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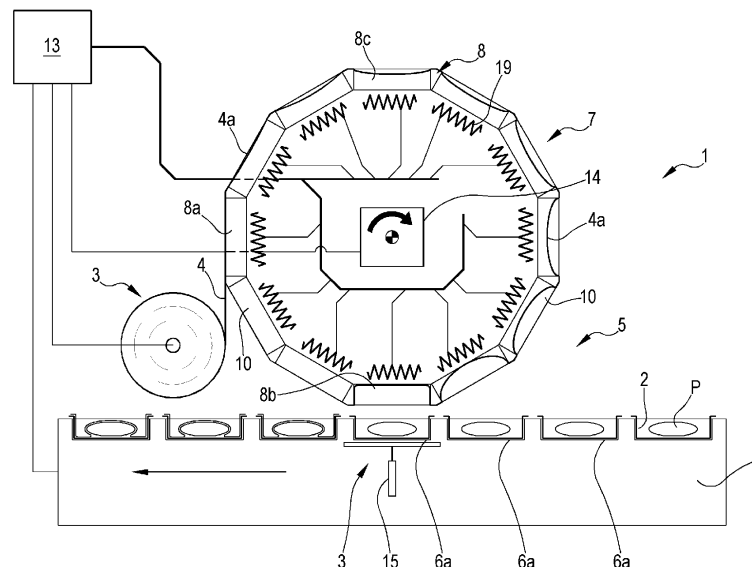
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(54) APPARATUS AND PROCESS FOR PACKAGING A PRODUCT ARRANGED ON A SUPPORT

(57) Apparatus for packaging a product (P) arranged on a support (2) comprising a film supplying assembly (3) and a packaging assembly (5) for receiving the film (4) and coupling the support with the film. The packaging assembly (5) has a lower tool (6) defining a seat for receiving the support (2) with the product (P) arranged thereon, and an upper tool (7) comprising a drum (8) having heads (8a, 8b, 8c) angularly offset from each other around a rotation axis. Each head has a respective active

surface (9) for receiving a respective film portion (4a) of said film. The drum (8) is movable around the rotation axis to position each head in distinct angular positions comprising at least a receiving position, where the respective active surface of the respective head is positioned for receiving the respective film portion (4a) of said film from the film supplying assembly (3), and an alignment position where the respective head is in alignment with and faces the seat in the lower tool (6).

FIG.1



Description

FIELD OF THE INVENTION

[0001] The present invention relates to an apparatus and to a process of packaging a product arranged on a support. In detail, the invention relates to an apparatus and to a process for packaging a product under vacuum 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 a head of 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 within a cavity defined by the head of the upper tool, so that the film is formed and heated while held by suction in contact with the heated surface of the head. 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 cavity above the support and the product. In order to be able to support the suction inside the cavity and the consequent forming around the contours of the product, the film needs to show an elastic return.

[0004] In the state of the art, the upper tool and the lower tool are movable away from each other for receiving the film and the support and towards each other for forming the film inside the cavity and coupling the support with the film. The film is heated and formed within the cavity when the upper tool and the lower tool are aligned and the support with the product already positioned at the lower tool ready to be coupled with the film. 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 highly cross-linked films.

[0005] Also, when the forming of the film inside the cavity 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

[0006] The object of the present invention is to solve the drawbacks and/or limitations of the above prior art.

[0007] An object of the present disclosure is to provide a packaging apparatus and process capable of reducing downtimes and increasing the yield of the packaging process. An object of the present disclosure is to provide a packaging apparatus and process capable of using a recyclable film and a recyclable support.

[0008] Another object of the present invention is to provide an apparatus and process capable of reducing the downtimes due to film breakages.

[0009] A further object is to provide a more versatile packaging apparatus and process capable of using a large variety of film materials.

SUMMARY

[0010] 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.

[0011] A first aspect concerns an apparatus for 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 configured for cooperating with the lower tool, the upper tool comprising a drum having heads angularly offset from each other around a rotation axis, optionally a horizontal rotation axis, each head having a respective active surface configured for receiving a respective film portion of said film,

wherein the drum is movable around the rotation axis to position each head in distinct angular positions comprising at least:

a receiving position where the respective active surface of the respective head is positioned for receiving the respective film portion of said film from the film supplying assembly,
an alignment position where the respective head is in alignment with and faces the seat in the lower tool.

[0012] In a 2nd aspect in accordance with the preceding aspect, the upper tool and the lower tool are configured for being movable the one relative to the other between at least a first operating condition, where the lower tool and the upper tool allow positioning of the support at said seat, and a second operating condition, where the lower tool and the upper tool are approached to each other.

[0013] In a 3rd aspect in accordance with the preceding aspect, the upper tool and the lower tool are configured for cooperating for defining a packaging chamber when the upper tool and the lower tool are in the second operating condition.

[0014] In a 4th aspect in accordance with the two preceding aspects, the lower tool is movable along a movement direction, optionally a vertical movement direction, and the upper tool is fixed along said movement direction.

[0015] In a 5th aspect in accordance with the preceding aspect, the lower tool is configured for being movable along the movement direction away from and towards to the upper tool causing the lower tool and the upper tool to pass from the first operating condition to the second operating condition and vice versa.

[0016] In a 6th aspect in accordance with any one of the four preceding aspects, the apparatus is configured to position the upper tool and the lower tool in the second operating condition when the drum positions at least one respective head in the alignment position.

[0017] In a 7th aspect in accordance with any one of the preceding aspects, the distinct angular positions that each head is adapted to take further comprise a working position where the respective head is configured for heating at least part of the respective film portion.

[0018] In an 8th aspect in accordance with any one of the preceding aspects, the distinct angular positions that each head is adapted to take further comprise a working position where the respective head is configured for forming at least part of the respective film portion.

[0019] In an 9th aspect in accordance with any one of the preceding aspects, the distinct angular positions that each head is adapted to take further comprise a working position where the respective head is configured for three-dimensionally forming at least part of the respective film portion.

[0020] In a 10th aspect in accordance with any one of the preceding aspects, the distinct angular positions that each head is adapted to take further comprise a working position where the respective head is configured for heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion.

[0021] In a 11th aspect in accordance with any one of the preceding aspects, the heads on the drum comprise one or more first heads and one or more second heads, wherein the one or more first heads are angularly offset from the one or more second heads. In a 12th aspect in accordance with the preceding aspect, the heads on the drum comprise one or more third heads angularly offset

from the one or more first heads and from the one or more second heads.

[0022] In an 13th aspect in accordance with any one of the two preceding aspects, the one or more first heads are in one of the distinct angular positions and the one or more second heads are in another one of the distinct angular positions.

[0023] In an 14th aspect in accordance with any one of the three preceding aspects, the one or more first heads and the one or more second heads are in different distinct angular positions with respect to each other.

[0024] In an 15th aspect in accordance with any one of the four preceding aspects, the drum is configured such that when the one or more first heads are in the receiving position, then the one or more second heads are in the alignment position.

[0025] In a 16th aspect in accordance with any one of the five preceding aspects in combination with the 12th aspect, the one or more first heads and the one or more third heads are in different distinct angular positions with respect to each other, and the one or more second heads and the one or more third heads are in different distinct angular positions with respect to each other.

[0026] In a 17th aspect in accordance with any one of the six preceding aspects in combination with the 12th aspect and in combination with any one of the aspects from the 7th to the 10th, the drum is configured such that when the one or more first heads are in the receiving position, then the one or more third heads are in the working position.

[0027] In a 18th aspect in accordance with any one of the aspects from the 11th to the 17th, the drum is movable around the rotation axis to move each head among the distinct angular positions such that the one or more first heads, the one or more second heads, optionally the one or more third heads, are simultaneously moved among the distinct angular positions.

[0028] In a 19th aspect in accordance with any one of the preceding aspects from the 11th to the 18th aspect, the one or more first heads comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis.

[0029] In a 20th aspect in accordance with any one of the preceding aspects from the 11th to the 19th aspect, the one or more second heads comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis.

[0030] In a 21st aspect in accordance with any one of the preceding aspects from the 11th to the 20th aspect, the one or more third heads comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis.

[0031] In a 22nd aspect in accordance with any one of the preceding aspects from the 11th to the 21st aspect, the one or more first heads comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis.

[0032] In a 23rd aspect in accordance with any one of

the preceding aspects from the 11th to the 22nd aspect, the one or more second heads comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis.

[0033] In a 24th aspect in accordance with any one of the preceding aspects from the 11th to the 23rd aspect, the one or more third heads comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis.

[0034] In a 25th aspect in accordance with any one of the preceding aspects, the heads and the distinct angular positions are respectively angularly offset around the rotation axis by a same angular offset.

[0035] In a 26th aspect in accordance with any one of the preceding aspects, the heads are angularly offset around the rotation axis by 180° or 90°.

[0036] In a 27th aspect in accordance with any one of the preceding aspects, each head has holding means configured for attracting and holding the respective film portion against the respective active surface.

[0037] In a 28th aspect in accordance with any one of the preceding aspects, each head comprises a heater coupled with the respective active surface and configured for heating the respective film portion.

[0038] In a 29th aspect in accordance with any one of the preceding aspects, each head has a cavity delimited by the respective active surface and adapted for three-dimensionally forming the respective film portion.

[0039] In a 30th aspect in accordance with any one of the preceding aspects from the 1st to the 28th aspect, the upper tool has at least one peripheral body coupled with each one of the heads, each head and the peripheral body being mounted for relative motion the one with respect to the other among a plurality of relative positions and being configured for defining a cavity adapted for three-dimensionally forming the respective film portion, the cavity being delimited by the respective active surface of the respective head and by an inner wall of said peripheral body.

[0040] In a 31st aspect in accordance with any one of the two preceding aspects, the respective active surface is concave.

[0041] In a 32nd aspect in accordance with any one of the preceding aspects, the film supplying assembly is configured for cooperating with the packaging assembly for feeding the respective film portion parallel to the rotation axis.

[0042] In a 33rd aspect in accordance with any one of the preceding aspects from the 1st to the 31st aspect, the film supplying assembly is configured for cooperating with the packaging assembly for feeding the respective film portion transversely to the rotation axis.

[0043] In a 34th aspect in accordance with any one of the preceding aspects from the 1st to the 31st aspect, the film supplying assembly is configured for cooperating with the packaging assembly for feeding the respective film portion parallel to or transversely to the rotation axis.

[0044] In a 35th aspect in accordance with any one of

the preceding aspects, the film supplying assembly is configured for feeding the respective film portion to the packaging assembly in the form of a continuous film, and optionally wherein the respective film portion of one of the heads is connected to the respective film portion of an angularly consecutive of the heads.

[0045] In a 36th aspect in accordance with any one of the preceding aspects from the 1st to the 34th aspect, the film supplying assembly is configured for:

- > cutting from the film the respective film portion in the form of one or more film sheets,
- > feeding each film sheet to the packaging assembly, optionally feeding each film sheet to a respective head positioned in the receiving position.

[0046] In a 37th aspect in accordance with any one of the preceding aspects in combination with the 3rd aspect, the apparatus comprises a vacuum assembly having a vacuum source fluidly couplable with the packaging chamber and configured to reduce the pressure within the packaging chamber.

[0047] In a 38th aspect in accordance with any one of the preceding aspects, the apparatus comprises a control unit and an upper tool actuator in signal communication with each other, the upper tool actuator being coupled to the upper tool and configured for moving the drum around the rotation axis, the control unit being configured for commanding the upper tool actuator for rotating the drum around the rotation axis by steps such that each step causes the motion of each head from one of the distinct angular positions to an angularly consecutive of the distinct angular positions.

[0048] In a 39th aspect in accordance with the preceding aspect, the upper tool actuator comprises an electric piston or a hydraulic piston or a pneumatic piston, or an electric motor, or a hydraulic motor, or a pneumatic motor.

[0049] In a 40th aspect in accordance with any one of the preceding two aspects in combination with the 2nd aspect, the control unit is in signal communication with the packaging assembly and configured for executing the steps of:

- > commanding the lower tool and the upper tool to pass from the first operating condition to the second operating condition or vice versa,
- > commanding the packaging assembly to cause the coupling of the support with the respective film portion obtaining a package.

[0050] In a 41st aspect in accordance with the preceding aspect, the control unit is in signal communication with the film supplying assembly and further configured for executing one or more of the steps of:

- > commanding the film supplying assembly for supplying the respective film portion to each head positioned in the receiving position, and

- > commanding each head positioned in the receiving position for receiving the respective film portion,
- > commanding each head positioned in the alignment position for coupling the respective film portion with the support.

[0051] In a 42nd aspect in accordance with the preceding aspect when dependent on the 11th aspect, the step of commanding each head positioned in the receiving position comprises commanding the one or more first heads for receiving the respective film portion.

[0052] In a 43rd aspect in accordance with any one of the two preceding aspects in combination with the 11th aspect, the step of commanding each head positioned in the alignment position comprises commanding the one or more second heads for coupling the respective film portion with the support.

[0053] In a 44th aspect in accordance with any one of the three preceding aspects, the control unit is further configured for executing the step of:

- > commanding each head positioned in the working position for heating and/or forming, optionally three-dimensionally forming, the respective film portion.

[0054] In a 45th aspect in accordance with the preceding aspect in combination with the 12th aspect, the step of commanding each head positioned in the working position comprises commanding the one or more third heads for heating and/or forming, optionally three-dimensionally forming, the respective film portion.

[0055] In a 46th aspect in accordance with any one of the aspects from the 38th to the 45th in combination with the 27th aspect, the control unit is in signal communication with each head and configured for commanding the holding means for attracting and holding the respective film portion against the respective active surface.

[0056] In a 47th aspect in accordance with any one of the preceding aspects from the 38th to the 46th aspect in combination with the 28th aspect, the control unit is configured for commanding the heater for heating the respective film portion.

[0057] In a 48th aspect in accordance with any one of the two preceding aspects in combination with any one of the preceding aspects from the 29th to the 31st aspect, the control unit is configured for commanding the holding means and the heater for three-dimensionally forming the respective film portion within the cavity.

[0058] In a 49th aspect in accordance with any one of the preceding aspects from the 38th to the 48th in combination with the 30th aspect, the apparatus comprises a peripheral body actuator active on the peripheral body, wherein the control unit is in signal communication with the peripheral body actuator and configured for commanding the peripheral body actuator to cause the relative motion of the peripheral body with respect to the head in order to define the cavity.

[0059] In a 50th aspect in accordance with any one of the preceding aspects from the 38th to the 49th, the control unit is in signal communication with the film sup-

plying assembly and configured for commanding the film supplying assembly for:

- > feeding the respective film portion to the packaging assembly in the form of a continuous film.

[0060] In a 51st aspect in accordance with any one of the preceding aspects from the 38th to the 49th aspect in combination with the 36th aspect, the control unit is in signal communication with the film supplying assembly and configured for commanding the film supplying assembly for:

- > cutting from the film the respective film portion in the form of one or more film sheets,
- > feeding each film sheet to the packaging assembly, optionally feeding each film sheet to a respective head in the receiving position.

[0061] In a 52nd aspect in accordance with any one of the preceding aspects from the 38th to the 51st aspect in combination with the 37th aspect, the control unit is in signal communication with the vacuum assembly and configured for commanding the vacuum assembly for reducing the pressure within the packaging chamber.

[0062] A 53rd aspect concerns a process of packaging, in particular of vacuum skin packaging, a product arranged on a support, the process using an apparatus in accordance with any one of the preceding aspects.

[0063] In a 54th aspect in accordance with the preceding aspect, the process comprises the steps of:

- > supplying the film to the packaging assembly,
- > turning the drum around the rotation axis to move each head among the distinct angular positions and position at least one head in alignment with and facing a seat in the lower tool where a support with a product arranged thereon is positioned,
- > coupling the support positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool for obtaining a package, optionally a vacuum skin package.

[0064] In a 55th aspect in accordance with the preceding aspect, the process optionally uses an apparatus in accordance with any one of the preceding aspects from the 11th to the 52nd in combination with the 11th aspect, wherein the step of supplying the film to the packaging assembly comprises:

- > supplying the respective film portion to each head positioned in the receiving position, optionally supplying the respective film portion to the one or more first heads, and
- > commanding each head positioned in the receiving position for receiving the respective film portion, optionally commanding the one or more first heads for receiving the respective film portion.

[0065] In a 56th aspect in accordance with the preceding aspect, the step of coupling the support with the respective film portion obtaining a package is executed by each head positioned in the alignment position, optionally coupling the support with the respective film portion obtaining a package is executed by the one or more second heads.

[0066] In a 57th aspect in accordance with any one of the preceding four aspects, the process comprises the step of heating at least part of the respective film portion.

[0067] In a 58th aspect in accordance with any one of the preceding five aspects, the process comprises the step of forming at least part of the respective film portion.

[0068] In a 59th aspect in accordance with any one of the preceding six aspects, the process comprises the step of three-dimensionally forming at least part of the respective film portion.

[0069] In a 60th aspect in accordance with any one of the preceding seven aspects, the process comprises the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion.

[0070] In a 61st aspect in accordance with any one of the preceding aspects from the 57th to the 60th, the apparatus is according to any one of the preceding aspects from the 1st to the 52nd in combination with any one of the aspects from the 7th to the 10th, wherein the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion is executed by each head positioned in the working position.

[0071] In a 62nd aspect in accordance with any one of the preceding aspects from the 57th to the 61st, the apparatus is according to any one of the preceding aspects from the 1st to the 52nd in combination with the 12th aspect, wherein the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion is executed by the one or more third heads.

[0072] In a 63rd aspect in accordance with any one of the preceding aspects from the 57th to the 62nd aspect, the process uses the apparatus according to any one of the preceding aspects from the 29th to the 52nd when dependent on the 29th or 30th aspect, wherein the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion is executed by commanding the holding means and the heater and comprises three-dimensionally forming the respective film portion within the cavity.

[0073] In a 64th aspect in accordance with any one of the preceding aspects from the 55th to the 63rd in combination with the 55th aspect, the steps of:

- > commanding each head positioned in the receiving position for receiving the respective film portion,
- > coupling the support positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and

are simultaneously executed through respective heads with respective film portions.

[0074] In a 65th aspect in accordance with any one of the preceding aspects from the 55th to the 63rd in combination with the 55th aspect and any one of aspects from the 57th to the 63rd, the steps of:

- > commanding each head positioned in the receiving position for receiving the respective film portion,
- > coupling the support positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and
- > heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion,

are simultaneously executed through respective heads with respective film portions.

[0075] In a 66th aspect in accordance with any one of the preceding aspects from the 55th to the 63rd in combination with the 55th aspect, the steps of:

- > commanding each head positioned in the receiving position for receiving the respective film portion,
- > coupling the support positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and
- > optionally heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion,

are simultaneously executed through respective heads with respective film portions.

[0076] In a 67th aspect in accordance with any one of the preceding aspects from the 53rd to the 66th aspect, the process comprises the steps of:

- > defining a packaging chamber around the support and the product arranged thereon, and
- > reducing the pressure within the packaging chamber.

[0077] In a 68th aspect in accordance with the preceding aspect, defining a packaging chamber around the support and the product arranged thereon is executed by commanding the lower tool and the upper tool to pass from the first operating condition to the second operating condition.

[0078] In a 69th aspect in accordance with any one of the preceding two aspects, the step of defining a packaging chamber comprises relatively moving the upper tool and the lower tool towards each other.

[0079] In a 70th aspect in accordance with any one of the preceding aspects from the 53rd to the 69th, the process comprising the step of defining the cavity adapted for three-dimensionally forming the respective film portion.

[0080] In a 71st aspect in accordance with the preceding aspect, the process uses an apparatus according to any one of the preceding aspects from the 30th to the 52nd when dependent on the 30th aspect, wherein defining the cavity comprises the step of relatively moving the peripheral body with respect to at least one of the heads among the plurality of relative positions defining the cavity.

[0081] In a 72nd aspect in accordance with any one of the preceding aspects from the 53rd to the 71st, the step of supplying the film comprises:

- > feeding the respective film portion to the packaging assembly, optionally to each head positioned in the receiving position, in the form of a continuous film.

[0082] In a 73rd aspect in accordance with any one of the preceding aspects from the 53rd to the 71st, the step of supplying the film comprises:

- > cutting from the film the respective film portion in the form of one or more film sheets, and
- > feeding each film sheet to the packaging assembly, optionally feeding each film sheet to each head positioned in the receiving position.

[0083] In a 74th aspect in accordance with any one of the preceding two aspects, the process uses an apparatus according to any one of the preceding aspects from the 35th to the 52nd aspect in combination with the 35th aspect.

[0084] In a 75th aspect in accordance with any one of the preceding aspects from the 67th to the 74th aspect in combination with the 67th aspect, the process uses the apparatus according to any one of the preceding aspects from the 37th to the 52nd in combination with the 37th aspect, and wherein the step of reducing the pressure within the packaging chamber is executed by the vacuum assembly.

[0085] In a 76th aspect in accordance with any one of the preceding aspects from the 53rd to the 75th aspect, the apparatus is according to any one of the preceding aspects from the 4th to the 52nd when dependent on the 4th aspect, the process comprises the step of:

- > moving the lower tool along the movement direction away from and/or towards the upper tool causing the lower tool and the upper tool to pass from the first operating condition to the second operating condition or vice versa.

[0086] In a 77th aspect in accordance with any one of the preceding aspects from the 53rd to the 76th aspect, the process uses the apparatus according to any one of the preceding aspects from the 6th to the 52nd when dependent on the 5th aspect, wherein the process comprises the step of positioning the upper tool and the lower

tool in the second operating condition when at least one respective head is positioned in the alignment position.

BRIEF DESCRIPTION OF THE DRAWING

[0087] 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:

> Fig. 1 shows a schematic side view of an apparatus for packaging in accordance with the embodiments described herein,

> Fig. 2 depicts a perspective side view of an apparatus for packaging in accordance with the embodiments described herein, for example of the apparatus of figure 1, with some elements removed to better show others,

> Figures 3a and 3b depicts a schematic side view of another apparatus for packaging in accordance with the embodiments described herein with some elements removed to better show others; in figure 3a the upper and lower tools of the packaging assembly are approached to form a packaging chamber, while in figure 3b the upper and lower tools are relatively moved apart from each other and

> Fig. 4 shows a schematic side view of an assembly, which may be part of the upper tool of the apparatus of figures 1 to 3 according to a possible variant; in this variant the upper tool comprising one or more heads each with a respective peripheral body cooperating with the head to form a cavity.

CONVENTIONS

Product

[0088] The term product 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.

Control unit

[0089] 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

[0090] As used herein support 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 may be flat.

[0091] The support 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.

[0092] Supports 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

[0093] The present disclosure concerns an apparatus 1 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.

[0094] 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.

[0095] 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.

[0096] The apparatus 1 of the present description is adapted for packaging a product arranged on the support 2 and comprises a film supplying assembly 3 and a packaging assembly 5. The film supplying assembly 3 is configured for supplying a film 4 suitable for the packaging of products. In detail, the film supplying assembly 3 is configured for supplying a film to the packaging assembly. The packaging assembly 5 is configured for receiving the film 4 and coupling the support 2 with the film 4 such that a package is obtained.

[0097] In detail, the packaging assembly 5 comprises a lower tool 6 and an upper tool 7 configured for cooperating with the lower tool 6. The lower tool 6 defines a seat 6a 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. In detail, the lower tool 6 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 configured for supplying the support 2 or multiple supports 2 at a time, providing the lower tool with a support for each seat.

[0098] In an embodiment, the support received by the lower tool may be connected to a plurality of interconnected supports, which are connected to each other through the top rims. The lower tool may comprise blades configured for dividing each support or package and the other ones of the plurality interconnected supports.

[0099] The upper tool 7 comprises a drum 8 having heads 8a, 8b, 8c angularly offset from each other around a rotation axis, which may be a horizontal rotation axis. The drum 8 of the upper tool 7 is movable around the rotation axis to position each head in distinct angular positions. In other words, the drum 8 may rotate around the rotation axis for moving and positioning each head among the distinct angular positions. In detail, each head has a respective active surface 9 configured for receiving and contacting a respective film portion 4a of said film.

[0100] More in detail, the distinct angular positions comprise a receiving position, where the respective active surface 9 of the respective head is positioned for receiving the respective film portion 4a of said film from

the film supplying assembly 3, and an alignment position where the respective head is in alignment with and faces the seat in the lower tool 6.

[0101] In some embodiments, the upper tool 7 and the lower tool 6 are configured for being movable the one relative to the other between at least a first operating condition (see for example figures 1 and 3b), where the lower tool 6 and the upper tool 7 allow positioning/extraction of the support 2 at/from said seat 6a, and a second operating condition (see figure 3a), where the lower tool 6 and the upper tool 7 are approached to each other. In detail, in the first operating condition, the upper tool and the lower tool are spaced apart from each other allowing the positioning of the respective film portion 4a at the upper tool 7 and the positioning of the support 2 with the product P at the lower tool 6. More in detail, in the second operating condition, the upper tool 7 and the lower tool 6 are approached to each other allowing the coupling of the support with the product with the respective film portion obtaining a package.

[0102] In an embodiment, the upper tool 7 and the lower tool 6 are configured for cooperating for defining a packaging chamber 11 (figure 3a) when the upper tool 7 and the lower tool 6 are in the second operating condition. In detail, when the upper tool 7 and the lower tool 6 are in the second operating condition, the upper and the lower tool are approached to each other such that a hermetic packaging chamber 11 is defined around the support and the product. More in detail, when the upper tool and the lower tool are in second operating condition, the drum and the lower tool are approached to each other and configured for defining the packing chamber 11.

[0103] Advantageously, defining a packaging chamber 11 around the support and the product allows the coupling of the support with the respective film portion in a chamber with reduced pressure level obtaining a vacuum package, particularly a vacuum skin package.

[0104] In addition, the lower tool is movable along a movement direction. The movement direction may be a vertical movement direction. The movement direction may be transverse to the rotation axis. In detail, the upper tool is fixed along the movement direction. In other words, the upper tool may be stationary along the movement direction.

[0105] In other words, the movement direction may be transverse to a feeding direction along which the support 2 with the product P is fed to the lower tool 6.

[0106] The lower tool 6 may be configured for being movable along the movement direction away from and towards to the upper tool 7 causing the lower tool 6 and the upper tool 7 to pass from the first operating condition to the second operating condition and vice versa. In other words, the motion of the upper tool 7 and the lower tool 6 between the first operating condition and the second operating condition and vice versa may be driven by the motion of the lower tool 6, for example under the action of lower tool actuator 15 controlled by the control unit 13, along the movement direction away from and

towards to the upper tool 7.

[0107] In an embodiment, the apparatus is further configured to position the upper tool 7 and the lower tool 6 in the second operating condition when the drum 8 positions at least one respective head in the alignment position. In detail, the upper and the lower tools pass from the first operating condition to the second operating condition when the drum positions at least one head with the respective film portion above the support with the product. More in detail, the lower and the upper tools pass to the second operating condition moving the support with the product towards the respective film portion of the head on the drum positioned in the alignment position. In other words, the lower tool 6 is configured to move along the movement direction towards the upper tool 7 when at least one head is positioned in the alignment position facing the support and the product located in the seat.

[0108] In some embodiments, the distinct angular positions, that each head is adapted to take, further comprise a working position where the respective head is configured for heating and/or forming at least part of the respective film portion 4a. In detail, the respective head may be configured for heating and three-dimensionally forming at least part of the respective film portion when the head is positioned in the working position. More in detail, the distinct angular positions may comprise multiple working positions where the respective head is configured for heating and/or forming at least part of the respective film portion 4a. For example, Fig. 1 shows an apparatus 1 having at least eight working positions where each head is configured for heating and forming the respective film portion.

[0109] In an embodiment, the heads 8a, 8b, 8c on the drum 8 comprise one or more first heads 8a and one or more second heads 8b. The one or more first heads 8a are angularly offset from the one or more second heads 8b. In detail, the one of more first heads 8a are in one of the distinct angular positions and the one or more second heads 8b being in another one of the distinct angular positions.

[0110] Furthermore, the heads 8a, 8b, 8c on the drum 8 comprise one or more third heads 8c angularly offset from the one or more first heads 8a and angularly offset from the one or more second heads 8b. In detail, the drum is configured such that when the one or more first heads 8a are in the receiving position, then the one or more second heads 8b are in the alignment position and the one or more third heads 8c are in the working position.

[0111] In an embodiment, the drum 8 is movable around the rotation axis to move each head among the distinct angular positions such that the one or more first heads 8a, the one or more second heads 8b, optionally the one or more third heads 8c, are simultaneously moved among the distinct angular positions.

[0112] In some embodiments, the one or more first heads 8a comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis.

In addition, the one or more second heads 8b may comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis. Moreover, the one or more third heads 8c may comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis.

[0113] In some embodiments, the one or more first heads 8a comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis. In addition, the one or more second heads 8b may comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis. Moreover, the one or more third heads 8c may comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis.

[0114] Note that the one or more first heads, the one or more second heads and the one or more third heads may comprise both a respective plurality of heads arranged offset from each other parallel to the rotation axis and a respective plurality of heads arranged offset from each other transversely to the rotation axis.

[0115] In detail, the heads 8a, 8b, 8c and the distinct angular positions are respectively angularly offset around the rotation axis by a same angular offset. The heads 8a, 8b, 8c and the distinct angular positions may be respectively angularly offset around the rotation axis by 180° or 90° or 60° or 45° or 30°. In other words, at least when the apparatus is in use, the heads on the drum are positioned at least in one of the distinct angular positions and consequently, each of the distinct angular positions is took by at least one of the heads. For example, fig. 1 depicts an apparatus having the heads and the distinct angular positions angularly offset by 30°.

[0116] The apparatus may further comprise a vacuum assembly 12 having a vacuum source 12a fluidly couplable with the packaging chamber 11 and configured to reduce the pressure within the packaging chamber 11. The vacuum source 12a may be in the form of a vacuum pump or multiple vacuum pumps. The apparatus, in particular the vacuum assembly, comprises a fluid communication line 12b through which the vacuum source and the packaging chamber 11 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 11. The vacuum source may also be configured for removing air within the packaging chamber as described in EP2722279A1.

[0117] 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 volume 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.

[0118] In an embodiment, each head has holding means 18 (which are shown in fig. 4 only but which may be present in each one of the heads used in the apparatus of figures 1-3a, 3b) configured for attracting

and holding the respective film portion 4a against the respective active surface 9. In detail, the holding means 18 may comprise a plurality of suction apertures 18a, leading to the respective active surface 9, couplable to the vacuum source 12a described above or to a distinct vacuum source (not shown). Note that in addition or in alternative to the suction apertures, the holding means may comprise one or more of:

mechanical holders, such as pincers, clamps or the like;

adhesive systems, for example comprising adhesive portions associated to the respective active surface; heating systems, for example comprising heatable portions associated to the holding means for causing heating of the respective active surface and thus of the respective film portion in order to increase stickiness of the respective film portion to the respective active surface;

electric systems, for example the respective active surface may be charged with a polarity different from that typical of the respective film portion 4a.

[0119] In addition, each head may comprise a heater 19 coupled with the respective active surface 9 and configured for heating the respective film portion 4a. The heater 19 may be configured for heating the respective film portion by thermal conduction, or thermal convection or thermal radiation. The heater 19 may be configured to contact the respective film portion or the respective active surface for transferring thermal energy and heating it. The heater 19 may comprise resistors configured for heating the respective portion.

[0120] In some embodiments, each head has a cavity 10 delimited by the respective active surface 9 and adapted for three-dimensionally forming the respective film portion 4a. In detail, the respective active surface 9 may be planar or concave. In more detail, the respective active surface may have any conformation or geometry suitable for heating of the respective film portion. The respective active surface may be dome-shaped. In detail, the concavity of the respective active surface faces the lower tool when the upper and lower tools are in the second operating condition and the respective head is in the alignment position.

[0121] In an embodiment (see figure 4), the upper tool 7 has at least one peripheral body 16 coupled with each one of the heads 8a, 8b, 8c. Each head and the peripheral body 16 are mounted for relative motion the one with respect to the other among a plurality of relative positions and are configured for defining a cavity 10' adapted for three-dimensionally forming the respective film portion 4a. The cavity 10' of the head is in this case delimited by the respective active surface 9 of the respective head and by an inner wall of said peripheral body 16. In detail, each head 8a, 8b, 8c and the respective peripheral body 16 are movable among the plurality of relative positions in order

to define the cavity 10'. More in detail, the shape and the volume of the cavity is defined by the relative position taken by the peripheral body and the respective head. For example, the upper tool 7 may have each head with a respective peripheral forming an assembly of the kind described as upper tool in WO2015091404.

[0122] In some embodiments, the film supplying assembly 3 is configured for cooperating with the packaging assembly 5 for feeding the respective film portion 4a parallel to or transversely to the rotation axis. In detail, the film supplying assembly 3 comprises an unwinding system configured for receiving and unwinding a reel of film. The unwinding system of the film supplying assembly is configured for unwinding the reel of film in a direction parallel to or transversely to the rotation axis. For example, in the embodiment shown in fig. 2, the film supplying assembly is configured for feeding the respective film portion parallel to the rotation axis.

[0123] In an embodiment, the film supplying assembly 3 is configured for feeding the respective film portion 4a to the packaging assembly 5 in the form of a continuous film. In detail, the respective film portion of one of the heads is connected to the respective film portion of an angularly consecutive of the heads. In other words, the continuous film fed to the packaging assembly is a continuous sequence of connected respective film portions for respective heads. For example, the film supplying assembly of the embodiment shown in Fig. 1 is configured for feeding a continuous film comprising at least ten respective film portions of ten respective heads are connected to each other. Alternatively, the film supplying assembly 3 may be configured for:

- > cutting from the film the respective film portion 4a in the form of one or more film sheets, and
- > feeding each film sheet to the packaging assembly 5, in particular feeding each film sheet to a respective head positioned in the receiving position.

[0124] In some embodiments, the apparatus comprises a control unit 13 and an upper tool actuator 14 in signal communication with each other. The upper tool actuator 14 may comprise an electric piston or a hydraulic piston or a pneumatic piston, or an electric motor, or a hydraulic motor, or a pneumatic motor. In detail, the upper tool actuator 14 is coupled to the upper tool 7 and configured for moving the drum 8 around the rotation axis. More in detail, the control unit 13 is configured for commanding the upper tool actuator 14 for rotating the drum 8 around the rotation axis by steps such that each step causes the motion of each head from one of the distinct angular positions to an angularly consecutive of the distinct angular positions. For example, in an embodiment having the heads and the distinct angular positions angularly offset by 30°, the control unit 13 may be configured for commanding the upper tool actuator 14 for rotating the drum by steps of 30° around the rotation axis.

[0125] Moreover, the control unit 13 may be in signal

communication with the packaging assembly 5 and configured for executing the steps of:

- > commanding the lower tool 6 and the upper tool 7 to pass from the first operating condition to the second operating condition or vice versa,
- > commanding the packaging assembly 5 to cause the coupling of the support 2 with the respective film portion 4a obtaining a package.

[0126] In detail, commanding the lower tool 6 and the upper tool 7 to pass from the first operating condition to the second operating condition or vice versa comprises commanding the lower tool 6 to move along the movement direction towards and away from the upper tool 7. More in detail, the control unit may be configured for commanding the lower tool 6 to move along the movement direction towards and away from the upper tool 7.

[0127] In some embodiments, the control unit is in signal communication with the film supplying assembly 3 and further configured for executing one or more of the steps of:

- > commanding the film supplying assembly 3 for supplying the respective film portion 4a to each head positioned in the receiving position,
- > commanding each head positioned in the receiving position for receiving the respective film portion 4a,
- > commanding each head positioned in the alignment position for coupling the respective film portion 4a with the support 2,
- > commanding each head positioned in the working position for heating and/or forming, optionally three-dimensionally forming, the respective film portion 4a.

[0128] In addition, commanding the film supplying assembly 3 for supplying the respective film portion 4a to each head positioned in the receiving position comprises commanding the unwinding system for unwinding the reel of film.

[0129] In detail, the step of commanding each head positioned in the receiving position comprises commanding the one or more first heads for receiving the respective film portion. More in detail, the step of commanding each head positioned in the alignment position comprises commanding the one or more second heads for coupling the respective film portion with the support. Again, more in detail, the step of commanding each head positioned in the working position comprises commanding the one or more third heads for heating and/or forming, optionally three-dimensionally forming, the respective film portion.

[0130] The control unit 13 may be in signal communication with each head and configured for commanding the holding means 18 for attracting and holding the respective film portion 4a against the respective active surface 9.

[0131] In some embodiments, the control unit 13 may be further configured for:

- > commanding the heater 19 for heating the respective film portion 4a, and/or
- > commanding the holding means 18 and the heater 19 for three-dimensionally forming the respective film portion 4a within the cavity 10 or 10'.

[0132] The control unit 13 may be configured for commanding the holding means 18 to cause the respective film portion to move from a substantially flat configuration to a substantially three-dimensional configuration inside the cavity 10, 10'. The control unit 13 is configured for commanding the holding means 18 such that the respective film portion is shaped to the shape of the cavity 10, 10'.

[0133] In an embodiment, the apparatus comprises a peripheral body actuator 17 active on the peripheral body 16. The peripheral body actuator 17 may include a respective electric piston or a respective hydraulic piston or a respective pneumatic piston, or a respective electric motor, or a respective hydraulic motor, or a respective pneumatic motor. The control unit 13 may be in signal communication with the peripheral body actuator 17 and configured for commanding the peripheral body actuator 17 to cause the relative motion of the peripheral body 16 with respect to the head in order to define the cavity 10'.

[0134] In an embodiment, the control unit 13 is in signal communication with the film supplying assembly 3 and configured for commanding the film supplying assembly 3 for:

- > feeding the respective film portion 4a to the packaging assembly 5 in the form of a continuous film.

[0135] Alternatively, the control unit 13 is in signal communication with the film supplying assembly 3 and configured for commanding the film supplying assembly 3 for:

- > cutting from the film the respective film portion 4a in the form of one or more film sheets, and
- > feeding each film sheet to the packaging assembly 5, in particular feeding each film sheet to a respective head positioned in the receiving position.

[0136] In addition, the control unit 13 may be in signal communication with the vacuum assembly 12 and configured for commanding the vacuum assembly 12 for reducing the pressure within the packaging chamber 11. Moreover, the control unit 13 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 11,
- > commanding the vacuum assembly 12, optionally the vacuum source, for reducing the pressure within the packaging chamber 11 based on the pressure data and the control signal.

[0137] In detail, the control unit 13 is configured for commanding the vacuum assembly 12, optionally the vacuum source, for reaching the defined pressure within the packaging chamber 11. The control unit 13 may be configured for commanding the vacuum assembly 12 for reducing the pressure within the packaging chamber 11 at least until the pressure within the packaging chamber 11 is equal to the defined pressure.

[0138] In detail, the control unit 13 is configured for commanding the vacuum assembly 12 such that after reaching the defined pressure within the packaging chamber 11, a gas is inserted within the packaging chamber 11 to cause the respective film portion to drape over the product and to bond the respective film portion to the support obtaining a vacuum skin package.

[0139] A further object of the present disclosure is a process of packaging, in particular of vacuum skin packaging, a product arranged on a support 2. The process uses an apparatus as described in the present description.

[0140] In an embodiment, the process comprises the steps of:

- > supplying the film to the packaging assembly 5,
- > turning the drum 8 around the rotation axis to move each head among the distinct angular positions and position at least one head in alignment with and facing a seat in the lower tool where a support with a product arranged thereon is positioned,
- > coupling the support 2 positioned in the seat 2a with the respective film portion 4a held by said at least one head aligned with and facing the seat in the lower tool for obtaining a package.

[0141] In detail, the step of supplying the film to the packaging assembly 5 comprises:

- > supplying the respective film portion 4a to each head positioned in the receiving position, and
- > commanding each head positioned in the receiving position for receiving the respective film portion 4a.

[0142] In an embodiment, the step of supplying the film to the packaging assembly 5 comprises:

- > supplying the respective film portion 4a to the one or more first heads 8a, and
- > commanding the one or more first heads 8a for receiving the respective film portion 4a.

[0143] In some embodiments, supplying the film to the packaging assembly comprises:

- > feeding the respective film portion parallel to the rotation axis, or
- > feeding the respective film portion transverse to the rotation axis.

[0144] In detail, the step of supplying the film to the packaging assembly is executed by the film supplying assembly and comprises commanding the unwinding system for unwinding the reel of film parallel to or transverse to the rotation axis.

[0145] More in detail, the step of coupling the support 2 with the respective film portion obtaining a package is executed by each head positioned in the alignment position. The step of coupling the support 2 with the respective film portion obtaining a package may be executed by the one or more second heads 8b.

[0146] In an embodiment, the process comprises the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion 4a. In detail, the step of heating and/or forming at least part of the respective film portion 4a is executed by each head positioned in the working position. More in detail, the step of heating and/or forming at least part of the respective film portion 4a is executed by the one or more third heads 8c.

[0147] The step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion 4a may be executed by commanding the holding means 18 and the heater 19. The step of heating and/or forming comprises three-dimensionally forming the respective film portion 4a within the cavity 10, 10'.

[0148] The step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion 4a may be executed by commanding the holding means 18 to cause the respective film portion to move from a substantially flat configuration to a substantially three-dimensional configuration inside the cavity 10, 10' such that the respective film portion is shaped to the shape of the cavity 10, 10'.

[0149] In some embodiments, two or more of the steps of:

- > commanding each head positioned in the receiving position for receiving the respective film portion 4a,
- > coupling the support 2 positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and
- > heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion 4a,

are simultaneously executed through respective heads with respective film portions. In other words, the steps of:

- > commanding each head positioned in the receiving position for receiving the respective film portion 4a,
- > coupling the support 2 positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and

> heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion 4a,

5 may take place simultaneously on angularly offset heads with respective film portions.

[0150] For example, each head positioned in the receiving positions may be commanded for receiving the respective film portion while each respective film portion of the heads positioned in the working position are heated and formed. Advantageously, executing two or more steps simultaneously through different heads on distinct respective film portions allow the reduction of the time needed for packaging a product.

10 **[0151]** In addition, the process may comprise the steps of defining a packaging chamber 11 around the support 2 and the product P arranged thereon. In detail, defining a packaging chamber 11 around the support 2 and the product P arranged thereon is executed by commanding the lower tool 6 and the upper tool 7 to pass from the first operating condition to the second operating condition. More in detail, step of defining a packaging chamber 11 comprises relatively moving the upper tool 7 and the lower tool 6 towards each other. Again, more in detail, the step of defining a packaging chamber 11 comprises moving the lower tool 6 along the movement direction towards and away from the upper tool 7 causing the lower and upper tools to pass from the first operating condition to the second operating condition.

20 **[0152]** In an embodiment, the process comprises the step of reducing the pressure within the packaging chamber 11. In detail, the step of reducing the pressure within the packaging chamber 11 may be executed by the vacuum assembly 12. Reducing the pressure within the packaging chamber 11 may comprise the step of reaching a defined pressure level within the packaging chamber 11.

25 **[0153]** In some embodiments, the step of reducing the pressure within the packaging chamber 11 comprises:

- > receiving a pressure data representative of a defined pressure and a control signal representative of a pressure within the packaging chamber 11,
- > commanding the vacuum assembly 12, optionally the vacuum source, for reducing the pressure within the packaging chamber 11 based on the pressure data and the control signal.

30 **[0154]** In other words, the pressure within the packaging chamber 11 is reduced at least until the pressure is equal to the defined pressure.

35 **[0155]** The process may comprise the step of defining the cavity 10' adapted for three-dimensionally forming the respective film portion 4a. In detail, defining the cavity 10' comprises the step of relatively moving the peripheral body 16 with respect to at least one of the heads 8a, 8b, 8c among the plurality of relative positions defining the cavity. In some embodiments, the step of supplying the

film comprises:

- > feeding the respective film portion 4a to the packaging assembly 5 in the form of a continuous film, in particular feeding the respective film portion 4a to each head positioned in the receiving position in the form of a continuous film.

[0156] Alternatively, the step of supplying the film may comprise:

- > cutting from the film the respective film portion 4a in the form of one or more film sheets, and
- > feeding each film sheet to the packaging assembly, in particular feeding each film sheet to each head positioned in the receiving position.

[0157] In an embodiment, the process comprises the step of:

- > moving the lower tool along the movement direction away from and/or towards the upper tool causing the lower tool and the upper tool to pass from the first operating condition to the second operating condition or vice versa.

[0158] In detail, the process may comprise the step of positioning the upper tool and the lower tool in the second operating condition when at least one respective head is positioned in the alignment position.

[0159] 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. Apparatus (1) for packaging a product (P) arranged on a support (2), the apparatus comprising:

- a film supplying assembly (3) configured for supplying a film (4),
- a packaging assembly (5) configured for receiving the film (4) and coupling the support (2) with the film (4), the packaging assembly (5) comprising:

- a lower tool (6) defining a seat (6a) for receiving the support (2) with the product

(P) arranged thereon, and
 an upper tool (7) configured for cooperating with the lower tool (6), the upper tool (7) comprising a drum (8) having heads (8a, 8b, 8c) angularly offset from each other around a rotation axis, optionally a horizontal rotation axis, each head having a respective active surface (9) configured for receiving a respective film portion (4a) of said film,

wherein the drum (8) is movable around the rotation axis to position each head in distinct angular positions comprising at least:

a receiving position where the respective active surface (9) of the respective head is positioned for receiving the respective film portion (4a) of said film from the film supplying assembly (3),
 an alignment position where the respective head is in alignment with and faces the seat in the lower tool (6).

2. Apparatus according to the preceding claim, wherein the upper tool (7) and the lower tool (6) are configured for being movable the one relative to the other between at least a first operating condition, where the lower tool (6) and the upper tool (7) allow positioning of the support (2) at said seat (6a), and a second operating condition, where the lower tool (6) and the upper tool (7) are approached to each other, and wherein the upper tool (7) and the lower tool (6) are configured for cooperating for defining a packaging chamber (11) when the upper tool (7) and the lower tool (6) are in the second operating condition.

3. Apparatus according to the preceding claim, wherein the lower tool (6) is movable along a movement direction, optionally a vertical movement direction, and the upper tool (7) is fixed along said movement direction, and

wherein the lower tool (6) is configured for being movable along the movement direction away from and towards to the upper tool (7) causing the lower tool (6) and the upper tool (7) to pass from the first operating condition to the second operating condition and vice versa, and
 wherein the apparatus is configured to position the upper tool (7) and the lower tool (6) in the second operating condition when the drum (8) positions at least one respective head in the alignment position, and
 wherein the distinct angular positions that each head is adapted to take further comprise a working position where the respective head is configured for heating and/or forming, optionally three-dimensionally forming, at least part of

the respective film portion (4a).

4. Apparatus according to preceding claim, wherein the heads (8a, 8b, 8c) on the drum (8) comprise:

one or more first heads (8a) and one or more second heads (8b), wherein the one or more first heads (8a) are angularly offset from the one or more second heads (8b), optionally the one of more first heads (8a) being in one of the distinct angular positions and the one or more second heads (8b) being in another one of the distinct angular positions, and one or more third heads (8c) angularly offset from the one or more first heads (8a) and from the one or more second heads (8b), and wherein the drum is configured such that:

when the one or more first heads (8a) are in the receiving position, then the one or more second heads (8b) are in the alignment position and the one or more third heads (8c) are in the working position, and wherein the drum (8) is movable around the rotation axis to move each head among the distinct angular positions such that the one or more first heads (8a), the one or more second heads (8b), optionally the one or more third heads (8c), are simultaneously moved among the distinct angular positions.

5. Apparatus according to the preceding claim, wherein:

the one or more first heads (8a) comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis, and/or the one or more second heads (8b) comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis, and/or the one or more third heads (8c) comprise a respective plurality of heads arranged offset from each other parallel to the rotation axis;

or wherein:

the one or more first heads (8a) comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis, and/or the one or more second heads (8b) comprise a respective plurality of heads arranged offset from each other transversely to the rotation axis, and/or the one or more third heads (8c) comprise a

respective plurality of heads arranged offset from each other transversely to the rotation axis.

6. Apparatus according to any one of the preceding claims, wherein the heads (8a, 8b, 8c) and the distinct angular positions are respectively angularly offset around the rotation axis by a same angular offset, and

wherein each head has holding means (18) configured for attracting and holding the respective film portion (4a) against the respective active surface (9), and wherein each head (8a, 8b, 8c) comprises a heater (19) coupled with the respective active surface (9) and configured for heating the respective film portion (4a).

7. Apparatus according to any one of the preceding claims, wherein each head has a cavity (10) delimited by the respective active surface (9) and adapted for three-dimensionally forming the respective film portion (4a), optionally the respective active surface (9) being concave, or wherein the upper tool (7) has at least one peripheral body (16) coupled with each one of the heads (8a, 8b, 8c), each head and the respective peripheral body (16) being mounted for relative motion the one with respect to the other among a plurality of relative positions and being configured for defining a cavity (10') adapted for three-dimensionally forming the respective film portion (4a), the cavity (10') being delimited by the respective active surface (9) of the respective head and by an inner wall of said peripheral body (16).

8. Apparatus according to any one of the preceding claims, wherein the film supplying assembly (3) is configured for cooperating with the packaging assembly (5) for feeding the respective film portion (4a) parallel to or transversely to the rotation axis, and wherein the film supplying assembly (3) is configured for feeding the respective film portion (4a) to the packaging assembly (5) in the form of a continuous film, and optionally wherein the respective film portion of one of the heads is connected to the respective film portion of an angularly consecutive of the heads, or wherein the film supplying assembly (3) is configured for:

> cutting from the film the respective film portion (4a) in the form of one or more film sheets,
> feeding each film sheet to the packaging assembly (5), optionally feeding each film sheet to a respective head positioned in the receiving position.

9. Apparatus according to any one of the preceding claims in combination with claim 2, comprising a vacuum assembly (12) having a vacuum source fluidly couplable with the packaging chamber (11) and configured to reduce the pressure within the packaging chamber (11). 5
10. Apparatus according to any one of the preceding claims, comprising a control unit (13) and an upper tool actuator (14), optionally comprising an electric piston or an hydraulic piston or a pneumatic piston, or an electric motor, or a hydraulic motor, or a pneumatic motor, in signal communication with each other, the upper tool actuator (14) being coupled to the upper tool (7) and configured for moving the drum (8) around the rotation axis, the control unit (13) being configured for commanding the upper tool actuator (14) for rotating the drum (8) around the rotation axis by steps such that each step causes the motion of each head from one of the distinct angular positions to an angularly consecutive of the distinct angular positions. 10
11. Apparatus according to the preceding claim, in combination with claim 2, wherein the control unit (13) is in signal communication with the packaging assembly (5) and configured for executing the steps of: 15
- > commanding the lower tool (6) and the upper tool (7) to pass from the first operating condition to the second operating condition or vice versa,
 - > commanding the packaging assembly (5) to cause the coupling of the support (2) with the respective film portion (4a) obtaining a package, and 20
- wherein the control unit (13) is in signal communication with the film supplying assembly (3) and further configured for executing one or more of the steps of: 25
- > commanding the film supplying assembly (3) for supplying the respective film portion (4a) to each head positioned in the receiving position, and 30
 - > commanding each head positioned in the receiving position for receiving the respective film portion (4a), 35
 - > commanding each head positioned in the alignment position for coupling the respective film portion (4a) with the support (2), 40
 - > optionally commanding each head positioned in the working position for heating and/or forming, optionally three-dimensionally forming, the respective film portion (4a). 45
12. Apparatus according to the any one of the preceding two claims in combination with claims 6 and 7, wherein the control unit (13) is in signal communication 50

tion with each head and configured for:

- > commanding the holding means (18) for attracting and holding the respective film portion (4a) against the respective active surface (9), and
- > commanding the heater (19) for heating the respective film portion (4a), and
- > commanding the holding means (18) and the heater (19) for three-dimensionally forming the respective film portion (4a) within the cavity (10; 10'). 10

13. Apparatus according to any one of the preceding claims from 10 to 12 in combination with claim 7, comprising a peripheral body actuator (17) active on the peripheral body (16), wherein the control unit (13) is in signal communication with the peripheral body actuator (17) and configured for commanding the peripheral body actuator (17) to cause the relative motion of the peripheral body (16) with respect to the respective head in order to define the cavity (10'). 15
14. Apparatus according to any one of the preceding claims from 10 to 13 in combination with claims 8 and 9, wherein the control unit (13) is in signal communication with the film supplying assembly (3) and configured for commanding the film supplying assembly (3) for: 20
- > feeding the respective film portion (4a) to the packaging assembly (5) in the form of a continuous film, or
 - > cutting from the film the respective film portion (4a) in the form of one or more film sheets,
 - > feeding each film sheet to the packaging assembly (5), optionally feeding each film sheet to a respective head in the receiving position, and 25
- wherein the control unit (13) is in signal communication with the vacuum assembly (12) and configured for commanding the vacuum assembly (12) for reducing the pressure within the packaging chamber (11). 30
15. A process of packaging, in particular of vacuum skin packaging, a product arranged on a support (2), the process using an apparatus (1) in accordance with any one of the preceding claims. 35
16. Process according to the preceding claim, the process optionally using an apparatus (1) according to any one of the preceding claims from 4 to 14 when dependent on claim 4, comprising the steps of: 40
- > supplying the film to the packaging assembly (5), 45

> turning the drum (8) around the rotation axis to move each head among the distinct angular positions and position at least one head in alignment with and facing a seat in the lower tool where a support with a product arranged thereon is positioned, 5
 > coupling the support (2) positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool for obtaining a package, optionally a vacuum skin package, and 10

wherein the step of supplying the film to the packaging assembly (5) comprises:

> supplying the respective film portion (4a) to each head positioned in the receiving position, optionally supplying the respective film portion (4a) to the one or more first heads (8a), and 20
 > commanding each head positioned in the receiving position for receiving the respective film portion (4a), optionally commanding the one or more first heads (8a) for receiving the respective film portion (4a), and 25

wherein the step of coupling the support (2) with the respective film portion obtaining a package is executed by each head positioned in the alignment position, optionally coupling the support (2) with the respective film portion obtaining a package is executed by the one or more second heads (8b). 30

17. Process according to the preceding claim, the process using an apparatus (1) according to any one of the preceding claims from 1 to 14 in combination with claim 7 and optionally with claim 4, the process comprising the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion (4a), 40

wherein the step of heating and/or forming at least part of the respective film portion (4a) is executed by each head positioned in the working position, optionally by the one or more third heads (8c), and 45
 wherein the step of heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion (4a) is executed by commanding the holding means (18) and the heater (19) and comprises three-dimensionally forming the respective film portion (4a) within the cavity (10; 10'). 50

18. Process according to any one of the preceding two claims, the steps of:

> commanding each head positioned in the receiving position for receiving the respective film portion (4a),
 > coupling the support (2) positioned in the seat with the respective film portion held by said at least one head aligned with and facing the seat in the lower tool, and
 > optionally heating and/or forming, optionally three-dimensionally forming, at least part of the respective film portion (4a),

are simultaneously executed through respective heads with respective film portions.

19. Process according to any one of the preceding claims from 15 to 18, wherein the process comprises the steps of:

> defining a packaging chamber (11) around the support (2) and the product (P) arranged thereon, and
 > reducing the pressure within the packaging chamber (11), and

wherein defining a packaging chamber (11) around the support (2) and the product (P) arranged thereon is executed by commanding the lower tool (6) and the upper tool (7) to pass from the first operating condition to the second operating condition, and wherein the step of defining a packaging chamber (11) comprises relatively moving the upper tool (7) and the lower tool (6) towards each other.

20. Process according to any one of the preceding claims from 15 to 19, the process using an apparatus according to any one of the preceding claims from 1 to 14 when dependent on claim 9 and optionally on claim 7, the process comprising the step of defining the cavity (10; 10') adapted for three-dimensionally forming the respective film portion (4a), 40

and optionally wherein defining the cavity comprises the step of relatively moving the peripheral body (16) with respect to at least one of the heads (8a, 8b, 8c) among the plurality of relative positions defining the cavity (10'), and wherein the step of reducing the pressure within the packaging chamber (11) is executed by the vacuum assembly (12).

21. Process according to any one of the preceding claims from 15 to 20, the process optionally using an apparatus (1) according to any one of the preceding claims from 8 to 14 when dependent on claim 8, wherein the step of supplying the film comprises: 55

> feeding the respective film portion (4a) to the packaging assembly (5) in the form of a contin-

uous film, optionally feeding the respective film portion (4a) to each head positioned in the receiving position in the form of a continuous film, or

> cutting from the film the respective film portion (4a) in the form of one or more film sheets, and
> feeding each film sheet to the packaging assembly, optionally feeding each film sheet to each head positioned in the receiving position.

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- 22.** Process according to any one of the preceding claims from 15 to 21, wherein the apparatus is according to any one of the preceding claims from 3 to 14 in combination with claim 3, wherein the process comprises the steps of:

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> moving the lower tool along the movement direction away from and/or towards the upper tool causing the lower tool and the upper tool to pass from the first operating condition to the second operating condition or vice versa, and
> positioning the upper tool and the lower tool in the second operating condition when at least one respective head is positioned in the alignment position.

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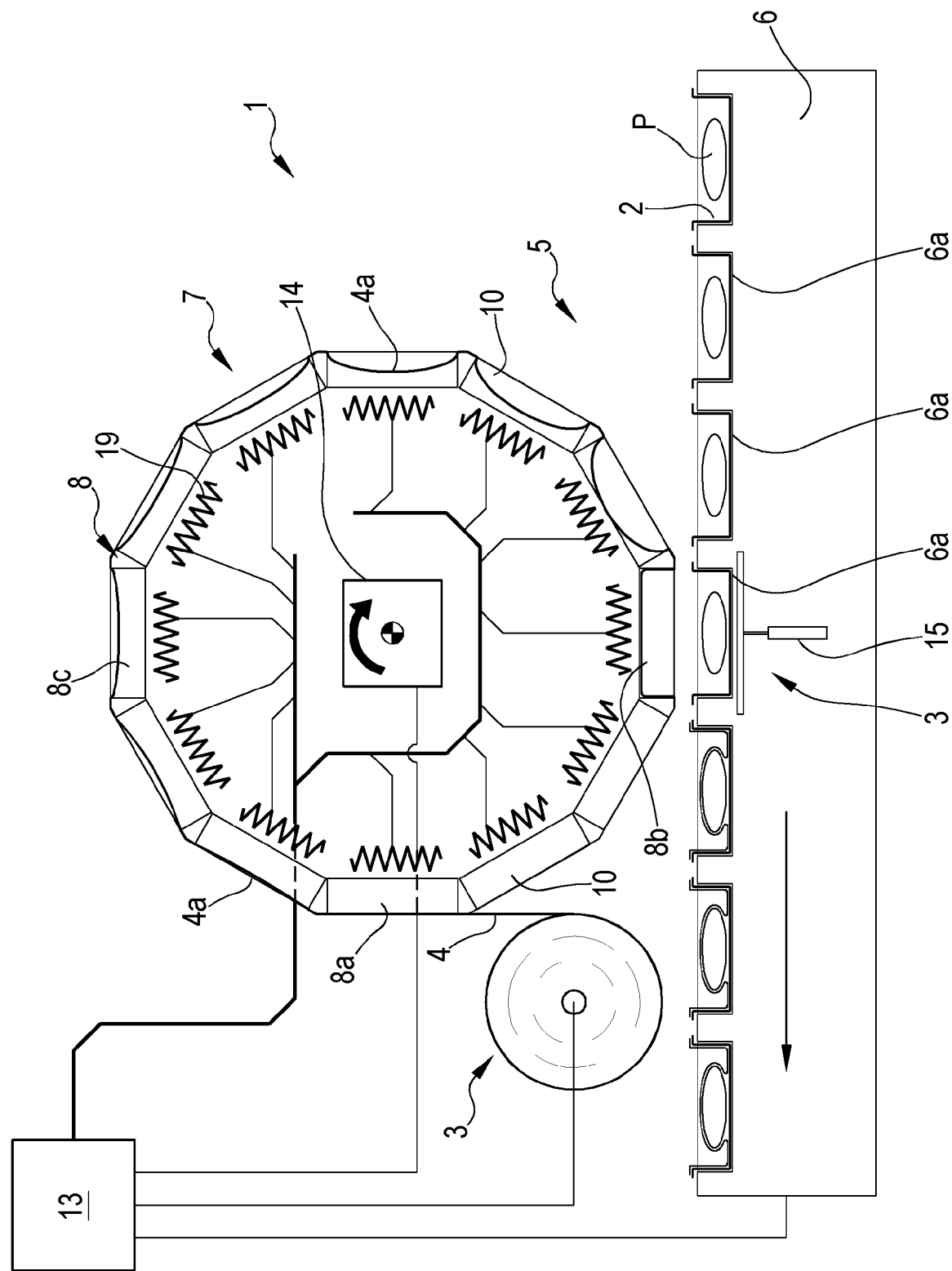
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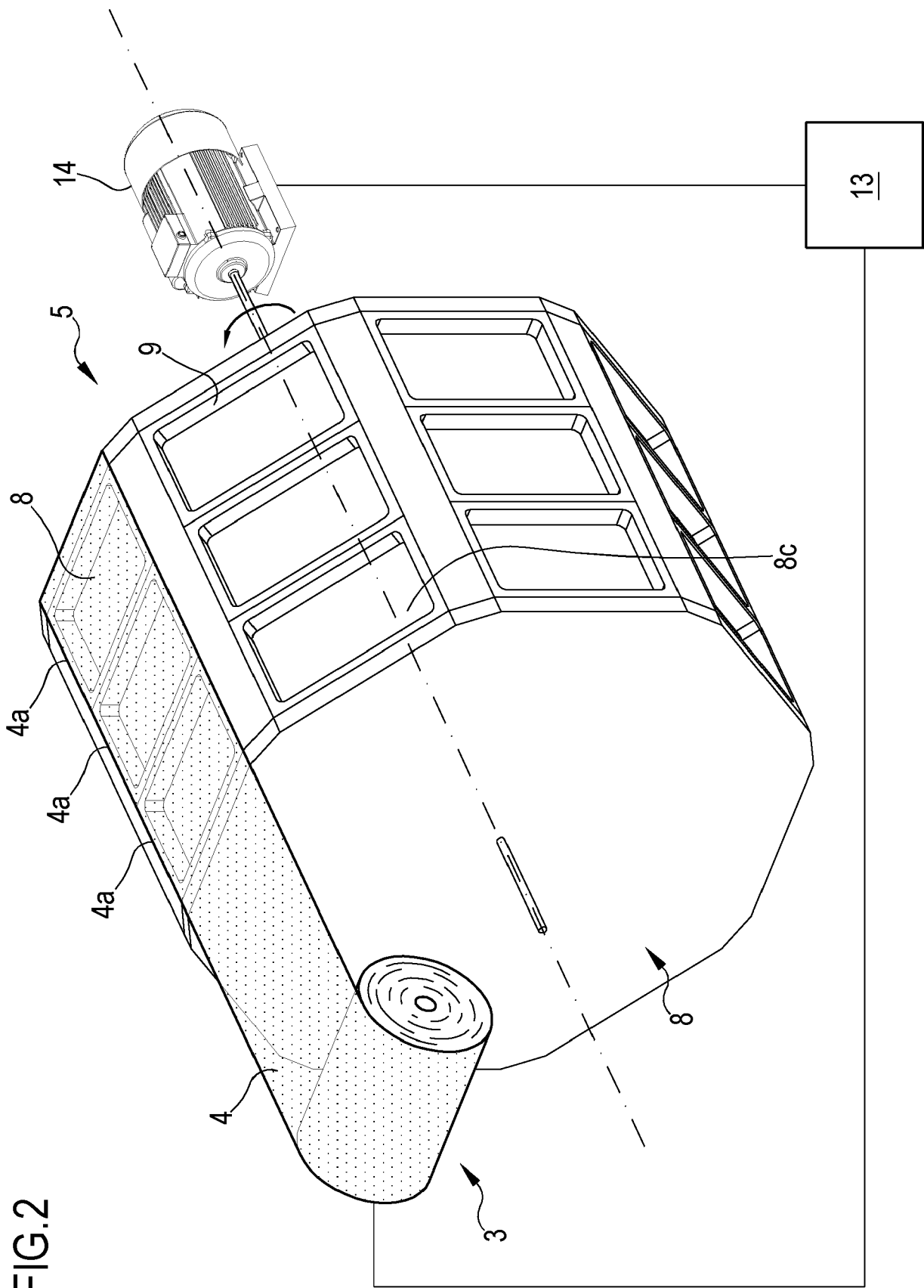
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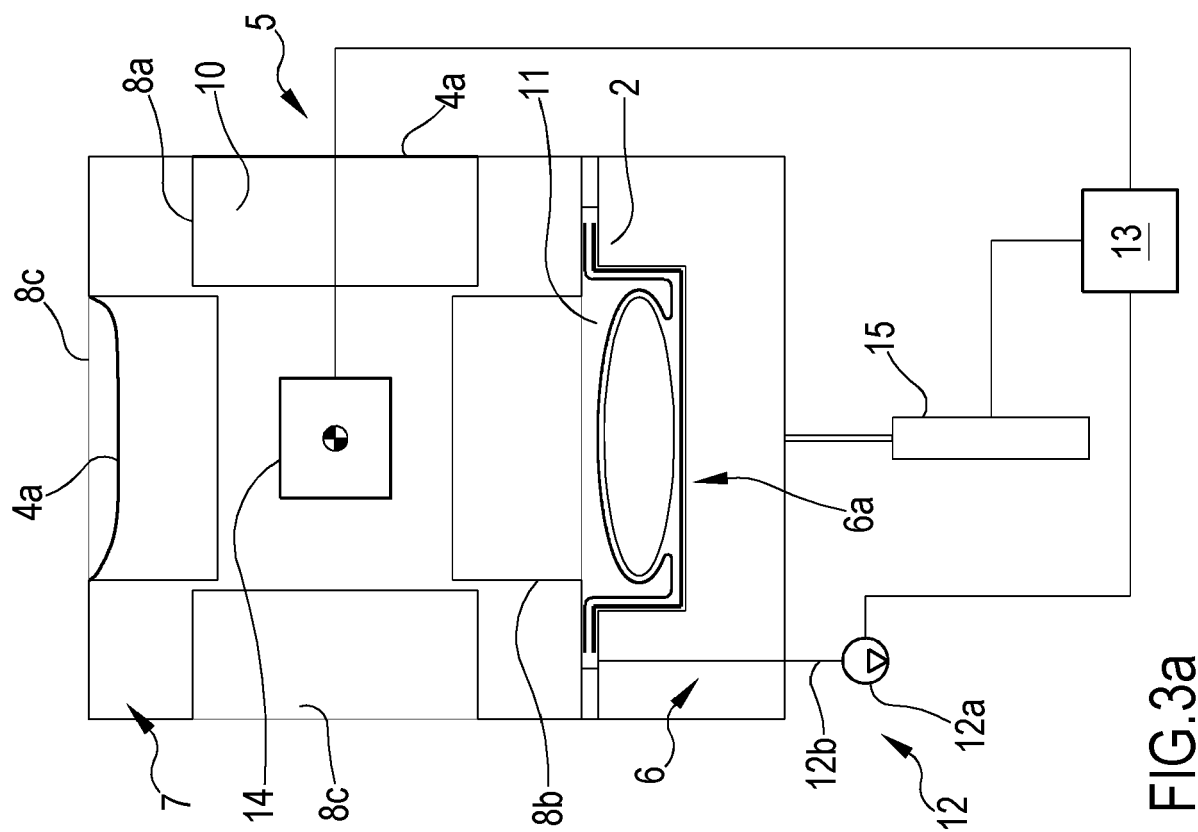
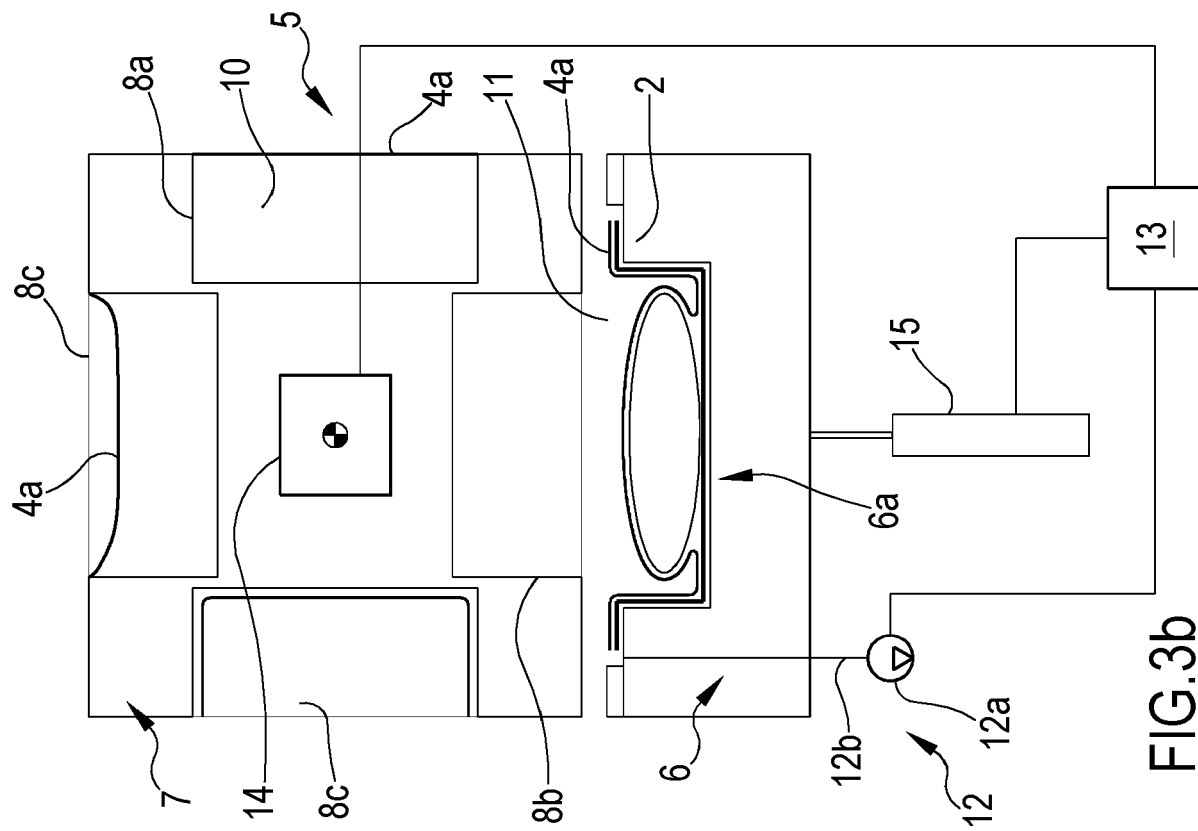
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FIG.1







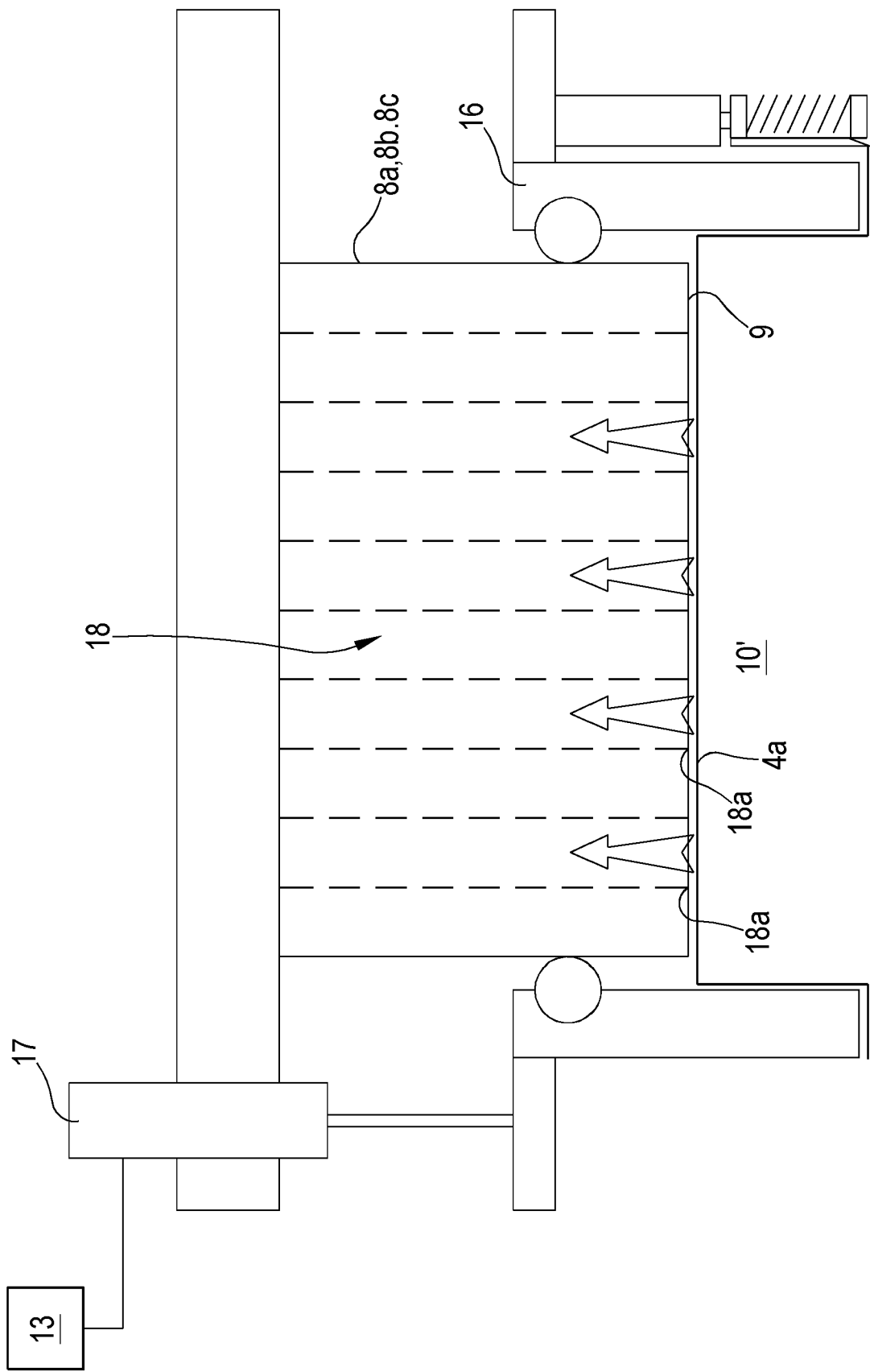


FIG.4



EUROPEAN SEARCH REPORT

Application Number

EP 23 20 5121

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 4 265 070 A (MAINBERGER WALTER A ET AL) 5 May 1981 (1981-05-05)	1-5, 8-16, 19-22	INV. B65B11/52 B29C65/00
A	* figures 1-6 * * column 4, lines 13-19, 42-54 * * column 6, lines 7-44 * * column 7, line 5 - column 8, line 52 * -----	17	B65B41/16 B65B43/52 B65B47/02 B65B47/10
X	US 2017/029146 A1 (PALUMBO RICCARDO [IT] ET AL) 2 February 2017 (2017-02-02)	1,2, 6-16, 18-21	ADD. B65B7/16 B65B7/28
A	* figures 8-17 * * paragraphs [0311], [0312], [0321], [0325], [329] * -----	17	B65B9/04
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B B29C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		15 April 2024	Schmitt, Michel
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X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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15-04-2024

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 4265070 A	05-05-1981	CA 1138318 A	28-12-1982
		JP S5632202 A	01-04-1981
		US 4265070 A	05-05-1981
<hr/>			
US 2017029146 A1	02-02-2017	AU 2014364722 A1	23-06-2016
		BR 112016013393 A2	08-08-2017
		CA 2933419 A1	25-06-2015
		EP 3083411 A1	26-10-2016
		ES 2655280 T3	19-02-2018
		PL 3083411 T3	30-03-2018
		US 2017029146 A1	02-02-2017
		WO 2015091404 A1	25-06-2015
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Patent documents cited in the description

- EP 2722279 A1 [0116]
- WO 2015091404 A [0121]