(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 3 215 422 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
12.09.2018 Bulletin 2018/37

(21) Application number: **15785133.8**

(22) Date of filing: **27.10.2015**

(51) Int Cl.:
B65B 31/02 (2006.01) ***B65B 5/04*** (2006.01)
B65B 7/02 (2006.01) ***B65B 61/02*** (2006.01)
B65B 65/00 (2006.01) ***B65B 51/14*** (2006.01)
B65B 53/02 (2006.01) ***B65B 59/02*** (2006.01)
B65B 61/06 (2006.01) ***B65B 9/02*** (2006.01)
B65B 9/073 (2012.01) *B65B 53/04* (2006.01)
B65B 53/06 (2006.01)

(86) International application number:
PCT/EP2015/074878

(87) International publication number:
WO 2016/071160 (12.05.2016 Gazette 2016/19)

(54) PROCESS AND APPARATUS FOR GAS EXTRACTION IN PACKAGING

VERFAHREN UND VORRICHTUNG ZUR GASEXTRAKTION BEIM VERPACKEN

PROCÉDÉ ET APPAREIL D'EXTRACTION DE GAZ DANS UN EMBALLAGE

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR

(30) Priority: **05.11.2014 EP 14191956**

(43) Date of publication of application:
13.09.2017 Bulletin 2017/37

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Description

Technical Field

[0001] The present invention relates to a packaging process using a gas extraction station and a packaging apparatus comprising a gas extraction station. The packaging process includes extraction of gas from a package or from a semi-sealed package in a gas extraction station having a single vacuum chamber.

Background Art

[0002] A packaging apparatus can be used to package a food product. The product can be a naked product or a product pre-loaded onto a tray. A tube of plastic wrap can be continuously fed through a bag/package forming, filling and sealing apparatus. The film and the product are joined, for example the product is deposited on the film or the film is wrapped around the product. In some examples, the naked product is fed through an infeed belt. A tube is created around the product by sealing opposite longitudinal edges of the film. Alternatively, the product is placed in the tube and a leading edge of the packaging is sealed. Then the tube is sealed at the trailing edge (at the upstream end) of the package and is severed from the continuously moving tube of packaging.

[0003] In some embodiments, the tube can be provided as a tube, or be formed from two films or webs sealed longitudinally at two longitudinal edges, or from a single film that is folded over and sealed along its longitudinal edges. In other embodiments, products are loaded into pre-formed bags which are then supplied to a gas extraction station and sealing station. Further, some embodiments can facilitate gas extraction from two or more packages at the same time in the same process step. The latter can be realized, for example, by processing two or more bags at the same gas extraction station or by feeding, in parallel, two or more tubes of film into a packaging apparatus, where the tubes are processed in parallel.

[0004] Sealing bars can be used to seal the package, wherein a lower bar and an upper bar are moved with respect to one another in order to contact each other, squeezing the packaging material in between and providing one or more seals. The sealing bars typically also form an adjacent seal, which comprises the opposite end of the next following package, thereby providing one semi-sealed (e.g. having an open end) and one sealed package during a single packaging process step.

[0005] The seals are typically transversally extending regions of packaging material that have been processed to provide a seal between the inside of the packaging and the environment. In the context of this document, whenever extraction of gas is referred to, it is understood that the term "gas" can comprise an individual particular gas or a mixture of gases and can, for example, consist of air (i.e. consist of a mixture of gases corresponding to ambient air). In some embodiments, packages can be flushed with a protective gas (sometimes also referred to as "inert" gas). It is noted that any known protective gas or gas mixture can be used here, for example CO_2.

[0006] Gas can be injected into the package in the space between the product and the film at a loading station with or without a first seal closing the pack at the first end thereof (i.e. at a trailing edge). Any remaining gas inside the package after gas or air has been extracted therefrom and after the package has been sealed assures a very low residual level of O_2 inside the package (e.g., a residual level of O_2 of 1% or lower). This is particularly beneficial with respect to protection of perishable products (e.g. cheese with low gassing level during maturation).

[0007] A packaging apparatus is typically used for numerous different products with respect to the type of product, size, weight, composition, etc. A range of vacuum chamber machines for an application called "soft vacuum" exists, in which a product (e.g. soft or medium hard cheese with holes) is vacuumized in machines based on a two-chamber apparatus. The two chambers are provided with different air pressures and are separated by a dividing wall having a gasket. The first chamber is a vacuumized chamber provided with a vacuum pressure. The second chamber is a vacuumized chamber provided with vacuum pressure that is higher than the vacuum pressure provided in the first chamber and contains the product placed in a bag.

[0008] Generally, such a setup may entail several limitations. For example, the complexity and cost for the equipment leaves room for improvement due to the many components required. Further, the size of products that can be processed depend upon the size of the second chamber holding the product during packaging. In some applications, it is difficult to provide chambers of sufficient size due to structural limitation of some components (e.g. actuators). Also, maintaining process reliability and durability of components may be difficult with increasing size of components (e.g. chambers, actuators, gaskets) as the size typically impacts wear and tear properties. Additionally, processing times may increase due to vacuumization of larger chambers taking comparably longer time.

[0009] US 2012/0174531 discloses a packaging machine and a method of forming a vacuum package. A first evacuable chamber is used for accommodating therein a product-accommodating section of a package, whereas a second evacuable chamber is used for accommodating therein an opening section of the package. Pressure gauges measure the pressure in both chambers, and a supply air valve serves to supply air into the first chamber. The disclosure is characterized in that the supply air valve is a control valve and is adapted to be controlled in dependence upon the difference between the pressures which prevail in the first and second chambers and which are measured by means of the two pressure gauges. The disclosure also relates to the fact that a gap is provided in a partition between the two chambers and that an adjuster is provided for varying and adjusting the cross-sectional area of said gap.

[0010] EP 1564147 describes an apparatus and process for vacuum packaging a product in a bag. The apparatus comprises a cover hinged to a base member, the cover and the base member being provided with upper and lower divider walls cooperatively defining a first vacuum chamber, a second vacuum chamber adjacent to the first chamber, and an aperture connecting the first and second chambers for passing therethrough the neck of the bag. The apparatus further comprises means to evacuate the first and second chambers independently from each other and means to close the receptacle. The apparatus further comprises means to admit air in the first vacuum chamber and the aperture is provided with means to reduce the passage of air from one chamber to the other. The evacuation process includes one or more cycles of alternately removing air from within the first and second vacuum chambers, while in some phases pressure is at least partially restored in the first vacuum chamber.

[0011] An aim of the present invention is to provide a packaging process that facilitates efficient packaging of products of larger sizes irrespective of the size of a vacuum or processing chamber. A further aim of the present invention is to provide a packaging process that facilitate extraction of gas and/or air from a package - similar to vacuumization achieved by known apparatuses and processes - using one chamber only. US4601159 discloses a packaging apparatus having an upper sealing jaw and a lower sealing jaw acting on a tubular film to form both a seal on an upstream portion of the tubular film and a vacuum plus a seal on a downstream portion of the same tubular film. EP 0836996A1 and US4640081 show respective packaging processes with a vacuum station enclosing the package to be put under vacuum.

Summary of invention

[0012] According to the invention, there is provided a packaging process according to claim 1.

[0013] According to the invention, in a second embodiment there is provided a packaging process according to claim 2.

[0014] In a third embodiment, the process further comprises providing a second vacuum chamber and, optionally, operating the second vacuum chamber substantially in parallel to the vacuum chamber.

[0015] Advantages of the packaging process and the packaging apparatus include that the packaging process can be performed using a single vacuum chamber only. This may also entail a decrease in processing times and/or processing costs.

[0016] Advantages of the packaging process and the packaging apparatus include that the evacuation station allows for scaling the evacuation procedure in order to optimize the duration of evacuation with respect to an operating rate and/or throughput of remaining operative stations or steps included in the packaging apparatus or process.

[0017] Advantages of the packaging process and the packaging apparatus further include that products of larger sizes can be efficiently packaged irrespective of the size of the vacuum chamber.

[0018] Advantages of the packaging process and the packaging apparatus further include that the risk of deterioration of the products (e.g. molding caused by residual oxygen) can be reduced by providing the packages with a protective gas, prior to extraction of gas or air.

[0019] The packaging process may also facilitate full integration and automation with a horizontal form, fill, and seal (HFFS) apparatus.

Brief description of drawings

[0020]

FIGs. 1 and 2 depict a first embodiment of a packaging apparatus for implementing a process according to the present invention;

FIG. 3 shows a cross-section view of a portion of a gas extraction station for implementing a process in accordance with the present invention;

FIG. 4 shows a cross-section view of a portion of a gas extraction station for implementing a process in accordance with the present invention, illustrating a particular profile of terminal portions of first and second members of the vacuum chamber as well as a schematic drawing of gas flow;

FIG. 5 shows an isometric view of a portion of a gas extraction station for implementing a process in accordance with the present invention;

FIGs. 6 and 7 depict a second embodiment of a packaging apparatus for implementing a further process according to the present invention;

FIG. 8 shows a cross-section view of a portion of a gas extraction station for implementing a process in accordance with the present invention;

FIGs. 9 and 10 show a cross-section view of a gas extraction station for implementing a process in accordance with the present invention;

FIGs. 11A to 11I show a cross-section view of a gas extraction station and associated means for moving for implementing a process in accordance with the present invention, whereas different stages of the gas extraction process are depicted;

FIG. 12 shows an isometric view of a third embodiment of a packaging apparatus according to the present invention employing a gas extraction station having two vacuum chambers arranged in parallel; and

FIGs. 12A and 12B show detailed views of the gas extraction station of FIG. 12.

Detailed Description

[0021] FIGs. 1 and 2 depict a first embodiment of a packaging apparatus for a process according to the present invention. The packaging apparatus 1 comprises a sealing station 3, a gas extraction station 35, and means for moving 30. Packaging apparatus 1 further comprises a loading station (not shown). Means for moving 30 are configured to move a product 20, placed inside a film 21, from the loading station towards and through the sealing station 3 and towards and through the gas extraction station 35.

[0022] Typically, products 20 are loaded onto a continuously supplied film, for example supplied from a roll of film (not shown), the film being subsequently longitudinally sealed in order to create a sequence of products 20 placed in tubular film 21. Optionally, a flusher 34 may be provided in order to flush the inside of tubular film 21 with a protective gas or mixture of gases. The gas or gases may substantially comprise or consist of CO_2.

[0023] Products 20 to be packaged assume different states (e.g. 20a, 20b, 20c, 20d) of packaging. States 20a, 20b, 20c, and 20d denote a product 20 being in different packaging stages. For example, state 20a denotes product 20 placed inside tubular film 21, state 20b denotes product 20 being contained in a semi-sealed package (i.e. a package having a sealed end and an open end), and states 20c and 20d denotes product 20 being contained in a sealed package (i.e. a package having two sealed ends, wherein gas in the package being has or has not been extracted).

[0024] In state 20a, film 21 is positioned around product 20 or product 20 is positioned in a tubular film 21. Alternatively, in state 20a product 20 is positioned on film 21, which is subsequently folded over and sealed at its longitudinal edges in order to form a tubular film 21. This step can be carried out at the loading station and/or at a (separate) longitudinal sealing station.

[0025] Sealing station 3 comprises an upper sealing and cutting member 31 and a lower sealing and cutting member 32 configured to seal and cut film 21. Sealing and cutting members 31 and 32 are configured to create a first seal on film 21, thereby creating a semi-sealed package 23 containing product 20 in state 20b and separating semi-sealed package 23 from the continuously supplied film 21 that is sealed at the downstream end of the film. Product 20 in state 20b is situated inside film 21 and semi-sealed package 23 comprises a sealed end and an opposite open end.

[0026] The gas extraction station 35 is configured to create a second seal on film 21 at the second open end of the semi-sealed package, thereby creating a sealed package 24. In state 20d, product 20 is situated inside film 21 and sealed package 24 comprises a first sealed end and an opposite second sealed end. The first and second sealed ends can also be situated not directly opposite each other, for example in cases where one of the seals is created at an angle to a longitudinal extension of the package and/or to a lateral extension of the other seal. In another embodiment, the gas extraction station 35 take over the function of sealing station 3 in that while gas is extracted from a semi-sealed package, gas extraction station 35 performs sealing and cutting as described above with respect to sealing station 3. This concept can be visualized based on the embodiment shown in FIG. 2. Instead of operating only on one end of packages 24 in state 20d (see on the left hand side of gas extraction station 35), it can be imagined that package 23 immediately to the right of gas extraction station 35 (see package/product directly below arrow 30a) is sealed at the downstream end of the package at the same time members 351 and 352 are in contact with one another in order to extract gas from the previous package and to seal the package after the extraction. The sealing at both the upstream and downstream ends of gas extraction station 35 could be effected at substantially the same time.

[0027] Gas extraction station 35 comprises a first (or upper) member 351 and a second (or lower) member 352, which can be brought from a first configuration, in which the members 351 and 352 are spaced apart from one another (see FIG. 1), into a second configuration, in which the members 351 and 352 are substantially in contact with one another (see FIG. 2). In some embodiments, members 351 and 352 are, in the second configuration, in contact with one another along a perimeter of members 351 and 352, except for at least one opening that is formed between members 351 and 352. In a cross section taken along a horizontal plane (i.e. a plane parallel to a horizontal working surface of packaging apparatus 1, e.g. an upper surface of conveyor belt 30), members 351 and 352 may have a substantially rectangular shape. Members 351 and 352 are configured to define, in the second configuration, a vacuum chamber 353. FIGs. 1 and 2 show members 351 and 352, as well as vacuum chamber 353 in (vertical; see above with respect to horizontal) cross section. Thus, front and back sidewalls (i.e. walls parallel to the view plane) are not shown in order to visualize the inside of vacuum chamber 353.

[0028] With respect to FIGs. 1 and 2, the packaging apparatus 1 further comprises a control unit 50. The control unit is connected (individual connections are not shown for clarity) to one or more components of the packaging apparatus 1, including the loading station, sealing station 3, sealing and cutting members 31 and 32, means for moving 30, members 351 and 352, and flusher 34. Flusher 34 may be provided in order to flush the inside of the packaging film 21 with a protective gas or mixture of gases. The control unit 50 is further connected to gas extraction station 35, where gas is extracted from the semi-packaged products in state 20b and where they are sealed (and, thus, are brought into state 20d).

[0029] Control unit 50 may further be connected to additional components, such as a hot air or shrink tunnel 33, where the film material around packaged products 20 in state 20d can be additionally shrinked after having been sealed. It is noted that the gas extraction station 35 can comprise any means for gas extraction known in the art. FIGs. 1 and 2 do not show individual connection lines between the control unit 50 and other components for clarity. It is understood that packaging apparatus 1 can comprise common connection means for connecting control unit 50 to other components, for example electrical, optical, or other connections and/or leads.

[0030] Control unit 50 can be configured for controlling the transport of products 20 along a predefined path, for example by controlling a motor comprised in means for moving 30 according to a step-by-step motion or according to a continuous motion. The control unit can also control actuators of different components as described below, for example, in order to create transverse seals on the tubular film or in order to actuate members 31, 32, 351, and/or 352.

[0031] Control unit 50 can comprise a digital processor (CPU) with memory (or memories), an analogical type circuit, or a combination of one or more digital processing units with one or more analogical processing circuits. In the present description and in the claims it is indicated that the control unit is "configured" or "programmed" to execute certain steps. This may be achieved in practice by any means, which allow for configuring or programming the control unit. For instance, in case of a control unit comprising one or more CPUs, one or more programs are stored in an appropriate memory. The program or programs contain instructions, which, when executed by the control unit, cause the control unit to execute the steps described and/or claimed in connection with the control unit. Alternatively, if the control unit is of an analogical type, then the circuitry of the control unit is designed to include circuitry configured, in use, to process electric signals such as to execute the control unit steps herein disclosed.

[0032] Control unit 50 is connected to a means for evacuating (not shown) and is configured to send and/or receive control signals to/from the means for evacuating. Control unit 50 can further be configured to control the means for evacuating to provide an internal vacuum pressure to vacuum chamber 353. To this aim, control unit 50 can be configured to control a power driving a vacuum pump connected to vacuum chamber 353.

[0033] Control unit 50 can be configured to control the means for moving 30. For example, control unit 50 can be configured to increase or decrease an operating speed of means for moving 30. Control unit 50 can further be configured to control the operating speed of means for moving 30 depending on a position of products 20 with respect different components of the packaging apparatus 1 (e.g., with respect to sealing station 3 or gas extraction station 35).

[0034] Control unit 50 can additionally or alternatively be configured for controlling the sealing and cutting members 31 and 32. The control unit 50 can further be configured to control the sealing and cutting members 31 and 32 depending on a position of products 20 with respect to the means for evacuating and/or the sealing and cutting members 31 and 32. For example, the control unit 50 can be configured to activate the sealing and cutting members 31 and 32 depending on a position of products 20 and/or tubular film 21 with respect to the outlet and/or sealing and cutting members 31 and 32.

[0035] In particular, the control unit 50 can be configured to control one or more components depending on signals sent to and/or received from other components. For example, the control unit 50 can be configured to control an activation of one or more components depending on the position of products 20 and/or tubular film 21 with respect to other components of packaging apparatus 1. This way, the control unit 50 can activate, for example, the sealing and cutting members 31 and 32 when two subsequent products 20 are in state 20a, such that between the two products 20 the first seal is created on the film 21 and the film is cut accordingly.

[0036] After the creation of the first seal and the cutting of film 21, semi-sealed packages 23 are moved along movement direction 30a through the packaging machine, towards and through gas extraction station 35. In FIG. 1, members 351 and 352 are in their first configuration in which a semi-sealed package 23 can be moved through the open vacuum chamber 353. Before the semi-sealed package 23 exits gas extraction station 35, the semi-sealed package 23 is positioned such that the second open end thereof is at least partially inside the open vacuum chamber 353. In detail, it is ensured that the respective product 20 contained in semi-sealed package 23 as well as a non-terminal portion of film 21 at the second open end of semi-sealed package 23 are outside of open vacuum chamber 353, while a terminal portion of film 21 at the second open end is still inside open vacuum chamber 353. Consequently, an intermediate portion of film 21 at the second open end of the semi-sealed package and extending between the non-terminal and terminal portions is located between at least a section of members 351 and 352.

[0037] Members 351 and 352 are now brought into their second configuration, in which members 351 and 352 are substantially in sealed contact to one another, thereby defining closed vacuum chamber 353. The contact between members 351 and 352 is substantially sealed (e.g. air-tight), except for an elongated opening at which members 351 and 352 engage the intermediate portion of the second open end of semi-sealed package 23 without creating an air-tight seal along the opening.

[0038] This configuration facilitates at least the following effects upon extraction of gas from vacuum chamber 353. On one hand, a gas flow through the opening towards the inside of vacuum chamber 353 is created between opposing surfaces of members 351 and 352 and corresponding surfaces of the intermediate portion of the second open end interposed between members 351 and 352. This gas flow causes adjacent layers of film at the second end of the semi-sealed package 23 to assume and/or maintain a substantially spaced-apart configuration (i.e. opposite layers of film are pulled apart from one another). On the other hand, gas is not only aspirated from outside vacuum chamber 353 and semi-sealed package 23, but also from inside semi-sealed package 23, thereby extracting air from semi-sealed package 23. Typically, the gas aspirated from the outside is air and the gas aspirated from inside the semi-sealed package is a protective gas or gas mixture, such as CO_2. This process is described in more detail below.

[0039] When gas has been extracted from semi-sealed package 23, a sealing assembly, typically integrated into gas extraction station 35, creates a second seal at the second open end, thereby sealingly closing the package and transforming the semi-sealed package 23 into a sealed package 24, which contains product 20 in state 20d (see far left of FIG. 2) and from which substantially all inside gas has been extracted . Optionally, an outer portion of excess film material of the second end (which is now sealed) is cut from sealed package 24.

[0040] With respect to FIGs. 1 and 2, the means for moving 30 can comprise one or more conveyor belts 30. The one or more conveyor belts are configured to transport the products 20 in states 20a, 20b, and 20d, for example as packages 22, 23, and 24, along a pre-defined path through the packaging apparatus 1. For example, the packaging apparatus may comprise a number of conveyor belts 30 (e.g. three, as shown in FIGs. 1 and 2). A first conveyor belt 30 is configured to transport the products 20 and/or film 21 upstream of the sealing and cutting members 31 and 32. A second conveyor belt 30 is configured to transport the products 20 and/or packages 22 and 23 downstream of the sealing and cutting members 31 and 32. And a third conveyor belt is configured to transport the packages 24 downstream of the gas extraction station 35.

[0041] FIG. 3 shows a cross-section view of a portion of the gas extraction station 35 for implementing a process in accordance with the present invention. Generally, the inside of vacuum chamber 353 and the ambient atmosphere (e.g. around the chamber and/or the semi-sealed package 23) are connected through one or more channels extending along or near and through opening 354. Here, the different portions of the second open end of the semi-sealed package 23 are shown as terminal portion 236, intermediate portion 234, and non-terminal portion 232. It is noted that "terminal" refers to the outermost portion of film 21 at the second open end of semi-sealed package 23, which has been cut from continuous film 21 and which has not been sealed (see description of FIGs. 1 and 2 above). FIGs. 3, 4, and 5 are not to scale for reasons of clarity. In general, a height of opening 354 is typically 0.3 mm to 1 mm or about 8 to 20 times the thickness of a single layer of film 21. In some embodiments, the height of opening 354 is 0.8mm, 0.5mm, or 0.4mm. The film 21 typically has a thickness in the range of 30 μm to 60 μm, preferably in the range of 40 μm to 55 μm, most preferably in the range of 45 μm to 52 μm.

[0042] As shown in FIG. 3, members 351 and 352 engage intermediate portion 234 of the second open end without creating an air-tight seal between the inside of vacuum chamber 353 and the ambient atmosphere. The channels between the two volumes (i.e. the volume inside the vacuum chamber 353 and the volume outside thereof) may be created mechanically between members 351 and 352 and the non-terminal portion 232, the intermediate portion 234, and/or the terminal portion 236 in order to ensure a possible airflow due to the pressure differential created by means of the extraction of gas from vacuum chamber 353. In other words, gas or air from outside the semi-sealed package can pass between members 351 and 352 and the non-terminal portion 232 (channels C1), between members 351 and 352 and the intermediate portion 234 (channels C2), and/or between members 351 and 352 and the terminal portion 236 (channels C3). It is noted that the individual spacing of channels does not have to be identical on both (e.g. upper and lower) sides of the film material of the second open end. For example, the size (e.g. height) of a channel C2 between member 351 and intermediate portion 234 (i.e. the channel C2 on the upper side of intermediate portion 234) does not have to be identical to the size of a channel C2 between member 352 and intermediate portion 234 (i.e. the channel C2 on the lower side of intermediate portion 234). Due to several effects (e.g. force of gravity, turbulences, non-identical pressures and/or pressure variations) acting upon the flexible film material, the dimensions of the channels may vary before, during, and after extraction of gas. The same applies to channels C1 and C3. Further, the spacing between the film material may vary along the length of opening 354, for example due to an undulating shape of the film material at the second open end of the semi-sealed package.

[0043] The width of opening 354 may vary according to the application and, preferably is designed to meet the product size with respect to the width of the product or a multiple thereof, in addition to a certain margin. This means that vacuum chamber 353 can be sized to meet the width of the product in the sense that opening 354 largely corresponds to the width of film 21 at the second open end (when brought into a flattened configuration, as shown in FIGs. 3 and 4), whereas the width of the opening should be slightly wider than the film in order to account for positioning or manufacturing tolerances during packaging. It should further be avoided to have large portions of opening 354 unoccupied by film material because of the resulting loss of gas flow resistance in areas adjacent to film material and the subsequent loss in gas flow through the opening in areas occupied by the film material. That said, it is possible to extract gas from two or more semi-sealed packages 23 side by side by providing a vacuum chamber 353 (and, thus, opening 354) having a width that is a multiple of the package width or larger (e.g. up to 33% wider; in some embodiments 25% wider). In some examples, gas from three or more semi-sealed packages 23 can be extracted in parallel in a gas extraction station having an operative width of up to 1000 mm (i.e. having an opening being 1000 mm in width). In some embodiments, the gas extraction station has an operative width of (i.e. the opening has a width of) 900 mm. In other embodiments it has a width of 450 mm. In reference to a portion of the opening occupied by film material, the second ends of a number of semi-sealed packages can occupy 70-90% of the opening, preferably 75-80% of the opening.

[0044] The different effects facilitating extraction of gas from the packages are explained in more detail with respect to FIGs. 4 and 5. FIG. 4 shows a cross-section view of a portion of gas extraction station 35 for implementing a process in accordance with the present invention, illustrating a particular profile of terminal portions of members 351 and 352 as well as a schematic drawing of gas flow. One key issue in extraction of gas from semi-sealed packages is to ensure that the open end of the package is sufficiently open in order to facilitate aspiration of gas from inside the package. In some cases, film material tends to adhere to adjacent film material, thereby temporarily substantially closing the open end of the semi-sealed package and preventing extraction of gas from the package. In other cases, film material partially adheres to adjacent film material, thereby reducing the size of the opening(s) such that aspiration of gas from inside the semi-sealed package is at least partially impaired.

[0045] One way to separate opposite layers of film or to prevent opposite layers from adhering to one another is to create a transition from a relatively high pressure, low velocity, area (shown as HP/LV on the left at the top of FIG. 4) into a relatively low pressure, high velocity, area (shown as LP/HV) or vice versa, and, optionally, back again (shown as HP/LV on the right). Here, the transition from high to low pressure (or vice versa) as well as the transition from low velocity to high velocity (or vice versa) in combination with excitation of the film material (e.g. due to turbulence and/or gas flow) can cause layers of contacting film material to cease adhesion and be pulled apart from one another by the gas flow pressure differential, the velocity differential, and/or frictional effects. Additionally, the position of the layers of film in the opening can influence the properties of the gas flow in a self-regulating manner. For example, if a channel between a layer of film and one of members 351 and 352 becomes smaller (or larger), the pressure and velocity of gas flowing through the channel changes correspondingly and, thus, may in turn influence the position of the film, thereby changing the size of the channel.

[0046] The gradient of pressure/velocity changes in transition between HP/LV and LP/HV areas can be modified by providing edges D, F, D', and/or F' with corresponding profiles. Modification of the shape of edges D, D', F, and F' impacts gas flow in the associated areas and can, for example, facilitate or prevent delamination of gas flow or facilitate or prevent turbulences. The individual effect can be a result of the effects of corresponding shapes on the gas flow (e.g. pressure, velocity, direction, etc.). Edges D and D' denote entry edges in the figures, while edges F and F' denote exit edges, with reference to gas flow upon extraction of gas from vacuum chamber 353. As shown in FIG. 4, edges D, F, D', and F' can have a substantially rounded shape, for example defined by a radius of between 1 and 5 mm, in some embodiments preferably 2 mm or 2.5 mm. It is noted that edges D, F, D', and F' can have the same or different shapes in that, in particular, entry edges D and D' can have a different shape than exit edges F and F', but also in that edges D or F of member 351 can have a different shape than edges D' or F' of member 352.

[0047] FIG. 5 shows an isometric view of a portion of a gas extraction station 35 for implementing a process in accordance with the present invention. Here, a particular profile of members 351 and 352 is illustrated. Parameters which characterize members 351 and 352 as well as opening 354 include: depth C, height B, width A, angle G, and radii D, E, and F. Opening 354 has a height of B of 1 mm or less, preferably between 0.4 and 0.8 mm (e.g. 0.4 mm, 0.5 mm, or 0.8 mm). Opening 354 further has a width of 1000 mm or less (e.g. 900 mm), preferably 500 mm or less (e.g. 450 mm). Opening 354 further has a depth of 50 mm or less (e.g. 45 mm), preferably 20 mm or less (e.g. 20 mm), and more preferably 12 mm or less (e.g. 12 mm). The shape of entry edge D is based on a curvature defined by a radius of 5 mm or less, preferably 2.5 mm or less (e.g. 2.5 mm or 2 mm). The shape of inclination edge E is based on a curvature defined by a radius of 50 mm or less (e.g. 50 mm), preferably 30 mm or less (e.g. 30 mm). Inclination edge E can be present (i.e. the corresponding radius being greater than 0) or not present (i.e. the corresponding radius being equal to 0). The shape of exit edge F is based on a curvature defined by a radius of 10 mm or less (e.g. 9 mm), preferably 5 mm or less (e.g. 2 mm). Corresponding edges D', E', and/or F' (not shown) associated with member 352 can have the same properties as described above with respect to edges D, E, and F, although the individual values do not have to be identical (e.g. edge D being based on a radius of 2.5 mm and edge D' being based on a different radius). Thickness H pertains to the thickness of film material, whereas H denotes the thickness of two layers of film material since an open end of a semi-sealed package as described comprises at least two layers of film material. A width of the second open end of semi-sealed package 23 or package 24 can be defined by a percentage of A with reference to the width A of opening 354. The second end of package 23/24 can have a width of, for example, 70-90% of A, preferably 75-80% of A.

[0048] Another effect that predominantly occurs with members 351 and 352 having profiles as described above and with reference to FIG. 5 pertains to characteristics of gas flow through the opening and along the profiles of members

351 and 352. It is noted that the cross section of the opening is non-constant along the depth C of the opening (see "C" in FIG. 5) and, in particular, increases from inclination edges E and E' towards exit edges F and F'. Gas flow along the surfaces of members 351 and 352 tends to follow the shape of the surfaces due to viscosity effects between the gas flow and the adjacent surfaces, as well as the Coandă effect. The same effects occur between the gas flow and the surfaces of the film material of package 23. Since the gas flow between the film material and, for example, member 351 tends to follow the surface (i.e. the shape of the surface) of both the film material and member 351, the gas flow has to expand and slow, thereby exerting a force upon both surfaces directed towards the gas flow. In other words, the gas flow will pull both the film and the respective member towards one another. As the members 351 and 352 are fixedly held in their respective positions, essentially the layers of film material at the intermediate and terminal portions of the second end are pulled apart from one another. This pulling action creates and/or maintains a channel extending from inside the package towards and through the second end through which gas from inside the package can be evacuated.

[0049] The individual parameters for achieving the above effects vary depending on the individual application. For example, thicker film material may require a different pressure differential gradient than thinner film material. Further, the values of the different pressures and gas flow velocities are also decisive factors. The following table 1 of examples illustrates different parameter combinations that have proven to be effective with respect to the first embodiment described above. In these examples, an opening of the processed semi-sealed packages was ensured and efficient extraction of gas from the packages was achieved.

Table 1

		Example 1	Example 2	Example 3
Opening	Width (A)	900	900	450
	Height (B)	0.5	0.8	0.4
	Depth (C)	20	20	12
	Entry (D)	2.5	2.5	2
	Inclination (E)	30	50	0
	Exit (F)	2	9	2
	Angle (G)	25	15	0
Pumping Capacity m^3/h		500	800	630
Differential Pressure mbar		350-450	350-450	280
Coverage % (of A)		75-80	75-80	75-80
Film Thickness (μm)		40-60	40-60	40-60
Material		BK, BB, OSB	BK, BB, OSB	BK, BB, OSB

[0050] In general, the described process and apparatus can be used in combination with a large number of known film materials. In some examples, the film materials used have the properties listed in the following table 2 (LD denotes longitudinal direction, TD denotes transversal direction). It is noted that these films are merely examples showing the applicability of the described process and apparatus.

Table 2

Material	OSB3050	BK3550	BB3050
Thickness (μm)	50	52	50
Elastic Modulus LD/TD (kg/cm2) ASTM D882	3000/2800	3000/2800	2000/2000
Elongation at Break LD/TD (%) ASTM D882	140/170	210/220	160/230
Free Shrink 85°C LD/TD (%) ASTM D2732	30/38	35/40	32/40
OTR 0%RH, 23°C (cc/m^2*day) ASTM D3985	17	175	17

[0051] FIGs. 6 to 8 depict a second embodiment of a packaging apparatus for implementing a further process according to the present invention. In general, components operate in the same manner as described above with respect to the first embodiment and as shown in FIGs. 1 and 2, unless specifically described otherwise here below. The same reference numerals in FIGs. 6 and 7 denote components corresponding to those in FIGs. 1 and 2. Unless stated otherwise, such components have the same function and properties as described above.

[0052] Sealing and cutting members 31 and 32 are, in the second embodiment, configured to create not only a first seal on tubular film 21 but also a second seal. In this manner, products 20 placed within tubular film 21 exit the sealing station 3 in state 20c, namely in a sealed package 24' (instead of state 20b and in a semi-sealed package 23). A sealed package 24' differs from a sealed package 24 in that gas present in package 24' has not yet been extracted. As shown, means for moving 30 move packages 24' towards and through gas extraction station 35. Gas extraction station 35 operates essentially similar as described above, although it is adapted to handle sealed packages in the manner described below. After extraction of gas from package 24', thereby transforming package 24' into sealed (and gas-extracted) package 24, movement means 30 move packages 24 away from gas extraction station 35.

[0053] As can be seen in FIG. 7, sealed packages 24 are positioned with respect to vacuum chamber 353 such that, upon bringing members 351 and 352 into their second configuration, the second (here sealed) end of package 24' is engaged by members 351 and 352 such that a non terminal portion of the second is positioned outside vacuum chamber 353, an intermediate portion of the second end is engaged by members 351 and 352, and a terminal portion of the second end is positioned inside vacuum chamber 353. The setup is largely identical to what is described above with respect to the first embodiment and the semi-sealed package, with the exception that the second embodiment is configured to process sealed packages. The details of the gas extraction process are described in more detail with respect to FIGs. 8-10.

[0054] FIG. 8 shows a cross-section view of a portion of a gas extraction station for implementing a process in accordance with the present invention. Members 351 and 352 engage the sealed end of a sealed package 24' at an intermediate portion of the second end. It is noted that non-terminal (232), intermediate (234), and terminal (236) portions of a second end of a sealed package correspond to what is shown with respect to a semi-sealed package 23 in FIG. 3. For clarity, these portions are not shown in FIG. 8. Upon members 351 and 352 being brought into their second configuration, the terminal portion of the second end as well as the remainder of package 24' (outside of vacuum chamber 353) is slightly expanded due to the gas present in the intermediate portion of the second end being pushed outwardly both in direction of the terminal portion and the non terminal portion of the second end. In addition to the components described above, vacuum chamber 353 can further comprise first 355 and second 356 holding elements that engage an outermost part of the terminal portion of the second end. This can be done in order to fixedly hold the terminal portion in a particular position within vacuum chamber 353.

[0055] A puncturing means 359 is engaged in order to provide the terminal portion with an aperture 241, thereby providing a potential passage of gas from inside package 24' into vacuum chamber 353. In general, any puncturing means suitable for puncturing the terminal portion of the second end can be employed here, for example, a punch (e.g. creating a substantially round hole by punching or stamping) or a suitably shaped heat wire (e.g. a horseshoe-shaped heat wire creating a corresponding substantially round hole by thermally cutting the film). The puncturing means are preferably configured to provide the terminal portion of the second end with a hole that prevents (further) rupture of the film material, which can happen, for example, when creating a simple (linear) cut or an opening having sharp corners. Upon extraction of gas from vacuum chamber 353, the terminal portion expands (see outward pointing double arrows in FIG. 8) due to the pressure differential between the inside of package 24' and the inside of vacuum chamber 353. The expansion of the terminal portion causes film material of the second end to maintain a spaced apart configuration, thereby ensuring that gas from inside package 24' can flow towards and through the non-terminal portion, the intermediate portion, and the terminal portion of the second end, before being drawn through aperture 241 and into vacuum chamber 353 as indicated by the dashed arrows. In this manner, gas is extracted from package 24', which is subsequently sealed with corresponding sealing means (not shown in FIG.8). Sealing means can comprise sealing bars as known in the art (e.g. similar to sealing and cutting members 31 and 32) and can be, for example, integrated into members 351 and 352 or provided as separate units outside of vacuum chamber 353, configured to seal package 24' and cut an outer part of the second end from package 24', thereby providing sealed package 24 from which gas has been extracted (see FIG. 6). It is noted that the puncturing of the terminal portion can alternatively be effected after the extraction of gas has begun and while it is ongoing. In this case, the expansion of the terminal portion - which is caused due to the pressure differential and irrespective of aperture 241 being present or not - can serve to counter the action of a punch or other puncturing means, thereby facilitating precise and reliable placement of the puncturing means and creation of aperture 241.

[0056] FIGs. 9 and 10 show a cross-section view of a third embodiment of a gas extraction station for implementing a process accordance with the present invention. FIGs. 9 and 10 illustrate one of the advantages of the present invention as well as additional components associated to vacuum chamber 353. Product 20 as shown in FIGs. 9 and 10 is illustrated as a much larger object than in the remaining figures. It is noted that the size of the vacuum chamber and, thus, the opening 354 merely limits one dimension of the potential size of the products to be processed, namely the width of the package. As shown in FIGs. 9 and 10, the size (e.g. length) of a product 20 does not impact the gas extraction process because merely a portion of the sealed (or unsealed) end of the package has to fit into the vacuum chamber 353, instead of the entire product. Also the height of product 20 has only a negligible impact on the gas extraction process in that the operative height of members 351 and 352, as well as the clearance between the two members 351 and 352 when in the first configuration can be adjusted accordingly.

[0057] FIG. 9 shows members 351 and 352 in their first configuration, allowing for a package 24' to be positioned such that the non-terminal, intermediate, and terminal portions of the sealed end of package 24' can be positioned as described above. Additionally, members 351 and 352 are respectively associated with cutting means 357 and 357' as well as sealing means 358 and 358'. Adjacent to cutting means 357 and 357', members 351 and 352 exhibit curved shapes for engaging the intermediate portion of the second end of package 24'. Sealing means 358 and 358' are arranged adjacent thereto.

[0058] FIGs. 11A to 11I show a cross-section view of the third embodiment of a gas extraction station and associated means for moving for implementing a process accordance with the present invention, whereas different stages of the gas extraction process in accordance with the third embodiment are depicted. The direction of movement of packages through the packaging apparatus is from right to left, corresponding to FIGs. 1, 2, 6, and 7. In Fig. 11A, members 351 and 352 are in the first configuration, such that a sealed package 24' can move along members 351 and 352 into a position where a terminal portion of package 24' is positioned between members 351 and 352 but where the product is positioned outside of the area interested by members 351 and 352. In FIG. 11B, an optional step of adjusting the means for moving 30 is illustrated. In some embodiments, the means for moving 30 are adjustable in order to facilitate efficient movement of packages through the packaging apparatus, while assisting in the positioning of the packages with respect to members 351 and 352. As illustrated, a section of the means for moving can assume a transport configuration in which packages can be moved through station 35 and a gas extraction configuration, in which a package is positioned with respect to members 351 and 352 in order to facilitate extraction of gas from the package. In FIG. 11C, members 351 and 352 are brought into the second configuration and, as shown in FIG. 11D, cutting means 357 are activated in order to cut excess film material from the terminal portion of the package, thereby opening the package again. Substantially at the same time as the package is opened (i.e. shortly before or after), chamber 353 is evacuated such that a pressure differential is created between the inside of chamber 353 and the outside atmosphere. In FIG. 11E it can be seen that the excess film material has dropped into a receptacle (or is otherwise disposed of) and that gas is extracted from the inside of package 24' (shown in that residual gas between the film and product 20 is reduced). Consequently, the film of package 24' approaches product 20 as gas is extracted. FIG. 11F shows the final stages of gas extraction, in which the film lies closely against product 20 and gas has substantially been extracted from the package 24'. Subsequently, evacuation of chamber 353 is stopped and package 24' is re-sealed by sealing means 358 and 358'. In FIG. 11G, the sealing means 358 and 358' disengage and in FIG. 11H, members 351 and 352 assume the first configuration (i.e. chamber 353 is opened), thereby releasing package 24'. Optionally, a section of means for moving 30 is adjusted for moving package 24' onwards and/or for receiving a subsequent package. FIG. 11I shows how the subsequent package is moved between members 351 and 352 in their first configuration and, thus, through open chamber 353 in order to be positioned as described above. The process then starts over with the subsequent package 24' as described above.

[0059] FIG. 12 shows an isometric view of a third embodiment of a packaging apparatus for implementig another process according to the present invention employing a gas extraction station 35' having two vacuum chambers 353' arranged in parallel. The gas extraction station 35' of the packaging apparatus 1' includes two vacuum chambers 353' arranged on either side of an infeed belt 30i. As shown in FIG. 12, products 20 can enter the gas extraction station 35' along movement direction 30a via an infeed belt, for example in form of pillow packs (i.e. packages 24', preferably flushed with an inert gas and sealed at both ends, that have not yet undergone gas extraction; see also the description of FIGs. 6 and 7 above). The control unit 50 is configured to control a middle cross conveyor 30m to receive packages 24' via the infeed belt 30i along movement direction 30a and to move the packages 24' selectively either to the left along path 30a-l or to the right along path 30a-r, respectively onto additional cross conveyors 301 or 30r. A respective vacuum chamber 353' is located to either side of the middle cross conveyor 30m.

[0060] The vacuum chamber 353' structurally and functionally corresponds to vacuum chambers 353 as described above. Thus the vacuum chambers 353' may include members 351' and 352' and may be configured to open and close (not shown in FIG. 12 for clarity) as described in detail above. Additional components, for example actuators configured to move members 351' and/or 352', are not shown in FIG. 12 for clarity. The packages 24' being moved along paths 30a-l and 30a-r can be moved to laterally introduce an upstream end of the package into the open vacuum chambers 353'. Subsequently, the vacuum chambers can be closed and evacuation can be performed as described above. In this manner, the two vacuum chambers can be operated in alternating fashion (or substantially parallel and/or independent from one another) and during each operating cycle of a respective vacuum chamber 353' (e.g. opening, introducing upstream end of one or more packages, closing, evacuating, opening again), one or more packages 24' can be evacuated using the respective (e.g. left or right) vacuum chamber 353'. It is understood that vacuum chambers 353' can be operated substantially independent from one another, for example in order to account for different evacuation times, packages 24' of different sizes, etc.

[0061] Substantially upon introduction (e.g. at the same time or shortly before/after) of the upstream end of the package

24' into the opening (see state 20c in FIG. 12), the film material at the upstream end can be perforated or pinched in order to facilitate subsequent gas extraction. The perforation can be performed using perforation rollers 360 (see FIGs. 12A, and 12B). As the upstream ends of the packages is introduced into the vacuum chamber 353', gas or air from inside the package can be evacuated upon closing of the vacuum chamber 353' as described above. When gas extraction is completed, sealing and cutting is performed as described above, in order to release the now evacuated packages 24' (see state 20d in FIG. 12) from vacuum chamber 353'.

[0062] FIGs. 12A and 12B show detailed views of the gas extraction station of FIG. 12. The control unit 50 is operably connected to the middle cross conveyor 30m, the left cross conveyor 301 and the right cross conveyor 30r. The middle cross conveyor is controlled to receive the packages and to laterally move the packages in either direction towards and onto the respective cross conveyor (e.g. 301 or 30r). The lateral cross conveyors are controlled to receive a corresponding package and to move the upstream end thereof into and through the respective pinch station 360 and further into the respective open vacuum chamber 353' as described above. The pinch station 360 perforates the respective package and the package is evacuated while the perforated upstream end of the package is positioned inside the vacuum chamber 353', the film extending into the vacuum chamber 353' through the opening. After gas extraction, the respective vacuum chamber 353' is opened and the packages 24' are moved further along paths 30a-l and 30a-r, respectively, and back towards the middle cross conveyor 30m and outfeed belt 30o in order to be placed in an outlet region of the packaging apparatus 1'.

[0063] Pinch station 360 can include pinch rollers having protrusions 360', on a peripheral surface of a roller, configured to, in combination with recesses 360" present on a counter surface, perforate a film 21 being supplied to the pinch station 360. As shown, pinch station 360 can be implemented as a set of oppositely arranged rollers carrying, for example, protrusions 360' and recesses 360" (alternatively also any combination of protrusions and/or recesses configured to create one or more apertures; see also above). It is noted that other means for perforating the film 21 can be employed (e.g. heat wires as mentioned above or knife rollers configured to cut along an upstream edge of the package) as long as it is ensured that a seal established by film 21 at the upstream end of the package 24' has been compromised in order to facilitate gas extraction as described in detail above.

[0064] In some embodiments, several subsequently processed packages are directed into the vacuum chambers 353' in an alternating fashion such that each vacuum chamber 353' receives, for example, every second package in a series of packages (alternatively, any number of subsequent packages 24' - e.g. 3 - can be directed to one of the vacuum chambers 353' for evacuation). Each vacuum chamber 353' can be sized and configured to be able to process several packages simultaneously, for example between 2 and 5 packages, preferably at least 3 packages as shown in FIG. 12. The evacuation station of packaging apparatus 1' has a modular structure, thereby allowing for two or more vacuum chambers 353' to be used simultaneously. This modular design can prevent or alleviate a bottle-neck situation, in which the packaging apparatus 1' can operate only at the speed of the slowest station thereof.

[0065] The packaging apparatus 1 can comprise an HFFS machine. The HFFS machine may comprise a conveyor belt 30 for supporting and transporting the packages 22, in a horizontal direction. The product 20 may be disposed on a surface. The surface may extend substantially in the horizontal direction. The surface may comprise the upper surface of a conveyor belt 30. The conveyor belt 30 may be a continuous conveyor belt 30. For example, the conveyor belt 30 may be suspended between at least two rollers. The conveyor belt 30 may transport the product 20 in a horizontal direction.

[0066] The product 20 can be disposed in a tray. The tray supports the product 20. The tray can comprise walls that extend substantially vertically from the base of the tray to a height greater than the vertical dimension of the product 20. Alternatively, the tray height may be less than or equal to the height of the product 20. The packaging extends around the tray. The tray can comprise a material selected from a list consisting of polystyrene, Aluminium, or other thermoplastic material such as PET, or cardboard. The tray can be rigid, solid or foamed, and have any color and shape.

[0067] The packaging can comprise a multi-layer film 21. The film 21 can comprise a polyolefin. The film 21 can be a fully coextruded shrinkable film 21. The package provides a barrier to gas passing between the interior of the package to the exterior of the package. Accordingly, the environment inside the package is isolated from the environment outside the package. This helps to preserve food products 20 and avoid contamination. This can be advantageous with respect to food hygiene. The package can provide a barrier to aromas or to gasses. This can be particularly useful when the product 20 is a food product 20. The package can be abuse-resistant.

[0068] The packaging can be transparent or translucent. This allows a customer to see the product 20 through the packaging. For example, the packaging may comprise a transparent film 21. The packaging film can have anti-fog properties. This ensures high consumer appeal. The packaging film can be printable. This allows labels to be printed directly onto the packaging.

[0069] The packaging may be formed from a roll of film 21. The tubular film 21 can be formed by forming a tube from the roll of film 21. The packaging apparatus 1 can comprise a former configured to form the roll of film 21 into a tube. The former can form the tube by forming a longitudinal seal along the longitudinal edges of the roll of film 21. The tube may be formed from two webs of film 21. In this case, the former forms two longitudinal seals along the opposing edges of the two rolls of film 21.

[0070] The packaging apparatus 1 can comprise a flusher 34. The flusher 34 is configured to flush gas through the tube of film 21 that forms the packaging. The gas flush prevents the tube from collapsing. The gas flush helps to maintain a distance between a product 20 in a tray and the film 21. This helps to improve the hygienic appearance of the film 21 because the film 21 remains untarnished by the product 20. The flusher 34 flushes gas longitudinally through the tube. The gas used for flushing can comprise about 70% oxygen and about 30% carbon dioxide or other suitably modified atmosphere.

[0071] Additionally, the flush gas allows the product 20 to be packaged in a modified atmosphere. The gas may help to preserve the product 20, prolonging its shelf life. The desired amount of gas inside each sealed package depends on the type of product 20 and the length of shelf life needed.

[0072] The packaging apparatus 1 can comprise a shrinking machine configured to shrink the film 21. The shrinking machine may be a water- or air-based shrink tunnel, for example a hot air tunnel 33. The sealed package 24 is shrunk in the shrinking machine. The shrinking process may involve heating the sealed package. The package 24 may be heated to a temperature within the range of from about 130°C to about150°C.

[0073] Before the sealed package 24 is shrunk, there may be undesirable gas trapped in the sealed package along with the product 20. Additionally, the sealed package 24 may comprise undesirable "dog ears", where a dog ear is a portion of the packaging that extends away from the product 20 (for example due to the product 20 not being a regular rectangular prism). After the shrinking process the dog ears and the gas content are reduced. This gives the sealed package 24 a more aesthetic appearance. In the case of cheese, the cheese may consume any residual gas that remains in the sealed package 24 following the shrinking step.

[0074] The product 20 can be a food product 20. For example, the product 20 may comprise meat, cheese, pizza, ready meals, poultry and fish. The product 20 may be substantially dry, as in the case of cheese. For some products, such as cheese, there is no need for a tray to support the cheese. Alternatively, the product 20 may be wet. In this case, it is particularly desirable for the product 20 to be disposed in a tray.

[0075] The packaging process of the invention may be employed to package food products 20 that are to have a shelf life in the region of from about six days to about 14 days, for example.

[0076] Desirably, the packaging apparatus 1 comprises a horizontal form fill and seal machine. However, the packaging apparatus 1 may comprise other types of form fill and seal machines, such as a vertical form fill and seal (VFFS) machine. In a vertical form fill and seal machine, the packages 22 move through the packaging apparatus 1 in a vertical direction during the packaging process.

[0077] In a VFFS machine, the packaging may be sealed once to form the lower end of a sealed package. The product 20 is then fed into the open-ended package. The top end of the package 22 is then sealed to form a sealed package 24'.

Claims

1. A packaging process comprising:

providing a semi-sealed package (23) containing a product (20) to be packaged, the semi-sealed package (23) being made from a film (21) and having a first sealed end and a second open end,
providing a vacuum chamber (353) including a first member (351) and a second member (352) arranged opposite the first member (351), the first member (351) and the second member (352) being relatively movable between a first configuration, in which the first and second members (351, 352) are spaced apart from one another, and a second configuration, in which the first and second members (351, 352) are in contact with one another along a perimeter thereof except for at least one opening (354) being formed between the first and second members (351, 352),
adjusting a spacing between the first and second members (351, 352) to bring the first and second members (351, 352) into the first configuration, thereby opening the vacuum chamber (353),
relatively positioning the semi-sealed package (23) and the vacuum chamber (353) such that a terminal portion (236) of the second end is positioned within the vacuum chamber (353) and a non-terminal portion (232) of the second end is positioned outside the vacuum chamber (353), an intermediate portion (234) of the second end passing through the opening (354), the intermediate portion (234) extending between the terminal and non-terminal portions (236, 232) of the second end,
adjusting the spacing between the first and second members (351, 352) to bring the first and second members (351, 352) into the second configuration, wherein in the second configuration, the first and second members (351, 352) are, except for the opening (354), substantially sealingly in contact with one another, and the intermediate portion (234) of the second end is received in the opening (354),
with the first and second members (351, 352) in the second configuration creating, within the vacuum chamber (353), an internal vacuum pressure that is lower than an ambient pressure present in an ambient atmosphere

outside the vacuum chamber (353), the internal vacuum pressure being selected such as to:

- determine a gas flow through the opening (354) causing opposing layers of the film (21) at the second end to maintain a substantially spaced-apart configuration, and
- aspirate both gas from inside the semi-sealed package (23) and gas from the ambient atmosphere through the opening (354),

and creating a second seal on the semi-sealed package (23) at the second end, thereby forming a sealed package (24) containing the product (20) and having first and second sealed ends.

2. A packaging process comprising:

providing a sealed package (24') containing a product (20) to be packaged, the sealed package (24') being made from a film (21) and having a first sealed end and a second sealed end,
providing a vacuum chamber (353) including a first member (351) and a second member (352) arranged opposite the first member (351), the first member (351) and the second member (352) being relatively movable between a first configuration, in which the first and second members (351, 352) are spaced apart from one another, and a second configuration, in which the first and second members (351, 352) are in contact with one another along a perimeter thereof except for at least one opening (354) being formed between the first and second members (351, 352),
adjusting a spacing between the first and second members (351, 352) to bring the first and second members (351, 352) into the first configuration, thereby opening the vacuum chamber (353),
relatively positioning the sealed package (24') and the vacuum chamber (353) such that a terminal portion (236) of the second end is positioned within the vacuum chamber (353) and a non-terminal portion (232) of the second end is positioned outside the vacuum chamber (353), an intermediate portion (234) of the second end passing through the opening (354), the intermediate portion (234) extending between the terminal and non-terminal portions (236, 232) of the second end,
adjusting the spacing between the first and second members (351, 352) to bring the first and second members (351, 352) into the second configuration, wherein in the second configuration, the first and second members (351, 352) are, except for the opening (354), substantially sealingly in contact with one another, and the intermediate portion (234) of the second end is received in the opening (354),
with the first and second members (351, 352) in the second configuration creating an aperture in the film (21) at the terminal portion (236) of the second end, and creating, within the vacuum chamber (353), an internal vacuum pressure that is lower than an ambient pressure present in an ambient atmosphere outside the vacuum chamber (353), the internal vacuum pressure and the size of the aperture being selected such as to:

- determine an expansion of the terminal portion (236) causing opposing layers of the film (21) at the second end to maintain a substantially spaced-apart configuration, and
- aspirate gas into the vacuum chamber (353) from the ambient atmosphere through the opening (354) and from inside the package (24') through the opening (354) and through the aperture.

3. The process of claim 1, wherein the step of providing the semi-sealed package (23) comprises:

positioning a tubular film (21) around the product (20) to be packaged, and
creating, at a sealing station (3), a first seal on the tubular film (21), thereby forming the semi-sealed package (23) containing the product (20) to be packaged, and optionally creating a longitudinal seal along a film (21) in order to obtain the tubular film.

4. The process of claim 2, wherein the step of providing the sealed package (24') comprises:

positioning a tubular film (21) around the product (20) to be packaged creating, at a sealing station (3), a first seal on the tubular film (21), thereby forming a semi-sealed package (23) containing the product (20), and creating, at the sealing station (3), a second seal on the tubular film (21), thereby forming the sealed package (24') containing the product (20), and optionally creating a longitudinal seal along a film (21) in order to obtain the tubular film.

5. The process of one of the preceding claims, wherein relatively positioning the package (23, 24') and the vacuum chamber (353) comprises:

moving the first member (351) of the vacuum chamber (353) and/or moving the second member (352) of the vacuum chamber (353) relative to the other, and
moving the package and/or moving the vacuum chamber (353) relative to the other.

6. The process of one of the preceding claims, wherein adjusting the spacing comprises:
moving the first member (351) of the vacuum chamber (353) and/or moving the second member (352) of the vacuum chamber (353) relative to the other.

7. The process of one of the preceding claims, wherein adjusting the spacing comprises:

providing the opening (354) with a height of 8 to 20 times a thickness of the film (21), or
providing the opening (354) with a height of 1.0 mm or less, preferably 0.8 mm or less, most preferably 0.5 mm or less, or
providing the opening (354) with a height of between 0.3 mm and 1.0 mm, preferably between 0.3 mm and 0.8 mm, most preferably between 0.3 mm and 0.5 mm.

8. The process of one of the preceding claims, wherein creating the internal vacuum pressure within the vacuum chamber (353) comprises creating an internal vacuum pressure of between 800 mbar and 500 mbar, preferably between 750 mbar and 525 mbar, most preferably between 700 mbar and 550 mbar.

9. The process of one of the preceding claims, further comprising providing the inside of the film (21) and/or the package (23, 24') with a protective gas, optionally the protective gas substantially consisting of CO_2.

10. The process of one of the preceding claims, further comprising providing a second vacuum chamber and, optionally, operating the second vacuum chamber substantially in parallel to the vacuum chamber (353).

11. The process of the preceding claim, wherein steps of:

- adjusting the spacing between the first and second members (351, 352) of the vacuum chamber (353) to bring the first and second members (351, 352) into the first configuration, thereby opening the vacuum chamber (353), and
- adjusting a spacing between first and second members of the second vacuum chamber to bring the first and second members of the second vacuum chamber into a second configuration, in which the first and second members of the second vacuum chamber are, except for an opening of the second vacuum chamber, substantially sealingly in contact with one another,

are performed substantially at the same time.

Patentansprüche

1. Verpackungsprozess, umfassend:

Bereitstellen einer halb-abgedichteten Verpackung (23), welche ein zu verpackendes Produkt (20) enthält, wobei die halb-abgedichtete Verpackung (23) aus einer Folie (21) hergestellt ist und ein erstes abgedichtetes Ende und ein zweites offenes Ende aufweist,
Bereitstellen einer Vakuumkammer (353), umfassend ein erstes Element (351) und ein zweites Element (352), welches gegenüberliegend zu dem ersten Element (351) angeordnet ist, wobei das erste Element (351) und das zweite Element (352) relativ beweglich zwischen einer ersten Konfiguration, in welcher das erste und das zweite Element (351, 352) voneinander beabstandet sind, und einer zweiten Konfiguration sind, in welcher das erste und das zweite Element (351, 352) entlang eines Umfangs davon mit Ausnahme wenigstens einer Öffnung (354), welche zwischen dem ersten und dem zweiten Element (351, 352) ausgebildet ist, miteinander in Berührung stehen,
Einstellen eines Abstandes zwischen dem ersten und dem zweiten Element (351, 352), um das erste und das zweite Element (351, 352) in die erste Konfiguration zu bringen, wodurch die Vakuumkammer (353) geöffnet wird,
Relativpositionieren der halb-abgedichteten Verpackung (23) und der Vakuumkammer (353) derart, dass ein Endabschnitt (236) des zweiten Endes innerhalb der Vakuumkammer (353) positioniert wird und ein Nicht-Endabschnitt (232) des zweiten Endes außerhalb der Vakuumkammer (353) positioniert wird, wobei ein Zwi-

schenabschnitt (234) des zweiten Endes die Öffnung (354) durchtritt, wobei der Zwischenabschnitt (234) sich zwischen dem End- und dem Nicht-Endabschnitt (236, 232) des zweiten Endes erstreckt,
Einstellen des Abstandes zwischen dem ersten und dem zweiten Element (351, 352), um das erste und das zweite Element (351, 352) in die zweite Konfiguration zu bringen, wobei in der zweiten Konfiguration das erste und das zweite Element (351, 352) mit Ausnahme der Öffnung (354) im Wesentlichen abdichtend miteinander in Berührung stehen und der Zwischenabschnitt (234) des zweiten Endes in der Öffnung (354) aufgenommen ist, wobei das erste und das zweite Element (351, 352) in der zweiten Konfiguration innerhalb der Vakuumkammer (353) einen inneren Vakuumdruck erzeugen, welcher geringer als ein Umgebungsdruck ist, welcher in einer Umgebungsatmosphäre außerhalb der Vakuumkammer (353) vorliegt, wobei der innere Vakuumdruck gewählt ist, um:

- einen Gasstrom durch die Öffnung (354) zu bestimmen, welcher verursacht, dass gegenüberliegende Schichten der Folie (21) an dem zweiten Ende eine im Wesentlichen voneinander beabstandete Konfiguration aufrechterhalten, und
- sowohl Gas von innerhalb der halb-abgedichteten Verpackung (23) als auch Gas von außerhalb der Umgebungsatmosphäre durch die Öffnung (354) anzusaugen,

und Erzeugen einer zweiten Abdichtung an der halb-abgedichteten Verpackung (23) an dem zweiten Ende, wodurch eine abgedichtete Verpackung (24) ausgebildet wird, welche das Produkt (20) enthält und ein erstes und ein zweites abgedichtetes Ende aufweist.

2. Verpackungsprozess, umfassend:

Bereitstellen einer abgedichteten Verpackung (24'), welche ein zu verpackendes Produkt (20) enthält, wobei die abgedichtete Verpackung (24') aus einer Folie (21) hergestellt ist und ein erstes abgedichtetes Ende und ein zweites abgedichtes Ende aufweist,
Bereitstellen einer Vakuumkammer (353), umfassend ein erstes Element (351) und ein zweites Element (352), welches gegenüberliegend zu dem ersten Element (351) angeordnet ist, wobei das erste Element (351) und das zweite Element (352) relativ beweglich zwischen einer ersten Konfiguration, in welcher das erste und das zweite Element (351, 352) voneinander beabstandet sind, und einer zweiten Konfiguration sind, in welcher das erste und das zweite Element (351, 352) entlang eines Umfangs davon mit Ausnahme wenigstens einer Öffnung (354), welche zwischen dem ersten und dem zweiten Element (351, 352) ausgebildet ist, miteinander in Berührung stehen,
Einstellen eines Abstandes zwischen dem ersten und dem zweiten Element (351, 352), um das erste und das zweite Element (351, 352) in die erste Konfiguration zu bringen, wodurch die Vakuumkammer (353) geöffnet wird,
Relativpositionieren der abgedichteten Verpackung (24') und der Vakuumkammer (353) derart, dass ein Endabschnitt (236) des zweiten Endes innerhalb der Vakuumkammer (353) positioniert wird und ein Nicht- Endabschnitt (232) des zweiten Endes außerhalb der Vakuumkammer (353) positioniert wird, wobei ein Zwischenabschnitt (234) des zweiten Endes die Öffnung (354) durchtritt, wobei der Zwischenabschnitt (234) sich zwischen dem End- und dem Nicht-Endabschnitt (236, 232) des zweiten Endes erstreckt,
Einstellen des Abstandes zwischen dem ersten und dem zweiten Element (351, 352), um das erste und das zweite Element (351, 352) in die zweite Konfiguration zu bringen, wobei in der zweiten Konfiguration das erste und das zweite Element (351, 352) mit Ausnahme der Öffnung (354) im Wesentlichen abdichtend miteinander in Berührung stehen und der Zwischenabschnitt (234) des zweiten Endes in der Öffnung (354) aufgenommen ist, wobei das erste und das zweite Element (351, 352) in der zweiten Konfiguration eine Apertur in der Folie (21) an dem Endabschnitt (236) des zweiten Endes erzeugen und innerhalb der Vakuumkammer (353) einen inneren Vakuumdruck erzeugen, welcher geringer als ein Umgebungsdruck ist, welcher in einer Umgebungsatmosphäre außerhalb der Vakuumkammer (353) vorliegt, wobei der innere Vakuumdruck und die Größe der Apertur gewählt sind, um:

- eine Ausdehnung des Endabschnitts (236) zu bestimmen, welche verursacht, dass gegenüberliegende Schichten der Folie (21) an dem zweiten Ende eine im Wesentlichen voneinander beabstandete Konfiguration aufrechterhalten, und
- Gas in die Vakuumkammer (353) von der Umgebungsatmosphäre durch die Öffnung (354) und von innerhalb der Verpackung (24') durch die Öffnung (354) und durch die Apertur anzusaugen.

3. Verfahren nach Anspruch 1, wobei der Schritt des Bereitstellens der halbabgedichteten Verpackung (23) umfasst: Positionieren einer schlauchartigen Folie (21) um das zu verpackende Produkt (20) und Erzeugen, an einer Abdichtstation (3), einer ersten Abdichtung an der schlauchartigen Folie (21) wodurch die halbabgedichtete Verpackung (23) ausgebildet wird, welche das zu verpackende Produkt (20) enthält, und wahlweise Erzeugen einer Längsabdichtung entlang einer Folie (21), um die schlauchartige Folie zu erhalten.

4. Verfahren nach Anspruch 2, wobei der Schritt des Bereitstellens der abgedichteten Verpackung (24') umfasst:

Positionieren einer schlauchartigen Folie (21) um das zu verpackende Produkt (20), Erzeugen, an einer Abdichtstation (3), einer ersten Abdichtung an der schlauchartigen Folie (21) wodurch eine halbabgedichtete Verpackung (23) ausgebildet wird, welche das Produkt (20) enthält, und
Erzeugen, an der Abdichtstation (3), einer zweiten Abdichtung an der schlauchartigen Folie (21) wodurch die abgedichtete Verpackung (24') ausgebildet wird, welche das Produkt (20) enthält, und wahlweise Erzeugen einer Längsabdichtung entlang einer Folie (21), um die schlauchartige Folie zu erhalten.

5. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Relativpositionieren der Verpackung (23, 24') und der Vakuumkammer (353) umfasst:
Bewegen des ersten Elements (351) der Vakuumkammer (353) und/oder Bewegen des zweiten Elements (352) der Vakuumkammer (353) relativ zu dem anderen, und Bewegen der Verpackung und/oder Bewegen der Vakuumkammer (353) relativ zu dem anderen.

6. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Einstellen des Abstandes umfasst:
Bewegen des ersten Elements (351) der Vakuumkammer (353) und/oder Bewegen des zweiten Elements (352) der Vakuumkammer (353) relativ zu dem anderen.

7. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Einstellen des Abstandes umfasst:

Bereitstellen der Öffnung (354) mit einer Höhe von 8 bis 20 mal einer Dicke der Folie (21),
oder
Bereitstellen der Öffnung (354) mit einer Höhe von 1,0 mm oder weniger, vorzugsweise von 0,8 mm oder weniger, besonders bevorzugt von 0,5 mm oder weniger, oder
Bereitstellen der Öffnung (354) mit einer Höhe von zwischen 0,3 mm und 1,0 mm, vorzugsweise von zwischen 0,3 mm und 0,8 mm, besonders bevorzugt von zwischen 0,3 mm und 0,5 mm.

8. Verfahren nach einem der vorhergehenden Ansprüche, wobei das Erzeugen des inneren Vakuumdrucks innerhalb der Vakuumkammer (353) ein Erzeugen eines inneren Vakuumdrucks von zwischen 800 mbar und 500 mbar, vorzugsweise von zwischen 750 mbar und 525 mbar, besonders bevorzugt von zwischen 700 mbar und 550 mbar umfasst.

9. Verfahren nach einem der vorhergehenden Ansprüche, ferner umfassend ein Bereitstellen des Inneren der Folie (21) und oder der Verpackung (23, 24') mit einem Schutzgas, wobei das Schutzgas wahlweise im Wesentlichen aus CO_2 besteht.

10. Verfahren nach einem der vorhergehenden Ansprüche, ferner umfassend ein Bereitstellen einer zweiten Vakuumkammer und wahlweise Betreiben der zweiten Vakuumkammer im Wesentlichen parallel zu der Vakuumkammer (353).

11. Verfahren nach dem vorhergehenden Anspruch, wobei die Schritte:

- Einstellen des Abstandes zwischen dem ersten und dem zweiten Element (351, 352) der Vakuumkammer (353), um das erste und das zweite Element (351, 352) in die erste Konfiguration zu bringen, wodurch die Vakuumkammer (353) geöffnet wird, und
- Einstellen eines Abstandes zwischen einem ersten und einem zweiten Element der zweiten Vakuumkammer, um das erste und das zweite Element der zweiten Vakuumkammer in eine zweite Konfiguration zu bringen, in welcher das erste und das zweite Element der zweiten Vakuumkammer mit Ausnahme einer Öffnung der zweiten Vakuumkammer im Wesentlichen abdichtend miteinander in Berührung stehen,

im Wesentlichen zur gleichen Zeit ausgeführt werden.

Revendications

1. **1.** Procédé d'emballage comprenant :

   la fourniture d'un emballage semi-scellé (23) contenant un produit (20) à emballer, l'emballage semi-scellé (23) étant constitué d'un film (21) et présentant une première extrémité scellée et une seconde extrémité ouverte,
   la fourniture d'un caisson de vide (353) comprenant un premier élément (351) et un second élément (352) disposé opposé au premier élément (351), le premier élément (351) et le second élément (352) étant relativement mobiles entre une première configuration, dans laquelle le premier et le second élément (351, 352) sont espacés l'un de l'autre, et une seconde configuration, dans laquelle le premier et le second élément (351, 352) se trouvent en contact l'un avec l'autre le long d'un périmètre de ceux-ci excepté pour au moins une ouverture (354) qui est formée entre le premier et le second élément (351, 352),
   l'ajustement d'un espacement entre le premier et le second élément (351, 352) pour porter le premier et le second élément (351, 352) dans la première configuration, ouvrant de là le caisson de vide (353),
   le positionnement relativement de l'emballage semi-scellé (23) et du caisson de vide (353) de sorte qu'une partie terminale (236) de la seconde extrémité soit positionnée à l'intérieur du caisson de vide (353) et qu'une partie non terminale (232) de la seconde extrémité soit positionnée à l'extérieur du caisson de vide (353), une partie intermédiaire (234) de la seconde extrémité passant à travers l'ouverture (354), la partie intermédiaire (234) s'étendant entre les parties terminale et non terminale (236, 232) de la seconde extrémité,
   l'ajustement de l'espacement entre le premier et le second élément (351, 352) pour porter le premier et le second élément (351, 352) dans la seconde configuration, dans la seconde configuration, le premier et le second élément (351, 352) étant, excepté pour l'ouverture (354), sensiblement en contact hermétique l'un par rapport à l'autre, et la partie intermédiaire (234) de la seconde extrémité étant reçue dans l'ouverture (354),
   avec le premier et le second élément (351, 352) en la seconde configuration créant, à l'intérieur du caisson de vide (353), une pression de vide interne qui est inférieure à une pression ambiante présente dans une atmosphère ambiante à l'extérieur du caisson de vide (353), la pression de vide interne étant sélectionnée afin :

   - de déterminer un écoulement de gaz à travers l'ouverture (354) maintenant les couches opposées du film (21) au niveau de la seconde extrémité selon une configuration sensiblement espacée, et
   - d'aspirer à la fois le gaz de l'intérieur de l'emballage semi-scellé (23) et le gaz de l'atmosphère ambiante à travers l'ouverture (354),

   et créant un second joint sur l'emballage semi-scellé (23) à la seconde extrémité, formant de là un emballage scellé (24) contenant le produit (20) et présentant une première et une seconde extrémité scellée.

2. **2.** Procédé d'emballage comprenant :

   la fourniture d'un emballage scellé (24') contenant un produit (20) à emballer, l'emballage scellé (24') étant constitué d'un film (21) et présentant une première extrémité scellée et une seconde extrémité scellée,
   la fourniture d'un caisson de vide (353) comprenant un premier élément (351) et un second élément (352) configuré à l'opposé du premier élément (351), le premier élément (351) et le second élément (352) étant relativement mobiles entre une première configuration, dans laquelle le premier et le second élément (351, 352) sont espacés l'un de l'autre, et une seconde configuration, dans laquelle le premier et le second élément (351, 352) se trouvent en contact l'un avec l'autre le long de leur périmètre excepté pour au moins une ouverture (354) qui est formée entre le premier et le second élément (351, 352),
   l'ajustement d'un espacement entre le premier et le second élément (351, 352) pour porter le premier et le second élément (351, 352) dans la première configuration, ouvrant de là le caisson de vide (353),
   le positionnement relativement de l'emballage scellé (24') et du caisson de vide (353) de sorte qu'une partie terminale (236) de la seconde extrémité est positionnée à l'intérieur du caisson de vide (353) et qu'une partie non terminale (232) de la seconde extrémité est positionnée à l'extérieur du caisson de vide (353), une partie intermédiaire (234) de la seconde extrémité passant à travers l'ouverture (354), la partie intermédiaire (234) s'étendant entre les parties terminale et non terminale (236, 232) de la seconde extrémité,
   l'ajustement de l'espacement entre le premier et le second élément (351, 352) pour porter le premier et le second élément (351, 352) en la seconde configuration, dans laquelle dans la seconde configuration, le premier et le second élément (351, 352) sont, excepté pour l'ouverture (354), sensiblement en contact hermétique l'un avec l'autre, et la partie intermédiaire (234) de la seconde extrémité est reçue dans l'ouverture (354),
   avec le premier et le second élément (351, 352) dans la seconde configuration créant une orifice dans le film (21) au niveau de la partie terminale (236) de la seconde extrémité, et créant, à l'intérieur du caisson de vide

(353), une pression de vide interne qui est inférieure à une pression ambiante présente dans une atmosphère ambiante à l'extérieur du caisson de vide (353), la pression de vide interne et la taille de l'ouverture étant sélectionnées afin :

- de déterminer une expansion de la partie terminale (236) maintenant les couches opposées du film (21) au niveau de la seconde extrémité en une configuration sensiblement espacée, et
- d'aspirer le gaz dans le caisson de vide (353) depuis l'atmosphère ambiante à travers l'ouverture (354) et depuis l'intérieur de l'emballage (24') à travers l'ouverture (354) et à travers l'orifice.

3. Procédé selon la revendication 1, l'étape de fourniture de l'emballage semi-scellé (23) comprenant :

le positionnement d'un film tubulaire (21) autour du produit (20) à emballer, et
la création, au niveau d'un poste de scellage (3), d'un premier joint sur le film tubulaire (21), formant de là l'emballage semi-scellé (23) contenant le produit (20) à emballer, et créant éventuellement un joint longitudinal le long d'un film (21) afin d'obtenir le film tubulaire.

4. Procédé selon la revendication 2, l'étape de fourniture de l'emballage scellé (24') comprenant :

le positionnement d'un film tubulaire (21) autour du produit (20) à emballer
créant, au niveau d'un poste de scellage (3), un premier joint sur le film tubulaire (21), formant de là un emballage semi-scellé (23) contenant le produit (20), et
créant, au niveau du poste de scellage (3), un second joint sur le film tubulaire (21), formant de là l'emballage scellé (24') contenant le produit (20), et créant éventuellement un joint longitudinal le long d'un film (21) afin d'obtenir le film tubulaire.

5. Procédé selon l'une des revendications précédentes, le positionnement relativement de l'emballage (23, 24') et du caisson de vide (353) comprenant :

le déplacement du premier élément (351) du caisson de vide (353) et/ou le déplacement du second élément (352) du caisson de vide (353) l'un par rapport à l'autre, et
le déplacement de l'emballage et/ou le déplacement du caisson de vide (353) l'un par rapport à l'autre.

6. Procédé selon l'une des revendications précédentes, l'ajustement de l'espacement comprenant :
le déplacement du premier élément (351) du caisson de vide (353) et/ou le déplacement du second élément (352) du caisson de vide (353) l'un par rapport à l'autre.

7. Procédé selon l'une des revendications précédentes, l'ajustement de l'espacement comprenant :

la présentation à l'ouverture (354) d'une hauteur de 8 à 20 fois une épaisseur du film (21), ou
la présentation à l'ouverture (354) d'une hauteur de 1,0 mm ou moins, préférablement de 0,8 mm ou moins, de manière préférée entre toutes de 0,5 mm ou moins, ou
la présentation au niveau de l'ouverture (354) d'une hauteur comprise entre 0,3 mm et 1,0 mm, préférablement entre 0,3 mm et 0,8 mm, de manière préférée entre toutes entre 0,3 mm et 0,5 mm.

8. Procédé selon l'une des revendications précédentes, la création de la pression de vide interne à l'intérieur du caisson de vide (353) comprenant la création d'une pression de vide interne comprise entre 800 mbars et 500 mbars, préférablement entre 750 mbars et 525 mbars, de manière préférée entre toutes entre 700 mbars et 550 mbars.

9. Procédé selon l'une des revendications précédentes, comprenant en outre la fourniture à l'intérieur du film (21) et/ou de l'emballage (23, 24') d'un gaz protecteur, éventuellement le gaz protecteur contenant sensiblement du CO_2.

10. Procédé selon l'une des revendications précédentes, comprenant en outre la fourniture d'un second caisson de vide et, éventuellement, le fonctionnement du second caisson de vide sensiblement en parallèle au caisson de vide (353).

11. Procédé selon la revendication précédente, les étapes :

- d'ajustement de l'espacement entre le premier et le second élément (351, 352) du caisson de vide (353) pour porter le premier et le second élément (351, 352) en la première configuration, ouvrant de là le caisson de vide (353), et

- d'ajustement d'un espacement entre le premier et le second élément du second caisson de vide pour porter le premier et le second élément du second caisson de vide en une seconde configuration, dans laquelle le premier et le second élément du second caisson de vide se trouvent, excepté pour une ouverture du second caisson de vide, sensiblement en contact hermétique l'un par rapport à l'autre,

étant exécutées sensiblement en même temps.

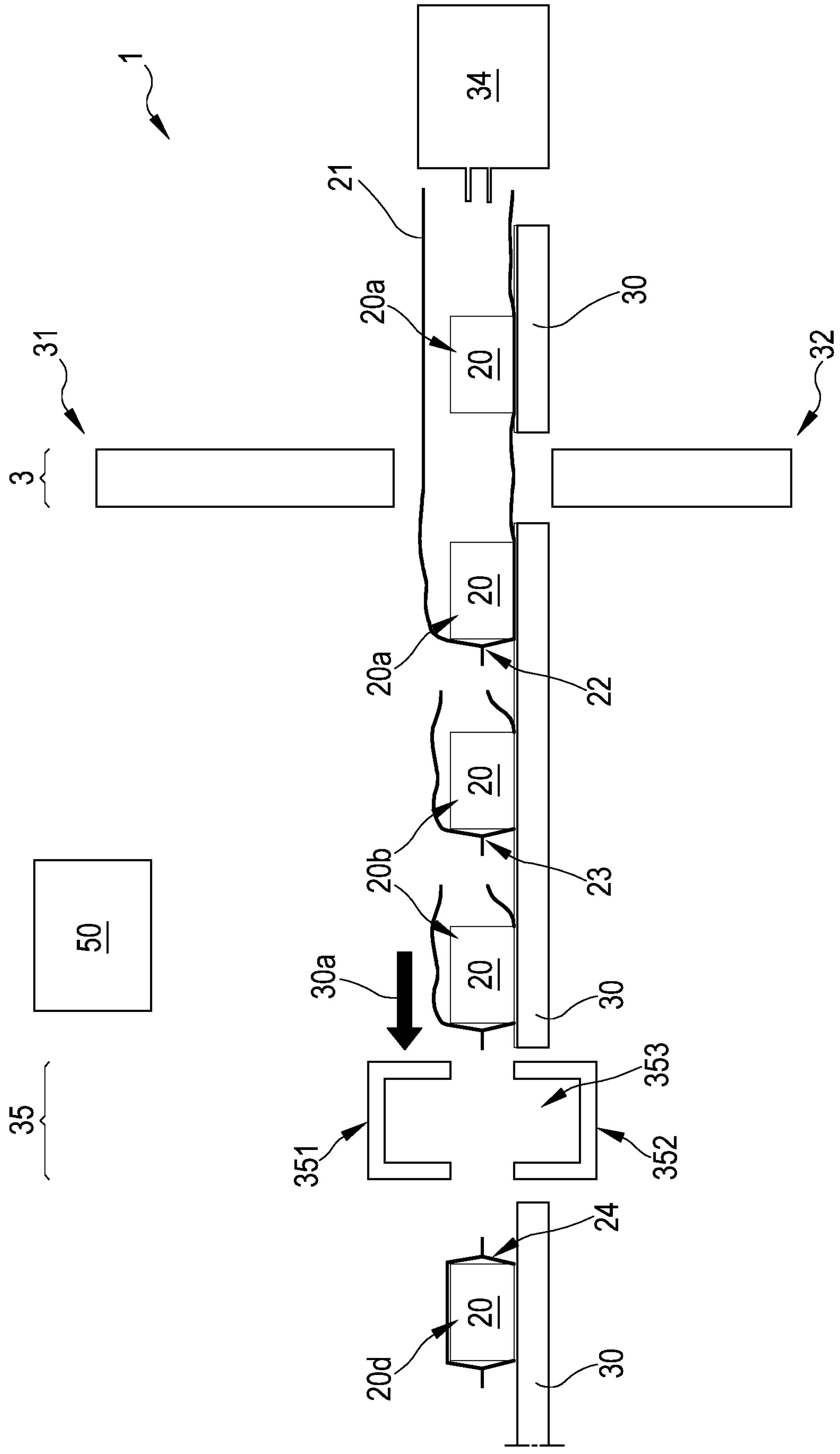

1
34
21
20a
20
30
31
3
32
20a
20
22
20b
20
23
20b
20
30a
30
50
35
351
352
353
24
20d
20
30

FIG.1

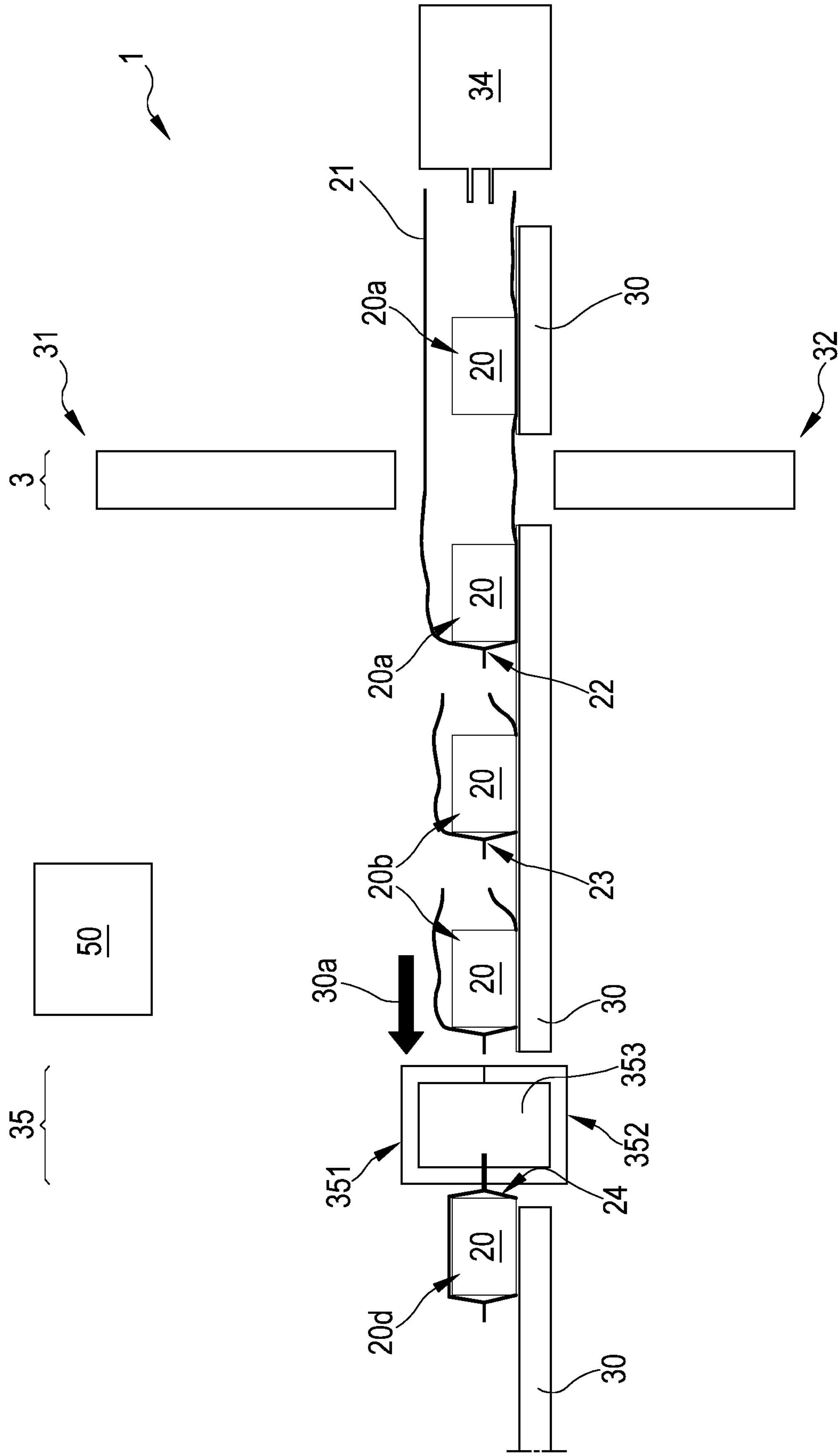

1
34
21
20a
20
30
31
32
3
20
20a
22
20
20b
23
50
20
30a
30
35
353
351
352
24
20
20d
30

FIG.2

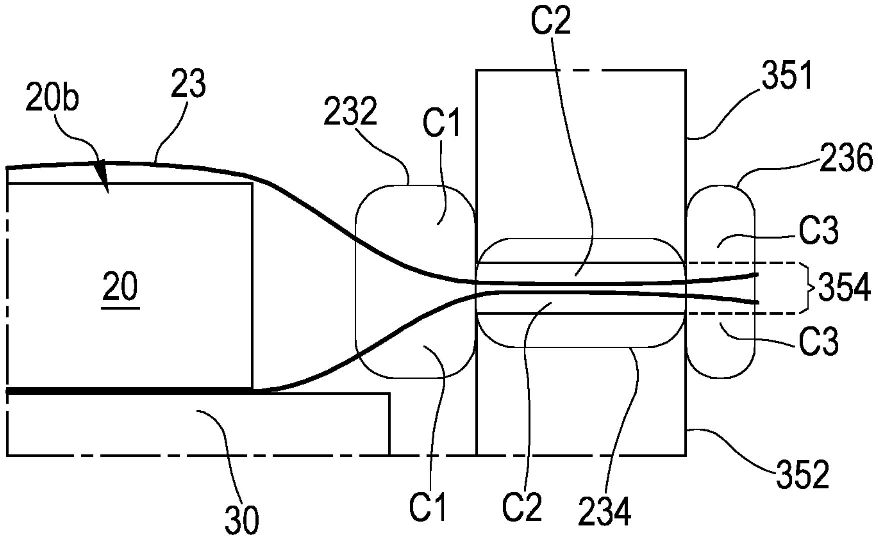

C2
351
20b
23
232
C1
236
C3
20
354
C3
30
C1
C2
234
352

FIG.3

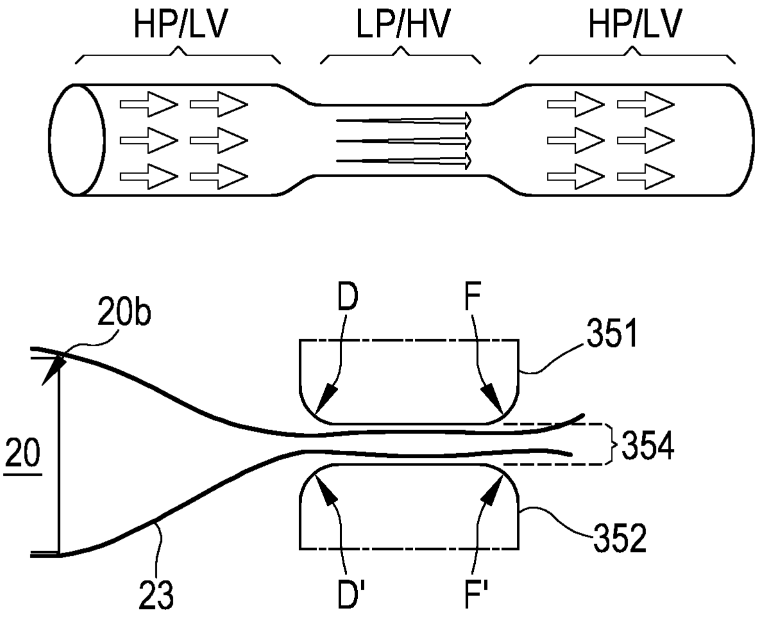

HP/LV
LP/HV
HP/LV
20b
D
F
351
20
354
352
23
D'
F'

FIG.4

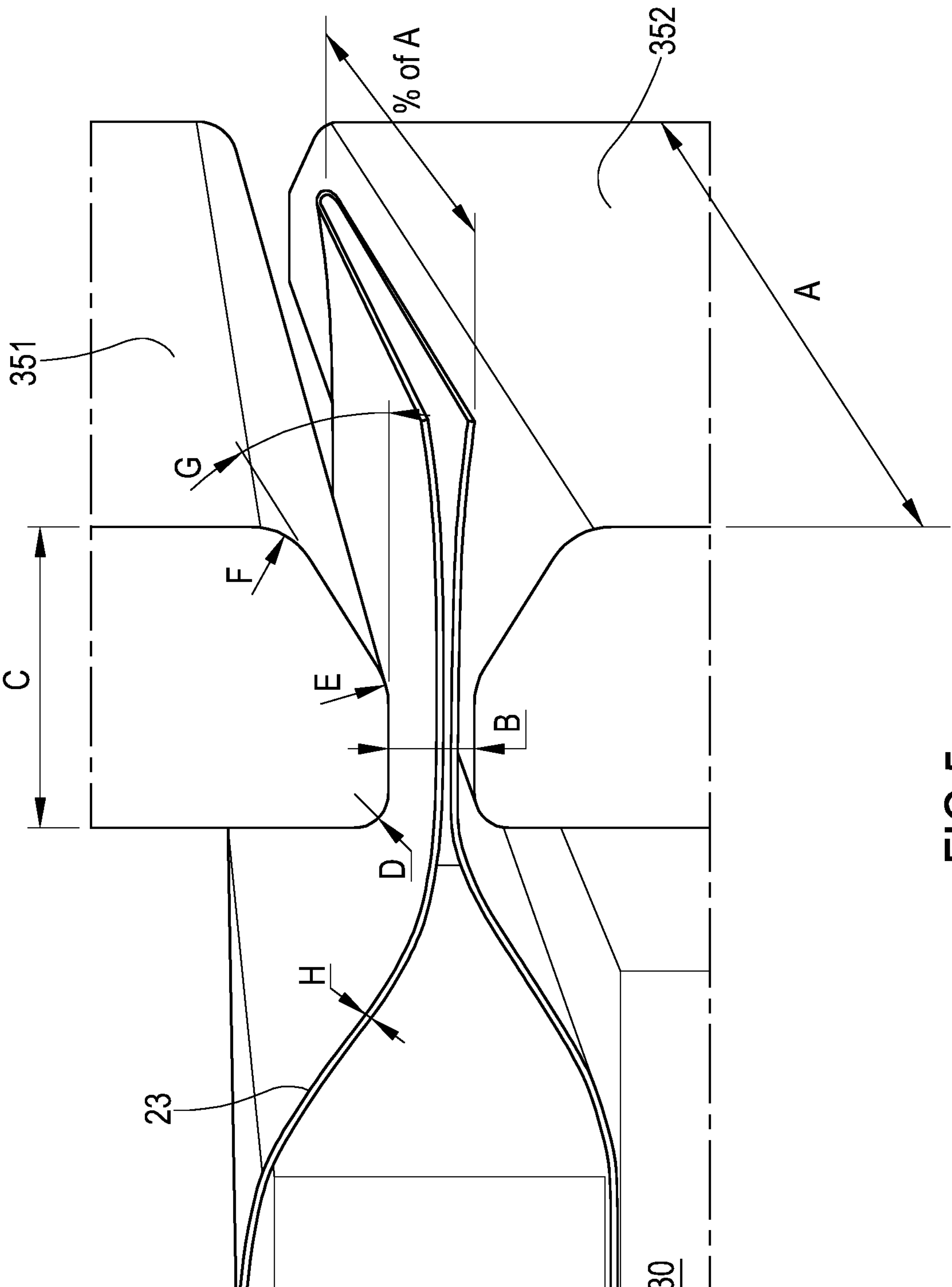


FIG.5

FIG.6

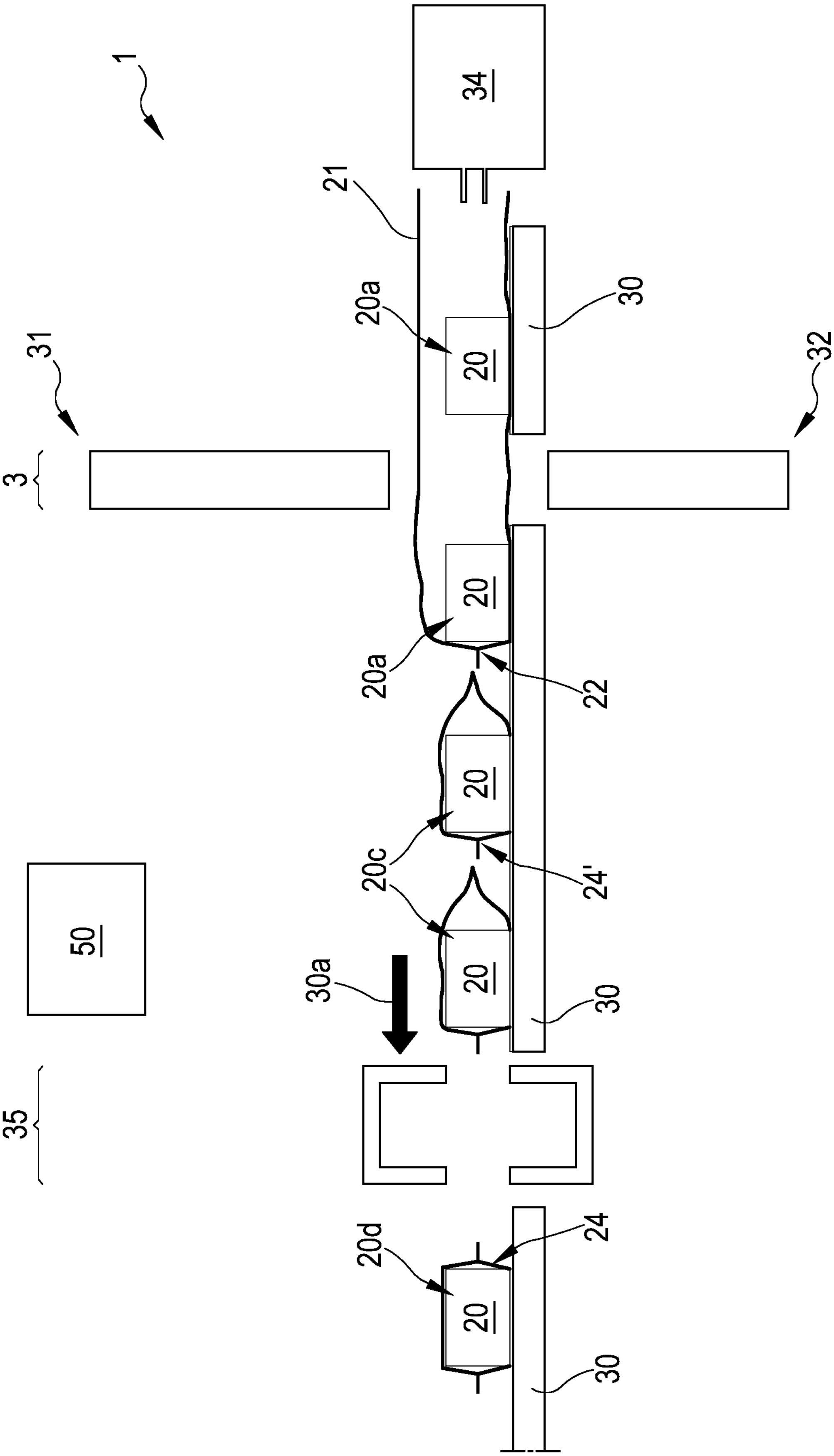

1
34
21
20a
30
31
32
3
20
20
20a
22
20c
20
24'
20c
20
50
30a
30
35
20d
24
20
30

FIG.7

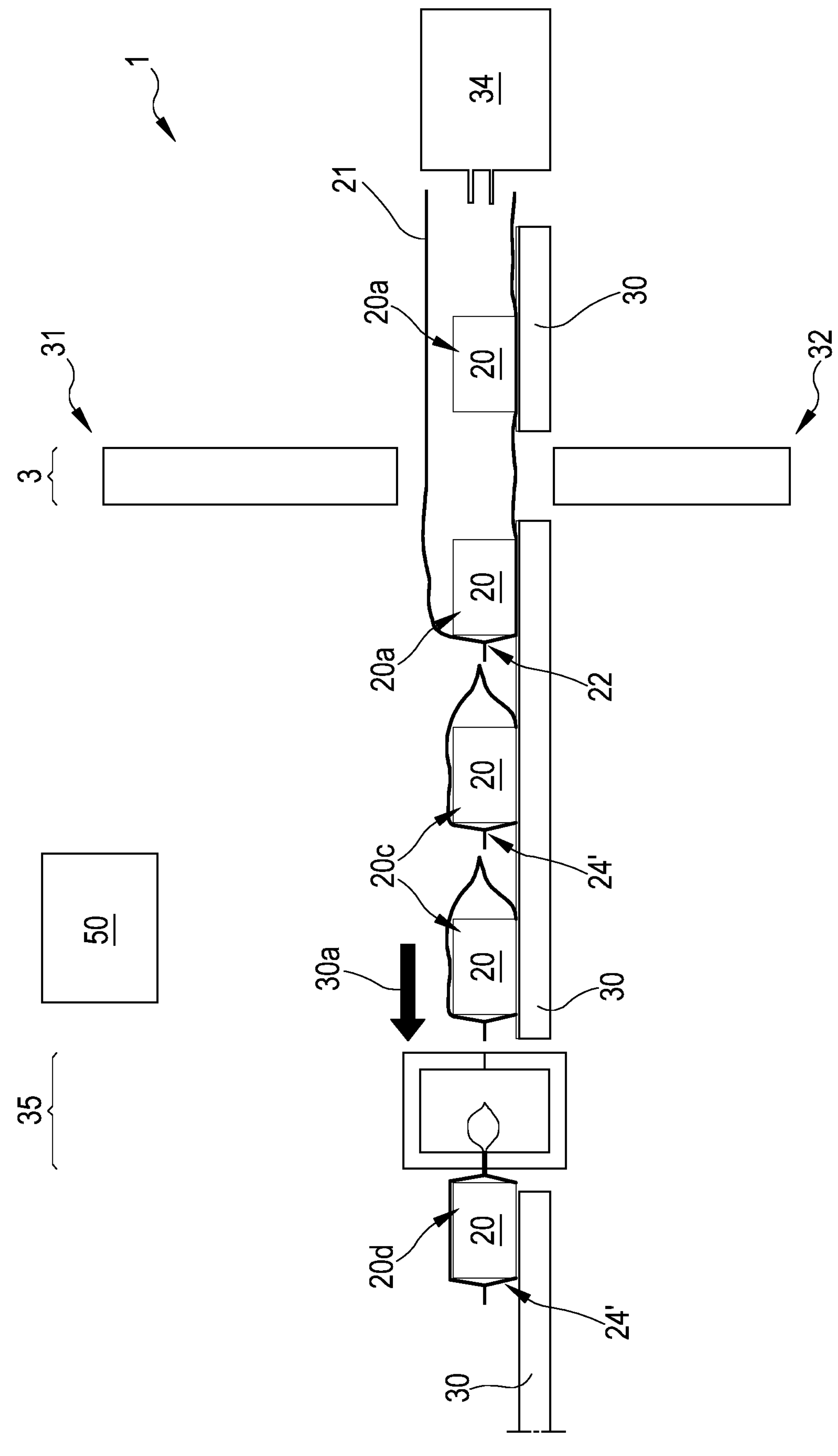

1
34
21
20a
20
30
31
32
3
20
20a
22
20
20c
24'
50
30a
20
30
35
20
20d
24'
30

FIG.8

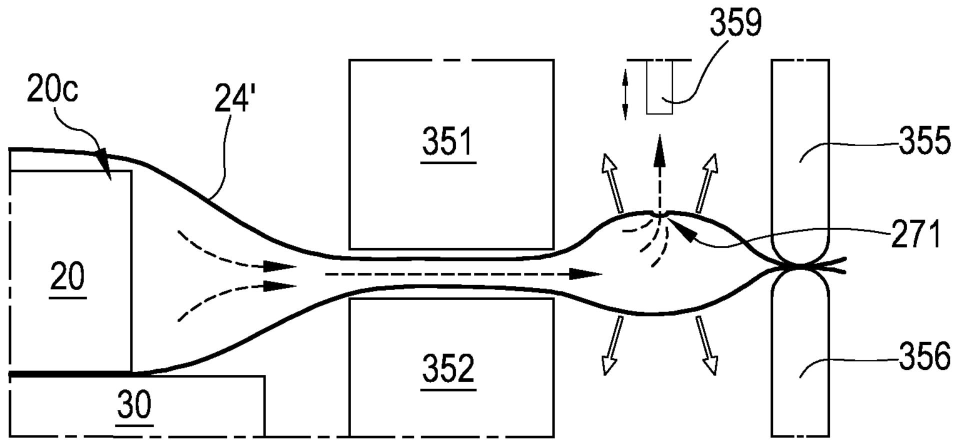


FIG.9

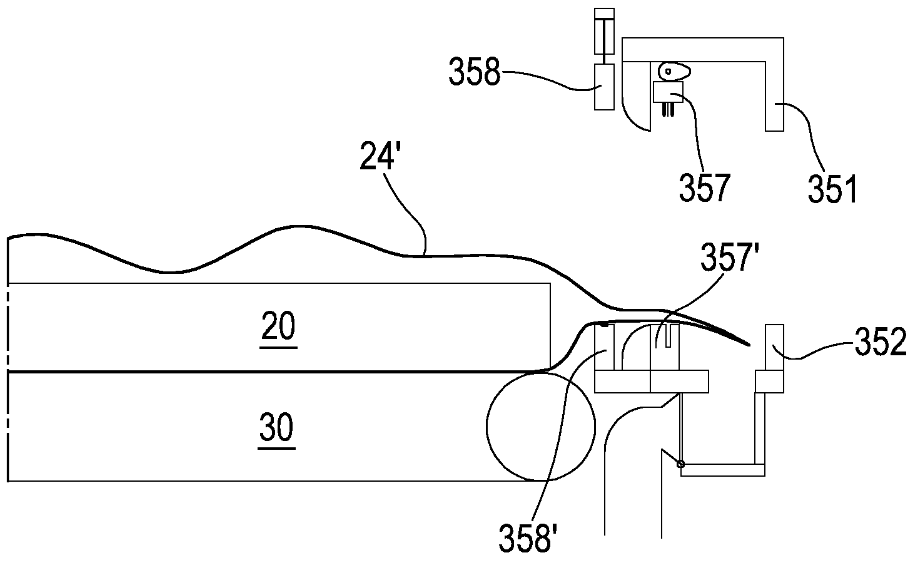
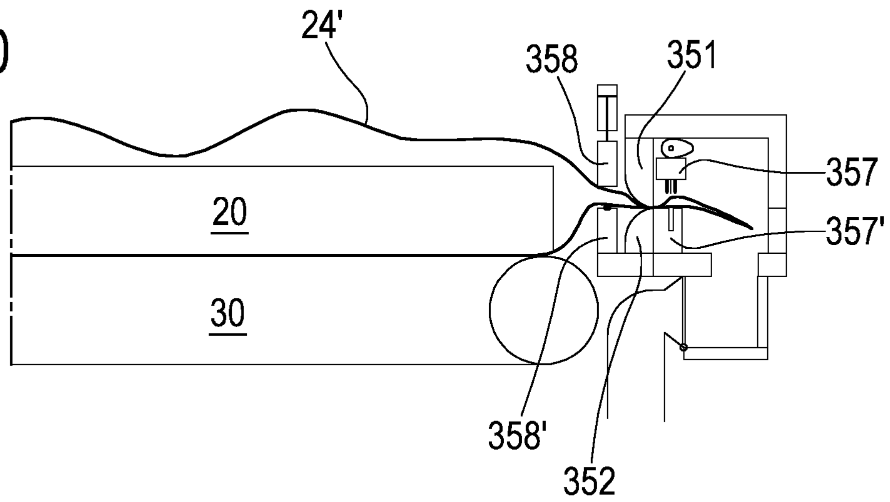


FIG.10



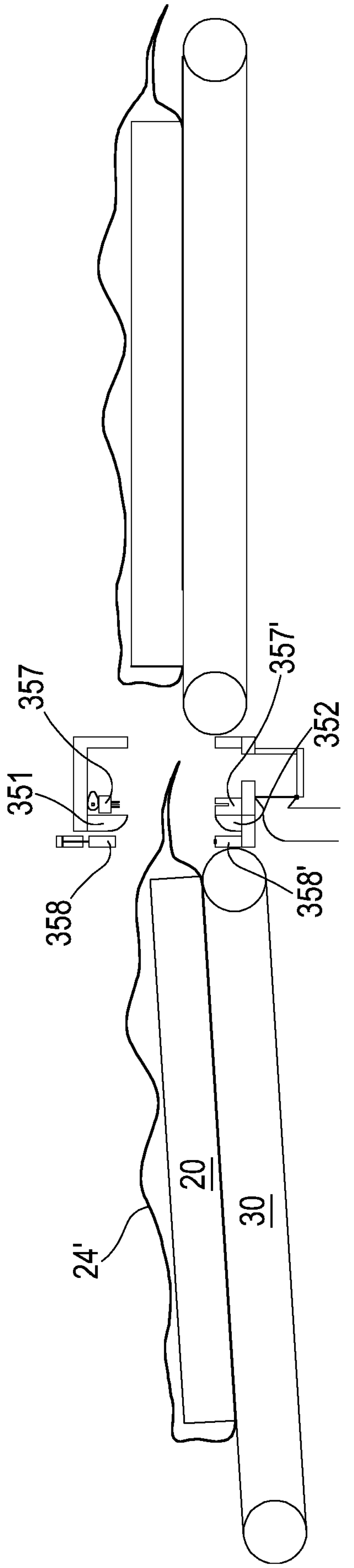


FIG.11A

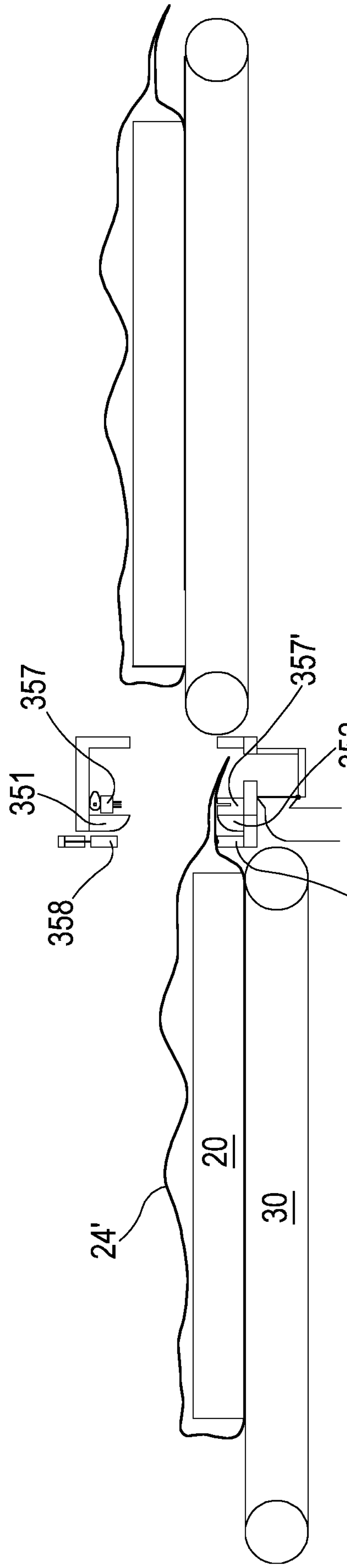


FIG.11B

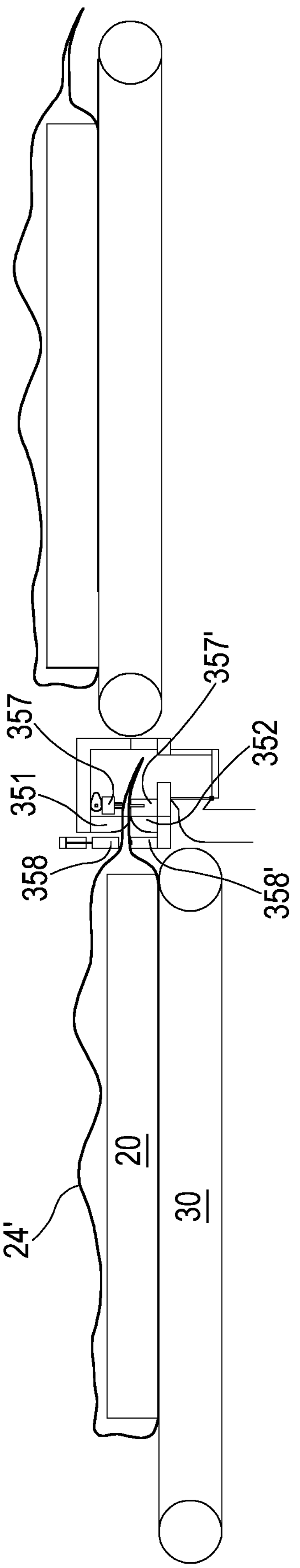


FIG.11C

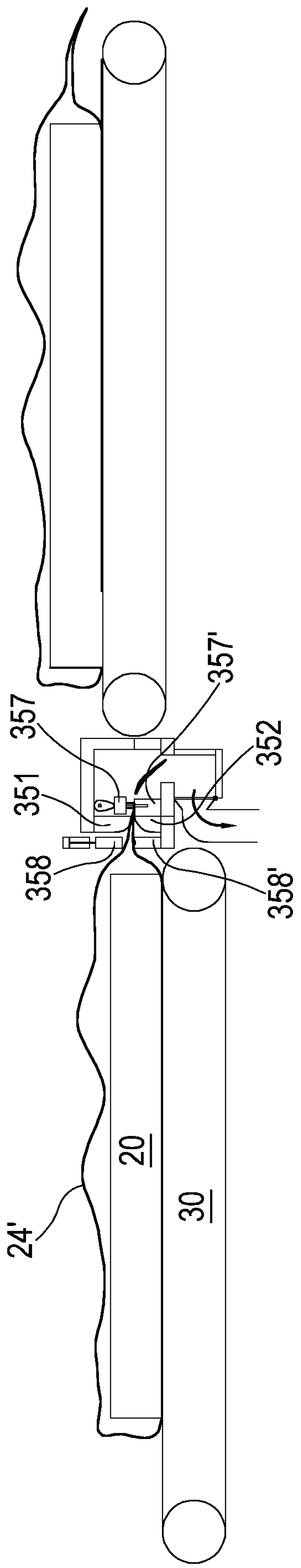


FIG.11D

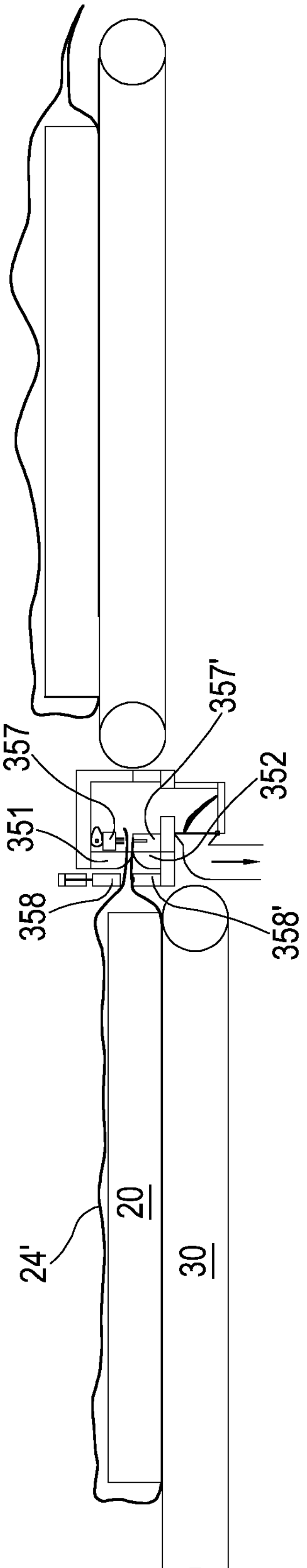


FIG.11E

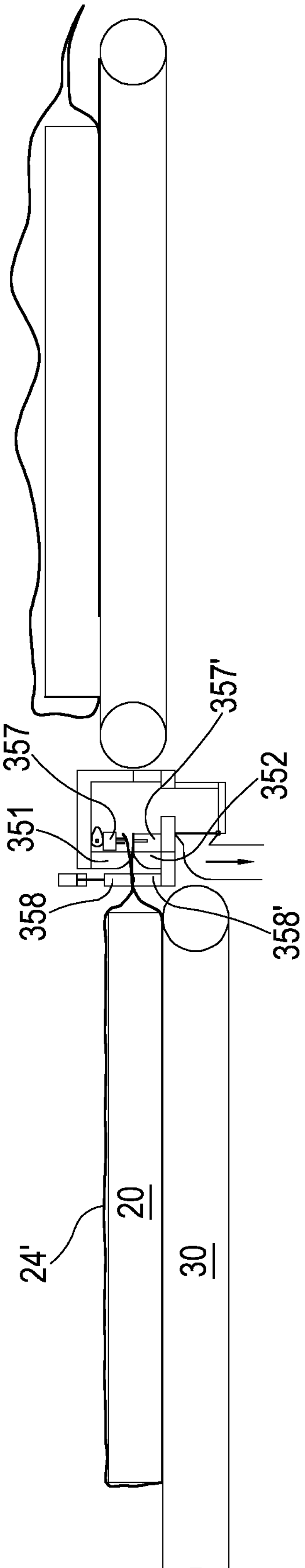


FIG.11F

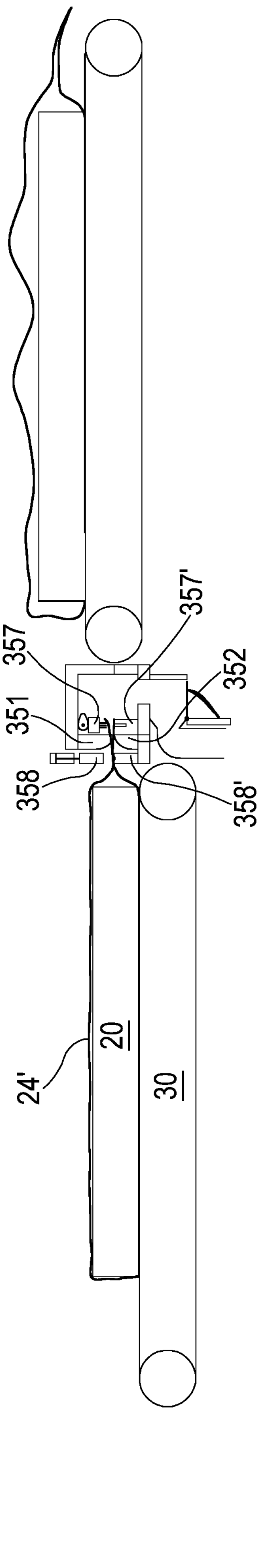


FIG.11G

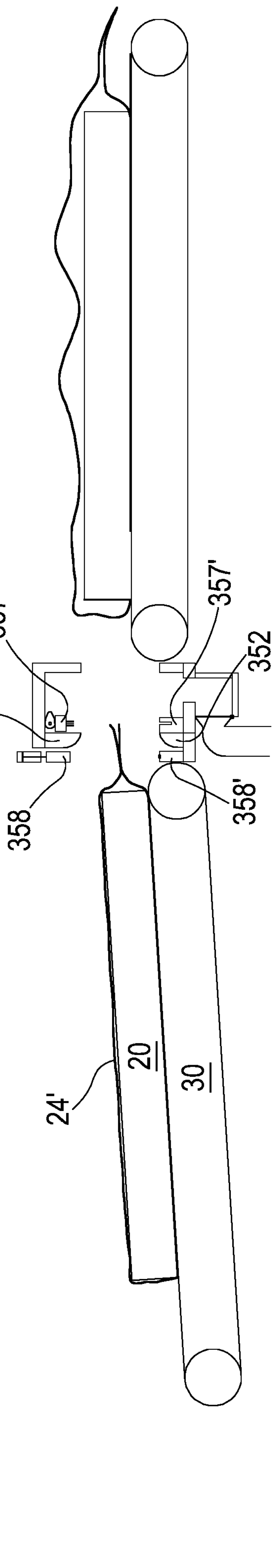


FIG.11H

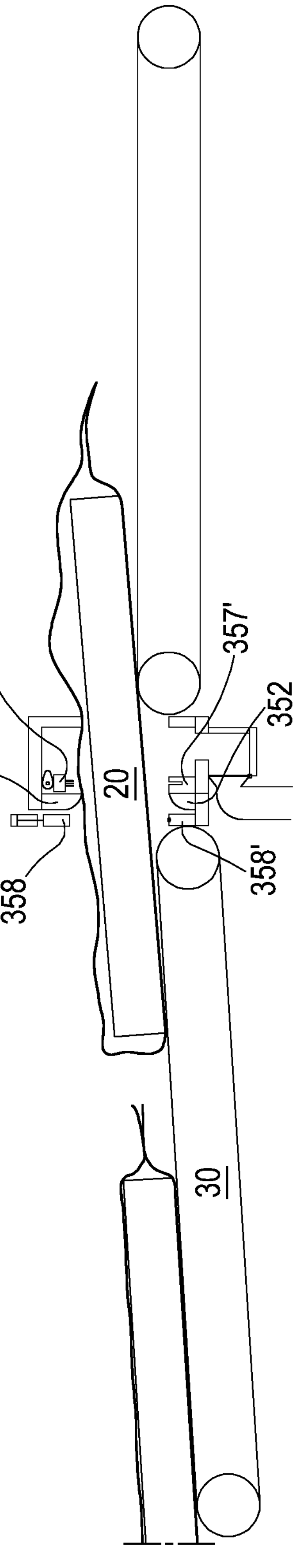


FIG.11I

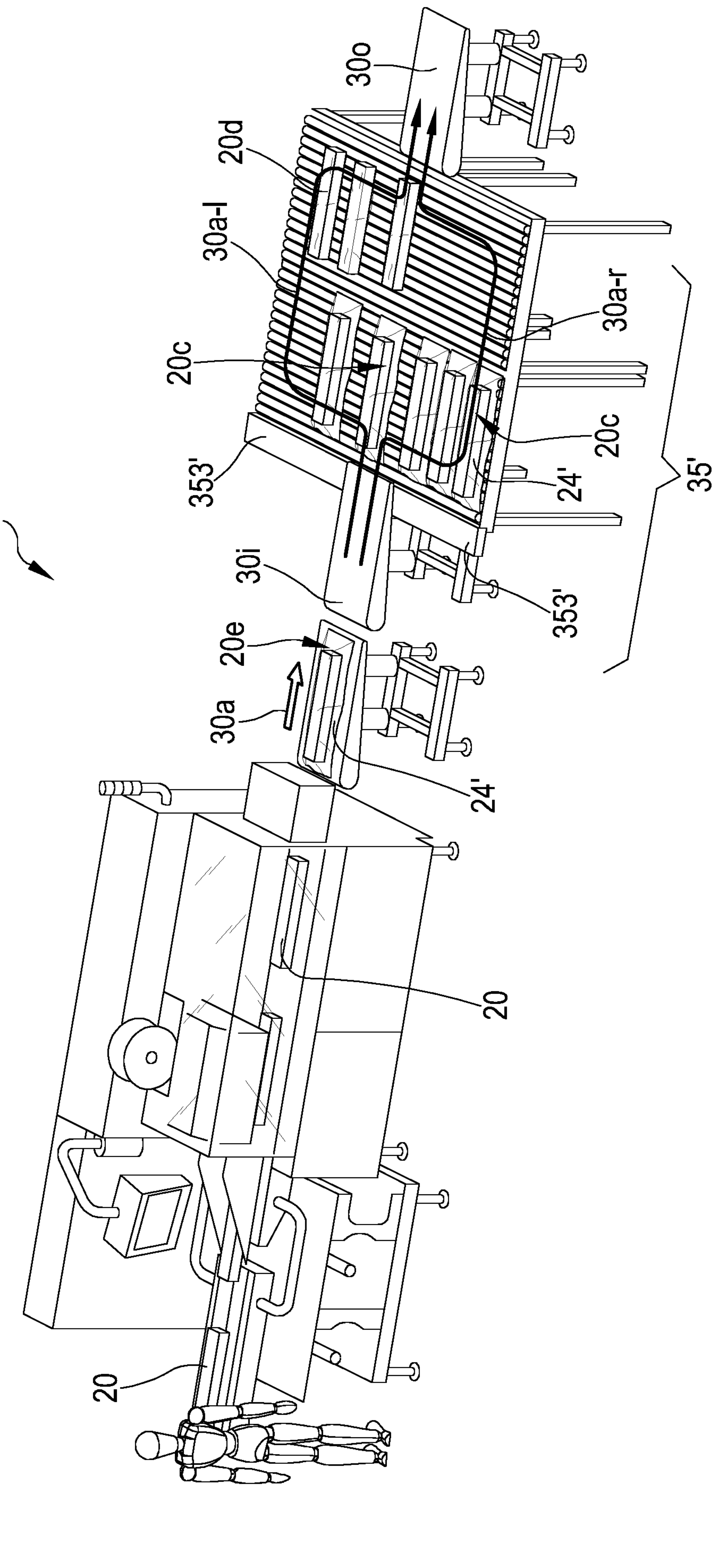


FIG.12

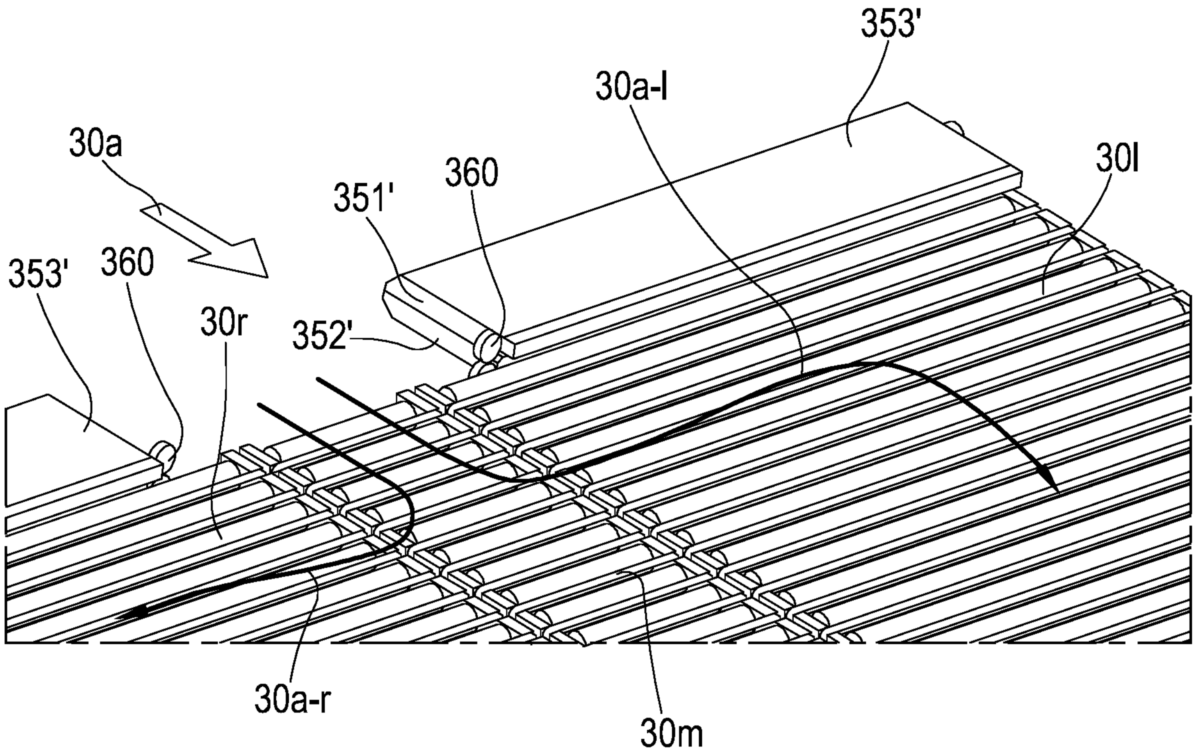


FIG.12A

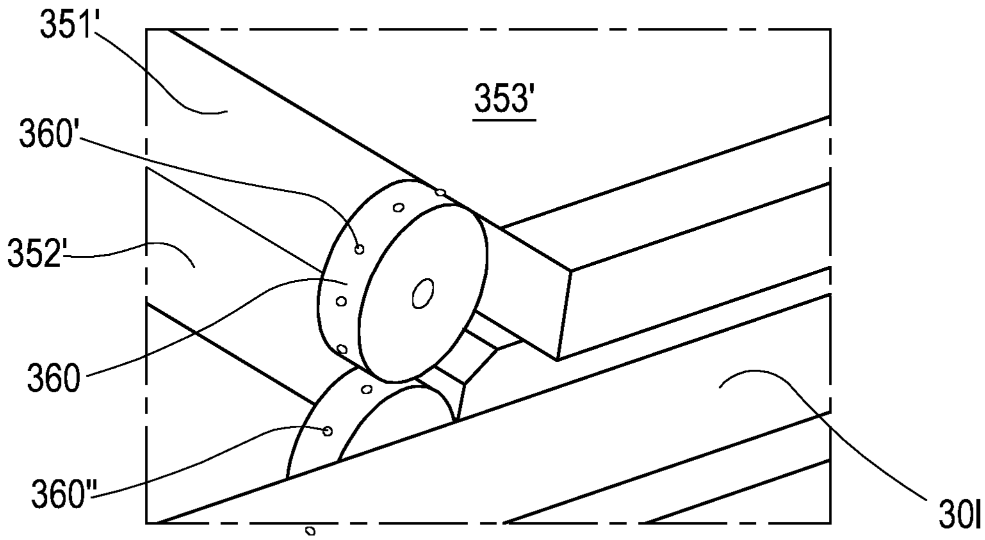


FIG.12B

REFERENCES CITED IN THE DESCRIPTION

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