

MIXING NOZZLE

Field of the invention

5 The present disclosure generally relates to beverage dispensing devices. More specifically, the present disclosure relates to mixing nozzle fitments for dispensing beverages.

Background of the invention

10 There are a variety of beverage dispensers currently on the market. Some beverage dispensers operate by dispensing a hot or cold ready-to-drink fluid directly into a container such as a cup. Other beverage dispensers operate by dispensing a powdered or liquid concentrate along with a separate diluent through a beverage dispensing nozzle and into a container or cup to form the drink.

15 The present invention relates to post-mix dispensers in which a liquid concentrate is stored and is automatically combined at the time of dispensing with a diluent such as water. The combination is usually operated in a mixing chamber in which the concentrate and the diluent emerge. The relative flows of the concentrate and diluent can be controlled to maximize the qualities of the beverage such as mixing and foam production. This mixing chamber can be a mixing tee fitment such as described in WO 2010115888. This mixing tee fitment cooperates with the end of a flexible tube attached to a concentrate container. The concentrate can be
20 pumped through the flexible tube by peristaltic pump as well known in the state of the art. In the mixing tee fitment a flow of water mixes with a dose of concentrate. It has been observed that for concentrates presenting high viscosity properties the mixing and dilution with water can be difficult. Then the beverage in the drinking cup may not be homogeneous.

25 Summary of the invention

According to a first aspect, the invention concerns a mixing nozzle for mixing a beverage concentrate and a diluent and dispensing the beverage mixture comprising :

- a mixing chamber comprising an input end with an inlet opening for the concentrate and a discharge opening at an output end thereof, said mixing chamber having an axial bore extending
30 from the input end to the discharge opening,
- a toroidal chamber around said mixing chamber having a diluent inlet conduit to introduce diluent in said toroidal chamber, said toroidal chamber presenting multiple openings in the internal lateral wall of the toroidal chamber for directing the diluent from said toroidal chamber concentrically about the axial bore,

wherein :

- the mixing chamber inlet opening is opened so that a flow of concentrate can freely be directed through the input end along the mixing chamber axial bore and collide with the diluent emerging from the multiple openings of the toroidal chamber, and

5 - the mixing chamber section surface narrows at its output end.

According to a second aspect the invention concerns a package assembly comprising a concentrate container, a flexible tube and a mixing nozzle.

According to a third aspect the invention concerns a method of making a beverage, the method comprising :

10 - providing a mixing nozzle such as described hereabove,
 - dispensing a flow of concentrate through the opened input end of the mixing chamber and a diluent through the diluent inlet conduit of the mixing chamber, the concentrate and the diluent being mixed and dispensed through the mixing chamber to form the beverage.

According to a fourth aspect the invention concerns a beverage preparation machine
 15 comprising :

- a source of concentrate, said source of concentrate comprising a container and a flexible tube, said tube being configured for dispensing the concentrate from the container,
 - a source of diluent,
 - a mixing nozzle such as described hereabove, wherein the mixing nozzle and the flexible tube
 20 of the source of concentrate are positioned one to the other so that the outlet end of the flexible tube is positioned just above the inlet opening of the mixing chamber of the mixing nozzle and is centred on the axis XX' of the axial bore of said mixing chamber.

The dependent claims further define the difference aspects of the invention.

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Brief description of the drawings

The characteristics and advantages of the invention will be better understood in relation to the following figures :

- Figures 1 and 2 are perspective views of a mixing nozzle according to the invention,
 30 - Figure 3 is a side view of the mixing nozzle of Figure 1,
 - Figure 4 is a longitudinal section view of the mixing nozzle of Figure 1,
 - Figure 5 is a schematic view of a beverage production machine comprising a mixing nozzle according to the invention.
 - Figure 6 is a magnified view of the mixing nozzle in Figure 5.

Detailed description of the drawings

Figures 1 to 4 illustrates a mixing nozzle 1 for mixing a concentrate and a diluent and dispensing the mixture according to the invention.

5 The mixing nozzle comprises a mixing chamber 2 which an input end 2a for the concentrate and a discharge opening 3 at an output end 2b thereof, said mixing chamber having an axial bore extending from the input end 2a to the discharge opening 3 according to an axis XX'. The input end presents an inlet opening 7 for introducing the concentrate. This inlet opening 7 is preferably sufficiently large to enable the introduction of a flow concentrate in free fall state
10 that is without contacting the edge of the opening.

The mixing nozzle 1 comprises a toroidal chamber 5 around the mixing chamber 2 having a diluent inlet conduit 4 to introduce diluent in the toroidal chamber. According to the preferred embodiment the diluent inlet conduit 4 is parallel to the axial bore of the mixing chamber that is the axis XX'. This toroidal chamber 5 presents multiple openings 6 in its internal lateral wall 5a
15 that is the wall separating the toroidal chamber from the mixing chamber 2. At their ends the multiple openings 6 emerge in the mixing chamber for directing the diluent from said toroidal chamber concentrically about the axial bore. Preferably the multiple outlets are equally positioned one from the other on the circumference of the toroidal chamber. Preferably the multiple outlets are all positioned in a same plan perpendicular to the axis XX' of the axial bore.
20 Preferably the multiple openings 6 in the internal lateral wall 5a of the toroidal chamber are inclined in direction of the output end 2b of the axial bore. This inclination of the openings 6 can also help in reducing splashing though the input end 2a of the axial bore. The inclination can present an angle of about 30° with horizontal. Preferably all the multiple outlets 5a present the same inclination.

25 As mentioned hereabove the mixing chamber input end 2a presents an inlet opening 7 so that a flow of concentrate can freely be directed though the inlet opening 7 along the mixing chamber axial bore and collide with the diluent emerging from the multiple openings of the toroidal chamber.

30 Preferably the section surface of the axial bore of the mixing chamber changes along the axis XX' and in particular said section surface narrows at the output end of the mixing chamber. The shape of the section along the axis XX' can also varies. It usually presents a substantially circular section. At the output end of the mixing chamber it is preferred that the section presents small indentations 3a. This shape enables to deliver the beverage mixture in a cup without splashing.

As illustrated it is preferred that the toroidal chamber 5 is positioned in the upper part of the mixing chamber. By upper part it is meant the half part of the mixing chamber that is close to the output end 2a.

Preferably the section surface of the axial bore 2 of the mixing chamber successively narrows and then expands between the input end 2a and the toroidal chamber multiple openings 6. Preferably the largest section of the axial bore is in the area of the multiple outlets 6. This shape can avoid that fluids splash out of the inlet opening when diluent and concentrate mix together. It also provides a larger section of the mixing chamber axial bore in the area so that diluent jets can efficiently mix with the flow of concentrate.

Referring to **Figure 5**, a beverage production machine 100 is represented that includes an area for receiving a bag-in-box container 9 containing a beverage concentrate and having a flexible tube 8 at its outlet. The machine also comprises a peristaltic pump 10 that engages the flexible tube 8 in order to pump the concentrate from the bag-in-box. The machine comprises a supply of diluent 12, preferably water, in a tank 11 or a connection to tap water. The water supply is connected to a diluent pump 13 for pumping water in direction of the nozzle 1. The machine can also comprise a device for heating and/or cooling the diluent, preferably downstream to the pump. The mixing nozzle 1 of the invention is fixed to the machine by means of its diluent conduit 4 that is directly attached to the conduit 41 delivering pumped water from the pump outlet. The mixing nozzle and the water conduit can be attached together by any means for example a screw 42. The mixing nozzle 1 and the flexible tube 8 are positioned one to the other in the machine so that the outlet end 8a of the flexible tube is positioned just above the inlet opening 7 of the mixing chamber 2 and is centered on the axis XX' of the axial bore .

The machine 100 comprises a process control unit 14 that controls the activation of the diluent pump 13 and the peristaltic pump 10 when a beverage is ordered.

Figure 6 is a magnified view of the mixing nozzle when a beverage is prepared. The flexible tube 8 delivers a flow 71 of concentrate through the mixing chamber opening 7. This concentrate flows is centered on the axis XX'. Simultaneously multiple flows of diluent 61 are ejected from the multiple outlets in direction of the flow of concentrate. Consequently concentrate and diluent mixes in the air in the middle of the bore of the mixing chamber 2. Beverage 31 prepared from the mixture is dispensed from the mixing chamber discharge opening 3 inside a cup 15.

Preferably the controller 14 is provided to rinse with water the mixing nozzle 1 at the end of the beverage preparation.

According to a particular aspect of the invention the invention the mixing nozzle can be

made disposable.

According to another particular aspect of the invention, the bag-in-box, the flexible tube and the mixing nozzle can form an assembly that can cooperate with the peristaltic pump and the diluent conduit 41 when placed inside a beverage preparation machine. Such an assembly

5 presents the advantage of being disposable.

CLAIMS

1. Mixing nozzle for mixing a beverage concentrate and a diluent and dispensing the beverage mixture comprising :

5 - a mixing chamber comprising an input end with an inlet opening for the concentrate and a discharge opening at an output end thereof, said mixing chamber having an axial bore extending from the input end to the discharge opening,

- a toroidal chamber around said mixing chamber having a diluent inlet conduit to introduce diluent in said toroidal chamber, said toroidal chamber presenting multiple openings in the
10 internal lateral wall of the toroidal chamber for directing the diluent from said toroidal chamber concentrically about the axial bore,

wherein :

- the mixing chamber inlet opening is opened so that a flow of concentrate can freely be directed
15 through the input end along the mixing chamber axial bore and collide with the diluent emerging

from the multiple openings of the toroidal chamber, and

- the mixing chamber section surface narrows at its output end.

2. Mixing nozzle according to Claim 1 wherein the input end of the diluent inlet conduit is parallel to the axial bore of the mixing chamber.

3. Mixing nozzle according to Claim 1 or 2 wherein the toroidal chamber is positioned in the upper part of the mixing chamber.

4. Mixing nozzle according to any one of the precedent claims wherein the mixing
25 chamber section successively narrows and then expands between the opened input end and the toroidal chamber multiple openings.

5. Mixing nozzle according to any one of the precedent claims wherein the multiple openings in the internal lateral wall of the toroidal chamber are inclined in direction of the output
30 end of the axial bore.

6. Package assembly comprising a concentrate container, a flexible tube and a mixing nozzle according to any one of Claims 1 to 5.

7. Package assembly according to the precedent claim wherein the flexible tube is positioned relatively to the mixing nozzle so that the outlet end of the flexible tube is positioned at the inlet opening of the mixing chamber and is centred on the axis XX' of the axial bore.

5 8. Method of making a beverage, the method comprising :

- providing a mixing nozzle according to any one of Claims 1 to 5,
- dispensing a flow of concentrate through the opened input end of the mixing chamber and a diluent through the diluent inlet conduit of the mixing chamber, the concentrate and the diluent being mixed and dispensed through the mixing chamber to form the beverage.

10 9. Method according the precedent claim wherein the flow of concentrate is dispensed through the opened input end of the mixing chamber in a state of free fall along the mixing chamber axial bore.

15 10. Method according Claim 8 or 9 wherein the diluent is introduced with a flow configured for creating jets of diluent emerging out of the toroidal chamber multiple openings, said jets being able to hit the flow of concentrate flowing through the opened input end of the mixing chamber.

20 11. Method according to any one of Claims 8 to 10 wherein the concentrate is stored in a bag-in-box container having a flexible tube connected to a container outlet and pumped by a peristaltic pump cooperating with the flexible tube.

25 12. Method according the precedent claim, wherein the output end of the flexible tube emerges above the opened input end of the mixing chamber so that a flow of concentrate freely flows in the mixing chamber.

30 13. Method according to any one of claims 8 to 12, wherein the diluent is water and the concentrate presents a viscosity of at least ...

14. Beverage preparation machine comprising :

- a source of concentrate, said source of concentrate comprising a container and a flexible tube, said tube being configured for dispensing the concentrate from the container,
- a source of diluent,

- a mixing nozzle according to any one of Claims 1 to 5, wherein the mixing nozzle and the flexible tube of the source of concentrate are positioned one to the other so that the outlet end of the flexible tube is positioned just above the inlet opening of the mixing chamber of the mixing nozzle and is centred on the axis XX' of the axial bore of said mixing chamber.