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

(11) EP 3 412 584 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
12.12.2018 Bulletin 2018/50

(51) Int Cl.:
B65B 9/20 *(2012.01)*

(21) Application number: **17382344.4**

(22) Date of filing: **07.06.2017**

(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
Designated Validation States:
MA MD

(71) Applicant: **Ulma Packaging Technological Center, S. Coop**
20560 Oñati (Gipuzkoa) (ES)

(72) Inventors:
- **OTXOA-AIZPURUA CALVO, Alberto**
  20560 OÑATI (ES)
- **OLALDE ARREGUI, Oier**
  20560 OÑATI (ES)

(74) Representative: **Igartua, Ismael et al**
Galbaian S. Coop.
Garaia Parke Teknologikoa
Goiru Kalea 1
20500 Arrasate-Mondragón (ES)

(54) PRODUCT PACKAGING METHOD AND MACHINE

(57) Packaging method in which a film (200) is fed to a vertical forming tube (1), whereby the film is formed into a tubular shape, the ends of the tubular-shaped film are longitudinally sealed to one another by applying pressure on said ends, the product (P) to be packaged is introduced into the forming tube (1) and the film formed downstream of the forming tube (1) is transversely sealed and cut. Furthermore, in the method, the ends of the film are pressed to one another with a force that keeps both ends static, the drop of the product (P) upstream of the transverse seal is stopped or limited, and by maintaining said pressure and said stop or limitation, an airflow (A) is generated inside the forming tube (1). Packaging machine.

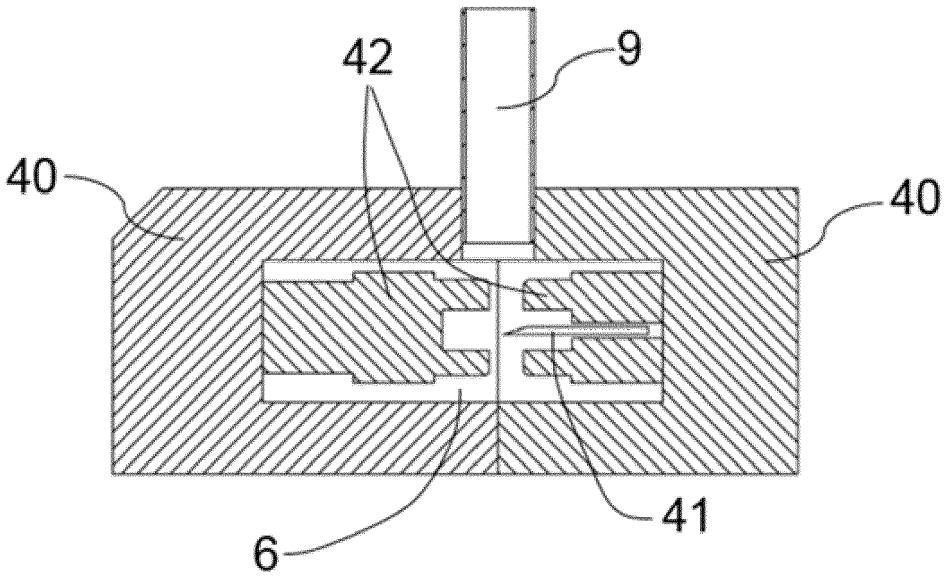

Fig. 7

EP 3 412 584 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to product packaging methods and machines.

PRIOR ART

[0002] Certain types of conventional product packaging machines, particularly vertical packaging machines, comprise a feeder whereby a continuous film which is wound like a reel is supplied. The film is supplied to a vertical forming tube which forms said film into a tubular shape. The machine also comprises a drive device for driving the tubular-shaped film in a descending forward movement direction, around the forming tube, and at least one longitudinal sealing tool sealing the longitudinal ends of the tubular-shaped film to one another, a film tube thereby being generated. The forming tube is open at its upper and lower parts.

[0003] A machine of this type further comprises a transverse sealing and cutting tool, arranged downstream of the forming tube, for generating a transverse seal and a transverse cut on the film tube. After this operation (or operations), a tube closed at one end is obtained upstream of the transverse cut and a package closed at both ends downstream of the transverse cut and physically separated from the film tube is obtained. During said operation (or operations), the end farther upstream of the package is closed, whereas the closed end farther downstream corresponds with the hardened end of the film tube of the previous cycle, i.e., the transverse seal which closes one end of the film tube will be a closed end of the package attained in the next cycle.

[0004] The machine also comprises a hopper or a similar device upstream of the forming tube, from where the product to be packaged is introduced into the forming tube, which product is arranged on the transverse seal of the film tube closed at one end after falling through the forming tube. The product is introduced into the forming tube through its upper part, and exits through its lower part towards the transverse seal of the film tube. It must be kept in mind that the film tube surrounds the forming tube, such that when the product is introduced into the forming tube, it is also introduced into the film tube.

[0005] The product is generally supplied in a controlled manner, a predetermined amount corresponding with the amount of product to be packaged in each package being supplied each time.

[0006] Patent document US6179015B1 discloses such a machine as well as a method to perform packaging in said machine. To accelerate the fall of the product, or to compact the product at the closed end of the film tube, air is injected into the film tube at certain time intervals in a controlled manner by means of a control device. The control device controls the injection of air depending on the position of the product being fed from the hopper.

DISCLOSURE OF THE INVENTION

[0007] The object of the invention is to provide a product packaging method and machine, as defined in the claims.

[0008] A first aspect relates to a product packaging method, in which a continuous film is fed to a vertical forming tube, the continuous film is formed into a tubular shape by means of the forming tube, said film surrounding said forming tube, the longitudinal ends of the tubular-shaped film are longitudinally sealed to one another by means of a longitudinal sealing tool that presses said ends to one another, a film tube being generated, the product to be packaged is introduced into the forming tube from the upper part of said forming tube in a downward direction, and the film tube is transversely sealed and cut with a transverse sealing and cutting tool downstream of the forming tube in the downward direction, a tube of transversely closed film material being obtained upstream of the transverse cut and a package closed and physically separated from the tube of transversely closed film material being obtained downstream of the film tube.

[0009] In the method, a descending airflow is generated inside the forming tube for a given time for each packaging cycle, such that it precedes the corresponding product in said forming tube. During said generation, the longitudinal ends of the continuous film are pressed to one another with a minimum force sufficient to keep both ends static with respect to one another, the longitudinal seal being protected against a possible opening of said seal due to the force of the airflow, and the falling of the product upstream of the transverse seal and downstream of the forming tube is stopped or limited in order to protect said transverse seal from sudden action of the product thereon, and if necessary, of the air that may hit said transverse seal, the unwanted opening of said transverse seal thereby being prevented.

[0010] Therefore, as a result of the airflow at least an acceleration of the product falling through the forming tube and a compaction of the product in the film tube is generated, while at the same time assuring that the film tube does not open longitudinally or transversely during said acceleration, preventing said acceleration and compaction of the product from negatively influencing the packaging process and/or the resulting package quality. This is particularly advantageous in terms of improving production times and reducing film consumption, given that, with the solutions of the prior art, before generating an airflow there is a need to wait for the transverse seal and/or the longitudinal seal to harden (for example, by means of a cooling time when said transverse and/or longitudinal seal is made by applying heat to the film), or to make more robust transverse and/or longitudinal seals (resulting in a larger transverse and longitudinal sealing surface and increased film consumption), since without the protections proposed in the method of the invention there is a risk of the longitudinal and/or transverse seal

opening due to the force of the product as it falls and/or the pressure generated by the airflow inside the film tube.

[0011] Additionally, film consumption is reduced with the proposed method because a stronger airflow can be generated, whereby the product can be compacted without any risk of damaging the package, resulting in a reduction in the height of the resulting package (thereby increasing the packaging speed as well), and, since greater airflows can be generated, the product is also prevented from blocking the forming tube or the inlet of the forming tube, resulting in the ability to use a forming tube with a smaller circumference, generating a narrower package, thereby also saving film material.

[0012] A second aspect of the invention relates to a packaging machine comprising a feeder for feeding a continuous film, a vertical forming tube to form the continuous film fed by the feeder into a tubular shape, a longitudinal sealing tool configured for longitudinally sealing the longitudinal ends of the tubular-shaped film to one another, a film tube being generated after said action of the longitudinal sealing tool, and a transverse sealing and cutting tool arranged downstream of the forming tube for transversely sealing and cutting the film tube, a transversely closed film tube being obtained on one side of the cut and a package closed and physically separated from the film tube being obtained on the other side of the cut in the downward direction.

[0013] The machine further comprises a protective element for stopping or limiting the fall of the product onto the transverse seal generated by the transverse sealing and cutting tool, upstream of said transverse seal, a generation device configured for generating an airflow inside the forming tube, and a control device configured for causing the generation of the airflow, the longitudinal sealing tool pressing the ends of the continuous film to one another with a minimum force sufficient to keep both ends static with respect to one another, and the protective element protecting the transverse seal. The advantages described with respect to the first aspect of the invention are also obtained with the machine.

[0014] These and other advantages and features of the invention will become evident in view of the drawings and detailed description of the invention.

DESCRIPTION OF THE DRAWINGS

[0015]

Figure 1 shows an embodiment of a packaging machine of the invention in which an airflow is generated in the forming tube by means of injecting air into said tube and by means of applying a suction on said tube.

Figure 2 shows an embodiment of a packaging machine of the invention in which an airflow is generated in the forming tube by means of applying a suction on the forming tube.

Figure 3 shows an embodiment of a packaging machine of the invention in which an airflow is generated in the forming tube by means of injecting air into said tube, and comprising an element for making a plurality of longitudinally distributed perforations on the film tube and a specific protective element for protecting the transverse seal.

Figure 4 shows an embodiment of a packaging machine of the invention in which an airflow is generated in the forming tube by means of injecting air into said tube and comprising a forming tube formed by an inner tube and an outer tube surrounding the inner tube and said tubes being coaxial.

Figure 5 shows in greater detail a generation device suitable for injecting air into the forming tube of the machine according to Figure 1, Figure 3 or Figure 4.

Figure 6 shows an actuator of an embodiment of the machine of the invention, with two recesses and a plurality of suction holes in each of them.

Figure 7 shows a suction chamber generated for causing suction in the forming tube 1 of the machine according to Figure 1 or Figure 2.

DETAILED DISCLOSURE OF THE INVENTION

[0016] A first aspect of the invention relates to a product packaging method, which is suitable for being implemented in a packaging machine 100 such as the one schematically shown by way of example and in a simplified manner in Figures In the method, a continuous film 200 is fed to a vertical forming tube 1, the continuous film 200 is formed into a tubular shape by means of the forming tube 1, said film surrounding said forming tube 1, and the longitudinal ends of the tubular-shaped film are longitudinally sealed to one another by means of a longitudinal sealing tool 2 that presses said ends to one another, a film tube 3 being generated. For longitudinally sealing the longitudinal ends of the film, the longitudinal sealing tool 2 presses said ends against the forming tube 1, or it comprises two opposite faces pressing both longitudinal ends of the film between them, for example.

[0017] In the method, for each packaging cycle the film tube 3 is transversely sealed and cut with a transverse sealing and cutting tool 4 downstream of the forming tube 1, a closed film tube 3 being obtained upstream of the transverse cut and a package closed and physically separated from the film tube 3 being obtained downstream of the transverse cut, and the product P to be packaged is introduced into the forming tube 1 from the upper part of said forming tube 1 in a downward direction by means of a hopper 110 or the like.

[0018] The seals are preferably made by means of pressure and heat application, or by means of ultrasound.

[0019] In the method, a descending airflow A is gen-

erated inside the forming tube 1 for a given time. The airflow A forces the product P to fall through the forming tube 1, causing the acceleration and compaction thereof in the film tube 3, where as a result of said forcing, said product P is prevented from getting stuck in the forming tube 1 or at the inlet of the forming tube 1.

[0020] During the generation of airflow A, with the longitudinal sealing tool 2 the longitudinal ends of the continuous film 200 are pressed to one another with a minimum force sufficient to keep both ends static with respect to one another, assuring that said film remains longitudinally sealed and is not severely affected by the airflow A, the transverse seal of the film tube 3 thus being protected in a simple manner. Furthermore, during said generation of airflow A, the fall of the product P upstream of the transverse seal (or the area of the film tube 3 where the transverse seal will be made) and downstream of the forming tube 1 is stopped or limited in order to protect said transverse seal from sudden action of the product P thereon, and if necessary, of the air that may hit said transverse seal, the unwanted opening of said transverse seal thereby being prevented. Therefore, with this last protection, when the product P falls, said fall is prevented from being able to cause the opening of the film tube 3 at said transverse seal (which could happen without stopping or limiting the fall of the product P, particularly if the transverse seal is newly made or the falling product P is compacted and falling at a high speed), the packaging process being able to be accelerated as this risk does not have to be contemplated when establishing the times required for carrying out said method.

[0021] It is therefore assured that during the generation of airflow A, the seals of the film tube 3 are kept stable: the pressure applied by the longitudinal sealing tool 2 on the longitudinal ends of the film prevents the difference in pressure, due to the pressure inside the film tube 3 generated by the airflow A with respect to the pressure outside the film tube 3, from causing the entry or exit of air into or from the film tube 3 through the longitudinal ends of the film, relative movement between said longitudinal ends of the film thereby being prevented and resulting in a high quality longitudinal seal; additionally, protection of the transverse seal by means of stopping or limiting the fall of the product P upstream of the transverse seal of the film tube 3 and downstream of the forming tube 1 assures the stability of the film tube 3 (the accidental opening thereof due to the airflow A and the impact of the product P itself being prevented).

[0022] In order to stop or limit the fall of the product P on the transverse seal, and where appropriate, to also limit the effect of airflow A on the transverse seal, a protective element is caused to move towards an area of the film tube 3 downstream of the forming tube 1 and upstream of the transverse seal (or of the area where the transverse seal will be made) so that said protective element limits or prevents the passage of the product P, and where appropriate, of the airflow, through said area. Therefore, the product P encounters said protective element as it travels downwards, which protective element either stops the product P from falling by allowing, at the height thereof, a smaller space for the passage of said product P as it travels downwards through the film tube 3, or limits the fall of said product P by preventing it from continuing said travel as long as said protective element is in said position (in this case, the protective element closes the passage through the film tube 3).

[0023] In some embodiments, the transverse sealing and cutting tool 4 can sometimes act as a protective element, as will be described more in detail below, whereas, in other embodiments, such as in the one shown in Figure 3 for example, the protective element is a specific protective element 5. In this case, the protective element 5 can comprise two opposite elements with the film tube 3 arranged between them, and at least one of said elements moves closer to the other, compressing the film tube 3, closing the passage through this area of the film tube 3 and halting or stopping the product P (in this case leaving a smaller space which makes deceleration of the product P necessary).

[0024] In some embodiments, prior to the generation of airflow A, at least one partial cut is generated in an area of the continuous film 200 from which the film tube 3 is formed, or in an area of the film tube 3, air being extracted from the film tube 3 through said partial cut, at least during the generation of airflow A.

[0025] In the context of the invention, partial cut must be interpreted as any type of action on an area of the film tube 3 which allows fluid communication therethrough between the inside and the outside of the film tube 3, or any type of action on an area of the film which subsequently allows fluid communication therethrough between the inside and the outside of the subsequently formed film tube 3, which in no case entails a physical separation between two areas of the film tube 3 (i.e., not a complete transverse cut of the film or of the film tube 3). In this sense, partial cut can be interpreted as a linear cut, a discontinuous cut, one or more perforations, etc.

[0026] The partial cut allows accessing the inside of the film tube 3 in a simple, easy and effective manner, making the extraction of air from inside said film tube 3 therethrough easier upon generating the airflow A, without it entailing any risk for the integrity or continuity of the film or of the film tube 3, and without there being any risk of the product P coming out of the film tube 3 through said partial cut.

[0027] In some embodiments, the descending airflow A in the forming tube 1 is generated by means of injecting air in a downward direction into the forming tube 1 (the case of embodiments of Figures 3 and 4); in other embodiments, it is generated by means of extracting air present inside the forming tube 1 by suction, from below said forming tube 1 (see Figure 2, for example); and in other embodiments, it is generated by means of combining both methods (see Figure 1, for example): injecting air in a downward direction into the forming tube 1, and extracting air present inside the forming tube 1 by suction

from below said forming tube 1.

[0028] In embodiments in which air is injected into the forming tube 1 to generate the airflow A (alone or in combination with suction), said injection of air is performed by means of a generation device 7 schematically depicted in a simplified manner in Figure 5, which is configured and suitable for injecting air into the forming tube 1 such that a negative pressure is caused upstream of the area of the forming tube 1 through which air is injected into said forming tube 1, the injection of air and the introduction of the product P being controlled and synchronized such that the product P arranged on said area follows the injected air, the fall thereof being accelerated and the product P being prevented from getting stuck in the forming tube 1 or at the inlet of the forming tube 1.

[0029] In some embodiments, such as the one shown in Figure 3, for example, a plurality of perforations (not depicted in said Figure 3), which are longitudinally distributed in the film tube 3 and above the area of the transverse seal, are made by means of a tool 104 configured for such purpose, and at least part of the airflow A exits the film tube 3 through said perforations. This reduces the pressure inside the film tube 3 due to the airflow A, which allows applying less pressure between the longitudinal ends of the film for keeping them static with respect to one another.

[0030] In some embodiments in which the airflow A is generated by means of injecting air alone, such as in the embodiment shown in Figure 4, for example, the partial cut is not used for discharging the injected air from the film tube 3, rather a specific configuration of the forming tube 1 is used to that end. Said configuration involves the forming tube 1 being formed by an inner tube 10 and an outer tube 11 surrounding the inner tube 10, said tubes being coaxial and demarcating a space existing between them. The air and product P are injected and introduced into the inner tube 10, and the film tube 3 surrounds the outer tube 11. The injected air exits through the lower part of the inner tube 10 and is introduced through the space between both tubes 10 and 11, moving upwards until exiting the forming tube 1. In other embodiments, the injected air is discharged by combining the partial cut and the forming tube 1 formed by the two coaxial tubes 10 and 11. The pressure inside the film tube 3 is therefore reduced due to airflow A, which allows applying less pressure between the longitudinal ends of the film for keeping them static with respect to one another.

[0031] In some embodiments in which suction is used for generating airflow A (alone or in combination with the injection of air), the suction is generated through the partial cut by means of a generation device, not depicted in Figures, and, furthermore, before the product P reaches the height of the partial cut. This therefore helps the fall of the product P itself and its compaction in the film tube 3.

[0032] In some embodiments in which at least one partial cut is generated and suction is generated through said partial cut, before generating the partial cut, the area of the film tube 3 in which said partial cut will be made is arranged in a suction chamber 6, said suction chamber 6 surrounding said area of the film tube 3 on the outside, fluid communication being allowed between the inside of the film tube 3 upstream of said suction chamber 6 and the inside of the film tube 3 of the area of said film tube 3 arranged in the suction chamber 6. In other alternative embodiments in which at least one partial cut is also generated and suction is generated through said partial cut, a suction chamber 6 is closed around and on the outside of an area of the film tube 3 corresponding with the area of the film tube 3 where the previously generated partial cut is arranged, fluid communication being allowed between the inside of the film tube 3 of the area arranged in the suction chamber 6 and the inside of the film tube 3 upstream of said suction chamber 6. In any of these embodiments, the suction chamber 6 is communicated with the inside of the film tube 3 through the partial cut, and suction is caused in the suction chamber 6, said suction and the communication through the partial cut resulting in suctioning air from inside the film tube 3 upstream of the suction chamber 6.

[0033] To close the suction chamber 6, for example, two opposite actuators 40 cooperate with one another (at least one of them moving towards the other, preferably both of them moving towards one another), and transversely hold the film tube 3 with their contours, the suction chamber 6 being demarcated by said contours. There is at least one free area between the contours of the actuators 40 where the film tube 3 is not held when both actuators 40 cooperate with one another to close the suction chamber 6, such that the area of the inside of the film tube 3 arranged in said suction chamber 6 can be placed in fluid communication with the inside of the film tube 3 which is located outside the suction chamber 6 through the area of the film tube 3 which is located in said free area. If said free area is upstream of the suction chamber 6, then the communication is with the inside of the film tube 3 which is located upstream of said suction chamber 6.

[0034] In some embodiments in which a suction chamber 6 is closed, when said suction chamber 6 is closed, the film tube 3 which is in the free area is drawn to the contours of the actuators 40 by suction, for example, such that a leak-tight space is generated inside the suction chamber 6, preventing the entry of air from outside the suction chamber 6 and allowing fluid communication between the inside of the film tube 3 arranged upstream of the suction chamber 6 and the inside of the film tube 3 arranged inside the suction chamber 6 through said free area in a more efficient manner. This suction is additional to the suction generated for generating airflow A, and is performed through, for example, suction holes 49 arranged in the contours of the actuators 40 opposite the free area. The free area can be generated, for example, by means of at least one recess 48 in the contour of at least one of the actuators 40, and the suction holes 49 would be located in that recess 48 (see Figure 6).

[0035] In the embodiments comprising two actuators

40, said actuators 40 can also sometimes act as a protective element, as depicted in Figures 1 and 2, for example. In the embodiments not comprising two actuators 40, the machine 100 can comprise a specific protective element 5 (see Figure 3), or the transverse sealing and cutting tool 4 can sometimes act as a protective element, as depicted in Figure 4, for example.

[0036] In some embodiments, the forming tube 1 comprises at least one nozzle attached to the forming tube 1, extending downwards from the inside of said forming tube 1. The nozzle comprises at least one inner cavity communicating the inside of the forming tube 1 with the lower end of said nozzle. The lower end of said nozzle is inserted into the free area which is located between the contours of the actuators 40 when they close the suction chamber 6, such that the film tube 3 is arranged held between the contour of the nozzle and the contour of the actuators 40, preventing the entry of air from outside the suction chamber 6 and allowing fluid communication between the inside of the film tube 3 arranged upstream of the suction chamber 6 and the inside of the film tube 3 arranged inside the suction chamber 6 through the inner cavity of said nozzle (see Figure 7).

[0037] The inside of the area of the film tube 3 arranged in the suction chamber 6 is placed in fluid communication with the suction chamber 6 through the partial cut. Suction is generated in the suction chamber 6, said suction and the fluid communication through the partial cut resulting in suctioning air from inside the film tube 3 both from the area which is in the suction chamber 6 and from the area of the film tube 3 which is upstream of said suction chamber 6. The forming tube 1 is upstream of said suction chamber 6, surrounded by the film tube 3, such that air is also suctioned from the forming tube 1, being extracted into the film tube 3 through the lower part of the forming tube 1 and then extracted from the film tube 3 through the partial cut.

[0038] In some embodiments, the partial cut and the transverse cut whereby a closed package physically separated from the film tube 3 is generated are made by means of one and the same cutting tool 41 of the transverse sealing and cutting tool 4, which allows making the design of the machine 100 compact and simplifying it. The cutting tool 41 is arranged in a first position with respect to the film tube 3 for making the partial cut (in said first position, it contacts the film tube 3 with a first cutting profile), and in a second position with respect to said film tube 3 to make the complete cut (in said second position, it contacts the film tube 3 with a second cutting profile). The cutting tool can therefore be arranged in at least three different positions: the first one in which it does not contact the film tube 3, the second one in which the first cutting profile contacts at least one area of said film tube 3 that does not cover the entire width of the film tube 3 for making perforations or partial cuts, and the third one in which the second cutting profile contacts the film tube 3 to make the complete cut.

[0039] In embodiments in which packaging processes are performed intermittently, for example, when the forward movement of the film tube 3 is stopped every time a transverse sealing and cutting operation is to be performed, the protective element performs horizontal movements between a first open position, allowing the passage of the product P, and a second closed position, limiting or preventing the passage of the product P. Additionally, in embodiments in which packaging processes are performed continuously, for example, when the transverse sealing and cutting tool 4 moves forward at the speed of the film tube 3 in the forward movement direction of the film tube 3 during the transverse sealing and cutting operation, the protective element moves in the forward movement direction of the film tube 3 in the closed position thereof accompanied by the film tube 3 during the movement thereof in the forward movement direction while the passage of the product P is limited or prevented.

[0040] A second aspect of the invention relates to a packaging machine 100, such as those shown by way of example in Figures, comprising:

- a feeder 102 for feeding a continuous film 200,
- a vertical forming tube 1 receiving the continuous film 200 and whereby said continuous film 200 is formed into a tubular shape,
- a longitudinal sealing tool 2 configured for longitudinally sealing the longitudinal ends of the tubular-shaped film to one another, a film tube 3 being generated after said action of the longitudinal sealing tool 2, and
- a transverse sealing and cutting tool 4 arranged downstream of the forming tube 1, for transversely sealing and cutting the film tube 3, a transversely closed film tube 3 being obtained on one side of the cut and a package closed and physically separated from the film tube 3 being obtained on the other side of the cut in the downward direction.

[0041] For longitudinally sealing the longitudinal ends of the film, for example, the longitudinal sealing tool 2 presses said ends against the forming tube 1, or it comprises two opposite faces pressing both ends between them. The transverse sealing and cutting tool 4 in turn comprises a cutting tool 41 responsible for making the transverse cut and a sealing tool 42 responsible for making the transverse seal on both sides, above and below the transverse cut.

[0042] The machine 100 also comprises a protective element for stopping or limiting the fall of the product P on the transverse seal that has been generated or the transverse seal that will be generated by the transverse sealing and cutting tool 4, upstream of said transverse seal and downstream of the forming tube 1, said transverse seal being protected from sudden action of the product P thereon, and if necessary, of the air that may hit said transverse seal, as mentioned above for the packaging method.

[0043] The machine 100 further comprises a genera-

tion device configured for generating a descending airflow A in the forming tube 1. The film tube 3 surrounds the forming tube 1 and an area of said film tube 3 extends downstream of the forming tube 1, such that if an airflow A is generated in the forming tube 1, this airflow A is also found inside the film tube 3. In some embodiments, the generation device 7 is configured for generating airflow A by means of injecting air in a downward direction into the forming tube 1, in other embodiments the generation device is configured for generating airflow A by means of extracting air present inside the forming tube 1 by suction through the lower part of said forming tube 1, and in other embodiments the generation device is configured for generating airflow A by means of injecting air and suction. The machine 100 comprises a control device, not depicted in Figures, which is communicated with the generation device 7 and configured for causing said generation device 7 to generate the airflow A when required and for the amount of time required.

[0044] Particularly, the control device is configured for causing the generation of airflow A, the longitudinal sealing tool 2 pressing the ends of the continuous film 200 to one another with a minimum force sufficient to keep both ends static with respect to one another and the protective element 5 protecting the transverse seal. The seals of the tube 3 are therefore protected during packaging, as described above for the first aspect of the invention.

[0045] In order to stop or limit the fall of the product P on the transverse seal, and where appropriate, to also limit the effect of airflow A on the transverse seal, the protective element is caused to move towards an area of the film tube 3 downstream of the forming tube 1 and upstream of the transverse seal (or of the area of the film tube 3 where the transverse seal will be made), so that said protective element limits or prevents the passage of the product P, and where appropriate, of the airflow, through said area. Therefore, the product P encounters said protective element as it travels downwards, which protective element either stops the product from falling by allowing, at the height thereof, a smaller space for the passage of said product P as it travels downwards, or limits the fall of said product P by preventing it from continuing said travel as long as said protective element is in said position.

[0046] In some embodiments, the protective element 5 is a specific element of the machine 100 for stopping or limiting the product P, which is arranged upstream of the generated transverse seal and downstream of the transverse sealing and cutting tool 4 and the forming tube 1. In these embodiments, the protective element 5 preferably comprises two opposite elements between which there is arranged the film tube 3, these elements moving closer to one another, compressing the film tube 3, closing the product P passage through this area of the film tube 3, or stopping said passage (if they leave a space between them, the product P can pass through this space, but at a lower speed).

[0047] In other embodiments, an element of the machine used for other functions can also act as a protective element, as will be described in detail below.

[0048] In some embodiments, the machine 100 comprises a cutting tool for making a partial cut in an area of the already formed film tube 3 or in an area of the continuous film 200 before the film tube 3 is formed. In either case, the partial cut does not cover the complete transverse width of the corresponding film tube 3.

[0049] In some embodiments, the machine 100 comprises two opposite actuators 40 configured for closing a suction chamber 6 around an area of the film tube 3 when they cooperate with one another (when they hold the film tube 3 between them). The actuators 40 are configured for pressing the film tube 3 together with respective contours which demarcate the suction chamber 6 when they press the film tube 3. The contours are configured such that they allow fluid communication between the inside of the film tube 3 of the area of said film tube 3 arranged in the suction chamber 6 and the inside of the film tube 3 upstream of said suction chamber 6, at least through at least one free area which is defined between both contours. The free area is upstream of the suction chamber 6, such that fluid communication between the inside of the area of the film tube 3 which is in said suction chamber 6 and the inside of the film tube 3 which is upstream of the actuators 40 is allowed.

[0050] In some embodiments, the cutting tool generating the partial cut is associated with at least one of the actuators 40, such that it is configured for making the partial cut in the area of the film tube 3 which is in the suction chamber 6. The control device is configured for controlling the action of said cutting tool on the film tube 3.

[0051] The generation device is configured for causing suction in the suction chamber 6, and since the suction chamber 6 is communicated through the partial cut with the inside of the film tube 3 arranged therein, and the partial cut is in turn communicated with the inside of the film tube 3 arranged upstream of the actuators 40, the suction also causes suction inside the film tube 3 and inside the forming tube 1, airflow A being generated. Generating a suction chamber 6 and applying suction therein makes this task easier, given that a complex connection is not required for connecting the generation device with the inside of the tube 3, and nor was there any need for ducts that are hard to install in the machine 100 due to the size and configuration of the machine 100.

[0052] In some embodiments, the actuators 40 comprise holes arranged in the contours, facing the free area, through which suction can be generated for drawing the film tube 3 towards said contours, the passage through said area of the film tube 3 being opened and the inside of the suction chamber 6 being isolated from the outer atmosphere (because air is prevented from entering or exiting the suction chamber 6 between the actuators 40 and the film tube 3). For these cases, the machine 100 comprises a device for generating said suction.

[0053] In some embodiments in which suction is gen-

erated in the suction chamber 6, the contour of the actuators 40 furthermore allows fluid communication between the inside of the film tube 3 of the area of the film tube 3 arranged in the suction chamber 6 and the inside of the film tube 3 downstream of said suction chamber 6, when both actuators 40 are pressing the film tube 3 together, through an additional free area. In these cases, the suction also affects the inside of the part of the film tube 3 arranged downstream of the sealing and cutting tool 4, at least part of the fluid present in said part of the film tube 3 being extracted. Said part of the film tube 3 comprises a transverse seal closing the film tube 3, and a product P which is arranged on said transverse seal and has been introduced in the previous cycle, and the extraction of fluid causes compaction of said product P and a reduction in volume of the generated package, thereby minimizing the space needed for product storage and transport, and in some cases, for product preservation.

[0054] In some embodiments in which a partial cut is made, the cutting tool generating the partial cut is the cutting tool 41 of the transverse sealing and cutting tool 4 making the transverse cut, and it comprises a first cutting profile configured for making the partial cut when it contacts the film tube 3, and a second cutting profile configured for making the complete transverse cut of the film tube 3 when it contacts the film tube 3, a single cutting tool 41 therefore being sufficient for both operations. The cutting tool 41 can therefore be arranged in at least three positions: the first one in which it does not contact the film tube 3, the second one in which the first cutting profile contacts the film tube 3, and the third one in which the second cutting profile contacts the film tube 3.

[0055] In embodiments in which a suction chamber 6 is closed and in which the cutting tool 41 is responsible for both the partial cut and the transverse cut, said cutting tool 41 and the sealing tool 42 are attached with freedom of movement to at least one of the actuators 40. Preferably, the cutting tool 41 is attached with freedom of movement to one of said actuators 40, and the sealing tool 42 is formed by two opposite elements cooperating with one another for transversely sealing the film tube 3, each of the elements being attached with freedom of movement to a respective actuator 40. In these embodiments, the protective element corresponds with the actuators 40 which stop or limit the fall of the product P upstream of the transverse seal that has been or will be generated, upstream of the transverse sealing and cutting tool 4, and downstream of the forming tube 1.

[0056] In some embodiments, the machine 100 comprises a hollow conduit 9 fixed to the inside of the forming tube 1 and extending downwards through the inside of the film tube 3, to the area of said film tube 3 which is surrounded by the suction chamber 6. The conduit 9 comprises at least a first hole, not depicted in Figures, for communicating the inside thereof with the suction chamber 6 through the partial cut, and a second hole upstream of the first hole, not depicted in Figures, for communicating the inside of said conduit 9 with the inside of the forming tube 1. The first hole of the conduit 9 is arranged inside the suction chamber 6 when the actuators 40 cooperate with one another, the conduit 9 being arranged in the free area of the suction chamber 6 and the film tube 3 being held between the conduit 9 and the actuators 40 of the suction chamber 6, such that the inside of the suction chamber 6 is isolated from the outside atmosphere. The conduit 9 therefore comprises an external shape complementary to the shape of the free area of the suction chamber 6, such that the conduit 9 is embedded in the free area of the suction chamber 6 and the film tube 3 is held with said conduit 9 and the actuators 40, leaving the inside of the suction chamber 6 isolated from the outside atmosphere. The second hole of the conduit 9 is arranged at the required height inside the film tube, such that the suction can be transferred vertically to the desired point inside the film tube 3 (and/or forming tube 1).

[0057] In some embodiments, air is injected into the forming tube 1 to generate airflow A. In these embodiments, the generation device 7 is configured for performing said injection and arranged in the machine 100 such that it injects air into the forming tube 1 such that a negative pressure is caused above the area of the forming tube 1 where the injection is performed. This generates what is commonly known as the Venturi effect, so if the product P is introduced thereafter, said product P will be affected by said negative pressure and the fall thereof will be accelerated. In addition to accelerating the fall of the product P and to causing the compaction thereof, as its speed (and force) increases, the risk of said product P getting stuck in the forming tube 1 or at the inlet of the forming tube 1 is eliminated, or at least greatly reduced. In these embodiments, the protective element corresponds with the transverse sealing and cutting tool 4 which is arranged upstream of the transverse seal and downstream of the forming tube 1, or with a specific protective element 5 arranged upstream of the generated transverse seal and downstream of the transverse sealing and cutting tool 4 and the forming tube 1.

[0058] In some embodiments, the generation device is configured for causing the injection of air and suction as described, being able to comprise a respective generation device for each operation.

[0059] In some embodiments, the machine 100 comprises a detection device, not depicted in figures, for detecting if the product P to be packaged in a package has passed into the forming tube 1, which is communicated with the control device. The control device is in this case furthermore configured for stopping airflow A taking into account said detection (stopping suction, injection of air or both, as appropriate). For example, a given time during which the generation device 7 generates the airflow A can be preestablished, and the control device can be configured for stopping said generation when both conditions are met: said time has elapsed and it has been detected that all the product P has passed into the form-

ing tube 1.

Claims

1. Product packaging method, wherein a continuous film (200) is fed to a vertical forming tube (1), the continuous film (200) is formed into a tubular shape by means of the forming tube (1), said continuous film (200) surrounding said forming tube (1), the longitudinal ends of the tubular-shaped film are longitudinally sealed to one another by means of a longitudinal sealing tool (2) that presses said ends to one another, a film tube (3) being generated, and, for each packaging cycle, the product (P) to be packaged is introduced into the forming tube (1) from the upper part of said forming tube (1) in a downward direction, and the film tube (3) is transversely sealed and cut with a transverse sealing and cutting tool (4) downstream of the forming tube (1), a transversely closed film tube (3) being obtained upstream of the transverse cut and a package closed and physically separated from the film tube (3) being obtained downstream of said transverse cut, **characterized in that** a descending airflow (A) is generated inside the forming tube (1) for a given time for each packaging cycle, such that it precedes the corresponding product (P) in said forming tube (1), and during said generation, the longitudinal ends of the continuous film (200) are pressed to one another with a minimum force sufficient to keep both ends static with respect to one another, the longitudinal seal being protected, and the fall of the product (P) upstream of the transverse seal and downstream of the forming tube (1) is stopped or limited, said transverse seal being protected from sudden action of the product (P) thereon.

2. Packaging method according to claim 1, wherein in order to stop or limit the fall of the product (P), a protective element (4; 40; 5) is caused to move towards an area of the film tube (3) which is upstream of the transverse seal that has been or will be generated and downstream of the forming tube (1), so that said protective element (4; 40; 5) stops or limits at least the passage of the product (P) through said area.

3. Packaging method according to claim 1 or 2, wherein, for each packaging cycle, at least one partial cut is generated in an area of the continuous film (200) from which the film tube (3) is formed or in an area of said film tube (3), air being extracted from the film tube (3) through said partial cut at least during the generation of the airflow (A).

4. Packaging method according to claim 3, wherein the partial cut and the transverse cut made on the film tube (3) for obtaining a transversely closed film tube (3) upstream of said transverse cut and a package closed and physically separated from the film tube (3) downstream of said transverse cut are made by means of one and the same cutting tool of the transverse sealing and cutting tool (4), which is arranged in a first position with respect to the film tube (3) for making the partial cut and in a second position with respect to said film tube (3) for making the transverse cut.

5. Packaging method according to claim 3 or 4, wherein a suction chamber (6) is closed around and on the outside of an area of the film tube (3) comprising the partial cut during the generation of the airflow (A), by means of the relative movement of two opposite actuators (40), which demarcate between them said suction chamber (6), towards one another, fluid communication being allowed between the inside of the area of the film tube (3) arranged in the suction chamber (6) and the inside of the film tube (3) upstream of said suction chamber (6), said suction chamber (6) being communicated with the inside of the tube (3) through said partial cut and suction being caused in the suction chamber (6) through said partial cut, said suction and the communication through the partial cut resulting in the airflow (A) in the forming tube (1) and the extraction of air from inside the film tube (6).

6. Packaging method according to claim 5, wherein the actuators (40) act as protective elements for the transverse seal when they generate the suction chamber (6), said transverse seal being made in the area of the film tube (3) which is in the suction chamber (6) and with said suction chamber (6) closed.

7. Packaging method according to any of the preceding claims, wherein in order to generate the airflow (A), air is injected into the forming tube (1) causing a negative pressure upstream of the area of the forming tube (1) where air is injected, the controlled and synchronized injection of air and introduction of the product (P) being such that the product (P) is drawn through the forming tube (1) by the airflow (A) preceding it.

8. Packaging machine comprising a feeder (102) for feeding a continuous film (200), a vertical forming tube (1), whereby the continuous film (200) fed by the feeder (102) is formed into a tubular shape, a longitudinal sealing tool (2) configured for longitudinally sealing the longitudinal ends of the tubular-shaped film to one another, a film tube (3) being generated after said action of the longitudinal sealing tool (2), and a transverse sealing and cutting tool (4) arranged downstream of the forming tube (1) for transversely sealing and cutting the film tube (3), a transversely closed film tube (3) being obtained on

one side of the cut and a package closed and physically separated from the film tube (3) being obtained on the other side of the cut in the downward direction, **characterized in that** the machine (100) comprises a protective element (4; 40; 5) for stopping or limiting the fall of the product (P) on the transverse seal that has been or will be generated by the transverse sealing and cutting tool (4), upstream of said transverse seal, a generation device (7) configured for generating a descending airflow (A) inside the forming tube (1), and a control device configured for causing the generation of the airflow (A), the longitudinal sealing tool (2) pressing the ends of the continuous film (200) to one another with a minimum force sufficient to keep both ends static with respect to one another and the protective element (4; 40; 5) protecting the transverse seal.

9. Packaging machine according to claim 8, wherein the protective element (4; 40; 5) is configured for being moved towards an area of the film tube (3) which is upstream of the transverse seal that has been or will be generated, and downstream of the forming tube (1), in order to stop or limit the passage of the product (P).

10. Packaging machine according to claims 8 or 9, comprising a cutting tool for making a partial cut in an area of the continuous film (200) from which the film tube (3) is formed or in an area of said film tube (3).

11. Packaging machine according to claim 10, wherein the cutting tool generating the partial cut comprises a first cutting profile configured for making the partial cut when it contacts the film tube (3), and a second cutting profile configured for making the complete transverse cut of the film tube (3) when it contacts the film tube (3).

12. Packaging machine according to claim 10 or 11, comprising two opposite actuators (40) cooperating with one another for closing a suction chamber (6) around an area of the film tube (3), said actuators (40) comprising respective contours which are configured such that they allow fluid communication between the inside of the film tube (3) of the area arranged in the suction chamber (6) and the inside of the film tube (3) upstream of said suction chamber (6) through a free area, and the generation device being configured for generating the suction which generates the airflow (A) in the suction chamber (6) through the partial cut.

13. Packaging machine according to claim 12, wherein the cutting tool generating the partial cut is associated with at least one of the actuators (40) and is arranged such that it generates the partial cut in the area of the film tube (3) arranged in the suction chamber (6).

14. Packaging machine according to claim 12 or 13, comprising at least one hollow conduit (9) fixed to the inside of the forming tube (1) and extending vertically downwards to the area of said film tube (3) which is surrounded by the suction chamber (6), said conduit (9) comprising at least a first hole for communicating the inside thereof with the suction chamber (6) through the partial cut and a second hole upstream of the first hole for communicating the inside of said conduit (9) with the inside of the film tube (3).

15. Packaging machine according to any of claims 8 to 14, wherein the generation device (7) is arranged such that it injects air into the forming tube (1), a negative pressure being caused upstream of the area of the forming tube (1) where air is injected.

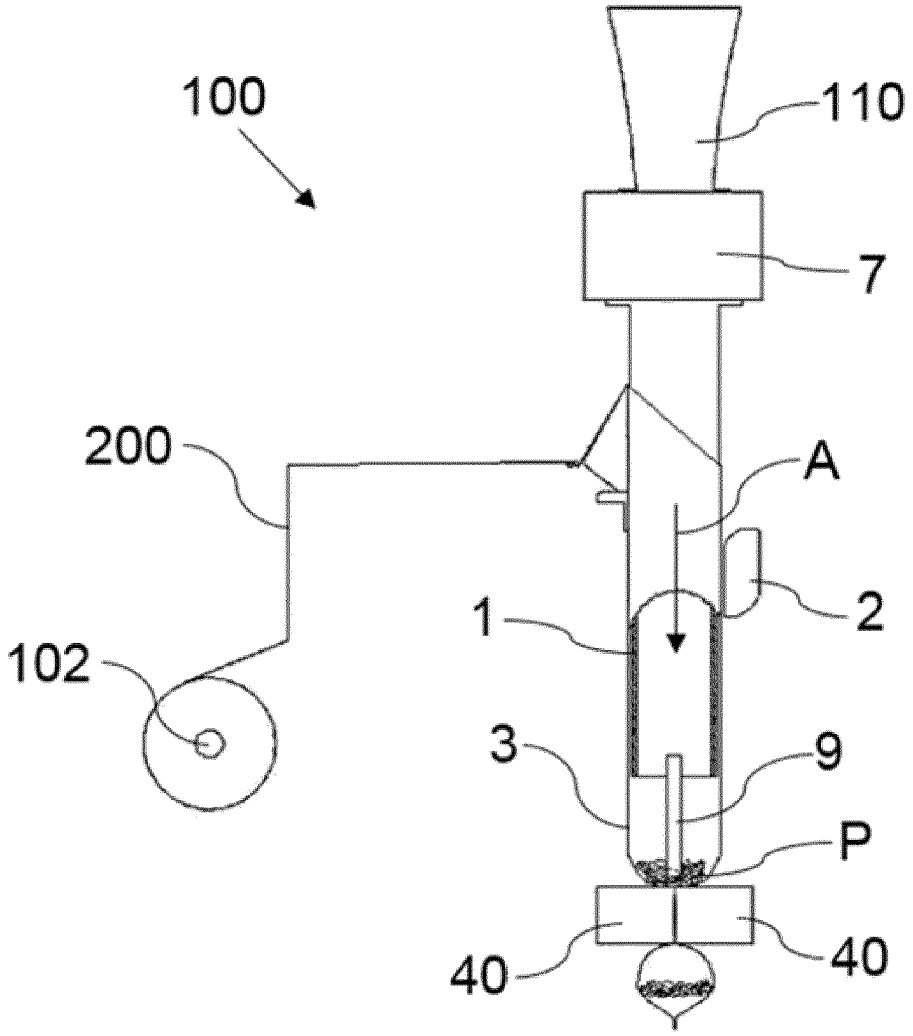

Fig. 1

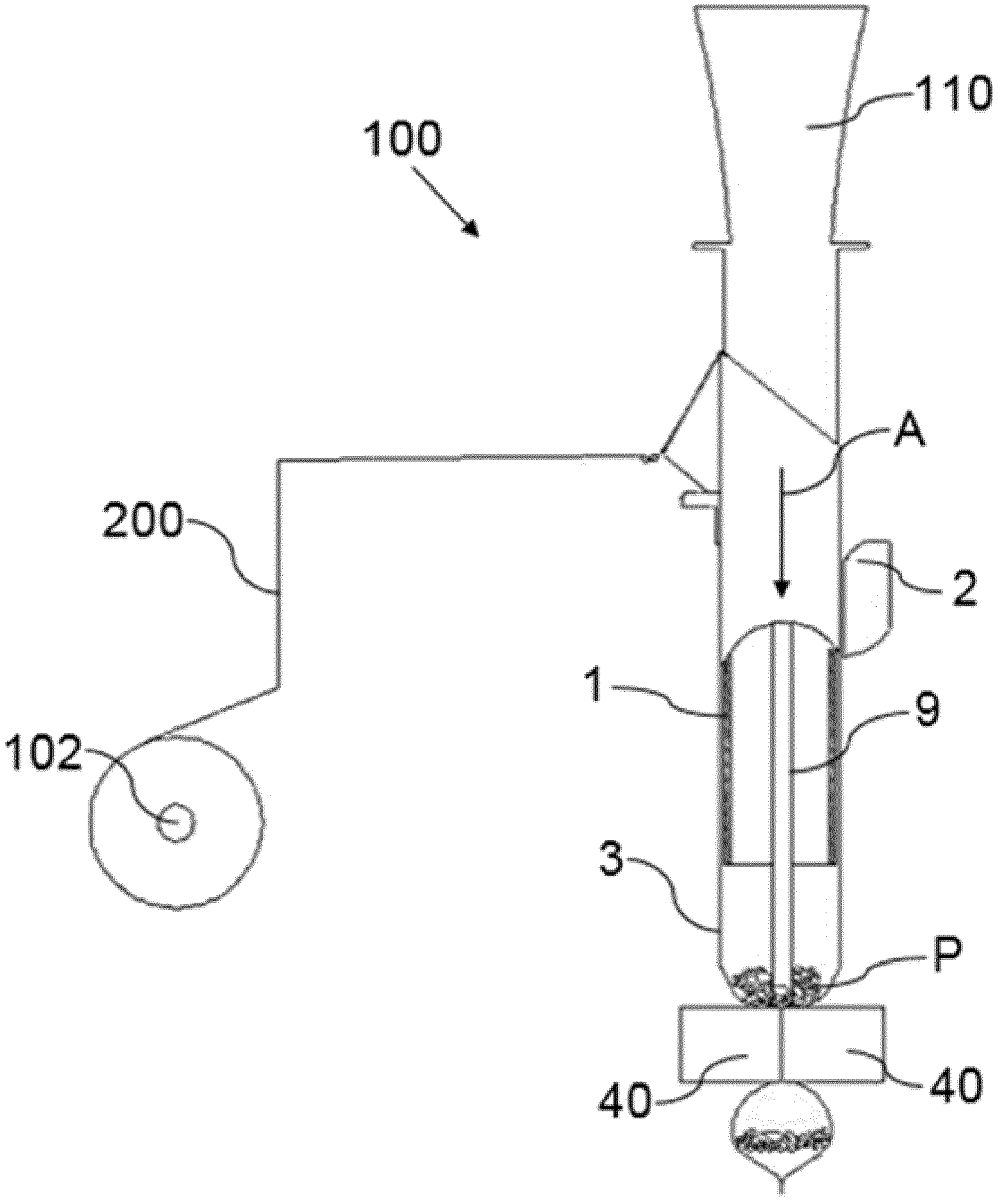

Fig. 2

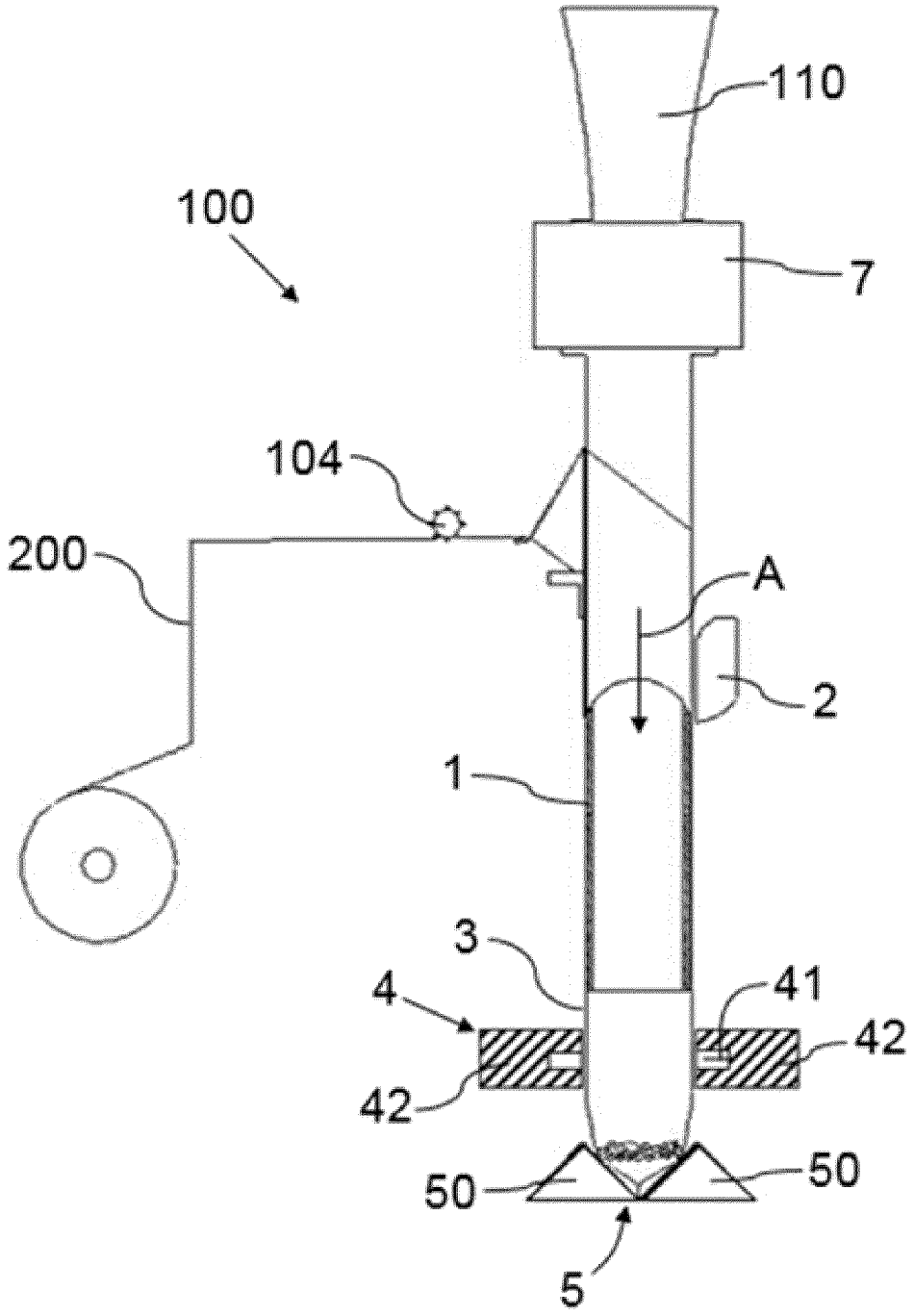

Fig. 3

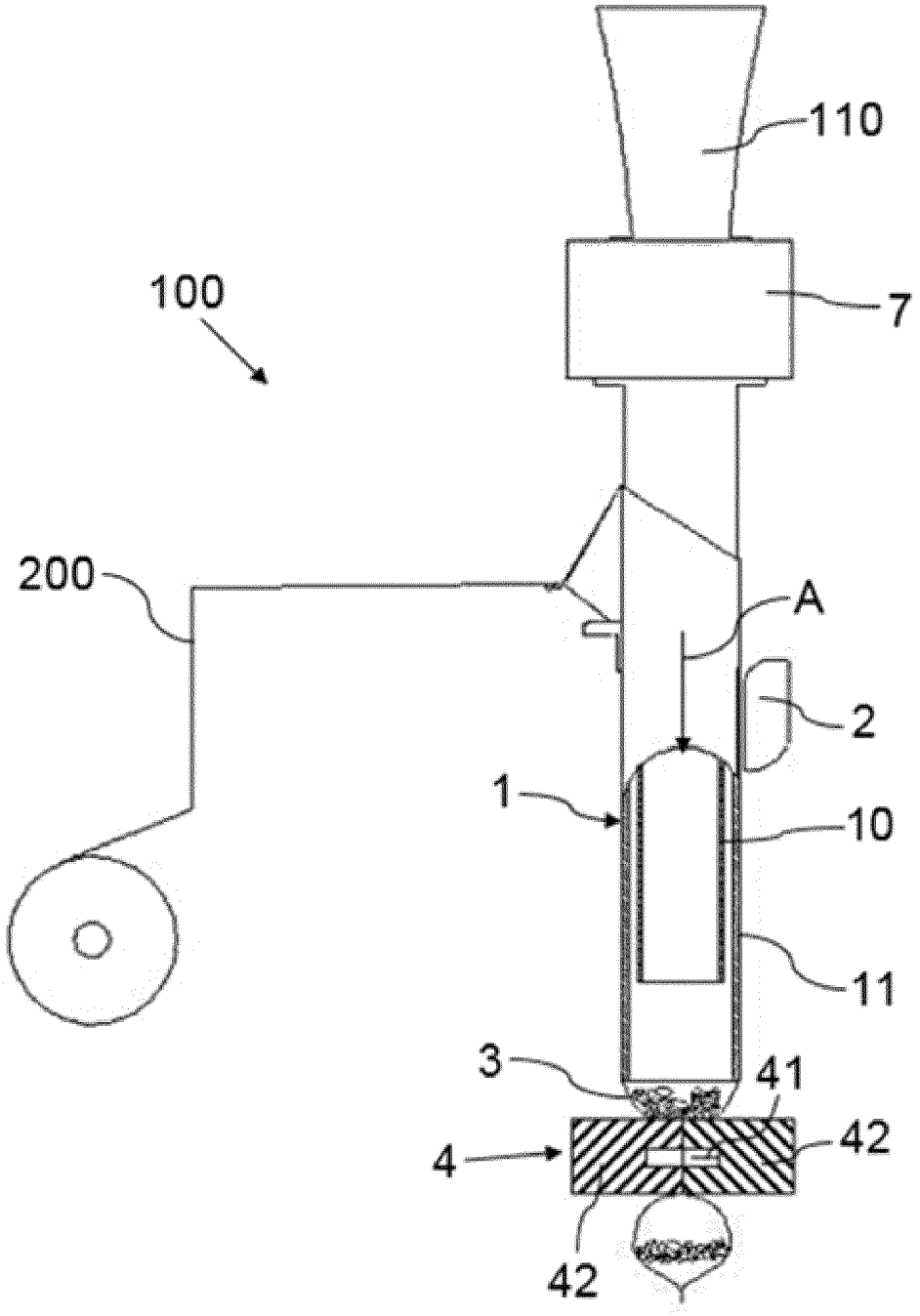

Fig. 4

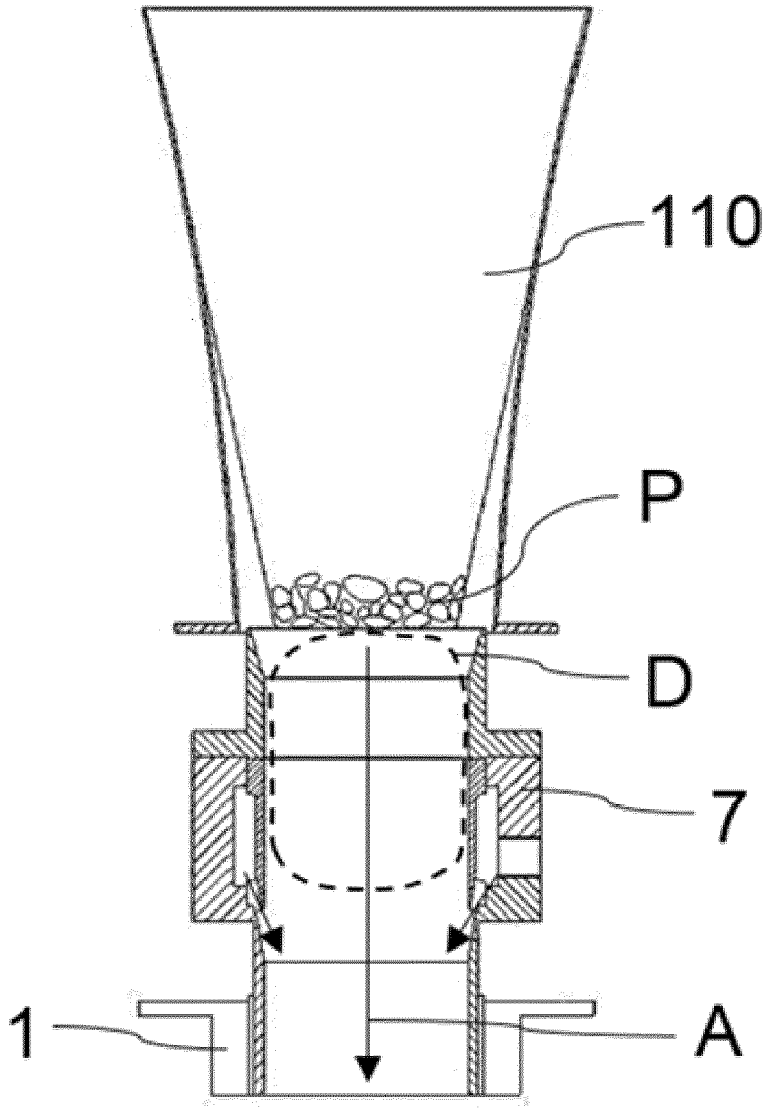

Fig. 5

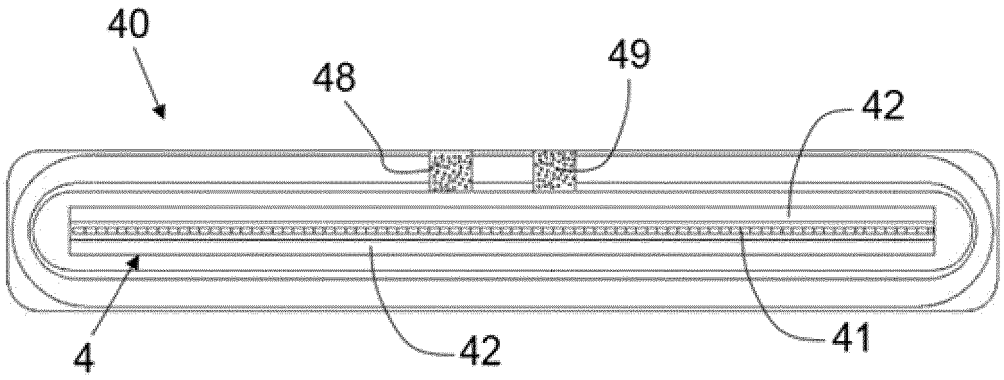

Fig. 6

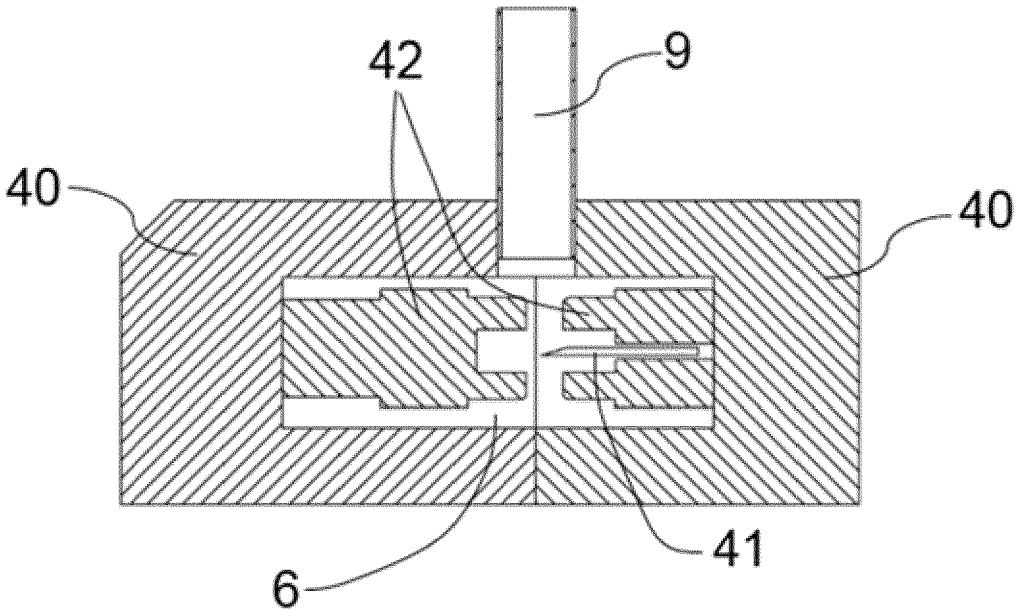

Fig. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 17 38 2344

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,D A	US 6 179 015 B1 (KAMMLER ROMAN [DE] ET AL) 30 January 2001 (2001-01-30) * the whole document *	1,2,7-9, 15 3-6, 10-14	INV. B65B9/20

Y A	US 6 116 001 A (KAMMLER ROMAN [DE] ET AL) 12 September 2000 (2000-09-12) * the whole document *	1,2,7-9, 15 3-6, 10-14	

Y	ES 1 059 065 U (PASTRANA ROJAS JOSE MARIA [ES]) 1 March 2005 (2005-03-01) * the whole document *	1,2,8,9	

Y A	US 3 045 404 A (WILSON PETER G) 24 July 1962 (1962-07-24) * the whole document *	1,2,7-9, 15 3-6, 10-14	

TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	17 November 2017	Ngo Si Xuyen, G

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

EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 38 2344

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.

17-11-2017

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 6179015 B1	30-01-2001	AU 763800 B2	31-07-2003
		DE 19852107 A1	18-05-2000
		EP 1000859 A1	17-05-2000
		US 6179015 B1	30-01-2001
US 6116001 A	12-09-2000	AU 746134 B2	18-04-2002
		DE 19748805 A1	06-05-1999
		EP 0915016 A1	12-05-1999
		US 6116001 A	12-09-2000
ES 1059065 U	01-03-2005	NONE	
US 3045404 A	24-07-1962	NONE	

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 6179015 B1 **[0006]**