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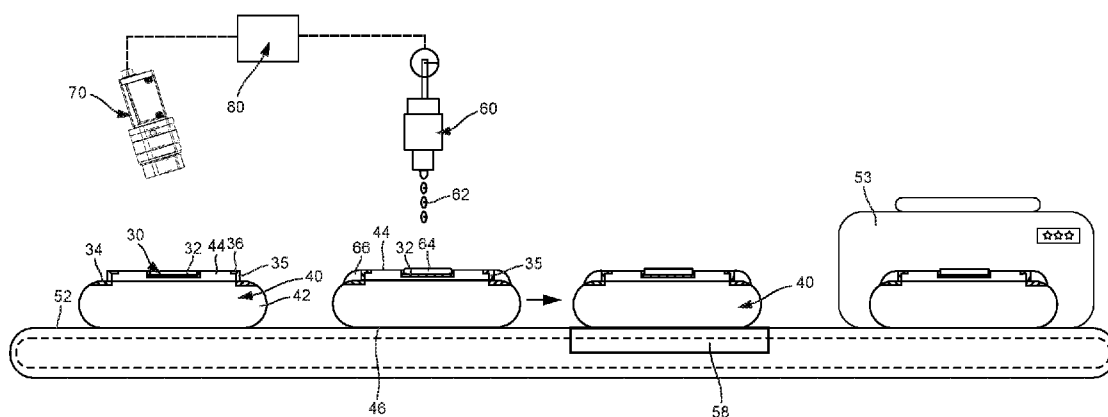


Figure 1b

(57) Abstract: The invention relates to a biscuit production assembly, comprising a hot stamp (20) engaging to the individual biscuit (40) to form a cavity (32) with a predetermined pattern by means of a support wall (24) having a temperature selected from 80°C to 350°C, and a depositor (60) supplying a filling (62) at least partially fills the cavity (32) at the filling mode. The biscuit production assembly also comprises a camera (70) that captures an image (31) of the individual biscuit (40) on the conveyor (50) by being positioned above the conveyor (50), a controller (80) with a signal transmission by the camera (70) is detecting a first position (R) of the cavity (32) on the conveyor (50) via image (31) processing and switching the depositor (60) to filling mode when the depositor (60) is aligned to the first position (R).



## A BISCUIT PRODUCTION ASSEMBLY WITH THERMAL PRINTING

### 5 TECHNICAL FIELD

The invention relates to a biscuit production method, in particular to a production assembly comprising the step of application of decorative features to the baked biscuit that travels in a conveyor.

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### BACKGROUND OF THE INVENTION

Baked food products made of dough are generally obtained by mixing grain flours such as wheat or starch-based mixtures thereof and various excipients with water and subjecting to various processes in weight ratios according to a predetermined recipe to form biscuit dough with plastic properties.

In order to obtain patterns of different colors with biscuit dough, an additional dough auxiliary body is usually provided the color of which is changed with a coloring agent such as cocoa, malt, and caramel and the auxiliary body having a different color is added to the biscuit dough by methods such as co-injection or like to form a pattern.

WO2018096420 discloses an apparatus for printing various graphical elements to the biscuit body by applying a food grade ink. Accordingly, a printing station having an edible ink prints for example any type of letters, marks, numbers, etc. to the upper surface of a layer that completes the final appearance of a biscuit. Here, the biscuit is manufactured from a dough of two different colors. It is also disclosed that the biscuit body can be manufactured from different biscuit dough of different colors in a multi-layered structure.

NL1020104C2 discloses a method for preparing a baked product provided with letters, numbers, a logo, a decoration or similar marking baked in a cooking zone. The method discloses the process steps of preparing, optionally raising the dough, portioning by measuring, optionally applying a filling and baking by placing a carrier such as conveyor or cooking tray that delivers it into an oven until a ready-made baked product emerges and marking via infrared laser by a laser marker.

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## SUMMARY OF THE INVENTION

The object of the invention is to rapidly apply an edible filling to an individual biscuit in the biscuit production process.

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In order to achieve above-mentioned object, the invention comprises a biscuit production assembly, comprising a conveyor provided with an individual biscuit taken from the outlet of an oven, a hot stamp engaging to the individual biscuit so as to form a cavity with a predetermined pattern from a support wall having a temperature selected from 80°C to 350°C, preferably from 150°C-350°C, particularly from 150-320°C, and a depositor supplying a filling such that it at least partially fills the cavity in the filling mode. The biscuit production assembly also comprises a camera captures an image of the individual biscuit on the conveyor by being positioned above the conveyor and a controller with a signal transmission by the camera is detecting a first position of the cavity on the conveyor via image processing and switching the depositor to filing mode when the depositor is aligned to the first position. The controller can determine the first position on video or intermittent pictures transmitted from the camera for image processing, from the color difference of the cavity on the biscuit, a predetermined geometry or the shadow of the cavity. The first position can be defined by predetermining a reference as a position on or at the boundary of the cavity. In a preferred embodiment, the temperature of the support wall is selected between 170-200°C. At this temperature, when the hot stamp engage with the individual biscuit, the cavity becomes darker without being burned such that it provides a contrast that the camera can detect while maintaining individual biscuits structural strength.

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A preferred embodiment of the invention includes the conveyor comprises a movable conveyor belt on which the individual biscuit is transferred from the outlet of the oven and the camera and the depositor is provided at a predefined distance. The conveyor belt ensures that the individual biscuits taken from the oven travels quickly towards the position of the camera. The camera detects the position of the cavity from the image in all of the plurality of individual biscuits on the conveyor. The cavity is filled with the filling, with the individual biscuits travelling to the depositor.

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A preferred embodiment of the invention comprises the depositor includes a plurality of nozzles disposed transversely and vertical to the travelling direction on the conveyor belt and in which the controller only opens the selected one aligned to the cavity while keeps the remaining closed in the filling mode. In this case, while the individual biscuit travels on the conveyor, each nozzle allows the cavities of different geometries on the individual biscuit to

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be filled with a completely edible filling, for example chocolate in the form of liquid that hardens in the room temperature, by scanning the area to be filled in as a line. Whether the first position of the biscuit is determined as a point or a cavity area, it is possible for the nozzles transversely placed to completely fill the cavity geometry by line scanning at an exact  
5 determined point or along the area in the vertically travelling conveyor.

In a preferred embodiment of the invention, the controller is configured to calculate a second position at a predetermined distance relative to the first position in the individual biscuit and switches the depositor into a filling mode to provide the filling to the cavity when the depositor  
10 is aligned to the second position. In this way, when the image of the individual biscuit is captured by the camera, the controller calculates the second position based on its calculation of the first position with the image processing algorithm. The depositor can be both put into filling mode by first reaching the first position or the second position, and it can also provide filling to both positions by reaching both positions at the same time. Preferably, the depositor  
15 with transversely placed nozzles on the conveyor allows this.

In a preferred embodiment of the invention, the depositor is arranged in a circular route when aligned to the second position, such that it provides the filling following an outer rim surrounding the cavity from outside. In this way, an outer rim is drawn from the filling by the  
20 depositor on the individual biscuit, while the cavity inside thereof is filled. In a possible embodiment, the viscosity of the outer filling may be chosen higher than the inner filling when the outer filling and the inner filling are fluid. In this way, while the rim remains fixed on the individual biscuit, the inner filling in the cavity moves in such a way to completely cover the  
25 cavity.

In a preferred embodiment of the invention, the depositor is filled with liquid filling, e.g. chocolate, which is in solid state at room temperature. In this way, it is possible to supply continuous filling to the individual biscuit via dripping or flowing over the conveyor through the  
30 depositor.

A preferred embodiment of the invention includes a cooling region is defined between the outlet of the oven and the hot stamp in the conveyor arranged such that cools down the temperature of the individual biscuit between 10-40 degrees. Thereby, the structural strength of the individual biscuit is increased before the hot stamping step. This prevents the  
35 individual biscuit from disintegrating during cavity forming.

A preferred embodiment of the invention includes an outlet cooling region in the conveyor which is adjusted such that the depositor then cools the individual biscuit to a temperature between 30-15°. The outlet cooling region makes the fluid edible filling, e.g. chocolate, packageable by allowing it to solidify on the individual biscuit.

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A preferred embodiment of the invention includes a projection on the support wall which is adjusted such that it forms the cavity in an angular geometry. The cavity in the form of a projection accelerates the recognition of the camera of the cavity by the image processing algorithm.

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In order to achieve the above-mentioned object, an embodiment of the invention includes a biscuit production assembly and a biscuit production method according to the description above. The method also comprises the process steps of supplying the individual biscuit from the outlet of the oven to the movable conveyor belt; engaging the hot stamp to the individual biscuit from the support wall having a temperature selected between 150°C to 350°C to apply a cavity with a predetermined pattern; delivering an image of the individual biscuit to the controller by the camera; detecting the first position of the cavity via image recognition algorithm by the controller; and filling the cavity with edible filling by taking the depositor into a filling mode by the controller when the depositor is aligned with the first position.

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A preferred embodiment of the invention comprises the process steps of staying in contact of the hot stamp on the individual biscuit for at least 1 second by baking the cavity to darken the color and detecting the first position from contrast difference in the image by the control element.

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A preferred embodiment of the invention comprises the process steps of detecting the second position by calculating from the first position with a predetermined distance by the controller and supplying a filling in a route that forms a ring such that it surrounds the cavity when the depositor is aligned to the second position.

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A preferred embodiment of the invention is a individual biscuit with filling inside having a hardened region comprising the cavity with filling obtained by a biscuit production method described above.

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## BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1a is the schematic front view of a representative embodiment of the biscuit production assembly including the hot stamping process according to the invention.

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Figure 1b is the schematic view of the part in which the camera and depositor are located at the rest of the conveyor of the biscuit production assembly shown in Figure 1a.

Figure 2 is the schematic top view of two individual biscuits with different patterns aligned on the conveyor before they enter into the depositor.

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Figure 3 is a perspective view of a filled individual biscuit obtained by the biscuit production assembly according to the invention.

Figure 4 is an invert view of the camera image in the processed state.

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## DETAILED DESCRIPTION OF THE INVENTION

In this detailed description, the development of the invention has been described without any limitation and only with reference to the examples for a better explanation of the subject.

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In Figure 1a, a representative embodiment of the biscuit production method, according to the invention is partially shown from the front. Here, a individual biscuit (40) is obtained by baking a biscuit dough in an oven (10). The biscuit dough contains generally 5-25% by weight water, 30-80% by weight flour, 0.1-6% by weight baking agent, 5-35% by weight sugar and/or other sweetening ingredients and 0.1-6% by weight butter or vegetable oil. Other ingredients such as cocoa, hazelnuts can also be added to these typical ingredients. The individual biscuit (40) is formed from the biscuit dough obtained by mixing the ingredients. Before being baked in the oven (10), the individual biscuit (40) takes its outer form by injection (47) without losing its plastic property, in a shell structure filled with for example an oil-based fluid chocolate. A biscuit dough with sugar obtained according to the Example 4 of the WO1992010101A1 incorporated herein with reference forms a individual biscuit (40) in the form of a truncated sphere which is flattened from the top and the bottom.

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The body of the individual biscuit (40) made of edible crunchy material obtained by injection molding and firing of biscuit dough still forms a by-product (41) at the outlet of the oven (10) with a moisture content of over 5% and having a plastic shapeable structure under pressure,

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and at an outer wall periphery temperature ( $T_c$ ) of 180°C. The by-product (41) has a flat top part (44). A conveyor assembly (50) comprising a conveyor belt (52) facing an outlet (12) of the oven (10) at one end transfers a plurality of individual biscuits (40) supplied from the outlet (12) arranged in an order and at a distance from each other in an environment at room temperature. Meanwhile, the individual biscuits (40) baked in the oven (10) at 200°C travels at the opposite end of the conveyor belt (52) by being cooled.

The individual biscuit (40) at the part of the outer periphery temperature ( $T_c$ ) of 80°C is cooled to a temperature selected from 25-35°C by travelling at the room temperature to a cooling region (51) in the inlet of the conveyor belt (52). A stamping temperature ( $T_d$ ) is positioned to be higher at a distance such that a hot stamp (20) set to 180°C faces to the upper part of the by-product (41) on the conveyor belt (52). The hot stamp (20) comprises a flat support wall (24) which is delimited by a circumferential edge (28) adjacent to an inner part (25) and a projection (23) which is placed at the center of the support wall (24) and shorter than the height of the inner part (25). The projection (23) is in a star-like form with rounded corners. The hot stamp (20) has an inverted U-like cross-section form at the center of which the support wall (24) is located and a flat circumferential edge (28) facing downwards. The circumferential edge (28) is in the form of a ring. A flat and ring-shaped inner rim (27) abutting against the circumferential edge (28) fits to the flat face of the support wall (24) at a distance surrounding the projection (23). A lifting arm (26) in the form of a flat bar carries from its lower end the support wall (24) by rising vertically from its opposite face. The lifting arm (26) is at the end of a robot arm (not show) and carries the support wall (24) such that it follows the by-product (41) thereon with which it is aligned by making a relative movement according to the speed of the conveyor belt (52). An electrical resistor (21) is adapted to the hot stamp (20) so as to raise the stamping temperature ( $T_d$ ) of the metal support wall (24) to 180°.

A lifting arm (26) in a forming position abuts against the individual biscuit (40) to apply a force providing a plastic deformation from the top part (44) by travelling with a first relative speed ( $v_1$ ) both forward such that it follows the individual biscuit (40) and towards an outer periphery (42) in a downstream direction. This force is selected between 0.01-0.2 N. In the meantime, the resistor (21) heats the hot stamp (20) and the hot stamp (20) provides a pressure with a pre-stress from the circumferential edge (28) to the top part (44). The top part (44) is significantly filled to the support wall (24) by means of the plastic deformation from the outer periphery (42) by providing a neck (35), until it contacts with the inner rim (27). In the meantime, for avoiding any type of breakage, the lifting arm (26) travels with a much lower speed that the speed of approaching to the individual biscuit (40). During the forming of the

neck (35), having a crack on the outer periphery (42) is provided by arranging the support wall (24) approximately 80-100°C warmer than the individual biscuit (40). Hot stamp (20) with a temperature set to 180°C applies high temperature from the circumferential edge (28) to the top part (44) by the projection (23) and the circumferential edge (28). The individual biscuit (40) both minimizes the porous structure by reducing the moisture and deforms by means of the Maillard reaction in the parts to which high temperature is applied, due to the high sugar contents that it contains and it forms a hardened region (30) having a higher breakage strength. The hardened region (30) includes a ring structure with two steps formed by the joining of an outer rim (34) and an inner rim (36) coaxial therewith and having a narrow diameter with the neck (35), and a cavity (32) the depth of which is created by projection (23) entering inwards at the center of the top part (44). In Figure 3, the filling (62) on the hardened region (30) that the hot stamp (20) creates on the individual biscuit (40) is seen in perspective. The cavity (32) is a depression formed by the projection (23) at the top part (44) in the form of a rounded star. The cavity (32) is surrounded by both the inner rim (36) and the adjacent concentric outer rim (34) in a ring form at a radial distance. A base (46) of the individual biscuit (40) is in a planar form such that it provides a stable placement on the conveyor belt (52).

As shown in Figure 1a, the hot stamp (20) applies heat to the individual biscuit (40) until it forms the hardened region (30) from the contacting parts by means of the resistor (21), by being placed on the top part (44). In the present embodiment, the hot stamp (20) is applied onto the top part (44) with a stamping temperature ( $T_d$ ) of 180°C for 5 seconds. Meanwhile, the lifting arm (26) travels at the first relative speed ( $v_1$ ) both in the downward direction and in the travelling direction of the conveyor belt (52) and thus the production continues on the moving conveyor belt (52) without interruption. During the application, the hot stamp (20) differentiates from the support wall (24) by browning the outer periphery (42) with which it contacts.

In an alternative embodiment, by performing the conveyor (50) in the form of a station not moving, a pressure can be applied onto the individual biscuits (40) on a tray or conveyor belt (52) only by means of the up and down movement of the lifting arm (26) without sliding to any side.

After the formation of the hardened region (30) is completed, the lifting arm (26) lifts the hot stamp (20) over the individual biscuit (40) by means of a forward and upward movement at a second relative speed ( $v_2$ ). The individual biscuit (40) is heated around 40°C by the application of the hot stamp (20). A camera (70) placed to face to the individual biscuits (40)

on the conveyor belt (52) feeds an image (31) on the conveyor belt (52) over a video stream to a controller (80) with a central processor, as shown in invert color for the clarity of image in Figure 4. The controller (80) recognizes the star form of the cavity (32) through the image (31) with a contrast-based image recognition algorithm. Accordingly, it determines a first position (R) of the cavity (32) on the conveyor belt (52) in Cartesian coordinates. The distance of the outer rim (34) from the cavity (32) is equal to the distance of the corresponding inner rim (27) from the projection (23) in the hot stamp (20). The controller (80) calculates a second position (R') in Cartesian coordinates by adding as much as the distance between the first position (R) accordingly. The second position (R) is the starting point of the circular path of the outer rim (34). Subsequently, a depositor (60) positioned on the upper part of the conveyor belt (52) and comprising a filling (62) made of hot chocolate covers the hardened regions (30) with the filling (62). The hardened region (30) prevents the cracking against the thermal stresses provided by the depositor (60) and created by the temperature difference between the outer periphery (42) and the filling (62) of different temperatures. The depositor (60) forms a middle part (64) of the filling (62) by completely filling the cavity (32). On the other hand, the depositor (60) aligned with the outer rim (34) forms a circular ring (66) of the filling (62). The cooled filling (62) solidifies and is fixed on the outer periphery (42).

The controller (80) includes a plurality of nozzles (68) arranged transversely in order on the conveyor belt (52) as seen in Figure 2. The nozzles (68) are aligned to each other transversely and in an inclined manner on the first line (54) and the second line (56) that form the passage path on the conveyor belt (52) of each individual biscuit (40). Each individual biscuit (40) is baked by pulling in different outer diameters according to the baking parameters in the oven (10). Therefore, the offset distance of the cavity (32) from the center of the individual biscuit (40) varies. The camera (70) calculates the second position (R') based on the first position (R) of the cavity (32). Accordingly, the depositor (60) passes into the filling mode when the cavity (32) of each one of individual biscuits (40) is aligned vertically to the depositor (60). The filling mode is finalized by transferring the filling (62), in the example liquid chocolate, to the individual biscuit (40) on the conveyor belt (52) such that it will free-fall from the nozzle (68) corresponding to the depositor (60) and then closing the nozzle (68) such that it blocks the filling (62). The depositor (60) is taken into the filling mode by providing signal transmission by the controller (80). This process is carried out only when the nozzles (68) that the cavity (32) is aligned with are opened during the travelling thereof and while it moves on the conveyor belt (52). The controller (80) both transfers a filling (62) from the nozzles (68) corresponding to the top of the outer rim (34) such that it forms a cavity (32) based ring (66) according to the second position (R') and fills the cavity (32) by

activating the nozzles (68) along the geometrical pattern of the cavity (32) according to the first position (R). In the example, the cavity (32) is in the form of a star. First, by vibrating the individual biscuit (40) passing on the depositor (60) by means of a vibration unit (58), it is ensured that the filling (62) completely fills the cavity (32) by penetrating into the corners thereof. Then, the individual biscuit (40) passing to an outlet cooling region (53) is cooled to a filling hardening temperature of 18°C on the conveyor belt (52). Then, the product is packaged.

## REFERANCE NUMBERS

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10 Oven	50 Conveyor
12 Outlet	51 Cooling region
20 Hot stamp	52 Conveyor belt
21 Resistor	54 First line
23 Projection	53 Outlet cooling region
24 Support wall	56 Second line
25 Inner part	58 Vibration unit
26 Lifting arm	60 Depositor
27 Inner rim	62 Filling
28 Circumferential edge	64 Center part
30 Hardened region	66 Ring
31 Image	68 Nozzle
32 Cavity	70 Camera
34 Outer rim	80 Controller
35 Neck	$T_c$ Outer periphery temperature
36 Inner rim	$T_d$ Stamping temperature
40 Individual biscuit	$v_1$ First relative speed
41 By-product	$v_2$ Second relative speed
42 Outer periphery	R First position
44 Top part	R' Second position
46 Base	
47 Inner filling	

## CLAIMS

- 5 1- A biscuit production assembly comprising a conveyor (50) provided with an individual biscuit (40) transferred from the outlet (12) of an oven (10); a hot stamp (20) engaging to the individual biscuit (40) so as to form a cavity (32) with a predetermined pattern by means of a support wall (24) of the hot stamp (20) set a temperature selected from 80°C to 350°C, and a depositor (60) supplying a filling (62) at least partially fills the cavity (32) at the filling mode characterized in that a camera (70) captures an image (31) of the individual biscuit (40) on the conveyor (50) by being positioned above the conveyor (50) and a controller (80) with a signal transmission by the camera (70) is detecting a first position (R) of the cavity (32) on the conveyor (50) via image (31) processing and switching the depositor (60) to filling mode when the depositor (60) is aligned to the first position (R).
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- 15 2- A biscuit production assembly according to claim 1, wherein the conveyor (50) comprises a movable conveyor belt (52) on which the individual biscuit (40) is transferred from the outlet (12) of the oven (10) and the camera (70) and the depositor (60) is provided at a predefined distance.
- 20 3- A biscuit production assembly according to claim 2, wherein the depositor (60) includes a plurality of nozzles (68) disposed transversely and vertical to the travelling direction on the conveyor belt (52) and in which the controller (80) only opens the selected one aligned to the cavity (32) while keeps the remaining closed in the filling mode.
- 25 4- A biscuit production assembly according to any one of the preceding claims, wherein the controller (80) is configured to calculate a second position (R') at a predetermined distance relative to the first position (R) in the individual biscuit (40) and switches the depositor (60) into a filling mode to provide the filling (62) to the cavity (32) when the depositor (60) is aligned to the second position (R').
- 30 5- A biscuit production assembly according to claim 4, wherein the depositor (60) is arranged in a circular route when aligned to the second position (R'), such that it provides the filling (62) following an outer rim (34) surrounding the cavity (32) from outside.
- 35 6- A biscuit production assembly according to any one of the preceding claims, wherein the depositor (60) is filled with liquid filling (62) which is in solid state at the room temperature.

- 5 7- A biscuit production assembly according to claim 6, wherein a cooling region (51) is defined between the outlet (12) of the oven (10) and the hot stamp (20) in the conveyor (50) arranged such that cools down the temperature of the individual biscuit (40) between 10-40 degrees.
- 10 8- A biscuit production assembly according to claims 6-7, wherein an outlet cooling region (53) following the depositor (60) in the conveyor (50) is arranged such that cools down the individual biscuit (40) to a temperature between 30-15°.
- 15 9- A biscuit production assembly according to any one of the preceding claims, wherein a projection (23) is arranged such that form the cavity (32) in a cornered geometry in the support wall (24).
- 20 10- A biscuit production method with a biscuit production assembly according to any one of the preceding claims comprising the steps of: supplying the individual biscuit (40) from the outlet (12) of the oven (10) to the movable conveyor belt (52); engaging the hot stamp (20) to the individual biscuit (40) from the support wall (24) having a temperature selected between 80°C to 350°C to form the cavity (32) with a predetermined pattern; delivering an image (31) of the individual biscuit (40) to the controller (80) captured by the camera (70); detecting the first position (R) of the cavity (32) via image recognition algorithm run by the controller (80); and filling the cavity (32) with edible filling (64) by switching the depositor (60) into a filling mode by the controller (80) when the depositor (60) is aligned with the first position (R).
- 25 11- A biscuit production method according to claim 10, further comprising the process steps of press the hot stamp (20) on the individual biscuit (40) for at least 1 second to bake the cavity (32) to darken the color and detecting the first position (R) from contrast difference in the image (31) by the controller (80).
- 30 12- A biscuit production method according to claims 10-11, further comprising the process steps of detecting the second position (R') by calculating relative to the first position (R) with a predetermined distance by the controller (80) and supplying a filling (62) in a route forming a ring (64) surrounding the cavity (32) when the depositor (60) is aligned to the second position (R').
- 35 13- An individual biscuit (40) with filling (43) having a hardened region (30) comprising the cavity (32) with filling (60) obtained by a biscuit production method according to claims 10-12.
- 40



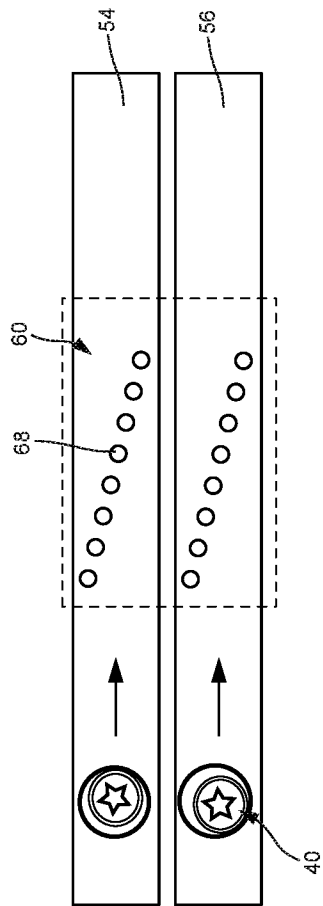


Figure 2

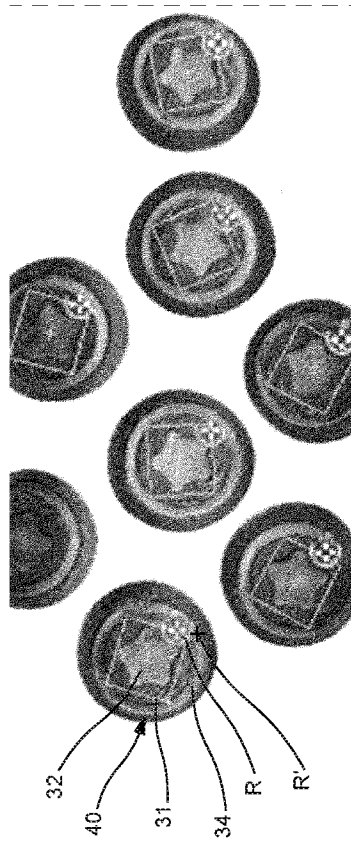


Figure 4

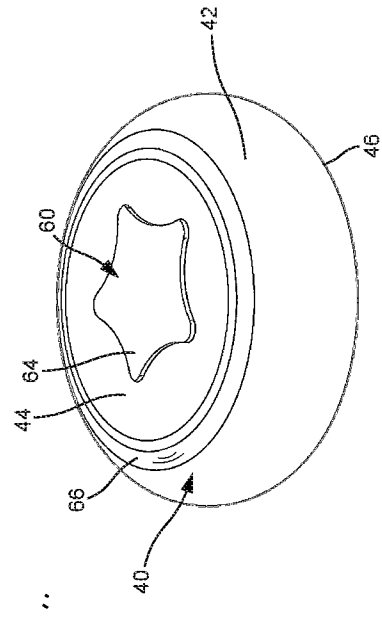


Figure 3