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(54) LABELLING MACHINE AND METHOD WITH ACTIVE CONTROL OF WEB TENSION

(57) The present invention relates to a method for labelling a plurality of containers (3) by means of respective portions of a web (4) of labelling material, and to a machine (1) configured for carrying out the method, wherein the method allows a more accurate control of the web tension.

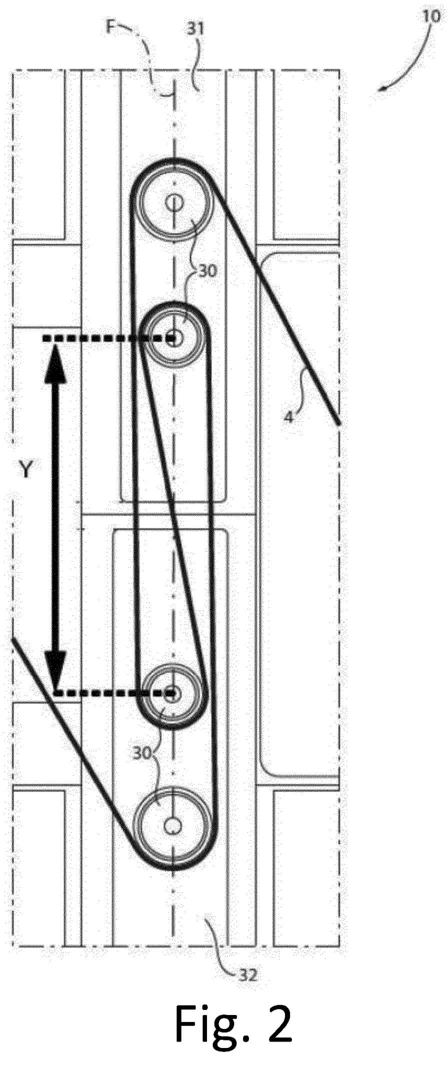


Fig. 2

Description

TECHNICAL FIELD

[0001] The present invention relates to a method for labelling a plurality of containers by means of respective portions of a web of labelling material, and to a machine configured for carrying out the method, wherein the method allows a more accurate control of the web tension.

BACKGROUND ART

[0002] Labelling machines are known for labelling containers. The labelling machine comprises an advancement device for advancing the web according to an advancement direction. The advancement device comprises a web feeding device for feeding the web according to a feeding device parameter. The advancement device comprises a web buffering unit located downstream of the feeding device according to the advancement direction. The buffering unit comprises a first guide roller and a second guide roller distinct from the first guide roller. A spring is interposed between the rollers for influencing the position of the second roller with respect to the first roller, to control automatically in passive way the tension of the web downstream of the web feeding device.

DISCLOSURE OF INVENTION

[0003] A labelling method according to any of the appended method claims or according to present description allows to improve the precision and/or accuracy and/or the speed of the control of the web tension.

[0004] A labelling machine according to any of the appended machine claims or according to present description is configured for carrying out a method according to any of the appended method claims or according to present description.

[0005] The following brief description of the drawings and detailed description of the invention will be referred to a possible example embodiment of a labelling method according to present description and a possible example embodiment of a labelling machine according to present description.

[0006] In the following brief description of the drawings and detailed description of the invention, the example embodiment of the labelling method will be defined for the sake of convenience as "method". In the following brief description of the drawings and detailed description of the invention, the example embodiment of the labelling machine will be defined for the sake of convenience as "machine".

BRIEF DESCRIPTION OF THE DRAWINGS

[0007] The following detailed description will be referred to the accompanying drawings, in which:

Figure 1 is a view from above of the machine;
Figure 2 is a view of a buffer unit of the machine;
Figure 3 is a block diagram of a tension control system and a position control system which are a part of the machine;
Figure 4 is a flow diagram explaining an active and automatic controlling the web tension, which can be carried out by means of the machine.

DETAILED DESCRIPTION OF THE INVENTION

[0008] The method is for labelling a plurality of containers 3 by means of respective portions 2 of a web 4 of labelling material.

[0009] The method comprises advancing the web 4 of labelling material according to an advancement direction D1. The machine 1 comprises an advancement device 30 for carrying out said advancing.

[0010] The advancing comprises, by means of a feeding device 8, feeding the web according to a feeding device parameter K. The feeding device parameter K is showed in Figure 3. The machine 1 comprises the feeding device 8 for carrying out said feeding. The feeding device 8 is indicated in Figure 1 and in the block diagram of Figure 3.

[0011] Feeding device 8 comprises a support shaft rotatable around a rotation axis E. The shaft is for carrying a reel 26 carrying the web of labeling material 4.

[0012] The advancing comprises buffering the web 4 by means of at least one guide roller 30 guiding the advancing web 4. The at least one guide roller 30 is showed in Figure 2. The machine 1 comprises a web buffering unit 10 for carrying out said buffering. The buffering unit 10 is showed in more detail in Figure 2.

[0013] Said buffering is carried out downstream of the feeding device 8 according to the advancement direction D1. The web buffering unit 10 is located downstream of the feeding device 8 according to the advancement direction D1.

[0014] The method comprises automatically and actively controlling a position Y of the at least one guide roller 30, by means of at least a buffer motor BM influencing said position Y. The position Y is showed in Figure 2. The buffer motor BM is indicated for the sake of convenience only in the block diagram of Figure 3.

[0015] The at least one guide roller 30 comprises a first guide roller and a second guide roller distinct from the first guide roller. The position Y is a distance between the first guide roller and the second guide roller. Each of said rollers is for guiding the advancing web 4.

[0016] The first guide roller is supported by a first support 31 supporting the first guide roller. The second guide roller is supported by a second support 32 supporting the second guide roller. In Figure 2, each of the first guide roller and second guide roller is indicated with 30. The first support 31 can be a first carriage carrying the first roller. The second support 32 can be a second carriage carrying the second roller.

[0017] The buffer motor BM is mechanically interposed between the first support 31 and the second support 32, to influence the position Y. The first support 31 and the second support 32 are movable with respect to each other to allow said position Y to be changed or influenced by the buffer motor BM.

[0018] The buffering unit 10 comprises the first support 31, the second support 32, the first roller and the second roller.

[0019] The machine 1 comprises a position control system for carrying out said automatically and actively controlling the position Y. The position control system is indicated with the box PCS in Figure 3. The position control system PCS comprises a buffer motor control unit BMCU and the buffer motor BM. The position control system PCS is configured so that the buffer motor control unit BMCU controls the buffer motor BM by means of a control variable. The control variable is represented by letter m in Figure 3.

[0020] The method comprises automatically detecting a resistance parameter Z. The resistance parameter Z is correlated to a tension of the web 4. The tension of the web 4 acts on the first guide roller and/or on the second guide roller, so that the resistance parameter Z is dependent upon or correlated to the tension of the web. The tension is downstream of the feeding device 8 according to the advancement direction D1.

[0021] The machine 1 is configured so that an increase of the position Y produces an increase of the tension. The machine 1 is configured so that a decrease of the position Y produces a decrease of the tension. The method comprises controlling the tension. Controlling the tension is carried out by automatically and actively controlling the feeding device 8. Automatically and actively controlling the feeding device 8 comprises automatically and actively controlling the feeding device parameter K. Controlling the tension is carried out also by automatically and actively controlling the position control system PCS. Automatically and actively controlling the position control system PCS comprises automatically and actively controlling the automatically and actively controlling the position Y. Controlling the tension is carried out based at least on the detected resistance parameter Z. As controlling the tension is carried out also by automatically and actively controlling the position control system PCS, and automatically and actively controlling the position control system PCS comprises automatically and actively controlling the automatically and actively controlling the position Y, controlling the tension is carried out based also at least on the position Y. The tension control system TCS actively and automatically controls the position control system PCS and the feeding device 8.

[0022] The machine 1 comprises a tension control system for carrying out said controlling the tension. The tension control system is also for carrying out said detecting the resistance parameter Z. The tension control system is indicated with TCS in Figure 3. The tension control system TCS comprises a tension control unit TCU. The feeding device parameter K can be a linear speed of the advancing web 4 or an angular speed of the shaft of the feeding device 8 or another parameter K influencing the feeding, and the variation of which can produce a variation of said tension.

[0023] As the tension is actively controlled by actively controlling both the feeding device parameter K and the position Y, the tension of the web 4 is automatically controlled with higher precision, and/or with higher accuracy and/or with higher speed.

[0024] The machine 1 is configured so that the higher the tension, the higher the resistance parameter Z, and so that the lower the tension, the lower the resistance parameter Z. Therefore, the machine 1 is configured so that the resistance parameter Z is directly proportional to the tension.

[0025] The resistance parameter Z is indicative of a force or torque acting on the buffer motor BM. In this way it is increased the accuracy of controlling the tension as the resistance parameter Z, which is detected for controlling the tension, is strictly correlated with the same component, that is the buffer motor BM, which is used also for controlling the position Y, which position Y is another variable used for adjusting the tension together with the detected resistance parameter Z.

[0026] In general, a variation of the feeding device parameter K produces an effect or disturbance on the buffer motor BM. This effect or disturbance is represented by letter w in Figure 3. Therefore also the position Y can be influenced by a variation of the feeding device parameter K.

[0027] Controlling the tension is carried out based at least on a first threshold Z_1 and a second threshold Z_2. The first threshold Z_1 and the second threshold Z_2 are preestablished. The second threshold Z_2 is greater than the first threshold Z_1 or equal to the first threshold Z_1. If the second threshold Z_2 is equal to the first threshold Z_1, the first threshold Z_1 and the second threshold Z_2 are not different from each other. The example flow diagram of Figure 4 is preferably referred to a situation in which the second threshold Z_2 is greater than the first threshold Z_1. However, the example flow diagram of Figure 4 can be considered applicable also to a situation in which the first threshold Z_1 and the second threshold Z_2 are equal to each other.

[0028] Actively and automatically controlling the feeding device parameter K is carried out by decreasing the feeding device parameter K if the detected resistance parameter Z is smaller than the first threshold Z_1. The amplitude of the feeding device parameter K decrease is based on, for example directly proportional to, the difference between the first threshold Z_1 and the detected resistance parameter Z.

[0029] The detecting of the resistance parameter Z is represented in Figure 4 by block S1. The evaluation about whether the detected resistance parameter Z is smaller than the first threshold Z_1 can be considered represented in Figure 4 globally by block S2 and block S3. It is to be noted that, in block S2, it is evaluated whether the detected resistance parameter Z falls within the range from first threshold Z_1 to second threshold Z_2. If the detected resistance parameter Z falls within this range, the method returns to the detecting S1 of the resistance parameter Z. If the first threshold Z1 is equal to second threshold Z_2, the falling of the detected resistance parameter Z within this range means that the detected resistance parameter Z is equal to the first threshold Z_1 and equal to the second threshold Z_2.

[0030] Decreasing the feeding device parameter K is represented in Figure 4 by block S6.

[0031] The position Y is automatically and actively controlled in a closed loop way with a reference or setpoint variable Y_0.

[0032] It is to be considered that the higher the detected resistance parameter Z, the higher the tension, because the detected resistance parameter Z being higher means that the buffer motor BM is struggling more in trying to maintain the reference variable Y_0 and because the machine 1 is configured so that an increase of the position Y corresponds to an increase of the tension.

[0033] If the detected resistance parameter Z is less than the first threshold Z1, an increase of the tension is desired. If the buffering unit 10 is located downstream of the feeding device 8 according to the feeding direction D1, the machine 1 is configured so that an increase of the feeding device parameter K produces a decrease of the tension, and a decrease of the feeding device parameter K produces an increase of the tension. Therefore, if the detected resistance parameter Z is less than the first threshold Z1, decreasing the feeding device parameter K produces a desired increase of the tension.

[0034] The position control system PCS is actively and automatically controlled by controlling the reference variable Y_0. Therefore, actively and automatically controlling the position Y is actively and automatically controlled by controlling the reference variable Y_0. The tension control system TCS controls the position control system PCS by controlling the reference variable Y_0 on which the feedback control of the position control system PCS is based.

[0035] The reference variable Y_0 is controlled by increasing the reference variable Y_0 if the detected resistance parameter Z is smaller than the first threshold Z_1. The amplitude of the reference variable Y_0 increase is based on, for example directly proportional to, the difference between the first threshold Z1 and the detected resistance parameter Z.

[0036] Increasing the reference variable Y_0 is represented in Figure 4 by block S7. As an increase of the reference variable Y_0 produces an increase of the position Y by means of the position control system PCS, and an increase of the position Y produces an increase of the tension, increasing the reference variable Y_0 can allow the web tension, during the transient of the feeding device 8, to increase more than it would do without the increase of the reference variable Y_0, and therefore can compensate the transient of the feeding device 8. In this way the controlling of the tension is quicker.

[0037] Actively and automatically controlling the feeding device parameter K is carried out by increasing the feeding device parameter K if the detected resistance parameter Z is greater than the second threshold Z_2. The amplitude of the feeding device parameter K increase is based on, for example directly proportional to, the difference between the detected resistance parameter Z and the second threshold Z_2.

[0038] Increasing the feeding device parameter K is represented in Figure 4 by block S4.

[0039] It is to be considered that the smaller the detected resistance parameter Z, the smaller the tension, because the detected resistance parameter Z being smaller means that the buffer motor BM is less struggling in trying to maintain the reference variable Y_0 and because the machine 1 is configured so that a decrease of the position Y corresponds to a decrease of the tension.

[0040] If the detected resistance parameter Z is greater than the second threshold Z2, a decrease of the tension is desired. If the buffer unit 10 is located downstream of the feeding device 8 according to the feeding direction D1, increasing the feeding device parameter K produces a desired decrease of the tension.

[0041] The reference variable Y_0 is controlled by decreasing the reference variable Y_0 if the detected resistance parameter Z is greater than the second threshold Z_2. The amplitude of the reference variable Y_0 decrease is based on, for example directly proportional to, the difference between the detected resistance parameter Z and the second threshold Z_2.

[0042] Decreasing the reference variable Yo is represented in Figure 4 by block S5.

[0043] As a decrease of the reference variable Y_0 produces a decrease of the position Y by means of the position control system PCS, and a decrease of the position Y produces a decrease of the web tension, decreasing the reference variable Y_0 can allow the web tension, during the transient of the feeding device 8, to decrease more than it would do without the decrease of the reference variable Y_0, and therefore can compensate the transient of the feeding device 8. In this way the controlling of the tension is quicker.

[0044] Therefore, by means of the tension control system TCS and the position control system PCS, an excessive rise of the tension causes automatically a reduction of the position Y and an increase of the feeding device parameter K, thereby decreasing the tension very quickly and/or precisely. Moreover, by means of the tension control system TCS and the position control system PCS, an excessive lowering of the tension causes automatically an increase of the position Y and a decrease of the feeding device parameter K, thereby increasing the tension.

[0045] The tension control system TCS is configured for detecting the resistance parameter Z through the buffer motor BM.

[0046] The tension control system TCS is configured so that said resistance parameter Z is detected by means of a resistance sensor which is a part of the buffer motor BM or which is not a part of the buffer motor BM.

[0047] The position control system PCS is configured for detecting the position Y through the buffer motor BM.

[0048] The position control system TCS is configured so that said position Y is detected by means of a position sensor which is a part of the buffer motor BM.

[0049] In this way the compactness of the tension control system TCS and/or of the position control system PCS is increased.

[0050] Alternatively the position sensor is not be part of the buffer motor BM.

[0051] Position sensor could comprise an encoder coupled to buffer motor BM and/or a capacitive sensor and/or a position transducer or similar.

[0052] It is to be considered that the feeding device 8, in another not shown embodiment, can be located upstream of the buffering unit 10, with respect to the advancement direction D1.

[0053] It is to be considered that the resistance parameter Z, in another not shown embodiment, is the tension. In this case the resistance sensor is a tension sensor.

[0054] Containers 3 may be bottles, jars, vessels, containers or the like, in particular being made of base components, like glass, paper or cardboard, plastics, aluminum, steel, multilayer packaging material and composites.

[0055] In the following, reference will be made without any limiting scope to the case in which the label sheets 2 which are applied on the respective containers 3 for labelling the containers 3 are cut from the web 4 and applied onto respective containers 3.

[0056] Alternatively, the label sheets could also be of the heat-shrink type obtained from a respective web of labeling material or of the pressure sensitive type and, which are stuck on a base web.

[0057] In the following description, reference will be made to a web of labeling material 4 comprising a repetition of (successively arranged) decorative patterns. In particular, each pattern defines (the extension of) a respective label sheet 2.

[0058] With particular reference to Figure 1, machine 1 comprises at least:

- a conveyor 5, in particular a conveying carousel, configured to advance containers 3 along a container advancement path P, in particular container advancement path P being arc-shaped, and through a label application station 6; and
- a labeling apparatus 7 configured to apply at least one label sheet 2 onto each container 3 at label application station 6.

[0059] In more detail, labeling apparatus 7 comprises the advancement device 30.

[0060] The advancement device 30 is configured to advance web 4 along an advancement path Q, in particular from an initial station 9 to and/or towards label application station 6.

[0061] The buffering unit 10 is designed to buffer web 4, and in particular is arranged downstream from initial station 9 along web advancement path Q.

[0062] Additionally, labeling apparatus 7 may comprise:

- a cutting unit 15 configured to cut label sheets 2 from web of labeling material 4 at a cutting station 16, in particular cutting unit 15 being arranged downstream from buffer unit 10 along web advancement path Q; and
- a transfer conveyor 17, in particular a transfer drum rotatable around a rotation axis A (having a substantially vertical orientation), configured to transfer label sheets 2 from cutting station 16 to label application station 6 and onto containers 3.

[0063] Furthermore, labeling apparatus 7 may comprise a gluing unit 18 designed to apply glue onto label sheets 2 and/or onto web of labeling material 4.

[0064] In further detail, cutting unit 15 may be designed to cut web of labeling material 4 so as to define respective leading edges 19 and respective trailing edges 20 of label sheets 2. In particular, in use, during each cutting step, cutting unit 15 defines the respective trailing edge 20 of one respective label sheet 2 and the respective leading edge 19 of the respective successive label sheet 2 (while it is still part of web of labeling material 4).

[0065] Cutting unit 15 comprises at least one cutting knife 21 and a counter-element 22 designed to cooperate with one another for cutting web of labeling material 4 at cutting station 16.

[0066] In more detail, cutting unit 15 may comprise a cutting drum 23 rotatable around a rotation axis B, in particular having a vertical orientation, and carrying cutting knife 21.

[0067] Alternatively or in addition, cutting unit 15 could comprise a laser for cutting web of labeling material 4 at cutting station 16.

[0068] In more detail, gluing unit 18 may be designed to apply glue onto label sheets 2 in the area of and/or at the respective leading edge 19 and the respective trailing edge 20.

[0069] Gluing unit 18 is configured to apply glue onto label sheets 2, in particular at a glue application station interposed between cutting station 16 and label application station 6.

[0070] In particular, gluing unit 18 may be designed to apply the glue onto label sheets 2 while label sheets 2 are advanced, in use, by transfer conveyor 17.

[0071] According to the embodiment shown, gluing unit 18 is designed to apply the glue by contacting label sheets 2 (by means of a glue roller) . Alternatively or in addition, gluing unit 18 could comprise a nozzle for the non-contact application of the glue.

[0072] Initial station 9 and labeling station 6 define a main advancement direction D1 of web of labeling material 4.

[0073] With particular reference to Figure 1, the advancement device 30 comprises:

- a feed roller 24 rotatable about a respective rotation axis C, in particular having a (substantially) vertical orientation, and configured to at least partially control advancement of web of labeling material 4 along advancement path Q; and
- a drive motor operatively coupled to feed roller 24 and configured to actuate (and control) a rotation, in particular an angular speed, of feed roller 24 around rotation axis C.

[0074] Preferentially, feed roller 24 is arranged downstream from initial station 9, in particular also downstream from buffer unit 10, along advancement path Q.

[0075] Even more preferentially, feed roller 24 is arranged upstream from cutting station 16 along advancement path Q.

[0076] Moreover, advancement device 30 may comprise an auxiliary roller 25, arranged adjacent, in particular tangential, to feed roller 24 for interposing, in use, web of labeling material 4 between auxiliary roller 28 and feed roller 24.

[0077] Additionally, feeding device 8 may comprise a support shaft rotatable around a rotation axis E, in particular being parallel to rotation axis C (i.e. having a (substantially) vertical orientation) and being designed to carry a reel 26 carrying web of labeling material 4, which is wound onto reel 26. In particular, the support shaft is arranged in the area of (at) initial station 9.

[0078] Support shaft may be passively rotatable around rotation axis E (i.e. by means of the traction forces resulting from rotation of feed roller 24 around rotation axis C) for unwinding web of labeling material 4 from reel 26. According to such an embodiment, feeding unit 8 may comprise a break system for acting on reel 26 and/or web of labeling material 4.

[0079] Feeding device 8 may comprise a drive motor operatively coupled to the support shaft being designed to actively actuate a rotation of support shaft around rotation axis E and therewith also of reel 26 around rotation axis E. In particular, such a drive motor may be designed to control the angular speed of reel 26 around rotation axis E.

[0080] Moreover, advancement device 30 may comprise one or more auxiliary rollers 27 arranged along advancement path Q so as to define advancement path Q in collaboration with feed roller 28, reel 26 and buffer unit 10.

[0081] As the feed roller contributes to the feeding of the web, the feed roller 24, in an embodiment which is not shown and is different from the embodiment shown in Figure 1, can be considered a part of the feeding device 8. In this not shown embodiment, the feeding device parameter K can be the angular speed of feed roller 24.

[0082] The feeding device parameter K can be the advancement velocity of web of labeling material 4 and/or the angular speed of reel 26 and/or the operating parameters of the drive motor operatively coupled to feed roller 24.

[0083] With particular reference to Figures 1 and 2, buffering unit 10 comprises at least one guide roller 30 and at least one (for example electrical) buffer motor BM operatively coupled to the at least one guide roller 30 and designed to control a position, in particular a desired position, of the at least one guide roller 30 for controlling the tension of web of labeling material 4, and in particular for also controlling a buffering capacity of buffering unit 10.

[0084] According to an alternative embodiment not shown, buffering unit 10 could comprise a support arm connected to one guide roller and the support arm being angularly moveable for modifying the position of the guide roller and thereby controlling the tension of web of labeling material 4, and in particular to also the buffering capacity. According to such an alternative embodiment, buffer motor BM is operatively coupled to the support arm and designed to angularly move the support arm for controlling the position of the guide roller.

[0085] With particular reference to Figure 2, first support 31 and second support 32 are disposed along a linear axis F. Additionally, first support 31 and/or second support 32 are linearly moveable so as to allow for a modification of distance Y between first guide roller, supported by first support 31, and second guide roller, supported by second support 32.

[0086] In particular, distance Y is determined with respect to and/or along linear axis F.

[0087] Clearly, changes may be made to machine 1 and/or labeling apparatus 7 and/or the method as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. Labeling machine (1) for labelling a plurality of containers (3) by means of respective portions of a web (4) of labelling material, comprising:

   - an advancement device (30) for advancing the web (4) according to an advancement direction (D1);

   wherein the advancement device (30) comprises:

   - a web feeding device (8) for feeding the web according to a feeding device parameter (K);
   - a web buffering unit (10), the buffering unit (10) comprising at least one guide roller (30) for guiding the advancing web (4);

wherein:

- the machine (1) comprises a position control system (PCS) for automatically and actively controlling a position (Y) of the at least one guide roller (30), the position control system (PCS) comprising a buffer motor (BM) for influencing said position (Y);
- the machine (1) comprises a web tension control system (TCS);
- the web tension control system (TCS) is configured for automatically detecting a resistance parameter (Z) correlated to a tension of the web (4);
- the web tension control system (TCS) is configured for controlling said tension by automatically and actively controlling the position control system (PCS) and by automatically and actively controlling the feeding device (8), based at least on the detected resistance parameter (Z).

2. Machine (1) according to claim 1, wherein the web buffering unit (10) is located downstream of the feeding device (8) according to the advancement direction (D1) and said tension is downstream of the feeding device (8) according to the advancement direction (D1).

3. Machine (1) according to claim 1 or 2, wherein the tension control system (TCS) is configured for automatically and actively controlling the position control system (PCS) and the feeding device (8) based at least on a first threshold (Z_1) and a second threshold (Z_2), the second threshold (Z_2) being greater than the first threshold (Z_1) or equal to the first threshold (Z_1).

4. Machine (1) according to claim 3, wherein the tension control system (TCS) is configured for actively and automatically controlling the feeding device (8) by decreasing (S6) the feeding device parameter (K) if the detected resistance parameter (Z) is smaller than the first threshold (Z_1) and by increasing (S4) the feeding device parameter (K) if the detected resistance parameter (Z) is greater than the second threshold (Z_2).

5. Machine (1) according to any of the previous claims, wherein:

- the position control system (PCS) is configured for automatically and actively controlling said position (Y) in a closed loop way with a reference variable (Y_0);
- the tension control system (TCS) is configured for actively and automatically controlling said position control system (PCS) by controlling the reference variable (Y_0).

6. Machine (1) according to claims 3 and 5, wherein the tension control system (TCS) is configured for controlling the reference variable (Y_0) by increasing the reference variable (Y_0) if the detected resistance parameter (Z) is smaller than the first threshold (Z1) and by decreasing the reference variable (Y_0) if the detected resistance parameter (Z) is greater than the second threshold (Z2).

7. Machine (1) according to any of the previous claims, wherein:

- the at least one guide roller (30) comprises a first guide roller (30) and a second guide roller (30) distinct from the first guide roller (30), said position (Y) being a distance between the first guide roller (30) and the second guide roller (30), each of said rollers being for guiding the advancing web (4);
- the buffering unit (10) comprises a first support (31) carrying the first guide roller (30) and a second support carrying the second guide roller (30);
- said buffer motor (BM) is mechanically interposed between the first support (31) and the second support (32), for influencing said position (Y), the first support (31) and the second support (32) being movable with respect to each other to allow said position (Y) to be changed by the buffer motor (BM).

8. Machine (1) according to any of the previous claim, wherein:

- the resistance parameter (Z) is indicative of a force or torque acting on the buffer motor (BM);
- the machine (1) is configured so that the resistance parameter (Z) is directly proportional to the tension.

9. Machine (1) according to claim 8, wherein the tension control system (TCS) is configured so that said resistance parameter (Z) is detected by means of a resistance sensor which is a part of the buffer motor (BM) or is not a part of the buffer motor (BM).

10. Machine (1) according to any of the previous claims, wherein the position control system (PCS) is configured so that said position (Y) is detected by means of a position sensor which is a part of the buffer motor (BM) or is not a part of the buffer motor (BM).

11. Method for labelling a plurality of containers (3) by means of respective portions of a web (4) of labelling material, comprising:

- advancing the web (4) of labelling material according to an advancement direction (D1);

wherein the advancing comprises:

- by means of a feeding device (8), feeding the web according to a feeding device parameter (K);
- buffering the web (4) by means of at least one guide roller (30) guiding the advancing web (4);

wherein:

- the method comprises automatically and actively controlling a position (Y) of the at least one guide roller (30), by means of at least a buffer motor (BM) influencing said position;
- the method comprises automatically detecting a resistance parameter (Z) correlated to a tension of the web (4);
- the method comprises, based at least on the detected resistance parameter (Z), controlling the tension by automatically and actively controlling the feeding device parameter (K) and by automatically and actively controlling said automatically and actively controlling the position (Y).

12. Method according to claim 11, wherein the buffering is carried out downstream of the feeding device (8) according to the advancement direction (D1) and said tension is downstream of the feeding device (8) according to the advancement direction (D1).

13. Method (1) according to claim 11 or 12, wherein said controlling the tension is carried out based at least on a first threshold (Z_1) and a second threshold (Z_2), the second threshold (Z_2) being greater than the first threshold (Z_1) or equal to the first threshold (Z_1).

14. Method according to claim 13, wherein said actively and automatically controlling the feeding device parameter (K) is carried out by decreasing the feeding device parameter (K) if the detected resistance parameter (Z) is smaller than the first threshold (Z_1) and by increasing the feeding device parameter (K) if the detected resistance parameter (Z) is greater than a second threshold (Z_2).

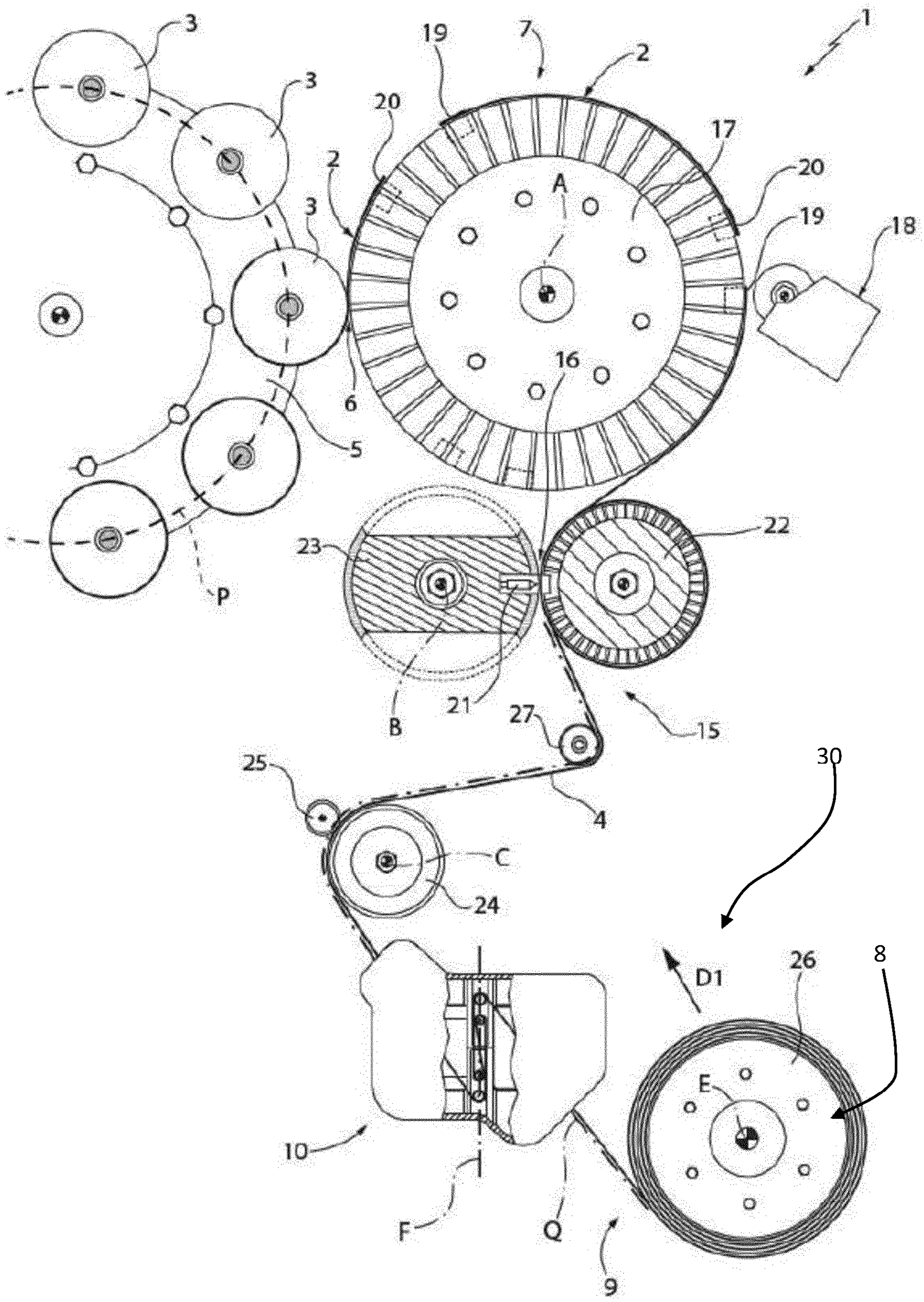
15. Method according to any of claims from 11 to 14, wherein:

- said position (Y) is automatically and actively controlled in a closed loop way with a reference variable (Y_0) ;
- said actively and automatically controlling the position (Y) is actively and automatically controlled by controlling the reference variable (Y_0).

16. Method according to claim 15, wherein said reference variable (Y_0) is controlled by increasing the reference variable (Y_0) if the detected resistance parameter (Z) is smaller than the first threshold (Z1) and by decreasing the reference variable (Y_0) if the detected resistance parameter (Z) is greater than the second threshold (Z2).

17. Method according to any of claims 11 to 16, wherein:

- the resistance parameter (Z) is indicative of a force or torque acting on the buffer motor (BM);
- the resistance parameter (Z) is directly proportional to the tension.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24
4
30
D1
26
8
E
10
F
Q
9

Fig. 1

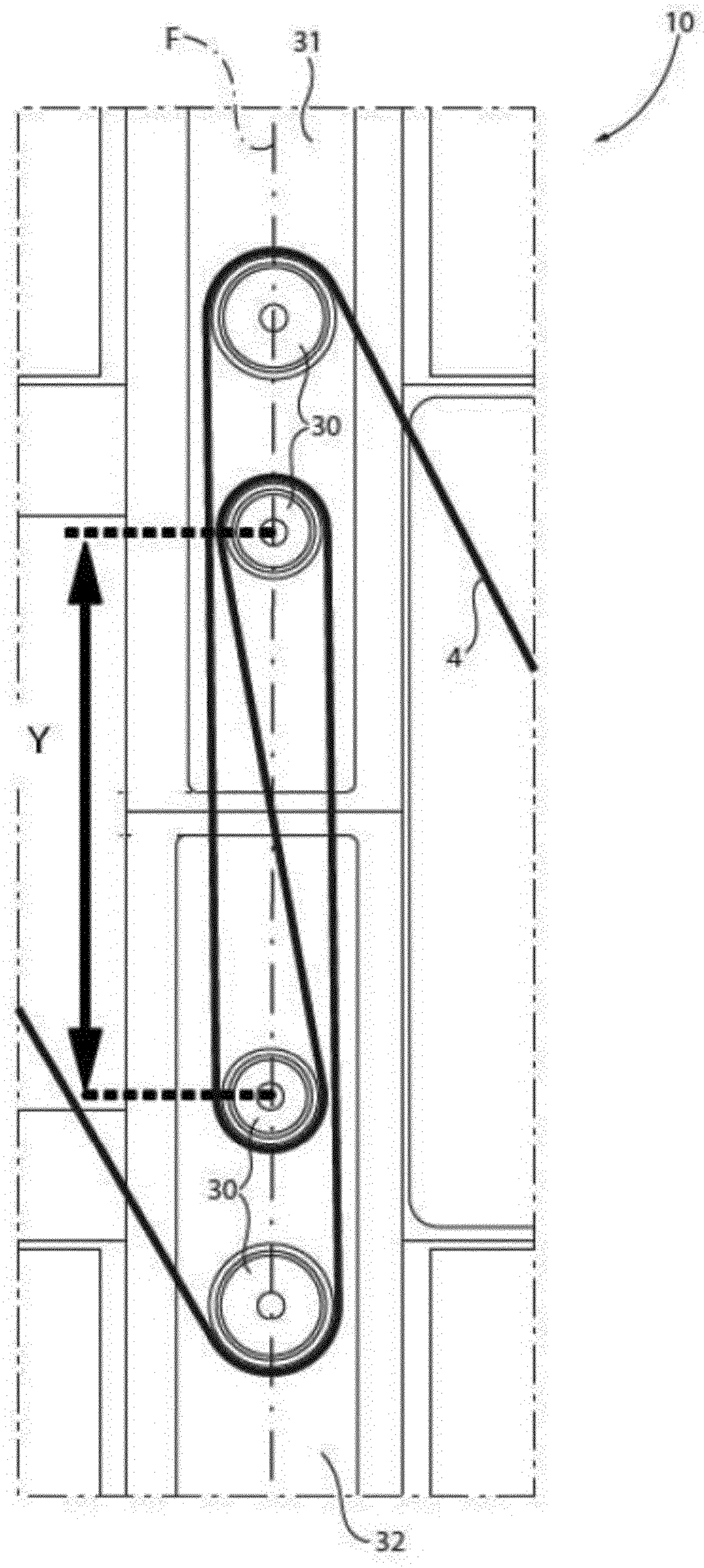

Fig. 2

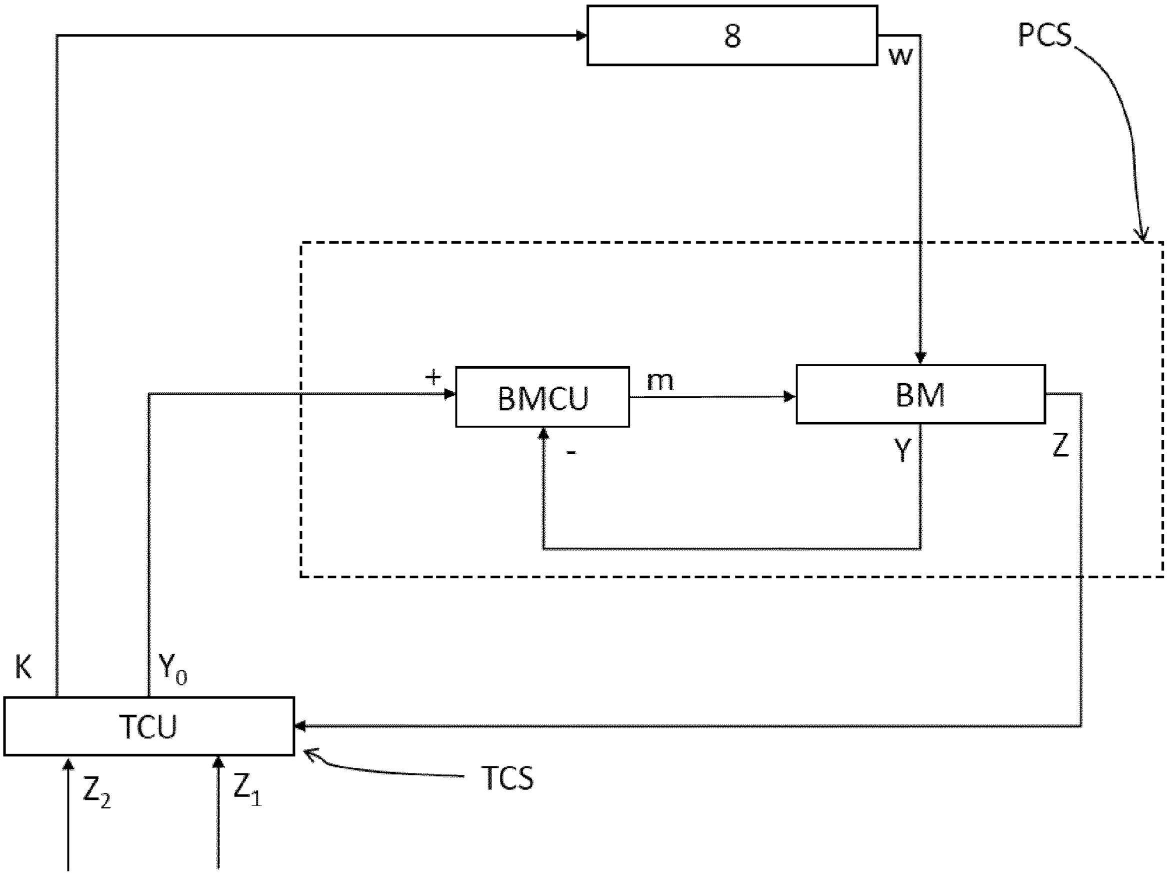

Fig. 3

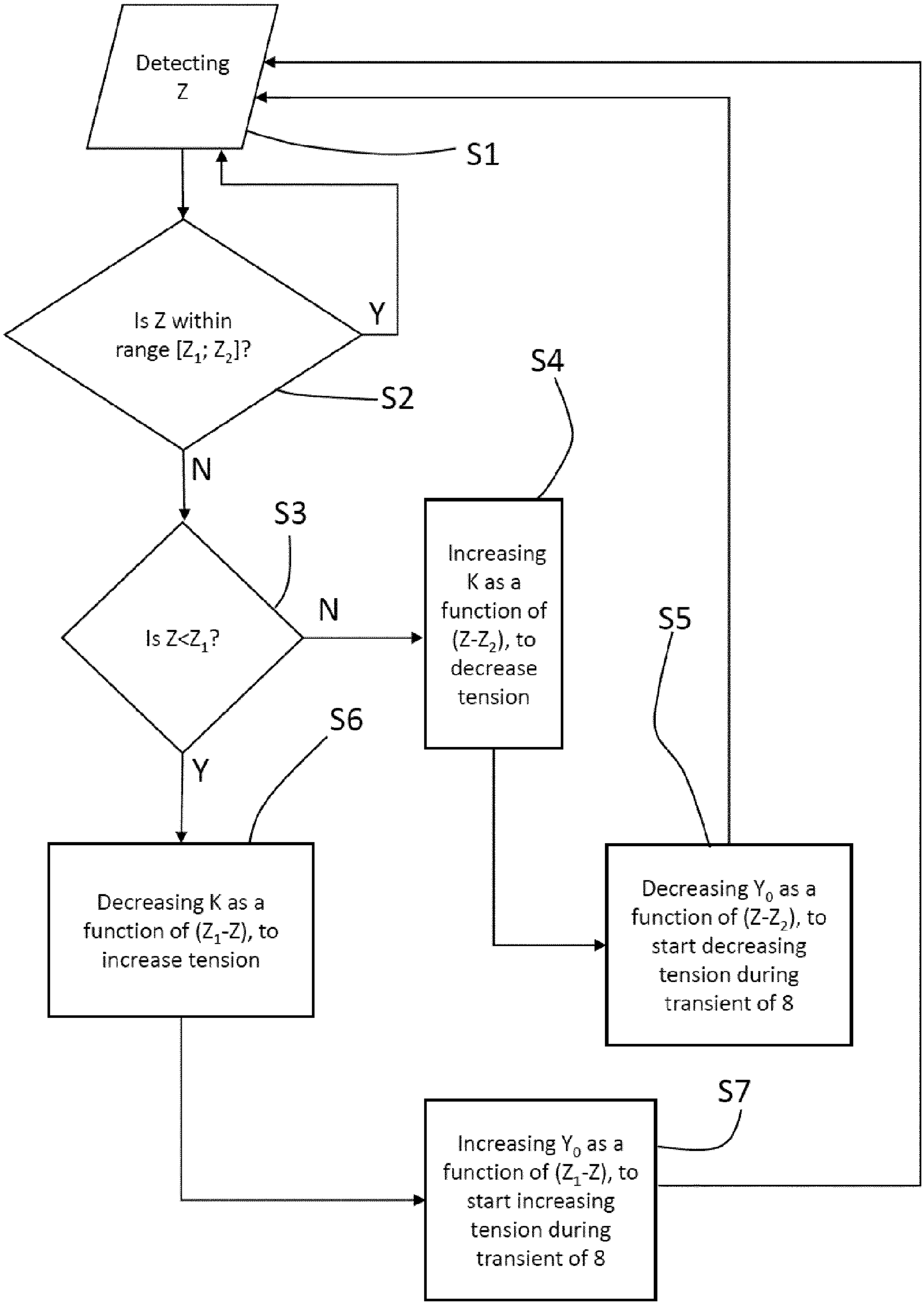
Detecting Z
S1
Is Z within range [Z1; Z2]?
Y
S2
N
S3
Is Z<Z1?
N
S4
Increasing K as a function of (Z-Z2), to decrease tension
S5
Y
S6
Decreasing K as a function of (Z1-Z), to increase tension
Decreasing Y0 as a function of (Z-Z2), to start decreasing tension during transient of 8
S7
Increasing Y0 as a function of (Z1-Z), to start increasing tension during transient of 8

Fig. 4

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EUROPEAN SEARCH REPORT

Application Number
EP 20 21 0525

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 20 2014 100204 U1 (KRONES AG [DE]) 22 April 2015 (2015-04-22) * paragraph [0036] - paragraph [0038]; figures 1-3 * -----	1-17	INV. B65C9/42 B65H20/34
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TECHNICAL FIELDS SEARCHED (IPC)

B65C
B65H

The present search report has been drawn up for all claims

1

Place of search	Date of completion of the search	Examiner
The Hague	29 April 2021	Luepke, Erik

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29-04-2021

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