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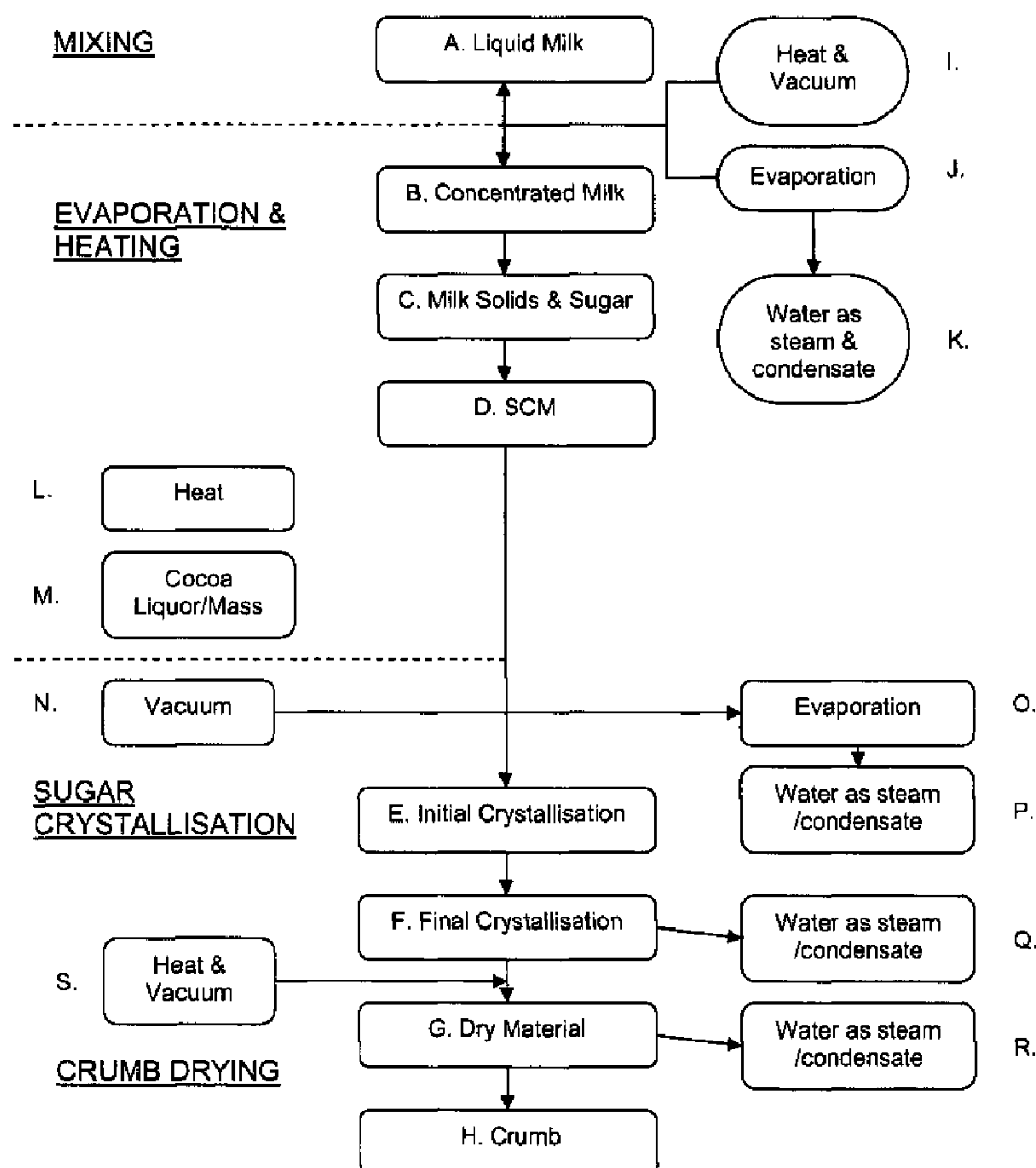
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(54) **Titre : PROCÉDE DE PREPARATION DE CHOCOLAT EN PAIN**

(54) **Title: PROCESS FOR PREPARING CHOCOLATE CRUMB**



(57) **Abrégé/Abstract:**

A process for chocolate crumb manufacture and an apparatus for preparing chocolate crumb. The process for preparing chocolate crumb comprises: a) supplying a milk and sugar mixture, or mixing together milk and sugar, in a reaction vessel; b)



(57) Abrégé(suite)/Abstract(continued):

evaporating excess liquid from the mixture in the reaction vessel so as to form sweetened condensed milk; c) adding cocoa mass/liquor to the reaction vessel during and/or after steps (a) and/or (b); d) subjecting the mixture in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture; and e) drying the mixture so as to form chocolate crumb. The process is efficient in that initial evaporation of excess liquid takes place in the same vessel used for mixing and processing the constituents of the crumb. In one embodiment all of the steps a to e take place in a single reaction vessel.

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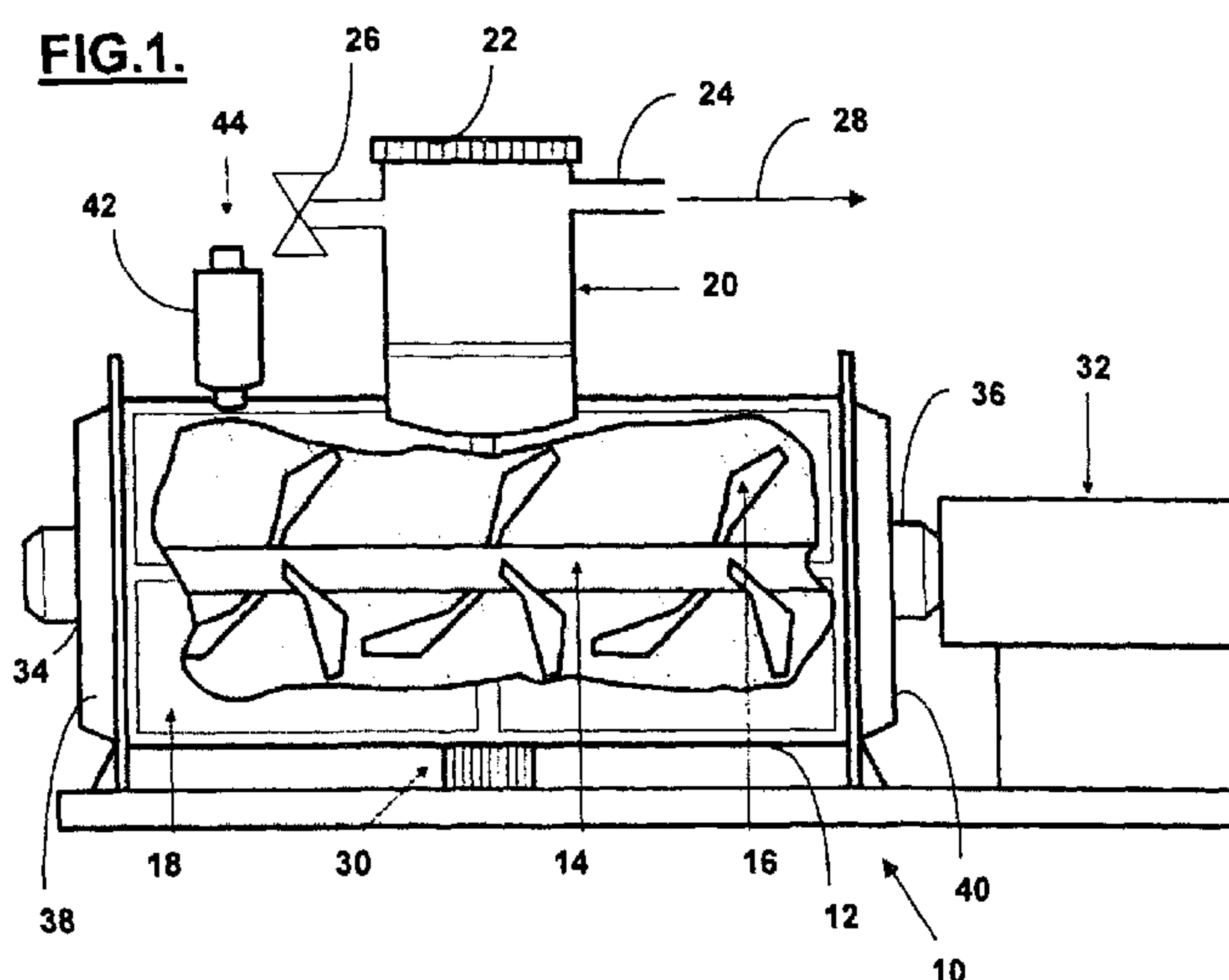
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(54) Title: PROCESS FOR PREPARING CHOCOLATE CRUMB



(57) **Abstract:** A process for chocolate crumb manufacture and an apparatus for preparing chocolate crumb. The process for preparing chocolate crumb comprises: a) supplying a milk and sugar mixture, or mixing together milk and sugar, in a reaction vessel; b) evaporating excess liquid from the mixture in the reaction vessel so as to form sweetened condensed milk; c) adding cocoa mass/liquor to the reaction vessel during and/or after steps (a) and/or (b); d) subjecting the mixture in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture; and e) drying the mixture so as to form chocolate crumb. The process is efficient in that initial evaporation of excess liquid takes place in the same vessel used for mixing and processing the constituents of the crumb. In one embodiment all of the steps a to e take place in a single reaction vessel.

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PROCESS FOR PREPARING CHOCOLATE CRUMB

Technical Field of the Invention

The present invention relates to a process for chocolate crumb manufacture. In particular, the present invention relates to a more efficient process for manufacturing chocolate crumb whereby the initial evaporation of excess liquid takes place in the same vessel used for mixing and processing the constituents of the crumb.

Background to the Invention

The use of chocolate crumb in the manufacture of milk chocolate is well known in the chocolate industry. In particular, the low water content, and the presence of sugar and cocoa (which contains antioxidants) ensure that chocolate crumb has a far greater shelf life than the fresh milk from which it is made. This in turn removes the need for final chocolate production to take place at a location with plentiful access to milk.

However, it can be difficult to achieve an efficient production process giving consistent quality and taste of crumb. A key feature of crumb production is the Maillard reaction between proteins (present in milk and cocoa), water and reducing sugars (such as lactose, present in milk), which is responsible for the generation of caramel flavours in the crumb. Overexposure to conditions which promote this reaction (such as prolonged heat and moisture) will lead to the crumb having an unwanted flavour profile, and so must be avoided.

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Generally speaking, the manufacture of crumb involves a number of steps comprising mixing the ingredients and processing the mixture under certain conditions so as to produce the crumb product. Typically, the apparatus for producing crumb comprises a number of reaction/mixing vessels which are linked
5 together so as to process the mixture according to different protocols at different reaction stages. The use of separate reaction/mixing vessels increases not only the overall cost of the apparatus, but also the running costs and time involved in servicing and cleaning.

10 EP0248462 discloses a process for preparing a raw material for milk chocolate, which comprises kneading and drying a concentrated mixture of milk, sugar and optionally cocoa mass to form a homogeneous mass. Both examples cited in this document describe mixing milk and sugar together so as to form a mixture which is then condensed prior to being continuously fed into a cylindrical drum for
15 further processing.

It is an object of the present invention to provide a more efficient apparatus and/or process for producing chocolate crumb.

20 Summary of the Invention

In accordance with a first embodiment of the invention, there is provided a process for preparing chocolate crumb comprising:

- a) supplying a milk and sugar mixture, or mixing together milk and sugar, in a reaction vessel;

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- b) evaporating excess liquid from the mixture in the reaction vessel so as to form sweetened condensed milk;
- c) adding cocoa mass/liquor to the reaction vessel during and/or after step (a) and/or step (b);
- 5 d) subjecting the mixture in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture; and
- e) drying the mixture so as to form chocolate crumb.

The invention provides a process in which the evaporation takes place in the mixing chamber, without the necessity of separate vessels for processing the constituents into chocolate crumb. This not only reduces the cost of building the apparatus in which to produce the chocolate crumb, but also allows for throughput to be increased and the apparatus to be cleaned and serviced more quickly. The use of a single vessel has been found to produce a higher quality chocolate crumb with a particularly good texture, processing and flavour profile. It is believed that the quality of the chocolate crumb is a direct result of the use of a single reaction vessel, in which precise processing parameters can be applied sequentially to the mixture during the stages of the texture and flavour development. In contrast, the prior art uses different vessels, where the parameters of the mixture are difficult to control between stages due to the requirement of transferring the mixture to different processing vessels.

In accordance with the invention, steps (a) to (d) are undertaken in a single reaction vessel. Step (e) may be undertaken in the same reaction vessel as steps

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(a) to (d). Alternatively, step (e) may be undertaken in a different reaction vessel to the one used for steps (a) to (d).

In one embodiment step (a) is undertaken such that the reaction vessel contains a
5 milk and sugar mixture having a solids content of less than 90%, less than 85%,
less than 80% or less than 75%. It has been found to be advantageous to begin the
process with an excess of liquid and then evaporate the excess to form a
sweetened condensed milk. If a mixture having a very high solids content is used
there may be adverse effects due to the mixture adhering to the reaction vessel and
10 a lack of flavour development. The use of excess liquid minimises in-process
losses, reduces the frequency of cleaning and reduces the power required to
subsequently effect the phase change.

In one embodiment, step (c) is undertaken after step (b) i.e. the cocoa mass/liquor
15 is added to the sweetened condensed milk.

It will be apparent that the process could be employed for producing chocolate
crumb from powdered milk, liquid milk, or a mixture thereof. Step (a) may
further comprise the addition of water. If powdered milk is used in the process, it
20 may be wetted initially. If the milk is liquid milk, it may comprise concentrated
liquid milk. If desired, the process may further comprise adding milk solids to the
reaction vessel, prior to undertaking step (d).

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The sugar may be any naturally occurring sugar. In one embodiment the sugar is selected from one or more of sucrose, dextrose, glucose syrup solids, fructose, lactose and maltose. In a certain embodiment the sugar is sucrose.

5 Steps (b) and/or (d) may comprise heating the mixture. The mixture may be heated under a lowered pressure. Combining the heat with a lowered pressure, lowers the boiling temperature of the mixture and thus reduces the risk of burnt “off” flavours in the resulting crumb product and also prevents fouling of the vessel.

10

The process may further comprise the step of adding a fat to the mixture before or during step (e). The fat may be cocoa butter, butterfat, a cocoa butter equivalent (CBE), a cocoa butter substitute (CBS), a vegetable fat that is liquid at standard ambient temperature and pressure (SATP, 25°C and 100kPa) or any combination
15 of the above. CBEs are defined in Directive 2000/36/EC. Suitable CBEs include illipe, Borneo tallow, tengkawang, palm oil, sal, shea, kokum gurgi and mango kernel. CBE’s may be used in combination with cocoa butter. The addition of fat to the mixture will result in increasing the overall fat content of the crumb and assisting in the drying step. It will also be evident that increasing the fat content
20 may be desirable so that the chocolate confectionery produced with the crumb will have an increased mouth feel and desirable melt characteristics.

The process may further comprise the step of:

- f) forming the chocolate crumb into briquettes.

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Briquettes, allow the crumb to be handled and transported with ease. Of course, other ways of reducing the size of the crumb into manageable pieces, may also be apparent to the skilled addressee.

- 5 In a second embodiment of the invention, there is provided a chocolate crumb formed using the process as herein above described.

In a third embodiment of the invention, there is provided a confectionery product formed using a chocolate crumb as herein above described.

10

In a fourth embodiment of the invention, there is provided chocolate crumb producing apparatus comprising:

- a) a single reaction vessel for receiving and mixing together milk, sugar, or mixture thereof and optionally cocoa mass/liquor;
- 15 b) means for evaporating excess liquid from the mixture in the reaction vessel;
- c) means for subjecting the mixture in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture;
- 20 d) means for drying the mixture so as to form chocolate crumb; and
- e) means for discharging the chocolate crumb.

In accordance with this embodiment, the apparatus comprises a single reaction vessel, to which the means of (b) and (c) are attached or incorporated. If desired,

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the means of (d) and/or (e) may also be attached or incorporated with the single reaction vessel. Alternatively, the means of (d) and/or (e) may be attached or incorporated in different reaction vessel(s).

5 The means for evaporating excess liquid from the mixture in the reaction vessel may comprise an evaporation device. The means for subjecting the mixture in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture, may comprise a sugar crystallisation device. The means for drying the mixture so as to form chocolate crumb may comprise a drying device. The means
10 for discharging the chocolate crumb may comprise a discharge device.

The reaction vessel may comprise a substantially cylindrical body having a mixing means disposed therein. A number of mixing arrangements for use in such reaction vessels will be apparent to the skilled addressee. The mixing means may comprise one or more mixing blades or paddles. The one or more mixing
15 blades or paddles may be attached to a shaft which is rotatable within the cylindrical body. Alternatively, the vessel may be rotatable around the shaft. In a further alternative, the vessel may be rotatable and have one or more mixing blades or paddles disposed about the interior of the vessel.

20 The means for evaporating excess liquid and/or subjecting the mixture to conditions effective to bring about sugar crystallisation in the mixture may comprise a heating means. The means for evaporating excess liquid and/or subjecting the mixture to conditions effective to bring about sugar crystallisation in the mixture may further comprise a pressure lowering means. The heating

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means may comprise a number of arrangements suitable to heat the mixture, such as heating elements attached or incorporated within the side of the vessel, or a heated jacket surrounding at least part of the vessel. If a heated jacket is employed, the jacket may be heated by means of a fluid – such as a steam or water. The pressure lowering means may comprise a vacuum pump. The means for discharging the chocolate crumb may simply be an aperture formed in the wall of the vessel, which can be opened when desired.

Detailed Description of the Invention

A specific embodiment of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a cut-away diagram of the apparatus used in accordance with the present invention; and

Figure 2 shows a schematic flow diagram illustrating the various steps used in the process of the present invention.

With reference to Figure 1, there is shown a reactor 10 briefly comprising a generally cylindrical reaction vessel 12 having a single horizontal shaft 14 which is rotatable through the centre of the vessel. A number of agitator paddles 16, extend outwardly from the shaft 14, to a position close to the interior surface of the vessel 12 so that when the shaft rotates, the paddles run close to the interior surface and sweeps across the whole inner surface of the vessel. The exterior

- 9 -

surface of the vessel 12 is covered by a number of jackets 18 which are divided into different sections, through which fluids can flow so as to heat and cool the vessel during operation.

5 The vessel 12 has a condensation tower 20 extending vertically upright from a central location in the vessel. The tower 20 is formed from a large cylindrical extension which is of a diameter approximately 1/4 the size of the diameter of the vessel 12 itself. The tower 20 terminates with a removable cover plate 22 and has an outlet 24 which connects to the vapour handling system (not shown) for the
10 processing of vapour 28 and the tower 20 also accommodates inlet valves 26 for liquid.

At the base of vessel 12, there is provided a discharge valve 30 which is used to discharge of finished product.

15

The shaft 14 is driven by a high-powered motor 32 capable of a speed ratio of approximately 100 rpm. The rotation of the shaft 14 is permitted by means of mechanical shaft seals 34,36 located within end caps 38,40 disposed at either end of the vessel 12. The mechanical shaft seals 34,36 have water flowing through
20 them under pressure, so as to cool and lubricate the seal faces. The seals are protected by temperature, pressure and may also include flow level switches if desired.

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The vessel 12 also has an additional powder inlet 42, extending vertically from the vessel, through which powdered constituents 44 can be inserted into the vessel 12 if required.

5 In use, the reactor 10 is used to produce chocolate crumb from the various constituents. Generally speaking, the milk, sugar and cocoa mass and/or liquor are added to the vessel via the inlet valve 26 and/or the powder inlet 42. The inlet used for a particular constituent will be dependent upon whether they are in a liquid or powder form 44 and in some instances - only the liquid inlet valve will
10 be used. The constituents can be added at the same time, or added sequentially if desired. During addition, the motor 32 is used to rotate the shaft 14 and in doing so, the agitator blades 16 thoroughly mix the constituents together. The vessel 12 is substantially sealed during mixing as it is sealed at both ends via the end caps 38,40 and the shaft 14 freely rotates within the mechanical face seals 34,36.

15 During the mixing, the jackets 18 are heated with a hot fluid (such as water or steam) to a particular temperature so as to evaporate excess liquid from the mixture into vapour. The vapour forms in the tower 20 and the vapour 28 is removed via the outlet 24 for further processing by means of the vapour handling
20 system (which will be described in greater detail below). The jackets 18 are subjected to different heating and cooling parameters which are dictated by the particular chocolate crumb protocol which is employed. After sugar crystallisation, the crumb is dried and is discharged via the discharge valve 30 for further processing/storage/shipment. To facilitate cleaning and servicing, the

- 11 -

cover plate 22 on the tower is removable so as to allow entry to the interior of the vessel 12.

The Reactor 10 is an extremely effective mixer and the incorporation of
5 ingredients is accomplished in a shorter time when compared to conventional apparatus which requires separate mixing vessels for evaporating excess liquid from the initial mixture. The tower 20 reduces the gas velocity and solids carry-over during the low-pressure high gas flow stage, occurring during crystallisation. The motor 32 is sized to cope with the power required at the peak of
10 crystallisation. The shaft 14 speed can also be automatically reduced by the motor 32 if the drive rating is exceeded for a certain period of time.

With reference to Figure 2, there is shown a schematic flow diagram and process chart illustrating the overall steps used in the process of the present invention.

15 The key to the letters used in the Figure 2 is as follows:

- | | | |
|----|----|------------------------------|
| | A. | Liquid Milk; |
| | B. | Concentrated Milk; |
| | C. | Milk Solids & Sugar; |
| 20 | D. | SCM; |
| | E. | Initial Crystallisation; |
| | F. | Final Crystallisation; |
| | G. | Dry Material; |
| | H. | Crumb; |
| 25 | I. | Heat & Vacuum |
| | J. | Evaporation; |
| | K. | Water as steam & condensate; |
| | L. | Heat; |
| | M. | Cocoa Liquor/Mass; |
| 30 | N. | Vacuum; |
| | O. | Evaporation; |
| | P. | Water as steam/condensate; |

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Q. Water as steam/condensate;
R. Water as steam/condensate; and
S. Heat & Vacuum.
T.S. Total Solids

5

If liquid milk (A) is used, then it is first placed in the reactor and heated under vacuum (I) conditions, so that evaporation (J) of the excess liquid takes place.

The excess liquid is expelled as water as steam and condensate (K). If

concentrated milk (B) is used, then this is mixed with milk solids and sugar (C) so

10 as to form SCM (D). The mixture is heated (L) and cocoa liquor/mass (M) is added. A vacuum (N) is applied during the heating so as to initiate crystallisation and excess liquid is subjected to evaporation (O) and disposed of as water as steam/condensation (P). . Water as steam/condensate (Q) is released during the initial crystallisation (F). Finally, heat and vacuum (S) is applied to the mixture,
15 so as to dry the material (G) – again resulting in the removal of water as steam/condensate (R), so as to produce the crumb (H) product.

The vapour handling system which effects the removal of the water as

steam/condensate after evaporation relies upon a vacuum system. There are three

20 stages of the Reactor Crumb process when the vacuum system is critical: (i) during low pressure evaporation of condensed milk; (ii) during the crystallisation stage at low pressure; and (iii) during the drying process.

The water evaporates through the tower 20 and passes through the following

25 components:

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Condenser - The condenser is a large shell and tube heat exchanger mounted vertically with the process vapours on the tube side. Tubes are used to avoid blockage by any solids carried over from the Reactor. A large surface area is
5 required to condense the very high vapour load at low pressure during and immediately after Crystallisation.

Condensate Receiver - Where applicable, condensate is collected in a vessel below the condenser. In liquid milk Reactors, measurement of the condensate
10 weight that has been collected is used during the milk evaporation phase to identify the end of the evaporation process and to trigger the next stage of the process.

Vacuum Pump - The vacuum pump achieves a pressure 50- 90mbar. Charging of
15 liquids (milk and liquor/mass) into the reactor 10 is generally through butterfly valves mounted on the tower 20. Powders (milk powder, sugar) are loaded through the main body of the machine.

Milk powder wetting is required if the milk constituent is at least partially formed
20 from powder. Water is either added to milk powder, or after milk powder and sugar have been mixed together. This powder and water is mixed for a short time before heating starts.

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Heating - Heating is controlled with steam pressure/temperature and vacuum. The application of vacuum reduces the boiling temperatures and the use of low pressure steam for heating will reduce surface temperatures and so help control burn-on. Typically the agitator is run at high speed during heating.

5

Evaporation – Evaporation is effected by heating the mixture to a temperature in the range of 90°C to 100°C under a lowered pressure of approximately 24kPa for approximately 30 minutes. The milk evaporation stage takes place at a reduced pressure to maximise heat transfer. Frothing and boil over of the milk into the condenser can occur if the pressure is reduced to below the boiling pressure at the current mass temperature. The process is most commonly monitored and controlled by measuring the condensate collected although boiling point evaluation can also be used.

10

15 Adjusting the % of Total Solids – It is desirable to modify the mixture so that the total solids present in the sweetened condensed milk is in the range of 75% to 90% of the mixture.

20

Heating and Liquor/mass addition - Once the correct solids of the sweetened condensed milk (SCM) are reached, the vacuum is released and the SCM is heated with steam in the jacket 18 to about 85°C for between 10 to 60 minutes. Cocoa Liquor/mass is then added and the mass is heated to between 80°C and 110°C. At this time, the steam on the jacket 18 is turned off, the jacket vented and vacuum is pulled again to initiate Initial Crystallisation (F).

- 15 -

Crystallisation (F) - is when the mass of material in the reactor 10 is converted from a liquid, pasty solid to a substantially dry material by sucrose or sugar crystallisation. The process step before Crystallisation has to deliver a mass that

5 has sufficient energy stored within it so that when a vacuum is applied, a sufficient amount of water will evaporate whereby crystallisation (E) can be initiated and develop through the mass. If there is insufficient energy (due to low temperature prior to Crystallisation or high moisture) the mass will not crystallise and break up and may either stall the drive or release fat. If there is too much

10 stored energy, a very rapid rate of sucrose crystallisation will result generating very fine crystals along with a lot of carry over of dust into the condenser. Sugar crystallisation is effected by subjecting the mixture to a temperature of about 100°C, under a lowered pressure of approximately 15kPa for 10 to 20 minutes.

15 Drying - Immediately following Crystallisation, the crumb is at about 60°C and is extremely reactive, rapidly developing flavours due to the reaction of milk protein and lactose (Maillard Reaction). This is in addition to any flavour developed prior to Crystallisation when there is more moisture with cocoa liquor available. Drying is effected at a temperature in the range of 70°C to 80°C for about 25

20 minutes.

The pressure is initially kept low to evaporate some of the remaining moisture thus reducing the temperature of the mass during crystallisation. Evaporative cooling is far more effective than any other form of cooling because it removes

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heat from the reactive sites (where moisture, lactose and milk protein are concentrated as the sucrose crystallises).

Once the reactions have been “quenched”, the option exists to either continue
5 drying to achieve the final desired moisture content at low pressure or to allow the pressure to rise slightly, so as to stop evaporation and allow the flavour development reactions to continue.

Cooling - Once crumb is dry it will hardly change in flavour for an hour or so if
10 the temperature is below about 80°C. If cooling is required, the crumb is cooled to about 30 °C for about 120 minutes.

Pasting (optional) - In some embodiments, fat is added directly to the material in the Reactor and a paste is discharged, whilst in other embodiments, the dry crumb
15 is discharged for later mixing.

Discharge - Discharge from the Reactor is generally through a bottom mounted, discharge valve and is generally quite rapid.

20 Example 1 - Liquid Milk

Initial process:

The initial ingredients are loaded into the mixing vessel and the shaft rotated at a low speed. The milk and sugar are loaded into reactor and the shaft rotated at a

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pre-determined speed. The vacuum system is started and evaporation pressure is reduced. Steam and condensate valves are then opened.

Evaporation and Heating:

- 5 The milk and sugar mix is evaporated to between 85 – 88% solids by heating the mixture to between about 85°C to 95°C under a lowered pressure of approximately 24kPa for 30 minutes. The end point is determined by the measurement of the weight of the condensate collected. The vacuum system is stopped so as to break the vacuum, and the condensate is drained into a collection
- 10 vessel. The loading of molten cocoa liquor (~50°C) to liquor weighing vessel is initiated, so that the cocoa liquor is already in the liquor feed vessel above the Reactor. The reactor is heated further to a “liquor addition” temperature, which is typically between 95-105°C.

15 Addition of Liquor:

The liquor from the weighing vessel is loaded into the reactor and heating is continued to “Vacuum On” temperature. The cocoa liquor is often West African or Asian with a fat content of between 50 to 56% and non-fat cocoa solids in the range of 40 to 48%.

20

Vacuum ramp and Crystallisation:

At the vacuum on temperature, the steam and vent jackets are turned off. The motor speed is reduced to about 50% and the vacuum system is started with control valve fully open. The vacuum ramp is initiated at approximately

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15kPa/min and the reactor heated, or cooled to about 100°C for 10 to 20 minutes.

Evaporation starts and the crumb paste cools and thickens. The drive power is increased steadily and then more rapidly as the process continues. Crystallisation is initiated by the mixing action and the mass changes from a paste to a powder

5 with a rapid evolution of vapour. At this point the power is reduced and a pressure “spike” occurs as the vapour evolution briefly overwhelms the condenser and affects the vacuum pump. The process then continues either via flavour development and drying or directly to drying.

10 Final drying:

The pressure is adjusted to the drying set point and the crumb is heated to approximately 80°C for about 25 minutes. Heating is continued under low pressure (3.5-10 kPa) until drying is complete. The steam and vent jackets are then turned off and the vacuum and vent systems released and the condensate

15 vessel drained.

Cooling:

If required, cold water is introduced into the Reactor jacket for about 120 minutes so as to cool the crumb down to about 30°C.

20

Fat addition:

If required, fat is added and mixed with the crumb.

Discharge:

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Lastly, the discharge and vent valves are opened and motor at low speed to assist discharge via the discharge valve.

Example 2 - Powdered Milk

5 Initial Process:

The reactor is started at low speed and powder milk and sugar loaded into the mixing vessel. The mix is allowed to dry and water is then loaded into the reactor and blended at low speed. The reactor is then run at a higher speed and the steam and condensate valves opened.

10

Heating:

The milk/sugar/water paste is then heated to between 85°C to 95°C under a lowered pressure of about 24kPa for approximately 30 minutes to result in a mixture having between 85-88% solids. The loading of cocoa liquor to liquor weigh vessel is initiated and the reactor heated to the “liquor addition” temperature.

15

Addition of Liquor:

The liquor from weighing vessel is loaded into the reactor and heating is continued to the “Vacuum On” temperature.

20

Vacuum ramp and Crystallisation:

The steam and vent jackets are turned off and speed reduced to 50% at which point the motor has maximum torque. The vacuum system is started with the

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control valve fully open. The vacuum ramp at 15 kPa/min and the pressure reduced steadily to the Crystallisation set point and the temperature of the reactor raised to 100°C for 10 to 20 minutes. Evaporation commences and the paste cools and thickens. The drive power increases steadily at first but more rapidly as the process continues. Crystallisation is then initiated by the mixing action and the mass changes from a paste to a powder along with a rapid evolution of vapour. The power is then reduced and evaporation is continued until the end point temperature is reached or drying time has been exceeded. Steam can be applied to obtain the final drying temperature. The process then continues either via flavour development and drying or directly to drying.

Final drying:

Pressure is reduced and the crumb is heated to approximately 80°C for about 25 minutes. Heating is continued under low pressure until drying is complete. The steam and vent jackets are turned off and the vacuum and vent system released. The condensate vessel is then drained.

Cooling:

If required, cold water is added to the jacket of the Reactor for about 120 minutes so as to cool the crumb down to about 30°C.

Fat addition:

If required, the fat is added and mixed with crumb.

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Discharge:

The discharge and vent valves are opened and the crumb discharged through the discharge valve.

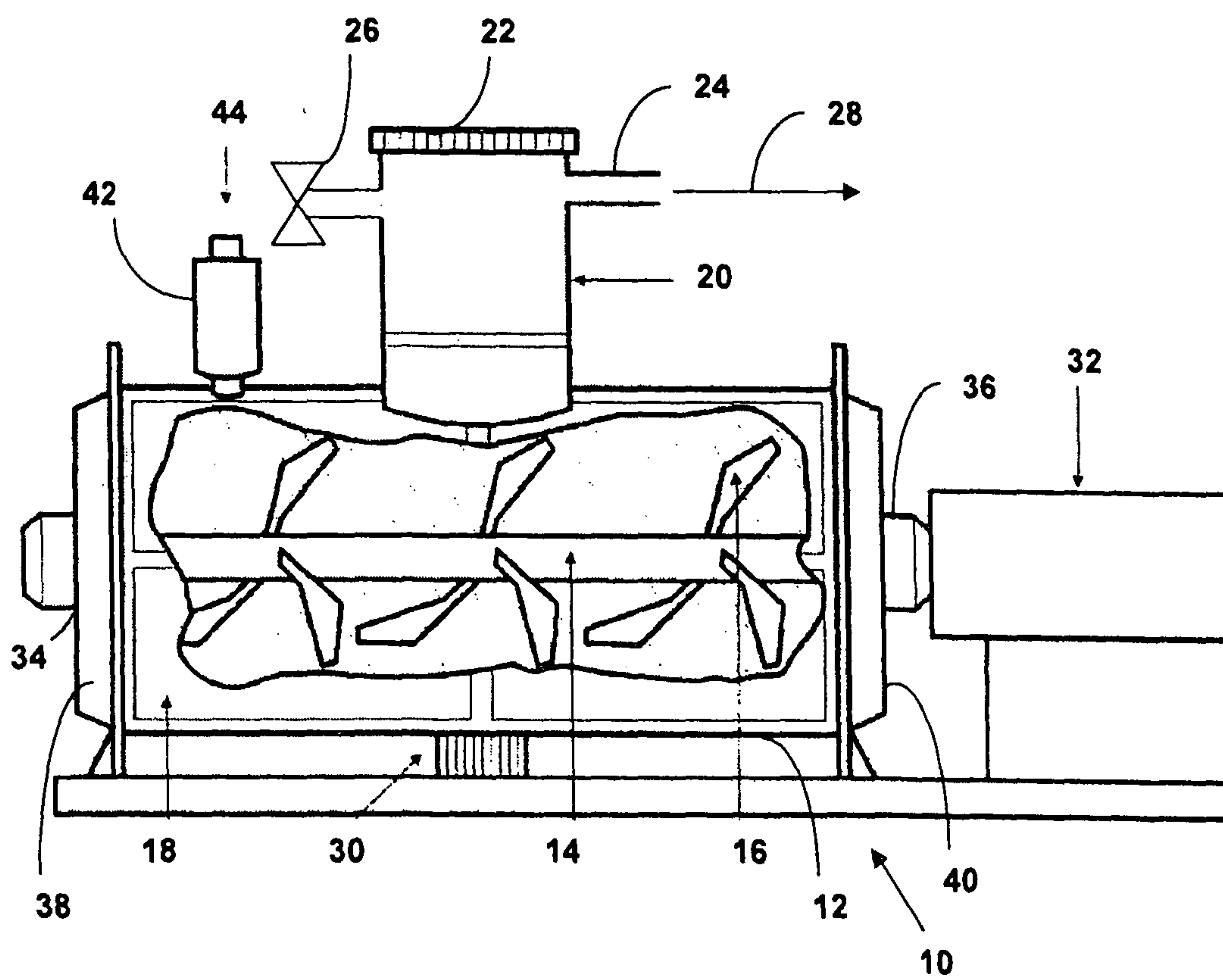
- 5 The foregoing embodiments are not intended to limit the scope of protection afforded by the claims, but rather to describe examples how the invention may be put into practice.

Claims

1. A process for preparing chocolate crumb comprising:
 - a) supplying a milk and sugar mixture, or mixing together milk and sugar, in a reaction vessel;
 - b) evaporating excess liquid from the mixture in the reaction vessel so as to form sweetened condensed milk;
 - c) adding cocoa mass/liquor to the reaction vessel after step (b);
 - d) subjecting the mixture of sweetened condensed milk and cocoa mass/liquor in the reaction vessel to conditions effective to bring about sugar crystallisation in the mixture; and
 - e) drying the crystallised mixture so as to form chocolate crumb,wherein step (a) is undertaken so that the reaction vessel contains a mixture of sugar and milk having a solids content of less than 90%; and wherein step (e) is undertaken in the same reaction vessel as steps (a) to (d).
2. A process as claimed in claim 1, wherein the milk is powdered milk.
3. A process as claimed in claim 2, wherein step (a) further comprises the addition of water.
4. A process as claimed in claim 1, wherein the milk comprises liquid milk.
5. A process as claimed in claim 4, wherein the liquid milk comprises concentrated liquid milk.
6. A process as claimed in claim 1, wherein the process further comprises adding milk solids to the reaction vessel, prior to undertaking step (d).

7. A process as claimed in claim 1, wherein step (b) and/or (d) comprises heating the mixture.
8. A process as claimed in claim 7, wherein the mixture is heated under a lowered pressure.
9. A process as claimed in claim 1, wherein the process further comprises the step of adding a fat to the mixture before or during step (e).
10. A process as claimed in claim 1, wherein the process further comprises the step of:
 - f) forming the chocolate crumb into briquettes.

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FIG.1.

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FIG.2.