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Nuss

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[54] **OVEN DOOR WITH AIR COOLING SYSTEM**

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[73] Assignee: **General Electric Company**, Louisville, Ky.

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[52] **U.S. Cl.** **126/198**; 126/200

[51] **Int. Cl.** **F23n 7/00**

[58] **Field of Search** 126/198, 200

[56] **References Cited**

UNITED STATES PATENTS

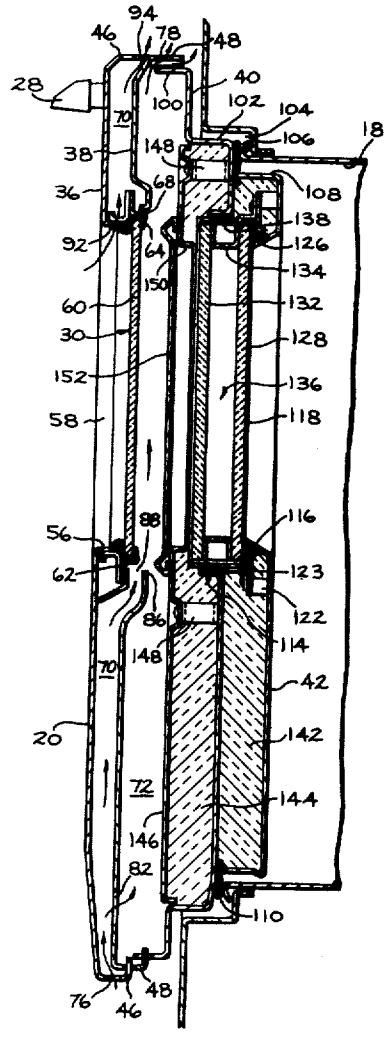
3,717,138	2/1973	Upp	126/200
3,760,792	9/1973	White	126/198
3,818,890	6/1974	Evans et al.	126/198

Primary Examiner—Carroll B. Dority, Jr.
Assistant Examiner—Larry I. Schwartz

[57] **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



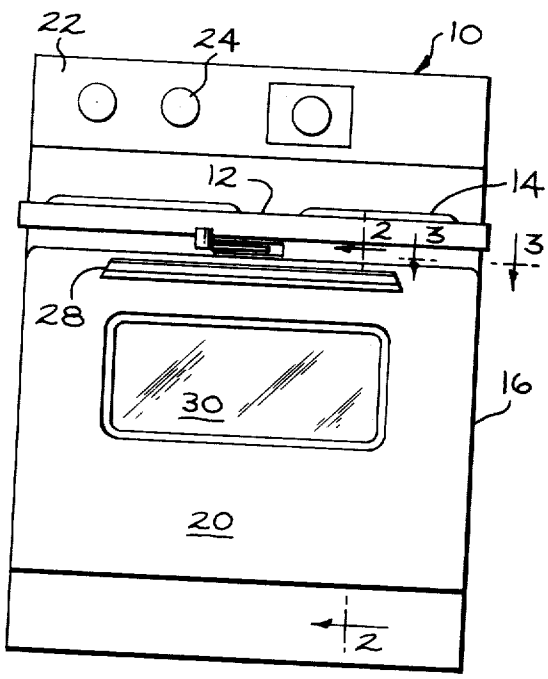


FIG.1

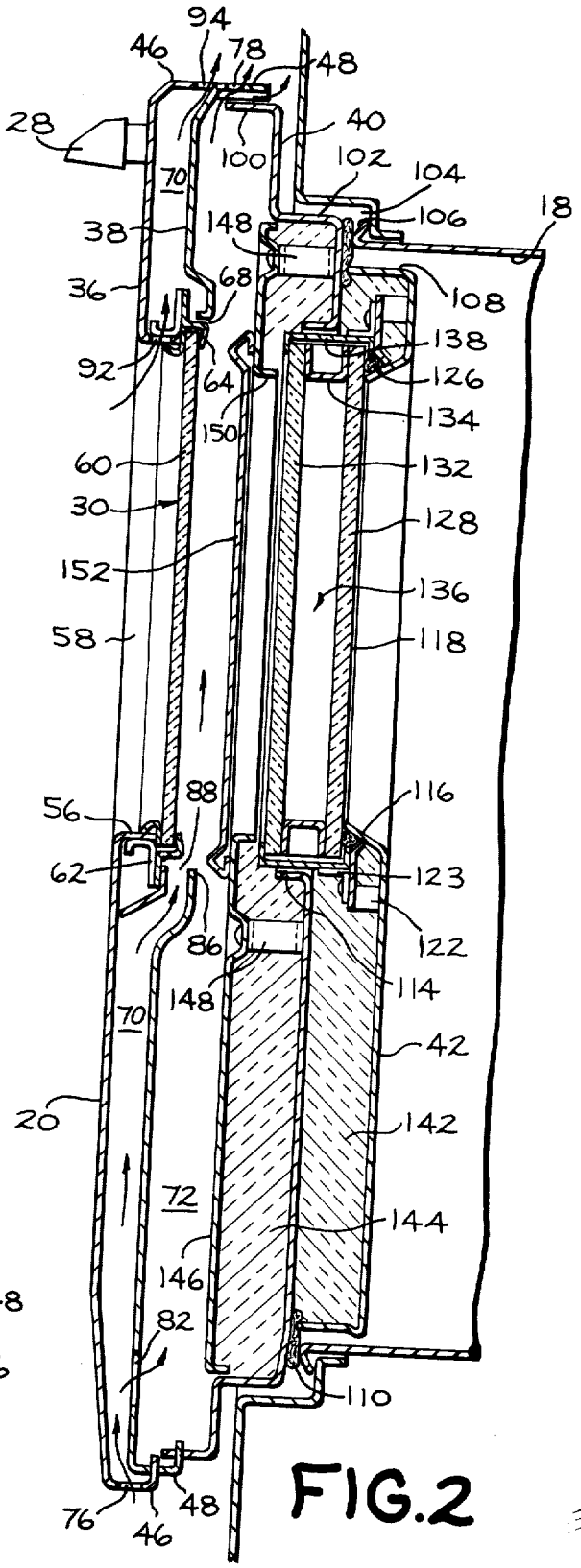


FIG.2

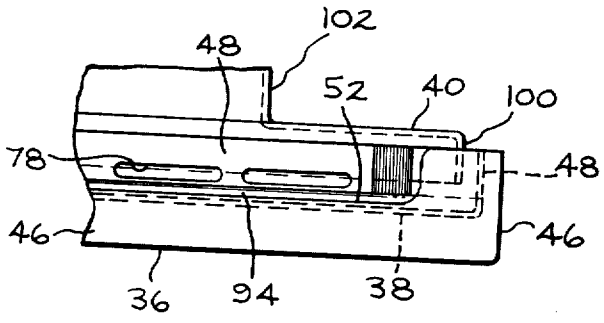


FIG.3

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 movable 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 channel, where the intermediate door panel shields the outer door panel from the higher temperature on the innermost parts 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 elevational view of a domestic range having an oven door embodying the present invention.

FIG. **2** is a cross-sectional, side elevational 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 will readily be 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 diagramatically, 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 along 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 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 bleedoff 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 **30** by the location of secondary air inlet openings **92** in the top section of the rearwardly turned flange **58** of the window opening **56** 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 constructions. However, certain of the design details of 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. **3,189,020**, 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 or 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 not 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 is 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 overn 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 forwardly 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 forwardly 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.

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