Milk-feeding device for a fully automatic coffee machine, and corresponding method

The ~~invention~~ present disclosure relates to a milk delivery device having a steam nozzle for generating a steam flow, and a mixing chamber adjoining a steam outlet opening of the steam nozzle, wherein the milk is guided at an entry point into the mixing chamber, wherein the entry point is upstream with respect to a direction of the steam flow of the steam outlet opening. Such a milk delivery device can be used in particular in a fully automatic coffee machine in order to deliver milk for coffee beverages. Furthermore, such a milk delivery device can also be used as a milk-frothing device in order to produce and to deliver milk froth.

Furthermore, the ~~invention~~ present disclosure relates to an associated method for delivering milk, in particular in the form of milk froth, with the aid of a steam flow generated by a steam nozzle, wherein the milk is delivered on the basis of the Venturi effect.

Many coffee machines, in particular fully automatic coffee machines, have a milk delivery device, as described at the beginning, for preparing coffee specialities with milk. Since pumps are expensive, recourse is made here to the Venturi principle for delivering the milk: in this connection, a negative pressure is generated with the aid of said steam nozzle in order to suck up milk out of a container or the like, wherein the steam is mixed with the milk in said mixing chamber to form a steam and milk mixture.

The Venturi effect is based here on the fact that, when a flow cross section of the steam nozzle is constricted, the speed of the steam flow necessarily increases, which leads to a drop in the pressure. These relationships are described by the known

steam flow. Accordingly, at very low flow rates of the milk, pulsing of the delivered milk flow or even an abrupt breaking off of same is frequently to be observed.

Starting from these observations, it is an object of the ~~invention~~ present disclosure to provide a milk delivery device or an associated method still permitting a stable delivery even at very low flow rates.

In order to achieve this object, according to the ~~invention~~present disclosure, in the case of a milk delivery device, the features of Claim 1 are provided. In particular, in order to achieve the object in the case of a milk delivery device of the type mentioned at the beginning, it is thus proposed according to the ~~invention~~ present disclosure that the entry point is formed by means of a constriction. The constriction can form a structural boundary of the mixing chamber such that flowing back of steam and/or of a steam and milk mixture out of the mixing chamber into the milk line can be better prevented.

In a first aspect, the present disclosure provides a milk delivery device (1), in particular for use in a fully automatic coffee machine and/or as a milk-frothing device (50), having a steam nozzle (2) for generating a steam flow (9), and a mixing chamber (3) adjoining a steam outlet opening (16) of the steam nozzle (2), wherein the milk (7) is guided at an entry point (38) into the mixing chamber (3), wherein the entry point (38) is upstream with respect to a direction (51) of the steam flow (9) of the steam outlet opening (16), characterized in that the entry point (38) is formed by means of a constriction (40), wherein the constriction (40) forms a structural boundary which separates an intake chamber (17) upstream of the mixing chamber (3) from the mixing chamber (3), and wherein the mixing chamber (3) and the intake chamber

(17) are arranged annularly around the steam nozzle (2), and wherein the mixing chamber (3) has a greater opening cross section than the constriction (40).

In a second aspect, the present disclosure provides a method for delivering milk (7) with the aid of a steam flow (9) generated by a steam nozzle (2) and on the basis of the Venturi effect, characterized in that the milk (7) is oriented as a milk flow (8) along the steam flow (9), in particular wherein, for this purpose, a milk delivery device (1) according to one of the preceding claims is used, wherein, for this purpose, the milk (7) is mixed with air (6) beforehand in an intake chamber (17), which is upstream of a mixing chamber (3) and is separated from the mixing chamber (3) by means of a constriction (40) forming a structural boundary, to form a milk and air flow (14), before the milk and air flow (14) is subsequently combined in the mixing chamber (3) with the steam flow (9), and wherein the milk and air flow (14) before entering the mixing chamber (3) flows through the constriction (40), the opening cross section of which is smaller than that of the mixing chamber (3), and therefore flowing back of a steam and milk mixture out of the mixing chamber (3) into the upstream intake chamber (17) is avoided.

In other words, it is accordingly proposed that the milk enters the mixing chamber in such a manner that the milk covers a distance in the direction of the steam flow or along the latter before being combined with the steam flow. Since the milk typically passes as a milk flow into the mixing chamber, a section can thus be provided within the mixing chamber, in which the milk flow flows in the same direction as the steam flow before the milk flow is combined with the steam flow to form a milk and steam flow.

Accordingly, shifting forward of the entry point can be

understood as meaning in particular an arrangement in which the entry point, counter to a direction of the steam flow in a steam outlet opening of the steam nozzle, is arranged spaced apart from the steam outlet opening (cf. in this respect

Figure 3). In such an arrangement, the entry point is accordingly shifted back with respect to the steam outlet opening and the steam flow.

An advantage of all of these refinements is that a flow direction of the milk flow can be oriented in the direction of the steam flow before the milk flow is combined with the steam flow. Unlike in the case of previously known devices, the milk flow thus no longer impinges on the milk flow at a more or less large angle, in particular right angle, but rather the milk flow is deposited tangentially on the steam flow and is conveyed uniformly here by the steam flow.

It can be observed as a result that, with the solution according to the ~~invention~~present disclosure, a milk jet or milk froth jet delivered with the device emerges much more gently from the mixing chamber, this being in particular acoustically perceptible. This uniform flowing out owing to a continuous delivery rate can be maintained here even at very low delivery rates, because of the more stable realization of the Venturi principle by the novel arrangement of the entry point and the associated novel feeding of the milk flow to the steam flow conveying the latter.

The advantages of the solution according to the ~~invention~~ present disclosure can be increased further by means of embodiments which are described in the dependent claims.

Thus, for example, an admixing opening for milk or else for milk and air can be provided, said admixing opening defining the entry point and opening into the mixing chamber. Said admixing opening can now be oriented rectilinearly and/or shaped in such a manner that the milk is fed as a milk flow in the direction of the steam flow to the steam flow. Said feeding can be configured in particular in such a manner that,