

# US Patent & Trademark Office

## Patent Public Search | Text View

United States Patent Application Publication

20250255430

Kind Code

A1

Publication Date

August 14, 2025

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### CENTRIFUGAL BEVERAGE CHAMBER WITH CLOSURE FASTENER

#### Abstract

A machine (1) is configured for preparing a beverage (4) from a flavouring ingredient (5a) in a processing cavity (5) by mixing it with water (4') and centrifuging them about a processing axis (30'). The machine (1) has an ingredient handling system (10, 20) with at least one beverage outlet (25) and at least one water inlet (24). The system (10, 20) has a first ingredient handler (10) and a second ingredient handler (20) that are movable one relative to the other from an ingredient transfer configuration to an ingredient processing configuration. The machine has: a handler actuator (41) configured to relatively move the first and second capsule handlers (10, 20) between the transfer and the processing configurations; and at least one fastener (41') movable selectively into a fastening position to fasten together the first and second capsule handlers (10, 20) in the processing configuration and into an unfastening position. The fastener (41') is actuated by the handler actuator (41) into the fastening position and/or into the unfastening position.

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**Family ID:** 1000008605184

**Appl. No.:** 18/856406

**Filed (or PCT  
Filed):** April 13, 2023

**PCT No.:** PCT/EP2023/059650

#### Foreign Application Priority Data

EP 22168290.9 Apr. 14, 2022

## Publication Classification

**Int. Cl.:** A47J31/40 (20060101); A47J31/36 (20060101); A47J31/44 (20060101); A47J31/46 (20060101)

**U.S. Cl.:**

**CPC** A47J31/407 (20130101); A47J31/3628 (20130101); A47J31/3633 (20130101); A47J31/3638 (20130101); A47J31/405 (20130101); A47J31/4403 (20130101); A47J31/461 (20180801);

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## Background/Summary

### FIELD OF THE INVENTION

[0001] The field of the invention pertains to beverage preparation machines by centrifuging capsules containing an ingredient of the beverage to be prepared.

[0002] For the purpose of the present description, a “beverage” is meant to include any human-consumable liquid substance, such as coffee, tea, hot or cold chocolate, milk, soup, baby food, etc. . . . A “capsule” is meant to include any container such as a packaging for containing a pre-portioned beverage ingredient, e.g. a flavouring ingredient, the packaging forming an enclosure of any material, in particular an airtight or pervious material, porous or non-porous material, e.g. plastic, aluminium, recyclable and/or biodegradable packagings, and of any shape and structure, including soft pods or rigid cartridges for containing the ingredient.

### BACKGROUND ART

[0003] Certain beverage preparation machines use capsules containing ingredients to be extracted or to be dissolved and/or ingredients that are stored and dosed automatically in the machine or else are added at the time of preparation of the drink. Some beverage machines possess filling means that include a pump for liquid, usually water, which pumps the liquid from a source of water that is cold or indeed heated through heating means, e.g. a thermoblock or the like.

[0004] Especially in the field of coffee preparation, machines have been widely developed in which a capsule containing beverage ingredients is inserted in a brewing device. The brewing device is tightly closed about the capsule, water is injected at the first face of the capsule, the beverage is produced in the closed volume of the capsule and a brewed beverage can be drained from a second face of the capsule and collected into a receptacle such as a cup or glass.

[0005] Brewing devices have been developed to facilitate insertion of a “fresh” capsule and removal of the capsule upon use. Examples of such brewing devices are disclosed in EP 1 767 129, WO 2009/043630, WO 2005/004683 and WO 2007/135136. It is known to secure brewing chambers using a hook system, as for example disclosed in WO 2006/005755 and WO 2006/005756.

[0006] The opening of capsules using a capsule opener is for example known from EP 0 512 470, EP 2 068 684, WO 02/00073, WO 02/35977, U.S. Pat. Nos. 3,260,190, 5,649,472, CH 605 293, EP 512 468, EP 242 556, WO 2014/076041, WO 2015/022342, WO 2015/022344, WO 2015/022345 and WO 2015/144356.

[0007] The preparation of a beverage by using centrifugation is also known. Examples of centrifugation processes and corresponding devices are disclosed in WO 2008/148601, WO2008/148650, U.S. Pat. No. 5,566,605, WO 2013/007776, WO 2013/007779 and WO 2013/007780.

[0008] It has also been proposed to facilitate the handling of capsules by systems for extracting

them, in particular by motorizing the opening and/or closure of the extraction system for inserting and/or removing a capsule. Examples of such systems are for example disclosed in EP 1 767 129, WO 2009/113035, WO 2012/025258, WO 2012/025259, WO 2012/041605, WO 2013/127476, WO 2014/096122, WO 2014/096123 and EP2015185946.9.

[0009] The preparation of a beverage by using centrifugation is also known. Such beverage preparation includes: providing a beverage (flavoring) ingredient, e.g. as powder and/or leaves, in a capsule; circulating liquid into the capsule and rotating the capsule at sufficient speed to ensure interaction of the liquid with the ingredient while creating a gradient of pressure of liquid in the capsule. Such pressure increases gradually from the centre towards the periphery of the capsule. As liquid traverses the ingredient, e.g. coffee bed, extraction of the ingredient, e.g. coffee compounds, takes place and a liquid extract is obtained that flows out at the periphery of the capsule. Examples of such systems are disclosed in WO 2008/148601, WO 2013/007776, WO 2013/007779, WO 2013/007780, WO 2017/046294, WO 2017/068134 and WO 2017/202746. WO 2021/122502 discloses a centrifugal beverage machine with a rotatable valve arrangement for controlling a flow of water towards a centrifugal beverage mixing chamber. The capsule can be secured between facing capsule handlers that are secured by a fastening device, e. g. as disclosed in WO 2012/007293, WO 2013/007776, WO 2013/007779, WO 2013/007780 and WO 2014/102048.

[0010] WO 2008/148646 WO and 2008/148650 describe a beverage preparation device wherein a flow restriction is created downstream of the receptacle, in particular a capsule, for example, by a valve which opens or enlarges under the pressure created by the centrifuged liquid leaving the receptacle. The higher the rotational speed, the more the valve opens or enlarges. The valve can be formed by a mobile restriction part of the device which is elastically urged against a rim portion of the capsule. In WO 2017/068134 the centrifugal brewing chamber is fitted with an outlet valve that can be controlled by an inertia body of the machine rotating with the centrifugal brewing chamber. The valve leads into a collector forming a crema chamber in which the beverage upon undergoing a pressure drop at the valve is refined for dispensing into a user-recipient, e.g. a cup or a mug. Such collection chamber is typically arranged around the centrifugal brewing chamber, as for example disclosed in WO 2020/201469.

[0011] It has been proposed to prepare beverages by centrifugation along a horizontal axis.

[0012] WO 2015/173123 and WO 2015/173124 disclose a centrifugal brewing chamber formed between two enclosing parts that are relatively translatable between an open position and a closed position. The enclosing parts cooperate with a pair of jaws that are movable between a capsule holding position to hold a capsule between the enclosing parts in the open position and a capsule release position to release the capsule. The jaws are actuated by a first actuator and a second actuator that are activated by the enclosing parts during their the relative translation. The jaws guide a capsule into a position between the enclosing parts in the open position and immobilize the capsule thereinbetween. Then, when the enclosing parts are translated together to enclose the capsule, the jaws release the capsule so that the brewing chamber is formed about the capsule. The enclosing parts are rotated about a horizontal axis to centrifuge the capsule for preparing the beverage with the ingredient in the capsule. At the end of beverage preparation, centrifugation stops the parts and enclosing are relatively translated to the open position whereby the used capsule is allowed to drop from the enclosing parts. Then the jaws are brought back into their capsule holding position. Further centrifugal machines are disclosed in EP2021201687.7, EP2021202356.8, EP2021216919.7, EP2021216927.0, EP2021216930.4, EP 21216965.0, EP2021216970.0 and EP2021216976.7

## SUMMARY OF THE INVENTION

[0013] The invention relates to a machine for preparing a beverage from at least one ingredient. Normally such beverage is then dispensed to a user, e.g. to a user-cup or user-mug.

[0014] For instance, the machine is a coffee, tea, chocolate, cacao, milk or soup preparation machine. For example, the machine is arranged for preparing within a beverage processing module

that includes an ingredient holder, a beverage by passing hot or cold water or another liquid through the ingredient held in the holder, such as a flavouring ingredient, of the beverage to be prepared, such as ground coffee or tea or chocolate or cacao or milk powder.

[0015] Such beverage preparation typically includes the mixing of a plurality of beverage ingredients, e.g. water and milk powder, and/or the infusion of a beverage ingredient, such as an infusion of ground coffee or tea with water. One or more of such ingredients may be supplied in loose and/or agglomerate powder form and/or in liquid form, in particular in a concentrate form. A carrier or diluent liquid, e.g. water, may be mixed with such ingredient to form the beverage. Typically, a predetermined amount of beverage is formed and dispensed on user-request, which corresponds to a portion (e.g. a serving). The volume of such a serving may be in the range of 15 to 1000 ml such as 25 to 600 ml for instance 40 to 250 ml, e.g. the volume for filling a cup or mug, depending on the type of beverage. Formed and dispensed beverages may be selected from ristrettos, espressos, lungos, cappuccinos, café latte, americano coffees, teas, etc. . . . For example, a coffee machine may be configured for dispensing espressos, e.g. an adjustable volume of 20 to 60 ml per serving, and/or for dispensing lungos, e.g. a volume in the range of 70 to 200 ml per serving, and/or for dispensing americanos, e.g. a volume in the range of 150 to 750 ml.

[0016] An aspect of the invention relates to a machine for preparing a beverage from a flavouring ingredient in a processing cavity. Such a cavity may be configured for holding the ingredient supplied within a capsule. The beverage is prepared by mixing the ingredient with water and centrifugally driving such ingredient and water about a processing axis.

[0017] The centrifugation process for preparing a beverage is known for example from EP 2 000 062, EP 2 155 020, EP 2 152 128, WO 2008/148646, WO 2009/106175, WO 2009/106589, WO 2010/026045, WO 2010/026053, WO 2010/066736, WO 2008/148650, WO 2008/148834, WO 2010/066705, WO 2010/063644, WO 2011/023711, WO 2014/096122 or WO 2014/096123.

[0018] Typically, the machine includes one or more of the following components: [0019] a) a fluid system in fluid communication with the flavouring ingredient during beverage preparation; [0020] b) a thermal conditioner, such as in-line heater and/or cooler, for thermally conditioning a flow of liquid circulated to the flavouring ingredient or a batch thermal conditioner for circulating thermally conditioned liquid from the batch conditioner to the flavouring ingredient; [0021] c) a liquid driver, such as a pump, for driving liquid to the flavouring ingredient, in particular a low pressure pump e.g. within the range of 1 to 5 bar, such as 1.5 to 3 bar; [0022] d) a motor for driving the flavouring ingredient in rotation during beverage preparation; [0023] e) an electric control unit, in particular comprising a printed circuit board (PCB), for receiving instructions from a user via an input user-interface and for controlling the thermal conditioner, liquid driver and motor(s); and [0024] f) one or more sensors for sensing at least one characteristic selected from characteristics of fluid system, the thermal conditioner, the liquid driver, a liquid tank, an ingredient collector, a flow of the liquid (e.g. by a flowmeter), a pressure of the liquid and a temperature of the liquid, and for communicating such characteristic(s) to the control unit.

[0025] The abovementioned capsule may have a body containing the ingredient and a peripherally projecting flange, e.g. a body in the shape of a cup and a lid covering the mouth of the cup and extending beyond the mouth to form the peripherally projecting flange.

[0026] The capsule may have a body that is symmetric asymmetric, conical or frusto-conical or cylindrical or spherical or hemispherical or frusto-spherical, containing the ingredient, e.g. ground coffee, tea or cacao or another beverage ingredient.

[0027] The capsule may be of the type described above under the header “field of the invention”. The capsule may be a capsule that has a container-body, e.g. a generally cup-shaped or hemispherical or hemi-ellipsoidal body, having a flange to which a cover lid (or membrane) is attached, in particular sealed. Typically the capsule contains a beverage ingredient. Examples of suitable capsules are disclosed in WO 2008/148601, WO 2008/148604, WO 2008/148646, WO 2008/148650, WO 2008/148656, WO 2008/148834, WO 2011/141532, WO 2011/141535, WO

2013/072239, WO 2013/072297, WO 2013/072326, WO 2015/044400. The capsule may be of the variety commercialised by Nespresso under the brand Vertuo.

[0028] The machine has a rotatable ingredient handling system for holding and rotating about the processing axis the flavouring ingredient, e.g. contained within the abovementioned capsule, and water during centrifugation. The ingredient handling system has at least one beverage outlet and at least one water inlet for supplying the water to the flavouring ingredient, e.g. within the abovementioned capsule.

[0029] The handling system includes a first ingredient handler and a second ingredient handler that are movable one relative to the other from: [0030] an ingredient transfer configuration for receiving the flavouring ingredient by the first and second capsule handlers and/or releasing such ingredient from the first and second ingredient handlers; to [0031] an ingredient processing configuration for centrifuging the flavouring ingredient and the water by rotation about the processing axis; [0032] and vice versa.

[0033] Upon processing, the ingredient, e.g. contained in a capsule, may be collected in an ingredient (or ingredient capsule) collector downstream the handling system, as for example disclosed in WO 2009/074559 or WO 2009/135869.

[0034] The machine has a handler actuator, such as a motor or a user-handle, configured to relatively move the first and second capsule handlers between the transfer and the processing configurations, e.g. via a knee lever.

[0035] The machine includes at least one fastener movable selectively into a fastening position to fasten together the first and second capsule handlers in the processing configuration and into an unfastening position in which the first and second capsule handlers are movable from the processing configuration to the transfer configuration and/or vice versa.

[0036] The machine has a machine frame and/or housing which is stationary when the ingredient handling system is rotated for centrifugation and which supports the ingredient handling system. For example, the first and second handlers are mounted in rotation on the frame and/or housing via one or more bearings, such as ball bearings.

[0037] The fastener is actuated by the handler actuator into the fastening position and/or into the unfastening position.

[0038] For example, the fastener is biased into the fastening position or into the unfastening position e.g. by an elastic member, e.g. in the shape of an elongated arm.

[0039] The handler actuator can be angularly stationary relative to the frame and/or housing about the processing axis when the ingredient handling system is rotated for centrifugation.

[0040] The fastener may be angularly stationary relative to the first ingredient handler and/or second ingredient handler about the processing axis, e.g. when the ingredient handling system is rotated for centrifugation.

[0041] Providing one or more fasteners operated by such an actuator instead of using the actuator itself to maintain a closure force between the first and second ingredient handlers, typically by clamping the handlers together, may be used to avoid and/or reduce mechanical over-constraint situations on bearings, e.g. ball bearings, used to position the first and second handlers and/or may allow a reduction of the number of such bearings. Also the powering of the actuator, e.g. motor, driving the first and second handlers in rotation for centrifugation, may be reduced or the actuator itself may be downsized, as less adverse constraints to be overcome are likely to be generated.

[0042] The machine may include a fastener lock configured to lock the fastener in the fastening position and to unlock the fastener such that the fastener moves and/or is movable into the unfastening position. The fastener lock may be angularly stationary relative to the fastener about the processing axis, e.g. when the ingredient handling system is rotated for centrifugation.

[0043] The handler actuator can be configured to drive the fastener lock from: [0044] a fastener unlocking position into a fastener locking position once the first and second capsule handlers have been relatively moved by the handler actuator into the processing configuration; and/or [0045] a

fastener locking position into a fastener unlocking position before the first and second capsule handlers are relatively moved by the handler actuator out of the processing configuration towards the transfer configuration.

[0046] The handler actuator can be configured to drive the fastener lock via a transmission that is angularly stationary relative to the frame and/or housing when the ingredient handling system is rotated for centrifugation. The transmission may be movable in translation to drive the fastener lock between its fastener unlocking position and its fastener locking position. For example, the transmission is movable in parallel to the processing axis.

[0047] The fastener can be integral with or mounted on one of the first and second capsule handlers and can cooperate with a fastener receiver that is integral with or mounted on the other of the first and second capsule handlers. The fastener may have a substantial hook shape and the fastener receiver may have a substantial hook cooperation shape.

[0048] The machine may include a plurality of fasteners distributed around the processing axis, e.g. peripherally about at least one of the first and second capsule handlers. The fasteners can be integral with or fixed to or assembled to a base.

[0049] The base may extend peripherally at least partly around one of the first and second capsule handlers.

[0050] The base can be connected to the fasteners by at least one corresponding elastic member. For example, each fastener is connected to the base by a corresponding elastic member whereby each elastic member connects to the base one, two or at most three fasteners.

[0051] The handler actuator can be configured to relatively move the first and second capsule handlers and/or actuate the fastener, when present via the abovementioned transmission, via a connection including at least one of: a gear connection, a lever connection, a cam follower and cam connection, and a magnetic connection.

[0052] The machine frame and/or housing may delimit an ingredient supply passage configured to allow supply by gravity of the ingredient towards the rotatable ingredient handling system and a waste evacuation passage configured to allow an evacuation by gravity of waste, e.g. used ingredient, from the rotatable ingredient handling system. The passage may be configured to allow a passage of the capsule when the cavity is configured for holding the ingredient supplied within the abovementioned capsule.

[0053] The supply passage can be provided with a guide for guiding the capsule when supplied. For example, the guide forms a recess and/or a rail. The guide can be configured to cooperate with a complementary capsule shape such as a capsule flange.

[0054] The guide may be associated with a stop configured to immobilize the capsule guided by the guide at a level between the first and second ingredient handlers, e.g. at the processing axis. For example, the stop is fixed to or integral with the guide. The guide or a portion thereof can be mounted movably and away towards from the processing axis, such as movably mounted on an elastic arm between: [0055] a holding position for immobilizing the capsule at a level between the first and second ingredient handlers, e.g. at the processing axis; and [0056] a release position for releasing the capsule from such level.

[0057] The machine may have a beverage passage, e.g. a beverage conduit, in fluid communication with the beverage outlet, the passage being configured to guide the beverage from the outlet towards a beverage dispensing outlet. For example, the passage is associated with a valve, such as a centrifugal and/or electric valve, for controlling the flow and/or the pressure of the beverage along the beverage passage.

[0058] The machine may include a beverage conditioner delimiting a conditioning cavity, e.g. between two surfaces that are movable relatively to one another e.g. rotatably movable, the conditioning cavity being fluidically connected with the beverage passage. The conditioning cavity may be configured to refine the beverage supplied from the beverage outlet via the beverage passage.

[0059] For instance, the valve is fluidically located between the beverage outlet and the conditioning cavity.

[0060] The conditioning cavity may include at least one surface, such as an inner surface, that is driven with the ingredient handling system when rotated for centrifugation. Such at least one surface is for example driven in rotation about the processing axis.

[0061] For instance, when the beverage supplied from the outlet includes a gas (e.g. air), the beverage conditioner may be configured to refine the mixing, e.g. dispersion, of the gas in the beverage, e.g. to improve the quality of a beverage-gas emulsification. When the beverage is coffee, then the conditioner may be configured to refine the coffee crema.

[0062] Typically the beverage conditioner leads to a downstream beverage dispenser configured to dispense the beverage to a user receptacle, e.g. a cup or mug.

[0063] The frame and/or housing may include or be fixed to a bottom configured to rest on a support surface external to such machine when the ingredient handling system is rotated about the processing axis for centrifugation, e.g. an external support surface formed by a table top. The processing axis can be at an angle relative to such bottom in the range of 0° to 60°, for instance of 0° to 45°, such as of 0° to 30°, e.g. of 0° to 15°, typically of substantially 0°.

[0064] The frame and/or housing can support a motor that is connected to the ingredient handling system, for instance connected directly or via a transmission, such as at least one of belts e.g. toothed belts, gears e.g. spur gears, and connecting rods.

[0065] One or more of the beverage outlet(s) and the water inlet(s) can be associated with one or more capsule openers, such as capsule piercers.

[0066] An opener may have a narrowed cross-section to increase the opening between the capsule and the opener upon opening.

[0067] An openers may be bent to increase the opening between the capsule and the opener upon opening.

[0068] For example, an opener may be bent about a bending axis that is radial relative to the processing axis or a bending axis that is tangential about processing axis.

[0069] The processing cavity may have a plurality of beverage outlets peripherally arranged at the processing cavity about the central processing axis and/or having the water inlet located at the processing cavity on or adjacent to the processing axis.

[0070] The invention also relates to a system including a machine as described above and the abovementioned capsule containing the flavouring ingredient.

[0071] A further aspect of the invention relates to a method of preparing in the above described machine the beverage from the flavouring ingredient supplied within the capsule into the machine.

The method includes the steps of: [0072] holding the capsule between the first and second ingredient handlers in the transfer configuration; [0073] relatively moving the first and second ingredient handlers with the capsule into the ingredient processing configuration by actuation by the handler actuator; [0074] moving at least one fastener into the fastening position to fasten together the first and second capsule handlers with the capsule in the processing configuration by actuation by the handler actuator; [0075] feeding the water via the water inlet into the capsule in the processing cavity and centrifuging the flavouring ingredient with the water and forming the beverage; [0076] releasing the beverage from the capsule via the beverage passage;

[0077] moving at least one fastener into the unfastening position by actuation by the handler actuator; and [0078] relatively moving by actuation by the handler actuator the first and second ingredient handlers with the capsule from the ingredient processing configuration to the ingredient transfer configuration and releasing the capsule from the first and second handlers.

[0079] Another aspect of the invention relates to a use of a capsule as the capsule for: [0080] being handled by a machine as described above; [0081] implementing the system as described above; or [0082] carrying out the method as described above.

[0083] For this use, the capsule: [0084] is held between the first and second ingredient handlers in

the transfer configuration; [0085] is brought with the first and second ingredient handlers into the ingredient processing configuration by relatively moving the handlers into the ingredient processing configuration by actuation by the handler actuator; [0086] is fastened with the first and second capsule handlers in the processing configuration by moving the fastener(s) into the fastening position by actuation by the handler actuator; [0087] is supplied with water by feeding via the water inlet into the capsule in the processing cavity, the flavouring ingredient with the water being centrifuged and forming the beverage; [0088] releases the beverage via the beverage passage; [0089] is unfastened with the first and second capsule handlers by moving the fastener(s) into the unfastening position by actuation by the handler actuator; and [0090] is released from the first and second handlers by relatively moving the first and second ingredient handlers from the ingredient processing configuration to the ingredient transfer configuration by actuation by the handler actuator.

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## Description

### BRIEF DESCRIPTION OF THE DRAWINGS

[0091] The invention will now be described with reference to the schematic drawings, wherein:  
[0092] FIG. 1 is a cross-sectional side view of part of a machine that has a rotatable ingredient handling system and at least one fastener according to an embodiment of the invention;  
[0093] FIG. 2 is a cross-sectional side view of part of the handling system of the machine of FIG. 1, the handling system being in the ingredient transfer configuration;  
[0094] FIG. 3 is a cross-sectional side view of part of the handling system of the machine of FIG. 1, the handling system being in the ingredient processing configuration without any ingredient capsule;  
[0095] FIG. 4 is a cross-sectional side view of the handling system of the machine of FIG. 1, the handling system being in the ingredient processing configuration with an ingredient capsule;  
[0096] FIG. 5 is a perspective view of fasteners of the machine of FIG. 1;  
[0097] FIG. 6 is a cross-sectional view from above of the handling system of the machine of FIG. 1, the handling system being in the ingredient transfer configuration;  
[0098] FIG. 7 is a cross-sectional view from above of the handling system of the machine of FIG. 1, the handling system being in the ingredient processing configuration without any ingredient capsule;  
[0099] FIG. 8 is a cross-sectional side view of the of part of the machine of FIG. 1, the handling system being in the ingredient processing configuration and holding a capsule, the machine having a beverage conditioner and a thermal conditioner;  
[0100] FIG. 9 is a perspective view of an ingredient handler fitted with beverage outlets and corresponding capsule openers as well as a water inlet with corresponding capsule openers, the capsule openers of the beverage outlets being bent towards the processing axis to provide openings increased in size in the capsule at the level of the openers;  
[0101] FIG. 10 is a perspective view of several capsule openers (alternative to the ones shown in FIG. 9) to be associated with one or more beverage outlets, the capsule openers being bent tangentially about the processing axis to provide openings increased in size in the capsule at the level of the openers;  
[0102] FIG. 11 is a perspective view of several capsule openers (alternative to the ones shown in FIG. 9) associated with a water inlet, the capsule openers having a radially narrowed cross-section at a level of a capsule upon opening of the capsule to provide openings increased in size in the capsule at the level of the openers; and  
[0103] FIG. 12 is a perspective view of several capsule openers (alternative to the ones shown in FIGS. 9 and 11) associated with a water inlet, the capsule openers having a tangentially narrowed



cross-section at a level of a capsule upon opening of the capsule to provide openings increased in size in the capsule at the level of the openers.

#### DETAILED DESCRIPTION

[0104] FIGS. **1** to **12** illustrate an exemplary embodiment of part of a machine **1** in accordance with the invention as well as components and variations thereof.

[0105] Machine **1** is configured for preparing a beverage **4** from a flavouring ingredient **5a** in a processing cavity **5**. Cavity **5** may be arranged for holding ingredient **5a** supplied within a capsule **5b**. Ingredient **5a** is mixed with water **4'** and centrifugally driven with water **4'** about a processing axis **30'** to form beverage **4**.

[0106] Machine **1** includes a rotatable ingredient handling system **10,20** for holding and rotating flavouring ingredient **5a** and water during centrifugation about processing axis **30'**. Ingredient handling system **10,20** has at least one beverage outlet **25** and at least one water inlet **24** for supplying water **4'** to ingredient **5a**, e.g. within capsule **5b**.

[0107] Water **4'** to be supplied into cavity **5** may be heated in a heater **5**, e.g. a thick film flow heater and/or a thermoblock flow heater and/or a water batch boiler. Heater **5** may be generally tubular and/or provided with a helicoidal channel for guiding water **4'**.

[0108] System **10,20** has a first ingredient handler **10** and a second ingredient handler **20** that are movable one relative to the other from: [0109] an ingredient transfer configuration for receiving ingredient **5a** by first and second capsule handlers **10,20** and/or releasing ingredient **5a** from first and second ingredient handlers **10,20**; to [0110] an ingredient processing configuration for centrifuging ingredient **5a** and water **4'** by rotation about the processing axis **30'**; [0111] and vice versa.

[0112] One handler may be moved away from or towards the other, or both handlers may be moved together or apart.

[0113] Machine **1** includes a handler actuator **41**, such as a motor or a user-handle, configured to relatively move first and second capsule handlers **10,20** between the transfer and the processing configurations.

[0114] Machine **1** has at least one fastener **41'** movable selectively into: [0115] a fastening position to fasten together first and second capsule handlers **10,20** in the processing configuration; and [0116] an unfastening position in which first and second capsule handlers **10,20** are movable from the processing configuration to the transfer configuration and/or vice versa.

[0117] Machine **1** includes a machine frame and/or housing **40** which is stationary when ingredient handling system **10,20** is rotated for centrifugation and which supports ingredient handling system **10,20**. First and second handlers **10, 20** may be mounted in rotation on frame and/or housing **40** via one or more bearings **19,29**, such as ball bearings.

[0118] When first and second handlers **10,20** are moved between the transfer and processing configurations, one handler **20** may be stationary and the other handler **10** may be movable in machine frame and/or housing **40**, or both handlers may be movable in the machine frame and/or housing.

[0119] Fastener **41'** is actuated by handler actuator **41** into the fastening position and/or into the unfastening position. Fastener **41'** can be biased into the fastening position or into the unfastening position, for instance by an elastic member **41''** e.g. an elongated arm.

[0120] Handler actuator **41** may be angularly stationary relative to frame and/or housing **40** about processing axis **30'** when ingredient handling system **10,20** is rotated for centrifugation.

[0121] Fastener **41'** can be angularly stationary relative to first ingredient handler **10** and/or second ingredient handler **20** about processing axis **30'**, e.g. when ingredient handling system **10,20** is rotated for centrifugation.

[0122] Machine **1** may include a fastener lock **41b** configured to lock fastener **41'** in the fastening position and to unlock fastener **41'** such that fastener **41'** moves and/or is movable into the unfastening position. For example, fastener lock **41b** is angularly stationary relative to fastener **41'**

about processing axis **30'**, e.g. when ingredient handling system **10,20** is rotated for centrifugation. [0123] Handler actuator **41** may be configured to drive fastener lock **41b** from: [0124] a fastener unlocking position into a fastener locking position once first and second capsule handlers **10,20** have been relatively moved by handler actuator **41** into the processing configuration; and/or [0125] a fastener locking position into a fastener unlocking position before first and second capsule handlers **10,20** are relatively moved by handler actuator **41** out of the processing configuration towards the transfer configuration.

[0126] Handler actuator **41** can be configured to drive fastener **41b** lock via a transmission **41a** that is angularly stationary relative to the frame and/or housing **40** about processing axis **30'** when ingredient handling system **10,20** is rotated for centrifugation. Transmission **41a** may be movable in translation to drive fastener lock **41b** between its fastener unlocking position and its fastener locking position. For example, transmission **41a** is movable in parallel to processing axis **30'**.

[0127] Fastener **41'** may be integral with or mounted on one of first and second capsule handlers **10,20** and cooperates with a fastener receiver **21** that is integral with or mounted on the other of first and second capsule handlers **10,20**. Fastener **41'** can have a substantial hook shape and fastener receiver **21** can have a substantial hook cooperation shape.

[0128] Machine **1** may include a plurality of fasteners **41'** distributed around processing axis **30'**, e.g. peripherally about at least one of first and second capsule handlers **10,20**. Fasteners **41'** may be integral with or fixed to or assembled to a base **41'''**.

[0129] Base **41'''** may extend peripherally at least partly around one of first and second capsule handlers **10,20**.

[0130] Base **41'''** may be connected to fasteners **41'** by at least one corresponding elastic member **41''**. For example fastener **41'** each is connected to base **41'''** by a corresponding elastic member **41''** whereby each elastic member **41''** connects to base **41'''** one, two or at most three fasteners **41'** to base **41'''**.

[0131] Handler actuator **41** can be configured to relatively move first and second capsule handlers **10,20** and/or actuate fastener **41'**, when present via transmission **41a**, via a connection comprising at least one of: a gear connection, a lever connection, a cam follower and cam connection, and a magnetic connection.

[0132] Machine frame and/or housing **40** may delimit an ingredient supply passage **60** configured to allow supply by gravity of ingredient **5a** towards rotatable ingredient handling system **10,20** and a waste evacuation passage **70** configured to allow an evacuation by gravity of waste, e.g. used ingredient, from rotatable ingredient handling system **10,20**. Such passages can be configured to allow a passage of capsule **5b** when cavity **5** is configured for holding ingredient **5a** supplied within a capsule **5b**.

[0133] Supply passage **60** can be provided with a guide **61,61a** for guiding capsule **5b** when supplied, such as a guide **61,61a** forming a recess and/or a rail, guide **61,61a** being configured to cooperate with a complementary capsule shape such as a capsule flange **5b'**, guide **61,61a** being associated with a stop **61b** configured to immobilize capsule **5b** guided by guide **61,61a** at a level between first and second ingredient handlers **10,20**, e.g. at processing axis **30'**. For example stop **61b** is fixed to or integral with guide **61,61a**.

[0134] The guide or a portion **61a** thereof may be mounted movably towards and away from processing axis **30'**, for example movably mounted on an elastic arm between a holding position for immobilizing capsule **5b** at a level between first and second ingredient handlers **10,20**, e.g. at processing axis **30'**, and a release position for releasing capsule **5b** from such level.

[0135] Machine **1** can have a beverage passage **26**, e.g. a beverage conduit, in fluid communication with beverage outlet **25**. Passage **26** may be configured to guide beverage **4** from outlet **25** towards a beverage dispensing outlet **54**. Passage **26** may be associated with a valve **30**, such as a centrifugal and/or electric valve, for controlling the flow and/or the pressure of beverage **4** along passage **26**.

[0136] Machine **1** can include a beverage conditioner **50** delimiting a conditioning cavity **51**, e.g. between two surfaces **52,53** that are movable relatively to one another e.g. rotatably movable, conditioning cavity **51** being fluidically connected with beverage passage **26**. Conditioning cavity **51** can be being configured to refine beverage **4** supplied from beverage outlet **25** via beverage passage **26**. Valve **30** can be fluidically located between beverage outlet **25** and conditioning cavity **51**.

[0137] Frame and/or housing **40** may include or be fixed to a bottom configured to rest on a support surface external to such machine **1** when ingredient handling system **10,20** is rotated about processing axis **30'** for centrifugation. External support surface may be formed by a table top. During centrifugation, processing axis **30'** can be at an angle relative to such bottom in the range of 0° to 60°, for instance of 0° to 45°, such as of 0° to 30°, e.g. of 0° to 15°, typically of substantially 0°.

[0138] Frame and/or housing **40** can support a motor **2** that is connected to ingredient handling system **10,20**, for instance connected directly or via a transmission **3** such as at least one of belts e.g. toothed belts, gears e.g. spur gears, and connecting rods.

[0139] One or more of beverage outlet(s) **25** and water inlet(s) **24** may be associated with one or more capsule openers **24',25'**, such as capsule piercers **24',25'**.

[0140] Openers **24'** may have a narrowed cross-section **24a',24b'** (e.g. FIGS. **11** and **12**) to increase the opening between capsule **5b** and openers **24'** upon opening.

[0141] Openers **25'** may be bent to increase the opening between capsule **5b** and openers **25'** upon opening.

[0142] For example, an opener **25'** may be bent about an axis **25b'** that is radial relative to processing axis **30'** (e.g. FIG. **10**) or an axis **25a'** that is tangential about processing axis (e.g. FIG. **9**).

[0143] Processing cavity **5** can have a plurality of beverage outlets **25** peripherally arranged at processing cavity **5** about central processing axis **30'** and/or have water inlet **24** located at processing cavity **5** on or adjacent to processing axis **30'**.

[0144] During operation, beverage **4** can be prepared from flavouring ingredient **5a** supplied within capsule **5b** into machine **1**. The beverage preparation method can include: [0145] holding capsule **5b** between first and second ingredient handlers **10,20** in the transfer configuration; [0146] relatively moving first and second ingredient handlers **10,20** with capsule **5b** into ingredient processing configuration by actuation by handler actuator **41**; [0147] moving at least one fastener **41'** into the fastening position to fasten together first and second capsule handlers **10,20** with capsule **5b** in the processing configuration by actuation by handler actuator **41**; [0148] feeding water **4'** via water inlet **24** into capsule **5b** in processing cavity **5** and centrifuging flavouring ingredient **5a** with water **4'** and forming beverage **4**; [0149] releasing beverage **4** from capsule **5b** via beverage passage **26**; [0150] moving at least one fastener **41'** into the unfastening position by actuation by handler actuator **41**; and [0151] relatively moving by actuation by handler actuator **41** first and second ingredient handlers **10,20** with capsule **5b** from the ingredient processing configuration to the ingredient transfer configuration and releasing capsule **5b** from first and second handlers **10,20**.

## Claims

**1.** A machine for preparing a beverage from a flavouring ingredient in a processing cavity by mixing said ingredient with water and centrifugally driving such ingredient and said water about a processing axis to form said beverage, such machine comprising: a rotatable ingredient handling system for holding and rotating said flavouring ingredient and water during centrifugation about the processing axis, the ingredient handling system having at least one beverage outlet and at least one water inlet for supplying said water to said ingredient, the system having a first ingredient

handler and a second ingredient handler that are movable one relative to the other from: an ingredient transfer configuration for receiving said ingredient by the first and second capsule handlers and/or releasing said ingredient from the first and second ingredient handlers; to an ingredient processing configuration for centrifuging said ingredient and water by rotation about the processing axis; and vice versa; a handler actuator configured to relatively move the first and second capsule handlers between the transfer and the processing configurations; at least one fastener movable selectively into a fastening position to fasten together the first and second capsule handlers in the processing configuration and into an unfastening position in which the first and second capsule handlers are movable from the processing configuration to the transfer configuration and/or vice versa; and a machine frame and/or housing which is stationary when the ingredient handling system is rotated for centrifugation and which supports the ingredient handling system the fastener is actuated by the handler actuator into the fastening position and/or into the unfastening position.

**2.** The machine of claim 1, which comprises a fastener lock configured to lock the fastener in the fastening position and to unlock the fastener.

**3.** The machine of claim 2, wherein the handler actuator is configured to drive the fastener lock from: a fastener unlocking position into a fastener locking position once the first and second capsule handlers have been relatively moved by the handler actuator into the processing configuration; and a fastener locking position into a fastener unlocking position before the first and second capsule handlers are relatively moved by the handler actuator out of the processing configuration towards the transfer configuration.

**4.** The machine of claim 1, wherein the handler actuator is configured to drive the fastener lock via a transmission that is angularly stationary relative to the frame and/or housing about the processing axis when the ingredient handling system is rotated for centrifugation.

**5.** The machine of claim 1, wherein the fastener is integral with or mounted on one of the first and second capsule handlers and cooperates with a fastener receiver that is integral with or mounted on the other of the first and second capsule handlers, the fastener having a substantial hook shape and the fastener receiver having a substantial hook cooperation shape.

**6.** The machine of claim 1, which comprises a plurality of fasteners distributed around the processing axis.

**7.** The machine of claim 1, wherein the handler actuator is configured to relatively move the first and second capsule handlers and/or actuate the fastener, when present via said transmission, via a connection comprising at least one of: a gear connection, a lever connection, a cam follower and cam connection, and a magnetic connection.

**8.** The machine of claim 1, wherein the machine frame and/or housing delimits an ingredient supply passage configured to allow supply by gravity of said ingredient towards the rotatable ingredient handling system and a waste evacuation passage configured to allow an evacuation by gravity of waste.

**9.** The machine of claim 8, wherein the supply passage is provided with a guide for guiding said capsule when supplied, such as a guide forming a recess and/or a rail, the guide being configured to cooperate with a complementary capsule shape such as a capsule flange, the guide being associated with a stop configured to immobilize said capsule guided by the guide at a level between the first and second ingredient handlers.

**10.** The machine of claim 1, which comprises a beverage passage, the passage being configured to guide said beverage from the outlet towards a beverage dispensing outlet.

**11.** The machine of claim 10, which comprises a beverage conditioner delimiting a conditioning cavity, the conditioning cavity being fluidically connected with the beverage passage, the conditioning cavity being configured to refine said beverage supplied from the beverage outlet via the beverage passage, the valve being for instance fluidically located between the beverage outlet and the conditioning cavity.

**12.** The machine of claim 1, wherein: the frame and/or housing comprises or is fixed to a bottom configured to rest on a support surface external to such machine when the ingredient handling system is rotated about the processing axis for centrifugation; and the frame and/or housing supporting a motor that is connected to the ingredient handling system; and one or more of the beverage outlet(s) and the water inlet(s) being associated with one or more capsule openers.

**13.** A system comprising a machine for preparing a beverage from a flavouring ingredient in a processing cavity by mixing said ingredient with water and centrifugally driving such ingredient and said water about a processing axis to form said beverage, such machine comprising: a rotatable ingredient handling system for holding and rotating said flavouring ingredient and water during centrifugation about the processing axis, the ingredient handling system having at least one beverage outlet and at least one water inlet for supplying said water to said ingredient, the system having a first ingredient handler and a second ingredient handler that are movable one relative to the other from: an ingredient transfer configuration for receiving said ingredient by the first and second capsule handlers and/or releasing said ingredient from the first and second ingredient handlers; to an ingredient processing configuration for centrifuging said ingredient and water by rotation about the processing axis; and vice versa; a handler actuator configured to relatively move the first and second capsule handlers between the transfer and the processing configurations; at least one fastener movable selectively into a fastening position to fasten together the first and second capsule handlers in the processing configuration and into an unfastening position in which the first and second capsule handlers are movable from the processing configuration to the transfer configuration and/or vice versa; and a machine frame and/or housing which is stationary when the ingredient handling system is rotated for centrifugation and which supports the ingredient handling system, the fastener is actuated by the handler actuator into the fastening position and/or into the unfastening position and said capsule containing said flavouring ingredient.

**14.** A method of preparing in a machine a beverage from a flavouring ingredient in a processing cavity by mixing said ingredient with water and centrifugally driving such ingredient and said water about a processing axis to form said beverage, such machine comprising: a rotatable ingredient handling system for holding and rotating said flavouring ingredient and water during centrifugation about the processing axis, the ingredient handling system having at least one beverage outlet and at least one water inlet for supplying said water to said ingredient, the system having a first ingredient handler and a second ingredient handler that are movable one relative to the other from: an ingredient transfer configuration for receiving said ingredient by the first and second capsule handlers and/or releasing said ingredient from the first and second ingredient handlers; to an ingredient processing configuration for centrifuging said ingredient and water by rotation about the processing axis; and vice versa; a handler actuator configured to relatively move the first and second capsule handlers between the transfer and the processing configurations; at least one fastener movable selectively into a fastening position to fasten together the first and second capsule handlers in the processing configuration and into an unfastening position in which the first and second capsule handlers are movable from the processing configuration to the transfer configuration and/or vice versa; and a machine frame and/or housing which is stationary when the ingredient handling system is rotated for centrifugation and which supports the ingredient handling system, the fastener is actuated by the handler actuator into the fastening position and/or into the unfastening position, said beverage from said flavouring ingredient supplied within said capsule into the machine, the method comprising: holding said capsule between the first and second ingredient handlers in the transfer configuration; relatively moving the first and second ingredient handlers with said capsule into the ingredient processing configuration by actuation by the handler actuator; moving said at least one fastener into the fastening position to fasten together the first and second capsule handlers with said capsule in the processing configuration by actuation by the handler actuator; feeding said water via the water inlet into said capsule in the processing cavity and centrifuging the flavouring ingredient with the water and forming said beverage; releasing the

beverage from said capsule via the beverage passage; moving said at least one fastener into the unfastening position by actuation by the handler actuator; and relatively moving by actuation by the handler actuator the first and second ingredient handlers with said capsule from the ingredient processing configuration to the ingredient transfer configuration and releasing said capsule from the first and second handlers.

**15.** (canceled)

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