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(54) FREEZING TUNNEL FOR FREEZING INDIVIDUAL FOOD PORTIONS

(57) Freezing tunnel (1) for cooling and freezing individual food portions, comprising a freezing room (3) in which food is frozen by means of cooled air, and a conveying device for moving the food through the freezing room (3), wherein the conveying device comprises a conveyor belt (9) and has at least a top layer made of silicone material in which a number of flexible mould cavities (17) are provided which are suitable for receiving an individual food portion. The conveyor belt (9) after passing a guide roller (6) follows a downwardly directed course.

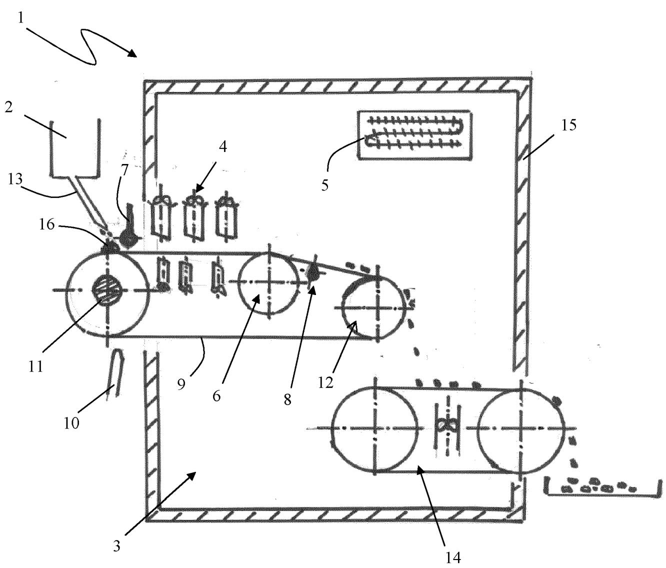

Fig. 1

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Description

[0001] The present invention relates to a freezing tunnel for cooling and freezing individual food portions, comprising a freezing room in which food is frozen by means of cooled air, and a conveying device for moving the food through the freezing room wherein the conveying device comprises an endless conveyor belt which is movable about a drive roll and a reversing roller and has at least a top layer made of silicone material in which a number of flexible mould cavities are provided which are suitable for receiving an individual food portion. The freezing tunnel is in particular suitable for freezing individual portions rather liquid foods such as soups, (fruit) juices, purees, smoothies, etc.

[0002] Many foods are refrigerated and frozen in industrial cooling or freezing tunnels, with various different types being available on the market. Thus, there are the plate or contact freezers, wherein packaged food portions are brought into contact with double-walled plates through which a coolant flows. The heat from the product is in this case dissipated to the coolant by means of conduction.

[0003] Furthermore, the known Pello freezer, described in the US patent publication US 4,517,814, wherein the food is evenly provided between two stainless steel belts and is frozen in the form of a long tablet which is subsequently divided into smaller portions. One of the belts has a profiled shape, so that grooves are formed in order to obtain a frozen tablet shape. The food is frozen during transportation between the two belts. The belts are kept at freezing temperature through contact with a glycol solution which is continuously sprayed on both sides of the two belts. When the frozen food is ejected, the tablet is broken either at the location of the grooves, producing pellet-like pieces (portions) of frozen food. Then, the tablet is sawn into smaller portions by means of a conventional steel saw. Thereafter, the frozen portions leave the freezing device and head in the direction of the packaging or storage room. However, such a solution for forming individual portions has a number of drawbacks. Thus, the Pello freezer is of a complicated mechanical design and comprises a large number of moving components which require a lot of maintenance and specialist knowledge to keep them working. Since the portions are formed by breaking and/or sawing, a lot of product is lost in the form of sawing waste. There is also a risk that the products may become contaminated by sawing/metal particles caused by the saw and/or by cooled glycol which is situated on the sides of the belts. In addition, the Pello freezer is also difficult to clean which causes a considerable number of problems in case of a product changeover, such as contamination due to the sequence of different types of product, and the risk of the growth of microorganisms on the parts which are difficult to clean increases. In this case, it is mainly the cleaning of the stainless steel conveyor belts which is difficult because two stainless steel belts are pressed against each other.

[0004] Another type uses a conveyor belt which passes the product through a freezing room. Freezing takes place during transportation through the freezing room by injecting a coolant, usually liquid nitrogen, over the conveyor belt and allowing it to expand. The conveyor belt is usually made of rigid plastic links which are hingedly attached to each other, so that every mould will individually release its contents by rolling the successive links over a discharge roller. However, such a device has the drawback that it is very difficult to clean the conveyor belt correctly. In addition, the use of nitrogen for freezing is a very expensive process because nitrogen has to be bought regularly, as a result of which this system is only economically viable in sectors with high profit margins and/or relatively small production volumes, such as for example the pharmaceutical industry.

[0005] European patent publication EP 2 216 613 describes a device for forming ice cubes in a refrigerator. The ice cubes are formed by pouring water into mould cavities provided for the purpose in a conveyor belt of silicone material. The conveyor belt is an endless conveyor belt which is movable about a first and second axle in a freezing room. When the water in a mould cavity is frozen, the respective mould cavity passes the first axle (reversing roller) where the mould cavity transfers from an upwardly directed position to a downwardly directed position. Due to the effect of the force of gravity and the elastic deformation of the mould cavity, the frozen ice cube is demoulded. Such a device which uses the force of gravity and the elastic deformation of the conveyor belt to demould frozen products is ideal for small volumes, but is not suitable to continuously freeze products on an industrial scale, where a conveyor belt will perform hundreds of revolutions per day at high production volumes, because continuous significant deformation of the conveyor belt when changing the position of the mould cavity filled with ice, results in (micro) damage, which will certainly lead to premature breaking or tearing of the belt.

[0006] It is now an object of the present invention to provide a freezing tunnel for the foods industry for cooling and freezing individual food portions, and this preferably in a fully automated manner. An additional object of the present invention is to provide a freezing tunnel which makes it possible to demould the individual portions in an easy and high-quality manner and this without causing damage to the frozen product and without the risk of contamination.

[0007] The object of the invention is achieved by providing a freezing tunnel for cooling and freezing individual food portions, comprising a freezing room in which food is frozen by means of cooled air, and a conveying device for moving the food through the freezing room, wherein the conveying device comprises an endless conveyor belt which is movable about a drive roll and reversing roller and has at least a top layer made of silicone material in which a number of flexible mould cavities are provided which are suitable for receiving an individual food portion, wherein the conveying device furthermore comprises a guide roller for the conveyor belt, which guide roller is situated between the drive roll and reversing roller, wherein the conveyor belt, after passing the guide roller, follows a downwardly directed course, preferably in the direction of the exit side of the conveyor belt. At the location of the guide roller, portions are demoulded. Such a course of the conveyor belt, also referred to as mould belt, will ensure a limited elastic deformation of the conveyor belt - and thus also of the at least partly filled mould cavities- at the location of the guide roller, so that the material from which the belt is made will not be damaged due to the frequent deformations of the mould cavities during a large number of revolutions. In use, due to the contact of the conveyor belt with the guide roller, the bottom surface of the mould cavity at the location of the guide roller will transform from flat to convex and the food portions accommodated and frozen in the mould cavity can be demoulded more easily. This effect (convex course) is made possible by the flexibility at very negative temperatures of the material (silicone) from which the conveyor belt is at least partly made.

[0008] The course of the conveyor belt is determined by the positioning of the various rollers, in particular the drive roll, the guide roller and the reversing roller, with respect to each other. Preferably, the drive roll and the guide roller are at equal height at a certain horizontal distance apart from each other, and the reversing roller is situated at a distance beyond the guide roller, at a position situated under the drive roll and the guide roller. Consequently, the conveyor belt follows a horizontal course between the drive roll and the guide roller which changes to a sloping downwardly directed course after passing the guide roller. The slope angle is preferably between 1° and 90°, more particularly between 10° and 45°. After the conveyor belt has passed the reversing roller, it moves back in the direction of the drive roll. The exit side of the conveyor belt is situated at the location of the reversing roller. In a preferred embodiment, the drive roll is driven and the guide roller and the reversing roller are freely rotatable. In an alternative embodiment, the guide roller and/or the reversing roller may also be designed to be drivable instead of the drive roll. It is also possible for all three rollers to be driven.

[0009] The fact that the conveyor belt is made of silicone makes perfect cleaning possible. Such a conveyor belt of which at least the layer in which the mould cavities are formed is made of silicone material is, in addition, able to withstand very cold temperatures, and this while retaining the required flexibility up to approximately -50°C. Preferably, in use, the cooled air will have a temperature of between -10°C and -50°C, preferably between -20°C and -40°C. The conveyor belt preferably consists of a top layer which is made entirely from silicone material, which is glued onto a backing material. The backing material is preferably a fabric-reinforced PU layer. The flexible mould cavities will, in addition, ensure that the individual frozen food portions can easily be released and demoulded, and this without parts of the frozen food breaking off.

[0010] In order to demould the food portions accommodated and frozen in the mould cavities even more easily, the present invention, in a preferred embodiment, provides a vibration device which is configured to make the conveyor belt vibrate locally and thus to generate at least an upwardly directed force which causes the food portions accommodated in the mould cavities to be released and/or to be at least partly lifted from the mould cavity. The vibration device is provided to make the conveyor belt vibrate locally at limited amplitude (0-50 mm, preferably 0-20 mm,) and adjustable frequency (0-250 Hz).

[0011] In a more preferred embodiment of the device according to the invention, the vibration device is provided between the guide roller and the reversing roller. In particular, said vibration device comprises a rotatable camshaft.

[0012] The vibration (oscillation) of the conveyor belt will generate an upwardly directed force, as a result of which the portions accommodated and frozen in the mould cavities are released and/or are already partly lifted from the mould cavity before they reach (pass) the guide roller of the conveying device. However, during filling of the mould cavities, some of the product will always remain on the mould cavities and this product will also be frozen. This causes the individual portions to be connected to each other at their top sides and a tablet-shaped unit to be formed. As a result of, on the one hand, the vibration of the conveyor belt and, on the other hand, the downwardly sloping course thereof, this tablet shape will break into pieces after it has passed the guide roller. By positioning the vibration device between the guide roller and the reversing roller, the vibration device will also create a wave-like movement in the downwardly directed part of the conveyor belt (mould belt), due to the rotating movement of the camshaft which in each case contacts the underside of the conveyor belt, as a result of which the (broken) pieces are broken down further into the separate individual portions during their trajectory in the downwardly directed part. As a result of the wave-like movement, the demoulded parts will also undergo an acceleration. The individual portions then leave the conveyor belt on the exit side, at the location of the reversing roller.

[0013] According to the present invention, the dimensions of the mould cavity were optimized so that the frozen portions are easily released (demoulded) from their mould cavity. In a preferred embodiment of the freezing tunnel according to the invention, at least a number of said mould cavities comprise a bottom surface and a peripheral wall. The mould cavities preferably have a depth of between 0.5 and 10 cm, more particularly a depth of between 2 cm and 7 cm. The length of the mould cavity is preferably between 0.5 cm and 10 cm. In this case, due to the chamfering of the mould cavity, the length of the bottom surface is never greater than the top surface. The ratio between the length/width of the mould cavity is preferably between 0.5 and 3. The ratio between depth and length is preferably between 0.05 and 1. The mould cavity should not be excessively deep in order not to make the freezing time too long.

[0014] In order to be able to work as economically as possible, the mould cavities are arranged as closely next to each other as is possible from a structural point of view for the strength of the conveyor belt. The mould cavities are preferably arranged at an intermediate space of 1 to 100 mm apart, in particular at an intermediate space of 5 mm to 50 mm apart.

[0015] The mould cavities have a well-defined chamfer angle in order to make demoulding easier. In a more preferred embodiment of the freezing tunnel according to the invention, the angle between the bottom surface and the peripheral wall is between 90° and 170°, preferably between 90° and 130°. Adjusting the angle, the more oblique the better, contributes to an improved demoulding of the frozen products. However, the angle should also not be too inclined in order not to limit the product volume per mould cavity too much. The design of the mould cavities will also contribute to an improved demoulding. In particular, at least a number of said mould cavities have a shape which, in top view, is irregular or polygonal. A shape of the mould cavity in which the smallest (most acute) angle (corner), viewed in top view, is turned towards the direction of rotation of the conveyor belt is preferred. In this way, each frozen portion in each mould cavity initially undergoes a minimal resistance during demoulding.

[0016] In a more particular embodiment of the freezing tunnel according to the invention, the conveyor belt has upright side edges. The upright side edges, also referred to as strips, provide an overflow protection when filling the various mould cavities. For filing, the freezing tunnel preferably comprises a filling device suitable for filling the flexible mould cavities with food to be frozen. Filling the mould cavities will take place by allowing the product to be frozen to flow freely over the conveyor belt. For correct filling, the filling device is provided, in particular, with (optical) sensors which continuously monitor filling of the mould cavities.

[0017] Preferably, the freezing tunnel furthermore also comprises a scraping element, preferably a heated scraping element, configured to scrape excess product from the conveyor belt after the mould cavities have been filled.

[0018] In a most particular embodiment of the freezing tunnel according to the invention, the freezing tunnel comprises a cleaning system for cleaning the conveyor belt. The cleaning system is preferably a continuous system. The conveyor belt is first cleaned using a cleaning liquid which is applied via a system of various spray pipes. Subsequently, the conveyor belt is dried by means of a fan, so that the conveyor belt with the mould cavities is dry before the mould cavities are filled again. In this way, a maximum food safety and cleanliness of the frozen product is achieved.

[0019] As the mould belt is made from silicone material, which has a high insulating capacity, freezing the food present in the mould cavities will proceed rather slowly, in an advantageous embodiment, the freezing tunnel according to the present invention furthermore comprises a hard-freezing belt to continue to freeze the demoulded portions and remove them from the freezing room. The hard-freezing belt (discharge belt) preferably has an open structure, and has a lower insulating capacity than the mould belt. The hard-freezing belt is preferably a stainless steel linked belt. By providing the freezing tunnel with a first mould belt and a second hard-freezing belt, it becomes possible to provide the food portions with the suitable shape in the mould belt and continue to freeze the individual portions after to demoulding on the hard-freezing belt until the desired core temperature is reached, and this in an economical way (the freezing process on the hard-freezing belt is much quicker than in the mould belt). In this way, it is also possible to limit the length of the (more expensive) mould belt.

[0020] The coolant is preferably cooled air which is circulated in the freezing room by means of fans. In order to maximize the air velocity and consequently the heat transfer across products, blow nozzles are placed above the conveyor belt. The air is refrigerated in a conventional way by passing it through a heat exchanger in which a liquid coolant evaporates and/or heats up as a result of the heat transfer.

[0021] The present invention will now be explained in more detail by means of the following detailed description of a preferred embodiment of a freezing tunnel according to the present invention. The sole aim of this description is to give explanatory examples and to indicate further advantages and particulars thereof, and can therefore by no means be interpreted as a limitation of the area of application of the invention or of the patent rights defined in the claims.

[0022] In this detailed description, reference numerals are used to refer to the attached drawings, in which:

- ***Fig. 1**: shows a diagrammatic representation of the freezing tunnel according to the invention;*
- ***Fig. 2**: shows a top view of a first embodiment of a conveyor belt with bowl-shaped mould cavities;*
- ***Fig. 3**: shows a cross section A-B of the conveyor belt illustrated in Fig. 2;*
- ***Fig. 4**: shows a top view of a second embodiment of a conveyor belt with pyramid-shaped mould cavities;*
- ***Fig. 5**: shows a cross section A-B of the conveyor belt illustrated in Fig. 4;*
- ***Fig. 6**: illustrates the transformation of the mould cavity, with Fig. 6.1 showing the shape of a mould cavity during the course through the freezing room, and Fig. 6.2 showing the shape of the mould cavity when leaving the conveyor belt at the location of the reversing roller.*

[0023] The present invention is illustrated diagrammatically in Fig. 1 and relates to a freezing tunnel (1) for cooling and freezing individual food portions, comprising a freezing room (3) in which food is frozen by means of cooled air, and a conveying device for moving the food through the freezing room (3). The conveying device comprises a conveyor belt (9) (mould belt) provided with mould cavities suitable for receiving individual food portions (product) (16). The conveyor belt (9) is preferably an endless conveyor belt which runs on a drive roll (11), a guide roller (6) and a reversing roller (12). The guide roller (6) is situated between the drive roll (11) and the reversing roller (12). Between the drive roll (11) and the guide roller (6), the conveyor belt (9) follows a horizontal course in which the individual portions provided in the mould cavities are given time to at least partly freeze. At the location of the guide roller (6), the conveyor belt (9) changes to a downwardly directed course (slope angle between 10° and 45°) in the direction of the exit side of the conveyor belt (9). At the location of the guide roller (6), the at least partly frozen portions are demoulded. The course of the conveyor belt will result in a limited elastic deformation of the conveyor belt - and thus also of the mould cavities- at the location of the guide roller, so that the material from which the belt is made will not be damaged due to the large number of revolutions. In use, at the location of the guide roller (6), the bottom surface of the mould cavity will transform from flat to convex due to the conveyor belt (9) coming into contact with the guide roller (6), and the food portions accommodated and frozen in the mould cavity can be demoulded more readily. This effect (convex course) is made possible by the flexibility of the material (silicone) from which the conveyor belt (9) is at least partly made at very negative temperatures.

[0024] As is clear from Fig. 1 , the conveyor belt (9) partly extends in the freezing room (3). In this case, the exit side of the conveyor belt (9) is situated in the freezing room (3), while the entry side of the conveyor belt (9), where the food (16) to be frozen is arranged in the various mould cavities (17) of the conveyor belt (9), is situated outside the freezing room (3).

[0025] To maintain the temperature inside the freezing room (3), it is enclosed by an insulated housing (15). In order to be able to freeze the portions to a core temperature of at least -18°C, cooled air of approximately -40°C will be passed through the freezing room (3). The cooled air is generated by forcing an air stream through a fitted heat exchanger (5). This air is then injected into the freezing room (3) at high speeds via a blow nozzle system (4) - above the food to be frozen. After it has absorbed the heat from the product, the same air is sucked in again by fans and passed over the heat exchanger(s) (5).

[0026] The freezing tunnel (1) comprises a filling device (2) for filling the various mould cavities (17) with a food (16) to be frozen. The mould cavities will be filled by allowing the product to be frozen to flow freely across the conveyor belt (9) at the entry side. In order to spread the product to be frozen evenly across the conveyor belt (9), a distribution roller (7) is situated at the entry side and extends virtually across the entire width of the conveyor belt (9). The distribution roller (7) is height-adjustable, as a result of which it is possible to ensure that a layer of product of a certain layer thickness is present above the mould cavities, as a result of which the individual portions in the mould cavities are joined to each other and a connected unit (tablet structure) is created, as it were. The thickness of the layer is determined by the distance between the distribution roller and the top surface of the conveyor belt. The respective distance is variable between 0 mm and 10 mm. In order to achieve a correct filling, the filling device is in particular provided with a buffer system which is controlled by means of (optical) sensors which continuously check the filling procedure of the mould cavities. In order to prevent a significant part of the product to be frozen from disappearing via the sides of the conveyor belt (9), the conveyor belt has upright side edges as overflow protection. In order to remove excess product from the conveyor belt (9) to ensure that there is no excess of product on the conveyor belt (9), a scraping element (13), preferably a heated scraping element (13), is provided at the entrance to the freezing room (3).

[0027] The mould cavities (17) which are provided in the conveyor belt are flexible; to this end at least the top layer of the conveyor belt, and preferably the entire conveyor belt is made of silicone material. In an alternative embodiment, the conveyor belt is formed by a top layer of silicone material, wherein the mould cavities (17) are provided in the top layer which is mounted on a backing material (bottom layer), preferably a fibre-reinforced PU material. The connection between the bottom and top layer is preferably achieved by means of adhesive bonding. By using a conveyor belt made of silicone, it is possible to ensure perfect cleaning. In addition, the conveyor belt (9) is able to withstand very cold temperatures while maintaining its flexibility up to approximately -50°C. This flexibility is important when demoulding the frozen food portions.

[0028] Due to the low negative temperatures in the freezing room (3) - cooled air up to -40°C to be able to freeze the portions to a core temperature of at least -18°C - the food placed in the mould cavity will expand. This results in the frozen products being difficult to demould. In order to make it easier to demould the frozen products, the present invention provides a solution by using flexible mould cavities which will ensure that the frozen individual food portions, when they leave the conveyor belt, can readily be demoulded, and without parts breaking off. Due to its good flexibility at very negative temperatures, the silicone material ensures that the shape of the cavities will change at the location of the guide roller (6), in particular the shape of the bottom surface will transform from flat to convex. The angle of the peripheral wall with respect to the bottom surface will also change, as is illustrated in Fig. 6, in this case, π is greater than π'. In operation, the bottom surface of the mould cavity will transform from flat to convex at the location of the guide roller (6), as a result of which the food portions accommodated in the mould cavity and at least partly frozen can readily be demoulded. Further measures to ensure that the (partly) frozen product is demoulded is described in more detail below.

[0029] The mould cavity may have all kinds of forms; the attached figures show two possible embodiments, obviously, other embodiments are also possible. Figs. 2 and 3 show a bowl-shaped mould cavity, whereas Figs. 4 and 5 show a pyramid-shaped mould cavity with a pointed bottom surface.

[0030] The angle between the bottom surface and the peripheral wall of the mould cavity is between 90° and 170°, preferably between 90° and 130°. Adjusting the angle - the greater the incline, the better - contributes to easier demoulding of the frozen products, although it does reduce the product volume per mould cavity. Said mould cavities preferably have a shape which, in top view, is irregular or polygonal. It is preferable to use a shape of the mould cavity in which, viewed in top view, the smallest angle always points in the direction of rotation of the conveyor belt (9). In this way, each frozen product in each mould cavity initially undergoes a minimal resistance during demoulding by means of rolling over a reversing roller.

[0031] In order to make it even easier to demould the food portions accommodated and frozen in the mould cavities, a vibration device (8) may furthermore be fitted. This vibration device is in particular fitted between the guide roller (6) and the reversing roller (12), preferably at the location of or in the vicinity of the guide roller (6). The vibration device is preferably a rotatable camshaft. The vibration device (8) will make the conveyor belt (9) vibrate locally at a limited amplitude (0-50 mm) and adjustable frequency (0 - 250 Hz).

[0032] The vibration (oscillation) of the conveyor belt will generate an upwardly directed force, as a result of which the portions accommodated and frozen in the mould cavities are released and/or are already partly lifted from the mould cavity before they reach (pass) the guide roller (6). However, during filling of the mould cavities, some of the product will always remain on the mould cavities and this product will also be deep-frozen. This causes the individual portions to be connected to each other at their top sides and a tablet-shaped unit to be formed. However, it is also possible to produce a tablet structure on purpose by placing the distribution roller (7) at some distance from the top surface of the conveyor belt (9). As a result of, on the one hand, the vibration of the conveyor belt and, on the other hand, the downwardly sloping course thereof, this tablet shape will break into pieces after it has passed the guide roller. By positioning the vibration device (8) between the guide roller (6) and the reversing roller (12), the vibration device (8) will also create a wave-like movement in the downwardly directed part of the conveyor belt (9), due to the rotating movement of the camshaft which in each case contacts the underside of the conveyor belt (9), as a result of which the (broken) pieces are broken down further into the separate individual portions during their trajectory in the downwardly directed part. As a result of the wave-like movement, the demoulded parts will also undergo an acceleration. The individual portions then leave the conveyor belt on the exit side, at the location of the reversing roller.

[0033] The conveying device furthermore comprises, in addition to the first endless conveyor belt (also referred to as mould belt), a second endless conveyor belt to continue to freeze the demoulded portions and transport them out of the freezing room. This second conveyor belt is referred to as the hard-freezing belt (14) and will collect the demoulded portions and transport them further in the direction of a storage device which is suitable for the purpose. The first conveyor belt (9) has a closed structure, whereas the hard-freezing belt (14) is a belt with an open structure, preferably a stainless steel linked belt, where the demoulded portions can continue to hard-freeze. Due to the open structure, the individual portions will reach the desired core temperature much more quickly than if they were to be frozen only on the first conveyor belt. The length of the hard-freezing belt (14) is preferably 1/3 of the length of the first conveyor belt (9).

[0034] By placing the hard-freezing belt (14) largely in the freezing room, it is possible to opt for freezing the portions during their course through the freezing room in the mould cavities of the first conveyor belt only partly, in which case it has to be ensured that the outer surface of the portions is sufficiently strong so that it does not break during demoulding. The material in the core remains liquid. After the partly frozen portions have been demoulded at the location of the guide roller (6) and, by way of the sloping part of the first conveyor belt (9), land on the second conveyor belt (hard-freezing belt) where they are frozen further until the core has reached a temperature of approximately - 18° to - 20°C. Due to the open structure, freezing will be much quicker compared to the first belt which is made of silicone.

[0035] The freezing tunnel (1) may furthermore be fitted with a cleaning system (10) for cleaning the conveyor belt (9). The cleaning system (10) is preferably a continuous system. The cleaning system (10) comprises a cleaning unit consisting of a spraying unit and a drying fan. The conveyor belt is first cleaned by means of a cleaning liquid which is applied via a system of various spray pipes of the spraying unit. Subsequently, the conveyor belt is dried by means of the drying fan, so that the conveyor belt (9) with the mould cavities is dry before the mould cavities are able to be filled again.

[0036] The freezing tunnel according to the present invention is particularly suitable for freezing individual portions of rather liquid food, such as soups, (fruit) juices, purees, smoothies, etc.

[0037] The freezing tunnel (1) according to the present invention is an industrial freezing tunnel, wherein the housing has a length which is between 25 metres and

40 metres.

Claims

1. Freezing tunnel (1) for cooling and freezing individual food portions, comprising a freezing room (3) in which food is frozen by means of cooled air, and a conveying device for moving the food through the freezing room (3), wherein the conveying device comprises an endless conveyor belt (9) which is movable about a drive roll (11) and reversing roller (12) and has at least a top layer made of silicone material in which a number of flexible mould cavities (17) are provided which are suitable for receiving an individual food portion, **characterized in that** the conveying device furthermore comprises a guide roller (6) for the conveyor belt (9), which guide roller (6) is situated between the drive roll (11) and reversing roller (12), wherein the conveyor belt (9), after passing the guide roller (6), follows a downwardly directed course.

2. Freezing tunnel (1) according to Claim 1, **characterized in that** the freezing tunnel (1) comprises a vibration device (8) which is configured to make the conveyor belt (9) vibrate locally and thus to generate at least an upwardly directed force which causes the food portions accommodated in the mould cavities (17) to be released and/or to be at least partly lifted from the mould cavity (17).

3. Freezing tunnel (1) according to Claim 2, **characterized in that** the vibration device (8) is provided between the guide roller (6) and the reversing roller (12).

4. Freezing tunnel (1) according to Claim 2 or 3, **characterized in that** said vibration device (8) comprises a rotatable camshaft.

5. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** at least a number of said mould cavities (17) comprise a bottom surface (18) and a peripheral wall (19).

6. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** the mould cavities (17) have a depth of between 0.5 and 10 cm.

7. Freezing tunnel (1) according to Claim 5 or 6, **characterized in that** the angle between the bottom surface (18) and the peripheral wall (19) is between 90° and 170°.

8. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** at least a number of said mould cavities (17) have a shape which, in top view, is irregular or polygonal.

9. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** the conveyor belt (9) has upright side edges.

10. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** the freezing tunnel (1) comprises a filling device (2) suitable for filling the flexible mould cavities (17) with food to be frozen.

11. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** the freezing tunnel (1) comprises a cleaning system (10) for cleaning the conveyor belt (9).

12. Freezing tunnel (1) according to one of the preceding claims, **characterized in that** the freezing tunnel (1) furthermore comprises a hard-freezing belt (14) to continue to freeze the demoulded portions and remove them from the freezing room (3).

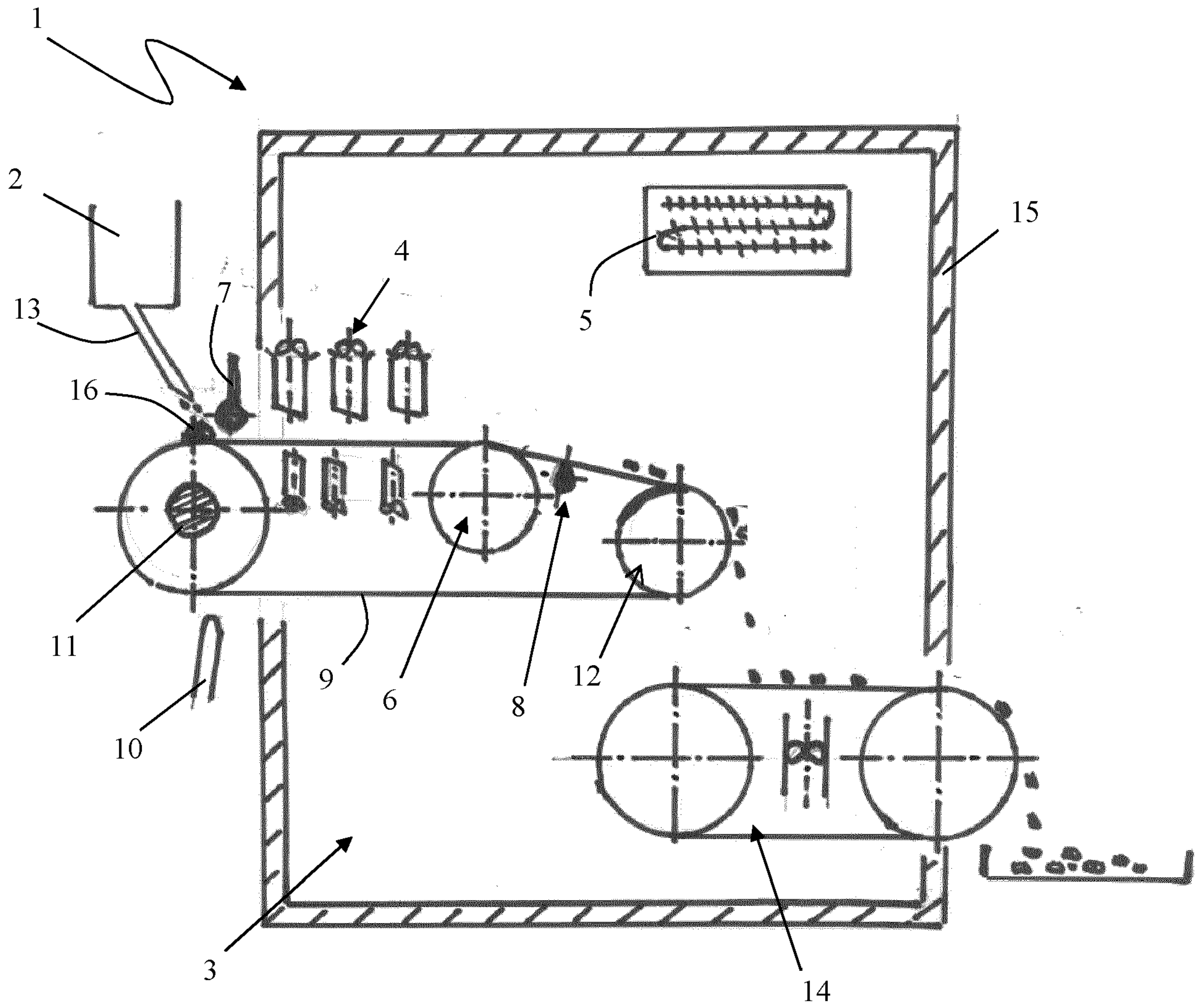

Fig. 1

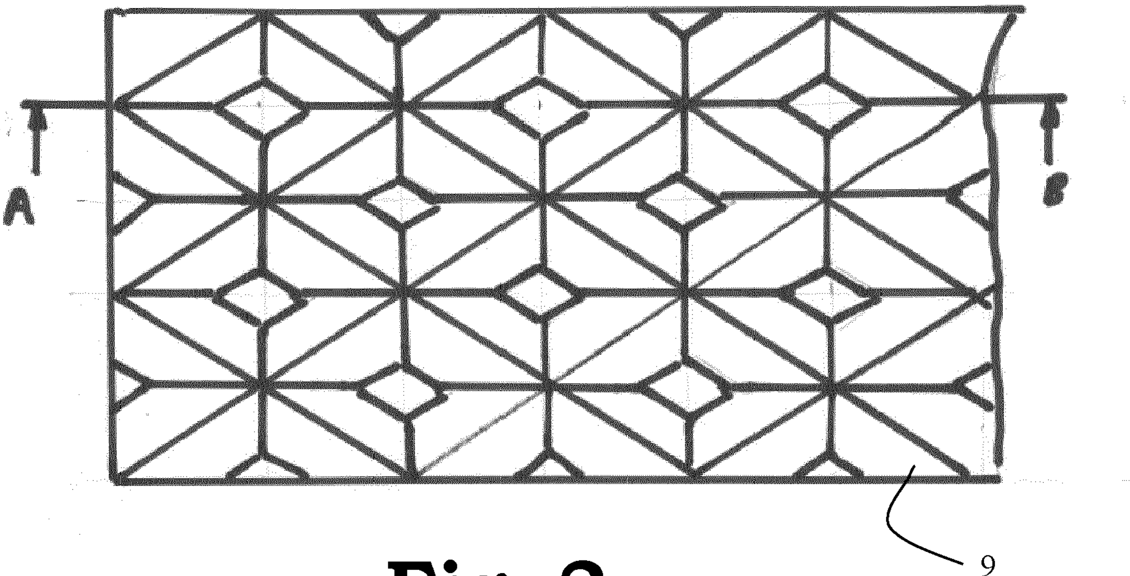

Fig. 2

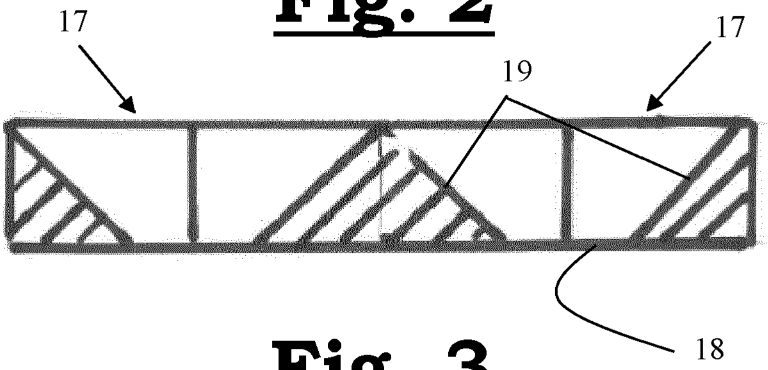

Fig. 3

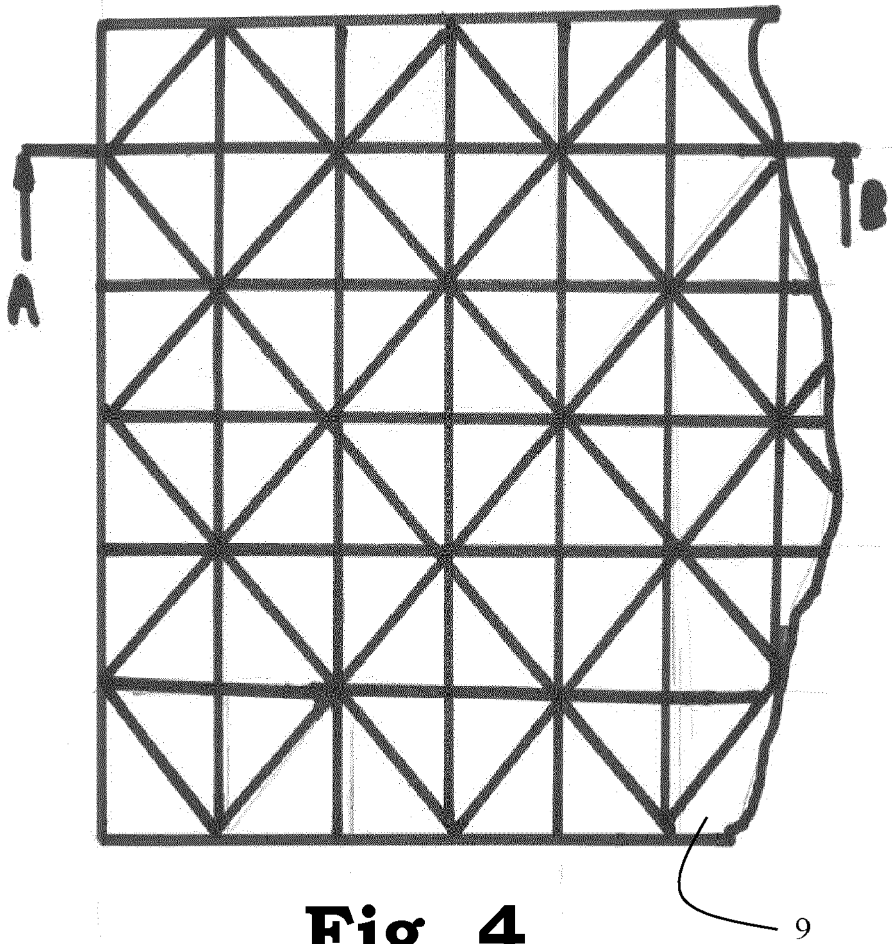

Fig. 4

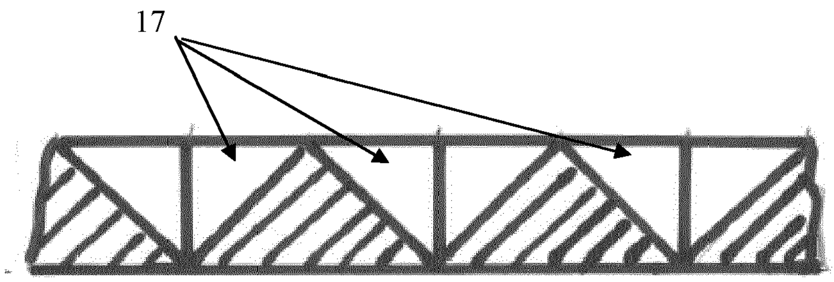

Fig. 5

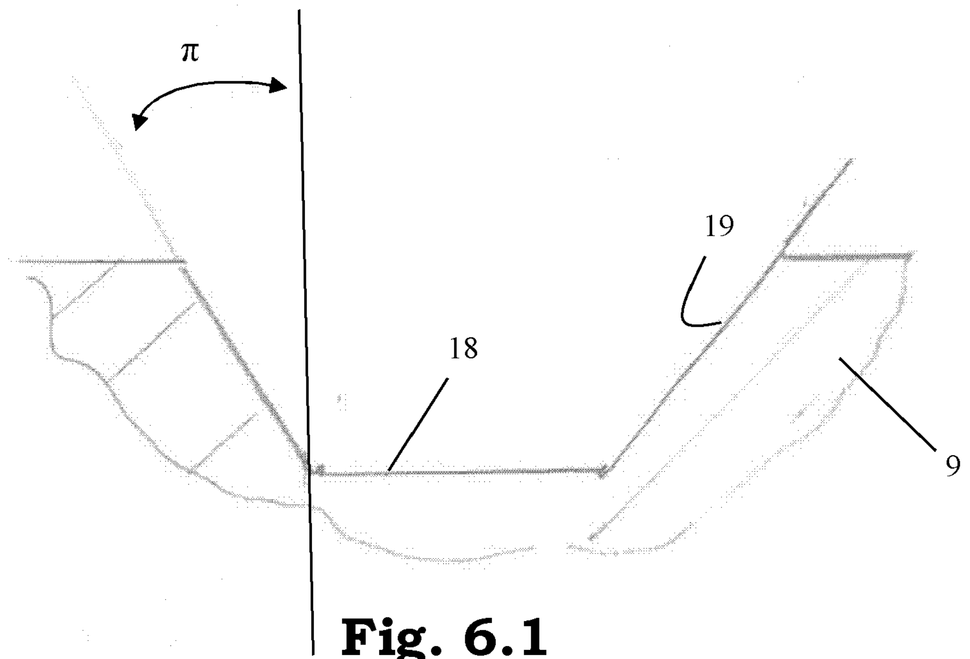

Fig. 6.1

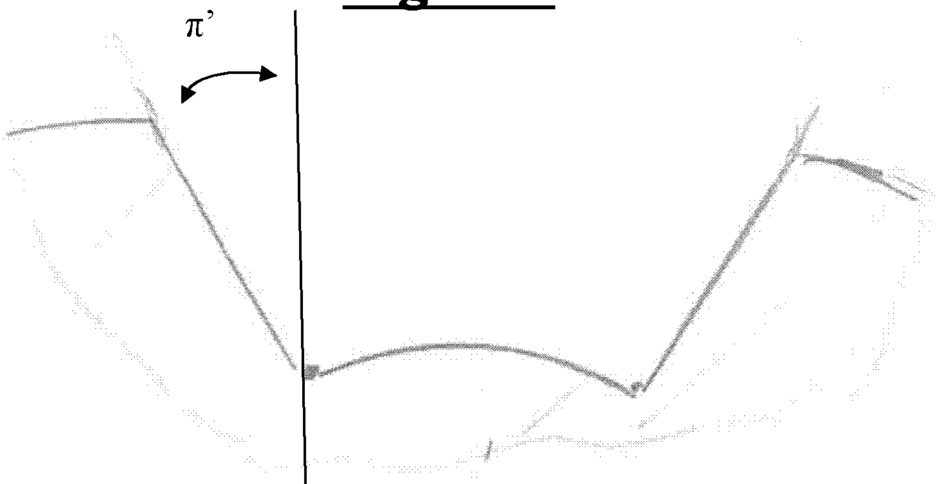

Fig. 6.2

Fig. 6

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EUROPEAN SEARCH REPORT

Application Number
EP 20 17 9701

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The present search report has been drawn up for all claims

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Place of search	Date of completion of the search	Examiner
The Hague	29 September 2020	Yousufi, Stefanie

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