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(54) **APPARATUS AND PROCESS FOR PACKAGING A PRODUCT**

(57) Apparatus for packaging a product (P) arranged on a support (2) comprising a film supplying assembly (30) and a packaging assembly (4) for coupling the support (2) with a film (3). The packaging assembly has a lower tool (5) for receiving the support (2) and an upper tool (6), which comprises a frame (8) for holding a respective portion (3a) of the film. The frame (8) and the lower tool (5) are relatively movable the one with respect to the other among a plurality of positions. The plurality of

positions comprises a first position, where the frame (8) is distanced from the lower tool (5) to keep the respective portion flat and apart from the support (2), and a second position, where the frame (8) is approached to the lower tool (5) to allow the respective portion (3a) to initiate contacting the product (P) and/or the support (2). The frame (8) is configured to maintain the respective portion (3a) flat when the frame (8) and the lower tool (5) move from the first position to the second position.

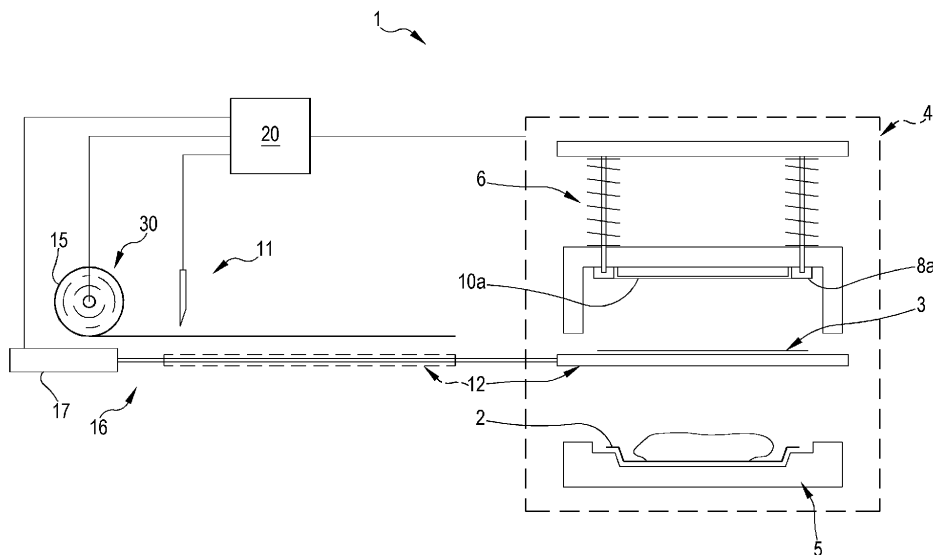


FIG. 2A

Description

FIELD OF THE INVENTION

[0001] The present invention relates to an apparatus and to a process for packaging of a product. In detail, the invention relates to an apparatus and process for packaging a product under vacuum for obtaining a vacuum skin package.

BACKGROUND ART

[0002] Vacuum skin packaging is a known process for the packaging of food products which involves placing a product on a support, for example a tray or a flat cardboard support. In the state of the art, the support containing the product is moved towards a packaging assembly. The packaging assembly has a lower tool for receiving the support with the product arranged thereon and an upper tool for receiving a packaging film. In detail, the film is positioned at the upper tool and above the product placed on the support. Once received the film and the support, the lower tool and the upper tool move one towards the other to define and close a packaging chamber around the support and the product. Then, the film is drawn upward against a heated dome of the upper tool, so that the film is formed and heated while held by suction in contact with the heated surface of the dome. Then, vacuum is applied to the packaging chamber below the film and all around the supported product. Once the pressure in the packaging chamber reaches a pressure level suitable for packaging, the suction applied to the film is released and the film is pulled downwards to drape over the contours of the product and in contact with the support. The film is thus welded to the support and forms a tight skin around the product.

[0003] Therefore, vacuum skin packaging is basically a thermoforming process where the film is formed inside a dome above the support and the product. In order to be able to support the suction inside the dome and the consequent forming around the contours of the product, the film needs to show an elastic return. A drawback of the prior art system is the need of using a film showing elastic return capabilities, often resulting in the need of using cross-linked films.

[0004] Also, when the forming of the film inside the dome takes place, it is not uncommon to obtain breakages of the film due to inadequate heating, excessive forming, or inappropriate mechanical and chemical properties of the film.

OBJECT OF THE INVENTION

[0005] The object of the present invention is to solve the drawbacks and/or limitations of the above prior art.

[0006] An object of the present disclosure is to provide a packaging apparatus and process capable of using a recyclable film and a recyclable support.

[0007] Another object of the present invention is to provide an apparatus and process capable of reducing the downtimes due to film breakages.

[0008] A further object is to provide a more versatile packaging apparatus and process capable of using a large variety of film materials.

SUMMARY

[0009] This summary is provided to introduce a selection of concepts in a simplified form that are further described below in the Detailed Description. This summary is not intended to identify key features of the claimed subject matter, nor is it intended to be used as an aid in determining the scope of the claimed subject matter.

[0010] A first aspect concerns an apparatus for packaging, in particular for vacuum skin packaging, a product arranged on a support, the apparatus comprising:

a film supplying assembly configured for supplying a film,
a packaging assembly configured for receiving the film and coupling the support with the film, the packaging assembly comprising:

a lower tool defining a seat for receiving the support with the product arranged thereon, and
an upper tool having a main body configured for cooperating with the lower tool, wherein the packaging assembly is configured to operate at least in a first operative condition, where the lower tool and the upper tool are distanced from each other, and in a second operative condition, where the lower tool and the upper tool are approached to each other,

wherein the upper tool comprises a frame coupled with the main body and configured for receiving and holding a respective portion of the film, and wherein the frame and the lower tool are mounted for relative motion the one with respect to the other among a plurality of positions, said plurality of positions comprising:

a first position, where the frame is distanced from the lower tool to keep the respective portion of the film flat and apart from the support and product arranged on the support,
a second position, where the frame is approached to the lower tool to allow said respective portion of the film to initiate contacting the product and/or the support, and wherein the frame is configured to maintain the respective portion of the film flat when the frame and the lower tool move from the first position to the second position.

[0011] In a 2nd aspect in accordance with the preceding aspect, the upper tool is mounted for rotation around a rotation axis, optionally a horizontal rotation axis, and comprises multiple main bodies angularly offset from each other and multiple frames also angularly offset from each other,

wherein each one of said frames is coupled with a respective one of said main bodies and configured for receiving and holding a respective portion of the film,
wherein each pair formed by one respective main body and one respective frame:

- > is selectively positionable in alignment with the lower tool, and
- > when positioned in alignment with the lower tool, has said respective frame relatively movable with respect to the lower tool among said plurality of positions and configured to maintain the respective portion of the film flat when the respective frame and the lower tool move from the first position to the second position.

[0012] In a 3rd aspect in accordance with any one of the preceding aspects, the lower tool and the upper tool, optionally the main body of the upper tool, are configured for cooperating for defining a packaging chamber when the packaging assembly is in the second operative condition.

[0013] In a 4th aspect in accordance with any one of the preceding aspects, the/each frame is positioned within a/the packaging chamber when the packaging assembly is in the second operative condition.

[0014] In a 5th aspect in accordance with the preceding aspect, the/each frame and the lower tool are configured to be movable the one with respect to the other when the packaging assembly is in the second operative condition.

[0015] In a 6th aspect in accordance with any one of the preceding aspects, the film supplying assembly is configured to cooperate with the packaging assembly for positioning the respective portion of the film between the/each frame and the support and product arranged on the support.

[0016] In a 7th aspect in accordance with the preceding aspect, the film supplying assembly is configured to cooperate with the packaging assembly for positioning the respective portion of the film below the/each frame and above the support and product arranged on the support.

[0017] In an 8th aspect in accordance with any one of the preceding aspects, the/each frame has a holding surface configured for contacting and holding the respective portion of the film, the holding surface being configured to be positioned within a/the packaging chamber and facing the lower tool when the packaging assembly is in the second operative condition.

[0018] In a 9th aspect in accordance with the preceding

aspect, the holding surface is configured for facing the lower tool when the packaging assembly is in the first operative condition and when the packaging assembly is in the second operative condition.

[0019] In a 10th aspect in accordance with any one of the preceding aspects, the apparatus comprises a heater positioned upstream the packaging assembly and downstream the film supplying assembly, said heater being configured for:

- > receiving the film from the film supplying assembly,
- > heating the respective portion of the film,
- > feeding the respective heated portion of the film to the packaging assembly.

[0020] In a 11th aspect in accordance with the preceding aspect, the heater is configured to be positioned outside a/the packaging chamber when the packaging assembly is in the second operative condition.

[0021] In a 12th aspect in accordance with any one of the preceding aspects from the 1st to the 9th, the upper tool comprises a heater coupled with the main body, the heater being configured for heating the respective portion of the film, and wherein the heater is coupled with the frame for relative motion the one with respect to the other among an operative configuration, where the heater and the frame are distanced by a minimum distance, and an inoperative configuration, where the heater and the frame are distanced by a maximum distance, the maximum distance being greater than the minimum distance, and

wherein the heater is configured for heating the respective portion of the film when the heater and the frame are in the operative configuration.

[0022] In a 13th aspect in accordance with the preceding aspect, the heater is configured to be surrounded by the frame in the operative configuration.

[0023] In a 14th aspect in accordance with any one of the preceding aspects from the 12th to the 13th when dependent on the 2nd aspect, the upper tool comprises multiple heaters angularly offset from each other, each one of said heaters being coupled with a respective pair formed by the one respective main body and the one respective frame, and wherein each heater:

- > is configured for heating the respective portion of the film,
- > is relatively movable with respect to the respective frame among the operative configuration and the inoperative configuration.

[0024] In a 15th aspect in accordance with any one of the preceding aspects from the 12th to the 14th, the/each heater is configured to be positioned within a/the packaging chamber when the packaging assembly is in the second operative condition.

[0025] In a 16th aspect in accordance with any one of the preceding aspects from the 12th to the 15th, the/each

heater has an active surface configured to contact the respective portion of the film and configured to be positioned within a/the packaging chamber when the packaging assembly is in the second operative condition,

[0026] In a 17th aspect in accordance with the preceding aspect, in the operative configuration, the active surface of the/each heater is coplanar with the holding surface of the frame or respective frame.

[0027] In a 18th aspect in accordance with any one of the preceding aspects from the 12th to the 17th, the/each heater is fixed to or coupled with the main body or the respective main body, and the/each frame is fixed to or coupled with the main body or the respective main body.

[0028] In a 19th aspect in accordance with any one of the preceding aspects, the apparatus comprises a vacuum assembly comprising a vacuum source fluidly couplable with a/the packaging chamber and configured to reduce the pressure within the packaging chamber.

[0029] In a 20th aspect in accordance with any one of the preceding aspects, the apparatus comprises a film cutting assembly configured for:

- > receiving the film from the film supplying assembly as a continuous film,
- > cutting from the film the respective portion in the form of a film sheet,
- > optionally feeding the film sheet to the upper tool, optionally to the/each frame of the upper tool,
- > wherein feeding the film sheet includes cooperating with the packaging assembly for positioning the film sheet between the/each frame and the support and product arranged on the support, optionally for positioning the film sheet below the/each frame and above the support and product arranged on the support.

[0030] In a 21st aspect in accordance with the preceding aspect, the film cutting assembly comprises a transfer device configured for positioning the film sheet below the/each frame and above the support and product arranged on the support, and wherein the transfer device comprises:

- a backing structure having a flat surface adapted to receive and hold the film sheet, and
- a mechanism active on the backing structure and configured for relative movement of the backing structure with respect to the packaging assembly between an outside position, where the backing structure is distanced from the upper tool for receiving the film sheet, and an inside position, where the backing structure is approached to the upper tool for positioning the film sheet at the/each frame and above the support and product arranged on the support.

[0031] In a 22nd aspect in accordance with the preceding aspect, the backing structure and the/each frame

are coupled for relative movement from a distanced condition, where the frame and the backing structure are distanced one from the other, to an approached condition, where the backing structure and the frame are approached for transferring the film sheet.

[0032] In a 23rd aspect in accordance with the preceding aspect, the mechanism active on the backing structure is configured for moving the backing structure along a first direction between the outside and inside positions and vice versa.

[0033] In a 24th aspect in accordance with the preceding aspect, the mechanism active on the backing structure is further configured for moving the backing structure along a second direction transverse to the first direction between the distanced condition and the approached condition and vice versa.

[0034] In a 25th aspect in accordance with any one of the preceding aspects from the 20th to the 24th aspect, the apparatus comprises a movement mechanism coupled with the packaging assembly and configured for rotating at least the upper tool around a/the rotation axis among a plurality of angular positions, the plurality of angular positions comprises:

- an alignment position where the main body and the frame are in alignment with the lower tool or where the pair formed by one respective main body and one respective frame is in alignment with the lower tool, and
- a pick-up position where the frame or the pair is in alignment with the film cutting assembly for receiving the respective portion of the film in the form of the film sheet.

[0035] In a 26th aspect in accordance with the any one of the preceding aspects from the 20th to the 25th, the film cutting assembly comprises blades coupled with the upper tool and configured for cutting from the film the respective portion in the form of the film sheet.

[0036] In a 27th aspect in accordance with the preceding aspect, the blades are fixed to the/each main body and configured for cutting from the film the respective portion when the packaging assembly passes from the first operative condition to the second operative condition.

[0037] In a 28th aspect in accordance with any one of the two preceding aspects, the film cutting assembly comprises a stopper coupled with the blades and the/each main body and configured to be interposed between the upper tool and the lower tool in the second operating condition, the stopper being movable between a stop condition, where the stopper blocks the film against an abutting surface, and a release condition, where the film is allowed to move.

[0038] In a 29th aspect in accordance with the preceding aspect, the film supplying assembly is configured to cooperate with the film cutting assembly and the packaging assembly for feeding the film above the stopper and

below the/each frame, optionally for positioning the respective portion of the film between the/each frame and the stopper. In a 30th aspect in accordance with any one of the preceding aspects, the apparatus comprises a control unit in signal communication with the packaging assembly and configured for executing the steps of:

- > commanding the packaging assembly to pass from the first operative condition to the second operative condition or vice versa,
- > commanding the relative motion of the/each frame and of the lower tool from the first position to the second position or vice versa,
- > commanding the packaging assembly to cause coupling of the support with the respective portion of the film for obtaining a package.

[0039] In a 31st aspect in accordance with the preceding aspect, the step of commanding the packaging assembly to pass from the first operative condition to the second operative condition or vice versa comprises commanding execution of the following operations:

- > moving the upper tool and the lower tool away from and towards each other,
- > defining a/the packaging chamber around the support and the product arranged on the support, and

wherein the step of commanding the relative motion of the/each frame and of the lower tool comprises commanding execution of the following further operation:

- > moving the respective portion of the film and the lower tool away from and/or towards each other maintaining the respective portion of the film flat, and

wherein the control unit is in signal communication with the film supplying assembly and configured for executing the steps of:

- > when the packaging assembly is in the first operative condition, commanding the film supplying assembly for supplying the film to the packaging assembly, optionally for supplying the respective portion of the film to the/each frame of the upper tool,
- > commanding the/each frame for receiving and holding the respective portion of the film.

[0040] In a 32nd aspect in accordance with the preceding aspect, the control unit is configured such that the further operation of moving the respective portion of the film and the lower tool away from and/or towards each other maintaining the respective portion of the film flat takes place while the packaging assembly is in the second operative condition or after the operation of defining the packaging chamber.

[0041] In a 33rd aspect in accordance with any one of the two preceding aspects, the step of commanding the

film supplying assembly comprises commanding positioning of the respective portion of the film between the/each frame and the support and product arranged on the support, optionally below the/each frame and above the support and product arranged on the support.

[0042] In a 34th aspect in accordance with any one of the preceding aspects from the 30th to the 33rd when dependent on the 12th aspect, the control unit is in signal communication with the/each heater and configured for executing the steps of:

- > commanding the/each heater for heating the respective portion of the film,
- > commanding the relative motion of the/each heater and the frame or respective frame between the operative configuration and inoperative configuration and vice versa,

wherein the step of commanding the packaging assembly to cause coupling of the support with the respective portion of the film is for heat-bonding the respective portion of the film to the support.

[0043] In a 35th aspect in accordance with the preceding aspect, the step of commanding the relative motion of the/each heater and the frame or respective frame comprises the step of moving the respective portion of the film and the/each heater away from and/or towards each other maintaining the respective portion of the film flat.

[0044] In a 36th aspect in accordance with any one of the preceding aspects from the 30th to the 35th aspect when dependent on the 19th aspect, the vacuum assembly, optionally the vacuum source, is in signal communication with the control unit, the control unit being configured to execute the step of:

- > commanding the vacuum assembly, optionally the vacuum source, for reducing the pressure within the packaging chamber, optionally for reaching a defined vacuum level within the packaging chamber,

wherein the step of commanding the packaging assembly to cause coupling of the support with the respective portion of the film is for obtaining a vacuum skin package.

In a 37th aspect in accordance with any one of the preceding aspects from the 30th to the 36th when dependent on the 21st aspect, the control unit is in signal communication with the film cutting assembly and configured for:

- > commanding the film cutting assembly for cutting from the film the respective portion in the form of said film sheet,
- > commanding the transfer device for positioning the film sheet below the/each frame and above the support and product arranged on the support, and

wherein commanding the packaging assembly com-

prises leaving the packaging assembly in the first operating condition a time sufficient for the backing structure of the transfer device to:

- move from the outside position to the inside position for positioning the respective portion of the film in the form of the film sheet at and below the/each frame and above the support and product arranged on the support, 5
- move from the inside position to the outside position. 10

[0045] In a 38th aspect in accordance with the preceding aspect when dependent on any one of the aspects from the 22nd to the 24th, the control unit is configured for executing the steps of: 15

- > commanding the relative movement of the backing structure and the/each frame from the distanced condition to the approached condition for transferring the film sheet. 20

[0046] In a 39th aspect in accordance with the preceding aspect, the control unit is configured for executing the step of: 25

- > commanding the mechanism active on the backing structure for moving the backing structure along the first direction between the outside and inside positions and vice versa, 30

[0047] In a 40th aspect in accordance with the preceding aspect, the control unit is configured for executing the step of:

- > commanding the mechanism active on the backing structure for moving the backing structure along the second direction between the distanced condition and the approached condition and vice versa. 35

[0048] In a 41st aspect in accordance with any one of the preceding aspects from the 30th to the 40th when dependent on the 25th aspect, the control unit is in signal communication with the movement mechanism coupled with the packaging assembly, the control unit being configured for executing the steps of commanding the movement mechanism for rotating at least the upper tool around a/the rotation axis among the plurality of angular positions. 40

[0049] A 42nd aspect concerns a process of packaging, in particular of vacuum skin packaging, a product arranged on a support, 45

the process optionally using an apparatus according to any one of the preceding aspects, the process comprising the steps of: 50

- > supplying the support with the product ar-

ranged thereon,
> supplying a film,
> relatively moving a respective portion of the film and the support and the product arranged on the support between: 5

- a distanced position, where the respective portion of the film is distanced from the support and the product arranged on the support, and
- an approached position, where the respective portion of the film initiates contacting the product and/or the support, 10

> coupling the support with the film, optionally with the respective portion of the film, obtaining a package, optionally a vacuum skin package, and 15

wherein the step of relatively moving the respective portion of the film and the support and the product arranged on the support between the distanced and approached positions comprises maintaining the respective portion of the film flat. 20

[0050] In a 43rd aspect in accordance with the preceding aspect, the process further comprises the step of: 25

- > defining a packaging chamber around the support and the product arranged on the support, 30

wherein relatively moving a respective portion of the film and the support and the product arranged on the support takes place within the packaging chamber. 35

[0051] In a 44th aspect in accordance with any one of the two preceding aspects, the process comprises the step of relatively moving the respective portion of the film and the support and the product arranged on the support, optionally within the packaging chamber, between the approached position and a contact position, where the respective portion of the film contacts the product and the support. 40

[0052] In a 45th aspect in accordance with the preceding aspect, the step of relatively moving the respective portion of the film and the support and the product arranged on the support between the approached and the contact positions comprises three-dimensionally forming the respective portion of the film. 45

[0053] In a 46th aspect in accordance with any one of the two preceding aspects, the step of relatively moving the respective portion of the film and the support and the product arranged on the support between the approached and the contact positions is after relatively moving the respective portion of the film and the support and the product arranged on the support between the distanced and the approached positions. 50

[0054] In a 47th aspect in accordance with any one of the aspects from the 42nd to the 46th, the process 55

comprises one or more of the steps of:

- > heating the respective portion of the film, the step of coupling the support with the respective portion of the film comprising heat-bonding the respective portion of the film to the support,
- > reducing the pressure within the/a packaging chamber defined around the support and the product arranged on the support,
- > cutting from the film the respective portion in the form of a film sheet.

[0055] In a 48th aspect in accordance with any one of the preceding aspects from the 42nd to the 47th, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 41 st, wherein:

- > defining a/the packaging chamber around the support and the product is executed by commanding the packaging assembly to pass from the first operative condition to the second operative condition or vice versa.

[0056] In a 49th aspect in accordance with the preceding aspect, commanding the packaging assembly to pass from the first operative condition to the second operative condition or vice versa comprises moving the upper tool and the lower tool away from and towards each other.

[0057] In a 50th aspect in accordance with any one of the preceding aspects from the 42nd to the 49th, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 41 st, wherein:

- > relatively moving the respective portion of the film and the support and the product arranged on the support, optionally within the packaging chamber, between the distanced and the approached positions and/or between the approached and the contact positions is executed by commanding the relative motion of the/each frame and of the lower tool from the first position to the second position or vice versa.

[0058] In a 51 st aspect in accordance with the preceding aspect, the step of relatively moving the respective portion of the film and the support and the product arranged on the support, optionally within the packaging chamber, between the distanced and the approached positions comprises moving the respective portion of the film and the lower tool away from and/or towards each other, the step of moving the respective portion of the film and the lower tool away from and/or towards each other taking place while maintaining the respective portion of the film flat.

[0059] In a 52nd aspect in accordance with any one of the preceding aspects from the 42nd to the 51st, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 41 st, wherein:

- > supplying a film is executed by commanding the film supplying assembly for supplying the film to the packaging assembly, optionally for supplying the respective portion of the film to the/each frame of the upper tool.

[0060] In a 53rd aspect in accordance with any one of the preceding aspects from the 42nd to the 52nd, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 41 st, wherein:

- > supplying a film comprises positioning the respective portion of the film between the/each frame and the support and product arranged on the support, optionally below the/each frame and above the support and product arranged on the support.

[0061] In a 54th aspect in accordance with any one of the preceding aspects from the 42nd to the 53rd aspect when dependent on the 47th aspect, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 40th when dependent on the 12th aspect, the process comprises:

- > the step of heating the respective portion of the film, which is executed by the/each heater,
- > the step of relatively moving the respective portion of the film and the/each heater away from and towards each other.

[0062] In a 55th aspect in accordance with the preceding aspect, the step of relatively moving the respective portion of the film and the/each heater comprises relatively moving of the/each heater and the frame or respective frame between the operative configuration and inoperative configuration and vice versa.

[0063] In a 56th aspect in accordance with any one of the preceding aspects from the 42nd to the 55th when dependent on the 47th aspect, the process uses an apparatus according to any one of the preceding aspects from the 1 st to the 41 st when dependent on the 19th aspect, wherein the process comprises:

- > the step of reducing the pressure within the packaging chamber, which is executed by commanding the vacuum assembly, optionally the vacuum source, and comprises the step of reaching a defined vacuum level within the packaging chamber.

[0064] In a 57th aspect in accordance with any one of the aspects from the 42nd to the 56th aspect when dependent on the 47th aspect, the process uses an apparatus according to any one of the preceding aspects from the 1st to the 41st when dependent on the 21st aspect, wherein the process comprises:

- > the step of cutting from the film the respective portion in the form of a film sheet, which is executed

by commanding the film cutting assembly, and
> the step of leaving the packaging assembly in the first operating condition a time sufficient for the backing structure of the transfer device to:

- move from the outside position to the inside position for positioning the respective portion of the film in the form of the film sheet at and below the/each frame and above the support and product arranged on the support,
- move from the inside position to the outside position.

[0065] In a 58th aspect in accordance with the preceding aspect, the apparatus is according to any one of aspects from the 1st to the 41st when dependent on any one of aspects from the 22nd to the 24th, the process comprising one or more of the steps of:

- > relatively moving the backing structure and the/each frame from the distanced condition to the approached condition for transferring the respective portion of the film in the form of the film sheet,
- > moving the backing structure along the first direction between the outside and inside positions and vice versa,
- > moving the backing structure along the second direction between the distanced condition and the approached condition and vice versa, and

[0066] In a 59th aspect in accordance with the preceding aspect, the step of moving the backing structure along the first direction and/or the step of moving the backing structure along the second direction are executed by commanding the mechanism active on the backing structure.

[0067] In a 60th aspect in accordance with any one of the preceding aspects from the 42nd to the 59th aspect, the apparatus is according to any one of the preceding aspects from the 1st to the 41st when dependent on the 25th aspect, the process comprising the step of rotating at least the upper tool around a/the rotation axis among the plurality of angular positions.

BRIEF DESCRIPTION OF THE DRAWING

[0068] Some embodiments and some aspects of the invention are described hereinafter with reference to the accompanying drawings, provided only for illustrative and, therefore, non-limiting purposes, in which:

- Figure 1 depicts schematic views of a known apparatus for packaging during different operational steps of a process of packaging a product;
- Figures 2A - 2G depict schematic views of an apparatus during operational steps of a process for packaging a product in accordance with a first embodiment;

- Figures 3A - 3C show schematic views of an apparatus during operational steps of a process for packaging a product in accordance with the first embodiment;
- 5 - Figures 4A - 4E depict schematic views of an apparatus during operational steps of a process for packaging a product in accordance with the first embodiment;
- Figure 5 shows a schematic view of an apparatus in accordance with a second embodiment,
- 10 - Figure 6A - 6F depict schematic views of an apparatus during operational steps of a process for packaging a product in accordance with a third embodiment;
- 15 - Figure 7 shows a schematic view of the apparatus in accordance with a fourth embodiment.

CONVENTIONS

20 **Product**

[0069] The term product P means an article or a composite of articles of any kind. For example, the product may be of a foodstuff type and be in solid, liquid or gel form, i.e. in the form of one or more of the aforementioned aggregation states. In the food sector, the product may comprise: meat, fish, cheese, treated meats, prepared and frozen meals of various kinds.

30 **Control unit**

[0070] The packaging apparatus described herein includes at least one control unit designed to perform the steps of the process for making the package. The control unit can clearly be only one or be formed by a plurality of different control units according to the design choices and the operational needs. The term control unit means an electronic component which can comprise at least one of: a digital processor (for example comprising at least one selected from the group of: CPU, GPU, GPGPU), a memory (or memories), an analog circuit, or a combination of one or more digital processing units with one or more analog circuits. The control unit can be "configured" or "programmed" to perform some steps: this can be done in practice by any means that allows configuring or programming the control unit. For example, in the case of a control unit comprising one or more CPUs and one or more memories, one or more programs can be stored in appropriate memory banks connected to the CPU or to the CPUs; the program or programs contain instructions which, when executed by the CPU or the CPUs, program or configure the control unit to perform the operations described in relation to the control unit. Alternatively, if the control unit is or includes analog circuitry, then the control unit circuit may be designed to include circuitry configured, in use, for processing electrical signals so as to perform the steps related to control unit. The control unit may comprise one or more digital units, for example of the

microprocessor type, or one or more analog units, or a suitable combination of digital and analog units; the control unit can be configured for coordinating all the actions necessary for executing an instruction and instruction sets.

Support

[0071] As used herein support 2 may be a container in the form of a tray having a base wall, side wall and optionally a top rim radially emerging from the side wall; alternatively, the support 2 may be flat.

[0072] The support 2 may have a rectangular shape or any other suitable shape, such as round, square, elliptical and other. Supports with a side wall may be manufactured by thermoforming or injection molding or -in case of flat supports- they may be extruded, co-extruded, laminated and then cut to size.

[0073] Supports 2 may be at least partly made of paper material, e.g. paper or cardboard. Alternatively, supports may be made of a single layer or of a multi-layer polymeric material.

DETAILED DESCRIPTION

Apparatus

[0074] Reference number 1 overall indicates an apparatus for packaging a product P arranged on a support 2, for example a flat support or a tray. The support 2 may be any support known in the state of the art adapted for packaging food products, for example, for vacuum packaging, vacuum skin packaging, modified atmosphere packaging.

[0075] The support 2 may present a base wall, a side wall emerging from the base wall and delimiting a space or a surface where a product P can be arranged or contained. The support 2 has a top rim radially protruding from the side wall. The top rim has a horizontal portion, optionally flat, defining a sealing surface for tightly fixing a film, preferably for heat-bonding the film. The support 2 may comprises through holes adapted for allowing the reduction of pressure within the support or around the support. For example, the base wall or the side wall of the support may present through holes configured for coupling with nozzles, needles or pins, which are configured for putting a volume around the product arranged on the support in fluid communication with a vacuum source.

[0076] The product P to be packaged is housed or arranged on the support 2. The product may protrude above the top rim of the support, or the product may be entirely contained within the support. In other words, the product may either protrude or not above the top rim of the support. The apparatus 1 herein disclosed is also adequate for the packaging of products which are not protruding above the top rim. The apparatus 1 may be configured for the vacuum packaging, vacuum skin packaging, modified atmosphere packaging.

First embodiment of the apparatus

[0077] A non-limiting example of the apparatus 1 for packaging a product P arranged on a support 2 is shown in figures 2A-2G. The apparatus 1 comprises a film supplying assembly 30 and a packaging assembly 4. The film supplying assembly 30 is configured for supplying a film 3 to the packaging assembly 4. The film supplying assembly 30 may comprise an unwinding station configured for receiving a reel 15 of film 3 and for unwinding the reel 15 of film 3.

[0078] The film 3 may be a packaging film. The film 3 may be applied to the support 2 to form a lid onto the support or a skin associated to the support and matching the contours of the product P. The film may be made of a single layer material or of a flexible multilayer material comprising at least a first outer heat-sealable layer, an optional gas barrier and a second outer heat-resistant layer. The film 3 may also comprise other layers such as adhesive layers or bulk layers to increase thickness of the film and improve its abuse properties. All the film layers may contain appropriate amounts of additives. Some of these additives are included in the outer layers or in one of the outer layers, while some others are added to the inner layers. The additives may include slip and anti-black agents, antioxidants, stabilizers, plasticizers, fillers, pigments and dyes, cross-linking inhibitors, cross-linking enhancers, UV absorbers, odor absorbers, oxygen scavengers, bactericides, antistatic agents. One or more layers of the film may be cross-linked to improve the strength of the film and/or its heat resistance.

[0079] The packaging assembly 4 of the apparatus is configured for receiving the film 3 from the film supplying assembly 30 and coupling the support 2 with the film 3. The packaging assembly comprises a lower tool 5 and an upper tool 6 configured for cooperating with each other. In detail, the lower tool 5 and the upper tool 6 are configured for cooperating with each other for defining a packaging chamber 9 around the product and the support. At least one of the upper tool and the lower tool is configured to move towards and away from the other. In detail, both of the upper tool and the lower tool are configured to move towards and away the other. In other words, the upper tool may be movable towards and away from the lower tool with the lower tool stationary or the lower tool may be movable towards and away from the upper tool with the upper tool stationary or both the upper tool and the lower tool may be movable towards and away from each other.

[0080] The lower tool 5 defines a seat 5a for receiving the support 2 with the product P arranged thereon. The lower tool 5 may also define multiple seats 5a, where each one of the seats is configured for receiving a respective support containing a respective product.

[0081] In detail, the lower tool 5 may be configured for receiving the support 2 with the product P from an infeed conveyor, or from any suitable mean adapted for supplying at least the support containing the product to the lower tool of the apparatus. The infeed conveyor may be con-

figured for supplying the support 2 or multiple supports 2 at a time, providing the lower tool with a support for each seat.

[0082] The upper tool 6 of the packaging assembly 4 comprises a main body 7. The main body 7 is configured for cooperating with the lower tool 5, particularly for defining a packaging chamber 9. In detail, the main body and the lower tool are configured for defining the packaging chamber around the support and the product arranged thereon. Advantageously, defining a packaging chamber around the support and the product allows to reduce the pressure and the oxygen content around the support containing the product and to vacuum packaging or vacuum skin packaging the product.

[0083] More in detail, the packaging assembly 4 of the apparatus 1 is configured for operate at least in a first operative condition and in a second operative condition. When the packaging assembly 4 is in the first operative condition, the lower tool 5 and the upper tool 6 are distanced from each other. When the packaging assembly is in the second operative condition, the lower tool 5 and the upper tool 6 are approached to each other. For example, figures 2A - 2D show the packaging assembly 4 in the first operative condition whereas figures 2E - 2G show the packaging assembly in the second operative condition.

[0084] In more detail, the packaging assembly 4 is configured for receiving the film 3 and the support with the product when it is in the first operative condition. In other words, when the packaging assembly is in the first operative condition, the upper tool, particularly the main body, and the lower tool are distanced to each other and allow the film supplying assembly 30 to supply the film.

[0085] Moreover, the packaging assembly 4 is configured for defining a packaging chamber 9 around the support 2 and the product arranged on the support 2 when it is in the second operative condition. In other words, when the packaging assembly 4 is in the second operative condition, the upper tool, particularly the main body of the upper tool, and the lower tool are configured to contact each other defining the packaging chamber. In detail, the packaging chamber may have two or more sub-chambers, which may be limited at least in part by the respective portion of the film. In other words, the main body and the lower tool may define a packaging chamber with an upper sub-chamber, which is above the respective portion of the film, and a lower sub-chamber, which is below the respective portion of the film and around the support and the product.

[0086] In addition, the upper tool 6 comprises a frame 8 coupled with the main body 7. The frame 8 is configured for receiving and holding a respective portion 3a of the film 3. In detail, the film supplying assembly 30 is configured for supplying the respective portion 3a of the film to the frame of the upper tool. In more detail, the upper tool may comprise multiple frames coupled with the main body, each one according to the present description. For example, when the lower tool defines a number of seats

5a for receiving multiple respective supports, the upper tool may have an equal number of frames, each one configured for receiving a respective portion of the film adapted to be coupled with a respective one of the multiple supports.

[0087] The frame 8 of the upper tool 6 and the lower tool 5 are mounted for relative motion the one with respect to the other among a plurality of positions. The plurality of positions comprises a first position where the frame 8 is distanced from the lower tool 5 to keep the respective portion 3a of the film flat and apart from the support 2 and from the product P arranged on the support 2. In detail, the respective portion of the film is spaced from the support when the frame and the lower tool are in the first position.

[0088] The plurality of positions comprises a second position, where the frame 8 is approached to the lower tool 5 to allow the respective portion of the film to initiate contacting the product P and/or the support. In detail, the respective portion 3a may contact the product and/or the support when the frame 8 and the lower tool 5 are in the second position.

[0089] In detail, if the product is completely contained in the support with no protrusion above the top rim of the support, the respective portion of the film contact at least the support when the frame and the lower tool are in the second position. In more detail, if the product protrudes above the top rim of the support, the respective portion of the film contacts the product when the frame and the lower tool are in the second position. For example, figures 2B-2E show the apparatus with the frame and the lower tool in the first position with the respective portion of the film flat and apart from the support and product housed in the seat of the lower tool. Also, for example, figure 2F shows the apparatus with the frame and the lower tool in the second position with the respective portion of the film flat and initiating contacting the product arranged on the support.

[0090] In detail, the frame 8 is configured to maintain the respective portion 3a of the film flat when the frame 8 and the lower tool 5 move from the first position to the second position.

[0091] In addition, the plurality of positions comprises a third position, where the frame 8 is close to the lower tool 5 to allow the respective portion of the film to contact at least the support. More in detail, the relative motion of the frame and the lower tool from the second position to the third position is configured to cause the three-dimensional forming of the respective portion of the film. Figure 2G depicts the apparatus wherein the frame and the lower tool are in the third position with the respective portion of the film contacting the top rim of the support and draped over the contours of the product. In accordance with an aspect, the lower tool 5 and the upper tool 6 are configured for cooperating for defining the packaging chamber 9 when the packaging assembly is in the second operative condition. In detail, the upper tool, particularly the main body 7, and the lower tool 5 are configured for

defining the packaging chamber 9 around the support 2 and the product P arranged on the support 2.

[0092] In addition, the frame 8 is positioned within the packaging chamber 9 when the packaging assembly 4 is in the second operative condition. In detail, the frame is movable within the packaging chamber. Moreover, the frame 8 and the lower tool 5 are configured to be movable the one with respect to the other when the packaging assembly 4 is in the second operative condition. The frame 8 and the lower tool are able to move among the first position, the second position and, optionally the third position, while the packaging assembly 4 is in the second operative condition.

[0093] In accordance with an aspect, the film supplying assembly 30 is configured to cooperate with the packaging assembly 4 for positioning the respective portion 3a of the film between the frame 8 and the support 2 and product P arranged on the support 2. In detail, the film supplying assembly 30 is configured for cooperating with the packaging assembly for positioning the respective portion 3a of the film below the frame 8 and above the lower tool and, consequently above the support 2 and product P arranged thereon.

[0094] The frame 8 may have a holding surface 8a configured for contacting and holding the respective portion 3a of the film 3. The holding surface 8a is configured to be positioned within the packaging chamber 9 and facing the lower tool 5 when the packaging assembly 4 is in the second operative condition. In addition, the holding surface 8a may be configured for facing the lower tool 5 when the packaging assembly 4 is in the first operative condition and when the packaging assembly 4 is in the second operative condition. The holding surface 8a may be planar. In detail, the holding surface is configured for relative motion with respect to the lower tool 5. The holding surface is configured to be close to the lower tool when the frame and the lower tool are in the second and/or third position. More in detail, the holding surface is configured to be close to the top rim of the support when the frame and the lower tool are in the second and/or third position.

[0095] The upper tool 6 may comprise a heater 10 configured for heating the respective portion 3a of the film 3. The heater 10 may be configured for heating the respective portion by thermal conduction, thermal convection or thermal radiation. The heater may be configured to contact the respective portion for transferring thermal energy and heating it. The heater 10 may comprise resistors configured for heating the respective portion.

[0096] In detail, the heater is coupled with the main body 7. The heater is also coupled with the frame 8 for relative motion the one with respect to the other among an operative configuration and an inoperative configuration.

[0097] In the operative configuration, the heater 10 and the frame 8 are distanced by a minimum distance. In detail, the heater 10 is configured for heating the respec-

tive portion of the film when the heater and the frame are in the operative condition. More in detail, the heater is configured to contact the respective portion of the film when the heater and the frame are in the operative configuration. A non-limiting example of the apparatus wherein the heater and the frame are in the operative configuration is shown in figure 2A and figures 2C - 2E.

[0098] In the inoperative configuration, the heater 10 and the frame 8 are distanced by a maximum distance, where the maximum distance is greater than the minimum distance. In detail, the heater and the frame are distanced from each other such that the respective portion of the film held by the frame is distanced from the heater. For example, figures 2B, 2F and 2G show the apparatus wherein the heater and the frame are in the inoperative configuration. The transition from the operative to the inoperative configuration and vice versa is shown in figures 2A - 2C.

[0099] In detail, the heater is configured to be at least partly positioned, and optionally movable, within the packaging chamber when the packaging assembly is in the second operative condition.

[0100] In addition, the heater 10 has an active surface 10a configured to contact the respective portion 3a of the film 3. The active surface 10a is configured to heat the respective portion 3a by contacting and transferring heat to it. The active surface 10a is configured to be positioned, and optionally movable, within the packaging chamber 9 when the packaging assembly 4 is in the second operative condition. In more detail, the active surface of the heater may have any conformation or geometry suitable for heating of the respective portion of the film. The active surface of the heater may be planar or concave.

[0101] According to an aspect, the heater 10 is configured to be surrounded by the frame 8 in the operative configuration, as also shown for example in figure 2A and figures 2C - 2E. In detail, the heater 10 and the frame 8 are sized to allow the frame 8 to surround the heater 10 when the heater and the frame are in the operative configuration. In other words, the heater 10 is located in a central seat of the frame when the heater and the frame are in the operative configuration. More in detail, in the operative configuration, the active surface 10a of the heater 10 is coplanar with the holding surface 8a of the frame 8.

[0102] Alternatively, the heater and the frame may be substantially equal sized so that, in the operative configuration, the heater is not surrounded by the frame and the active surface 10a of the heater 10 is distanced from the holding surface 8a of the frame 8. In other words, the active surface 10a and the holding surface 8a may be not coplanar when the heater and the frame are in the operative configuration.

[0103] In accordance with an aspect, the heater 10 is configured to be positioned within the packaging chamber 9 when the packaging assembly 4 is in the second operative condition. In detail, the relative motion of the heater 10 and the frame 8 among the operative and

inoperative configurations may take place either when the packaging assembly 4 is in the first operative condition or when the packaging assembly is in the second operative condition. For example, the apparatus is shown wherein the packaging assembly is in the first operative condition and the heater and the frame are respectively in the operative configuration in figure 2C and in the inoperative configuration in figure 2B. On the contrary, figure 2E and figure 2F show the apparatus wherein the packaging assembly is in the second operative condition and the heater and the frame are respectively in the operative configuration and inoperative configuration.

[0104] In accordance with an aspect, the heater 10 is fixed to the main body 7 and the frame 8 is movably coupled with the main body 7. As also shown in figures 2A - 2G, the heater may be fixed to the main body 7 through all the different steps of the packaging process. In other words, the relative motion of the frame with respect to the main body is configured to cause the heater and the frame to pass from the inoperative configuration to the operative configuration and vice versa.

[0105] Alternatively, the heater 10 is movably coupled with the main body 7 and the frame 8 is fixed to the main body 7. In other words, the relative motion of the heater with respect to the main body is configured to cause the heater and the frame to pass from the inoperative configuration to the operative configuration and vice versa. An example of an apparatus wherein the heater is movably coupled with the main body and the frame is fixed to the main body is depicted in figures 3A - 3C.

[0106] Again alternatively, both the heater 10 and the frame 8 may be both movably coupled with the main body 7. In other words, the relative motion of either the heater or the frame or both with respect to the main body may be configured to cause the heater and the frame to pass from the inoperative configuration to the operative configuration and vice versa. An example of an apparatus wherein both the heater and the frame are movably coupled with the main body is depicted in figures 4A - 4E.

[0107] In addition, the apparatus may comprise a vacuum assembly comprising a vacuum source fluidly couplable with the packaging chamber 9 and configured to reduce the pressure within the packaging chamber 9. The vacuum source may be in the form of a vacuum pump or multiple vacuum pumps. The apparatus comprises a fluid communication line through which the vacuum source and the packaging chamber are fluidly couplable. The lower tool and/or the upper tool comprise passages through which the vacuum source is fluidly couplable with the packaging chamber. In detail, the main body of the upper tool has passages through which the packaging chamber and the vacuum source are fluidly couplable. The vacuum source may also be configured for removing air within the packaging chamber as described in EP2722279A1.

[0108] In detail, the apparatus may comprise needles or perforating means coupled to the upper tool or lower tool for fluidly coupling the vacuum source and the vo-

lume around the product arranged on the support. In detail, the needles or perforating means may be configured for piercing the support and optionally have a tip aperture.

[0109] The apparatus may further comprise a film cutting assembly 11. The film cutting assembly 11 is configured for:

- > receiving the film 3 from the film supplying assembly 30 as a continuous film,
- > cutting from the film 3 the respective portion 3a in the form of a film sheet.

[0110] The film cutting assembly may be further configured for feeding the film sheet to the upper tool. In detail, feeding the film sheet to the upper tool comprises feeding the film sheet to the frame of the upper tool. More in detail, the film cutting assembly may be of the type described in EP2459448A1.

[0111] The film cutting assembly may be configured for cooperating with the packaging assembly 4 for positioning the film sheet between the frame 8 and the support and product P arranged on the support 2, preferably for positioning the film sheet below the frame 8 and above the support 2 and product P arranged on the support 2. In detail, after the film cutting assembly feed the respective portion to the upper tool of the packaging assembly, the respective portion of the film is located between the frame and the support in direct contact with the frame and facing the support and the product.

[0112] In addition, the film cutting assembly 11 comprises a transfer device 16 configured for positioning the film sheet below the frame 8 and above the support 2 and product P arranged on the support 2. The transfer device 16 comprises a backing structure 12 that presents a flat surface 12a adapted to receive and hold the film sheet. The transfer device 16 may further comprise a mechanism 17 active on the backing structure for commanding the relative movement of the backing structure with respect to the packaging assembly.

[0113] The mechanism 17 active on the backing structure 12 is configured for relative movement of the backing structure with respect to the packaging assembly between an outside position, where the backing structure 12 is distanced from the upper tool 6 for receiving the film sheet, and an inside position, where the backing structure 12 is approached to the upper tool 6 for positioning the film sheet at the frame 8 and above the support 2 and product P arranged on the support 2. For example, the apparatus with the backing structure in the inside position is depicted in each one of figures 2A - 2C.

[0114] Moreover, the backing structure 12 and the frame 8 may be coupled for relative movement from a distanced condition, where the frame 8 and the backing structure 12 are distanced one from the other, to an approached condition, where the backing structure 12 and the frame 8 are approached for transferring the film sheet. For example, the apparatus is shown with the

backing structure and the frame respectively in the distanced condition in figure 2A and in the approached condition in figure 2B. In detail, the mechanism 17 active on the backing structure 12 may be configured for moving the backing structure 12 along a first direction between the outside and inside positions and vice versa. The mechanism 17 active on the backing structure 12 may be further configured for moving the backing structure 12 along a second direction transverse to the first direction between the distanced condition and the approached condition and vice versa. The second direction is indicated by the arrow A shown in figure 2B.

[0115] According to an aspect, the film cutting assembly 11 may comprise blades 13 coupled with the upper tool 6 and configured for cutting from the film 3 the respective portion 3a in the form of the film sheet. The blades 13 may be fixed to the main body and, optionally configured for cutting from the film 3 the respective portion 3a when the packaging assembly 4 passes from the first operative condition to the second operative condition. More in detail, the blades are configured for cutting from the film the respective portion after the pressure within the packaging chamber is reduced.

[0116] In accordance with some aspects, the film cutting assembly 11 may comprise a stopper 14 coupled with the blades 13 and the main body 7, as for example shown in figures 4A - 4E and figure 5. The stopper 14 is configured to be interposed between the upper tool 6 and the lower tool 5 at least in the second operating condition of the packaging assembly. In detail, the stopper 14 is movable between a stop condition, where the stopper 14 blocks the film 3 against an abutting surface, and a release condition, where the film 3 is allowed to move. In detail, when the stopper is in the stop condition, the feeding of the respective portion to the packaging assembly is prevented by the stopper, whereas the feeding of the respective portion is allowed when the stopper is in the release condition. In addition, the stopper is configured such that the stopper is not movable within the packaging chamber when the packaging assembly is in the second operative condition.

[0117] More in detail, the film supplying assembly 30 may be configured for cooperating with the film cutting assembly 11 and the packaging assembly 4 for feeding the film 3 above the stopper 14 and below the frame 8, optionally for positioning the respective portion 3a of the film between the frame 8 and the stopper 14.

[0118] The apparatus 1 may further comprise a control unit in signal communication with the packaging assembly 4 and configured for executing the steps of:

- > commanding the packaging assembly 4 to pass from the first operative condition to the second operative condition or vice versa,
- > commanding the relative motion of the frame 8 and of the lower tool 5 from the first position to the second position or vice versa,
- > commanding the packaging assembly 4 to cause

coupling of the support 2 with the respective portion 3a of the film for obtaining a package.

[0119] In detail, the step of commanding the packaging assembly 4 to pass from the first operative condition to the second operative condition or vice versa comprises commanding execution of the following operations:

- > moving the upper tool 6 and the lower tool 5 away from and/or towards each other,
- > defining the packaging chamber 9 around the support 2 and the product P arranged on the support 2.

[0120] In accordance with an aspect, moving the upper tool 6 and the lower tool 5 away from and towards each other comprises:

- > moving the upper tool towards and/or away from the lower tool, and/or
- > moving the lower tool towards and/or away from the upper tool.

[0121] In addition, moving the upper tool 6 and the lower tool 5 away from and/or towards each other comprises moving the main body and the lower tool away from and/or towards each other.

[0122] For example, figures 2A - 2G show the apparatus during different operational steps of a process of packaging the product wherein:

- > the lower tool is configured for being movable towards and away from the upper tool, and
- > the control unit is configured for commanding the execution of the step of moving the lower tool towards and away from the upper tool.

[0123] In other words, the relative motion of the lower tool and the upper tool is caused by the motion of the lower tool towards and away from the upper tool.

[0124] Note that, alternatively, the relative motion of the lower tool and the upper tool may be caused by the motion of the upper tool towards and away from the lower tool.

[0125] Again, alternatively, the relative motion of the lower tool and the upper tool may be caused by the motion of both the lower tool and the upper tool.

[0126] The step of commanding the relative motion of the frame 8 and of the lower tool 5 comprises commanding execution of the following further operation:

- > moving the respective portion 3a of the film and the lower tool 5 away from and/or towards each other maintaining the respective portion 3a of the film flat.

[0127] The step of commanding the relative motion of the frame and the lower tool comprises:

- > moving the frame towards and away from the lower tool, and/or
- > moving the lower tool towards and away from the frame.

[0128] In other words, the relative motion of the frame and the lower tool may be caused:

- > by the motion of the lower tool towards and away from the frame, or
- > by the motion of the frame towards and away from the lower tool, or
- > by the motion of both the frame and the lower tool towards and away from each other.

[0129] For example, figures 2A - 2G show the apparatus during different operational steps of a process of packaging the product wherein:

- > both the frame and the lower tool are configured for being movable towards and away from each other, and
- > the control unit 20 is configured for commanding the execution of the steps of moving the lower tool towards and away from the frame and moving the frame towards and away from the lower tool.

[0130] In other words, the relative motion of the frame and the lower tool and the relative motion of the respective portion and the lower tool are caused by the motion of both the frame and the lower tool towards and away from each other.

[0131] For example, figures 3A - 3C show the apparatus during different operational steps of a process of packaging the product wherein:

- > the frame is configured to be stationary with respect to the main body, and
- > the lower tool is configured for being movable towards and away from the frame, and
- > the control unit 20 is configured for commanding the execution of the steps of moving the lower tool towards and away from the frame.

[0132] In other words, the relative motion of the frame and the lower tool may be caused by the motion of the lower tool towards and away from the frame. In detail, the relative motion of the respective portion and the lower tool may be caused by the motion of the lower tool towards and/or away from the frame and the respective portion.

[0133] Alternatively, the lower tool may be configured to be stationary and the frame configured for being movable towards and away from the lower tool. The relative motion of the lower tool and the frame and the relative motion of the respective portion and the lower tool are caused by the motion of the frame towards and away from the lower tool.

[0134] In addition, the control unit 20 may be in signal

communication with the film supplying assembly 30 and configured for executing the steps of:

- > when the packaging assembly 4 is in the first operative condition, commanding the film supplying assembly 30 for supplying the film 3 to the packaging assembly 4, optionally for supplying the respective portion 3a of the film to the frame 8 of the upper tool 6,
- > commanding the frame 8 for receiving and holding the respective portion 3a of the film.

[0135] In accordance with an aspect, the control unit 20 is configured such that the further operation of moving the respective portion 3a of the film 3 and the lower tool 5 away from and/or towards each other maintaining the respective portion 3a of the film flat takes place while the packaging assembly 4 is in the second operative condition or after the operation of defining the packaging chamber 9.

[0136] In addition, the step of commanding the film supplying assembly 30 may comprise commanding positioning of the respective portion 3a of the film between the frame 8 and the support 2 and product P arranged on the support 2, in detail, below the frame 8 and above the support 2 and product P arranged on the support 2.

[0137] Moreover, the control unit 20 is in signal communication with the heater 10 and configured for executing the steps of:

- > commanding the heater 10 for heating the respective portion 3a of the film,
- > commanding the relative motion of the heater 10 and the frame between the operative configuration and inoperative configuration and vice versa.

[0138] The step of commanding the relative motion of the heater and the frame comprises:

- > moving the heater towards and away from the frame, and/or
- > moving the frame towards and away from the heater.

[0139] In other words, the relative motion of the heater and the frame may be caused by:

- > the motion of the heater towards and away from the frame, or
- > the motion of the frame towards and away from the heater, or
- > the motion of both the heater and the frame towards each other.

[0140] For example, figures 2A - 2G show the apparatus during different operational steps of a process of packaging the product wherein:

- > the heater is stationary with respect to the main

body,

- > the frame is configured for being movable towards and away from the heater,
- > the control unit 20 is configured for commanding the execution of the step of moving the frame towards and away from the heater.

[0141] Again, for example, figures 3A - 3C show the apparatus during different operational steps of a process of packaging the product wherein:

- > the frame is stationary with respect to the main body,
- > the heater is configured for being movable towards and away from the frame,
- > the control unit 20 is configured for commanding the execution of the step of moving the heater towards and away from the frame.

[0142] For example, figures 4A - 4D show the apparatus during different operational steps of a process of packaging the product wherein:

- > both the heater and the frame are configured for being movable towards and away from each other and optionally for being movable with respect to the main body,
- > the control unit 20 is configured for commanding the execution of the steps of moving the heater towards and away from the frame and moving the frame towards and away from the heater.

[0143] In detail, the step of commanding the packaging assembly 4 to cause coupling of the support 2 with the respective portion 3a of the film is for heat-bonding the respective portion of the film to the support.

[0144] The step of commanding the relative motion of the heater 10 and the frame 8 comprises the step of moving the respective portion of the film and the heater 10 away from and/or towards each other maintaining the respective portion 3a of the film flat. In detail, the relative motion of the respective portion of the film and the heater may be caused by the motion of the respective portion towards and away from the heater. Alternatively, the relative motion of the respective portion and the heater may be caused by the motion of the heater towards and away from the frame and the respective portion. Again, alternatively, the relative motion of the respective portion and the heater may be caused by the motion of both the heater and the respective portion towards and away from each other.

[0145] In addition, the control unit 20 may be in signal communication with the vacuum source and configured to execute the further step of:

- > commanding the vacuum assembly, optionally the vacuum source, for reducing the pressure within the packaging chamber, optionally for reaching a de-

fined vacuum level within the packaging chamber 9.

[0146] Moreover, the control unit 20 may be configured for:

- > receiving a pressure data representative of a defined pressure and a control signal representative of a pressure within the packaging chamber,
- > commanding the vacuum assembly, optionally the vacuum source, for reducing the pressure within the packaging chamber based on the pressure data and the control signal.

[0147] In other words, the control unit 20 is configured for commanding the vacuum assembly, optionally the vacuum source, for reaching the defined pressure within the packaging chamber. The control unit 20 may be configured for commanding the vacuum assembly for reducing the pressure within the packaging chamber at least until the pressure within the packaging chamber is equal to the defined pressure.

[0148] In detail, the step of commanding the packaging assembly 4 to cause coupling of the support 2 with the respective portion 3a of the film is for obtaining a vacuum skin package. The coupling of the support with the respective portion of the film is executed by relatively moving the respective portion and the lower tool.

[0149] In detail, after reaching the defined pressure within the packaging chamber and the frame and lower tool are in the second or third position, gas is inserted within the packaging chamber to cause the respective portion to drape over the product and to bond the respective portion of the film to the support obtaining a vacuum skin package. In accordance with an aspect, the control unit 20 is in signal communication with the film cutting assembly 11 and configured for:

- > commanding the film cutting assembly 11 for cutting from the film the respective portion 3a in the form of said film sheet, and
- > commanding the transfer device 16 for positioning the film sheet below the frame 8 and above the support 2 and product P arranged on the support 2.

[0150] The step of commanding the packaging assembly 4 may comprise the step of leaving the packaging assembly 4 in the first operating condition a time sufficient for the backing structure 12 of the transfer device 16 to:

- move from the outside position to the inside position for positioning the respective portion 3a of the film in the form of the film sheet at and below the frame 8 and above the support 2 and product P arranged on the support 2,
- move from the inside position to the outside position.

[0151] In addition, the control unit 20 may be config-

ured for executing the step of

> commanding the relative movement of the backing structure 12 and the frame 8 from the distanced condition to the approached condition for transferring the film sheet.

[0152] In detail, the relative movement of the backing structure 12 and the frame 8 may be caused by:

> the motion of the backing structure towards and away from the frame, or
 > the motion of the frame towards and away from the backing structure, or
 > the motion of both the frame and the backing structure towards and away from each other.

[0153] Moreover, the control unit 20 may be configured for executing the steps of:

> commanding the mechanism 17 active on the backing structure 12 for moving the backing structure 12 along the first direction between the outside and inside positions and vice versa,
 > optionally commanding the mechanism 17 active on the backing structure 12 for moving the backing structure 12 along the second direction between the distanced condition and the approached condition and vice versa.

Second embodiment

[0154] In a second embodiment, the heater 10 of the apparatus 1 is positioned upstream the packaging assembly 4 and downstream the film supplying assembly 30. A non-limiting example of an apparatus according to the second embodiment is in figure 5. The heater 10 may be configured to be positioned outside the packaging chamber 9 when the packaging assembly 4 is in the second operative condition.

[0155] The heater is configured for:

> receiving the film 3 from the film supplying assembly 30,
 > heating the respective portion 3a of the film 3,
 > feeding the heated respective portion 3a of the film to the packaging assembly 4.

[0156] Advantageously, the positioning of the heater outside of the packaging chamber allows the heating of a successive respective portion of the film while the packaging assembly is closing the support with a previous and already heated respective portion and packaging the product.

Third embodiment

[0157] In a third embodiment, the upper tool 6 of the

packaging assembly 4 is mounted for rotation around a rotation axis. A non-limiting example of an apparatus 1 according to the third embodiment is shown in figures 6A - 6F. In detail the rotation axis may be a horizontal rotation axis.

[0158] The apparatus 1 may further comprise a movement mechanism 40 coupled with the packaging assembly 4. The movement mechanism 40 is configured for rotating at least the upper tool 6 around the rotation axis among a plurality of angular positions. The movement mechanism may comprise a support frame onto which the upper tool is mounted and a motor or an actuator for placing in rotation the upper tool as desired. In detail, the plurality of angular positions comprises an alignment position and a pick-up position.

[0159] When the upper tool is in the alignment position, the main body 7 and the frame 8 are in alignment with the lower tool. For example, the upper tool is shown in the alignment position in figures 6D - 6F.

[0160] When the upper tool is in the pick-up position, the frame 8 is in alignment with the film cutting assembly for receiving the film sheet. The apparatus with the upper tool in the pick-up position is shown in figures 6A and 6B. In detail, when the upper tool is in the pick-up position, the frame is in alignment with the backing structure 12.

[0161] The control unit 20 may be in signal communication with the movement mechanism (40) coupled with the packaging assembly 4. In detail, the control unit 20 is configured for executing the steps of commanding the movement mechanism 40 for rotating at least the upper tool 6 around the rotation axis among the plurality of angular positions.

Fourth embodiment

[0162] In a fourth embodiment, the upper tool of the packaging assembly further comprises multiple main bodies angularly offset from each other, and multiple frames also angularly offset from each other. A non-limiting example of an apparatus in accordance with the fourth embodiment is shown in figure 7. Each one of the frames is coupled with a respective one of said main bodies and configured for receiving and holding a respective portion 3a of the film 3.

[0163] In detail, each pair formed by one respective main body 7 and one respective frame 8:

> is selectively positionable in alignment with the lower tool 5, and

> when positioned in alignment with the lower tool 5, has said respective frame 8 relatively movable with respect to the lower tool 5 among said plurality of positions and configured to maintain the respective portion 3a of the film flat when the respective frame 8 and the lower tool 5 move from the first position to the second position.

[0164] In addition, each pair formed by one respective

main body 7 and one respective frame 8 is selectively positionable in alignment with the film cutting assembly for receiving the film sheet. In detail, each pair formed by one respective main body 7 and one respective frame 8 is selectively positionable in alignment with the backing structure 12 for receiving the film sheet.

[0165] In addition, the upper tool 6 may comprise multiple heaters angularly offset from each other. Each one of said heaters is coupled with a respective pair formed by the one respective main body 7 and the one respective frame 8. In detail, each one of the heaters:

- > is configured for heating the respective portion 3a of the film 3,
- > is relatively movable with respect to the respective frame 8 among the operative configuration and the inoperative configuration.

[0166] Note that each one of said multiple frames, each one of said multiple main bodies and each one of said multiple heaters may be respectively in accordance with the frame, the main body and the heater described in connection with any one of the embodiments and aspects.

Process

[0167] A further object of the present description is a process of packaging, in particular of vacuum skin packaging the product P arranged on the support 2. The process may use the apparatus 1 as described herein in accordance with any one of the embodiments and/or aspects.

[0168] The process comprises the steps of:

- > supplying the support 2 with the product P arranged thereon,
- > supplying a film 3,
- > relatively moving a respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2 between:
 - a distanced position, where the respective portion 3a of the film 3 is distanced from the support 2 and the product P arranged on the support 2, and
 - an approached position, where the respective portion of the film initiates contacting the product P and/or the support 2,
- > coupling the support 2 with the film 3, optionally with the respective portion 3a of the film 3, obtaining a package, optionally a vacuum skin package.

[0169] In detail, the step of relatively moving the respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2 between the distanced and approached positions comprises maintaining

the respective portion 3a of the film flat. The step of supplying the support 2 with the product P arranged thereon may be executed by an infeed conveyor or from any suitable mean adapted for supplying at least the support containing the product to the lower tool of the apparatus. The step of supplying the support 2 with the product P arranged thereon may comprise providing the lower tool with a respective support containing a respective product for each one of the multiple seats.

[0170] In accordance with an aspect, the process may further comprise the step of:

- > defining a packaging chamber 9 around the support 2 and the product P arranged on the support 2.

[0171] Relatively moving a respective portion 3a of the film and the support 2 and the product P arranged on the support 2 takes place within the packaging chamber 9. In other words, the relative motion of the respective portion of the film and the support takes place within the packaging chamber.

[0172] The process may comprise the step of relatively moving the respective portion 3a of the film and the support 2 and the product P arranged on the support 2, optionally within the packaging chamber 9, between the approached position and a contact position where the respective portion 3a of the film contacts the product P and the support 2.

[0173] The step of relatively moving the respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2 between the approached and the contact positions comprises three-dimensionally forming the respective portion 3a of the film 3.

[0174] In detail, the step of relatively moving the respective portion 3a of the film and the support 2 and the product P arranged on the support 2 between the approached and the contact positions is after relatively moving the respective portion 3a of the film and the support 2 and the product P arranged on the support 2 between the distanced and the approached positions.

[0175] In detail, relatively moving the respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2 between the distanced position, the approached position and, optionally the contact position, is executed by:

- > moving the respective portion of the film, optionally the frame, towards and/or away from the support and the product arranged thereon, optionally the lower tool, and/or
- > moving the support and the product arranged thereon, optionally the lower tool, towards and/or away from the respective portion of the film, optionally the frame.

[0176] In other words, the relative motion of the respective portion of the film and the support with the product arranged thereon may be caused by:

- > the motion of the respective portion of the film towards and/or away from the support and the product arranged thereon, or
- > the motion of the support and the product arranged thereon towards and/or away from the respective portion of the film, or
- > the motion of both the respective portion and the support containing the product towards and/or away from each other.

[0177] In addition, the process may comprise the steps of:

- > heating the respective portion 3a of the film 3, which may be executed by the heater 10,
- > relatively moving the respective portion 3a of the film 3 and the heater 10 away from and towards each other.

[0178] In detail, the step of relatively moving the respective portion 3a of the film 3 and the heater 10 comprises relatively moving of the heater 10 and the frame between the operative configuration and inoperative configuration and vice versa.

[0179] More in detail, relatively moving the respective portion 3a of the film 3 and the heater 10 away from and towards each other, is executed by:

- > moving the respective portion of the film, optionally the frame, towards and away from the heater, and/or
- > moving the heater towards and away from the respective portion of the film, optionally the frame.

[0180] In other words, the relative motion of the respective portion 3a of the film 3 and the heater 10 away from and towards each other may be caused by:

- > the motion of the respective portion of the film, optionally the frame, towards and away from the heater, or
- > the motion of the heater towards and away from the respective portion of the film, optionally the frame, or
- > the motion of both the respective portion, optionally the frame, and the heater towards and away from each other.

[0181] The process may further comprise the step of reducing the pressure within the packaging chamber 9 defined around the support 2 and the product P arranged on the support 2. The step of reducing the pressure within the packaging chamber may be executed by the vacuum source and comprises the step of reaching a defined vacuum level within the packaging chamber 9.

[0182] Furthermore, the process may comprise the step of receiving a pressure data representative of a defined pressure and a control signal representative of a pressure within the packaging chamber. The step of reducing the pressure within the packaging chamber is

based on the pressure data and the control signal.

[0183] The process may comprise the step of cutting from the film 3 the respective portion 3a in the form of a film sheet, which may be executed by the film cutting assembly 11.

[0184] In detail, the step of coupling the support 2 with the respective portion 3a of the film 3 may comprise heat-bonding the respective portion 3a of the film 3 to the support 2.

[0185] According to an aspect, the step of defining the packaging chamber 9 around the support 2 and the product P is executed by commanding the packaging assembly 4 to pass from the first operative condition to the second operative condition or vice versa. The step of defining a packaging chamber 9 around the support and the product arranged thereon may be executed by the upper tool and the lower tool. In detail, the step of defining a packaging chamber is executed by the main body of the upper tool and the lower tool. More in detail, the step of defining a packaging chamber is executed through the movement of the main body and the lower tool towards and away from each other.

[0186] Moreover, the step of relatively moving the respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2, optionally within the packaging chamber 9, between the distanced and the approached positions and/or between the approached and the contact positions is executed by commanding the relative motion of the frame 8 and of the lower tool 5 from the first position to the second position or vice versa.

[0187] The step of commanding the packaging assembly 4 to pass from the first operative condition to the second operative condition or vice versa may further comprise moving the upper tool 6 and the lower tool 5 away from and towards each other.

[0188] In detail, the step of relatively moving the respective portion 3a of the film 3 and the support 2 and the product P arranged on the support 2, optionally within the packaging chamber, between the distanced and the approached positions comprises moving the respective portion 3a, optionally the frame, and the lower tool 5 away from and/or towards each other.

[0189] More in detail, the step of moving the respective portion 3a of the film 3 and the lower tool 5 away from and/or towards each other takes place while maintaining the respective portion 3a of the film flat.

[0190] In accordance with an aspect, the step of supplying a film 3 is executed by commanding the film supplying assembly 30 for supplying the film 3 to the packaging assembly 4, optionally for supplying the respective portion 3a of the film 3 to the frame 8 of the upper tool 6.

[0191] In addition, the step of supplying a film 3 comprises positioning the respective portion 3a of the film 3 between the frame 8 and the support 2 and product arranged on the support 2, in detail, below the frame 8 and above the support 2 and product arranged on the support 2.

[0192] In detail, the process may further comprise the step of leaving the packaging assembly 4 in the first operating condition a time sufficient for the backing structure 12 of the transfer device 16 to:

- move from the outside position to the inside position for positioning the respective portion 3a of the film 3 in the form of the film sheet at and below the frame 8 and above the support 2 and product P arranged on the support 2,
- move from the inside position to the outside position.

[0193] In accordance with an aspect, the process may comprise one or more of the steps of:

- > relatively moving the backing structure 12 and the frame 8 from the distanced condition to the approached condition for transferring the respective portion of the film in the form of the film sheet,
- > moving the backing structure 12 along the first direction between the outside and inside positions and vice versa, which may be executed by commanding the mechanism 17 active on the backing structure, and
- > moving the backing structure 12 along the second direction between the distanced condition and the approached condition and vice versa, which may be executed by commanding the mechanism 17 active on the backing structure.

[0194] The process may further comprise the step of rotating at least the upper tool 6 around the rotation axis among the plurality of angular positions.

[0195] Note that the process of packaging of the present description has been described in with reference to the apparatus with a single frame, main body and heater but the process may use an apparatus in accordance with any one of the aspects and embodiments described herein. In other words, the process may use an apparatus having multiple frames, multiple main bodies and/or multiple heaters. For example, the process may use an apparatus having the lower tool configured for receiving multiple supports and the upper tool with multiple frames, each one configured for receiving and coupling the respective portion of film with a respective one of the supports for obtaining a plurality of packages.

[0196] For purposes of this disclosure, terminology such as "upper," "lower," "vertical," "horizontal," "inwardly," "outwardly," "inner," "outer," "front," "rear," and the like, should be construed as descriptive and not limiting the scope of the claimed subject matter. Further, the use of "including," "comprising," or "having" and variations thereof herein is meant to encompass the items listed thereafter and equivalents thereof as well as additional items. Unless limited otherwise, the terms "connected," "coupled," and "mounted" and variations thereof herein are used broadly and encompass direct

and indirect connections, couplings, and mountings.

Claims

1. An apparatus (1) for packaging, in particular for vacuum skin packaging, a product (P) arranged on a support (2), the apparatus (1) comprising:

a film supplying assembly (30) configured for supplying a film (3),
a packaging assembly (4) configured for receiving the film (3) and coupling the support (2) with the film (3), the packaging assembly (4) comprising:

a lower tool (5) defining a seat (5a) for receiving the support (2) with the product (P) arranged thereon, and
an upper tool (6) having a main body (7) configured for cooperating with the lower tool (4),

wherein the packaging assembly (4) is configured to operate at least in a first operative condition, where the lower tool (5) and the upper tool (6) are distanced from each other, and in a second operative condition, where the lower tool (5) and the upper tool (6) are approached to each other,

wherein the upper tool (6) comprises a frame (8) coupled with the main body (7) and configured for receiving and holding a respective portion (3a) of the film (3), and

wherein the frame (8) and the lower tool (5) are mounted for relative motion the one with respect to the other among a plurality of positions, said plurality of positions comprising:

a first position, where the frame (8) is distanced from the lower tool (5) to keep the respective portion (3a) of the film (3) flat and apart from the support (2) and product (P) arranged on the support (2),

a second position, where the frame (8) is approached to the lower tool (5) to allow said respective portion (3a) of the film to initiate contacting the product (P) and/or the support (2), and

wherein the frame (8) is configured to maintain the respective portion (3a) of the film flat when the frame (8) and the lower tool (5) move from the first position to the second position.

2. Apparatus (1) according to the preceding claim, wherein the upper tool (6) is mounted for rotation around a rotation axis, optionally a horizontal rotation

axis, and comprises multiple main bodies angularly offset from each other and multiple frames also angularly offset from each other, wherein each one of said frames is coupled with a respective one of said main bodies and configured for receiving and holding a respective portion (3a) of the film (3), wherein each pair formed by one respective main body (7) and one respective frame (8):

> is selectively positionable in alignment with the lower tool (5), and

> when positioned in alignment with the lower tool (5), has said respective frame (8) relatively movable with respect to the lower tool (5) among said plurality of positions and configured to maintain the respective portion (3a) of the film flat when the respective frame (8) and the lower tool (5) move from the first position to the second position.

3. Apparatus (1) according to any one of the preceding claims, wherein the lower tool (5) and the upper tool (6), optionally the main body (7) of the upper tool (6), are configured for cooperating for defining a packaging chamber (9) when the packaging assembly (4) is in the second operative condition, and

wherein the or each frame (8) is positioned within the packaging chamber (9) when the packaging assembly (4) is in the second operative condition, optionally the/each frame (8) and the lower tool (5) are configured to be movable the one with respect to the other when the packaging assembly (4) is in the second operative condition, and

wherein the film supplying assembly (30) is configured to cooperate with the packaging assembly (4) for positioning the respective portion (3a) of the film between the/each frame (8) and the support (2) and product (P) arranged on the support (2), optionally for positioning the respective portion (3a) of the film below the/each frame (8) and above the support (2) and product (P) arranged on the support (2), and

wherein the/each frame (8) has a holding surface (8a) configured for contacting and holding the respective portion (3a) of the film, the holding surface (8a) being configured to be positioned within a/the packaging chamber (9) and facing the lower tool (5) when the packaging assembly (4) is in the second operative condition, optionally the holding surface (8a) being configured for facing the lower tool (5) when the packaging assembly (4) is in the first operative condition and when the packaging assembly (4) is in the second operative condition.

4. Apparatus (1) according to any one of the preceding

claims, comprising a heater (10) positioned upstream the packaging assembly (4) and downstream the film supplying assembly (30), said heater (10) being configured for:

> receiving the film from the film supplying assembly (30),
> heating the respective portion of the film,
> feeding the respective heated portion of the film to the packaging assembly (4),
and

optionally wherein the heater (10) is configured to be positioned outside a/the packaging chamber (9) when the packaging assembly (4) is in the second operative condition.

5. Apparatus (1) according to any one of the preceding claims from 1 to 3, wherein the upper tool (6) comprises a heater (10) coupled with the main body (7), the heater (10) being configured for heating the respective portion (3a) of the film, and

wherein the heater (10) is coupled with the frame (8) for relative motion the one with respect to the other among an operative configuration, where the heater (10) and the frame (8) are distanced by a minimum distance, and an inoperative configuration, where the heater (10) and the frame (8) are distanced by a maximum distance, the maximum distance being greater than the minimum distance, and

wherein the heater (10) is configured for heating the respective portion (3a) of the film when the heater (10) and the frame (8) are in the operative configuration, optionally the heater (10) being configured to be surrounded by the frame (8) in the operative configuration.

6. Apparatus (1) according to preceding claim when dependent on claim 2, wherein the upper tool (6) comprises multiple heaters angularly offset from each other, each one of said heaters being coupled with a respective pair formed by the one respective main body (7) and the one respective frame (8), and wherein each heater (10):

> is configured for heating the respective portion (3a) of the film (3),
> is relatively movable with respect to the respective frame (8) among the operative configuration and the inoperative configuration.

7. Apparatus (1) according to any one of the preceding claims from 5 to 6, wherein the/each heater (10) is configured to be positioned within a/the packaging chamber (9) when the packaging assembly (4) is in the second operative condition, and/or wherein

the/each heater (10) has an active surface (10a) configured to contact the respective portion (3a) of the film and configured to be positioned within a/the packaging chamber (9) when the packaging assembly (4) is in the second operative condition, optionally wherein, in the operative configuration, the active surface (10a) of the/each heater (10) is coplanar with the holding surface (8a) of the frame (8) or respective frame (8), and wherein:

- > the/each heater (10) is fixed to or movably coupled with the main body (7) or the respective main body (7), and
- > the/each frame (8) is fixed to or movably coupled with the main body (7) or the respective main body (7).

8. Apparatus (1) according to any one of the preceding claims, comprising a vacuum assembly comprising a vacuum source fluidly couplable with a/the packaging chamber (9) and configured to reduce the pressure within the packaging chamber (9), and/or wherein the apparatus (1) comprises a film cutting assembly (11) configured for:

- > receiving the film from the film supplying assembly (30) as a continuous film,
- > cutting from the film the respective portion in the form of a film sheet,
- > feeding the film sheet to the upper tool, optionally to the/each frame of the upper tool,
- > wherein feeding the film sheet includes cooperating with the packaging assembly (4) for positioning the film sheet between the/each frame (8) and the support (2) and product (P) arranged on the support (2), optionally for positioning the film sheet below the/each frame (8) and above the support (2) and product (P) arranged on the support (2), and

wherein the film cutting assembly (11) comprises a transfer device (16) configured for positioning the film sheet below the/each frame (8) and above the support (2) and product (P) arranged on the support (2), wherein the transfer device (16) comprises:

- a backing structure (12) having a flat surface (12a) adapted to receive and hold the film sheet, and
- a mechanism (17) active on the backing structure (12) and configured for relative movement of the backing structure (12) with respect to the packaging assembly (4) between an outside position, where the backing structure (12) is distanced from the upper tool (6) for receiving the film sheet, and an inside position, where the backing structure (12) is approached to the

upper tool (6) for positioning the film sheet at the/each frame (8) and above the support (2) and product (P) arranged on the support (2), and wherein the backing structure (12) and the/each frame (8) are coupled for relative movement from a distanced condition, where the frame (8) and the backing structure (12) are distanced one from the other, to an approached condition, where the backing structure (12) and the frame (8) are approached for transferring the film sheet, and wherein the mechanism (17) active on the backing structure (12) is configured for moving the backing structure (12) along a first direction between the outside and inside positions and vice versa, optionally the mechanism (17) active on the backing structure (12) is further configured for moving the backing structure (12) along a second direction transverse to the first direction between the distanced condition and the approached condition and vice versa.

9. Apparatus (1) according to the preceding claim, comprising a movement mechanism (40) coupled with the packaging assembly (4) and configured for rotating at least the upper tool (6) around a/the rotation axis among a plurality of angular positions, the plurality of angular positions comprises:

an alignment position where the main body (7) and the frame (8) are in alignment with the lower tool (5) or where the pair formed by one respective main body and one respective frame is in alignment with the lower tool (5), and a pick-up position where the frame (8) or the pair is in alignment with the film cutting assembly (11) for receiving the respective portion (3a) of the film in the form of the film sheet.

10. Apparatus (1) according to any one of the preceding claims from 8 to 9, wherein the film cutting assembly (11) comprises blades (13) coupled with the upper tool (6) and configured for cutting from the film (3) the respective portion (3a) in the form of the film sheet, optionally the blades (13) being fixed to the/each main body (7) and configured for cutting from the film the respective portion (3a) when the packaging assembly (4) passes from the first operative condition to the second operative condition, and wherein the film cutting assembly (11) comprises a stopper (14) coupled with the blades (13) and the/each main body (7) and configured to be interposed between the upper tool (6) and the lower tool (5) in the second operating condition, the stopper (14) being movable between a stop condition, where the stopper (14) blocks the film (3) against an abutting surface, and a release condition, where the film (3) is allowed to move, optionally the film supplying

assembly (30) being configured to cooperate with the film cutting assembly (11) and the packaging assembly (4) for feeding the film (3) above the stopper (14) and below the/each frame (8), optionally for positioning the respective portion (3a) of the film between the/each frame (8) and the stopper (14). 5

11. Apparatus (1) according to any one of the preceding claims, comprising a control unit (20) in signal communication with the packaging assembly (4) and configured for executing the steps of: 10

- > commanding the packaging assembly (4) to pass from the first operative condition to the second operative condition or vice versa, 15
- > commanding the relative motion of the/each frame (8) and of the lower tool (5) from the first position to the second position or vice versa,
- > commanding the packaging assembly (4) to cause coupling of the support (2) with the respective portion (3a) of the film for obtaining a package, and 20

wherein the step of commanding the packaging assembly (4) to pass from the first operative condition to the second operative condition or vice versa comprises commanding execution of the following operations: 25

- > moving the upper tool (6) and the lower tool (5) away from and towards each other, 30
- > defining a/the packaging chamber (9) around the support (2) and the product (P) arranged on the support (2), and 35

wherein the step of commanding the relative motion of the/each frame (8) and of the lower tool (5) comprises commanding execution of the following further operation: 40

- > moving the respective portion (3a) of the film and the lower tool (5) away from and/or towards each other maintaining the respective portion (3a) of the film flat, and 45

wherein the control unit (20) is in signal communication with the film supplying assembly (30) and configured for executing the steps of:

- > when the packaging assembly (4) is in the first operative condition, commanding the film supplying assembly (30) for supplying the film (3) to the packaging assembly (4), optionally for supplying the respective portion (3a) of the film to the/each frame (8) of the upper tool (6), 50
- > commanding the/each frame (8) for receiving and holding the respective portion (3a) of the film, and 55

wherein the control unit (20) is configured such that the further operation of moving the respective portion (3a) of the film and the lower tool (5) away from and/or towards each other maintaining the respective portion (3a) of the film flat takes place while the packaging assembly (4) is in the second operative condition or after the operation of defining the packaging chamber (9), and/or

wherein the step of commanding the film supplying assembly (30) comprises commanding positioning of the respective portion (3a) of the film between the/each frame (8) and the support (2) and product (P) arranged on the support (2), optionally below the/each frame (8) and above the support (2) and product (P) arranged on the support (2).

12. Apparatus (1) according to the preceding claim when dependent on claim 5, wherein the control unit (20) is in signal communication with the/each heater (10) and configured for executing the steps of:

- > commanding the/each heater (10) for heating the respective portion (3a) of the film,
- > commanding the relative motion of the/each heater (10) and the frame or respective frame between the operative configuration and inoperative configuration and vice versa,

wherein the step of commanding the packaging assembly (4) to cause coupling of the support (2) with the respective portion (3a) of the film is for heat-bonding the respective portion (3a) of the film to the support (2), optionally wherein commanding the relative motion of the/each heater (10) and the frame or respective frame comprises the step of moving the respective portion of the film and the/each heater (10) away from and/or towards each other maintaining the respective portion (3a) of the film flat.

13. Apparatus (1) according to any one of the preceding claims from 11 to 12 when dependent on any one of claims from 8 to 10, wherein the vacuum assembly, optionally the vacuum source, is in signal communication with the control unit (20), the control unit (20) being configured to execute the step of:

- > commanding the vacuum assembly, optionally the vacuum source, for reducing the pressure within the packaging chamber (9), optionally for reaching a defined vacuum level within the packaging chamber (9),

wherein the step of commanding the packaging assembly (4) to cause coupling of the support (2) with the respective portion (3a) of the film is for obtaining a vacuum skin package, and

wherein the control unit (20) is in signal communication with the film cutting assembly (11) and configured for:

- > commanding the film cutting assembly (11) for cutting from the film the respective portion (3a) in the form of said film sheet,
- > commanding the transfer device (16) for positioning the film sheet below the/each frame (8) and above the support (2) and product (P) arranged on the support (2), and

wherein commanding the packaging assembly (4) comprises leaving the packaging assembly (4) in the first operating condition a time sufficient for the backing structure (12) of the transfer device (16) to:

- move from the outside position to the inside position for positioning the respective portion (3a) of the film in the form of the film sheet at and below the/each frame (8) and above the support (2) and product (P) arranged on the support (2),
- move from the inside position to the outside position, and

wherein the control unit (20) is configured for executing the step of:

- > commanding the relative movement of the backing structure (12) and the/each frame (8) from the distanced condition to the approached condition for transferring the film sheet, and/or

wherein the control unit (20) is configured for executing the steps of:

- > commanding the mechanism (17) active on the backing structure (12) for moving the backing structure (12) along the first direction between the outside and inside positions and vice versa,
- > optionally commanding the mechanism (17) active on the backing structure (12) for moving the backing structure (12) along the second direction between the distanced condition and the approached condition and vice versa.

- 14.** Apparatus (1) according to any one of the preceding claims from 11 to 13 when dependent on claim 9, wherein the control unit (20) is in signal communication with the movement mechanism (40) coupled with the packaging assembly (4), the control unit (20) being configured for executing the steps of commanding the movement mechanism (40) for

rotating at least the upper tool (6) around a/the rotation axis among the plurality of angular positions.

- 15.** A process of packaging, in particular of vacuum skin packaging, a product (P) arranged on a support (2),

the process optionally using an apparatus (1) according to any one of the preceding claims, the process comprising the steps of:

- > supplying the support (2) with the product (P) arranged thereon,
- > supplying a film (3),
- > relatively moving a respective portion (3a) of the film (3) and the support (2) and the product (P) arranged on the support (2) between:

- a distanced position, where the respective portion (3a) of the film (3) is distanced from the support (2) and the product (P) arranged on the support (2), and
- an approached position, where the respective portion of the film initiates contacting the product (P) and/or the support (2),

- > coupling the support (2) with the film (3), optionally with the respective portion (3a) of the film (3), obtaining a package, optionally a vacuum skin package, and

wherein the step of relatively moving the respective portion (3a) of the film (3) and the support (2) and the product (P) arranged on the support (2) between the distanced and approached positions comprises maintaining the respective portion (3a) of the film flat.

- 16.** Process according to the preceding claim, wherein the process further comprises the step of:

- > defining a packaging chamber (9) around the support (2) and the product (P) arranged on the support (2),
- wherein relatively moving a respective portion (3a) of the film and the support (2) and the product (P) arranged on the support (2) takes place within the packaging chamber (9), and
- wherein the process comprises the step of relatively moving the respective portion (3a) of the film and the support (2) and the product (P) arranged on the support (2), optionally within the packaging chamber (9), between the approached position and a contact position, where the respective portion (3a) of the film contacts the product (P) and the support (2), and

wherein the step of relatively moving the respective portion (3a) of the film (3) and the support (2) and the product (P) arranged on the support (2) between the approached and the contact positions comprises three-dimensionally forming the respective portion (3a) of the film (3), and wherein relatively moving the respective portion (3a) of the film and the support (2) and the product (P) arranged on the support (2) between the approached and the contact positions is after relatively moving the respective portion (3a) of the film and the support (2) and the product (P) arranged on the support (2) between the distanced and the approached positions, and wherein the process comprises one or more of the steps of:

- > heating the respective portion (3a) of the film, the step of coupling the support (2) with the respective portion (3a) of the film (3) comprising heat-bonding the respective portion (3a) of the film (3) to the support (2),
- > reducing the pressure within the/a packaging chamber (9) defined around the support (2) and the product (P) arranged on the support (2),
- > cutting from the film (3) the respective portion (3a) in the form of a film sheet.

17. Process according to any one of the preceding claims from 15 to 16, using an apparatus (1) according to any one of the preceding claims from 1 to 14, wherein:

- > defining a/the packaging chamber (9) around the support (2) and the product (P) is executed by commanding the packaging assembly (4) to pass from the first operative condition to the second operative condition or vice versa, and/or
- > relatively moving the respective portion (3a) of the film (3) and the support (2) and the product (P) arranged on the support (2), optionally within the packaging chamber (9), between the distanced and the approached positions and/or between the approached and the contact positions is executed by commanding the relative motion of the/each frame (8) and of the lower tool (5) from the first position to the second position or vice versa, and

wherein:

- > commanding the packaging assembly (4) to pass from the first operative condition to the second operative condition or vice versa comprises moving the upper tool (6) and the lower tool (5) away from and towards each other, and/or

- > the step of relatively moving the respective portion (3a) of the film (3) and the support (2) and the product (P) arranged on the support (2), optionally within the packaging chamber (9), between the distanced and the approached positions comprises moving the respective portion (3a) of the film (3) and the lower tool (5) away from and/or towards each other, the step of moving the respective portion (3a) of the film (3) and the lower tool (5) away from and/or towards each other taking place while maintaining the respective portion (3a) of the film flat, and

wherein:

- > supplying a film (3) is executed by commanding the film supplying assembly (30) for supplying the film (3) to the packaging assembly (4), optionally for supplying the respective portion (3a) of the film (3) to the/each frame (8) of the upper tool (6), and/or
- > supplying a film (3) comprises positioning the respective portion (3a) of the film (3) between the/each frame (8) and the support (2) and product (P) arranged on the support (2), optionally below the/each frame (8) and above the support (2) and product (P) arranged on the support (2).

18. Process according to any one of the preceding claims from 16 to 17 when dependent on claim 16, using an apparatus (1) according to any one of the preceding claims from 1 to 14 when dependent on claim 5, wherein the process comprises:

- > the step of heating the respective portion (3a) of the film (3), which is executed by the/each heater (10),
- > the step of relatively moving the respective portion (3a) of the film (3) and the/each heater (10) away from and towards each other, and

optionally wherein the step of relatively moving the respective portion (3a) of the film (3) and the/each heater (10) comprises relatively moving of the/each heater (10) and the frame or respective frame between the operative configuration and inoperative configuration and vice versa.

19. Process according to any one of the preceding claims from 16 to 18 when dependent on claim 16, using an apparatus (1) according to any one of the preceding claims from 1 to 14 when dependent on claim 8, wherein the process comprises:

- > the step of reducing the pressure within the packaging chamber (9), which is executed by commanding the vacuum assembly, optionally the vacuum source, and comprises the step of

reaching a defined vacuum level within the packaging chamber (9), and wherein the process comprises:

- > the step of cutting from the film the respective portion in the form of a film sheet, which is executed by commanding the film cutting assembly (11), and 5
- > the step of leaving the packaging assembly (4) in the first operating condition a time sufficient for the backing structure (12) of the transfer device (16) to: 10
 - move from the outside position to the inside position for positioning the respective portion (3a) of the film (3) in the form of the film sheet at and below the/each frame (8) and above the support (2) and product (P) arranged on the support (2), 20
 - move from the inside position to the outside position, and

the process comprising one or more of the steps of: 25

- > relatively moving the backing structure (12) and the/each frame (8) from the distanced condition to the approached condition for transferring the respective portion of the film in the form of the film sheet, 30
- > moving the backing structure (12) along the first direction between the outside and inside positions and vice versa,
- > moving the backing structure (12) along the second direction between the distanced condition and the approached condition and vice versa, and 35

optionally wherein the steps of moving the backing structure (12) along the first direction and/or the second direction are executed by commanding the mechanism (17) active on the backing structure (12). 40

20. Process according to any one of the preceding claims from 15 to 19, wherein the apparatus (1) is according to any one of the preceding claims from 1 to 14 when dependent on claim 9, the process comprising the step of rotating at least the upper tool (6) around a/the rotation axis among the plurality of angular positions. 50

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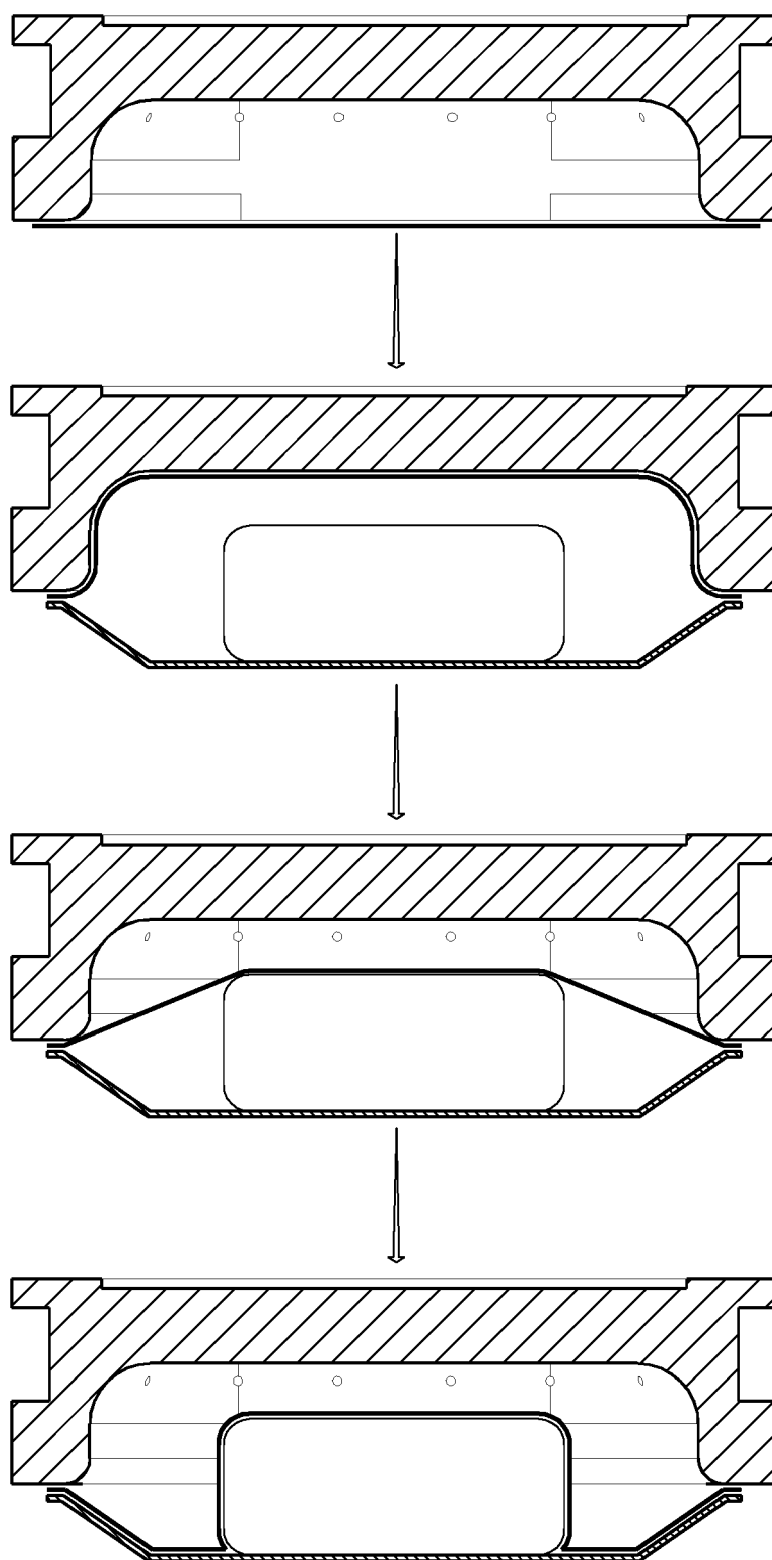


FIG.1

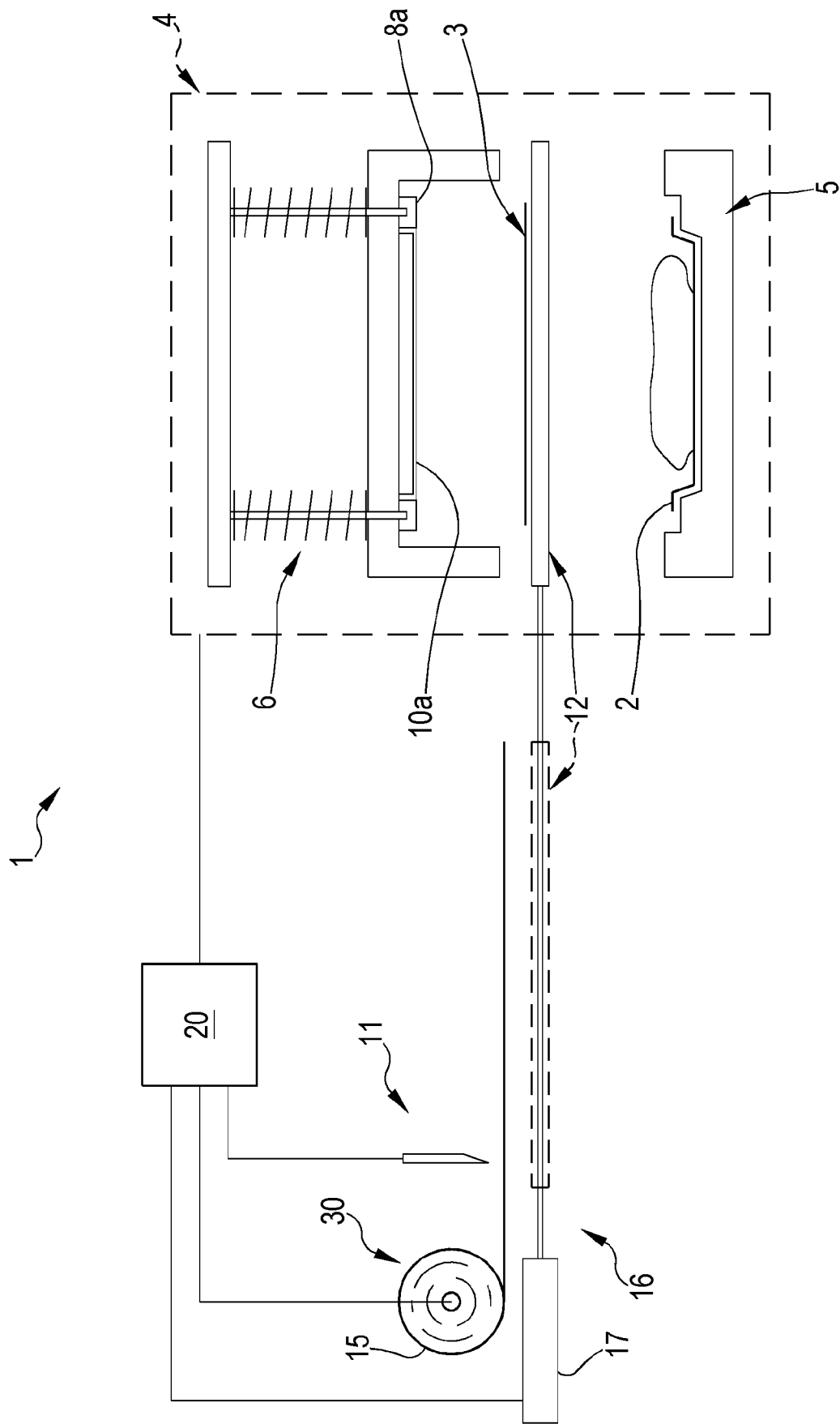


FIG.2A

FIG.2B

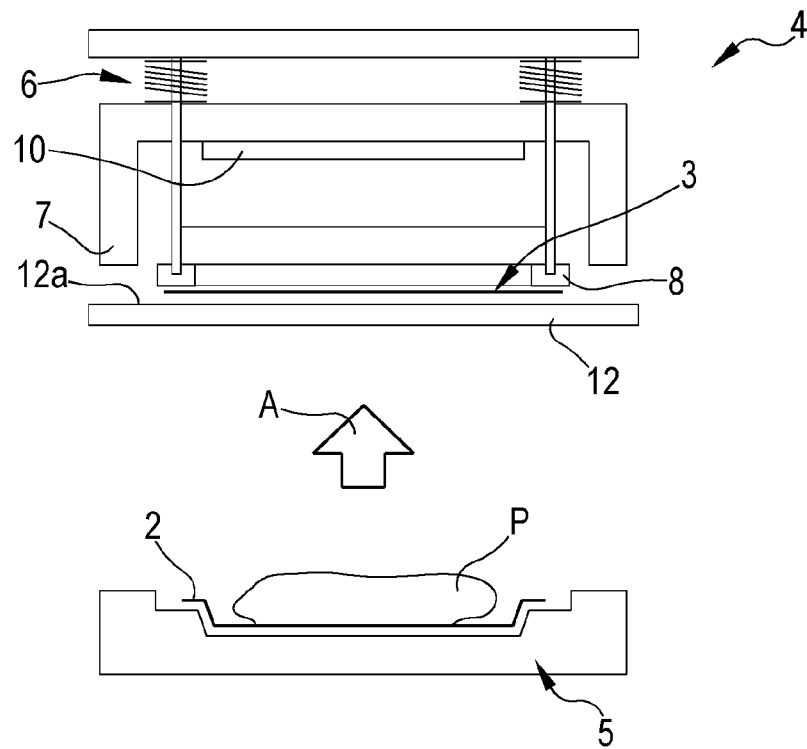


FIG.2C

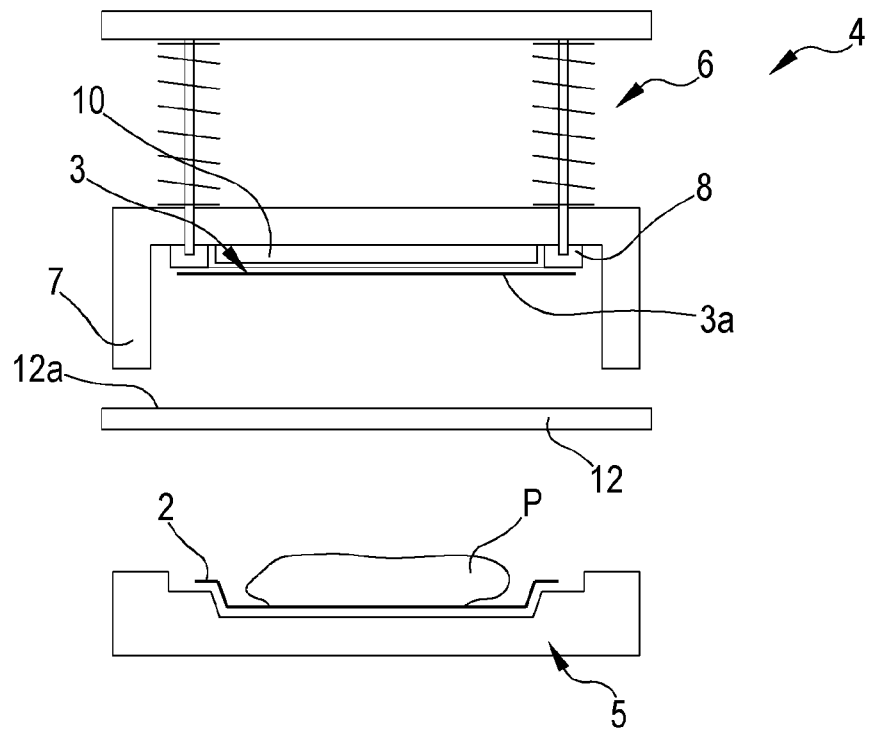


FIG.2D

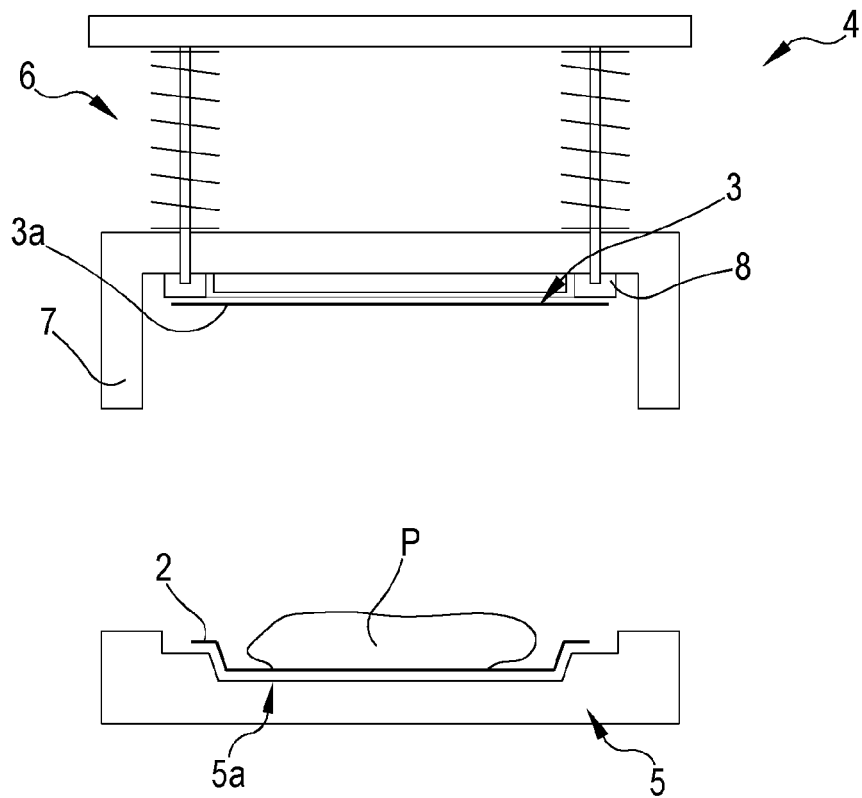


FIG.2E

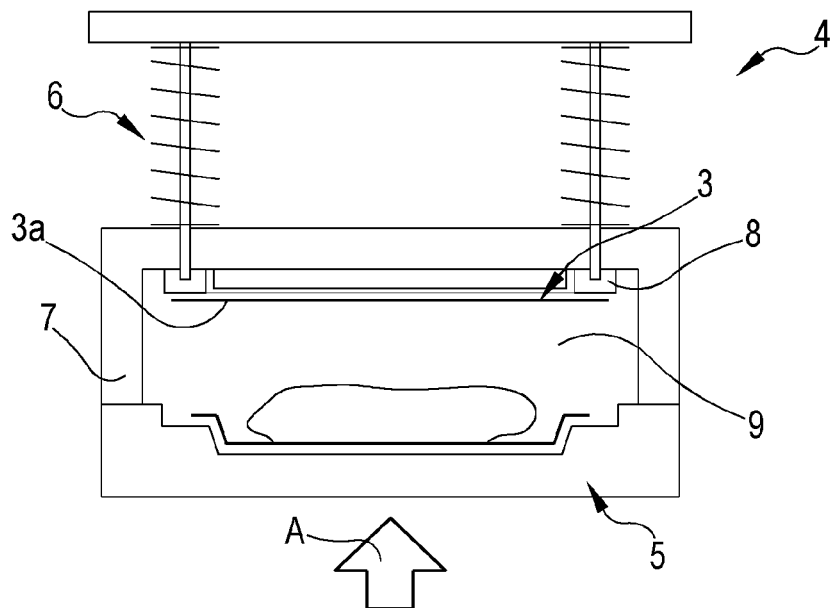


FIG.2F

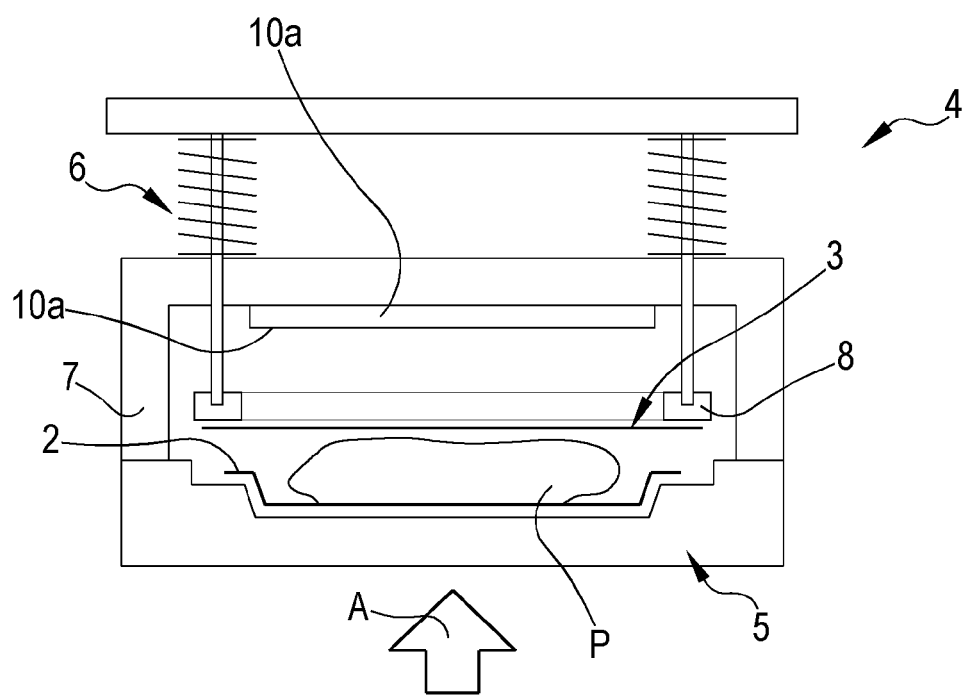
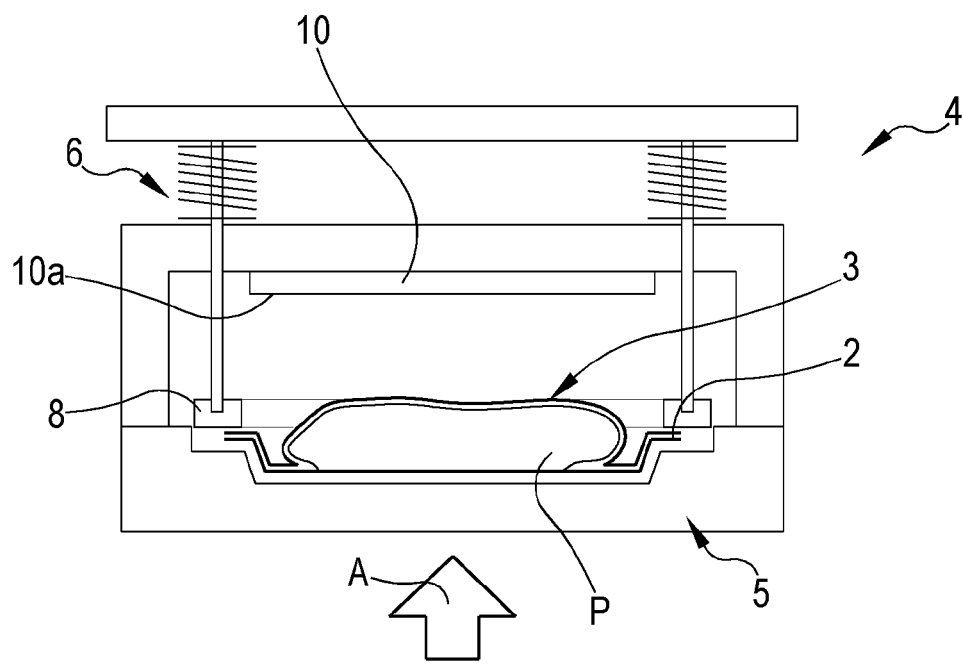
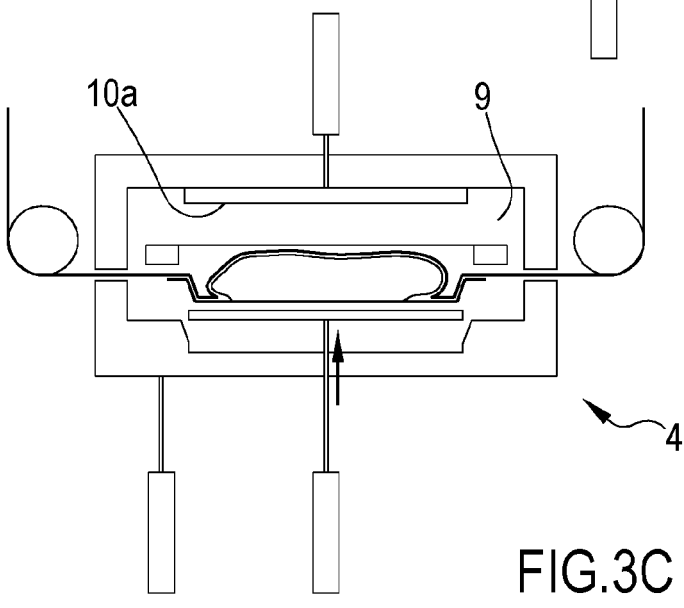
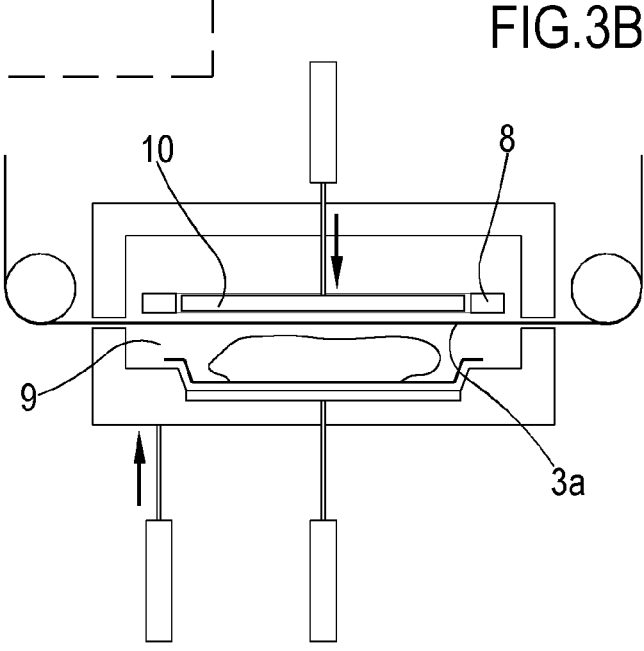
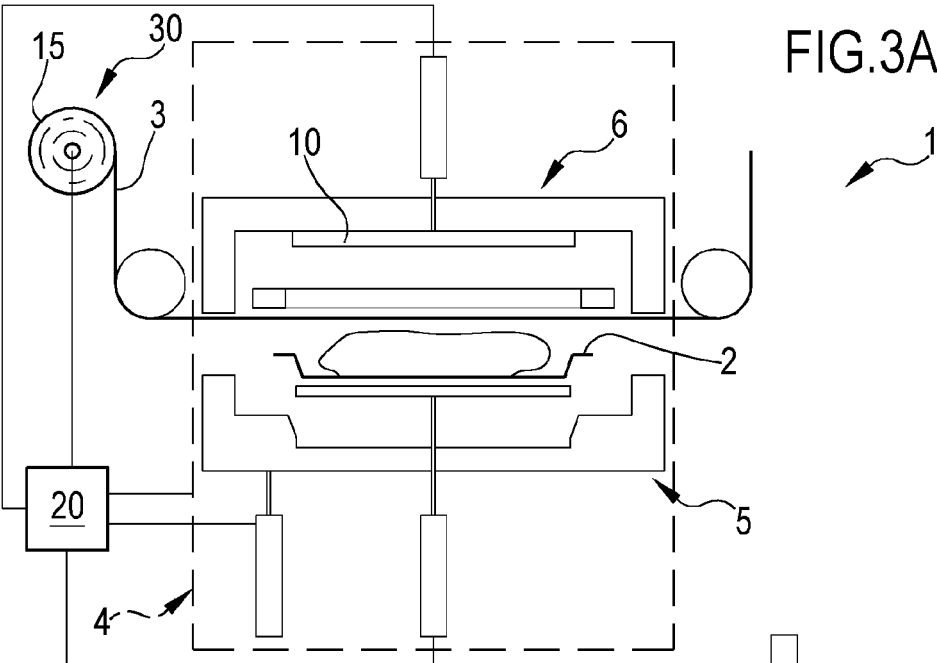


FIG.2G





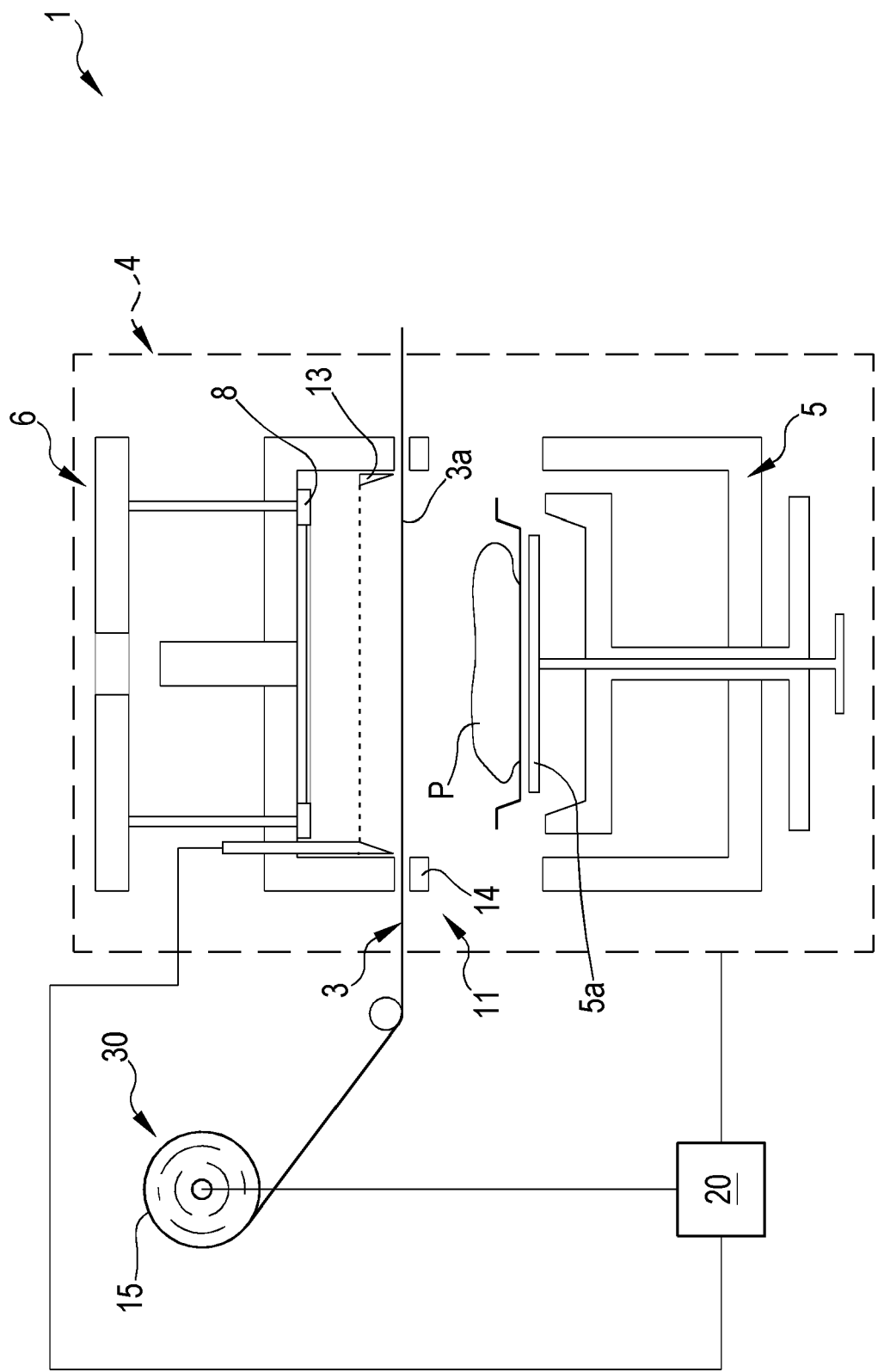


FIG.4A

FIG.4B

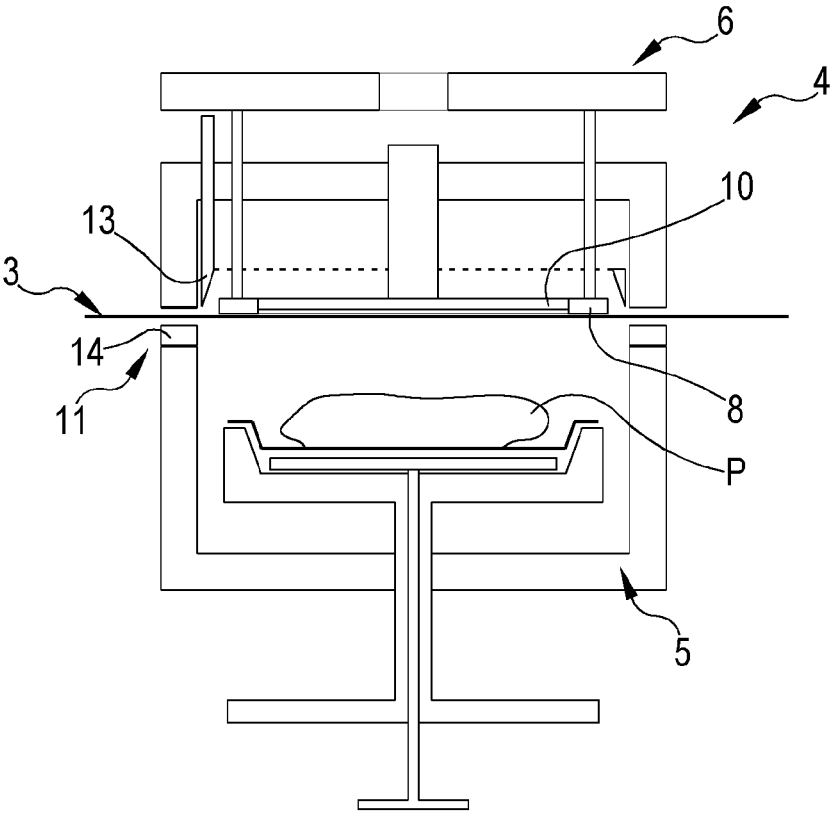


FIG.4C

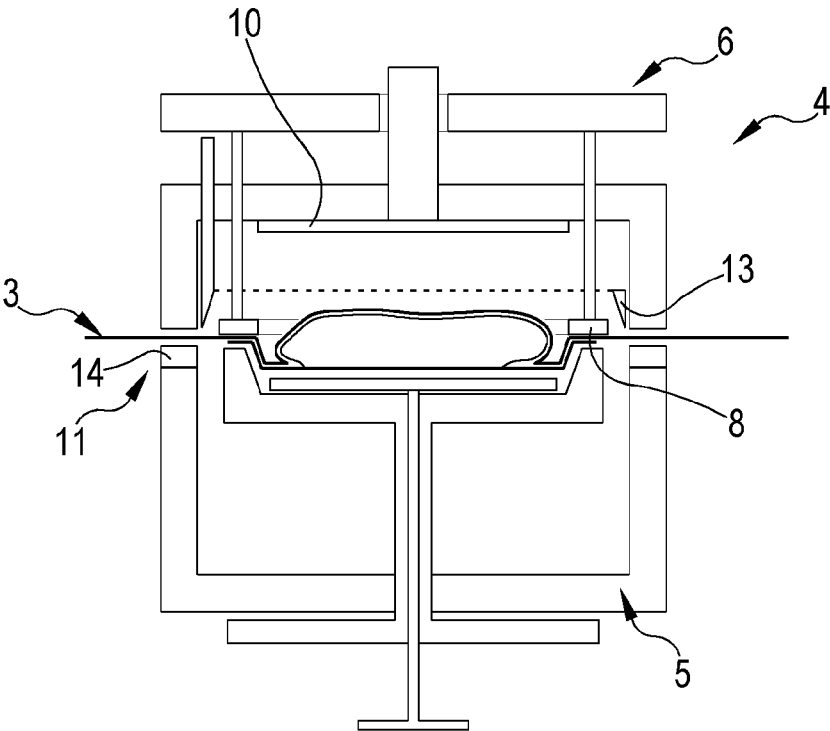


FIG.4D

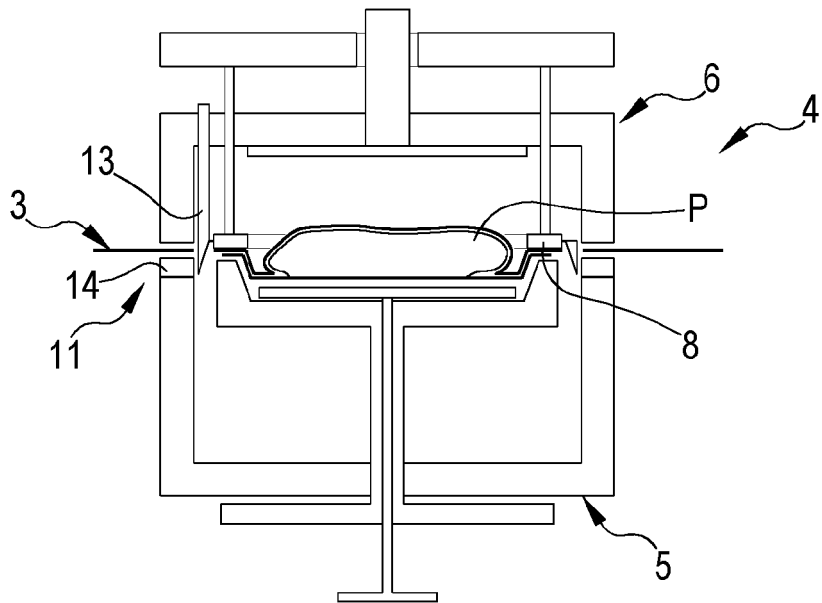
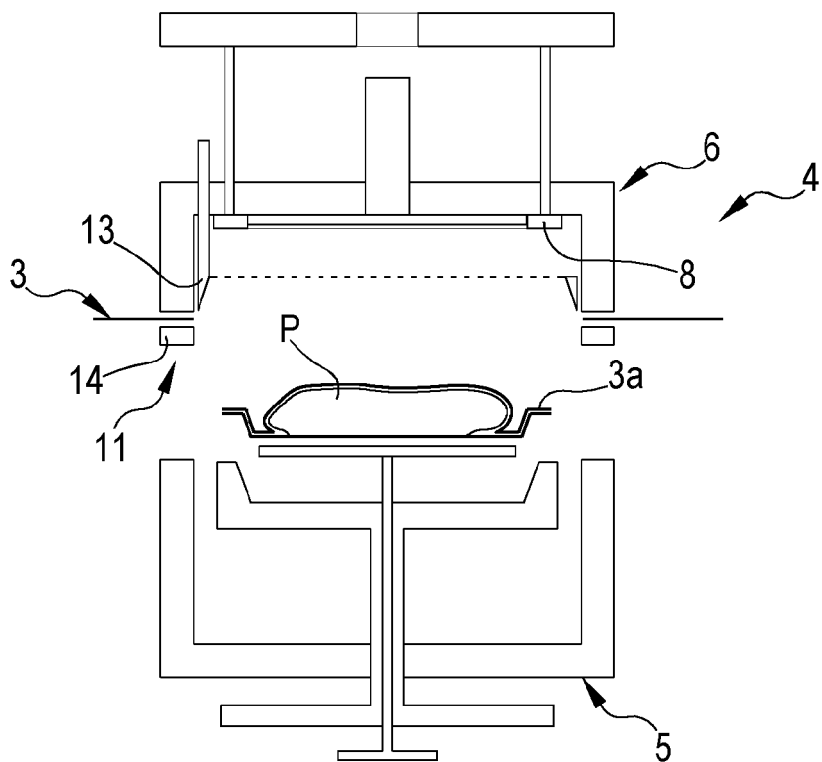


FIG.4E



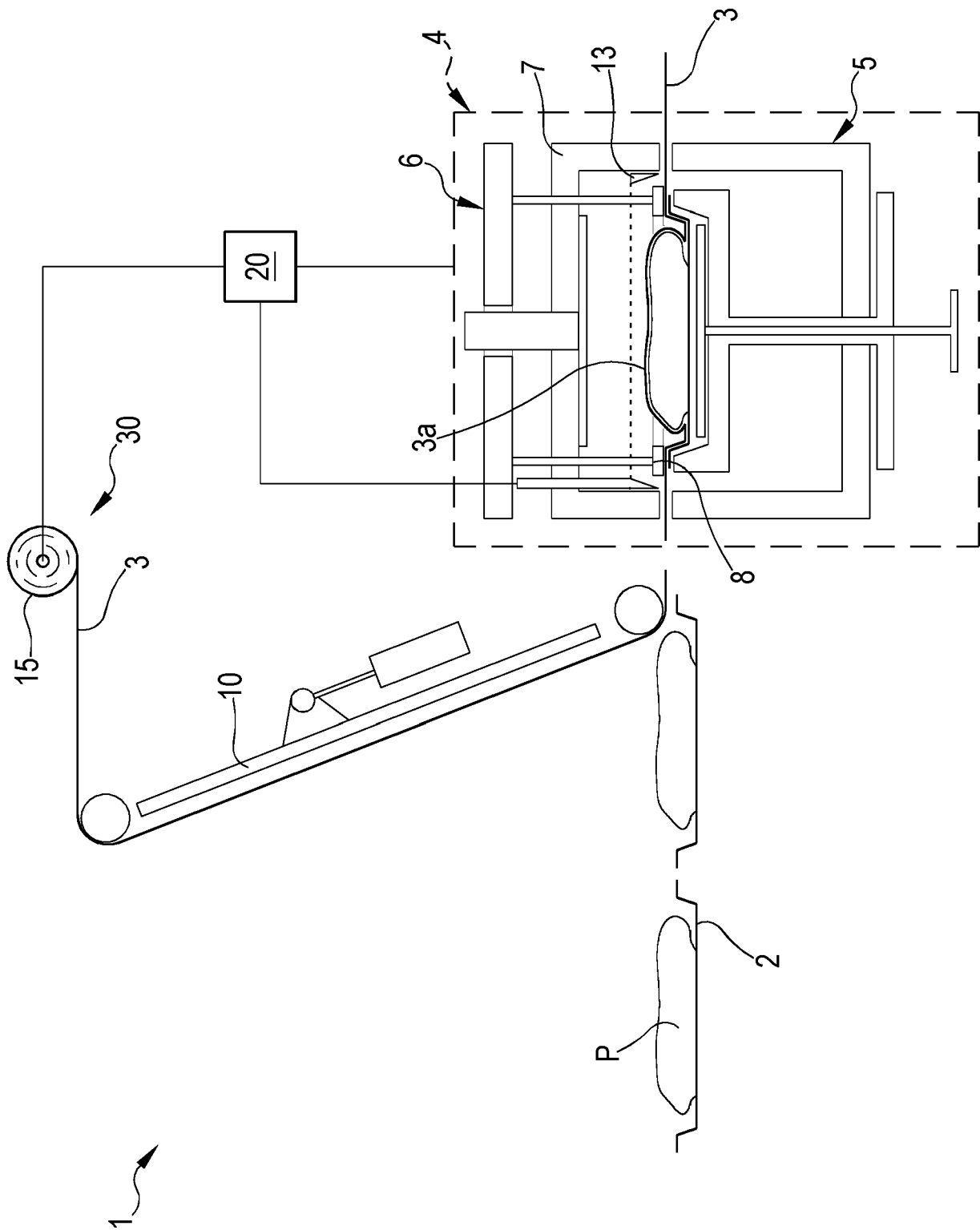


FIG.5

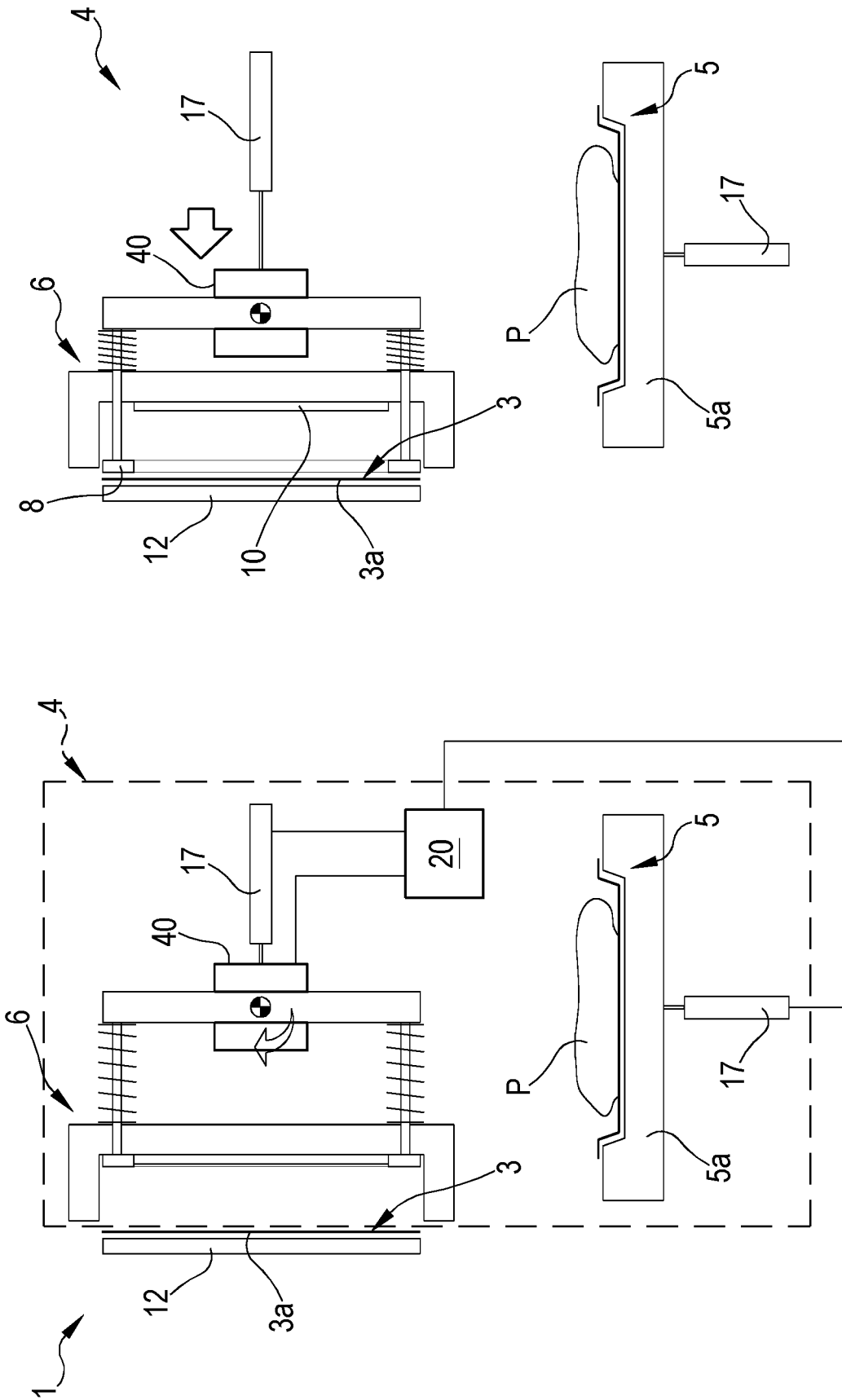


FIG. 6A

FIG. 6B

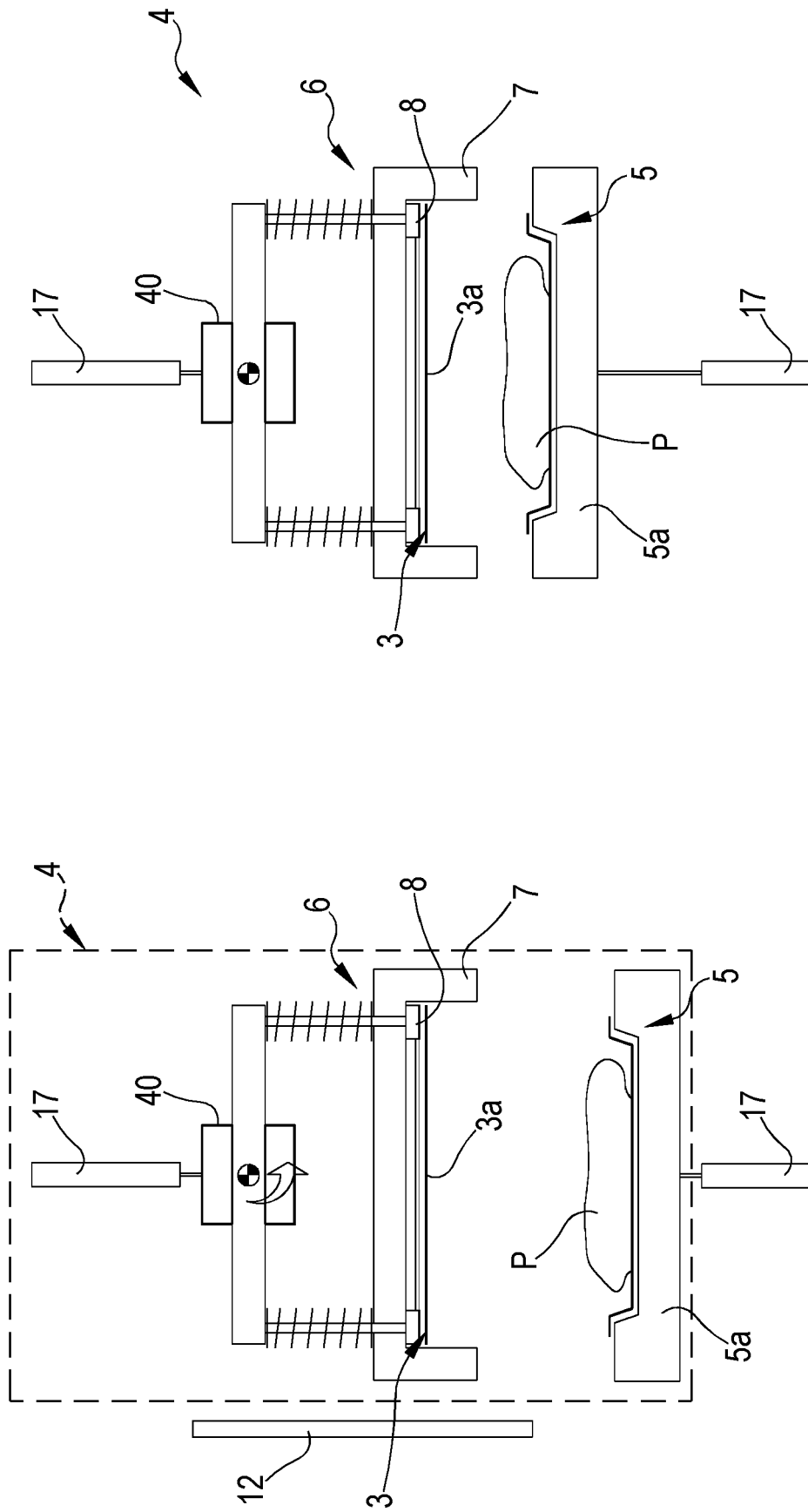


FIG. 6D

FIG. 6C

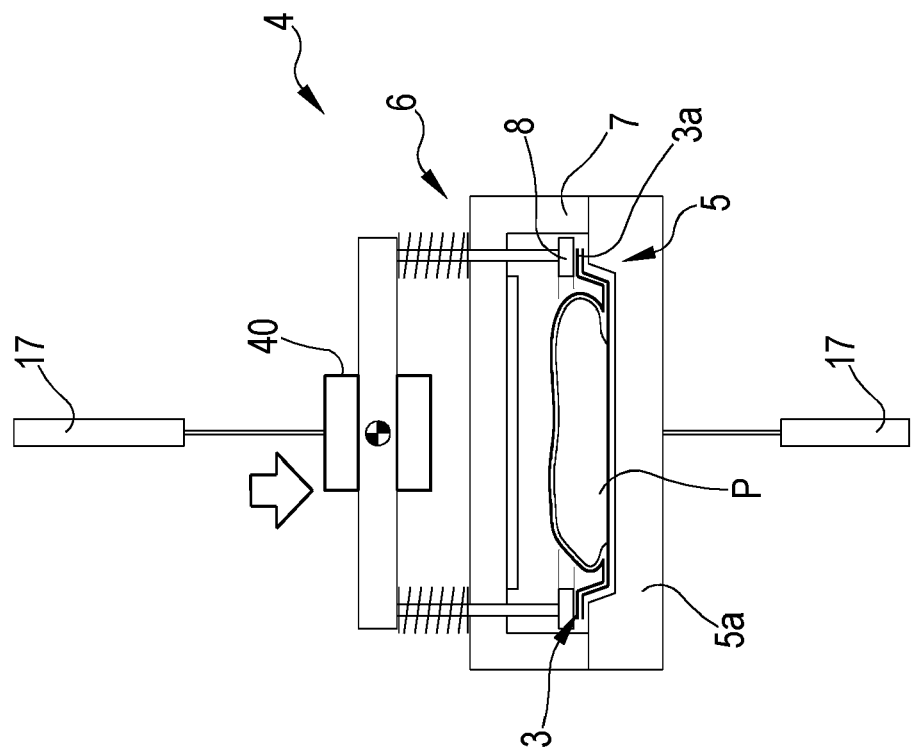


FIG. 6F

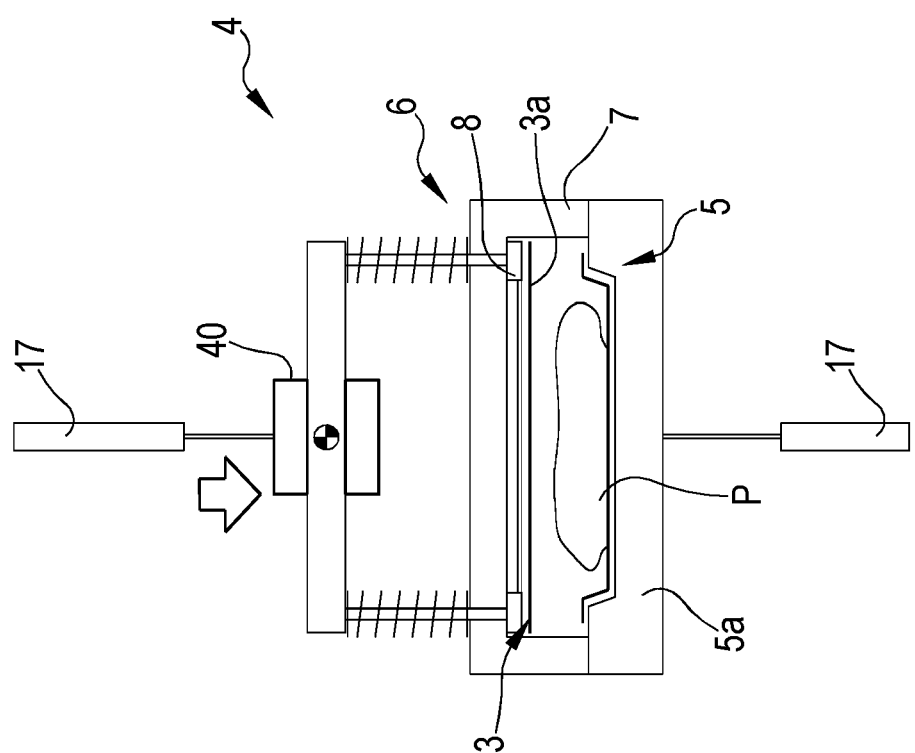


FIG. 6E

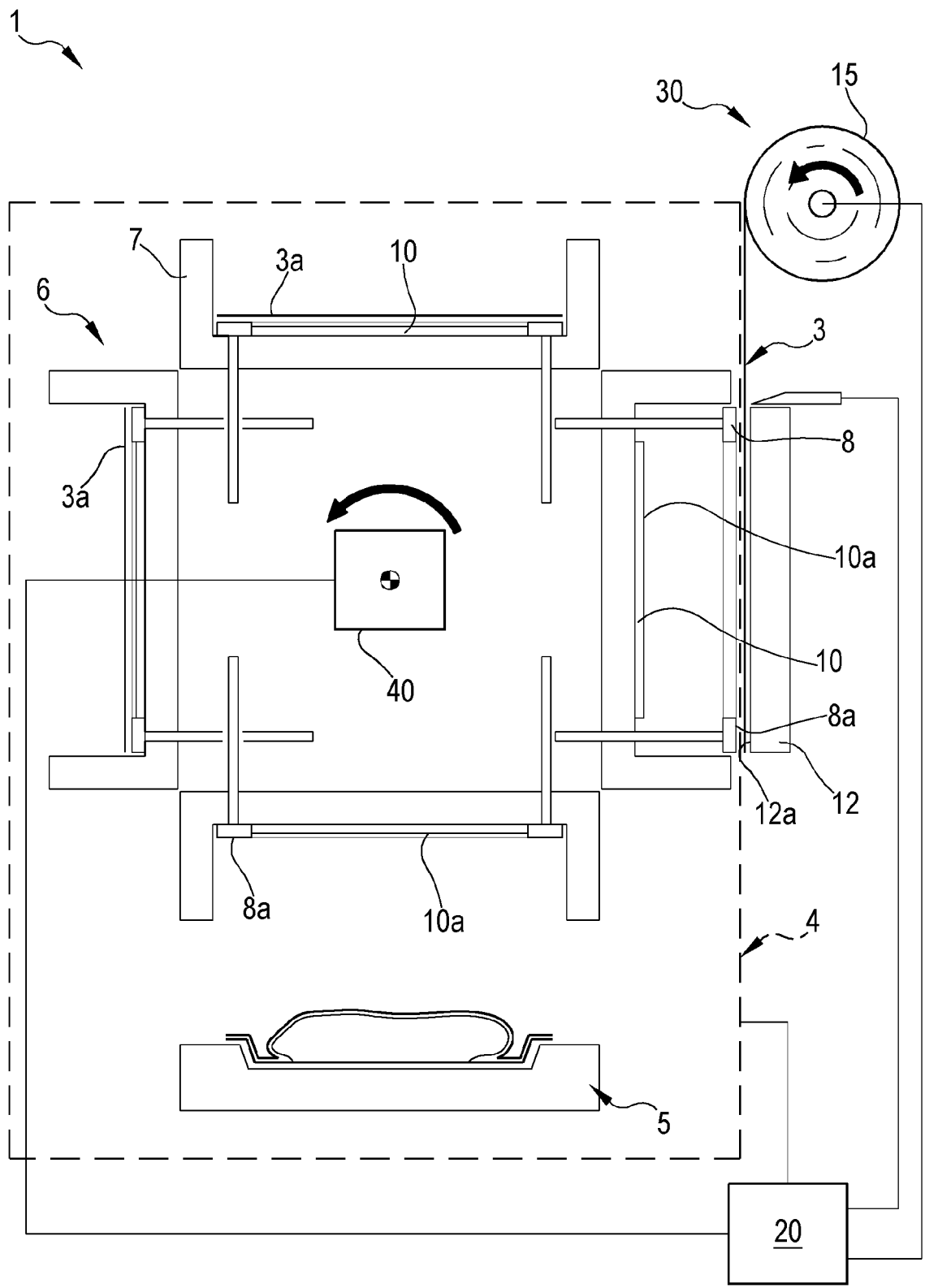


FIG.7



EUROPEAN SEARCH REPORT

Application Number

EP 23 20 5124

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Y	* figures 1, 23-31 *	4, 10	
A	* paragraphs [0364], [0423], [0634] - [0642], [0649], [0650] * -----	5-7, 12, 18	
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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		18 April 2024	Schmitt, Michel
CATEGORY OF CITED DOCUMENTS			
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