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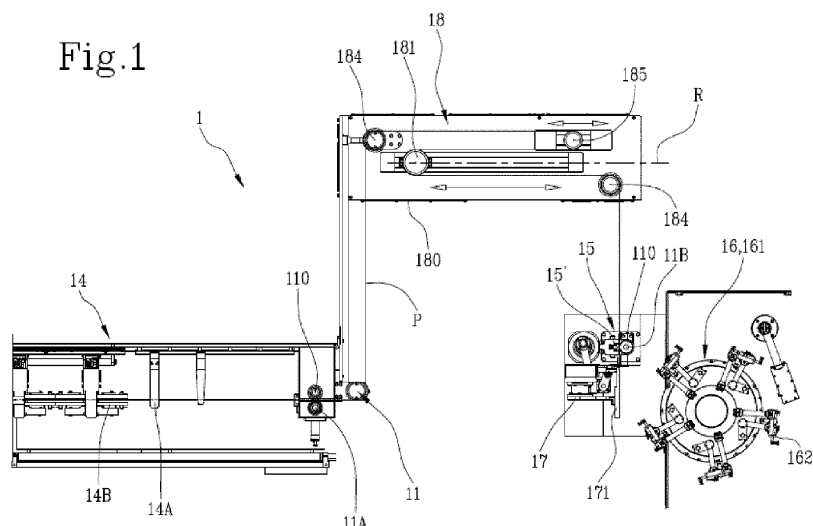
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(54) **PACKAGING LINE FOR PRODUCTS IN BAGS**

(57) Described is a packaging line (1) for products in bags comprising: a feed unit (11), configured to receive a web to from a reel (12A) and for moving it along a feed path (P); a control unit (10), connected to the feed unit (11) for moving the web intermittently; a folding station (13), configured for folding the web about a folding line (131); a sealing station (14), configured for sealing the first and second flap of the web folded along sealing lines (14A); a cutting station (15), configured for cutting the packaging web and defining a plurality of packaging bags; a filling station (16), configured for filling with a product the plurality of packaging bags; a sealing station, configured for sealing the plurality of packaging bags. The feed unit (11) includes a first motor-driven roller

(11A), for moving the web through the folding (13) and sealing (14) stations, by a first succession of forward movements (S1) with a first feed step, and a second motor-driven roller (11B), for moving the web by a second succession of forward movements (S2), with a second feed step. The line includes an adjustment unit (18), positioned between the first (11A) and the second (11B) motor-driven roller. The adjustment unit includes a tensioning element (181), operatively in contact with the web and movable between a first operating position (P1) and a second operating position (P2), and an actuator (182), connected to the tensioning element (181) for varying a position of the tensioning element (181), so as to vary the length of the feed path (P).

Fig.1



Description

Technical Field

[0001] The present invention relates to a line for packaging products in bags. The technical sector to which this invention belongs is that of the lines for packaging products, for example food, which may be liquid, solid or granular.

Prior Art

[0002] In the technical sector of packaging products in bags there are prior art packaging lines which, starting from a web of plastic or paper material, produce bags in which to package the products. More specifically, the web passes through a plurality of processing stations along the packaging line. Following a feed path of the web, the line includes a folding station, wherein the web is folded, a sealing station, wherein at least two flaps of the web (folded) are sealed to each other (for example by heat-sealing) to define an un-sealed bag, a cutting station, wherein the un-sealed bags are separated from each other, a filling station (usually a rotary carousel), wherein the bags are filled with the product, and a sealing station, wherein the bag is sealed.

[0003] In these packaging lines, the feeding of the web is an alternating forward movement generated by a plurality of motor-driven rollers, each of which may be associated with (that is, is designed to feed) a respective processing station. Each motor-driven roller is characterised by a feed step which depends on the productivity of the respective machine with which the motor-driven roller is associated.

[0004] The productivity of the processing stations may be heterogeneous and, consequently, the feed step of the motor-driven rollers may be different.

[0005] In the lines in which this condition occurs, the difference between the steps of feeding the motor-driven rollers could cause a loss of tension of the web in the line or, on the other hand, and excessive tensioning of the web.

[0006] Solutions are known in the trade aimed at regulating this problem. They are described in documents EP0999134A2, BO93A000453 and BO94A000073.

[0007] Patent document EP0999134A2 describes a solution wherein a movable element (connected to the web) responds to a variation in the tension of the web by varying the position of a piston. The position of the piston is measured by a control unit which, as a function of the position, determines a tension of the web. As a function of the tension of the web, the control unit adjusts the unwinding speed of a reel for feeding the web. However, this solution does not take into consideration imbalances between the processing stations which are known before the start of the machine. For this reason, the system adjusts the tension only after having detected an increase in the tension, thus increasing the risk that the web can

deteriorate.

[0008] Patent document BO93A000453 illustrates a station including a plurality of rollers on which the web is wound. However, it does not describes in any way how this solution can overcome the unbalance generated by heterogeneous steps along the line.

[0009] Patent document BO94A000073 illustrates an adjustment unit wherein the tension of the web is kept constant by adjusting the pressure of a negative pressure chamber, in which the web is sucked. The negative pressure in the chamber is proportional to the tension of the web. This is a self-regulating solution, for which the system responds to variations in length of the unwound web by adapting autonomously. However, the adjustment is not precise and not very reliable, since any failings of the negative pressure pump could adversely affect the operation. Moreover, the solution of BO94A000073, having to guarantee a pressure inside the vacuum chamber (delimited by the web), has serious problems related to the hydraulic seals, which further reduce the degree of reliability.

Description of the Invention

[0010] The aim of this invention is to provide a line for packaging products in bags and a method for packaging products in bags which overcomes the above-mentioned drawbacks of the prior art.

[0011] This aim is fully achieved by the line for packaging products in bags and by the method for packaging products in bags according to the invention as characterised in the appended claims.

[0012] According to one aspect of this invention, the method provides a line for packaging products in bags. The line comprises a feed unit. The feed unit is configured for receiving a web from a reel. The feed unit is configured for moving the web along a feed path. In some embodiments it is possible that the web has been divided upstream and, therefore, the movement unit is configured for moving portions of the web.

[0013] The line comprises a control unit. The control unit is connected to the feed unit for moving the web. In one embodiment, the control unit is connected to the feed unit for moving the web intermittently, by a sequence of forward movements of predetermined spacing.

[0014] In one embodiment, the line comprises a folding station. The folding station is configured for folding the web about a folding line. In one embodiment, the folding line is oriented along the feed path, for superposing a first and a second flap of the web. In some embodiments the line is also fed with two separate webs, superposed to form the first and second flap of the web.

[0015] In one embodiment, the line comprises a sealing station. The sealing station is configured for sealing the first and second flap (of the folded web). In one embodiment, the sealing station is configured for sealing the first and second flaps (of the folded web) along sealing lines oriented transversally to the folding line. In one em-

bodiment, the sealing station is configured for sealing the first and second flaps (of the folded web) along sealing lines oriented parallel to the folding line.

[0016] In one embodiment, the line comprises a cutting station. A cutting station is configured for cutting the packaging web, for defining a plurality of packaging bags.

[0017] In one embodiment, the line comprises a filling station. The filling station is configured for filling with a product the plurality of packaging bags.

[0018] In one embodiment, the line comprises a sealing station. The sealing station is configured for sealing the plurality of packaging bags.

[0019] In one embodiment, the feed unit includes a first motor-driven roller. The first motor-driven roller is controlled by the control unit. The first motor-driven roller is configured for moving the web through the folding and/or sealing stations. The first motor-driven roller is configured for moving the web through the folding and/or sealing stations, by a first succession of forward movements, with a first feed step.

[0020] In one embodiment, the feed unit comprises a second motor-driven roller. The second motor-driven roller is controlled by the control unit. The second motor-driven roller is controlled by the control unit for moving the web by a second succession of forward movements, with a second feed step. The second feed roller is configured for moving the web through the cutting station. In one embodiment, the second motor-driven roller is positioned upstream of the cutting station. The second motor-driven roller is positioned downstream of the first motor-driven roller. In one embodiment, the first feed step and the second feed step are different.

[0021] In one embodiment, the line includes an adjustment unit. The adjustment unit is positioned between the first and second motor-driven roller. The adjustment unit is configured for adjusting a tension of the web. The adjustment unit is configured for varying the length of the feed path.

[0022] In one embodiment, the adjustment unit includes a tensioning element. The tensioning element is operatively in contact with the web. The tensioning element is movable between a first operating position, wherein the feed path has a first length, and a second operating position, wherein the feed path has a second length. In one embodiment, the first length is different from the second length. The length of the feed path means the length of the web unwound starting from the reel up to the point in which it is cut in the cutting station.

[0023] In one embodiment, the adjustment unit includes an actuator. The actuator is connected to the tensioning element for varying a position of the tensioning element, so as to vary the length of the feed path.

[0024] In this way, by actively controlling the actuator, there is a more precise control of the tension of the web which will always be kept at an optimum tension value.

[0025] The actuator is connected to the control unit. The actuator is connected to the tensioning element by a transmission unit. The transmission unit is configured

for transmitting (and, if necessary, transforming) the motion of the actuator into a movement of the tensioning element along an adjustment direction.

[0026] In one embodiment, the control unit is configured for receiving working data. The working data representing operating parameters of the line. More specifically, they may include information relating to the work cycle of the bags to be packaged and/or the working times of each station and/or the starting times of the first and second motor-driven rollers and/or the number of bags to be produced. In one embodiment, the working data represent the first and second succession. In one embodiment, the control unit is configured for generating control signals. The control signals are a function of the working data. The control unit is configured for controlling the actuator by means of the control signals, thus, as a function of the working data.

[0027] This feature makes it possible to know before the activation of the line the speed profile (thus the position at any instant) which the tensioning element must follow (have). For this reason, the control is not a feedback control which has, by its very nature, a certain delay in the adaptation which sometimes may prove critical.

[0028] In one embodiment, the actuator is configured for moving the tensioning element according to a predetermined speed profile. In one embodiment, the speed profile is a constant profile over time. In one embodiment, the speed profile is a linear profile increasing or decreasing over time. In one embodiment, the speed profile is a profile which increases up to a maximum point and then decreases to zero in such a way as to prevent excessive inertial loads on the tensioning element.

[0029] In one embodiment, the actuator is an electric actuator.

[0030] Using an electric actuator considerably simplifies the command and control of the movement of the tensioning element.

[0031] In other embodiments, the actuator may be a pneumatic actuator and/or a hydraulic actuator and/or an internal combustion engine.

[0032] In one embodiment, the adjustment unit comprises a supplementary tensioning unit. The supplementary tensioning element is operatively in contact with the web. The supplementary tensioning element is movable for varying the tension of the web. The supplementary tensioning element is movable for varying the length of the feed path as a function of its position. In one embodiment, the supplementary tensioning element is configured for varying its position automatically with the variation of the tension of the web.

[0033] The presence of a supplementary tensioning element is very advantageous for the reliability of the system. In effect, it constitutes an important backup for the tensioning element if the latter is damaged or incorrectly controlled.

[0034] In one embodiment, the supplementary tensioning element is connected to a damping member. The damping member, in one embodiment, includes an elas-

tic element. The elastic element is configured for applying an opposing force, opposite to the direction of a movement of the supplementary tensioning element. In one embodiment, the elastic element is a spring. In other embodiments it may be a pneumatic cylinder.

[0035] The elastic element includes a first end connected to a frame of the adjustment unit and a second end connected to the supplementary tensioning element in such a way as to dampen its movement relative to the frame of the adjustment unit.

[0036] In one embodiment, the adjustment unit comprises a guide. In one embodiment, the tensioning element includes a slide. The slide may also be part of the adjustment unit and be rigidly connected to the tensioning element.

[0037] In one embodiment, the tensioning element includes an idle roller.

[0038] The slide of the tensioning element is configured for translating in the guide of the adjustment unit for moving the tensioning element, along the adjustment direction, from the first to the second operating position.

[0039] In one embodiment, the tensioning element is oriented parallel to the direction of the weight force. In one embodiment, the tensioning element is oriented parallel to a plane perpendicular to the direction of the weight force.

[0040] In one embodiment, the line comprises a tension sensor. The tension sensor is configured for measuring the tension of the web. The tension sensor is configured for generating tension signals, representing the tension of the web. In one embodiment, the tension sensor is configured for sending the tension signals to the control unit. The control unit is configured for receiving the tension signals. The control unit is configured for generating at least a part of the control signals as a function of the tension signals. The control unit is configured for instructing the actuator for moving the tensioning element.

[0041] The tension sensor may constitute a further secondary system to be used if the tensioning element is not correctly controlled by the control unit as a function of the working data previously set.

[0042] In one embodiment, the first motor-driven roller is located downstream of the sealing station along the feed path.

[0043] In one embodiment, the adjustment unit (the line) comprises a plurality of fixed rollers. The plurality of fixed rollers is operatively in contact with the web. The plurality of fixed rollers operates in conjunction with the tensioning element to define the path of the packaging web inside the adjustment unit.

[0044] According to one aspect of this invention, this invention intends to protect an adjustment unit for a packaging line.

[0045] The adjustment unit includes a tensioning element, operatively in contact with a web and movable between a first operating position and a second operating position for varying the length of a feed path followed by

the web in the packaging line.

[0046] The adjustment unit includes an actuator, connected to the tensioning element for varying a position of the tensioning element, so as to vary the length of the feed path. The actuator of the adjustment unit may be an electric motor or a pneumatic motor.

[0047] The adjustment unit comprises a control unit, configured for generating control signals, as a function of working data, representing operating parameters of (a first succession of forward movements of the web and a second succession of forward movements of the web, performed by) a first motor-driven roller and a second motor-driven roller of the packaging line. The adjustment unit is configured for being positioned between the first and the second motor-driven roller of the packaging line wherein the adjustment unit is integrated. In one embodiment, the control unit is connected to the actuator to control it, through the control signals, in order to modify the position of the tensioning element.

[0048] The adjustment unit which is to be protected by this invention can include one or more features described for the adjustment unit belonging to the packaging line according to the invention. These features are not repeated for sake of brevity.

[0049] According to one aspect of this invention, a method is provided for the packaging of products in bags.

[0050] The method comprises a step for receiving the web from a reel. The method comprises a step of intermittent feeding of the web along a feed path by a succession of forward movements of predetermined spacing.

[0051] The method comprises a step of folding the web about a folding line. The folding line may be oriented along the feed path, for superposing a first and a second flap of the web.

[0052] The method comprises a step of sealing the first and second flap of the web along sealing lines. The sealing lines may be oriented transversally or parallel to the folding line.

[0053] The method comprises a step of cutting the packaging web to define a plurality of packaging bags.

[0054] The method comprises a step of filling the plurality of packaging bags with the product.

[0055] The method comprises a step of sealing of the plurality of packaging bags.

[0056] In one embodiment, the feed step includes a first succession of forward movements, with a first feed step, carried out by a first motor-driven roller.

[0057] In one embodiment, the feed step includes a second succession of forward movements, with a second feed step, carried out by a second motor-driven roller.

[0058] In one embodiment, the method comprises a step for adjusting the tension of the web by means of an adjustment unit. The adjustment unit is positioned, on the packaging line, in an intermediate position between the first and second motor-driven rollers along the feed path.

[0059] According to one aspect of this invention, the

method comprises a step for controlled movement of a tensioning element, connected with the web, between a first operating position and a second operating position. In one embodiment, the movement is controlled by means of an actuator controlled by a control unit. The movement step produces a variation in length in the feed path and, consequently, influences the tension of the web.

[0060] In one embodiment, the control unit receives working data in the controlled moving step. The working data represents the first and second succession of forward movements. The control unit, in the controlled movement step, generates the control signals, as a function of the working data. The control unit in the controlled movement step, sends the control signals to the actuator to instruct it to move the tensioning element in such a way as to vary the length of the feed path.

[0061] In one embodiment, during the controlled movement step, the actuator moves the tensioning element according to a predetermined speed profile. In one embodiment, the actuator moves the tensioning element with a constant speed. In one embodiment of the, the method comprises a step of moving a supplementary tensioning element, connected with the web, for varying, as a function of a supplementary tensioning position, the length of the feed path.

[0062] In one embodiment, the step of moving the supplementary tensioning element comprises a damping step. In this damping step, a damping member applies an opposing force on the supplementary tensioning element. The opposing force is opposite to the direction of a movement of the supplementary tensioning unit due to a variation of the web tension. In this way, the web never reaches excessive tension values which might adversely affect the condition.

[0063] In one embodiment, the step of moving the tensioning element comprises a step of translation of a slide, connected tensioning element, in a guide of the adjustment unit.

[0064] In one embodiment, the method comprises a feedback control step. In this feedback control step, a tension sensor measures a tension value of the web and generates corresponding tension signals, representing the tension value of the web. In this feedback control step, the tension sensor sends the tension signals to the control unit. The control unit generates corresponding control signals, as a function of the tension signals. The control unit sends the control signals to the actuator for controlling it during the movement of the tensioning element.

[0065] This and other features of the invention will become more apparent from the following description of a preferred embodiment of it, illustrated purely by way of example in the accompanying drawings.

Brief Description of the Drawings

[0066]

Figure 1 schematically illustrates a plan view of a line for packaging products in bags;

Figure 1A is a plan view of a part of the line of Figure 1;

Figure 2 is a perspective view of a part of the line of Figure 1;

Figures 3A and 3B schematically illustrate a unit for adjusting the line of Figure 1 in a first and in a second operating configuration, respectively;

Figures 4A and 4B schematically illustrate two embodiments of a first succession of forward movements, performed by a first motor-driven roller, and a second succession of forward movements, performed by a second motor-driven roller, respectively.

Preferred Forms of Embodiment of the Invention

[0067] With reference to the accompanying drawings, numeral 1 denotes a line for packaging products in bags. The products may be liquid, solid, gases or granular.

[0068] The line 1 comprises a control unit 10. The control unit 10 is configured for controlling operating parameters (working parameters) of the line 1. The line 1 comprises a user interface 10'. The user interface 10' is configured for allowing a user to enter configuration data, representing operating parameters of the line 1.

[0069] More specifically, the configuration data include working data 101. In one embodiment, the working data 101 is data which identifies the work cycle of the line. For this reason, in some embodiments, the working data 101 represents the productivity of each machine of the line (units processed per unit time).

[0070] The line 1 comprises a feed unit 11. The feed unit 11 is configured for receiving a packaging web and for moving it in the line 1 along a feed path P. The feed path P change its direction during the path.

[0071] In one embodiment, the feed unit 11 is configured for moving the web intermittently. In short, the feed unit is connected to the control unit for moving the web according to a succession of forward movements and pauses. Each feed and each pause defines a feed time and a pause time, respectively.

[0072] In one embodiment, the feed path is included in a plane perpendicular to the direction of the weight force. In one embodiment, the feed unit includes a plurality of feed rollers 110. The web is wound around the plurality of feed rollers 110 for being moved along the line 1. More specifically, the plurality of feed rollers 110 is configured for conveying the web while keeping it at a predetermined tension value.

[0073] In one embodiment, a part of the plurality of feed rollers 110 is motor-driven, that is to say, their movement is determined by a driving force transmitted by an actuator. In one embodiment, a part of the plurality of feed rollers 110 is idle, that is to say, their movement is determined by the friction force of the web drawn by the plurality of motor-driven rollers.

[0074] In one embodiment, each motor-driven roller

defines a respective stationary time and feed time. For this reason, within the feed unit, the feed line may comprise different pause and feed times. These differences are substantially due to the processing times of each machine (units worked per unit time).

[0075] The control unit 10 is connected to the feed unit 11 for controlling it as a function of the working data 101.

[0076] In one embodiment, the line 1 comprises a feed station 12. The feed station 12, in one embodiment, includes a reel 12A. In one embodiment, the feed station 12 may comprise a reserve of pre-machined web.

[0077] The feed station 12 is configured for feeding the web to the feed unit 11 to allow a relative movement along the feed path P.

[0078] In one embodiment, the line comprises a folding station 13. The term "station" means a plurality of elements which contribute to the performance of a specific function. The folding station 13 is configured for folding the web. In one embodiment, the folding station 13 is configured for folding the web around folding lines 131, oriented along the feed path P. The folding station 13 is configured for folding the web about the folding lines 131, superposing a first and a second flap of the web. The folded web is thus formed by two flaps connected at the folding line (that part of the web, in a preferred embodiment, is set up to become the bottom of the packaged bag). In one embodiment, the folding station 13 is located downstream of the feed station 12.

[0079] In one embodiment, the line 1 comprises a sealing station 14. The sealing station 14 is configured for sealing the first and second flap of the web along sealing lines 141. The sealing station 14, in one embodiment, comprises a transversal sealing station 14A, configured for sealing the first and second flap of the web along transversal sealing lines 141A, perpendicular to the feed path P. The sealing station 14, in one embodiment, comprises a longitudinally sealing station 14B, configured for sealing the first and second flap of the web along longitudinal sealing lines 141B, parallel to the feed path P. In one embodiment, wherein the first and second flaps might come from two webs separate from each other, the longitudinal sealing lines 141B define the bottom of the packaged bag. In one embodiment, the transversal sealing lines 141A define the sides of the packaged bag.

[0080] In one embodiment, the sealing station 14 is configured for sealing at a first working speed. The sealing station 14, is configured for processing, during a stationary time, a first length of the web.

[0081] In one embodiment, the line 1 comprises a cutting station 15. The cutting station is configured for cutting the web, separating it into a plurality of portions which define a plurality of packaging bags. The cutting station includes a cutting tool 15'. The cutting tool 15' is configured for cutting the web along cutting lines 151. In one embodiment, the cutting lines 151 are transversal, perpendicular to the feed path.

[0082] In one embodiment, the cutting station 15 is configured for sealing at a second working speed. For

example, the cutting station 15 is configured for processing, during a stationary time, a second length of the web.

[0083] The control unit is configured for receiving the working data 101, representing the first and second working speeds.

[0084] In one embodiment, the line 1 comprises a filling station 16. The filling station 16 is configured for allowing the filling of the plurality of packaging bags with the product. In one embodiment, the filling station 16 includes a filling carousel 161. The filling carousel may include a plurality of suction surfaces 162. The plurality of suction surfaces 162 is configured for retaining the bags during their filling by means of a negative pressure generated by a suction of air.

[0085] In one embodiment, the line 1 comprises a conveyor 17.

[0086] The conveyor 17 is configured for picking up the packaging bags from the cutting station 15 is placing them at the filling station 16. The conveyor 17, in one embodiment, includes a suction surface 171, on which each packaging bag for is retained during its conveying to the filling station 16.

[0087] In one embodiment, the line 1 comprises a sealing station. The sealing station is configured so as to seal (close) the packaging bags for making them watertight (preventing escape and entrance of products).

[0088] In one embodiment, the feed unit 11 comprises a first motor-driven roller 11A. The first motor-driven roller 11A is controlled by the control unit 10. The first motor-driven roller 11A is configured for moving the web through the folding and sealing stations. The first motor-driven roller 11A is configured for moving the web through the folding and sealing stations, by a first succession of forward movements S1, with a first feed step. In short, the first feed step is a feed step which corresponds to a feeding of the web of the first length.

[0089] In one embodiment, the first motor-driven roller 11A is located downstream of the sealing station. In one embodiment, the first motor-driven roller 11A is located upstream of the sealing station.

[0090] The first motor-driven roller 11A rotates at a first rotation speed. The first motor-driven roller 11A is rotated for a first feed time T1.

[0091] The first succession of forward movements S1 is spaced by a corresponding first succession of pauses.

[0092] In one embodiment, the feed unit 11 comprises a second motor-driven roller 11B. The second motor-driven roller 11B is controlled by the control unit 10. The second motor-driven roller 11B is configured for moving the web through the cutting station. The second motor-driven roller 11B is configured for moving the web through the cutting station by a second succession of forward movements S2, with a second feed step. In short, the second feed step is a feed step which corresponds to a feeding of the web of the second length.

[0093] The second motor-driven roller 11B rotates at a second rotation speed.. The second motor-driven roller 11B is rotated for a second feed time T2.

[0094] The second succession of forward movements S2 is spaced by a corresponding second succession of pauses.

[0095] In one embodiment, the second motor-driven roller 11B is positioned upstream of the cutting station 15. In other embodiments, the second motor-driven roller 11B is positioned downstream of the cutting station 15. The second motor-driven roller 11B is positioned downstream of the first motor-driven roller 11A.

[0096] It should be noted that the first feed step and the second feed step are different.

[0097] In one embodiment, the first and second feed steps are different because the first T1 and the second T2 feed times are different for values of the first and second rotation speeds which are equal to each other. In one embodiment, the first and the second feed steps are different because the first and second rotation speeds are different for values of the first T1 and the second T2 feed times which are equal to each other.

[0098] In one embodiment, the line 1 includes an adjustment unit 18. The adjustment unit 18 is configured for adjusting the tension of the web. The adjustment unit 18 is positioned, along the feed path P, between the first motor-driven roller 11A and the second motor-driven roller 11B. The adjustment unit 18 comprises a frame 180.

[0099] In one embodiment, the adjustment unit 18 includes a tensioning element 181. The tensioning element 18 is operatively in contact with the web in order to keep it at a predetermined tension value. The tensioning element 18 is movable. The tensioning element 18 is movable between a first operating position P1 and a second operating position P2 for varying the length of the feed path P. More specifically, a first length L1 of the feed path P corresponds to the first operating position. A second length L2 of the feed path P corresponds to a second length of the feed path P, different from the first feed path length. Since the choice of first and second position is totally arbitrary, in one embodiment, the first length L1 is greater than the second length L2. More specifically, in one embodiment, the difference between the first length L1 and the second length L2 is equal to the difference between the first feed step and the second feed step. In effect, the travel of the tensioning element 18 makes it possible to balance the line 1 being able to keep the tension of the web constant with the predetermined value.

[0100] In one embodiment, the adjustment unit 18 comprises an actuator 182. The actuator 182 is connected to the tensioning element 181 for varying a relative position. This makes it possible to vary the length of the feed path and to keep constant the tension of the web. In one embodiment, the control unit 10 is configured for determining control signals 102 as a function of the working data 101. The working data 101 represents the first S1 and the second S2 succession of forward movements and, consequently, the first and second succession of pauses. In one embodiment, the control unit 10 is configured for sending the control signals 102 to the actuator 182 for varying the position of the tensioning element

181. For this reason, the tensioning element 181 is a controlled element which, by knowing the work cycle of the web, can anticipate the variations of tension induced by imbalances in the line 1 and may, therefore, ensure an optimum tension of the web.

[0101] In one embodiment, the control signals 102 represent a speed profile, representing the position of the tensioning element 181 over time. In short, the control signals are configured for changing operating parameters of the actuator 182 (electrical power, chemical power, hydraulic power, pneumatic power etc.) in such a way as to obtain the speed profile required for the tensioning element 181. This allows an overall control of the movement of the tensioning element 181, which may vary speed and direction of movement. In one embodiment, the actuator 182 includes an electric motor and/or an internal combustion engine and/or a pneumatic motor and/or a hydraulic motor.

[0102] In one embodiment, the adjustment unit 18 includes a transfer unit 183. The transfer unit 183 is designed for transferring the motion of the actuator 182 to the tensioning element 181.

[0103] In one embodiment, the adjustment unit includes a slider 183', constrained to the tensioning element 181. In one embodiment, the adjustment unit includes a guide 183", in which the slide 183' can slide to define a direction R for adjusting the tensioning element 181.

[0104] In one embodiment, the adjustment unit 18 includes a lead screw 182', integral with and in rotation with a drive shaft of the actuator 182. The terms integral and in rotation mean that the lead screw 182' rotates at a speed of rotation which depends on the speed of rotation of the drive shaft according to the specifications and any speed reducer.

[0105] The lead screw 182' is coupled with the slide 183' to transform a rotation of the lead screw 182' into a translation of the slide 183' along the adjustment direction R. The translation of the slide 183' produces a variation in the position of the tensioning element 181 and a consequent variation in the length of the feed path P.

[0106] In this embodiment, the slide 183' is movable along the lead screw 182' from a first position, corresponding to the first operating position P1 of the tensioning element 181, to a second position, corresponding to the second operating position P2 of the tensioning element 181.

[0107] In one embodiment, the tensioning element 181 is a tensioning roller (idle) on which the web is wound. In one embodiment. The tensioning roller has a maximum direction of extension parallel to the direction of the weight force. In a preferred embodiment, the adjustment direction R belongs to a plane lying perpendicular to the direction of the weight force. In one embodiment, the direction of adjustment R is parallel to the direction of the weight force.

[0108] In one embodiment, the adjustment unit 18 includes a plurality of fixed rollers 184. The plurality of fixed

rollers 184 is operatively into contact with the web. The plurality of rollers fixed 184 operates in conjunction with the tensioning element 181 to define the path of the web inside the adjustment unit 18.

[0109] In one embodiment, the adjustment unit 18 comprises a supplementary tensioning element 185. The supplementary tensioning element may be a tensioning roller, on which the web is wound. The supplementary tensioning element 185 is operatively in contact with the web. The supplementary tensioning element 185 is movable in order to vary, as a function of a relative position, the length of the feed path P. More specifically, the supplementary tensioning element 185, in response to any variations in tension of the web due to faults or failings in the tensioning element 181, is configured for varying its position, in such a way as to vary the length of the feed path P and therefore the tension of the web.

[0110] In one embodiment, the supplementary tensioning element 185 is coupled with the frame 180 of the adjustment unit 18 by a prismatic pair. In short, in this embodiment, the supplementary tensioning element 185 comprises a carriage 185' slidable inside a track 185".

[0111] In one embodiment, the adjustment unit 18 includes a damping member 186, configured for damping any sudden jolting of tension which the web may undergo in particular situations. The damping member 186 is connected to the supplementary tensioning element 185 to dampen its movement. The damping member 186 comprises an elastic element 186' which may be a spring, rather than a pneumatic piston. The elastic element 186' is configured for applying an opposing force, opposite to the direction of movement of the supplementary tensioning element 185. This makes it possible to reduce the amount of movement of the tensioning supplementary element 185 which would otherwise overload the web.

[0112] In one embodiment, the line 1 comprises a tension sensor 19. The tension sensor 19 is configured for measuring the tension of the web. The tension sensor is configured for generating tension signals 103, as a function of the tension value of the web.

[0113] In one embodiment, the tension sensor is configured for sending the tension signals 103 to the control unit 10.

[0114] In one embodiment, the control unit 10 is configured for generating the control signals 102 as a function of the tension signals 103.

[0115] The control unit is then configured for sending the control signals 102 to the actuator, as a function of which the latter is configured for varying the position of the tensioning element 181.

[0116] This embodiment makes it possible to obtain a feedback signal which allows it, if there are errors or faults to the normal operation, to continue to work without irreparably damaging the web.

[0117] According to one aspect of this invention, this invention also provides an adjustment unit for a packaging line according to one or more features described above.

[0118] According to one aspect of this invention, a method is provided for packaging products in bags. The method comprises a feed step. In the feed step, a reel 12A feeds a web (consisting of plastic material or of paper material) to a feed unit 11.

[0119] In the feeding step it is also possible that the web is fed already in a separate manner, that is to say, in the form of the portions already separated.

[0120] According to an aspect of the invention, the method comprises a step of setting the line 1. The step of setting up the line 1 comprises a step for receiving, in a control unit 10, working data 101, representing operating parameters of the line 1.

[0121] The method comprises a step of feeding the web along a feed path, preferably belonging to a plane perpendicular to the direction of the weight force.

[0122] In the feed step, a plurality of conveyors, for example a plurality of roller conveyors 110, moves the web along a plurality of stations of the packaging line 1.

[0123] In one embodiment, the web is fed to a folding station 13. In this folding station 13, the method comprises a step of folding the web along folding lines 131. The folding lines 131 are preferably oriented parallel to the feed path P.

[0124] In the folding step, the web is folded to define a first and a second flap.

[0125] The web is then subsequently fed to a sealing station 14. In this sealing station 14, the method comprises a step of sealing the first and second flap of the web. More specifically, in one embodiment, the sealing step comprises a transversal sealing step, wherein the first and the second flap are sealed along transversal sealing lines 14A, perpendicular to the feed path P. In one embodiment, the sealing step comprises a longitudinal sealing step, wherein the first and the second flaps are sealed along longitudinal sealing lines 14B, parallel to the feed path P.

[0126] The sealing station 14 is characterised by a first productivity P1.

[0127] In one embodiment, the method comprises a step of cutting the web. In this cutting step, the web is cut along transversal cut lines 151, to define a plurality of packaging bags. The cutting station is characterised by a second productivity P2.

[0128] In one embodiment, the feed step comprises a first succession of forward movements S1, carried out by a first motor-driven roller 11A. In one embodiment, the first motor-driven roller 11A is located upstream of the sealing station 14. In one embodiment, the first motor-driven roller 11A is located downstream of the sealing station 14.

[0129] In any case, the first motor-driven roller 11A feeds the web to the sealing station 14 feeding it by a first feed step, which is correlated with the first productivity P1 of the sealing station (that is, the number of seals per unit time). In this first succession of forward movements P1, the first motor-driven roller 11A unwinds the web by a first feed length. In this first succession of for-

ward movements P1, the first motor-driven roller 11A rotates at a first speed of rotation for a first feed time T1.

[0130] In one embodiment, the feed step comprises a second succession of forward movements S2, carried out by a second motor-driven roller 11B. In one embodiment, the second motor-driven roller 11B is located downstream or upstream of the sealing station 14. In one embodiment, the second motor-driven roller 11B is located downstream of the cutting station 15. In one embodiment, the second motor-driven roller 11B is located upstream of the cutting station 15.

[0131] In any case, the second motor-driven roller 11B feeds the web to the cutting station 15 feeding it by a second feed step, which is correlated with the second productivity P2 of the cutting station (that is, the number of cuts per unit time). In this second succession of forward movements S2, the second motor-driven roller 11B unwinds the web by a second feed length. In this second succession of forward movements S2, the second motor-driven roller 11B rotates at a second speed of rotation for a second feed time T2.

[0132] For this reason, the feed unit performs a first length of forward movement and a second length of forward movement, different from each other. The difference in length could cause a loss of tension and therefore a reduction in the quality of the bags.

[0133] In order to solve this problem, in one embodiment the method comprises a step for adjusting the tension of the web. In this adjusting step, an adjustment unit 18 varies the length of the feed path P for adjusting the tension of the web. In this adjusting step, a tensioning element 181 moves along an adjustment direction R for varying the length of the feed path P and keeping the tension of the web at an optimum value. The adjustment step includes a step of controlled moving of the tensioning element 181. In this controlled movement step, the control unit 10 sends control signals 102 to an actuator 182 of the adjustment unit 18 for instructing it to move the tensioning element 181. The control unit generates the control signals 102 as a function of the working data 101.

[0134] In one embodiment, the actuator 182 moves the tensioning element 181 with a predetermined speed profile.

[0135] In one embodiment, the variation of the feed path P per unit time due to the movement of the tensioning element 181 must be equal to the difference between the first rotation speed of the first motor-driven roller 11A and the second rotation speed of the second motor-driven roller 11B per unit of time. For this reason, in one embodiment, the speed profile depends on the first feed step and on the second feed step.

[0136] The drawings illustrate the first S1 and the second S2 succession of forward movements. An embodiment of a cycle of the method is described below with reference to the drawings.

[0137] The first motor-driven roller 11A feeds the web of the first feed step, rotating at the first rotation speed for a time equal to the first feed time T1.

[0138] The second motor-driven roller 11B feeds the web of the second feed step, rotating at the second rotation speed for a time equal to the second feed time T2.

[0139] The first feed time T1 is greater than the second feed time T2, since the sealing station is able to process simultaneously a greater number of units than the cutting station. For example, but not necessarily, the sealing station may process four units for each feed whilst the cutting station may process two or a single unit for each feed.

[0140] After the second feed time T2, the second motor-driven roller 11B stops whilst the first motor-driven roller 11A is still in rotation. The cutting station 15 performs the cutting step in a cutting time Tt. When the cutting station 15 performs the cutting step, the second motor-driven roller continues to unwind the web, increasing the quantity of web interposed between the first motor-driven roller 11A and the second motor-driven roller 11B. To keep the web under tension, the adjustment unit 18 moves the tensioning element 181 by means of the actuator 182, in such a way as to increase the length of the feed path P. When the first motor-driven roller has rotated for a time equal to the first feed time T1, the latter stops and starts the sealing step. At this instant, that is to say, when the first motor-driven roller 11A stops, the feed path P has a first length L1. In one embodiment, the first length L1 is the maximum length of the feed path P.

[0141] The sealing station 14 performs the sealing step in a sealing time Ts.

[0142] During the sealing step, the second motor-driven roller 11B will continue the second succession of forward movements S2 thus recalling the web and reducing the length of the unwound web interposed between the first 11A and the second 11B motor-driven rollers.

[0143] To keep the web under tension, the adjustment unit 18 moves the tensioning element 181 by means of the actuator 182 in such a way as to reduce the length of the feed path P.

[0144] In one embodiment, at the end of the sealing step, the first motor-driven roller 11A remains stationary for a stationary time Tf, to allow the cutting station 14 to cut a number of units equal to the number of units sealed. When the cutting station 15 has cut the units which the sealing station 14 has sealed, the length of the web interposed between the first 11A and 11B motor-driven roller is at its minimum and the feed path P has a second length L2. In one embodiment, the second length L2 is the minimum length of the feed path P.

[0145] According to one aspect of this invention, the step of moving the tensioning element 181 includes a translation step. In the translation step, a slide 183', connected to the tensioning element 181, translates in a guide 183" along the adjustment direction R.

[0146] The translation, in one embodiment, is generated by a lead screw 182', connected to and rotating with a drive shaft of the actuator (which in this example embodiment is rotary).

[0147] The lead screw 182' is coupled with the slide 183' of the tensioning element 181 for transforming the

rotary motion of the drive shaft into a translating motion of the tensioning element 181.

[0148] In one embodiment, the method comprises a step of moving a supplementary tensioning element 185. In one embodiment, the step of moving the supplementary tensioning element 185 includes a damping step. In this damping step, a damping member 186 dampens movement of the supplementary tensioning unit 185 due to a variation of the web tension. More specifically, an elastic element 186' of the damping member 186 applies an opposing force, in the opposite direction to the direction of movement of the supplementary tensioning element 185.

[0149] In one embodiment, the elastic element is a spring 186'. In this embodiment, a carriage 185' of the supplementary tensioning element 185 slides inside a rail 185" made on a frame 180 of the adjustment unit 18. The sliding of the carriage 185' in the rail 185" is opposed by the action of the spring 186'.

[0150] In one embodiment, the method comprises a feedback control step. In this feedback control step, a tension sensor 19 measures a tension value of the web and generates corresponding tension signals 103, representing the tension value of the web. The tension sensor 19 may be located upstream or downstream of the first and/or the second motor-driven roller 11A, 11. In this feedback control step, the tension sensor 19 sends the tension signals 103 to the control unit. The control unit 10 generates corresponding control signals 102, as a function of the tension signals 103. The control unit 10 sends the control signals 102 to the actuator 182 for controlling it during the movement of the tensioning element 181.

Number	Feature
1	line
11	movement unit
12	feed station
12A	coil
10	control unit
10'	user interface
101	working data
110	plurality of feed rollers
P	feed path
11A	first motor-driven roller
11B	second motor-driven roller
131	Folding step
13	folding station
14	sealing station

14A	transversal sealing station
14B	longitudinal sealing station
141B	longitudinal sealing lines
141A	transversal sealing lines
15	cutting station
15'	cutting tool
151	cutting lines
16	filling station
161	filling carousel
162	plurality of suction surfaces
17	conveyor
171	suction surface
18	adjustment unit
181	tensioning element
182	actuator
R	adjustment direction
183'	slide
103	Tension signals
19	Tension sensor
183"	guide
182'	lead screw
185	Supplementary tensioning element
185'	carriage
185"	track
186	damping member
186'	Elastic element
180	Adjustment unit frame
184	Plurality of fixed rollers
T1	First movement time
T2	Second movement time
Ts	Sealing time
Tt	Cutting time
S1	First succession of forward movements
S2	Second succession of forward movements
Tf	stationary time

Claims

1. A packaging line (1) for products in bags, comprising:

- a feed unit (11), configured to receive a web to from a reel (12A) and for moving it along a feed path (P);
- a control unit (10), connected to the feed unit (11) for moving the web intermittently, by a succession of forward movements of predetermined spacing;
- a folding station (13), configured for folding the web about a folding line (131) oriented along the feed path (P), for superposing a first and a second flap of the web;
- a sealing station (14), configured for sealing the first and second flap of the folded web, along sealing lines (14A) oriented transversely to the folding line (131);
- a cutting station (15), configured for cutting the packaging web and defining a plurality of packaging bags;
- a filling station (16), configured for filling with a product the plurality of packaging bags;
- a sealing station, configured for sealing the plurality of packaging bags;

wherein the feed unit (11) includes

- a first motor-driven roller (11A), controlled by the control unit (10) for moving the web through the folding (13) and sealing (14) stations, by a first succession of forward movements (S1), with a first feed step;
- a second motor-driven roller (11B), controlled by the control unit (10) for moving the web by a second succession of forward movements (S2), with a second feed step, the second motor-driven roller (11B) being positioned downstream of the first motor-driven roller (11A), for moving the web through the cutting station (15);
- an adjustment unit (18), positioned between the first (11A) and the second motor-driven roller (11B) and configured for adjusting a tension of the web,

characterised in that the adjustment unit (18) includes:

- a tensioning element (181), operatively in contact with the web and movable between a first operating position (P1), wherein the feed path (P) has a first length (L1), and a second operating position (P2), wherein the feed path (P) has a second length (L2) different from the first length (L1);
- an actuator (182), connected to the tensioning element (181) for varying a position of the tensioning element (181), so as to vary the length of the feed path (P).

2. The line (1) according to claim 1, wherein the control

unit (10) is configured for receiving working data (101), representing the first (S1) and a second (S2) succession of forward movements, and for generating control signals (102), for controlling the actuator (182) as a function of the working data (101).

3. The line (1) according to claim 1 or 2, wherein the actuator (182) is configured for moving the tensioning element (181) according to a predetermined speed profile.

4. The line (1) according to claim 3, wherein the actuator (182) of the adjustment unit (18) includes an electric motor.

5. The line (1) according to any one of the preceding claims, wherein the adjustment unit (18) comprises a supplementary tensioning element (185), operatively in contact with the web and movable in order to vary, as a function of a relative position, the length of the feed path (P).

6. The line (1) according to claim 5, wherein the supplementary tensioning element (185) is connected to a damping member (186).

7. The line (1) according to any one of the preceding claims, wherein the adjustment unit (18) comprises a guide (183") and the tensioning element (181) includes an idle roller and a slide (183'), configured for translating in the guide (183") of the adjustment unit (18) and pulling the tensioning element (181) from the first (P1) to the second (P2) operating position.

8. The line (1) according to any one of the preceding claims, wherein the tensioning element (181) is oriented parallel to the direction of the weight force.

9. The line (1) according to any one of the preceding claims, comprising a tension sensor (19), configured for measuring the tension of the web, and wherein the control unit is configured for receiving tension signals (103), representing the tension of the web, from the tension sensor (19), for generating control signals (102), as a function of the tension signals (103), and for instructing the actuator (182), through the control signals (102), for moving the tensioning element (181).

10. The line (1) according to any one of the preceding claims, wherein the first motor-driven roller (11A) is located downstream of the sealing station (14) along the feed path (P), and/or wherein the second motor-driven roller (11B) is positioned upstream of the cutting station (15).

11. An adjustment unit (18) for a packaging line (1), configured for being positioned between a first (11A) and

a second (11B) motor-driven roller of the line (1) and comprising:

- a tensioning element (181), operatively in contact with a web and movable between a first operating position (P1) and a second operating position (P2) for varying the length of a feed path (P) followed by the web of the packaging line;
- an actuator (182), connected to the tensioning element (181) for varying a position of the tensioning element (181), so as to vary the length of the feed path (P)

characterised in that it comprises a control unit (10), configured for generating control signals (102), as a function of working data (101), representing a first succession of forward movements (S1) of the web and a second succession of forward movements (S2) of the web, performed through the first (11A) and the second (11B) motor-driven roller of the packaging line (1), respectively, and wherein the control unit (10) is connected to the actuator (182) for commanding it, through the control signals (102), to modify the position of the tensioning element (181).

12. A method for packaging products in bags comprising the following steps:

- receiving the web from a reel (12A) and intermittent feeding of the web along a feed path (P) using a succession of forward movements of predetermined spacing;
- folding the web around a folding line (131) oriented along the feed path (P), for superposing a first and a second flap of the web;
- sealing the first and second flap of the web along sealing lines (14A) oriented transversely to the folding line (131);
- cutting the packaging web to define a plurality of packaging bags;
- filling the plurality of packaging bags with the product;
- sealing the plurality of bags;

wherein the feeding step includes:

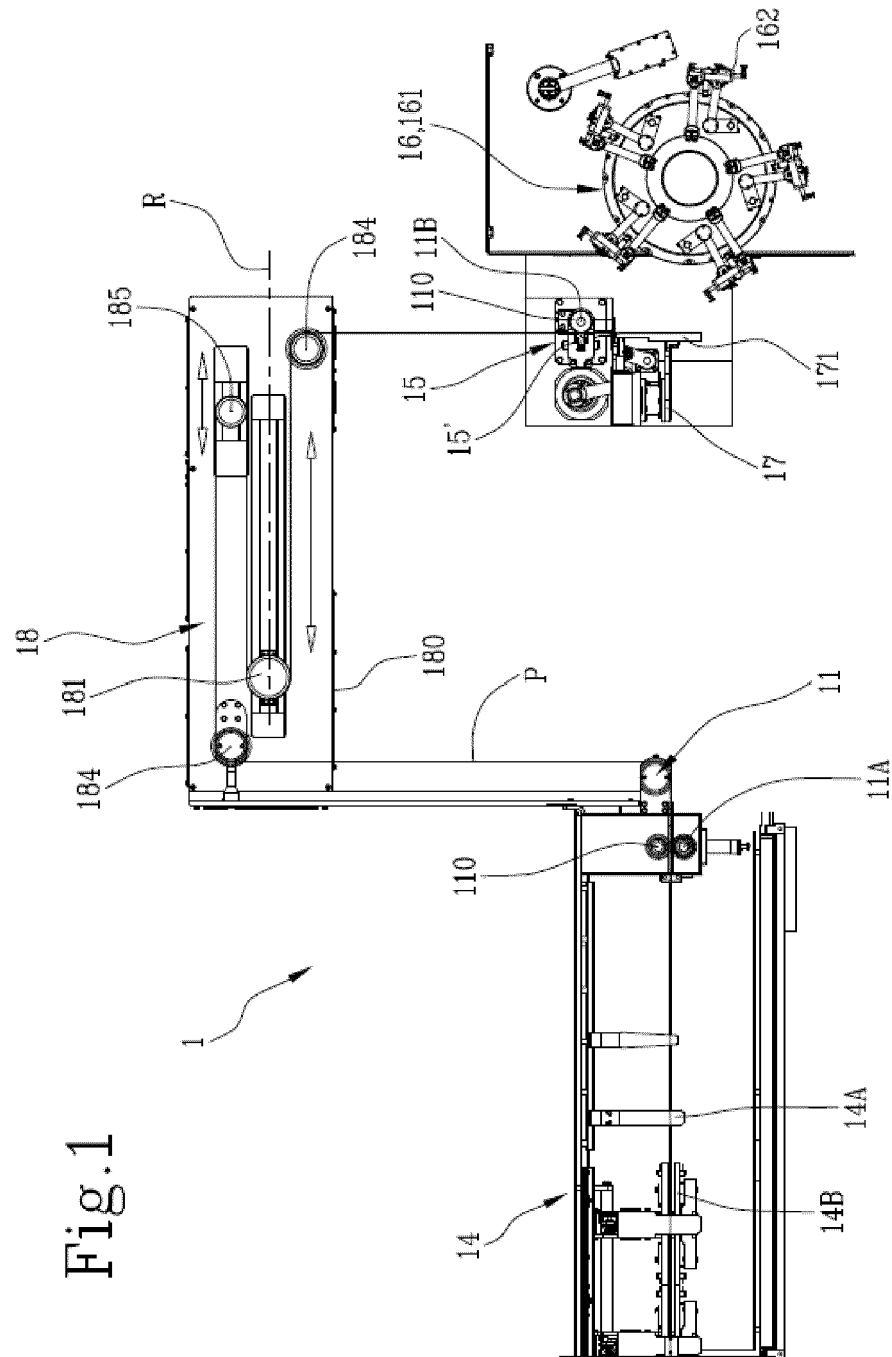
- first succession of forward movements (S1), with a first feed step, using a first motor-driven roller (11A);
- second succession of forward movements (S2), with a second feed step, using a second motor-driven roller (11B);
- adjusting the tension of the web by means of an adjustment unit (18) positioned, on the packaging line, in an intermediate position between the first (11A) and the second (11B) motor-driven roller along the feed path (P), **characterized in that** it comprises the following steps:

- controlled movement of a tensioning element (181), connected with the web, between a first operating position (P1) and a second operating position (P2), by means of an actuator (182) controlled by a control unit (10), for varying the length of the feed path (P).

13. The method according to claim 12, wherein in the controlled movement step the control unit (10) receives the working data (101), representing the first (S1) and a second (S2) successions of forward movements, generates control signals (102) as a function of the working data (101) and sends the control signals (102) to the actuator (182), for instructing it to move tensioning element (181) so as to vary the length of the feed path (P).

14. The method according to claim 12 or 13, comprising a step of moving a supplementary tensioning element (185), connected with the web, for varying, as a function of a position of the supplementary tensioning element (185), the length of the feed path (P).

15. The method according to claim 14, wherein the step of moving the supplementary tensioning element (185) includes a damping step absorbing, wherein a damping member (186) applies an opposing force, opposite to the direction of a movement of the supplementary tensioning element (185).



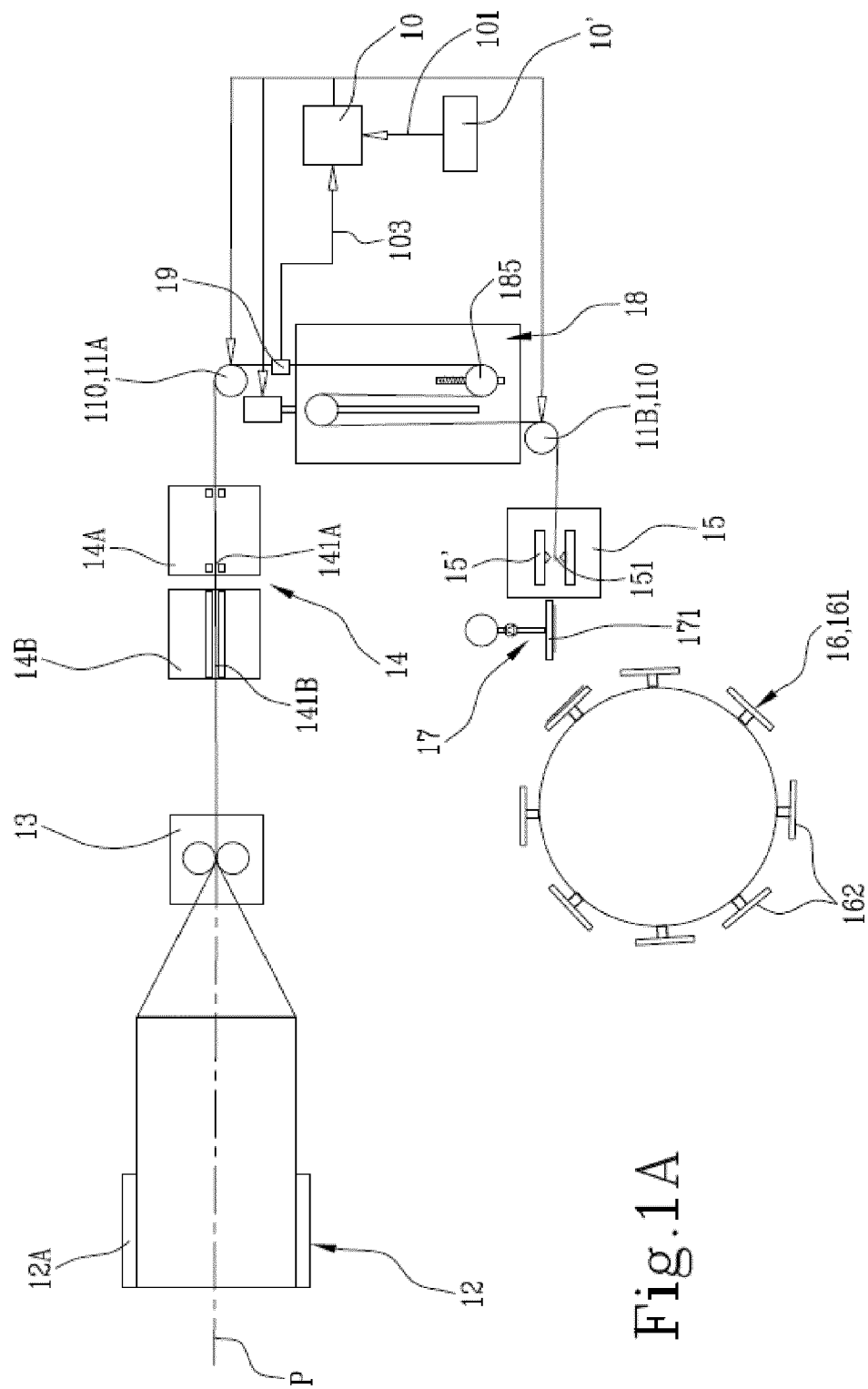


Fig.1A

Fig. 2

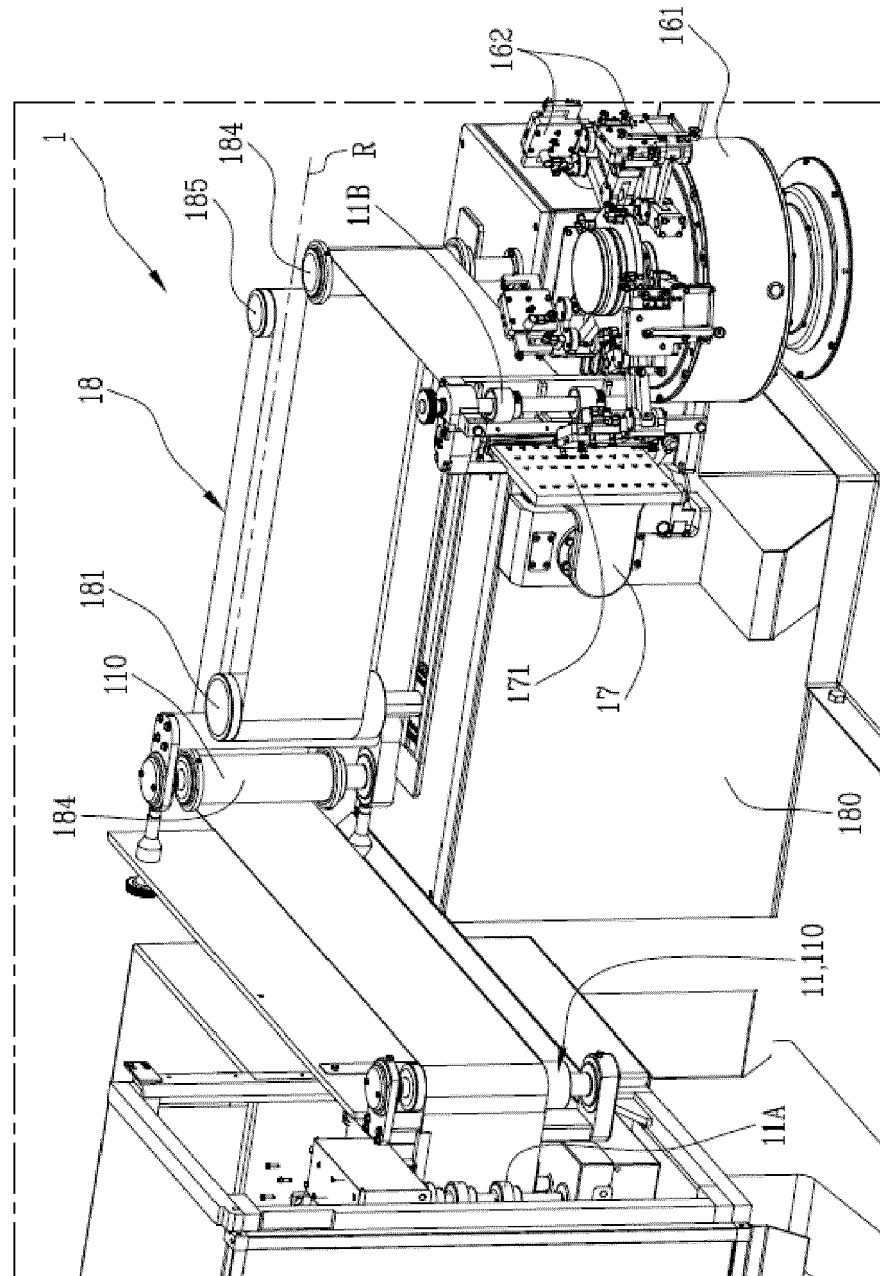


Fig. 3A

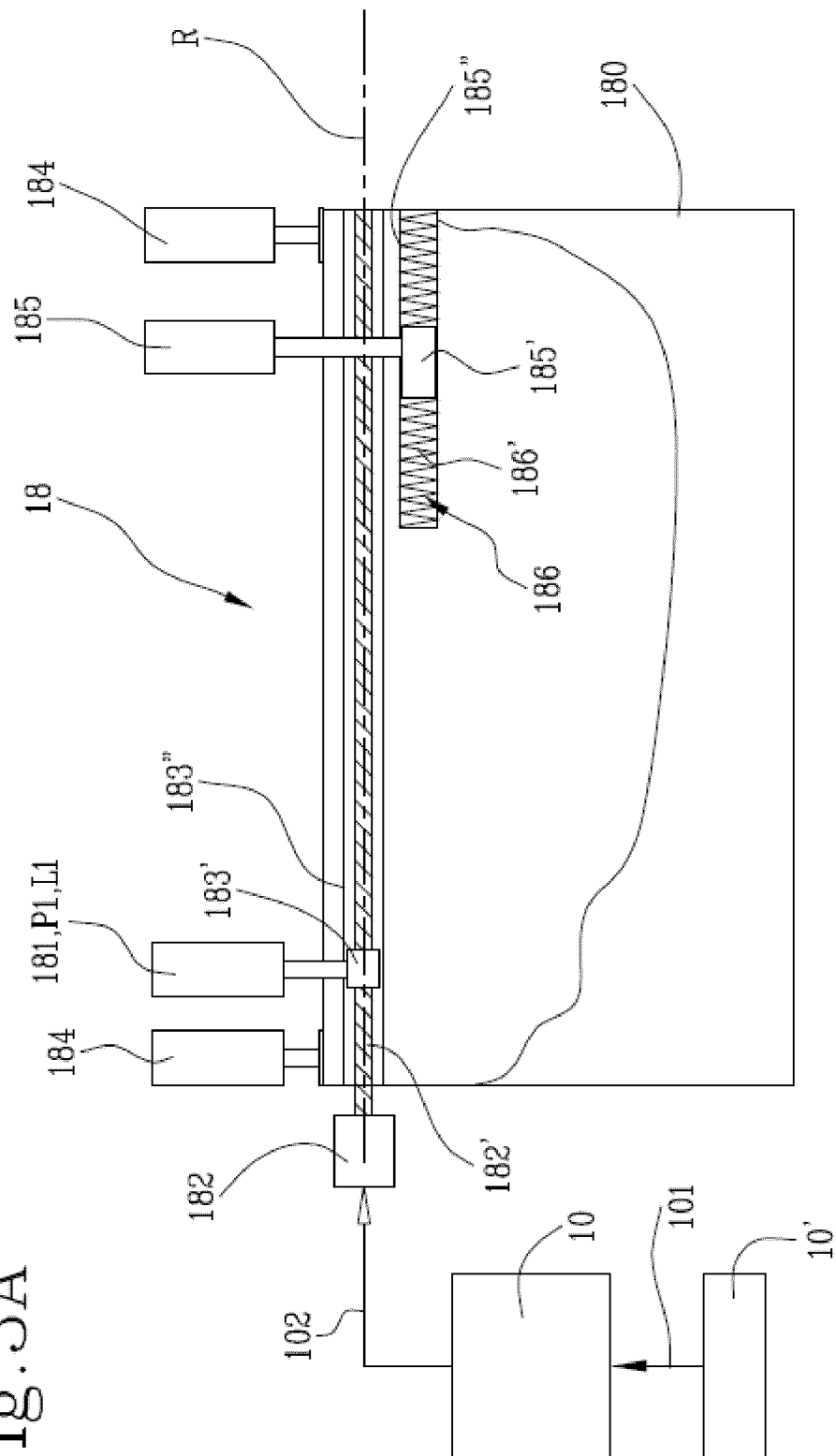
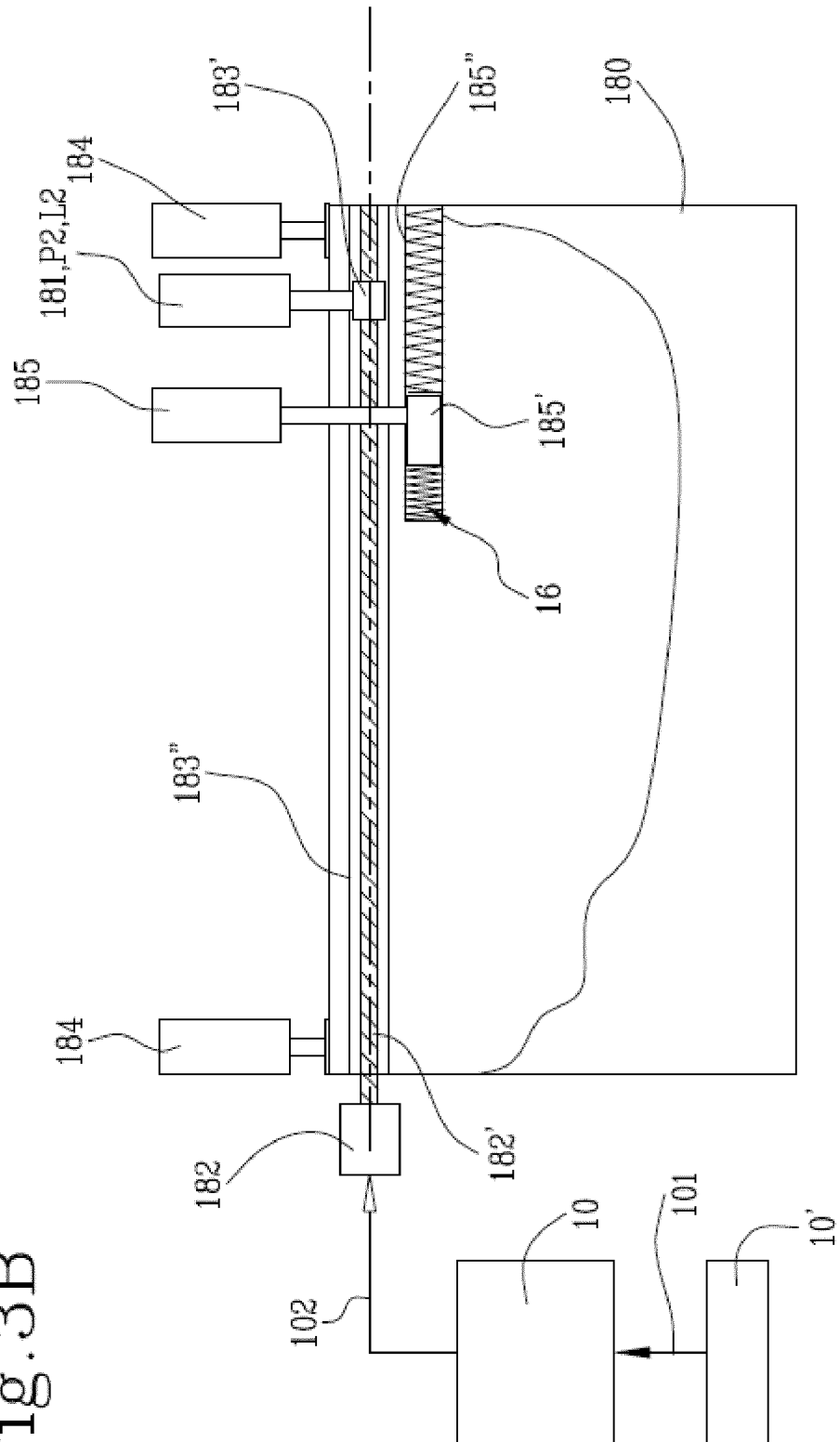
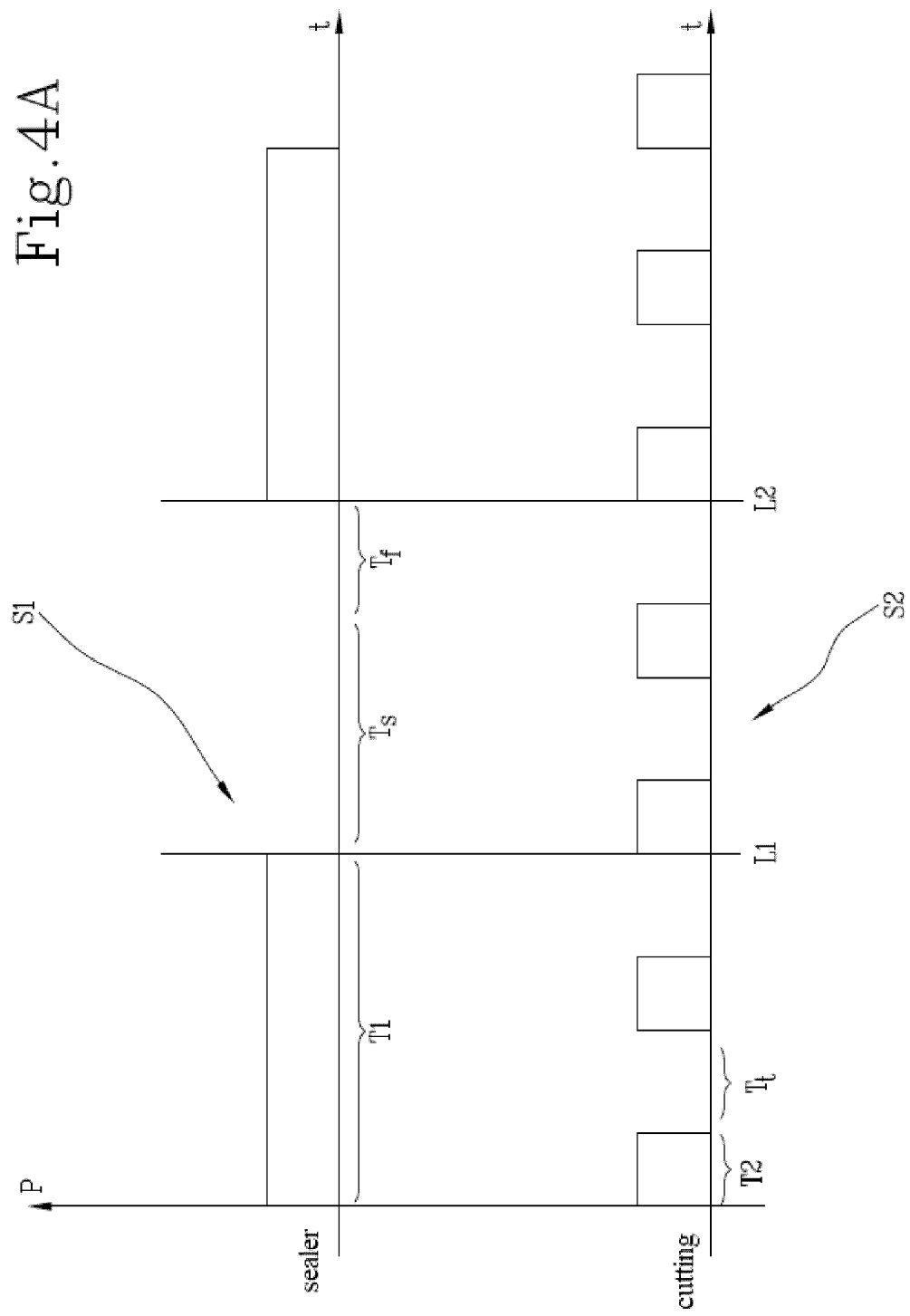
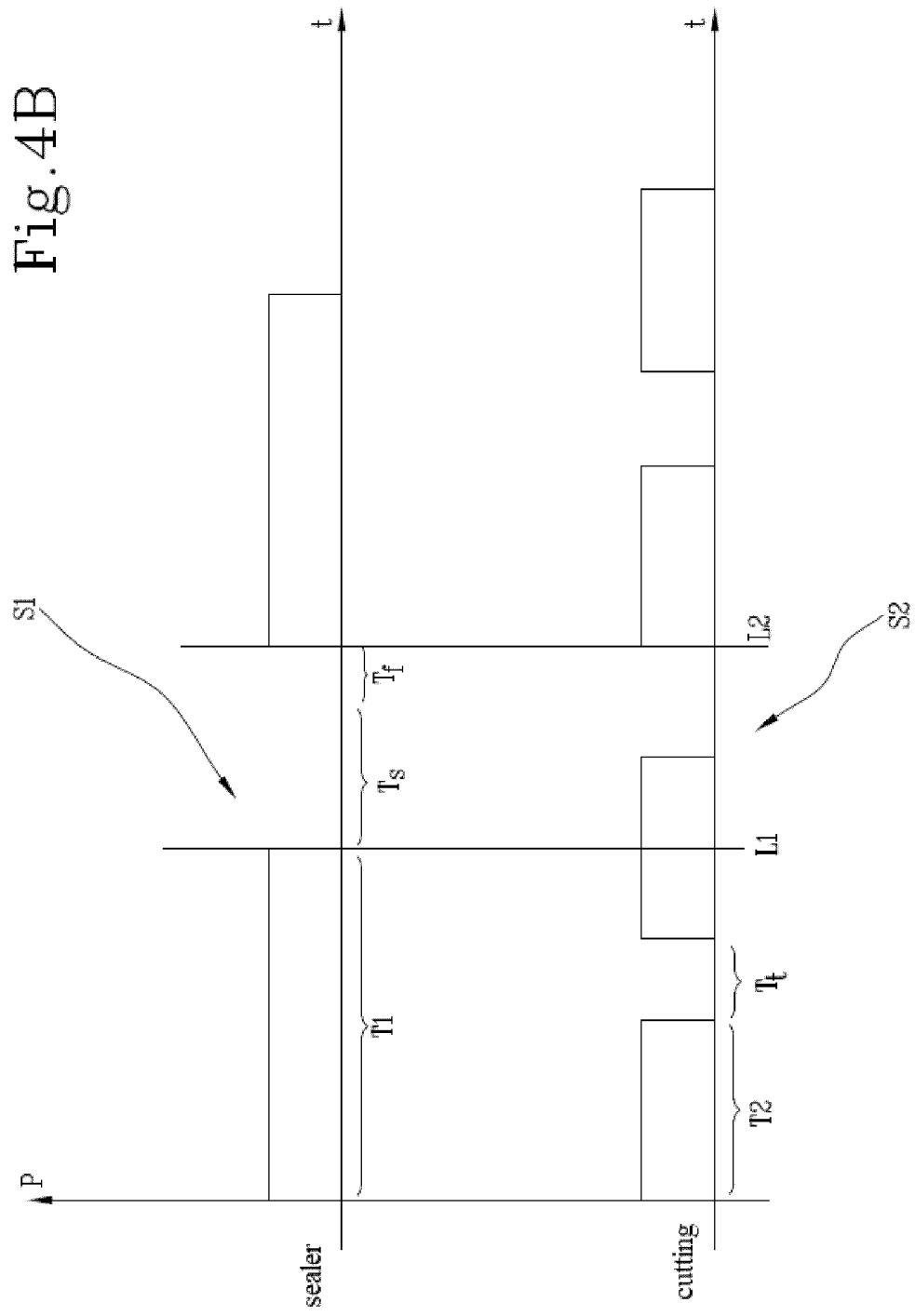


Fig. 3B









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 Application Number
 EP 18 18 9504

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			B65B B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 November 2018	Examiner Yazici, Baris
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