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(54) Packaging process and packaging apparatus

(57) A packaging process and a packaging apparatus are provided. The packaging process comprises the steps of directing towards a semi-sealed package containing a product (20) to be packaged a flow of gas (17) and creating relative motion between the outlet (16) of the gas flow and the semi-sealed package such that the flow of gas passes the semi-sealed package, thereby compressing it and expelling gas present within the package. The packaging apparatus comprises a gas blower (13), an outlet (16) coupled to the gas blower (13), and a means for moving the semi-sealed package (30). The means for moving (30) are configured to move the semi-

sealed package, thereby creating relative motion between the outlet (16) and the semi-sealed package such that the flow of gas (17) passes the semi-sealed package, thereby compressing and expelling gas present within the semi-sealed package. The apparatus can further comprise a housing (11), for example in the shape of a tunnel. Further, the housing can be arranged in a fixed position with respect to the operating region. In particular, the housing can be configured to contact the means for moving (30) in a substantially sealed manner or it can have a tubular shape configured to encompass the means for moving (30).

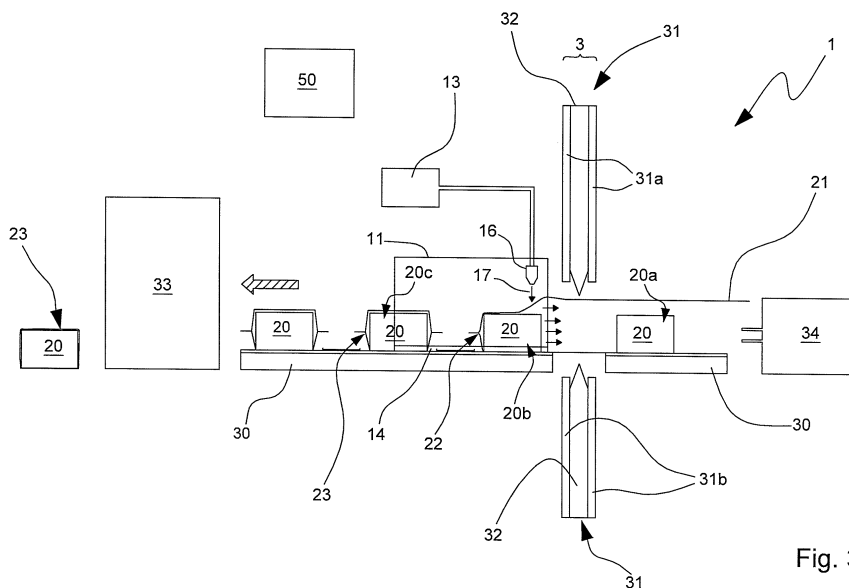


Fig. 3

Description

Technical Field

[0001] The present invention relates to a packaging process and a packaging apparatus. The packaging process includes moving a packaged product through an air curtain in order to expel excess gas from within the package prior to sealing. The packaging apparatus can advantageously comprise a tunnel-shaped housing in order to intensify or concentrate the flow of air. Heat shrinking can also be applied.

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 is 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] 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.

[0004] Sealing jaws can be used to seal one end of the package. The sealing jaws also form an adjacent seal, which comprises the opposite end of the next following package. Gas can be trapped in the package in the space between the product and the film after sealing both ends. The problem is how to reduce the amount of gas in the package prior to sealing the package.

[0005] It is desirable to deflate the package so as to reduce the package volume. Additionally, evacuation of the gas from the package can improve packaging appearance after heat shrinking and can also reduce the possibility of deterioration of the product due to exposure to oxygen or other gas. For example, some foods such as cheese can oxidise or mould over a period of time if a suitable atmosphere is contained within the package.

[0006] One way of deflating packages is to puncture or perforate the package with small holes before or after the goods are sealed therein. The small holes allow the excess gas within the package to be expelled, for example by mechanical application of force or simply by the force of gravity settling the products during shipment, or, preferably, by heat shrinking the packaging material. However, this particular solution to the problem has disadvantages, for example when foods are contained within the package. The pinholes allow the ingress of con-

taminants or environmental air from outside the package, for example containing oxygen. Stickers can later be used to cover the pinholes.

[0007] Another way of deflating packages is to provide a vacuum drawn on the inside of the package or container through the fill opening. The vacuum extracts the excess air or other gas and collapses the plastic sidewalls prior to the sealing of the opening. However, use of this system will slow the process due to the time required to evacuate gas from the package. These systems further require the installation of equipment within the fill tube to close the tube off from the environment. This additional equipment can reduce the tube diameter, which may cause plugging due to product bridging. Further, the additional equipment renders the apparatus and its operation more complex and expensive.

[0008] A further way of deflating packages is to provide mechanical force directly to the outside of the package before the sealing takes place. Examples of this are sponge rubber or coiled springs which engage the outside of the package to expel excess gas prior to the time the sealing jaws engage and seal the fill opening.

[0009] However, the surfaces of the product within the package are often irregular and, thus, tend to cause uneven wear of the foam rubber and uneven elongation of the springs. As a result of the uneven wear and deterioration from the close proximity to the heated sealing elements, the long term manufacturing standards may not be maintained at a desired level. Additionally, fragile products are easily crushed by exterior mechanical applications of force. Additional drawbacks of using mechanical force via sponge rubber can include poor hygiene due to difficulties of cleaning porous material such as sponges, thereby providing ideal media for bacterial growth. Further, the sponge or coils can push the film into contact with the product thereby changing the appearance of the product. For example, in the case of meat, blood may soil the interior of the film.

[0010] Further, variations of the product size can cause problems for mechanical deflators. When using mechanical deflators, correction of these variations requires a shutdown of the machine to modify the deflation force or position. This is because it is necessary to provide different pressure pads individually shaped for the packages and products to be processed.

[0011] US 4,964,259 discloses a process and apparatus for forming, filling, sealing and deflating a package of goods prior to the time the fill opening is sealed. The system includes a blast of air against the exterior flexible sidewalls of the package thereby to bring the sidewalls of the package closer together before sealing, thereby to reduce the amount of trapped gas sealed in the package.

[0012] JP 2003-072702 discloses a bag-packing machine having a chamber. By the pressure of compressed air supplied into the chamber through an air hose, a bag is pressed to push out the air in the bag through the back edge, which is open.

[0013] DE 10 2009 017 993 discloses a packaging apparatus comprising a perforation unit which is configured to perforate the lower film in order to facilitate evaporation of gas, for example ethylene or CO₂, when packaging products that generate such gas during ripening. Also, such products may require a constant oxygen content while being packaged.

[0014] DE 10 2007 013 698 discloses a packaging apparatus comprising a means for providing a controlled atmosphere inside a package depending on a breathing property of the package product.

[0015] WO 2008/122680 discloses a packaging machine based on applying mechanical force to a film arranged around a product to be packaged by means of a tamper device and further on shrink wrapping the film around the product by means of an oven device. Excess air or gas is expelled both by means of the tamper device and by means of shrink wrapping.

[0016] US 5,590,509 discloses a process for packaging a product on a receptacle. The process includes blowing air heated to a temperature suitable for heat-shrinking the film onto an outer surface of the forward sealed end region of a tubing to pre-shrink the tubing and to expel gas. The process further includes stopping the heat shrinking before the film contacts the product by supplying a cold flow of air.

[0017] An aim of the present invention is to provide a packaging process in which gas is expelled from a package before sealing. Another aim of the present invention is to provide a packaging apparatus.

Summary of invention

[0018] According to the invention, there is provided a packaging process in which a tubular film is positioned around a product to be packaged, a first seal is created on the tubular film at a sealing station, thereby forming a semi-sealed package containing the product to be packaged and having a sealed end and an open end, a flow of gas is directed at the semi-sealed package by means of at least one gas flow outlet and relative motion in a first direction is created between the outlet of the gas flow and the semi-sealed package such that the flow of gas passes the semi-sealed package from the first sealed end to the second open end thereby compressing the semi-sealed package and expelling gas present within the semi-sealed package, and, at the sealing station, a second seal is created on the semi-sealed package spaced apart from the first seal, thereby forming a sealed package containing the product and having first and second sealed ends.

[0019] In another aspect, the first seal and/or second seals can be created transversal to the first direction, thereby creating first and/or second transversal seals. The process can further comprise a step of displacing the product to be packaged along a predefined path from a loading station to the sealing station.

[0020] In another aspect, the gas flow outlet can be

positioned outside the semi-sealed package, such that said flow of gas impacts on an external surface of the semi-sealed package. The process can further comprise a step of heat shrinking the semi-sealed package and/or the sealed package. The relative motion can be created by means of a conveyor belt and the process can further comprise a step of supporting the semi-sealed package and/or the sealed package on the conveyor belt. The flow of gas can be continuous over time.

[0021] In another aspect, the process can further comprise the step of varying the pressure and/or volume of the flow of gas while the flow of gas passes the semi-sealed package. The flow of gas can have a temperature substantially lower than a temperature required for effecting heat shrinking of the semi-sealed package and/or the sealed package. Alternatively, the flow of gas can have a temperature of 130°C to 200°C. In this embodiment the heat shrinking effected by the flow of gas can contribute to the expulsion of air effected by the compression of the film due to the air flow.

[0022] In another aspect, the process can include filling the semi-sealed package with an inert gas.

[0023] In another aspect, directing the flow of gas towards the package can comprise adjusting a distance in a second direction between the outlet of the gas flow and the semi-sealed package depending on the relative motion, the second direction being perpendicular to the first direction. The gas flow can comprise a first gas having a first temperature and a second gas having a second temperature, wherein the first temperature is higher than the second temperature. The gas flow can comprise a first component directed at the semi-sealed package at a first angle and a second component directed at the semi-sealed package at a second angle. The gas flow can comprise a third component directed at the semi-sealed package at a third angle, wherein the first, second, and third angles are different from each another.

[0024] In another aspect, the process can include directing a second gas flow by means of a second outlet towards the semi-sealed package, the second gas flow passing the semi-sealed package from the first end of the semi-sealed package to the second end of the semi-sealed package, wherein the second outlet is arranged longitudinally along the first direction at a second position different from a position of the outlet; and varying a pressure and/or volume of the gas flow of gas and a pressure and/or volume of the second gas flow while the gas flow and the second gas flow pass the package.

[0025] In another aspect, the outlet and/or the second outlet can be comprised in a housing. The housing can optionally have the shape of a tunnel.

[0026] According to the invention, there is provided a packaging apparatus comprising a control unit; a loading station configured to position a tubular film around a product to be packaged; a sealing station coupled to the control unit, the control unit being configured to control the sealing station to create a first seal on the tubular film, thereby forming a first sealed end and creating a semi-

sealed package containing the product to be packaged, the semi-sealed package having a second open end; a gas blower coupled to the control unit, the control unit being configured to control the gas blower to supply a gas flow of gas to an outlet, the outlet being coupled to the gas blower; a means for moving the semi-sealed package, the means for moving being coupled to the control unit, the control unit being configured to control the means for moving to move the semi-sealed package, thereby creating relative motion in a first direction between the outlet and the semi-sealed package such that the flow of gas passes the semi-sealed package from the first sealed end to the second open end, thereby compressing the semi-sealed package and expelling gas present within the semi-sealed package; wherein the control unit is further configured to control the sealing station to create a second seal on the tubular film, thereby sealing the second open end, forming a second sealed end spaced apart from the first sealed end, and creating a sealed package containing the product to be packaged.

[0027] In another aspect, the packaging apparatus can further comprise a housing configured to encompass the outlet. The housing can be a tunnel having a longitudinal axis extending along the first direction. The housing can comprise means for controlling a temperature inside the housing. The housing can be arranged in a fixed position with respect to the operating region.

[0028] In another aspect, the packaging apparatus can further comprise a housing configured to contact the means for moving in a substantially sealed manner. Alternatively, the packaging apparatus can comprise a housing having a tubular shape and configured to encompass the means for moving. For example, the housing can have a tubular, funnel, or duct shape and be configured to encompass (i.e. surround laterally) the means for moving for a length of tract along the direction of movement provided by the means for moving.

[0029] In another aspect, the packaging apparatus can further comprise one or more additional outlets arranged along the first direction. The apparatus can comprise an actuator configured to move the outlet and/or additional outlets in a second direction perpendicular to the first direction. The apparatus can comprise a control unit coupled to the gas blower and configured to control the means for moving, and/or control the flow of gas. The control unit can be configured to control the flow of gas depending on a relative motion between the outlet and the package. The outlet can be configured to direct the flow of gas towards the operating region at a first angle and at a second angle, the first and second angles being different from each other.

[0030] In another aspect, the packaging apparatus can further comprise means for filling the inside of the package with an inert gas. The means for moving the package can comprise a conveyor belt configured to support the semi-sealed package and/or the sealed package. The outlet and/or additional outlets can comprise one or more nozzles.

[0031] Advantages of the packaging process and the packaging apparatus include an alternative and more efficient method of removing excess gas from a packaged product. A more efficient expulsion of gas can be effected by a more precisely directed flow of gas towards the semi-packaged product. In addition, a housing can serve to increase and maintain a desired pressure outside of the semi-packaged product in order to optimize gas expulsion. The individual distribution and/or arrangement of outlets/nozzles can provide for a gas flow that affects the semi-packaged product in a manner optimized for gas expulsion. For example, additional outlets (holes) in the means for moving the product (e.g. a conveyor belt) can provide for gas flow from the bottom, whereas the outlets/nozzles provide for gas flow from the top and sides, in combination providing an area of increased pressure surrounding the product.

[0032] The expulsion of gas can be effected in a manner optimized for a packaging line in which products are continuously fed through a packaging apparatus. In such an embodiment, the gas flow passes the semi-packaged products from one end to another end in a one-pass manner, thereby providing an application of increased pressure effecting the expulsion of gas from inside the semi-package towards an open end in an effective manner not requiring an interruption of the movement of the products to be packaged. Further, a complex mechanical motion of different components of the packaging apparatus (e.g. oscillating up/down and horizontally) is not required in some embodiments. In some cases, it might be desirable to expel gas from inside the packaging without affecting the packaging material (e.g. by heat shrinking). In such cases, an optimized supply and distribution of a flow of gas directed externally at the packaging material as described above can be used.

[0033] In some embodiments, the expulsion of gas from the semi-packaged product is further intensified by a combination of the flow of gas and an application of heat shrinking to the packaging material. The heat shrinking can be effected by a flow of gas having a suitable temperature. The heat shrinking can alternatively be effected by a suitable heating device (e.g. by radiation from an electrical heater).

Brief description of drawings

[0034] Figures 1 and 2 depict a first embodiment of the present invention;

[0035] Figures 3 and 4 depict a second embodiment of the present invention, further including a housing;

[0036] Figures 5 and 6 show different arrangements of outlets 16.

[0037] Figure 7 depicts the second embodiment of the present invention, including an alternative embodiment of the housing;

[0038] Figures 8 to 10 depict an embodiment comprising a housing showing an alternative arrangement and connection between the gas blower 13 and the outlet 16,

as well as different configurations of outlet 16 comprising a plurality of individual nozzles;

[0039] Figures 11 to 13 depict prior art configurations of a closed chamber;

[0040] Figures 14 to 16 depict an embodiment comprising a housing showing an alternative arrangement and connection between the gas blower 13 and the outlet 16;

[0041] Figures 17 to 19 depict different types of outlets 16 comprising one or more nozzles; and

[0042] Figures 20 to 25 depict different arrangements of nozzles of one or more outlets 16.

Detailed Description

[0043] Figures 1 and 2 depict a first embodiment of the present invention. The packaging apparatus 1 comprises a loading station (not shown), a sealing station 3, a gas blower 13, an outlet 16, and means for moving 30.

[0044] Generally, the means for moving 30 are configured to move product 20 situated inside film 21 from the loading station towards and through the sealing station 3 and along outlet 16. While product 20 is being moved, blower 13 and outlet 16 cooperate to create an air curtain (or, generally, a gas curtain) that is configured to compress film 21 around product 20. The combination of the relative movement between the semi-packaged product 20 and outlet 16 and the gas flow from the outlet (e.g. the air curtain) expels air or gas contained inside tubular film 21 and around product 20 from the semi-sealed package 22 containing product 20. The expulsion of gas from inside the package can be effected in a one-pass manner, where the semi-packaged product passes underneath the air curtain and the gas inside the semi-sealed package is expelled from the sealed end to the open end of the semi-sealed package. Due to the relative motion and from the view of the product 20, the air curtain passes over the semi-packaged product and the gas inside the semi-sealed package is expelled in the same way as described. The above is explained in more detail in the following paragraphs.

[0045] The product to be packaged 20 can assume different states (20a, 20b, 20c) of being packaged. States 20a, 20b, 20c denote product 20 being in different packaging stages. For example, state 20a denotes product 20 positioned inside tubular film 21, state 20b denotes semi-packaged product 20, and state 20c denotes packaged product 20.

[0046] In state 20a, a 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 can be carried out at the loading station.

[0047] The sealing station 3 comprises a sealer 31 configured to seal the packaging. Sealer 31 is configured to create a first seal on film 21, thereby creating a semi-sealed package 22 containing product 20 in state 20b.

Product 20 in state 20b is situated inside film 21 whereas semi-sealed package 22 comprises a sealed end and an open end. The open end can be situated opposite the sealed end.

[0048] Sealer 31 is further configured to create a second seal on film 21, thereby creating a sealed package 23. Product 20 in state 20c is situated inside film 21 whereas sealed package 23 comprises a first sealed end and a second sealed end. The first and second sealed ends can be situated opposite each other.

[0049] Sealer 31 can be configured to create both seals at once. For example, sealer 31 can create the second seal of a first product and the first seal of a second product at substantially the same time, whereas the first product is then contained in a sealed package and the second product is then contained in a semi-sealed package.

[0050] When the product 20 is in state 20c, i.e. product 20 is contained in sealed package 23, the interior of the sealed package 23 is isolated from the exterior of the package. The sealer 31 can comprise one or more sealing bars 31 a and 31 b. The sealer 31 can further be configured to form a transversal seal in the packaging. A transversal seal denotes a seal oriented substantially transversal to a longitudinal extension of film 21 and to the direction of movement of the products. In the case of the packaging being supplied from a roll of film 21, the sealer 31 can form a transversal seal across the tube of film 21, substantially perpendicular to the length of film 21.

[0051] The means for moving 30 are configured to create relative motion between product 20 and outlet 16. For example, the means for moving 30 are configured to move product 20 through states 20a, 20b, and 20c, such that product 20 is moved from the loading station towards and through the sealing station 3 and towards and through the air curtain 17. The means for moving can comprise one or more conveyor belts. In particular, the means for moving 30 can comprise a conveyor belt, for example an exit belt. The exit belt may have a plurality of distributed holes in it, through which a gas (e.g. hot or cold air) may be injected to increase or intensify the air expulsion around product 20. This injection of gas/air is especially advantageous if product 20 is of irregular shape and/or is not being supported by a tray. The flow of gas directed at the semi-sealed package 23 through the holes in the exit belt can be part of the same flow of gas directed at the semi-sealed package 23 through outlet 16, for example the flow of gas provided by the gas blower 13. In some embodiments, the flow of gas directed through the holes is different from the flow of gas provided through outlet 16 (it can have, e.g., a different temperature or composition; it can be provided, e.g., at a different flow rate or pressure, etc.).

[0052] The gas blower 13 can comprise a fan. The gas blower 13 is connected to the outlet 16 and is configured to supply a flow of gas to and/or through outlet 16. The outlet 16 is configured to direct the gas flow supplied by the gas blower 13 towards the semi-sealed package 22

as product 20 moves along from state 20a to state 20b and state 20c.

[0053] The gas blower 13 can be configured to supply a gas flow in a manner substantially continuous over time. For example, the gas blower 13 can supply a constant gas flow. The gas blower 13 can further be configured to supply a gas flow varying over time in pressure and/or volume. The gas blower 13 can create a gas flow with high volume and low pressure. This can be defined in relation to a compressor, which creates a gas flow with low volume and high pressure.

[0054] The packaging apparatus 1 further comprises a control unit 50 (shown in FIGs. 1 and 3; not shown in FIGs. 2, 4, and 7). The control unit is connected to one or more components of the packaging apparatus 1, including the loading station, the sealing station 3, the sealing and cutting members 31 and 32, the means for moving 30, the gas blower 13, the outlet 16, the flusher 34, and the hot air tunnel 33 or shrink tunnel 33.

[0055] For reasons of clarity, the figures do not show individual connection lines between the control unit 50 and other components. It is understood that the 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.

[0056] The control unit 50 can be configured for commanding the transport along the predefined path, e.g. 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 command actuators of different components as described below, for example, in order to create transverse seals on the tubular film.

[0057] The control unit 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.

[0058] The control unit 50 can be connected to the gas blower 13 and be configured to send and/or receive control signals to/from the gas blower 13. The control unit 50 can further be configured to control the gas blower 13 to supply a constant or a variable gas flow to the outlet 16,

as described above. To this aim, the control unit can be configured to control a power driving the gas blower 13 and/or to control one or more valves controlling the gas flow towards the outlet 16.

[0059] In one aspect, the control unit 50 can be configured to control the gas blower 13 as described above depending on one or more signals received from one or more other components. For example, the control unit 50 can be configured to control the gas blower 13 in response to one or more signals received from the means for moving 30. This allows for controlling the gas flow (e.g. increasing or decreasing the gas flow) depending on the position and/or movement of product 20 with respect to the outlet 16 and/or the air curtain 17. For example, the gas flow can be increased when a first portion of a semi-packaged or sealed product 20 passes the air curtain and the gas flow can be decreased, when a second portion of the product 20 passes the air curtain 17.

[0060] In accordance with another aspect, the control unit controls the gas blower such that the gas flow supplied is not interrupted during packaging of a plurality of consecutively packaged products. This can serve to avoid generation of variable forces, which may compromise product positional stability.

[0061] The control unit 50 can be configured to control the means for moving 30. For example, the control unit 50 can be configured to increase and decrease an operating speed of the means for moving 30. The control unit 50 can further be configured to control the operating speed of the means for moving 30 depending on a position of products 20 with respect to the outlet 16 and/or the air curtain 17.

[0062] The control unit 50 can be configured to control the sealing member 31 and/or the cutting member 32.

The control unit 50 can further be configured to control the sealing member 31 and/or the cutting member 32 depending on a position of products 20 with respect to the outlet 16 and/or the air curtain 17. For example, the control unit 50 can be configured to activate the sealing member 31 and/or the cutting member 32 depending on a position of products 20 and/or tubular film 21 with respect to the outlet 16, air curtain 17, and/or sealing and/or cutting members 31 and 32.

[0063] In particular, in another aspect, 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 when one product 20 is in state 20a and another product 20 is in state 20b, such that between the two products 20 the first and second seals are created on the film 21, respectively.

[0064] The outlet 16 can be configured to create an air or gas curtain 17. The air curtain 17 can be directed in a

manner substantially perpendicular to the direction of relative motion between the product 20 and the outlet 16. The air curtain 17 can further be directed in a manner substantially normal to a plane of movement of product 20, for example at an angle of approximately 90° with respect to the plane of movement. The plane of movement can be defined by the means for moving 30. Alternatively, the air curtain can be directed in a manner substantially perpendicular to the direction of relative motion between the product 20 and the outlet 16, but at the same time be inclined in the direction of relative movement or opposite to the direction of relative movement, such that the air curtain impinges on the semi-sealed package 22 at an angle, such as an angle of 75° or less. FIG. 5, for example, shows two outlets 16a and 16b, whereas outlet 16b is arranged at an angle α of approximately 75° with respect to a plane parallel to the first direction (e.g. a plane on which products 20 are conveyed by means for moving 30). Angle α can substantially comprise any angle between 0° and 180°; for example, angle α can be 25°, 45°, 65°, 75°, 80°, 85°, or 90°. Further, angle α can be 95°, 100°, 105°, 115°, 135°, or 155°. Individual outlets 16, for example outlets 16a and 16b, can be arranged at individual angles, irrespective of the angle in which other outlets are arranged. FIG. 6 shows another arrangement of outlets 16, whereas the outlets are all arranged at the same angle. It is noted that FIGs. 5 and 6 show outlets arranged with respect to a housing 11. However, also in embodiments that do not have a housing 11 outlets 16 can be arranged at different angles as described above.

[0065] The above-described configuration of outlet 16b can also be used in a packaging apparatus 1 comprising only one outlet 16. The individual configurations of outlet 16b can further be used with respect to one or more additional outlets comprised in packaging apparatus 1.

[0066] As the semi-sealed package 22 passes underneath the outlet 16, the gas flow forming the air curtain 17 impinges on the semi-sealed package 22 in a substantially transversal manner, thereby impacting the width of the semi-sealed package 22. The high volume, low pressure gas flow creating the air curtain 17 compresses the tubular film 21 in a one-pass manner due to the relative movement of the semi-packaged product with respect to the outlet 16, such that the air curtain first impinges on the semi-sealed package 22 at the first sealed end and subsequently impinges on the semi-sealed package 22 increasingly towards the second open end of tubular film 21. Due to the compression of the tubular film 21 against product 20, air or gas contained inside the semi-sealed package 22 is expelled from inside the semi-sealed package 22.

[0067] When the product 20 has passed the air curtain 17 and the air inside the semi-sealed package 22 has been expelled, sealing member 31 creates the second seal at the open end of semi-sealed package 22, thereby creating sealed package 23 containing product 20. Sealing member 31 can, during the same operation, create

the first sealed end for the packaging of the subsequent product 20, which is in state 20a, situated inside tubular film 21, upstream of now sealed package 23, thereby creating a semi-sealed package 22 for the subsequent product 20. The mentioned control unit may control the blower to maintain a constant flow while sealing member creates the first and second transversal seals.

[0068] 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 20c, for example as packages 22 and 23, along a pre-defined path through the packaging apparatus 1. For example, the packaging apparatus comprises at least two conveyor belts 30 as shown in FIG. 1. A first conveyor belt 30 is configured to transport the product 20 and/or film 21 upstream of the sealer 31 and cutter 32. A second conveyor belt 30 is configured to transport the product 20 and/or packages 22 and 23 downstream of the sealer 31 and cutter 32.

[0069] The apparatus can further comprise a cutting member 32 integrated with the sealing member 31. The cutting member 32 is configured to separate the semi-sealed packages 22 from the sealed packages 23 when forming the first and second seals. As shown in FIG. 1, the sealing station 3 includes cutting members 32 and a separation of packages 22 and 23 is effected substantially at the same time when sealing the packages 22 and 23.

[0070] Alternatively, the cutting member 32 can be independent from the sealing member 31. In such a case, the separation of packages 23 is effected downstream of the sealing station. For example, a cutting station (not shown) operates in a similar manner as sealing station 3 downstream of sealing station 3 and is used to separate sealed packages 23 from one another.

[0071] Further, cutting members 32 and/or a cutting station arranged independent from sealing station 3 can be used to separate groups of packages 23, such that groups of packages 23 are separated. The cutting can also be effected that a semi-cut is created, which allows for later separation of products 23, for example by hand, whereas a connected band of products 23 is output by apparatus 1.

[0072] In another aspect, the control unit 50 can be configured to control the gas blower 13 to supply a continuous gas flow to outlet 16 and/or to control the means for moving 30 to maintain a continuous speed. This way, the gas flow towards outlet 13 is not interrupted, thereby eliminating undesired effects of a lack of gas flow on the packaging process, for example undesired folding up of film 21 and/or inflow of gas or air into semi-sealed package 22. Further, the movement of products 20 through the packaging apparatus 1 is not interrupted or effected in a stepwise manner, such that the output of the packaging apparatus, for example in terms of packaged products within a certain time frame, is increased. Also, some products are sensitive to acceleration/deceleration (e.g. fluids or some kinds of bulk goods, possibly contained in

an open container) such that a continuous movement is required.

[0073] According to the present invention, it is possible to evacuate a greater percentage of gas from the package 22 compared to using the systems of the prior art. In particular, in accordance with the present invention, it is possible to evacuate gas from packages carrying unsupported and/or soft goods, since the expulsion of gas is effected by a low pressure, high volume gas flow that does not impact the product to be packaged in the manner of a high pressure burst of gas configured to compress packaging for sealing as known in the art. This can be advantageous when packaging soft or delicate bulk goods sensitive to mechanical compression forces that could damage the goods. This can also be particularly important for unsupported products 20 such as cheese or processed meat chunks because in these cases a full contact package appearance is desirable. In general, a low pressure, high volume gas flow can be more suitable for products being processed in a tray, for example fluids, wet products, soft or semi-hard cheeses. A low pressure, high volume gas flow can further be useful to avoid flange distortion when using trays made from materials such as aluminium or cardboard, or other materials that can deform in a similar way during the packaging process.

[0074] The present invention allows gas to be evacuated from the package 22 without perforating the package. Therefore, there is no need to apply a barrier label later in the packaging process to seal the perforation. Hence the cost of packaging is not increased by the use of the barrier labels and the risk of contamination prevented.

[0075] The present invention is advantageous over systems that involve the use of mechanical pressure such as via a sponge or a foam pad. In particular, use of a foam pad, for example, is not hygienic because the foam pad can become contaminated, thus requiring periodical replacement. The foam pad (or other means for producing a mechanical force) has to make contact with the packaging (e.g. film 21) in order to expel the gas from the package. This can result in fouling of the packaging and compromises presentation. The present invention allows the gas to be expelled from the package 22 without compromising presentation. This is because none of the components of the housing 11 need to contact the packaging in order to expel the gas from the package.

[0076] According to the present invention, the gas is expelled from the package 22 by ventilation provided by the flow of gas applied in a one-pass manner. This is different from expelling gas by applying pressure to a particular portion of the package 22 via, for example, a single blast of air. The present invention is advantageous over such systems in that the flow of gas is applied in a one-pass manner substantially equally to the entire external exposed surface of the package 22. Hence, it is possible to expel gas from substantially every pocket within the package 22. In contrast, the use of a single blast of air is effective on only the portion of the package

22 that the blast of air is directed at.

[0077] According to the present invention, the flow of gas is provided a gas blower 13. The present invention provides advantages over systems using compressed air because the ventilation provided by the flow of gas provided by a gas blower is more reliable than the pressure increase provided by compressed air. For example, a high volume low pressure flow of gas provided by a gas blower can be maintained and controlled in a more reliable way than a high pressure low volume flow of gas provided by a system based on compressed air. This is in part due to the lower pressures involved and due to the lower complexity of the air circulation system, compressor(s), valves, etc. Further, the provision of compressed air can incur higher cost due to a more complex system of conduits and increased requirements as to individual components of the compressed air system, for example because of the higher pressures involved. However, the present invention can also be operated using compressed air.

[0078] Figures 3 and 4 show a second embodiment of the present invention, further including a housing 11. The housing can have the shape of a tunnel, whereas the housing provides two open ends in direction of the relative motion between packages 22 and 23 and the outlet 16. In general, the embodiment shown in FIGs. 3, 4, and 8 to 10, provides for a number of advantages. Depending on the actuation and movement of the housing 11 (or the housing being fixed), the housing 11 can alternatively have open or closed upstream or downstream ends. For example, if connected to a standard transversal seal carriage & pressure pad actuator (i.e. moving up/down and horizontally along the conveyor belt), the housing 11 can have both open and/or closed ends. In another example, if the housing moves horizontally with respect to the product to be packaged, the housing 11 can have open ends. In one example, the housing 11 is fixedly mounted over the means for moving (e.g. exit belt 30) and relative motion between the housing 11 and the product to be packaged is effected by the means for moving.

[0079] The housing 11 is configured to encompass a tract of the pre-defined path whereas the outlet 16 is arranged inside the housing 11. As seen along the length of the housing 11, the housing 11 can have any desired shape, for example rectangular, trapezoid, circular or a section thereof, elliptic or a section thereof, horseshoe-shaped, or any other suitable shape. The housing 11 may have any size according to the size of the package to be enclosed such that the packages 22 and 23 partly or fully covered by the housing 11.

[0080] The housing can further be in contact with the means for moving 30. The contact can be a sliding or slipping contact. Alternatively, the contact can comprise contacting means, for example one or more rollers. The housing 11 is arranged in a fixed manner with respect to the outlet 16. The housing is further arranged in a fixed manner with respect to the sealing station 3 and the loading station 4.

[0081] FIGs. 8 to 10 depict an embodiment comprising a housing showing an alternative arrangement and connection between the gas blower 13 and the outlet 16, as well as different configurations of outlet 16 comprising a plurality of individual nozzles.

[0082] In one aspect, the outlet 16 comprises a plurality of individual nozzles, which are configured to form an air curtain 17 that extends in two dimensions perpendicular to the vertical component of the gas flow. For example, the outlet comprises a number of nozzles aligned in a manner perpendicular to the first direction. The outlet 16 further comprises a number of rows of nozzles arranged in this way. The number of nozzles in each row can be different. Different arrangements of nozzles of one or more outlets 16 are also shown in FIGs. 20 to 25.

[0083] In another aspect, the outlet can comprise nozzles configured to direct air in a direction having a component transversal to the first direction. This configuration is shown, for example, in FIG. 9. Here, air curtain 17 comprises a plurality of components of gas flow that are arranged in one plane but are individually directed at the tubular film 21 and/or the product 20 in the way shown. Such a individual direction of gas flow components can be effected by individual configuration of nozzles.

[0084] FIG. 7 depicts the second embodiment of the present invention, including an alternative embodiment of the housing. In one aspect, the housing can further encompass the means for moving 30 and not be in contact with the same. In this case, the housing can have a tubular structure with the means for moving 30 arranged inside the housing, preferably opposite the outlet 16.

[0085] The housing 11 of the present invention can be simple, relatively inexpensive and is easy to maintain. In an embodiment the housing 11 is made of a thermoplastic such as PMMA (Poly(methyl methacrylate)). In an embodiment the housing 11 is substantially transparent. This allows a user to see the package 22 easily when it is housed by the housing 11.

[0086] For instance the housing 11 may have a length within the range of from about 0.2m to about 0.4m. The housing 11 may have a width within the range of from about 0.1 m to about 0.2m. The housing 11 may have a height within the range of from about 0.05m to about 0.2m.

[0087] In case the housing 11 contacts a horizontal surface of the means for moving 30, for example conveyor belt 30, the housing 11 can comprise a gasket 14 that extends along a part of an edge of an opening in the housing 11. The purpose of the gasket 14 is to form a seal between the part of the edge of the housing 11 and a facing surface (e.g. a conveyor belt 30) of the packaging apparatus 1. Desirably, the gasket 14 forms a gastight seal between the longitudinal edges of the housing 11 and the surface.

[0088] The gasket 14 can comprise an elastomer. However, the material or construction of the gasket 14 is not particularly limited. The gasket 14 should be able to form a seal with a facing surface.

[0089] The housing 11 can further comprise a heating member configured to effect heat shrinking of tubular film 21. The heating member can be realized as one or more additional outlets supplying gas at a temperature suitable for heat-shrinking tubular film 21. Alternatively, the heating member can be a conventional heating element, for example an electric heating element, supplying radiation at a temperature suitable for heat-shrinking.

[0090] The housing 11 can be configured and/or arranged to intensify the effect of the air curtain 17. For example, the housing 11 can prevent a lateral loss of volume from the gas flow and thereby intensify the impingement of the gas flow upon tubular film 21.

[0091] The housing 11 can be configured and/or arranged to facilitate and/or intensify the heat-shrinking process. For example, the housing 11 can prevent a loss of temperature and effect maintaining a temperature suitable for heat shrinking inside the housing 11 for a desirable time. The desirable time can be defined by the speed of the relative motion between the packages 22 and 23 and the outlet 16, as well as by the dimensions, in particular the length, of housing 11.

[0092] The transportation of the products 20 may not be continuous. For example, a controller 50 may be configured to stop the conveyor belt 30 momentarily while the sealing member 31 and/or the cutting member 32 is in operation. This allows for a short time for the packages 22 and 23 to be sealed and cut before the conveyor belt 30 is restarted.

[0093] The gas blower 13 may be any means for supplying a flow of gas to outlet 16. The gas blower 13 can be configured to supply a gas flow to outlet 16 at a pressure within the range of from about 110kPa to about 200kPa. The pressure of the environment surrounding the housing 11 may be substantially atmospheric pressure, namely about 100kPa. The pressure within the housing 11 may be increased to a few hPa above atmospheric pressure. For example, the pressure within the housing can be increased above atmospheric pressure within the range of from about 1 hPa to about 5hPa above atmospheric pressure.

However, any pressure above the pressure outside the housing can be used. In an embodiment the pressure inside the housing 11 remains substantially equal to the pressure outside the housing 11. In an embodiment the pressure inside the housing 11 is greater than the pressure inside the package 22.

[0094] The gas blower 13 can comprise a simple 1.5kW gas blower. In general, a suitable gas blower can have a power rating within a range from approximately 0.25 W to 4 kW. The gas blower can comprise a fan. In an embodiment, the gas blower 13 provides a flow of gas at a temperature lower than the ambient temperature. This aids the effect of cooling the seals at either end of the packages 22 and 23. The cooling effect of the flow of gas on the seals is particularly advantageous in operations in which the sealing is performed at high temperature (e.g. when packaging a whole bird), or operations

in which the product 20 to be packaged is heat sensitive.

[0095] The gas blower 13 can be capable of producing a large volume of gas, preferably air. Provided that the gas blower 13 can produce a sufficiently large volume of gas, the pressure of the source of gas fed to the outlet 16 by the gas blower 13 does not have to be particularly high.

[0096] Alternatively, the gas blower 13 may comprise a store of gas at high pressure. The high-pressure gas can then be fed to the outlet 16. However, tests have shown that the provision of a large volume of gas rather than the provision of high-pressure gas is more effective at expelling gas from the package 22. Use of a high volume of gas that originates from a relatively low-pressure source is advantageous over use of highly pressurised gas because it is less expensive. This is because pressurised gas (e.g. air) can be expensive, thereby increasing the packaging costs.

[0097] The housing 11 can comprise a gas inlet 15. The gas inlet 15 is connected to the gas blower 13. The gas blower 13 feeds gas into the housing 11 via the gas inlet 15.

[0098] The outlet can comprise a gas diffuser, for example, one or more nozzles. The purpose of a gas diffuser is to shape the air curtain 17 and to reduce the turbulence of the gas as it impinges upon tubular film 21. Such turbulence can lead to negative results. The gas diffuser can comprise a plate that comprises one or more holes forming the one or more nozzles. The holes may be formed in a substantially regular pattern across the plate. The holes may have an average diameter within the range of from about 0.5mm to about 2mm. Alternatively, the gas diffuser can comprise at least one slit-shaped nozzle configured to create the air curtain 17.

[0099] The gas blower 13 can be stationary with respect to the packaging apparatus 1 and can be coupled to the outlet 16 via a flexible pipe. The flexible pipe can accommodate relative motion between outlet 16 and the blower 13.

[0100] Figures 17 to 19 depict different types of outlets 16 comprising one or more nozzles. The packaging apparatus 1 can comprise one or more outlets 16 having different configurations. The air curtain 17 can be created using one or more slit-shaped outlets 16 (see, e.g. FIG. 17) or using multiple (e.g. circular-shaped) outlets 16 arranged in a substantially linear manner (see, e.g., FIGs. 18 and 19). The one or more outlets can interest substantially the whole width of the tubular film 21, or of the means for moving 30, or substantially the width of housing 11 (see also FIG. 9).

[0101] For example, outlet 16 as depicted in FIG. 17 comprises a single slit-shaped nozzle, thereby creating an air curtain 17 substantially corresponding to the shape of the single nozzle. The single slit-shaped nozzle can be positioned transverse to the motion direction and the apparatus can further comprise a plurality of outlets 16, each comprising a single slit-shaped nozzle.

[0102] In another aspect, outlet 16 as depicted in FIG.

18 comprises a series of nozzles (e.g., circular) arranged in a linear formation, thereby creating an air curtain 17 comprising a collective gas flow from the individual nozzles forming the series of nozzles. The line of adjacent nozzles can be positioned transverse to the motion direction and the apparatus can further comprise a plurality of outlets 16, each comprising a series of adjacent nozzles.

[0103] In another aspect, outlets 16 as depicted in FIG. 19 form a series of outlets arranged in a linear formation, each outlet comprising a single nozzle (e.g., circular), thereby creating an air curtain 17 comprising a collective gas flow from the individual nozzles forming the series of nozzles.

[0104] In another aspect, one or more outlets 16 can be arranged as shown in FIGs. 20 to 25, whereas the air curtain comprises components having a direction perpendicular to the first direction (e.g. the direction of movement of products 20 through packaging apparatus 1 as effected by means for moving 30), and components directed laterally towards the products to be packaged 20 and/or tubular film 21.

[0105] In another aspect, as shown in FIGs. 8 to 10 and 14 to 16, a single gas blower 13 can convey gas to a nozzles or slits forming a true (thin) curtain (as shown, for example, in FIGs. 17 to 19). Alternatively, a gas blower 13 can supply gas to a diffuser placed at the top of housing 11, which diffuser comprises a first horizontal portion and a second portion continuously directing air onto a discrete portion of the package (forming a relatively thick curtain) such that by relative motion the entire package is treated.

[0106] 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, 23 in a horizontal direction.

[0107] The product 20 may be within a package. The package 22 is unsealed when the gas is expelled from the package. The packaging may comprise a film 21. For example, the product 20 may be wrapped or partially wrapped in a film 21. The film 21 extends around the product 20. Gas is enclosed with the product 20 by the film 21.

[0108] 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.

[0109] 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 colour and shape.

[0110] 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 23 provides a barrier to gas passing between the interior of the package 23 to the exterior of the package. Accordingly, the environment inside the package 23 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 23 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 23 can be abuse-resistant.

[0111] 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 be anti-fog. This ensures high consumer appeal. The packaging film can be printable. This allows labels to be printed directly onto the packaging.

[0112] 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.

[0113] 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.

[0114] 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 23 depends on the type of product 20 and the length of shelf life needed.

[0115] The amount of gas that remains in the package 22 following the expulsion process can depend on the configuration of the air curtain. The air curtain can be operated at a higher pressure and/or volume in order to expel more gas from the package. The air curtain can be configured by modifying the type, number, and arrangement of the one or more nozzles. The nozzles can be of a slit-shape type, circular, elliptic, or any other suitable type. The controller 50 can be configured to control the flow rate of the flow of gas supplied to outlet 16, the pres-

sure and/or volume of the gas flow, thereby controlling the amount of gas to be expelled.

[0116] The packaging apparatus 1 comprises a cutter 32. The cutter 32 is configured to cut the packaging material. For example, the cutter 32 may cut the tube of film 21 once the package 23 has been sealed. The cutter 32 may be positioned adjacent the sealer 31. In particular, the cutter 32 may be disposed near to the sealer 31 such that the sealer 31 seals the only open end of one package 22 (after gas has been expelled from that package), the sealer 31 seals the opposite end of a subsequent package 23 and the cutter 32 separates the two packages 22 substantially simultaneously. Alternatively, the cutter 32 may be positioned further downstream so as to separate the packages 22 after they have been completely sealed. The cutter 32 can comprise two parts above and below the conveyor belts 30.

[0117] The housing 11 can be positioned adjacent to the sealing member 31. Desirably the housing 11 is positioned immediately downstream of the sealing member 31. The term downstream is relative to the direction of transportation of the products 20 through the packaging apparatus 1.

[0118] The packaging apparatus 1 can comprise a shrinking machine configured to shrink the film 21. The shrinking machine may be, for example a shrink tunnel 33, or a hot air tunnel 33. The sealed package 23 is shrunk in the shrinking machine. The shrinking process may involve heating the sealed package. The package 23 may be heated to a temperature within the range of from about 130°C to about 150°C.

[0119] Before the sealed package 23 is shrunk, there may be undesirable gas trapped in the sealed package 23 along with the product 20. Additionally, the sealed package 23 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 second position are reduced. This gives the sealed package 23 a more aesthetic appearance. In the case of cheese, the cheese may consume any residual gas that remains in the sealed package 23 following the shrinking step.

[0120] 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 as cheese, there is no need for a tray to support the cheese. However, the product 20 may be wet. In this case, it is particularly desirable for the product 20 to be disposed in a tray.

[0121] 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.

[0122] 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.

[0123] 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 23. Before the step of sealing the top end of the package, the process comprises the step of expelling gas from the package.

[0124] While the invention has been described in connection with what is presently considered to be the most practical and preferred embodiments, it is to be understood that the invention is not to be limited to the disclosed embodiments, but on the contrary, is intended to cover various modifications and equivalent arrangements included within the spirit and the scope of the appended claims.

Claims

1. A packaging process comprising:

positioning a tubular film around a product to be packaged,
creating, at a sealing station, a first seal on the tubular film thereby forming a semi-sealed package containing the product to be packaged and having a first sealed end and a second open end, directing towards the semi-sealed package a flow of gas, by means of at least one gas flow outlet,
creating relative motion in a first direction between the outlet of the gas flow and the semi-sealed package such that the flow of gas passes the semi-sealed package from the first sealed end to the second open end thereby compressing the semi-sealed package and expelling gas present within the semi-sealed package, and
creating, at the sealing station, a second seal on the semi-sealed package spaced apart from the first seal, thereby forming a sealed package containing the product and having first and second sealed ends.

2. The process of one of the preceding claims, wherein the gas flow outlet is positioned outside the semi-sealed package, such that said flow of gas impacts on an external surface of the semi-sealed package.

3. The process of one of the preceding claims, further comprising the step of:

heat shrinking the semi-sealed package and/or the sealed package.

4. The process of one of the preceding claims, wherein the relative motion is created by means of a conveyor belt; and the process further comprises the step of:

supporting the semi-sealed package and/or the sealed package on the conveyor belt, and optionally directing a second gas flow towards the semi-sealed package through a plurality of holes distributed throughout at least a part of the conveyor belt, thereby increasing or intensifying the expelling of gas present within the semi-sealed package.

5. The process of one of the preceding claims, wherein the flow of gas is continuous over time.

6. The process of one of the preceding claims, wherein the flow of gas has a temperature substantially lower than a temperature required for effecting heat shrinking of the semi-sealed package and/or the sealed package, or wherein the flow of gas has a temperature of 130°C to 200°C.

7. The process of one of the preceding claims, wherein directing the flow of gas towards the package comprises adjusting a distance in a second direction between the outlet of the gas flow and the semi-sealed package depending on the relative motion, the second direction being perpendicular to the first direction.

8. The process of one of the preceding claims, wherein the gas flow comprises a first gas having a first temperature and a second gas having a second temperature, wherein the first temperature is higher than the second temperature.

9. The process of one of the preceding claims, wherein the gas flow comprises a first component directed at the semi-sealed package at a first angle and a second component directed at the semi-sealed package at a second angle, optionally wherein the gas flow further comprises a third component directed at the semi-sealed package at a third angle, wherein the first, second, and third angles are different from each another.

10. The process of one of the preceding claims, further comprising:

directing a second gas flow by means of a second outlet towards the semi-sealed package, the second gas flow passing the semi-sealed package from the first end of the semi-sealed package to the second end of the semi-sealed package, wherein the second outlet is arranged longitudinally along the first direction at a second position different from a position of the outlet;

- and
varying a pressure and/or volume of the gas flow
of gas and a pressure and/or volume of the second
gas flow while the gas flow and the second
gas flow pass the package.
11. The process of one of the preceding claims, wherein
the outlet and/or the second outlet are comprised in
a housing, the housing having a tunnel shape.
12. A packaging apparatus (1) comprising:
- a control unit;
a loading station configured to position a tubular
film around a product to be packaged;
a sealing station coupled to the control unit, the
control unit being configured to control the seal-
ing station to create a first seal on the tubular
film, thereby forming a first sealed end and cre-
ating a semi-sealed package containing the
product to be packaged, the semi-sealed pack-
age having a second open end;
a gas blower coupled to the control unit, the con-
trol unit being configured to control the gas blow-
er to supply a gas flow of gas to an outlet, the
outlet being coupled to the gas blower;
a means for moving the semi-sealed package,
the means for moving being coupled to the con-
trol unit,
the control unit being configured to control the
means for moving to move the semi-sealed
package,
thereby creating relative motion in a first direc-
tion between the outlet and the semi-sealed
package such that the flow of gas passes the
semi-sealed package from the first sealed end
to the second open end, thereby compressing
the semi-sealed package and expelling gas
present within the semi-sealed package;
wherein the control unit is further configured to
control the sealing station to create a second
seal on
the tubular film, thereby sealing the second open
end, forming a second sealed end spaced apart
from the first sealed end, and creating a sealed
package containing the product to be packaged.
13. The packaging apparatus of claim 12, further com-
prising a housing configured to encompass the out-
let, the housing having a tunnel shape with a longi-
tudinal axis extending along the first direction, op-
tionally wherein
the housing is arranged in a fixed position with re-
spect to the operating region.
14. The packaging apparatus of one of claims 12 to 13,
wherein the housing comprises means for controlling
a temperature inside the housing, and/or wherein
- the housing has, with respect to the relative motion,
a closed upstream end and/or a closed downstream
end.
15. The packaging apparatus of one of claims 12 to 14,
further comprising a flusher configured to flush the
tubular film with a modified gas, optionally wherein
the modified gas is configured to preserve the prod-
uct to be packaged, further optionally wherein the
modified gas comprises about 70% oxygen and
about 30% carbon dioxide.
16. The packaging apparatus of one of claims 12 to 15,
wherein the means for moving comprise a conveyor
belt, optionally wherein
the conveyor belt comprises a plurality of distributed
holes, the holes being configured to facilitate direct-
ing a second gas flow through the holes and towards
the semi-sealed package.
17. The packaging apparatus of one of claims 12 to 16,
wherein the
housing is configured to contact the means for mov-
ing in a substantially sealed manner or wherein the
housing has a tubular shape and is configured to
encompass the means for moving.
18. The packaging apparatus of one of claims 12 to 17,
further comprising one or more additional outlets,
the outlets being arranged in series along the first
direction.
19. The packaging apparatus of one of claims 12 to 18,
further comprising an actuator configured to move
the outlet and/or additional outlets in a second direc-
tion perpendicular to the first direction, optionally
wherein the outlet and/or additional outlets is/are
configured to direct the flow of gas towards the op-
erating region at a first angle and at a second angle,
the first and second angles being different from each
other.
20. The packaging apparatus of one of claims 12 to 19,
further comprising a control unit coupled to the gas
blower and configured to:
- control the means for moving, and/or
control the flow of gas, optionally wherein the
control unit is configured to control the flow of
gas depending on a relative motion between the
outlet and the package.

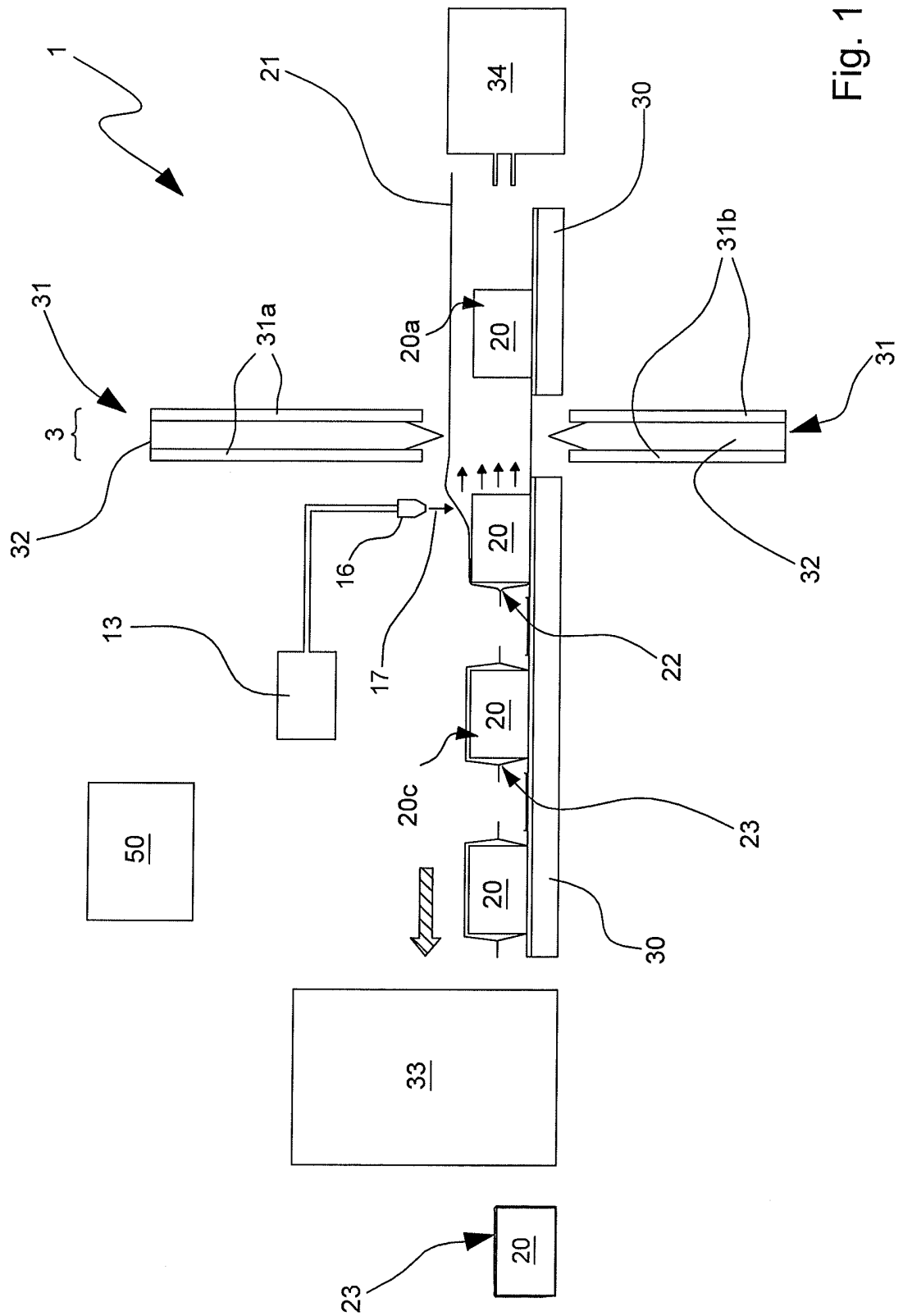


Fig. 1

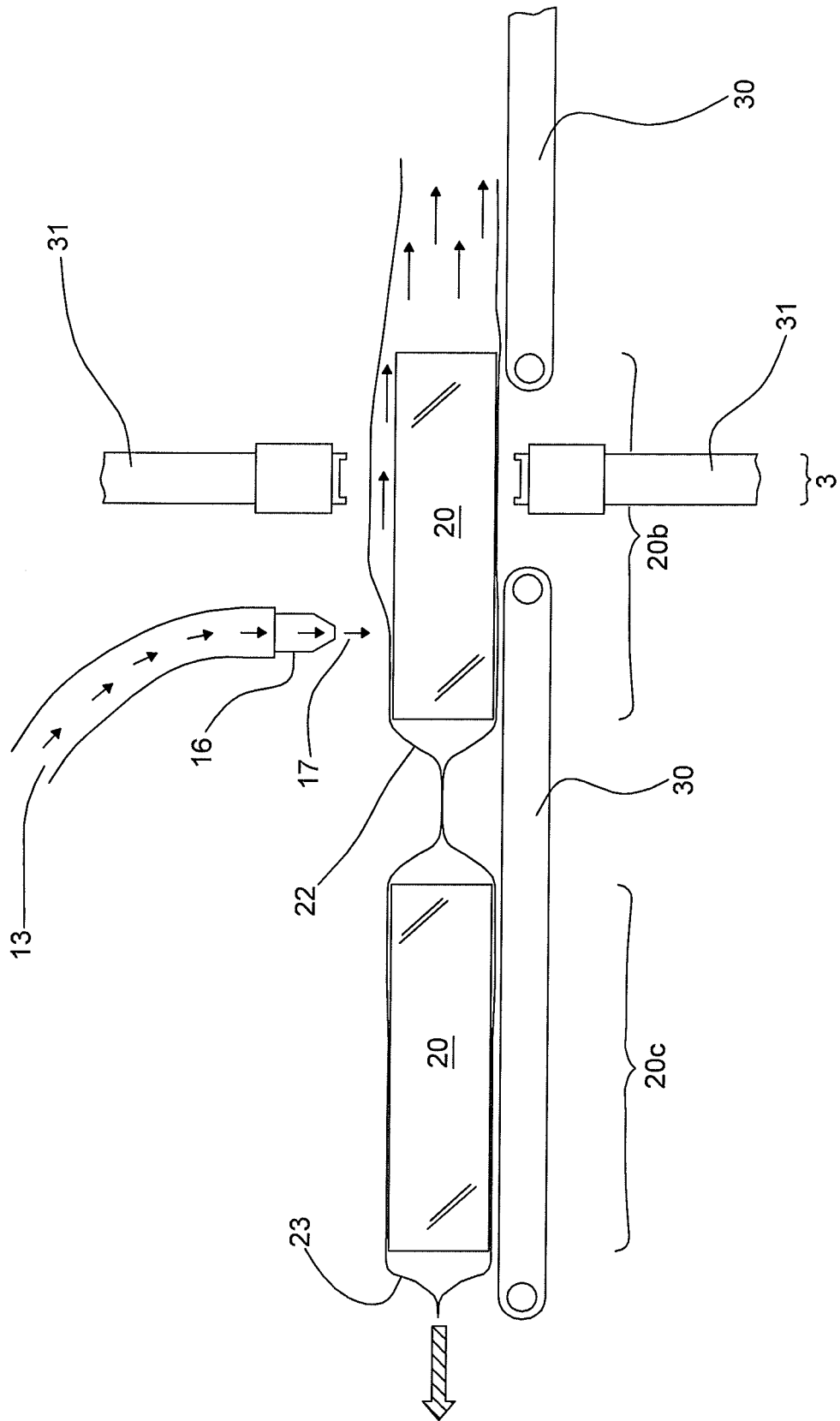


Fig. 2

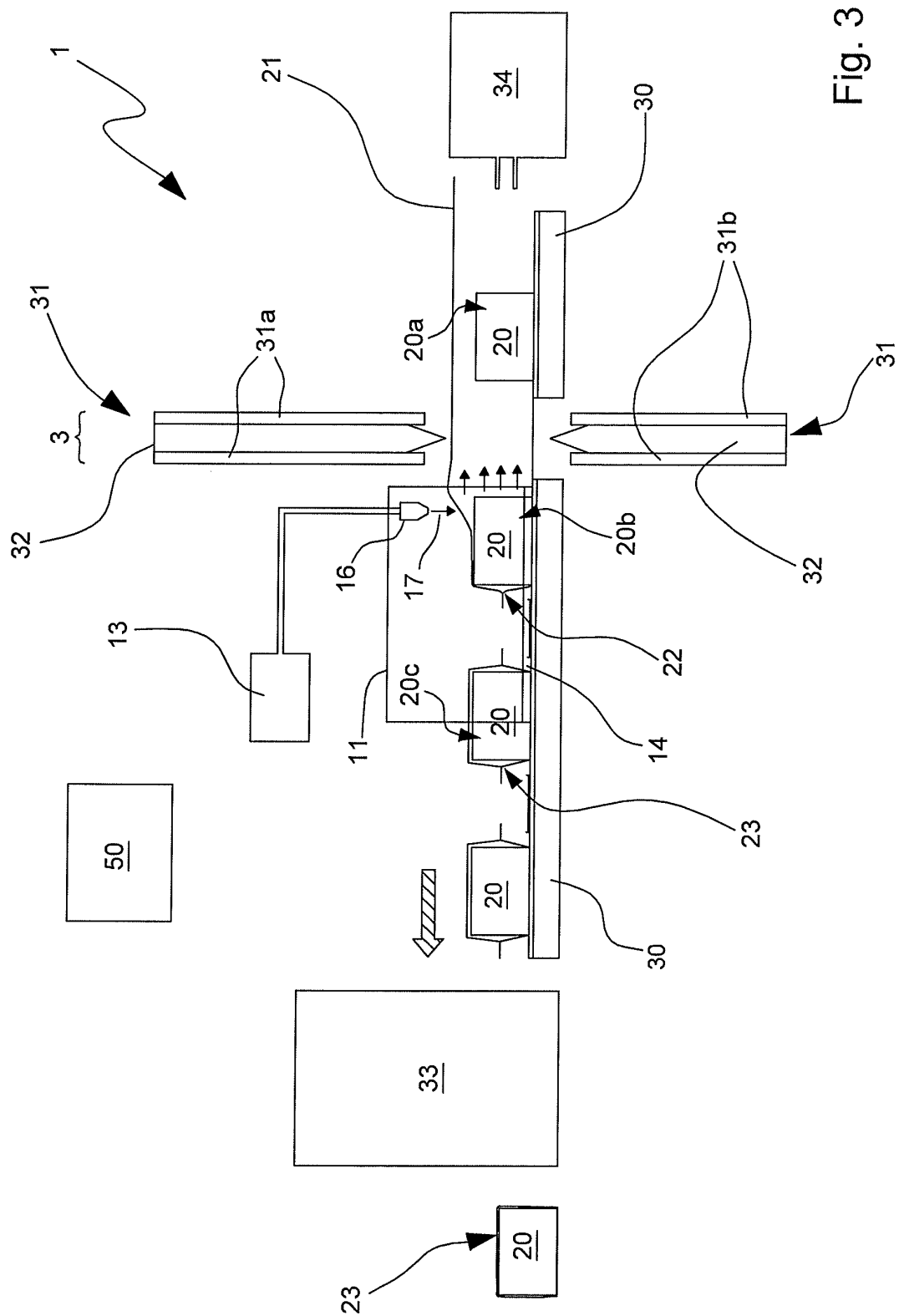
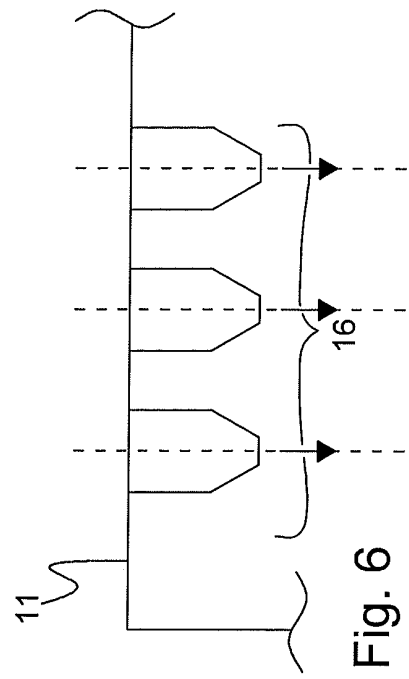
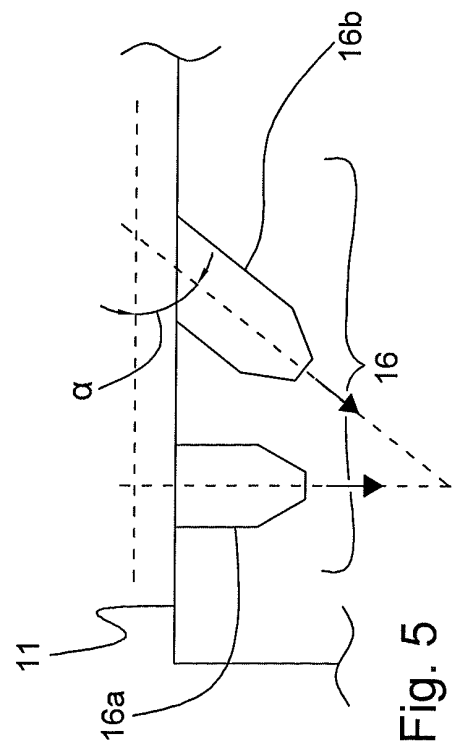
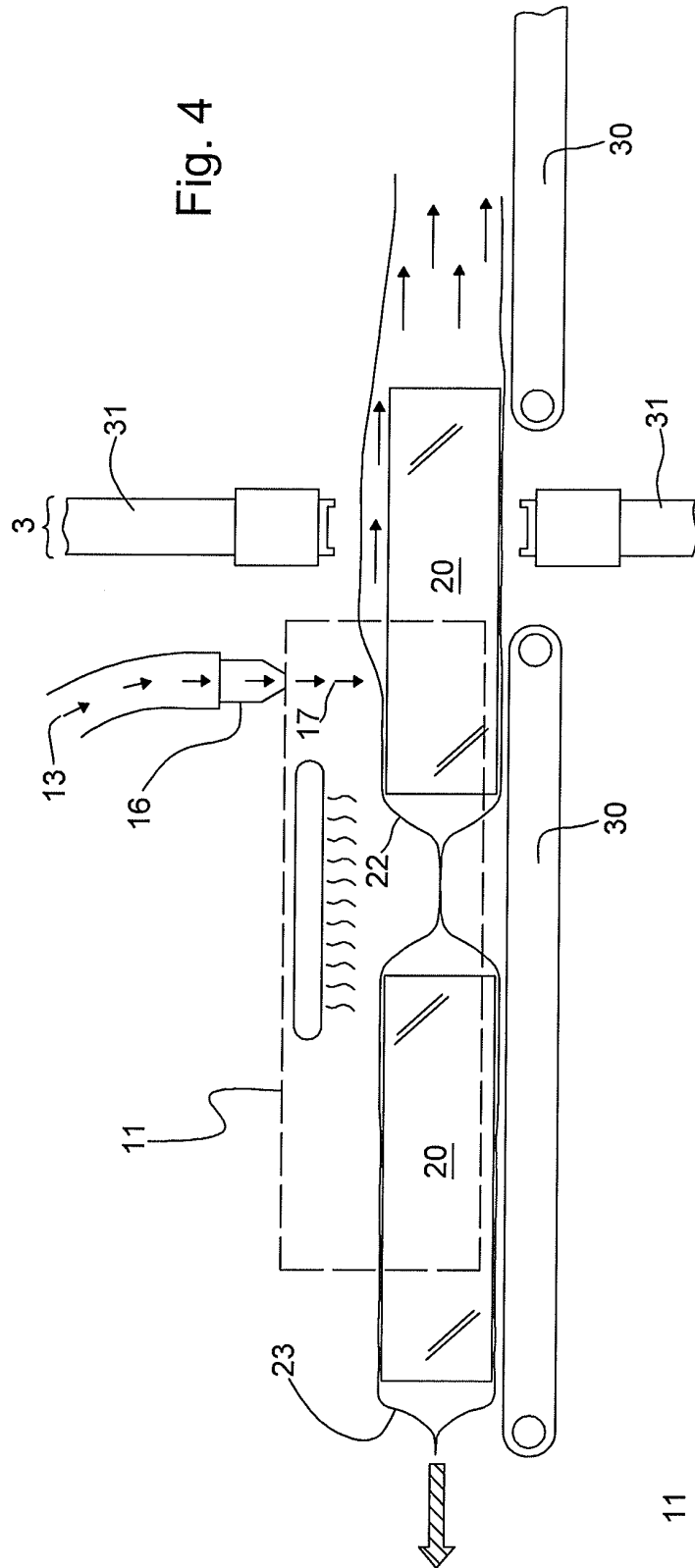


Fig. 3



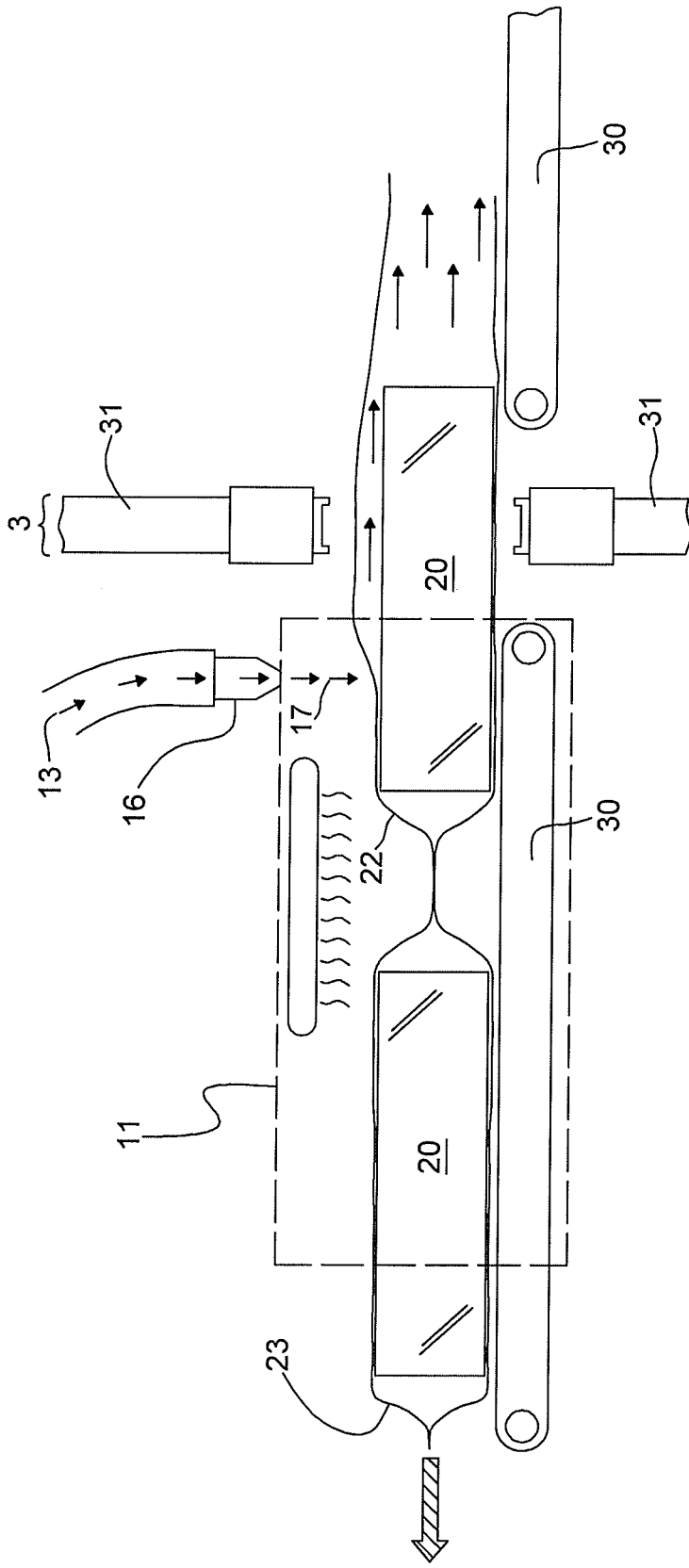
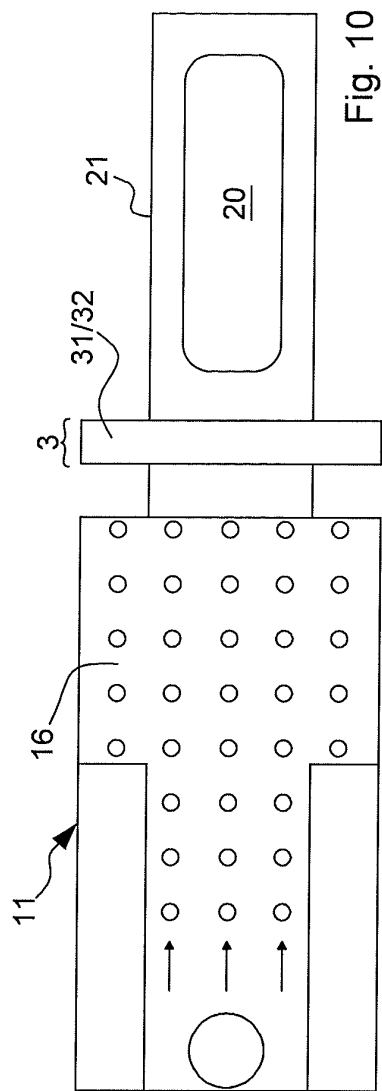
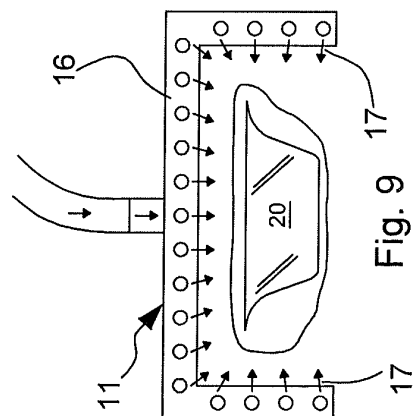
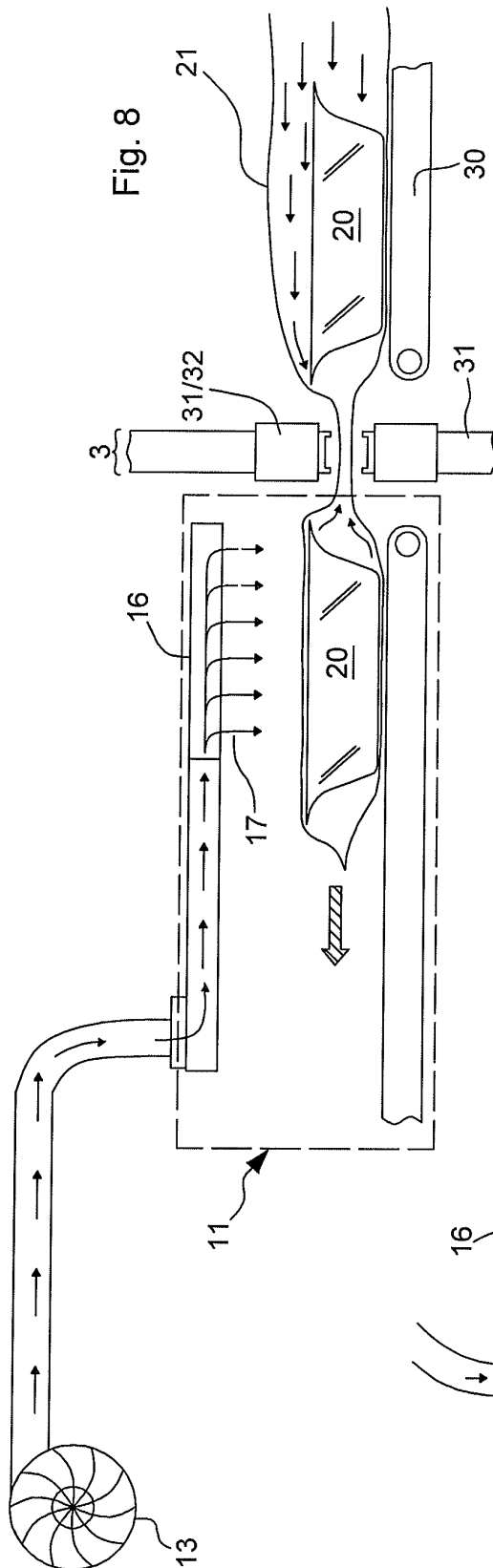


Fig. 7



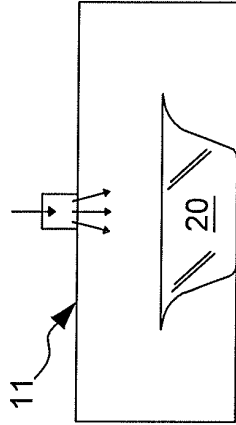


Fig. 13 (Prior Art)

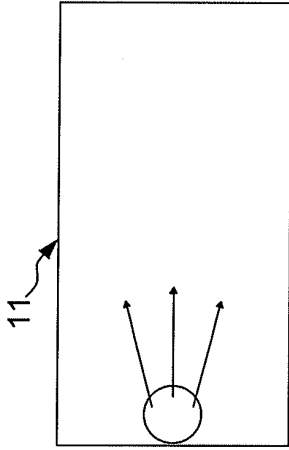


Fig. 12 (Prior Art)

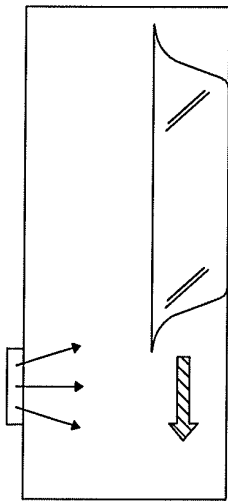


Fig. 11 (Prior Art)

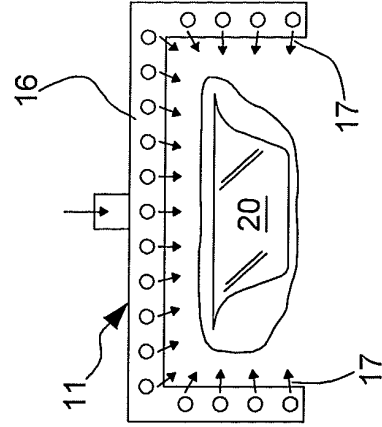


Fig. 16

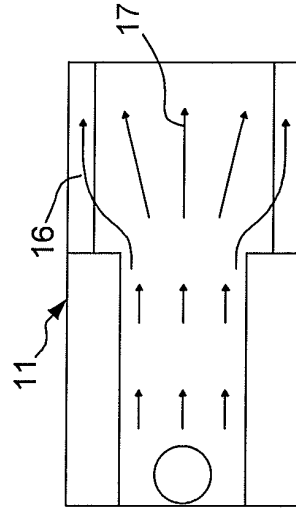


Fig. 15

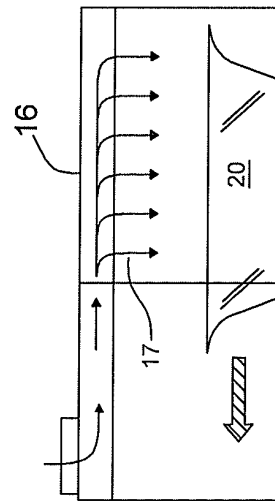
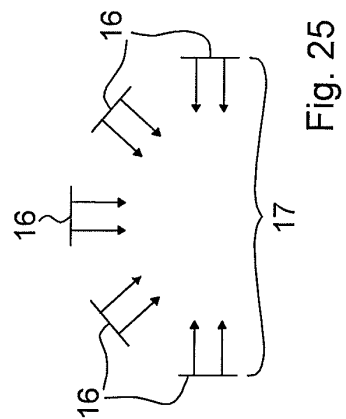
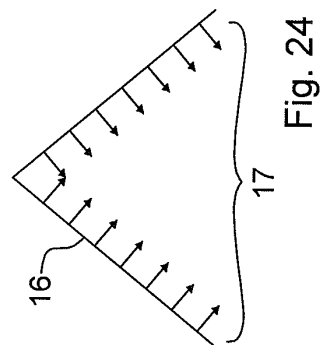
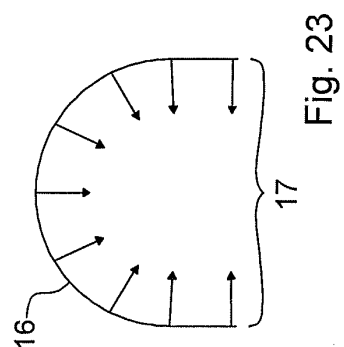
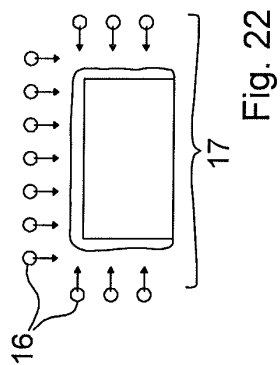
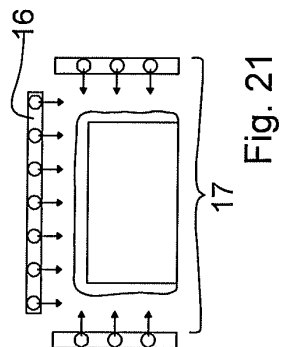
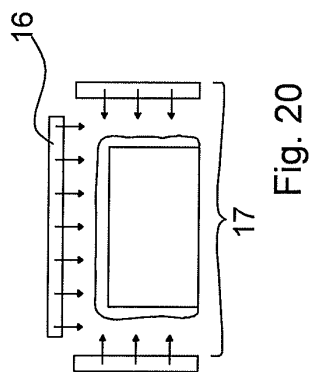
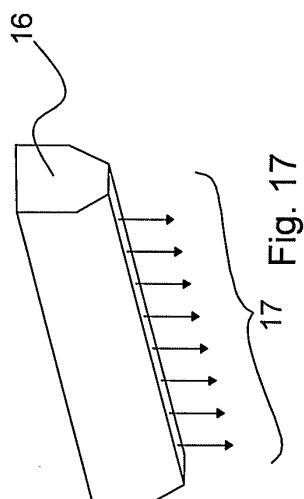
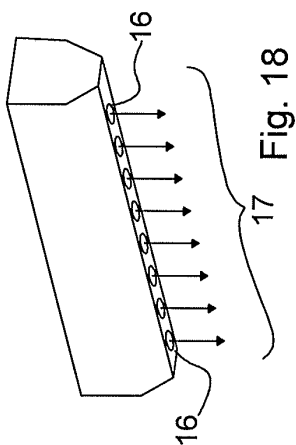
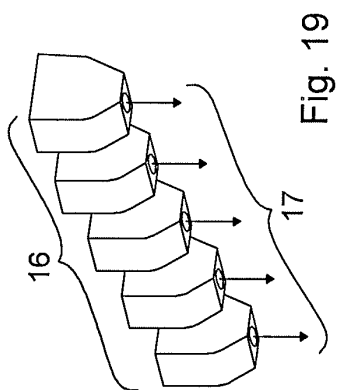


Fig. 14





EUROPEAN SEARCH REPORT

Application Number
EP 12 18 8885

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Y	* column 1, line 60 - column 4, line 24; figures 1, 2 *	16,17	B65B31/00 B65B51/14 B65B53/06 B65B61/06
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			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 February 2013	Examiner Paetzke, Uwe
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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