

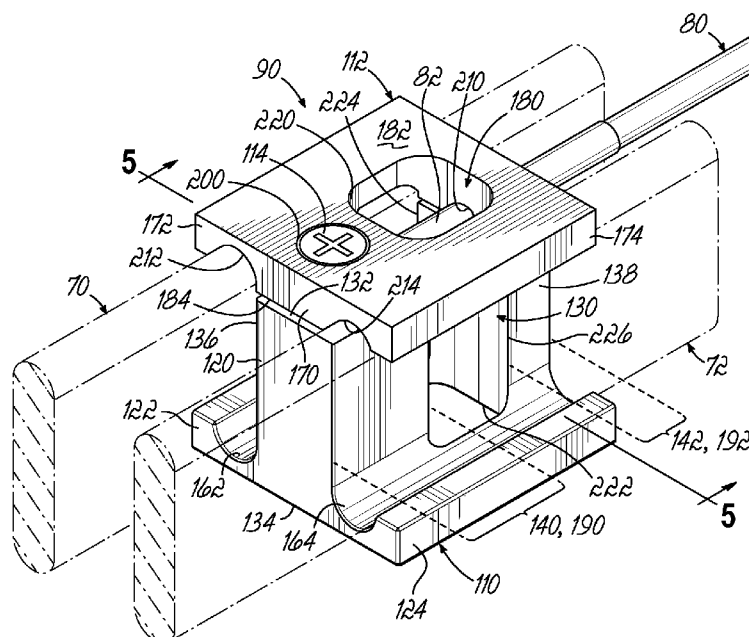
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(54) Title: HIGH LIMIT RTD HOLDER BLOCK

**FIG. 4**

(57) **Abstract:** A holder block (90) for retaining a temperature sensor (80) includes a base portion (110) configured to operatively engage a portion of the temperature sensor (80) and a portion of a heating element (70, 72). The holder block (90) also includes a cap portion (112) removably attachable to the base portion (110), the cap portion (112) being configured to operatively engage a portion of the temperature sensor (80) and a portion of the heating element (70, 72). The base portion (110) and cap portion (112) are moveable relative to each other such that movement of the base portion (110) and cap portion (112) toward each other provides a first clamping action on the heating element (70, 72) and a second clamping action on the temperature sensor (80) to define a clamped position of the holder block (90). When in the clamped position, the base portion (110) and cap portion (112) provide conductive thermal paths and define apertures (220, 222, 224, 226) providing convective thermal paths between the heating element (70, 72) and the temperature



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HIGH LIMIT RTD HOLDER BLOCK

CROSS REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application Serial No. 62/562,673, filed September 25, 2017, the disclosure of which is incorporated by reference herein in its entirety.

TECHNICAL FIELD

[0002] The invention generally relates to fryers and, more particularly, to systems and methods for monitoring the cooking medium temperature and controlling a heater of the fryer to improve temperature management of the cooking medium.

BACKGROUND

[0003] Oil-based frying is commonly used as a cooking method for a wide range of food, such as poultry, fish, and potato products. Commercial fryers include one or more fry pots that are filled with a cooking medium such as oil or solid fats. Heat is provided to the cooking medium using a heater, which typically includes an electrical heating element submerged in the cooking medium or a gas burner thermally coupled to the cooking medium through the walls of the fry pot. When the cooking medium reaches a preset cooking temperature, food products are placed into the cooking medium for a predetermined amount of time during which the food products are cooked by heat from the cooking medium. To facilitate insertion and removal of the food product, the food product is typically placed inside a container, such as a wire basket, and the container is lowered into the cooking medium for the predetermined amount of time.

[0004] Fryers typically include an electronic controller that controls the temperature of the cooking medium by adjusting the output of the heater. To this end, the controller monitors the temperature of the cooking medium and adjusts the output of the heater in response to the temperature of the cooking medium varying from a temperature set-point. If the cooking medium becomes too hot, it may begin to break down, releasing free radicals and substances that can give the food products an undesirable flavor. To prevent the cooking medium from being over-heated, the fryer may also include a high limit temperature module configured to deactivate the heater in response to the temperature of the cooking medium exceeding a maximum allowable temperature.

[0005] High limit temperature modules have a hard trip temperature that is set to prevent the temperature of the cooking medium from ever exceeding the maximum temperature. In response to detecting that the temperature of the cooking medium has exceeded the hard trip temperature, the high limit temperature module cuts power to the heater. The high limit temperature module must then be reset by the operator to resume operation of the fryer after the temperature of the cooking medium has dropped to a suitable level. This need to reset the high limit module can result in significant down time for the fryer. Current systems and methods of operating high limit temperature modules provide a narrow range of operation between the typical cooking temperature and the hard trip temperature. This frequently results in undesirable “nuisance trips,” e.g., tripping of the module during cook cycles even though the temperature of the cooking medium is safely below the accepted level. A contributing factor to this problem is the imprecision with which the temperature of the cooking medium is measured. In this regard, conventional high limit temperature modules rely on high limit temperature sensors, such as thermocouples or resistance temperature detectors (RTD’s), typically arranged to measure either the temperature of the cooking medium or the direct temperature of the heater elements (these values typically differ). Such methods of temperature measurement can lead to inaccurate readings and reduce the precision with which the high limit temperature module operates.

[0006] Thus, there is a need for improved systems and methods for monitoring cooking medium temperature and/or controlling heaters of fryers to prevent the temperature of the cooking medium from exceeding the maximum temperature, while avoiding nuisance trips.

SUMMARY

[0007] In one embodiment, a holder block for retaining a temperature sensor in a cooking apparatus includes a base portion including a bottom central member and first and second legs extending from opposite sides of the bottom central member. The bottom central member includes a lower channel and a bottom probe groove configured to operatively engage at least a portion of the temperature sensor. The first and second legs include first and second bottom element grooves, respectively, each configured to operatively engage at least a portion of first and second heating elements, respectively. The holder block also includes a cap portion removably attachable to the base portion and including a top central member and first and second arms extending from opposite sides of the top central member, the top central member including an upper channel and a top probe groove configured to operatively engage at least a portion of the temperature sensor and located opposite the bottom probe groove, the

first and second arms including first and second top element grooves located opposite the first and second bottom element grooves, respectively, each configured to operatively engage at least a portion of the first and second heating elements, respectively. The base portion and cap portion are moveable relative to each other such that movement of the base portion and cap portion toward each other provides a first clamping action on the first heating element via the first top and bottom element grooves, a second clamping action on the second heating element via the second top and bottom element grooves, and a third clamping action on the temperature sensor via the top and bottom probe grooves. In one embodiment, the base portion and cap portion are configured to provide a plurality of conductive thermal paths between the first and second heating elements and the temperature sensor. In addition or alternatively, the lower and/or upper channels define a plurality of apertures configured to provide a plurality of convective thermal paths between the first and second heating elements and the temperature sensor through a cooking medium. The upper and lower channels may be configured to collectively define a passageway for receiving at least a portion of the temperature sensor.

[0008] In one embodiment, the bottom probe groove is centered along a width of the bottom central member. In addition or alternatively, the top probe groove is centered along a width of the top central member. The top central member may be shorter than the bottom central member. In one embodiment, the bottom probe groove and/or top probe groove is configured to position the temperature sensor $\frac{1}{4}$ inch from the first and/or second heating element. In addition or alternatively, the top probe groove is configured to position the temperature sensor $\frac{1}{4}$ inch from a top surface of the cap portion.

[0009] In another embodiment, a holder block for retaining a temperature sensor in a cooking apparatus containing a cooking medium includes a base portion configured to operatively engage at least a lower portion of the temperature sensor and configured to operatively engage at least a lower portion of at least one heating element. The holder block also includes a cap portion removably attachable to the base portion, the cap portion being configured to operatively engage at least an upper portion of the temperature sensor and configured to operatively engage at least an upper portion of the at least one heating element. The base portion and cap portion are moveable relative to each other such that movement of the base portion and cap portion toward each other provides a first clamping action on the at least one heating element and a second clamping action on the temperature sensor to define a clamped position of the holder block. When in the clamped position, the base portion and cap portion provide a plurality of conductive thermal paths between the at least one heating

element and the temperature sensor and define a plurality of apertures providing a plurality of convective thermal paths between the at least one heating element and the temperature sensor through the cooking medium. In one embodiment, the base portion includes a T-shaped profile. In addition or alternatively, the cap portion includes a truncated T-shaped profile.

[0010] In yet another embodiment, a cooking apparatus includes a fry pot, first and second heating elements configured to heat a cooking medium in the fry pot, and the holder block described above clamped over the first and second heating elements. The cooking apparatus also includes a high limit temperature sensor including a sensing element retained by the holder block and that provides a signal indicative of a temperature in the fry pot. The cooking apparatus further includes a high limit module configured to selectively decouple the first and second heating elements from an energy source in response to the signal indicating the temperature has exceeded a threshold temperature defining a hard trip condition. And the cooking apparatus includes a controller configured to selectively regulate the first and second heating elements in response to the signal indicating the temperature is approaching the threshold temperature. In one embodiment, the sensing element is positioned to sense a temperature greater than an actual temperature of the cooking medium. For example, the sensing element may be positioned to sense a temperature between 40°F and 50°F greater than the actual temperature of the cooking medium. In one embodiment, the sensing element is positioned ¼ inch from the first and/or second heating element. In addition or alternatively, the sensing element is positioned ¼ inch from a top surface of the cap portion.

[0011] In another embodiment, a method of controlling a temperature in a cooking apparatus includes clamping a holder block retaining a temperature sensor over first and second heating elements of the cooking apparatus and sensing, via the temperature sensor, a sensed temperature resulting from heat transfer from a cooking medium in the cooking apparatus and from each of the first and second heating elements. The method also includes comparing the sensed temperature to a threshold temperature. The method further includes, in response to the sensed temperature being equal to or greater than the threshold temperature, deactivating the first and second heating elements. And the method includes, in response to the sensed temperature approaching the threshold temperature, regulating at least one of the first or second heating elements. In one embodiment, sensing the sensed temperature includes providing conductive thermal paths to a sensing element of the temperature sensor. In addition or alternatively, sensing the sensed temperature includes providing convective thermal paths to a sensing element of the temperature sensor.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] The accompanying drawings, which are incorporated in and constitute a part of this specification, illustrate various embodiments of the invention and, together with the general description of the invention given above, and the detailed description of the embodiments given below, serve to explain the embodiments of the invention.

[0013] FIG. 1 is a perspective view of a fryer according to an embodiment of the invention.

[0014] FIG. 2 is a partial perspective view of the heating elements positioned within one of the fry pots of the fryer of FIG. 1, and also showing an exemplary high limit temperature probe holder.

[0015] FIG. 3 is an exploded view of the high limit temperature probe holder of FIG. 2 and a high limit temperature probe.

[0016] FIG. 4 is a perspective view of the high limit temperature probe holder of FIG. 2, showing the high limit temperature probe clamped over the high limit temperature probe.

[0017] FIG. 5 is a front cross sectional view of the high limit temperature probe holder of FIG. 4, taken along section line 5-5.

DETAILED DESCRIPTION

[0018] Embodiments of the invention are directed to systems and methods of controlling a fryer and, more particularly, to systems and methods of controlling a heater that heats a cooking medium in a fry pot of the fryer. The heater is controlled to prevent both overheating of the cooking medium, damage to the fryer, and automatic shutdowns due to the temperature of the cooking medium exceeding a maximum allowable temperature.

[0019] A controller monitors signals received from at least one high limit temperature probe (also referred to as “high limit probe”) and, based on this temperature data, the controller determines if a high limit temperature module (also referred to as “high limit module”) is approaching a hard trip condition. In this regard, the high limit temperature probe is positioned to detect an optimum amount of heat transfer from the cooking medium and from one or more heating elements of the fryer, such that the high limit temperature probe detects a sensed temperature greater than the actual temperature of the oil. If the controller determines the high limit module is approaching the hard trip condition, it preemptively adjusts the output of the heater to avoid the hard trip condition. The controller may thereby prevent the high limit temperature module from detecting a hard trip condition.

This may prevent the down time that typically results from the reset procedure required for the high limit temperature module each time the hard trip condition occurs.

[0020] Referring now to the figures, FIG. 1 depicts an exemplary fryer 10 in accordance with an embodiment of the invention. The fryer 10 includes fry pots 12, 14, a cabinet 16, control panels 18, 20, access panels 22, 24, wheels 26, a basket hanger 28, and a backsplash 30. Each of the fry pots 12, 14, cabinet 16, access panels 22, 24, basket hanger 28, and backsplash 30 may be constructed from stainless steel, mild steel, or some other suitable material. Various features and/or components of the fryer 10 may be similar to those described in Applicant's own U.S. Provisional Application Serial No. 62/507,945, filed on May 18, 2017, and titled "Heating Element Controller for Oil Based Fryer," which is incorporated by reference herein in its entirety.

[0021] A food product may be placed into the fry pots 12, 14, for example, by lowering a basket containing the food product into the fry pot 12, 14. At completion of a cooking cycle, the basket may be removed from the fry pot 12, 14 and hung from the basket hanger 28 to allow excess cooking medium to drain back into the fry pot 12, 14. Each of the fry pots 12, 14 may be associated with a corresponding one of the control panels 18, 20 to provide a human-machine interface for operating the fryer 10. The control panels 18, 20 may receive commands from an operator of the fryer, and display information regarding a status of the fryer 10 to the operator. The access panels 22, 24 may provide access to the interior of cabinet 16 to service the components of the fryer 10, for example.

[0022] Exemplary fryer 10 is depicted as having a separate control panel 18, 20 for each fry pot 12, 14. However, it should be understood that one control panel could be configured to control multiple fry pots, and embodiments of the invention are not limited to fryers having a separate control panel for each fry pot. In addition, although the fryer 10 depicted in FIG. 1 is an electrically-heated open fryer having two fry pots 12, 14, it should be further understood that embodiments of the invention may also be used with many other designs and types of cooking devices, including pressure fryers and/or gas-heated fryers, as well as fryers having a different number of fry pots.

[0023] Referring now to FIG. 2, in addition to fry pots 12, 14, the fryer 10 may include a high limit module 50 and a controller 60. Each fry pot 12, 14 may include first and second heating elements 70, 72 and a high limit temperature probe 80 such as an RTD including a sensing element 82, and may be at least partially filled with a cooking medium such as oil (not shown). The heating elements 70, 72 provide heat energy to the cooking medium and therefore are typically at a higher temperature than the cooking medium. Each probe 80 may

be coupled to the heating elements 70, 72 by a respective holder block or holder 90 and configured so that the corresponding sensing element 82 is in contact with some of the cooking medium under normal operating conditions. Each of the heating elements 70, 72 may be coupled to an energy source 100 (e.g., a source of electricity or fuel) by the high limit module 50. The high limit module 50 may be in communication with the high limit temperature probe 80 and configured to interrupt the supply of electric power to the heating elements 70, 72 in response to detecting a high limit trip condition. The high limit module 50 may thereby provide a mechanism for interrupting power to the heating elements 70, 72 that is independent of the controller 60.

[0024] As shown, the high limit temperature probe 80 may also be in communication with the controller 60. The controller 60, in turn, may be in communication with one or more of the heating elements 70, 72 and/or various other components of the fryer 10, and may control the various cooking and maintenance cycles of the fryer 10 by transmitting signals to, and receiving signals from, these components of the fryer 10. The controller 60 may also be coupled to the control panels 18, 20 to provide operating information to, and receive input from, the operator of the fryer 10. The controller 60 may control the temperature of the cooking medium in each fry pot 12, 14 by selectively activating or otherwise controlling the output of the respective heating element 70, 72, among other functions such as, for example, controlling the filtering and/or addition of cooking oil.

[0025] In the embodiment shown in Fig. 2, the high limit temperature probe 80 is located proximate to one or more heating elements 70, 72. Signals from the high limit temperature probe 80 may be used by the high limit module 50 to determine if power should be cut to the heating elements 70, 72 to avoid burning the cooking medium and/or damaging the fryer 10. These signals may also be used by the controller 60 to determine when the heating elements 70, 72 should be adjusted and/or deactivated to avoid generating a hard trip condition in the fryer 10.

[0026] The temperature probes 80 may each have a certain amount of effective thermal coupling to one or more heating elements 70, 72 and/or to the cooking medium. For example, a temperature probe 80 may be thermally coupled to the heating elements 70, 72 by the holder 90 that supports the temperature probe 80. The amount of effective thermal coupling between each probe 80 and the heating element(s) 70, 72 to which it is coupled by its holder 90 may be determined by the characteristics of the respective holder 90. For example, the use of materials having a high thermal conductivity in the holder 90 may produce a strong thermal coupling between the temperature probe 80 and the heating

element(s) 70, 72 to which the holder 90 is attached. In this regard, components of the holder 90 may provide conductive thermal paths from the heating element(s) 70, 72 to the temperature probe 80. In addition or alternatively, convective thermal paths from the heating element(s) 70, 72 to the temperature probe 80 through voids in the holder 90 may be established to produce a strong thermal coupling with the cooking medium. The proximity of the temperature probe 80 to the respective heating element(s) 70, 72 as a result of the configuration of the holder 90 may also affect the amount of effective thermal coupling. Thus, the thermal coupling between each probe 80 and the cooking medium and/or the heating element(s) 70, 72 to which it is attached by its respective holder 90 may be configured to produce a specific relationship between a temperature of the heating element(s) 70, 72, a temperature of the cooking medium, and a sensed temperature detected by the probe 80, which is generally between the other two temperatures based on the effective thermal coupling to both the cooking medium and the heating elements 70, 72.

[0027] The high limit temperature probe 80, and the control processes that use signals received from this probe 80, may be configured to provide consistent temperatures and to balance the thermal energy in the heating element(s) 70, 72 with the thermal energy in the cooking medium. In other words, the temperature probe holder 90 may be configured to balance the heat received by the sensing element 82 from the heating element(s) 70, 72 and the heat received from contact with the cooking medium such that the sensed temperature is substantially greater than the actual temperature of the cooking medium, as discussed in greater detail below. In this regard, the probe holder 90 of the high limit temperature probe 80 may be configured to position the sensing element 82 of the probe 80 securely and precisely with respect to the heating element(s) 70, 72.

[0028] Referring now to FIG. 3, each temperature probe holder 90 is configured to hold the corresponding probe 80 in place within the corresponding fry pot 12, 14. For example, each temperature probe holder 90 may be configured to clamp onto one or more heating elements 70, 72 and also sandwich the probe 80 in a fixed position. In this regard, each holder 90 may include a base portion 110 and a cap portion 112 coupled together by at least one fastener, such as a threaded screw 114.

[0029] As shown, the base portion 110 may have a generally T-shaped profile and may include an elongate bottom central member 120 and first and second legs 122, 124 extending from opposite sides of the bottom central member 120. The bottom central member 120 may have a width approximately equal to or slightly less than a distance between adjacent heating elements 70, 72 of the fry pot 12, 14 such that the bottom central member 120 may be

positioned therebetween. As shown, a lower channel 130 is provided through the bottom central member 120 and may extend the height of the base portion 110 from a top surface 132 thereof to a bottom surface 134 thereof, and may extend the width of the bottom central member 120 from a first side 136 thereof to a second side 138 thereof to bifurcate the bottom central member 120 into front and rear sections 140, 142. A bore 150 extends through the front section 140 of the bottom central member 120 from the top surface 132 and may be threaded (not shown) for threadably receiving the screw 114. A bottom probe groove 160 longitudinally extends across the top surface 132 of the bottom central member 120 along a path which traverses the rear section 142, spans the lower channel 130 (e.g., the lower channel 130 interrupts the bottom probe groove 160), and terminates at or near the bore 150 on the front section 140. As shown, the bottom probe groove 160 may be substantially centered along the width of the base portion 110 for reasons discussed below. In any event, the bottom probe groove 160 is configured to operatively engage at least a portion of the high limit temperature probe 80. For example, the bottom probe groove 160 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the high limit temperature probe 80. In this regard, the cap portion 112 is highly similar in construction to the base portion 110.

[0030] The first and second legs 122, 124 include first and second bottom element grooves 162, 164, respectively, each longitudinally extending the length of the base portion 110 and configured to operatively engage at least a portion of one or more heating elements 70, 72. For example, the first bottom element groove 164 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the first heating element 70, and the second bottom element groove 164 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the second heating element 72.

[0031] As shown, the cap portion 112 may have a generally truncated T-shaped profile and may include an elongate top central member 170 and first and second arms 172, 174 extending from opposite sides of the top central member 170. The top central member 170 may have a width approximately equal to or slightly less than a distance between adjacent heating elements 70, 72 of the fry pot 12, 14 such that the top central member 170 may be positioned therebetween. In the embodiment shown, the top central member 170 is relatively shorter in height than the bottom central member 120 of the base portion 110. An upper channel 180 is provided through the top central member 170 and may extend the height of the cap portion 112 from a top surface 182 thereof to a bottom surface 184 thereof, and may extend the width of the top central member 170 from a first side 186 thereof to a second side

188 thereof to bifurcate the top central member 170 into front and rear sections 190, 192. As shown, the upper channel 180 may be sized, shaped, and positioned for alignment with the lower channel 130 of the base portion 110. A hole 200 extends through the front section 190 from the top surface 182 to the bottom surface 184 for receiving the screw 114 and may be sized and positioned for alignment with the bore 150 of the base portion 110 to facilitate coupling of the cap portion 112 to the base portion 110 via the screw 114. A top probe groove 210 longitudinally extends across the bottom surface 184 of the top central member 170 along a path which traverses the rear section 192, spans the upper channel 180 (e.g., the upper channel 180 interrupts the top probe groove 210), and terminates at or near the hole 200 on the front section 190. As shown, the top probe groove 210 may be substantially centered along the width of the cap portion 112 for alignment with the bottom probe groove 160. The top probe groove 210 is configured to operatively engage at least a portion of the high limit temperature probe 80. For example, the top probe groove 210 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the high limit temperature probe 80.

[0032] The first and second arms 172, 174 include first and second top element grooves 212, 214, respectively, each longitudinally extending the length of the cap portion 112 for alignment with the first and second bottom element grooves 162, 164, and configured to operatively engage at least a portion of one or more heating elements 70, 72. For example, the first top element groove 212 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the first heating element 70, and the second top element groove 214 may be sized and shaped (e.g., contoured) to generally complement a surface of at least a portion of the second heating element 72.

[0033] When the cap portion 112 is positioned over and aligned with the base portion 110 for clamping, the top surface 132 of the bottom central member 120 is located opposite the bottom surface 184 of the top central member 170, the top probe groove 210 is located opposite the bottom probe groove 160, and the first and second top element grooves 212, 214 are located opposite the first and second bottom element grooves 162, 164, respectively. The cap portion 112 is movable relative to the base portion 110 such that the top probe groove 210 is movable relative to the bottom probe groove 160 and the first and second top element grooves 212, 214 are movable relative to the respective bottom element grooves 162, 164. In this manner, the top and bottom probe grooves 210, 160 may provide a clamping action on the high limit temperature probe 80 positioned therebetween, and the top and bottom element grooves 212, 214, 162, 164 may provide a clamping action on one or more heating elements

70, 72 positioned therebetween. For example, advancing the screw 114 in the bore 150 of the base portion 110 moves the top probe groove 210 toward the bottom probe groove 160 and the top element grooves 212, 214 toward the respective bottom element grooves 162, 164. The screw 114 may be tightened to form a secure and tight connection between the high limit temperature probe 80, the heating element(s) 70, 72, and the holder 90. It will be appreciated that other clamping or securing elements may be used to tighten the engagement of the base portion 110 and the cap portion 112 in other embodiments.

[0034] It will be appreciated that the high limit temperature probe 80 may be clamped at multiple locations on the holder 90. For example, the high limit temperature probe 80 may be clamped by the portions of the top and bottom probe grooves 210, 160 residing on the rear sections 192, 142 of the central members 170, 120 of the cap and base portions 112, 110, respectively, and may also be clamped by the portions of the top and bottom probe grooves 210, 160 residing on the front sections 190, 140 of the central members 170, 120 of the cap and base portions 112, 110, respectively, such as proximate the screw 114. The particular shape and contour of the probe grooves 210, 160 will dictate how and where clamping action occurs on the high limit temperature probe 80.

[0035] With reference now to FIGS. 4 and 5, when the holder 90 is clamped over the high limit temperature probe 80 and one or more heating elements 70, 72, the sensing element 82 of the high limit temperature probe 80 resides at least partially in a generally continuous passageway through the assembled holder 90 provided by the lower and upper channels 130, 180. While the cap and bottom portions 112, 110 pull heat from the heating elements 70, 72 and conduct such heat to the sensing element 82 of the high limit temperature probe 80, the lower and/or upper channels 130, 180 define top, bottom, and first and second side apertures 220, 222, 224, 226 which allow convective thermal entry to the passageway and thus provide a convective thermal path to the sensing element 82. In this manner, one or more of the apertures 220, 222, 224, 226 allow the cooking medium to flow across the sensing element 82 so that the sensing element 82 may absorb heat from the cooking medium in the fry pot 12, 14, which is at a lower temperature than the heating elements 70, 72. Thus, the temperature of the cooking medium may have a cooling effect on the sensed temperature relative to the actual temperature of the heating elements 70, 72. In this manner, the apertures 220, 222, 224, 226 may promote a balanced temperature reading that is less than the temperature of the heating elements 70, 72 and greater than the temperature of the cooking medium.

[0036] In this regard, it will be appreciated that the sensed temperature at the high limit temperature probe 80 is not based solely on either the actual temperature of the heating

elements 70, 72 or the actual temperature of the cooking medium. Rather, the sensed temperature results from heat transfer from both the cooking medium and from the heating element(s) 70, 72, and thus may be considered a hybrid of the temperature of the heating elements 70, 72 and the actual temperature of the cooking medium. Therefore, while the sensed temperature does not directly represent the actual temperature of the cooking medium, the sensed temperature is closely related to and may be indicative of trends in the actual temperature of the cooking medium.

[0037] As shown, the top surface 132 of the bottom central member 120 may not contact the bottom surface 184 of the top central member 170. Alternatively, the top surface 132 of the bottom central member 120 may contact the bottom surface 184 of the top central member 170, depending on the dimensions of the probe 80 and/or heating element(s) 70, 72. In any event, the outer periphery of the holder 90 in its assembled state may be generally cube-shaped. For example, the length, width, and height of the assembled holder 90 may each be substantially the same dimension. For example, the length, width, and/or height may be approximately 1 inch.

[0038] As best shown in FIG. 5, the sensing element 82 of the high limit temperature probe 80 is generally centered between the heating elements 70, 72, by virtue of the probe grooves 160, 210 being centrally positioned along the width of the respective portion 110, 112. For example, the sensing element 82 may be positioned approximately $\frac{1}{4}$ inch from each of the heating elements 70, 72. This may allow the sensed temperature to be substantially equally influenced by both heating elements 70, 72 and/or may prevent the sensed temperature from being dominated by either heating element 70, 72. In this regard, the first and second sides 136, 138 of the bottom central member 120 may abut the first and second heating elements 70, 72 to promote equal spacing of the heating elements 70, 72 from the sensing element 82. Alternatively, the sensing element 82 may be positioned relative to the heating elements 70, 72 in various other configurations. For example, the sensing element 82 may be positioned closer to either heating element 70, 72 relative to the other heating element 70, 72. In another embodiment, the sensing element 82 may be positioned on an outer side of an outermost heating element, such that the sensing element 82 is not between two heating elements. For example, the holder 90 may be configured to clamp over a single heating element.

[0039] In the embodiment shown, the sensing element 82 is located proximate upper portions of the heating elements 70, 72, by virtue of the top central member 170 being shorter than the bottom central member 120. This may allow the sensed temperature to be more

heavily influenced by the temperature of the cooking medium (e.g., via the top aperture 220) than if the sensing element 82 were located proximate middle portions of the heating elements 70, 72, where the effect of the heating elements 70, 72 on the sensed temperature would be greater and may overpower the effect of the cooking medium. For example, the sensing element 82 may be positioned approximately ¼ inch from the top surface 182 of the cap portion 112. Alternatively, the sensing element 82 may be located proximate middle portions of the heating elements 70, 72. For example, the bottom central member 120 may be shorter than that shown and/or the top central member 170 may have a height approximately equal to that of the bottom central member 120. It will also be appreciated that, while the cap portion 112 is shown being positioned above the base portion 110, the arrangement may be switched such that the cap portion 112 is positioned below the base portion 110. In any event, by positioning the sensing element 82 so as to balance the heat received from the heating elements 70, 72 and from the cooking medium, the holder 90 allows the high limit temperature probe 80 to detect a temperature indicative of an imminent high limit condition prior to that condition actually occurring, enabling the controller 60 to take preventative action and avoid a high trip/nuisance trip.

[0040] To that end, embodiments of the invention may monitor the temperature of the high limit temperature probe 80, and incorporate the temperature readings obtained therefrom into one or more processes executed by the controller 60. For example, by comparing the temperature readings (e.g., one or more sensed temperatures) provided by the high limit temperature probe 80 with one or more condition parameters (e.g., the sensed temperature being greater than or equal to a predetermined temperature threshold, such as 425°F), the controller 60 can determine when the high limit module 50 is getting close to a hard trip. In response to this determination, the controller 60 may regulate the heating element(s) 70, 72 accordingly to avoid entering the hard trip state. For example, the controller 60 may deactivate and/or decrease the output of the heating element(s) 70, 72. In this regard, the positioning of the sensing element 82 as a result of the configuration of the holder 90 may cause the sensed temperature to be substantially greater than the actual temperature of the cooking medium. For example, the sensed temperature may be between approximately 40°F and approximately 50°F greater than the actual temperature of the cooking medium. As such, when the sensed temperature reaches the exemplary threshold of 425°F, the temperature of the cooking medium may be only between approximately 375°F and approximately 385°F, while the actual temperature of the heating element(s) 70, 72 may be greater than 425°F such as, for example, 525°F. Thus, the sensed temperature being at the threshold temperature may

indicate that the cooking medium has not yet reached the threshold temperature but may be approaching the threshold temperature.

[0041] Advantageously, the improved control provided by embodiments of the invention may reduce the amount of down time for the fryer 10 due to “nuisance tripping” of the high limit module 50 by recognizing the existence of an imminent high limit trip condition. A high limit trip may cause the high limit module 50 to cut off the supply of gas or electricity to the heating elements 70, 72. As initially described above, to use the fryer 10 after a high limit trip condition, the operator may be required to manually reset the high limit module 50 after waiting for the temperature detected by the high limit temperature probe 80 to fall below a predetermined threshold. By positioning the sensing element 82 to detect a sensed temperature that is a hybrid of the temperatures of the heating elements 70, 72 and the cooking medium and by regulating the output of the heating elements 70, 72 using the sensed temperature, embodiments of the invention may reduce the output of the heating elements 70, 72 before the high limit trip condition is reached. This may save the operator the time and effort of resetting the fryer 10, and prevent associated food production delays caused by nuisance trips.

[0042] The processes executed by the controller 60 to control the heating elements 70, 72 may be configured to take into account heat transfer characteristics of the heating elements 70, 72 and temperature dependent flow characteristics of the cooking medium. For example, the material from which the fry pot 12, 14 is made may have a continuous use temperature (e.g., 800°F) above which the fry pot 12, 14 should not be operated for an extended time. Thus, the control processes may be configured to limit the temperatures of the material of the fry pot 12, 14 to less than the continuous use temperature. In addition or alternatively, the high limit temperature control processes and/or high limit module 50 may be configured to prevent cooking medium temperatures from exceeding a maximum allowable temperature, e.g., 446°F outside of the United States and 475°F within the United States. The use of signals from the high limit probe 80 may allow the controller 60 to maximize the temperature of the cooking medium while protecting the fryer operator from cooking delays and interruptions.

[0043] The terminology used herein is for the purpose of describing particular embodiments only and is not intended to be limiting of the embodiments of the invention. As used herein, the singular forms “a”, “an” and “the” are intended to include the plural forms as well, unless the context clearly indicates otherwise. It will be further understood that the terms “comprises” and/or “comprising,” when used in this specification, specify the presence

of stated features, integers, actions, steps, operations, elements, and/or components, but do not preclude the presence or addition of one or more other features, integers, actions, steps, operations, elements, components, and/or groups thereof. Furthermore, to the extent that the terms “includes”, “having”, “has”, “with”, “comprised of”, or variants thereof are used in either the detailed description or the claims, such terms are intended to be inclusive in a manner similar to the term “comprising”.

[0044] While the invention has been illustrated by a description of various embodiments, and while these embodiments have been described in considerable detail, it is not the intention of the Applicant to restrict or in any way limit the scope of the appended claims to such detail. Additional advantages and modifications will readily appear to those skilled in the art. The invention in its broader aspects is therefore not limited to the specific details, representative apparatus and method, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the Applicant's general inventive concept.

CLAIMS

What is claimed is:

1. A holder block (90) for retaining a temperature sensor (80) in a cooking apparatus (10), comprising:

a base portion (110) including a bottom central member (120) and first and second legs (122, 124) extending from opposite sides of the bottom central member (120), the bottom central member (120) including a lower channel (130) and a bottom probe groove (160) configured to operatively engage at least a portion of the temperature sensor (80), the first and second legs (122, 124) including first and second bottom element grooves (162, 164), respectively, each configured to operatively engage at least a portion of first and second heating elements (70, 72), respectively;

a cap portion (112) removably attachable to the base portion (110) and including a top central member (170) and first and second arms (172, 174) extending from opposite sides of the top central member (170), the top central member (170) including an upper channel (180) and a top probe groove (210) configured to operatively engage at least a portion of the temperature sensor (80) and located opposite the bottom probe groove (160), the first and second arms (172, 174) including first and second top element grooves (212, 214) located opposite the first and second bottom element grooves (162, 164), respectively, each configured to operatively engage at least a portion of the first and second heating elements (70, 72), respectively;

wherein the base portion (110) and cap portion (112) are moveable relative to each other such that movement of the base portion (110) and cap portion (112) toward each other provides a first clamping action on the first heating element (70) via the first top and bottom element grooves (212, 162), a second clamping action on the second heating element (72) via the second top and bottom element grooves (214, 164), and a third clamping action on the temperature sensor (80) via the top and bottom probe grooves (210, 160).

2. The holder block of claim 1, wherein the base portion and cap portion are configured to provide a plurality of conductive thermal paths between the first and second heating elements and the temperature sensor.

3. The holder block of any preceding claim, wherein the lower and/or upper channels define a plurality of apertures configured to provide a plurality of convective thermal paths

between the first and second heating elements and the temperature sensor through a cooking medium.

4. The holder block of any preceding claim, wherein the upper and lower channels are configured to collectively define a passageway for receiving at least a portion of the temperature sensor.

5. The holder block of any preceding claim, wherein the bottom probe groove is centered along a width of the bottom central member.

6. The holder block of any preceding claim, wherein the top probe groove is centered along a width of the top central member.

7. The holder block of any preceding claim, wherein the top central member is shorter than the bottom central member.

8. The holder block of any preceding claim, wherein the bottom probe groove and/or top probe groove is configured to position the temperature sensor $\frac{1}{4}$ inch from the first and/or second heating element.

9. The holder block of any preceding claim, wherein the top probe groove is configured to position the temperature sensor $\frac{1}{4}$ inch from a top surface of the cap portion.

10. A holder block (90) for retaining a temperature sensor (80) in a cooking apparatus (10) containing a cooking medium, comprising:

a base portion (110) configured to operatively engage at least a lower portion of the temperature sensor (80) and configured to operatively engage at least a lower portion of at least one heating element (70, 72);

a cap portion (112) removably attachable to the base portion (110), the cap portion (112) being configured to operatively engage at least an upper portion of the temperature sensor (80) and configured to operatively engage at least an upper portion of the at least one heating element (70, 72);

wherein the base portion (110) and cap portion (112) are moveable relative to each other such that movement of the base portion (110) and cap portion (112) toward each other

provides a first clamping action on the at least one heating element (70, 72) and a second clamping action on the temperature sensor (80) to define a clamped position of the holder block (90),

wherein, when in the clamped position, the base portion (110) and cap portion (112) provide a plurality of conductive thermal paths between the at least one heating element (70, 72) and the temperature sensor (80) and define a plurality of apertures (220, 222, 224, 226) providing a plurality of convective thermal paths between the at least one heating element (70, 72) and the temperature sensor (80) through the cooking medium.

11. The holder block of claim 10, wherein the base portion includes a T-shaped profile.

12. The holder block of any of claims 10-11, wherein the cap portion includes a truncated T-shaped profile.

13. A cooking apparatus comprising:

a fry pot;

first and second heating elements configured to heat a cooking medium in the fry pot;

the holder block of any preceding claim clamped over the first and second heating elements;

a high limit temperature sensor including a sensing element retained by the holder block and that provides a signal indicative of a temperature in the fry pot;

a high limit module configured to selectively decouple the first and second heating elements from an energy source in response to the signal indicating the temperature has exceeded a threshold temperature defining a hard trip condition; and

a controller configured to selectively regulate the first and second heating elements in response to the signal indicating the temperature is approaching the threshold temperature.

14. The cooking apparatus of claim 13, wherein the sensing element is positioned to sense a temperature greater than an actual temperature of the cooking medium.

15. The cooking apparatus of claim 14, wherein the sensing element is positioned to sense a temperature between 40°F and 50°F greater than the actual temperature of the cooking medium.

16. The cooking apparatus of any of claims 13-15, wherein the sensing element is positioned ¼ inch from the first and/or second heating element.
17. The cooking apparatus of any of claims 13-16, wherein the sensing element is positioned ¼ inch from a top surface of the cap portion.
18. A method of controlling a temperature in a cooking apparatus (10), comprising:
 - clamping a holder block (90) retaining a temperature sensor (80) over first and second heating elements (70, 72) of the cooking apparatus (10);
 - sensing, via the temperature sensor (80), a sensed temperature resulting from heat transfer from a cooking medium in the cooking apparatus (10) and from each of the first and second heating elements (70, 72);
 - comparing the sensed temperature to a threshold temperature;
 - in response to the sensed temperature being equal to or greater than the threshold temperature, deactivating the first and second heating elements (70, 72); and
 - in response to the sensed temperature approaching the threshold temperature, regulating at least one of the first or second heating elements (70, 72).
19. The method of claim 18, wherein sensing the sensed temperature includes providing conductive thermal paths to a sensing element of the temperature sensor.
20. The method of any of claims 18-19, wherein sensing the sensed temperature includes providing convective thermal paths to a sensing element of the temperature sensor.

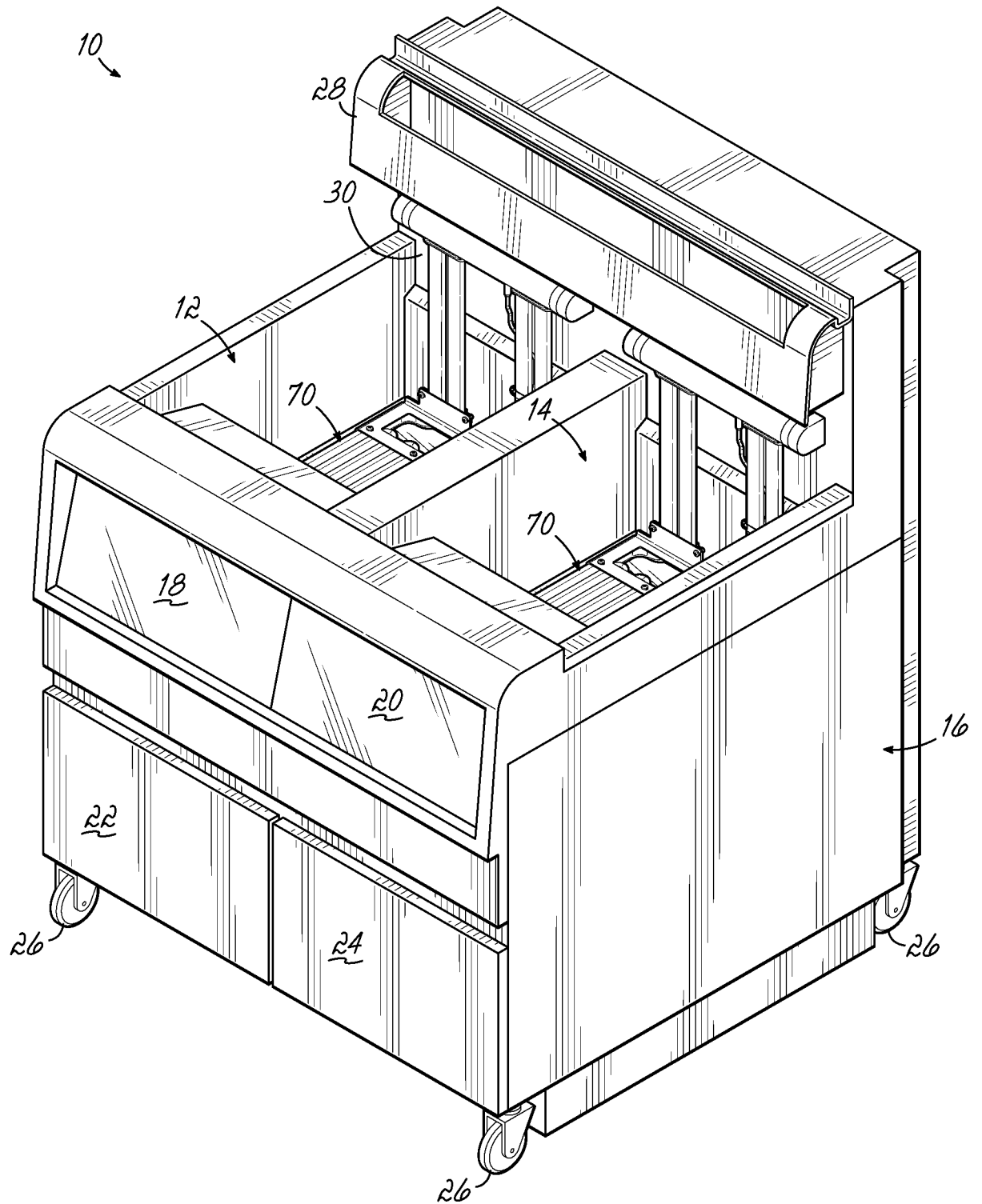


FIG. 1

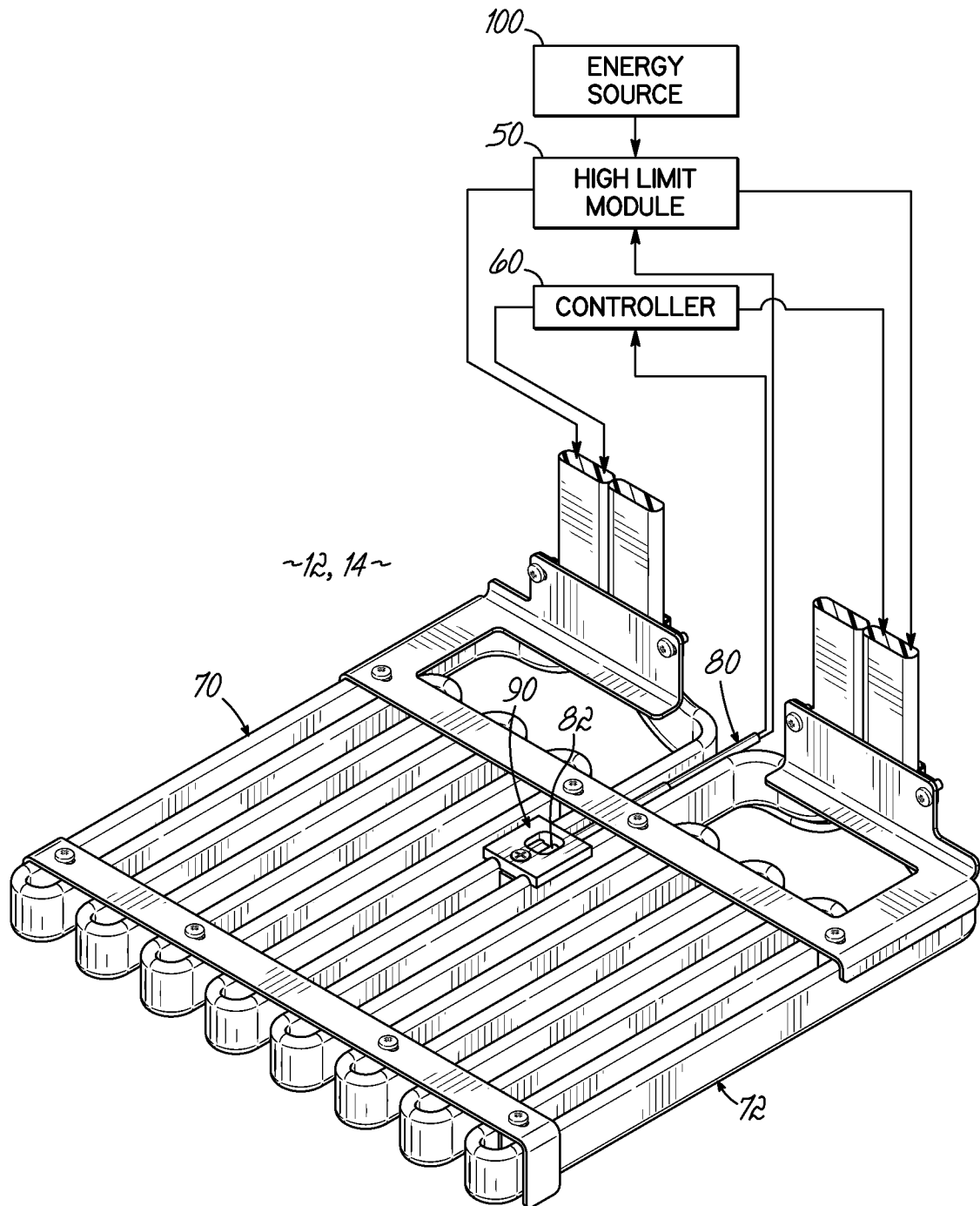


FIG. 2

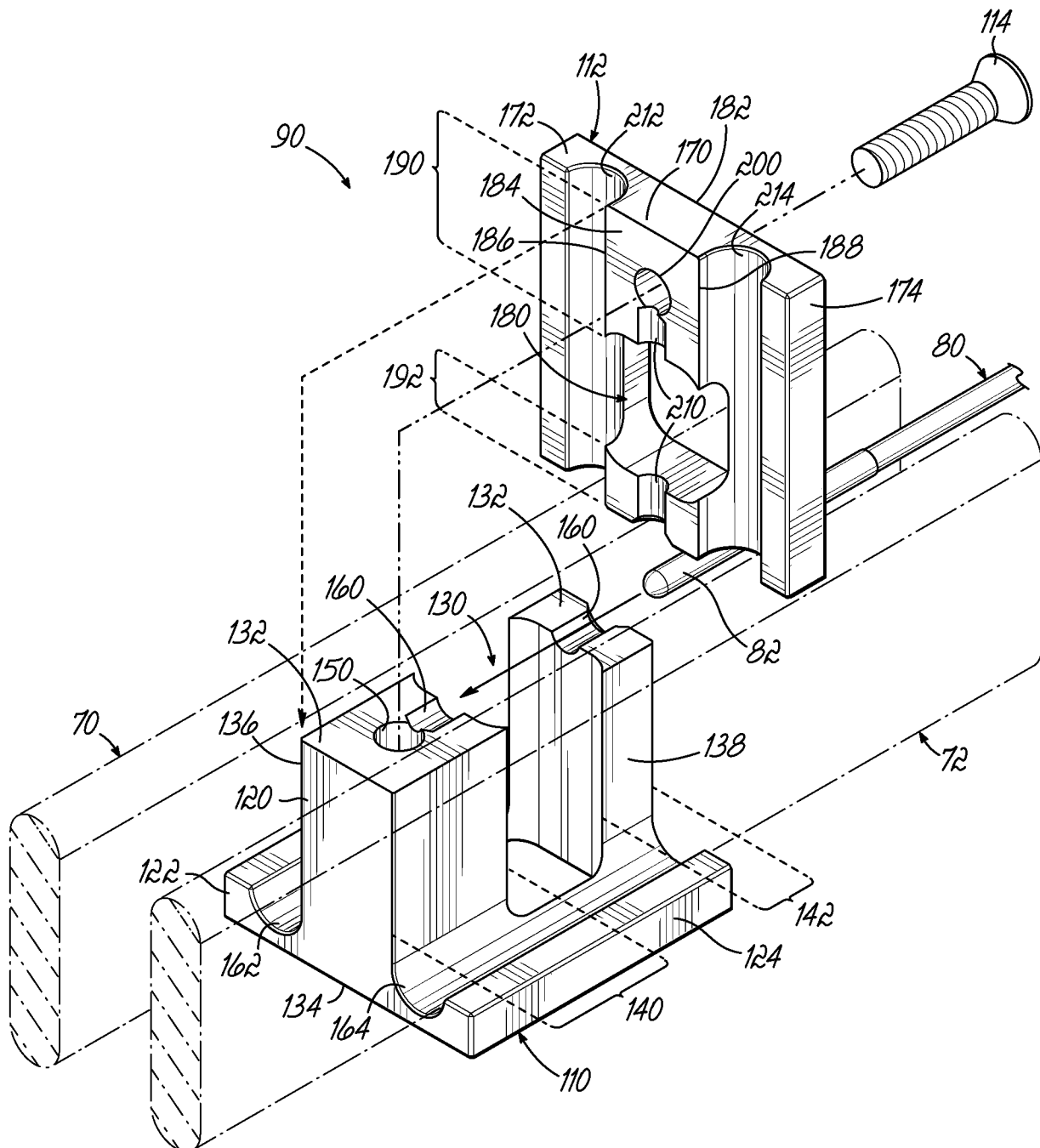


FIG. 3

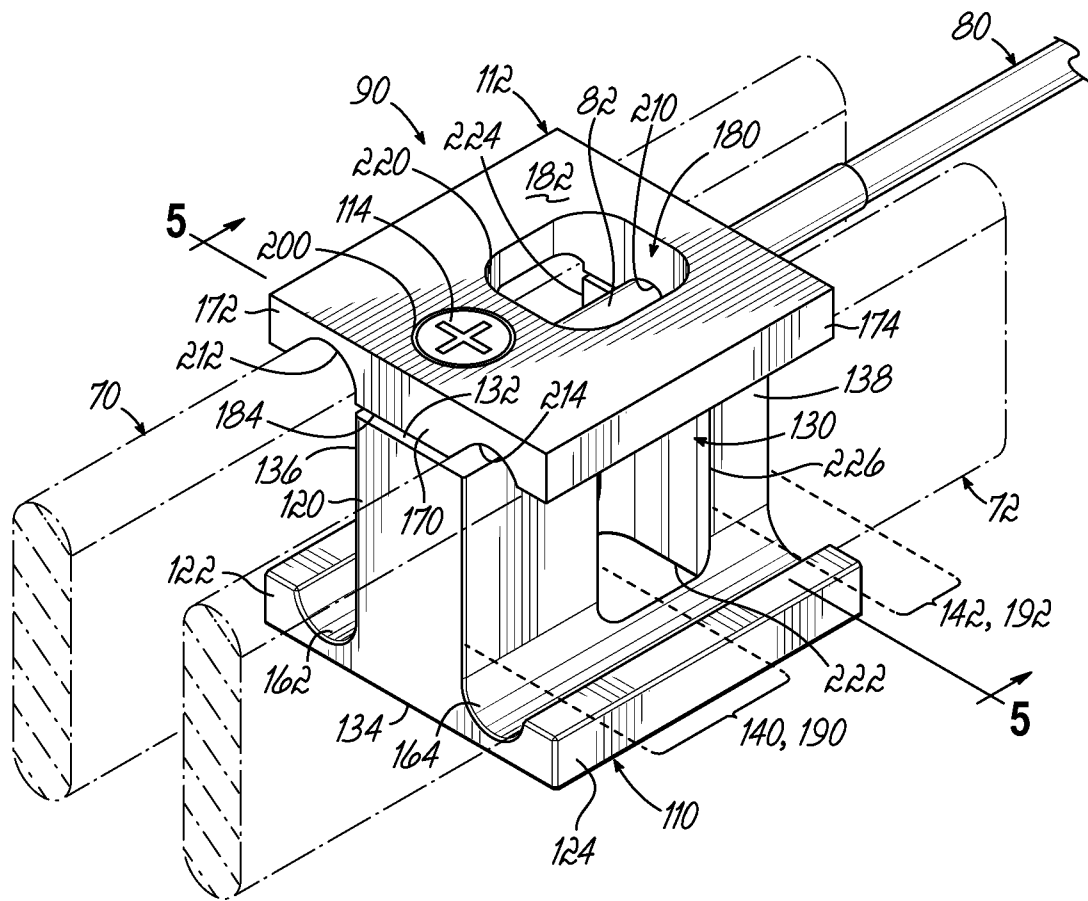


FIG. 4

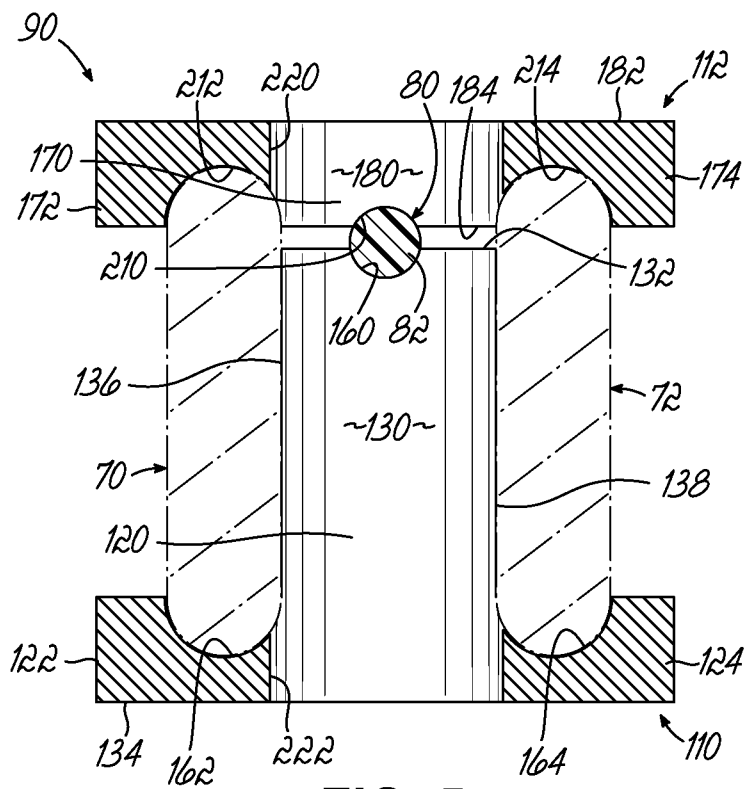


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/052592

A. CLASSIFICATION OF SUBJECT MATTER
INV. A47J37/12
ADD.

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)
A47J

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)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 1 228 731 A1 (RATINGEN NAAMLOZE VENNOTSCHAP [BE]) 7 August 2002 (2002-08-07) paragraphs [0011], [0012], [0023] - [0045]; figures -----	1,2,4-9, 13-20
X	US 9 386 881 B1 (JOHNSON LANCE P [US]) 12 July 2016 (2016-07-12) column 5, line 10 - column 7, line 51; figures 1,8 -----	1,2,4-6, 13-15, 18-20
A	US 2005/194372 A1 (LAU JOSEPH W C [HK] ET AL) 8 September 2005 (2005-09-08) paragraphs [0030] - [0042]; figure 6 ----- -/--	1-20



Further documents are listed in the continuation of Box C.



See patent family annex.

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Date of the actual completion of the international search

8 January 2019

Date of mailing of the international search report

15/01/2019

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2018/052592

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	KR 101 412 577 B1 (MIRATECH KOREA CO LTD [KR]) 27 June 2014 (2014-06-27) paragraphs [0017] - [0035]; figure 2 -----	1-20
A	EP 1 329 181 A1 (EASTERN SOURCES HOUSEWARES HON [CN]) 23 July 2003 (2003-07-23) paragraphs [0025] - [0044]; figures -----	13-20
A	WO 2012/152675 A1 (HAAS FOOD EQUIPMENT GMBH [AT]; HAAS JOHANN [AT]; HAAS JOSEF [AT]; JIRA) 15 November 2012 (2012-11-15) page 5, paragraph 7 - page 10, line 4; figures -----	1-4

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2018/052592

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 1228731	A1	07-08-2002	AT 271338 T 15-08-2004
		BE 1013955 A3 14-01-2003	
		DE 60200760 T2 21-07-2005	
		EP 1228731 A1 07-08-2002	
US 9386881	B1	12-07-2016	US 9386881 B1 12-07-2016
		US 2016213019 A1 28-07-2016	
US 2005194372	A1	08-09-2005	CN 1666699 A 14-09-2005
		US 2005194372 A1 08-09-2005	
		US 2005269309 A1 08-12-2005	
KR 101412577	B1	27-06-2014	NONE
EP 1329181	A1	23-07-2003	CN 1432330 A 30-07-2003
		EP 1329181 A1 23-07-2003	
		EP 1332704 A2 06-08-2003	
		US 2003132221 A1 17-07-2003	
WO 2012152675	A1	15-11-2012	AT 511409 A1 15-11-2012
		BR 112013028729 A2 09-08-2016	
		CN 103619179 A 05-03-2014	
		EP 2706857 A1 19-03-2014	
		JP 2014518622 A 07-08-2014	
		RU 2013154376 A 20-06-2015	
		US 2014090566 A1 03-04-2014	
		US 2017112144 A1 27-04-2017	
		WO 2012152675 A1 15-11-2012	