

Beverage machine with height-adjustable device for
controlling distance between beverage recipient and
outlet

The present invention generally relates to the field
5 of beverage dispensing machines, in particular, machines
that can brew or extract coffee and coffee specialties
such as cappuccino and the like or tea.

There is trend to propose beverage machines that are
versatile enough to be able to deliver various coffee
10 beverages such as espresso type coffee or coffee
specialties such as cappuccino (coffee with a milk froth)
or latte (coffee with liquid milk). Typically, those
coffee beverages are received in beverage recipients,
e.g., cups or glasses, of variable volume. For instance,
15 an espresso coffee or ristretto is served in a small cup
of about 40 mL, whereas a cappuccino can be served in a
larger/taller cup or glass of from 110 mL to 250 mL. A
long black coffee cup can also be served in a 110-mL cup.
For cold coffee drinks, one also uses tall glasses.

20 The coffee beverages must also meet different quality
attributes which are important. For instance, an espresso
coffee must have a fine and stiff "crema" which is a
stable emulsion formed by the oily compounds during
extraction of the coffee product in the machine. The
25 extraction process can be finely controlled to provide
this crema, when the product is extracted from closed
capsules, such as in the processes described in EP 0512
470, EP 0604 615 or EP 0870 457.

With other coffee specialities, one may need to
30 distribute a milk froth on top of the beverage such as
with cappuccino-type beverages.

One problem is that due to the variable volumes of
recipients for receiving the varied coffee beverages, the

distance between the beverage outlet(s) and the recipient cannot be precisely guaranteed. In order for the machine to accommodate different recipients' sizes, the distance between the outlet and the recipient is usually too high.

5 A too high distance creates splashing issues.

Surprisingly, we have also noticed that this can also be detrimental to the quality of the "crema" or foam. For instance, if the distance between the coffee outlet and the recipient is too high, larger bubbles are formed in the coffee "crema". Larger bubbles induce a "crema" which is less stable and less stiff.

Therefore, there is a need for controlling and precisely adjusting the distance between the outlet and the recipient as a function of the recipient used in order to solve these hygiene and crema/foam quality problems.

There have been attempts for machines that have height-adjustable discharge outlets. For instance, in WO 2004/052159, the beverage outlet is borne by a height-adjustable slider. Therefore, A full beverage delivery block must be made moveable relative to stationary cups underneath. It is uneasy to make the beverage delivery moveable to an extent that encompasses a wide range of cup sizes. In particular, this complicates the construction of the machine when the machine comprises an extraction module for closed capsules because the module requires to be precisely closed about the capsule in a repetitive manner. The module must also be linked to a hot water line that needs to stand the repetitive height changes of the module.

Furthermore, there is no indication how precise the height adjustment can be controlled in WO 2004/052159, which is also a problem because only containers of

standardized shapes can so be used otherwise the quality of the beverage's foam cannot be guaranteed.

EP 0 585 607 relates to an espresso machine which comprises a support plate for the recipient that can be
5 adjusted in height. The plate is supported on an appliance base with a collecting tray arranged therebetween which receives the surplus liquid and is detachably connected with the collecting tray. First of all, the adjustment of the support plate is merely
10 mechanical and carried out by the user himself. Therefore, it cannot be controlled with all the precision and knowledge required. Secondly, the drip tray assembly raises hygienic problems because splashing is likely to occur on the support plate; and because the distance
15 between the support plate and the drip tray increases for short cups of coffee, the liquid projections and dripping may not be well collected in the drip tray and the service area is likely to require frequent cleaning.

Therefore, there is a need for a beverage machine
20 that can deliver a foamy beverage or beverage with "crema" with optimised foam/crema quality.

There is also a need for a beverage machine that can deliver beverages from various recipient sizes without splashing issues.

25 Therefore, an object of the invention lies in having a beverage machine with a height-adjustment mechanism, for the position of the beverage recipient relative to the beverage outlet, that can be precisely and automatically controlled and requires as less
30 intervention from the user as possible.

Another object of the invention lies in having a beverage machine that includes a recipient's height-

adjustment function to serve the aforementioned purposes and which in addition requires less cleaning.

According to a first aspect of the invention, the beverage machine for the preparation of beverages such as espresso coffee and coffee specialities comprises a height adjustment device comprising a movable support plate for adjusting the position of the recipient relative to at least one beverage outlet when resting on a support plate, wherein the support plate is mobile relative to the at least one beverage outlet and comprises a displacement mechanism for displacing the support plate relative to the said outlet.

The height adjustment device comprises:

motorized drive means for driving the displacement mechanism and,

control means for controlling the actuation of the drive means which are configured to control the distance between the said outlet and the recipient as a function of the size of the recipient being placed on the support plate.

According to one feature, the control means controls said distance as a function of at least one height related dimension of the recipient being placed on the support plate. As a result, the optimal distance can be determined at each beverage delivery cycle.

According to another feature, the control means comprises at least one sensor that detects the position of at least one part of the recipient being placed on the support plate and a control unit that stops the motorized drive means in response to the sensor's input to the control unit. For instance, the sensor can be advantageously positioned in a predetermined position

below the beverage outlet to detect the position of the upper edge of the recipient.

According to a second aspect, the invention is for a beverage machine for the preparation of beverages

5 comprising a frame, a beverage outlet adapted to deliver a beverage in a recipient placed in a support plate of a beverage service area, characterized in that it comprises a drip collecting means which is configured to be selectively placed above the beverage recipient and below
10 or around the said beverage outlet to collect liquid or froth when the machine is not delivering the beverage or when the recipient is removed from the beverage service area. The motorized drive means can comprise: a drive electrical motor and a continuous displacement
15 transmission system that is arranged to be driven by the electrical motor to move the support plate in a continuous manner.

This second aspect of the invention enables to provide a clean and lower cost solution for removing the
20 inconvenience of dripping of liquid after the recipient has been removed from the service area. It enables to simplify the beverage service area and/or to provide a simpler service area of controllable height to adjust the beverage delivery distance according to the recipient's
25 size. For instance, the support plate can thus be omitted and the beverage recipient can directly stand on an external support (e.g., a kitchen table). In an alternative, a simple support plate can be provided that can be adjusted in height but does not need to carry a
30 bulky drip tray with the risk that liquid could flow over the tray when it is moved up and down.

According to one feature, the drip collecting means is mobile between a collecting position in which it is placed under the said outlet and a retracted position in

which it is placed away relative to the vertical of the said outlet.

The invention also relates to a method for the preparation of a beverage in a beverage machine comprising a beverage preparation head and a beverage outlet and a service area for the positioning of the recipient,
5 characterized in that:

10 it comprises selectively placing a drip-collecting device which collects liquid falling from the beverage outlet before the liquid can reach the bottom of the service area.

Further advantages, objects and features of the present invention will appear when reading the following detailed explanation of an embodiment of the present
15 invention taken in conjunction with the figures of the enclosed drawings.

Figure 1 shows a perspective frontal view of a device according to the present invention,

20 Figure 2 shows a perspective rear view of the device of Figure 1,

Figure 3 shows a perspective frontal view of a detail of the invention, in particular, of the drip collector system in a retracted position,

25 Figure 4 shows the front view of Figure 3,

Figure 5 shows a perspective view similar to Figure 3 but in a deployed collecting position of the drip collector system,

Figure 6 shows the front view of Figure 5,

30 Figure 7 shows schematically a control unit of the present invention;

Figure 8 shows an exemplary flow chart of the operations for preparing a beverage in the beverage machine of the invention;

Figure 9 shows a perspective view of a second embodiment of the drip collector system in collecting position;

Figure 10 shows a perspective view of the drip collector of figure 9 when engaged in retracted position by the recipient.

European patent application No. 04 026 844.3 relates to "a self cleaning mixing head for producing a milk-based mixture and beverage production machines comprising such mixing head". The content of the patent application is incorporated here by reference.

Now, a detailed embodiment of the present invention will be explained. Figure 1 shows a coffee machine 1 with its cover being removed for showing a frame 10 onto which is assembled the main parts of the system.

The frame 10 comprises an extraction module 11 positioned in the upper portion of the machine. The module 11 is such that it can extract capsules after the capsule is inserted through a complementary shaped slot 12 of the module. The capsule usually contains a beverage product such as a roast and ground coffee, tea or cocoa. The extraction module is fed in hot pressurized water by a water pump 13 such as a piston pump. Water can be heated before reaching the head through a heater 15 such as a thermoblock. The extraction module can comprise tearing or puncturing elements enabling to open the capsule under pressure. As a matter of illustration, a principle of extraction of closed capsule is described in EP 0512470 B1, an example of extraction module is described in international patent application WO 2005/004683. The extraction module comprises a front beverage outlet 14 forming a short duct extending forwardly and downwardly from the body of the module.

At the vertical below the beverage outlet 14 is positioned a beverage service area 2 comprising a height adjustment device 3 which is conceived to properly adjust the position of a beverage recipient 9 (e.g., a coffee cup, a latte mug or a macchiato glass, etc.) at a relative position with respect to the beverage outlet. The height adjustment device comprises a support plate 4 and a displacement mechanism 5 for displacing the support plate up and down relative to the outlet. The height adjustment device 3 can be associated to a drip collecting device 8 which will be described in further details later in the present description in relation to Figures 3 to 6. However, the present invention in view of the adjustment of the distance between the recipient and beverage outlet can be utilized without the drip-collecting device.

The support plate 4 is guided in linear vertical movement through a rectilinear groove 30 performed within a side profiled member 31 of the frame. The support plate can comprise a lateral projection 40 which can fit in the groove to be capable of sliding along the groove. On the side of the lateral projection is positioned a reference protrusion 41 that protrudes outwards to cooperate with the different position sensors as will be explained later on. The support plate 4 can also comprise a central recess 42 for positioning a recipient in a more stable manner on the plate.

As can be seen from Figure 2, the displacement mechanism 5 comprises a continuous displacement system that is arranged to be driven by a motor 50 that can move the support plate 4 up and down in a continuous manner. For this, a gear rack 51 is attached to the lateral projection 40 at the other side of the profiled member 31. The gear rack is vertically arranged and sufficiently

long to move the support plate at an amplitude sufficient from the bottom of the service area to near the top of the service area so as to accommodate recipients within a wide range of sizes. The gear rack co acts with a gear wheel 52 attached to the electrical motor 50. Of course, a set of wheels can be provided to offer a suitable speed reduction, if necessary.

Other designs of motorized drive means can be envisaged. For example, co-pending European patent application No. 04 026 844.3 describes a system utilizing a vertically arranged threaded spindle linked to the drive motor and a complementary threaded ring attached to the support; which ring travels along the rotary spindle 25 in response to the rotation of the motor. The system is preferably continuous in the sense that the support plate can take any possible vertical position in relation to a size of recipient. In other terms, two different heights of recipients should lead to position the support plate in two different vertical positions. It is to be noted that an incremental or stepwise displacement is considered as being continuous if the increment is not larger than about 10 mm.

The invention further comprises control means that are capable of controlling actuation of the motorized drive means in such a manner that the recipient on the support surface can be placed at a controlled distance from the beverage outlet. In particular, the control means comprises at least one sensing means 60 and a control unit 61 (see Fig. 7). One sensing means is a means that detects the reference position of at least a part of the recipient. Preferably, the part of the recipient which is detected by the sensing means is the upper rim 90 of the recipient as it usually corresponds to the highest point of the recipient and therefore, the

closest point to the beverage outlet. A preferred sensing means is an electro-mechanical or light beam-emitting sensor 60. The sensor 60 is positioned in a fixed predetermined vertical position below the beverage outlet to ensure that the recipients are all and always stopped at a same distance from the beverage outlet whatever the height of the recipients and whatever the distance of the support plate from the beverage outlet. The position of the sensor is determined to provide an optimal distance range for the beverage to be distributed. For instance, for coffee based product, the distance can be preferentially chosen between about 20 to 45 mm. The sensor can be a plate or finger made of relatively flexible or be hinged to prevent breaking in case of defective working of the system. When the cup rim contacts the sensor, an input signal is sent to the control unit. Depending on the location of the sensor 60, the control unit may further command a downward motion of the cup support plate to properly position the cup in its final delivery distance from the beverage outlet.

Position sensing means can be further installed to determine the end positions of the support plate. This proves to be useful to ensure a convenient loading of the support plate with the recipient of whatever size and for ensuring that extraction cannot be started until a recipient is loaded on the movable support plate.

A first position sensor 62 can be placed fixedly on the profile member and close to the bottom of the beverage service area. This position sensor 62 senses when the reciprocating support plate reaches the lowest admitted position. The sensor can be an electromechanical switch which is mechanically actuated by the reference protrusion 41 of the support plate when the plate reaches the low position of reference. One advantage of a low

position sensor is that one ensures that the support plate is initialised in a same (low) position before each beverage preparation cycle so that a step for the recipient detection can start at each cycle and all the recipients can be detected of whatever size that fits between the low position and the cup rim sensor level.

A second position sensor 63 is also preferably placed to sense the highest admitted position for the support plate. In a similar way, the sensor can be an electromagnetic switch which is mechanically actuated by the reference protrusion 41 of the support plate when the plate reaches the highest position of reference not to be exceeded by the support plate. The advantage of the high position sensor lies essentially in controlling whether or not a recipient has been properly placed on the support plate while the beverage machine is ready to deliver a beverage. In the event, the high position sensor is sensed by the support plate, this indicates that no recipient has been detected by the cup rim sensor 90. As a result, the beverage machine can be prevented from delivering the beverage.

Of course, the electromechanical switches could be replaced by other types of sensors, for instance, visual detectors such as light beams.

Figures 3 to 6 illustrate another aspect of the beverage machine of the invention. The inventive principle lies in having a drip-collecting device 8 which collects liquid falling from the beverage outlet before the liquid can reach the recipient. The drip-collecting device comprises a liquid collecting member that is movable relative to the beverage outlet.

As "relatively movable", one means that either the collecting device is mobile and the beverage outlet is fixed, or the collecting device is fixed and the beverage

outlet is mobile or, alternatively, both the collecting device and the beverage outlet are mobile.

In the present example, the beverage outlet 13 is fixed and the drip collecting device 8 is movable to be selectively placed above the recipient that rests on the support plate and below the said beverage outlet to collect liquid falling down from the beverage outlet as shown by figures 5 and 6. More precisely, the drip-collecting device comprises a collecting member 80 which is mobile between a collecting position (figures 5-6) in which it is placed under the said outlet and a retracted position (figures 3-4) in which it is placed away relative to the vertical (Axis O in figure 4) of the said outlet.

Therefore, the drip collecting member 80 is associated to an actuation means 81 which is controlled by the control unit 61 (figure 7) to move it from the collecting position to the retracted position and vice versa. In the illustrated example, the drip-collecting member 80 has a L-shape with a portion of gutter 82 that extends upwardly by a base portion 83. The base portion is articulated via a crank mechanism comprising a fixed pivot joint 84 connected to the frame and a mobile pivot joint 85 connected to a shaft 86 of a solenoid motor 87. As shown in figure 4, in a deployed position of the drive shaft, the base portion 83 is made to rotate along pivot joint 84 in direction A which results in the portion of gutter 82 to be withdrawn from the vertical axis O. In this position, the beverage can drip from the outlet to the recipient placed on the support plate. Conversely, as shown in figure 6, in a retracted position of the drive shaft, the base portion 83 is made to rotate in the opposite direction B (figure 6) which results in the portion of gutter 82 to be deployed at the vertical of

axis O. In this position, the portion of gutter 82 is slightly inclined to deliver the collected liquid to a drip tray 88 positioned behind the vertical axis O. For this the portion of gutter ends at the vertical of the tank in the collecting position of the drip-collecting member so that all collected liquid is readily drained to the drip tray 88.

An exemplary mode of operation for the beverage machine is depicted in figures 7 and 8. Figure 7 shows the control unit 61 receiving input signals 610, 611, 612, 613 from respectively, the user via a command button (not shown), the low position sensor 62, the cup rim detection sensor 60 and the high position sensor 63. The control unit sends output signals 620, 621, 622, 623 for respectively controlling the water pump 13, the heating block 15, the motor of the support plate displacement mechanism 50 and the drip collector solenoid 87. Other input and output signals can be added, as necessary, for other functions not described here.

As an example, the beverage operation cycle can be summarized in view of figure 8. Before the beverage cycle is activated by the user pressing on the selected command button in step 200, the support plate 4 is positioned in low position allowing a recipient to be placed in the central recess of the plate. The user input signal is received by the control unit that sends an output signal to start the support plate motor 50 in step 210. As a result, the support plate is moved upwards up to a point where the upper edge of the recipient is detected by the cup rim's sensor 60. As long as the recipient is not detected, the support plate continues to be moved upwards by the motor 50 until the maximal position is sensed by the high position sensor 63 in test 225. When the high position is detected, the control unit sends a signal to

the DC motor 50 to be driven in reverse direction in step 275 which causes the support plate to return to its low position. When the low position level is detected in test 265, the motor 50 is stopped in step 280 and the cycle is over without beverage preparation having actually started.

When the rim detection test 220 becomes positive, i.e., a recipient has been detected by sensor 60, the motor 50 is stopped in step 230. The motor can be stopped immediately or after a time lag depending on the desired position of the recipient relative to the beverage outlet. After this step, the control unit sends a signal to the drip collector solenoid 87 to retract the collecting member 80 (step 240). In a next step 250, the extraction can start and the control unit starts the water pump 13. If during beverage delivery, the recipient went to be removed from the support plate as detected by test 255, the pump would be stopped in step 260. If the beverage delivery goes without this incident, the controller stops the pump after a predetermined time corresponding to the type of beverage to be delivered. In the next step 270, the drip collector solenoid 87 is moved back in the collect position. The motor 50 is reversed to return the support plate in low position at step 275 until the low position is detected resulting in the motor 50 to be stopped in step 280 and the cycle to be ended. Of course, this operational mode can vary in many ways.

Figures 9 and 10 show a second embodiment of the drip-collecting device 8 of the invention. In this solution, the drip collector is moved from the deployed or collecting position to the retracted position by effect of the recipient mechanically engaging the device 8. For that, the drip collector 8 comprises a collecting

member 800 with a gutter 801 adapted to collect the residual liquid dripping from the beverage outlet 14. The collecting member is mounted to the frame of the machine in a movable, controllable manner, e.g., in rotation
5 along a vertical axis situated inside the machine such that it can move, from one position to the other and reciprocally, within a substantially vertical plane P. The collecting member 800 extends rearward by a mechanical actuating member, i.e., a lever 810 slanted
10 outwardly in a manner to engage the side or upper edge of the recipient when the recipient is placed on the support plate or the support plate is elevated to the beverage delivery position. Figure 10 illustrates the position when the collecting device 8 is pushed aside by the edge
15 of the recipient as the support plate moves upwards, thus leaving the path of beverage free between the outlet 14 and cup.

Other possible solutions can be envisaged for the drip-collecting device such as a collecting means forming
20 a chamber that covers the beverage outlet when the beverage delivery is not carried out. For example, the actuation means can comprise an hydraulic system actuated to place the collecting member in a retracted position when water is supplied to the beverage preparation head
25 and is actuated to place the collecting member in a collecting position when water is no longer supplied to the beverage preparation head.

Claims:

1. A beverage machine (1) for the preparation of a beverage comprising a distance adjustment device (3) comprising a movable support plate (4) for adjusting the position of the recipient (9) relative to at least one beverage outlet (14) when resting on the support plate, wherein the support plate (4) is mobile relative to the at least one beverage outlet (14),
- 10 characterized in that:
- it comprises a displacement mechanism (5) for displacing the support plate (4) relative to the said outlet (14) comprising:
- motorized drive means (50, 51, 52) for driving the
- 15 displacement mechanism,
- control means (60, 61) for controlling the actuation of the drive means which are configured to set a predetermined distance between the said outlet (14) and the recipient (9).
- 20
2. A beverage machine according to claim 1, wherein the control means (60, 61) controls said distance as a function of a height related dimension of the recipient (9) being placed on the support plate (4).
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3. A beverage machine according to claim 2, wherein the control means (60, 61) comprise at least one sensor (60) that detects the position of at least one part of the recipient being placed on the support plate (4) and a
- 30 control unit (61) that stops the motorized drive means (50, 51, 52) in response to the sensor's input to the control unit (61).

4. A beverage machine according to claim 3, wherein the sensor (60) is positioned in a predetermined position below the beverage outlet (14) to detect the position of the upper edge of the recipient (9).

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5. A beverage machine according to any of the preceding claims, wherein the motorized drive means comprises:

a drive electrical motor (50) and,

10 a continuous displacement transmission system (51, 52) that is arranged to be driven by the electrical motor to move the support plate in a continuous manner.

6. A beverage machine according to claim 5, wherein the continuous displacement transmission system comprises:

15 - a gear rack (51) attached to the support plate,
- at least one gear wheel (52) attached to the drive motor (50).

20 7. A beverage machine according to claim 5, wherein the continuous displacement transmission system comprises:

- a threaded spindle attached to the drive motor,
- a complementary threaded ring attached to the support plate.

25 8. A beverage machine according to any of the preceding claims, wherein the control means further comprise a low position sensor (62) that senses a low position of the support plate (4) corresponding to the recipient load position on the support plate and a control unit (61)

30 that commands the motorized drive means (50, 51, 52) to return the support plate in low position and to stop the motorized drive means as a response of the input received by the low position sensor (62).

9. A beverage machine according to any of the preceding claims, wherein the control means further comprise a high position sensor (63) that senses the maximal position of the support plate (4) corresponding to a non-loaded position of the support plate and a control unit (61) that commands the motorized drive means to stop the motorized drive means (50, 51, 52) in this position as a response of the input received by the high position sensor (63).

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10. A beverage machine according to any of the preceding claims, wherein it comprises a drip collecting device (8) that is configured to collect liquid, from the said outlet, which drip collecting device (8) is positionable to collect liquid between the beverage outlet (14) and the recipient.

11. A beverage machine according to claim 10, wherein the drip collecting device (8) comprises a collecting member (80) which is mobile between a collecting position in which it is placed under the said outlet (14), and a retracted position in which it is away relative to the vertical of the said outlet.

12. A beverage machine according to claim 11, wherein the drip collecting member (80) is displaced from its collecting position to its retracted position by effect of the upward motion of the support plate.

13. A beverage machine according to claim 11, wherein the drip collecting member is associated to an actuation means (81) which is controlled by a control unit (61) to move from the collecting position to the retracted position and vice versa.

14. A beverage machine according to claim 13, wherein the actuation means (81) comprises an electromagnetic solenoid (87) or an electrical motor.

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15. A beverage machine for the preparation of beverages, comprising a frame (10), a beverage outlet (14) adapted to deliver a beverage in a recipient (9) placed in a beverage service area (2),

10 characterized in that:

it comprises a drip collecting means (8) which is configured to be selectively placed below or around the said beverage outlet (14) to collect liquid or froth when the machine is not delivering the beverage and/or when
15 the recipient is removed from the beverage service area.

16. Beverage machine according to claim 15, wherein the drip collecting means (8) which is configured to be selectively placed at a position above the recipient.

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17. Beverage machine according to claims 15 or 16, wherein the drip collecting means (8) is mobile between a collecting position in which it is placed under the said outlet (14) and a retracted position in which it is
25 placed away relative to the vertical of the said outlet.

18. Beverage machine according to claim 17, wherein the drip collecting means (8) is displaced from its collecting position to its retracted position by effect
30 of the upward motion of the support plate or the recipient being placed onto the support plate.

19. Beverage machine according to claim 18, wherein the drip collecting means (8) comprises a collecting member

(800) and an arm or lever (810) attached to said member, that is engaged by the recipient to move the collector away in the retracted position.

- 5 20. Beverage machine according to claim 17, wherein the drip collecting means (8) is associated to an actuation means (81) which is controlled by a control unit (61) to move from the collecting position to the retracted position and vice versa.

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21. Beverage machine according to any one of claims 15 to 20, wherein a height adjustment device (3) is provided for adjusting the position of the recipient relative to the beverage outlet (14), when resting on the support
15 plate (4), wherein the support plate (4) is mobile relative to the beverage outlet (14) relative to the said outlet and it comprises a displacement mechanism (5) for displacing the support plate.

- 20 22. Method for the preparation of a beverage in a beverage machine comprising a beverage preparation head (11) and a beverage outlet (14) and a service area (2) for the positioning of the recipient (9), characterized in that:

25 it comprises selectively placing a drip-collecting device (8) which collects liquid falling from the beverage outlet (14) before the liquid can reach the bottom of the service area (2).

- 30 23. Method according to claim 22, wherein the drip-collecting device (8) is placed in a collecting position when the machine is not delivering the beverage and/or

when the recipient is removed from the beverage service area.