ABSTRACT

A door construction having a transparent sealed window for use with a high temperature self-cleaning baking and broiling oven. The innermost half of the door when viewed in cross-section is well insulated thermally, while the outermost half of the door is provided with an intermediate door panel that establishes two vertical cooling air channels. The intermediate door panel has rearwardly turned peripheral flanges that thermally shield the outer door panel from the innermost half of the door.

7 Claims, 3 Drawing Figures
3,893,442

1

OVEN DOOR WITH AIR COOLING SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The invention relates to oven doors and particularly to the doors of baking and broiling ovens which have a high temperature pyrolytic self-cleaning oven cycle which require some means for restricting the maximum temperatures experienced by the outer door panel.

2. Description of the Prior Art

The present invention is particularly useful as the access door of a pyrolytic self-cleaning oven that operates at oven temperatures as high as 950°F as is described in the basic patent of Bohdan Hurko, U.S. Pat. No. 3,121,158, which is assigned to the same assignee as is the present invention. Windows have been available in conventional oven doors for many years. Oven users have become accustomed to the convenience of being able to observe the food through the oven door window while the food is being cooked. This avoids the necessity of opening the oven door and thereby losing some of the oven heat in order to be able to judge the degree of doneness of the food.

Special window designs are necessary for oven doors of pyrolytic self-cleaning ovens such as the use of a removable heat radiation shield or shutter which is positioned to close the window during the self-cleaning oven cycle as is taught in the patent of James A. White U.S. Pat. No. 3,760,792, that is also assigned to the present assignee. The main advantages of such a heat shield are that it reduces the heat loss through the window passage and thereby lowers the external surface temperatures of the door, as well as maintains a high temperature on the innermost glass pane of the window structure during the self-cleaning oven cycle so as to ensure the complete removal of all food soils from the inner pane of the window by the pyrolytic process. Safety regulations of Underwriters Laboratories, Inc., the American Gas Association and Federal safety regulating bodies are becoming more strict regarding the maximum allowable surface temperatures on the outer surface of the range cabinet, especially during the high temperature self-cleaning oven cycle. Therefore, it is incumbent upon range manufacturers to continuously improve their designs to satisfy the more demanding needs of the public.

A principal object of the present invention is to provide an oven door with an intermediate door panel establishing two vertical air cooling channels, where the intermediate door panel shields the outer door panel from the higher temperature on the innermost part of the door.

A further object of the present invention is to provide an oven door of the class described where the intermediate door panel is spaced closely to the outermost window pane so as to substantially maintain two separate cooling air channels through the door.

SUMMARY OF THE INVENTION

The present invention, in accordance with one form thereof, relates to a door construction provided with a viewing window having a plurality of transparent panes for sealing the window. The innermost half of the door includes a multiple pane window module surrounded by thermal insulation. The front half of the door includes an intermediate door panel having a window opening substantially coinciding with the window. At least the two sides and the top of the intermediate door panel have rearwardly turned peripheral flanges which shield the outer door panel from the high temperatures of the inner parts of the door. Air entrance openings are formed in the bottom portion of the door and air outlet openings are formed along the top edge of the door so that room air may pass up through the door channels on both sides of the intermediate door panel.

BRIEF DESCRIPTION OF THE DRAWINGS

This invention will be better understood from the following description taken in conjunction with the accompanying drawings and its scope will be pointed out in the appended claims.

FIG. 1 is a front elevation view of a domestic range having an oven door embodying the present invention.

FIG. 2 is a cross-sectional, side elevation view on an enlarged scale taken on the line 2—2 of FIG. 1 to show the interior construction of the door and air flow patterns both in front of and behind the intermediate door panel.

FIG. 3 is a fragmentary top view on an enlarged scale taken on the line 3—3 of FIG. 1 at the top right corner of the door to show the air outlet openings in the top peripheral flange of the intermediate door panel and the manner in which the peripheral flange of the outer door panel is shortened or scalloped to form an air gap therebetween.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Turning now to a consideration of the drawings, and in particular to FIG. 1, there is shown for illustrative purposes a free-standing domestic range 10 having a top cooking surface 12 with a plurality of surface heating elements 14. A baking and broiling oven 16 is located beneath the cooktop 12 and formed by a box-like oven liner 18 shown in FIG. 2 and a front-opening drop door 20 of the present invention. While the oven door of the present invention is shown as being installed on an electric range, it is readily apparent to those skilled in this art that the invention is not limited to use with an electric oven, for it could just as well be installed on a gas-fired oven. A backsplash 22 rises from the cooktop 12 along the back edge thereof, and it contains the necessary control components 24 for the surface heating units 14 and the oven heating units (not shown). These control components 24 are illustrated diagrammatically, since they do not form part of the present invention.

The oven door 20, as seen in the front view of FIG. 1, is a generally rectangular structure which is adapted to be hinged along its bottom edge to the range body or cabinet by hinge straps (not shown) for movement between a vertical closed position and a horizontal fully open position. The door is provided with an elongated handle 28 that is located near its top edge so that the door may be grasped and pulled open or pushed closed with ease. The door 20 includes a rectangular viewing window 30 that is of reduced size as compared with the overall size of the door, and it is located generally in the top half of the door structure so that a person standing near the front of the oven may peer down into the oven cooking cavity through the window 30 and observe the food while it is being cooked therein.

As is best seen in FIG. 2, the oven door 20 is of generally sheet metal construction having four main ele-
ments; an outer door panel 36, an intermediate door panel 38, an inner door liner 40, and an inner panel 42 that is supported from the inner door liner. The outer door panel 36 is of shallow pan configuration by virtue of the fact that it has a slight rearwardly facing peripheral flange 46. The intermediate door panel 38 is also of shallow pan configuration that has a slight rearwardly facing peripheral flange 48. This intermediate door panel 38 is telescoped within the outer door panel 36. Looking at the fragmentary top view of FIG. 3, it can be seen that the side flange 46 of the outer door panel 36 completely hides the smaller side flange 48 of the intermediate door panel 38. Now considering the top edge of the door 20, the flange 46 is cut back or scalloped as at 52 for almost the entire top edge of the door. Also, it is to be noted that on the top edge of the door as is best seen at the top of FIG. 2, the flange 46 is generally in the same horizontal plane as the flange 48. This relationship is different from the spaced relationship along the two sides of the door as seen in FIG. 3, and along the bottom of the door as seen at the bottom of FIG. 2.

The outer door panel 36 is furnished with a rectangular window opening 56 which has a rearwardly turned flange 58 over which is mounted a first transparent window pane 60 by means of spaced bracket members 62 and a window trim frame 64.

The intermediate door panel 38 is also provided with a window opening 68 which generally coincides with the window pane 60 and its trim frame 64 such that at least two vertical air channels 70 and 72 are formed in the door. The air channel 70 is located in the space separating the outer door panel 36 from the intermediate door panel 38, while the second vertical air channel 72 is behind the intermediate door panel 38. Since the window opening 68 in the intermediate door panel 38 is closely positioned with respect to the window pane 60, the two air channels 70 and 72 are generally independent of each other. Relatively cool air flows up through the first air channel 70, while relatively hot air flows up through the second air channel 72. Air inlet openings 76 are formed in the flange 46 along the bottom portion of the door while air outlet openings 78 are formed in the flange 48 along the top edge of the door. The air inlet openings 76 communicate with the lower portion of the front air channel 70. Similar air inlet openings could be formed in the flange 48 along the bottom of the door, but the preferred embodiment of the present invention has a series of large slots 82 formed in the lower portion of the intermediate door panel 38 such that the cooling air entering the bottom of the door through the inlet openings 76 enter the second air channel 72 through the slots 82 to provide two parallel paths of air streaming up through the door structure.

Attention is directed to FIG. 2 along the lower edge of the front window pane 60. In this area the lower edge 86 of the window opening 68 of the intermediate door panel 38 is formed away from the lower edge of the window pane 60 to form an air gap 88 which will create an air bleed section to bleed relatively cool air from the front air channel 70 such that this cool air will hug the inner surface of the window pane 60 as it flows upwardly through the air channel 72 until it discharges from the air outlet openings 78 in the top flange 48. Of course, this assists in holding down the maximum temperature of the front window pane 60.

Additional cooling action is provided for the outer door panel 36 in the area above the window pane 30 by the location of secondary air inlet openings 92 in the top section of the rearwardly turned flange 58 of the window pane 60 in the outer door panel. Thus, relatively cool air is able to pass through these secondary air inlet openings 92 and mix with the air rising up through the air channel 70 and then to pass out through the air gap 94 formed between the shortened or scalloped top section of the flange 46 of the outer door panel 36 and the top section of the flange 48 of the intermediate door panel 38, as is best seen at the top of FIG. 2. This air gap 94 also serves as air outlet openings similar in function to the slots 78.

The remainder of the oven door 20, which is the innermost half of the door as seen in FIG. 2, is somewhat of standard construction as it has been used before in self-cleaning oven construction. However, certain of the design details to the inner half of the door will be described in order to give a complete understanding of the environment in which the present invention is used. The inner door liner 40 is also of shallow pan configuration due to the presence of a front turned flange 100 which is adapted to telescope within the mating flange 48 of the intermediate door panel 38. The inner door liner 40 also includes a generally rectangular plug-like outward embossment 102 of such size as to fit closely within a recessed front frame 104 of the oven body 16. The box-like oven liner 18 has a front opening that is circumscribed by a front flange 106, which bears against the peripheral edge of the recessed front frame in which the oven liner is mounted. The inner panel 42, that was mentioned earlier, is likewise of shallow pan configuration having a slight front-turned peripheral flange 108. A door gasket 110 of woven fiber glass is sandwiched under the edge of the flange 108 and it extends almost entirely around the periphery of the inner panel 42, although it is not designed to have a butt joint. The free ends of the gasket are usually stopped short of each other to create a controlled air gap for the admission of a slight amount of air into the oven cavity during the self-cleaning cycle. For a better understanding of the nature of a conventional door gasket, reference may be made to the patent of Clarence Getman U.S. Pat. No. 3,119,020, which is also assigned to the assignee of the present invention. Another alternative is to form a door gasket 110 as a continuous gasket but to have it of open weave design which would allow a controlled amount of air to enter the oven cooking cavity during the self-cleaning oven cycle when the oven door is latched shut. Notice that this door gasket 110 is adapted to bear against the front flange 106 of the oven liner and to form a good sealing action for the purpose intended.

The inner door liner 40 is furnished with a window opening that is defined by a front-turned flange 114. Moreover the inner panel 42 has a window opening defined by the front turned flange 116. A double window pack of module 118 is mounted to the inner panel 42 by means of spaced brackets 122 and 123. An asbestos woven fiber glass gasket 126 is held between the innermost window pane 128 and the tapered flange 116 to seal against moisture and greases passing into the interior of the door. This double window module 118 has the inner window pane 128 and a second window pane 132. These two panes are joined in a subassembly or module by means of a peripheral spacer frame 134.
which separates the panes as well as provide a sealing means such that there is a dead air space 136 formed between the two window panes. This module is clamped together by means of an outer channel frame 138 that encircles the periphery of the two window panes and prevents them from being separated. While a double window module is illustrated it will be understood by those skilled in this art that additional window panes could be added without departing from the scope of the present invention. Moreover, heat reflective coatings may be applied to the inner surfaces of the three window panes 60, 128 and 132 in order to further restrict the heat losses from the oven cooking cavity.

Thermal insulation 142 such as fiber glass is shown filling the interior of the inner panel 42. Moreover, a layer of thermal insulation 144 is positioned within the inner door liner 40 in the area surrounding the double window module 118. A plain sheet metal insulation guard 146 is fastened within the inner door liner 40 by means of spaced brackets 148 so as to hold the fiber glass layer 144 in place. This insulation guard 146 also serves as one wall of the second vertical air channel 72. This insulation guard 146 also has a window opening defined by a rearwardly turned flange 150 so as to obstruct viewing through the three window panes 60, 128 and 132.

A movable radiation shield or shutter 152 of unanodized aluminum is located within the second vertical air channel 72 so that in a raised position it serves to block the window opening for use during the self-cleaning oven cycle and in a lowered position it may be shifted into the lower half of the door 20 so that it is out of sight. Such a radiation shield or shutter 152 is best understood from the description given in the U.S. Pat. No. 3,311,106 of Howard Baughman and Kermit Keeling, Sr., which is also assigned to the assignee of the present invention.

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

I claim:

1. A windowed oven door comprising an outer door panel, intermediate door panel positioned behind and spaced from the outer door panel, an inner door liner and an inner panel carried by the inner door liner, a multiple pane window module supported within the inner panel and the inner door liner, at least one window pane supported by the outer door panel, thermal insulation means combined within the inner panel and inner door liner in the area surrounding the said window module, the said intermediate door panel having a window opening substantially coinciding with the said window panes for allowing viewing, the intermediate door panel having a rearwardly facing peripheral flange at least along the two sides and the top edge of the door, the outer door panel having a rearwardly facing peripheral flange at least along the two sides of the door which overlies the adjacent flange of the intermediate door panel, and air entrance openings arranged along the bottom edge of the door and air outlet openings arranged in the top portion of the peripheral flange of the intermediate door panel, whereby room air may pass up through the door passing both sides of the intermediate door panel before exiting from the top of the door.

2. A windowed oven door as recited in claim 1 wherein the said outer door panel has a shortened rearwardly turned peripheral flange along the top edge of the door which is not exposed to the flow from the air outlet openings in the flange of the intermediate door panel and forms an additional air outlet means between the flange of the outer door panel and the intermediate door panel.

3. A windowed oven door as recited in claim 2 wherein the upward air flow behind the intermediate door panel is relatively hot while the upward air flow in front of the intermediate door panel is relatively cool, the said window opening in the intermediate door panel being closely positioned with respect to the window pane of the outer door panel to separate the hot air flow behind the intermediate door panel from the cool air flow in front of the intermediate door panel, and an air gap formed between the intermediate door panel and the lower edge of the window pane of the outer door panel so as to bleed off some of the cool air to flow up the inner surface of the said window pane.

4. A windowed oven door as recited in claim 3 wherein the said inner door liner has a rearwardly facing peripheral flange that telescopes within the peripheral flange of the intermediate door panel, and means for spacing apart the peripheral flanges of the outer door panel, the intermediate door panel and the inner door liner to form thermal breaks therebetween and restrict the maximum temperature of the said outer door panel.

5. A windowed oven door as recited in claim 1 wherein the said inner door liner has a rearwardly facing peripheral flange that telescopes within the peripheral flange of the intermediate door panel, and means for spacing apart the peripheral flanges of the outer door panel, the intermediate door panel and the inner door liner to form thermal breaks therebetween and restrict the maximum temperature of the said outer door panel.

6. A windowed oven door as recited in claim 2 wherein the said window opening of the intermediate door panel is substantially sealed with respect to the said outer window pane so as to separate the air flows in front of and behind the intermediate door panel.

7. A windowed oven door as recited in claim 6 with secondary air inlet openings in the outer door panel adjacent the upper edge of the outer window pane for introducing additional room air into the air channel in front of the intermediate door panel in the area above the window so as to reduce the temperature of the upper section of the outer door panel.

* * * * *