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(54) **LIQUID OR PASTY PRODUCT ICE CUBE MAKER**

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(57) **ABSTRACT**

The invention concerns a method and an equipment for making ice cubes of liquid or pasty products comprising a honeycomb conveyor belt transporting the product to be processed along a path passing through at least the following three zones: a zone for metering and depositing the product to be processed in the cells; a cold input zone where preferably a cryogenic liquid solution completes the freezing of the ice cubes; and a stripping zone. Further, the honeycomb belt is bottomless, and located in an upstream zone opposite a cooled surface acting as a base of the partial mold formed by the cells, so as to harden the part of the product in contact with the cooled surface, thereby producing the base of the ice cube.

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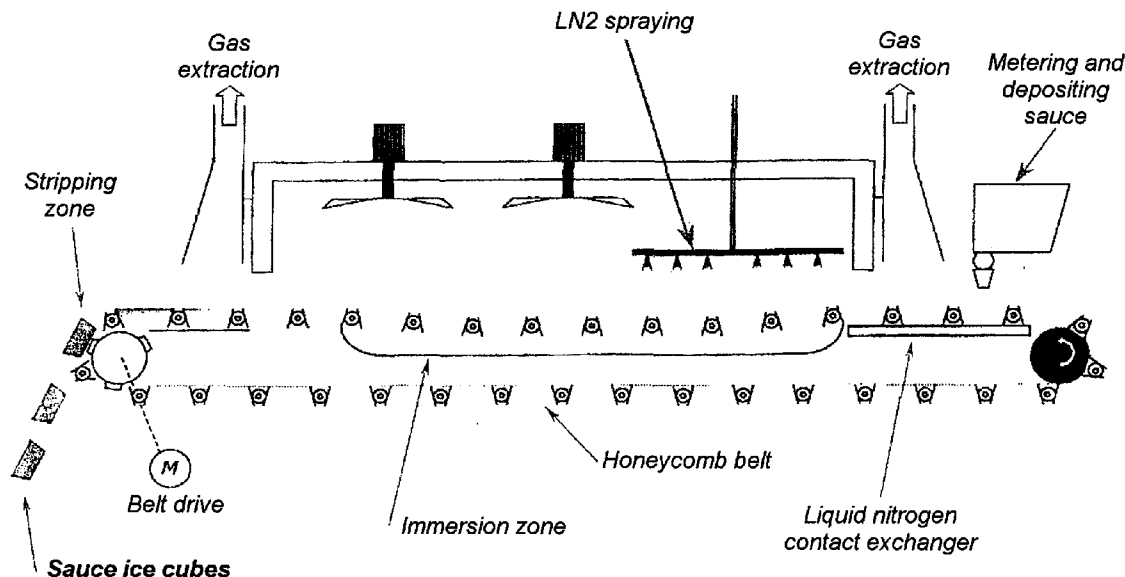
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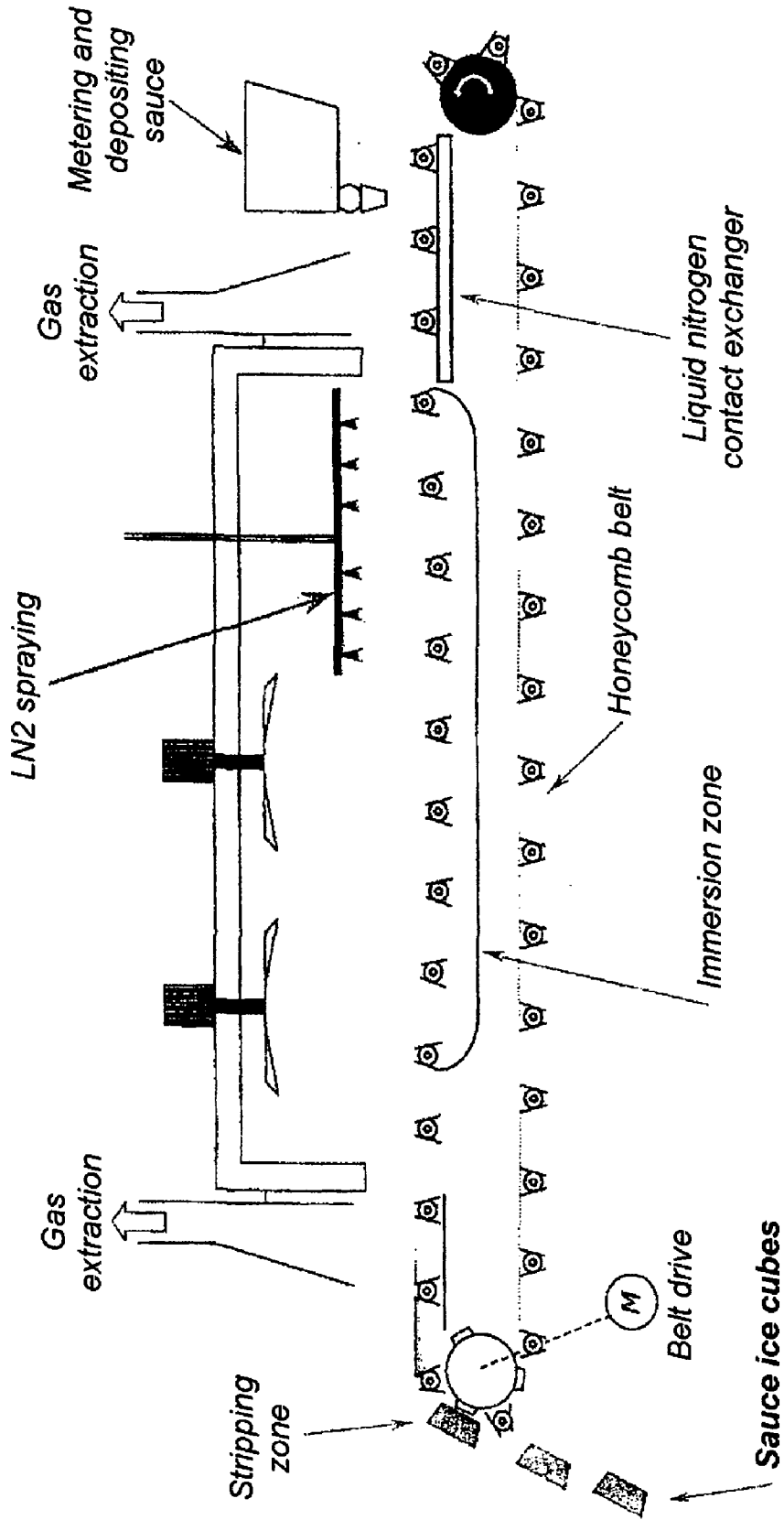
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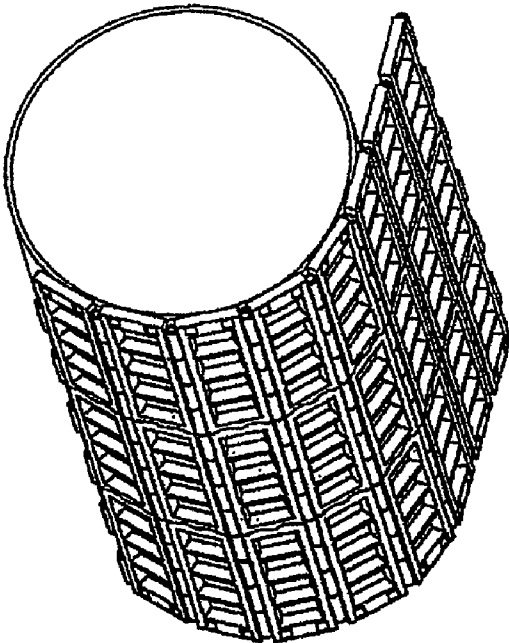
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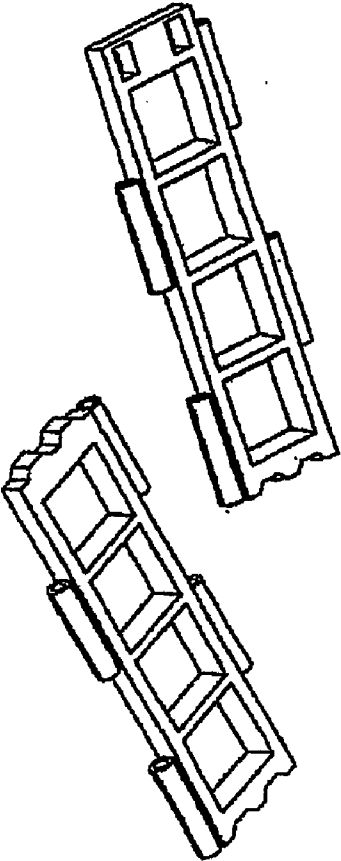


**Figure 1**





**Figure 2**



**LIQUID OR PASTY PRODUCT ICE CUBE  
MAKER**

[0001] The present invention relates to the field of methods and installations for the cryogenic treatment of products, in particular food products, and more particularly methods and installations for producing “ice cubes” or “pellets” or “tablets” from liquid or pasty products. Mention may be made in this category of examples of ice cubes from sauce, puree, juice or other liquids.

[0002] In recent years, methods have been seen to appear that employ, in order to produce such ice cubes, tunnels with honeycomb belts, thus consisting of an articulated chain of small molds that are filled with the mixture to be frozen, the stripping of which molds makes it possible to obtain ice cubes with the desired shape and characteristics.

[0003] This category of methods is found in document EP-1 115 637.

[0004] One of the well-known problems for these production methods is the adhesion of the tablets to the belt or support used, and therefore stripping difficulties, giving rise to material loss, surface marking of the tablets etc.

[0005] Document EP-1 115 637 provides, for its part, a special honeycomb belt structure facilitating stripping and limiting material losses. It provides precooling of the belt by dipping in a bath of cryogenic liquid before the liquid to be treated is poured into the honeycomb cells, which makes it possible for them to obtain crusting of the outer surfaces of the tablets, and the products are then stripped and transferred to a more conventional deep freezer in order to complete deep freezing the tablets to the core.

[0006] It is therefore one of the objectives of the present invention to provide a novel method for producing frozen tablets or ice cubes making it possible not only to solve problems of adhesion and material loss, but also to provide a more simple solution that can be incorporated within a single item of equipment.

[0007] As will be seen in greater detail below, the method for producing ice cubes from liquid or pasty products according to the invention is characterized by the employment of the following arrangements:

[0008] employing a bottomless honeycomb belt, conveyed in the equipment along a path passing through various zones of the equipment;

[0009] metering and depositing the fluid to be treated (sauce, juice etc.) in the cells of the belt in an upstream zone of the equipment;

[0010] the belt is located in this deposition zone opposite a cooled surface (for example a metal plate of a cryogenic fluid exchanger) that serves as a bottom for the partial mold made up of the cells. In this first zone, the part of the liquid in contact with the cooled surface is cooled or crusted so as to a certain degree to create the bottom of the ice cube;

[0011] thereafter, the belt continues its path in the equipment to bring the “pre-crusted” ice cubes into a zone where cooling is provided, making it possible to achieve freezing of the ice cubes, completely or partly, but preferably freezing to the core (it will be understood that according to the intended applications downstream, it is not always necessary to have core-freezing available), provision of cooling by any means even though it is preferred according to the invention to achieve this pro-

vision of cooling by causing the belt to pass through (be immersed in) a bath of cryogenic liquid, to a height preferably at least equal to the height of the bed of product in the molds.

[0012] For reasons that will be given in greater detail below, other methods for providing cooling can be envisaged according to the applications (mechanical cooling, sprays, porous belt of the type of that of document EP-A-505 222 etc.) but they are not preferred according to the present invention for reasons of productivity (it is necessary to run fast) but also in order to limit the risk of blowing away the fluid, for example the sauce.

[0013] The belt then leaves the zone where cooling is provided, for example the zone where there is immersion in a bath, in order to reach a zone where stripping occurs, for example due to the fact that, on leaving the equipment, the belt is rolled up around a shaft fitted with positive impressions that not only drive the belt but that can also be forced into the orifices of the belt (since it is bottomless) in order to push the ice cubes out of the molds.

[0014] The present invention therefore relates to an item of equipment for producing ice cubes from liquid or pasty products, comprising a honeycomb conveyor belt capable of conveying the product to be treated in the equipment along a treatment path passing through various zones of the equipment, and employing the following measures:

[0015] the equipment comprises successively at least the following three zones:

[0016] i) an upstream zone comprising a device for metering and depositing the product to be treated in the cells of the belt;

[0017] j) a zone for providing cooling;

[0018] k) a stripping zone.

[0019] said conveyor belt is a bottomless honeycomb belt;

[0020] the belt is located in said upstream zone opposite a cooled surface that acts as a bottom for the partial mold made up of the cells.

[0021] In preferred embodiments of the invention, it is additionally possible to make use of one and/or another of the following arrangements:

[0022] said cooled surface is a metal plate of a cryogenic liquid exchanger;

[0023] said zone for providing cooling is a bath of cryogenic liquid into which the belt passes on leaving said upstream zone, the height of the bath being preferably at least equal to the height of the bed of product in the cells;

[0024] said zone for providing cooling comprises one or more processes for providing cooling among the following processes: mechanical cooling, sprays of cryogenic liquid, a porous belt that can be impregnated with cryogenic liquid;

[0025] the stripping zone comprises a shaft fitted with positive impressions around which the belt is rolled up, that not only drive the belt but can also be forced into the cells of the belt in order to push the ice cubes out of these cells.

[0026] The invention also relates to a method for producing ice cubes from liquid or pasty products, in an item of equipment comprising a honeycomb conveyor belt capable of conveying the product to be treated in the equipment along a

treatment path passing through various zones of the equipment, the equipment comprising at least the following three zones:

- [0027] i) an upstream zone comprising a device for metering and depositing the product to be treated in the cells of the belt;
- [0028] j) a zone for providing cooling;
- [0029] k) a stripping zone,

the method employing the following measures:

- [0030] said conveyor belt is a bottomless honeycomb belt;
- [0031] the belt is located in the zone upstream from where the product to be treated is deposited, opposite a cooled surface that serves as a bottom for the partial mold made up of the cells, so as to produce crusting of the part of the product in contact with the cooled surface and to create in this way the bottom of the ice cube;
- [0032] complete or partial freezing of the ice cubes is carried out in the zone for providing cooling.

[0033] Preferably, the ice cubes are frozen to the core in the zone for providing cooling.

[0034] According to one of the embodiments of the method according to the invention, the ice cubes are frozen in the zone for providing cooling by causing the belt to pass through a bath of cryogenic liquid, of which the height is preferably at least equal to the height of the bed of product in the cells.

[0035] Other features and advantages will become apparent from the following description, given solely by way of example and made with reference to the appended figures in which:

[0036] FIG. 1 is a diagrammatic representation in section of an installation for generating ice cubes according to the invention;

[0037] FIG. 2 makes it possible to visualize better an embodiment of the "bottomless" honeycomb belt.

[0038] The present invention has the advantage of being used in a single and complete item of equipment, that ranges from the formation of ice cubes to their freezing and stripping.

[0039] It is traversed from one end to the other by a honeycomb conveyor belt, but with the important point that the belt, and therefore the cells, is bottomless (as can be seen perfectly in FIG. 2 that shows an example for the production of such a belt suitable for implementing the invention).

[0040] In an upstream zone, the belt encounters a device for metering and depositing the product (for example a sauce) to be treated in the cells of the belt. According to the invention, the belt is situated in this upstream zone opposite a cooled surface (here a liquid nitrogen contact exchanger) that serves as a bottom for the partial mold made up of the cells.

[0041] It has been understood in the light of the preceding description that this first zone makes it possible to cool/crust the portion of product in contact with the cooled zone and therefore to a certain degree to create the bottom of the ice cube, which will facilitate subsequent stripping.

[0042] Indeed, on leaving this upstream zone, the belt leaves the contact with the cooled surface and reaches a zone for providing cooling, here a zone for immersion in a bath of liquid nitrogen, a bath of which the height is preferably at least equal to the thickness of the bed of sauce in the cells, in order to obtain freezing of the pre-crusting of the ice cubes to the core.

[0043] As has been already mentioned above, other methods for providing cooling can be used, complementary to, or

as a replacement for, the cryogenic bath in the zone for providing cooling, according in particular to the subsequent application for which such ice cubes are intended (FIG. 1 illustrates for example the additional presence of fans and cryogenic fluid sprays) but it has already been noted that these methods are not preferred according to the present invention for reasons of productivity (it is necessary to run fast) but also in order to limit the risk of blowing away the sauce by the action of such fans or sprays.

[0044] The belt then leaves the zone for providing cooling in order to reach a stripping zone, which for the embodiment shown here is constituted by the fact that on leaving the equipment the belt is rolled up around a shaft fitted with positive impressions that not only drive the belt but can also be forced into the orifices of the belt (since it is bottomless) in order to push the ice cubes out of the honeycomb molds.

[0045] Although the production of square ice cubes has been described as an example in the preceding description, it will be understood that the cells of the belt could adopt any other form, and in particular a cylindrical, rectangular or even fantasy form, for example in the form of small figures.

1-7. (canceled)

8. An item of equipment for producing ice cubes from liquid or pasty products, comprising a honeycomb conveyor belt capable of conveying the product to be treated in the equipment along a treatment path passing through various zones of the equipment, and employing the following arrangements:

- a) the equipment comprises successively at least the following three zones:
  - 1) an upstream zone comprising a device for metering and depositing the product to be treated in the cells of the belt;
  - 2) a zone for providing cooling; and
  - 3) a stripping zone;
- b) said conveyor belt is a bottomless honeycomb belt; and
- c) the belt is located in said upstream zone opposite a cooled surface that acts as a bottom for the partial mold made up of the cells.

9. The item of equipment for producing ice cubes of claim 8, wherein said cooled surface is a metal plate of a cryogenic liquid exchanger.

10. The item of equipment for producing ice cubes of claim 8, wherein said zone for providing cooling is a bath of cryogenic liquid into which the belt passes on leaving said upstream zone, the height of the bath being preferably at least equal to the height of the bed of product in the cells.

11. The item of equipment for producing ice cubes of claim 8, wherein said zone for providing cooling comprises one or more processes for providing cooling among the following processes: mechanical cooling, sprays of cryogenic liquid, a porous belt that can be impregnated with cryogenic liquid.

12. The item of equipment for producing ice cubes of claim 8, wherein the stripping zone comprises a shaft fitted with positive impressions around which the belt is rolled up, that can in this way not only drive the belt but can also be forced into the cells of the belt in order to push the ice cubes out of these cells.

13. A method for producing ice cubes from liquid or pasty products, in an item of equipment comprising a honeycomb conveyor belt capable of conveying the product to be treated in the equipment along a treatment path passing through various zones of the equipment, the equipment comprising at least the following three zones:

- a) an upstream zone comprising a device for metering and depositing the product to be treated in the cells of the belt;
  - b) a zone for providing cooling; and
  - c) a stripping zone,
- and employing the following measures:
- d) said conveyor belt is a bottomless honeycomb belt;
  - e) the belt is located in the zone upstream from where the product to be treated is deposited, opposite a cooled surface that serves as a bottom for the partial mold made up of the cells, so as to produce crusting of the part of the

- product in contact with the cooled surface and to create in this way the bottom of the ice cube; and
- f) complete or partial freezing of the ice cubes is carried out in the zone for providing cooling.

**14.** The method for producing ice cubes of claim **13**, wherein the ice cubes are frozen in the zone for providing cooling by causing the belt to pass through a bath of cryogenic liquid, of which the height is preferably at least equal to the height of the bed of product in the cells.

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