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(54) **COMMERCIAL FROZEN FOOD PREPARATION APPARATUS ELECTRONICS**

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Publication Classification

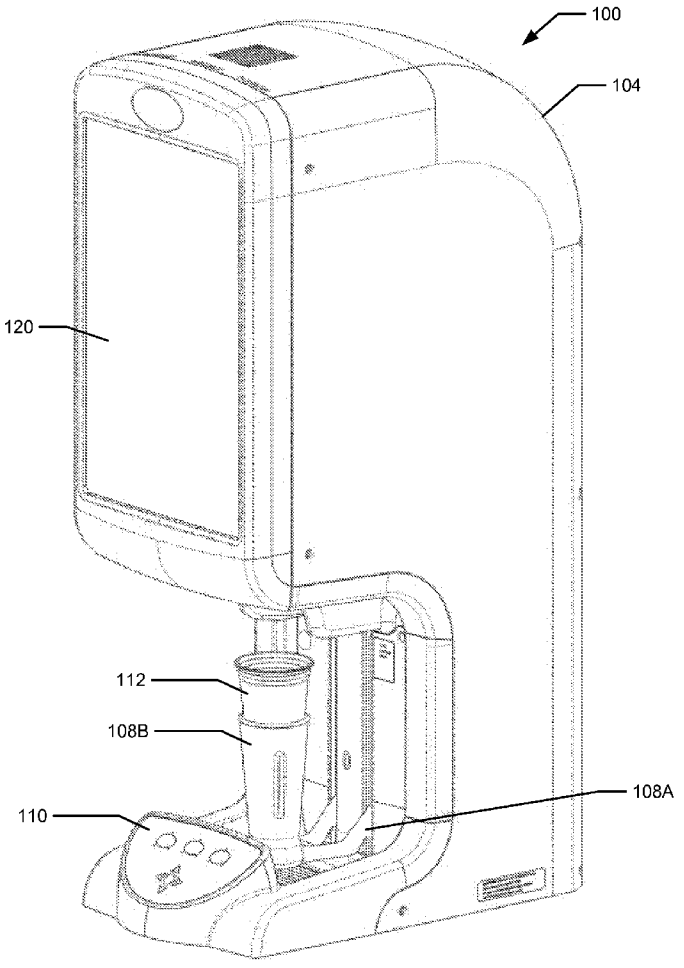
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G08B 21/00	(2006.01)
G06F 17/00	(2006.01)

(52) **U.S. Cl.** **99/460**; 222/132; 340/540; 700/236

(57) **ABSTRACT**

A machine prepares semi frozen food products and/or beverages from pre-prepared (e.g. frozen) cups. A user chooses the desired frozen cup, inserts it into the machine, chooses how they would like it prepared from a range of thickness options, and the machine then opens a sealed chamber door and inserts the product upward into the chamber and prepares the product by blending it in the cup. Upon removal of the product and resealing of the chamber door, the cleaning mechanisms provide thorough cleaning of all food contact surfaces and the chamber interior. Automatic high temperature steam sanitation takes place in the chamber if the machine is not used for an extended period of time, thus greatly reducing or eliminating the need for manual cleansing and sanitation by an attendant and ensuring healthy food preparation at all times.



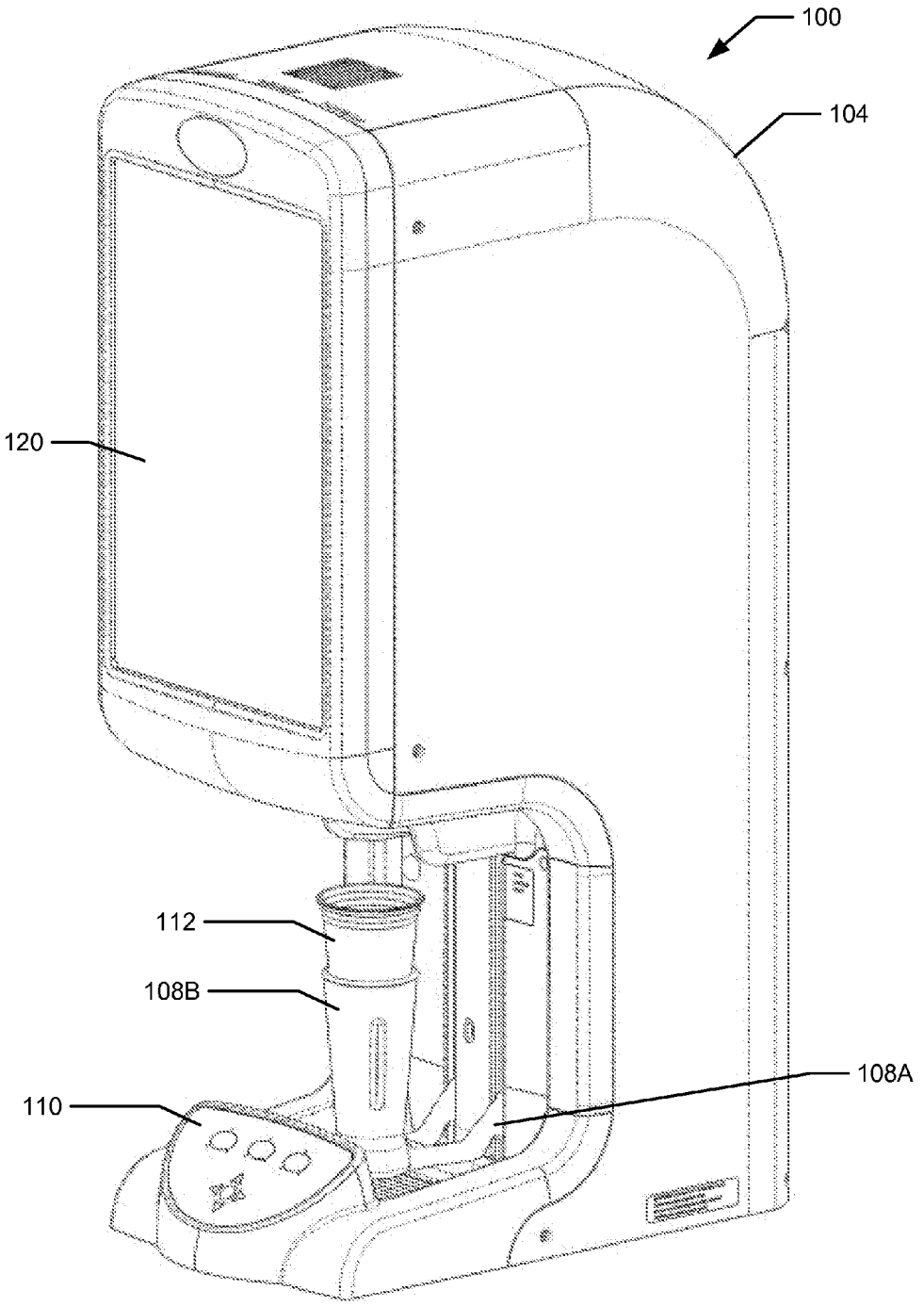


FIG. 1A

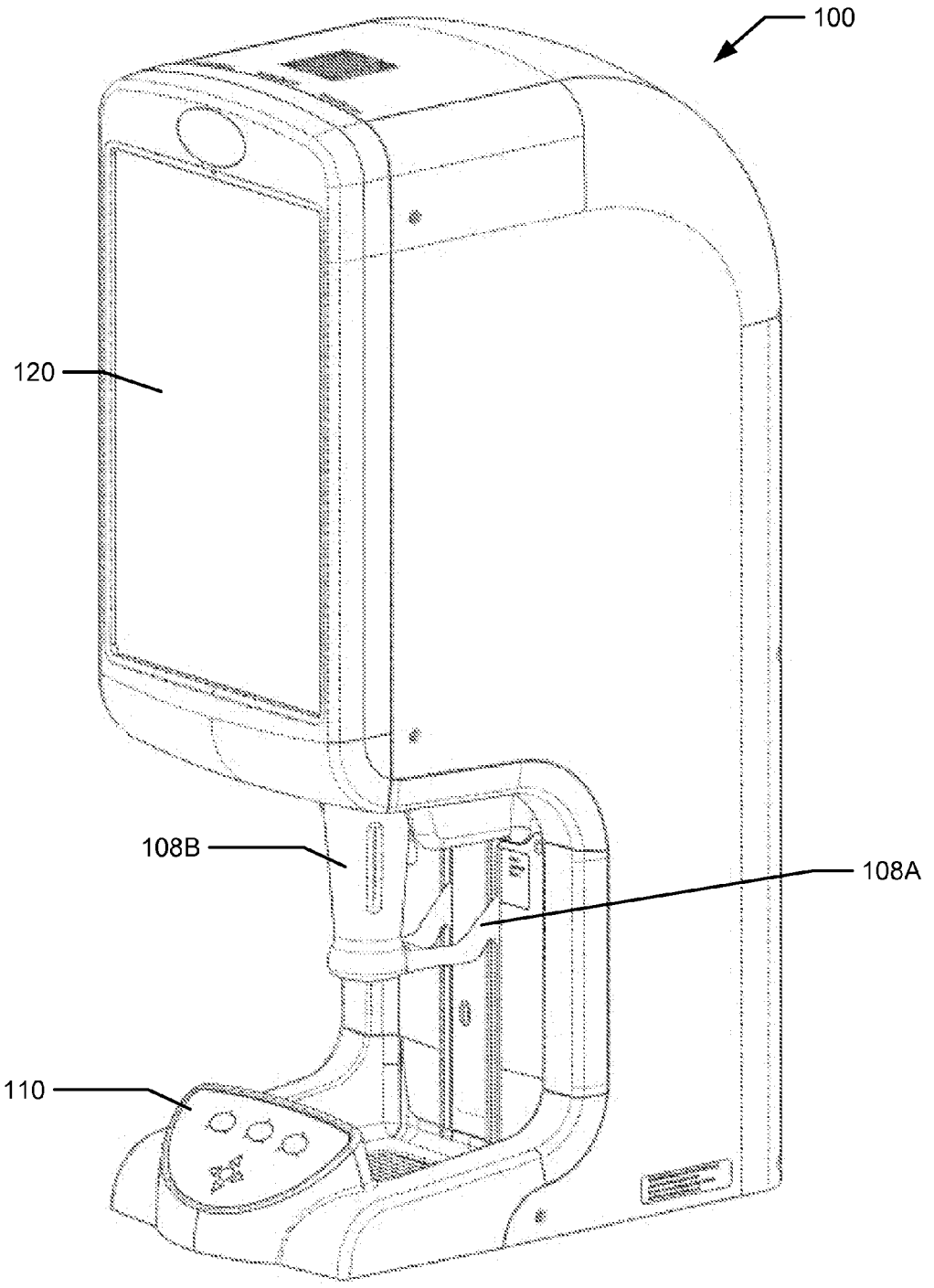


FIG. 1B

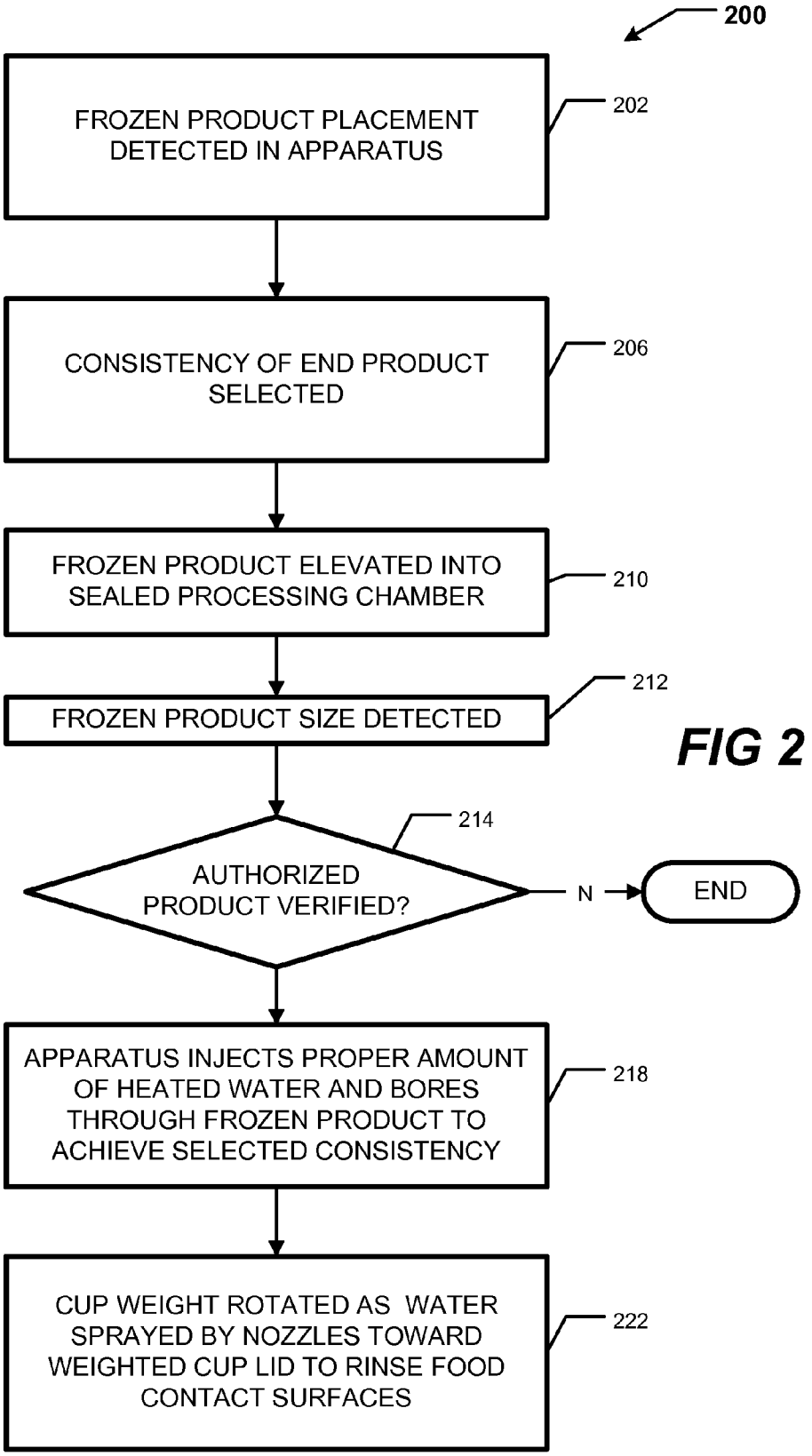

200
FROZEN PRODUCT PLACEMENT DETECTED IN APPARATUS
202
CONSISTENCY OF END PRODUCT SELECTED
206
FROZEN PRODUCT ELEVATED INTO SEALED PROCESSING CHAMBER
210
FROZEN PRODUCT SIZE DETECTED
212
AUTHORIZED PRODUCT VERIFIED?
214
N
END
APPARATUS INJECTS PROPER AMOUNT OF HEATED WATER AND BORES THROUGH FROZEN PRODUCT TO ACHIEVE SELECTED CONSISTENCY
218
CUP WEIGHT ROTATED AS WATER SPRAYED BY NOZZLES TOWARD WEIGHTED CUP LID TO RINSE FOOD CONTACT SURFACES
222

FIG 2

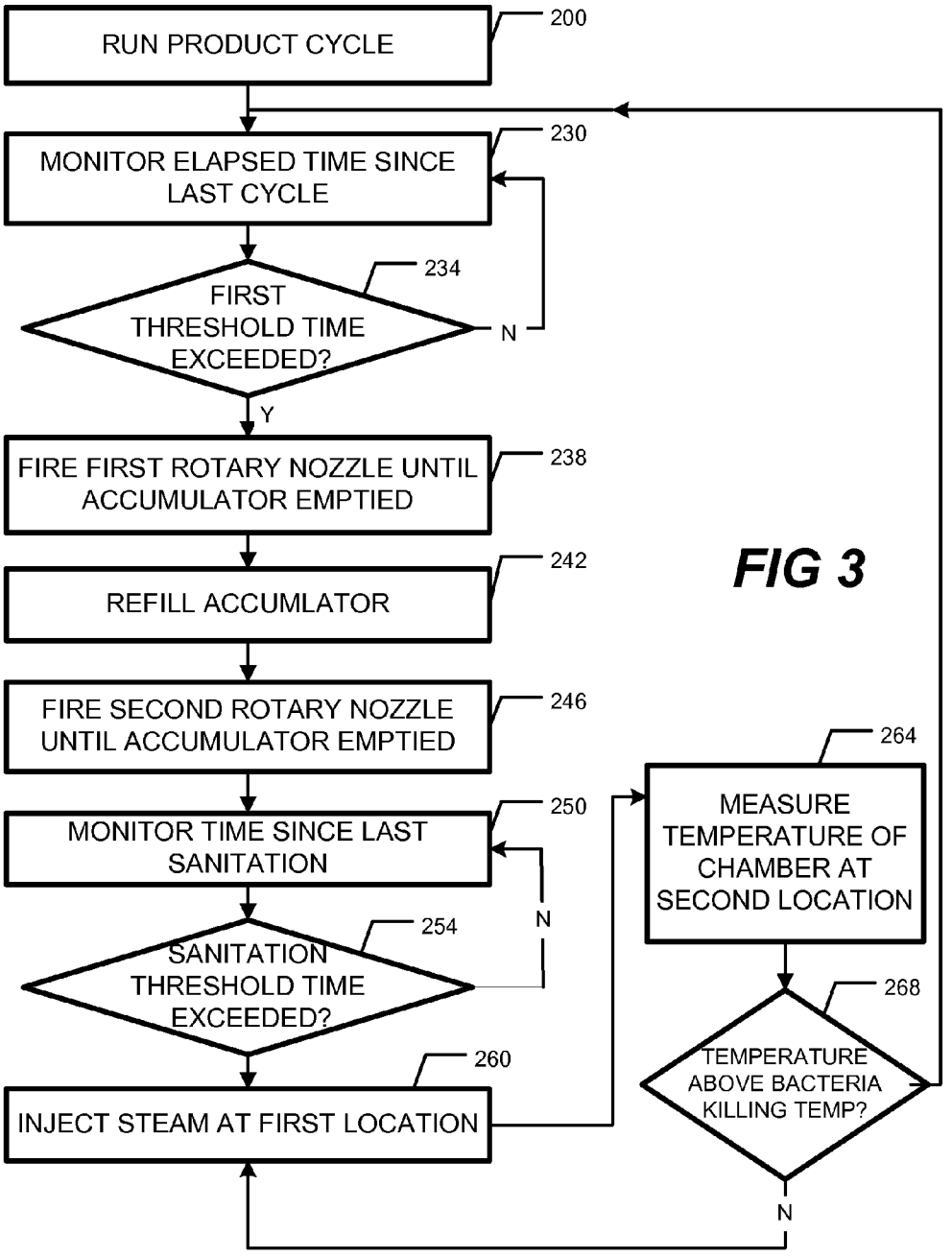

RUN PRODUCT CYCLE
200
MONITOR ELAPSED TIME SINCE LAST CYCLE
230
FIRST THRESHOLD TIME EXCEEDED?
234
N
Y
FIRE FIRST ROTARY NOZZLE UNTIL ACCUMULATOR EMPTIED
238
REFILL ACCUMLATOR
242
FIRE SECOND ROTARY NOZZLE UNTIL ACCUMULATOR EMPTIED
246
MONITOR TIME SINCE LAST SANITATION
250
N
SANITATION THRESHOLD TIME EXCEEDED?
254
INJECT STEAM AT FIRST LOCATION
260
MEASURE TEMPERATURE OF CHAMBER AT SECOND LOCATION
264
TEMPERATURE ABOVE BACTERIA KILLING TEMP?
268
N

FIG 3

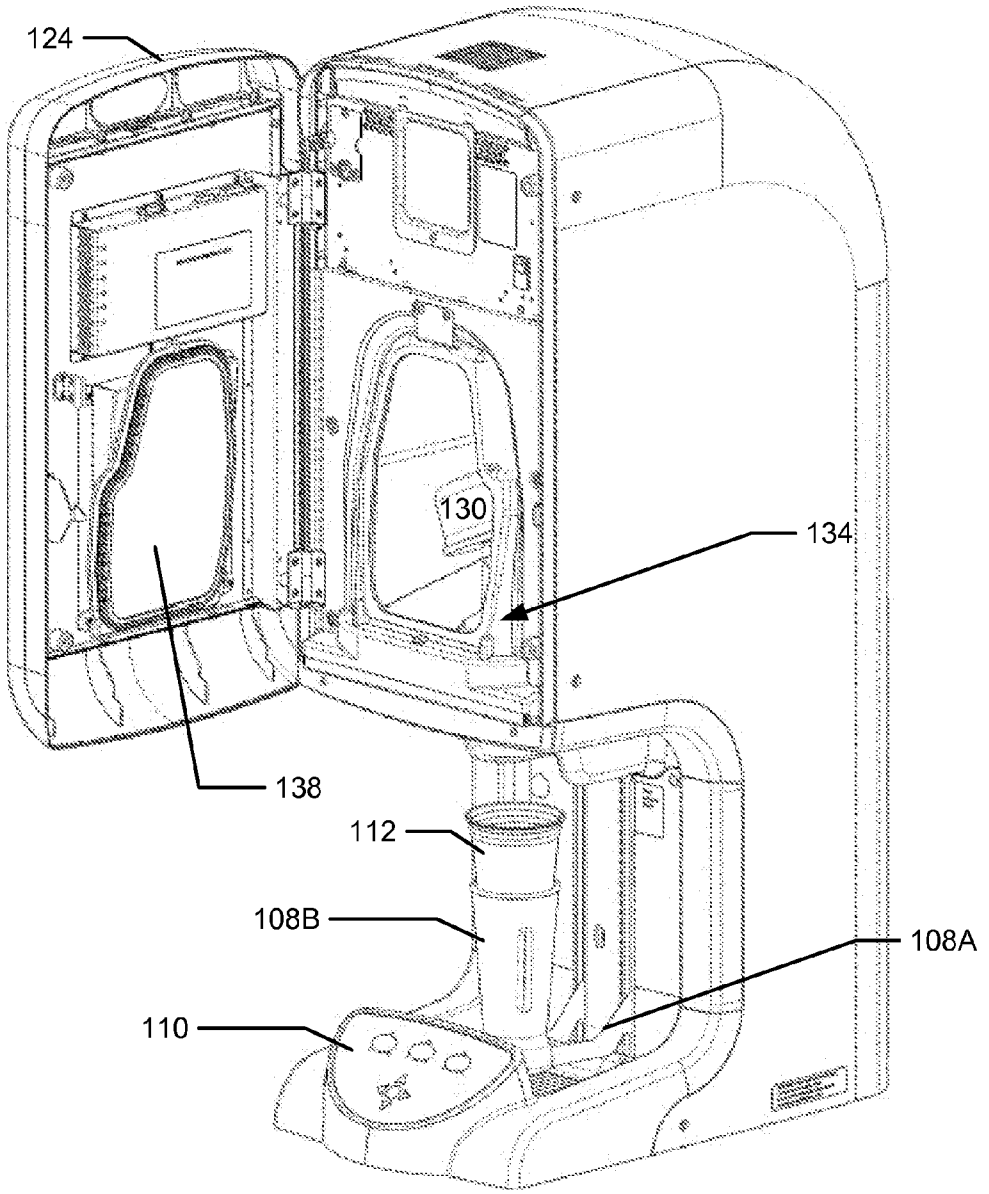


FIG. 4A

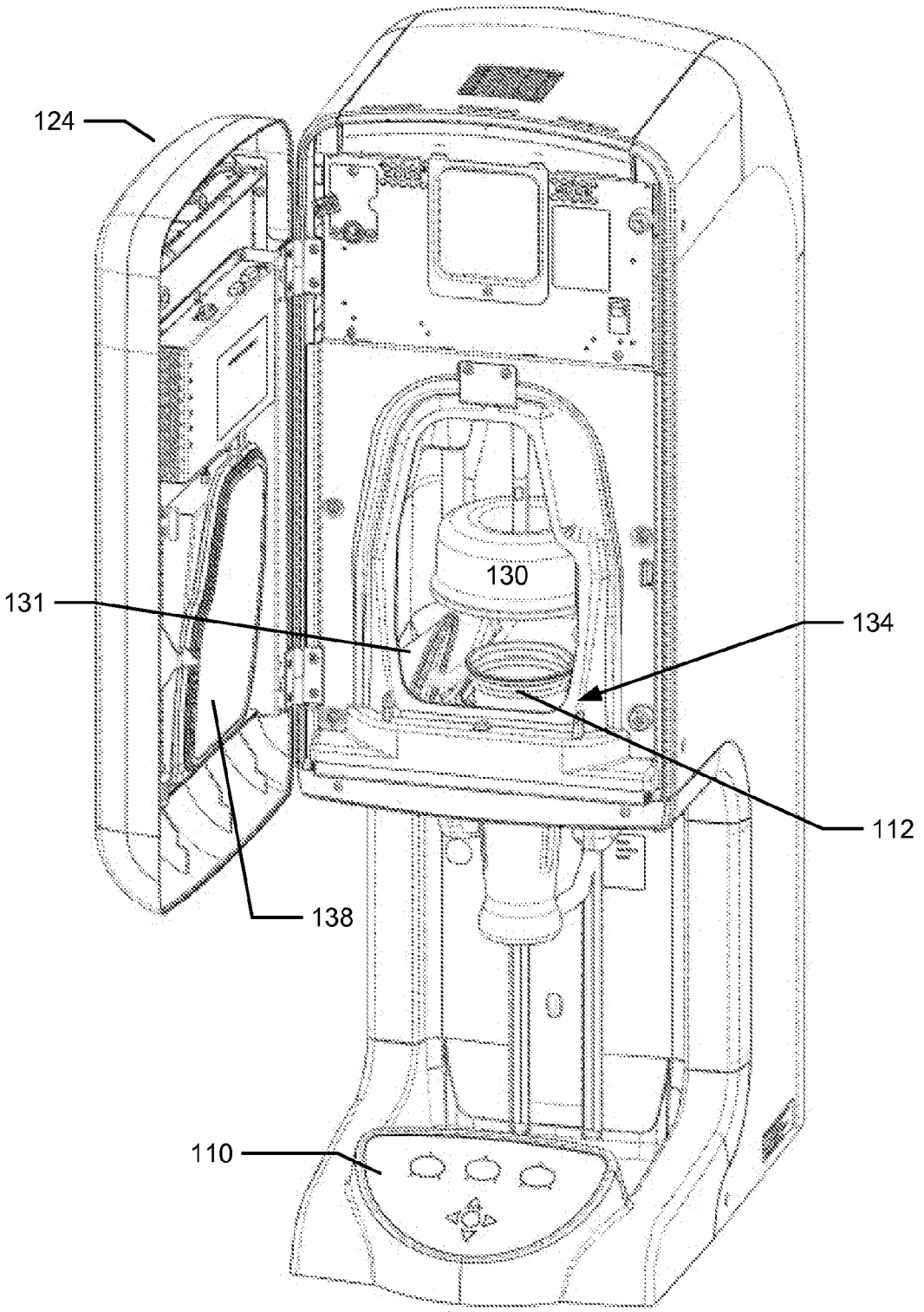


FIG. 4B

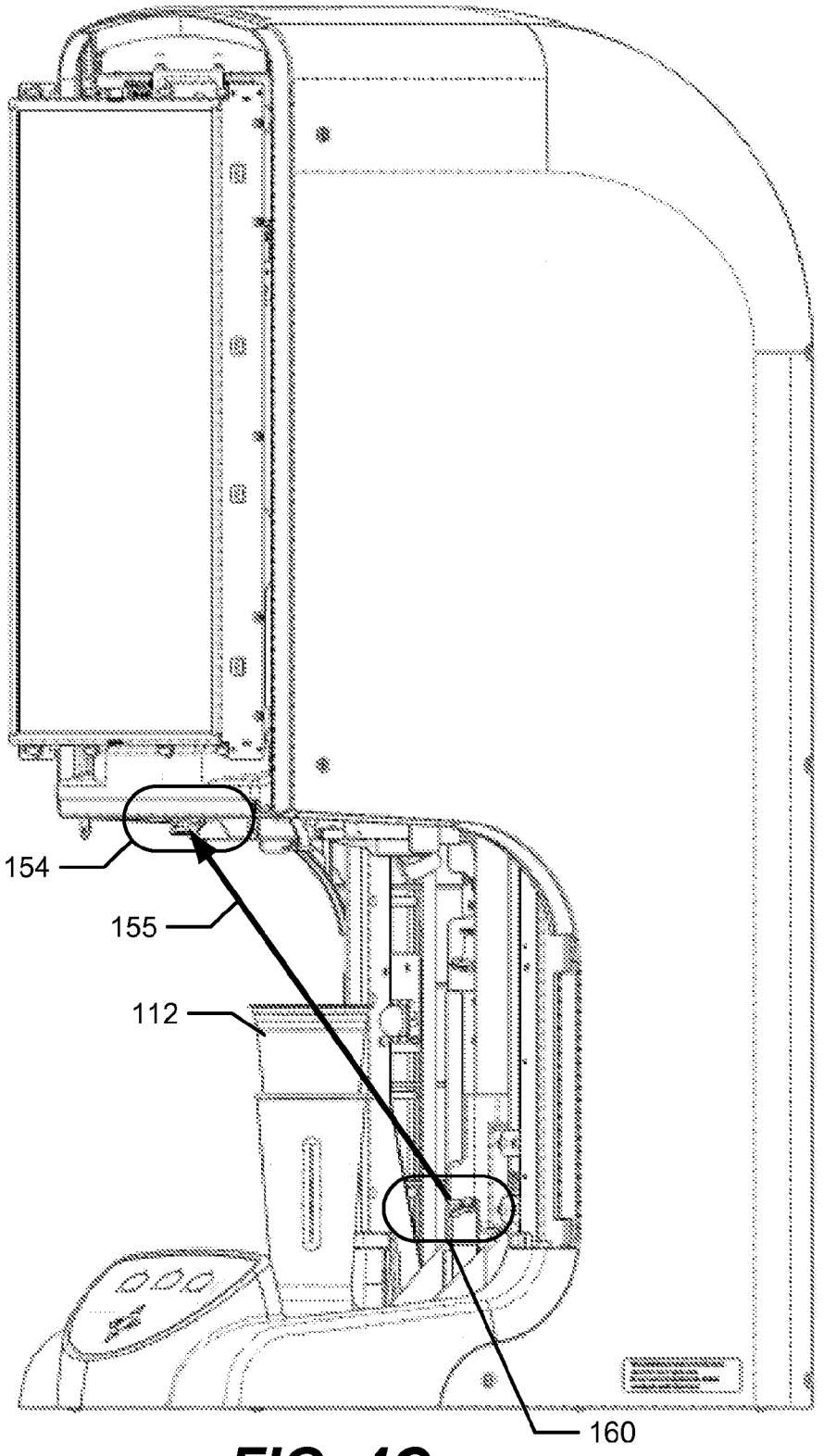


FIG. 4C

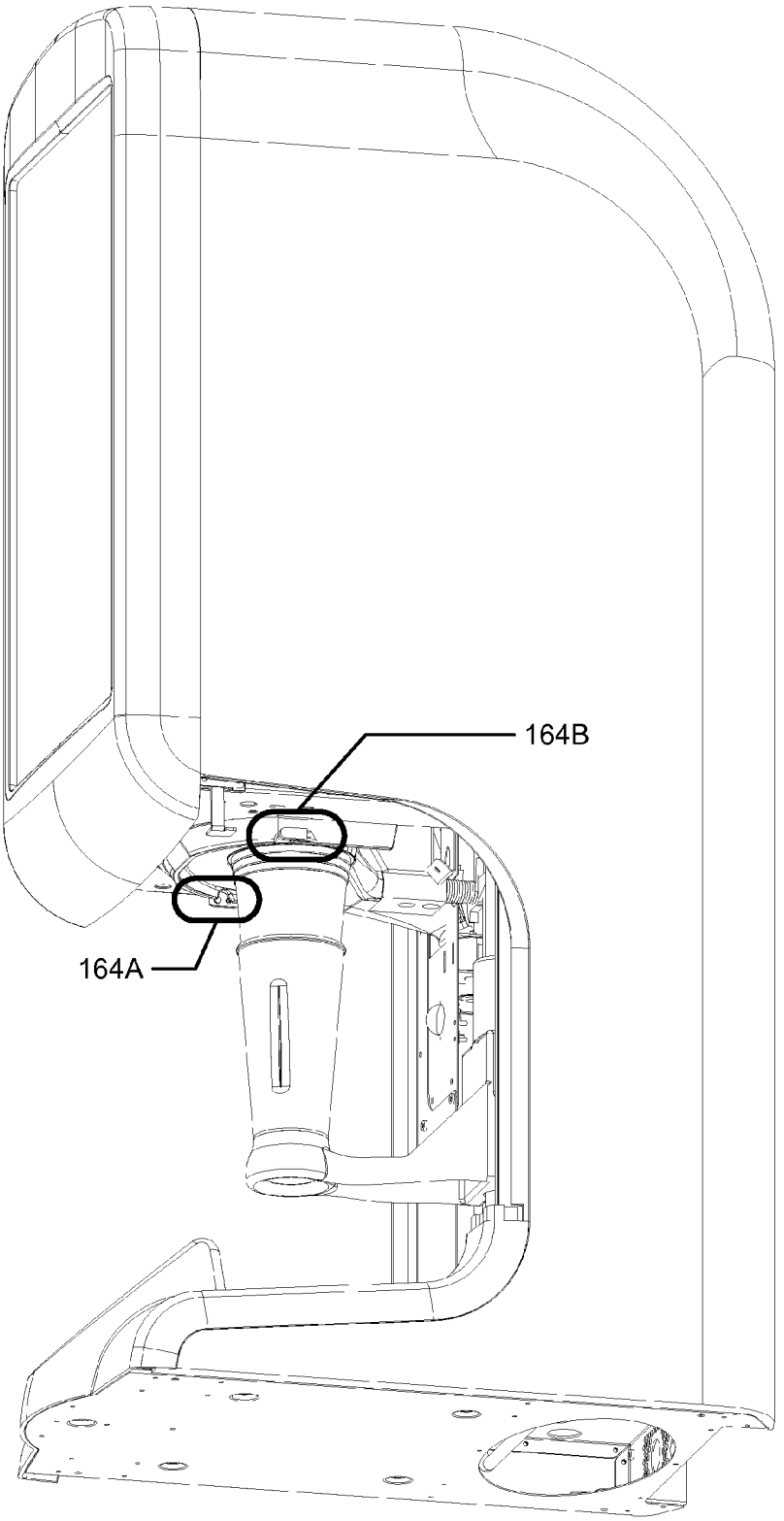


FIG. 4D

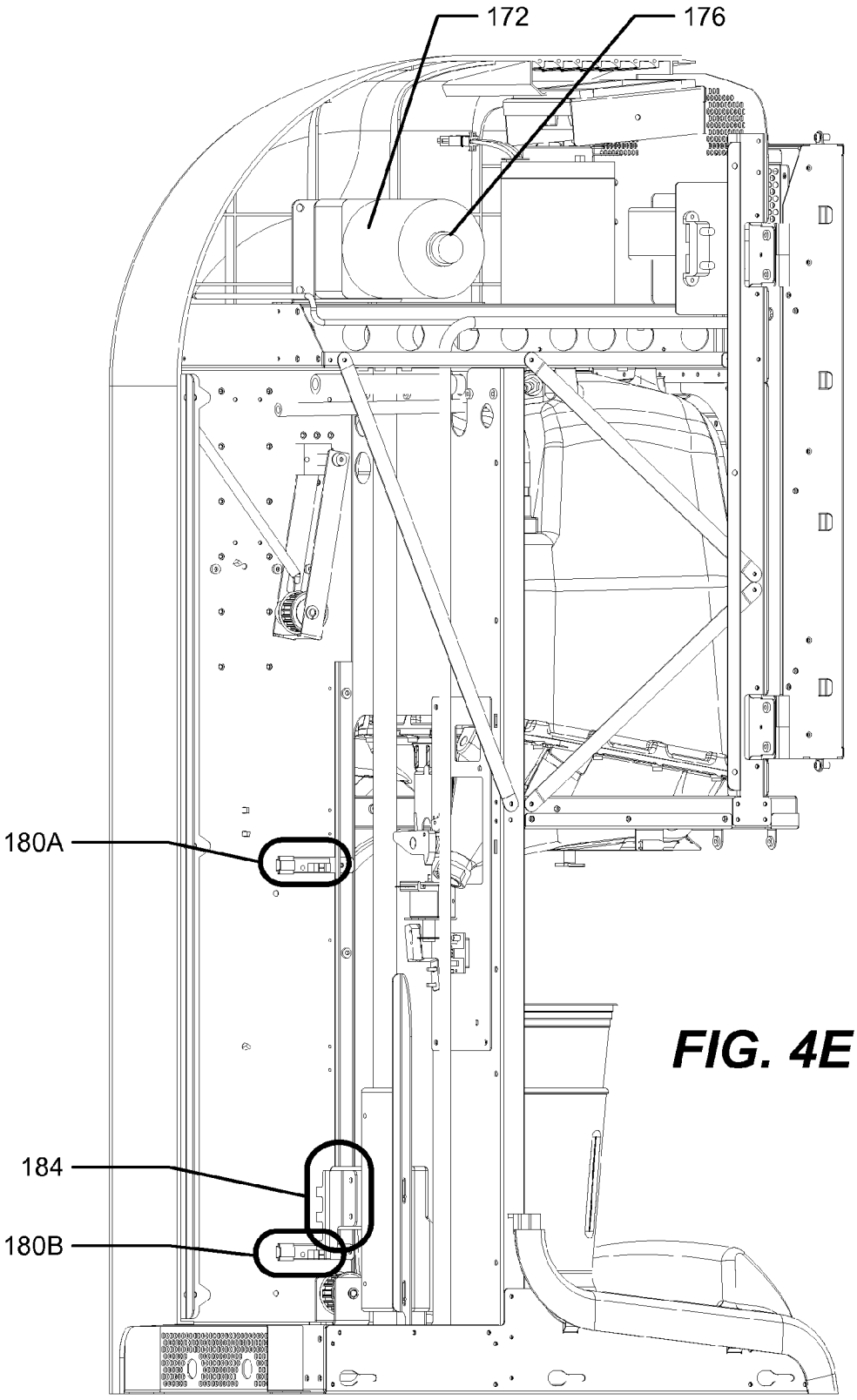


FIG. 4E

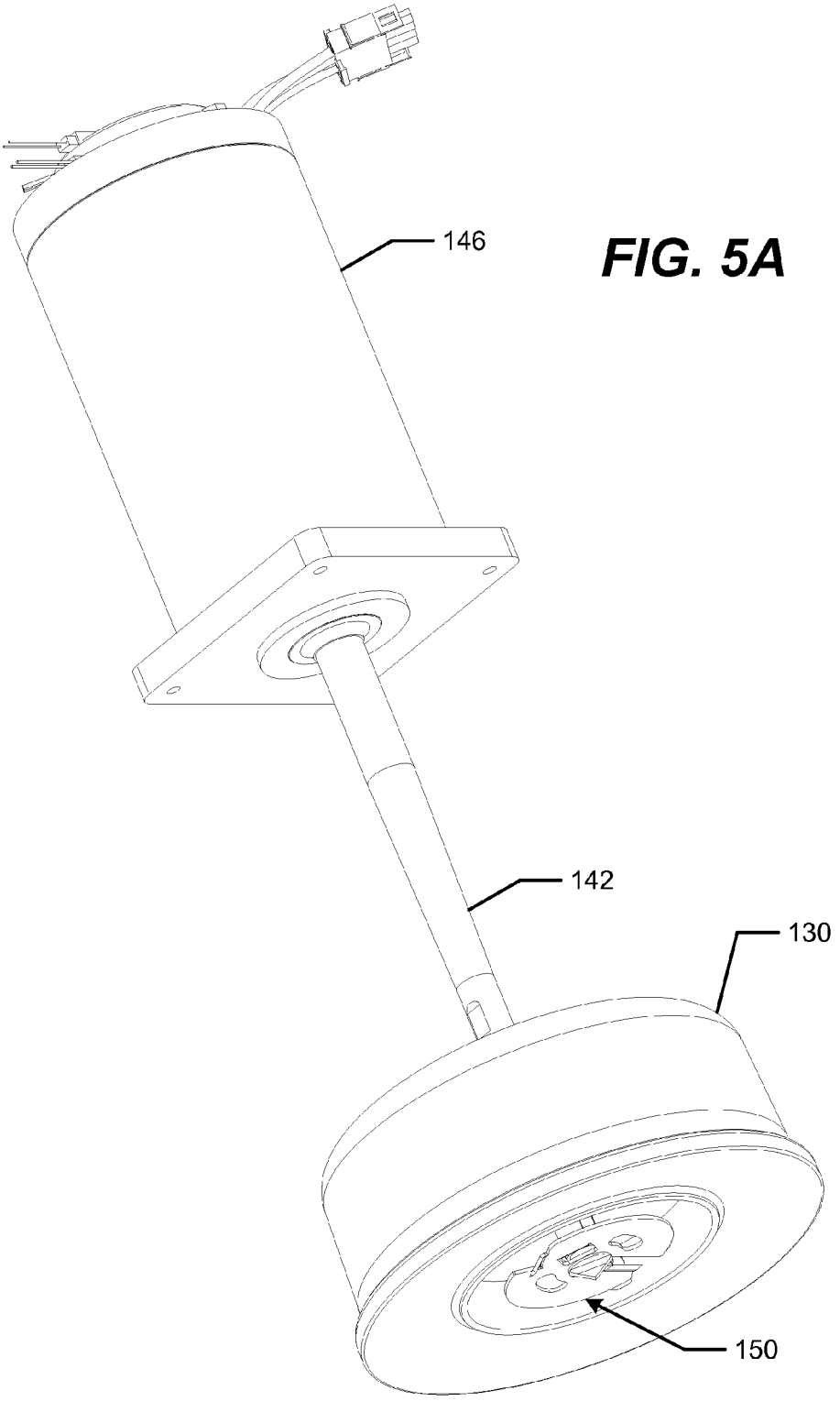


FIG. 5A

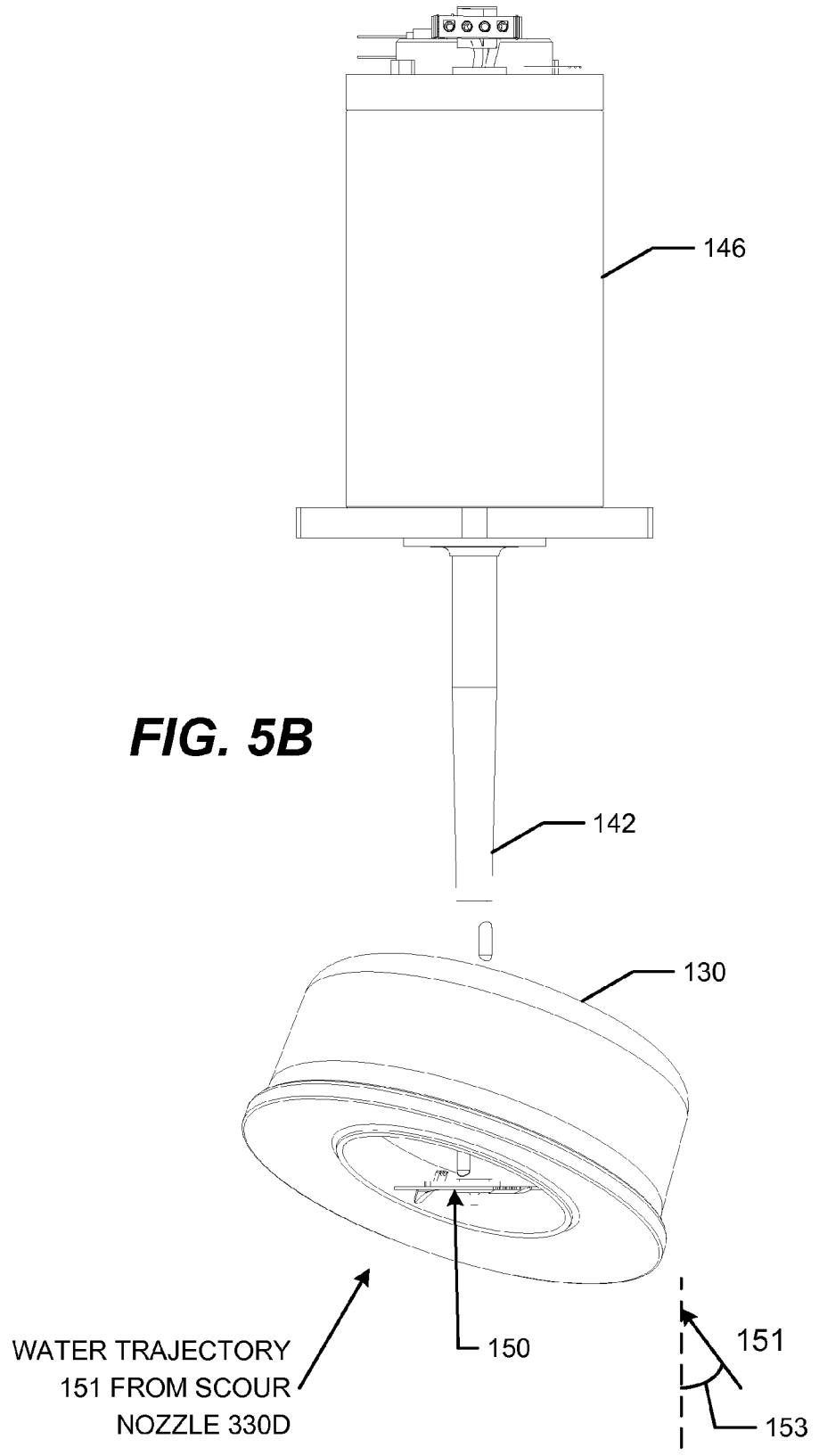

146
142
130
WATER TRAJECTORY
151 FROM SCOUR
NOZZLE 330D
150
151
153

FIG. 5B

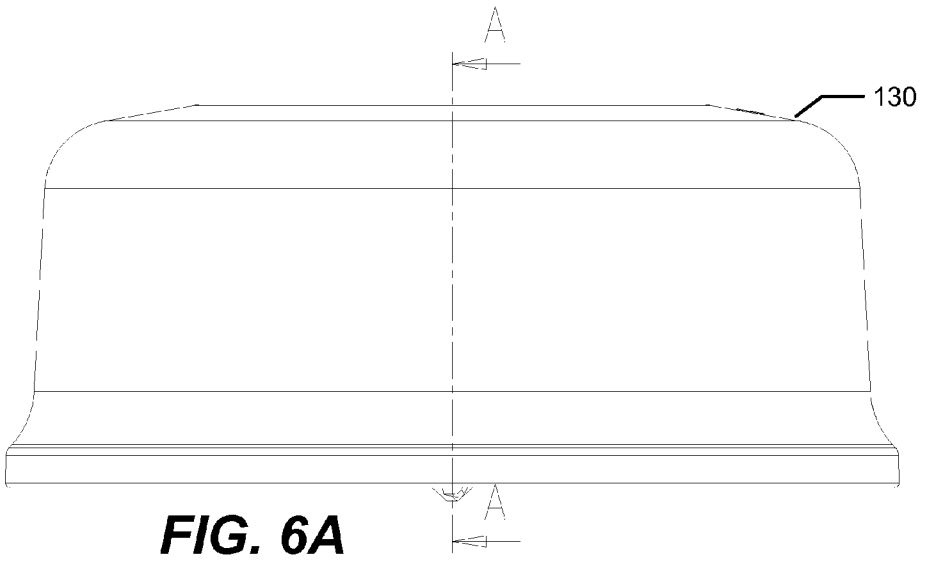

A
130
A

FIG. 6A

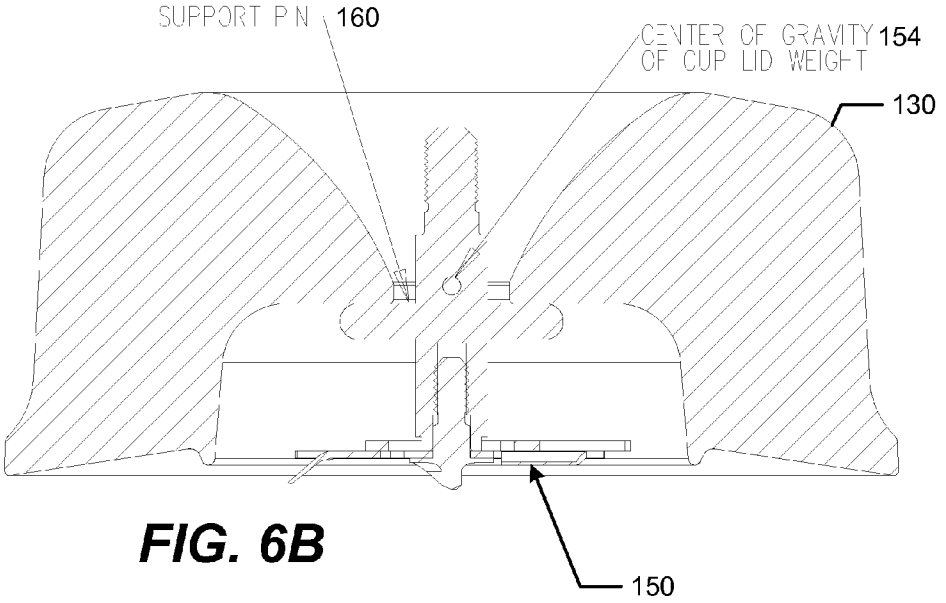

SUPPORT PIN
160
CENTER OF GRAVITY
OF CUP LID WEIGHT
154
130
150

FIG. 6B

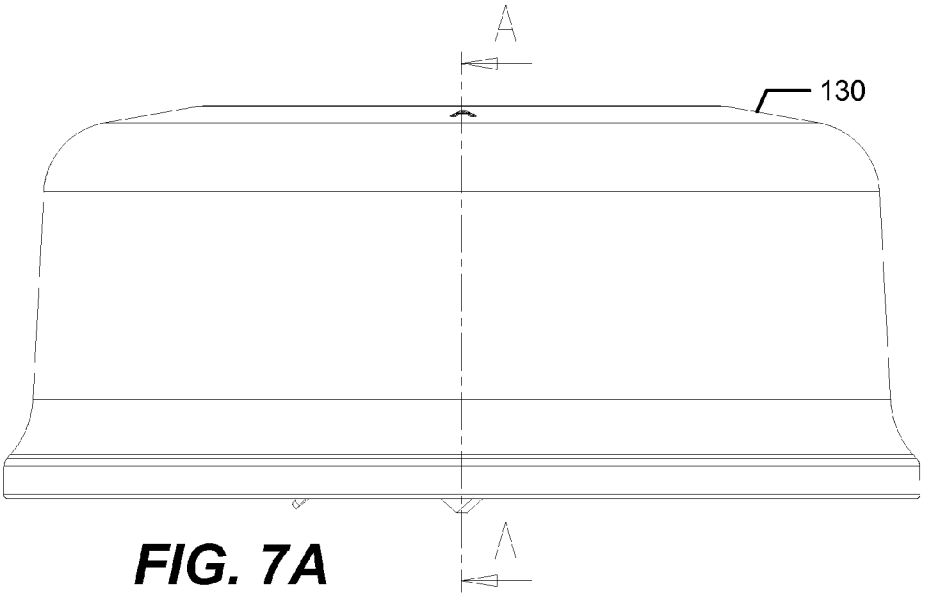

A
130
A

FIG. 7A

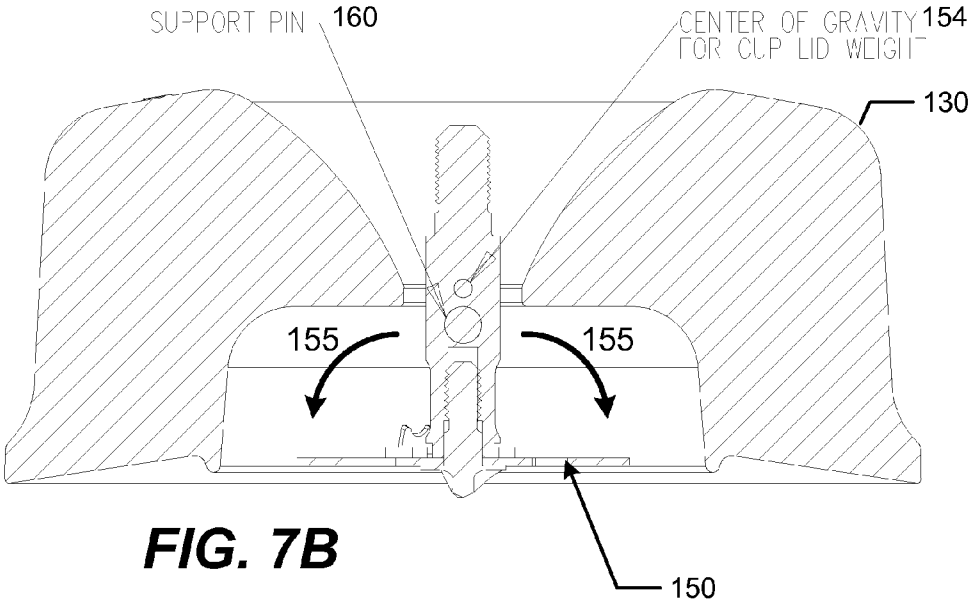

SUPPORT PIN
160
CENTER OF GRAVITY
FOR CUP LID WEIGHT
154
130
155
155
150

FIG. 7B

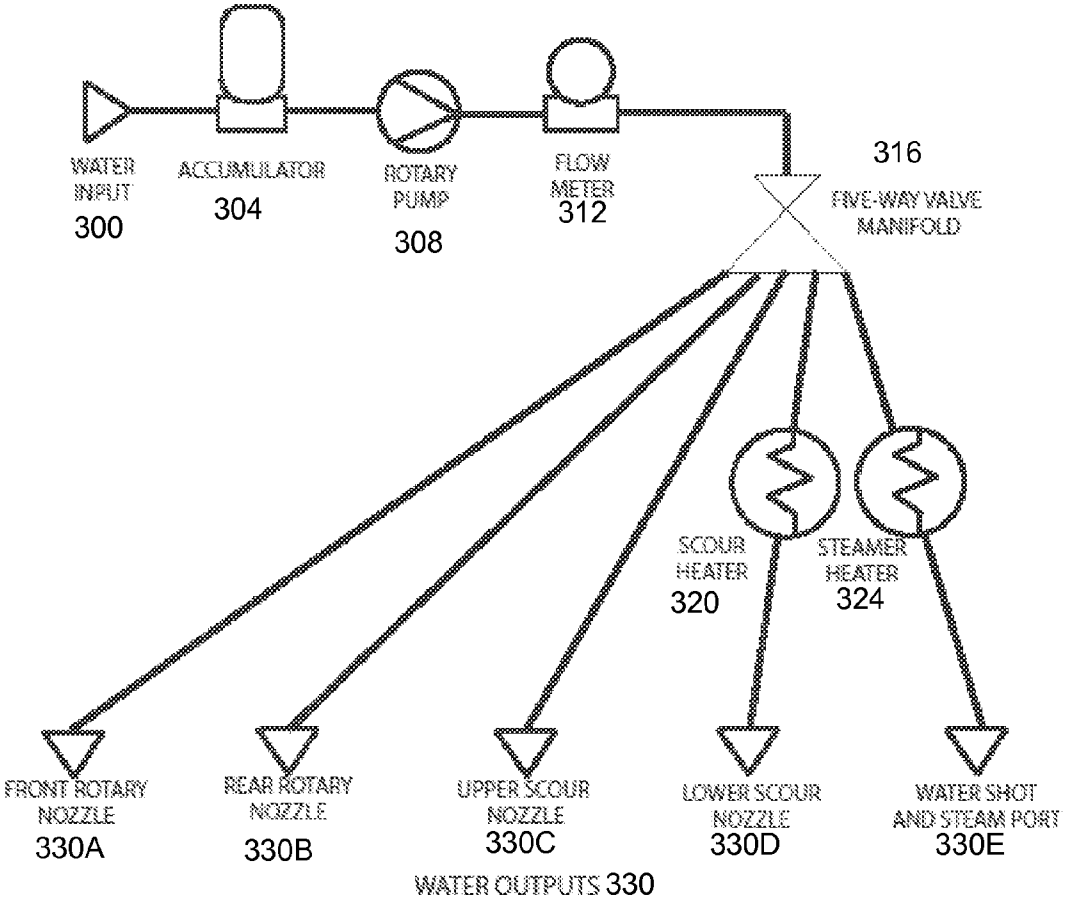

WATER INPUT
300
ACCUMULATOR
304
ROTARY PUMP
308
FLOW METER
312
316
FIVE-WAY VALVE MANIFOLD
SCOUR HEATER
320
STEAMER HEATER
324
FRONT ROTARY NOZZLE
330A
REAR ROTARY NOZZLE
330B
UPPER SCOUR NOZZLE
330C
LOWER SCOUR NOZZLE
330D
WATER SHOT AND STEAM PORT
330E
WATER OUTPUTS 330

FIG. 8A

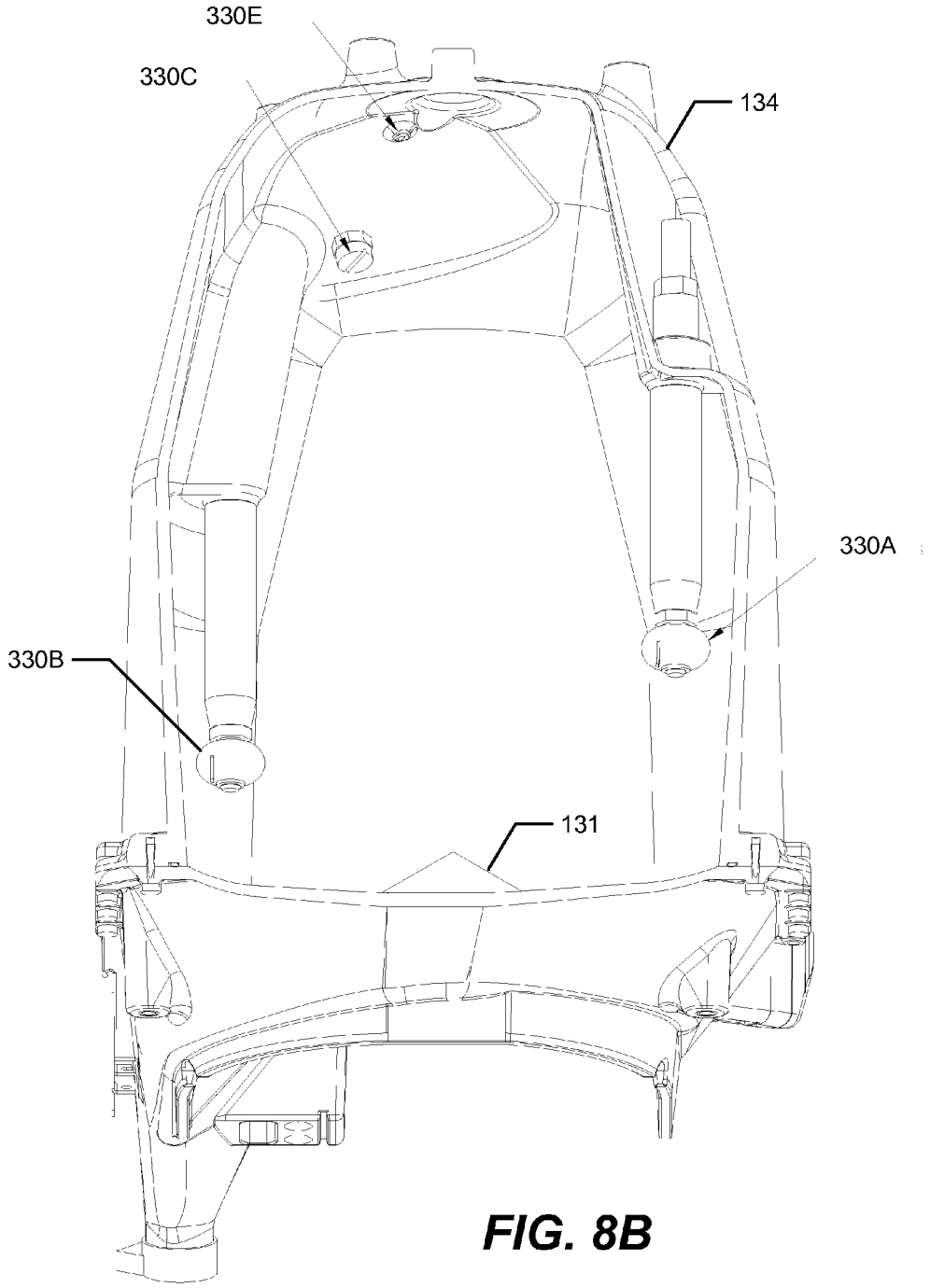
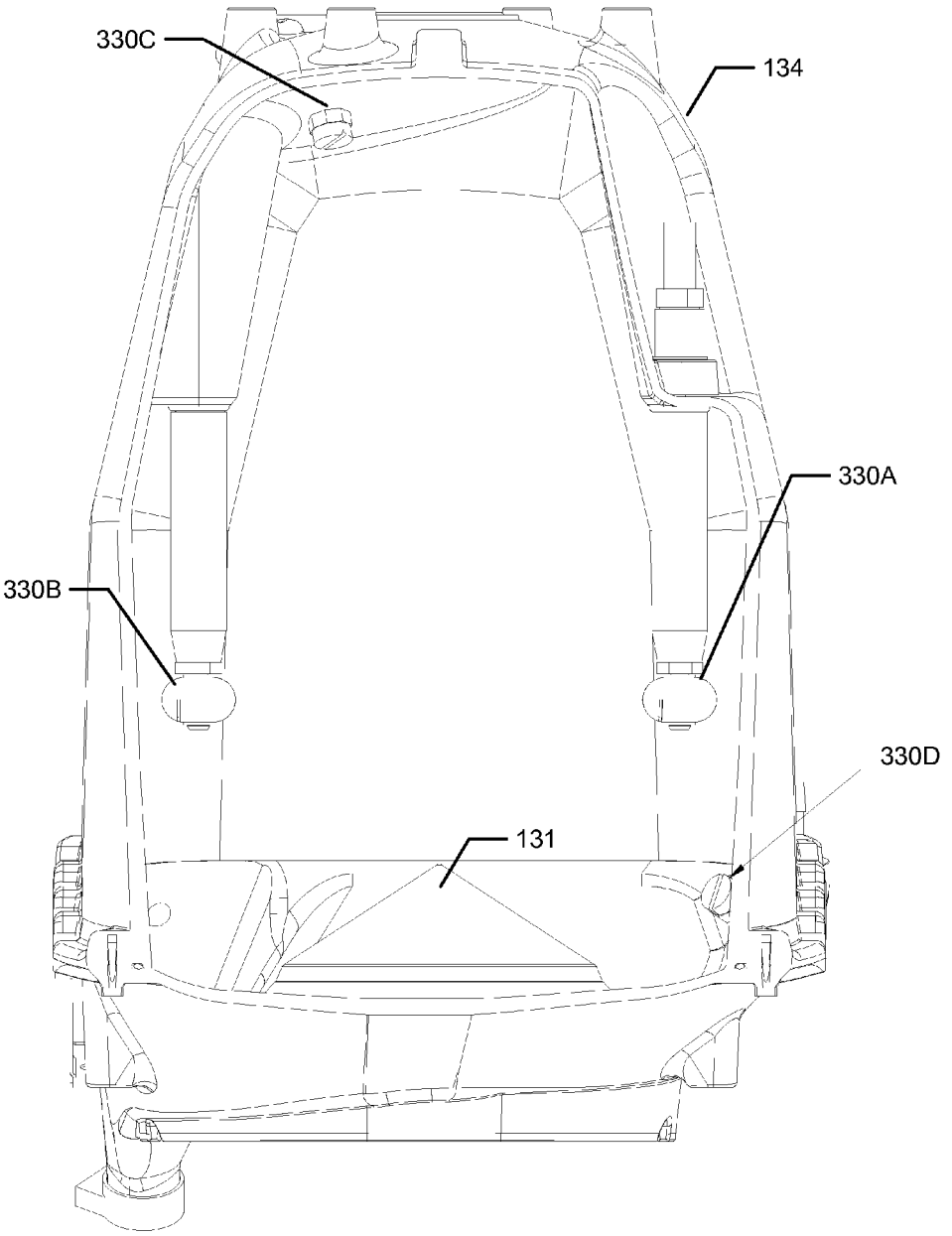


FIG. 8B

FIG. 8C



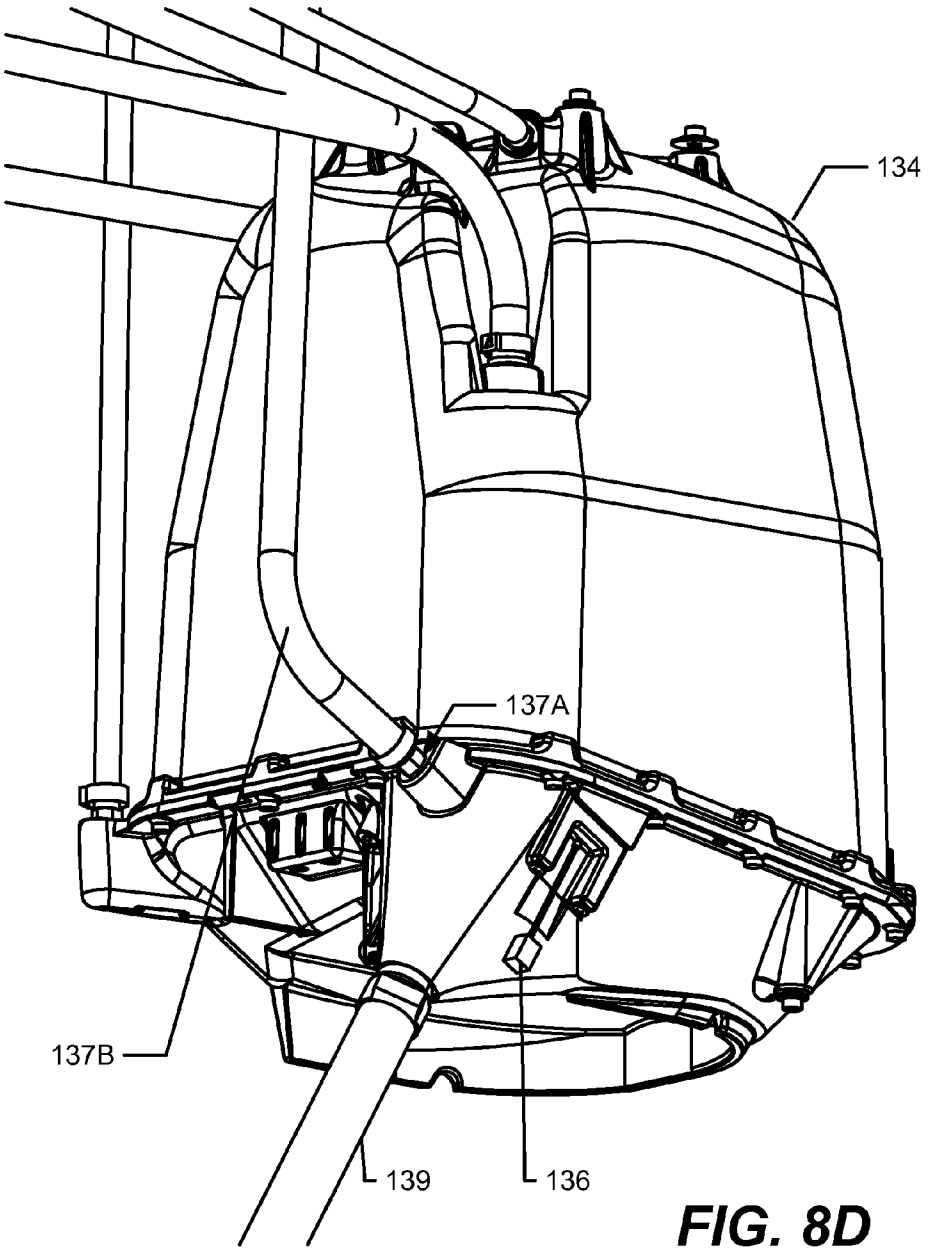


FIG. 8D

COMMERCIAL FROZEN FOOD PREPARATION APPARATUS ELECTRONICS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims benefit of U.S. Provisional Patent Application No. 61/252,606, entitled "COMMERCIAL FROZEN FOOD PREPARATION APPARATUS," filed on Oct. 16, 2009, which is hereby incorporated by reference in the entirety. This application is also related to applications entitled: "COMMERCIAL FROZEN FOOD PREPARATION APPARATUS" and "COMMERCIAL FROZEN FOOD PREPARATION APPARATUS SANITATION" filed concurrently with the present application and also claiming the benefit of U.S. Provisional Patent Application No. 61/252,606, each of which is also hereby incorporated by reference in the entirety into this application.

BACKGROUND OF THE INVENTION

[0002] This invention relates generally to food preparation and more specifically to instant preparation of frozen solids by blending in cups or similar vessels.

[0003] Milkshakes and other beverages or foods are a desirable offering for convenience stores or other retail formats. An apparatus in a convenience store that serves on-the-go consumers prepares a beverage, e.g. a milkshake, by blending the ingredients in a cup containing the frozen ingredients. A consumer may directly choose the type or flavor to be prepared and insert it into the apparatus, which with the press of a button will then provide the finished product, e.g. the blended milkshake, at the desired consistency, to the consumer.

[0004] While it is desirable to minimize or eliminate the time and attention of an employee in running and servicing the apparatus, this generates its own set of concerns.

SUMMARY

[0005] A machine prepares semi frozen food products and/or beverages from pre-prepared (e.g. frozen) cups. A user chooses the desired cup, inserts it into the machine, chooses how they would like it prepared from a range of thickness options, and the machine then opens a sealed chamber door and inserts the product upward into the chamber and prepares the product by blending it in the cup. Upon removal of the product and resealing of the chamber door, the cleaning mechanisms provide thorough rinsing of all food contact surfaces and the chamber interior. Automatic high pressure rinsing, subsequent cleaning, and high temperature steam sanitation takes place in the chamber at defined intervals, thus substantially reducing or even eliminating the need for manual cleansing and sanitation by an attendant and ensuring healthy food preparation at all times.

BRIEF DESCRIPTION OF THE DRAWINGS

[0006] FIG. **1**A is a perspective view of apparatus **100** in an initial "cup down" position.

[0007] FIG. **1**B is another perspective view of apparatus **100** in a subsequent "cup up" position.

[0008] FIG. **2** is a flow chart illustrating a product cycle according to a disclosed embodiment.

[0009] FIG. **3** is a flowchart illustrating operating of apparatus **100** according to a process incorporating the product cycle illustrated in FIG. **2**.

[0010] FIGS. **4**A-**4**E illustrate differing views and aspects of apparatus **100**.

[0011] FIGS. **5**A-**7**B illustrate different views and aspects of components of apparatus **100**.

[0012] FIG. **8**A is a schematic diagram of some components of a water delivery system of the apparatus.

[0013] FIGS. **8**B, **8**C, and **8**D illustrate a chamber and various components within the chamber.

DETAILED DESCRIPTION OF SPECIFIC EMBODIMENTS

[0014] Reference will now be made in detail to specific embodiments of the invention including the best modes contemplated by the inventors for carrying out the invention. Examples of these specific embodiments are illustrated in the accompanying drawings. While the invention is described in conjunction with these specific embodiments, it will be understood that it is not intended to limit the invention to the described embodiments. On the contrary, it is intended to cover alternatives, modifications, and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims. In the following description, specific details are set forth in order to provide a thorough understanding of the present invention. The present invention may be practiced without some or all of these specific details. In addition, well known features may not have been described in detail to avoid unnecessarily obscuring the invention.

[0015] While the embodiments described below relate to preparation of a frozen milkshake, other frozen beverages or food are encompassed and may be prepared by the described embodiments and appended claims.

[0016] FIG. **1**A is a perspective view of apparatus **100** in an initial "cup down" position, and FIG. **1**B is another perspective view of apparatus **100** in a subsequent "cup up" position. Apparatus **100** will prepare the frozen ingredients in cup **112** for consumption by a user. User interface **120** comprises a large video screen **120** which conveys information including product availability and features. A microprocessor (not shown) controls the operation of the various components of apparatus **100**, including the video screen. In certain embodiments, a user may select a desired consistency level of a milkshake, for example, regular, less thick or more thick by pushing a push button on the control panel **110**. In other embodiments, such function can be incorporated into the user interface screen **120** as a touchscreen. A cup carriage **108** comprises carriage arms **108**A and cup holder **108**B, that travels in a vertical direction along guide rail or track (not shown). Various components within housing **104** of apparatus **100** will be described in relation to the flow charts of FIGS. **2** and **3** illustrating aspects of operation of apparatus **100**, which should be viewed in conjunction with FIGS. **4**A-**8**C.

[0017] Product preparation cycle **200** is initiated by a user through the control panel **110** push buttons or the touch screen of user interface **120** after the user has placed the frozen cup in the cup holder. In initiating the cycle, the user may select the desired consistency, as represented by step **206**. In step **202**, apparatus **100** detects the placement of the product cup in the cup holder. As seen in FIG. **4**C, the placement or presence of the cup **112** in the holder is detected when cup sensing beam **155** is interrupted. Cup sensing beam is generated by transmitter **160** and received by receiver **154**. When the beam is interrupted, a cup is determined to be present in the cup holder. While in some embodiments the location of the transmitter and receiver may be the opposite of that shown

in FIG. **4**C, the receiver is preferably at the upper location as it is partially shielded from ambient light by housing **104**. This is advantageous because in some lighting conditions false cup present detection may occur and this is thus avoided with the transmitter/receiver layout and geometry shown in FIG. **4**C.

[0018] After the cup has been detected and the cycle initiated, the cup will then be elevated up into the sealed chamber in step **210** so that the frozen contents may be bored while warm water is injected into the cup. Prior to blending, the cup size will be sensed in step **212**. The carriage is moved up and down by a position motor **172** and a toothed belt system. An encoder **176** on position motor **172** is used to determine the position of the carriage **108**A and cup holder **108**B. This position, together with cup size sensors **164**A and **164**B, shown in FIG. **4**D, is used to determine the cup size. One of sensors **164**A is a transmitter while the other is a receiver. When a through beam travelling from transmitter to receiver is interrupted, a cup is detected. A larger and thus taller cup will extend higher up from the cup holder **108**B/carriage **108**A and thus interrupt the through beam sensors **164**A and **164**B before a shorter cup. The boring time and/or amount or temperature of water may be varied with cup size to arrive at the desired consistency.

[0019] The cup height may also be used to determine if an appropriate or authorized product is in the cup holder. If the height does not match a predetermined authorized height the cycle may be aborted or the user may be notified of such an error via the touch screen. Alternatively an RFID chip or a bar code or some other unique markings or image on the cup may be scanned to determine cup size and/or authorization.

[0020] Such authorization/verification also prevents damage to the apparatus and ensures the safety of the user because an odd object may easily be destroyed by boring blade **150** shown in FIG. **5**A (which will be described later) and result in potential damage to the apparatus or injury to those nearby.

[0021] In the embodiment shown in FIG. **4**E, the position as determined by the position motor **172** and encoder **176** is redundantly verified. This is beneficial because the position motor moves the carriage via a toothed belt. If the belt slips or skips a position on the belt, the position motor and encoder may indicate an erroneous position, which is undesirable and potentially dangerous. For example, if the cup is not in the raised position (appropriate for each size of cup) so that the cup lid weight is not resting upon the top of the cup, but is instead resting on the support pins of the drive shaft, the cup lid weight may spin at several hundred RPM as the product is bored and create severe vibration (similar to an unbalanced washing machine) due to the unbalanced lid weight. Additionally, the cup will not be properly held by the carriage and may potentially rotate in a dangerous fashion. The position is verified by upper sensor **180**A and lower sensor **180**B to sense the position of flag **184** of the carriage as it translates up and down. In one embodiment, sensors **180**A and **180**B are through beam sensors and when the beam is blocked by the flag of the carriage it is known that the carriage is between an emitter and collector of the through beam sensor. Alternatively sensors **180**A and **180**B may have one dual purpose emitter/collector on one side of the flag, and when the signal is reflected by the flag the carriage is detected at the location of the sensor. In a third embodiment, sensors **180**A and **180**B can be simple switches contacted and tripped by the flag.

[0022] In step **218**, the apparatus injects the proper amount of heated water and bores through the frozen product to achieve the selected consistency. After the product is lowered, the cup lid weight **130**, which will be described later in more detail with regard to FIGS. **5-7**, is rotated as heated water is sprayed by nozzles **330**C and **330**D, as shown in FIG. **8**C, above and below the cup weight at opposite sides of the cup weight to clean all of the food contact surfaces. Thus, as part of each product cycle **200**, the food contact surfaces (e.g. blade **150** and cup lid weight **130** in the illustrative embodiments) are cleaned so as to remove product after each milkshake is prepared. Note that the nozzles cannot be in the trajectory of the cup as it travels vertically in the sealed chamber, and thus cannot be directly under the blade **150**, which complicates the cleaning process, as will be discussed in greater detail below.

[0023] In prior devices, a clerk was required from time to time to clean the blade and other food contact surfaces with a brush. Also, a sanitizing solution was utilized to occasionally sanitize the device.

[0024] Embodiments functioning in accordance with the flow chart of FIG. **3** and as depicted in the associated figures eliminate the need for regular human intervention and for stocking a sanitizer that needs to be replaced, which is advantageous for installations where such milkshakes and other frozen beverages are made, such as convenience stores.

[0025] As seen in FIG. **3**, after each product cycle **200** previously described with regard to FIG. **2**, in step **230** the elapsed time since the last product cycle completion is monitored. If a threshold time is not exceeded, monitoring will continue. If on the other hand, as seen in step **234**, the threshold time has been met or exceeded, in step **238** a first rotary nozzle will be fired with a short burst of water pumped from an accumulator reservoir. The threshold is on the order of 10-60 minutes and in one example is 15 minutes. The first rotary nozzle may be either of front rotary nozzle **330**A or rear rotary nozzle **330**B seen in FIGS. **8**A-**8**C. It is desirable to dispense a very high flow rate of water, greater than 3 gallons per minute, for example 4 gallons per minute, for a short time, for some 1-5 seconds, e.g. about 1.5 seconds from each rotary nozzle firing. While the rotary nozzles are capable of dispensing a large quantity of water in a short time, sufficient volume of water at sufficient pressure is typically unavailable at the blender's water supply input **300** due to restrictions and filters on the supply line upstream of the apparatus. Therefore an accumulator tank **304** and a rotary pump **308** are used to increase the supply and pressure of water for the rotary nozzles to function more effectively. The increase in water pressure over input pressure is approximately 50-100 p.s.i., allowing for both a large flow in a short period and for high pressure rinsing. While accumulators are typically used at the output side of a pump, accumulator **304** is located at the input to pump **308** in certain embodiments, although in other embodiments it may be at the output. This placement of the accumulator before the pump eliminates the susceptibility of the system to loss of pressure by the accumulator pressure bladder. In this embodiment, the accumulator is simply serving as an inexpensive and readily available reservoir from which the pump can pump water at a high rate until the accumulator is exhausted. When the pump is turned off, the accumulator is refilled with water at a slower rate by the pressure of the water supply line. In this manner, the accumulator is never relied upon to provide pressure to push water through the rotary nozzles. The more typical arrangement with an accumulator is to have the accumulator's bladder pressurized so that when water is to be released from the

accumulator by opening a valve downstream, the pressurized bladder pushes the water out. The valve is then closed and the accumulator is then recharged by a pump that is located upstream of the accumulator.

[0026] Returning to FIG. **3**, accumulator **304** is refilled in step **242** and then the second rotary nozzle, e.g. **330**A or **330**B, is fired (by a valve of manifold **316** under control of a system microprocessor) with a short burst of water pumped from the accumulator reservoir. Then in step **250**, the time since the last sanitation is monitored and if a threshold time since the last sanitation is met or exceeded, as seen in step **254**, steam is injected at a first location **330**E of FIG. **8**B in step **260**. The sanitation time threshold may vary from approximately one hour to several days, but is preferably 24 hours and preferably is controlled to occur at night time when the apparatus is unlikely to be in use. It should be noted that the US FDA Food Code (section 4-601-11 in particular), which is hereby incorporated by reference in the entirety, requires that a food apparatus of the type described herein be cleaned and/or sanitized every 4 hours. Aspects of the design in certain embodiments (e.g. the rinsing, cleaning and sanitizing systems) are expected to result in a variance from the FDA to allow sanitation only once every 24 hours, which greatly improves availability and acceptance of the commercial embodiments by retail institutions and consumers. In step **264**, the temperature of the chamber (as increased by the injected steam) is measured until a thermister **136** in the lower area of the chamber registers a warm enough temperature (~175 F) to indicate that all parts of the chamber have reached a temperature sufficient to kill bacterial organisms. As seen in FIG. **8**, the steam is provided at water shot and steam port **330**E at the top of the chamber and the temperature is measured at the bottom of chamber **134** with thermister **136**. By injecting steam at the top of the chamber and determining that the temperature near the bottom of the chamber has reached a sufficient temperature to kill bacteria, bacteria upon all surfaces within the chamber are ensured to be killed because the heated steam first fills the upper volume of the chamber and propagates from the top to the bottom due to its moist and heated condition making it lighter than the air it is displacing in the chamber.

[0027] While the injection temperature alone could be utilized, by also measuring that a given temperature has been achieved in the chamber, and then immediately stopping the steam injection, a shorter sanitation time is achieved while still ensuring killing of bacteria, thus making the apparatus available for further food production in a shorter period of time as compared to simply injecting steam at a given temperature for a preset duration.

[0028] FIG. **4**A illustrates the apparatus with front door **124** opened. Product preparation chamber **134**, also referred to as mixing chamber **134**, can be seen within the upper portion of the apparatus. Although chamber **134** may be referred to as a mixing chamber, it should be understood, in certain of the described embodiments, that the product production involves boring through a frozen product, unlike what is typically referred to as a mixer. The front door opening of chamber **134** is sealed closed by inner chamber door seal **138** when front door **124** is in the closed position. Chamber **134** is also sealed when the bottom door **131** is closed. Bottom door **131** rotates about a hinge located at the side of the door and chamber in order to flip up and out of the way as the cup and holder are moved into the chamber. Bottom door **131** also incorporates a seal that ensures neither liquid nor steam escapes at the door locations. The doors **124** and **131** are sealed to the chamber when they are closed, effectively sealing the chamber during the steam sanitation cycle, thus allowing more quick and effective steam sanitation. Prior designs incorporated an open slot in the side wall of the chamber through which the cup holder mechanism traveled. While this open slot allowed a simpler and more vertically compact means of providing for cup travel up into the chamber, it stood as an impediment to effectively sealing the chamber for steaming, especially due to its location in the side of the chamber, and the tendency of steam to escape from the slot as it filled progressively from the top to the bottom of the chamber.

[0029] A consequence of sealing the chamber well is that the injected steam is unable to enter the chamber without increasing the pressure in the chamber. As seen in FIG. **8**D, to alleviate this increased pressure, and to ensure that any escaping moisture from the steam does not reach any of the moisture sensitive electronic control components, a chamber vent hole **137**A and connected chimney **137**B are positioned adjacent the drain outlet, but still within the chamber. The chimney **137**B extends upward to vent out the top of the apparatus, thus directing any moisture upward in the direction it naturally flows and out of the apparatus. The venting of steam from the bottom of the chamber through vent hole **137**A and chimney **137**B eliminates the need for a pressure relief valve because the steam can build up and fill the chamber without achieving a high pressure or relying on valve to be opened and closed.

[0030] A drain line **139** is also provided from the chamber in order to drain waste and rinse water from the chamber and out of the apparatus. This drain line is susceptible to growth of bacterial organisms which over time can grow and accumulate and clog the drain line. The bacteria may also migrate into the chamber, especially when the drain is clogged, which is especially problematic. This accumulation occurs most frequently at fittings in the drain line, which provide ready places for bacteria to grow. Therefore, the apparatus is provided with a flexible, bacteria resistant one piece extended drain line connected to the blending chamber outlet and running down and out through the back panel of the apparatus without any fittings. This line is provided with sufficient length to reach a drain proximate (within approximately 2 meters) to the installed location of the apparatus, all without any fittings.

[0031] In FIG. **4**A, within chamber **134**, cup lid weight **130** is shown in a tilted position. Cup **112** and carriage **108** are shown at a lower position. FIG. **4**B illustrates cup **112** partially in mixing chamber **134**, and cup lid weight **130** in a level position. Please note that the cup lid weight **130** is tilted when not supported by the cup, but that in FIG. **4**B it is depicted as level, e.g. with a bottom surface parallel to the plane of the rim of the cup, for illustrative purposes to show the cup entering the chamber. Note that the tilt angle of the cup lid weight will be changed and the cup lid weight will be moved by the cup as it makes contact with the lid weight and lifts it off its support pin (described later). Cup lid weight **130** is a solid polymer based structure weighing about 4 or more pounds, for example 5.4 pounds in a preferred embodiment. Chamber **134** and cup lid weight **130** are preferably made of an unsaturated polyester in a thermoset process. The cup lid weight comprises a high density filler such as barium sulfate to create a high density and overall weight. In one embodiment the specific gravity of the cup lid weight is in the range of 2.5 to 3.5, for example 2.8.

[0032] The surface of the chamber walls and the cup lid weight is not smooth but is rather purposefully fabricated with a texture configured to aid in the release of food particles. The surface texture for the chamber walls and the cup lid weight is best achieved by acid etching the thermoset plastic to create a surface roughness of approximately 0.5-2.0 micron diameter protrusions, which are approximately 1-4 microns high, and are spaced approximately every 5-15 microns.

[0033] The cup lid weight **130**, in addition to acting as a lid or splash guard, aids in preventing the cup from spinning when the rotating blade bores into the frozen material. The cup and the cup holder of the carriage have interlocking male/female features. The weight of the cup lid weight, provides a sufficient force to keep the mating surfaces of the interlocking features in contact with each other. For further information on the anti-rotation mechanisms, please refer to U.S. Pat. No. 6,041,961 entitled "CUP WITH ANTI-ROTATION MECHANISM" and U.S. patent application Ser. No. 12/265,397 entitled "METHOD AND APPARATUS FOR ROTATIONALLY RESTRAINING A MIXING CONTAINER" which are hereby incorporated by reference in the entirety. As mentioned earlier, the cup weight also acts as a splash guard, keeping the blended food product within the cup during the boring and liquid injection phase.

[0034] FIGS. **5**A-**7**B illustrate the cup lid weight **130** and associated boring components. Boring motor **146** is coupled to drive shaft **142**, at the end of which is boring blade **150**. Cup weight/lid **130** has an opening, through which drive shaft **142** passes. As seen in FIG. **5**B, cup lid weight **130** may tilt about the axis of drive shaft **142**. The ability to tilt allows greater access to the underside of the cup weight. The tilt angle is about 20-30 degrees and in one preferred embodiment is about 25 degrees. When a stream is directed upward from nozzle **330**D of FIG. **8**C from below the cup weight, with the cup weight in the tilted position, the stream can better reach the underside surface of the cup weight to dislodge food that may have been deposited upon the underside surface during blending because the underside of the cup weight is more exposed to the water stream and the water stream is less obstructed by the blending disc **150**, which is located just below the cup weight. In one embodiment, as depicted in FIG. **5**B, the water is provided at an angle **153** from the axis of shaft **142** so as to provide a direct path to and proper cleaning of the underside of the cup weight. Lower scour nozzle **330**D (FIG. **8**C) is located so as to achieve a delivery angle **153** of about 15 to 45 degrees.

[0035] FIG. **6**B is a cross section along line A-A of FIG. **6**A. Cup lid weight **130** rests upon support pin **160** of (multi piece) drive shaft **142**. In one embodiment, the cup lid weight **130** is designed so that the center of gravity **154** is located above the support pin **160**. The inner diameter of the hole within the cup lid weight **130** is about 50-100% larger than the outer diameter of drive shaft **142**, so that the cup lid weight may rotate about the support pin and tilt with respect to the drive shaft. Note that in some embodiments the center of gravity may also be below or at the level of the support pin, and the titling may be achieved by the rotational force alone or means of a tilted support pin, as allowed by the gap in outer/inner diameter of the shaft and cup lid weight respectively. FIG. **7**B illustrates another cross section 90 degrees from that shown in FIG. **6**B. The direction of tilting either clockwise or counterclockwise about support pin **160**, as represented by arrows **155** is most clearly shown in FIG. **7**B. By placing the center of gravity above the pin, tipping occurs randomly either clockwise or counterclockwise, thus improving the cleaning of the underside of the cup weight by more completely, randomly exposing all of the cup weight underside to the rinsing fluid from blending cycle to blending cycle.

[0036] FIG. **8**A, touched upon earlier, is a plumbing diagram. Water input **300** is connected to a water supply line, which supplies water to accumulator **304** at the pressure of the incoming water supply. Rotary pump **308** increases the pressure and flow rate of the water as it is pumped from the accumulator through the flow meter **312** and valve manifold **316**. As mentioned earlier, the increase in water pressure over input water supply line pressure is approximately 50-100 p.s.i. The flow rate through flow meter **312** may be used by control circuitry to alter the running time, flow rate and/or output pressure of pump **308**. The control circuitry also uses the flow meter to measure and dispense precise amounts of liquid appropriate for various tasks. For example, a measured amount for a first size or consistency of milkshake may be different than for a second size or consistency. Amounts for scour nozzles and rotary nozzles are also measured by the flow meter. This improves upon prior designs utilizing an approximation of dispensed amounts (of e.g., water) based upon the elapsed time open of the valves, which is problematic when flow/pressure restrictions or variations arise. The valves of valve manifold **316** are activated by logic so as to supply one or more of: front rotary nozzle **330**A; rear rotary nozzle **330**B; upper scour nozzle **330**C; lower scour nozzle **330**D; and water shot and steam port **330**E. Water passed to lower scour nozzle **330**D is heated by scour heater **320**. Water passed to water shot and steam port **330**E is passed through steam heater **324**. The heaters **320** and **324** may be discrete heaters and or may be different water passages through one heating element or core. In addition, steam heater **324** can serve as both a steam heater for steam sanitization of the apparatus and also can serve as the heater which heats water for addition to the milkshake during blending. By monitoring the temperature of heater **324**, the water can be maintained at the approximately 125 degree Fahrenheit temperature desirable for addition to the milkshake, or when desired, steam can be created by running the heater at a temperature sufficiently high (approximately 225 degrees Fahrenheit) to generate steam. Because these two desired conditions do not occur simultaneously, these two functions can be combined into one heater, reducing the necessary heating units as well as the associated plumbing and valves.

[0037] FIGS. **8**B and **8**C illustrate the chamber **134** and the various water dispensing components **330**. As mentioned earlier, water shot nozzle and steam injection location **330**E is located at the top of the blending chamber near the drive shaft and injects a shot of warm, e.g. approximately 125 degree Fahrenheit water into the cup during the boring of the product. After each production cycle, warm water is sprayed by the scour nozzles **330**C and **330**D in order to rinse any food residue off the food contact surfaces while the tipped cup lid weight **150** is slowly rotated.

[0038] If no product is run for an extended period, e.g. on the order of fifteen minutes, then the two rotary nozzles **330**A and **330**B are fired. A first nozzle is fired until the accumulator is nearly emptied, then the accumulator is refilled and the second nozzle is fired. This is to clear any splatters off of the chamber **134** walls. There are two nozzles to ensure there are no areas that are "shadowed" from both nozzles. With only one nozzle, this is difficult if not impossible.

[0039] A telecommunications transceiver may be incorporated into the apparatus. In one embodiment, the transceiver comprises a cellular modem that communicates over a "cellular" mobile telephone network, which eliminates any need for a wired connection. In another embodiment the transceiver comprises a wireless network or "wifi" modem operating under one or more of the 802.11 or other protocols. The modem may communicate with a remote monitoring facility to communicate various pertinent data about the apparatus. For example, any errors within the apparatus may be reported so that a technician can be sent to tend to the machine before the errors result in machine malfunction. For example, if the position verification system indicates that the belt has slipped, this condition may be reported and repaired. As another example, errors achieving necessary temperatures and pressures may be reported. As yet another example, a parameter that may be tracked and reported is motor current and/or time required to bore through a shake. A higher than normal motor current during shake preparation indicates that the freezer is colder than a baseline recommended temperature, or in other words too cold. A longer than usual elapsed time necessary to bore through the shake is also an indicator of an overly cold freezer, and similarly, a shorter than usual time may be indicative of a warmer than recommended freezer. Other parameters include but are not limited to the water pressure (as determined by the flow rate), cup presence, and line voltage supplied to the apparatus. Additionally, the sales volume of different sizes and types of products may be reported, and as a result inventory may be automatically restocked. Further, the food preparation apparatus is configured to allow the monitoring facility or other remote entity to disable the apparatus if certain product parameters or quantities are outside of expected or contracted ranges. The communication means can also be used to update the content of the user interface screen for new product information, or to provide new blending programs or parameters to blend newly developed products.

[0040] While the invention has been particularly shown and described with reference to specific embodiments thereof, it will be understood by those skilled in the art that changes in the form and details of the disclosed embodiments may be made without departing from the spirit or scope of the invention.

[0041] In addition, although various advantages, aspects, and objects of the present invention have been discussed herein with reference to various embodiments, it will be understood that the scope of the invention should not be limited by reference to such advantages, aspects, and objects. Rather, the scope of the invention should be determined with reference to the appended claims.

What is claimed is:

1. A food preparation apparatus, comprising:

an enclosed food preparation chamber;

a carriage comprising a cup holder;

a motor that elevates the carriage and a cup within the cup holder into the preparation chamber from a starting position and returns the carriage and cup to the starting position; and

a cup sensing beam utilized to detect the presence of the cup within the cup holder, the apparatus configured to elevate the carriage and cup only if a cup is detected by the cup sensing beam.

2. The food preparation apparatus of claim **1**, further comprising a receiver to detect the beam or interruption thereof, the receiver shielded, at least partially, from ambient light.

3. The food preparation apparatus of claim **2**, wherein the receiver is located above the cup.

4. A food preparation apparatus, comprising:

a food preparation chamber;

a carriage comprising a cup holder;

a motor that elevates the carriage and a cup within the cup holder into the preparation chamber from a starting position and returns the carriage and cup to the starting position, the apparatus configured to maintain the carriage at the starting position outside of the chamber when awaiting a cup to be placed in the cup holder by a user of the apparatus; and

a system that senses the size of a cup that is placed within the cup holder by the user, the system comprising:

a position encoder, and one or more cup size sensors, wherein the cup size is determined by referencing the position of the motor to determine a corresponding position of the carriage, and wherein the carriage position is referenced in conjunction with the time when a cup size sensor is tripped to determine the cup size.

5. The food preparation apparatus of claim **4**, wherein the system comprises a transmitting cup size sensor and a receiving cup size sensor, and wherein the presence of an upper portion of the cup is sensed when a beam travelling from the transmitting cup size sensor to the receiving cup size sensor is interrupted.

6. The food preparation apparatus of claim **4**, wherein the apparatus is configured to select a blade boring time and a water quantity for food preparation based upon the determined cup size.

7. The food preparation apparatus of claim **6**, wherein the apparatus is configured to select a blade boring speed based upon the determined cup size.

8. The food preparation apparatus of claim **4**, wherein the apparatus is configured to receive a desired food consistency from a user and to select the blade boring time and/or water quantity based upon the cup size and the desired food consistency.

9. The food preparation apparatus of claim **4**, wherein the apparatus is configured to redundantly verify the position of the carriage as it translates up and down with one or more carriage position sensors.

10. The food preparation apparatus of claim **4**, wherein the apparatus is configured to abort a product preparation cycle if the cup size does not match a predetermined authorized size.

11. The food preparation apparatus of claim **4**, wherein the apparatus is configured to notify a user if the cup size does not match a predetermined authorized size.

12. The food preparation apparatus of claim **4**, wherein the apparatus is configured to notify a remote computing device over a network connection if the cup size does not match a predetermined authorized size.

13. A food preparation apparatus, comprising:

a food preparation chamber;

a carriage comprising a cup holder;

a motor that elevates the carriage and a cup within the cup holder into the chamber from a starting position and returns the carriage and cup to the starting position;

a mechanism that opens the door of the chamber as the carriage is elevated and the cup is placed within the chamber and closes the door as the carriage is lowered to the starting position;

a microprocessor; and

a telecommunications transceiver, the apparatus configured to transmit information regarding operation of the apparatus to a remote entity via the telecommunications transceiver.

14. The food preparation apparatus of claim **13**, wherein the telecommunications transceiver comprises a cellular modem.

15. The food preparation apparatus of claim **13**, wherein the apparatus is configured to detect errors indicative of potential malfunction and report the errors to the remote entity.

16. The food preparation apparatus of claim **15**, wherein the apparatus is configured to detect if a belt coupled to the carriage has slipped and to report it to the remote entity.

17. The food preparation apparatus of claim **15**, wherein the apparatus is configured to detect if there is difficulty achieving a desired temperature or pressure and report it to the remote entity.

18. The food preparation apparatus of claim **15**, wherein the apparatus is configured to detect if one or more performance parameters is not met.

19. The food preparation apparatus of claim **18**, wherein one or more of the performance parameters indicates an excessively cold freezer is making product preparation more difficult and time consuming for the apparatus

20. The food preparation apparatus of claim **15**, wherein the apparatus is configured to track the products made with the apparatus by type and sales volume and to report relevant information to the remote entity.

21. The food preparation apparatus of claim **20**, wherein sales volume and sales type, when compared to prior sales history, is utilized to indicate a probable product type out-of-stock condition in a freezer of a retail location.

22. The food preparation apparatus of claim **20**, wherein the food preparation apparatus is configured to allow the remote entity to disable the apparatus if certain product parameters or quantities are outside of expected or contracted ranges.

22. A food preparation apparatus, comprising:

a chamber comprising a door at a lower portion of the chamber, the door sealing the door to the chamber when the door is in a closed position;

a carriage comprising a cup holder;

a motor that elevates the carriage and a cup within the cup holder into the chamber from a starting position and returns the carriage and cup to the starting position; and

a flow meter coupled to a pump, the apparatus configured to measure an amount of liquid passed through the flow meter.

23. The apparatus of claim **22**, wherein the apparatus is further configured to dispense a precise amount based upon the amount measured by the flow meter.

24. The apparatus of claim **23**, wherein the apparatus is configured to measure and dispense a first amount into the cup when the cup in an elevated position, the first amount selected to vary based upon cup size.

25. The apparatus of claim **23**, wherein the apparatus is configured to measure and dispense a first amount into the cup when the cup in an elevated position, the first amount selected to vary based upon a selected consistency for a product within the cup.

26. The apparatus of claim **23**, wherein the apparatus is configured to measure and dispense a second amount sprayed by one or more rotary nozzles, the second amount sufficient to clean walls of the chamber.

27. The apparatus of claim **23**, wherein the apparatus is configured to measure and dispense a third amount sprayed by one or more scour nozzles, the third amount sufficient to remove food from a boring blade of the apparatus.

28. The apparatus of claim **23**, wherein the flow meter is utilized to identify a problem with the operation of the water delivery system, including an insufficient flow volume or flow rate.

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