



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
19.09.2012 Bulletin 2012/38

(51) Int Cl.:
B65B 31/08 (2006.01) **B65B 9/20** (2012.01)
B65B 31/04 (2006.01) **B65B 51/30** (2006.01)

(21) Application number: **12159647.2**

(22) Date of filing: **15.03.2012**

(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
Designated Extension States:
BA ME

(71) Applicant: **GKS Packaging B.V.**
5692 HH Son (NL)

(72) Inventor: **Geukes, Ivo Richard Elias**
5629 JZ Eindhoven (NL)

(74) Representative: **Hutter, Jacobus Johannes**
Nederlandsch Octrooibureau
J.W. Frisolaan 13
2517 JS The Hague (NL)

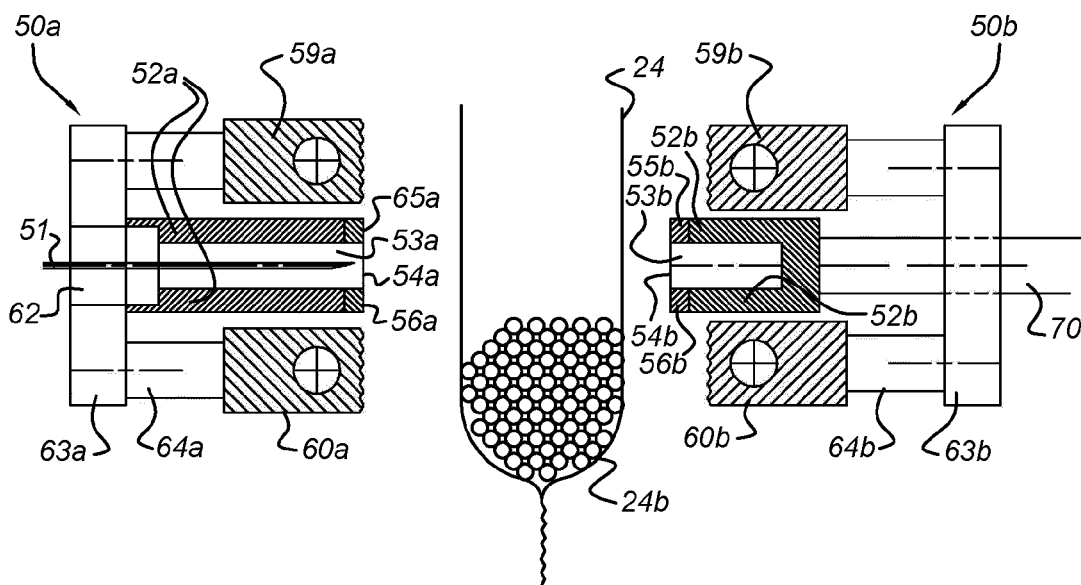
(30) Priority: **15.03.2011 NL 2006393**

(54) **Vacuum packaging apparatus**

(57) A vacuum form, fill, and seal apparatus for packaging products in a product packaging line is disclosed. A foil transportation subsystem (26a, 26b) transports a foil (24) in a transportation direction along a foil transportation path. A tubular foil former (23, 21, 27) and a cutting member (51) are provided. A first vacuum space member (52a) and a second vacuum space member (52b) are disposed on opposite sides of the foil transportation path,

wherein the first vacuum space member (52a) comprises a cavity (53a) having an opening (54a) towards the foil transportation path, wherein the first vacuum space member (52a) comprises an edge (55a, 56a) around the opening (54a) that matches a shape of the second vacuum space member (52b). At least one actuator for closes the cavity (53a) by pressing the vacuum space members (52a, 52b) together to form an inner space 57.

Fig 3



Description

FIELD OF THE INVENTION

[0001] The invention relates to a vacuum form, fill, and seal apparatus. The invention further relates to a vertical vacuum form, fill, and seal apparatus. The invention further relates to a method of packaging products using a vacuum form, fill, and seal apparatus in a product packaging line. The invention further relates to a roll of packaging foil.

BACKGROUND OF THE INVENTION

[0002] Vertical form, fill, and seal machines are known to have tubes extending into the package before sealing. These tubes are used to evacuate any air from the package. Fig. 1 illustrates part of such a vertical form, fill, and seal machine. The figure shows a cylindrical column 5 extending in a vertical direction. A flat sheet of foil 7 is folded around the column 5 and sealed vertically (not shown), to obtain a tubular foil 8 around the column 5. A pair of clamping jaws 2 are arranged for clamping the tubular foil in transverse direction in airtight fashion. One or more tubes 1 extend from below the clamping jaws, through a passage in between the clamping jaws 2 upwards through the column 5, to outlets 6. At outlets 6, these tubes 1 may be connected to a vacuum pump. Below the clamping jaws 2 there is provided a first pair of sealing bars 3, 3' and a second pair of sealing bars 4, 4' and a cutting member (not drawn) in between the sealing bars 3 and 4.

[0003] In operation, the tubular foil (with its bottom 10 sealed) is lowered to have the foil for one package 9 below the sealing bars 3', 4', and the product is inserted through the column 5. Then, the clamping jaws 2 close the package with the tubes 1 providing a passage into the package 9. Air is sucked out through the tubes 1. Next the pairs of sealing bars 3, 3' and 4, 4' seals the tubular foil along two strips, and cutting member in between the seal bars 3 and 4 cuts the tubular foil in between the two sealed strips, separating the package 9 from the tubular foil 8.

[0004] In an alternative arrangement, the column 5 is closed and the vacuum pump is connected to the interior of the column 5 directly to remove the air from the column 5 and the foil 8 with package 9. In such an alternative arrangement, the tubes 1 and the clamping jaws 2 may be left out.

[0005] However, these systems do not provide a high quality vacuum. Also, it may take a relatively long time to achieve a sufficient level of vacuum in the package.

SUMMARY OF THE INVENTION

[0006] It would be advantageous to have an improved vacuum form, fill, and seal apparatus. To better address this concern, a first aspect of the invention provides an

apparatus for packaging products in a product packaging line, comprising

a foil transportation subsystem for transporting a foil in a transportation direction along a foil transportation path; a tubular foil former along the foil transportation path for converting the foil from flat foil into tubular foil;

at least one cutting member for cutting the tubular foil transversely to the transportation direction;

a first vacuum space member and a second vacuum space member disposed on opposite sides of the foil transportation path, wherein at least one of the vacuum space members comprises a cavity having an opening towards the foil transportation path, wherein the first vacuum space member comprises an edge around the opening that matches a shape of the second vacuum space member;

at least one actuator for closing the cavity by pressing the vacuum space members together to form an inner space, with a part of the tubular foil clamped in between the first and second vacuum space members;

a vacuum generator connected to the inner space to create a vacuum in the inner space and sucking a fluid from the package; and

sealing members for sealing a package transversely to the transportation direction.

[0007] The vacuum space members make it possible to remove more fluids, in particular gases, such as air, from the package. This way, a higher-quality vacuum can be achieved. In addition or alternatively, the apparatus can be used to remove the fluids from a package more quickly than the prior art apparatus. The prior art solutions may allow air to leak back into the package, making it more difficult or impossible to achieve high-quality vacuum. Also, the prior art solution may be arranged to make the whole column 5 vacuum, which is a large space and which needs more time and makes it difficult to create high quality vacuum in the package.

[0008] The sealing members may be disposed outside the inner space. Positioning the seal bars outside the cavity and/or inner space of the vacuum space members allows the seal bars to be thermally isolated from the vacuum space members, so that the vacuum space members do not inadvertently seal the package before the package has been made vacuum.

[0009] A space may be provided between the sealing members and the vacuum space members. Such a space further improves the thermal isolation between the sealing members and the vacuum space members.

[0010] A first pair of sealing members may be disposed on opposite sides of the foil transportation path. Moreover, a second pair of sealing members may be disposed on opposite sides of the foil transportation path. The vacuum space members may be disposed in between the first pair of sealing members and the second pair of sealing members. The apparatus may be arranged for transporting the foil sequentially along the first pair of sealing members, the vacuum space members, and the second pair of sealing members. This arrangement facilitates

quick and efficient packaging of successive packages. The foil is clasped between the vacuum space members, sucked vacuum, and then sealed on both sides of the vacuum space members. This way, the vacuum package is closed entirely, and the tubular foil on the inlet side is sealed so that the product can be dropped into the next package.

[0011] The at least one cutting member may be arranged for cutting the foil inside the inner space. This is an efficient arrangement, because it allows the foil to be cut while it is clamped in between the two vacuum space members. In a vertical form, fill, and seal apparatus, this arrangement may prevent the package from falling after being cut off.

[0012] The apparatus may be arranged for causing the cutting member to cut the tubular foil, the vacuum generator to create the vacuum in the inner space, and sucking the gases from the package, and the sealing members to seal the package. This sequence of operations may be controlled by a controller. This is an efficient operation mode of the apparatus.

[0013] The vacuum space members and the actuator may be arranged for clasping the tubular foil of a part of a package, wherein a clasping pressure exerted by at least part of the edge is strong enough to prevent the package from falling and/or to prevent the foil from being sucked into the inner space, and wherein the pressure is weak enough to allow fluid to be sucked out of the package through channels formed by a relief on an inner surface of the tubular foil. This configuration allows the apparatus, in particular the vacuum space members, to have a relatively simple design because the channels of the relief on the inner surface of the tubular foil are used for removing the fluid from the package.

[0014] The clasping pressure exerted by the edges of the vacuum space members on the tubular foil on a foil inlet side of the vacuum space members may be arranged to be strong enough to deform the tubular foil such that any channels formed by the relief are closed. Having the filled package on the outlet side, and the remainder of the tubular foil on the inlet side of the vacuum space members, only the filled package needs to be made vacuum. Consequently, only the channels on the outlet side need to be used to draw fluids from the package. To prevent fluids (in particular air) leaking into the inner space via any channels in the foil on the inlet side, the latter channels may be closed by exerting a sufficiently strong pressure to the foil on the inlet side.

[0015] At least part of the edge may comprise a resilient material. A resilient material is suitable for providing sufficient grip on the foil without closing the channels.

[0016] At least part of the edge on a foil outlet side of the vacuum space members may be made of a softer material than the edge on the foil inlet side. This is a suitable configuration to provide sufficient grip on the foil and closing the channels on the inlet side, while drawing fluids from the package through the channels in the foil clasped on the outlet side of the vacuum space member.

[0017] The apparatus may be loaded with a roll of foil comprising a relief on at least part of at least one side of the foil, wherein the tubular foil former is arranged for forming the tubular foil with the relief on an inner surface of the tubular foil. Such a tubular foil is suitable for drawing a vacuum with the vacuum space members set forth.

[0018] The apparatus may comprise a relief creator for creating the relief on at least part of at least one side of a foil unrolled from a roll of flat foil, and a tube generator for converting the foil into the tubular foil having the relief on at least part of an inside surface of the tubular foil. This way, a roll of flat foil can be converted into a foil with relief just before being folded into the tubular form. The relief creator may be arranged for embossing the relief.

[0019] The edge on the foil inlet side of the vacuum space member may comprise a plurality of protrusions for locally deforming the foil to form channels to enable fluid communication inside the tubular foil across the clamping edges of the vacuum space members. This way, a foil may be used that does not have a relief by itself.

[0020] The transportation direction may be substantially vertical downwards. The vertical vacuum fill, form, seal machine thus obtained is particularly advantageous, because of the simple design. For example, the vacuum space members continue to clasp the package even after it has been cut and before it has been sealed, which may be used to prevent falling down of the package, and making it possible to create a high quality vacuum inside the package by a vacuum pump attached to the vacuum inner space.

[0021] Another aspect of the invention provides a method for packaging products in a product packaging line, comprising
transporting a foil in a transportation direction along a foil transportation path;
converting the foil from flat foil into tubular foil along the foil transportation path;
transporting the tubular foil in between a first vacuum space member and a second vacuum space member disposed on opposite sides of the foil transportation path, wherein at least one of the vacuum space members comprises a cavity having an opening towards the foil transportation path and an edge around the opening that matches a shape of the second vacuum space member;
pressing the vacuum space members together to form an inner space, with a part of the tubular foil clasped in between the first and second vacuum space members;
cutting the tubular foil transversely to the transportation direction;

creating a vacuum in the inner space and sucking a fluid from the package; and
sealing a package transversely to the transportation direction, using sealing members disposed outside the inner space.

[0022] This provides an efficient method of using the apparatus set forth. The foil used in the method may comprise a relief on at least part of at least one side of the foil, to facilitate removing fluids, in particular air, from the

packages.

[0023] Another aspect of the invention provides a roll of foil for use in one of the vacuum form, fill, and seal apparatuses set forth, wherein the foil comprises a relief on at least part of at least one side of the foil. This foil comprises a sheet of foil arranged on a roll, ready to be formed into a tubular foil having the relief on at least part of the inside of the tubular foil.

[0024] It will be appreciated by those skilled in the art that two or more of the above-mentioned embodiments, implementations, and/or aspects of the invention may be combined in any way deemed useful. Also, it will be appreciated that aspects of the invention explained in respect of the apparatus may be applied by the skilled person to define variations of the method.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025] These and other aspects of the invention are apparent from and will be elucidated with reference to the drawings described hereinafter. The drawings are all diagrammatic. Throughout the figures, similar items have been labeled with the same reference numeral.

Fig. 1 is an illustration of a prior art form, fill, seal apparatus.

Fig. 2 is an overview of a prior art form, fill, seal apparatus.

Fig. 3 is a sectional view of a pair of joining members in an open mode.

Fig. 4 is a sectional view of a pair of joining members in a closed, cutting and vacuum mode.

Fig. 5 is a sectional view of a pair of joining members in a sealing mode.

Fig. 6 is a flowchart of a method of packaging products using a vacuum form, fill, and seal apparatus in a product packaging line.

Fig. 7A, B, and C are sectional views of a joining member.

Fig. 8 shows a sketch of a roll of foil and a detail thereof.

DETAILED DESCRIPTION OF EMBODIMENTS

[0026] Fig. 2 gives an overview showing some of the main parts of a vertical form, fill, seal apparatus. It will be understood that the apparatus comprises more elements that are not shown in the drawings. Such elements include for example a housing, constructional elements, motor, and product supply. These elements may be added by the skilled person in view of the present description and figures.

[0027] The packaging machine of Fig. 2 comprises a vertically disposed filling tube 21, on the inlet side of which a feed funnel 22 is present. Near the inlet side, a guide element 23 is fitted round the filling tube, which guide element includes shoulder-like parts 23a and 23b. A band of foil material 24 from a roll is passed over said

shoulder-like parts 23a and 23b and subsequently led between filling tube 21 and guide element 23, so that an elongated container of foil material 24a is created around the filling tube 21. The foil may be made of plastic. Alternative materials, such as aluminum, may also be used. Said passing of the foil material 24 over guide element 23 takes place by transport means 26a, 26b, which are disposed on either side of the vertically disposed filling tube 21. The transport means 26a, 26b are an example of a foil transportation subsystem. Said transport means 26a, 26b can be placed in abutment with the filling tube 21 by well-known means, and they pass the foil material 24 that is present between the filling tube 21 and the transport means 26a, 26b. Guide rollers 25a and 25b may be used to guide the foil material 24 in a smooth manner, and furthermore they may be used to create a desired pre-tension in the foil material.

[0028] First joining means 27 are disposed at the longitudinal free sides of the foil container 24a that has been created round the filling tube 21. Said first joining means 27 can likewise be placed in abutment with the filling tube 21 by well-known means, after which the free sides 24c and 24d of the foil material 24 that are present between the filling tube 21 and the joining means 27 are joined by means of friction or heat. In this manner, a closed foil container 24a having a longitudinal joint 28 is created.

[0029] The filling tube 21, the guide element 23, and the first joining means 27 form an example of a tubular foil former along the foil transportation path for converting the foil from flat foil into tubular foil, because the flat foil at the inlet is converted to a tubular foil at the outlet side as the foil is transported along the foil path.

[0030] The packaging machine may furthermore comprise second joining means 29a and 29b, which are disposed on either side of the outlet side of filling tube 21. Said second joining means 29a and 29b can be moved towards and away from each other by suitable means. By moving second joining means 29a and 29b towards each other, the foil container 24a is pressed together between the two joining means, after which a transverse joint 30a can be formed in the pressed-together foil material by means of heat or friction.

[0031] As a result, the foil container 24a is closed from below, after which it can be filled with all kinds of products, for example cookies or candies, via feed funnel 22. Once the foil container has been filled with the desired quantity (or number or weight) of products, foil container 24a is moved the required distance by transport means 26a and 26b. Then the second joining means 29a and 29b form a second transverse joint 30b in the foil material just above the products that are present in foil container 24a, so that a foil package 24b is obtained.

[0032] Usually, a transverse joint 30a or 30b is so dimensioned that it can function as the lower joint for the next foil package at the same time. It is also possible for the second joining means 29a, 29b to form two parallel, closely spaced-apart transverse joints in the foil container 24a in one process step. Furthermore, the second joining

means usually comprise cutting or perforating means (not shown), which cut the foil material through or perforate it after having formed the (single or double) joint 30b. Thus the foil package 24b can be separated from the foil container 24a and be carried out of the packaging machine for further processing.

[0033] A modification of the system described above for realizing a low-quality vacuum in the foil package 24b has been described above with reference to Fig. 1. Hereinafter, it will be described how the apparatus described with reference to Fig. 2 may be modified to create an alternative apparatus that is capable of generating a vacuum in the foil package 24b.

[0034] Figs. 3, 4, and 5 show joining means 50a, 50b in three different positions. These joining means 50a, 50b may replace the joining means 29a, 29b in a form, fill, seal apparatus. The joining means 50a, 50b may be used in a form, fill, seal apparatus, for example a vertical form, fill, seal apparatus, to produce vacuum packages. Fig. 3 shows the joining means 50a, 50b in an open position, with a tubular foil 21 in between the joining means 50a, 50b. Fig. 4 shows the joining means 50a, 50b while clamping the foil, cutting the foil, and creating a vacuum inside the separated package 24b. Fig. 5 shows the joining means 50a, 50b while sealing the foil. Throughout the text and the drawings, the same reference numerals have been used to indicate similar features.

[0035] Fig. 7A shows the joining means 50a of Figs. 3-5 (in mirrored view). Fig. 7B and Fig. 7C show different orthogonal section views of the joining means 50a, as indicated in the figures.

[0036] Fig. 3 shows the joining means 50a, 50b in an open position. The joining means 50a comprises a cutting member 51 for cutting the tubular foil 24 transversely to the transportation direction, as shown in Fig. 4. The transportation direction is substantially downwards in Figs. 3-5. Thus, the foil inlet side corresponds to the upper side, and the foil outlet side corresponds to the lower side in the illustrated embodiment.

[0037] The first joining means 50a and the second joining means 50b are disposed on opposite sides of the foil transportation path. The joining means 50a comprises frame parts 63a, 64a; the joining means 50b comprises frame parts 63b, 64b, 70. The frame parts are part of the construction of the apparatus and carry at least some of the other parts described herein. Both joining means 50a, 50b comprise vacuum space members 52a, 52b attached to the frame parts. Consequently, the first vacuum space member 52a and the second vacuum space member 52b are disposed on opposite sides of the foil transportation path. These vacuum space members may be made of any suitable material, such as metal or plastic. The first vacuum space member 52a comprises a cavity 53a having an opening 54a towards the foil transportation path. The opening thus faces the foil. The second vacuum space member 52b also has a cavity 53b. Different embodiments may be designed wherein either or both of the vacuum space members have a cavity with an opening

facing the foil path. The first vacuum space member 52a comprises an edge 55a, 56a around the opening 54a that matches a shape of the second vacuum space member 52b. The edge 55a may enclose the opening 54a. Likewise, edge 55b may enclose opening 54b. In the particular example drawn in the figures, the first vacuum space member 52a and the second vacuum space member 52b both have the cavity and the opening, and they have edges 55a, 55b that are formed to match each other, so that by abutting the two edges, as shown in Figs. 4 and 5, an inner space 57, or chamber, is formed by both cavities 53a and 53b. To that end, at least one actuator is provided (not shown) for moving either or both of the vacuum space members 52a and 52b towards and away from each other. The joining means 50a and 50b may be arranged for being moved towards each other in their entirety. The joining means 50a and 50b may be constructed such that, when the joining means 50a and 50b are moved towards each other, the edges 55a and 55b touch the foil 24 and/or each other first, with the sealing members 59a, 59b, 60a, 60b spaced apart, as shown in Fig. 4. The part of the tubular foil 24 that is between the two joining means 50a, 50b is thus clasped in between the first and second vacuum space members 55a, 55b.

[0038] The joining members 50a, 50b may be dimensioned such that the length of the joining members is larger than the width of the tubular foil. The length of the opening 53a, as indicated by arrows A-A in Fig. 7B, may be made larger than the width of the tubular foil. A complete transverse strip of the tubular foil may be clasped between the joining members, without any folds in the foil material except for the two end points of the clasped strip. In particular, a transverse strip of the tubular foil may be trapped inside the inner space 57. Similarly, the sealing members are long enough to allow each pair of sealing members 59a, 59b and 60a, 60b to seal a transverse strip of tubular foil. The width of the inner space as indicated by arrows B-B in Fig. 7B may be made large enough to accommodate the cutting member 51.

[0039] A vacuum generator is connected to the inner space 57, for example via a tube 67 having an opening 66 in the cavity 53a, and thus in the inner space 57, as shown in Figs. 7B and 7C. The vacuum generator draws any fluids, such as air, from the inner space 57 through the tube 67, to create a vacuum in the inner space 57. With the foil 24 clasped between the vacuum space members 52a, 52b as shown in Fig. 4, the fluids, in particular air, are drawn out of the package and out of the inner space 57 roughly in the direction of the arrows in Fig. 4, as will be described below.

[0040] Sealing members 60a, 60b are disposed outside the inner space 57. When a sufficiently high vacuum has been achieved, the sealing members 60a, 60b are pressed together as shown in Fig. 5. One or both of the sealing members 60a, 60b may be heated using heating elements 61 to obtain a strong closure of the package. The seal may also be created by mere pressure, depending on the material of the foil. The sealing members may

create a non-leaking union between the two layers of foil that are part of the tubular foil.

[0041] A space 68 may be provided between the sealing members 60a and the vacuum space members 56a. Such a space improves the thermal isolation of the vacuum space members 52a, 52b. Other isolation material may also be used. This way, any unintended sealing of the package by the vacuum space members, which might prevent the fluid from being drawn out of the package, may be prevented.

[0042] Two pairs of sealing members 59a,59b and 60a,60b may be provided. It is also possible to use only one pair of sealing members 60a,60b at the outlet side of the vacuum space members 52a,52b, although this would lower the throughput of the apparatus. In the figures, a first pair of sealing members 59a, 59b is disposed on opposite sides of the foil transportation path and a second pair of sealing members 60a, 60b is disposed on opposite sides of the foil transportation path, and the vacuum space members 52a, 52b are disposed in between the first pair of sealing members and the second pair of sealing members. The apparatus is arranged for transporting the foil sequentially through the spaces between the first pair of sealing members, the vacuum space members, and the second pair of sealing members. This happens as the foil is transported in downward direction by the transportation means 26a,26b.

[0043] As shown in the drawings, the at least one cutting member 51 may be arranged for cutting the foil 24 inside the inner space 57. In particular, the cutting member may be disposed in the cavity 53a and may be movable to cut or perforate the foil.

[0044] In operation, the foil proceeds along the foil path for the length of a package, with the joining means 50a, 50b in the open position, as shown in Fig. 3. After the product has been delivered into the package, the vacuum space members 52a, 52b clamp the foil as shown in Fig. 4. The cutting means 51 cuts the foil. This cutting can comprise a complete separation of the package 24b from the foil 24. Alternatively, the cutting can comprise perforating the foil to allow air to be drawn from the package 24b through the perforations without completely separating the package 24b from the foil 24. Then, the vacuum generator may create a vacuum inside the inner space 57 and draw the fluid from the package 24b. Next, the pairs of sealing members 59a,59b and 60a,60b may be pressed together and (optionally) heated. Sealing members 60a,60b seal the package 24b, and sealing members 59a,59b create the bottom for the next package. Then, the joining means 50a and 50b are moved away from each other, releasing the package 24b and allowing the foil 24 to be lowered, and the process is repeated for the next package.

[0045] The process described above may be performed at least partly by a controller (not shown). The controller may be arranged for controlling one or more actuators, wherein an actuator may comprise an electro-motor for moving a movable part of the apparatus. The

controller may be arranged for controlling: the transportation of the foil by the transport means 26a, 26b; the longitudinal joining means 27; the transverse joining means 50a, 50b, in particular the vacuum space members 52a, 52b, the cutting member 51; the movement and temperature of the sealing members 60a, 60b, 59a, 59b; the vacuum generator 62. Also the delivery of goods through the feed funnel 22 and/or the transport of the completed, packaged product 24b away from the packaging apparatus may be controlled by the controller.

[0046] The vacuum space members 52a, 52b may be arranged for clasping the tubular foil 24, as described above. The inlet side of the edge 55a is generally indicated at 65a in Figs. 3 and 6B, and the outlet side of the edge 55a is generally indicated at 56a in these figures. Furthermore, there may be parts of the edge 69a connecting the inlet side and the outlet side. The vacuum space member 52b similarly has edge 55b with a part of the edge 65a at the inlet side and a part of the edge 56a at the outlet side and parts connecting the inlet side with the outlet side. What is described for the edge of the first vacuum space member 52a may be likewise be applied to the edge of the second vacuum space member 52b. The clasping pressure exerted by at least part of the edges 55a,55b may be configured, for example, by choosing an appropriate material for the edges and/or by configuring the pressure with which the vacuum space members 52a, 52b are pushed to each other. This configuration may be arranged in such a way that the package 24b is prevented from falling down after it has been cut. Moreover, it may be prevented that the foil is sucked back into the inner space 57 due to the vacuum power. At the same time, it may be prevented that the foil 24 is pressed together so strongly that it is not possible to suck air out of the package any more. For example, a material that is resilient and that has a relatively large friction coefficient may be selected to achieve these properties. Rubber is an example of such a material. For example, silicone rubber, natural rubber, such as Linatex rubber, or sponge rubber may be used for the edges 55a, 55b. Other kinds of natural or artificial rubber may be used as well. An example of a thickness and height of the edges 55a, 55b is 4 or 5 mm.

[0047] The foil 24 may be prepared with a relief on an inside of the tubular foil 24, enabling air to leak through channels formed by the relief, even when clasped by the edges 55a,55b.

[0048] The clasping pressure exerted by the edges 55a, 55b of the vacuum space members 52a, 52b on the tubular foil 24a on a foil inlet side of the vacuum space members may be made strong enough to deform the tubular foil 24a such that any channels formed by the relief are closed. This may be realized, for example, by using a material for the edge on the inlet side of the vacuum space members, which material is harder than at least part of the material used for the edge 56a, 56b on a foil outlet side of the vacuum space members 52a, 52b. The edge portions 69a on the sides of both vacuum space

members 52a, 52b may also be made of the harder material. This way, any air leaking in via these portions is prevented. Alternatively, the softer material or a different material is used for the sides.

[0049] In an alternative embodiment, the sealing members 59a, 59b on the inlet side of the vacuum space members 52a, 52b may be arranged for sealing the foil before generating the vacuum, this way preventing air from leaking in through the inlet side of the foil.

[0050] The apparatus may be loaded with a roll of foil 24. This foil may comprise a relief on at least part of at least one side of the foil. For example, the foil surface may be embossed to generate the relief. For example, the relief is provided substantially on the entire surface of one side (or both sides) of the foil. Alternatively, the relief may be applied in strips that correspond to the places where the foil will be clasped by the edges at the outlet side of the vacuum space members.

[0051] Fig. 8 illustrates a roll 801 of flat foil 802. The roll 801 may be mounted on a form, fill, and seal apparatus described above, to provide the roll of foil 24. The foil 802 has a relief on one side thereof. The other side of the illustrated foil 802 is smooth. However, this is not a limitation. The figure further shows an enlargement of a detail 803 of the side of the foil 802 with the relief on it. As shown, the surface of the foil 803 comprises protruding knobs 804 with spaces 805 between the protruding knobs 804. This is just one example of a relief. Other relief patterns may be used, the main criterion being that, when two layers of foil are pressed together between the edges 56a, 56b of the vacuum space members 52a, 52b, the relevant fluids, usually air, can flow in between the pressed together layers of foil, thus enabling the package to be made vacuum.

[0052] It is also possible to use a roll of foil having a smooth surface on both sides, i.e. a foil that does not have a relief beforehand. The relief may be applied to the foil by the packaging apparatus by means of a relief creator (not shown). The relief creator may be located, for example, between the roll 24 and the first roll guider 25a. After the relief is created, the tubular foil may be formed around the filling tube 21 such that the relief is at the inside surface of the tubular foil. Any suitable known way of generating a relief in a foil may be used, for example a press having a relief on it may be pressed to the foil. Again, the relief may be created on the entire surface of the foil or part of the surface of the foil, in particular depending on which portions of the foil will be clasped by the vacuum space members.

[0053] One or both of the edges 56a and 56b on the foil outlet side of the vacuum space members 52a, 52b may comprise a plurality of protrusions for locally deforming the foil when the foil is clasped between the vacuum space members 52a, 52b. This way, a relief is created on the inner surface of the foil by the vacuum space members. The relief may be created by the protrusions in such a way that channels are formed in between the two layers of foil of the tubular foil through which fluid may be drawn

out of the package into the inner space, across the clamping edges 56a, 56b of the vacuum space members 52a, 52b. This way, a foil with a smooth surface may be used.

[0054] It will be appreciated that in the shown embodiment, the transportation direction is substantially vertical downwards. Although the techniques described herein are particularly advantageous for this type of form, fill and seal apparatus, the techniques may also be of value for horizontal type form, fill, and seal apparatuses, in which the transportation direction is substantially horizontal.

[0055] Fig. 6 illustrates a method of packaging products using a vacuum form, fill, and seal apparatus in a product packaging line. The method may comprise the following steps.

[0056] In step 601, a foil is transported in a transportation direction along a foil transportation path. In step 602, which may be performed, for example, simultaneously with the step 601, the foil is converted from flat foil into tubular foil. This step may comprise moving the foil along the guide element 23 with shoulder like elements 23a, 23b, around the tube 21. This step may further comprise sealing the tubular foil in longitudinal direction using first joining means 27. In step 603, the tubular foil is clamped in between the first vacuum space member and the second vacuum space member disposed on opposite sides of the foil transportation path. At least one of the vacuum space members comprises a cavity having an opening towards the foil transportation path, wherein the first vacuum space member comprises an edge around the opening that matches a shape of the second vacuum space member. In step 604, the vacuum space members are pressed together to form an inner space, with a part of the tubular foil clasped in between the first and second vacuum space members. In step 605, the tubular foil is cut transversely to the transportation direction. In step 606, a vacuum is created in the inner space and fluid is sucked out of the package into the inner space. In step 607, the package is sealed transversely to the transportation direction, using sealing members disposed outside the inner space. As noted hereinabove, the foil may comprise a relief on at least part of at least one side of the foil. Alternatively, the relief may be generated by a relief creator. Such a relief creator may be applied preferably before converting the flat foil into tubular foil. Alternatively, vacuum space members having an edge with protrusions may be used to generate a relief in the foil surface while the foil is clasped in between the vacuum space members.

[0057] It will be understood that many variations are possible. The foil may be arranged for having a relief on an inner surface of the tubular foil where the foil is clasped between edges of the vacuum space members at the foil outlet side of the vacuum space members. Moreover, the foil may be arranged for being closed in airtight way on a foil inlet side of the vacuum space members. This may be realized in different ways, for example by using different materials for the edges on the foil inlet side and on the foil outlet side, wherein the edges on the foil inlet side

are made of a more rigid material than the edges on the foil outlet side. The edges on the foil outlet side may be made of a softer material than the edges on the foil inlet side. When the foil is made of a deformable material, and has a relief on one side of the foil, which foil is folded by the apparatus such that the relief is on the inner surface of the tubular foil, the soft edge may allow air to be pumped out of the package using the vacuum pump, and the hard edge may deform the foil's relief to substantially close the tubular foil to prevent environmental air to leak into the vacuum inner space. Moreover, a configuration with the sealing members (60a, 60b) disposed inside the cavities 53a, 53b, and thus inside the inner space 57, is possible.

[0058] It should be noted that the above-mentioned embodiments illustrate rather than limit the invention, and that those skilled in the art will be able to design many alternative embodiments without departing from the scope of the appended claims. In the claims, any reference signs placed between parentheses shall not be construed as limiting the claim. Use of the verb "comprise" and its conjugations does not exclude the presence of elements or steps other than those stated in a claim. The article "a" or "an" preceding an element does not exclude the presence of a plurality of such elements. The invention may be implemented by means of hardware comprising several distinct elements, and by means of a suitably programmed computer. In the device claim enumerating several means, several of these means may be embodied by one and the same item of hardware. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

Claims

1. A vacuum form, fill, and seal apparatus for packaging products in a product packaging line, comprising a foil transportation subsystem (26a, 26b) for transporting a foil (24) in a transportation direction along a foil transportation path;
a tubular foil former (23, 21, 27) along the foil transportation path for converting the foil from flat foil into tubular foil;
at least one cutting member (51) for cutting the tubular foil (24) transversely to the transportation direction;
a first vacuum space member (52a) and a second vacuum space member (52b) disposed on opposite sides of the foil transportation path, wherein the first vacuum space member (52a) comprises a cavity (53a) having an opening (54a) towards the foil transportation path, wherein the first vacuum space member (52a) comprises an edge (55a, 56a) around the opening (54a) that matches a shape of the second vacuum space member (52b);
at least one actuator for closing the cavity (53a) by

pressing the vacuum space members (52a, 52b) together to form an inner space (57), with a part of the tubular foil clamped in between the first and second vacuum space members;

- a vacuum generator connected to the inner space (57) to create a vacuum in the inner space and sucking a fluid from a package (58); and
sealing members (60a, 60b) disposed outside the inner space, for sealing the package transversely to the transportation direction.

2. The apparatus according to any preceding claim, wherein a space is provided between the sealing members (60a) and the vacuum space members (56a) for providing thermal isolation.

3. The apparatus according to any preceding claim, wherein
a first pair of sealing members (59a, 59b) is disposed on opposite sides of the foil transportation path and a second pair of sealing members (60a, 60b) is disposed on opposite sides of the foil transportation path,
the vacuum space members (52a, 52b) are disposed in between the first pair of sealing members and the second pair of sealing members, and
the apparatus is arranged for transporting the foil sequentially along the first pair of sealing members, the vacuum space members, and the second pair of sealing members.

4. The apparatus according to any preceding claim, wherein the at least one cutting member (51) is arranged for cutting the foil (24) inside the inner space (57).

5. The apparatus according to any preceding claim, further comprising a controller for sequentially causing:

the cutting member (51) to cut the tubular foil (24);
the vacuum generator to create the vacuum in the inner space (57) and sucking the gases from the package (58);
the sealing members (60a, 60b) to seal the package (58).

6. The apparatus according to any preceding claim, wherein the vacuum space members (52a, 52b) and the actuator are arranged for clamping the tubular foil (24) of a part of a package (58), wherein a clamping pressure exerted by at least part of the edge (56a) is strong enough to prevent the package (58) from falling and/or to prevent the foil (24) from being sucked into the inner space, and wherein the pressure is weak enough to allow fluid to be sucked out of the package (58) through channels formed by a relief on an inner surface of the tubular foil (24).

7. The apparatus according to claim 6, wherein the clasp pressure exerted by the edges (55a, 55b) of the vacuum space members (52a, 52b) on the tubular foil (24a) on a foil inlet side of the vacuum space members is strong enough to deform the tubular foil (24a) such that any channels formed by the relief are closed. 5
8. The apparatus according to claim 6 or 7, wherein at least part of the edge (56a, 56b) comprises a resilient material. 10
9. The apparatus according to claim 8, wherein at least part of the edge (56a, 56b) on a foil outlet side is softer than the edge (65a, 65b) on the foil inlet side. 15
10. The apparatus according to any one of claims 6 to 9, further comprising a roll of foil (24) comprising a relief on at least part of at least one side of the foil. 20
11. The apparatus according to any one of claims 6 to 9, further comprising a relief creator for creating the relief on at least part of at least one side of a foil unrolled from a roll of flat foil (24). 25
12. The apparatus according to any one of claims 6 to 9, wherein the edge (56a, 56b) on the foil outlet side comprises a plurality of protrusions for locally deforming the foil to form channels to enable fluid communication inside the tubular foil across the clamping edges (56a, 56b) of the vacuum space members (52a, 52b). 30
13. The apparatus according to any preceding claim, wherein the transportation direction is substantially vertical downwards. 35
14. A method of packaging products using a vacuum form, fill, and seal apparatus in a product packaging line, comprising 40
 - transporting a foil in a transportation direction along a foil transportation path; converting the foil from flat foil into tubular foil along the foil transportation path; transporting the tubular foil in between a first vacuum space member and a second vacuum space member disposed on opposite sides of the foil transportation path, wherein the first vacuum space member comprises a cavity having an opening towards the foil transportation path, wherein the first vacuum space member comprises an edge around the opening that matches a shape of the second vacuum space member; 45
 - pressing the vacuum space members together to form an inner space, with a part of the tubular foil clasped in between the first and second vacuum space members; 50
 - cutting the tubular foil transversely to the transportation direction; 55
 - creating a vacuum in the inner space and sucking a fluid from a package; and sealing the package transversely to the transportation direction, using sealing members disposed outside the inner space.
15. A roll of packaging foil for use in the vacuum form, fill, and seal apparatus according to claim 1, comprising a relief on at least part of at least one side of the foil.

Fig 1

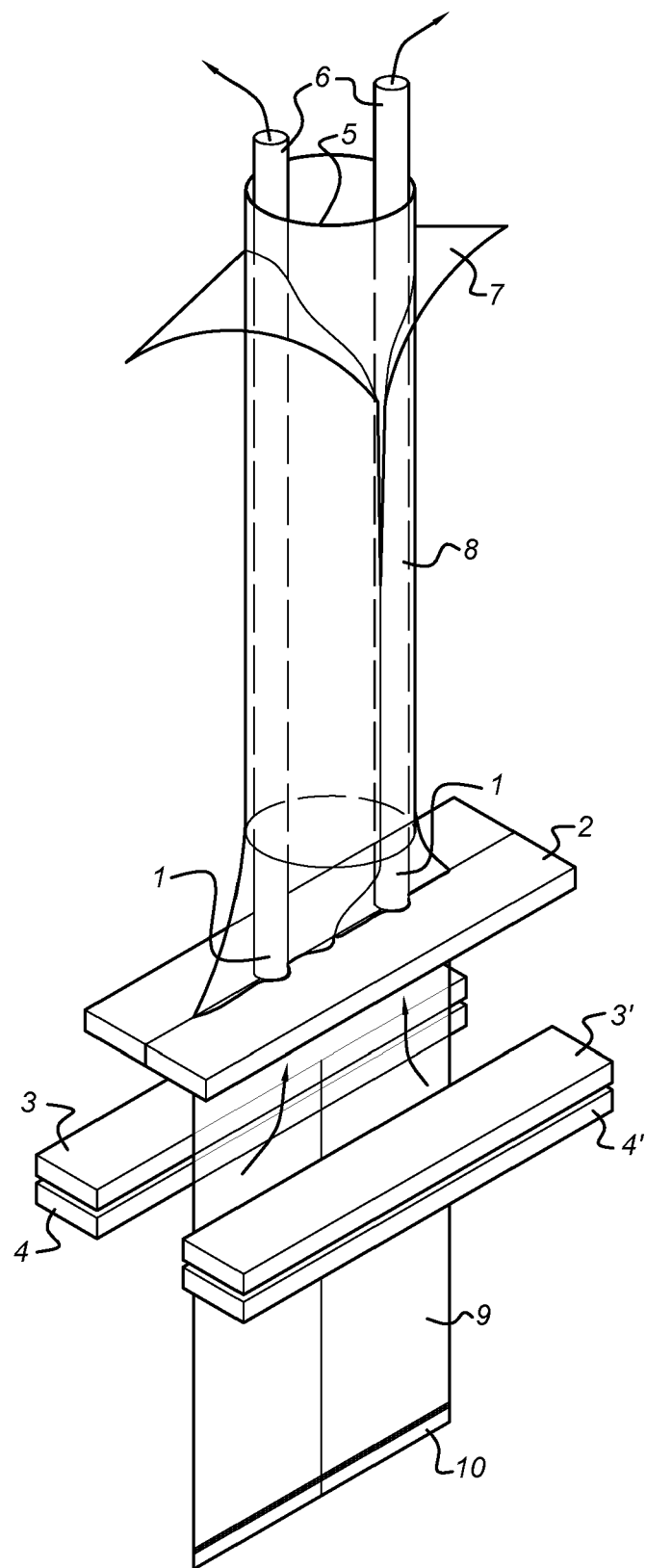


Fig 2

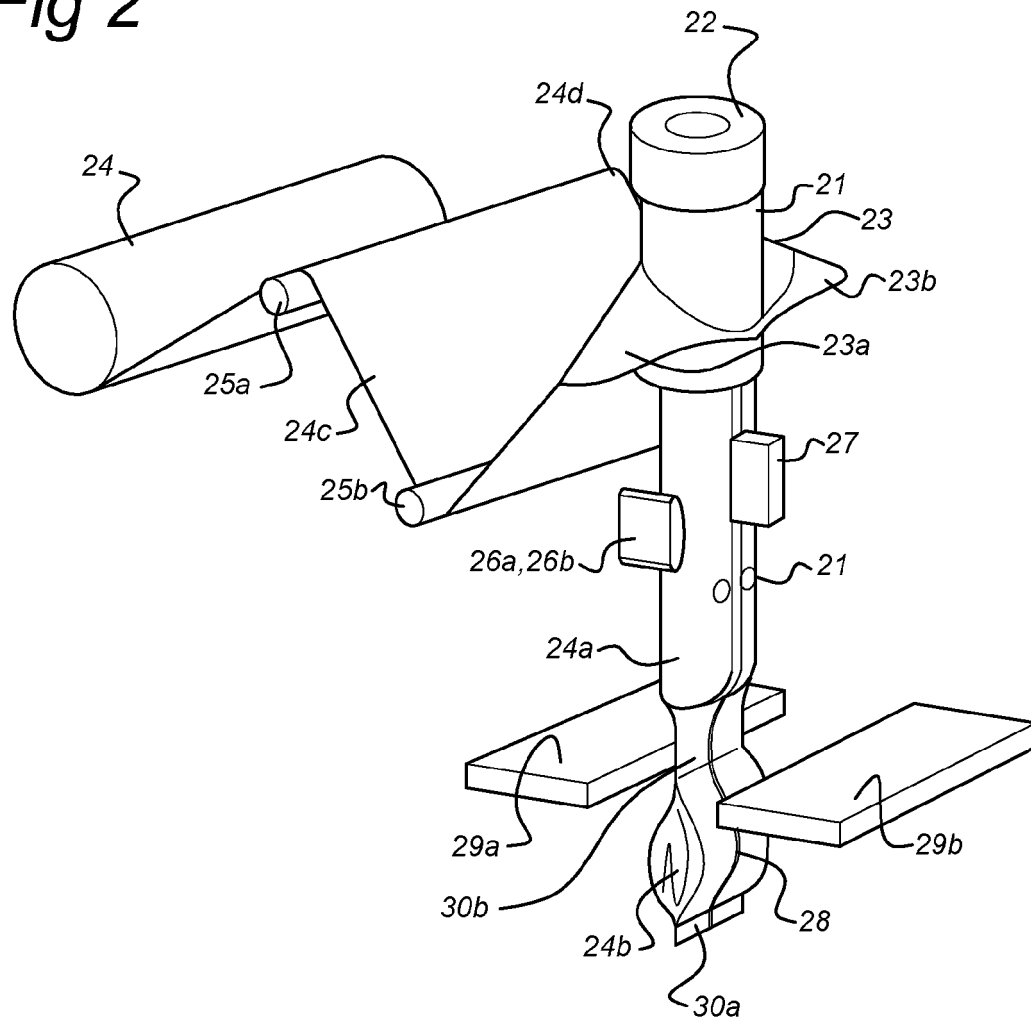


Fig 3

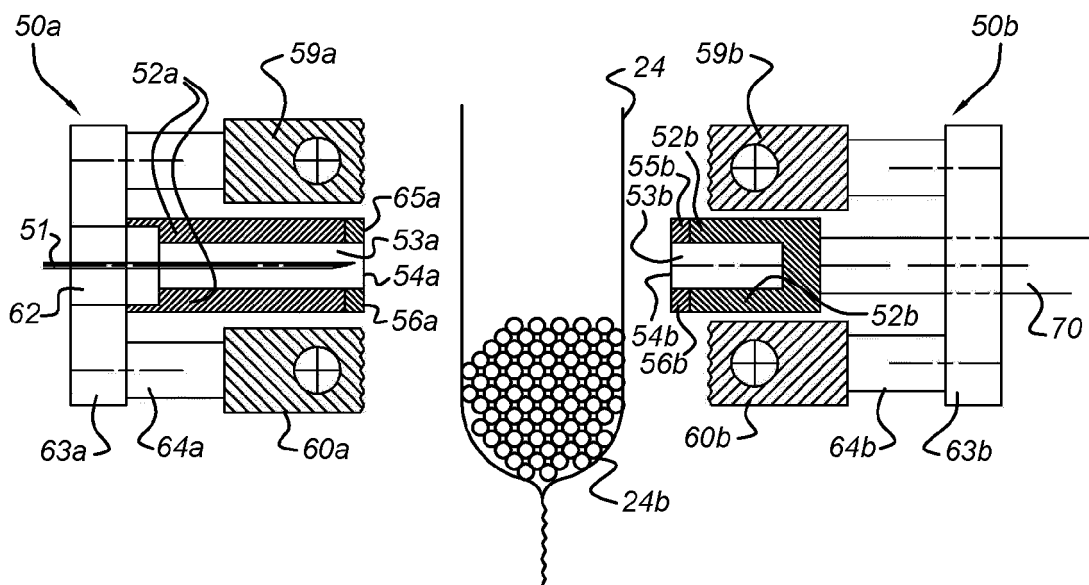


Fig 4

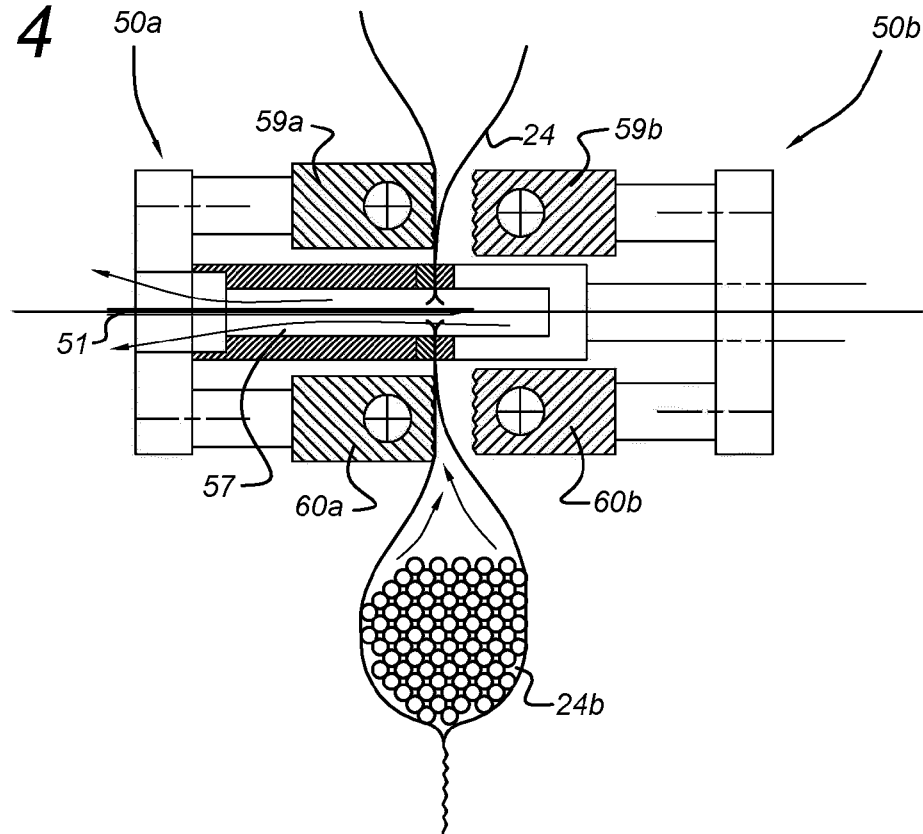


Fig 5

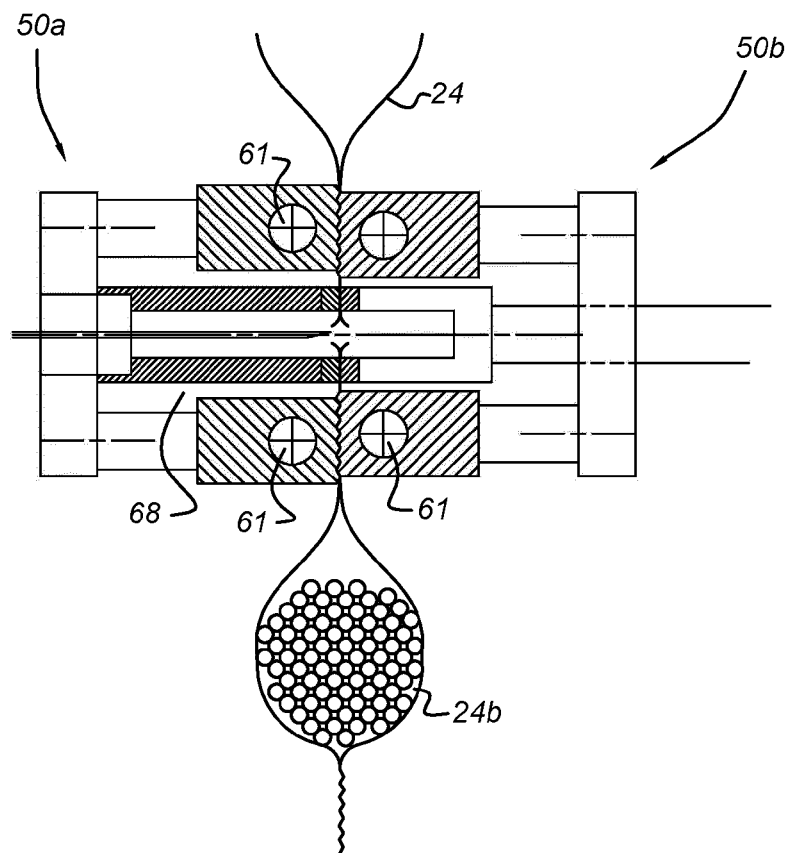


Fig 6

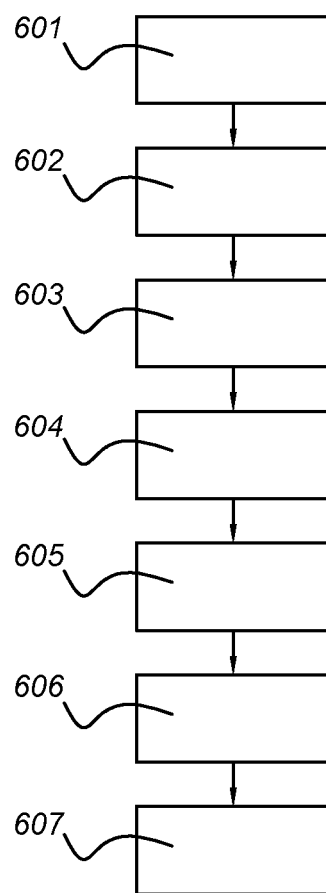


Fig 7a

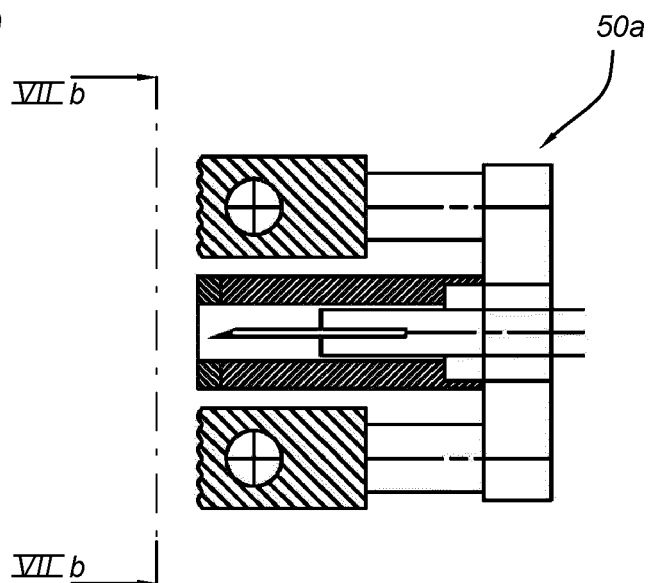


Fig 7b

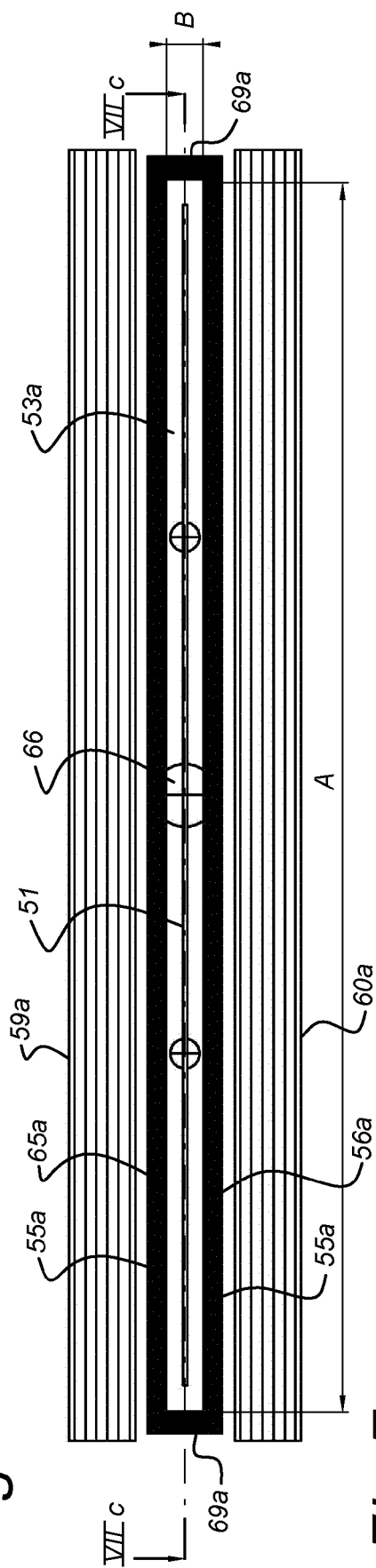


Fig 7c

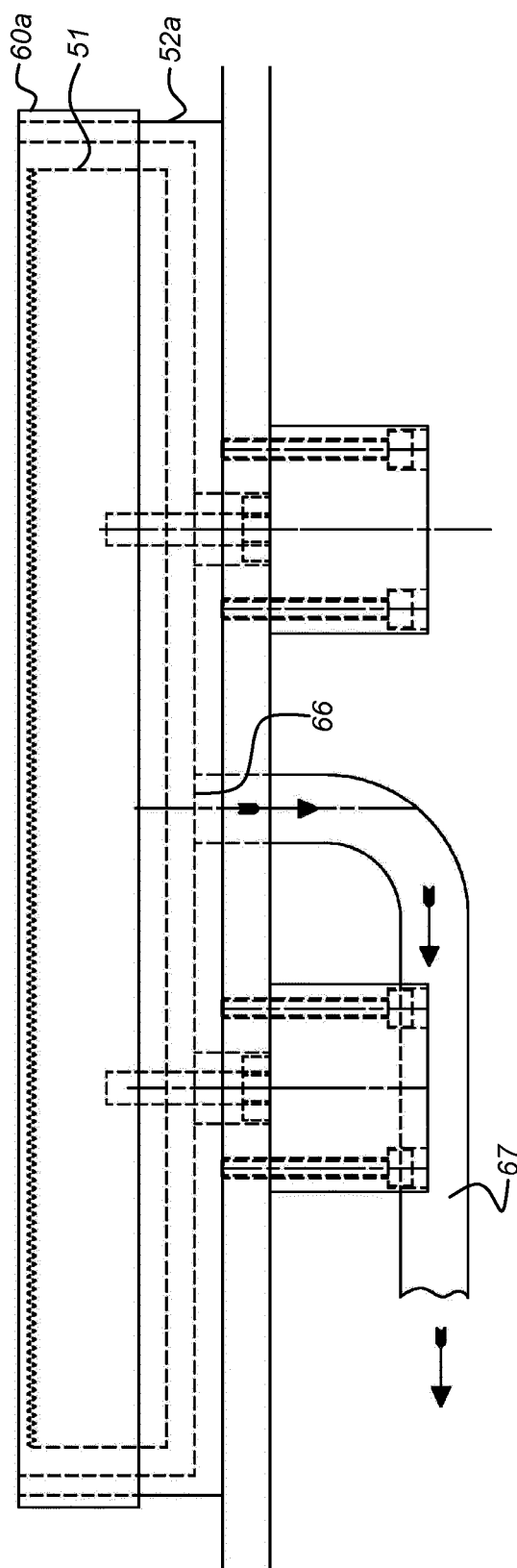
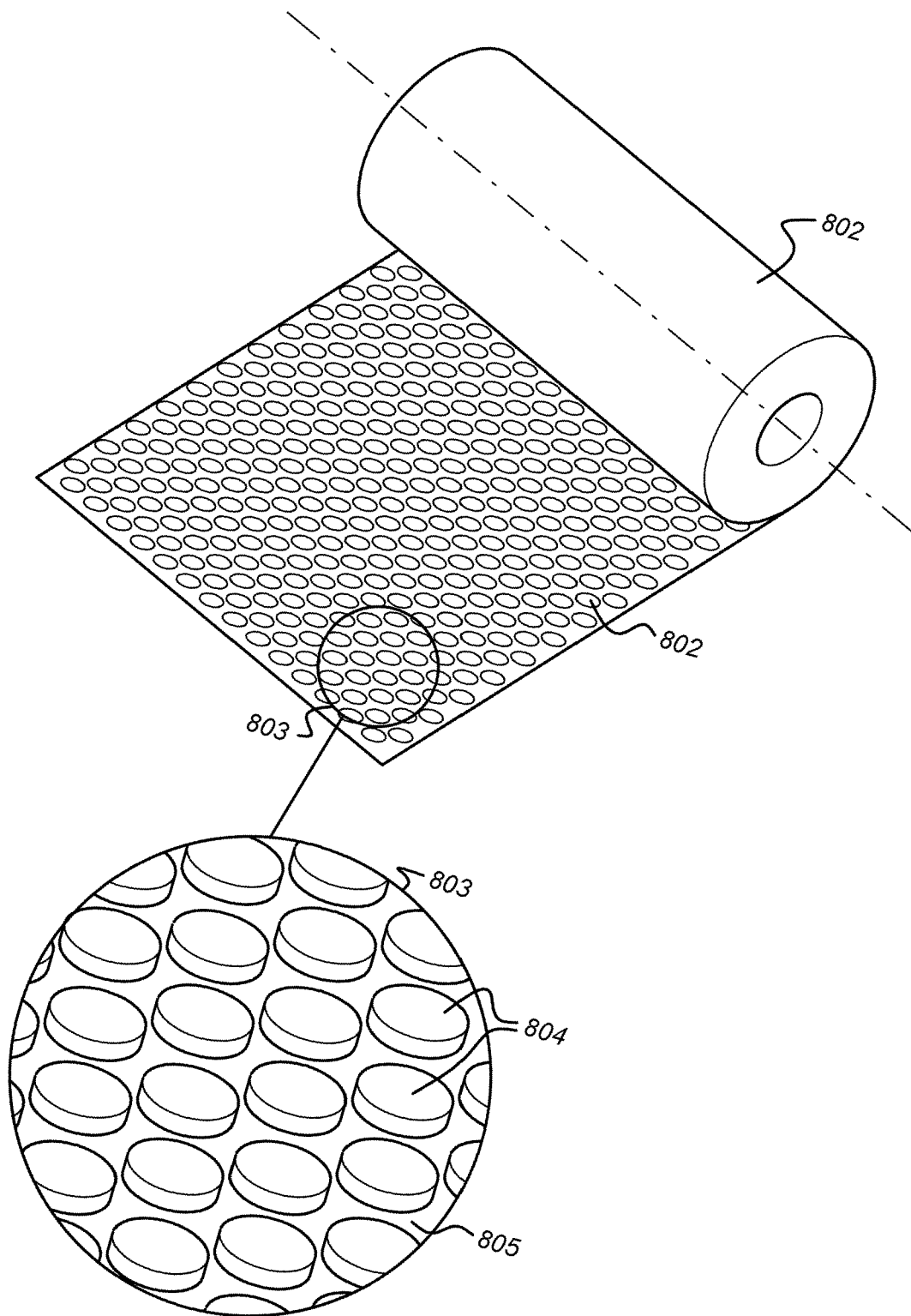


Fig 8





EUROPEAN SEARCH REPORT

Application Number
EP 12 15 9647

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 2 387 812 A (SONNEBORN JOHN R ET AL) 30 October 1945 (1945-10-30) * the whole document *	1-11,13,14	INV. B65B31/08 B65B9/20 B65B31/04 B65B51/30
A	-----	12	
Y	EP 0 175 448 A1 (GRACE W R & CO [US]) 26 March 1986 (1986-03-26) * page 7, line 1 - line 14; figure 2 *	1-11,13,14	
Y	-----		
Y	US 2 778 173 A (GERALD TAUNTON) 22 January 1957 (1957-01-22) * the whole document *	6,7	
X	-----		
X	WO 2006/012564 A2 (TILIA INT INC [US]) 2 February 2006 (2006-02-02) * abstract; figure 13 *	15	
Y	-----	10,11	
A	EP 1 221 411 A1 (IBARAKI SEIKI MACH CO [JP]) 10 July 2002 (2002-07-10) * abstract; figure 3 *	1,14	
A	-----		
A	EP 1 138 603 A1 (OPTIMA FILLING & PACKAGING [DE]) 4 October 2001 (2001-10-04) * paragraph [0030]; figure 1 *	1,14	TECHNICAL FIELDS SEARCHED (IPC) B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 11 May 2012	Examiner Schelle, Joseph
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		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	

1
EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 12 15 9647

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

11-05-2012

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
US 2387812	A	30-10-1945	NONE	

EP 0175448	A1	26-03-1986	AU 572323 B2	05-05-1988
			AU 4554585 A	20-03-1986
			BR 8503953 A	03-06-1986
			CA 1299085 C	21-04-1992
			DE 3563194 D1	14-07-1988
			EP 0175448 A1	26-03-1986
			GB 2164315 A	19-03-1986
			JP 2043806 C	09-04-1996
			JP 7080491 B	30-08-1995
			JP 61081928 A	25-04-1986
			NZ 212823 A	23-01-1987
			US 4601159 A	22-07-1986
			ZA 8506526 A	25-06-1986

US 2778173	A	22-01-1957	NONE	

WO 2006012564	A2	02-02-2006	CA 2574658 A1	02-02-2006
			EP 1786677 A2	23-05-2007
			US 2006073291 A1	06-04-2006
			WO 2006012564 A2	02-02-2006

EP 1221411	A1	10-07-2002	DE 60103120 D1	09-06-2004
			DE 60103120 T2	28-04-2005
			EP 1221411 A1	10-07-2002
			ES 2220644 T3	16-12-2004
			JP 3707538 B2	19-10-2005
			JP 2002205710 A	23-07-2002

EP 1138603	A1	04-10-2001	AT 242724 T	15-06-2003
			DE 10015628 A1	04-10-2001
			EP 1138603 A1	04-10-2001
			ES 2199907 T3	01-03-2004
