FIG. 2
ABSTRACT OF THE DISCLOSURE

This invention pertains to a baking and broiling oven which is also capable of a high temperature operating cycle to remove the food soils lodged on the walls forming the oven cavity by a pyrolytic process whereby the soil is transformed into gaseous degradation products which are exhausted from the oven.

This invention is directed toward an improved air cooling system for the walls of a high temperature self-cleaning oven where the cooling system is efficient both in a natural draft mode during normal cooking as well as in a forced draft mode during the heat-cleaning cycle. A plenum chamber is located beneath the oven and it has an air inlet opening in its bottom with a cooling fan mounted in the opening. Vertical air channels extend up the two opposite sides of the oven as well as up the back of the oven and the air discharges underneath the cooktop of the range. Graded orifices communicate between the plenum chamber and the vertical air channels, and the air inlet to the cooling system is at the bottom of the oven and the air outlet is at the top of the oven to create a high chimney effects for the system.

BACKGROUND OF THE INVENTION

It is important in a high temperature self-cleaning oven to provide means for limiting the maximum temperature reached by any external point of the oven and especially at the two sides of the oven. Two safety hazard conditions must be borne in mind; first, an excessive temperature might cause a burn or blister on the hand of a person who might touch the oven exterior, and secondly, an excessive temperature on the sides panels of the oven might create a fire hazard since the oven or range might be located flush against a wooden kitchen counter or cabinet structure which might become ignited if the maximum external temperature of the oven were not taken into consideration in the design of the oven.

There is always a compromise reached between first the design of the oven isolation system; that is, the amount of reducing to a minimum the conduction of heat from the oven; second, the oven insulation system or the amount or thickness of the layer of thermal insulation surrounding the oven liner; and, third, the amount of air cooling for carrying off the heat transmitted through the insulating layer so as to reduce the external temperature of the oven as well as for the secondary purpose of reducing the operating temperatures of the range control components and lead wires and thereby increasing their useful life. Size is always a factor in the design considerations because the external width and depth of the range or oven cabinet is generally fixed to a standard, for example, 30 inch overall width and between 24 and 26 inch overall depth. Moreover, it is preferable to have the maximum size oven liner for a given width and depth of the oven, and this presents quite a challenge to the engineering profession to offer the maximum design at the minimum cost without sacrificing quality, reliability and performance.

The principal object of the present invention is to provide an air cooling system for the walls of a self-cleaning oven where the system has optimum flow characteristics.

A further object of the present invention is to provide an oven of the class described with a strong natural draft cooling system which is augmented by a forced cooling system during a high temperature heat-cleaning cycle.

A still further object of the present invention is to provide a self-cleaning oven with an air cooling system that is biased toward the front portion of the oven in the vicinity of the oven door.

SUMMARY OF THE INVENTION

The present invention, in accordance with one form thereof, relates to a cooking apparatus having an outer supporting structure and inner walls forming an oven cooking cavity, where one inner wall includes a door for gaining access to the cooking cavity. Heating means, either gas or electric, are furnished for raising the temperature of the oven cavity for both cooking foods placed therein as well as for heat-cleaning the food soils from the inner surfaces of the walls forming the oven cavity. A layer of thermal insulating material surrounds the inner walls of the oven for retaining the heat within the oven. An air flow chamber is formed beneath the insulated oven as well as up to the opposite sides of the oven and up the back of the oven and across the top of the oven. There is an air inlet opening in the bottom wall of the bottom chamber, and air is directed upward through the two sides and the back and across the top where it exits through discharge openings to return to the kitchen atmosphere. A cooling fan is located in the air inlet opening for creating a forced draft of cooling air to circulate through the air channels.

BRIEF DESCRIPTION OF THE DRAWINGS

My invention will be better understood from the following description taken in conjunction with the accom-
panying drawings and its scope will be pointed out in the appended claims.

FIG. 1 is a right side elevational view of an electric range equipped with a self-cleaning oven having an air-cooling system embodying the present invention with some parts broken away and others in cross-section to best illustrate the present invention.

FIG. 2 is a front, cross-sectional elevational view taken generally on the line 2—2 of FIG. 1showing the cooling system with a fan inlet opening in the bottom wall of a plenum chamber beneath the oven, as well as the provision for air flow up the sides of the oven and across the top.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Turning now to a consideration of the drawings and in particular to FIG. 1, there is shown a free-standing domestic electric range 10 in right side elevational view comprising a supporting superstructure which begins with a large U-shaped frame 12 at each side of the range, where each side frame has a front leg 13 which extends for nearly the complete height of the range, a back leg 14 of the same type and a base 16 which extends along the floor and braces the bottoms of the legs 13 and 14. The top ends of the four legs 13, 13 and 14, 14 are joined together by generally horizontal cover plates 18 which is sometimes referred to as a spillage tray. This designation stems from the fact that overlying this inner cover plate 18 is a cooktop 20 of shallow sheet metal construction which supports a plurality of surface heating units or means 21 which are usually four in number on a standard electric or gas range. There are occasional times when foods being cooked on the surface units may overflow or spill onto the cooktop and pass through openings in the cooktop in which the surface units are located. This explains why the inner cover plate 18 is formed with deep bowl-shaped embossments 23 in order to catch and retain the spillage and prevent it from traveling any further so that it may be wiped out when convenient by reaching down through the receiving openings for the heating unit 21. A backsplash 22 is positioned along the back edge of the cooktop 20, and it has a control panel mounted in its front face with controls 24 for governing both the surface units 21 and the oven heating and cleaning means.

Other supporting or connecting members between the two side frames 12 are a front oven door frame 25 which is connected between the two front legs 13 and 13. Next, there is a range opening the range by inserting it through the opening in the oven door frame 25. The oven liner 36 has a bottom wall 38, opposite side walls 39, 39, a back wall 40 and a top wall 41. The front of the oven liner 36 is open, and it has a peripheral flange 43 which is outwardly turned to be of a size slightly larger than the opening in the oven door frame 25. Hence the oven liner 36 is assembled into the range by inserting it through the opening in the oven door frame 25. Tension means such as adjustable tension springs (not shown) would connect the back of the oven liner to the back legs 14, as is well known in this art. Notice that a metal sheathed resistance heating element 45 is sandwiched between the front flange 43 of the oven liner and the periphery of the opening in the oven door frame as a supplemental heating means in the vicinity of the door to compensate for the heat lost through and around the door so as to obtain generally uniform oven wall temperatures during the heat-cleaning cycle.

The oven door 37 is of hollow sheet metal construction which is shown in full lines since its particular details of construction do not form part of the present invention. In general terms, it has an outer sheet metal pan-shaped panel 47 with a rear-turned flange 48. One or more heavy layers of heat-insulating material (not shown) such as fiber glass or the like is packed within the door. The door is furnished with an inner door panel (not shown) which closes the inner side of the outer door panel 37 but is not visible in a side view. An inner panel 49 is carried on the inner side of the door and it is of generally plug-shape to fit into the mouth of the oven liner and substantially seal the oven cavity. A high temperature gasket 51 is sandwiched between the inner panel 49 and the inner door panel. The gasket is continuous around the periphery of the inner panel 49 and it is designed to bear against both the front flange 43 of the oven liner as well as the front of the oven door frame 25. There is a controlled air intake into the oven cavity both through the cover plate at the cleaning, and this is created by spacing the gasket 51 away from the oven flange 43 across the bottom and the two lower corners of the oven liner to provide narrow, rectangular air intake openings at 52.

In a high temperature self-cleaning oven, it is imperative to insure that the oven door is first closed before the self-cleaning cycle can be initiated, and while the cleaning cycle is running to prevent the door from being opened until the oven temperature returns to the normal cooking temperature somewhere around 500° F. and 600° F. An oven door latch handle 53 is shown protruding out the front of the range body just above the top edge of the door 37, but it is not shown in greater detail as it does not form part of the present invention. For more information on the door latching system, reference may be made to the patent of Ronald B. Barber No. 3,139,918, which is assigned to the same assignee as is the present invention.

Heating means are provided for the oven such as a lower baking element 55 and an upper broiling element 56 as is conventional in the electric oven art. In other words, for optimum results in a self-cleaning oven there would be provided three horizontally fastened in the inner sides of the oven cavity among elements 55 and 56 and the additional heating element 45 to obtain proper cleaning of the mouth of the oven particularly along the bottom edge thereof which is difficult if not impossible to clean without the additional heating means near the door to compensate for the heat loss.

All ovens have an oven vent adjacent the top portion and this oven is no exception. The oven vent opening is at 58 in the top wall 41 of the oven liner 36. Over this opening is installed a catalytic oxidation unit 60 which receives the oven exhaust and oxidizes the gas fumes. This is returned to the kitchen through duct work 61 that is open under one of the surface heating units 21, in this case the right rear unit as is best seen in FIG. 2.

Before the oven liner 36 is installed in the range body through the oven door frame 25, the assembly worker packs a thick layer of heat-insulating material 63 in the range body such that when the oven liner is pushed into place and fastened down this layer of insulation 63 completely surrounds the outside of the oven liner and serves to retain the heat of the oven within the oven cavity and retard the flow of heat to the outer surfaces of the range. Beneath the oven, the insulation 63 is held in place by a bottom cover panel 64 which is fastened at its four corners to the four legs 13, 13 and 14, 14 of the two U-shaped side frames 12. As mentioned previously
there is an inner side panel 30 at each side of the oven, an inner panel 27 at the back of the oven and a top inner panel or spillage tray 18. All of these panels 64, 30, 27 and 18 serve as insulation guards to hold the insulation 63 in place.

As in many standard ranges, the range in which the present invention is incorporated is furnished with a storage drawer 66 located beneath the oven. It is a slide-out contraption with a storage compartment 67 and a front drawer plate 65 which blends in with the configuration of the oven door 37. The storage drawer 66 does not take up all of the space between the floor and the bottom of the oven. The top of the storage compartment 67 is spaced from the bottom of the oven to allow for the assembly of a pan-shaped panel 70 to the underside of the inner bottom cover 64 and thereby forming a plenum chamber 71. An air inlet opening 72 is formed in the bottom panel 70 and the fan blades 74 of a cooling fan 75 are mounted in that air inlet opening. The fan blades 74 are mounted on the shaft 76 of a fan motor 77. A metal strap (not shown) is used to attach the fan motor 77 to the underside of the bottom panel 70. A protective cage 79 is positioned over the underside of the cooling fan 75 to prevent any interference with either the motor 77 or the fan blades 74. This cage 79 is a four sided metal housing having a bottom wall 80, opposite side walls 81, as best seen in FIG. 2, a rear wall 82 and an inclined opening 83 as its front wall which is covered by a wire screen 84 for ease of air movement into the fan blades. The three vertical walls; namely, the two opposite side walls 81, 82 and the back wall 84 are provided with a series of louvers 87 punched therein so as not to obstruct the free flow of room air to the fan blades 74.

This cooling fan 75 would not be used during the normal cooking operations but it would be energized during the high temperature heat-cleaning cycle when the oven walls are to reach a maximum temperature somewhere between about 750° F. and about 950° F. When the cooling fan 75 is energized the air pressure within the plenum chamber 71 is increased. Air is allowed to flow from the plenum chamber 71 up the air channels 33, 33 at the two sides of the oven as well as up the back channel 29 as well as across the top channel 32 beneath the cooktop 20. Notice in FIG. 1, looking at the plenum chamber, an air inlet opening in the front of the oven, there is a large slot or orifice 90 toward the front of the oven, and a smaller slot or orifice 91 toward the rear of the oven. These slots 90 and 91 allow cooling air to flow from the plenum chamber 71 to the side air channels 33 with more of the air being allowed to flow toward the front of the oven to lower the external surface temperature of the range body in the vicinity of the front door 37. As is seen in FIG. 1, a short lancing 93 is formed in the inner bottom cover 64 adjacent the back edge thereof to form a small orifice 94 communicating between the plenum chamber 71 and the back air channel 29. Thus it can be seen that the orifices in the plenum chamber 71 communicating with the three vertical air channels 33, 33 and 29 are graduated from the front to the back of the oven with the larger orifice 90 at the front, a medium size orifice 91 toward the back and the smallest orifice 94 orifice with the back air channel.

Means must be provided for allowing the air in the three vertical air channels to exit, preferably into the horizontal top air channel 32. This is provided by recessing the two side edges of the spillage tray 18 as at 96 in FIG. 2, and to recess the back edge of the spillage tray 18 at 97 in FIG. 1. It should be noted that the air inlet opening 72 of this air cooling system is at the bottom of the oven while the air outlets are at the top of the oven so as to create a rather tall chimney effect and to obtain a good natural draft of air when the oven is heated whether the cooling fan 75 is operating or not. This natural draft is augmented during the heat-cleaning cycle by energizing the cooling fan 75 and this forced draft is metered by graduated orifices 90, 91 and 94 to bias the major flow toward the front of the oven for maximum efficiency.

Modifications of this invention will occur to those skilled in the art. Therefore, it is to be understood that this invention is not limited to the particular embodiment disclosed but that it is intended to cover all modifications which are within the true spirit and scope of this invention as claimed.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A cooking apparatus comprising an outer supporting structure, inner walls forming an oven cooking cavity, one inner wall including a door for gaining access thereto, heating means for the oven cavity for cooking foods placed therein as well as for heat-cleaning the food soils from the inner surfaces of the walls forming the oven cavity, heat-insulating material surrounding the inner walls for retaining the heat within the oven cavity, air channels formed beneath the insulated oven cavity and up the two sides and the back thereof, cooling air inlet means in the bottom air channel beneath the oven, a horizontal air channel above the insulation and having a plurality of vent openings, the three vertical air channels discharging into the top horizontal air channel, and a cooling fan located beneath the oven for creating a forced draft of cooling air to circulate through the air channels wherein the air inlet means in the bottom air channel has the cooling fan positioned therein, a protective cage surrounding the cooling fan beneath the oven, and air flow control means in the bottom air channel to direct the air up the vertical channels with the major flow biased toward the front of the oven, whereby the oven cooling channels have an induced natural draft characteristic which augments the forced draft system.

2. An electric oven comprising an oven cavity formed by a box-like oven liner and a front-opening access door, resistance heating elements for raising the temperature of the oven cavity, a layer of heat-insulating material surrounding the oven cavity, a layer of insulation around the oven liner, and the three vertical air channels having air discharge means leading into the top horizontal air channel, and exhaust means from the top air channel, with a protective cage member fastened beneath the cooling fan, and orifices in the plenum chamber being enlarged toward the front of the oven to insures a major air flow up the side air channel in the vicinity of the front door, and a small orifice at the back of the oven so there is only a minor air flow up the back air channel.

3. A cooking range comprising an outer supporting structure with a horizontal cooktop mounted on top of an oven that is formed by a box-like oven liner and a front-opening access door, a storage drawer mounted beneath the oven, heating means for raising the temperature of the oven, a layer of thermal insulation surrounding the oven liner, inner cover panels held against the layer of thermal insulation, a shallow box adjacent the bottom inner cover panel and above the storage drawer to form a plenum chamber, an air inlet opening in the bottom of the said shallow box adjacent the rear thereof, a cooling fan positioned in the air inlet opening
opening and adapted to force room air into the plenum chamber, outer cover panels spaced outwardly of the inner cover panels at the two sides and the back of the oven liner to form vertical air channels, orifices in the plenum chamber communicating with the lower portions of the three vertical air channels, the orifices being graduated from a large size near the front of the oven to a small size at the back air channel, a top air channel formed between the inner cover panel and the said horizontal cooktop, and openings communicating between the top portion of the vertical air channels and the top air channel, whereby room air is forced into the plenum chamber wherein it is circulated and then exits through the orifices to pass up the three vertical air channels and then into the top air channels from which it returns to the atmosphere.

4. A cooking range as recited in claim 3 wherein a protective cage is fastened over the bottom of the cooling fan, the said air inlet opening being at the bottom of the range and the air outlets from the air channels being at the top of the range to create a tall chimney effect and obtain the maximum natural draft for the cooling system.

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