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(54) **Device for manufacturing frozen foodstuffs and method for using such a device**

(57) In a method for producing lump shaped bodies, such as ice cubes, by freezing a liquid substance, a package is provided comprising at least one mould element with at least a series of mould cavities which are interconnected and at least one filling opening. Said mould cavities are filled with the liquid substance. Next, the package is positioned in between a pair of cooling elements and the liquid substance is frozen while forming a freeze front in the substance starting from each of the cooling elements, behind which freeze front the substance has changed into the frozen state.

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Description

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates to a device for manufacturing frozen food products, such as a liquid or a paste-like food, and a method for use of such a device.

Description of the Related Art

[0002] Manufacturing of the frozen products is usually done in a mould as disclosed in the international patent publication WO2011/059333. A liquid, usually water, is frozen in a mould comprising two parts, which mould parts comprise pairs of interconnected hollow spaces for forming ice blocks. An elongated element is inserted into the mould upon filling. The elongated element is then moved backwards in the series of hollow spaces in such a manner that it is always situated in front of the freeze front. According to a first possibility, the freezing of the liquid substance is effected by slowly moving back the element in the mould cavities which initially contain a still liquid substance. The effect thereof is that the liquid substance is moved or stirred, which has the advantage that inclusions, such as air inclusions, can escape from the substance. The mould parts are moved away from each other after forming the ice blocks and the ice blocks can be released from the mould.

[0003] A disadvantage of such a method of freezing liquid is that the mould element should always have a suitable sized opening to accommodate the elongated element. Additionally, using such an elongated element requires the use of a relatively large mould to produce a significant number of ice lumps per batch. Moreover, after releasing the frozen lumps from the mould, the ice blocks will form individual loose ice blocks. These individual ice blocks are then packed for transportation and the like. Packing loose, individual ice blocks or blocks of frozen products in a container or a bag have the disadvantage that the volume of such a package is not used optimally. As it is, the cardboard containers used are usually larger than needed for the amount of frozen product inside, due to the random orientation, i.e. not ordered, of the blocks. This is also true for the used bags.

[0004] It would therefore be desirable to provide a device and a method to manufacture frozen products that overcome the disadvantages of the prior art.

BRIEF SUMMARY OF THE INVENTION

[0005] According to the invention, there is provided a method for producing lump shaped bodies, such as ice cubes, by freezing a liquid substance, the method comprising:

- providing a package comprising at least one mould element with at least a series of mould cavities which are interconnected and at least one filling opening;
- at least partly filling the mould cavities with the liquid substance through the filling opening;
- positioning the package in between a pair of cooling elements;
- freezing the liquid substance by reducing the temperature of the cooling elements while forming a freeze front in the substance starting from each of the cooling elements, behind which freeze front the substance has changed into the frozen state; and

[0006] Freezing a liquid substance in such a way has the advantage that the time needed to freeze the liquid substance in the mould element is reduced and the efficiency of the production of the frozen product is increased. Additionally, the lump shaped bodies can be frozen in the package and do not need to be separated after freezing. The package can thus be used for transportation and storage purposes as well.

[0007] The formation of two freeze fronts in the liquid substance has the advantage that the freezing step occurs more quickly than using one freeze front or to use an elongate body within the liquid substance.

[0008] According to a preferred embodiment, the method comprises adding a movement to the liquid substance while freezing the liquid substance.

[0009] Addition of movement to the liquid substance prevents contaminants, such as minerals, to pile up or from being included in the frozen body, such as air bubbles, and would in particular result in clear, transparent ice blocks when water is used. The movement of the liquid substance may be optimized so not to impede the freezing of the liquid substance.

[0010] According to a further embodiment, adding a movement to the liquid substance comprises providing a pulsating movement to the package and/or the cooling elements.

[0011] According to an embodiment, the package has parallel outer surfaces and the cooling elements comprise parallel cooling plates, the method comprising:

- positioning the package in between a pair of the parallel cooling plates such that each of the parallel outer surfaces of the package is adjacent to a respective cooling plate; and
- forming a freeze front in the liquid substance starting from each of the cooling plates.

[0012] Using a package with parallel outer surfaces and positioning the package between parallel cooling plates has the advantage that the freeze front in the liquid substance on either side of the package may progress in a parallel way towards each other. This would further benefit the efficiency increase of the production of lump shaped bodies.

[0013] According to another embodiment, the method comprises:

- positioning the package in an upright position, such that the filling opening is positioned at a top end of the mould element;
- filling the mould cavities with the liquid substance through the filling opening;
- moving the filled package while freezing the liquid substance.

[0014] The liquid substance used for making the lump shaped bodies can be a liquid, such as water, a paste, such as a spinach paste, an emulsion, such as a soup, or any other suitable liquid substance. In case a liquid such as water is used, it is preferred that the package is in the upright position, such that the filling opening is at the top end of the mould element. In such a way, the liquid may not leak from the mould element after filling and before freezing. For such a liquid, is would be beneficial if the filled package or mould element is moved, such that air bubbles or other contaminants are prevented from being included in the resulting ice lump.

[0015] According to another embodiment, each mould cavity comprises a base and a peripheral wall extending from the base, the method comprising:

- connecting a sealing element to the peripheral wall such that the base, the peripheral wall and the sealing element enclose a filling space;
- filling the filling space with the liquid substance; and
- positioning the package between the cooling elements such that the base of the mould cavity and the sealing element are each adjacent to one of the cooling elements.

[0016] The method may be advantageous when using a mould element of which each mould cavity comprises a base and a peripheral wall extending from the base and wherein a sealing element is connected to the peripheral wall the base, the peripheral wall and the sealing element enclose a filling space. The package is then positioned between the cooling elements such that the filling space is enclosed by the cooling elements at the base and at the sealing element. A part of the peripheral wall between two adjacent mould cavities may not be connected to the sealing element, for instance at the position of a recessed portion. This recessed portion and the sealing element may form an interconnecting space between adjacent mould cavities that are than in fluid connection. The interconnecting space may be used to fill all the mould cavities of the mould element upon filling. After freezing, the frozen liquid substance in the interconnecting space may form a connection between the lump shaped bodies.

[0017] Alternatively, the mould element may comprise a first mould element part comprising a series of interconnected mould cavities and a second mould element part comprising a series of interconnected mould cavities, wherein the first mould element part and the second mould element part are pivotably connected to each other, such that the parts are pivotable towards each other. The mould element parts can be pivotably connected by means of a living hinge part between the mould element parts. Preferably, the mould element parts are pivoted towards each other after connecting the sealing element to the peripheral wall of the mould cavities, wherein sides of the mould element parts comprising the sealing element face each other.

[0018] According to another embodiment, the method comprises after the step of freezing the liquid substance:

- transporting the mould element to a packing station;
- providing a container to put in one or more mould elements containing the frozen liquid substance.

[0019] After freezing, the resulting lump shaped bodies may remain in the mould cavities of the mould element, such that the mould element forms a package for the lump shaped bodies. The package may further comprise a container to put in one or more mould elements, or a sleeve holding at least one mould element. This way of packing the lump shaped bodies is more efficient volume wise than packing separated lump shaped bodies in a bag or a carton container.

[0020] The invention also relates to a device for carrying out the method as described above, the device comprising a freezing chamber provided with at least two cooling elements, as well as a liquid supply for supplying a liquid substance to a series of mould cavities of a mould element, which mould element is positionable in between the cooling elements, such that the cooling elements are each adjacent to a side of the mould element.

[0021] By providing at least two cooling elements in the freezing chamber, the refrigerating area of the freezing chamber is increased. It is preferred that at least two cooling elements are positioned opposite from each other, having a distance different from zero between them. This distance may be adjustable for different width dimensions of the mould element that is positionable between the cooling elements. When the mould element is positioned between the cooling elements, the mould element and the cooling elements are in contact with each other to increase the heat exchange between the mould element and the cooling elements.

[0022] According to an embodiment, the device comprises a manipulator for moving the cooling elements and/or the mould element in the freeze chamber in use.

[0023] Moving the cooling elements and/or the mould element in the freeze chamber has the result that upon filling of the mould cavities with the liquid substance from the liquid supply, the liquid substance is moved. The manipulator may provide a linear movement, a rotating movement, a pulsating movement or a combination thereof to the liquid substance in the mould cavities. By providing a movement to the liquid substance, inclusion of gas bubbles, such as air, or contaminant, such as minerals, may be prevented.

[0024] According to a further embodiment, the device

comprises a transporting element for transporting the mould element within the device, wherein the transporting element is moveable with respect to the cooling elements.

[0025] To optimize the manufacturing process, the mould element may be moved with respect to the cooling elements during filling the mould element with the liquid substance and/or freezing of the liquid substance, while the cooling elements and the mould element touch each other. The transporting element may be a conveyor belt or chain, for instance provided with a supporting surface to support the mould element. In this way, the mould element may be filled at a first part of the device, and while the liquid substance is frozen in the mould element, is moved towards a second or end part of the device.

[0026] It is preferred that the cooling elements comprise a pair of parallel cooling plates. The transporting element may comprise an engaging element for engaging the mould element during transport, wherein the engaging element is moveable between the cooling elements. The mould element may be engaged by the engaging element, such as a pusher extending in a perpendicular direction from the transporting element, the pusher engaging and pushing the mould element while the transporting element moves with respect to the cooling elements. In a preferred embodiment, a cleaning element to clean the cooling elements is provided, wherein the cleaning element is movable between and with respect to the cooling elements. The cleaning element and the engaging element may form an integral unit, wherein the cleaning element is formed by sides of the engaging element that slides over the surface of the cooling elements, thereby scraping any frozen material or spilled liquid substance off the cooling elements. Cleaning the cooling elements has the advantage that the cooling efficiency is maintained.

[0027] The invention also relates to a combination for carrying out the method as described above, comprising a device as described above, a mould element having at least a series of interconnected mould cavities, wherein the mould element is accommodated in the freezing chamber of the device, such that the mould element is positioned in between the cooling elements, wherein the cooling elements are each adjacent to a side of the mould element.

BRIEF DESCRIPTION OF THE DRAWINGS

[0028] The features and advantages of the invention will be further appreciated upon reference to the following drawings of a number of exemplary embodiments, in which:

Figure 1 shows a side view of an embodiment of the device according to the invention.
Figure 2 shows a top view of the device of Fig. 1.
Figures 3 and 4 show a mould element.

DESCRIPTION OF ILLUSTRATIVE EMBODIMENTS

[0029] Figure 1 shows a side view of an embodiment of the device 1 according to the invention. The device comprises a freeze chamber (not shown) with cooling plates 3 (see also fig. 2) that are placed parallel to each other at a distance different from zero (see fig. 2), transporting chain 4 having a supporting surface 7 and an engaging element 5. Furthermore, the device comprises a liquid supply 20 for filling the mould cavities 6', 6" of a mould element 2. The mould element 2, which is shown in more detail in figures 3 and 4, is placed onto the supporting surface 7 and is engaged by an engaging element 5, such that the mould element 2 is moveable with the transporting chain 4. Additionally, a separating wall 8 is provided in between neighbouring mould elements 2 placed in the device 1.

[0030] The mould element 2 comprises series of mould cavities 6', 6" which are interconnected through recesses 12. The mould cavities 6', 6"are defined by a base 10 and a peripheral wall 9 extending from the base 10 as a shown in figures 3 and 4. Between adjacent mould cavities 6', 6", lands 14 are formed which together with the peripheral wall 9 generally lie in the same imaginary flat plane. A sealing foil 13 is connected to the peripheral wall 9 and the lands 14 such that the base 10, the peripheral wall 9 and the sealing element 13 enclose a filling space made up by the cavities 6', 6". Filling openings 11 are provided at a top end of the mould element 2, as shown in figure 4, to fill the interconnected mould cavities 6', 6" with the liquid substance through the liquid supply 20.

[0031] In the embodiment shown, the mould element 2 comprises a first mould element part 2' comprising a series of interconnected mould cavities 6' and a second mould element part 2" comprising a series of interconnected mould cavities 6", wherein the first mould element part 2' and the second mould element part 2" are pivotably connected to each other through connecting strip 15, such that the parts are pivotable towards each other. The mould element parts 2', 2" are pivoted towards each other after connecting the sealing foils 13 to the peripheral walls 9 of the mould cavities, wherein sides of the mould element parts 2', 2" comprising the sealing foils 13 face each other.

[0032] The mould element 2 is filled by means of the liquid supply 20 before entering the freezing chamber and before being placed between the cooling plates 3. To that end, the liquid supply 20 interacts with the filling openings 11 on both sides of the foils 13 which are held next to each other as shown in figure 4. After filling, the mould element 2 is moved towards the cooling plates 3 and subsequently moved with respect to the cooling plates 3 by the transporting chain 4. The cooling plates 3 are positioned such that the bases 10 of the mould cavities 6', 6" of each mould element part 2', 2" are adjacent a cooling plate 3, i.e. the distance between the cooling plates 3 is similar to a distance between the bases

10 of the mould element parts 2', 2".

[0033] In case a mould element 2 with only one mould element part 2' is used, the mould element 2 is positioned in between the cooling plates 3 such that the sealing element 13 is adjacent one cooling plate 3 and the bases 10 of the mould cavities are adjacent the other, opposite, cooling plate 3.

[0034] After positioning the mould element 2 or pair of mould elements 2 in between the cooling plates 3, the liquid substance is frozen by reducing the temperature of the cooling plates 3 while forming a freeze front in the liquid substance starting from each of the cooling plates 3, behind which freeze front the liquid substance has changed into the frozen state.

[0035] During this freezing process, the mould element 2 is moved through the freezing chamber with respect to the cooling plates 3, such that subsequent mould elements 2 can be filled and enter the freezing chamber of the device 1. In such a way, a continuous process of producing lump shaped bodies of frozen foodstuffs can be obtained.

[0036] The engaging element 5 has a width dimension similar to the distance between the cooling plates 3. While moving between the cooling plates 3, the engaging element 5 is forms a cleaning element used to clean the cooling elements by scraping off condensate or spillage from the mould element 2 that is frozen onto the cooling plates 3. Such frozen condensate or spillage can form obstacles for a smooth movement of the mould element 2 in between the cooling plates 3. The cooling plates 3 are kept clean by the cleaning element 5 and the mould element 2 can pass between the cooling plates 3 without barriers.

[0037] After freezing of the liquid substance, the mould element 2 leaves the freezing chamber. The mould element 2 forms a package for the frozen lump shaped bodies that can further be packaged in a container for transport and/or storage.

[0038] Thus, the invention has been described by reference to certain embodiments discussed above. It will be recognized that many modifications in addition to those described above may be made to the structures and techniques described herein without departing from the spirit and scope of the invention. Accordingly, although specific embodiments have been described, these are examples only and are not limiting upon the scope of the invention.

LIST OF PARTS

[0039]

1.	Device
2.	Mould element
2'/2".	Mould element part
3.	Cooling plate
4.	Transport chain
5.	Engaging element/cleaning element
6'/6".	Mould cavity
7.	Support surface
8.	Separating wall
9.	Peripheral wall
10.	Base
11.	Filling opening
12.	Recess
13.	Sealing foil
14.	Land
15.	Connecting strip
20.	Liquid supply

Claims

1. Method for producing lump shaped bodies, such as ice cubes, by freezing a liquid substance, the method comprising:

- providing a package comprising at least one mould element with at least a series of mould cavities which are interconnected and at least one filling opening;
- at least partly filling the mould cavities with the liquid substance through the filling opening;
- positioning the package in between a pair of cooling elements;
- freezing the liquid substance by reducing the temperature of the cooling elements while forming a freeze front in the substance starting from each of the cooling elements, behind which freeze front the substance has changed into the frozen state.

2. Method according to claim 1, wherein the package has parallel outer surfaces and the cooling elements comprise parallel cooling plates, the method comprising:

- positioning the package in between a pair of the parallel cooling plates such that each of the parallel outer surfaces of the package is adjacent to a respective cooling plate; and
- forming a freeze front in the liquid substance starting from each of the cooling plates.

3. Method according to claim 1 or 2, comprising adding a movement to the liquid substance while freezing the liquid substance.

4. Method according to claim 3, wherein adding a movement to the liquid substance comprises providing a pulsating movement to the package and/or the cooling elements.

5. Method according to any of the preceding claims, comprising:

- positioning the package in an upright position, such that the filling opening is positioned at a top end of the mould element; and
- filling the mould cavities with the liquid substance through the filling opening.

6. Method according to any of the preceding claims, wherein each mould cavity comprises a base and a peripheral wall extending from the base, the method comprising:

- connecting a sealing element to the peripheral wall such that the base, the peripheral wall and the sealing element enclose a filling space;
- filling the filling space with the liquid substance; and
- positioning the package between the cooling elements such that the base of the mould cavity and the sealing element are each adjacent to one of the cooling elements.

7. Method according to any of the preceding claims, comprising after the step of freezing the liquid substance:

- transporting the mould element to a packing station;
- providing a container to put in one or more mould elements containing the frozen liquid substance.

8. Device for carrying out the method according to any of the preceding claims, comprising a freezing chamber provided with at least two cooling elements, as well as a liquid supply for supplying a liquid substance to a series of mould cavities of a mould element, which mould element is positionable in between the cooling elements, such that the cooling elements are each adjacent to a side of the mould element.

9. Device according to claim 8, comprising a manipulator for moving the cooling elements and/or the mould element in the freeze chamber in use.

10. Device according to claim 9, wherein the manipulator provides a linear movement, a rotating movement, a pulsating movement or a combination thereof to the cooling elements and/or the mould element.

11. Device according to any of claims 8-10, comprising a transporting element for transporting the mould element within the device in use, wherein the transporting element is moveable with respect to the cooling elements.

12. Device according to any of claims 8-11, wherein the cooling elements comprise a pair of parallel cooling plates.

13. Device according to claim 11 or 12, wherein the transporting element comprises an engaging element for engaging the mould element during transport in use, wherein the engaging element is moveable between and with respect to the cooling elements.

14. Device according to claim 12 or 13, wherein a cleaning element to clean the cooling elements is provided, wherein the cleaning element is movable between and with respect to the cooling elements.

15. Combination for carrying out the method according to one of claims 1-7, comprising a device according to any of claims 8-14, a mould element having at least a series of interconnected mould cavities, wherein the mould element is accommodated in the freezing chamber of the device, such that the mould element is positioned in between the cooling elements, wherein the cooling elements are each adjacent to a side of the mould element.

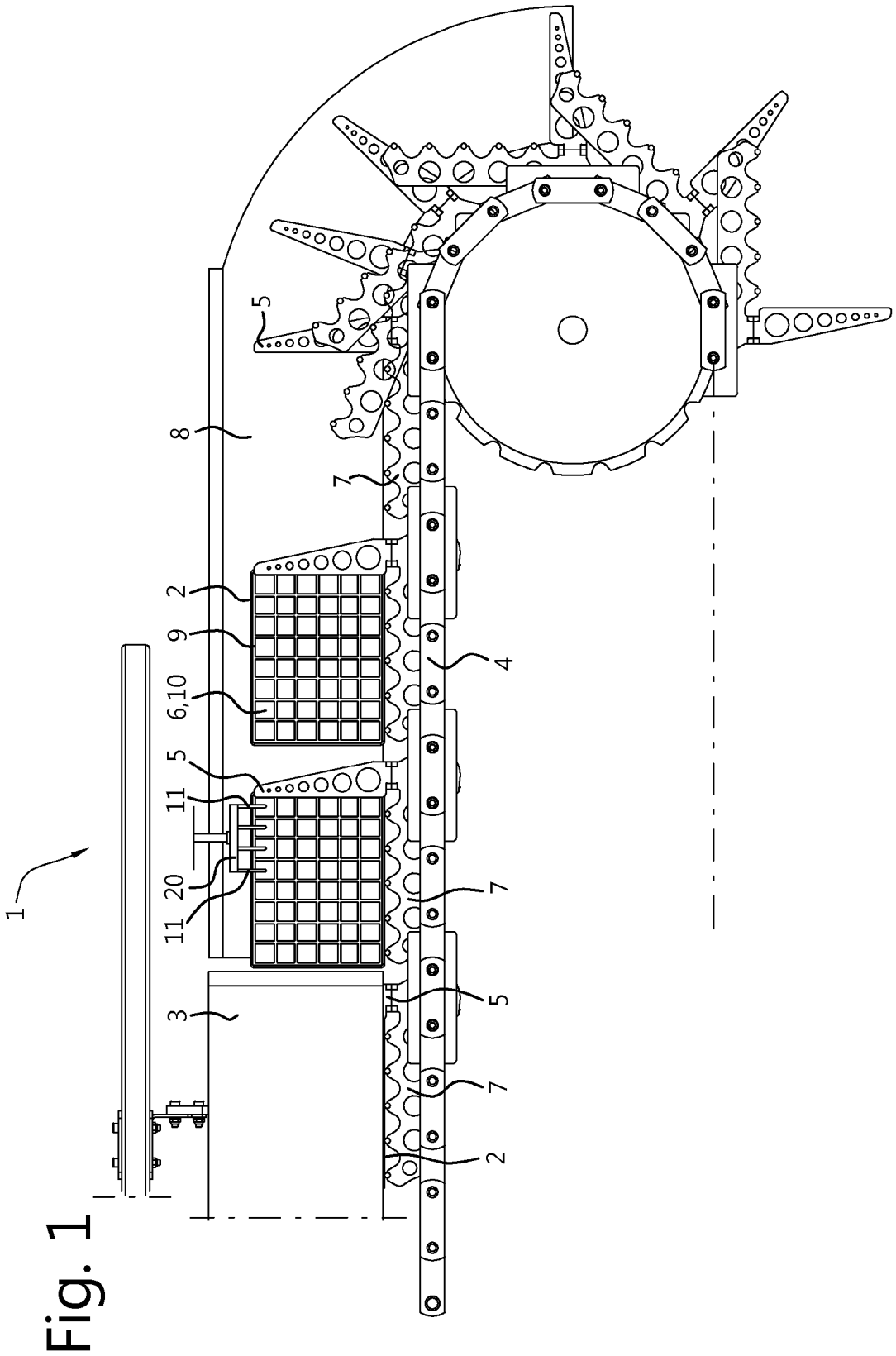


Fig. 1

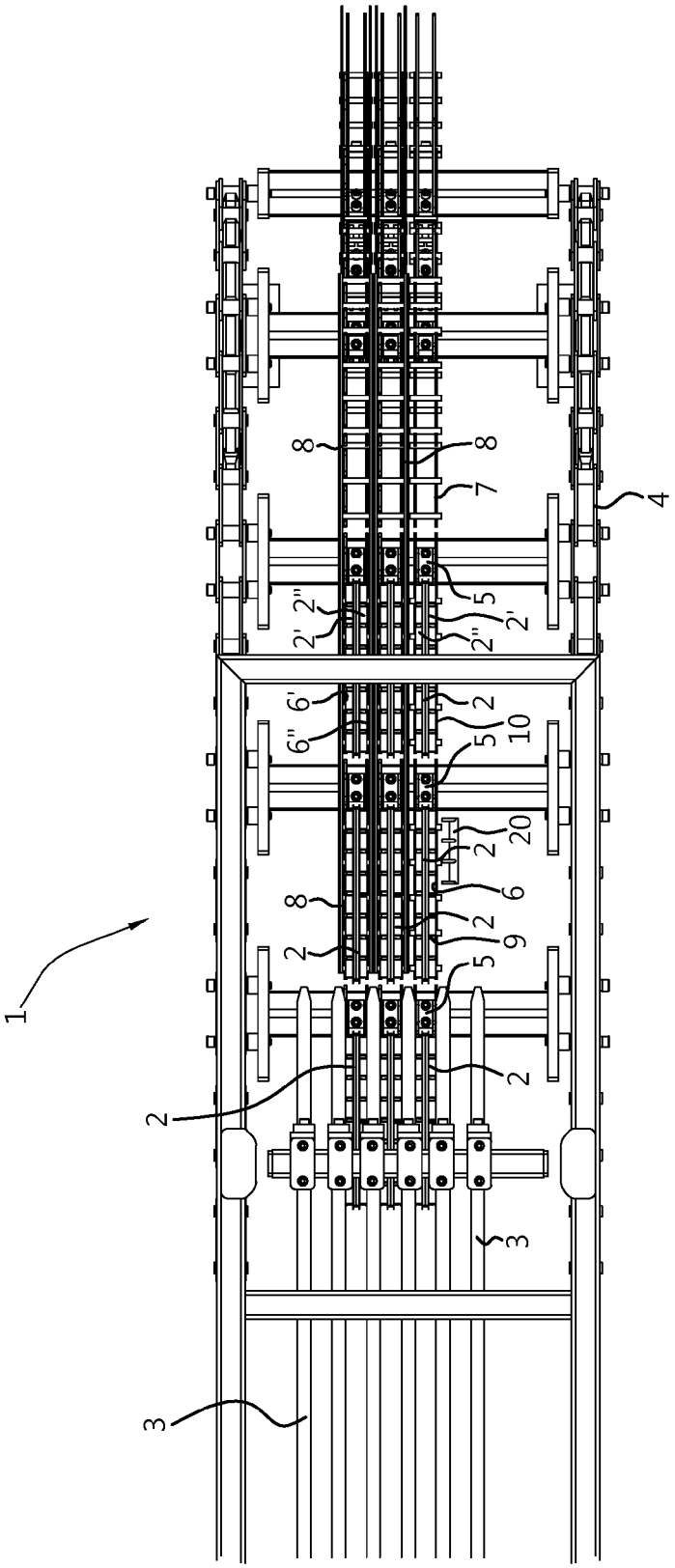


Fig. 2

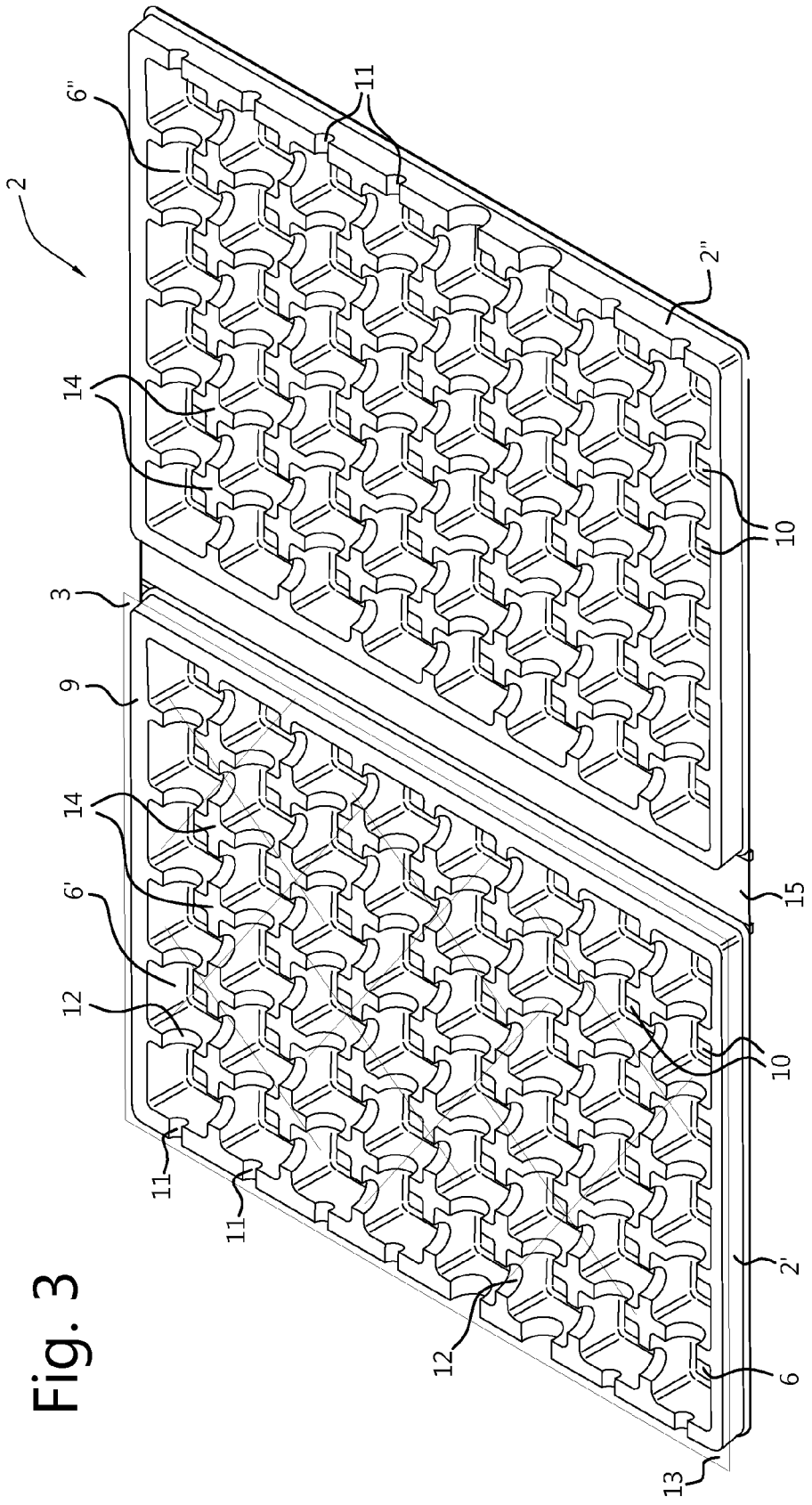
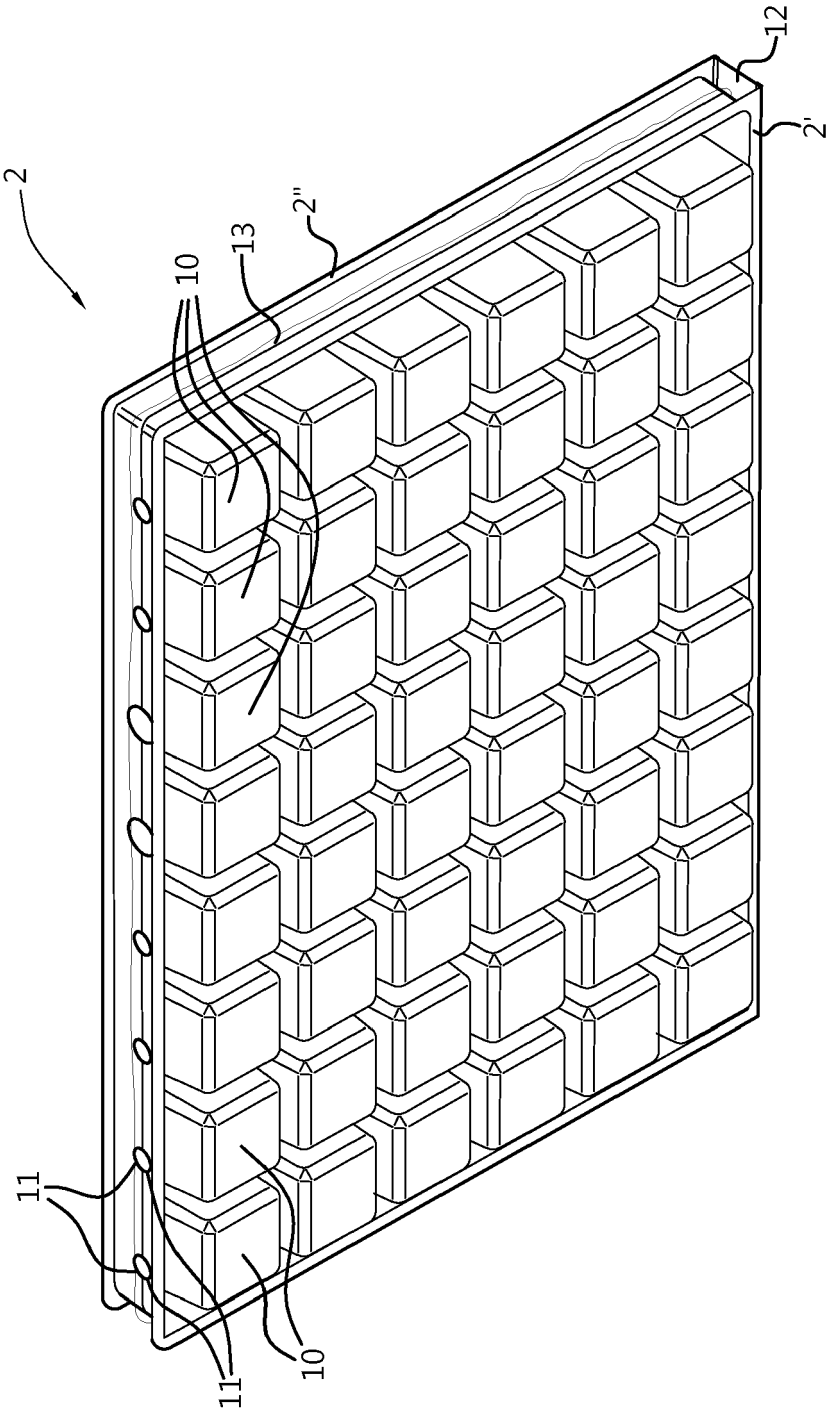


Fig. 3

Fig. 4



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EUROPEAN SEARCH REPORT

Application Number
EP 15 15 2346

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	WO 00/66956 A1 (WILTOE INNOVATIE B V [NL]; KOSTER ROELOF [NL]) 9 November 2000 (2000-11-09) * page 4, line 34 - page 5, line 4 *	1-15	INV. F25C1/20 F25C1/22
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TECHNICAL FIELDS SEARCHED (IPC)

F25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	16 July 2015	Melo Sousa, Filipe

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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