners 26. Disposed beneath plate 28 and in spaced parallel relation therewith is a heat retention shield 31. Shield 31 includes an upper metallic lamina 31a which is provided with a plurality of elongated spaced parallel slots 32, similar in shape and size to slots 30 of plate 28. Affixed to the underside of lamina 31a is a lamina 31b of heat insulating material. The lamina 31b is likewise provided with elongated slots which are coincident to slots 32. Shield 31 functions to reflect back towards the cooking chamber 11 the heat generated by the burners 26 and prevent the floor or base upon which the oven is placed from becoming overheated.

Substanting shield 31 and spaced therefrom is a frame bottom member 33 (commonly referred to as the cabinet bottom) which is provided with a plurality of apertures 34. The apertures 34 are offset in a lateral direction with respect to slots 32 so as to prevent line-of-sight radiation from the burners to the floor. Member 33 is normally positioned above the floor or base upon which the oven is placed, as seen in FIG. 2. The air space 35 between member 33 and the floor produces an added insulating effect. It will be noted in FIG. 1 that an apertured face plate 36 is mounted across the bottom of the front of the oven. During operation of the burners 26, outside air is drawn through face plate 36, air space 35, member 33, shield 31, and plate 28 before being heated by burners 26.

A panel 37 is fixedly mounted on the lower surface of the oven which functions normally as a barrier against contact with the burners, however, it can be removed when servicing of the burners is required. A heat insulated door 40 is provided which is hinged mounted on the front of the outside surface 37 and is adapted to close off the open front side of cooking chamber 11, see FIGS. 2 and 4. Because door 40, when closed, is subjected to the high temperatures developed within cooking chamber 11 during the cooking and self-cleaning cycles, it is essential that the door be adequately insulated so that the exposed outside surface 40b thereof will remain relatively cool. The structural details of the door are shown in FIG. 4. The interior surface 40a of the door is provided with a protruding central portion or pad 40c which is formed of sheet metal having one or both surfaces porcelain coated and is adapted when the
The portion 40c is delimited by a seal ring 41 formed of braided fiber glass or the like. The seal ring makes continuous contact with the exposed surface of the frame circumference during opening 11a, when the door is closed. Disposed behind the pad 40c is a thick layer 43 of high temperature fibrous insulating material. Layer 43 is sandwiched between pad 40c and a main door liner 44, the latter being formed of sheet metal having one or both surfaces coated with a porcelain enamel. A second layer 45 of high temperature fibrous insulating material is disposed behind liner 44. Layer 45 is held against second liner 44 by a galvanized sheet metal subliner 46. Subliner 46 is maintained in proper spaced parallel relation with respect to the main door liner 44 by a plurality of spacer brackets 42 which are affixed to both liners, see FIG. 4.

The periphery of subliner 46 is encompassed by a peripheral flange 47 formed on a front door panel 48. Flange 47, along the opposed vertical segments thereof, is provided with a plurality of air openings 50, which communicate with the outside surfaces of the subliner 46. Encompassing the outer marginal portion of panel 48 is an exposed door frame 52. Frame 52 is provided with an inwardly extending peripheral flange 53 which cooperates with flange 47 to form a pocket into which extends a peripheral flange 44a of the main door lining. This arrangement permits the pocket of flange 44a to be disposed within the pocket. The vertical segments of flange 53 are provided with suitable air openings which coincide with the openings 50 formed in flange 47.

Door 40 may be hingedly mounted along its lower edge to flange 45 so that when the door is swung to its open position it will serve as a shelf, or on the other hand the door may be hinged along either vertical side. In either case, the hinge connection, not shown, is spring biased so as to insure that the door will assume a properly closed position, when desired.

The top, back, and upright side walls of chamber 11 are provided with suitable insulation so as to prevent overheating of the exterior surfaces of the oven. One form of the heat insulation for the cooking chamber walls, except for door 40, is shown more clearly in FIG. 6. Second layer 55 of the outer surface of wall 16, 17, or 18 is a layer 54 of approximately ¾" thickness, which consists of high density insulation containing ceramic compounds. One such insulating material suitable for such use is known by the name of Cerarafel.

Overlying the outer surface of layer 54 is a layer 55 of metallic (e.g., aluminum) foil. Backing the foil layer of flange 44a disposed within the pocket. The vertical segments of flange 53 are provided with suitable air openings which coincide with the openings 50 formed in flange 47. Disposing within the filter unit D are two blowers 63 and a micro-switch 66 which normally assumes an open position. Closing of micro-switch 66 is effected by the flow of the exhaust gases and air, as influenced by the blower 63 by reason of the proximity of the switch 66 to the blower input side, impinging upon a pivotally mounted arm or blade 66a and forcing its foil layer and pilot and close said switch. Upon the blower 63 becoming inoperative or failing to produce a predetermined flow velocity, arm 66a will automatically return to its normally open position.

Connected in series with micro-switch 66 is the conventional flame switch 27 and a solenoid valve 67, the latter controlling gas input through pipe 68 to the burners 26. The flame switch 27, as is customary, has a portion thereof disposed within a pilot light or flame 70 and is sensitive to the heat generated by said flame. Thus, when the pilot flame is present, switch 27 will cause the solenoid valve 67 to be operable and permit gas to be fed to the burners 26, whereupon the gas will be ignited by the pilot light 70.

Various other conventional safety switches, and temperature limiting switches, not shown, may be incorporated in oven 10 in order to meet Underwriters and/or various other trade association requirements. Such additional safety switches form part of the instant invention and for that reason are not shown or described.

It is to be understood that the instant invention is not to be limited to the illustrated embodiment, but instead may be incorporated in a gas type oven having but a single cooking chamber. Likewise the invention may be incorporated in built-in ovens.
Regardless of the aforenoted styles of the gas oven utilized, the self-cleaning cycle operation is substantially the same. The time for completing the cycle is approximately two hours which commences immediately upon the control switch 64 being manually adjusted to a selected position. In a period of approximately 15–18 minutes the temperature within cooking chamber 11 will have reached approximately 950° F. While the chamber temperature remains within the range of 950° F., (approximately 1 1/4 hours) food soils deposited on the chamber-forming walls are removed therefrom by pyrolytic action whereby a dust-like residue is formed which may be readily removed from the chamber by gentle wiping of the inner surface of the above residues. The cycle has been completed and the walls have returned to a cool condition.

Switch 64 incorporates a timing mechanism 64a connected in series with micro-switch 66, which will automatically deactivate the burners 26 after a predetermined time period notwithstanding that micro-switch 66 remains closed by reason of the blower operation. It will be noted in FIG. 5 that mechanism 64a is mechanically connected at 64b to the selector knob 64c of switch 64.

To initiate the self-cleaning cycle requires a manual adjustment of switch 64 to its position of self-cleaning indicated on the switch dial. Once the adjustment of switch 64 to self-cleaning position 64a has occurred, blower 63 is actuated, which in turn closes valve switch 66. Simultaneously with the adjustment of switch 64, the timer section 64a thereof will also close. If the pilot light or flame 70 is present, flame switch 27 will also be closed causing the solenoid 67 to move to its open position, closing the circuit and permitting gas to be emitted from the burners. The time required for the cooking chamber 11 to reach its self-cleaning temperature has been factory-calibrated, based upon the B.t.u. capacity of the burners 26, the volumetric size of the chamber 11 and the rate of flow of the heated air through the chamber. Thus, if all the aforenoted series-connected switches are operating properly and the burners are ignited, they will continue to be ignited until automatically rendered inoperative by reason of timer 64a opening after a predetermined time period has elapsed, causing the solenoid 67 to return to its gas cut-off position. If, however, during the time period, there is a malfunction of the blower 63 or the pilot light or flame 70 is accidentally or unexpectedly extinguished, the circuit will automatically be broken by switch 66 or the flame switch 27, causing the solenoid to automatically return to its gas cut-off position. In addition to switches 27 and 66, timer mechanism 64a and solenoid 67 are connected in series, additional elements, such as a conventional high temperature limit switch, not shown, can be added in series, if desired.

Thus, it will be seen that a domestic gas oven incorporating a self-cleaning feature has been provided which is of a practical, simple, and efficient construction and is free of the numerous shortcomings possessed by the various prior art constructions. The improved gas oven is inexpensive to operate whether it be on normal cooking or self-cleaning cycle. When the oven is operating on the self-cleaning cycle, there is no excessive energy load imposed on the household electrical system and, thus, high load-carrying capacity electrical wiring for the household is not required. The inclusion of the afore-described self-cleaning feature in a gas oven does not adversely affect the volumetric capacity of the cooking chamber or the standardized exterior dimensions of the oven.

Many of the embodiments of this invention have been described above, further modifications may be made thereto and it is contemplated, therefore, by the appended claims, to cover any such modifications as fall within the true spirit and scope of this invention.

I claim:

1. A self-cleaning oven comprising an upright frame, an inner structure disposed within said frame and having upright side and back walls, a transversely disposed top wall, and a transversely disposed removable bottom wall, all of said walls cooperating with one another to form a cooking chamber having an open front side; a heat insulated wall extending therefrom to form a cooking chamber front side; gas heating means disposed beneath said removable bottom wall, said bottom wall being provided with at least one port through which heated air is caused to enter said chamber; a heat retention shield; a gas heating means disposed uppermost therein, said heating means and provided with a heat reflective surface adjacent said heating means, said shield being provided with a plurality of air admission apertures; a second bottom wall-like member disposed in spaced relation beneath said retention shield, said wall-like member being provided with a plurality of air admission apertures arranged in a vertically offset relation with respect to the apertures of said heat retention shield; means for supplying outside air through said apertures to said gas heating means; heat insulating means enveloping the exterior surfaces of said inner structure walls and spaced inwardly from said frame to form wall cavities through which air is caused to circulate; an exhaust vent system for said cooking chamber, said vent system including a first section having one end thereof in communication with said cooking chamber to effect ehaust of gases therefrom and said second section having one end thereof spaced from said cooking chamber and through which outside air is drawn into said exhaust system, and a third section having one end thereof communicating with corresponding ends of the said other sections whereby intermingling occurs of the exhaust gases flowing through said first section with the outside air flowing through said second section, said third section having a second end remote from said cooking chamber and said outside air inlet for said second section and communicating with said atmosphere, and blower means cooperating with said vent system sections for directing flow of the intermingled gases and air out through the second end of said third section and所述 means mounted on said frame and operationally connected to said heating means and said blower means for regulating the temperature within said cooking chamber.

2. The self-cleaning oven of claim 1 wherein said control means, when in a position for self-cleaning cycle maintaining the temperature range of from approximately 950° F. to approximately 1100° F. for a predetermined time period; said control means, when in said one position of adjustment, effecting continuous actuation of said blower means whereby continuous purging of gases from said cooking chamber occurs.

3. The self-cleaning oven of claim 1 including a plurality of exposed range gas burners disposed above said cooking chamber and insulated therefrom, and a second cooking chamber spaced above said exposed range gas burners and provided with a second heat insulated door adjustable independently of said first mentioned door; said second cooking chamber being heated by a second heating means operable independently of said first mentioned heating means.

4. A self-cleaning oven comprising an upright frame supported by a surface, an inner structure disposed within said frame and having upright side and back walls, a top wall, and a bottom wall, all of said walls cooperating to form a cooking chamber having an open front side; a heat insulated door, on which, adjustable and remotely from said cooking chamber, a top wall, and a bottom wall, all of said walls cooperating to form a cooking chamber having an open front side; a heat insulated door, substantially the shape of the cooking chamber; a gas heating means disposed beneath said bottom wall, means for circulating air past said gas heating means, the circulating air, said bottom wall permitting the circulated heated air to enter said chamber; a heat retention shield disposed beneath said gas heating means and provided with a heat reflective surface adjacent said gas heating means, said shield being provided with a plurality of air admission apertures through which the outside air flows prior to circulating past said gas heating means; a second bottom wall.
wall-like member disposed in spaced relation beneath said retention shield, said wall-like member being provided with a plurality of apertures through which the outside air flows prior to reaching said shield, said wall-like member being spaced above the frame-supporting surface, the apertures of said shield and said second bottom wall-like member being vertically offset with respect to one another; heat insulating means enveloping the exterior surfaces of said chamber-forming side, top and back walls; a vent system including a first section having one end thereof communicating with the interior of said chamber to effect continuous purging of volatile gases and the circulated heated air therefrom, a second section having an end thereof spaced from said chamber and communicating with cool outside air to effect flow of the latter through said second section, and a third section having an end thereof communicating with said first and second sections to effect intermingling of the chamber-purged gases and air with said flowing cool outside air whereby a gaseous mixture is produced having a temperature substantially less than the temperature of the gases and

heated air when purged from said chamber, said third section having means for discharging the gaseous mixture at a location remote from said chamber; and control means mounted on said frame and operatively connected to said gas heating means for actuating same.

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FREDERICK KETTERER, Primary Examiner.
UNIVERSAL PATENT OFFICE CERTIFICATE OF CORRECTION

Patent No. 3,422,809 January 21, 1969

Samuel J. Perry

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, lines 4 and 5, cancel "and a removable substantially horizontal top wall,"; line 22, "incudes" should read includes --. Column 3, line 9, "com-" should read -- co- --. Column 5, line 60, "operatures" should read -- apertures --. Column 8, line 66, cancel "a".

Signed and sealed this 17th day of March 1970.

(SEAL)

Attest:
Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents