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(54) **BEVERAGE VENDING MACHINE AND RELATED METHODS**

(57) A beverage vending machine and a method of vending a beverage. The beverage vending machines includes a carousel having a plurality of cup dispensing stations supporting a stack of cups and dispensing a lowermost cup from the stack, a drum positioned below the carousel that receives the dispensed cup during a beverage vend. A first nozzle is coupled to the carousel so that the first nozzle moves during rotation of the carousel. The first nozzle is configured to dispense a beverage into the dispensed cup during a beverage dispensing step. During the beverage dispensing step, at least one of: (1) the carousel rotates about a first rotational axis; and (2) the drum rotates about a second rotational axis, such that a position of the first nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle into the dispensed cup.

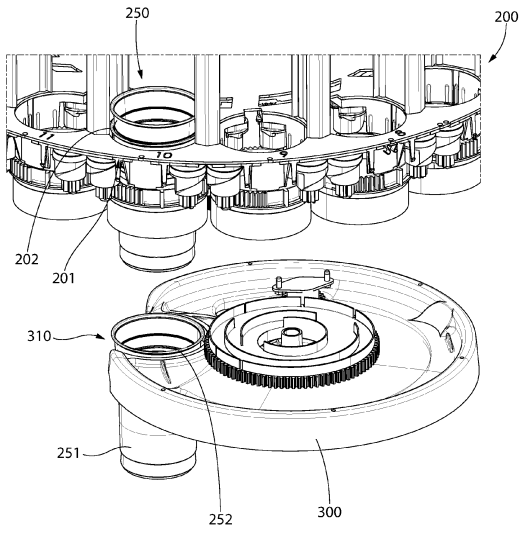

FIG. 10B

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Description

BACKGROUND

[0001] Beverage vending machines, also known as In-Cup Vending Machines, create a beverage in a disposable cup and then present the disposable cup with the beverage therein to a consumer. Such beverage vending machines use cups that are pre-filled with powdered ingredients and inject a liquid such as water into the cups to form the desired beverage as the liquid mixes with the powdered ingredient. Beverage vending machines have the capability of creating a variety of drinks, including creating sports drinks by mixing water with a sports drink powder and creating coffee beverages by mixing water with soluble coffee powder alone or in combination with a milk powder. However, such beverage vending machines, particularly when vending specialty coffee beverages such as cappuccinos and lattes, lack the added flair of latte art that can be created by a barista and which often wows the consumer. Thus, a need exists for an improved beverage vending machine that can create coffee beverages that mimic the artistic creations made by baristas.

BRIEF SUMMARY

[0002] The invention may be directed to a beverage vending machine and a method of vending a beverage. The beverage vending machines includes a carousel having a plurality of cup dispensing stations supporting a stack of cups and dispensing a lowermost cup from the stack, a drum positioned below the carousel that receives the dispensed cup during a beverage vend. A first nozzle is coupled to the carousel so that the first nozzle moves during rotation of the carousel. The first nozzle is configured to dispense a beverage into the dispensed cup during a beverage dispensing step. During the beverage dispensing step, at least one of: (1) the carousel rotates about a first rotational axis; and (2) the drum rotates about a second rotational axis, such that a position of the first nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle into the dispensed cup.

[0003] In one aspect, the invention may be a beverage vending machine comprising: a carousel comprising a plurality of cup dispensing stations, each of the plurality of cup dispensing stations configured to support a stack of cups and, during a beverage vend, to dispense a lowermost cup from the stack as a dispensed cup, wherein the carousel is configured to rotate about a first rotational axis; a drum positioned below the carousel and comprising a cup receiving portion that receives the dispensed cup during the beverage vend, wherein the drum is configured to rotate about a second rotational axis that is parallel to and offset from the first rotational axis of the carousel; a first nozzle coupled to the carousel so that the first nozzle moves during rotation of the carousel about the first rotational axis, the first nozzle configured to dispense a beverage into the dispensed cup during a beverage dispensing step of the beverage vend; and wherein during the beverage dispensing step of the beverage vend, at least one of: (1) the carousel rotates about the first rotational axis; and (2) the drum rotates about the second rotational axis, such that a position of the first nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle into the dispensed cup.

[0004] At least one of the stacks of cups may comprise a plurality of cups containing a milk powder. There may be a second nozzle configured to dispense water into the dispensed cup prior to the beverage dispensing step. Upon dispensing one of the plurality of cups containing the milk powder into the cup receiving portion of the drum, the drum may rotate about the second rotational axis to align the one of the plurality of cups with the second nozzle to dispense the water into the dispensed cup and generate a milk foam. Afterwards, the drum may rotate about the second rotational axis to align the one of the plurality of cups with the first nozzle to dispense the beverage into the milk foam in the one of the plurality of cup while the at least one of the carousel and the drum rotates to create the artistic pattern.

[0005] The beverage may be coffee. The dispensed cup may contain milk foam prior to the beverage dispensing step so that a colour of the coffee contrasts with a colour of the milk foam to create the artistic pattern.

[0006] The beverage may be dispensed continuously from the first nozzle during the beverage dispensing step of the beverage vend or the beverage may be dispensed intermittently from the first nozzle during the beverage dispensing step of the beverage vend.

[0007] The first nozzle may be aligned with a top opening of the dispensed cup during an entirety of the beverage dispensing step of the beverage vend.

[0008] The beverage machine may include a housing defining an interior cavity within which the carousel, the drum, and the first nozzle are located. A beverage brewing apparatus may be located within the interior cavity of the housing and operably coupled to the first nozzle. The beverage brewing apparatus may brew the beverage that is dispensed from the first nozzle. The machine may include a supply of beverage ingredient cartridges located within the interior cavity of the housing. The beverage ingredient cartridges may be fed to the beverage brewing apparatus one at a time to facilitate the brewing of the beverage with the beverage brewing apparatus.

[0009] The machine may include a user interface comprising a plurality of user selectable beverage options and a processor operably coupled to the user interface. Upon a user selecting a first beverage option from the plurality of user selectable beverage options on the user interface, the processor may initiate the beverage vend. The user interface may include a plurality of user selectable artistic patterns. Upon a user selecting one of the plurality of user selectable artistic patterns, the processor

may rotate the at least one of the carousel and the drum in a particular manner to create the artistic pattern associated with the one of the plurality of user selectable artistic patterns during the beverage vend. Upon the user selecting a second beverage option from the plurality of user selectable beverage options on the user interface, the processor may be configured to initiate a second type of beverage vend wherein the dispensed cup contains a beverage ingredient and a second nozzle dispenses water into the dispensed cup that mixes with the beverage ingredient in the dispensed cup to generate a drink without introducing the beverage into the dispensed cup from the first nozzle.

[0010] During the beverage dispensing step of the beverage vend, the carousel may rotate about the first rotational axis and the drum may rotate about the second rotational axis to modify the position of the first nozzle relative to the dispensed cup.

[0011] During the beverage dispensing step of the beverage vend, the position of the first nozzle relative to the dispensed cup may change due to the rotation of the at least one of the carousel and the drum while ensuring that any of the beverage dispensed by the first nozzle is introduced into the dispensed cup.

[0012] In another aspect, the invention may be a beverage vending machine comprising: a carousel comprising a plurality of cup dispensing stations, each of the plurality of cup dispensing stations configured to support a stack of cups and to dispense a lowermost cup from the stack as a dispensed cup; a drum positioned below the carousel and comprising a cup receiving portion that receives the from the carousel and holds the dispensed cup during a beverage vend; a beverage brewing apparatus configured to brew a beverage; and a first nozzle fluidly coupled to the beverage brewing apparatus to dispense the beverage brewed by the beverage brewing apparatus into the dispensed cup during a beverage dispensing step of the beverage vend.

[0013] The machine may include a housing defining an interior cavity within which the carousel, the drum, the beverage brewing apparatus, and the first nozzle are located. The beverage brewing apparatus may be coupled to the carousel. The carousel may be configured to rotate about a first rotational axis. The first nozzle may be coupled to the carousel so that the first nozzle moves during rotation of the carousel about the first rotational axis. The drum may be configured to rotate about a second rotational axis that is parallel to and offset from the first rotational axis of the carousel.

[0014] During the beverage dispensing step of the beverage vend, at least one of: (1) the carousel may rotate about the first rotational axis; and (2) the drum may rotate about the second rotational axis, such that a position of the first nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle into the dispensed cup.

[0015] The beverage brewing apparatus may be a coffee brewing machine or an espresso brewing machine.

[0016] The plurality of cup dispensing stations may comprise a first cup dispensing station that supports a first stack of cups. Each of the cups of the first stack of cups may contain a milk powder. The machine may include a second nozzle. When the dispensed cup is one of the cups from the first stack of cups, the second nozzle may be configured to dispense water into the dispensed cup to create a milk froth from the milk powder prior to the beverage dispensing step of the beverage vend. The beverage may be coffee having a colour that contrasts with the milk powder. During the beverage dispensing step of the beverage vend, the carousel may rotate about the first rotational axis; and the drum may rotate about the second rotational axis, such that a position of the first nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle into the milk froth in the dispensed cup. The plurality of cup dispensing stations may comprise a second cup dispensing station that supports a second stack of cups. Each of the cups of the second stack of cups may contain a beverage ingredient. When the dispensed cup is one of the cups from the second stack of cups, the second nozzle may be configured to dispense water into the dispensed cup and then present the dispensed cup to a consumer without performing the beverage dispensing step of the beverage vend.

[0017] In still another aspect, the invention may be a method of vending a beverage with a beverage vending machine, the method comprising: dispensing a cup from a carousel to a drum positioned below the carousel, the cup containing a milk powder; dispensing a first liquid into the cup to create a milk froth from the milk powder; dispensing a second liquid into the cup from a first nozzle that is coupled to the carousel while rotating at least one of the drum and the carousel to modify a position of the first nozzle relative to the cup to create an artistic pattern with the second liquid that is visible on the milk froth.

[0018] The second liquid may be a coffee product having a contrasting colour to the milk froth. The first liquid may be water that combines with the milk powder to form the milk froth. The drum and the carousel may both be configured to rotate clockwise and counteer-clockwise during the dispensing of the second liquid into the cup to create the artistic pattern. The second liquid may be dispensed into the cup continuously so that the artistic pattern is a continuous unbroken pattern. The second liquid may be dispensed into the cup intermittently so that the artistic pattern is a discontinuous pattern.

[0019] Prior to dispensing the cup from the stack of cups, a beverage type may be selected from a plurality of selectable beverage types and the artistic pattern may be selected from a plurality of selectable artistic patterns. The carousel may rotate about a first rotational axis and the drum may rotate about a second rotational axis that is parallel to and offset from the first rotational axis. The second liquid dispensed from the first nozzle may be introduced into the cup regardless of the position of the first nozzle relative to the cup due to the rotation of the

at least one of the drum and the carousel. The first nozzle may be maintained in alignment with a top opening of the cup as the at least one of the drum and the carousel rotate during the dispensing of the second liquid into the cup. The cup may be positioned in the cup receiving portion of the drum during the dispensing of the second liquid into the cup from the first nozzle such that rotation of the drum causes the cup to move and rotation of the carousel causes the first nozzle to move.

[0020] The method may include rotating the carousel about a first rotational axis until the cup dispensing station of the carousel is aligned with an actuation mechanism. The method may include actuating a cup dispensing mechanism of the cup dispensing station with the actuation mechanism to dispense the cup from the stack of cups. The method may include rotating the drum about a second longitudinal axis to align the cup with a second nozzle. The method may include dispensing the first liquid from the second nozzle into the cup to create the milk froth. The method may include rotating the drum about the second longitudinal axis to align the cup with the first nozzle. The method may include dispensing the second liquid into the cup from the first nozzle.

[0021] In yet another aspect, the invention may be a beverage vending machine comprising: a carousel comprising a cup dispensing station supporting a stack of cups containing a milk powder, wherein during a beverage vend the cup dispensing station is configured to dispense a lowermost cup from the stack of cups; a drum positioned below the carousel and comprising a cup receiving portion that receives the lowermost cup during the beverage vend; a water dispensing nozzle configured to dispense water, wherein the drum is configured to rotate about a rotational axis to position the dispensed cup so that the water dispensing nozzle dispenses the water into the dispensed cup to create a milk froth from the milk powder; a beverage dispensing nozzle coupled to the carousel so that the beverage dispensing nozzle moves during rotation of the carousel about the first rotational axis, the beverage dispensing nozzle configured to dispense a beverage into the dispensed cup during a beverage dispensing step of the beverage vend; and wherein during the beverage dispensing step of the beverage vend, at least one of: (1) the carousel rotates about a first rotational axis; and (2) the drum rotates about a second rotational axis, such that a position of the beverage dispensing nozzle relative to the dispensed cup changes to create an artistic pattern with the beverage that is visible on the milk froth in the cup.

[0022] The second rotational axis may be parallel to and offset from the first rotational axis.

[0023] In yet another aspect, the invention can be a method of vending a beverage with a beverage vending machine, the method comprising: dispensing a cup from a carousel to a drum positioned below the carousel; dispensing a first liquid into the cup, the first liquid having a first colour; and dispensing a second liquid into the cup from a first nozzle that is coupled to the carousel while rotating at least one of the drum and the carousel to modify a position of the first nozzle relative to the cup to create an artistic pattern with the second liquid that has a second colour that is different than the first colour.

[0024] Further areas of applicability of the present invention will become apparent from the detailed description provided hereinafter. It should be understood that the detailed description and specific examples, while indicating the preferred embodiment of the invention, are intended for purposes of illustration only and are not intended to limit the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] The present invention will become more fully understood from the detailed description and the accompanying drawings, wherein:

FIG. 1 is a front perspective view of a beverage vending machine in accordance with an embodiment of the present invention;

FIG. 2 is a front perspective view of the beverage vending machine of FIG. 1 with a door of the beverage machine in an open state;

FIG. 3 is a schematic illustration of the functional components of the beverage vending machine of FIG. 1;

FIG. 4 is a front view of a carousel and a drum of the beverage vending machine of FIG. 1;

FIG. 5 is a simplified top plan view of the carousel and the drum of the beverage vending machine of FIG. 1

FIG. 6 is a top view of the carousel of the beverage vending machine of FIG. 1;

FIG. 7 is a close-up view of area VII of FIG. 6, depicting a cup dispensing station of the carousel of FIG. 6;

FIG. 8 is a perspective view of a portion of the carousel of FIG. 6 wherein one of the cup dispensing stations is supporting a stack of cups;

FIGS. 9A and 9B are perspective and front views, respectively, of a scroll of the carousel that is used for dispensing a lowermost cup from a stack of cups supported thereby;

FIG. 10A is a perspective view of a portion of the carousel of FIG. 5 illustrating the scrolls supporting the stack of cups;

FIG. 10B is a partial perspective view of the carousel and the drum illustrating one of the cups having been dispensed from the carousel and received by the drum;

FIG. 11 illustrates a first liquid being introduced into the dispensed cup that is supported by the drum;

FIG. 12 is a schematic representation of the carousel and the drum illustrating their relative positions, and further depicting a nozzle coupled to the carousel;

FIGS. 13A and 13B illustrate the carousel and the drum rotating to align the nozzle with the centre of

the cup that is supported by the drum;

FIGS. 14A-14D-13F illustrate the carousel and the drum rotating to modify the position of the nozzle that is coupled to the carousel relative to the cup that is supported by the drum; and

FIGS. 15A-15C and 16A-16C are illustrations of a latte art created with the beverage vending machine of FIG. 1 in accordance with various embodiments of the present invention.

DETAILED DESCRIPTION

[0026] The following description of the preferred embodiment(s) is merely exemplary in nature and is in no way intended to limit the invention, its application, or uses.

[0027] The description of illustrative embodiments according to principles of the present invention is intended to be read in connection with the accompanying drawings, which are to be considered part of the entire written description. In the description of embodiments of the invention disclosed herein, any reference to direction or orientation is merely intended for convenience of description and is not intended in any way to limit the scope of the present invention. Relative terms such as "lower," "upper," "horizontal," "vertical," "above," "below," "up," "down," "top" and "bottom" as well as derivatives thereof (e.g., "horizontally," "downwardly," "upwardly," etc.) should be construed to refer to the orientation as then described or as shown in the drawing under discussion. These relative terms are for convenience of description only and do not require that the apparatus be constructed or operated in a particular orientation unless explicitly indicated as such. Terms such as "attached," "affixed," "connected," "coupled," "interconnected," and similar refer to a relationship wherein structures are secured or attached to one another either directly or indirectly through intervening structures, as well as both movable or rigid attachments or relationships, unless expressly described otherwise. Moreover, the features and benefits of the invention are illustrated by reference to the exemplified embodiments. Accordingly, the invention expressly should not be limited to such exemplary embodiments illustrating some possible non-limiting combination of features that may exist alone or in other combinations of features; the scope of the invention being defined by the claims appended hereto.

[0028] Referring to FIGS. 1 and 2, a beverage vending machine 100 is illustrated in accordance with an embodiment of the present invention. The beverage vending machine 100 comprises a carousel 200 that is configured to support a plurality of stacks of cups (the cups are not depicted in FIGS. 1 and 2, but are shown in FIG. 8). Operation of the beverage vending machine 100 includes automatic dispensing of one cup from the carousel 200, filling the cup (which may pre-filled with a beverage ingredient) with hot or cold water to form a beverage from the mixture of the beverage ingredient and the water, and presenting the cup with the beverage therein to a consumer. All of these actions may be achieved by the beverage vending machine 100 automatically upon a user putting money into the machine (if required) and pressing a button associated with a particular beverage. Thus, a user need not use his or her own cup with the beverage vending machine 100, but rather the beverage vending machine 100 vends a drink in a cup stored within the beverage vending machine 100 and then provides the cup and drink to the user. Beverage vending machines of this type are often called in-cup vending machines.

[0029] The beverage vending machine 100 comprises a housing 101 that includes a body portion 102 and a door 103 that can be altered between a closed state (FIG. 1) and an open state (FIG. 2). The door 103 is closed during normal use of the beverage vending machine 100 and open during maintenance, cleaning, and/or when additional cups need to be loaded into the beverage vending machine 100. In the exemplified embodiment, the beverage vending machine 100 comprises a user interface 120 which comprises a plurality of buttons 104 each associated with a beverage option. The user interface 120 may be located on the door 103. The buttons 104 may each include indicia, graphics, or labelling associated with a different type of beverage. For example, one of the buttons 104 may include a graphic image of a particular type of coffee and another one of the buttons 104 may include a graphic image of hot chocolate, iced or hot tea, plain or flavoured water, a type of soup, or the like. Basically, each of the buttons 104 is associated with one of the types of beverages that the beverage vending machine 100 is configured to create. The buttons 104 may be dynamic such that they can be changed by a caretaker of the beverage vending machine 100 either by physically replacing an indicia card or electronically changing a display on a screen. A user can select a particular beverage to be made by the beverage vending machine 100 by pressing the associated one of the buttons 104. In other embodiments, the user interface 120 may be omitted and a user may make beverage selections via an electronic device such as a smart phone, laptop, computer, or the like which may be connected (wirelessly or wired) to the beverage vending machine 100. Thus, a user may utilize a software application to make drink selections on the beverage vending machine 100.

[0030] The beverage vending machine 100 may comprise a payment receiving section 105 for receiving payment in coins, cash, or electronic payment which may include payment via a credit or debit card or payment via an electronic key that has money associated therewith. The beverage vending machine 100 may comprise a coin return area 106 where the change associated with a particular product purchase may be provided to a consumer. The beverage vending machine 100 may be pre-set to operate without requiring payment in some instances, such as if the beverage vending machine 100 is located in a place of employment and the employer desires to

provide free beverages from the beverage vending machine 100 as a perk. Furthermore, the beverage vending machine 100 includes a beverage pick-up zone 107 where the user/consumer can pick up the beverage after it is made by the beverage vending machine 100. The beverage pick-up zone 107 may be formed as an opening in the door 103 so that a user can reach into the opening to grab the beverage after it is made and presented to the user at the pick-up zone 107.

[0031] As shown in FIG. 2, the door 103 can be opened to expose an interior cavity 108 of the beverage vending machine 100. Typically the door 103 is only opened during maintenance or when the stacks of cups are being restocked. The carousel 200 is located within the interior cavity 108 of the housing 101 of the beverage vending machine 100. As noted above, the carousel 200 is configured to support a plurality of stacks of cups. The carousel 200 is also configured to dispense a lowermost cup from a particular stack of the cups that is associated with a drink type selected by a user on the user interface 120. The beverage vending machine 100 comprises a drum 300 that is located within the interior cavity 108 of the housing 101. The drum 300 is positioned below the carousel 200. The purpose of the drum 300 is to receive the cups that are dispensed from the carousel 200 and to carry the dispensed cup to various nozzles where liquids are introduced into the cup to form the user's selected drink. Thus, the drum 300 may also be referred to herein as a conveyor in that it carries the dispensed cup from place to place during the creation of a drink therein. Once the drink is formed, the drum 300 may be rotated so that the cup is aligned with the pick-up zone 107 and a user can grab the cup from the drum 300. Additional details about the carousel 200 and the drum 300 will be provided below.

[0032] The beverage vending machine 100 may also include a processor and/or circuitry 130 that includes all of the electronic components required for proper operation of the beverage vending machine 100. For example, the processor 110 may be configured to receive, from the user interface 120, signals indicative of a choice of beverage selected by a consumer (i.e., user input) and initiate operation of the carousel 200, the drum 300, and other components of the beverage vending machine 100 so that the correct drink is generated and provided to the consumer. The beverage vending machine 100 may include other components, such as a slop bucket 111 for collecting excess liquids, conduits/tubing for carrying liquids from a source to a nozzle, and other components that facilitate the proper operation of the machine. However, such components are not described herein in detail as they are generally conventional and understood by persons skilled in the art. The beverage vending machine 100 may include a power cord for plugging into a mains power supply to supply power to the beverage vending machine 100 and its electronic components. Alternatively, the beverage vending machine 100 may comprise its own power source (e.g., batteries) for powering the electronic components. The beverage vending machine 100 may include a switch for powering on and off.

[0033] Referring to FIG. 3, a schematic is provided illustrating at least some of the functional components of the beverage vending machine 100 which operate together to create the drink selected by the user during a beverage vend. As used herein, the term "beverage vend" refers to the entire process of vending a beverage, from the dispensing of the lowermost cup from one of the stacks of cups supported by the carousel 200 to the introduction of various liquids into the cup to form the beverage to the presentation of the cup to the consumer. Furthermore, the term drink is used herein to refer to the final drink product that is provided to the consumer. The term beverage is used herein to refer to a liquid other than water that is introduced into the cup during the beverage vend. The beverage may form the final drink product that is provided to the consumer, or the beverage may mix with other ingredients to form the drink that is provided to the consumer.

[0034] With reference to FIG. 3, in the exemplified embodiment the beverage vending machine 100 comprises the carousel 200, the drum 300, the processor 130, the user interface 120, a first nozzle 160, a second nozzle 180, a beverage brewing apparatus 400, and a supply of beverage ingredient cartridges 401 that are used to supply the beverage brewing apparatus 400. In the exemplified embodiment, each of the carousel 200, the drum 300, the processor 130, the first nozzle 160, the second nozzle 180, the beverage brewing apparatus 400, and the supply of beverage ingredient cartridges 401 is located within the interior cavity 108 of the housing 101 of the beverage vending machine 100. The user interface 120 may be located on the door 103 of the housing 101. In alternate embodiments, the beverage brewing apparatus 400 and/or the supply of beverage ingredient cartridges 401 may be located external to the interior cavity 108 of the housing 10. The beverage brewing apparatus 400 may be fluidly coupled to the first nozzle 160, such as by a tube or conduit 403.

[0035] The second nozzle 180 may be operably coupled to a water source 181 by a tube or conduit 182. The water source 181 may be a mains water supply. Thus, in FIG. 3 the water source 181 is depicted external to the interior cavity 108 of the housing 101. In other embodiments, there may be a water source or tank located within the interior cavity 108 of the housing 101 which is operably coupled to the second nozzle 180. The water source 181 may also be fluidly coupled to the beverage brewing apparatus 400 to supply the beverage brewing apparatus 400 with the water necessary to brew beverages (i.e., coffee and espresso), such as via the tube or conduit 402 depicted in FIG. 3.

[0036] The processor 130 may be operably coupled to the user interface 120, the carousel 200, the drum 300, the beverage brewing apparatus 400, the supply of beverage ingredient cartridges 401, the first nozzle 160 and the second nozzle 180 to receive signals/instructions

from the user interface 120 and utilize those instructions to control the operation of the remaining components for drink creation. While the processor 130 is illustrated as being operably coupled to the first and second nozzles 160, 180, in some embodiments the processor 130 may be operably coupled to a valve or a pump that is positioned between the first and second nozzles 160, 180 and the source of the liquid being supplied to and dispensed through the first and second nozzles 160, 180. In either case, the processor 130 may control the flow of a particular liquid to the first and second nozzles 160, 180 either by controlling the first and second nozzles 160, 180 directly or by controlling a pump or valve positioned between the liquid source and the first and second nozzles 160, 180 (e.g., a valve or pump may be located along each of the tubes/conduits 182, 402, 403).

[0037] The beverage brewing apparatus 400 may be a coffee machine or an espresso machine that generates a coffee beverage using beverage ingredient cartridges that are stored in the supply of beverage ingredient cartridges 401. The beverage ingredient cartridges may be sachets, containers, capsules, or any other type of package that contains a beverage ingredient, such as for example without limitation coffee grounds, tea leaves, cocoa powder, milk powder, or the like, therein. For example the beverage ingredient cartridges may be Lavazza Blue coffee capsules in some embodiments, Lavazza coffee sachets, or capsules, packages, or sachets sold by other companies that are compatible with the beverage brewing apparatus 400.

[0038] The beverage brewing apparatus 400 may be coupled to the water supply 181 by a tube or conduit 402 or to any other water supply whether it be a tank of water located within the interior cavity 108 of the housing 100 or a mains water supply. When a user selects a beverage product that requires coffee or espresso from the beverage brewing apparatus 400, the processor 130 will send signals to the supply of beverage ingredient cartridges 401 and to the beverage brewing apparatus 400 (and to any transfer mechanism used to transfer the beverage cartridges from the supply 401 to the beverage brewing apparatus 400) to accomplish the task of transferring one of the beverage cartridges 401 from the supply of beverage ingredient cartridges 401 to the beverage brewing apparatus 400. The processor 130 may then instruct the beverage brewing apparatus 400 to brew a beverage by introducing liquid, likely hot water, from the water supply 181 into the beverage cartridge. There may be an in-line heater positioned along the conduit 402 between the water supply 181 and the beverage brewing apparatus 400 for heating the water prior to introduction into the beverage cartridge. Alternatively, the beverage brewing apparatus 400 may comprise a heater within a housing of the beverage brewing apparatus 400 for heating the water prior to introduction into the beverage cartridge. The liquid introduced into the beverage cartridge will pass through the beverage ingredient (i.e., coffee grounds, espresso grounds, or the like) of the beverage ingredient cartridge to form a beverage (i.e., coffee or espresso), which then flows through the conduit 403 to the first nozzle 160. The beverage may then be dispensed from the first nozzle 160 into the cup held by the drum 300. Thus, the beverage brewing apparatus 400 is fluidly coupled to the first nozzle 160 for purposes of dispensing the beverage brewed by the beverage brewing apparatus 400 into the cup that is later provided to the consumer.

[0039] The first nozzle 160 may be coupled to the carousel 200 as depicted in FIG. 3. In some embodiments, the first nozzle 160 may be fixedly coupled to the carousel 200 so that as the carousel 200 rotates, the first nozzle 160 moves along with the carousel 200. The first nozzle 160 may move along an arcuate path as the carousel 200 rotates. By having the first nozzle 160 coupled to the carousel 200, artistic patterns can be created in the final drink product by moving the first nozzle 160 while the beverage is being dispensed from the first nozzle 160 into the cup held by the drum 300, as described in greater detail below.

[0040] With reference to FIGS. 1-3, the general operation of the beverage vending machine 100 will be briefly described. As noted above, the carousel 200 holds a plurality of stacks of cups. In particular, the carousel 200 comprises a plurality of cup dispensing stations 201, each of which is configured to support a stack of cups. Within each stack, the cups may contain a particular beverage ingredient. That is, each cup within a given stack main contain the same beverage ingredient. However, the cups of the different stacks may contain different beverage ingredients. For example, the cups of one or more of the stacks of cups may contain a soluble coffee powder, the cups of one or more of the stacks of cups may contain a milk powder, the cups of one or more of the stacks of cups may contain a mixture of coffee powder and milk powder, the cups of one or more of the stacks of cups may contain different flavours of juice or sports drink powder, the cups of one or more of the stacks of cups may contain tea leaves, and the cups of one or more of the stacks of cups may contain cocoa powder (for hot chocolate). The cups of one or more of the stacks of cups may be left empty so that they can be filled with plain water as the final beverage product which is delivered to the consumer.

[0041] A user first selects a drink type on the user interface 120 by pressing one of the buttons 104 on the user interface 120. Next, the processor 130 sends instructions to the carousel 200 to rotate until a cup dispensing station 201 supporting the stack of cups containing the beverage ingredient associated with the selected drink type is aligned with an actuation mechanism 135. For example, if the user selected a coffee beverage, the cup dispensing station 201 supporting the stack of cups containing coffee powder may be aligned with the actuation mechanism 135 whereas if the user selected a sports drink, the cup dispensing station 201 supporting the stack of cups containing a sports drink powder may be aligned with the actuation mechanism 135. The proc-

essor 130 may then send instructions to the actuation mechanism 135 to actuate a cup dispensing mechanism of the cup dispensing station 201 so that the cup dispensing station dispenses a lowermost cup from the stack of cups containing the beverage ingredient associated with the selected drink. The lowermost cup that is dispensed from the cup dispensing station 201 of the carousel 200 is received by the drum 300 which holds the dispensed cup until it is provided to the consumer with their desired beverage therein.

[0042] The processor 130 may then instruct the drum 300 to rotate to hold the dispensed cup beneath at least one, or perhaps both in succession, of the first nozzle 160 and the second nozzle 180. The particular nozzle or nozzles that the drum 300 holds the dispensed cup beneath is dependent on the drink type selected by the user. Various liquids and/or beverages, which may include water, coffee, and espresso, may be dispensed from the first and/or second nozzles 160, 180 (via instructions received from the processor 130) into the cup which may mix with the beverage ingredient contained therein to form the user's selected beverage. The processor 130 may then instruct the drum 300 to rotate until the dispensed cup containing the user's selected drink is aligned with the beverage pick-up zone 107. Thus, if the selected drink is a sports drink, the drum 300 may hold the dispensed cup only under the second nozzle 180 which dispenses water into the cup to mix with the sports drink powder, and then the drum 300 may present the dispensed cup to the user. If the selected drink is a latte or cappuccino, the drum 300 may first hold the dispensed cup under the second nozzle 180 to generate a milk foam from a milk powder in the dispensed cup, then the drum 300 may hold the dispensed cup under the first nozzle to dispense a coffee beverage into the dispensed cup, and then the drum 300 may present the drink to the user.

[0043] In one particular embodiment which is relevant to the invention described herein and will be described in more detail below, a user may select a latte, cappuccino, or similar drink. In such an embodiment, the processor 130 may instruct the carousel 200 to dispense a cup containing milk powder only to the drum 300. The drum 300 may then carry the cup to be positioned beneath the second nozzle 180 where water is dispensed into the cup as a jet stream of water so that as the water mixes with the milk powder in the cup a milk foam or milk froth is formed in the cup. Next, the drum 300 may carry the cup with the milk froth therein to be positioned beneath the first nozzle 160. The processor 130 may instruct the beverage brewing apparatus 400 to brew a beverage. Then, with the cup positioned beneath the first nozzle 160, the beverage brewed by the beverage brewing apparatus 400 may be dispensed into the cup, and more specifically into the milk froth in the cup. The stage of the beverage vend during which the beverage is dispensed into the cup from the first nozzle 160 may be referred to herein as a beverage dispensing step of the beverage vend. During the beverage dispensing step of the beverage vend, the drum 300 and/or the carousel 200 may move and/or rotate, in some cases while the beverage is being dispensed from the first nozzle 160, to alter the position of the first nozzle 160 relative to the cup in order to create an artistic pattern with the beverage on the milk foam in the cup. This will be described in greater detail below.

[0044] Referring to FIGS. 4 and 5, the carousel 200 and the drum 300 are illustrated partially, with some components and features thereof omitted for purposes of easily recognizing and describing the relative positions of the carousel 200 and the drum 300. The carousel 200 may comprise a rotating plate 204 comprising a plurality of openings 202, each associated with one of the cup dispensing stations 201. The carousel 200 may further comprise a plurality of cup support tubes 206 that extend vertically from the rotating plate 204 at each of the openings 202. The cup support tubes 206 may help with supporting a stack of the cups 250 (only one stack of cups is shown in FIG. 5) at each of the cup dispensing stations 201. There may also be a cup dispensing mechanism coupled to the rotating plate 204 for purposes of dispensing a lowermost cup from the stacks of cups as needed. The cup dispensing mechanism may comprise a plurality of cup dispensing scrolls 210, which are described in greater detail below.

[0045] The drum 300 is positioned below or beneath the carousel 200 so that a cup dispensed from the carousel 200 will drop into a cup receiving portion 310 of the drum 300. The dispensed cup may fall by gravity along from the carousel 200 into the cup receiving portion 310 of the drum 300 In the exemplified embodiment, the cup receiving portion 310 of the drum 300 comprises a recess 311 formed into an outer periphery 301 of the drum 300. The recess 311 may be defined by an inner wall 312 that is concave. Furthermore, the cup receiving portion 310 may comprise support protrusions 313 that extend from the inner wall 312 into the empty space of the recess 311. When a cup is dispensed into the cup receiving portion 310 of the drum 300, the rim of the cup may rest atop of the support protrusions 313 of the cup receiving portion 310 until a user removes the cup from the drum 300 after being presented with the drink. The cup receiving portion 310 may take on other structures or configuration in other embodiments, including being a platform upon which the cup is held and a clamp device or the like for holding the cup in place as the drum 300 rotates during drink preparation, a hole formed through the drum 300 without extending to the outer periphery of the drum 300, or various other structures that can achieve the purpose of holding the cup as it is carried to the nozzles and ultimately to the beverage pick-up zone 107.

[0046] The carousel 200 is configured to rotate about a first rotational axis A-A. The drum 300, which is positioned below the carousel 200, is configured to rotate about a second rotational axis B-B. The second rotational axis B-B may be parallel to the first rotational axis A-A while being offset from the first rotational axis A-A. That

is, the second rotational axis B-B may be spaced apart from the first rotational axis A-A. The second rotational axis B-B may be intersected by an outer peripheral edge 203 of the carousel 200. Rotation of the carousel 200 and the drum 300 may be accomplished by various motors, gears, and the like as would be commonly understood by persons skilled in the art. The carousel 200 and the drum 300 may be configured to rotate independently of one another such that the carousel 200 may rotate without the drum 300 also rotating and/or the drum 300 may rotate without the carousel 200 also rotating. Despite the independent nature of the rotation of the carousel 200 and the drum 300, the carousel 200 and the drum 300 may be made to rotate simultaneously about their respective rotational axes A-A, B-B. The carousel 200 may have a greater diameter than the drum 300, although this is not required in all embodiments.

[0047] The drum 300 is positioned beneath the carousel 200 so that a first portion 301 of the drum 300 is aligned with the carousel 200 and a second portion 302 of the drum 300 is not aligned with the carousel 200. This is best seen in FIG. 5, whereby the first portion 301 of the drum 300 is partially covered by the carousel 200 and the second portion 302 of the drum 300 is positioned beyond the outer periphery of the carousel 200. As noted, the drum 300 is configured to rotate about the rotational axis B-B, and thus the exact circumferential part of the drum 300 which forms the first and second portions 301, 302 thereof will change as the drum 300 rotates. In FIG. 5, the cup receiving region 310 is not aligned with the carousel 200. Rotating the drum 300 clockwise will align the cup receiving section 310 with one of the cup dispensing stations 201 of the carousel 200 so that a cup can be dispensed from the carousel 200 into the cup receiving section 310 of the drum 300. In FIG. 5, the cup dispensing station 201 labelled "10" is supporting a stack of cups 250. The drum 300 may be rotated clockwise until the cup receiving portion 310 is aligned with the cup dispensing station 201 labelled "10" so that one of the cups from the stack of cups 250 may be dispensed into the cup receiving portion 310 of the drum 300. The drum 300 can then be further rotated to move the cup receiving portion 310 of the drum 300 out of alignment with the carousel 200 and to bring the cup into alignment with the first and/or second nozzles 160, 180 as may be necessary during a particular beverage vend.

[0048] Referring to FIG. 6, a top plan view of the carousel 200 is illustrated (with only one stack of cups 250 shown in the view provided). The carousel 200 comprises the plurality of cup dispensing stations 201, each of which is configured to hold one of the stacks of cups 250 and to dispense cups from that stack one at a time upon user selection of a drink on the beverage vending machine 100. The carousel 200 is configured to rotate about the rotational axis A-A during operation of the beverage vending system 100 to align a desired one of the cup dispensing stations 201 with the actuation mechanism 135 to dispense a desired cup in accordance with a drink selection made by a consumer.

[0049] In FIG. 6, one of the stacks of cups 250 is depicted in one of the cup dispensing stations 201 and in that cup dispensing station 201 a top plate has been removed to expose the internal components that facilitate the dispensing of an individual cup. Each of the cup dispensing stations 201 may support one of the stacks of cups 250. Furthermore, for each stack 250, each cup within that stack 250 holds the same beverage ingredient. With that in mind, each stack of cups 250 may include cups holding the same beverage ingredient, with the beverage ingredient varying from one stack to another. Thus, the stack of cups 250 held by a first one of the cup dispensing stations 201a may contain a black coffee ingredient (e.g., coffee grounds), the stack of cups 250 held by a second one of the cup dispensing stations 201b may contain coffee grounds, sugar, and whitener, the stack of cups 250 held by a third one of the cup dispensing stations 201c may contain tea, the stack of cups 250 held by a fourth one of the cup dispensing stations 201d may contain milk powder. Of course, two of the stacks of cups 250 may contain the same beverage ingredient in some embodiments so that there are more cups available with the most popular beverage ingredient selections. However, in the exemplified embodiment there are sixteen different cup dispensing stations 201 and therefore it is possible for the beverage vending machine 100 to vend sixteen different beverages if each cup dispensing assembly 201 supports a stack of cups 250 holding a different beverage ingredient. As noted above and described further below, when the cups are inserted into the beverage vending machine 100, at least some of the cups may be pre-filled with a beverage ingredient (e.g., coffee grounds, hot chocolate powder, tea, flavoured water powder, soup base ingredients, etc.). Thus, when a beverage is selected by a consumer, a cup having the desired beverage ingredient is dispensed from the carousel 200 and then either hot or cold water is added to create the drink that is then provided to the consumer. As further noted above, it may also be possible to add brewed coffee or espresso from the beverage brewing apparatus 400 into the dispensed cups during the drink formation process.

[0050] Referring to FIGS. 6 and 7 concurrently, each of the cup dispensing stations 201 comprises one of the openings 202 through which a cup is dispensed, four scrolls 210 that support the stack of cups 250 and dispense the lowermost cup in the stack when desired (i.e., when a user pushes the button to vend a drink that is associated with a particular stack of cups), and a ring gear 205 that interacts with the four scrolls 210 as described further below to facilitate the dispensing of the lowermost cup from the stack 250. The four scrolls 210 and the ring gear 205 may be collectively referred to herein as a cup dispensing mechanism of the cup dispensing station 201. The four scrolls 210 are identical in structure in this embodiment, and the particular structure of the scrolls 210 will be described in greater detail below with

reference to FIGS. 9A and 9B. In the exemplified embodiment, there are two outer scrolls 210 that are spaced apart by a first distance and two inner scrolls 210 that are spaced apart by a second distance that is less than the first distance (the inner scrolls are the ones closest to the rotational axis A-A and the outer scrolls are the ones furthest from the rotational axis A-A). Of course, there could be more or less than four scrolls 210 in other embodiments and the spacing between the scrolls 210 could be modified to be different than that which is shown in the exemplified embodiment in some alternative embodiments. In FIG. 6, there is a cup or a stack of cups 250 positioned within the opening 202 of the cup dispensing assembly 201 that is shown in that figure.

[0051] Referring to FIGS. 7 and 8, one of the cup dispensing stations 201 will be described in greater detail. As noted above, the cup dispensing assembly mechanism of the cup dispensing stations 201 comprises the ring gear 205 and four of the scrolls 210. In the exemplified embodiment, the ring gear 205 has an inner surface 207 that faces the opening 202 and an opposite outer surface 208. In the exemplified embodiment, the inner surface 207 of the ring gear 205 is smooth and the outer surface 208 of the ring gear 205 comprises one or more sets of gear teeth 209 that are configured to interact with gear teeth 211 of the scrolls 210, as described further below. In other embodiments, the gear teeth 211 may be located on the inner surface 207 of the ring gear 205 rather than the outer surface 208 of the ring gear 205.

[0052] Briefly, the scrolls 210 comprise a body portion 220 and a gear portion 240 extending from a bottom end of the body portion 220. The gear portion 240 comprises gear teeth 211 that are configured to interact with the gear teeth 209 of the ring gear 205 as described in more detail below. In the exemplified embodiment, the four scrolls 210 are positioned so as to surround the outer surface 208 of the ring gear 205 so that the gear portions 240 of the four scrolls 210 are adjacent to the outer surface 208 of the gear ring 205. In other embodiments, the ring gear 205 may surround the scrolls 210 such that the scrolls 210 are positioned within the interior of the ring gear 205 and adjacent to the inner surface 207 of the ring gear 205. In such an embodiment, the gear teeth 209 on the ring gear 205 would be located on the inner surface 207 rather than the outer surface 208 of the ring gear 205.

[0053] In the exemplified embodiment, there are four sets of the gear teeth 209 arranged in a spaced apart manner along the outer surface 208 of the ring gear 205 so that each set of gear teeth 209 is located in the vicinity of the gear portion 240 of one of the scrolls 210. During operation, the actuation mechanism 135 is coupled to the ring gear 205 and causes the ring gear 205 to rotate about a rotational axis (when a drink associated with the beverage ingredient in the cups being supported by the scrolls 210 of a particular cup dispensing assembly 201 is actuated/selected by a user/consumer). As the ring gear 205 rotates, the gear teeth 209 of the ring gear 205 engage the gear teeth 211 of the scrolls 210, thereby causing the scrolls 210 to rotate about a rotational axis. The rotation of the scrolls 210 causes a lowermost cup of the stack of cups 250 to be separated from the remainder of the stack 250 and thereby dispensed into the cup receiving region 310 of the drum 300. The manner in which the scrolls 210 cause the lowermost cup to be separated from the remainder of the stack 250 will be better understood following a detailed description of the structure of the scrolls 210 provided below with reference to FIGS. 9A and 9B.

[0054] Once a particular drink is selected by a consumer, the carousel 200 rotates such that all of the cup dispensing stations 201 rotate about the rotational axis A-A (see FIG. 6). The carousel 200 rotates until the cup dispensing assembly 201 containing a stack of cups having the beverage ingredient that is associated with the particular drink selected by the consumer is aligned with the actuation mechanism 135 of the carousel 200. Next, the actuation mechanism 135 may actuate the ring gear 205 of that cup dispensing assembly 201 so that it rotates, which then causes the scrolls 210 of that cup dispensing assembly 201 to rotate, which causes dispensing of one of the cups held within that cup dispensing assembly 201 of the carousel 200.

[0055] Referring to FIGS. 9A and 9B, the scrolls 210 will be described in detail in accordance with one embodiment of the present invention. As noted above, each of the scrolls 210 may include the body portion 220 and the gear portion 240 having gear teeth 211 thereon. The body portion 220 may extend from a bottom end 221 to a top end 222, and the gear portion 240 may extend downwardly from the bottom end 221 of the body portion 220. As described above, the gear teeth 211 of the gear portions 240 of the scrolls 210 may interact with the gear teeth 209 of the ring gear 205 during operation to dispense a cup. Thus, each of the scrolls 210 may be rotatable about a rotational axis C-C during this operation, the rotational axes C-C being parallel to a rotational axis of the ring gear 205 and to the rotational axis A-A of the carousel 200.

[0056] The body portion 220 of the scroll 210 may comprise a main body 217 having a generally cylindrical shape and having an outer surface 218. Furthermore, the body portion 220 of the scroll 210 may comprise a support ledge 212 extending from the outer surface 218 of the main body 217. The support ledge 212 may comprise an upper surface 225, a lower surface 226, and a distal surface 227 which is the terminal end surface of the support ledge 212 located furthest from the main body 217. The support ledge 212 may be configured to support a rim of a lowermost cup of one of the stacks of cups 250 on its upper surface 225, thereby supporting the entire stack of cups. The support ledge 212 may be level or planar to facilitate the support of the rim of the cup as described herein. Stated another way, the upper surface 225 of the support ledge 212 may in a plane Y-Y. Referring briefly to FIGS. 6 and 7, the support ledges 212 of

the four scrolls 210 may collectively support the stack of cups 250 by the rim of the lowermost cup in the stack of cups 250 resting atop of the support ledges 212 of each of the four scrolls 210. In the exemplified embodiment, the support ledge 212 is located closer to the top end 222 of the body portion 220 than to the bottom end 221 of the body portion 220.

[0057] The main body 217 of the body portion 220 of the scrolls 210 may comprise an upstanding wall 230 that extends from the upper surface 225 of the support ledge 212 to the top end 222 of the scroll 210. The upstanding wall 230 may be in contact with an outer surface of the rim of the lowermost cup in the stack 250 in some embodiments, as will be described in greater detail below with particular reference to FIGS. 13-15.

[0058] Each of the scrolls 210 may also comprises a cup splitter 213 protruding from the outer surface 217 of the main body 218 of the scroll 210. The cup splitter 213 may be configured to force two adjacent cups in a stack of the cups (i.e., the lowermost cup and the second lowermost cup) to separate from one another so that the lowermost cup can be dispensed. The cup splitter 213 may comprise a bottom surface 214 and a top surface 215. The bottom surface 215 of the cup splitter 213 may also be referred to herein as a cam surface. In the exemplified embodiment, the top surface 215 of the cup splitter 213 may be flat and the bottom surface 214 of the cup splitter 213 may be inclined and/or arranged helically around the outer surface 217 of the main body 218 of the body portion 220 of the scroll 210. Due to the varying orientations (flat and helical) of the top and bottom surfaces 215, 214 of the cup splitter 213, the cup splitter 213 may have a tip portion 216, and a height of the cup splitter 213 measured between the bottom and top surfaces 214, 215 of the cup splitter 213 may increase as the cup splitter 213 extends circumferentially away from the tip portion 216. This is because the top surface 215 of the cup splitter 213 is flat and level (and perpendicular to the axis A-A) whereas the bottom surface 214 of the cup splitter 213 is inclined or angled or helical. Thus, as the scroll 210 rotates about the rotational axis A-A as has been described herein, the cup splitter 213 creates a separation between the lowermost cup and the second lowermost cup to force the lowermost cup to become detached from the remainder of the stack 250 and thereby dispensed from the cup dispensing assembly 201.

[0059] Referring to FIGS. 10A and 10B, the operation of dispensing a lowermost cup 251 from the stack of cups 250 will be described. FIG. 10A illustrates the stack of cups 250 with a rim 252 of the lowermost cup 251 resting atop of the support ledges 212 of the scrolls 210. The second lowermost cup 253 nests within the cavity of the lowermost cup 251, and additional cups (not shown) will nest within the cup directly below to form the stack 250. A bottom portion of the lowermost cup 251 (and some of the other cups in the stack of cups 250) extends through the opening 202 in the cup dispensing assembly 201. As the ring gear 205 is actuated and made to rotate, the scrolls 210 rotate so that the cam surface 214 of the cup splitter 213 drives the lowermost cup 251 downwardly through the opening 202 while the second lowermost cup 253 rests atop of the top surface 215 of the cup splitter 213. The ring gear 205 and the scrolls 210 then rotate in the opposite direction to reset the scrolls 210 to the starting position and the second lowermost cup 253, which is now the lowermost cup, rests atop of the ledges 212 of the scrolls 210.

[0060] Referring to FIG. 10B, as discussed above, the drum 300 is positioned below/beneath the carousel 200. During the dispensing of the lowermost cup 251 form the stack of cups 250, the cup receiving portion 310 of the drum 300 is aligned with the opening 202 of the associated cup dispensing station 201. Then, when the lowermost cup 251 is dispensed from the stack 250 as described above, the lowermost cup 251 drops into the cup receiving portion 310 of the drum 300. In particular, the lowermost cup 251 drops until the rim 252 of the lowermost cup 251 is supported by the support protrusions 313 (FIG. 5) and the remainder of the lowermost cup 251 hangs therefrom. The drum 300 is then rotated into alignment with one, or both in succession, of the first and second nozzles 160, 180 to dispense liquids (water, coffee, espresso) into the cup 251 to create the final drink product that is then provided to the consumer via the beverage pick-up zone 107.

[0061] In an embodiment, the user may select to have the beverage vending machine 100 create a drink that requires milk froth, such as a latte or a cappuccino. With such a selection, it is possible for the beverage vending machine 100 to create an artistic pattern on the beverage, which is known in the art as latte art. Latte art may be achieved by dispensing milk or milk froth into a darker liquid such as a coffee or espresso or by dispensing a darker liquid such as coffee or espresso into a milk froth. As the second liquid is dispensed into the cup, either the nozzle from which the liquid is being dispensed and/or the cup is moved to create an artistic pattern. In some embodiments, upon the user selecting a beverage on the user interface 120 which requires milk froth/foam, the user may be presented with an option to select a specific artistic design or pattern for the latte art. That is, the user interface 120 may present the user with several design options to choose from, and the user interface 120 may permit the user to make no design selection and to skip the latte art function of the beverage vending machine 100. The user may select the artistic design simultaneously with the selection of a drink which allows for latte art. The user may also be permitted to create a custom design that will be created in the cup by the beverage vending machine 100.

[0062] Referring to FIG. 11, in accordance with one or more embodiments, when the user selects a drink that allows for the creation of latte art, the lowermost cup 251 (also referred to herein as the dispensed cup) may contain a beverage ingredient 260 comprising milk powder. In some embodiments, the beverage ingredient 260 may

consist only of milk powder. In other embodiments, the beverage ingredient 260 may comprise milk powder and other ingredients. Upon the drum 300 receiving the dispensed cup 251 in the cup receiving portion 310 thereof, the drum 300 may rotate about its rotational axis B-B until the dispensed cup 250 is aligned with the second nozzle 180. Once so positioned, the processor 130 may instruct the second nozzle 180 to dispense a liquid into the dispensed cup 251 to mix with the beverage ingredient 260. The liquid may be water. The liquid may be dispensed from the second nozzle 180 as a jet stream or high pressure stream. This may facilitate the creation of a milk froth or a milk foam from the mixture of the jetted water with the milk powder in the dispensed cup 251.

[0063] After the milk froth or the milk foam has been created in the dispensed cup 251, the processor 130 may instruct the drum 300 and/or the carousel to rotate to place the dispensed cup 251 into alignment with the first nozzle 160. As discussed above, the first nozzle 160 is fluidly coupled to the beverage brewing apparatus 400 and thus the beverage brewed by the beverage brewing apparatus 400 is dispensed from the first nozzle 160. The beverage brewed by the beverage brewing apparatus 400 is preferably coffee, espresso, or the like.

[0064] Referring to FIG. 12, the first nozzle 160 may be coupled to the carousel 200 so that as the carousel 200 rotates about the first rotational axis A-A, the first nozzle 160 moves along an arcuate path. The first nozzle 160 may be located along one of the openings 202 of one of the cup dispensing stations 201 of the carousel 200 so that the beverage may be dispensed from the first nozzle 160, through the opening 202, and into the dispensed cup 251 below. In such an embodiment, the nozzle 160 should be positioned so that it does not block or impede the ability of the opening 202 to contain one of the stacks of cups as described herein. In other embodiments, the nozzle 160 may be located within an additional aperture formed through the carousel 200, such as an aperture located between two adjacent ones of the holes 202.

[0065] As depicted with arrows in FIG. 12, the carousel 200 is capable of rotating clockwise or counteer-clockwise about the first rotational axis A-A and the drum 300 is capable of rotating clockwise or counteer-clockwise about the second rotational axis B-B. From the position of the dispensed cup 251 and the first nozzle 160 in FIG. 12, it would be required for the carousel 200 and the drum 300 to rotate in order to align the dispensed cup 251 with the first nozzle 160. FIGS. 13A and 13B illustrate the carousel 300 being rotated counteer-clockwise about the first rotational axis A-A and the drum 300 being simultaneously rotated clockwise about the second rotational axis B-B until the first nozzle 160 is aligned exactly over the centre of the dispensed cup 251 held in the cup receiving portion 310 of the drum 300. The first nozzle 160 need not be aligned over the centre of the dispensed cup 251, but may need to be aligned with the top opening in the dispensed cup 251 to ensure that the beverage dispensed from the first nozzle 160 flows into the cup 251. Depending on the angle at which the first nozzle 160 is oriented relative to the cup 251, the first nozzle 160 may not need to be aligned with the cup 251 to dispense the beverage into the cup 251. However, the carousel 200 and the drum 300 should be rotated to ensure that the beverage dispensed from the first nozzle 160 passes into the dispensed cup 251. Moreover, as used herein, reference to aligning the first nozzle 160 with the dispensed cup 251 means that the beverage dispensed from the first nozzle 160 is introduced into the dispensed cup 251.

[0066] The beverage that is brewed by the beverage brewing apparatus 400 is dispensed from the first nozzle 160 into the dispensed cup 161 during a beverage dispensing step of the beverage vend (see

[0067] FIG. 3, for example). In the embodiment described herein, the beverage is dispensed into the dispensed cup 251 which already contains a milk froth. The colour of the beverage (e.g., coffee or espresso) may contrast with the colour of the milk froth so that latte art or an artistic pattern may be formed by the beverage as it contrasts with the colour of the milk froth.

[0068] Referring to FIGS. 14A-14D, during the beverage dispensing step, at least one of the carousel 300 and the drum 200 may rotate to modify the position of the first nozzle 160 relative to the dispensed cup 251. FIG. 14A depicts the first nozzle 160 aligned with a lower region of the dispensed cup 251. FIG. 14B illustrates the first nozzle 160 aligned with a left side region of the dispensed cup 251. FIG. 14C illustrates the first nozzle 160 aligned with a top region of the dispensed cup 251. FIG. 14D illustrates the first nozzle 160 aligned with a right side region of the dispensed cup 251. The carousel 200 and/or the drum 300 may be rotated varying degrees in either of the clockwise or counteer-clockwise direction during the beverage dispensing step to position the first nozzle 160 at different locations along the dispensed cup 251. Thus, while five positions are shown in FIGS. 13B and 14A-14D, this is merely exemplary and the first nozzle 160 may be aligned with virtually any part of the dispensed cup 251 by controlling the rotation of the carousel 200 and/or the drum 300.

[0069] In some embodiments, the beverage may flow continuously from the first nozzle 160 into the dispensed cup 251 during the beverage dispensing step. In such an embodiment, the beverage may generate a continuous artistic pattern that is visible on the milk froth in the dispensed cup 251. FIGS. 15A-15C depict some non-limiting exemplary continuous artistic patterns that may be formed by the contrasting appearance of the beverage 290 on the milk froth 291.

[0070] In some embodiments, the beverage may flow intermittently from the first nozzle 160 into the dispensed cup 251 during the beverage dispensing step. That is, the beverage may intermittently flow and not flow during the beverage dispensing step. In such an embodiment, the beverage may generate a discontinuous artistic pattern that is visible on the milk froth in the dispensed cup

251. FIGS. 16A-16C depict some non-limiting exemplary discontinuous artistic patterns that may be formed by the contrasting appearance of the beverage 290 on the milk froth 291. The intermittent flow may be controlled by the processor 130 opening and closing a valve located along the conduit that extends from the beverage brewing apparatus 400 to the nozzle 160, activating and deactivating a pump located along the conduit that extends from the beverage brewing apparatus 400 to the nozzle 160, or using similar techniques.

[0071] As noted above, the artistic pattern, whether they are continuous or discontinuous patterns, may be random, may be specifically selected by a user based on provided options, or may be customized by the user interacting with the user interface 120.

[0072] The formation of the various artistic patterns is possible, at least in part, because the carousel 200 and the drum 300 are independently rotatable about the first and second rotational axes A-A, B-B, because the first nozzle 160 is coupled to the carousel 200 and therefore rotates or moves along with the rotation of the carousel 200, and because the drum 300 supports the dispensed cup 251 which therefore rotates or moves along with the rotation of the drum 300. Thus, by rotating the drum 300 (and hence also the)dispensed cup 251 and the carousel 200 (and hence also the first nozzle 160), the position of the first nozzle 160 relative to the dispensed cup 251 may be readily modified to create art with the beverage dispensed from the first nozzle 160 into the milk froth held in the dispensed cup 251. Because the rotational movement of the carousel 200 and the drum 300 may be dynamically controlled while the beverage is flowing through the first nozzle 160, the artistic patterns are created due to the darker beverage (brown colour of coffee or espresso, for example) flowing through the light milk foam (white or off-white, for example). Thus, by rotating the carousel 200 and/or the drum 300 while dispensing the beverage into the milk froth already located within the dispensed cup 251, various artistic patterns may be created.

[0073] In an alternative embodiment, the dispensed cup 251 may first be filled with coffee and then milk rather than the other way around. For example, the dispensed cup 251 may contain a coffee powder, and the dispensed cup 251 may first be carried to a nozzle which dispenses water into the dispensed cup 251 to form coffee from the coffee powder mixed with the water. Alternatively, the dispensed cup 251 may not contain any beverage ingredient, and the dispensed cup 251 may be filled with coffee via the first nozzle 160 and the beverage brewing apparatus 400 in a first step. Next, after the dispensed cup 251 contains coffee, the dispensed cup 251 may be carried to another nozzle that dispenses a milk product (dairy or non-dairy) into the coffee in the dispensed cup 251. The another nozzle may be coupled to the carousel 200 so that the another nozzle and/or the dispensed cup 251 may be moved relative to one another as the milk product is dispensed into the dispensed cup 251 to form the artistic pattern by the contrast in colour of the milk dispensed onto the coffee. In such an embodiment, there may be one or more sources of milk products, including multiple sources of different milk products (cow's milk, cream, oat milk, almond milk, or the like), located within the housing 101 of the beverage vending machine 100. Thus, the latte art may be formed with the milk added to the cup already containing a coffee product or with the coffee product added to a cup already containing milk or milk froth.

[0074] As used throughout, ranges are used as shorthand for describing each and every value that is within the range. Any value within the range can be selected as the terminus of the range. In addition, all references cited herein are hereby incorporated by referenced in their entireties. In the event of a conflict in a definition in the present disclosure and that of a cited reference, the present disclosure controls.

[0075] While the invention has been described with respect to specific examples including presently preferred modes of carrying out the invention, those skilled in the art will appreciate that there are numerous variations and permutations of the above described systems and techniques. It is to be understood that other embodiments may be utilized and structural and functional modifications may be made without departing from the scope of the present invention. Thus, the spirit and scope of the invention should be construed broadly as set forth in the appended claims.

Claims

1. A beverage vending machine (100) comprising:

a carousel (200) comprising a plurality of cup dispensing stations (201), each of the plurality of cup dispensing stations (201) configured to support a stack of cups (250) and, during a beverage vend, to dispense a lowermost cup (251) from the stack (250) as a dispensed cup, wherein the carousel (200) is configured to rotate about a first rotational axis (A-A);

a drum (300) positioned below the carousel (200) and comprising a cup receiving portion (310) that receives the dispensed cup during the beverage vend, wherein the drum (300) is configured to rotate about a second rotational axis (B-B) that is parallel to and offset from the first rotational axis (A-A) of the carousel (200);

a first nozzle (160) coupled to the carousel (200) so that the first nozzle (160) moves during rotation of the carousel (200) about the first rotational axis (A-A), the first nozzle (160) configured to dispense a beverage into the dispensed cup during a beverage dispensing step of the beverage vend; and

wherein during the beverage dispensing step of

the beverage vend, at least one of: (1) the carousel (200) rotates about the first rotational axis (A-A); and (2) the drum (300) rotates about the second rotational axis (B-B), such that a position of the first nozzle (160) relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle (160) into the dispensed cup.

2. The beverage vending machine (100) according to claim 1 wherein at least one of the stacks of cups (250) comprises a plurality of cups containing a milk powder, and further comprising a second nozzle (180) configured to dispense water into the dispensed cup prior to the beverage dispensing step, wherein upon dispensing one of the plurality of cups containing the milk powder into the cup receiving portion (310) of the drum (300), the drum (300) is configured to rotate about the second rotational axis (B-B) to align the one of the plurality of cups with the second nozzle (180) to dispense the water into the dispensed cup and generate a milk foam, after which the drum (300) is configured to rotate about the second rotational axis (B-B) to align the one of the plurality of cups with the first nozzle (160) to dispense the beverage into the milk foam in the one of the plurality of cups while the at least one of the carousel (200) and the drum (300) rotates to create the artistic pattern.

3. The beverage vending machine (100) according to claim 1 or claim 2 further comprising one or more of the following features:

a) wherein the beverage is coffee and the dispensed cup contains milk foam prior to the beverage dispensing step so that a colour of the coffee contrasts with a colour of the milk foam to create the artistic pattern;
b) wherein the beverage is dispensed continuously from the first nozzle (160) during the beverage dispensing step of the beverage vend;
c) wherein the beverage is dispensed intermittently from the first nozzle (160) during the beverage dispensing step of the beverage vend; and
d) wherein the first nozzle (160) is aligned with a top opening of the dispensed cup during an entirety of the beverage dispensing step of the beverage vend.

4. The beverage vending machine (100) according to any one of claims 1 to 3 further comprising one or more of the following features:

a) a housing (101) defining an interior cavity (108) within which the carousel (200), the drum (300), and the first nozzle (160) are located and a beverage brewing apparatus (400) located within the interior cavity (108) of the housing (101) and operably coupled to the first nozzle (160), wherein the beverage brewing apparatus (400) is configured to brew the beverage that is dispensed from the first nozzle (160);
b) a user interface (120) comprising a plurality of user selectable beverage options and a processor (130) operably coupled to the user interface (120) and wherein upon a user selecting a first beverage option from the plurality of user selectable beverage options on the user interface (120), the processor (130) is configured to initiate the beverage vend;
c) wherein during the beverage dispensing step of the beverage vend, the carousel (200) rotates about the first rotational axis (A-A) and the drum (300) rotates about the second rotational axis (B-B) to modify the position of the first nozzle (160) relative to the dispensed cup; and
d) wherein during the beverage dispensing step of the beverage vend, the position of the first nozzle (160) relative to the dispensed cup changes due to the rotation of the at least one of the carousel (200) and the drum (300) while ensuring that any of the beverage dispensed by the first nozzle (160) is introduced into the dispensed cup.

5. The beverage vending machine (100) according to claim 4 part a) further comprising a supply of beverage ingredient cartridges (401) located within the interior cavity (108) of the housing (101), wherein the beverage ingredient cartridges are fed to the beverage brewing apparatus (400) one at a time to facilitate the brewing of the beverage with the beverage brewing apparatus (400).

6. The beverage vending machine (100) according to claim 4 part b) further comprising either or both of the following features:

a) wherein the user interface (120) further comprises a plurality of user selectable artistic patterns, and wherein upon a user selecting one of the plurality of user selectable artistic patterns, the processor (130) is configured to rotate the at least one of the carousel (200) and the drum (300) in a particular manner to create the artistic pattern associated with the one of the plurality of user selectable artistic patterns during the beverage dispensing step of the beverage vend; and
b) wherein upon the user selecting a second beverage option from the plurality of user selectable beverage options on the user interface (120), the processor (130) is configured to initiate a second type of beverage vend wherein the

dispensed cup contains a beverage ingredient and a second nozzle (180) dispenses water into the dispensed cup that mixes with the beverage ingredient in the dispensed cup to generate a drink without introducing the beverage into the dispensed cup from the first nozzle (160).

7. A method of vending a beverage with a beverage vending machine (100), the method comprising:

dispensing a cup from a carousel (200) to a drum (300) positioned below the carousel (200), the cup containing a milk powder;
dispensing a first liquid into the cup to create a milk froth from the milk powder;
dispensing a second liquid into the cup from a first nozzle (160) that is coupled to the carousel (200) while rotating at least one of the drum (300) and the carousel (200) to modify a position of the first nozzle (160) relative to the cup to create an artistic pattern with the second liquid that is visible on the milk froth.

8. The method according to claim 7 further comprising one or more of the following features:

a) wherein the second liquid is a coffee product having a contrasting colour to the milk froth;
b) wherein the first liquid is water that combines with the milk powder to form the milk froth;
c) wherein the drum (300) and the carousel (200) are both configured to rotate clockwise and counter-clockwise during the dispensing of the second liquid into the cup to create the artistic pattern;
d) wherein the second liquid is dispensed into the cup continuously so that the artistic pattern is a continuous unbroken pattern;
e) wherein the second liquid is dispensed into the cup intermittently so that the artistic pattern is a discontinuous pattern;
f) prior to dispensing the cup from the carousel, selecting a beverage type from a plurality of selectable beverage types and selecting the artistic pattern from a plurality of selectable artistic patterns;
g) wherein the carousel (200) rotates about a first rotational axis (A-A) and the drum (300) rotates about a second rotational axis (B-B) that is parallel to and offset from the first rotational axis (A-A);
h) wherein the second liquid dispensed from the first nozzle (160) is introduced into the cup regardless of the position of the first nozzle (160) relative to the cup due to the rotation of the at least one of the drum (300) and the carousel (200);
i) wherein the first nozzle (160) is maintained in alignment with a top opening of the cup as the at least one of the drum (300) and the carousel (200) rotate during the dispensing of the second liquid into the cup; and
j) wherein the cup is positioned in a cup receiving portion (310) of the drum (300) during the dispensing of the second liquid into the cup from the first nozzle (160) such that rotation of the drum (300) causes the cup to move and rotation of the carousel (200) causes the first nozzle (160) to move.

9. The method according to claim 7 or 8 further comprising:

rotating the carousel (200) about a first rotational axis (A-A);
actuating a cup dispensing mechanism of the carousel (200) to dispense the cup from a stack of cups; rotating the drum (300) about a second longitudinal axis (B-B) to align the cup with a second nozzle (180);
dispensing the first liquid from the second nozzle (180) into the cup to create the milk froth;
rotating the drum (300) about the second longitudinal axis (B-B) to align the cup with the first nozzle (160); and
dispensing the second liquid into the cup from the first nozzle (160).

10. A beverage vending machine (100) comprising:

a carousel (200) comprising a plurality of cup dispensing stations (201), each of the plurality of cup dispensing stations (201) configured to support a stack of cups (250) and to dispense a lowermost cup (251) from the stack (250) as a dispensed cup;
a drum (300) positioned below the carousel (200) and comprising a cup receiving portion (310) that receives the dispensed cup from the carousel (200) and holds the dispensed cup during a beverage vend;
a beverage brewing apparatus (400) configured to brew a beverage; and
a first nozzle (160) fluidly coupled to the beverage brewing apparatus (400) to dispense the beverage brewed by the beverage brewing apparatus (400) into the dispensed cup during a beverage dispensing step of the beverage vend.

11. The beverage vending machine (100) according to claim 10 further comprising one or more of the following features:

a) a housing (101) defining an interior cavity (108) within which the carousel (200), the drum (300), the beverage brewing apparatus (400),

and the first nozzle (160) are located;

b) wherein the beverage brewing apparatus (400) is coupled to the carousel (200);

c) wherein the carousel (200) is configured to rotate about a first rotational axis (A-A) and wherein the first nozzle (160) is coupled to the carousel (200) so that the first nozzle (160) moves during rotation of the carousel (200) about the first rotational axis (A-A);

d) wherein the beverage brewing apparatus (400) is a coffee brewing machine or an espresso brewing machine; and

e) wherein the plurality of cup dispensing stations (201) comprises a first cup dispensing station that supports a first stack of cups, wherein each of the cups of the first stack of cups contains a milk powder, and further comprising a second nozzle (180), and wherein when the dispensed cup is one of the cups from the first stack of cups, the second nozzle (180) is configured to dispense water into the dispensed cup to create a milk froth from the milk powder prior to the beverage dispensing step of the beverage vend.

12. The beverage vending machine (100) according to claim 11 part c) wherein the drum (300) is configured to rotate about a second rotational axis (B-B) that is parallel to and offset from the first rotational axis (A-A) of the carousel (200).

13. The beverage vending machine (100) according to claim 12 wherein during the beverage dispensing step of the beverage vend, at least one of: (1) the carousel (200) rotates about the first rotational axis (A-A); and (2) the drum (300) rotates about the second rotational axis (B-B), such that a position of the first nozzle (160) relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle (160) into the dispensed cup.

14. The beverage vending machine (100) according to claim 13 further comprising either or both of the following features:

a) wherein the beverage is coffee having a colour that contrasts with the milk powder, and wherein during the beverage dispensing step of the beverage vend, at least one of: (1) the carousel (200) rotates about a first rotational axis (A-A); and (2) the drum (300) rotates about a second rotational axis (B-B), such that a position of the first nozzle (160) relative to the dispensed cup changes to create an artistic pattern with the beverage being dispensed from the first nozzle (160) into the milk froth in the dispensed cup; and

b) wherein the plurality of cup dispensing stations (201) comprises a second cup dispensing station that supports a second stack of cups, wherein each of the cups of the second stack of cups contains a beverage ingredient, and wherein when the dispensed cup is one of the cups from the second stack of cups, the second nozzle (180) is configured to dispense water into the dispensed cup and then present the dispensed cup to a consumer without performing the beverage dispensing step of the beverage vend.

15. A method of vending a beverage with a beverage vending machine (100), the method comprising:

dispensing a cup from a carousel (200) to a drum (300) positioned below the carousel (200);

dispensing a first liquid into the cup, the first liquid having a first color; and

dispensing a second liquid into the cup from a first nozzle (160) that is coupled to the carousel (200) while rotating at least one of the drum (300) and the carousel 9200) to modify a position of the first nozzle (160) relative to the cup to create an artistic pattern with the second liquid that has a second colour that is different than the first colour.

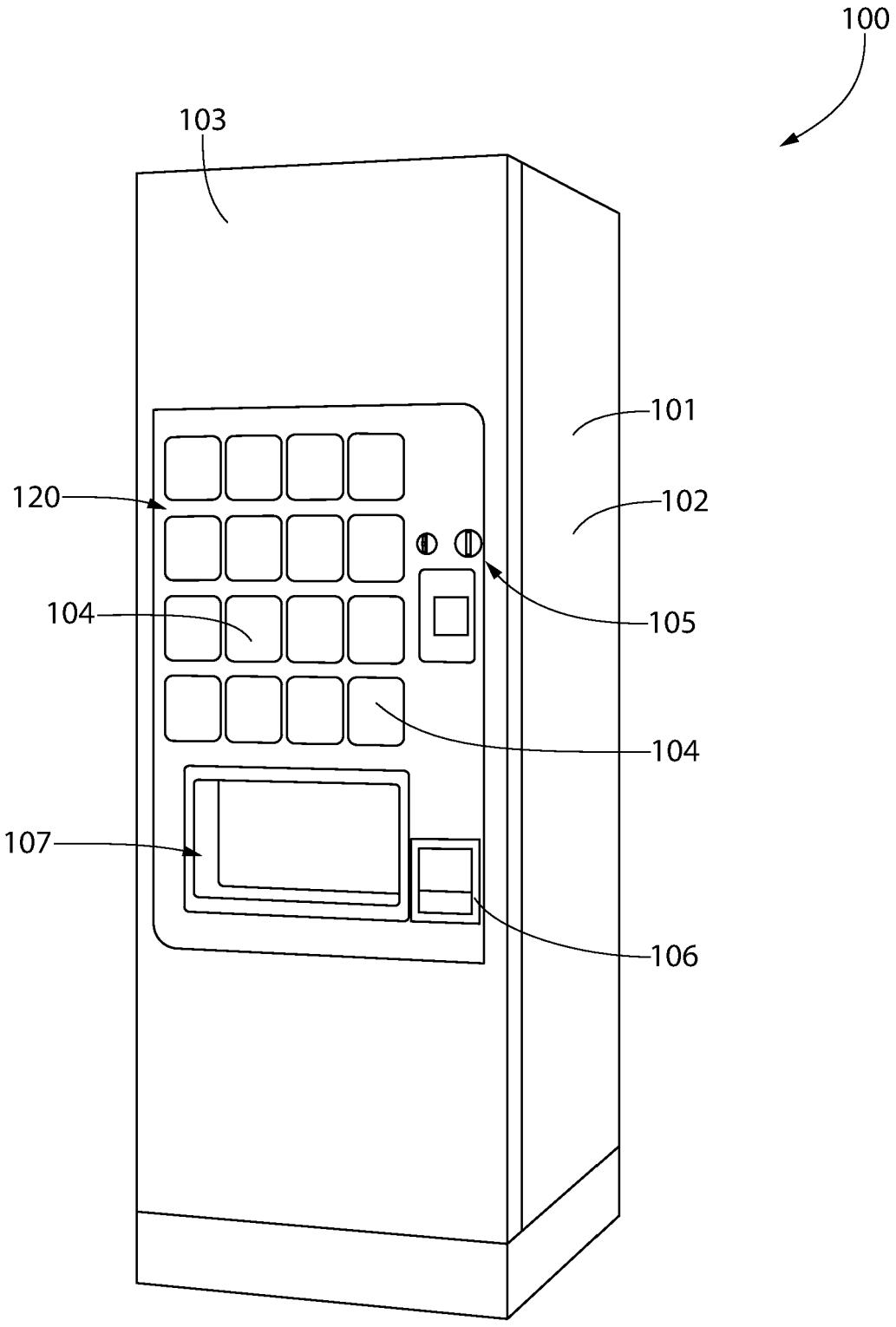

FIG. 1

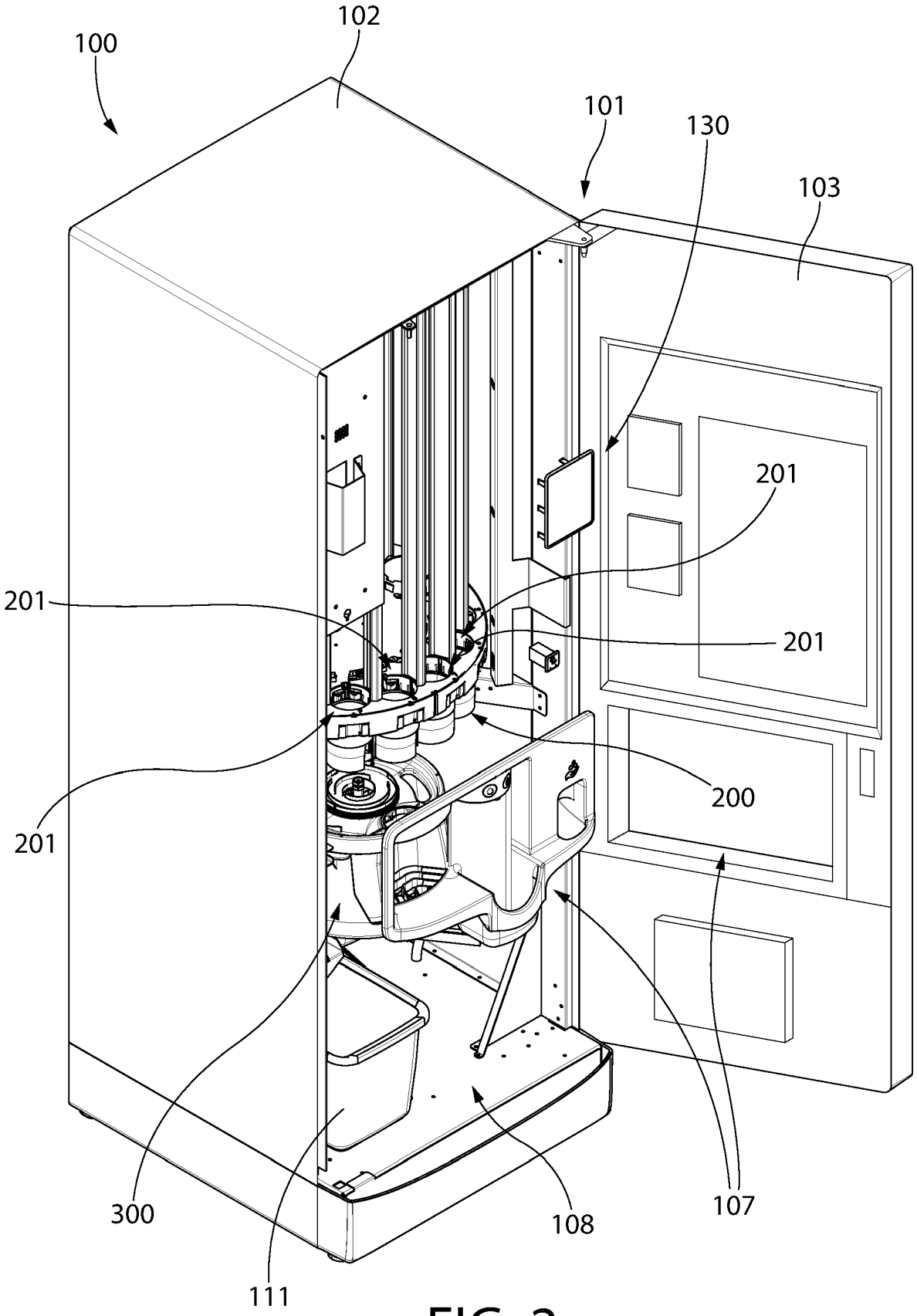

FIG. 2

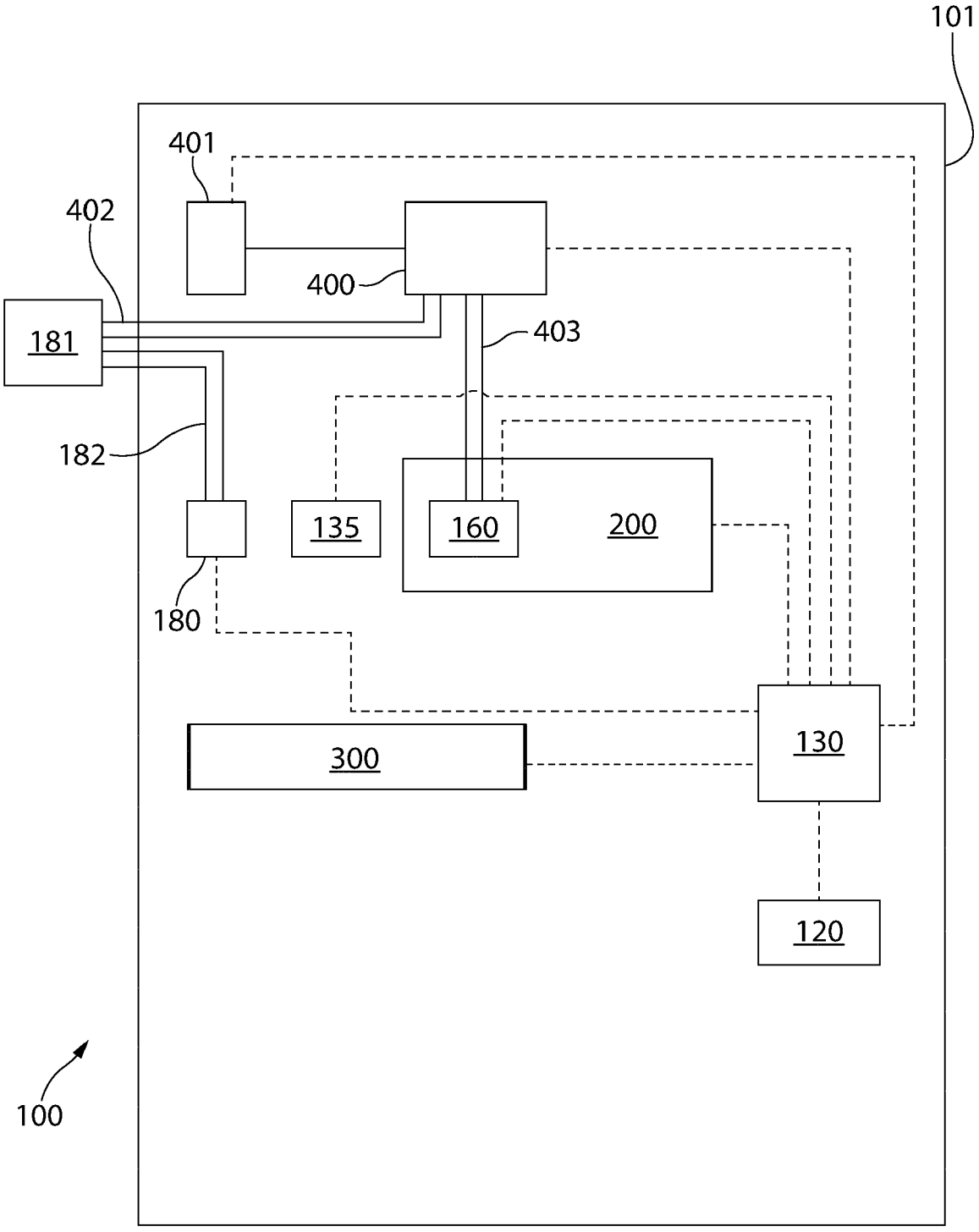

FIG. 3

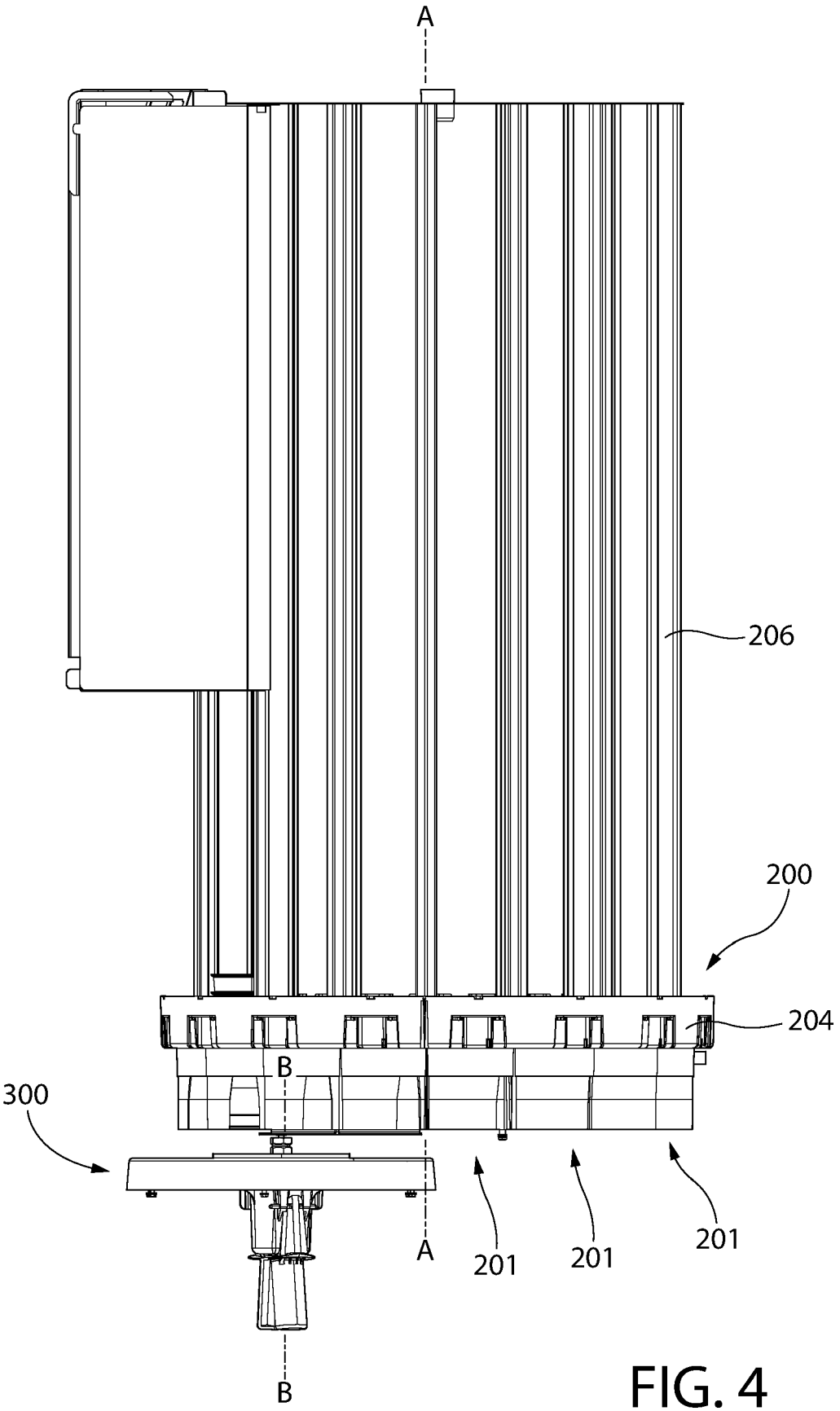

FIG. 4

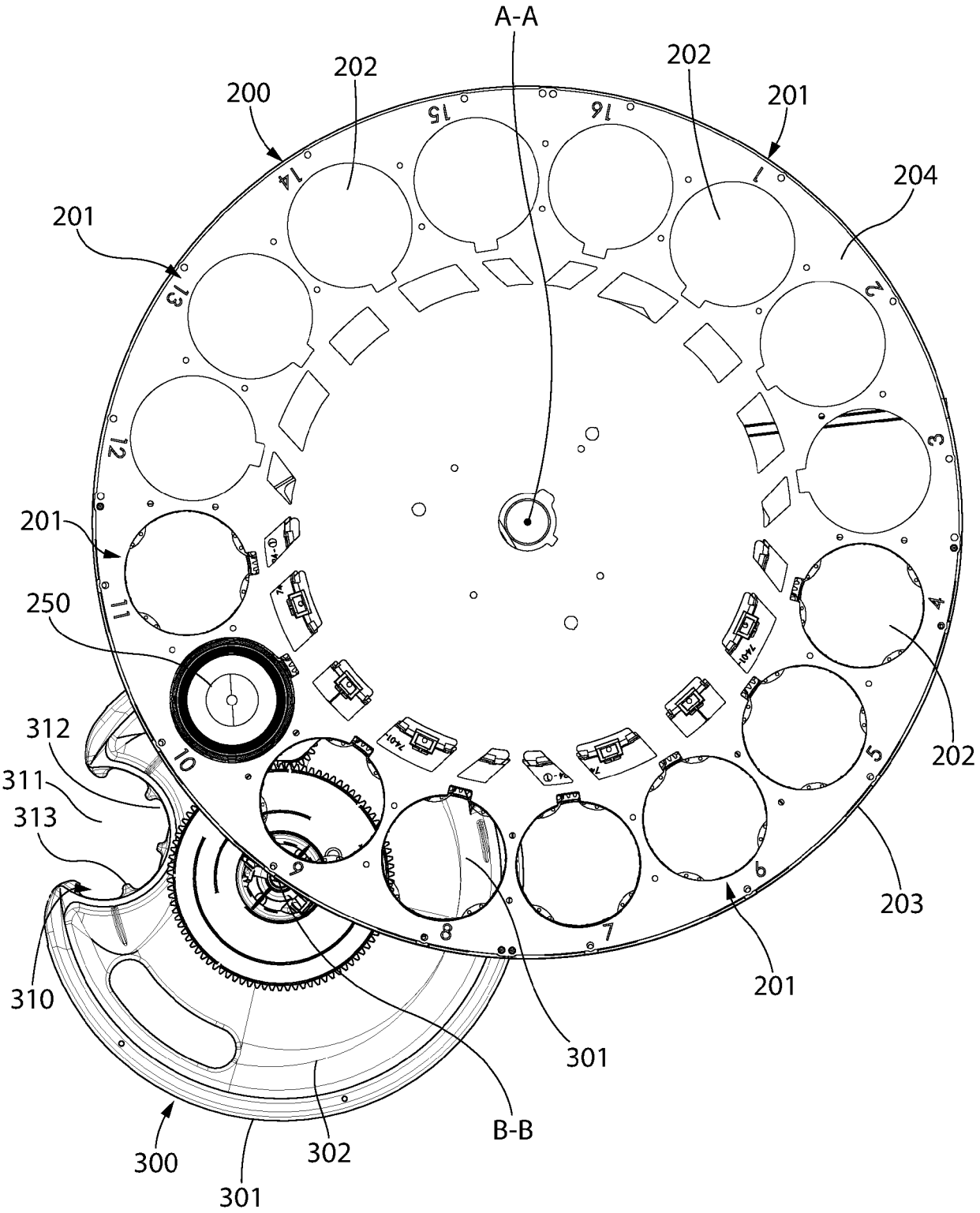
A-A
202
202
200
201
204
201
201
250
312
311
313
310
202
203
201
301
B-B
300
302
301

FIG. 5

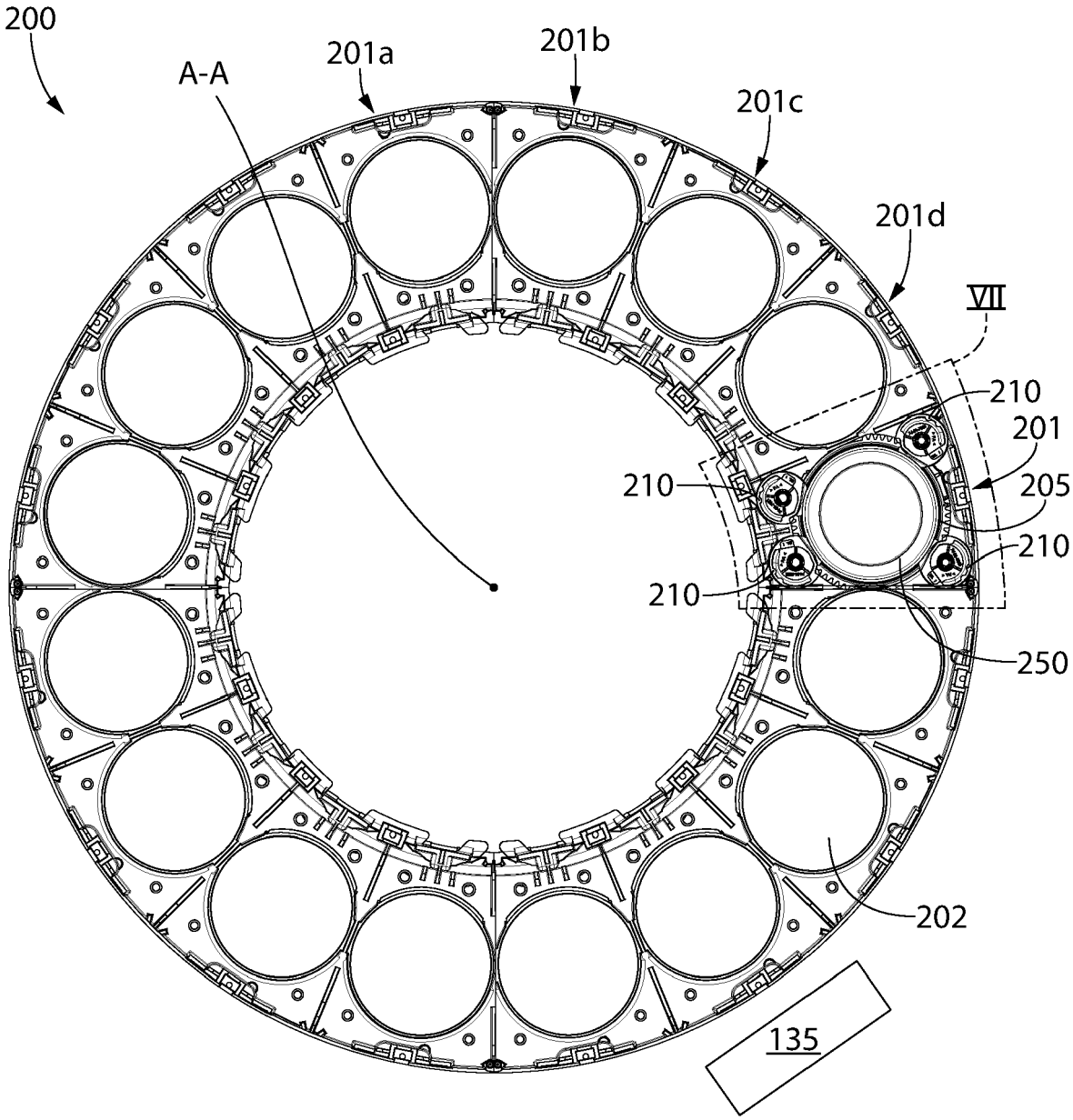
200
A-A
201a
201b
201c
201d
VII
210
201
205
210
210
210
250
202
135

FIG. 6

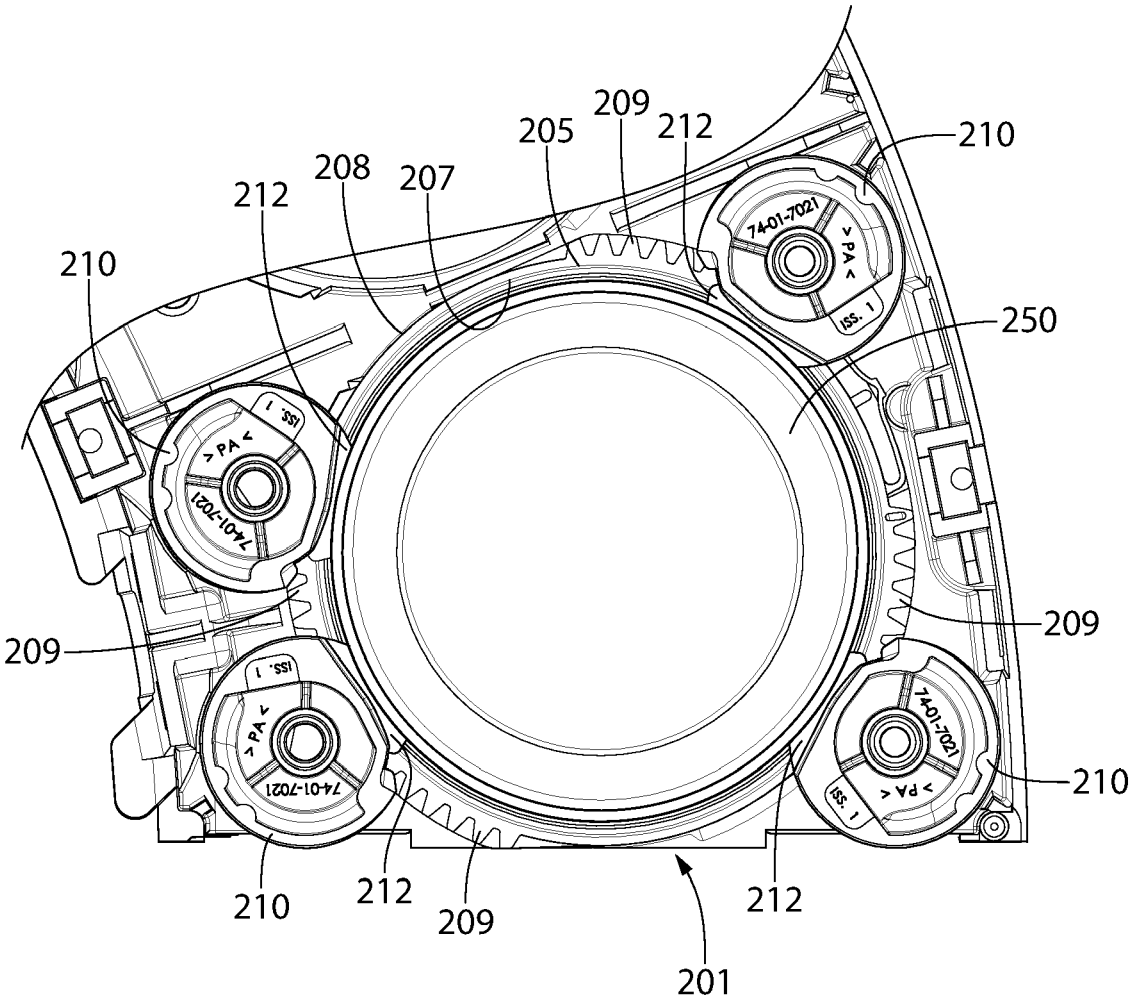

FIG. 7

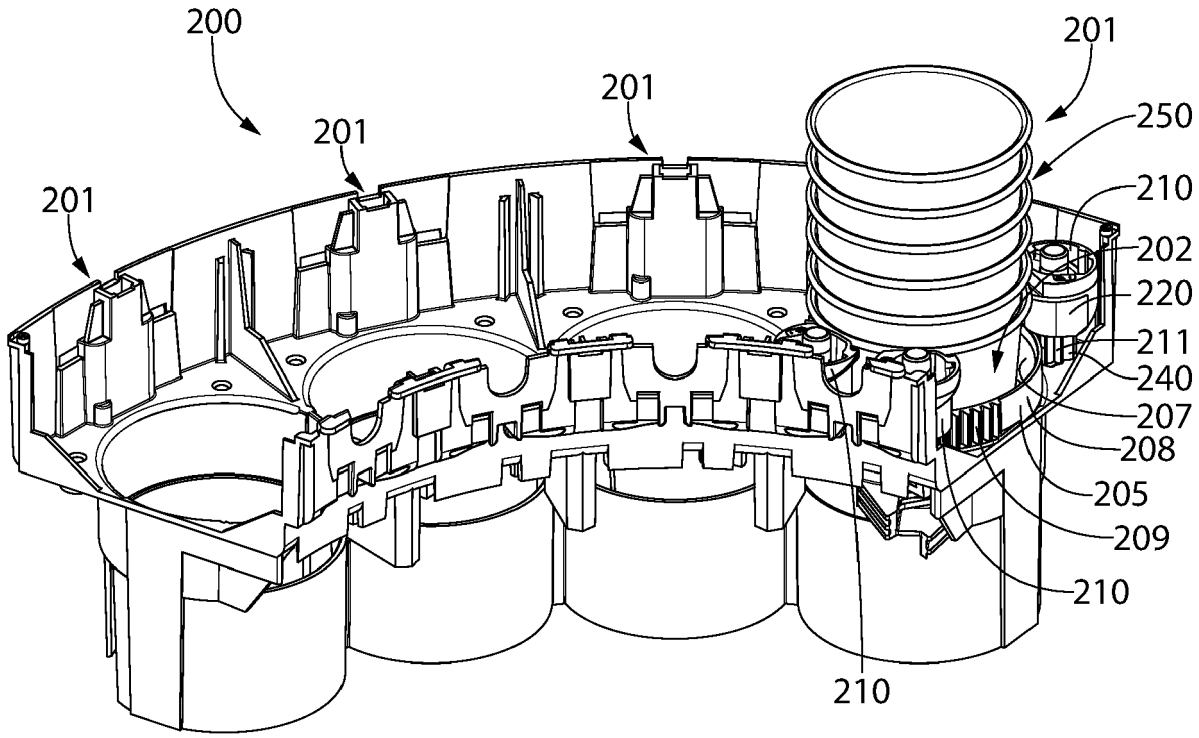
200
201
201
201
201
250
210
202
220
211
240
207
208
205
209
210
210

FIG. 8

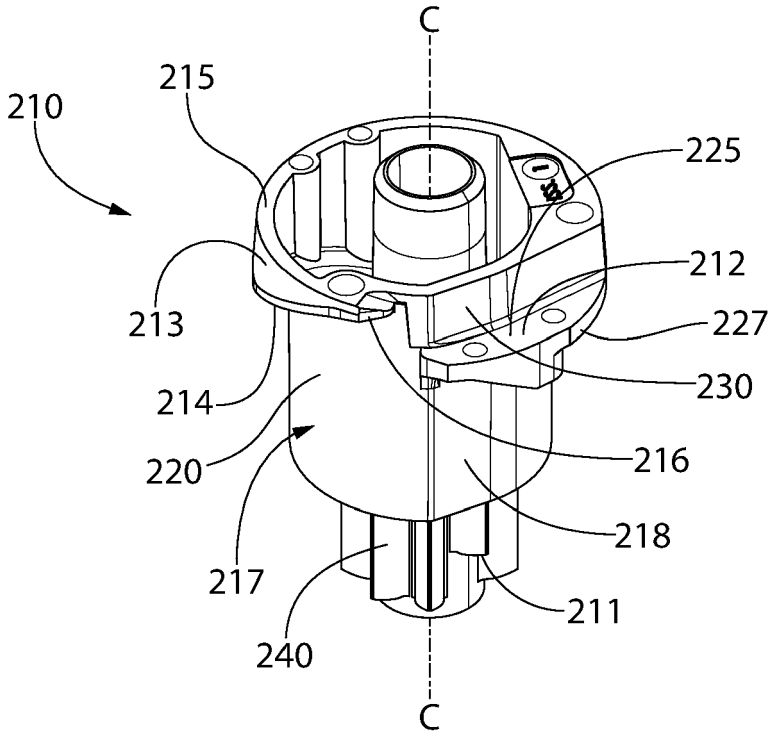
C
215
210
225
212
213
227
230
214
216
220
218
217
211
240
C

FIG. 9A

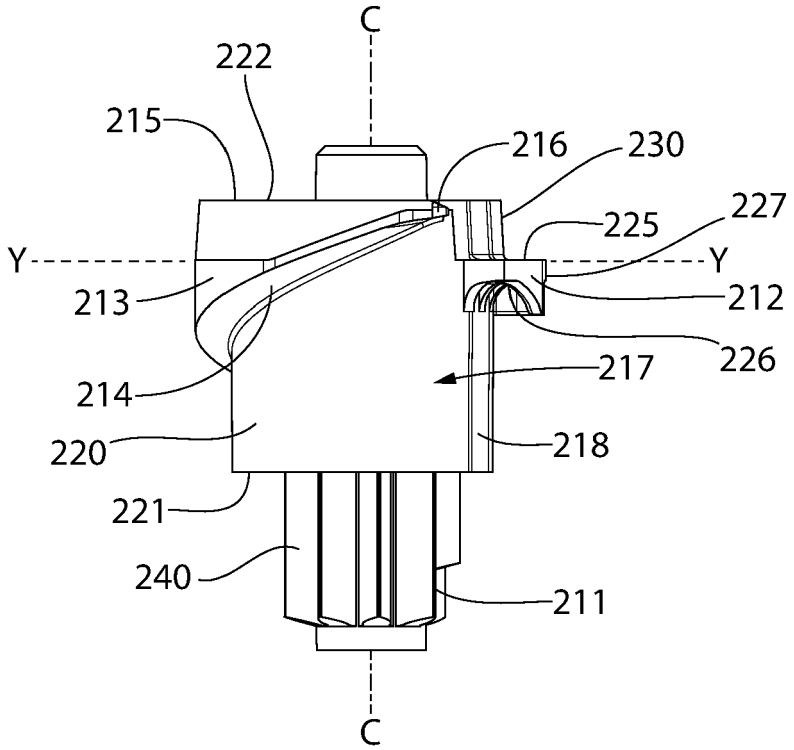
C
222
215
216
230
227
225
Y
Y
213
212
226
217
214
220
218
221
240
211
C

FIG. 9B

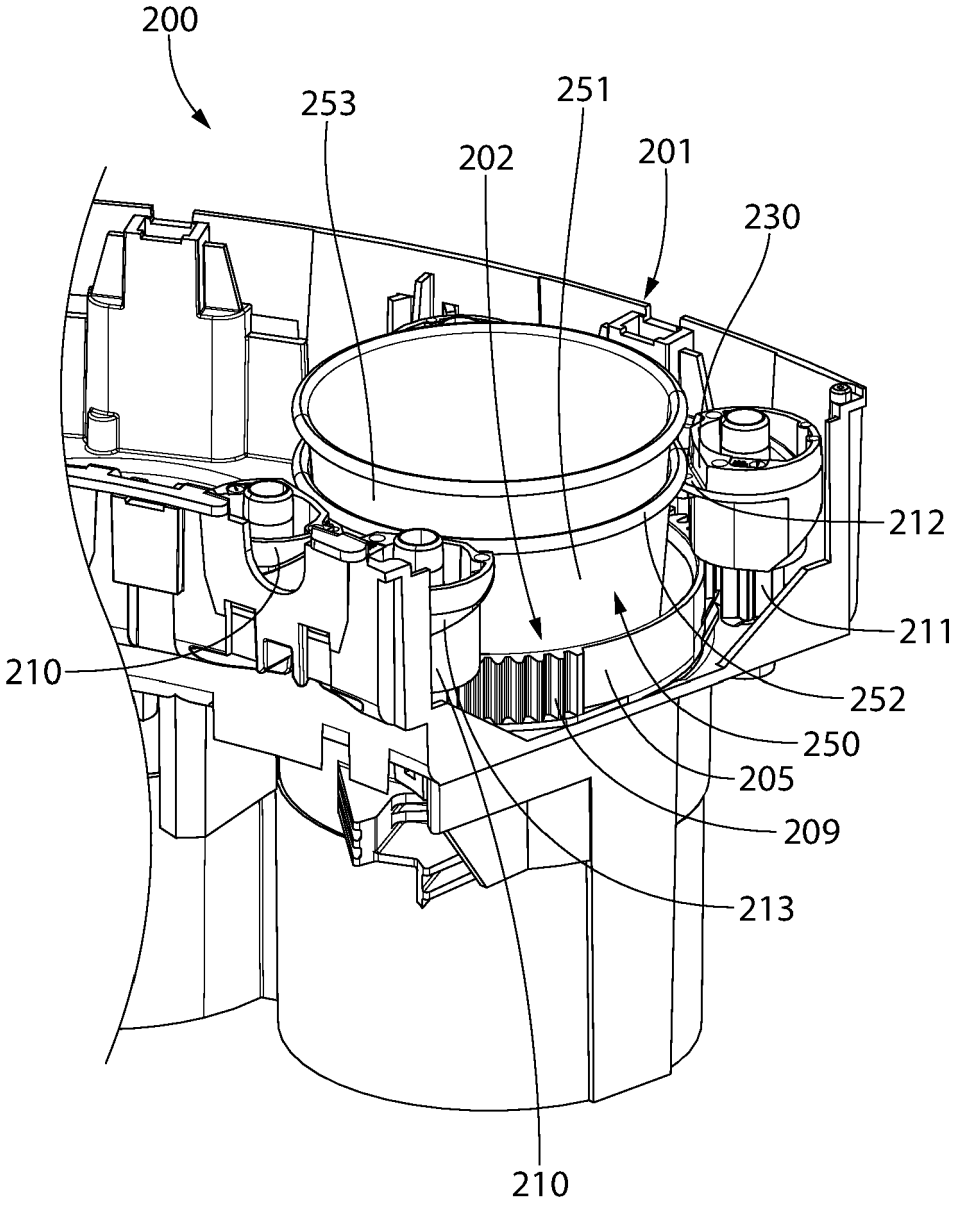

FIG. 10A

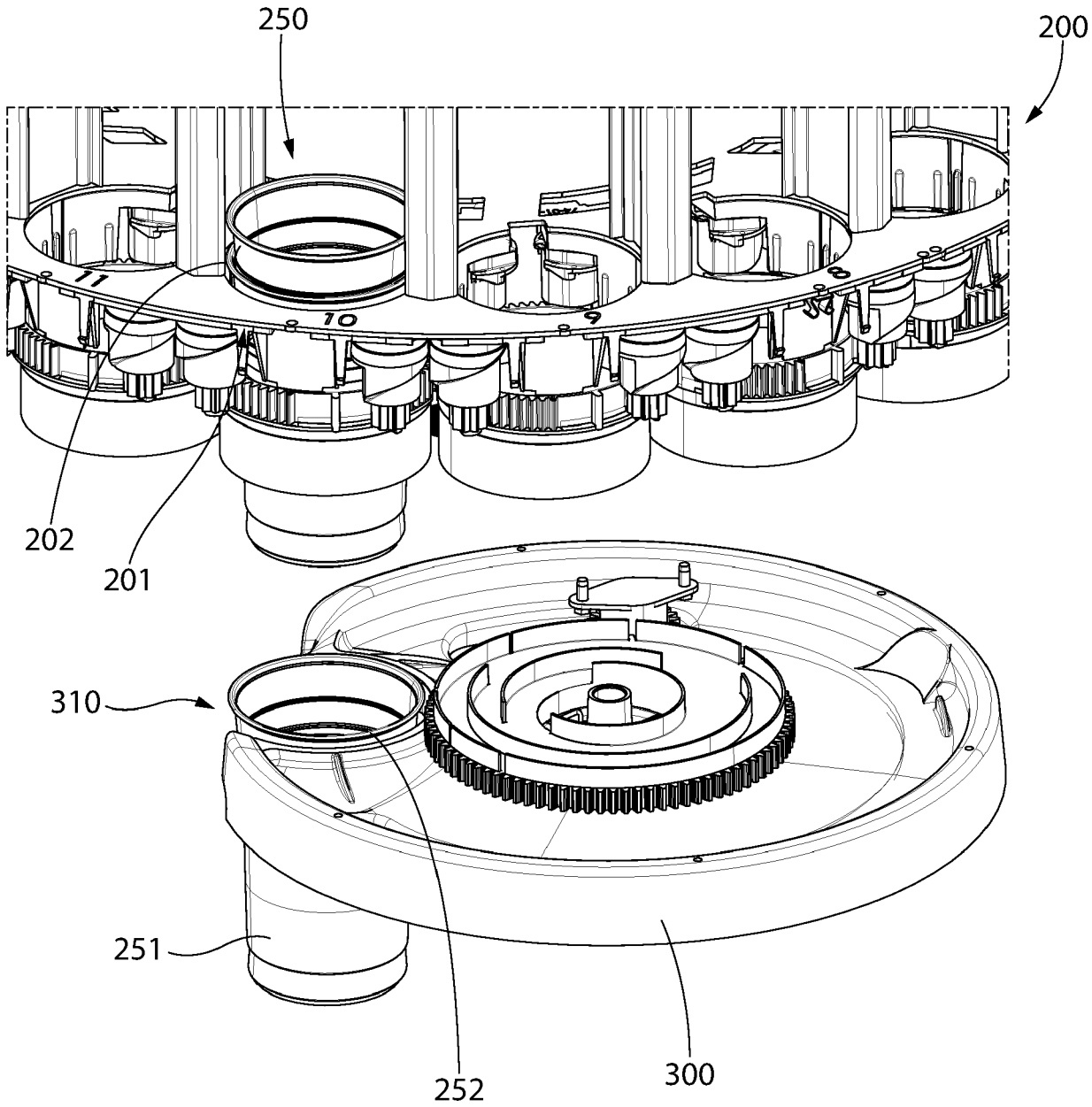

FIG. 10B

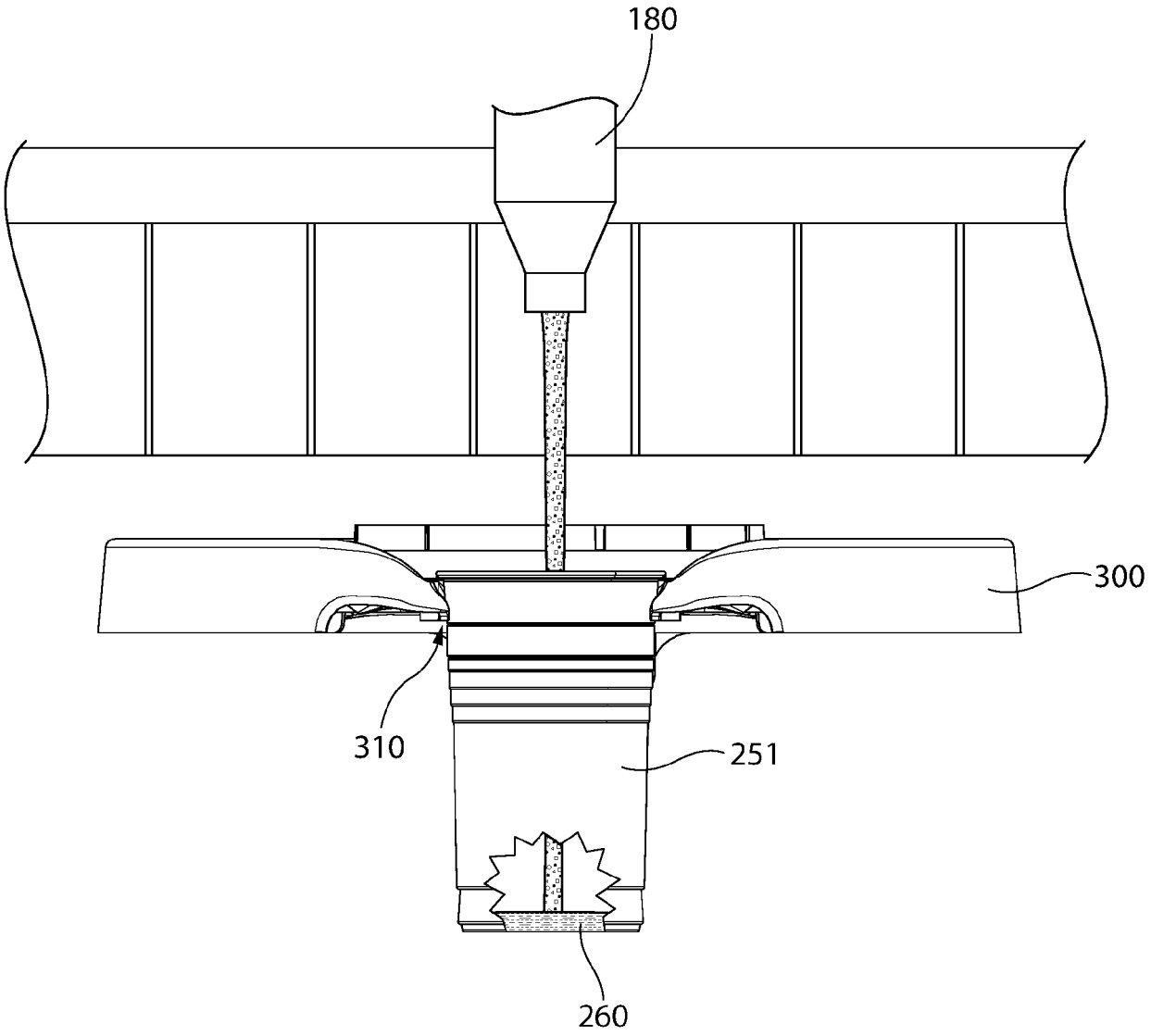

FIG. 11

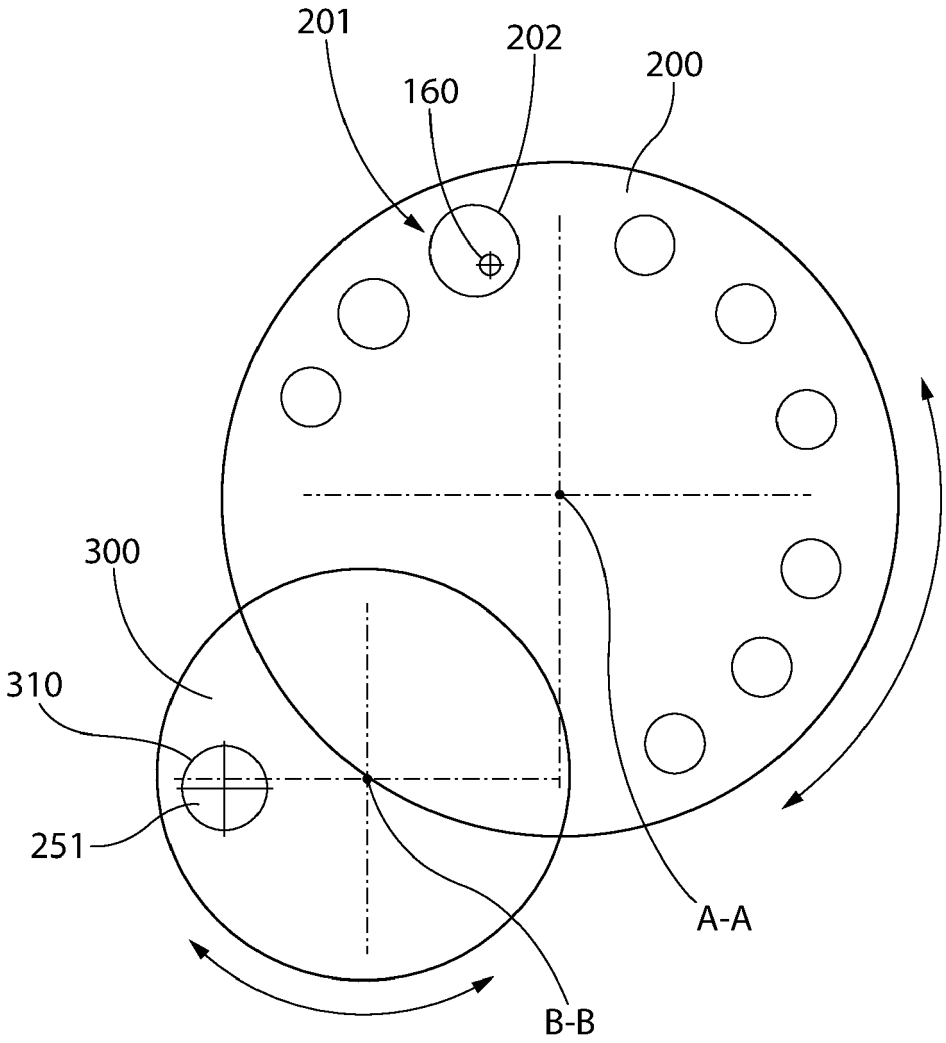

FIG. 12

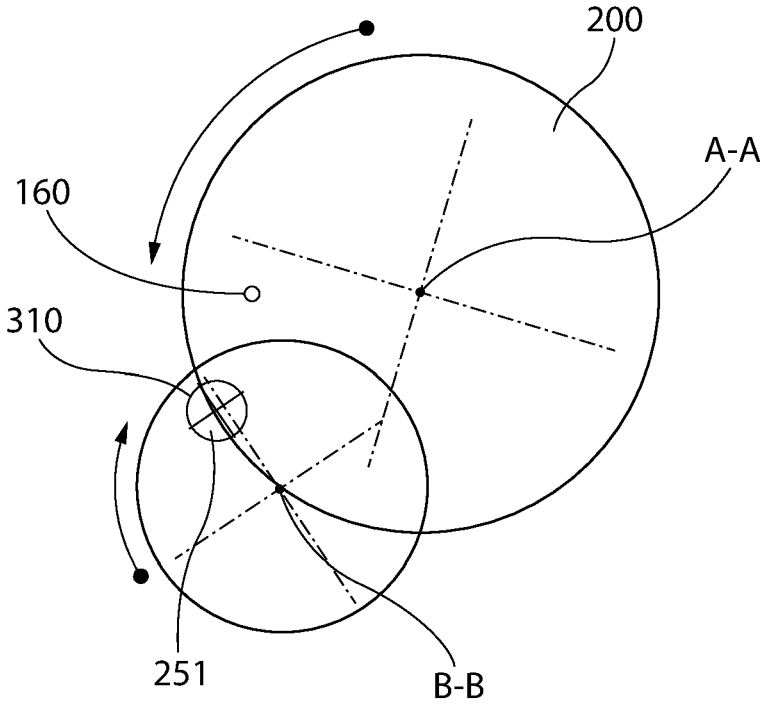

FIG. 13A

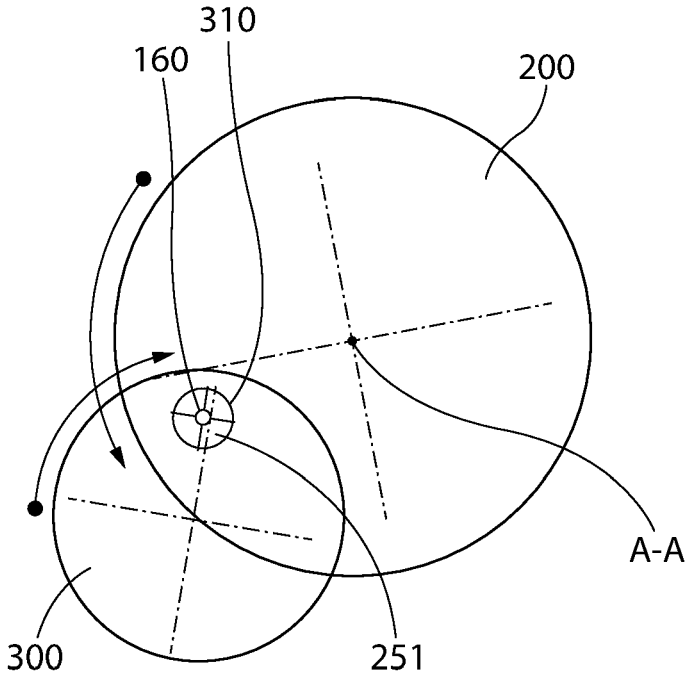

FIG. 13B

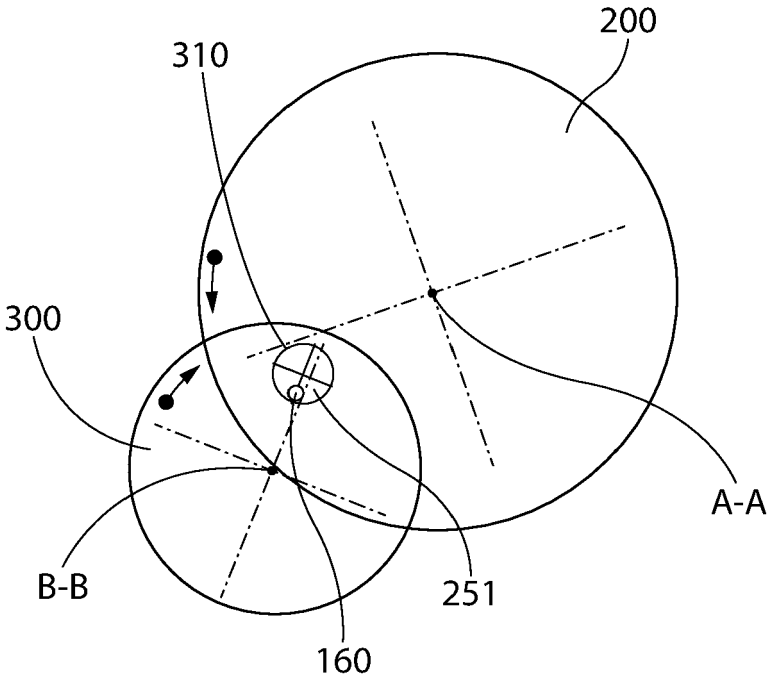

FIG. 14A

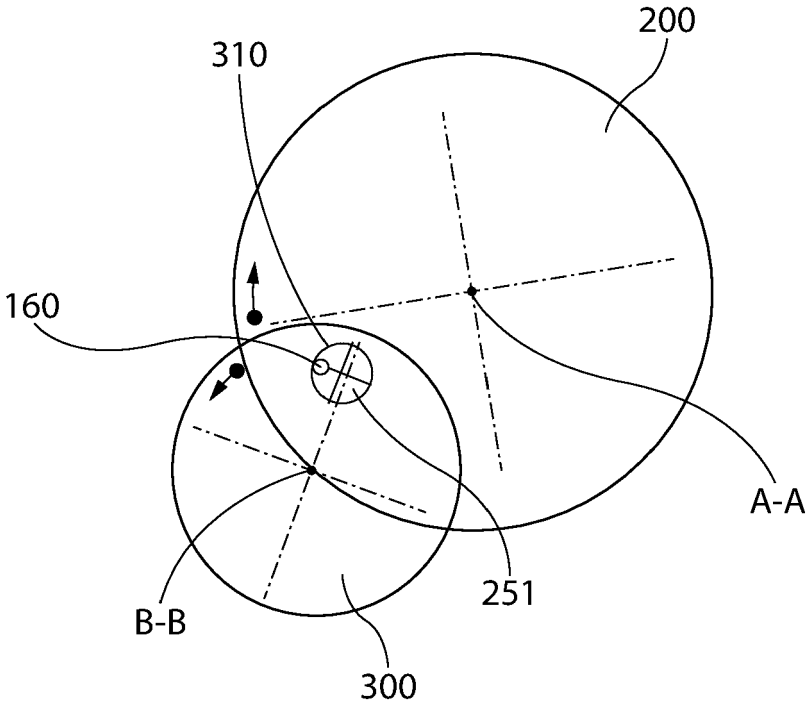

FIG. 14B

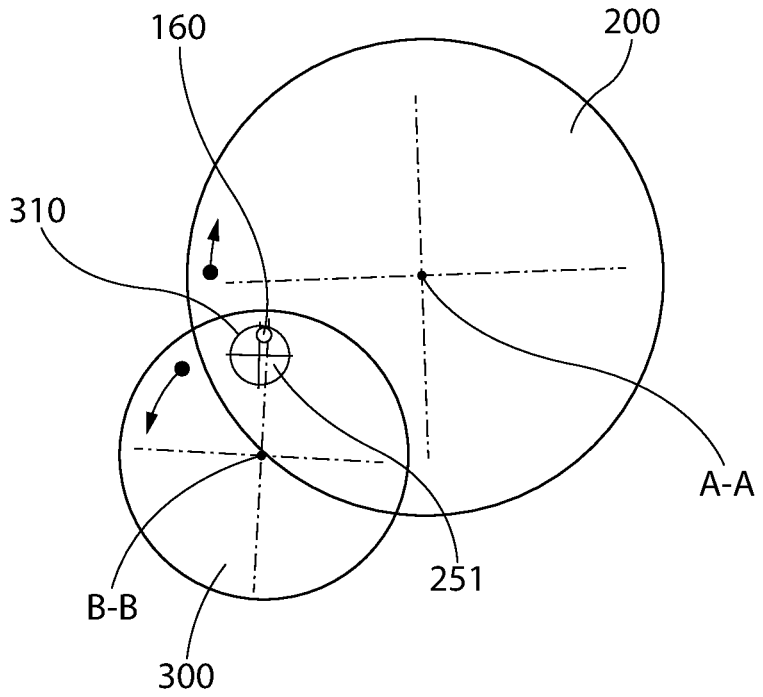

FIG. 14C

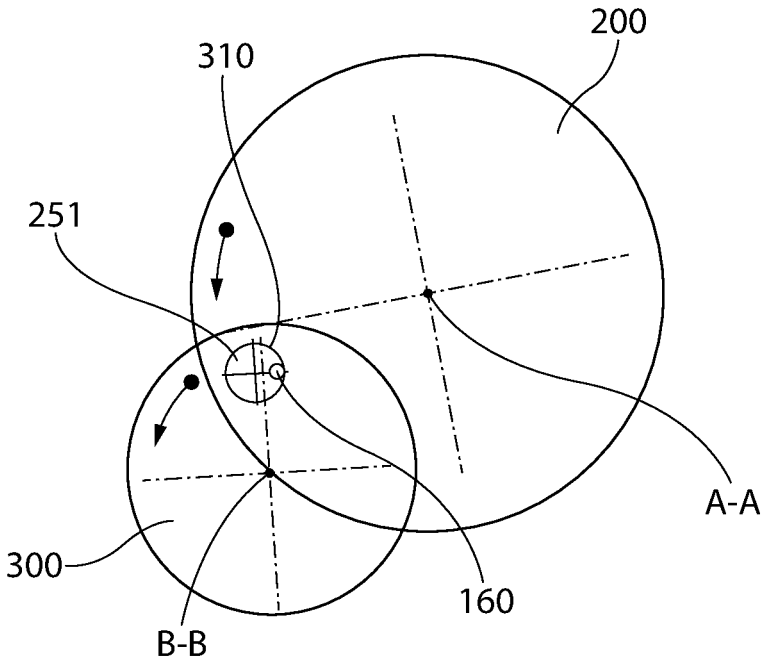

FIG. 14D

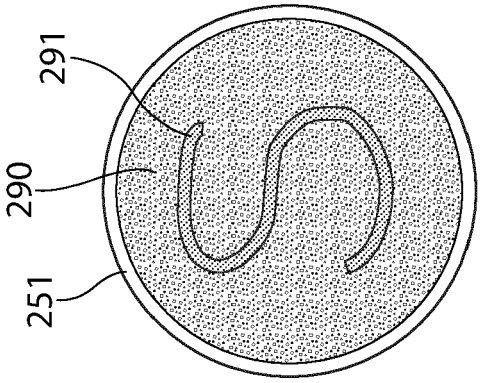

FIG. 15C

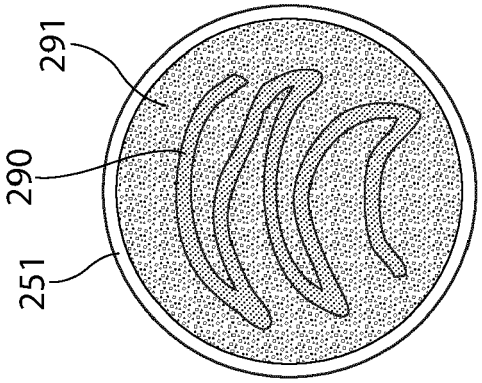

FIG. 15B

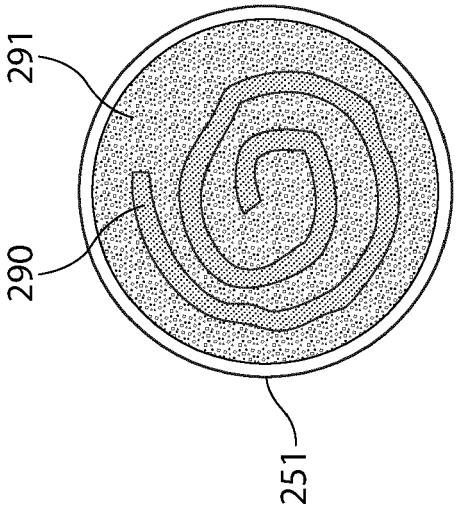

FIG. 15A

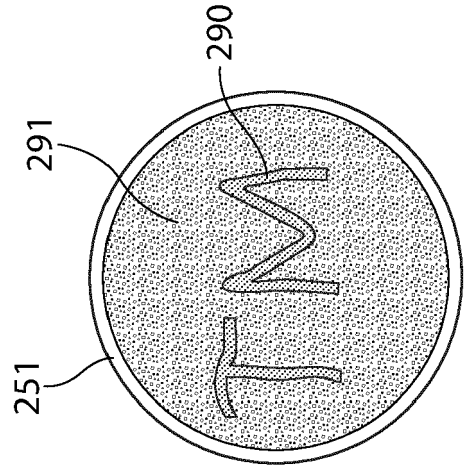

FIG. 16C

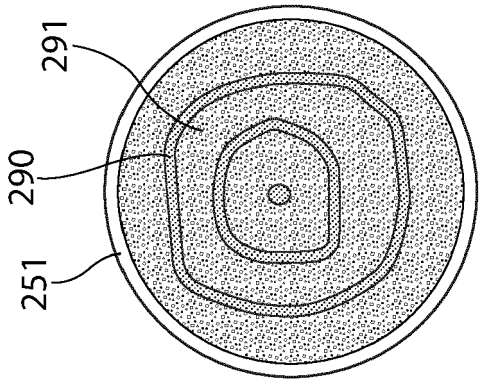

FIG. 16B

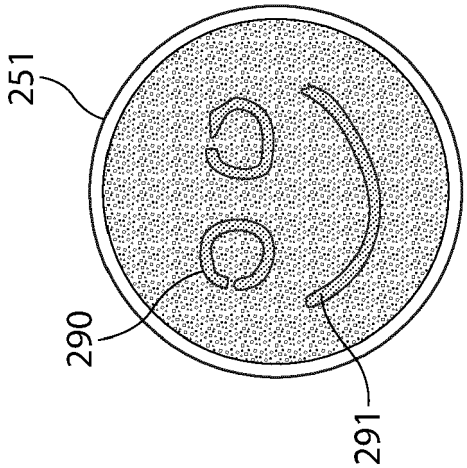

FIG. 16A

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EUROPEAN SEARCH REPORT

Application Number
EP 22 18 1699

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 2 369 559 A1 (RHEA VENDORS SPA [IT]) 28 September 2011 (2011-09-28)	10-12	INV. G07F13/06
A	* abstract * * paragraph [0008] - paragraph [0027] * * figures 1-7 *	1-9, 13-15	G07F13/10 G07F11/54 G07F11/24
A	US 2017/066252 A1 (ELIAV EYAL [IL] ET AL) 9 March 2017 (2017-03-09) * paragraph [0036] - paragraph [0042] * * claims 1-4 * * figures 1A, 1B *	1-15	
A	CN 108 961 567 A (SHANGHAI JUANG IND CO LTD) 7 December 2018 (2018-12-07) * the whole document *	1-15	

TECHNICAL FIELDS SEARCHED (IPC)

G07F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 December 2022	Cîrstet, Andrei

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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O : non-written disclosure
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L : document cited for other reasons

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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 22 18 1699

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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02-12-2022

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US 2017066252 A1	09-03-2017	NONE	
CN 108961567 A	07-12-2018	NONE	

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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82