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Warwick

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(54) **HEATER CONTROL FOR COUNTERTOP APPLIANCE**

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(60) Continuation of application No. 17/357,507, filed on Jun. 24, 2021, now Pat. No. 11,968,753, which is a division of application No. 16/196,561, filed on Nov. 20, 2018, now abandoned.

(60) Provisional application No. 62/640,952, filed on Mar. 9, 2018, provisional application No. 62/588,741, filed on Nov. 20, 2017.

(51) **Int. Cl.**

H05B 1/02	(2006.01)
H05B 3/68	(2006.01)

(52) **U.S. Cl.**
CPC ***H05B 1/0266*** (2013.01); ***H05B 3/68*** (2013.01)

(58) **Field of Classification Search**
CPC H05B 1/0266; H05B 3/68; A47J 37/10; A47J 37/105
USPC 219/448.17
See application file for complete search history.

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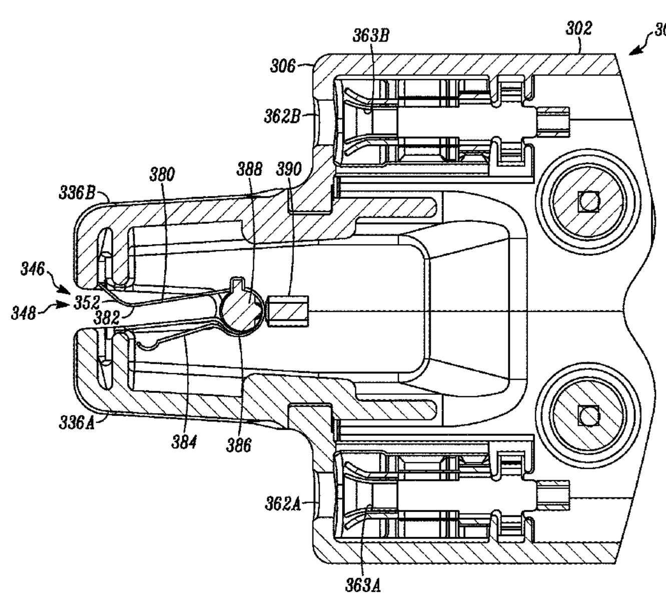
(57) **ABSTRACT**

A countertop appliance temperature controller configured to provide improved temperature control of a resistive heating element heated cooking surface of a countertop appliance through the use of a noncontact thermal sensor. The temperature controller including a pair of electrical output contacts selectively coupleable to the resistive heating element of the countertop appliance, a user input configured to receive a desired temperature setpoint for the cooking surface of the countertop appliance, a noncontact temperature sensor configured to receive temperature information directly from the cooking surface of the countertop appliance, and a thermostat configured to adjust an electrical output of the pair of electrical output contacts to minimize a difference between the desired temperature setpoint and a perceived actual temperature of the cooking surface based on the received temperature information.

19 Claims, 22 Drawing Sheets



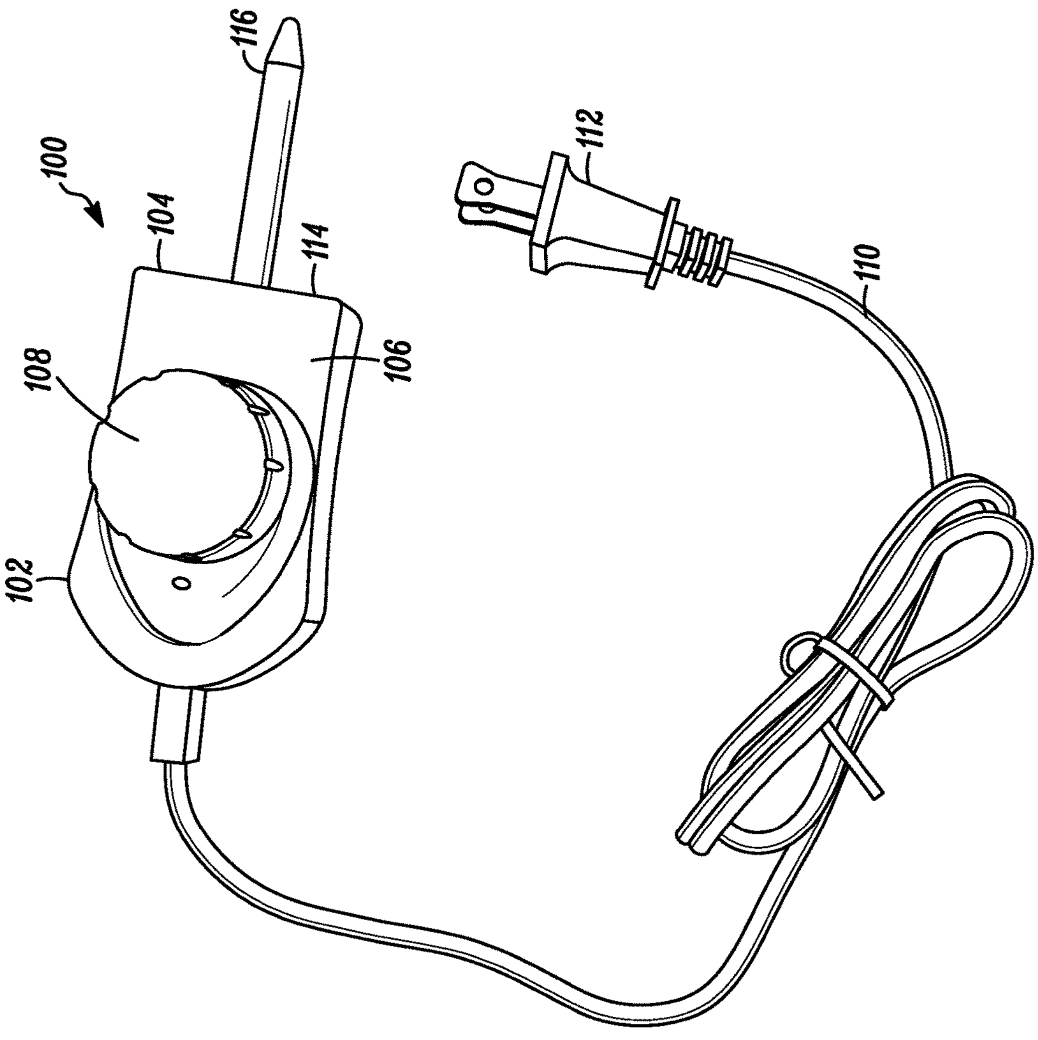


FIG. 1
PRIOR ART

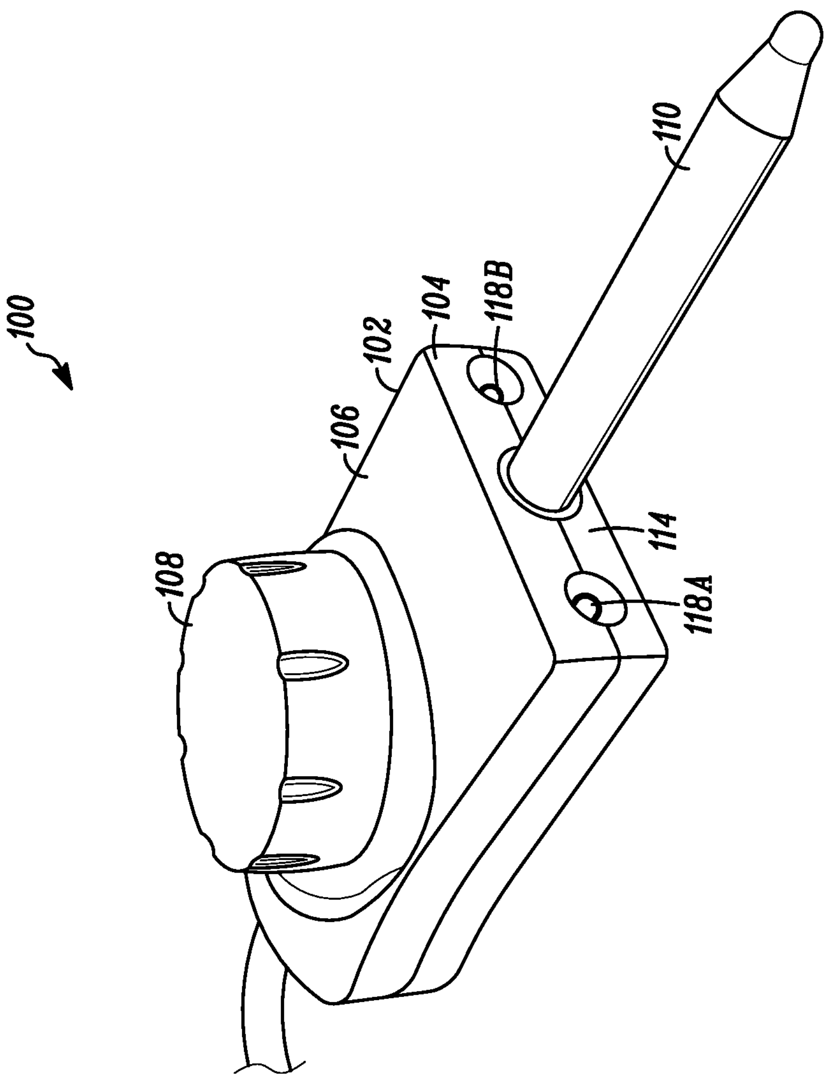


FIG. 2
PRIOR ART

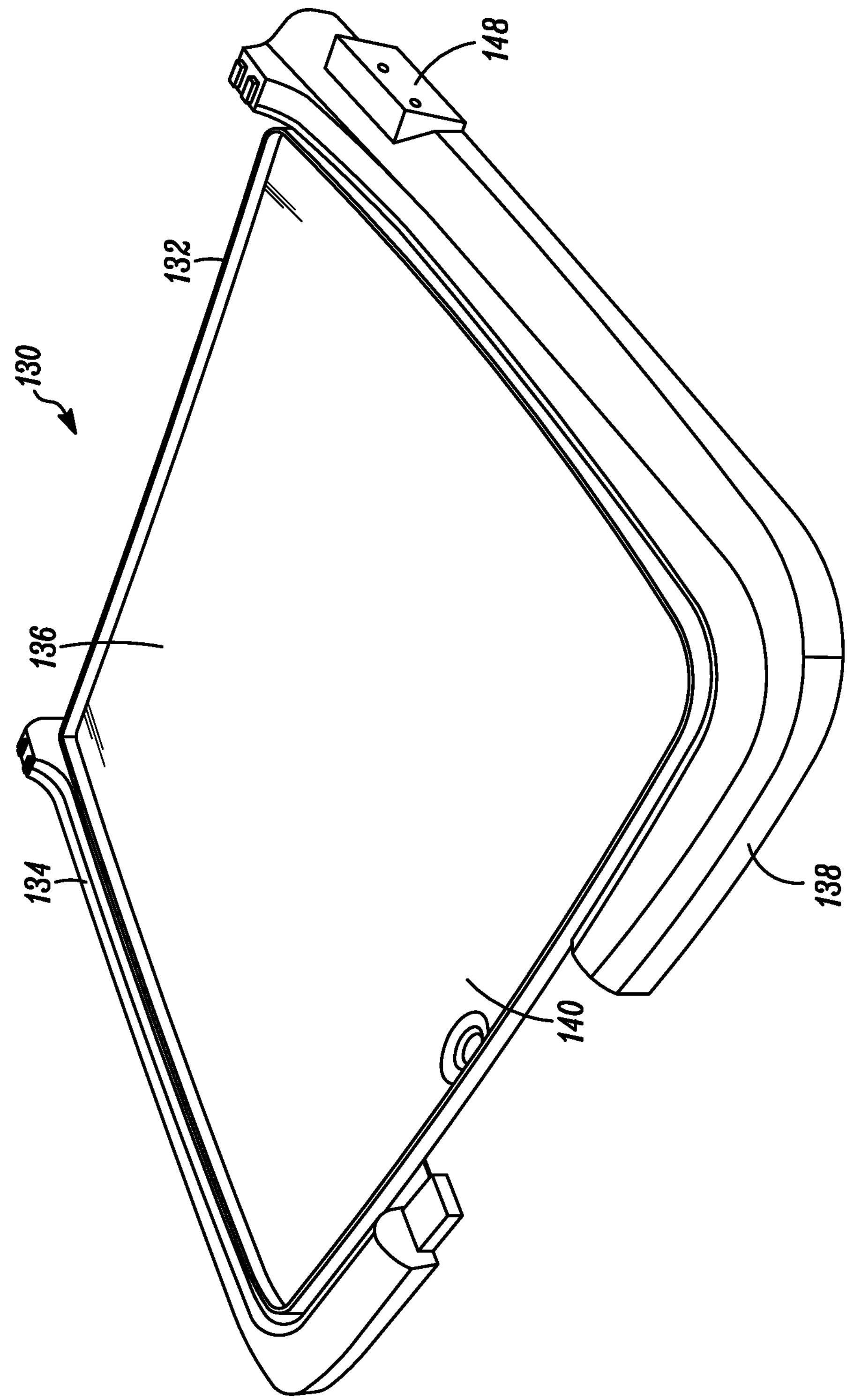


FIG. 3
PRIOR ART

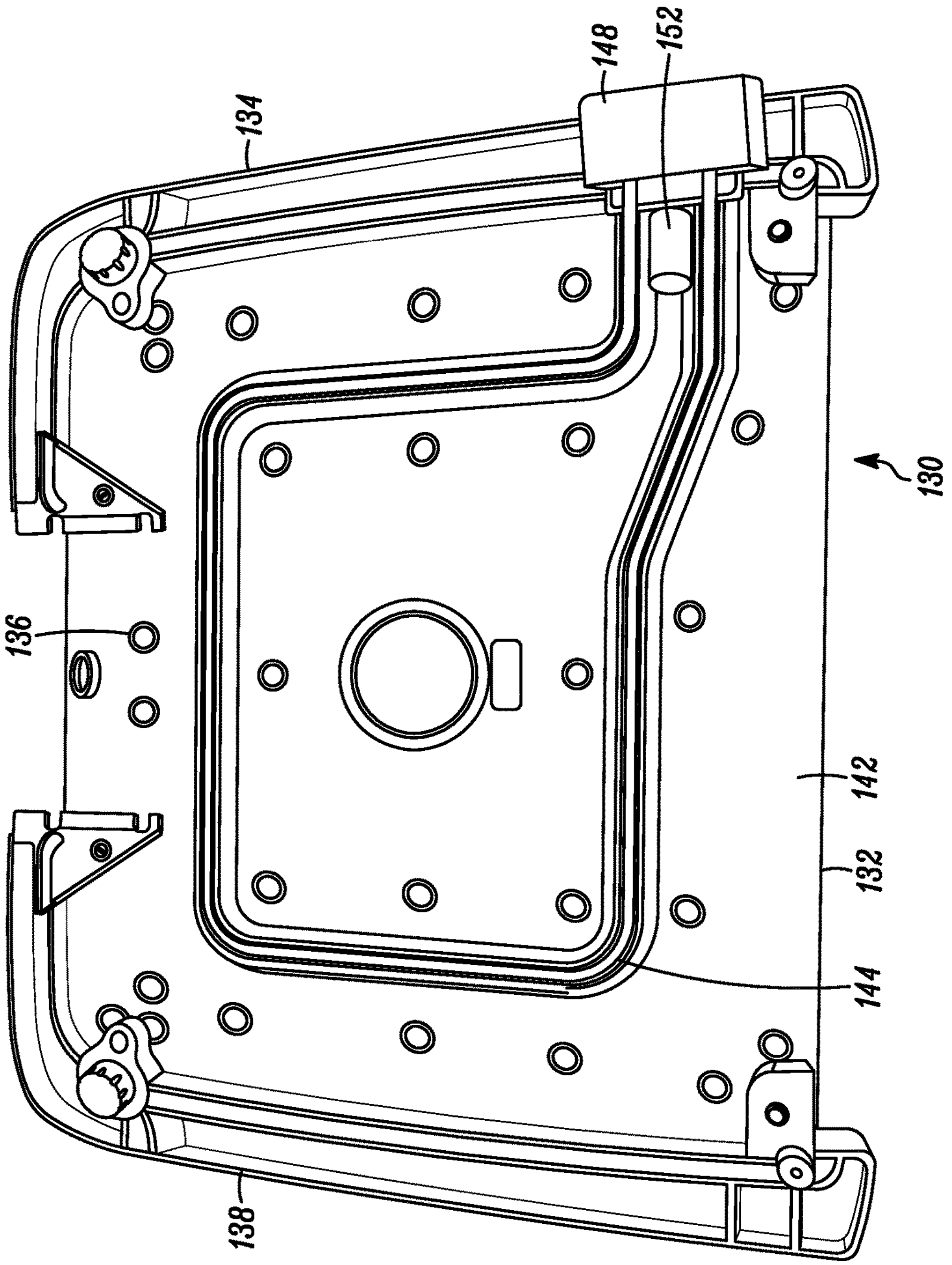


FIG. 4
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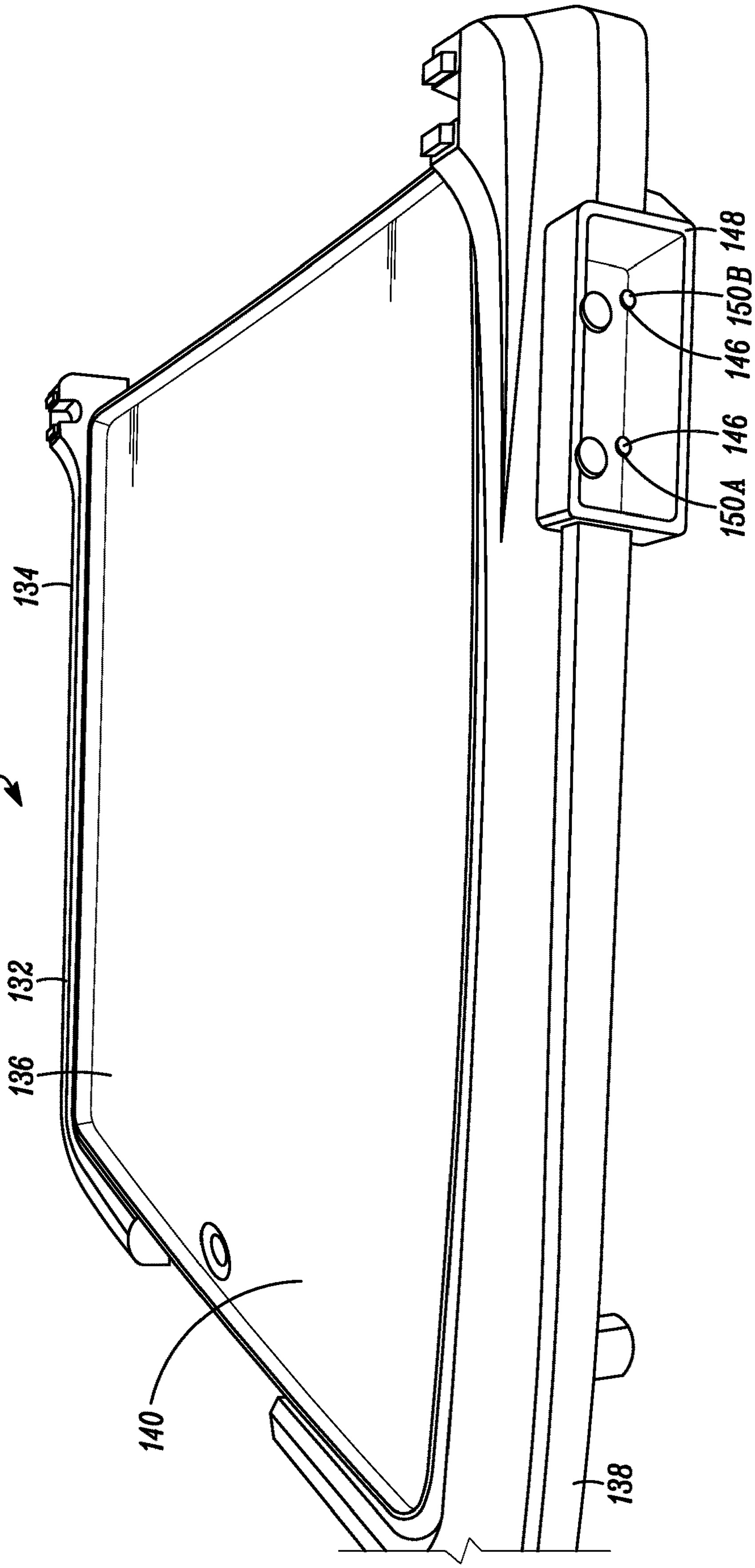


FIG. 5
PRIOR ART

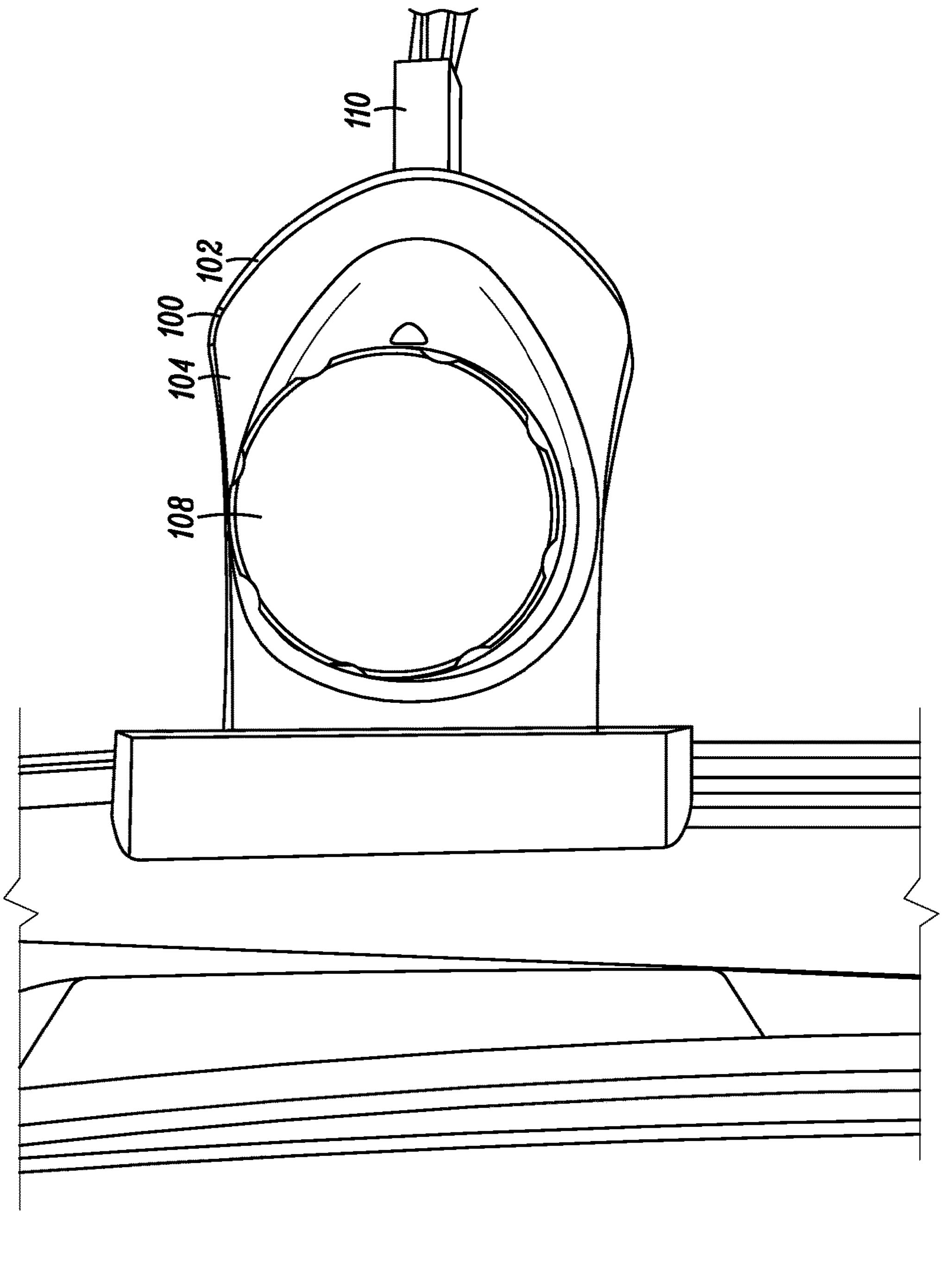


FIG. 6
PRIOR ART

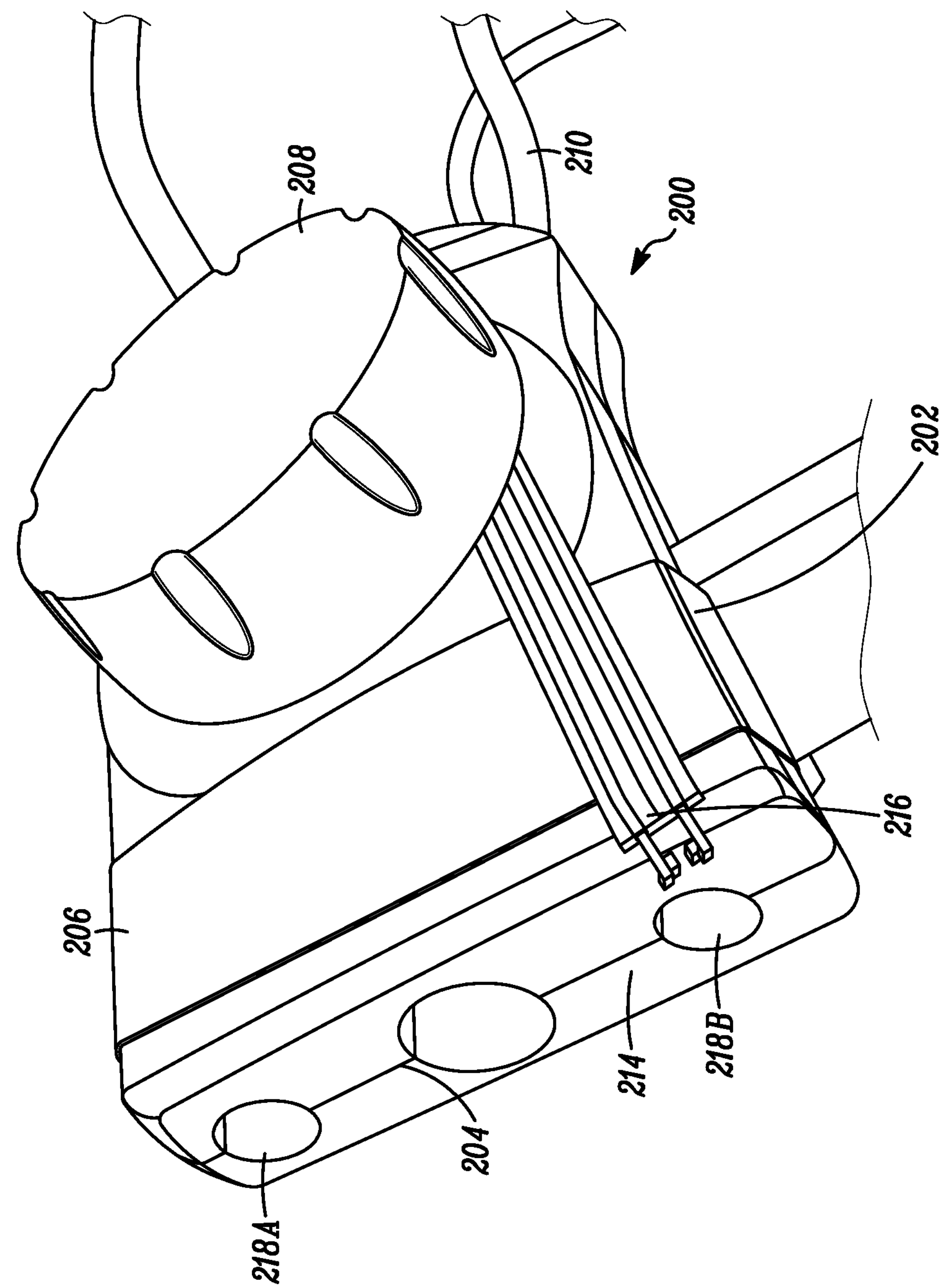


FIG. 7

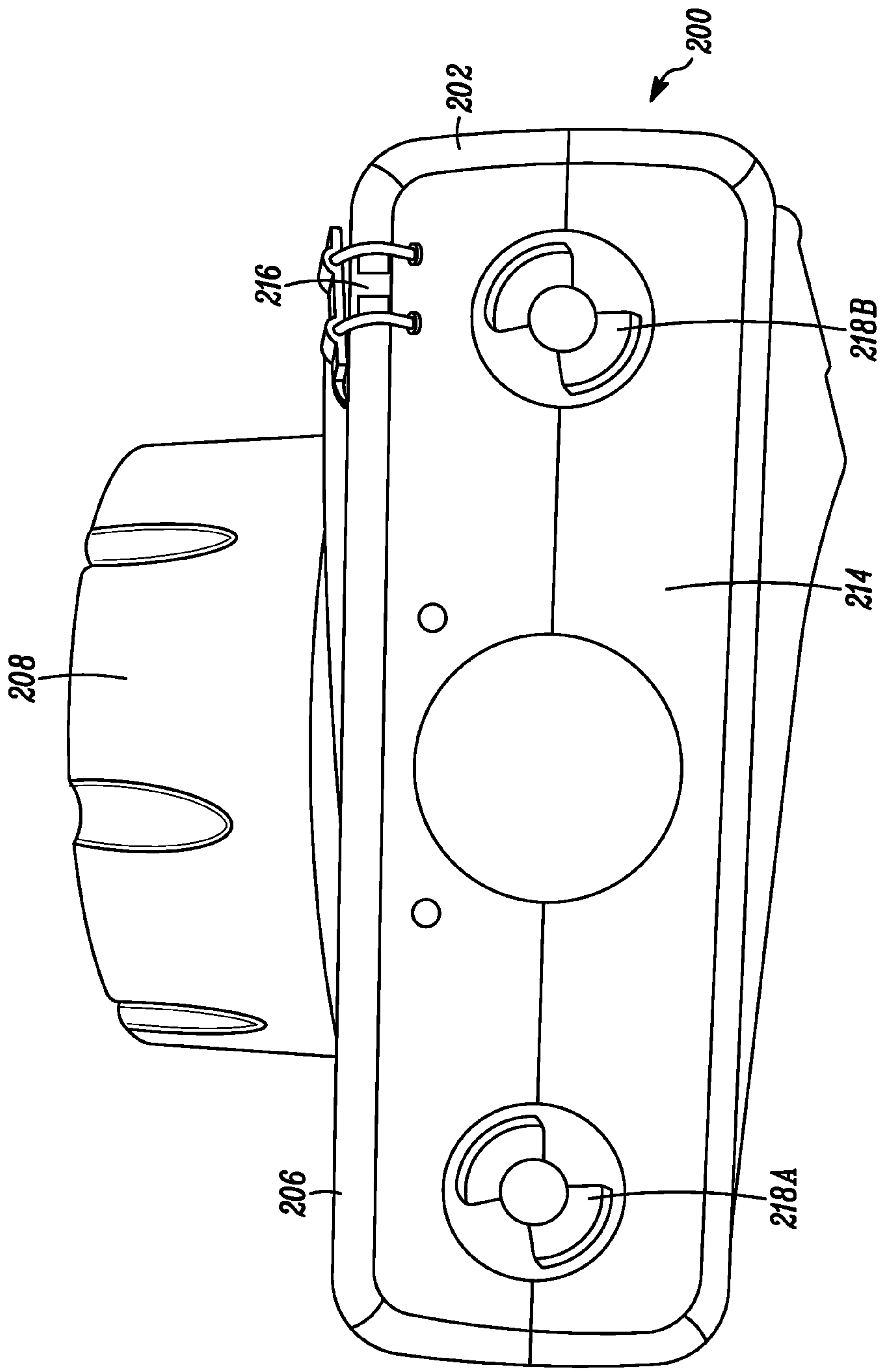


FIG. 8

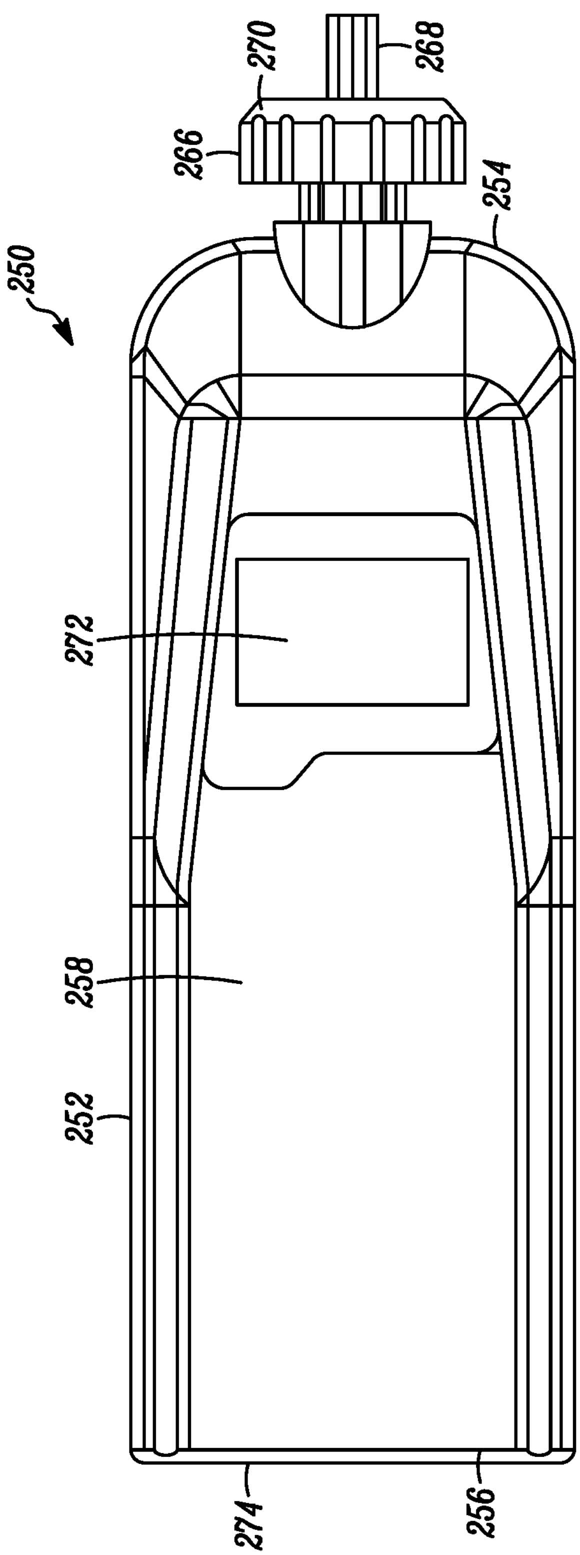


FIG. 9

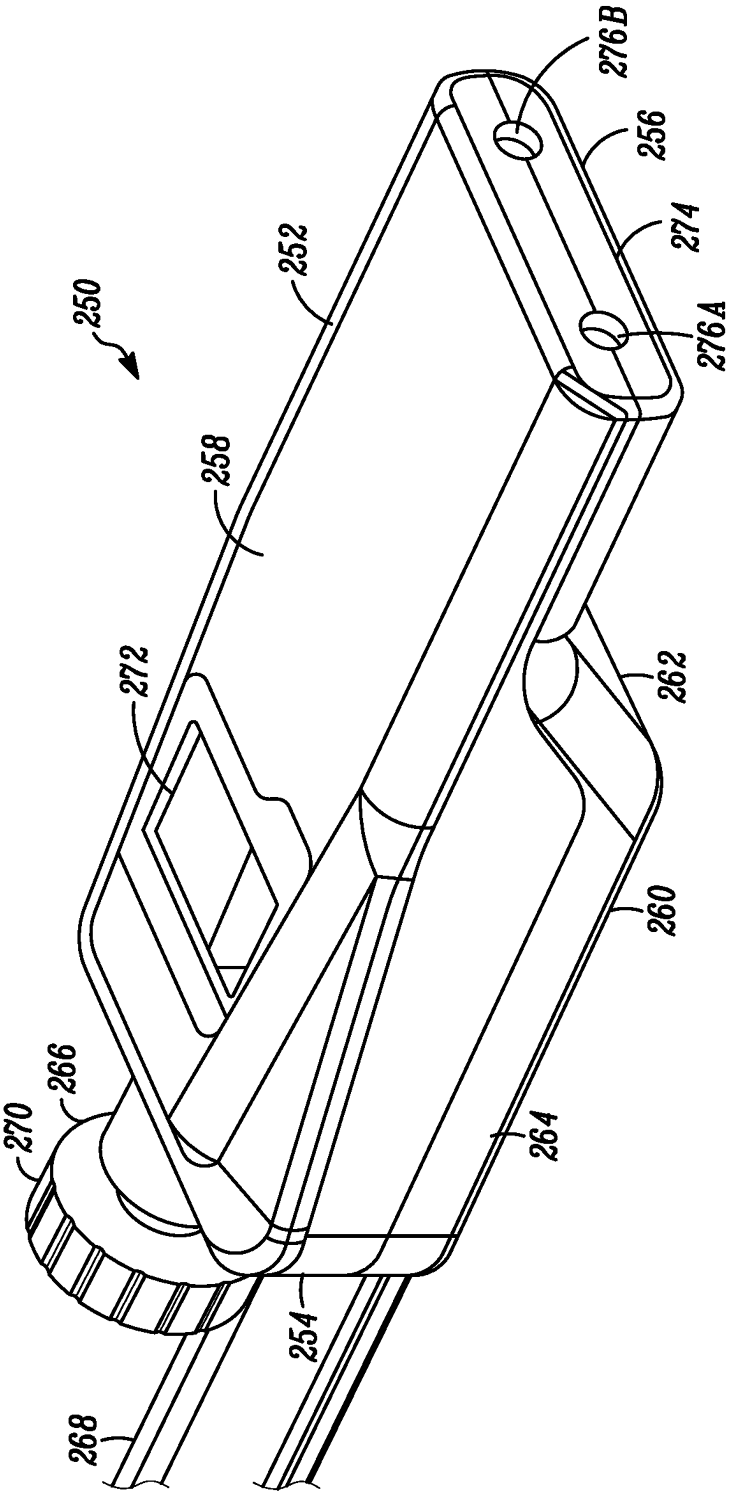
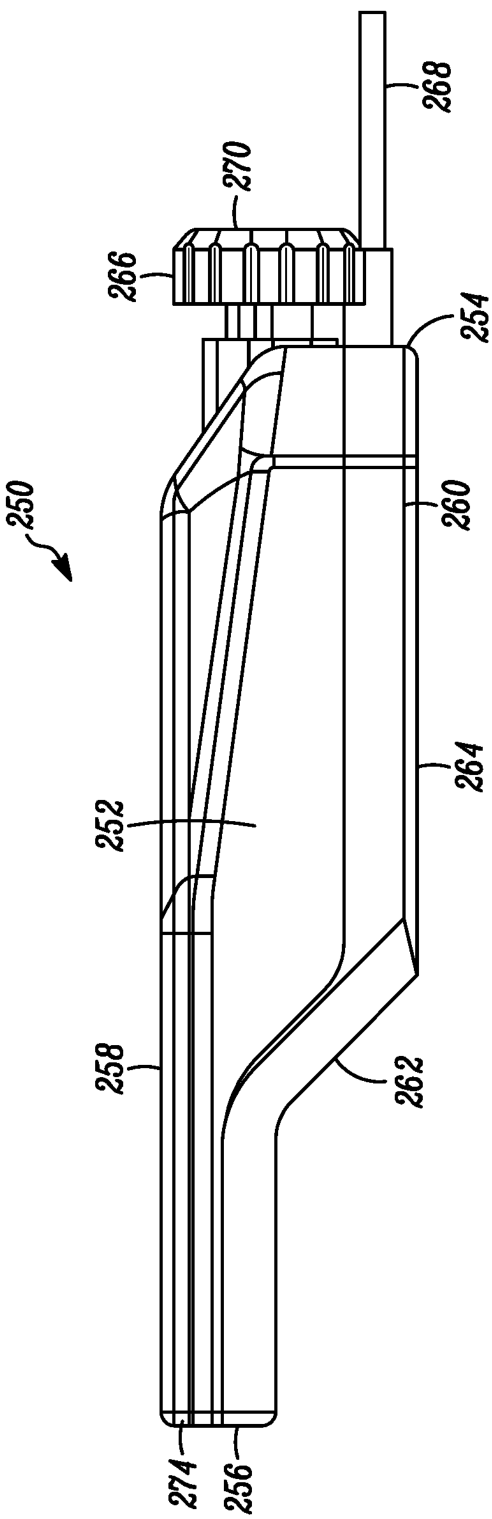


FIG. 10



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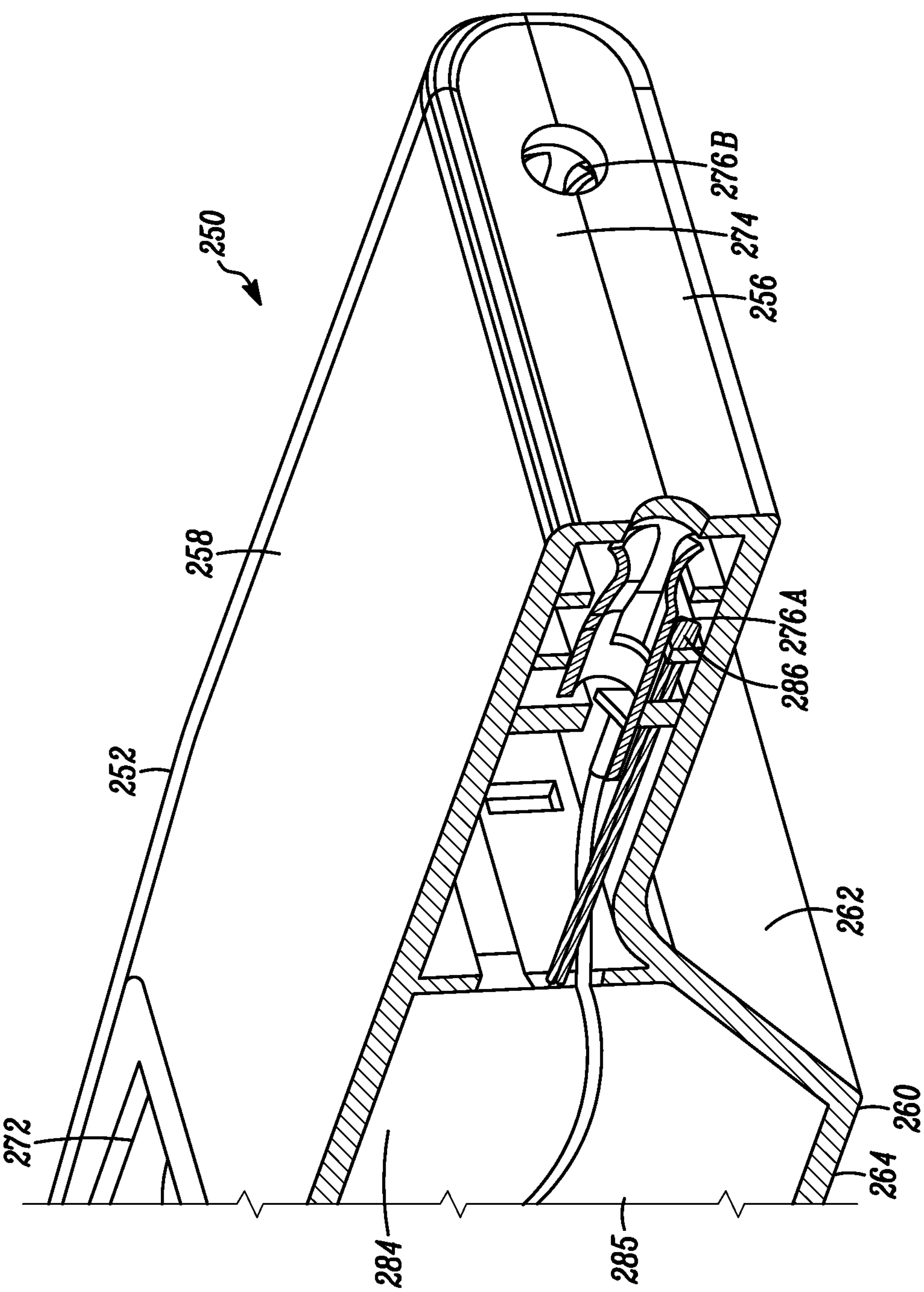

FIG. 12

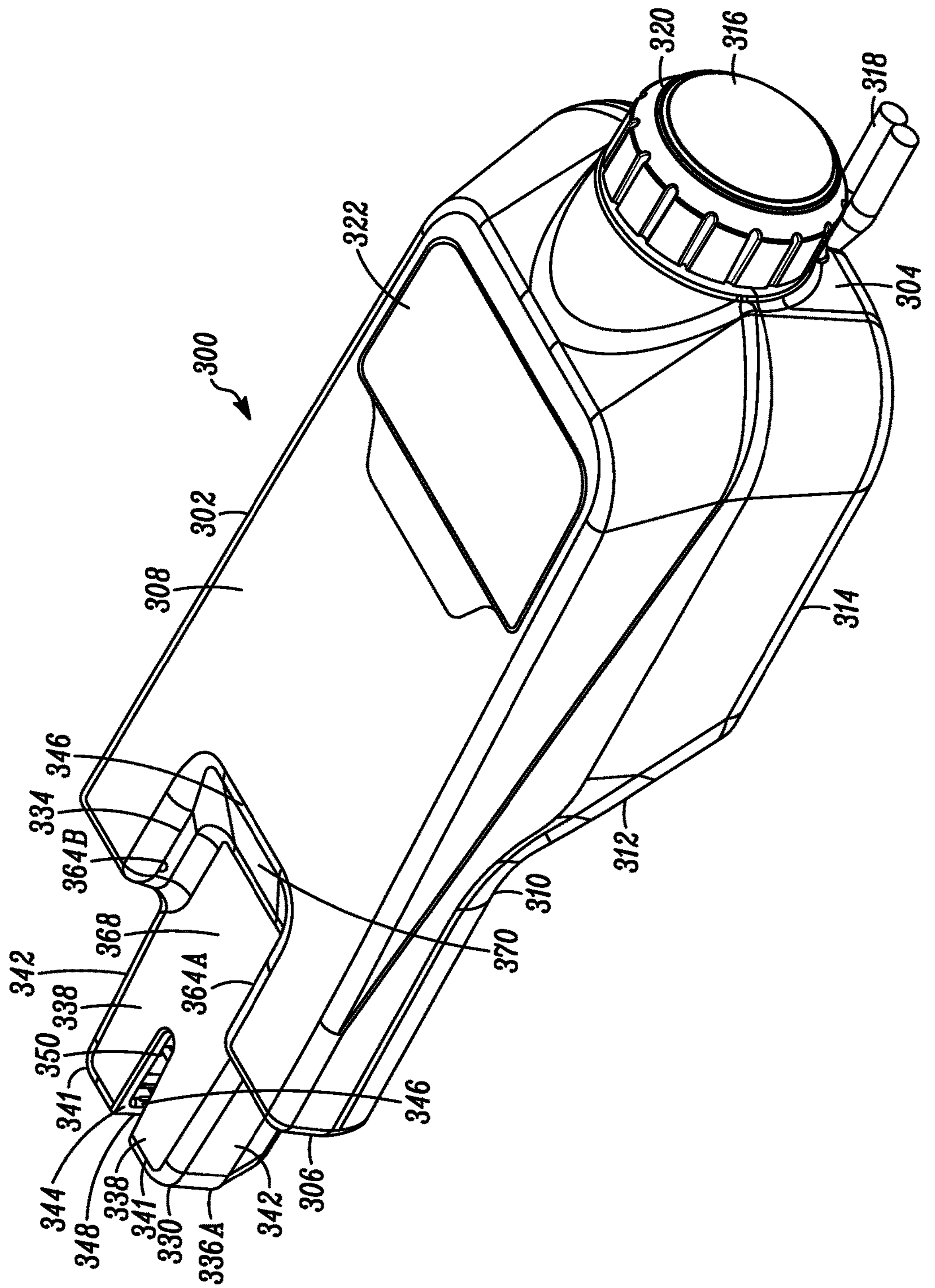
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FIG. 13

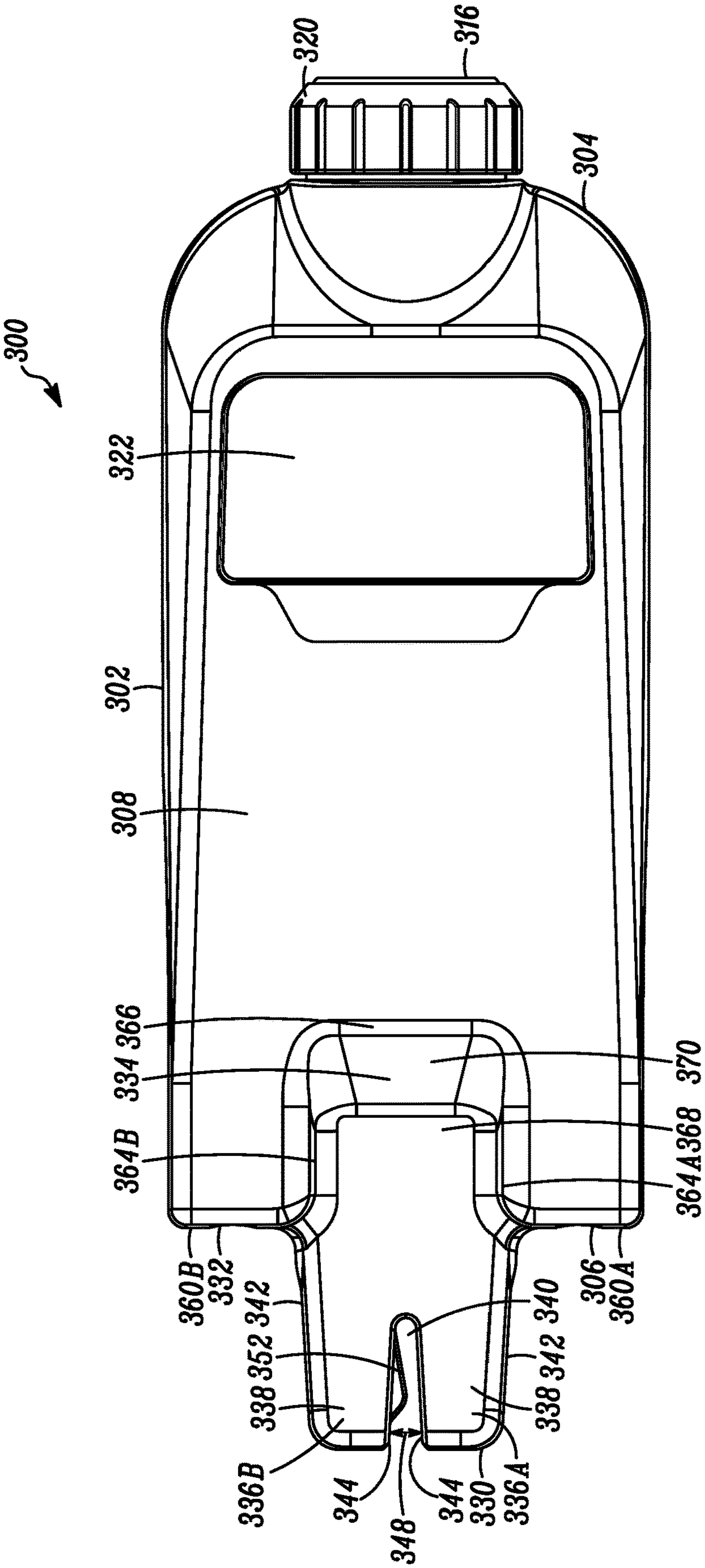

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FIG. 14

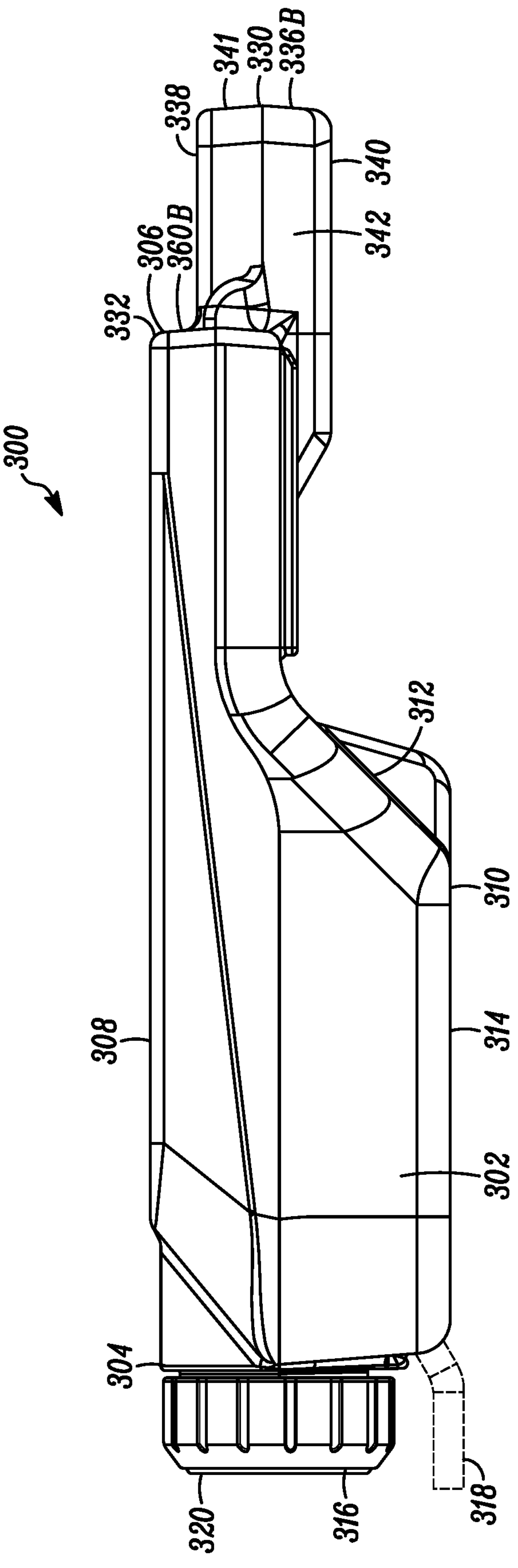

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FIG. 15

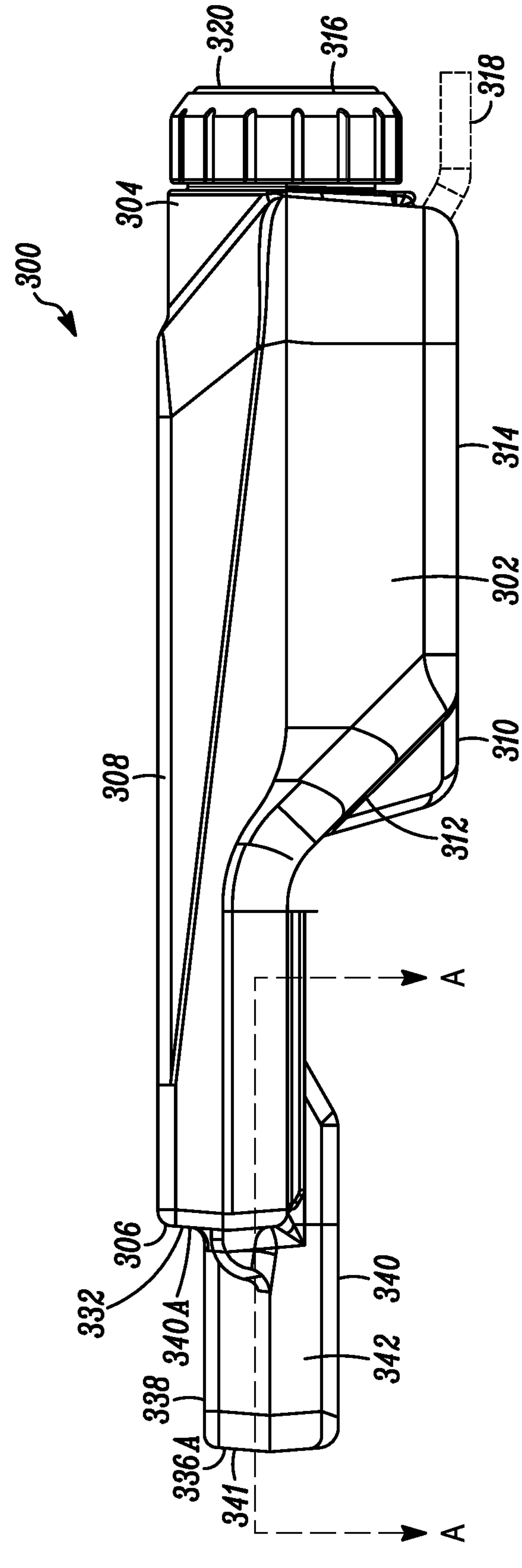
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FIG. 16

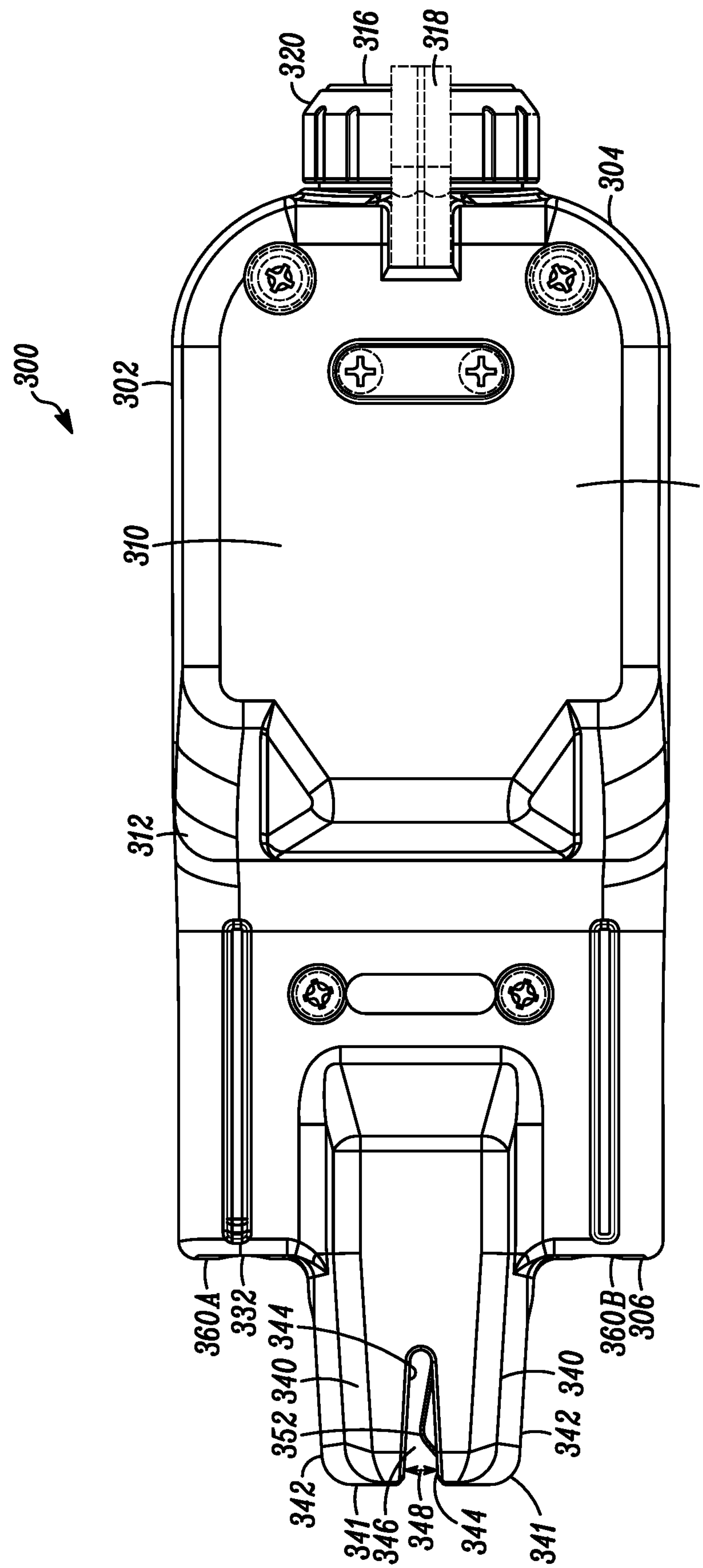
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FIG. 17

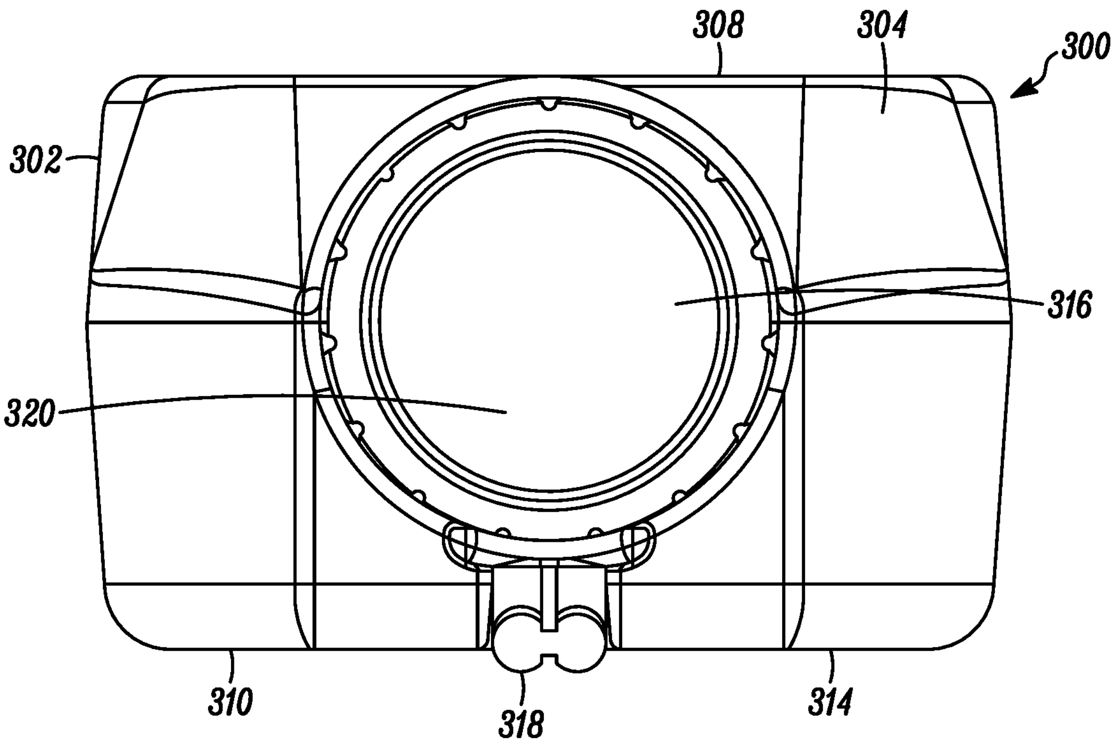
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FIG. 18

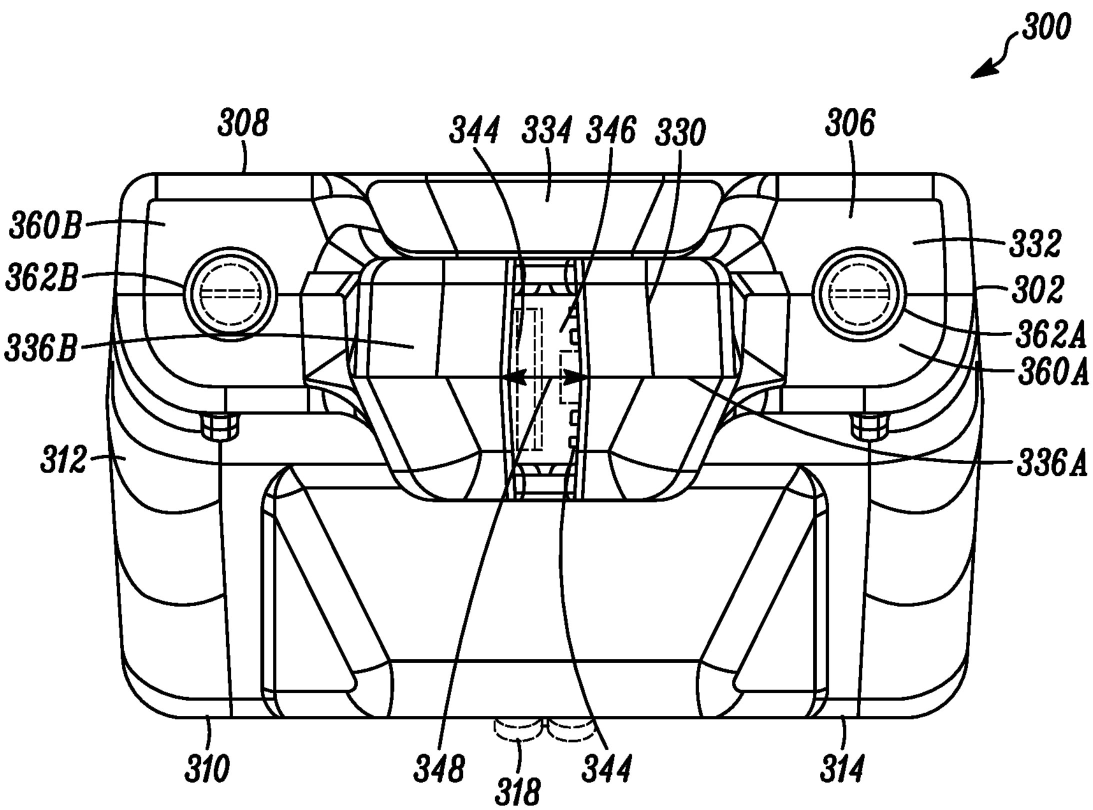
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FIG. 19

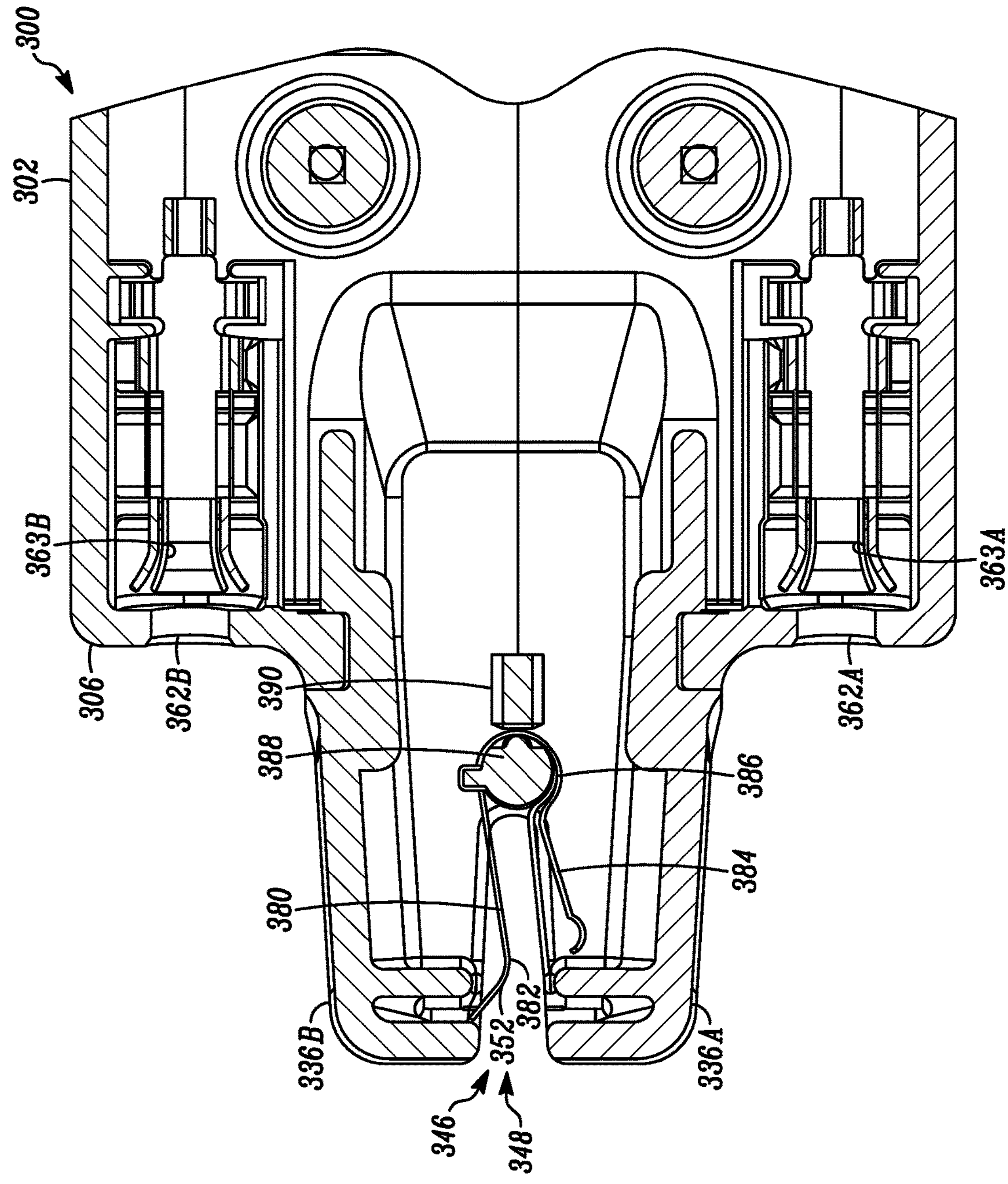
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FIG. 20

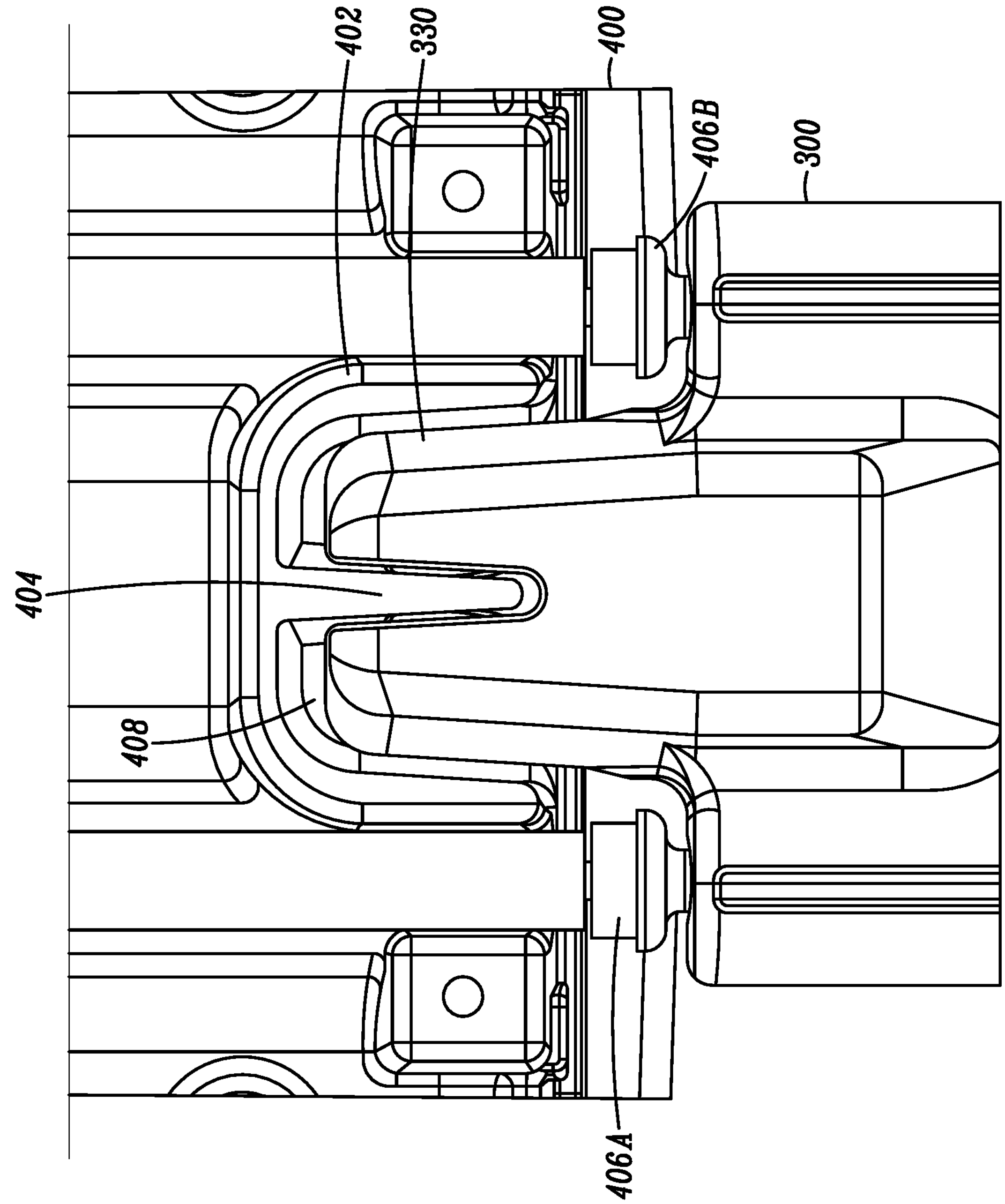

FIG. 21

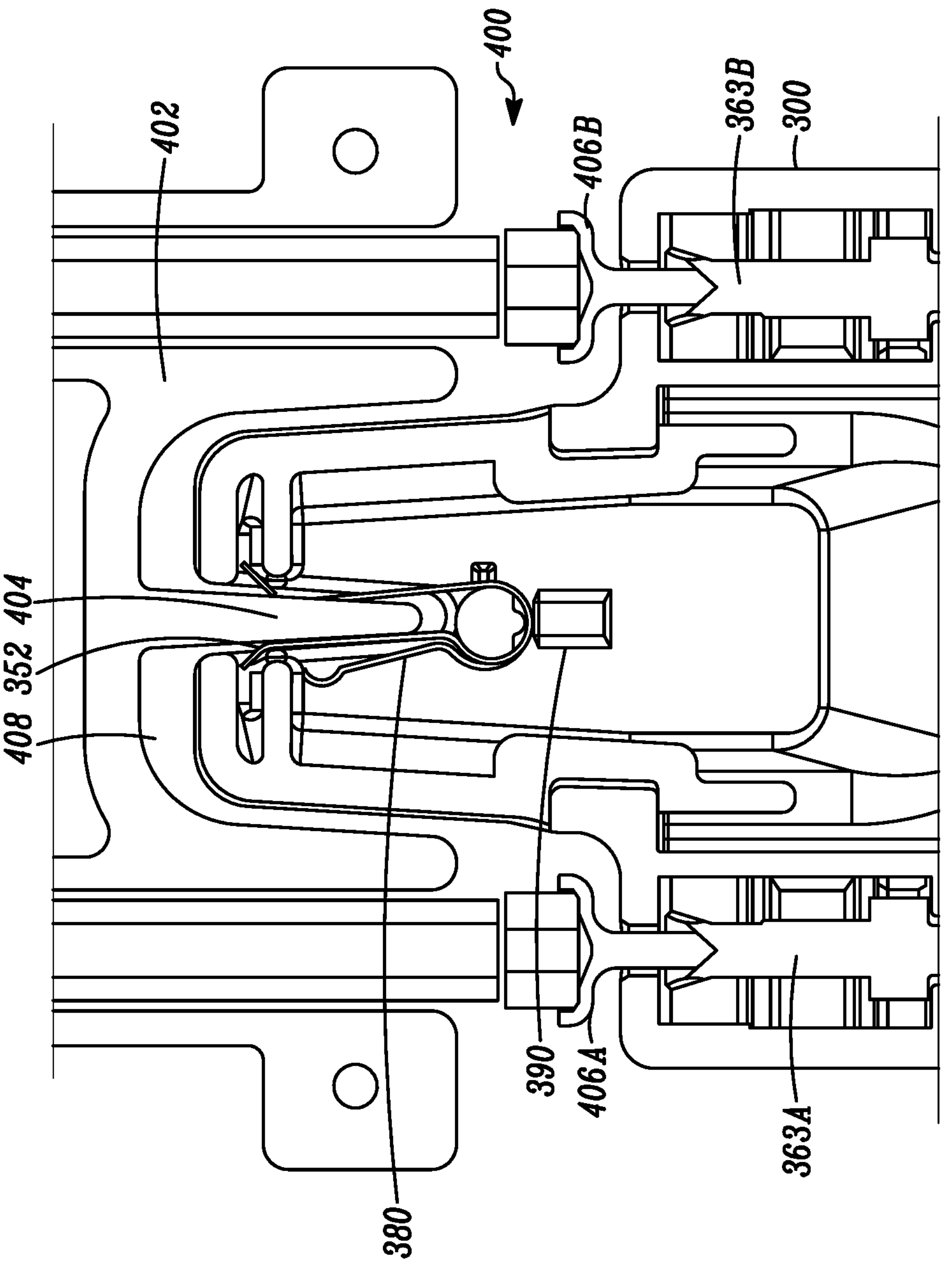

FIG. 22

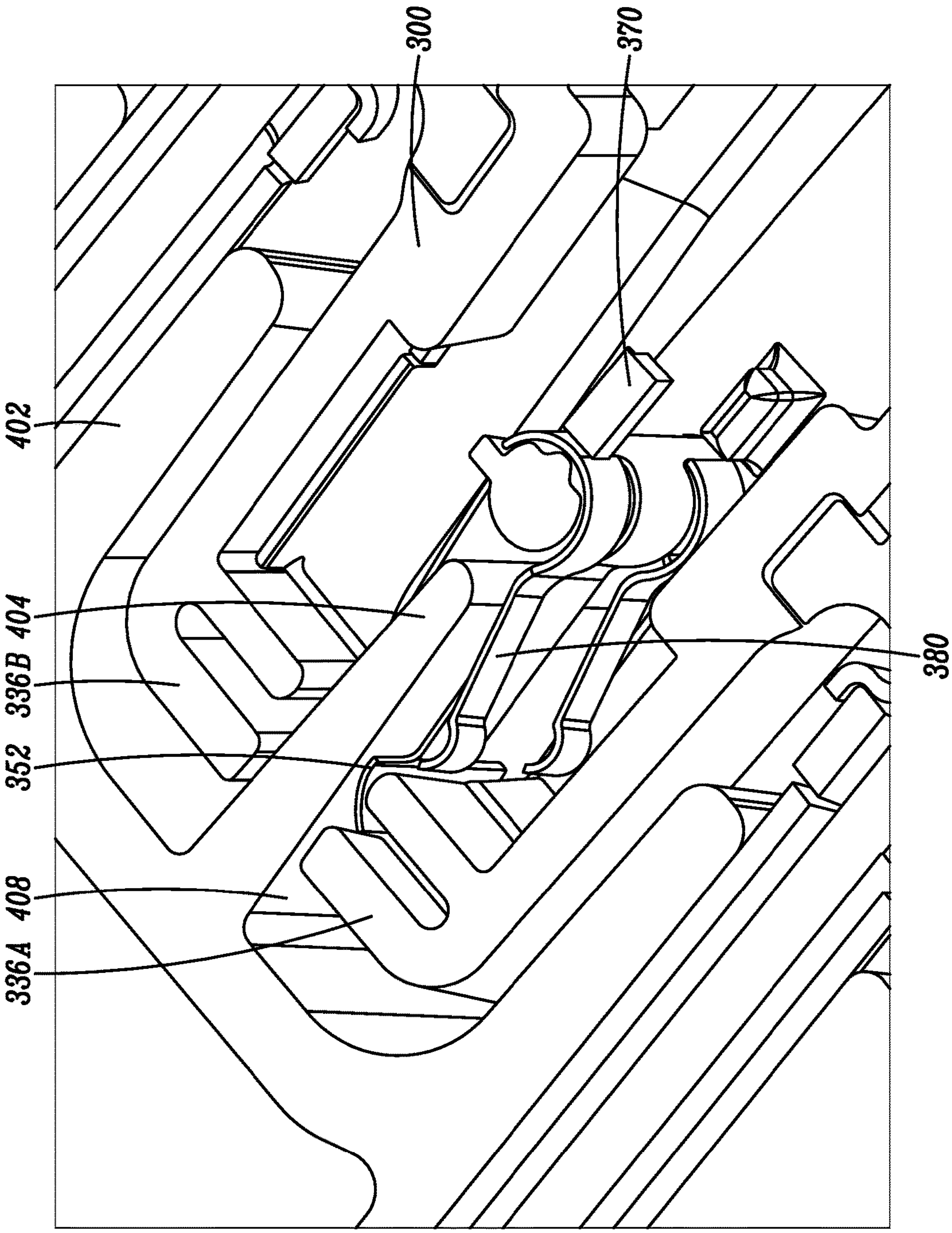

FIG. 23

HEATER CONTROL FOR COUNTERTOP APPLIANCE

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation of and claims the benefit of U.S. Nonprovisional application Ser. No. 17/357,507 filed Jun. 24, 2021, which claims the benefit of application Ser. No. 16/196,561 (filed Nov. 20, 2018), which claims the benefit of U.S. Provisional Application Nos. 62/588,741 (filed Nov. 20, 2017) and 62/640,952 (filed Mar. 9, 2018), the contents of which are fully incorporated herein by reference.

TECHNICAL FIELD

The present disclosure is directed to countertop appliances for preparing food. More specifically, the present disclosure is directed to a control system that uses a thermal sensor arranged to measure an appliance temperature so as to provide consistent temperature control and avoid large temperature swings during food preparation.

BACKGROUND

Countertop appliances for preparing food including, for example, slow cookers, multi-cookers, griddles and skillets are well known and are frequently used to prepare a variety of food types. Traditionally, these countertop appliances have utilized detachable temperature controllers that include a relatively large temperature probe with an embedded thermocouple to measure temperature. Typically, these temperature probes are insertable into a probe cavity such that the temperature probe is in physical contact with a lower side of a cooking surface. Due to the large size of the temperature probe, the physical contact with a lower surface of the cooking surface and the overall large heat sink encompassed by material that makes up the cooking surface, the measurements of the thermocouple within the temperature probe tend to trail the cooking surface temperature as the cooking surface is being heated and conversely the temperature measurements of the thermocouple tend to remain above the temperature of the cooking surface as the cooking surface is cooling and/or not being heated. As such, existing temperature probes make it difficult to maintain a consistent, desired temperature during cooking.

Due to the lagging and leading nature of existing countertop appliance temperature probes and the accompanying inefficiencies of said probes, it would be advantageous to improve upon conventional designs for monitoring and controlling the temperature of countertop appliances.

SUMMARY

The present disclosure provides a temperature controlling apparatus and method of use for consistent and efficient temperature control of a countertop appliance through the use of a temperature sensor that avoids both self-heating and heat retention such that the temperature sensor avoids coloring or impacting a response provided to a temperature control. For example, a representative temperature sensor for use in the present disclosure can comprise a noncontact temperature sensor such as an infrared or thermopile sensor. Alternatively, the temperature sensor can comprise either a linear or nonlinear NTC (Negative Temperature Coefficient) sensor. In the case of a noncontact temperature sensor, the noncontact temperature sensor can be positioned so as to face or be in proximity to a cooking surface without being placed in physical contact with the cooking surface. In one representative embodiment, the noncontact temperature sensor can comprise an infrared sensor that is positioned to directly measure the temperature of the cooking surface. In another representative embodiment, the temperature sensor can be located within a controller body so as to read a resilient temperature member that is in physical contact with a projecting rib on the appliance. As the noncontact temperature sensor allows for temperature measurement without heat conduction, the noncontact temperature sensor is able to measure the actual cooking surface temperature in real time. By measuring and communicating the cooking surface temperature to a temperature controller in real time, the temperature controller can respond immediately to any temperature changes and therefore enables the cooking temperature to be controlled and maintained in a consistent manner without experiencing large temperature over and undershoots. In one embodiment, the countertop appliance can utilize a temperature sensor that avoids self-heating and heat retention such that the temperature sensor avoids coloring or impacting a response provided to a temperature control. In one embodiment, the temperature sensor can be a noncontact temperature sensor, such as an infrared sensor or thermopile to measure a cooking surface temperature in real-time.

Another embodiment of the present disclosure provides a countertop appliance temperature controller configured to provide an improved temperature control of a resistive heating element heated cooking surface of a countertop appliance through the use of a noncontact thermal sensor. The temperature controller can include a pair of electrical output contacts selectively coupleable to the resistive heating element of the countertop appliance; a user input configured to receive a desired temperature setpoint for the cooking surface of the countertop appliance; a noncontact temperature sensor configured to receive temperature information directly from the cooking surface of the countertop appliance; and a thermostat configured to adjust an electrical output of the pair of electrical output contacts to minimize the difference between the desired temperature setpoint and a perceived actual temperature of the cooking surface based on the received temperature information.

In one embodiment, the noncontact sensor can be configured to receive temperature information directly from the cooking surface for the purpose of inferring the perceived actual temperature of the cooking surface in real-time. In one embodiment, the noncontact sensor is configured to face the cooking surface for receiving radiative temperature information directly from the cooking surface. In one embodiment, the noncontact temperature sensor is spaced apart from the cooking surface to minimize conductive heating from the cooking surface. In one embodiment, the noncontact temperature sensor is a low thermal capacitance sensor configured to minimize heat retention to avoid coloring a perceived actual temperature of the cooking surface. In one embodiment, the noncontact temperature sensor is at least one of a negative coefficient thermistor, a resistive temperature detector (RTD) a thermocouple, an infrared sensor, and/or a thermopile. In one embodiment, the user input is at least one of a rotating temperature control dial, one or more buttons, a touchscreen, and/or a signal receiver configured to receive external commands from a remote device. In one embodiment, the temperature controller further includes a display configured to display the desired temperature setpoint, received temperature information, the perceived actual temperature of the cooking surface, or a combination thereof.

Another embodiment of the present disclosure provides a countertop appliance having improved cooking surface temperature control. The countertop appliance can include a cooking surface, a resistive heating element configured to heat the cooking surface, and a temperature controller. The temperature controller can include an electrical output operably coupled to the resistive heating element; a user input configured to receive a desired temperature setpoint for the cooking surface; a noncontact temperature sensor configured to receive temperature information directly from the cooking surface; and a thermostat configured to adjust the electrical output to minimize a difference between the desired temperature setpoint and an actual temperature of the cooking surface based on the received temperature information. In one embodiment, the countertop appliance can be at least one of a griddle, skillet, slow cooker, and/or multi-cooker.

Another embodiment of the present disclosure provides a method of improved temperature control of a resistive heating element heated cooking surface of a countertop appliance through the use of a noncontact thermal sensor. The method can include: directly sensing an actual temperature of the cooking surface via a noncontact thermal sensor; and adjusting an electrical output of the resistive heating element to minimize a difference between a desired temperature setpoint and a perceived actual temperature of the cooking surface.

Another embodiment of the present disclosure provides a method of controlling temperature in a countertop appliance. The method can comprise the step of measuring a cooking surface temperature with a temperature sensor that avoids self-heating and heat retention such that the temperature sensor avoids coloring or impacting a response provided to a temperature control. The method can further comprise the step of communicating the cooking surface temperature in real-time to a temperature controller. In some embodiments, the temperature sensor can comprise a noncontact temperature sensor such as an infrared sensor or thermopile.

Another embodiment of the present disclosure provides a countertop appliance temperature controller configured to provide improved temperature control of a resistive heating element of a countertop appliance. The temperature controller can include a pair of electrical output contacts selectively coupleable to the resistive heating element of the countertop appliance; a user input configured to receive a desired temperature setpoint for the resistive heating element; a conductive temperature sensor in conductive heating communication with at least one electrical output contact of the pair of electrical output contacts, so as to receive temperature information from the resistive heating element; and a thermostat configured to adjust an electrical output of the pair of electrical output contacts to minimize the difference between the desired temperature setpoint and a measured temperature of the resistive heating element based on the received temperature information.

Another embodiment of the present disclosure provides a countertop appliance having improved cooking surface temperature control. The countertop appliance can include a cooking surface in conductive heating communication with a projecting rib; a resistive heating element configured to heat the cooking surface and projecting rib; and a temperature controller. The temperature controller can include in electrical output operably coupled to the resistive heating element; a user input configured to receive a desired temperature setpoint for the cooking surface; a temperature sensor configured to receive temperature information from the projecting rib; and a thermostat configured to adjust the electrical output to minimize a difference between the desired temperature setpoint and a perceived actual temperature of the cooking surface based on the received temperature information.

The above summary is not intended to describe each illustrated embodiment or every implementation of the subject matter hereof. The figures and the detailed description that follow more particularly exemplify various embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

Subject matter hereof may be more completely understood in consideration of the following detailed description of various embodiments in connection with the accompanying figures, in which:

FIG. **1** is a top view depicting a conventional temperature controller according to the prior art.

FIG. **2** is a perspective end view depicting the conventional temperature controller of FIG. **1**.

FIG. **3** is a perspective top view depicting a countertop griddle according to the prior art.

FIG. **4** is a bottom view depicting the countertop griddle of FIG. **3**.

FIG. **5** is a perspective, side view depicting the countertop griddle of FIG. **3**.

FIG. **6** is a detailed top view depicting the conventional temperature controller of FIG. **1** coupled to the countertop griddle of FIG. **3**.

FIG. **7** is a perspective, end view depicting a temperature controller according to a representative embodiment of the present disclosure.

FIG. **8** is an end view depicting the temperature controller of FIG. **7**.

FIG. **9** is a top view depicting a temperature controller according to another representative embodiment of the present disclosure.

FIG. **10** is a perspective, end view depicting the temperature controller of FIG. **9**.

FIG. **11** is a side view depicting the temperature controller of FIG. **9**.

FIG. **12** is a perspective, partial section view depicting the temperature controller of FIG. **9**.

FIG. **13** is a top perspective view depicting a temperature controller according to another representative embodiment of the present disclosure.

FIG. **14** is a top view depicting the temperature controller of FIG. **13**.

FIG. **15** is a right side view depicting the temperature controller of FIG. **13**.

FIG. **16** is a left side view depicting the temperature controller of FIG. **13**

FIG. **17** is a bottom view depicting the temperature controller of FIG. **13**.

FIG. **18** is a front view depicting the temperature controller of FIG. **13**.

FIG. **19** is a rear view depicting the temperature controller of FIG. **13**.

FIG. **20** is a partial section view depicting the temperature controller of FIG. **13** taken at line A-A of FIG. **16**

FIG. **21** is a partial section view depicting the temperature controller of FIG. **13** connected to a countertop appliance.

FIG. **22** is a partial section view depicting the temperature controller of FIG. **13** connected to a countertop appliance.

FIG. **23** is a partial section view depicting the temperature controller of FIG. **13** connected to a countertop appliance.

While various embodiments are amenable to various modifications and alternative forms, specifics thereof have been shown by way of example in the drawings and will be described in detail. It should be understood, however, that the intention is not to limit the claimed disclosures to the particular embodiments described. On the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the subject matter as defined by the claims.

DETAILED DESCRIPTION

A conventional countertop appliance temperature controller **100** of the prior art is illustrated generally in FIGS. **1**, **2** and **6**. Generally, the temperature controller **100** comprises a controller body **102** including a connection end **104**. The controller body **102** can include an upper surface **106** upon which a temperature control dial **108** is mounted. The controller body **102** can be coupled to an electrical cord **110** including a plug **112** for operably connecting the temperature controller **100** to an electrical power source, as is well known in the art. The connection end **104** can generally be defined as a connection wall **114** from which a temperature probe **116** projects, as well as a pair of electrical contacts **118***a*, **118***b*.

Referring now to FIGS. **3**, **4**, **5** and **6**, a countertop appliance **130** can be configured for connection to and operable control by the countertop appliance temperature controller **100**. Though countertop appliance **130** is shown as comprising a griddle **132**, it will be understood that the countertop appliance **130** could also comprise a skillet or a slow cooker/multi-cooker or similar countertop appliances that make use of a temperature controller without departing from the spirit and scope of the present disclosure. Griddle **132** generally comprises a body **134** including a cooking surface **136** and a support structure **138**. Cooking surface **136** generally comprises an upper surface **140** upon which food to be cooked is placed and a lower surface **142** that includes a heater channel **144** for enclosing and positioning a resistive heating element **146** against the lower surface **142**. Generally, the cooking surface **136** is formed of a suitable material, for example, a metallic material, that easily conducts heat such that the resistive heating element **146** can quickly heat the cooking surface **136** and correspondingly the upper surface **140** to a desired heating temperature. Generally, the support structure **138** can comprise a base or legs so as to position the heater channel away from a surface, such as a countertop or table, upon which the countertop appliance is positioned. The support structure **138** further defines a mounting block **148** that is dimensioned to received and retain the connection end **104** of the temperature controller **100**. The mounting block **148** generally exposes a pair of heater connectors **150***a*, **150***b* as well as a probe cavity **152**. Heater connectors **150***a*, **150***b* are generally configured to connect to the corresponding electrical contact **118***a*, **118***b* while the probe cavity **152** is dimensioned to accommodate insertion of the temperature probe **116**.

During conventional operation of the countertop appliance **130**, the connection end **104** of the temperature controller **100** is slidably inserted into the mounting block **148** as illustrated in FIG. **6**. Said connection of the temperature controller **100** to the countertop appliance **130** electrically connects the electrical contacts **118***a*, **118***b* with the resistive heating element **146**, such that the temperature controller **100** selectively supplies electrical current to the resistive heating element **146**. At the same time, the temperature probe **116** is placed in proximity to the lower surface **142** such that a thermocouple within the temperature probe **116** can provide temperature information to the temperature controller **100**. Using the temperature control dial **108**, a user can select a desired temperature for cooking, the temperature controller **100** can selectively power the resistive heating element **146** and the temperature probe **116** can provide temperature feedback to the temperature controller **100** as heat is conducted from the cooking surface **136** to the temperature probe **116**.

FIGS. **7** and **8** illustrate an improved countertop appliance temperature controller **200** according to a representative embodiment of the present disclosure. Preferably, the countertop appliance temperature controller **200** will have a controller body **202** that is substantially similar in size and shape to the controller body **102**, such that the countertop appliance temperature controller **200** can be used with new countertop appliances as well as a retrofit or replacement for existing countertop appliance **130**. Generally, the controller body **202** includes a connection end **204** and an upper surface **206** having a user input or temperature control dial **208**. The controller body **202** can be coupled to an electrical cord **210** including a plug **212** (not shown but similar to plug **112**) for operably connecting the temperature controller **200** to an electrical power source.

As illustrated in FIGS. **7** and **8**, connection end **204** includes a connection wall **214**, a noncontact temperature sensor **216** and a pair of electrical contacts **218***a*, **218***b*. The noncontact temperature sensor **216** can reside anywhere along the connection wall **214** but is generally to be positioned such that when the connection end **204** is attached to the mounting block **148**, the noncontact temperature sensor **216** faces the cooking surface **136**, but is otherwise spaced apart from and not in contact with the cooking surface **136**. As such, the noncontact temperature sensor **216** avoids any conduction of heat directly from the cooking surface **136** to the noncontact temperature sensor **216** itself. The noncontact temperature sensor **216** avoids self-heating and heat retention, so as to avoid coloring or impacting a response provided to a thermostat. The noncontact temperature sensor **216** can comprise an infrared sensor or thermopile that is operably connected to the thermostat and temperature control dial **208**.

In operation, the connection end **204** of the countertop appliance temperature controller **200** is slidably inserted into the mounting block **148** in a manner as described and illustrated previously with respect to countertop appliance temperature controller **100**. As the connection end **204** is received into the mounting block **148** of the countertop appliance **130**, the electrical contacts **218***a*, **218***b* operably engage the resistive heating element **146**. At the same time, the noncontact temperature sensor **216** is positioned to face but otherwise avoid direct contact with the cooking surface **136**. The user adjusts the temperature control dial **208** to a desired cooking temperature setpoint such that the thermostat selectively powers the resistive heating element and the noncontact temperature sensor **216** provides temperature feedback to the temperature controller **200**. In particular, the thermostat can be configured to adjust an electrical output of the pair of electrical output contacts **218***a*, **218***b* to minimize a difference between a desired cooking temperature setpoint established by the temperature control dial **208** and a perceived actual temperature of the cooking surface based on temperature information received by the noncontact temperature sensor **216**.

Due to the noncontact operational nature of the noncontact temperature sensor **216**, the temperature measurement of the cooking surface **136** is conducted in real-time without any conduction delays as experienced with temperature probe **116**. As the temperature measurement is in real-time, the temperature controller **200** immediately responds to temperature changes, thereby cutting off heat or calling for more heat without any lag caused by waiting for conduction to the temperature probe **116**. Furthermore, the large temperature over and undershoots resulting from the conduction delay and heat-sink properties of the cooking surface **136**, heater channel **144**, probe cavity **152** and the temperature probe **116** are eliminated. As such, the actual temperature of the cooking surface can be controlled and maintained in a consistent manner without experiencing large temperature over and undershoots. For instance, the temperature controller **200** can be utilized to maintain a skillet or slow cooker at a low simmer for extended periods of time which is impossible with temperature controller **100** of the prior art.

With reference to FIGS. **9-12**, another representative embodiment of a temperature controller **250** is illustrated. Generally, temperature controller **250** can comprise a controller body **252** having a control end **254** and a connection end **256**. Controller body **252** can further comprise an upper surface **258** and a lower surface **260**. The lower surface **260** can comprise a transition portion **262** between the connection end **256** and a support surface **264** of the lower surface **260**. The control end **254** can include a user input **266** and an electrical cord **268**. The user input **266** can comprise any of a variety of suitable input mechanism including a rotating knob **270** as illustrated or alternatively, a rotating dial, buttons or a touchscreen. Alternatively, the user input **266** can comprise a signal receiver for receiving external commands such as, for example, from a downloadable application on a smart phone or tablet computer via Bluetooth communications or the like. The upper surface **258** can include a temperature display **272** for displaying one or both of a temperature setpoint and an actual cooking temperature. Connection end **256** is generally sized and shaped for insertion into the mounting block **148**. Connection end **256** is generally defined by a connection wall **274** having a pair of electrical contacts **276***a*, **276***b*.

With specific reference to FIG. **12**, controller body **252** generally defines a body interior **284**. Mounted within the body interior **284** is a thermostat **285** and a temperature sensor **286** positioned either in proximity to or in direct contact with electrical contact **276***a*. The temperature sensor **286** can comprise any of a variety of suitable sensor designs including, for example, a Negative Temperature Coefficient (NTC) thermistor, a Resistive Temperature Detector (RTD), a thermocouple or an infrared sensor or thermopile. The temperature sensor **286** can be operably connected to the thermostat to **85**, user input **266** and temperature display **272**, such that the temperature of the electrical contact **276***a* can be measured and compared to the temperature input by a user using the user input **266** and consequently, can be selectively supplied to the resistive heating element **146** through the electrical contacts **276***a*, **276***b*. In this manner, the operational temperature of the countertop appliance **130** is measured and controlled by measuring the electrical contact **276***a* which is in direct thermal connection with resistive heating element **146** during operation. Temperature sensor **286** avoids self-heating and heat retention such that the temperature sensor **286** avoids coloring or impacting a response provided to a temperature control. As such, any heat sink delays attributed to the mass of the cooking surface **136** are avoided.

Another representative embodiment of an improved countertop appliance temperature controller **300** is illustrated within FIGS. **13-23**. Generally, temperature controller **300** can comprise a controller body **302** having a control end **304** and a connection end **306**. The controller body **302** can further comprise an upper surface **308** and a lower surface **310**. The lower surface **310** can comprise a transition portion **312** between the connection end **306** and a support surface **314** of the lower surface **310**. The control end **304** can include a user input **316** and an electrical cord **318**. The user input **316** can comprise any of a variety of suitable input mechanisms including a rotating knob **320** as illustrated or alternatively, a rotating dial, buttons or a touchscreen. Alternatively, the user input **316** can comprise a signal receiver for receiving external commands such as, for example, from a downloadable application on a smart phone or tablet computer via Bluetooth communications or the like. The upper surface **308** can include a temperature display **322** for displaying one or both of a temperature setpoint and an actual cooking temperature.

As seen in FIGS. **13-17** and **19-23**, the connection end **306** can generally be defined by a projecting portion **330**, an engagement wall **332** and an engagement recess **334**. The projecting portion **330** generally comprises a pair of opposed projecting members **336***a*, **336***b*, each of which comprise an upper guide surface **338**, a lower guide surface **340**, a projecting end wall **341**, an exterior guide surface **342** and interior cavity surfaces **344**. Generally, the opposed projecting members **336***a*, **336***b* define an engagement cavity **346** defining an engagement opening **348** between the projecting members **336***a*, **336***b*. Generally, at least one of the projecting members **336***a*, **336***b* defines a wall aperture **350**, through that allows a sensing member **352** to extend into the engagement cavity **346**. The engagement wall **332** generally defines a pair of engagement surfaces **360***a*, **360***b* having a pair of engagement apertures **362***a*, **362***b*. As seen in FIGS. **20-22**, each engagement aperture **362***a*, **362***b* includes an electrical contact **363***a*, **363***b* in electrical communication with the electrical cord **318**. The engagement recess **334** can include a pair of recess side walls **364***a*, **364***b* and a recess end wall **366** that cooperatively define a recess cavity **368**. The recess end wall **366** can include a tapered recess wall **370** that extends between the upper guide surface **338** and the upper surface **308** of the controller body **302**.

With specific reference to FIGS. **20** and **22-23**, the sensing member **352** can comprise a temperature conducting member **380** formed of an appropriate conductive material such as, for example, copper or aluminum based materials. The temperature conducting member **380** can generally define a resilient member including an exposed portion **382** that extends through the wall aperture **350** and is resiliently exposed within the engagement cavity **346**. In one representative embodiment, the temperature conducting member **380** can be configured as one or more resilient spring clips **384** including the exposed portion **382** and a mounting portion **386**. The mounting portion **386** generally mounts to an internal mounting post **388** defined between the upper surface **308** and the lower surface **310** of the controller body **302**. The temperature conducting member **380** can include an integral temperature sensor **390**, for example, a Negative Temperature Coefficient (NTC) thermistor such that the integral temperature sensor **390** is in direct contact with or in close proximity to the temperature conducing member **380**. Other suitable temperature sensors including, for example, a Resistive Temperature Detector (RTD), a thermocouple or an infrared sensor or thermopile, can be utilized as well. In this way, the integral temperature sensor **390** is located within the controller body **302** itself and away from the appliance and spaced apart from the engagement wall **332** and the projecting end walls **341**. The integral temperature sensor **390** can avoid self-heating and heat retention so as to avoid coloring or impacting a response provided to a temperature control.

Connection of the temperature controller **300** to a countertop appliance **400** is generally illustrated in FIGS. **21**-**23**. In use, the temperature controller **300** is generally positioned proximate a mounting block **402** of the countertop appliance **400**. The mounting block **402** generally will differ from the conventional mounting block **148**, in that the mounting block **402** includes a projecting rib **404** that is slightly undersized with respect to the size and shape of the engagement cavity **346**. The projecting rib **404** is preferably formed integrally with the cooking surface **136** such that the projecting rib **404** is the same temperature as the cooking surface **136**. As the projecting portion **330** is advanced into the mounting block **402**, the projecting rib **404** is guided into the engagement opening **348** and is forced into contact with the sensing member **352**. The resilient nature of the temperature conducting member **380** enables the projecting members **336***a*, **336***b* to be fully inserted into the mounting block **402**, while maintaining continual contact of the sensing member **352** with the projecting rib **404**. As the projecting portion **330** is inserted into the mounting block **402**, heating connectors **406***a*, **406***b* on the countertop appliance **400** are inserted into the corresponding electrical contacts **363***a*, **363***b*. In a preferred embodiment, projecting rib **404** is only in direct contact with the sensing member **352** when the temperature controller **300** is fully engaged with the mounting block **402** so as to define an air gap **408** between the connection end **306** and the portion of the mounting block **402** that are at the temperature of the cooking surface **136** such that the controller body **302** can be fabricated of appropriate high temperature thermoplastic or thermoset polymeric materials.

When the temperature controller **300** is operably engaged to the countertop appliance **400**, the integral temperature sensor **390** can sense the temperature of the temperature conducting member **382** which is in direct contact with the projecting rib **404**. The integral temperature sensor **390** communicates the temperature to a thermostat or digital processor within the temperature controller **300** and selectively powers the connected electrical contacts **363***a*, **363***b* and heating connectors **406***a*, **406***b* depending upon what the user has requested using the user input **316**.

Persons of ordinary skill in the relevant arts will recognize that the subject matter hereof may comprise fewer features than illustrated in any individual embodiment described above. The embodiments described herein are not meant to be an exhaustive presentation of the ways in which the various features of the subject matter hereof may be combined. Accordingly, the embodiments are not mutually exclusive combinations of features; rather, the various embodiments can comprise a combination of different individual features selected from different individual embodiments, as understood by persons of ordinary skill in the art. Moreover, elements described with respect to one embodiment can be implemented in other embodiments even when not described in such embodiments unless otherwise noted.

Although a dependent claim may refer in the claims to a specific combination with one or more other claims, other embodiments can also include a combination of the dependent claim with the subject matter of each other dependent claim or a combination of one or more features with other dependent or independent claims. Such combinations are proposed herein unless it is stated that a specific combination is not intended.

Any incorporation by reference of documents above is limited such that no subject matter is incorporated that is contrary to the explicit disclosure herein. Any incorporation by reference of documents above is further limited such that no claims included in the documents are incorporated by reference herein. Any incorporation by reference of documents above is yet further limited such that any definitions provided in the documents are not incorporated by reference herein unless expressly included herein.

For purposes of interpreting the claims, it is expressly intended that the provisions of 35 U.S.C. § 112(f) are not to be invoked unless the specific terms "means for" or "step for" are recited in a claim.

What is claimed is:

1. An appliance temperature controller, the temperature controller comprising:

at least two electrical output contacts selectively coupleable to an appliance;

a user input configured to receive a desired temperature setpoint;

a temperature sensor in thermal communication with a temperature conducting member, the temperature conductive member adapted to receive a projecting rib formed in a cook surface portion of the appliance such that the temperature sensor receives temperature information from the cook surface via the projecting rib, the temperature sensor positioned such that it does not receive temperature information from the projecting rib directly;

a mounting block positioned between the temperature sensor and an engagement opening configured to receive the projecting rib, the mounting block forming a barrier between the temperature sensor and the engagement opening; and

a thermostat configured to adjust an electrical output of at the least two of the electrical output contacts to minimize a difference between the desired temperature setpoint and a measured temperature of the projecting rib based on the received temperature information.

2. The temperature controller of claim **1**, wherein the temperature sensor is a low thermal capacitance sensor configured to minimize heat retention.

3. The temperature controller of claim **1**, wherein the temperature sensor is at least one of a negative coefficient thermistor, resistive temperature detector (RTD), a thermocouple, and a thermopile.

4. The temperature controller of claim **1**, wherein the user input is at least one of a rotating temperature control dial, one or more buttons, a touchscreen, and/or a signal receiver configured to receive external commands from a remote device.

5. The temperature controller of claim **1**, further comprising a display configured to display the desired temperature setpoint, received temperature information, a perceived actual temperature of the cooking surface, or a combination thereof.

6. The temperature controller of claim **1**, wherein an enclosure surrounds the temperature sensor, the enclosure having an engagement wall at a first surface comprising the least two electrical output contacts, the enclosure extending to second surface comprising a projecting end wall surface, the temperature conductive material being housed in a portion of the enclosure comprising the projecting end wall, the temperature conductive material held against the temperature sensor by the mounting block such that the temperature conductive material contacts the projecting rib in a position extending beyond the least two electrical output contacts.

7. The temperature controller of claim 1, wherein the temperature conductive material is held against the projecting rib by spring tension.

8. The temperature controller of claim 1, wherein the projecting end wall comprises an engagement cavity sized to admit the projecting rib and allows the temperature conductive material to contact the projecting rib.

9. A countertop appliance having improved cooking surface temperature control, the countertop appliance comprising:
- a cooking surface;
- a heating element configured to heat the cooking surface; and
- a temperature controller comprising:
  - at least two electrical output contacts selectively coupleable to the heating element;
  - a user input configured to receive a desired temperature setpoint for the resistive heating element;
  - a temperature sensor in thermal communication with a temperature conducting member, the temperature conductive member adapted to receive a projecting rib formed in a cook surface portion of the appliance such that the temperature sensor receives temperature information from the cook surface via the projecting rib, the temperature sensor positioned such that it does not receive temperature information from the projecting rib directly;
- a mounting block positioned between the temperature sensor and an engagement opening configured to receive the projecting rib, the mounting block forming a barrier between the temperature sensor and the engagement opening; and
  - a thermostat configured to adjust an electrical output of at the least two of the electrical output contacts to minimize a difference between the desired temperature setpoint and a measured temperature of the projecting rib based on the received temperature information.

10. The countertop appliance of claim 9, wherein the temperature sensor is a low thermal capacitance sensor configured to minimize heat retention.

11. The countertop appliance of claim 9, wherein an enclosure surrounds the temperature sensor, the enclosure having an engagement wall at a first surface comprising the least two electrical output contacts, the enclosure extending to a second surface comprising a projecting end wall surface, the temperature conductive material being housed in a portion of the enclosure comprising the projecting end wall, the temperature conductive material held against the temperature sensor by the mounting block such that the temperature conductive material contacts the projecting rib in a position extending beyond the least two electrical output contacts.

12. The countertop appliance of claim 9, wherein the temperature conductive material is held against the projecting rib by spring tension.

13. The countertop appliance of claim 9, wherein the projecting end wall comprises an engagement cavity sized to admit the projecting rib and allows the temperature conductive material to contact the projecting rib.

14. The countertop appliance of claim 9, wherein the temperature sensor is at least one of a negative coefficient thermistor, a resistive temperature detector (RTD), a thermocouple, an infrared sensor, and a thermopile.

15. The countertop appliance of claim 9, further comprising a display configured to display at least one of the desired temperature setpoint, received temperature information, and the perceived actual temperature of the cooking surface.

16. A method of providing improved temperature control of a cooking surface of an appliance, the method comprising:
- receiving a desired temperature setpoint from a user input;
- placing a thermal sensor in thermal communication with a temperature conducting member, the temperature conductive member the temperature sensor positioned such that it does not receive temperature information from cooking surface directly;
- causing a projecting rib formed in a cook surface portion of the appliance to become in contact with the temperature conductive member such that the temperature sensor receives temperature information from the cook surface via the projecting rib,
- the projecting rib prevented from contacting the temperature sensor by a barrier positioned between the temperature sensor and the projecting rib,
- sensing an actual temperature of the cook surface portion of the appliance via the thermal sensor;
- providing a signal representing the sensed actual temperature to a thermostat;
- comparing the desired temperature setpoint to the signal and
- adjusting an electrical output to the cooking surface of an appliance to minimize a difference between the desired temperature setpoint and an actual temperature of the cooking surface of an appliance.

17. The method of claim 16, wherein the thermal sensor is a low thermal capacitance sensor configured to minimize heat retention.

18. The method of claim 16, further comprising pressing the temperature conductive material against the projecting rib using spring tension.

19. The method of claim 16, wherein the thermal sensor is at least one of a negative coefficient thermistor, resistive temperature detector (RTD), a thermocouple, and a thermopile.

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