

BEVERAGE PREPARATION SYSTEM AND METHOD

Field of Invention

The present invention relates generally to a beverage preparation system for preparing a beverage.

Background

Beverage preparation in a retail setting is a laborious task. With the popularity of customised beverages, the variations in how a beverage can be prepared are plentiful. For a newcomer in the industry, the task of remembering how the various types of beverages are prepared is daunting. Further, adding of toppings to these beverages have become popular over the years. With the sheer quantity of toppings available and with the frequent occurrence of long queues, mistakes on beverage orders are bound to occur. This may lead to wastage of the wrongly prepared beverage and customer unhappiness. Further, the speed in which the beverages can be prepared is curtailed due to physical limitations. Increasing the number of staff to cope with the increased orders is usually not an option as the queues do not form at predictable timings and the staff are often left with nothing to do during times when the order volumes are low or non-existent. Further, having many individuals in the preparation area often leads to chaos as movements of the staff has to be coordinated and controlled to prevent bumping into each other. This consequently leads to a reduction in productivity. Therefore, there is an apparent need for an approach for addressing the foregoing problems.

Summary

In accordance with a first aspect of the invention, there is disclosed a beverage preparation system comprising a manipulator defining a working envelope and having an end-effector for positioning a container within the working envelope with the container for containing a beverage. The beverage preparation system further comprises a first dispenser for dispensing a solute and positionally configured with the manipulator to enable the container to be positioned for receiving the solute; and a second dispenser for dispensing a solvent and configured with the manipulator to enable the container to be positioned for receiving the solute. The beverage preparation system further comprising an agitator positionally configured with the manipulator to enable the container to be positioned for agitating of the

solute and the solvent contained in the container thereby, the beverage comprising the solvent and the solute.

In accordance with a second aspect of the invention, there is disclosed a beverage preparation method comprising dispensing a solute into a container for containing a beverage by a first dispenser with the dispenser being positionally configured with a manipulator to enable the container to be positioned for receiving the solute, and dispensing a solvent into the container by a second dispenser with the second dispenser being configured with the manipulator to enable the container to be positioned for receiving the solvent. The beverage preparation method further comprising agitating of the solute and the solvent contained in the container by an agitator being configured with the manipulator for positioning the container thereat, the beverage comprising the solvent and the solute.

In accordance with a third aspect of the invention, there is disclosed a beverage preparation system comprising a first dispenser for dispensing a solute into a container being positioned for receiving the solute; a second dispenser for dispensing a solvent into the container, and an agitator positionally configured with the container for agitating of the solute and the solvent contained in the container to thereby prepare a beverage comprising the solvent and the solute.

In accordance with a fourth aspect of the invention, there is disclosed a beverage preparation method comprising dispensing a solute into a container for containing a beverage by a first dispenser, the container being positioned for receiving the solute, dispensing a solvent into the container by a second dispenser, the container being further positioned for receiving the solvent, and agitating of the solute and the solvent contained in the container by an agitator to thereby prepare a beverage comprising the solvent and the solute.

Brief Description of the Drawings

FIG. 1 shows partial system diagram of a beverage preparation system according to an embodiment of the invention;

FIG. 2 shows a process flow diagram of a beverage preparation method for utilising the beverage preparation system of FIG. 2; and

FIG. 3 shows an exemplary partial implementation of the beverage preparation system of FIG. 1.

Detailed Description

Reference will now be made in detail to an exemplary embodiment of the present invention, examples of which are illustrated in the accompanying drawings. While the invention will be described in conjunction with the embodiment, it will be understood that they are not intended to limit the invention to these embodiments. On the contrary, the invention is intended to cover alternatives, modifications and equivalents, which may be included within the spirit and scope of the invention as defined by the appended claims. Furthermore, in the following detailed description of embodiments of the present invention, numerous specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be recognized by one of ordinary skill in the art that the present invention may be practiced without these specific details. In other instances, well-known methods, procedures, components, and circuits have not been described in detail as not to unnecessarily obscure aspects of the embodiments of the present invention

An exemplary embodiment of the invention, a beverage preparation system 20 and a beverage preparation method 100 for employing the beverage preparation system 20, is described with reference to FIGS 1 to 3. The beverage preparation system 20 preferably comprises a manipulator 22 that defines a working envelope. The manipulator 22 comprises an end-effector for positioning a container within the working envelope. The container is for containing a beverage. The beverage preparation system 20 further comprises a first dispenser 32 for dispensing a solute in a step 110 and is positionally configured with the

manipulator 22 to enable the container to be positioned for receiving the solute. The beverage preparation system 20 further comprises a second dispenser 36 for dispensing a solvent in a step 112 and is configured with the manipulator 22 to enable the container to be positioned for receiving the solvent. The beverage preparation system 20 further comprises an agitator 40 positionally configured with the manipulator 22 to enable the container to be positioned for agitating of the solute and the solvent contained in the container thereby in a step 114.

In one implementation of the beverage preparation system 20, the first dispenser 32, the second dispenser 36 and the agitator 40 can be three spatially segregated stations requiring the manipulator 22 to displace the container therebetween. In an alternative implementation, the first dispenser 32 may be integrated with the second dispenser 36 to enable simultaneous dispensing of the solute and the solvent into the container. This will require the manipulator 22 to position the container to the agitator 40 once the solute and the solvent has been dispensed into the container. In a further alternate implementation, the second dispenser 36 may be physically integrated with the agitator 40. This will require the solute to be first dispensed at the first dispenser 32 before being positioned at a station whereat the second dispenser 32 and the agitator 40 are integrated to enable the solvent to be dispensed in tandem with the solute and the dispensed solvent to be agitated by the agitator 40.

The beverage containable in the container comprises the solvent and the solute. Preferably, the solute dispensed by the first dispenser 32 is in at least one of liquid, powder, tablet, cream and gel form. Preferably, one of amount and quantity of the solute dispensed into the container by the first dispenser 32 is determined by one of a plurality of selectable concentration levels.

The beverage preparation system 20 further comprises a third dispenser 44 for dispensing additional liquid. The third dispenser 44 is configured with the manipulator 22 to enable the container to be positioned for receiving the dispensed additional liquid in a step 116. The beverage further comprises the dispensed additional liquid. The additional liquid is one of aerated and still liquid and can be of any temperature and of any viscosity.

Preferably, the third dispenser 44 comprises a pair of nozzles 48 for dispensing liquids at different temperatures in a controlled proportion to thereby obtain the dispensed additional liquid at one of a plurality of selectable temperatures. Preferably, the beverage further comprises the additional liquid. In such an instance, a selected one of the plurality of concentration levels will determine the proportion of the solvent and the additional liquid to the dispensed solute which in turn determines the amount of the solvent and the additional liquid to be dispensed into the container. In preparations where the beverage contains just the solute and the solvent in the absence of the additional liquid, the selected one of the plurality of concentration levels will determine the proportion of the solute to the solvent alone. As the container may come in various sizes which determines the amount of the beverage it can and is to be contained therein, the size of the container will determine the amount of each of the solute, the solvent, and in some instance, additional liquid for a selected one of the plurality of concentration levels.

Preferably, the beverage preparation system 20 further comprises a fourth dispenser 52 for dispensing at least one of a plurality of ingredients. The fourth dispenser 52 is configured with the manipulator 22 to enable the container to be positioned for receiving the dispensed at least one of the plurality of ingredients in a step 118. The beverage further comprises the dispensed at least one of the plurality of ingredients. Examples of the plurality of ingredients includes cream, fruit bits, chocolate-based food bits, gelatin-based food bits, confectionaries, candies and citrus bits or peels as well as fresh toppings like honey jelly, coffee jelly, lemon slices, lime slices, passion fruits, apple cider, milk, aloe vera, wolfberry and basil seed. Preferably, the fourth dispenser 52 comprises a plurality of hoppers with each of the plurality of ingredients being contained in and dispensed from one of the plurality of hoppers. In addition to or alternative to the plurality of hoppers, the fourth dispenser 52 can further comprise a shaved ice machine for dispensing shaved ice or flavoured shaved ice, or a pressure can-based dispenser for dispensing whipped cream, cheese or the like contents available in a pressurised can.

Further, the beverage preparation system 20 further comprises a sealing machine 58 positioned for receiving the container from the manipulator 22 for sealing an opening of the container in a step 120. The container may come in various shapes and sizes. For example,

the container is a plastic cup which is sealed by heat-sealing a plastic layer over the opening thereof. The container may also be a paper cup which is sealed by attaching a cover to the opening thereof, or a carton box-type of container which is sealed by crimping or plugging the opening thereof.

Further, the beverage preparation system 20 can further comprise a labelling machine 62 for printing a label 64 being indicative or descriptive of the beverage, for example being descriptive of the type of beverage, its sweetness level and temperature level, and for attaching the label 64 to the sealed container in a step 122. Alternatively, the labelling machine 62 could directly ink-print or laser print onto the container for labelling thereof.

Preferably, the beverage preparation system 20 further comprises a serving station 66. Once the container has been sealed by the sealing machine 58, and preferably labelled by the labelling machine 62, the manipulator 22 displaces the container towards the serving station 66 to be received by the serving station 66. The serving station 66 then repositions the container to enable access thereto by a person in a step 124. The serving station 66 can comprise a conveyor system 68 for conveying the container received from the manipulator 22 at one end thereof to where it is accessible by the person at the other end thereof. The serving station 66 can further comprise a display and a reader, for example a code scanner or an image capture device, for reading the label 64, for example a machine readable code on the label 64 like a bar code or a QR code, before displaying a name, identifier, a numerical code or a queue number on the display for identifying the person for whom the beverage is prepared.

Preferably, the manipulator 22 comprises a robotic arm 70 defining a base 72, and at least one linear stage 74 for supporting and positioning the base 72 of the robotic arm 70. The robotic arm 70 comprises at least one of a serial, prismatic, parallel and SCARA configuration. Preferably, the robotic arm 70 comprises a serial arm having four to seven degrees-of-freedom (DOF).

The beverage preparation system 20 further comprises a container dispenser 76 configured with the manipulator 22 to and for presenting the container for access by the end-effector of the manipulator 22. A plurality of the containers are contained within the container dispenser 76 with one or more thereof being biased, gravitationally, via spring-loading or by an actuator, to a ready position for access and pick-up by the end-effector of the manipulator. The end-effector is shaped for accommodating at least a portion of the container to enable gripping and spatial manipulation of the container from the container dispenser 76 in a step 126. This will enable the opening of the container to be posed in an orientation to enable receipt of contents therethrough.

The beverage preparation system 20 further comprising a controller 78 in signal communication with and for controlling and coordinating operations of at least a portion of the manipulator 22, the first dispenser 32, the second dispenser 36, the agitator 40, the third dispenser 44, the fourth dispenser 52, the sealing machine 58, the labelling machine 62, the serving station 66 and the container dispenser 76.

The beverage preparation system 20 further comprises a user-interface (UI) 80 for capturing inputs from a user to select one of a plurality of preferences for the beverage thereto and for providing the selected one of the plurality of preferences to the controller 78 in signal communication therewith. The plurality of preferences can comprise the type of the beverage, for example honey-based beverage, tea-based beverage, fruit-soda, and the like beverage types. The plurality of preferences can further comprise the plurality of selectable temperatures, the plurality of selectable concentration levels, a selection of one or more of the plurality of ingredients and ice preference, for example, ice cubes, crushed ice, shaved ice and no ice preferences. The UI 80 may be a standalone system adapted for use with a point-of-sales (POS) system, or may be formed integral with the POS system.

In an exemplary use of the beverage preparation system 20 employing the beverage preparation method 100, the beverage preparation system 20 is applied for preparing honey beverages, for example honey-based or honey-flavoured beverages, as the beverage. Preferably, the manipulator 22, the first dispenser 32, the second dispenser 36, the agitator 40, the third dispenser 44, the fourth dispenser 52, the sealing machine 58 and the container

dispenser 76 are disposed within a preparation area 84 while the UI 80 is sited within a user area 86 that is adjacent the preparation area 84. Preferably, the serving station 66 straddles both the preparation area 84 and the user area 86. For example, one portion of the conveyor system 68 may extend into the preparation area while another portion thereof may extend into the user area 86. The labelling machine 62 may be disposed within the preparation area 84 for printing and affixing the label 64 to the sealed container before the sealed container is provided to the serving station 66 by the manipulator 22, or may be formed integral with the serving station 66 to enable the label 64 to be affixed to the sealed container only after the sealed container has been provided to the serving station 66 by the manipulator 22 and during conveying of the sealed container from one end to the other end of the conveyor system 68.

The preparation area 84 may be contained within an enclosure, for example a see-through enclosure, be cordoned off and be physically segregated from the user area by a barrier, for example a see-through area, with an opening to enable the container to be conveyed therethrough to the user area 86. Alternatively, the preparation area 84 may be an area or space that has been physically or visually demarcated, for example, via line marking on the floor. As an example, the user area 86 may be sited at or adjacent the opening or entrance of a retail space or a shop while the preparation area 84 may be sited within the shop and away from the entrance thereof. A user wanting to purchase a honey beverage will approach the UI 80 at the user area 86 to place an order.

To place the order, the user selects one of the plurality of preferences for the beverage that has been presented on the UI 80. For example, the user may select a fizzy honey beverage as the one of the plurality of preferences, room temperature as the plurality of selectable temperatures, % sweetness as the concentration level and fruit bits and cream as the at least one of the plurality of ingredients.

Once the order has been confirmed, the UI 80 will prompt the user to make a payment. Preferably, the UI 80 further comprises a payment interface 88 for effecting payment for the order placed. The payment interface 88 may comprise card readers for interfacing with credit cards, debit cards or the like payment cards for effecting payment, a contactless interface for effecting payment with, for example, an NFC-enabled device like a smart phone, smart

device, a smart card or a smart wearable device, and/or a machine readable code generator, for example a QR code generator, to be displayed and read or image-scanned by a smart device for effecting payment. Additionally or alternatively, the UI 80 may further comprise a hard currency processing unit for accepting part or full payment of the order by currency notes and coins. Once the payment has been effected, an order number may be generated and provided to the user, for example on a printed chit. The confirmed order is also received by the controller 78 which proceeds to control the manipulator 22 to pick up the container from the container dispenser 76.

Next, the container is positioned at the first dispenser 32 to receive honey as the solute. The first dispenser 32 may dispense various types of honey, for example honey of varying UMF or source/country of origin, which may be selectable through interaction with the UI 80 at the point of placing the order. Next, the manipulator 22 will position the container at the second dispenser 36 for receiving a portion of room temperature water as the solvent for dissolving the honey. The agitator 40 then agitates the content of the container for mixing the honey with the water if the agitator 40 is formed integral with the second dispenser 36. If the agitator 40 is physically segregated from the second dispenser 36, the manipulator then has to position the container at the agitator 40 for the contents of the container to be agitated. Preferably, the concentration levels is determined by the amount of honey dispensed by the first dispenser 32 into the container.

Next, the container is positioned by the manipulator 22 to the third dispenser 44. Since the order is for a room temperature fizzy honey beverage, the third dispenser 44 then dispenses room temperature fizzy water as the additional liquid into the container. Next, the manipulator 22 then positions the container at the fourth dispenser 52 for the fourth dispenser 52 to dispense fruit bits and cream into the container. Following this, the manipulator then positions the container in the sealing machine 58 for sealing of the opening thereby. Next, the sealed container is then positioned by the manipulator 22 at the labelling machine 62 where the label 64 is printed with indication that the honey beverage is a room temperature fizzy honey beverage with fruit bits and cream. The label 64 may further indicate the name of the user which may be optionally provided by the user via the UI 80 at the point of placing the order.

Next, the sealed and labelled container is then provided to the serving station 66 which then initiate displays of the order number on the display before conveying the sealed container from the preparation area 84 to the user area 86 to be received or picked up by the user. At the user area 86, the user may just picked up the sealed container without any hindrance, or may be require the order chit containing the order number, and/or may code, to be scanned by the reader before the sealed container is provided to or physically released to the user. Alternatively, the serving station 66 may be able to contain a plurality of the sealed container and will only convey the respective sealed container to the user area for pick up by the associated user only after the order chit has been scanned by the reader.

In another exemplary embodiment of the invention, the foregoing beverage preparation system 20 may be implemented without the manipulator 22. An example of such an implementation is when the beverage preparation system 20 is adapted into a vending machine, for example a self-service vending machine. In such an implementation, the container is preferably dispensed from the container dispenser 76 via gravity to be gravity funnelled to a ready position for receiving of the solute and solvent 36 from the first dispenser 32 and the second dispenser respectively. Likewise, each of the third dispenser 44 and the fourth dispenser 52 may be configured and adapted to enable, respectively, the additional liquid the plurality of ingredients to be dispensed to the container positioned at the ready position.

In a forgoing manner, a beverage preparation system is described according to exemplary embodiments of the invention. Although only one embodiment of the invention is disclosed in this document, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modifications can be made to the disclosed embodiment without departing from the scope and spirit of the invention.

Claims

1. A beverage preparation system comprising:
 - a manipulator defining a working envelope and having an end-effector for positioning a container within the working envelope, the container for containing a beverage, the manipulator comprising a robotic arm defining a base;
 - a first dispenser for dispensing a solute and positionally configured with the manipulator to enable the container to be positioned for receiving the solute;
 - a second dispenser for dispensing a solvent and configured with the manipulator to enable the container to be positioned for receiving the solvent;
 - an agitator positionally configured with the manipulator to enable the container to be positioned for agitating of the solute and the solvent contained in the container thereby, the beverage comprising the solvent and the solute; and
 - a fourth dispenser for dispensing at least one of a plurality of ingredients, the fourth dispenser being configured with the manipulator to enable the container to be positioned for receiving the dispensed at least one of the plurality of ingredients, the beverage further comprising the dispensed at least one of the plurality of ingredients.
2. The beverage preparation system as in claim 1, the solute dispensed by the first dispenser being in at least one of liquid, powder, tablet, cream and gel form.
3. The beverage preparation system as in claim 2, one of amount and quantity of the solute dispensed into the container by the first dispenser being determined by one of a plurality of selectable concentration level.
4. The beverage preparation system as in claim 1, further comprising:
 - a third dispenser for dispensing additional liquid, the third dispenser being configured with the manipulator to enable the container to be positioned for receiving the dispensed additional liquid, the beverage further comprising the dispensed one of aerated and still liquid with the additional liquid being one of aerated and still liquid.

5. The beverage preparation system as in claim 4, the third dispenser comprising a pair of nozzles for dispensing liquids at different temperatures in a controlled proportion to thereby obtain the additional liquid at one of a plurality of selectable temperatures.
6. The beverage preparation system as in claim 1, the fourth dispenser comprising a plurality of hoppers, each of the plurality of ingredients being contained in and dispensed from one of the plurality of hoppers.
7. The beverage preparation system as in claim 1, further comprising:
 - a sealing machine positioned for receiving the container from the manipulator for sealing an opening of the container.
8. The beverage preparation system as in claim 7, further comprising:
 - a serving station for receiving the sealed container from the manipulator, the container being repositionable by the serving system to enable access thereto by a person.
9. The beverage preparation system as in claim 8, the serving station comprising:
 - a conveyor system for conveying the container from where the container is disposed by the manipulator to where it is accessible by the person.
10. The beverage preparation system as in claim 1, the manipulator further comprising:
 - at least one linear stage for supporting and positioning the base of the robotic arm, the robotic arm comprising at least one of a serial, prismatic, parallel and SCARA configuration.
11. The beverage preparation system as in claim 1, further comprising:
 - a container dispenser configured with the manipulator to and for presenting the container for access by the end-effector of the manipulator.

12. The beverage preparation system as in claim 1, further comprising a controller in signal communication with and for controlling operations of the manipulator, the first dispenser, the second dispenser and the agitator.
13. The beverage preparation system as in claim 1, further comprising a user-interface (UI) for capturing inputs from a user to select one of a plurality of preferences for the beverage thereto and for providing the selected one of the plurality of preferences to the controller in signal communication therewith.
14. A beverage preparation method comprising:
 - dispensing a solute into a container for containing a beverage by a first dispenser, the dispenser being positionally configured with a manipulator to enable the container to be positioned for receiving the solute, the manipulator comprising a robotic arm defining a base;
 - dispensing a solvent into the container by a second dispenser, the second dispenser being configured with the manipulator to enable the container to be positioned for receiving the solvent; and
 - agitating of the solute and the solvent contained in the container by an agitator being configured with the manipulator for positioning the container thereat, the beverage comprising the solvent and the solute; and
 - dispensing at least one of a plurality of ingredients from a fourth dispenser, the fourth dispenser being configured with the manipulator to enable the container to be positioned for receiving the dispensed at least one of the plurality of ingredients, the beverage further comprising the dispensed at least one of the plurality of ingredients.

15. A beverage preparation system comprising:
 - a first dispenser for dispensing a solute into a container being positioned for receiving the solute;
 - a manipulator comprising a robotic arm for positioning the container;
 - a second dispenser for dispensing a solvent into the container;
 - an agitator positionally configured with the container for agitating of the solute and the solvent contained in the container to thereby prepare a beverage comprising the solvent and the solute; and
 - a fourth dispenser for dispensing at least one of a plurality of ingredients, the fourth dispenser being configured with the manipulator to enable the container to be positioned for receiving the dispensed at least one of the plurality of ingredients, the beverage further comprising the dispensed at least one of the plurality of ingredients.,
 - wherein the fourth dispenser comprises a plurality of hoppers, each of the plurality of ingredients being contained in and dispensed from one of the plurality of hoppers.
16. The beverage preparation system as in claim 15, the solute dispensed by the first dispenser being in at least one of liquid, powder, tablet, cream and gel form,
 - wherein one of amount and quantity of the solute dispensed into the container by the first dispenser being determined by one of a plurality of selectable concentration level.
17. The beverage preparation system as in claim 15, further comprising:
 - a third dispenser for dispensing additional liquid, the third dispenser being configured with the manipulator to enable the container to be positioned for receiving the dispensed additional liquid, the beverage further comprising the dispensed one of aerated and still liquid with the additional liquid being one of aerated and still liquid.
18. The beverage preparation system as in claim 15, further comprising:
 - a container dispenser configured with the manipulator to and for presenting the container for access by the end-effector of the manipulator.

19. The beverage preparation system as in claim 15, further comprising:
- a controller in signal communication with and for controlling operations of the manipulator, the first dispenser, the second dispenser and the agitator; and
 - a user-interface (UI) for capturing inputs from a user to select one of a plurality of preferences for the beverage thereto and for providing the selected one of the plurality of preferences to the controller in signal communication therewith.