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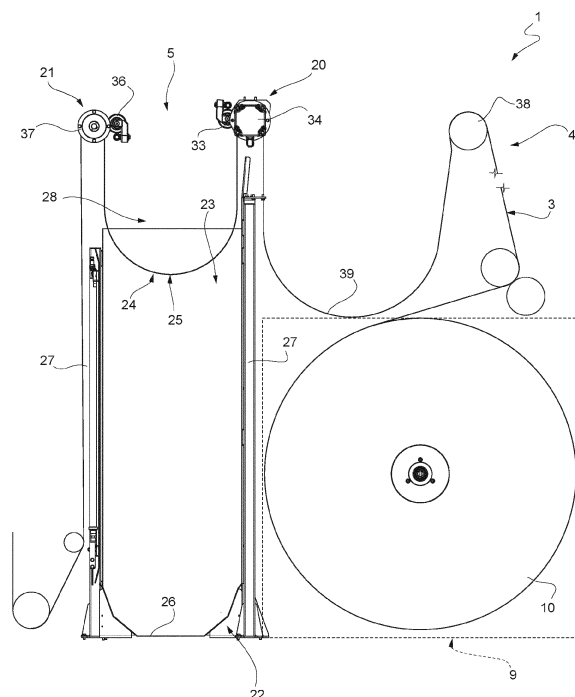
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(54) **BUFFER UNIT FOR A PACKAGING APPARATUS, PACKAGING APPARATUS AND METHOD FOR PRODUCING SEALED PACKAGES**

(57) There is described a buffer unit (5) for a packaging apparatus (1) for forming packages (2) from a web of packaging material (3) and being filled with a pourable product. The buffer unit (5) is configured to buffer the web of packaging material (3) and comprises an infeed roller device (20) configured to feed the web of packaging material (3) into the buffer unit (5), an outfeed roller device (21) configured to direct the web of packaging material (3) out of the buffer unit (5) and an accumulation housing (22) having an accumulation space (23) configured to randomly receive the web of packaging material (3) when the buffer unit (5) is controlled in an accumulation configuration, in which the web of packaging material (3) is randomly accumulated within the buffer unit (5).

FIG. 3



Description

TECHNICAL FIELD

[0001] The present invention relates to a buffer unit for a packaging apparatus for producing sealed packages from a web of packaging material and being filled with a pourable product, in particular a pourable food product.

[0002] Advantageously, the present invention also relates to a packaging apparatus for producing sealed packages from a web of packaging material and being filled with a pourable product, in particular a pourable food product.

[0003] Advantageously, the present invention also relates to a method for producing sealed packages from a web of packaging material and being filled with a pourable product, in particular a pourable food product.

BACKGROUND ART

[0004] As is known, many liquid or pourable products, such as fruit juice, UHT (ultra-high-temperature treated) milk, cream, water, wine, tomato sauce, salt, sugar, etc., are sold in packages made of a sterilized multilayer packaging material.

[0005] A typical example is the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by sealing and folding a multilayer packaging material. The multilayer packaging material comprises at least a layer of fibrous material, such as e.g. a paper or cardboard layer, and at least two layers of heat-seal plastic material, e.g. polyethylene, interposing the layer of fibrous material in between one another.

[0006] In the case of aseptic packages for long-storage products, such as UHT milk, the multilayer packaging material also comprises a layer of gas- and light-barrier material, e.g. aluminum foil, or ethylene vinyl alcohol (EVOH) film, in particular being arranged between one of the layers of the heat-seal plastic material and the layer of fibrous material.

[0007] Typically, the multilayer packaging material also comprises a further layer of heat-seal plastic material being interposed between the layer of gas- and light-barrier material and the layer of fibrous material.

[0008] Often the multilayer packaging material is provided in the form of a web of packaging material, in particular having a succession of repeated patterns, each pattern defining the pattern of one respective single package obtained at the end of the packaging process.

[0009] Packages of this sort are normally produced on a fully automatic packaging apparatus, which comprises a conveying device for advancing the web of packaging material along an advancement path, a sterilization unit for sterilizing the packaging material, a tube forming and sealing device arranged within an isolation chamber and configured to form a tube from the advancing packaging material and to longitudinally seal the tube, a filling device

for directing the pourable product into the tube and a package forming unit configured to form and to transversally seal and cut the tube for obtaining the single packages.

[0010] Typically the web of packaging material is provided in the form of a reel, which at some point of the operation of the packaging apparatus is about to exhaust. In order to avoid the need to interrupt the production, a typical packaging apparatus typically comprises a splicing unit for splicing a new web of packaging material to the web of packaging material in use. This, however, requires the portion of the web of packaging material in use, which will be spliced together with the new web of packaging material, to be in a fixed and initially non-moving position.

[0011] Therefore, a typical packaging apparatus also comprises a buffer unit arranged upstream of the tube forming and sealing device and configured to buffer the web of packaging material. Thus, prior to the need of splicing the new web of packaging material to the web of packaging material in use, the quantity of the web of packaging material present within the buffer unit (e.g. measured in meters and/or in seconds of the web of packaging material present within the buffer unit) is increased such that during the activation of the splicing unit, the portions of the web of packaging material being arranged upstream of the buffer unit do not advance, while the portions of the web of packaging material arranged downstream of the buffer unit advance as being feed by the buffer unit.

[0012] The known buffer units comprise an infeed roller device, an outfeed roller device and a first group of rollers and a second group of rollers. Thereby, the distance between the second group of rollers and the first group of rollers is variable so as to control the quantity of the web of packaging material being present within the buffer unit. When there is the need to increase the quantity of the web of packaging material, one increases the infeed speed with respect to the outfeed speed and increases the relative distance between the first group of rollers and the second group of rollers, while when there is the need to reduce the quantity of the web of packaging material within the buffer unit, one reduces the infeed speed with respect to the outfeed speed and reduces the relative distance between the first group of rollers and the second group of rollers. During a normal operation condition, the relative distance between the first group of rollers and the second group of rollers is kept substantially constant.

[0013] Even though such buffer units operate satisfactorily well, a desire is felt in the sector to further improve the known packaging apparatuses.

DISCLOSURE OF INVENTION

[0014] It is therefore an object of the present invention to provide an improved buffer unit for a packaging apparatus for producing packages formed from a web of packaging material and being filled with a pourable product.

[0015] It is a further object of the present invention to provide an improved packaging apparatus for producing packages formed from a web of packaging material and being filled with a pourable product.

[0016] It is another object of the present invention to provide an improved method for producing packages formed from a web of packaging material and being filled with a pourable product.

[0017] According to the present invention, there is provided a buffer unit as claimed in claim 1.

[0018] Further advantageous embodiments of the buffer unit according to the invention are specified in the respective dependent claims.

[0019] Advantageously and according to the present invention, there is provided a packaging apparatus according to claim 11.

[0020] Further advantageous embodiments of the packaging apparatus according to the invention are specified in the claims being directly or indirectly dependent on claim 11.

[0021] Advantageously and according to the present invention, there is provided a method according to claim 13.

[0022] Further advantageous embodiments of the method according to the invention are specified in the claims being directly or indirectly dependent on claim 13.

BRIEF DESCRIPTION OF THE DRAWINGS

[0023] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a schematic view of a packaging apparatus having a buffer unit according to the present invention, with parts removed for clarity;

Figure 2 is an enlarged schematic and perspective view of details of the packaging apparatus of Figure 1, with parts removed for clarity;

Figure 3 is a schematic side view of further details of the packaging apparatus of Figure 1 and with the buffer unit being in a first configuration, with parts removed for clarity;

Figure 4 is a schematic side view of further details of the packaging apparatus of Figure 1 and with the buffer unit being in a second configuration and having a first load level, with parts removed for clarity; and

Figure 5 is a schematic side view of further details of the packaging apparatus of Figure 1 and with the buffer unit being in the second configuration and having a second load level, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

[0024] Number 1 indicates as a whole a packaging apparatus, in particular an automatic packaging apparatus, for (continuously) producing packages 2 filled with a

pourable product, in particular a pourable food product, such as milk, fruit juice, wine, water, salt, sugar, and similar. Packaging apparatus 1 is configured to produce packages 2 from a web of packaging material 3, in particular by forming, filling and sealing the web of packaging material 3.

[0025] In more detail, web of packaging material 3 may have a multilayer structure (not shown) and may comprise at least one layer of fibrous material, such as e.g. a paper or cardboard layer, and at least two layers of heat-seal plastic material, e.g. polyethylene, interposing the layer of fibrous material in between one another. One of these two layers of heat-seal plastic material may define an inner face of package 2 eventually contacting the pourable product.

[0026] Preferably, web of packaging material 3 may also comprise a layer of gas- and light-barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, in particular being arranged between one of the layers of the heat-seal plastic material and the layer of fibrous material. Preferentially, web of packaging material 3 may also comprises a further layer of heat-seal plastic material being interposed between the layer of gas- and light-barrier material and the layer of fibrous material.

[0027] According to the embodiment disclosed, web of packaging material 3 comprises a succession of patterns, in particular each pattern being associated to one respective package 2 once the respective package 2 has been formed.

[0028] With particular reference to Figures 1 and 2, packaging apparatus 1 comprises at least:

- a conveying device 4 configured to advance web of packaging material 3 along a web advancement path P;
- a buffer unit 5 configured to buffer web of packaging material 3;
- a tube forming and sealing device 6 configured to form a tube 7 from the, in use, advancing web of packaging material 3 and to longitudinally seal tube 7;
- a filling device 8 configured to fill tube 7 with the pourable product; and
- a package forming unit (not shown and known as such) configured to form, to transversally seal and, preferably to transversally cut, tube 7, for forming packages 2.

[0029] Preferentially, operation of buffer unit 5 may be controlled in dependence of operation of conveying device 4.

[0030] In more detail, tube forming and sealing device 6 may be arranged downstream of buffer unit 5 along web advancement path P.

[0031] Preferentially, conveying device 4 may also be configured to advance tube 7 along a tube advancement path Q. In more detail, conveying device 4 may be con-

figured to advance tube 7 and any intermediate of tube 7, in a manner known as such, along tube advancement path Q. In particular, with the wording intermediates of tube 7 any configuration of web of packaging material 3 is meant prior to obtaining the tube structure and after folding of web of packaging material 3 by tube forming and sealing device 6 has started. In other words, the intermediates of tube 7 are a result of a gradual folding of web of packaging material 3 so as to obtain tube 7, in particular by overlapping lateral edges of web of packaging material 3 with one another.

[0032] Preferentially, packaging apparatus 1 may also comprise a control unit configured to control operation of packaging apparatus 1.

[0033] Advantageously, packaging apparatus 1 may also comprise an isolation chamber (not shown and known as such) having an inner environment, in particular a sterile inner environment. In particular, the isolation chamber separates the inner environment from an (hostile) outer environment.

[0034] Preferentially, the isolation chamber may have a vertical orientation.

[0035] Preferentially, tube forming and sealing device 6 may be at least partially arranged within the isolation chamber and/or the inner environment and configured to form and longitudinally seal tube 7 within inner environment.

[0036] According to some preferred non-limiting embodiments, packaging apparatus 2 may also comprise a splicing unit (not shown and known as such) configured to splice a new web of packaging material to web of packaging material 3 in use.

[0037] In particular, the splicing unit may be arranged upstream of buffer unit 5 along web advancement path P.

[0038] Preferentially, packaging apparatus 1 may also comprise a magazine unit 9 having at least a first support for carrying a reel 10 of web of packaging material 3. Even more preferentially, magazine unit 9 may also comprise a second support for carrying another reel 10 of web of packaging material 3.

[0039] More specifically, one of the first support and the second support may provide for web of packaging material 3 in use and the other one of the first support and the second support may provide for the new web of packaging material 3. In use, the roles of the first support and the second support alternate. For example, at first the first support carries reel 10 of web of packaging material 3 in use, while the second support carries reel 10 of the new of packaging material 3. After the splicing, the second support carries reel 10 of web of packaging material 3 in use, while the first support carries another reel 10 of the new of packaging material 3.

[0040] According to some preferred non-limiting embodiments, packaging apparatus 1 may also comprise a sterilizing unit (not shown and known as such) configured to sterilize, in particular by means of chemical and/or physical sterilization, the, in use, advancing web of packaging material 3. Preferentially, the sterilization station

may be arranged upstream of tube forming and sealing device 6 and downstream of buffer unit 5 along web advancement path P.

[0041] Preferentially, the package forming unit may be configured to shape and transversally seal and in particular cut, in use, tube 7 during advancement of tube 7 along at least a portion of tube advancement path Q.

[0042] With particular reference to Figure 1, tube forming and sealing device 6 may comprise a tube forming unit 13 at least partially, preferentially fully, arranged within the isolation chamber, in particular within the inner environment, and configured to gradually fold, in use, web of packaging material 3 into tube 7, in particular by (gradually) overlapping the lateral edges of web of packaging material 3 with one another. Preferentially, tube forming unit 13 may extend along a longitudinal axis, in particular having a vertical orientation.

[0043] Preferentially, tube forming and sealing device 6 may also comprise a sealing unit being at least partially arranged within the isolation chamber and/or the inner environment and configured to longitudinally seal tube 7.

[0044] Furthermore, the sealing unit may comprise a sealing head (not shown) arranged within the isolation chamber and being configured to transfer thermal energy to tube 7 for longitudinally sealing tube 7. In particular, the sealing head can be of any type, e.g. of the kind operating by means of induction heating and/or by a stream of a heated gas and/or by means of ultrasound and/or by laser heating and/or by any other means.

[0045] Preferentially, the sealing unit may also comprise a pressing assembly adapted to exert a mechanical force on tube 7 so as to ensure the longitudinal sealing of tube 7.

[0046] With particular reference to Figure 1, filling device 8 may comprise a filling pipe 14 for directing the pourable product, in use, into tube 7. In particular, filling pipe 14 may be in fluid connection or is controllable to be in fluid connection with a pourable product storage tank (not shown and known as such), which is adapted to store/provide for the pourable product, in particular the pourable food product, to be packaged.

[0047] Preferentially, filling pipe 14 may, in use, be at least partially placed within tube 7.

[0048] According to some preferred non-limiting embodiments, the package forming unit may comprise a plurality of pairs of at least one respective operative assembly (known as such and not shown) and at least one counter-operative assembly (known as such and not shown); and

- a conveying unit (known as such and not shown) adapted to advance the respective operative assemblies and the respective counter-operative assemblies of the pairs along respective conveying paths.

[0049] In more detail, each operative assembly may be configured to cooperate, in use, with the respective counter-operative assembly of the respective pair for

forming one respective package 2 from tube 7. In particular, each operative assembly and the respective counter-operative assembly may be configured to shape, to transversally seal and, preferably also to transversally cut, tube 7 for forming packages 2.

[0050] In further detail, each operative assembly and the respective counter-operative assembly may be configured to cooperate with one another for forming a respective package 2 from tube 7 when advancing along a respective operative portion of the respective conveying path. In particular, during advancement along the respective operative portion each operative assembly and the respective counter-operative assembly may advance parallel to and in the same direction as tube 7.

[0051] With particular reference to Figures 1 to 5, buffer unit 5 comprises:

- an infeed roller device 20 configured to feed web of packaging material 3 into buffer unit 5; and
- an outfeed roller device 21 configured to direct web of packaging material 3 out of buffer unit 5.

[0052] In particular, the portion of web of packaging material 3 being present within buffer unit 5 may extend between infeed roller device 20 and outfeed roller device 21.

[0053] In particular, buffer unit 5 may lack any further roller devices interposed between infeed roller device 20 and outfeed roller device 21 along web advancement path P. In other words, there are no further roller devices interposed between infeed roller device 20 and outfeed roller device 21 along web advancement path P.

[0054] Preferentially, web of packaging material 3 does not interact with any other kind of roller devices, and respective rollers, in addition to infeed roller device 20 and outfeed roller device 21 when being within buffer unit 5.

[0055] Moreover, the loading of buffer unit 5 can be measured as the quantity of web of packaging material 3 extending between infeed roller device 20 and outfeed roller device 21. Thereby, the quantity of web of packaging material 3 within buffer unit 5 can be expressed in terms of meters and/or seconds. In more detail, when expressing the quantity of web of packaging material 3 within in meters, one intends the meters of web of packaging material 3 extending between infeed roller device 20 and outfeed roller device 21, and along a longitudinal axis of web of packaging material 3. In addition or alternatively, when expressing the quantity in seconds, one indicates the quantity of web of packaging material 3 extending between infeed roller device 20 and outfeed roller device 21 and the time it is possible to feed web of packaging material 3 out of buffering unit 5 without the need to introduce new web of packaging material 3 into buffer unit 5.

[0056] Preferentially, buffer unit 5 is controllable in:

- an accumulation configuration, in which web of pack-

aging material 3 is accumulated within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21 (i.e. the quantity of web of packaging material 3 within buffer unit 5 is increased);

- a buffering configuration, in which the quantity of web of packaging material 3 present within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21, is kept substantially constant (i.e. the quantity of web of packaging material 3 within buffer unit 5 fluctuates around an average quantity); and
- a decumulation configuration, in which web of packaging material 3 present within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21, is decumulated (i.e. the quantity of web of packaging material 3 within buffer unit 5 is reduced).

[0057] Preferentially, buffer unit 5 is controlled, in use, in particular by means of the control unit, in the buffering configuration during a normal production of packaging apparatus 1 for forming packages 2. When it becomes necessary (e.g. because one needs to prepare for activation of the splicing unit) to buffer web of packaging material 3 within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21, buffer unit 5 is controlled, in use, in particular by means of the control unit, in the accumulation configuration. Afterwards (e.g. after completion of a splicing of web of packaging material 3 in use with the new web of packaging material 3), buffer unit 5 is controlled, in use, in particular by means of the control unit, in the decumulation configuration. Then, buffer unit 5 is controlled, in particular by the control unit, in the buffering configuration again.

[0058] Moreover, buffer unit 5 also comprises an accumulation housing 22 having an accumulation space 23 configured to randomly receive (see Figures 4 and 5) web of packaging material 3 while buffer unit 5 is controlled, in use, in the accumulation configuration.

[0059] In particular, accumulation housing 22 may delimit accumulation space 23.

[0060] More specifically and with particular reference to Figures 4 and 5, buffer unit 5, in particular accumulation housing 22, may be configured such that while buffer unit 5 is controlled in the accumulation configuration, web of packaging material 3 being present within buffer unit 5 randomly, in particular freely and randomly, falls into accumulation housing 22, i.e. web of packaging material 3 being present within buffer unit 5 may only interact with infeed roller device 20, outfeed roller device 21 and accumulation housing 22 and web of packaging material 3 does not take a defined and ordered position.

[0061] Additionally, in use, in dependence of the loading of buffer unit 5 (i.e. the quantity of web of packaging material 3 present within accumulation housing 22 or, in other words, the meters of web of packaging material 3 present within accumulation space 23) the shape of web of packaging material 3 continuously changes while buff-

er unit 5 is operated in the accumulation configuration. For example, web of packaging material 3 present within accumulation housing 22, in particular accumulation space 23, may take a form as the one shown in Figures 4 and 5, but not necessarily. For example, if web of packaging material 3 takes the form as the one shown in Figures 4 or 5, such a specific configuration would typically persist only for a short time as new web of packaging material 3 enters into accumulation space 23.

[0062] It should be noted that preferentially the term "randomly" indicates that the shape of web of packaging material 3 is not determined and may vary.

[0063] In further detail, web of packaging material 3 randomly, in particular randomly and freely, extends between infeed roller device 20 and outfeed roller device 21 while buffer unit 5 is controlled in the accumulation configuration.

[0064] In particular, as buffer unit 5 lacks any further roller device and/or roller between infeed roller device 20 and outfeed roller device 21, web of packaging material 3 present within buffer unit 5 is freely connected between infeed roller device 20 and outfeed roller device 21.

[0065] Moreover, while buffer unit 5 is controlled in the accumulation configuration, the quantity of web of packaging material 3 present within buffer unit 5 can be modified, in particular until accumulation space 23 is fully occupied and/or a maximum load is obtained.

[0066] In more detail and with particular reference to Figure 3, buffer unit 5 is configured such that web of packaging material 3 is arranged in a free loop 24 within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21, while buffer unit 5 is controlled in the buffering configuration.

[0067] In even more detail, buffer unit 5 is configured such that while, in use, buffer unit 5 is controlled in the buffering configuration free loop 24 present within buffer unit 5 fluctuates around an average shape, e.g. measured in meters and/or in dependence of the position of an apex 25 of free loop 24.

[0068] It should be noted that free loop 24 may develop as there are no further elements (such as, for example, rollers), which may define the shape of web of packaging material 3 extending within buffer unit 5, in particular between infeed roller device 20 and outfeed roller device 21, and in particular also because of the acting gravitational force.

[0069] Advantageously, buffer unit 5 may be configured such that while buffer unit 5 is controlled in the decumulation configuration, the randomly, in particular the freely and randomly, arranged web of packaging material 3 is decumulated out of accumulation space 23, and in particular out of buffer unit 5. Preferentially, buffer unit 5 is controlled back from the decumulation configuration to the buffering configuration once web of packaging material 3 present within buffer unit 5 takes the form of a free loop 24 again, and in particular having the desired quantity of web of packaging material 3.

[0070] With particular reference to Figures 2 to 5, ac-

cumulation housing 22 may comprise a main wall 26, a plurality of lateral delimiting walls 27 transversal, in particular perpendicular, to main wall 26 and a main opening 28 through which web of packaging material 3 enters into accumulation space 23.

[0071] In particular, main wall 26 may be opposite to main opening 28.

[0072] More specifically, main wall 26 may define a bottom wall of accumulation housing 22.

[0073] Preferentially, main opening 28 may be delimited by respective lateral delimiting walls 27.

[0074] In particular, main opening 28 may be arranged at an upper portion of accumulation housing 22.

[0075] In use, when buffer unit 5 is controlled in the accumulation configuration, web of packaging material 3 has a shape of a free loop until web of packaging material 3 starts to contact main wall 26. Then, web of packaging material 3 becomes randomly distributed within accumulation housing 22, in particular accumulation space 23.

[0076] With particular reference to Figures 1 to 5, infeed roller device 20 may comprise a drive roller 32 and one or more counter rollers 33, in the specific case shown two, in particular for interposing web of packaging material 3 between drive roller 32 and the one or more counter rollers 33.

[0077] Moreover, infeed roller device 20 may also comprise an actuator 34, in particular a motor, even more particular an electrical motor, configured to actuate a rotation of drive roller 32. In particular, actuator 34 may be configured to control an angular speed of drive roller 32 such to at least partially control an infeed speed of web of packaging material 3 into accumulation housing 22, in particular accumulation space 23.

[0078] Reverting again to Figures 1 to 5, outfeed roller device 21 may also comprise a main roller 35 and one or more counter rollers 36, in the specific case shown two, in particular so as to interpose, in use, web of packaging material 3 between main roller 35 and the one or more counter rollers 36.

[0079] Preferentially, outfeed roller device 21 may also comprise a brake 37 configured to decelerate main roller 35, in particular so as to control the tension of web of packaging material 3, in particular downstream of outfeed roller device 21 along web advancement path P.

[0080] In particular, web of packaging material 3 may freely extend between drive roller 32 and main roller 35.

[0081] According to some preferred non-limiting embodiments, buffer unit 5 and/or conveying device 4 may be configured such that:

- an infeed speed of web of packaging material 3 into buffer unit 5 substantially corresponds to an outfeed speed of web of packaging material 3 out of buffer unit 5, when buffer unit 5 is controlled in the buffering configuration; and/or
- the infeed speed of web of packaging material 3 into buffer unit 5 is larger than the outfeed speed of web

of packaging material 3 out of buffer unit 5, when buffer unit 5 is controlled in the accumulation configuration; and/or

- the infeed speed of web of packaging material 3 into buffer unit 5 is smaller than the outfeed speed of web of packaging material 3, in particular this may include the possibility of keeping the infeed speed of web of packaging material 3 at 0 m/s, out of buffer unit 5, when buffer unit 5 is controlled in the decumulation configuration.

[0082] In more detail, infeed roller device 20, in particular drive roller 32, is configured such to at least partially control the infeed speed of web of packaging material 3 into buffer unit 5 such that:

- the infeed speed is larger than the outfeed speed while the buffer unit 5 is, in use, controlled in the accumulation configuration; and/or
- the infeed speed is smaller than the outfeed speed, in particular including also the possibility of keeping the infeed speed at 0 m/s, while the buffer unit 5 is, in use, controlled in the decumulation configuration; and/or
- the infeed speed substantially corresponds to the outfeed speed while the buffer unit 5 is, in use, controlled in the buffering configuration.

[0083] According to some preferred non-limiting embodiments, conveying device 4 may comprise a roller 38 arranged upstream of infeed roller device 20 along web advancement path P. In particular, roller 38 may be arranged such that web of packaging material 3 has an auxiliary free loop 39 between roller 38 and infeed roller device 20.

[0084] In use, packaging apparatus 1 forms packages 2 filled with the pourable product. In particular, packaging apparatus 1 forms packages 2 from tube 7 formed from web of packaging material 3, tube 7 being continuously filled with the pourable product.

[0085] In more detail, operation of packaging apparatus 1 (in other words, the formation of packages 2) comprises at least the steps of:

- advancing web of packaging material 3 along web advancement path P, in particular by conveying device 4;
- forming tube 7, during which web of packaging material 3 is formed into tube 7, in particular by tube forming and sealing device 6, even more particular by tube forming unit 13;
- longitudinally sealing tube 7, during which tube 7 is longitudinally sealed, in particular by tube forming and sealing device 6, even more particular by the sealing unit;
- filling tube 7, during which the pourable product is filled into tube 7, in particular by filling device 8, even more particular by filling pipe 14.

[0086] Preferentially, the formation of packages 2 also comprises a further step of advancing, during which tube 7 is advanced, in particular by conveying device 4, along tube advancement path Q.

[0087] According to some preferred non-limiting embodiments, the formation of packages 2 also comprises a step of forming, during which packages 2 are formed from tube 7, in particular by shaping, transversally sealing and in particular transversally cutting tube 7. Preferentially, during the step of forming, packages 2 are formed by operation of the package forming unit.

[0088] Preferentially, operation of packaging apparatus 1 may also comprise the step of sterilizing, during which web of packaging material 3 is sterilized by the sterilization unit.

[0089] According to some preferred non-limiting embodiments, operation of packaging apparatus 1 may also comprise a step of splicing, during which a web of packaging material 3 in use is spliced with a new web of packaging material 3.

[0090] Operation of packaging apparatus 1 may also comprise a step of controlling during which the buffer unit 5 is controlled in one of the accumulation configuration, the buffering configuration and the decumulation configuration.

[0091] In more detail, a step of accumulating is executed while the buffer unit 5 is controlled in the accumulation configuration and during which web of packaging material 3 is randomly accumulated within buffer unit 5, in particular within accumulation space 23 of accumulation housing 22.

[0092] Moreover, a step of normal buffering is executed while the buffer unit 5 is controlled in the buffering configuration and during which free loop 24 of web of packaging material 3) is maintained within buffer unit 5, in particular between inlet roller device 20 and outlet roller device 21.

[0093] Additionally, a decumulation step is executed when the buffer unit 5 is controlled in the decumulation configuration and during which web of packaging material 3 is decumulated from buffer unit 5, in particular from accumulation space 23 of accumulation housing 22.

[0094] In even more detail, during the step of accumulating the infeed speed of web of packaging material 3 into buffer unit 5 may be larger than the outfeed speed of web of packaging material 3 out of buffer unit 5.

[0095] Moreover, during the step of decumulating, the infeed speed of web of packaging material 3 into buffer unit 5 may be smaller than the outfeed speed of web of packaging material 3 out of buffer unit 5. This may include the possibility of keeping the infeed speed of web of packaging material 3 at least for some time at 0 m/s.

[0096] Additionally, during the step of normal buffering, the infeed speed of web of packaging material 3 into buffer unit 5 may substantially correspond to the outfeed speed of web of packaging material 3 out of buffer unit 5.

[0097] Preferentially, the step of accumulating may be executed prior to the step of splicing.

[0098] Moreover the step of decumulating may be executed during the step of splicing.

[0099] In further detail, the step of accumulating may be executed after the step of normal buffering. After termination of the step of accumulating, the step of decumulating is executed and then the step of normal buffering is executed again.

[0100] The advantages of buffer unit 5 and/or packaging apparatus 1 and the method according to the present invention will be clear from the foregoing description.

[0101] In particular, buffer unit 5 comes along with a simple design. This because there is neither a first group of rollers nor a second group of rollers as in the prior art buffer units. Accordingly, one also avoids relying on means for varying the relative distance between the first group of rollers and the second group of rollers.

[0102] A further advantage resides in that web of packaging material 3 when passing through buffer unit 5 is not in contact with any roller besides the ones of infeed roller device 20 and outfeed roller device 21. This also reduces the stresses acting on web of packaging material 3.

[0103] Clearly, changes may be made to buffer unit 5 and/or packaging apparatus 1 and/or the method as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A buffer unit (5) for a packaging apparatus (1) for forming packages (2) from a web of packaging material (3) and being filled with a pourable product;

the buffer unit (5) being configured to buffer the web of packaging material (3) and comprises:

- an infeed roller device (20) configured to feed the web of packaging material (3) into the buffer unit (5);
- an outfeed roller device (21) configured to direct the web of packaging material (3) out of the buffer unit (5) ; and
- an accumulation housing (22) having an accumulation space (23) configured to randomly receive the web of packaging material (3)

wherein the buffer unit (5) is controllable in an accumulation configuration, in which the web of packaging material (3) is randomly accumulated within the buffer unit (5) .

2. Buffer unit according to claim 1, and also being controllable in a buffering configuration; wherein the buffer unit (5) is configured such that the web of packaging material (3) is arranged in a free

loop (24) between the infeed roller device (20) and the outfeed roller device (21) while the buffer unit (5) is controlled in the buffering configuration.

3. Buffer unit according to claim 1 or 2, wherein the buffer unit (5) is also controllable in a decumulation configuration; wherein the buffer unit (5) is configured such that while the buffer unit (5) is controlled in the decumulation configuration the randomly arranged web of packaging material (3) is decumulated out of the accumulation space (23) .
4. Buffer unit according to any one of the preceding claims, wherein the web of packaging material (3) freely and randomly extends between the infeed roller device (20) and the outfeed roller device (21) while the buffer unit (5) is controlled in the accumulation configuration.
5. Buffer unit according to any one of the preceding claims, wherein the accumulation housing (22) comprises a main wall (26), a plurality of lateral delimiting walls (27) transversal to the main wall (26) and a main opening (28) through which the web of packaging material (3) enters into the accumulation space (23).
6. Buffer unit according to claim 5, wherein the main wall (26) is opposite to the main opening (28).
7. Buffer unit according to any one of the preceding claims, wherein the infeed roller device (20) comprises a drive roller (32) and at least one counter roller (33).
8. Buffer unit according to any one of the preceding claims, wherein the outfeed roller device (21) comprises a main roller (35) and at least one counter roller (36).
9. Buffer unit according to claim 7 and 8, wherein the web of packaging material (3) freely extends between the drive roller (32) to the main roller (35).
10. Buffer unit according to any one of the preceding claims, wherein the infeed roller device (20) is configured such to keep an infeed speed of the web of packaging material (3) into the buffer unit (5) to be larger than an outfeed speed of the web of packaging material (3) from the buffer unit (5) while the buffer unit (5) is, in use, controlled in the accumulation configuration.
11. A packaging apparatus (1) for forming packages (2) from a web of packaging material (3) and being filled with a pourable product; the packaging apparatus (1) comprises:

- a conveying device (4) for advancing the web of packaging material (3) along a web advancement path (P);
 - a buffer unit (5) according to any one of the preceding claims; 5
 - a tube forming and sealing device (6) configured to form and longitudinally seal a tube (7) from the web of packaging material (3) and being arranged upstream of the buffer unit (5) along the web advancement path (P); 10
 - a filling device (8) configured to direct, in use, the pourable product into the tube (7); and
 - a package forming unit configured to at least form and to transversally seal the, in use, advancing tube (7) for forming the packages (2). 15
- 12.** Packaging apparatus according to claim 11, and further comprising a splicing unit configured to splice a new web of packaging material (3) to the web of packaging material (3) in use; 20
- wherein the buffer unit (5) is configured to be controlled in the accumulation configuration prior to an activation of the splicing unit.
- 13.** Method for forming packages (2) from a web of packaging material (3) and being filled with a pourable product comprising at least the steps of: 25
- advancing the web of packaging material (3) along a web advancement path (P); 30
 - forming a tube (7) from the web of packaging material (3);
 - longitudinally sealing the tube (7);
 - filling the tube (7) with the pourable product; and 35
 - accumulating the web of packaging material (3), during which a buffer unit (5) accumulates the web of packaging material (3);
- wherein the buffer unit (5) comprises: 40
- an infeed roller device (20) configured to feed the web of packaging material (3) into the buffer unit (5);
 - an outfeed roller device (21) configured to direct the web of packaging material (3) out of the buffer unit (5); and 45
 - an accumulation housing (22) having an accumulation space (23) configured to randomly receive the web of packaging material (3); 50
- wherein during the step of accumulating, the buffer unit (5) randomly accumulates the web of packaging material (3) within the accumulation space (23). 55
- 14.** Method according to claim 13, and further compris-

ing a step of controlling the buffer unit (5) in one of:

- an accumulation configuration for accumulating the web of packaging material (3) within the buffer unit (5);
- a buffering configuration at which the buffer unit (5) keeps the quantity of the web of packaging material (3) within the buffer unit (5) substantially constant; and
- a decumulation configuration during which the web of packaging material (3) present within the buffer unit (5) is decumulated;

wherein the step of accumulating is executed while the buffer unit (5) is controlled in the accumulation configuration and during which the web of packaging material (3) is accumulated within the buffer unit (5); wherein a step of normal buffering is executed when the buffer unit (5) is controlled in the buffering configuration and during which a free loop (24) of the web of packaging material (3) is maintained within the buffer unit (5); and

wherein a decumulation step is executed when the buffer unit (5) is controlled in the decumulation configuration and during which the web of packaging material (3) is decumulated from the buffer unit (5).

- 15.** Method according to claim 13 or 14, and further comprising a step of splicing, during which a web of packaging material (3) in use is spliced with a new web of packaging material (3);
- wherein the step of accumulating is executed prior to the step of splicing.

FIG. 1

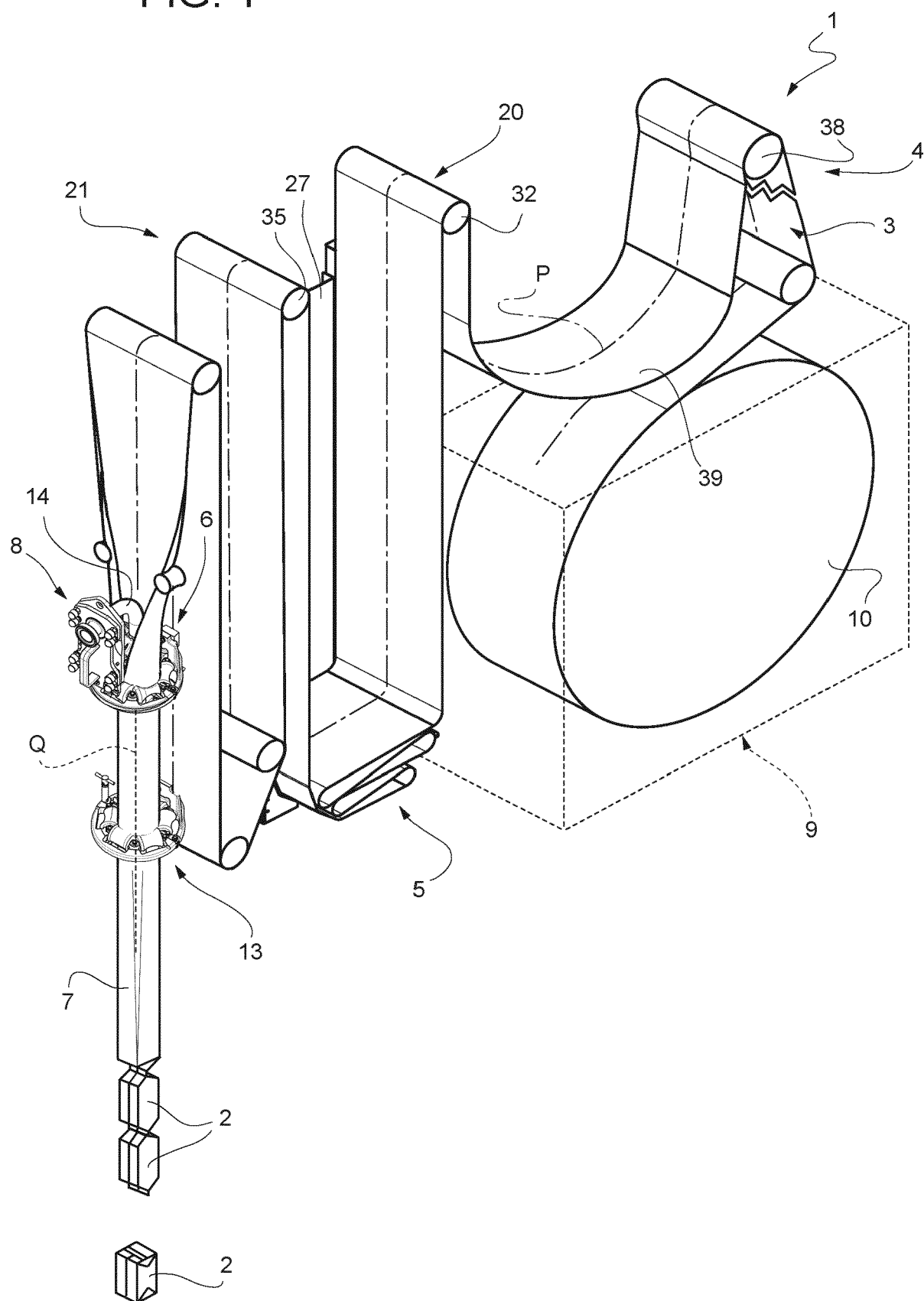


FIG. 2

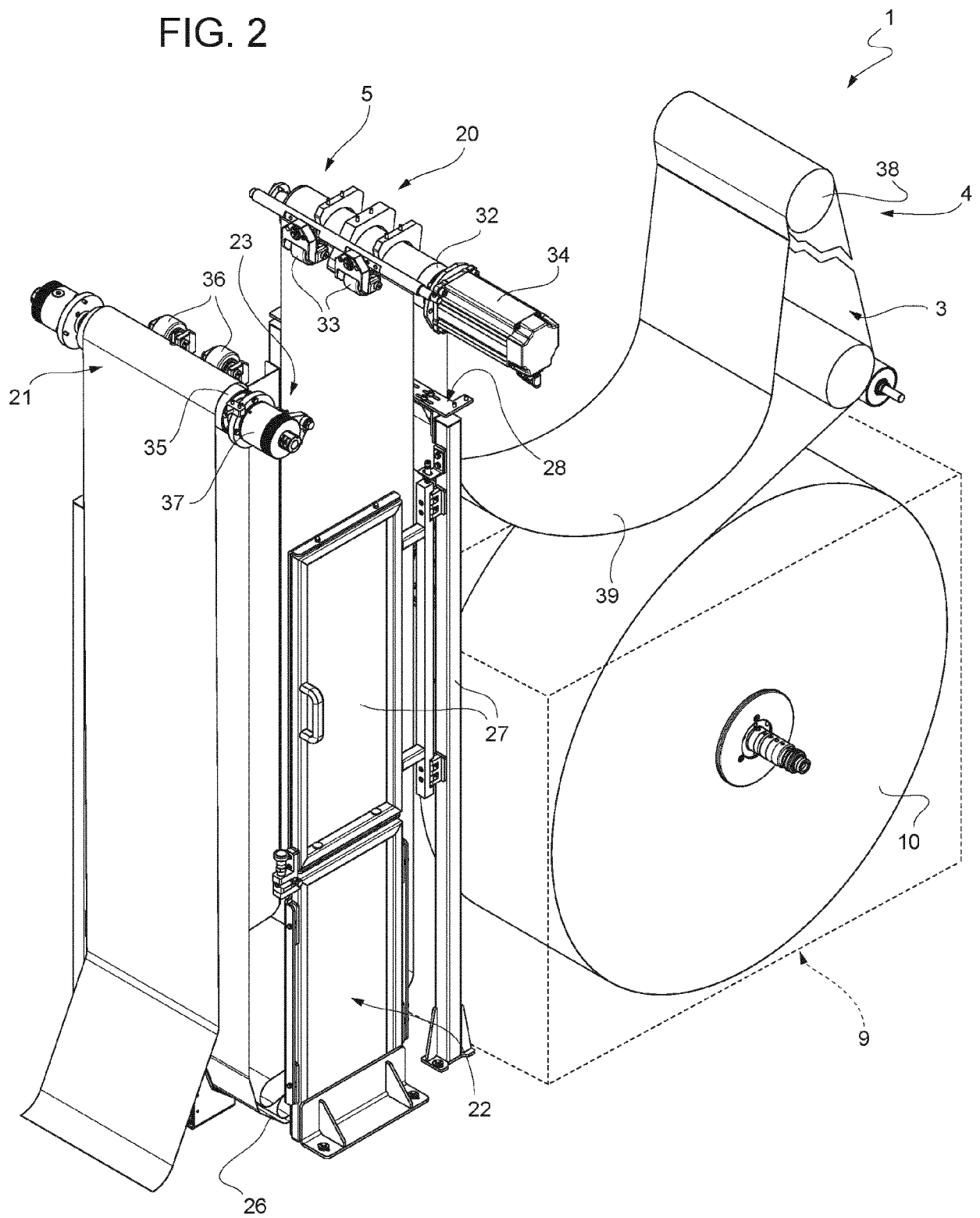


FIG. 3

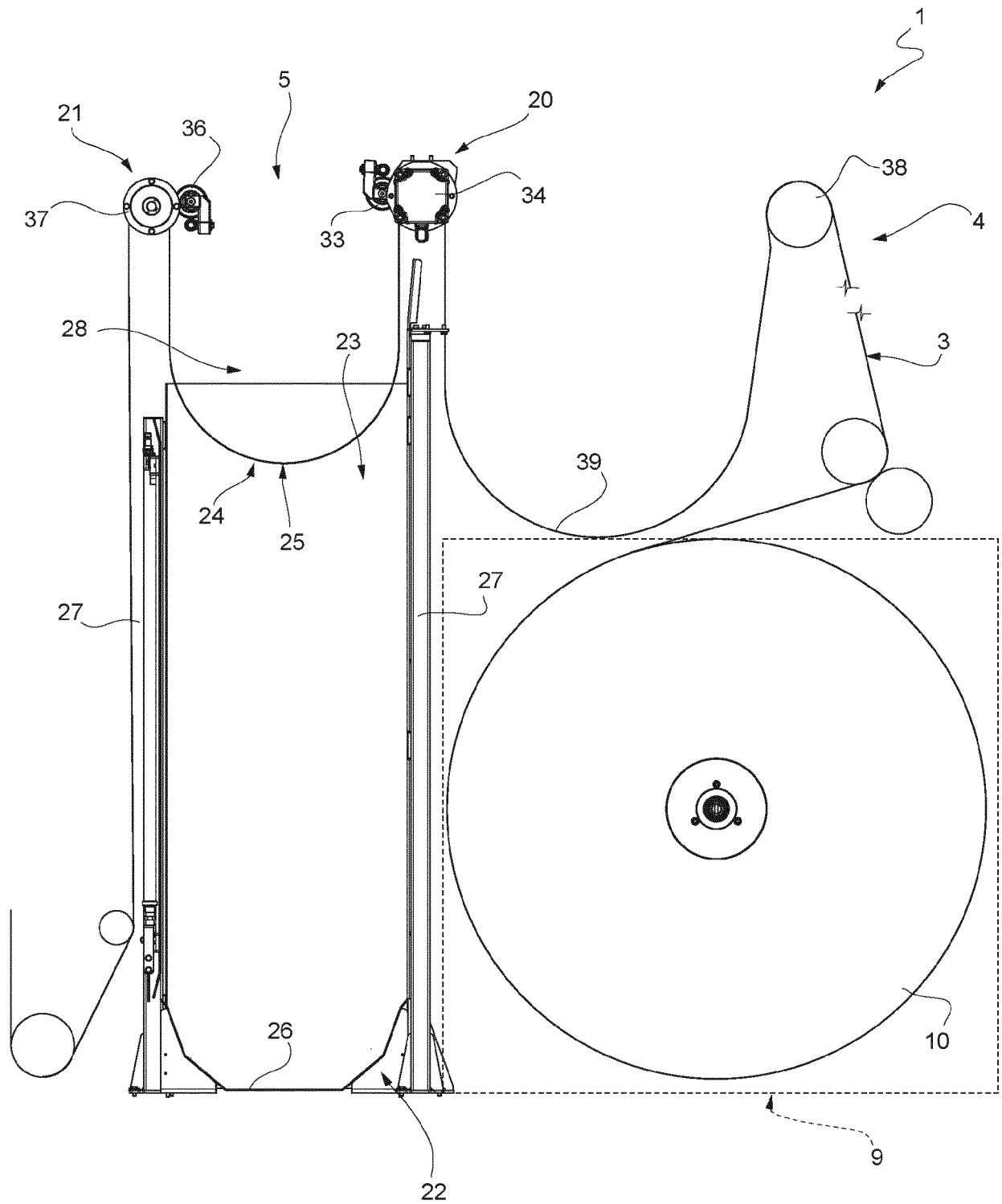


FIG. 4

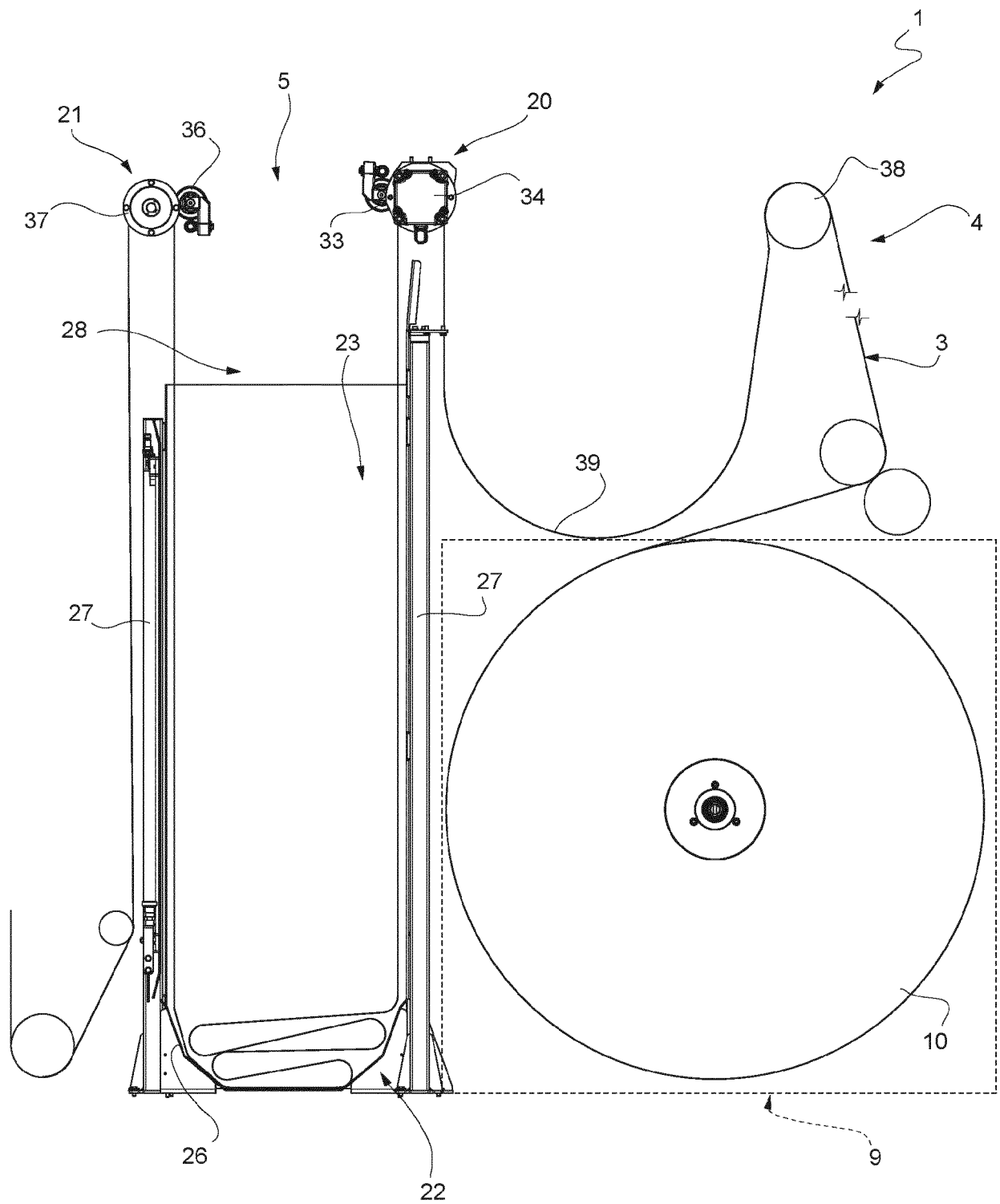
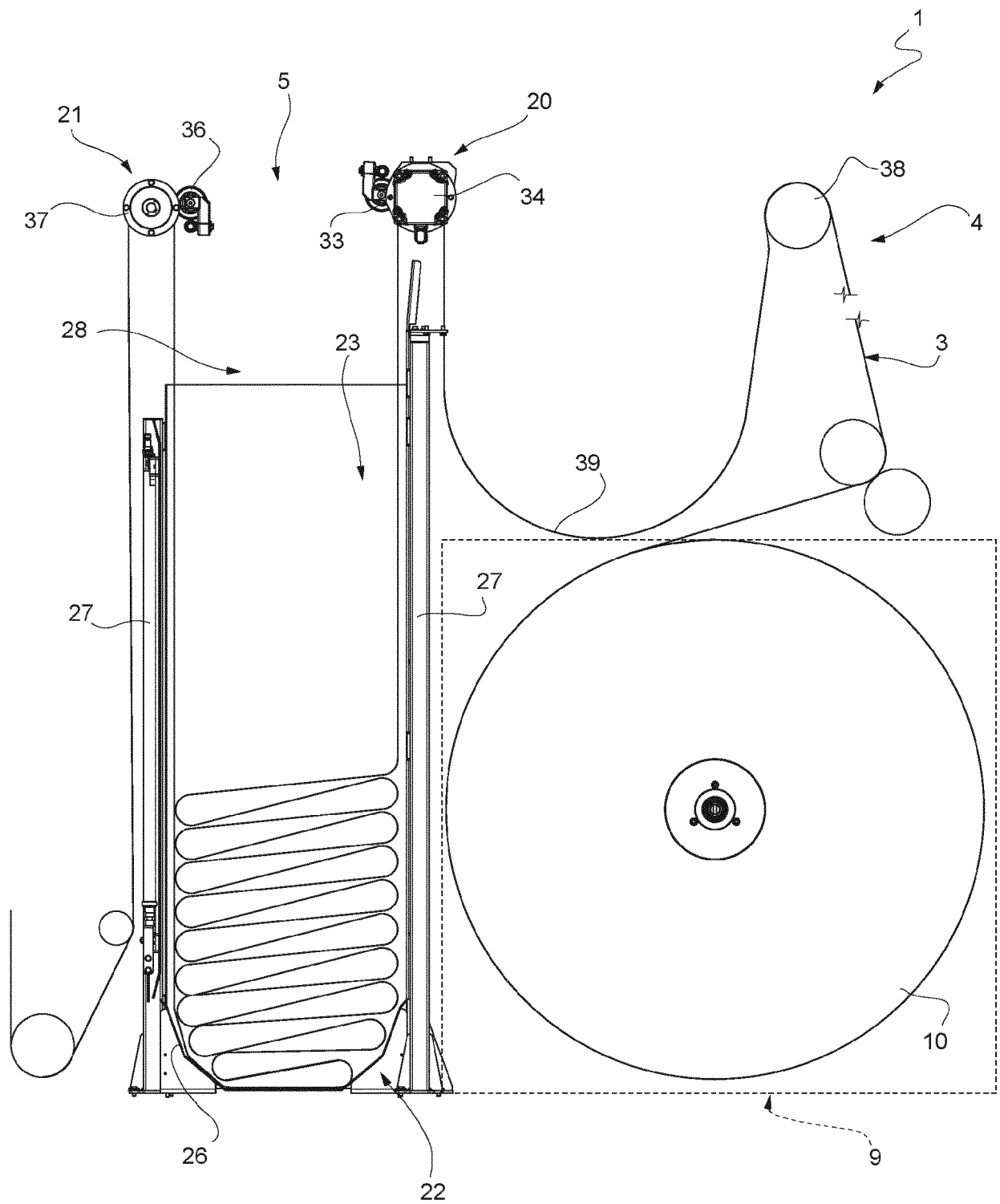


FIG. 5





EUROPEAN SEARCH REPORT

Application Number

EP 22 20 3486

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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			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		12 April 2023	Ungureanu, Mirela
CATEGORY OF CITED DOCUMENTS			
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