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(54) Title: COOKING APPLIANCE USING THIN-FILM HEATING ELEMENT

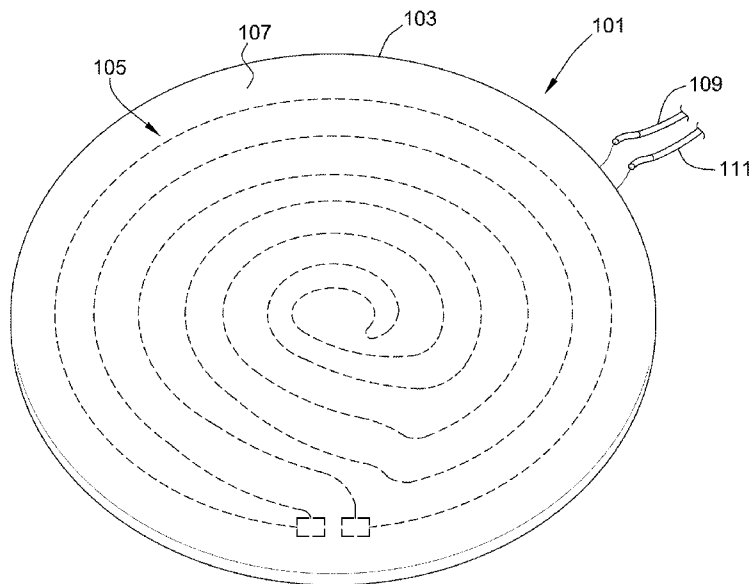


FIG. 1

(57) Abstract: In a cooking appliance and method for baking a food product, the appliance has a generally solid plate member, a first heating element disposed above the solid plate member in spaced relationship therewith and a thin-film heating element coupled to the solid plate member.





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COOKING APPLIANCE USING THIN-FILM HEATING ELEMENT**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] This application claims the benefit of U.S. Provisional Application No. 61/980,468 filed April 16, 2014, which is incorporated herein in its entirety.

BACKGROUND

[0002] The present invention relates generally to cooking appliances used for baking foods such as crusted foods, and more particularly to cooking appliances that include one or more thin-film heating elements.

[0003] Cooking appliances such as portable or tabletop cooking appliances that are used for baking crusted-type foods, e.g., breads, pizzas, calzones, and the like, are well known. Typically, such cooking appliances include a heat source and a flat stone or ceramic plate - often referred to as a pizza stone - on which the food to be baked is placed and subjected to heating by the heat source. The pizza stone has a high thermal mass to evenly and efficiently distribute heat over the pizza stone, and thus to the food being baked.

[0004] One drawback associated with using a pizza stone is that the pizza stone typically requires a long preheat time. Thus, while the heat generated by the heat source of the cooking appliance may be at a desired temperature for baking the food to be baked, the pizza stone may not be. As a result, the top of the food may be baked to a desired finish, while the bottom or crust of the food is undercooked.

[0005] Other types of cooking appliances, such as broilers, tabletop grills, and outdoor grills, may also require a relatively long preheat time. There is a need, therefore, for a cooking appliance that allows for faster heating or preheating for cooking food products.

SUMMARY

[0006] In one embodiment, a cooking appliance generally comprises a generally solid plate member, a first heating element disposed above the solid plate member in spaced relationship therewith, and a thin-film heating element coupled to the solid plate member.

[0007] In another embodiment, A method for baking a food product generally comprises supplying current to a first heating element of a cooking appliance to generate heat from the heating element. Current is supplied to a thin-film heating element separate from the first heating element, the thin-film heating element coupled to a solid plate member to initiate heating of the solid plate member, the first heating element being positioned above the solid plate member in spaced relationship therewith. A food product to be baked is placed on the solid plate member.

[0008] In another embodiment, a cooking appliance generally comprises a bottom unit, and a top unit hingedly coupled to the bottom unit, wherein at least one of the bottom unit and the top unit includes a thin-film heating element.

BRIEF DESCRIPTION

[0001] Figure 1 is a bottom view of a baking plate in accordance with one embodiment of the present disclosure;

[0002] Figure 2 is a schematic illustration of the baking plate of Figure 1 showing an embedded heating element;

[0003] Figure 3 is a schematic illustration of the baking plate of Figure 1 showing another embodiment of an embedded heating element;

[0004] Figure 4 is a perspective view of a cooking appliance in accordance with one embodiment of the present disclosure;

[0005] Figure 5 is a front view thereof;

[0006] Figure 6 is a front view of the cooking appliance of Figure 5 with a housing of the cooking appliance in an opened position;

[0007] Figure 7 is a bottom view of a top heating element of the cooking appliance of Figure 4;

[0008] Figure 8 is a top view of a baking plate of the cooking appliance of Figure 4;

[0009] Figure 9 is a top view of a heating element of the baking plate of Figure 8;

[0010] Figure 10 is a perspective view of another embodiment of a cooking appliance;

[0011] Figure 11 is a side view of the cooking appliance of Figure 10;

[0012] Figure 12 is an exploded view of the cooking appliance of Figure 10;

[0013] Figure 13 is a perspective view of an upper housing of the cooking appliance of Figure 10;

[0014] Figure 14 is a perspective view of a core insert for the upper housing of the cooking appliance of Figure 10;

[0015] Figure 15 is a top perspective view of a baking plate of the cooking appliance of Figure 10;

[0016] Figure 16 is a front view of the baking plate of Figure 15;

[0017] Figure 17 is a side view of the baking plate of Figure 15;

[0018] Figure 18 is a cross-section taken in the plan of line 18-18 of Figure 16; and

[0019] Figure 19 is a perspective view of one embodiment of a cooking appliance that incorporates thin-film heating elements.

[0020] Figure 20 is a perspective view of another embodiment of a cooking appliance that incorporates thin-film heating elements.

[0021] Figures 21-23 are perspective view of another embodiment of a cooking appliance that incorporates thin-film heating elements.

[0022] Figure 24 is a schematic view of a portion of the cooking appliance shown in Figures 21-23.

[0023] Figure 25 is a perspective view of another embodiment of a cooking appliance that incorporates thin-film heating elements.

[0024] Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

DETAILED DESCRIPTION

[0025] With reference now to the drawings and in particular to Figs. 1 and 2, a baking plate according to one embodiment of the present disclosure is generally indicated at 101. The baking plate 101, as disclosed herein, is intended for use with a cooking appliance used for baking crusted-type foods such as breads, pizza, calzones, and other foods that are typically baked on a baking tray in a conventional oven. In a particular embodiment, the cooking appliance is a portable or tabletop cooking appliance having a heating source to apply heat to the food to be baked. The baking plate 101 comprises a generally solid plate member 103 and a heating element 105 at least in part embedded within the plate member 103. While one or more segments of the heating element 105 are visible in Fig. 1, it is understood that the heating element may be entirely enclosed within the plate member 103 and otherwise not visible from the exterior of the plate member.

[0026] The plate member 103 of the baking plate 101 is suitably constructed of a high insulative material, such as, without limitation, ceramic, clay, stone, glass, concrete, brick, porcelain, or other suitable high insulative material. The illustrated plate member 103 is generally circular, such as in the form that is commonly referred to as

a pizza stone. However, it is understood that the plate member 103 may be other than circular without departing from the scope of this disclosure.

[0027] The heating element 105, according to one embodiment, is an electrically conductive wire and in one particular embodiment is a nichrome wire that is arranged in a continuous pattern within the plate member 103. For example, Fig. 2 illustrates one embodiment of a pattern formed by a wire 107 that defines the heating element 105. The wire 107 includes a pair of terminals 109, 111 at the edge margin of the plate member 103 for connection with a suitable source of electrical current. The wire 107 is arranged to form a plurality of circular winds 113 spaced radially from each other and from the edge margin of the plate member 103 toward the center thereof. In an alternative embodiment, illustrated in Fig. 3, the wire 107 is arranged to have an outermost circular wind 113 and a zig-zag pattern 115 within the outermost wind. In yet another alternative embodiment, the heating element 105 is a calrod heating element.

[0028] It is understood that in other embodiments the wire 107 may be arranged within the plate member 103 in any suitable pattern that covers a substantial area of the plate member. The wire 107 according to one embodiment may have a length (e.g., as measured from one terminal 109 to the other terminal 111) in the range of about 100 inches to about 140 inches. However, the length of the wire 107 may be less than or greater than this range, and may vary depending on the overall size or surface area of the plate member 103. It is also contemplated that more than one wire 107 may be used to

define the heating element 105 without departing from the scope of this disclosure.

[0029] Figs. 4-9 illustrate one embodiment of a cooking appliance, generally indicated at 200, for baking crusted-type foods. The cooking appliance 200 is illustrated in a mock-up assembly of representative components including a baking plate 201 constructed in accordance with the present disclosure. In particular, with reference to Figs. 4-6, the cooking appliance is an oven-type cooking appliance including a base panel 208 and a housing 206 removably positionable relative to the base panel such that the housing and base panel together define an interior space of the cooking appliance. The baking plate 201 is seated on the base panel within the interior space of the cooking appliance when the housing is closed over the base panel. The housing 206 may be hinged to the base panel 208 or may be completely separable from the base panel.

[0030] It is understood that the oven-type cooking appliance 200 may be configured other than as illustrated in Figs. 4-7. For example, the cooking appliance 200 may be configured as a front-loading oven (e.g., in the manner of what is typically referred to as a toaster-oven), or with a base unit supporting the base panel elevated above the surface (e.g., counter-top) on which the appliance sits, or other suitable configuration.

[0031] As illustrated in Figs. 6 and 7, an upper heating system 240 includes a pair of heating elements 242 held by the housing 206 for disposition above the baking plate 201. While not shown in the drawings, one or more reflectors may be mounted on the housing 206 for reflecting

heat from the heating elements 242 downward within the interior space toward the baking plate 201.

[0032] The baking plate 201, with particular reference to Figs. 6, 8 and 9, is substantially the same as the baking plate 101 of Fig. 1 in that it comprises a generally circular solid plate member 203 and a heating element 205. For illustrative purposes, the heating element 205 is shown as being arranged on a pad P that is placed beneath the plate member. However, in practice, the heating element is embedded in the plate member as illustrated in Fig. 1. The heating element of this embodiment is a wire 207 arranged in the pattern illustrated in Fig. 2. It is understood, however, that the wire 207 may be arranged in the pattern illustrated in Fig. 3 or in any other suitable pattern. It is also understood that more than one wire 207 may be used to define the embedded heating element without departing from the scope of this invention. The heating element 205 is electrically connected at its terminals 209, 211 to a source of electrical current - which in one embodiment is the same source of electrical current to which the upper heating system 240 is electrically connected.

[0033] In operation, before food is placed in the cooking appliance 200, the appliance is turned on to supply current to the upper heating system 240 as well as to the heating element 205 of the baking plate 201. In this manner, the plate member 203 of the baking plate 201 is brought up to a desired temperature more rapidly along with the air temperature (e.g., due to the upper heating system 240) in the interior space of the appliance. The food to be baked is then placed on the upper surface of the baking plate. In one embodiment, the heating element 205 of the baking plate 201

may be controlled to reduce or terminate heating of the plate member 203 after a predetermined time period, or after a threshold temperature of the interior space and/or the plate member is reached. In other embodiments, the heating element 205 may be maintained at constant heating for the entire cooking period of the food to be baked.

[0034] Figures 10-18 schematically illustrate another embodiment of a cooking appliance, generally indicated at 300, for baking crusted-type foods. In particular, the cooking appliance 300 of this embodiment is an open broiler-type cooking appliance including a baking plate 301 constructed in accordance with the present disclosure. As illustrated in Figs. 10 and 11, the cooking appliance 300 of this embodiment comprises a top unit (indicated generally by 302) and a bottom unit (indicated generally by 304) that are connected together via a hinge 306. The top unit 302, with reference to Figs. 12-14 includes a housing 308 and a core insert (indicated generally by 312 in Fig. 14) disposed within the housing 308. As illustrated in Fig. 13, the housing 318 includes a top wall 316, a first end wall 318, a second end wall 320, a first side wall 322, and a second side wall 324 that together define an interior space 326 sized to receive the core insert 312 (Fig. 14).

[0035] The core insert 312 is suitably configured for attachment to the top housing 308 within the interior space 326. The core insert 312 includes a frame 338, a reflector 340, and at least one top heating element 342. The frame 338 has a top wall 344, a first end wall 346, a second end wall 348, a first side wall 350, and a second side wall 352 that define a cavity 354 in which the reflector 340 and the top heating element(s) 342 are disposed. The walls 346, 348,

350, and 352 have a receiving mechanism for receiving and retaining the reflector 340 and the top heating element(s) 342 therein. Notably, in other embodiments, the top unit 302 may not include the frame 338 but, rather, the top housing 308 may perform the function of supporting the reflector 340 and/or the top heating element(s) 342 in the manner set forth herein. The illustrated top heating elements 342 are suitably quartz-type heating elements formed as a substantially linearly extending tube. However, it is understood that the top heating elements 342 may be any known heating elements other than quartz-type heating elements and remain within the scope of this disclosure.

[0036] Referring back to Figs. 10-12 the bottom unit 304 includes a bottom housing 310 and the baking plate 301 supported by the bottom housing. The bottom housing 310 may have at least one leg (or stand) 334 configured such that, when the appliance 300 is seated on a surface such as a counter-top, the baking plate 301 is oriented generally level or otherwise parallel to the counter-top. As illustrated in Figs. 12 and 15-18, the baking plate 301 has a pair of handles 336 connected thereto, and the handles 336 are configured to interface with the bottom housing 310 to facilitate detachable connection (e.g., magnetic connection) of the baking plate with the bottom housing. This allows the baking plate 301 to be removable from the bottom housing 310 for cleaning or replacement.

[0037] As in the previous embodiments, the baking plate 301 includes a plate member 303 and a heating element 305 (Fig. 18) at least in part embedded in the plate member. In this embodiment, the plate member 303 is generally rectangular in shape but is otherwise constructed in any

manner described above in connection with baking plate 301 of Figs. 10-12. The heating element 305 is suitably a wire 307 of similar construction to the wire 107 of the baking plate 101 of Figs. 1-3. As illustrated in Fig. 18, the wire 307 is arranged with an outer circumferential wind 366 and a serpentine pattern 368 within the outer circumferential wind. The wire 307 is electrically connected at terminals 309, 311 to a suitable source of current such as the same current source to which the top heating elements 342 are electrically connected.

[0038] With reference back to Figs. 11 and 12, the hinge 306 enables the top unit 302 to be pivoted relative to the bottom unit 304 between a raised position for loading food to be baked onto the baking plate 301 and a lowered position for baking the food on the baking plate. The hinge 306 is suitably configured to allow the top unit 302 to be adjustably positioned relative to the bottom unit 304 along a direction D to a desired height above the baking plate 301 to accommodate foods of different thicknesses to be baked on the baking plate.

[0039] In some embodiments, a thin-film heating element is utilized. As used herein, a thin-film heating element refers to an electrically conductive material (e.g., a conductive film) deposited on a substrate for heating the substrate. The heating element is said to be a "thin-film" heating element in the sense that the substrate and the electrically conductive material have a collective thickness that is only marginally greater than the substrate itself (i.e., the material forms a thin film on the substrate).

[0001] The thin-film heating element may include, for example, a metal oxide (e.g., tin oxide) resistive film bounded on opposing edges by electrical bus bars or wires. The bus bars or wires may connect to a controller and power source to run current through the resistive film to generate heat. Specifically, by applying a voltage between the bus bars or wires, current flows through the resistive film, heating the resistive film and the substrate on which the resistive film is deposited. Using a thin-film heating element improves power efficiency, heating uniformity, and speed of heating. Further, the thinness and conductive heat directionality of a thin-film heating element also permit a cooking appliance, such as a toaster, to have a thinner profile.

[0002] Fig. 19 is a perspective view of a cooking appliance 1900 that incorporates thin-film heating elements. Specifically, the cooking appliance 1900 includes a top unit 1902 hingedly coupled to a bottom unit 1904. The top unit 1902 includes a first thin-film heating element 1906 coupled to a first electrically insulating substrate 1908 (e.g., ceramic glass), and the bottom unit 1904 includes a second thin-film heating element 1910 coupled to a second electrically insulating substrate 1912. Each thin-film heating element 1906 and 1910 includes a resistive film 1920 extending between a first bus bar 1922 and a second bus bar 1924. In this embodiment, the resistive film 1920 of each thin-film heating element 1906 and 1910 is sputter coated onto the respective substrate 1908 and 1912. Thin-film heating elements 1906 and 1910 may each have an output power of approximately 1500 Watts.

[0003] A thin-film heating element may also be implemented, for example, in the cooking appliance 200 (shown in Figs. 2-9). For instance, instead of embedding a heating element in the baking plate 201, a thin-film heating element could be used to heat the baking plate 201. To evenly heat the baking plate 201, the resistive film can be applied to a top surface and/or a bottom surface of the baking plate 201.

[0004] Alternatively, or additionally, a thin-film heating element may be used to replace the heating elements 242 in the upper heating system 240. Notably, the resistive film may be substantially transparent. Accordingly, in one embodiment, at least a top portion of the housing 206 is made of a transparent material (e.g., ceramic glass) such that a user can look through the top portion and the resistive film to observe a food product during cooking.

[0005] Thin-film heating elements may also be implemented in the cooking appliance 300 (shown in Figs. 10-12). For example, a thin-film heating element can be used to heat baking plate 301. Alternatively, or additionally, heating elements 342 may be replaced with a thin-film heating element.

[0006] Fig. 20 is a perspective view of another example cooking appliance 2000 that incorporates thin-film heating elements. Similar to cooking appliance 1900 (shown in Fig. 19), cooking appliance 2000 includes a top unit 2002 hingedly coupled to a bottom unit 2004. The top unit 2002 includes a first thin-film heating element 2006 coupled to a first electrically insulating substrate 2008 (e.g., ceramic glass), and the bottom unit 2004 includes a second thin-film heating element 2010 coupled to a second electrically

insulating substrate 2012. Each thin-film heating element 2006 and 2010 includes a resistive film 2020 extending between a first bus bar 2022 and a second bus bar 2024. In this embodiment, the resistive film 2020 of each thin-film heating element 2006 and 2010 is sputter coated onto the respective substrate 2008 and 2012. The thin-film heating elements 2006 and 2010 may each have an output power of approximately 1500 Watts.

[0007] In the embodiment shown, the thin-film heating elements 2006 and 2010 are substantially planar. Alternatively, the heating elements 2006 and 2010 may have any suitable shape. For example, ribs (i.e., substantially parallel bars) may be formed on the heating elements 2006 and 2010 to facilitate forming sear marks on cooked food products. Notably, in this embodiment, the second thin-film heating element 2010 and substrate 2012 form a non-scratch surface. Accordingly, once a food product is cooked using the cooking appliance 2000, the food product may be cut while resting on the bottom unit 2004.

[0008] The cooking appliance 2000 also includes a drip tray 2030 that may be removably coupled to bottom unit 2004. When a food product is cooked in the cooking appliance 2000, the drip tray 2030 collects grease or oil emitted from the food product during cooking. Notably, the cooking appliance 2000 has a relatively slim profile. Further, because of the thin-film heating elements 2006 and 2010, the cooking appliance 2000 may heat up faster than at least some known cooking appliances. Further, the thin-film heating elements 2006 and 2010 cook food products using a combination of infrared and conduction cooking. The cooking appliance

2000 may be powered using direct current (DC) power or alternating current (AC) power.

[0009] Figs. 21-23 are perspective views of another example cooking appliance 2100 that incorporates one or more thin-film heating elements. The cooking appliance 2100 is a broiler that includes a top unit 2102 rotatably coupled to a bottom unit 2104. A handle 2106 coupled to the top unit 2102 facilitates rotating the top unit 2102 relative to the bottom unit 2104. The bottom unit 2104 includes at least one input device 2107 (e.g., a control knob) for controlling the temperature within the cooking appliance 2100. The bottom unit 2104 also includes indicators 2108 (e.g., LEDs) that may indicate, for example, when the cooking appliance 2100 is on and when the interior of the cooking appliance 2100 is hot or has reached a desired temperature.

[0010] The cooking appliance 2100 includes a lower heating element 2110 and an upper heating element 2112. In this embodiment, the lower heating element 2110 is a Nichrome heating element having a ribbed or grill-shaped configuration, and the upper heating element 2112 is a thin-film heating element. Alternatively, the upper and lower heating elements 2110 and 2112 may be any type of heating element that enables the cooking appliance 2100 to function as described herein.

[0011] Fig. 24 is a schematic diagram of a portion of the top unit 2102. Specifically, top unit 2102 includes the thin-film heating element 2112 positioned between an upper substrate 2120 (e.g., ceramic glass) and a lower substrate 2122 (e.g., ceramic glass). Heat generated by the thin-film heating element 2112 radiates downward, through the lower

substrate 2122. Notably, the heat generated by the thin-film heating element 2112 is substantially unidirectional, and little to no heat generated by the thin-film heating element 2122 is radiated upward, through the upper substrate 2120. The upper substrate 2120 prevents a user from accidentally coming in contact with the thin-film heat element 2122 during operation.

[0012] The thin-film heating element 2112 includes a resistive film 2124 extending between first and second bus bars (not shown in Fig. 24). To heat the resistive film 2124, a voltage is applied between the first and second bus bars, causing current to be conducted through the resistive film 2124. In this embodiment, the resistive film 2124 of the thin-film heating element 2112 is sputter coated onto the lower substrate 2122.

[0013] Notably, the thin-film heating element 2112, the upper substrate 2120, and the lower substrate 2122 are substantially transparent. Accordingly, as seen in Figs. 21-23, during cooking, a user may view the food product inside of the cooking appliance 2100 by looking through the top unit 2102. This allows a user to view the food product without needing to open the cooking appliance 2100, which would generate in a loss of heat within the cooking appliance 2100.

[0014] Because of the thin-film heating element 2112, the cooking appliance 2100 may heat up faster than at least some known cooking appliances, and may also provide improved thermal recovery and temperature stabilization. Further, the thin-film heating element 2112 cooks food products using a combination of infrared and conduction cooking. Moreover, because the food product cooked within the cooking appliance

2100 is not squeezed between the lower heating element 2110 and the upper heating element 2112, the food product may retain more moisture during cooking as opposed to if the food product was cooked in at least some known cooking appliances. The cooking appliance 2100 may be powered using direct current (DC) power or alternating current (AC) power.

[0015] Fig. 25 is a perspective view of another example cooking appliance 2500 that incorporates one or more thin-film heating elements. The cooking appliance 2500 is an outdoor grill that includes a top unit 2502 rotatably coupled to a bottom unit 2504. A handle (not shown) may be coupled to the top unit 2502 facilitates rotating the top unit 2502 relative to the bottom unit 2504.

[0016] As shown in Fig. 25, a grill plate 2510 rests in the bottom unit 2504. In this embodiment, the grill plate 2510 includes a thin-film heating element 2512 for cooking food placed on the grill plate 2510. Similar to the embodiments described above, the thin-film heating element 2512 includes a resistive film applied to a substrate (e.g., ceramic glass) and extending between two bus bars (none shown in Fig. 25). In this embodiment, the resistive film may be applied to the underside of the substrate such that the heat generated is radiated upward through the substrate. Further, the substrate and/or resistive film may have perforations defined therethrough that allow grease or oil emitted from the food product during cooking to fall through the grill plate 2510.

[0017] Thin-film heating elements may also be implemented in the cooking appliance 300 (shown in Figs. 10-12). For example, a thin-film heating element can be used to

heat baking plate 301. Alternatively, or additionally, heating elements 342 may be replaced with a thin-film heating element.

[0018] In some embodiments, a user may control cooking appliances 200, 300, 1900, 2000, 2100, and 2500 using a computing device (e.g., a tablet, a desktop computer, a laptop computer, a mobile phone, etc.), where the computing device communicates remotely with the cooking appliance over a wired and/or wireless network, such as the Internet, or any other communications medium (e.g., Bluetooth®). For example, the user may use a software application on a computing device that enables the user to set a cooking time, where the input is communicated from the computing device to the cooking appliance. Further, the cooking appliance may communicate information to the computing device (e.g., remaining cook time) to notify the user.

[0019] When introducing elements of the present invention or the preferred embodiment(s) thereof, the articles "a", "an", "the", and "said" are intended to mean that there are one or more of the elements. The terms "comprising", "including", and "having" are intended to be inclusive and mean that there may be additional elements other than the listed elements.

[0020] As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

WHAT IS CLAIMED IS:

1. A cooking appliance comprising:
 - a generally solid plate member;
 - a first heating element disposed above the solid plate member in spaced relationship therewith; and
 - 5 a thin-film heating element coupled to the solid plate member.
2. The cooking appliance of claim 1 wherein the solid plate member is constructed of at least one of: ceramic, clay, stone, glass, concrete, brick, porcelain, or the like.
3. The cooking appliance of claim 1 wherein the first heating element comprises an additional thin-film heating element.
4. The cooking appliance of claim 3 wherein the additional heating element is coupled to a substantially transparent substrate.
5. The cooking appliance of claim 1 wherein the thin-film heating element comprises a resistive film extending between a pair of electrical bus bars.
6. The cooking appliance of claim 5 wherein the resistive film is coupled to a top surface of the solid plate member.
7. The cooking appliance of claim 5 wherein the resistive film is coupled to a bottom surface of the solid plate member.
8. The cooking appliance of claim 1 wherein the cooking appliance further comprises a bottom housing, the solid plate member being supported by the bottom housing and providing a

heatable cooking surface, and a top housing, the first
5 heating element being supported by the top housing.

9. The cooking appliance of claim 8 wherein the top
housing is configurable between a raised position and a
lowered cooking position, the first heating element being
spaced from the solid plate member in the lowered cooking
5 position of the top housing.

10. A method for baking a food product, the method
comprising:

supplying current to a first heating element of a
cooking appliance to generate heat from the heating element;

5 supplying current to a thin-film heating element
separate from the first heating element, the thin-film
heating element coupled to a solid plate member to initiate
heating of the solid plate member, the first heating element
being positioned above the solid plate member in spaced
10 relationship therewith; and

placing a food product to be baked on the solid plate
member.

11. The method of claim 10 further comprising adjusting
a height of the first heating element above the solid plate
member at least in part as a function of the size of the food
to be baked by the cooking appliance.

12. The method of claim 10 further comprising encasing
the solid plate member and thin-film heating element within a
housing of the cooking appliance.

13. The method of claim 10 further comprising one of
reducing or terminating operation of the thin-film heating
element independent of operation of the first heating
element.

14. The method of claim 10 wherein supplying current to a first heating element comprises supplying current to an additional thin-film heating element.

15. A cooking appliance comprising:

a bottom unit; and

a top unit hingedly coupled to the bottom unit, wherein at least one of the bottom unit and the top unit comprises a
5 thin-film heating element.

16. The cooking appliance of claim 15, wherein the bottom unit comprises a first thin-film heating element, and wherein the top unit comprises a second thin-film heating element.

17. The cooking appliance of claim 16, wherein each of the first and second thin-film heating elements comprises a resistive film extending between a pair of electrical bus bars.

18. The cooking appliance of claim 16 wherein at least one of the first and second thin-film heating elements is coupled to an electrically insulating substrate.

19. The cooking appliance of claim 18 wherein at least one of the first and second thin-film heating elements is sputter coated onto the electrically insulating substrate.

20. The cooking appliance of claim 15, wherein the top unit comprises a substantially transparent thin-film heating element coupled to a substantially transparent substrate, the substantially transparent thin-film heating element and
5 the substantially transparent substrate forming a window that enables a user to view a food product placed in the cooking appliance.

21. The cooking appliance of claim 15, wherein the bottom unit comprises a perforated grill plate comprising the thin-film heating element.

22. The cooking appliance of claim 15, wherein the cooking appliance is a broiler.

23. The cooking appliance of claim 15, wherein the cooking appliance is an outdoor grill.

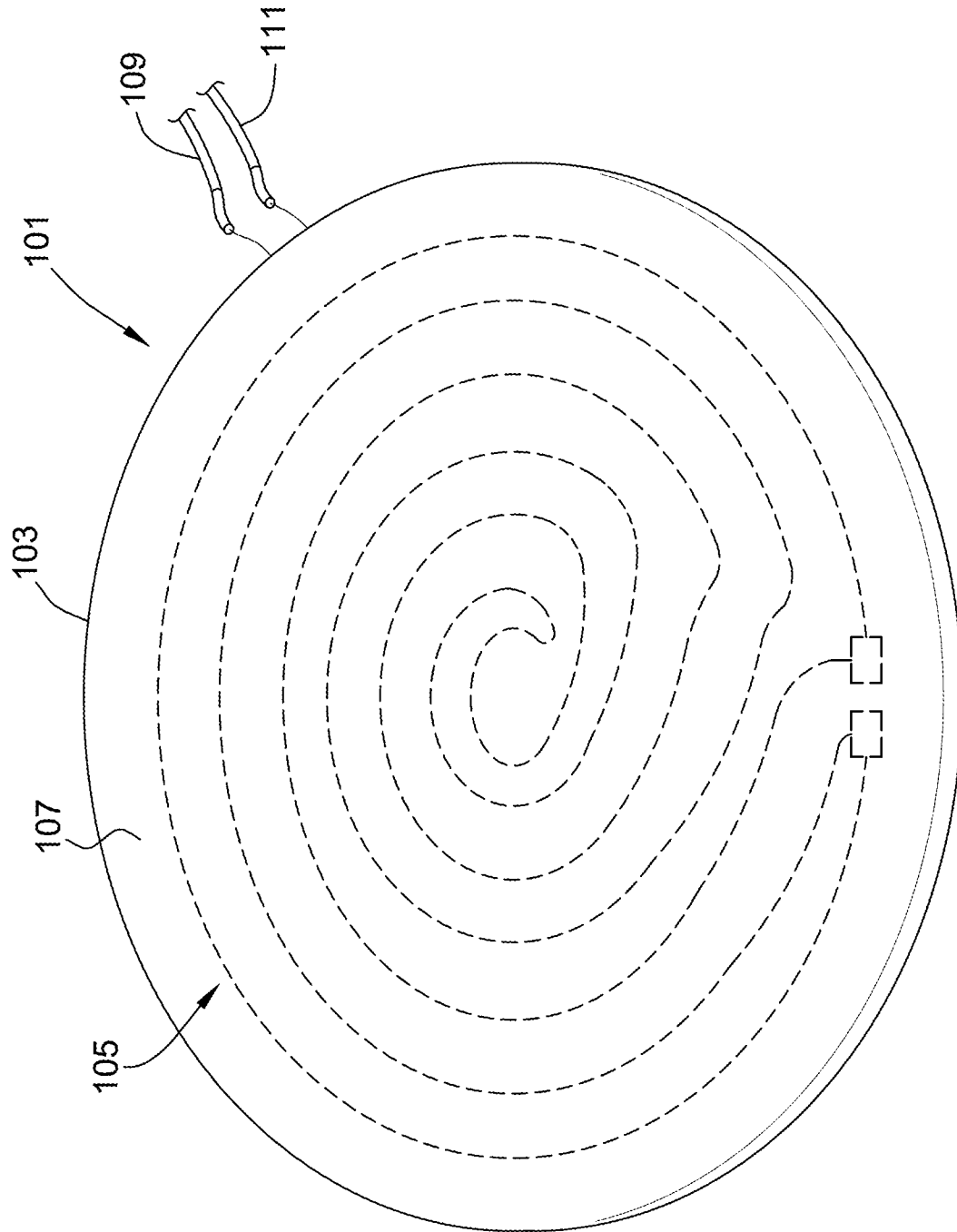


FIG. 1

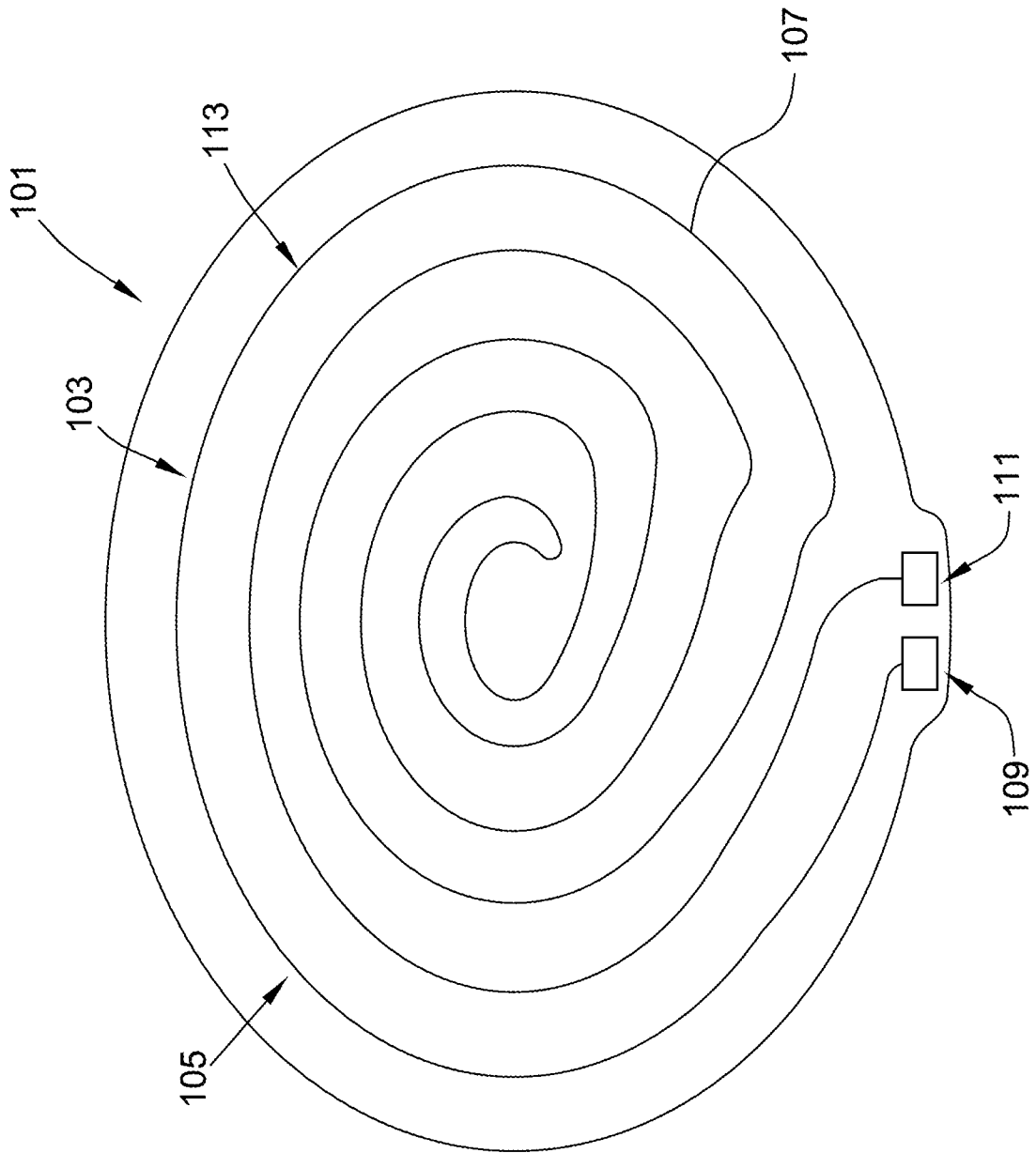


FIG. 2

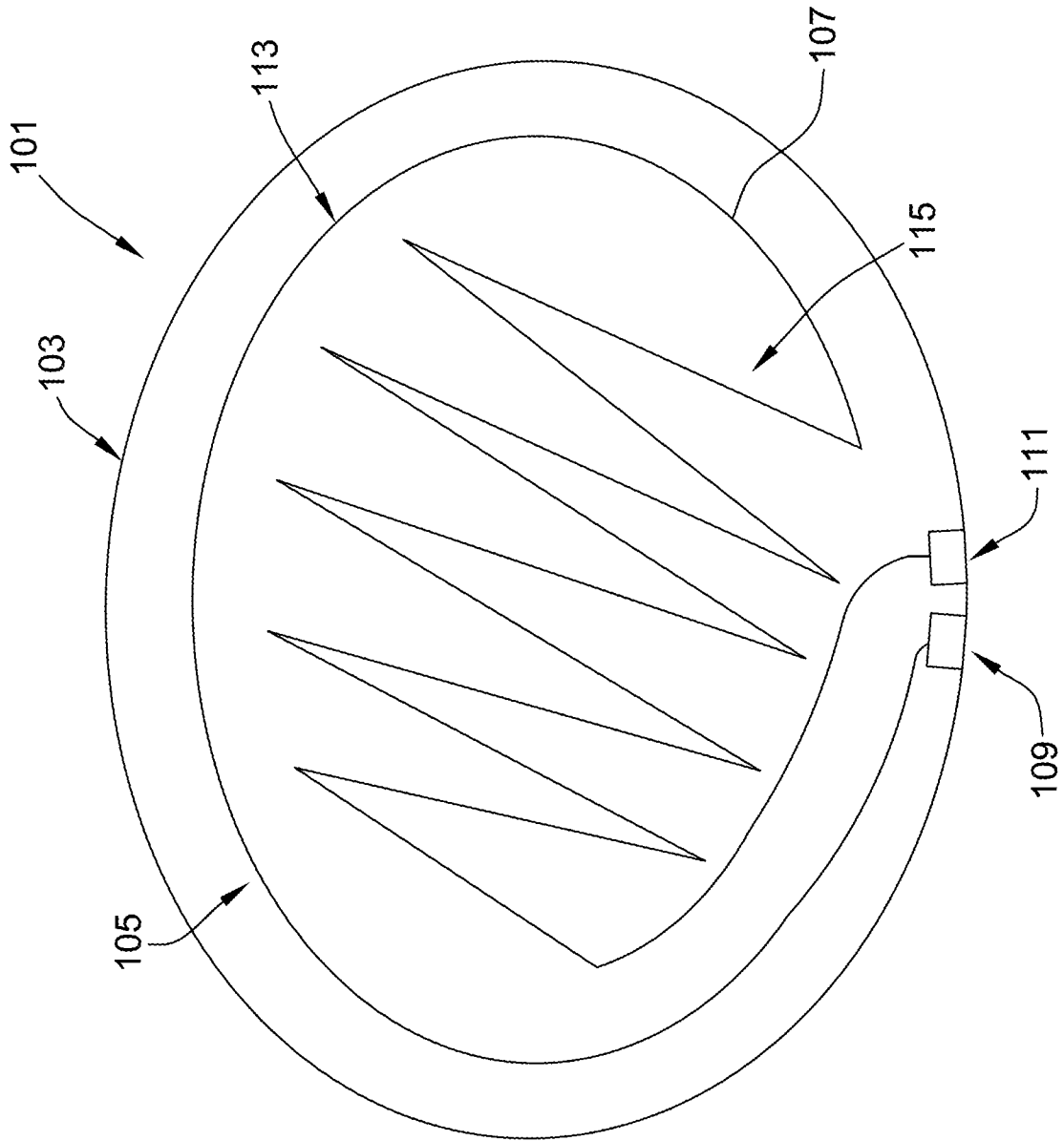


FIG. 3

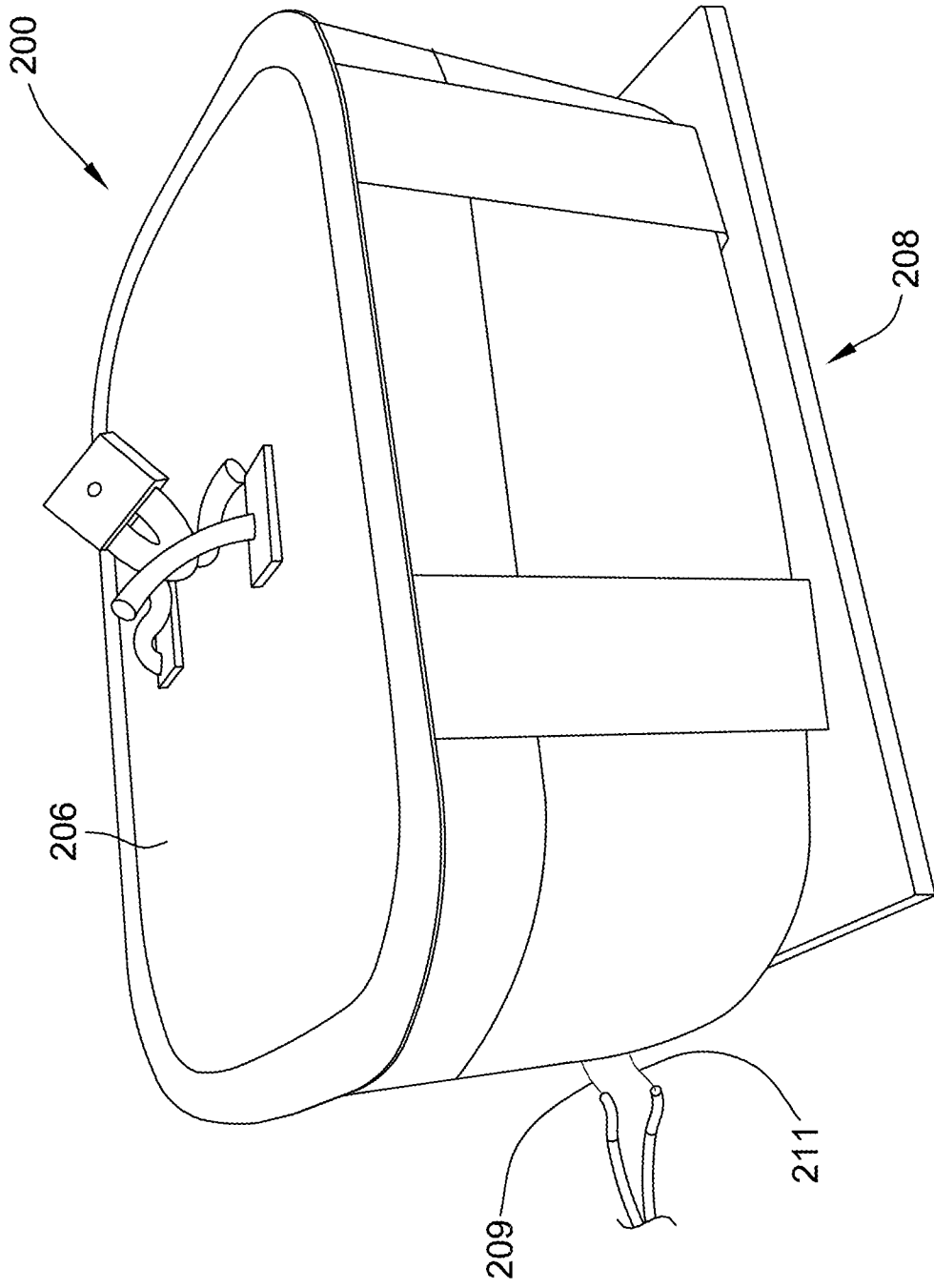


FIG. 4

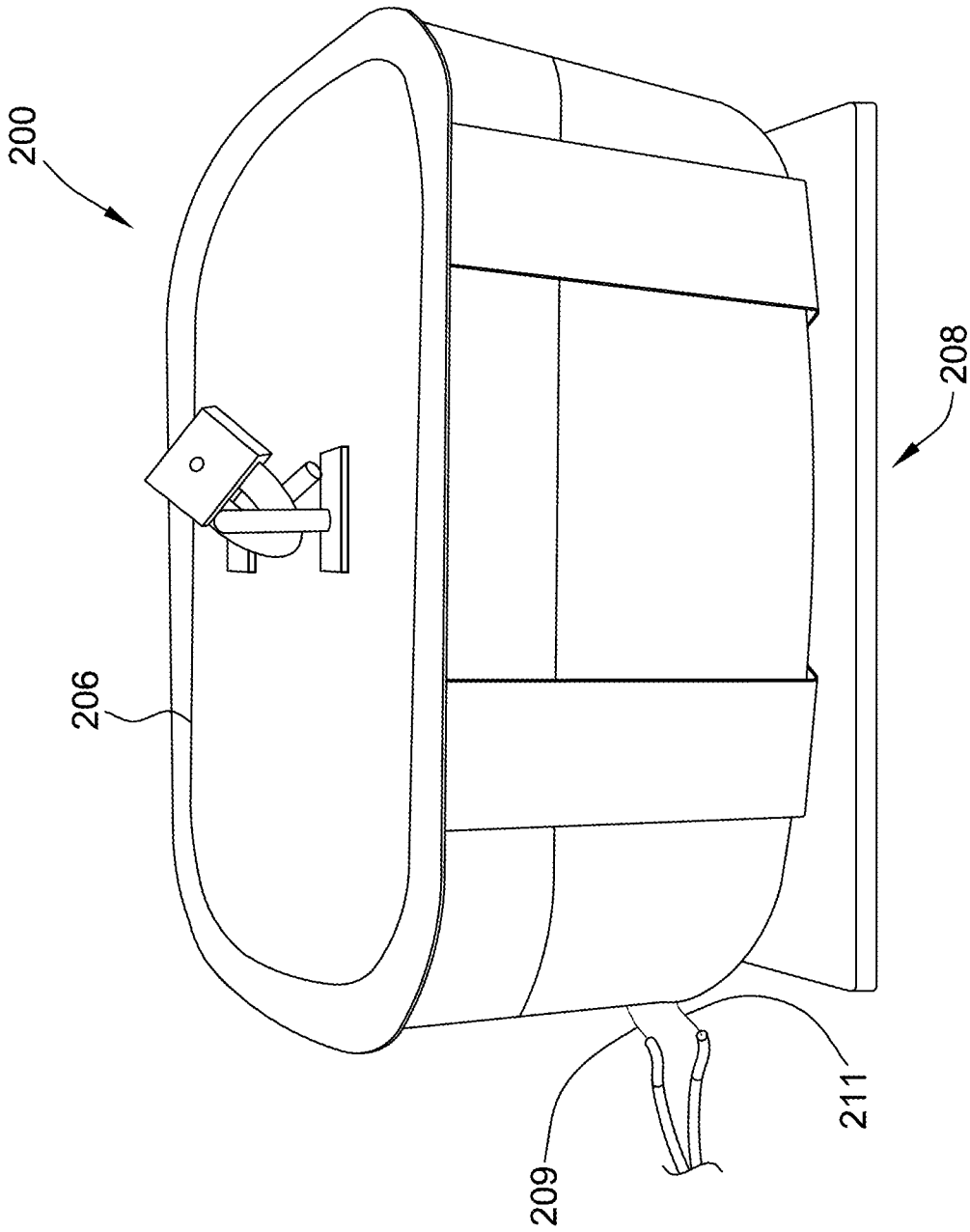


FIG. 5

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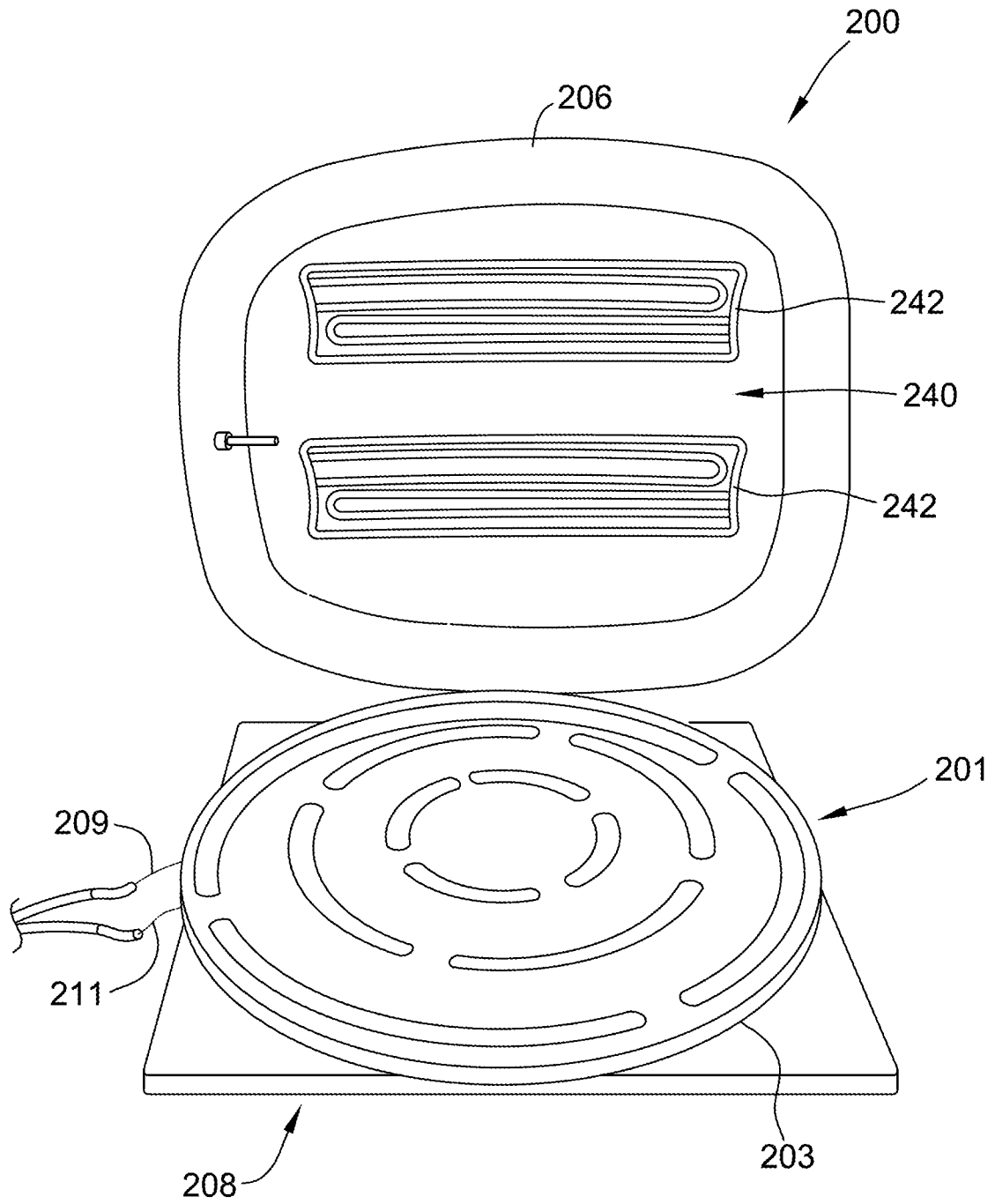


FIG. 6

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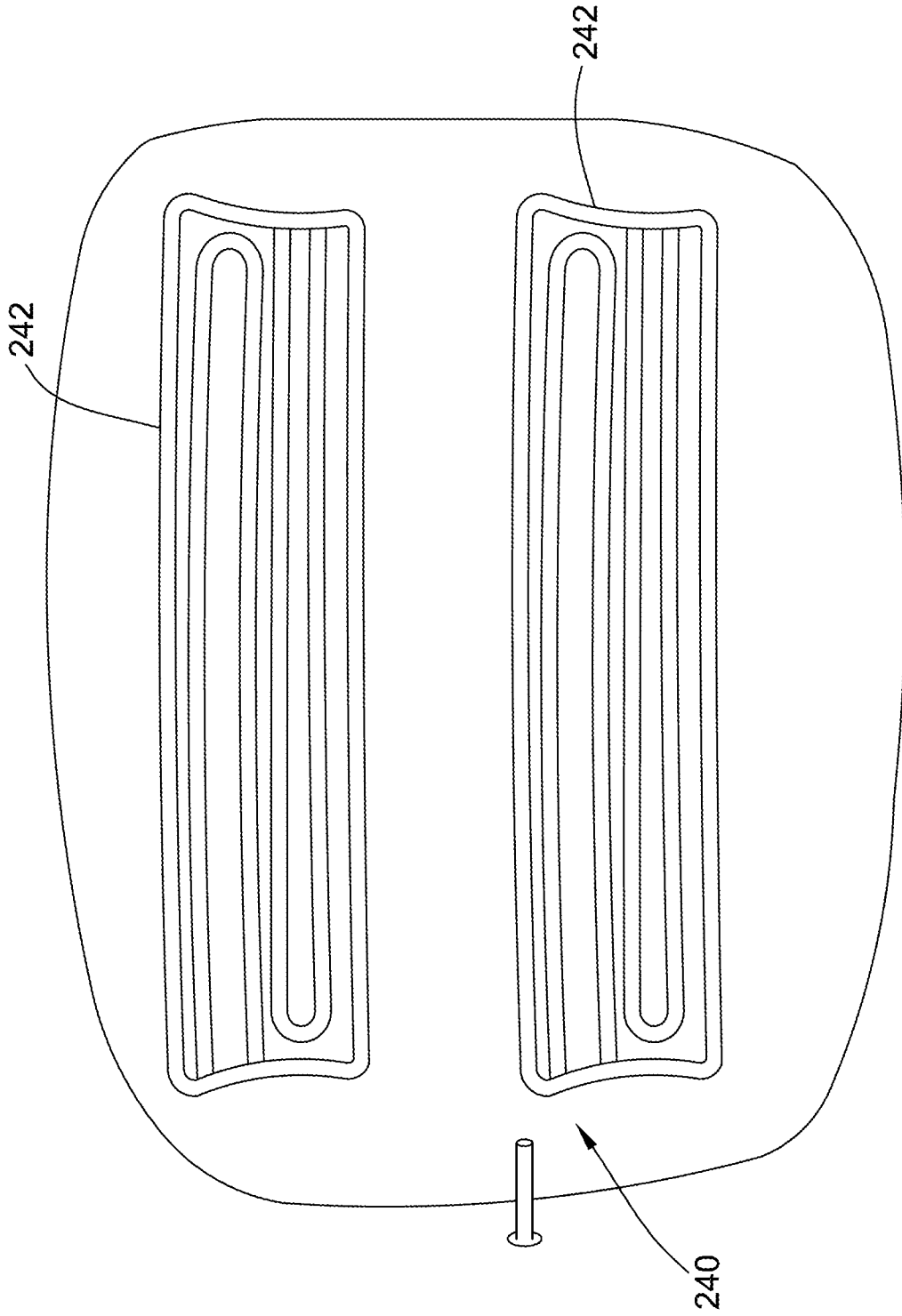


FIG. 7

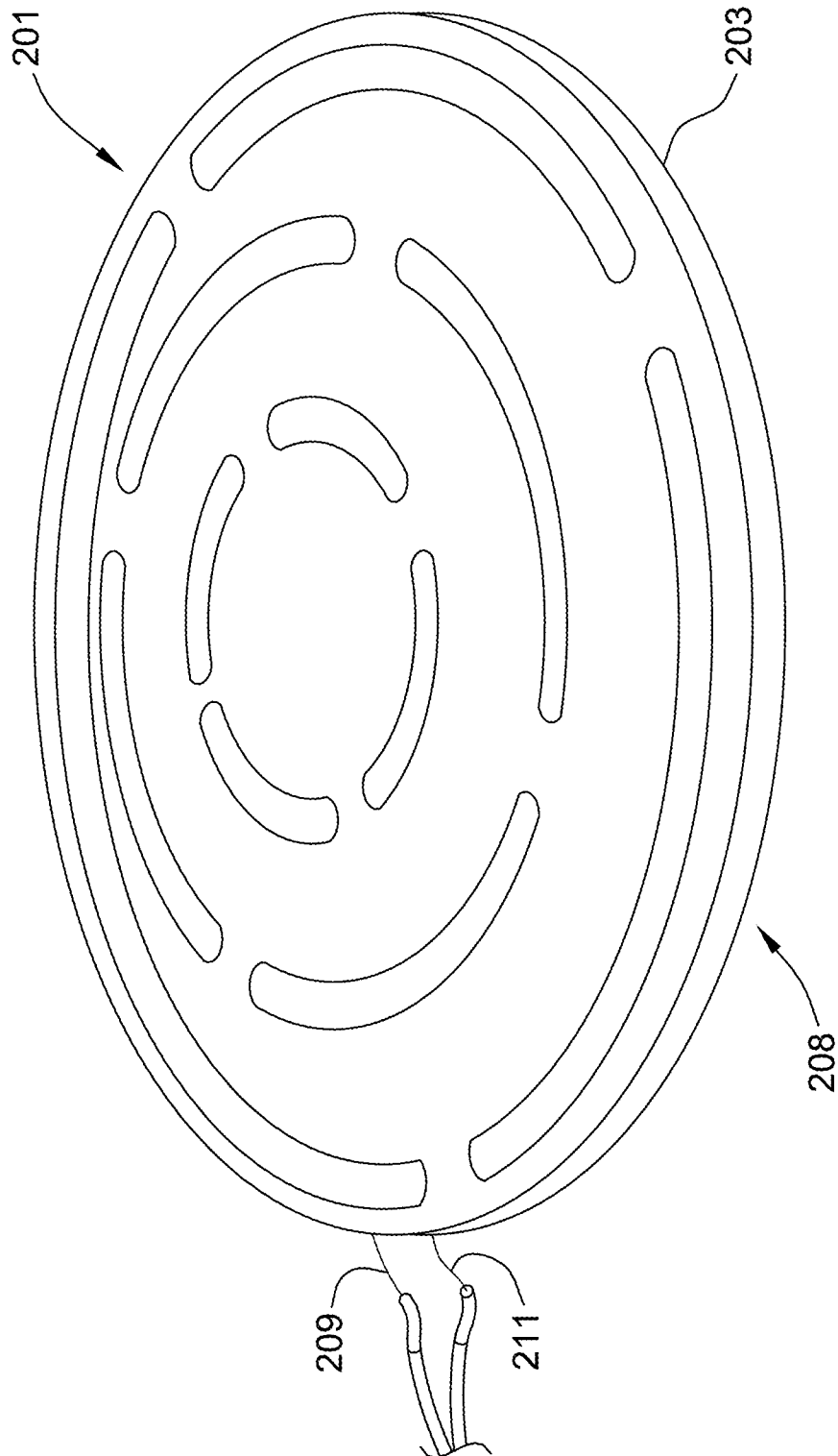


FIG. 8

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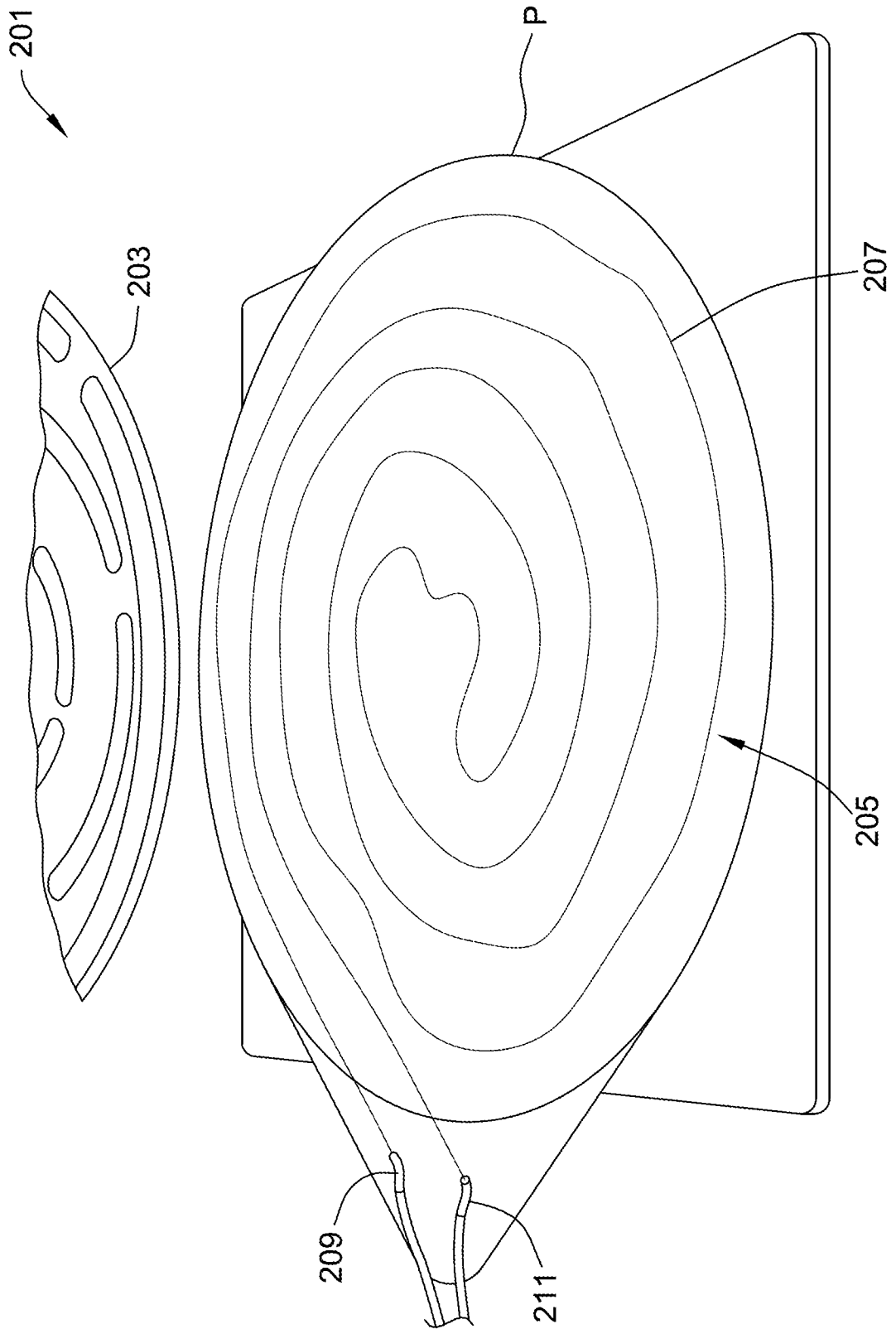


FIG. 9

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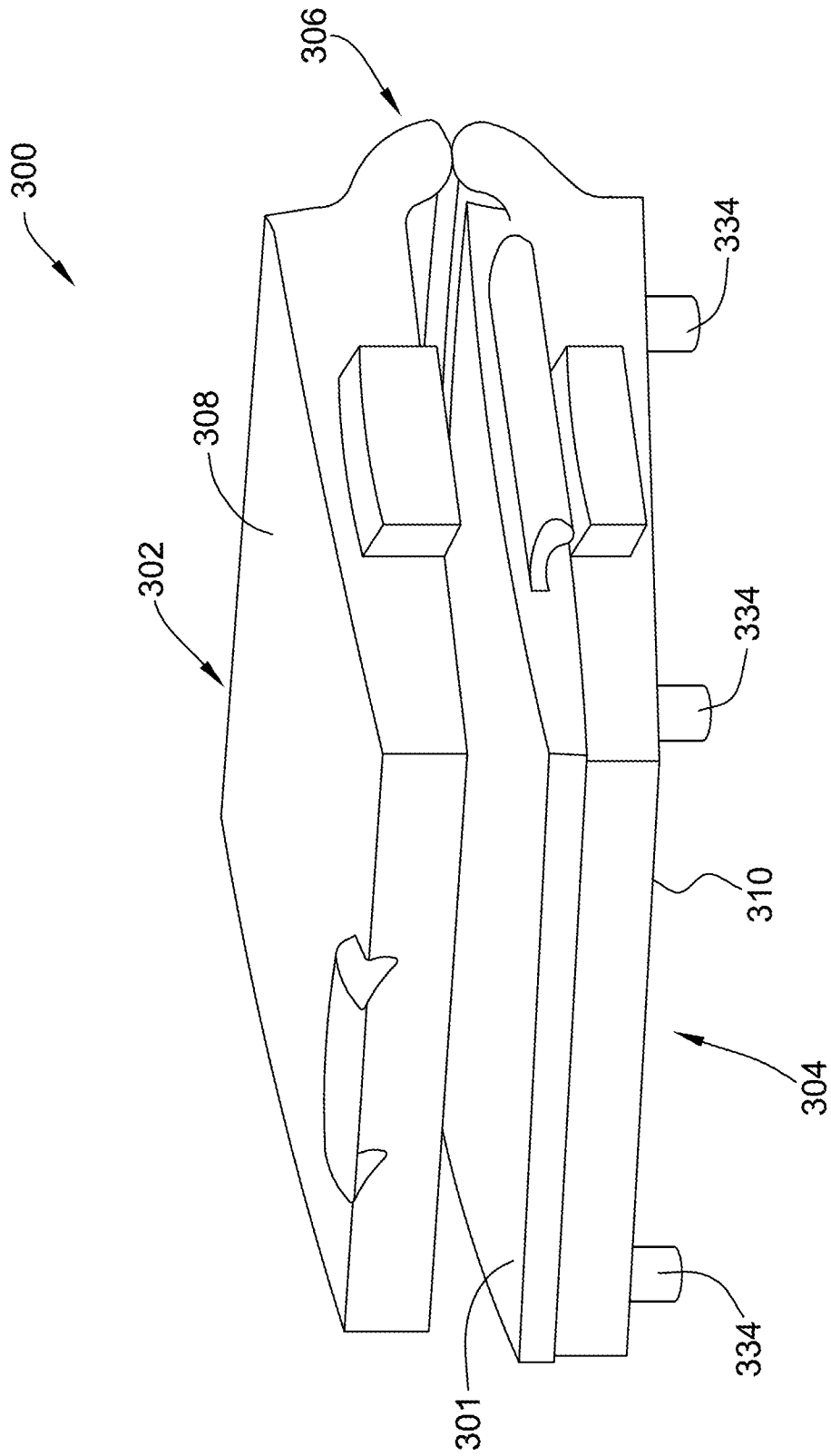


FIG. 10

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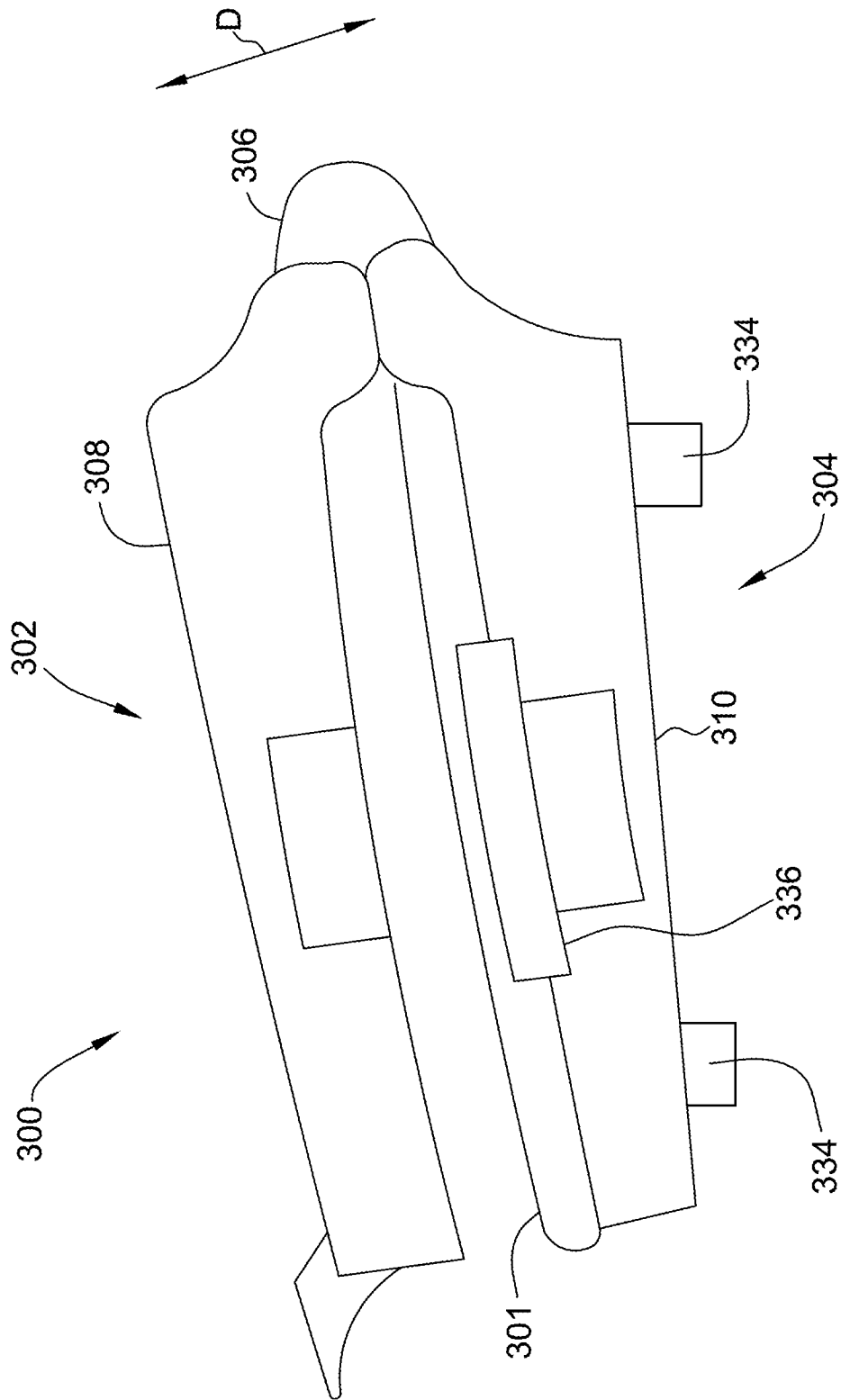


FIG. 11

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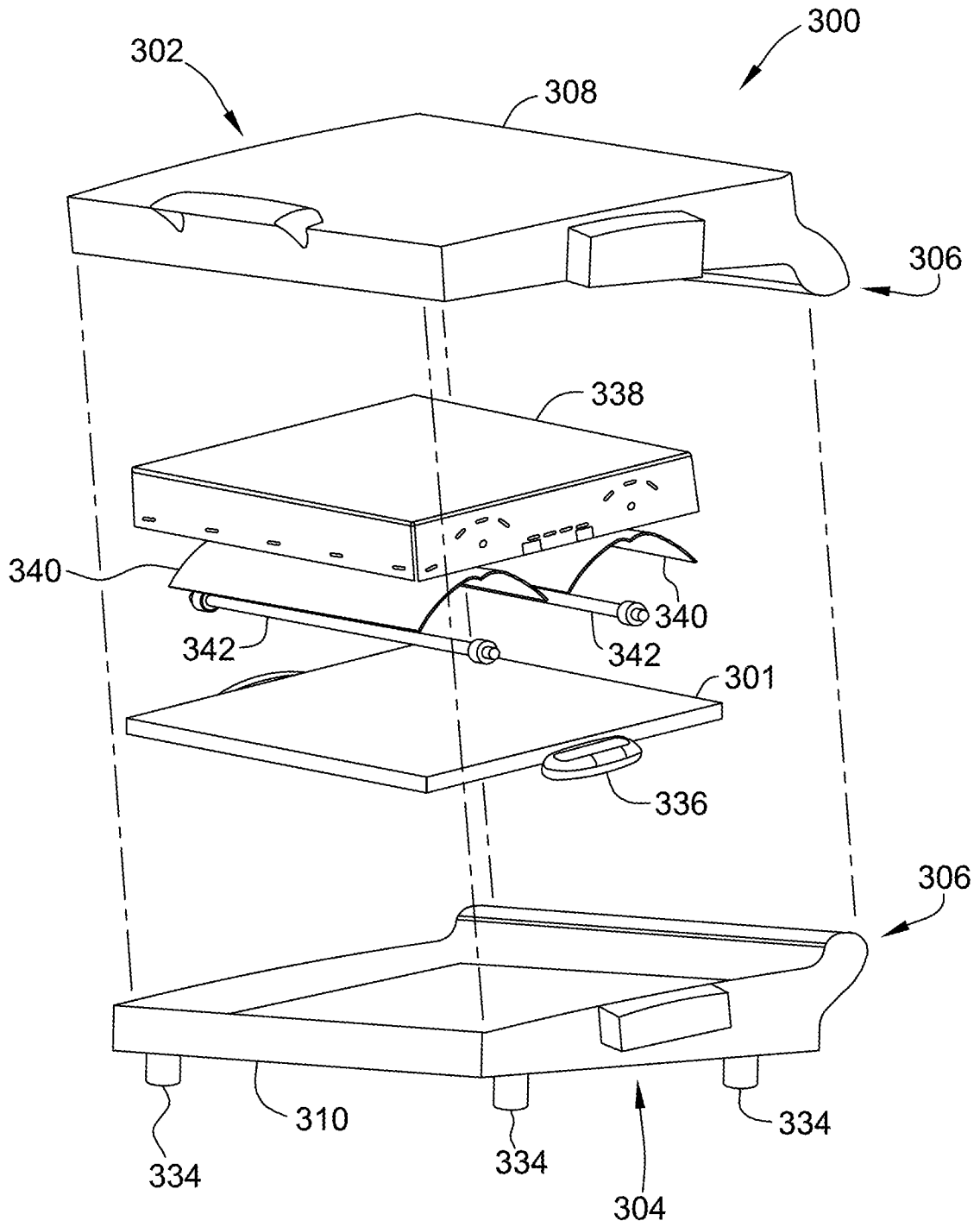


FIG. 12

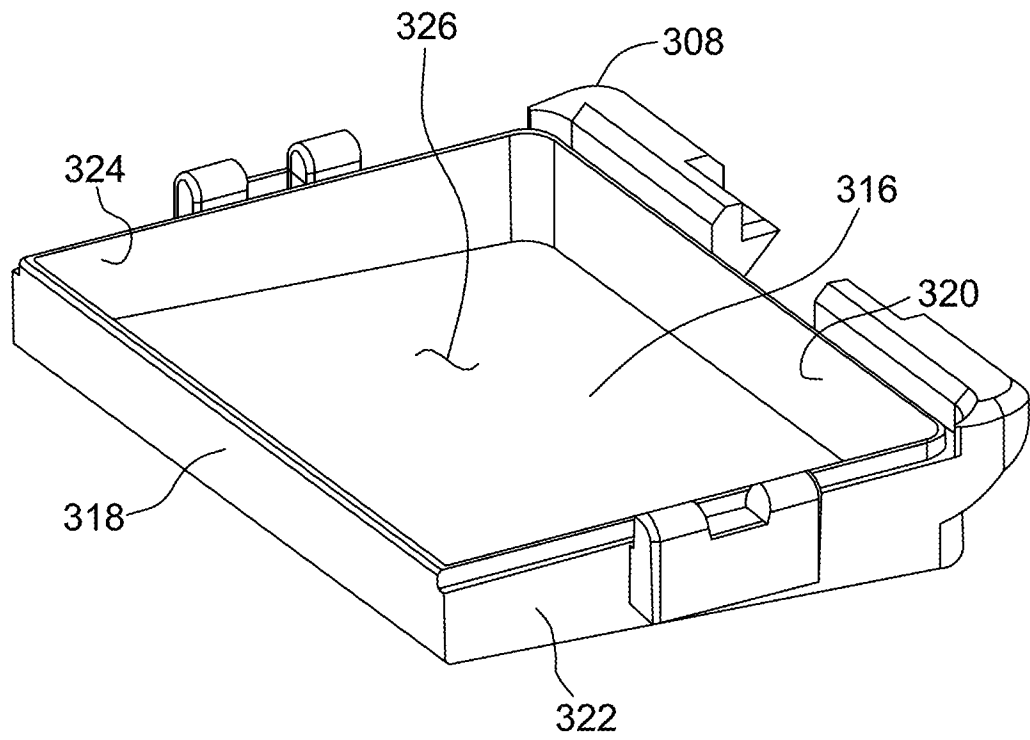


FIG. 13

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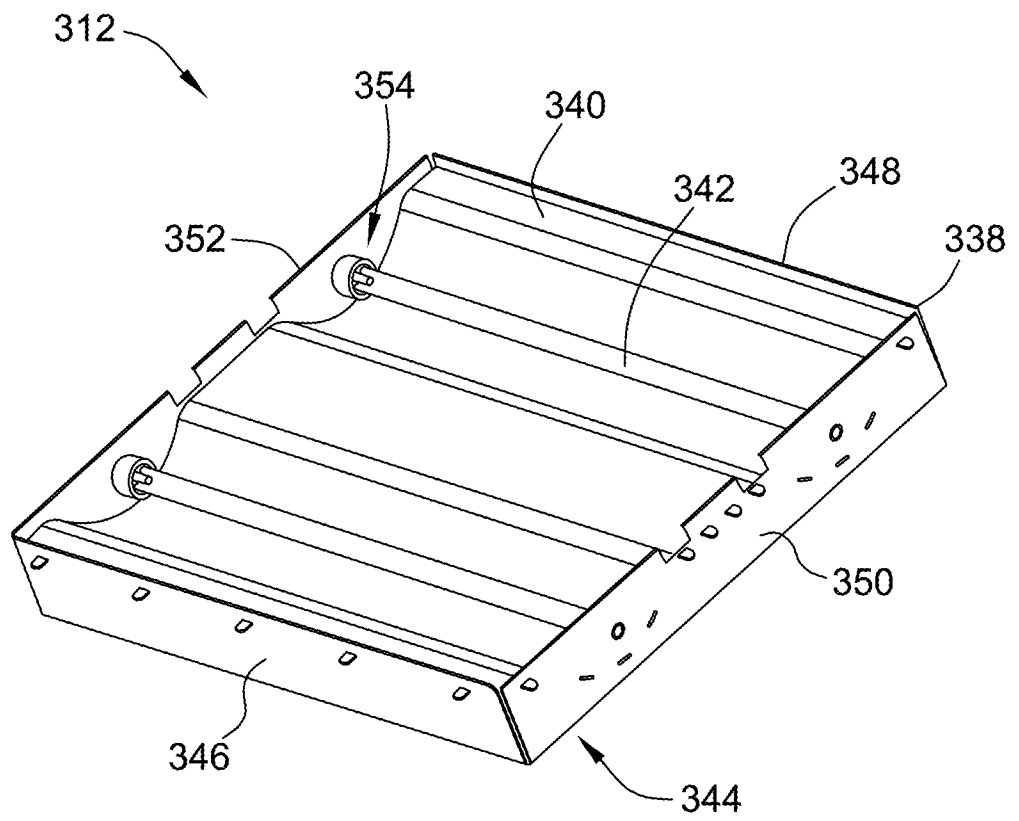


FIG. 14

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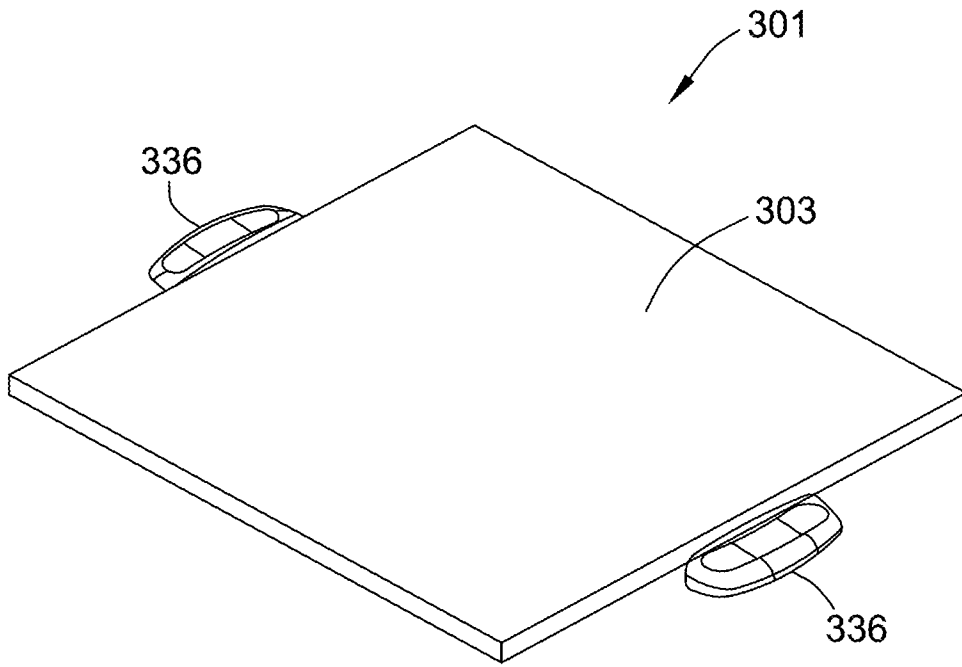


FIG. 15

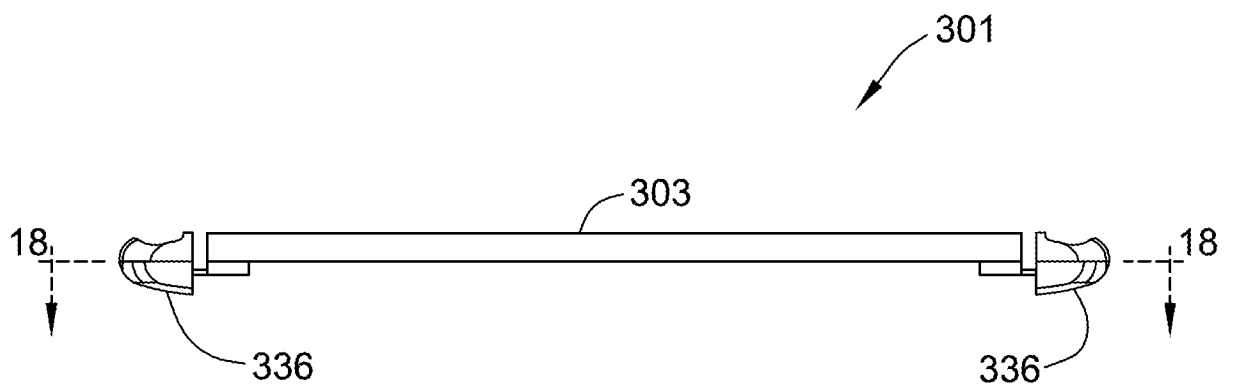


FIG. 16

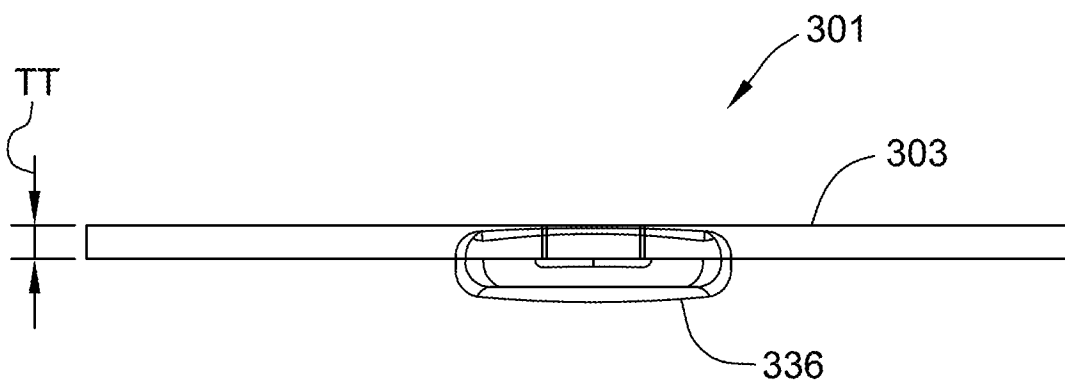


FIG. 17

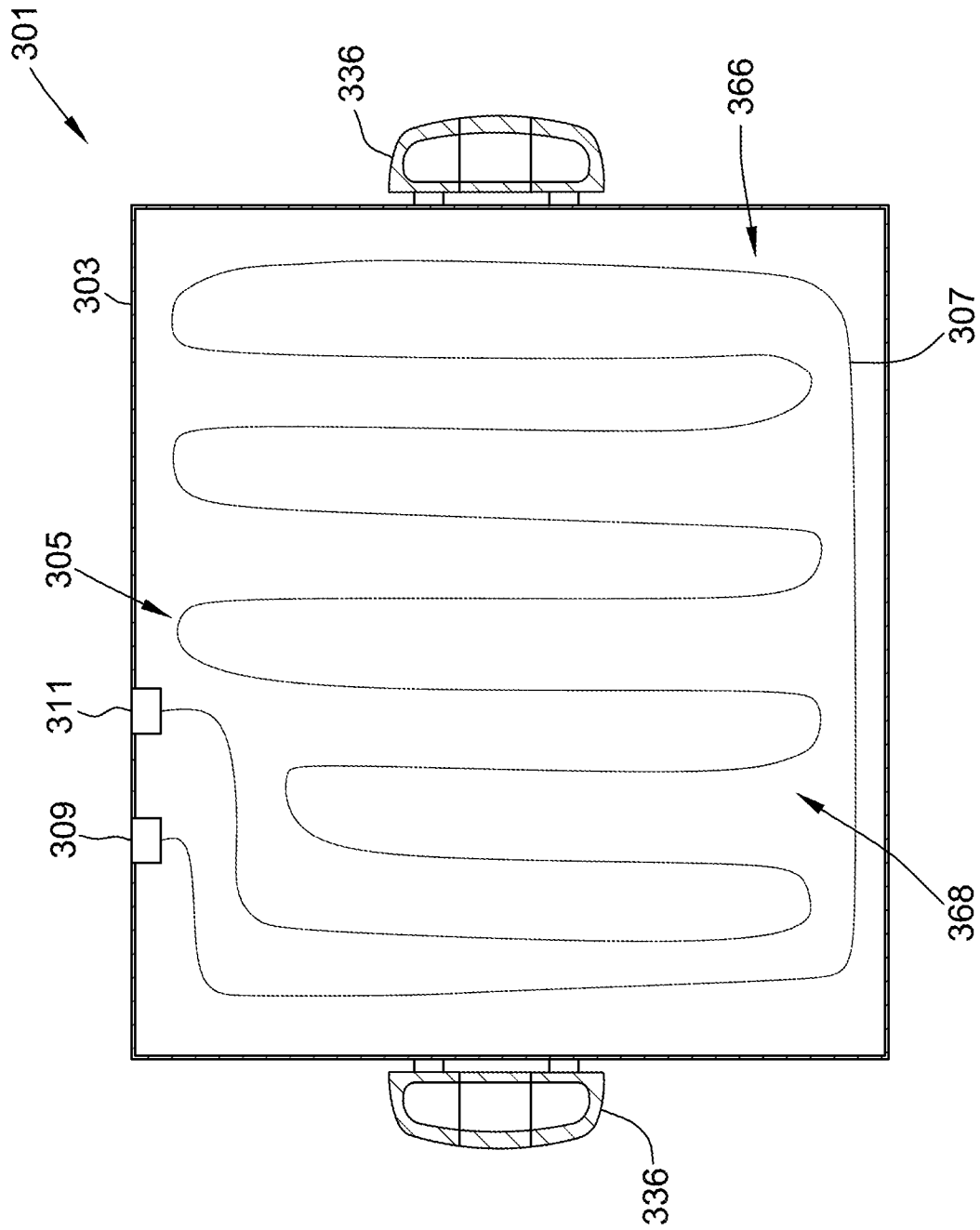


FIG. 18

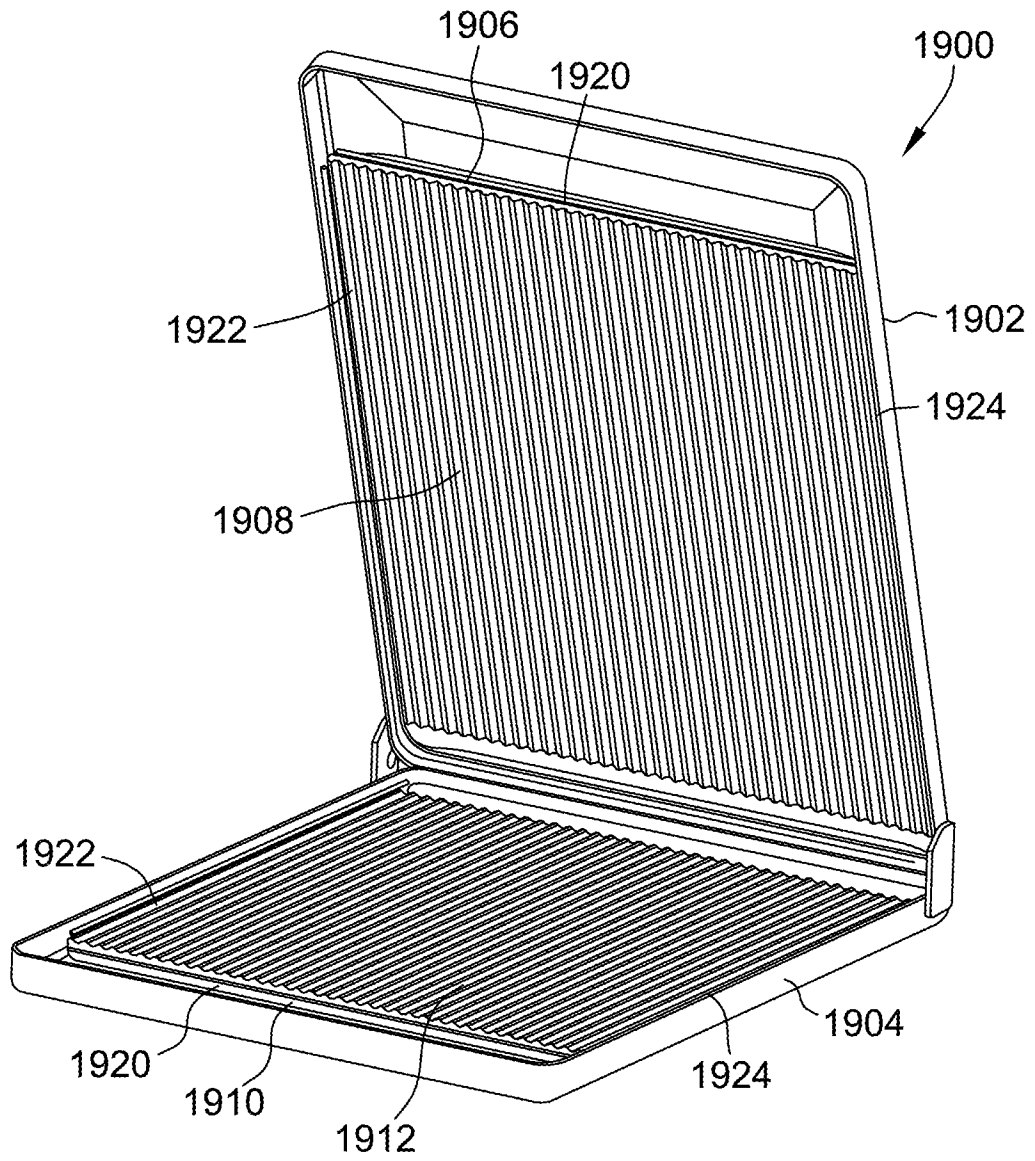


FIG. 19

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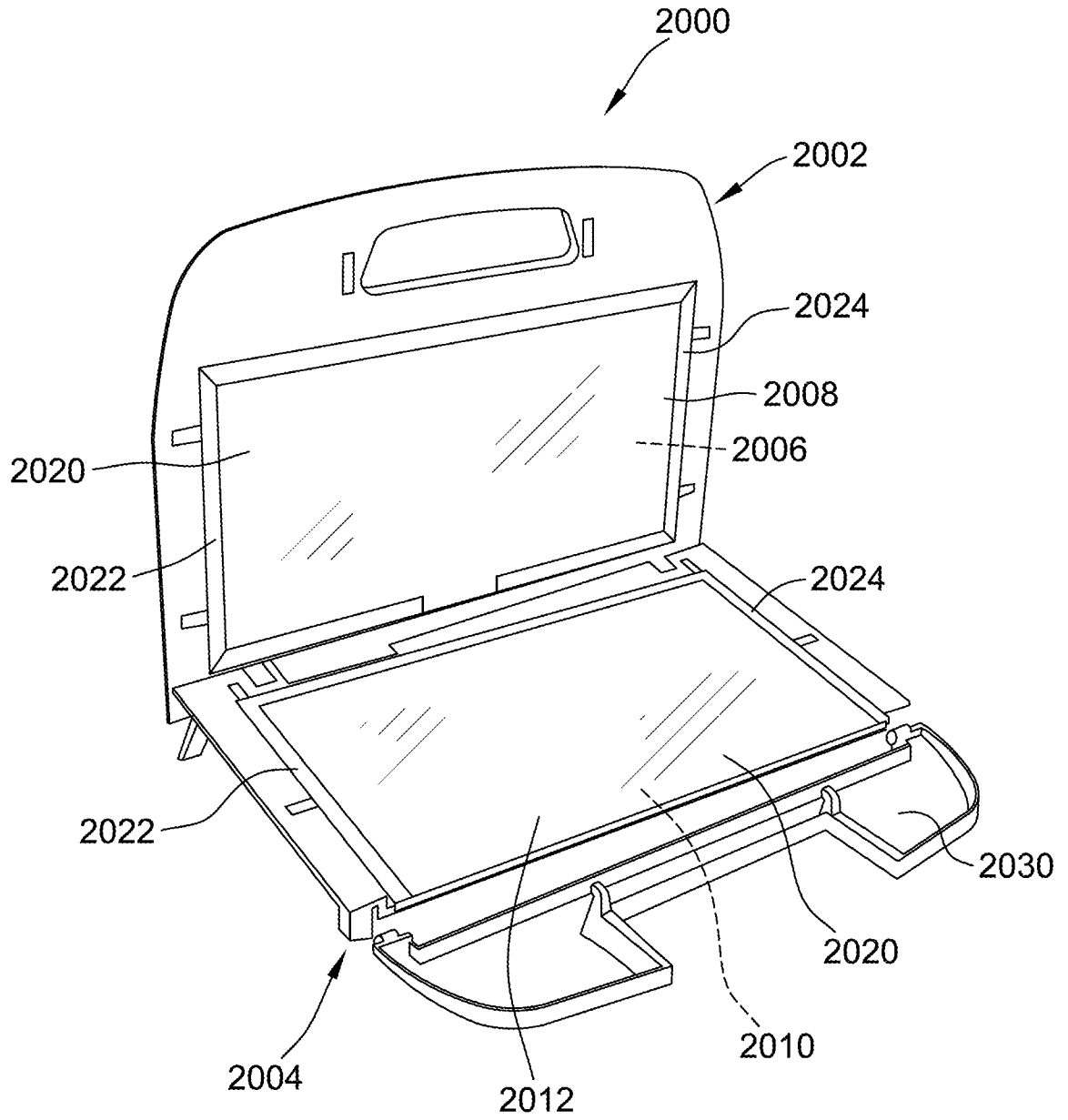


FIG. 20

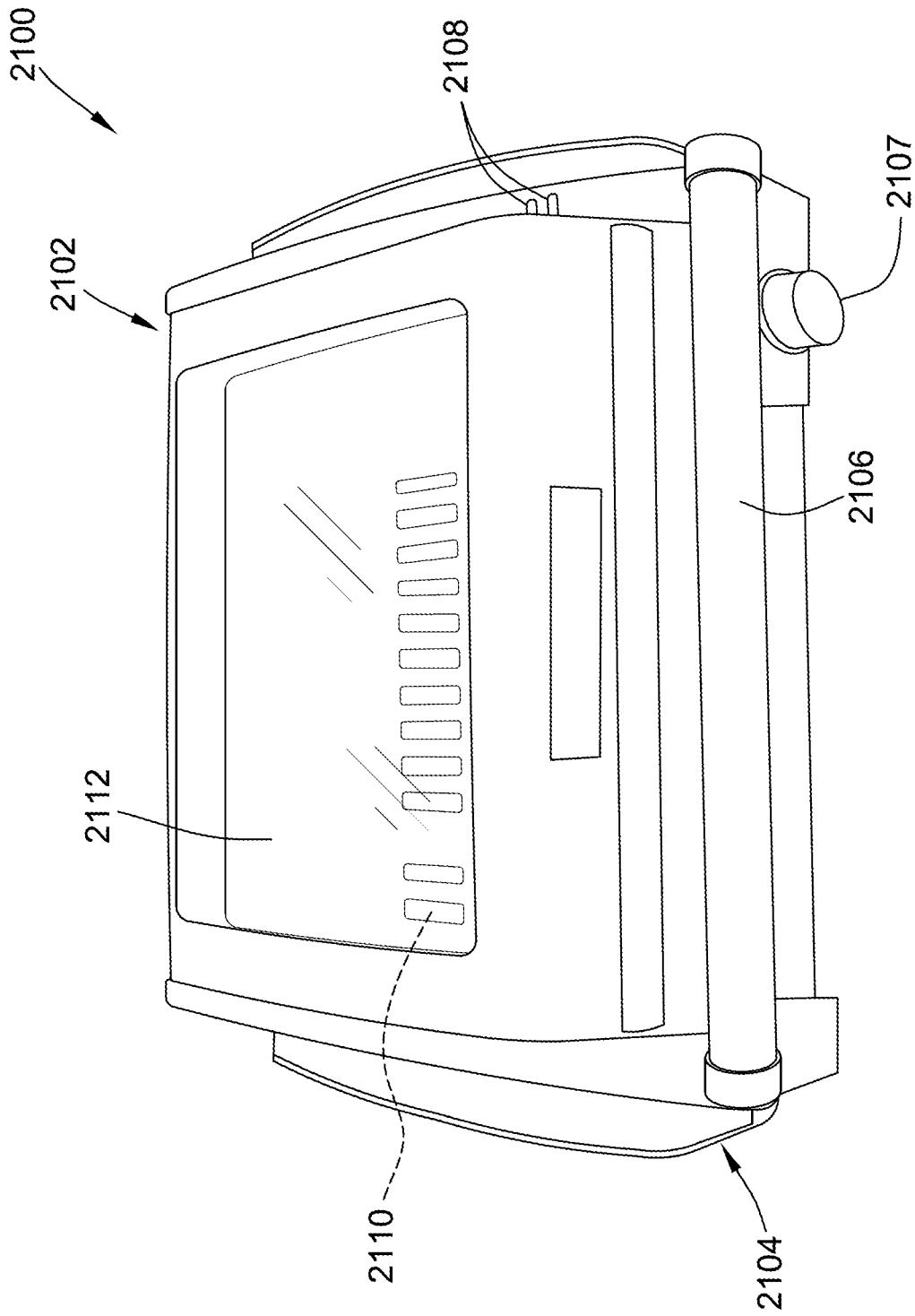


FIG. 21

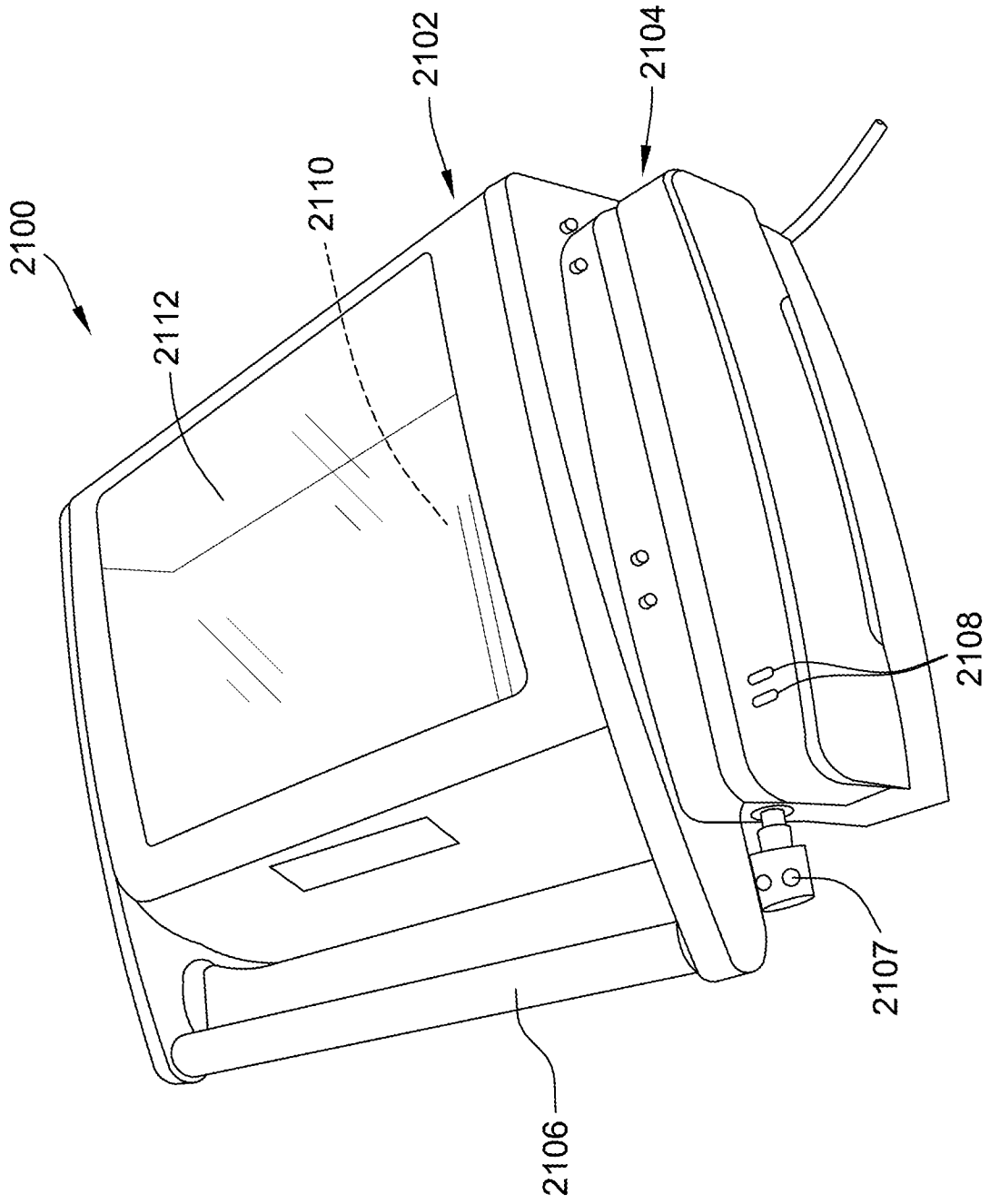


FIG. 22

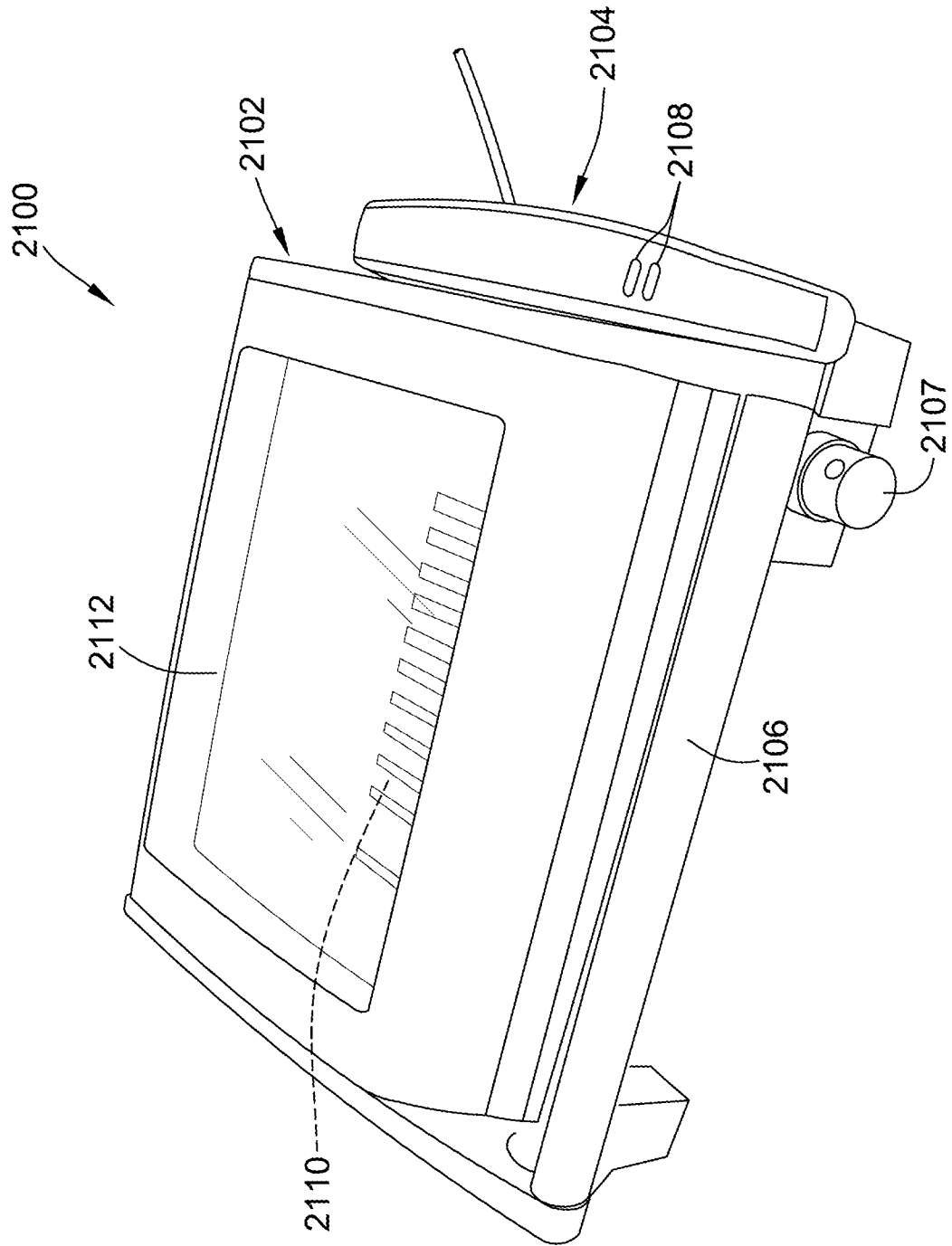


FIG. 23

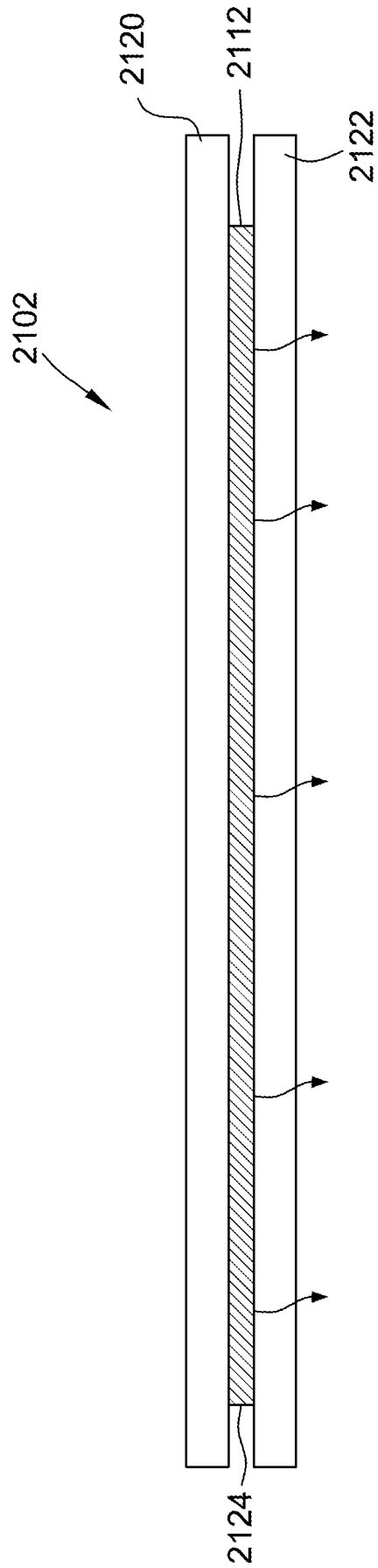


FIG. 24

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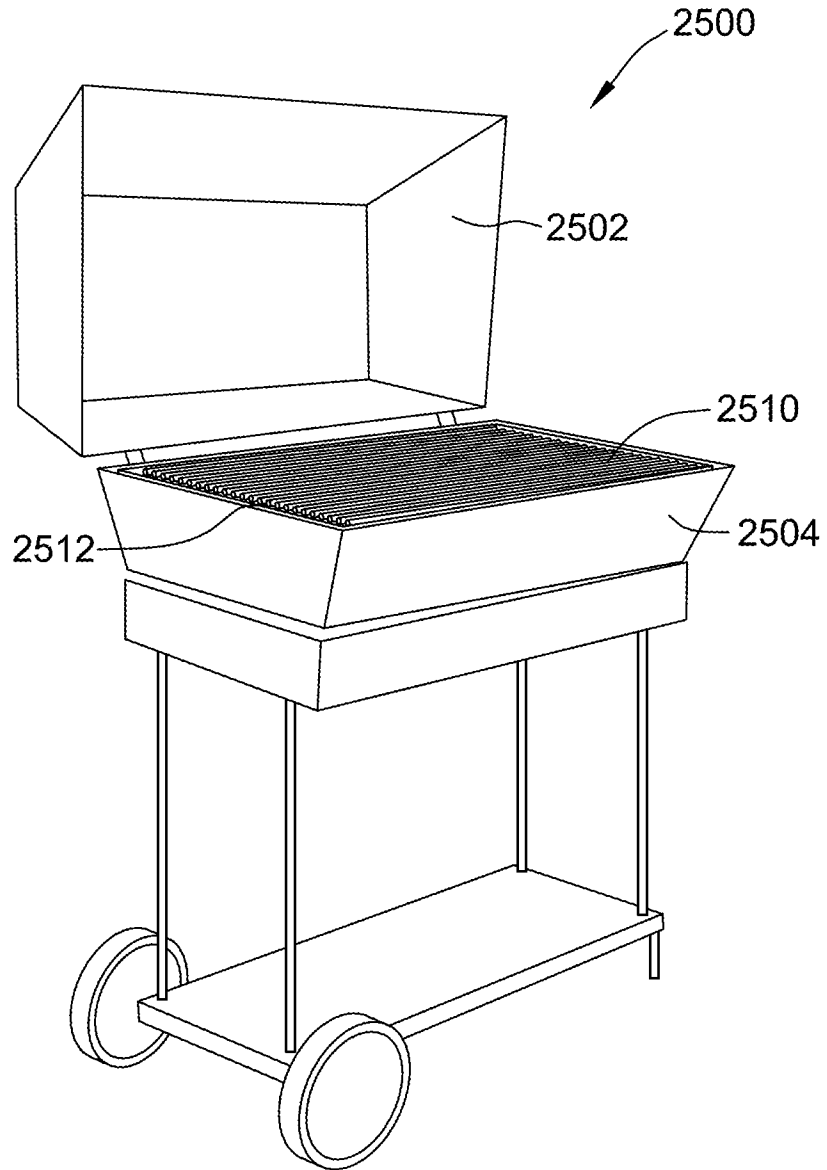


FIG. 25

INTERNATIONAL SEARCH REPORT

International application No.

PCT/US15/25881

A. CLASSIFICATION OF SUBJECT MATTER

IPC(8) - H05B 3/74, 6/12; F24C 15/10 (2015.01)

CPC - H05B 3/265, 3/74, 3/748

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC(8) - H05B 3/74, 6/12; F24C 7/02, 15/10; B65D 81/34; B32B 15/08; A23L 1/00; A47J 37/06; 27/00 (2015.01)

CPC - H05B 2203/017, 3/265, 3/74, 6/1218, 3/748; A47J 37/0611

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

PATSEER (US Granted, US Applications, EP, WO, JP, DE, GB, FR, KR, ES, AU, IN, CA); ProQuest (Derwent, INSPEC, NTIS, PASCAL, Current Contents Search, Dissertation Abstracts Online, Inside Conferences); IP.com; Google Scholar; KEYWORDS: thin film, heater, element, grill, transparent, cooking, ceramic, resistive

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	US 2011/0259869 A1 (HLAVATY, P) October 27, 2011; figure 1, 14-15, 18; paragraph [0016, 0053, 0060-0062]	1-12, 14-18, 20-22 --- 13, 19, 23
Y	US 8,216,622 B2 (GOLD MEDAL PRODUCTS COMPANY) July 10, 2012; column 2, lines 35-41; column 8, lines 10-25	13
Y	WO 99/09791 A1 (ELECTROLUX ABP et al.) February 25, 1999; page 5, lines 7-10).	19
Y	US 2006/043087 A1 (WESTERN IND INC) March 02, 2006; paragraphs [0009] & [0052]	23
A	WO 2013/038186 A1 (CLYNE ENERGY LIMITED) March 21, 2013; entire document	1-23

Further documents are listed in the continuation of Box C.

See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

05 July 2015 (05.07.2015)

Date of mailing of the international search report

24 JUL 2015

Name and mailing address of the ISA/

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Facsimile No. 571-273-8300

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