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A machine for the metered pouring of fluid products

The present invention relates to machines for the metered pouring of fluid or "flowing" products (for example, liquid, creamy or pasty products).

Machines of this type (currently known as "pouring" and/or "batching" machines) are used widely in various sectors of industry and particularly in the food industry for pouring measured quantities of liquid, creamy or pasty products such as, for example, fillings, stuffings or trimmings for food products such as confectionery.

Most pouring/batching machines of the prior art provide for the use of metering and delivery cylinders. Pistons which are movable substantially sealingly in the cylinders can perform a first sliding stroke within their respective cylinders, during which each piston draws in or admits a certain quantity of the product to the cylinder, and a delivery stroke, which is usually performed in the opposite direction from the loading stroke, and during which the piston expels from the cylinder, usually through a nozzle at its end, a measured quantity of the material previously loaded into the cylinder.

A solution of this type is described, for example, in United States patent 4 787 534.

Another type of batching machine which is very widespread uses a manifold. In this case, the product to be poured is sent towards a manifold in a substantially continuous flow (that is, under dynamic conditions), several supply ducts or nozzles branching

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out from the manifold and usually being controlled by valve or tap structures, which can be moved alternately to open and closed positions, so as to discharge measured quantities of the product from the manifold.

Both the solutions described above have been found unsatisfactory in practice when the product to be delivered is an aerated product, that is, a product which contains a certain amount of gaseous or aeriform substances trapped within it. This is the case, for example, with the so-called meringue mixture which is used in the food industry (particularly in the confectionery industry) and which is prepared by whipping egg whites and sugars to a froth, usually with the addition of flavourings. A mass of meringue mixture has a specific gravity of the order of 0.5-0.6 combined with an intrinsic resilient mechanical compressibility due to the presence of the air trapped within the mixture.

Other aerated products currently used in the food industry are, for example, whipped cream, mayonnaise, sponge-cake mixture, etc.

The pouring of aerated products by machines with pistons of the type described above has the disadvantage that, precisely because of the large quantity of air in the product, conditions may arise in which the machine has great difficulty both in loading the product (for example, it may load a smaller quantity than envisaged as a result of the drawing-in of a large quantity of air) and in delivering the product (which tends to take place in spurts so that the product delivered is unevenly distributed).



In the case of machines with manifolds, in addition to these problems, it is also difficult to ensure that the product delivered is distributed evenly by the various metering nozzles; this is due - primarily - to the different paths which the flow of the product has to follow to reach the nozzles.

These problems mean, amongst other things, that there is a marked difficulty in precisely metering the quantity of the product delivered during each pouring operation.

Although this difficulty is tolerable when the quantity of the product delivered during each pouring operation is quite large, in practice, it is insurmountable when very small measured quantities (for example, of the order of  $1/2\text{cm}^3$ ) of an aerated product with a low specific gravity (0.5-0.6 - as in the case of meringue mixture or even lower values, for example 0.3) are to be delivered.

The object of the present invention is to provide a machine for the metered pouring of fluid products which can completely overcome all the problems and difficulties described above, particularly in relation to the pouring of aerated products.

According to the present invention, this object is achieved by virtue of a machine having the specific characteristics recited in the following claims.

The invention will now be described, purely by way of non-limiting example, with reference to the appended drawings, in which:



Figure 1 is a front elevational view of a machine formed according to the invention with some parts cut away and sectioned for clarity of illustration, and

Figure 2 is a section taken on the line II-II of Figure 1.

In the drawings, a machine for the metered pouring of fluid or "flowing" products, such as aerated products like, for example, meringue mixture, is generally indicated 1.

As is known, this product is made of egg white which is whipped to a froth, possibly with the addition of sugars and flavourings such as chocolate, etc. After subsequent heating, for example, in an oven, the meringue mixture gives rise, as a result of the hardening of the egg white, to an aerated product known as meringue, which is compact but at the same time very light and can be used both to produce confectionery items covered with cream, whipped cream or the like, or as fillings for filled confectionery products.

Aerated products like meringue mixture, whipped cream, mayonnaise, etc., are usually produced on an industrial scale with the use of devices called turbo-mixers, one of which is generally indicated 2 in Figure 1.

A turbo-mixer is constituted essentially by a generally cylindrical stator body with fins or similar appendages projecting radially inwardly of the cavity in the stator. A rotor, which is rotatable in the stator, has blades which, as a result of their rotation induced by the movement of the rotor (naturally along paths which do not interfere with the fins of the stator)



have a forceful whipping effect on the ingredients of the meringue mixture which are admitted to the rotor chamber from a tank V. The whipping to a froth is usually facilitated by the blowing of air into the cavity in the turbo-mixer.

This is all according to widely known criteria which do not need to be described in detail herein and are not relevant for the purposes of an understanding of the invention.

The aerated product (in this case, the meringue mixture) prepared in the turbo-mixer 2 is supplied through a pipe 3 to a collecting tank 4 in which a certain amount of meringue mixture M collects.

The rate at which the turbo-mixer 2 operates (in practice, the rate at which the meringue mixture passes through the pipe 3) is regulated in a manner consistent with the volume of the tank 4, so that the tank 4, which is sealed at the top by a lid 5, is never completely full of meringue mixture.

In practice, the meringue mixture M only occupies the lower portion of the tank 4, leaving empty its upper portion which is thus filled by an aeriform mass (typically air). The upper portion of the tank 4 communicates with a pressure regulator 6 (for example, a device with a pneumatic plenum chamber) connected to a pump 7 (usually a pneumatic pump) which is operated intermittently in dependence on the detection signal supplied by a barometric sensor 8 which is sensitive to the aeriform pressure in the upper portion of the tank 4.



In particular, the pressure-regulating unit 6, 7, 8 is adjusted so as to keep the aeriform mass which is above the level of the free surface of the mass of meringue mixture M in the tank 4 at a relative pressure of the order of 0.2-0.3 atmospheres (an absolute pressure of 1.2-1.3 atmospheres).

The lower portion of the tank 4, which is usually funnel- or channel-shaped (see, in particular the sectional view of Figure 2), has one or more openings 9 for delivering the product M through respective supply nozzles 10 which are located below the openings 9, and are usually funnel-shaped, with the interposition of valve devices 11 for controlling the delivery. The valves are usually in the form of valves with rotary obturators of the type currently known as cylindrical male obturators.

In the currently-preferred embodiment, the tank 4 is generally elongate so that it can be arranged above a horizontal conveyor T such as a continuous mat or belt driven by a drive unit M. The tank 4 is usually oriented generally transverse the direction of transportation of the conveyor T.

With reference to the viewpoint of Figure 1, the direction of transportation of the conveyor is perpendicular to the plane of the sheet and the generally elongate tank 4 is thus aligned with the plane of the sheet.

In this embodiment, the openings 9 are thus arranged in a straight row which, since it extends substantially along the tank 4, is arranged transverse the direction of transportation of the underlying conveyor T. The



supply nozzles 10 are arranged in a similar manner and the valve devices 11 may therefore include a single cylindrical male obturator which is common to all the valves and is constituted by a shaft 12 with diametral holes 13 corresponding to analogous pairs of openings 9 and nozzles 10. The shaft 12 is fitted sealingly so as to be rotatable about its own axis in a valve body 14 which in practice is constituted by a tubular casing fitted below the tank 4 in alignment with the openings 9.

At least one end of the shaft 12 is connected to a drive member 15. This member, which is constituted, for example, by an electric motor associated with a reduction unit, can rotate the shaft 12 between:

- a delivery position (shown in continuous outline in Figures 1 and 2), in which each of the diametral holes 13 is exactly aligned with a respective opening 9 (which communicates with the cavity in the tubular casing 14 through a corresponding opening 9a in the casing 14) and with the underlying delivery nozzle 10, so that the product M (the meringue mixture) can be discharged from the tank 4, and

- a closure position (shown schematically in broken outline in Figure 2 only) in which the holes 13 are in positions approximately at right angles to their open positions, so as to close the openings 9 and 9a and thus prevent the product M from coming out of the tank 4.

Between the internal surface of the tubular casing 14 and the outer surface of the shaft 12, at least at the two ends of the shaft 12, there are preferably sealing



elements 16 constituted, for example, by tubular seals.

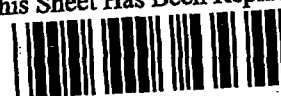
The metered pouring of the mass M from the tank 4 towards the underlying conveyor T thus takes place as a result of the rotation of the shaft 12 (by the motor 15) between the open position and the closure position described above.

In particular, the quantity of the aerated product M delivered at any particular time will depend (if other factors such as the cross-sections of the openings 9 and 9a, of the holes 13 and of the nozzles 10 remain the same) upon the duration of the period for which the shaft 12 is kept in the open position.

The Applicant has found that the functional solution described enables aerated products such as, for example, meringue mixture, to be poured in extremely precise measured quantities even when the specific gravity of the product delivered is very low (for example, of the order of 0.3) and the measured quantities to be achieved are extremely small, for example, of the order of  $1/2\text{cm}^3$ .

In particular, it has been found that, with the use of the solution according to the invention, none of the problems encountered with the supply of aerated products by pouring/batching machines according to the prior art (either of the type with pistons, or of the type with manifolds) occur in the nozzles 10 or in the delivery apertures (the openings 9, 9a and the holes 13).

Without wishing to be bound to any specific theory in this connection, this result seems to be attributable



primarily to the fact that, in the machine according to the invention, the mass of the aerated product  $M$  to be delivered is kept, in a substantially continuous and static manner, under a moderate relative pressure (0.2-0.3 relative atmospheres) without the alternating intake and compression stages which are typical of piston batching machines - under the action of the aeriform pressure plenum in the upper portion of the tank 4; this is quite unlike what occurs, on the other hand, in machines with manifolds, in which the product to be delivered is kept under dynamic pressure conditions by the pumping action of the device which supplies the product to the manifold (typically the turbo-mixer) with continual variations in the pressure level and conditions as a result of the opening and closing of the delivery nozzles and with pressure losses which differ according to the different paths which the mass of the product has to follow to reach the various supply nozzles.

Naturally, the principle of the invention remaining the same, the details of construction and forms of embodiment may be varied widely with respect to those described and illustrated, without thereby departing from the scope of the present invention.





10  
CLAIMS

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1. A machine for the metered pouring of fluid (flowing) products, characterised in that it includes:

- a generally closed tank (4) for collecting the product (M) to be poured,

- supply means (3) for supplying to the tank a mass (M) of the product to be poured and leaving a portion of the tank (4) empty of the product (M),

- pressure-regulating means (6-8) for maintaining a substantially continuous and static aeriform pressure in the empty portion of the tank (4), and

- valve means (9 to 14) which are connected to the tank (4) and can be switched selectively (15) between an open position, in which the product (M) can be discharged from the tank (4) in measured quantities through the valve means (9 to 14), and a closure position, in which the valve means (9 to 14) prevent the product from coming out of the tank (4).

2. A machine according to Claim 1, characterised in that the supply means (3) are constituted by a device (2) for producing an aerated product to be poured by the machine (1).

3. A machine according to Claim 2, characterised in that the device (2) is a turbo-mixer.

4. A machine according to any one of the preceding claims, characterised in that the pressure-regulating means (6 to 8) maintain a relative aeriform pressure of

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11

the order of 0.2-0.3 atmospheres (an absolute pressure of 1.2-1.3 atmospheres) in the empty portion of the tank (4).

5. A machine according to any one of the preceding claims, characterised in that the tank (4) has at least one outlet opening (9) for the product (M) to be poured, and in that the valve means (9 to 14) include at least one movable obturator (12) with at least one hole (13) which, in the open position, can be brought into alignment with the at least one opening (9) in the tank (4).

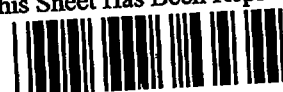
6. A machine according to Claim 5, characterised in that the obturator includes a rotatable body with at least one through-duct (13).

7. A machine according to Claim 6, characterised in that the obturator is a cylindrical body (12) with at least one diametral through-hole (13).

8. A machine according to any one of the preceding claims, characterised in that the tank (4) has a row of outlet openings (9) for the product (M) to be poured and in that the valve means (10 to 14) include at least one common obturator (12) with holes (13) arranged in a corresponding row.

9. A machine according to Claim 1, characterised in that a conveyor device T associated with the machine can move the product (M) delivered by the machine along a path of movement in a predetermined direction, and in that the tank has a row of outlet openings (9) for the product (M) to be poured, the row being arranged generally transverse the path of movement.

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12

10. A machine according to any one of the preceding claims, characterised in that the machine is associated with a device (2) for producing meringue mixture as the aerated product to be poured by the machine (1).

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