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(54) **HEATING ASSEMBLY FOR AN OVEN APPLIANCE**

(71) Applicant: **Haier US Appliance Solutions, Inc.**, Wilmington, DE (US)

(72) Inventor: **Stephen Bernard Froelicher**, Shepherdsville, KY (US)

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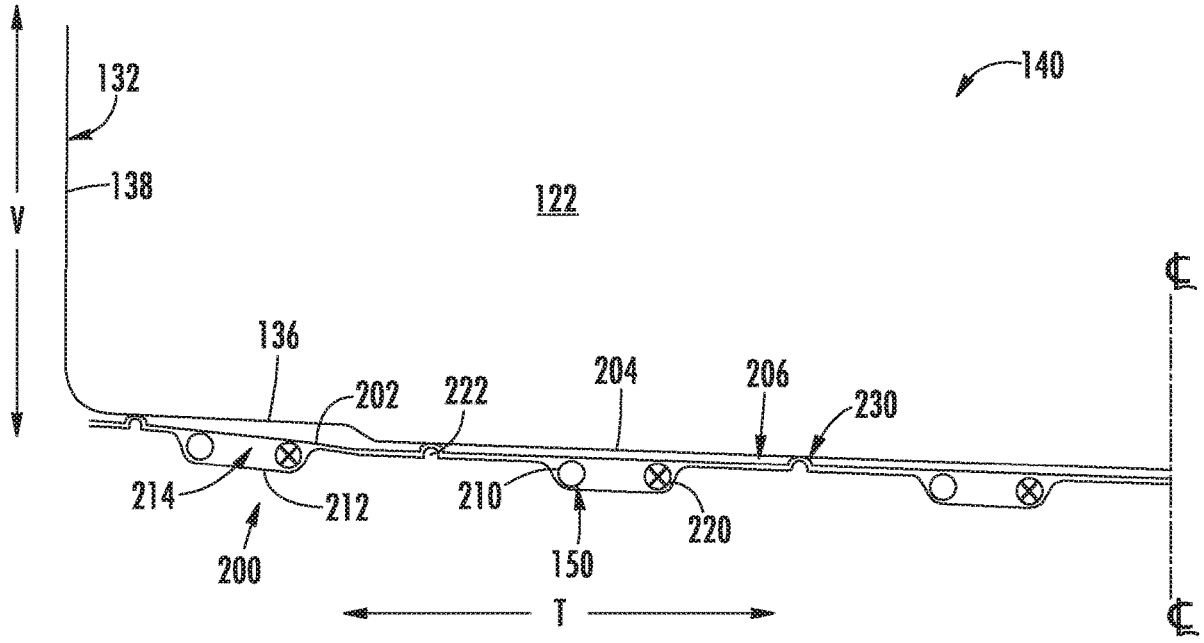
(57) **ABSTRACT**

An oven appliance includes a cooking chamber positioned within a cabinet and being defined at least in part by a chamber wall. A heating assembly is positioned outside the cooking chamber for heating the cooking chamber. The heating assembly includes a first plate and a second plate joined together to define a heater cavity containing a heating element. The first plate is spaced apart from the chamber wall to define an airgap therebetween.



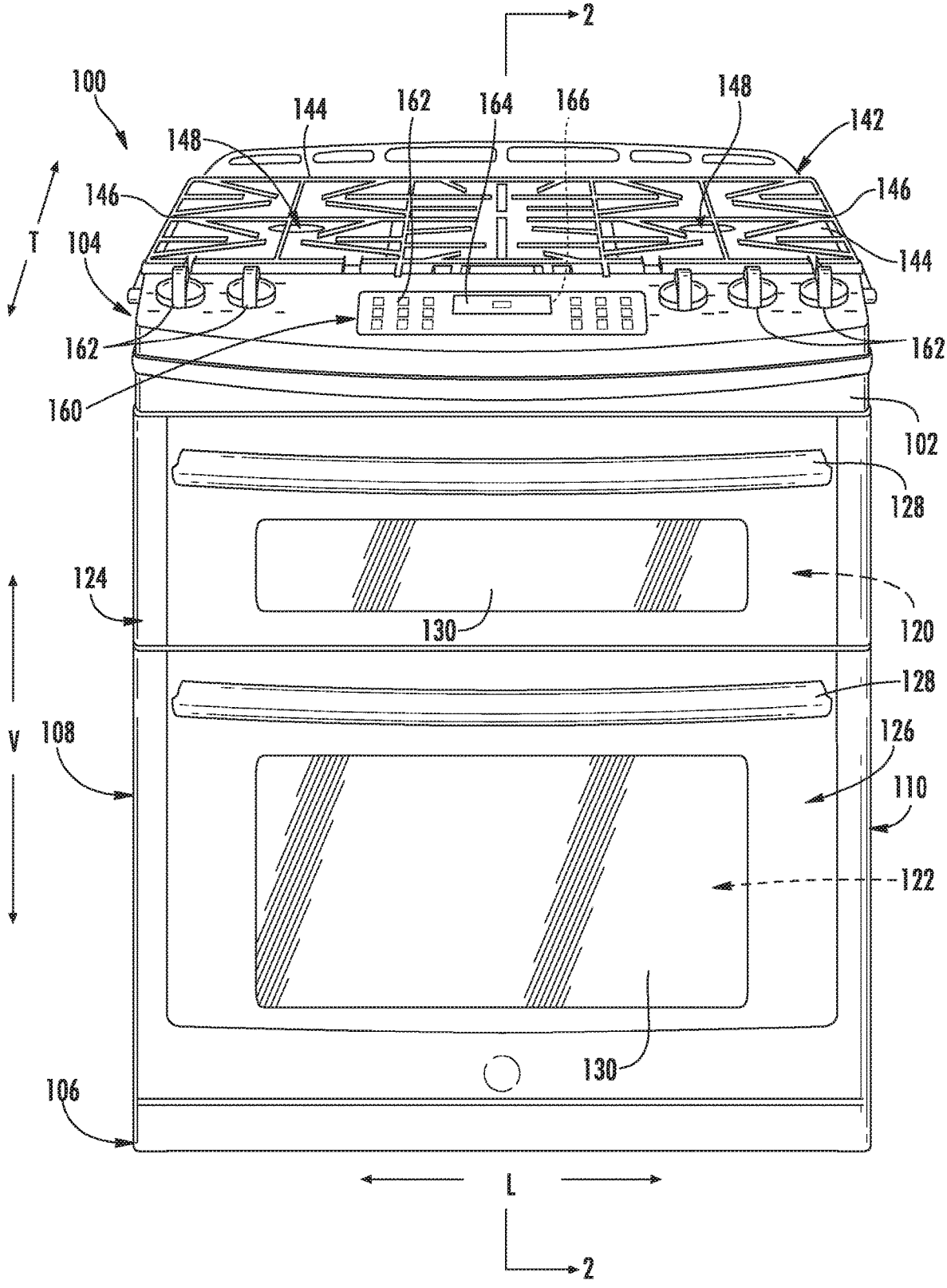

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FIG. 1

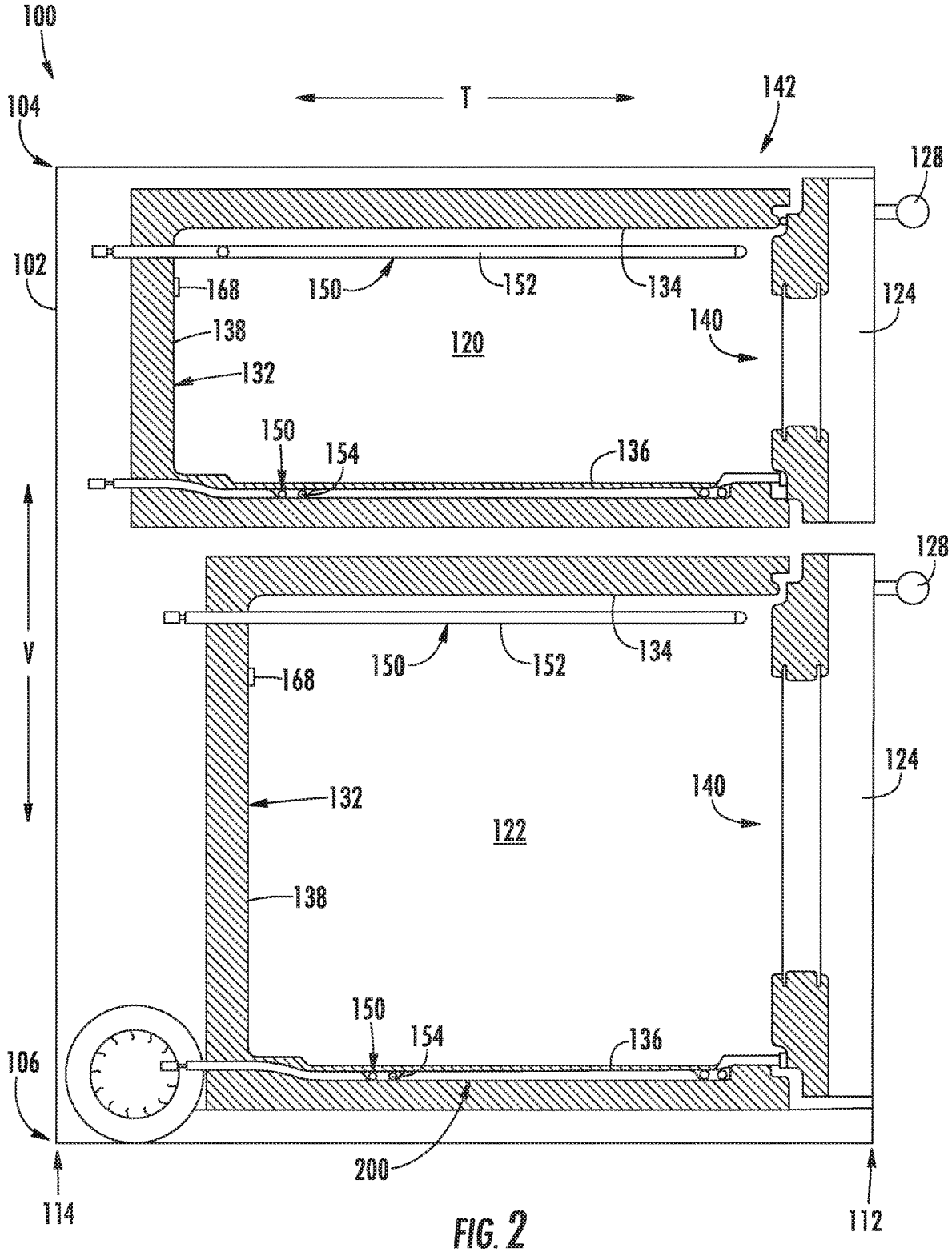
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FIG. 2

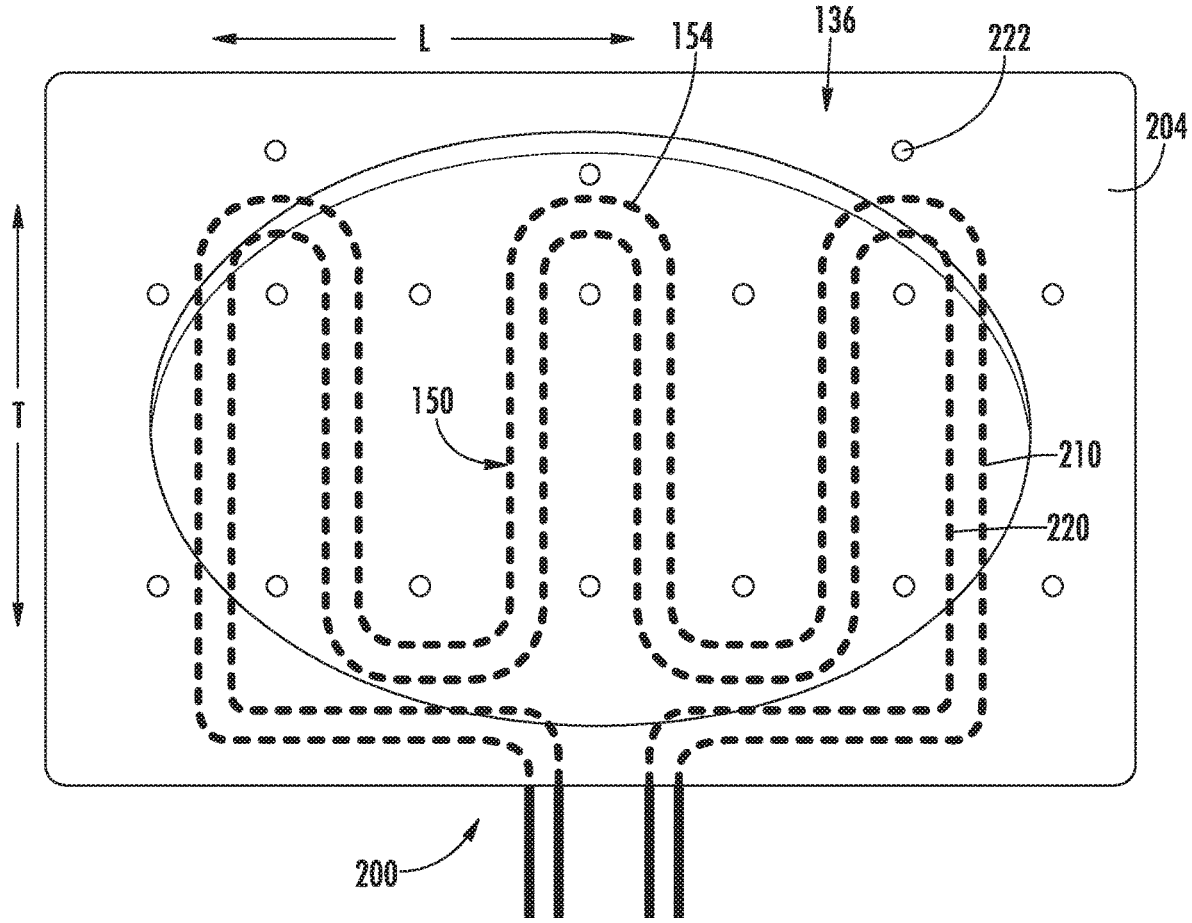
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FIG. 3

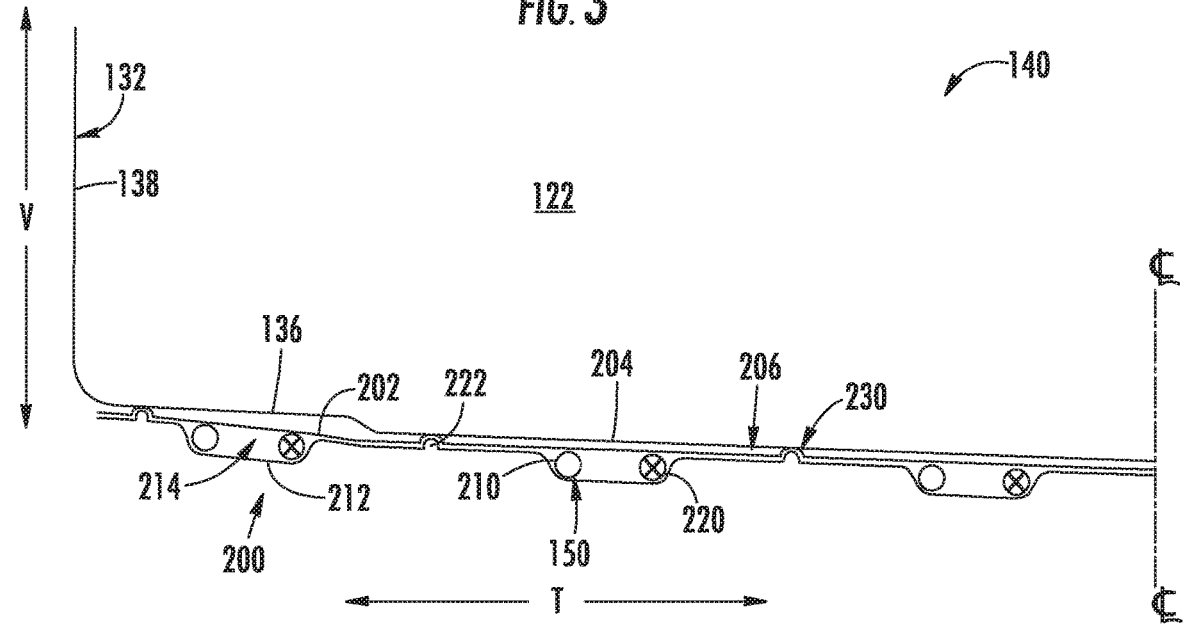
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FIG. 4

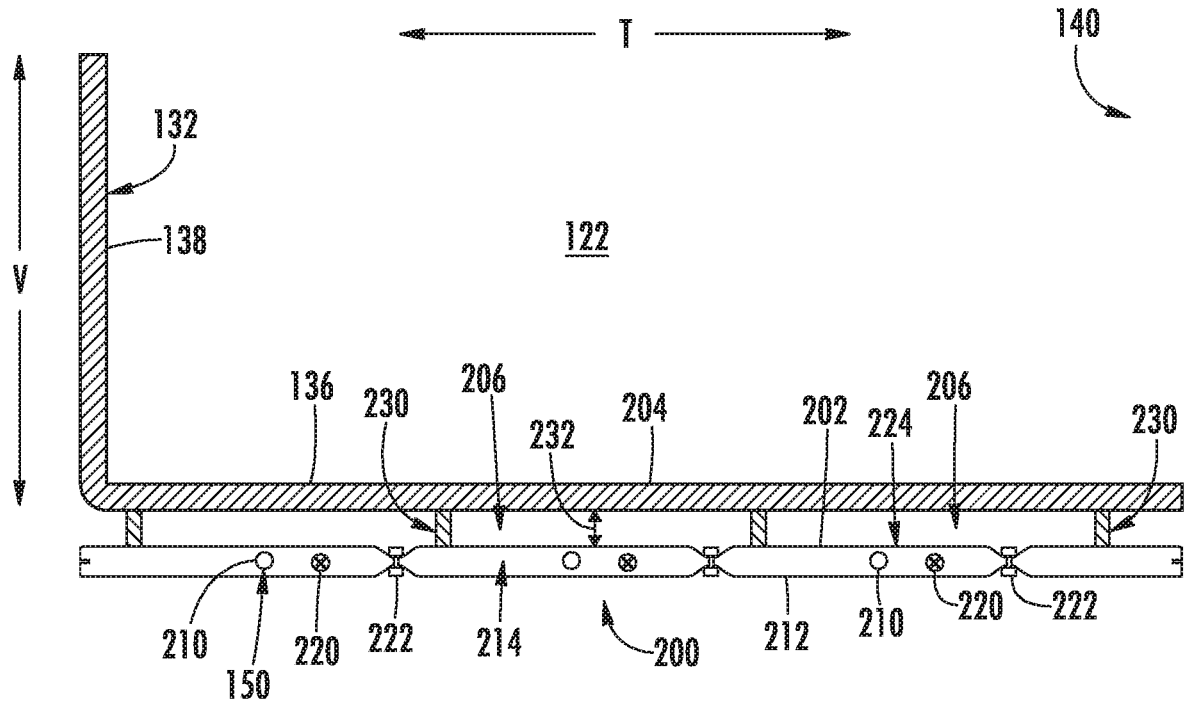
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FIG. 5

HEATING ASSEMBLY FOR AN OVEN APPLIANCE

FIELD OF THE INVENTION

[0001] The present subject matter relates generally to oven appliances, and more particularly, to heating assemblies of an oven appliance.

BACKGROUND OF THE INVENTION

[0002] Conventional residential and commercial oven appliances generally include a cabinet that includes a cooking chamber for receipt of food items for cooking. Multiple gas or electric heating elements are positioned within the cabinet for heating the cooking chamber to cook food items located therein. The heating elements can include, for example, a bake heating assembly positioned at a bottom of the cooking chamber and/or a separate broiler heating assembly positioned at a top of the cooking chamber.

[0003] Conventional heating elements may be positioned just outside of the cooking chamber within a heater cavity, e.g., to provide a larger cooking chamber and to facilitate easier cleaning of the oven. For example, a typical bake heating element is positioned underneath a bottom wall of the cooking chamber. However, positioning such heating elements immediately adjacent the bottom chamber wall may result in hot spots near the heating elements. Because the chamber walls must typically be maintained below a threshold temperature, the ability to heat the cooking chamber is limited by these hot spots, even though other portions of the chamber wall are much cooler. Thus, as a result of the direct exposure of the bottom chamber wall to the heating element, lower preheat power levels are necessitated, resulting in longer preheat times and customer dissatisfaction.

[0004] Accordingly, an oven appliance and heating assemblies that may improve preheat times are desirable. More particularly, a heating assembly that can provide higher watt density of thermal energy to the cooking chamber over the entire chamber wall for reduced preheat times would be particularly beneficial.

BRIEF DESCRIPTION OF THE INVENTION

[0005] Aspects and advantages of the invention will be set forth in part in the following description, or may be apparent from the description, or may be learned through practice of the invention.

[0006] In a first example embodiment, an oven appliance is provided defining a vertical, a lateral, and a transverse direction. The oven appliance includes a cabinet extending between a top and a bottom along the vertical direction, a cooking chamber positioned within the cabinet and being defined at least in part by a chamber wall, and a heating assembly positioned outside the cooking chamber for heating the cooking chamber. The heating assembly includes a first plate spaced apart from the chamber wall to define an airgap therebetween and a heating element positioned adjacent the first plate opposite from the airgap.

[0007] In a second example embodiment, a heating assembly for heating a cooking chamber defined at least in part by a chamber wall is provided. The heating assembly includes a first plate spaced apart from the chamber wall to define an airgap therebetween and a heating element positioned adjacent the first plate opposite from the airgap.

[0008] These and other features, aspects and advantages of the present invention will become better understood with reference to the following description and appended claims. The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and, together with the description, serve to explain the principles of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] A full and enabling disclosure of the present invention, including the best mode thereof, directed to one of ordinary skill in the art, is set forth in the specification, which makes reference to the appended figures.

[0010] FIG. **1** is a front, perspective view of an oven appliance according to an exemplary embodiment of the present subject matter.

[0011] FIG. **2** is a cross sectional view of the exemplary oven appliance of FIG. **1**, taken along Line **2-2** in FIG. **1**.

[0012] FIG. **3** is a top view of a bottom wall of a cooking chamber of the exemplary oven appliance of FIG. **1**.

[0013] FIG. **4** is a side cross sectional view of a heating assembly that may be used with the exemplary oven appliance of FIG. **1** according to an exemplary embodiment of the present subject matter.

[0014] FIG. **5** is a close up cross sectional view of the exemplary heating assembly of FIG. **4**.

[0015] Repeat use of reference characters in the present specification and drawings is intended to represent the same or analogous features or elements of the present invention.

DETAILED DESCRIPTION

[0016] Reference now will be made in detail to embodiments of the invention, one or more examples of which are illustrated in the drawings. Each example is provided by way of explanation of the invention, not limitation of the invention. In fact, it will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the scope or spirit of the invention. For instance, features illustrated or described as part of one embodiment can be used with another embodiment to yield a still further embodiment. Thus, it is intended that the present invention covers such modifications and variations as come within the scope of the appended claims and their equivalents.

[0017] As used herein, the terms "first," "second," and "third" may be used interchangeably to distinguish one component from another and are not intended to signify location or importance of the individual components. The terms "includes" and "including" are intended to be inclusive in a manner similar to the term "comprising." Similarly, the term "or" is generally intended to be inclusive (i.e., "A or B" is intended to mean "A or B or both"). In addition, it should be appreciated that as used herein, terms of approximation, such as "approximately," "substantially," or "about," refer to being within a ten percent margin of error.

[0018] FIG. **1** provides a front, perspective view of an oven appliance **100** as may be employed with the present subject matter. Oven appliance **100** generally defines a vertical direction V, a lateral direction L, and a transverse direction T, each of which is mutually perpendicular, such that an orthogonal coordinate system is generally defined. As illustrated, oven appliance **100** includes an insulated cabinet **102**. Cabinet **102** of oven appliance **100** extends

between a top **104** and a bottom **106** along the vertical direction V, between a first side **108** (left side when viewed from front) and a second side **110** (right side when viewed from front) along the lateral direction L, and between a front **112** and a rear **114** along the transverse direction T.

[0019] Within cabinet **102** is an upper cooking chamber **120** and a lower cooking chamber **122** configured for the receipt of one or more food items to be cooked. Thus, oven appliance **100** is generally referred to as a double oven range appliance. However, as will be understood by those skilled in the art, oven appliance **100** is provided by way of example only, and the present subject matter may be used in any suitable cooking appliance. Thus, the present subject matter may be used with other oven appliances such as wall ovens, electric ovens, gas ovens, microwave ovens, etc. In addition, the example embodiment shown in FIG. **1** is not intended to limit the present subject matter to any particular cooking chamber configuration or arrangement.

[0020] Oven appliance **100** includes an upper door **124** and a lower door **126** rotatably attached to cabinet **102** in order to permit selective access to upper cooking chamber **120** and lower cooking chamber **122**, respectively. Handles **128** are mounted to upper and lower doors **124** and **126** to assist a user with opening and closing doors **124** and **126** in order to access cooking chambers **120** and **122**. As an example, a user can pull on handle **128** mounted to upper door **124** to open or close upper door **124** and access upper cooking chamber **120**. Doors **124**, **126** may include windows **130**, constructed for example from multiple parallel glass panes to provide for viewing the contents of and insulating the insulated cooking chambers **120**, **122**.

[0021] As illustrated, each of insulated cooking chambers **120**, **122** are defined by a plurality of chamber walls, identified generally herein by reference numeral **132**. For example, insulated cooking chambers **120**, **122** each include a top wall **134** and a bottom wall **136** which are spaced apart along the vertical direction V. A left sidewall and a right sidewall extend between the top wall **134** and bottom wall **136**, and are spaced apart along the lateral direction L. A rear wall **138** may additionally extend between the top wall **134** and the bottom wall **136** as well as between the left sidewall and the right sidewall, and is spaced apart from doors **124**, **126** along the transverse direction T. In this manner, when doors **124**, **126** are in the closed position, cooking cavities are defined, and a front opening **140** is defined for each cooking chamber **120**, **122**, e.g., proximate front **112** of oven appliance **100**.

[0022] Referring to FIG. **1**, oven appliance **100** also includes a cooktop **142**. Cooktop **142** is positioned at or adjacent top **104** of cabinet **102**. Thus, cooktop **142** is positioned above upper cooking chamber **120** and includes a top panel **144** positioned proximate top **104** of cabinet **102**. By way of example, top panel **144** may be constructed of glass, ceramics, enameled steel, and combinations thereof. One or more grates **146** are supported on a top surface of top panel **144** for supporting cooking utensils, such as pots or pans, during a cooking process. As shown in FIG. **1**, oven appliance **100** may include a plurality of burners assemblies **148** mounted within or on top of top panel **144** underneath grates **146**, and such burner assemblies **148** can be configured in various sizes so as to provide e.g., for the receipt of cooking utensils (i.e., pots, pans, etc.) of various sizes and configurations and to provide different heat inputs for such cooking utensils.

[0023] Referring now specifically to FIG. **2**, oven appliance **100** may include various heating elements **150**, such as electric resistance heating elements, gas burners, microwave heating elements, halogen heating elements, electric tubular heaters (e.g., such as Calrod® heaters), or suitable combinations thereof. Heating elements **150** are positioned in thermal communication with upper cooking chamber **120** and lower cooking chamber **122** for heating upper cooking chamber **120** and lower cooking chamber **122**.

[0024] Specifically, an upper heating element **152** (also referred to as a broil heating element, electric burner, or gas burner) may be positioned in cabinet **102**, e.g., at a top portion of cooking chambers **120**, **122**, and a lower heating element **154** (also referred to as a bake heating element, electric burner, or gas burner) may be positioned proximate a bottom portion of cooking chambers **120**, **122**. Upper heating element **152** and lower heating element **154** may be used independently or simultaneously to heat cooking chambers **120**, **122**, perform a baking or broil operation, perform a cleaning cycle, etc. The size and heat output of heating elements **152**, **154** can be selected based on, e.g., the size of oven appliance **100** or the desired heat output. Oven appliance **100** may include any other suitable number, type, and configuration of heating elements **150** within cabinet **102** and/or on cooktop **142**. For example, oven appliance **100** may further include electric heating elements, induction heating elements, or any other suitable heat generating device.

[0025] One or more baking racks (not shown) may be positioned in insulated cooking chambers **120**, **122** for the receipt of food items or utensils containing food items. The baking racks may be slidably received onto embossed ribs or sliding rails such that the baking racks may be conveniently moved into and out of insulated cooking chamber **120**, **122** when doors **124**, **126** are open.

[0026] A user interface panel **160** is located within convenient reach of a user of the oven appliance **100**. For this example embodiment, user interface panel **160** includes knobs **162** that are each associated with one of heating elements **150**. In this manner, knobs **162** allow the user to activate each heating element **150** and determine the amount of heat input provided by each heating element **150** to a cooking food items within cooking chamber **120** or on cooktop **142**. Although shown with knobs **162**, it should be understood that knobs **162** and the configuration of oven appliance **100** shown in FIG. **1** is provided by way of example only. More specifically, user interface panel **160** may include various input components, such as one or more of a variety of touch-type controls, electrical, mechanical or electro-mechanical input devices including rotary dials, push buttons, and touch pads. User interface panel **160** may also be provided with one or more graphical display devices or display components **164**, such as a digital or analog display device designed to provide operational feedback or other information to the user such as e.g., whether a particular heating element **150** is activated and/or the rate at which the heating element **150** is set.

[0027] Generally, oven appliance **100** may include a controller **166** in operative communication with user interface panel **160**. User interface panel **160** of oven appliance **100** may be in communication with controller **166** via, for example, one or more signal lines or shared communication busses, and signals generated in controller **166** operate oven appliance **100** in response to user input via user input

devices **162**. Input/Output ("I/O") signals may be routed between controller **166** and various operational components of oven appliance **100** such that operation of oven appliance **100** can be regulated by controller **166**. In addition, controller **166** may also be communication with one or more sensors, such as temperature sensor **168** (FIG. **2**), which may be used to measure temperature inside cooking chamber **120** and provide such measurements to the controller **166**. Although temperature sensor **168** is illustrated at a top and rear of cooking chamber **120**, it should be appreciated that other sensor types, positions, and configurations may be used according to alternative embodiments.

[0028] Controller **166** is a "processing device" or "controller" and may be embodied as described herein. Controller **166** may include a memory and one or more microprocessors, microcontrollers, application-specific integrated circuits (ASICS), CPUs or the like, such as general or special purpose microprocessors operable to execute programming instructions or micro-control code associated with operation of oven appliance **100**, and controller **166** is not restricted necessarily to a single element. The memory may represent random access memory such as DRAM, or read only memory such as ROM, electrically erasable, programmable read only memory (EEPROM), or FLASH. In one embodiment, the processor executes programming instructions stored in memory. The memory may be a separate component from the processor or may be included onboard within the processor. Alternatively, controller **166** may be constructed without using a microprocessor, e.g., using a combination of discrete analog and/or digital logic circuitry (such as switches, amplifiers, integrators, comparators, flip-flops, AND gates, and the like) to perform control functionality instead of relying upon software.

[0029] Although aspects of the present subject matter are described herein in the context of a double oven appliance including a cooktop, it should be appreciated that oven appliance **100** is provided by way of example only. In this regard, the present subject matter is not limited to any particular style, model, or configuration of oven appliance **100**. For example, other oven or range appliances having different configurations, different appearances, and/or different features may also be utilized with the present subject matter as well, e.g., single ovens, electric cooktop ovens, gas cooktops ovens, etc. Moreover, aspects of the present subject matter may be used in any other consumer or commercial appliance where it is desirable to efficiently heat a cooking chamber.

[0030] Referring now generally to FIGS. **2** through **5**, a heating assembly **200** which may be used to heat cooking chambers **120**, **122** of oven appliance **100** will be described according to an exemplary embodiment of the present subject matter. Specifically, according to the illustrated embodiment, oven appliance **100** may include two heating assemblies **200**, each being placed in thermal communication with one of upper cooking chamber **120** and lower cooking chamber **122**. In general, heating assemblies **200** are illustrated as low-profile bake assemblies (replacing lower heating elements **154**), but could alternatively replace upper heating elements **152** or may be configured in any other suitable manner within other appliance **100**. The exemplary embodiment described herein is not intended to limit the scope of the present subject matter in any manner.

[0031] Referring for example to heating assembly **200** positioned below lower cooking chamber **122**, e.g., outside lower cooking chamber **122** beneath bottom wall **136** along the vertical direction V. Heating assembly **200** generally includes an upper plate or a first plate **202** which is spaced apart from chamber wall **204** (e.g., bottom wall **136**) to define an airgap **206** therebetween. In addition, heating assembly **200** includes a heating element **210** (e.g., such as lower heating element **154**) which is positioned adjacent to first plate **202** opposite from airgap **206**. In other words, first plate **202** and airgap **206** are positioned between chamber wall **204** and heating element **210**. As explained in more detail below, airgap **206** serves to distribute heat generated by a heating element **210**.

[0032] As used herein, the term "airgap" is intended to refer to an open space defined between chamber wall **204** and first plate **202**. Airgap **206** generally contains no appliance components or features, leaving a substantially open space through which air may circulate to distribute heat generated by heating elements **210**. However, it should be appreciated that airgap **206** may include various features for directing air or spreading the flow of heat within airgap **206**, such as baffles, flow guiding features, or other components. In addition, although airgap **206** is illustrated as a passive thermal distribution system, active air flow features may be used according to alternative embodiments. In this regard, for example, one or more fans may be used to circulate air within airgap **206**.

[0033] As shown, heating assembly **200** may further include a lower plate or a second plate **212** that is coupled to first plate **202** to define a heater cavity **214**. As illustrated, heating element **210** is positioned with in heater cavity **214**. In addition to heating element **210**, heating assembly **200** may further include a service heater **220** that is also positioned within heater cavity **214**. Service heater **220** may be identical to heating element **210** (e.g., may be a heating element **150**) but is not hooked up, powered, or otherwise energized for producing heat unless and until heating element **210** fails. If heating element **210** fails, a repair technician may disconnect heating element **210** and can connect service heater **222** to a power source and/or controller **166**, which may then operate service heater **220** as a redundant backup to the inoperative heating element **210**.

[0034] According to exemplary embodiments, first plate **202** and second plate **212** are upper and lower plates that extend substantially along the entire width and depth of chamber wall **204**, e.g., bottom wall **136**. First plate **202** and second plate **212** may be riveted or otherwise fastened together to define heater cavity **214** for receiving heating element **210** and/or service heater **220**. Specifically, when assembled, first plate **202** and second plate **212** may extend between rear wall **138** and front opening **140** along the transverse direction T, and along the lateral direction L between a first side wall and a second side wall of lower cooking chamber **122** (or any other suitable cooking chamber). First plate **202** and second plate **212** may be fastened together in any suitable manner. For example, according to the illustrated embodiment, first plate **202** and second plate **212** are joined using one or more fastening joints or rivets **222**. By contrast according to alternative embodiments, first plate **202** and second plate **212** may be joined using any other suitable mechanical fastener, by welding, or may be a single sheet of metal that is bent or otherwise formed to define heater cavities **214**.

[0035] First plate **202** and second plate **212** may be constructed from any suitable material and may have any

suitable size and configuration for improving the distribution of heat energy along the entire chamber wall **204**. For example, according to the illustrated embodiment, first plate **202** and second plate **212** are formed from aluminized steel to provide good heat conduction. In addition, according to exemplary embodiments, first plate **202** and second plate **212** may include a coating **224** that minimizes transfer of heat through thermal infrared radiation. For example, such coating **224** may be an aluminum ceramic paint or another low infrared emitting coating or plating.

[0036] Heating assembly **200** may further include standoff features **230** which are defined on first plate **202** or on chamber wall **204** for defining airgap **206**. Specifically, according to the illustrated embodiment, standoff features **230** are simple metal brackets that extend from first plate **202** toward chamber wall **204** and seat against the chamber wall **204** to maintain a constant airgap **206**. Alternatively, rivets **222** may be formed such that they have an extension or otherwise protrude from first plate **202** to define airgap **206**.

[0037] As illustrated, airgap **206** may define a gap size (e.g. identified herein by reference numeral **232**, see FIG. **5**) which is substantially constant along an entire width and depth of chamber wall **204**. In this regard, airgap **206** extends along the transverse direction T between rear wall **138** in front opening **140** and along the lateral direction L between a first side wall and a second side wall of cooking chamber **122**. According to exemplary embodiments, gap size **232** may be less than about 20 millimeters, less than 10 millimeters, or less than 5 millimeters. Alternatively, gap size **232** may be greater than 1 mm, greater than 3 millimeters, or greater than 5 millimeters. In addition, although airgap **206** is illustrated herein as having a constant gap size **232**, it should be appreciated that according to alternative embodiments, gap size **232** may vary a long a width and depth of chamber wall **204**.

[0038] As described above, heating assembly **200** includes features for efficiently distributing thermal energy from heating elements **210** along an entire width and depth of chamber wall **204**. In this regard, first plate **202** and second plate **212** facilitate improved conduction away from heating elements **210** along a width and depth of plates **202**, **212**. In addition, first plate **202** minimizes direct radiant energy onto chamber wall **204**. Furthermore, airgap **206** provides for homogenization of air heated by heating elements **210**. Thus, hot air may circulate within airgap **206** to provide uniform heating to chamber wall **204**. In this manner, heating elements **210** may be operated at a higher power relative to conventional heating elements, due in part to the uniform heating and the elimination of hotspots which would otherwise limit the maximum heating power. Thus, while maintaining acceptable watt density, the total thermal power crossing chamber wall **204** may increase, preheat times may be reduced, and user satisfaction may be improved.

[0039] This written description uses examples to disclose the invention, including the best mode, and also to enable any person skilled in the art to practice the invention, including making and using any devices or systems and performing any incorporated methods. The patentable scope of the invention is defined by the claims, and may include other examples that occur to those skilled in the art. Such other examples are intended to be within the scope of the claims if they include structural elements that do not differ from the literal language of the claims, or if they include equivalent structural elements with insubstantial differences from the literal languages of the claims.

What is claimed is:

1. An oven appliance defining a vertical, a lateral, and a transverse direction, the oven appliance comprising:
- a cabinet extending between a top and a bottom along the vertical direction;
- a cooking chamber positioned within the cabinet and being defined at least in part by a chamber wall; and
- a heating assembly positioned outside the cooking chamber for heating the cooking chamber, the heating assembly comprising:
  - a first plate spaced apart from the chamber wall to define an airgap therebetween; and
  - a heating element positioned adjacent the first plate opposite from the airgap.

2. The oven appliance of claim **1**, wherein the heating assembly comprises:
- standoff features defined on the first plate for seating against the chamber wall and defining the airgap.

3. The oven appliance of claim **1**, wherein the airgap defines a gap size that is substantially constant along the entire chamber wall.

4. The oven appliance of claim **1**, wherein the airgap extends in the transverse direction between a rear wall and a front opening of the cooking chamber, and in the lateral direction between a first side wall and a second side wall of the cooking chamber.

5. The oven appliance of claim **1**, wherein the heating assembly further comprises:
- a second plate coupled to the first plate to define a heater cavity, the heating element being positioned within the heater cavity.

6. The oven appliance of claim **5**, wherein the heating assembly further comprises:
- a service heater positioned within the heater cavity adjacent the heating element.

7. The oven appliance of claim **5**, wherein the first plate and the second plate are joined by one or more fastening joints.

8. The oven appliance of claim **1**, wherein the first plate is constructed from aluminized steel and the chamber wall is constructed from enameled steel.

9. The oven appliance of claim **1**, wherein the first plate comprises a coating that minimizes transfer of heat through thermal infrared radiation.

10. The oven appliance of claim **9**, wherein the coating is an aluminum ceramic paint or other low infrared emitting coating or plating.

11. The oven appliance of claim **1**, wherein the chamber wall is a bottom wall of the cooking chamber.

12. The oven appliance of claim **1**, wherein the cooking chamber is a lower cooking chamber and the heating assembly is a lower heating assembly, the oven appliance further comprising:
- an upper cooking chamber positioned within the cabinet above the lower cooking chamber and being defined in part by an upper chamber wall; and
- an upper heating assembly positioned outside the upper cooking chamber for heating the upper cooking chamber, the upper heating assembly comprising:
  - a third plate spaced apart from the upper chamber wall to define an airgap therebetween;

an upper heating element positioned adjacent the third plate opposite from the airgap; and

a fourth plate coupled to the third plate to define a second heater cavity, the upper heating element being positioned within the second heater cavity.

13. The oven appliance of claim **1**, wherein the heating element is a calrod heater.

14. The oven appliance of claim **1**, wherein the heating element is a low profile heating element.

15. A heating assembly for heating a cooking chamber defined at least in part by a chamber wall, the heating assembly comprising:

a first plate spaced apart from the chamber wall to define an airgap therebetween; and

a heating element positioned adjacent the first plate opposite from the airgap.

16. The heating assembly of claim **15**, further comprising:

standoff features defined on the first plate for seating against the chamber wall and defining the airgap.

17. The heating assembly of claim **15**, further comprising:

a second plate coupled to the first plate to define a heater cavity, the heating element being positioned within the heater cavity.

18. The heating assembly of claim **17**, wherein the first plate and the second plate are joined by one or more fastening joints.

19. The heating assembly of claim **15**, wherein the first plate is constructed from aluminized steel and the chamber wall is constructed from enameled steel.

20. The heating assembly of claim **15**, wherein the chamber wall is a bottom wall of the cooking chamber.

* * * * *