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(54) **LABELLING MACHINE FOR LABELLING CONTAINERS ADAPTED TO CONTAIN A POURABLE PRODUCT AND METHOD FOR SPLICING TWO WEBS OF LABELLING MATERIAL**

(57) There is described a labelling machine (1) for labelling containers (4) by means of labels (2) obtained from a web (3a, 3b) of labelling material, which web (3a, 3b) is defined by a plurality of labels (2) longitudinally joined, the labelling machine (1) comprises: a feeding unit (7) configured to support at least two windings (10), each formed by a respective web (3a, 3b) of labelling material, the feeding unit (7) being configured to feed each web (3a, 3b) along a feed path (Q), selectively; and a splicing device (14) configured for splicing an end portion of a first web (3a) with an initial portion of a second web (3b); the splicing device (14) comprises a pair of pads (16) movable between a first position, in which they are spaced apart from one another, and a second position, in which they cooperate with one another to perform a splicing operation; the labelling machine (1) further comprises: a first sensor (17) configured for detecting an unwinding degree of the first web (3a) and for generating an exhausted winding signal when the detected unwinding degree is above a predetermined threshold; a second sensor (18) arranged at a monitoring station (M) located along the feed path (Q) downstream of the splicing device (14), the second sensor (18) being configured to cyclically detect, for each label (2), a value (H) of a longitudinal coordinate defined with respect to a respective point of reference of each label (2), and to generate a triggering signal when the detected value (H) of said longitudinal coordinate reaches a preset value (H1, H2, Hn) associated with a triggering value for triggering the movement

of the pads (16) from the first position to the second position; and a control unit (20) configured for receiving the exhausted winding signal and the triggering signal, and for automatically triggering the movement of the pads (16) from the first position to the second position upon receiving the exhausted winding signal and the triggering signal.

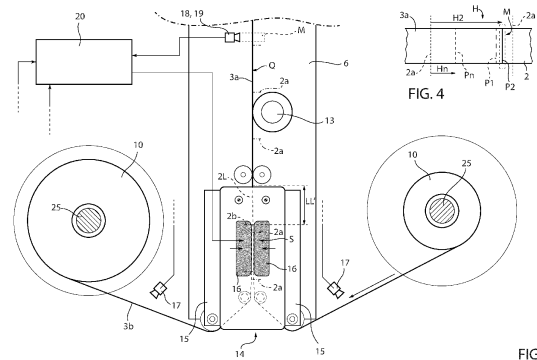


FIG. 2C

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**Description**TECHNICAL FIELD

**[0001]** The present invention relates to a labelling machine for labelling containers adapted to contain a pourable product, preferably a pourable food product, by means of labels obtained from a web of labelling material.

**[0002]** The present invention also relates to a method for splicing a first web of labelling material and a second web of labelling material.

BACKGROUND ART

**[0003]** Labelling machines are known, which are commonly used to prepare, transport and apply labels onto containers, such as bottles, flacons or receptacles of this sort, adapted to be filled with a pourable product, preferably a pourable food product.

**[0004]** Particularly widespread is the use of glued labels, i.e. portions of a labelling material that are cut at appropriate lengths from a web of labelling material initially wound around one or more storage reels and then sprinkled with glue.

**[0005]** In detail, the web of labelling material is progressively unwound off the relative reel and then sequentially cut to obtain successive labels of equal length, upon which glue is applied by gluing means, such as a gluing roller, spray or injector systems or the like.

**[0006]** Eventually, the labels so obtained are conveyed and applied onto the respective articles to be labelled.

**[0007]** Particularly widespread are also tubular labels, known as "sleeve labels" and obtained starting from a web of heat-shrinking film wound around one or more storage reels; the sleeve labels are applied with a certain clearance on the respective containers and then heated in an oven to obtain their shrinking and adhesion to the lateral surfaces of the containers themselves. These type of labels do not require the use of glue.

**[0008]** A further type of labelling known as "PSL", envisages the production of self-adhesive labels initially arranged on a support tape from which the labels must then be separated to be directly glued on the respective containers.

**[0009]** Regardless of the type of label used, a labelling machine of the known type typically comprises:

- a conveyor for the containers to be labelled, usually a carousel rotatable about a vertical axis and configured to convey a plurality of containers along an horizontal, arc-shaped path;
- an inlet station, at which the containers to be labelled are received by the carousel;
- an outlet station, at which the labelled containers exit the carousel; and
- a labelling module, peripherally arranged relatively to the carousel and configured to prepare, transport

and feed a plurality of labels to the carousel at an application station, in order to apply such labels to the respective containers.

5 **[0010]** According to a well-known configuration, a labelling module typically comprises:

- one or more storage units, for example a rotatable shaft around which the web of labelling material is initially wound in form of a reel;
- 10 - a plurality of unwinding rollers, which support, in use, the web progressively unwound from the reel and guide it, in use, along a feeding path;
- a cutting unit for repeatedly cut the web at a cutting station so as to separate a sequence of labels from the web itself; and
- 15 - a label transfer device, for example a known vacuum drum configured to receive, retain and advance each label and to feed each label to the carousel, at the application station.
- 20

**[0011]** In particular, the vacuum drum is configured to receive the labels, to retain them by means of suction and, after a rotation by a determined angle about its axis, to release these labels to the application station, so that they are applied onto the respective containers advanced by the carousel.

**[0012]** Furthermore, in the case of labels that provide for the use of glue, the labelling module comprises at least one gluing roller arranged substantially tangent to the vacuum drum, in a position operatively downstream of the cutting unit and upstream of the application station, for spreading glue onto at least the (leading and trailing) ends of each single label, prior to their application onto the relative containers.

**[0013]** In the case of PSL labelling, the labeling module does not comprise any cutting roller or gluing roller.

**[0014]** Regardless of the type of labels used, the need is known in the field for automatically splicing the end portion of a first web (or "old web") during the unwinding thereof from a first reel (i.e. the reel in use) with the initial portion of a second web (or "new web") wound about a second reel (i.e. a new reel), in order to avoid stopping the labelling machine every time a reel is empty or exhausted.

**[0015]** In this regard, labelling machines of the known type comprise a splicing device (or "splicer") operatively arranged between the storage unit and the unwinding rollers and configured to splice the end portion of the first web to the initial portion of the second web.

**[0016]** In detail, the splicing device typically comprises a pair of splicing members, usually in the form of "blocks", each hinged to a fixed frame of the labelling module and thereby movable in a pivotable manner between an opening position, in which it is spaced from the other block to receive the initial end portion of a new web, and a closing position, in which it is closer to the other block for cooperating with the other block to splice the aforementioned

web portions together.

**[0017]** In greater detail, the splicing members are usually manually moved by an operator between the opening position and the closing position.

**[0018]** Each splicing member comprises a retaining element, typically a vacuum pad fluidly connected to a known vacuum source, for receiving and retaining (by suction) the initial portion of a respective web of labelling material unwound from the respective reel.

**[0019]** More specifically, during the labelling process, and once the blocks are arranged in the closing position, the pads are automatically controllable between a first inoperative position, in which they are spaced apart from one another, and a second splicing position, in which they cooperate with one another for splicing the web portions together.

**[0020]** In addition, each pad, when in the respective first inoperative position, supports the web during its unwinding from the reel during the labelling process.

**[0021]** Typically, the splicing operation, i.e. the movement of the pads from the first inoperative position to the second splicing position, is automatically controlled based on a specific triggering signal for triggering the movement of the pads towards the second splicing position, the triggering signal being preset for each labelling process (or "production recipe", or "filling recipe" or "labelling recipe").

**[0022]** Although the labelling machines and the splicing devices and methods of the known type are functionally valid, the Applicant has observed that they are still prone to further improvement.

**[0023]** In particular, a progressive wear of the parts and components of the pads, e.g. the couplings between the pads and the respective blocks, could cause a variation in the transient time for the pads to travel from the first position to the second splicing position. That is, the movement of the pads from the first position to the second position could be faster or slower with respect to the nominal transient time, which the calibration of the labelling machine is based on.

**[0024]** Ultimately, this could cause an incorrect splicing of the first old web to the second new web, and therefore a misalignment between the designs, prints, drawings or motives of the two spliced webs, thereby requiring complicated compensations at the cutting station or a discard of the labelling material.

#### DISCLOSURE OF INVENTION

**[0025]** It is therefore an object of the present invention to provide a labelling machine and a method for splicing, which are designed to overcome at least one of the above-mentioned drawbacks in a straightforward and low-cost manner.

**[0026]** This object is achieved by a labelling machine and a method for splicing as claimed in the independent claims.

#### BRIEF DESCRIPTION OF THE DRAWINGS

**[0027]** 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 top view, with parts removed for clarity, of a labelling machine according to the invention;

Figures 2a-2c are larger-scale, schematic top views, with parts removed for clarity, of a detail of the labelling machine of Figure 1 during three distinct operative conditions; and

Figures 3 and 4 are schematic lateral views of a longitudinal portion of a web of labelling material used in the labelling machine of Figure 1, during respective operative conditions.

#### BEST MODE FOR CARRYING OUT THE INVENTION

**[0028]** With reference to Figure 1, number 1 indicates as a whole a labelling machine for labelling containers 4 by means of labels 2 obtained from a web 3a, 3b of labelling material.

**[0029]** In the preferred embodiment shown, containers 4 are adapted to contain a pourable product, preferably a pourable food product.

**[0030]** For simplicity, reference will be made in the following to a labelling machine 1 operating with the aforementioned glued labels 2.

**[0031]** However, what is described and claimed below is equally applicable in the case of labels of the aforementioned "sleeve" type or of the "PSL" type.

**[0032]** Web 3a, 3b is defined by a plurality of labels 2 longitudinally joined together at respective joining edges 2a thereof (schematically shown in Figures 2a-2c and in Figures 3 and 4).

**[0033]** In particular, the joining edges 2a will define, once each label 2 is separated from web 3a, 3b, the leading edge and the trailing edge of each label 2, respectively.

**[0034]** That is, each label 2 is longitudinally delimited by two successive joining edges 2a.

**[0035]** As schematically shown in Figures 3 and 4, each label 2 has a plurality of transversal portions P1, P2, Pn (only three of which are schematically illustrated) longitudinally distributed along the length of label 2, each transversal portion P1, P2, Pn corresponding to a respective longitudinal coordinate H1, H2, Hn on label 2 with respect to the longitudinal extension of the label 2 itself.

**[0036]** More in particular, for each label 2, the longitudinal coordinate H1, H2, Hn is also defined with respect to a respective point of reference.

**[0037]** Conveniently, the point of reference is defined, for each label 2, by one said joining edge 2a, in particular by the respective leading edge thereof, with respect to the advancing direction of web 3a, 3b along a feed path Q. The point of reference can be defined alternatively by

any other mark or tag or reference region which is located within the longitudinal extension of the label 2.

**[0038]** Labelling machine 1 comprises:

- a carousel 5 rotatable about a preferably vertical axis (not shown) and configured to convey a succession of containers 4 to be labeled along a preferably horizontal, arc-shaped labelling path;
- an inlet station (not shown), at which containers 4 to be labeled are fed to carousel 5;
- an outlet station (not shown), at which labeled containers 4 exit carousel 5; and
- a labelling module 6 arranged peripherally with respect to carousel 5 and configured to prepare and transport a plurality of labels 2, and to feed them to carousel 5 at an application station A, for the application thereof onto the respective containers 4.

**[0039]** In particular, the labelling module 6 comprises:

- a feeding unit 7;
- a plurality of unwinding rollers 8 that support, in use, web 3a, 3b being unwound from a respective winding 10, and guide the supported web 3a, 3b along feed path Q;
- a cutting device 11 for repeatedly cut web 3a, 3b, in particular at the aforementioned joining edges 2a, for separating a sequence of labels 2 thereof; and
- a transfer device 12 for labels 2, configured to receive and retain each label 2 previously separated and to feed this label 2 to carousel 5 at application station A.

**[0040]** Preferably, the transfer device is defined by a known vacuum drum 12 configured to receive labels 2 previously cut, to retain them by suction and, after a rotation by a given angle about its own axis, release these labels 2 to application station A, so that they are applied onto the respective containers 4.

**[0041]** In the case of labels 2 that require the use of glue, labelling module 6 further comprises at least one gluing roller (not illustrated) arranged substantially tangent to vacuum drum 12 to spread glue on at least the ends of each individual label 2.

**[0042]** Feeding unit 7 is configured to support at least two windings 10, in particular two reels 10, each one formed by one respective web 3a, 3b of labelling material. Feeding unit 7 is configured to feed each web 3a, 3b along feed path Q, selectively.

**[0043]** In detail, feeding unit 7 comprises:

- at least two shafts 25, each rotatable about a relative axis, preferably vertical, and each configured for supporting one respective web 3a, 3b in the form of reel 10; and
- a feed roller 13 arranged downstream of shafts 25 and upstream of cutting device 11, along feed path Q and with respect to the advancement direction of webs 3a, 3b, and configured for feeding selectively

webs 3a, 3b along feed path Q.

**[0044]** In practice, shafts 25 define a storage unit of labelling module 6, and each web 3a, 3b of labelling material is initially wound on a reel 10 and then unwound therefrom by feed roller 13.

**[0045]** The need is known in the industry for automatically splicing the end portion of a first web 3a during unwinding from a first reel of said reels 10, thereby defining a web in use (and therefore a reel in use), with the initial portion of a second web 3b wound on a second reel of said reels 10, thereby defining a web to be used (and therefore a "new" reel), in order to avoid stopping labelling machine 1 each time a reel 10 is exhausted (i. e. used up, ended, emptied or finished).

**[0046]** To this end, labelling machine 1 further comprises a splicing device 14 configured for splicing the end portion of first web 3a with the initial portion of second web 3b.

**[0047]** In particular, splicing device 14 is arranged operatively downstream of shafts 25, and therefore of reels 10, and upstream of feed roller 13.

**[0048]** Splicing device 14 is of the known type and comprises a pair of splicing members, or "blocks", 15 each one hinged to a fixed frame of labelling module 6 and thereby movable in a pivotable manner between an opening position (not shown), in which it is spaced from the other block 15 to receive the initial end portion of a new web (in the specific case, second web 3b), and a closing position (shown in the appended Figures), in which it is closer to the other block 15 for cooperating with the other block 15 to splice the aforementioned webs 3a, 3b.

**[0049]** In greater detail, blocks 15 are manually movable by an operator between the opening position and the closing position.

**[0050]** Hereinafter, the expression "first web" will refer to the web in use and the expression "second web" will refer to the new web to be used after splicing.

**[0051]** In order to perform the actual splicing, each block 15 comprise a retaining element, preferably in the form of a vacuum pad 16 which is fluidly connected to a known vacuum source, and is selectively configured for:

- receiving and retaining (by suction) the initial portion of second web 3b; or
- supporting first web 3a during unwinding and feeding thereof.

**[0052]** Hence, splicing device 14 comprises a pair of pads 16 movable between a first position (Figure 2a), in which they are spaced apart from one another, and a second position (Figures 2b and 2c), in which they cooperate with one another to perform a splicing operation, thereby splicing said end portion with said initial portion, so that second web 3b defines the web in use.

**[0053]** More specifically, during the labelling process, and once blocks 15 are arranged in the closing position, pads 16 are automatically controllable between the first

position and the second position, for automatically performing the splicing operation.

**[0054]** According to a first aspect of the present invention, labelling machine 1 further comprises:

- a first sensor 17 configured for detecting an unwinding degree of first web 3a and for generating an exhausted winding signal when the detected unwinding degree is above a predetermined threshold;
- a second sensor 18 arranged at a monitoring station M which is located along feed path Q downstream of splicing device 14, second sensor 18 being configured to cyclically detect, for each label 2, a value H of said longitudinal coordinate defined with respect to said point of reference, and to generate a triggering signal when the detected value H of said longitudinal coordinate reaches a preset value H1, H2, Hn associated with a triggering value for triggering the movement of pads 16 from the first position to the second position; and
- a control unit 20 configured for receiving said exhausted winding signal and said triggering signal, and for automatically triggering the movement of pads 16 from the first position to the second position upon receiving the exhausted winding signal and the triggering signal.

**[0055]** In particular, second sensor 18 is configured to generate the triggering signal upon generation of the exhausted winding signal by first sensor 17.

**[0056]** More precisely, in use, second sensor 18 generates the triggering signal only after first sensor 17 has generated the exhausted winding signal.

**[0057]** According to the embodiment shown, feeding unit 7, and particularly feed roller 13, is configured to feed first web 3a (and particularly each web 3a, 3b selectively) through monitoring station M in such a way that the conveying of first web 3a through monitoring station M corresponds to the cyclical variation of said value H of longitudinal coordinate of each label 2 with respect to the longitudinal extension of the label 2 along feed path Q and with respect to said point of reference on the label 2 itself.

**[0058]** Preferably, first sensor 17 is configured for detecting a reference element (not shown) on the respective web in use, i.e. first web 3a, which reference element corresponds to the imminent end of first web 3a, i.e. to the imminent exhaustion of the respective reel 10.

**[0059]** In one embodiment, such reference element is a colored transversal band, or a light-reflective transversal band, or a magnetic transversal band, or an electro-inductive transversal band, or any other mark or tag or reference region, or the like. Consequently, first sensor 17 is an optical sensor, a magnetic sensor, or an inductive sensor, or the like.

**[0060]** Conveniently, first sensor 17 is located facing first web 3a (i.e. the web in use), operatively between shaft 25 (and therefore the relative reel 10 supported

thereon) and splicing device 14.

**[0061]** Opportunely, labelling machine 1 comprises a pair of first sensors 17, one for each of the first web 3a and second web 3b (which after the splicing operation will become the first web 3a, and so on).

**[0062]** Preferably, second sensor 18 is an optical sensor, which is configured to detect said value H of said longitudinal coordinate by: detecting the aforementioned point of reference; counting a certain time elapsed from the detection of the point of reference; performing a calculation as a function of the measured elapsed time and of the known longitudinal advancing speed of first web 3a (which is "known" by the system), thereby resulting in the value H of longitudinal coordinate.

**[0063]** Conveniently, monitoring station M is located along feed path Q downstream of splicing device 14, and in particular upstream of cutting device 11.

**[0064]** Said splicing operation results in a splicing section S which, as it is known, is defined by a longitudinal overlap between the end portion of first web 3a and the initial portion of second web 3b.

**[0065]** According to a second aspect of the present invention, labelling machine 1 further comprises a third sensor 19 arranged along feed path Q downstream of splicing device 14, and configured to detect a longitudinal length LL, LL' of a last label 2L of first web 3a (i.e. the web in use) which is located longitudinally last on first web 3a before splicing section S, and to generate a length signal correlated with the detected longitudinal length LL, LL'.

**[0066]** More specifically, as visible in Figures 2b and 2c, longitudinal length LL, LL' is delimited between a joining edge 2a on first web 3a located longitudinally last before splicing section S, such joining edge 2a defining a leading edge of last label 2L, and the initial free end 2b of second web 3b, such initial free end 2b defining a trailing edge of last label 2L.

**[0067]** Said longitudinal length can be detected for example by detecting the distance between the point of reference of said last label and the point of reference of the initial label of the second web 3b.

**[0068]** Furthermore, it is specified that last label 2L is defined by the last label on first web 3a upstream of splicing section S, with respect to the advancing direction of first web 3a along feed path Q.

**[0069]** Figure 2b illustrates a first operative condition, in which the splicing operation is performed correctly: that is, longitudinal length LL of last label 2L is equal to a nominal (or desired or expected) longitudinal length and first web 3a and second web 3b are spliced correctly, i.e. with splicing section S corresponding to (and longitudinally defining) a label 2. Furthermore, in this case joining edges 2a of first web 3a and second web 3b correspondingly overlap.

**[0070]** Figure 2c illustrates a second operative condition, in which the splicing operation is performed incorrectly: for example, pads 16 (due to wear of their components) are too fast in moving from the first position up

to the second position. In this condition, the splicing happens in advance, resulting in a longitudinal length LL' of last label 2L which is different from nominal longitudinal length LL.

**[0071]** Accordingly, control unit 20 is further configured for:

- receiving said length signal;
- comparing said length signal with a length information correlated with the nominal longitudinal length LL of said last label 2L;
- calculating a length error between the detected longitudinal length LL, LL' and the nominal longitudinal length LL;
- updating the triggering value based on the calculated length error.

**[0072]** Accordingly, control unit 20 is configured for updating said preset value H1, H2, Hn of said longitudinal coordinate based on the calculated length error.

**[0073]** For example, with reference to Figures 3 and 4, based on the calculated length error, control unit 20 updates the preset value from a value H1 of longitudinal coordinate (Figure 3) to a value H2 of longitudinal coordinate (Figure 4). Such value H2 will become the new preset value associated with the triggering value for triggering the movement of pads 16.

**[0074]** In light of the above, control unit 20 is configured to trigger the movement of pads 16 from the first position to the second position based on the updated triggering value, so that pads 16 in the second position perform (again) a splicing operation whereby said calculated length error is as close as possible to zero, preferably zero.

**[0075]** For example, control unit 20 is configured to increase, with respect to said point of reference, the absolute value of said preset value H1, H2, Hn of said longitudinal coordinate, if the detected longitudinal length LL' of last label 2L is less than said nominal longitudinal length LL (as shown in Figure 2c).

**[0076]** Therefore, if the movement of the pads becomes faster over time, due for example to mechanical reasons, the triggering signal is generated afterwards, to compensate the variation in the speed of said movement. In this way, an optimal level of correctness of the splicing operation can be reached despite the variation in the speed of said movement. Therefore, a labelling machine is provided with an adaptive splicing device.

**[0077]** For example, in case the detected length is lower than the nominal value, the preset value can be increased from H1 of Figure 3 to H2 of Figure 4, so that the next splicing operation will be carried out more correctly.

**[0078]** Control unit 20 is configured to decrease, with respect to said point of reference, the absolute value of said preset value H1, H2, Hn of said longitudinal coordinate, if the detected longitudinal length of last label 2L is greater than said nominal longitudinal length LL (case

not shown).

**[0079]** Therefore, if the movement of the pads becomes slower over time, due for example to mechanical reasons, the triggering signal is generated earlier, to compensate the variation in the speed of said movement. In this way, an optimal level of correctness of the splicing operation can be reached despite the variation in the speed of said movement. Therefore, a labelling machine is provided with an adaptive splicing device.

**[0080]** For example, in case the detected length is greater than the nominal value, the preset value can be decreased from H2 of Figure 4 to H1 of Figure 3, so that the next splicing operation will be carried out more correctly.

**[0081]** Advantageously, third sensor 19 is arranged at said monitoring station M.

**[0082]** In particular, third sensor 19 corresponds to second sensor 18, that is labelling machine 1 comprises only one sensor which performs the function of second sensor 18 and third sensor 19.

**[0083]** In this way, the total number of components is reduced.

**[0084]** In one embodiment, control unit 20 is further configured to issue a warning for a user correlated to the calculated length error.

**[0085]** In this way, a user can intervene promptly on the splicing operation and/or on the labelling process based on the length error, e.g. if such length error is too big (for example, by stopping labelling machine 1).

**[0086]** It is clear how labelling machine 1 as described above allows the implementation of a method for splicing a first web of labelling material and a second web of labelling material, each web being defined by a plurality of labels longitudinally joined together at respective joining edges thereof, the method comprising the steps of:

- a) unwinding the first web from a respective winding and feeding it along a feed path;
- b) detecting an unwinding degree of the first web and generating an exhausted winding signal when the detected unwinding degree is above a predetermined threshold;
- c) cyclically detecting, for each label, a value of a longitudinal coordinate defined with respect to a respective point of reference of each label;
- d) generating a triggering signal when the detected value of said longitudinal coordinate reaches a preset value associated with a triggering value for triggering the movement of said pads from the first position to the second position;
- e) splicing an end portion of the first web with an initial portion of the second web upon generation of said exhausted winding signal and said triggering signal.

**[0087]** Preferably, the step e) of splicing results in a splicing section defined by a longitudinal overlap between the first web and the second web.

**[0088]** Preferably, the method further comprises the steps of:

- f) detecting a longitudinal length of a last label of the first web which is located longitudinally last on the first web before the splicing section; 5
- g) generating a length signal correlated with the detected longitudinal length;
- h) comparing said length signal with a length information correlated with a nominal longitudinal length of said last label; 10
- i) calculating a length error between the detected longitudinal length and the nominal longitudinal length; 15
- 1) updating said triggering value based on the calculated length error.

**[0089]** Preferably, the step f) of detecting a longitudinal length is carried out by measuring, after said step e) of splicing, the longitudinal length between a joining edge on the first web located longitudinally last before said splicing section, such joining edge defining a leading edge of said last label, and the initial free end of the second web, such initial free end defining a trailing edge of said last label. 20 25

**[0090]** Preferably, the method further comprises the step of:

m) triggering the step e) of splicing based on the updated triggering value.

**[0091]** Preferably, the method further comprises the step of: 30

n) updating said preset value of said longitudinal coordinate based on said length error.

**[0092]** The advantages of labelling machine 1 and of the method for splicing according to the present invention will be clear from the foregoing description. 35

**[0093]** In particular, thanks to the above configuration, the triggering of the splicing operation, i.e. of the movement of pads 16 from the first position to the second position, is adaptive, and takes into account possible variations in the transient time needed by pads 16 for moving between such positions. In fact, as said, such transient time could vary due to wear. 40

**[0094]** In this way, the subsequent splicing operation will be performed taking into account the varied transient time of pads 16, thereby reducing the need for heavy compensation of the longitudinal position of labels 2 at cutting. This results in a reduced risk of errors in compensation. 45

**[0095]** Therefore, the overall precision of the splicing operation and of the labelling process is improved, without requiring undue and cumbersome actions by a user, which are also prone to error. 50

**[0096]** Clearly, changes may be made to labelling machine 1 and to the method for splicing as described herein without, however, departing from the scope of protection as defined in the accompanying claims. 55

## Claims

1. Labelling machine (1) for labelling containers (4) adapted to contain a pourable product, by means of labels (2) obtained from a web (3a, 3b) of labelling material, which web (3a, 3b) is defined by a plurality of labels (2) longitudinally joined together at respective joining edges (2a) thereof, the labelling machine (1) comprising:

- a feeding unit (7) configured to support at least two windings (10), each formed by a respective web (3a, 3b) of labelling material, the feeding unit (7) being configured to feed each web (3a, 3b) along a feed path (Q), selectively; and
- a splicing device (14) configured for splicing an end portion of a first web (3a) of said webs, which defines a web in use, with an initial portion of a second web (3b) of said webs, which defines a web to be used;

the splicing device (14) comprising a pair of pads (16) movable between a first position, in which they are spaced apart from one another, and a second position, in which they cooperate with one another to perform a splicing operation, thereby splicing said end portion with said initial portion, so that the second web (3b) defines the web in use; wherein the labelling machine (1) further comprises:

- a first sensor (17) configured for detecting an unwinding degree of the first web (3a) and for generating an exhausted winding signal when the detected unwinding degree is above a predetermined threshold;
- a second sensor (18) arranged at a monitoring station (M) located along said feed path (Q) downstream of the splicing device (14), the second sensor (18) being configured to cyclically detect, for each label (2), a value (H) of a longitudinal coordinate defined with respect to a respective point of reference of each label (2), and to generate a triggering signal when the detected value (H) of said longitudinal coordinate reaches a preset value (H1, H2, Hn) associated with a triggering value, for triggering the movement of said pads (16) from the first position to the second position; and
- a control unit (20) configured for receiving said exhausted winding signal and said triggering signal, and for automatically triggering the movement of

the pads (16) from the first position to the second position upon receiving said exhausted winding signal and said triggering signal.

2. Labelling machine as claimed in claim 1, wherein the second sensor (18) is configured to generate said triggering signal upon generation of said exhausted winding signal by the first sensor (17).
3. Labelling machine as claimed in claim 1 or 2, wherein said splicing operation results in a splicing section (S) defined by a longitudinal overlap between the first web (3a) and the second web (3b);

wherein the labelling machine (1) further comprises a third sensor (19) arranged along said feed path (Q) downstream of the splicing device (14), the third sensor (19) being configured to detect a longitudinal length (LL, LL') of a last label (2L) of the first web (3a) which is located longitudinally last on the first web (3a) before the splicing section (S), and to generate a length signal correlated with the detected longitudinal length (LL, LL');  
and wherein the control unit (20) is further configured for:

- receiving said length signal;
- comparing said length signal with a length information correlated with a nominal longitudinal length (LL) of said last label (2L);
- calculating a length error between the detected longitudinal length (LL, LL') and the nominal longitudinal length (LL);
- updating said triggering value based on the calculated length error.

4. Labelling machine as claimed in claim 3, wherein said longitudinal length (LL, LL') is delimited between a joining edge (2a) on the first web (3a) located longitudinally last before said splicing section (S), such joining edge (2a) defining a leading edge of said last label (2L), and the initial free (2b) end of the second web (3b), such initial free end (2b) defining a trailing edge of said last label (2L).
5. Labelling machine as claimed in claim 3 or 4, wherein the third sensor (19) is arranged at said monitoring station (M).
6. Labelling machine as claimed in claim 5, wherein the third sensor (19) corresponds to or is integral with or is a part of said second sensor (18).
7. Labelling machine as claimed in any of the claims 3 to 6, wherein the control unit (20) is configured for updating said preset value (H1, H2, Hn) of said lon-

gitudinal coordinate based on said length error.

8. Labelling machine as claimed in Claim 7, wherein the control unit (20) is configured to:

- increase, with respect to said point of reference, the absolute value of said preset value (H1, H2, Hn) of said longitudinal coordinate, if the detected longitudinal length (LL') of last label (2L) is less than said nominal longitudinal length (LL); and/or
- decrease, with respect to said point of reference, the absolute value of said preset value (H1, H2, Hn) of said longitudinal coordinate if the detected longitudinal length of last label (2L) is greater than said nominal longitudinal length LL.

9. Labelling machine as claimed in any one of the claims 3 to 8, wherein the control unit (20) is configured to trigger the movement of the pads (16) from the first position to the second position based on the updated triggering value, so that the pads (16) in the second position perform a splicing operation whereby said calculated length error is as close as possible to zero.

10. Labelling machine as claimed in any one of the claims 3 to 9, wherein the control unit (20) is further configured to issue a warning for a user correlated to the calculated length error.

11. Labelling machine as claimed in any one of the foregoing claims, wherein the feeding unit (7) is configured to feed each web (3a, 3b) through the monitoring station (M) in such a way that the conveying of the web (3a, 3b) through the monitoring station (M) corresponds to the cyclical variation of said value (H) of longitudinal coordinate of each label (2) with respect to the longitudinal extension of the label (2) along the feed path (Q) and with respect to said point of reference on the label (2) itself.

12. Labelling machine as claimed in any of the foregoing claims, wherein, for each label (2), said point of reference is defined by the respective leading edge (2a) thereof, with respect to the advancing direction of the respective web (3a, 3b) along the feed path (Q).

13. Method for splicing a first web (3a) of labelling material and a second web (3b) of labelling material, each web (3a, 3b) being defined by a plurality of labels (2) longitudinally joined together at respective joining edges (2a) thereof, the method comprising the steps of:

- a) unwinding the first web (3a) from a respective winding (10) and feeding it along a feed path (Q);

- b) detecting an unwinding degree of the first web (3a) and generating an exhausted winding signal when the detected unwinding degree is above a predetermined threshold;
- c) cyclically detecting, for each label (2), a value (H) of a longitudinal coordinate defined with respect to a respective point of reference of each label (2);
- d) generating a triggering signal when the detected value (H) of said longitudinal coordinate reaches a preset value (H1, H2, Hn) associated with a triggering value, for triggering the movement of said pads (16) from the first position to the second position;
- e) splicing an end portion of the first web (3a) with an initial portion of the second web (3b) upon generation of said exhausted winding signal and said triggering signal.
14. Method as claimed in claim 12, wherein the step e) of splicing results in a splicing section (S) defined by a longitudinal overlap between the first web (3a) and the second web (3b);  
wherein the method further comprises the steps of:
- f) detecting a longitudinal length (LL, LL') of a last label (2L) of the first web (3a) which is located longitudinally last on the first web (3a) before the splicing section (S);
- g) generating a length signal correlated with the detected longitudinal length;
- h) comparing said length signal with a length information correlated with a nominal longitudinal length (LL) of said last label (2L);
- i) calculating a length error between the detected longitudinal length (LL, LL') and the nominal longitudinal length (LL);
- 1) updating said triggering value based on the calculated length error.
15. Method as claimed in claim 13, wherein the step f) of detecting a longitudinal length is carried out by measuring, after said step e) of splicing, the longitudinal length (LL, LL') between a joining edge (2a) on the first web (3a) located longitudinally last before said splicing section (S), such joining edge (2a) defining a leading edge of said last label (2L), and the initial free end (2b) of the second web (3b), such initial free (2b) end defining a trailing edge of said last label (2L).
16. Method as claimed in claim 13 or 14, and further comprising the steps of:
- m) triggering the step e) of splicing based on the updated triggering value; and/or
- n) updating said preset value (H1, H2, Hn) of said longitudinal coordinate based on said
- length error.

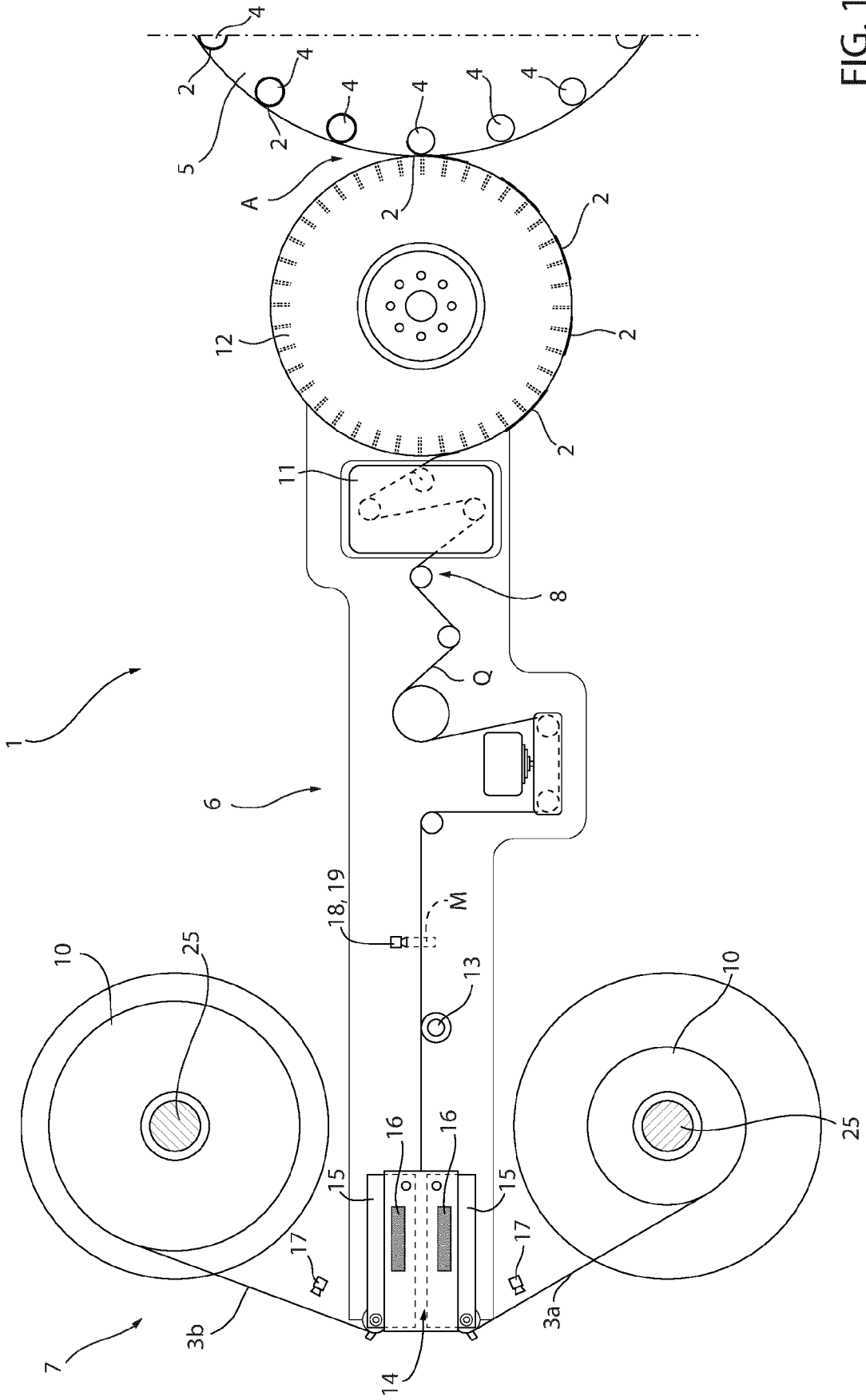


FIG. 1

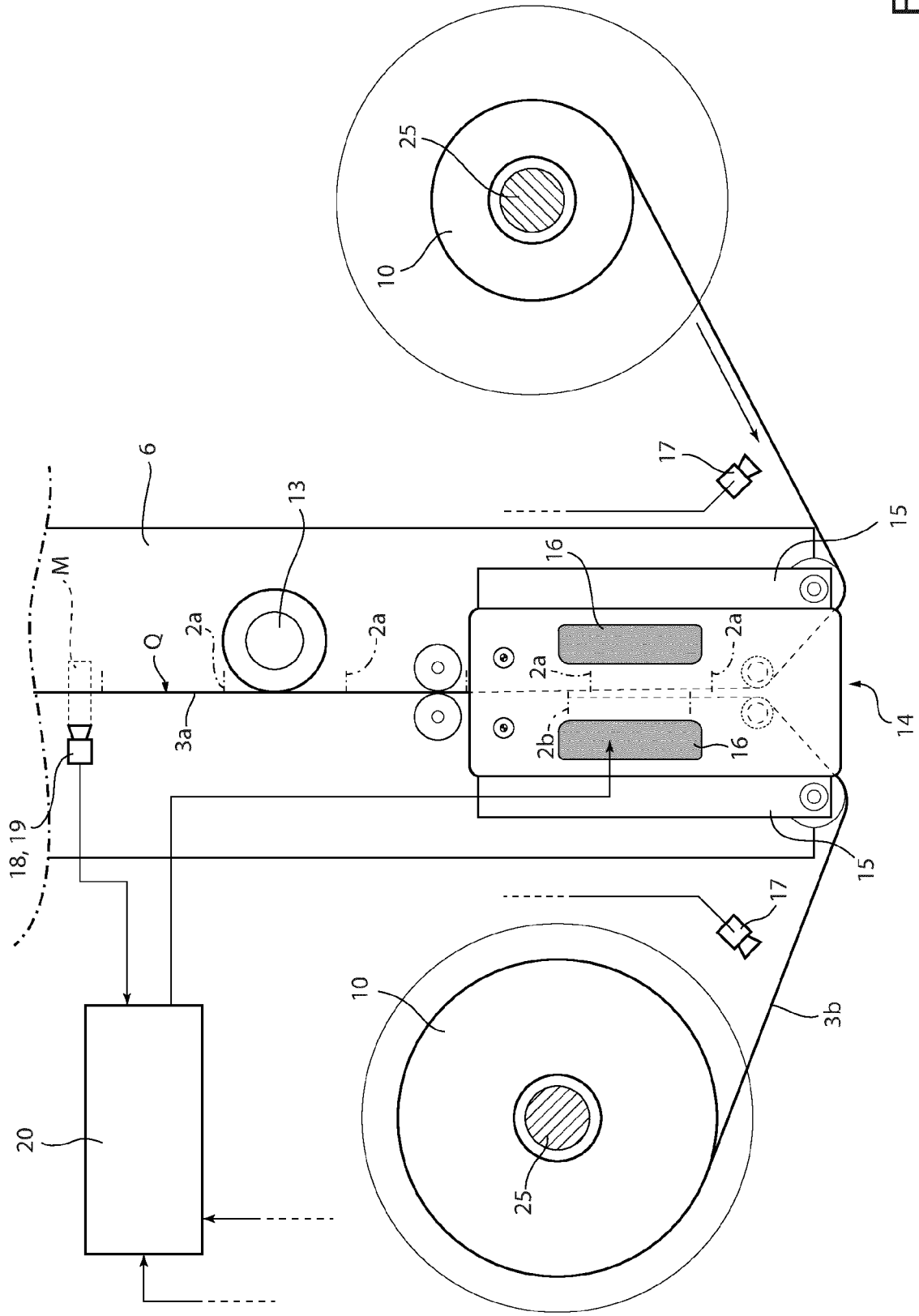


FIG. 2A

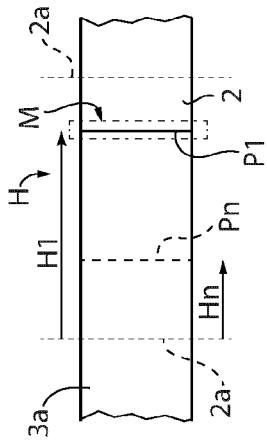


FIG. 3

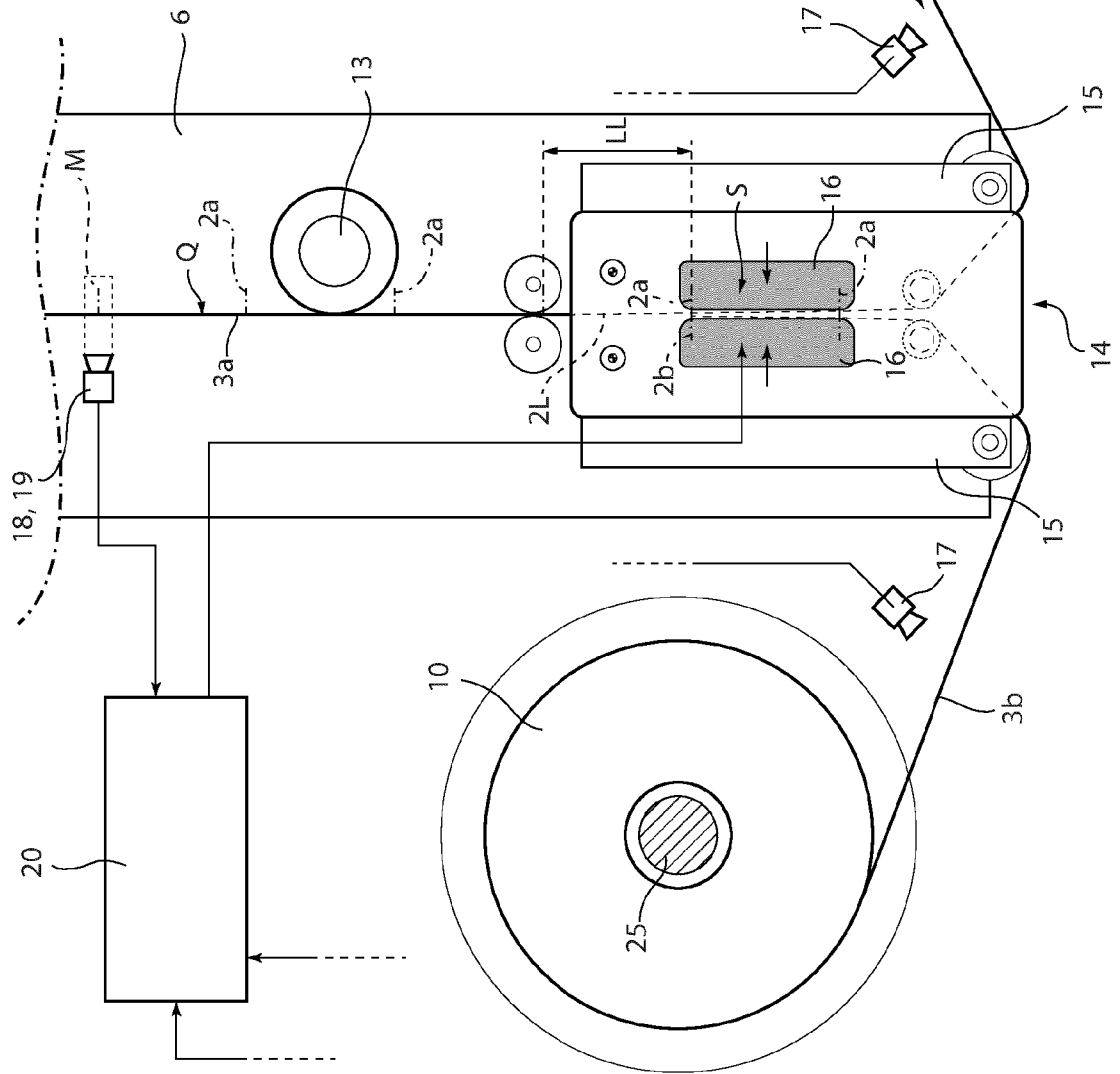


FIG. 2B

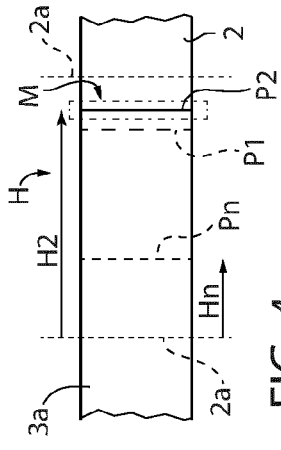


FIG. 4

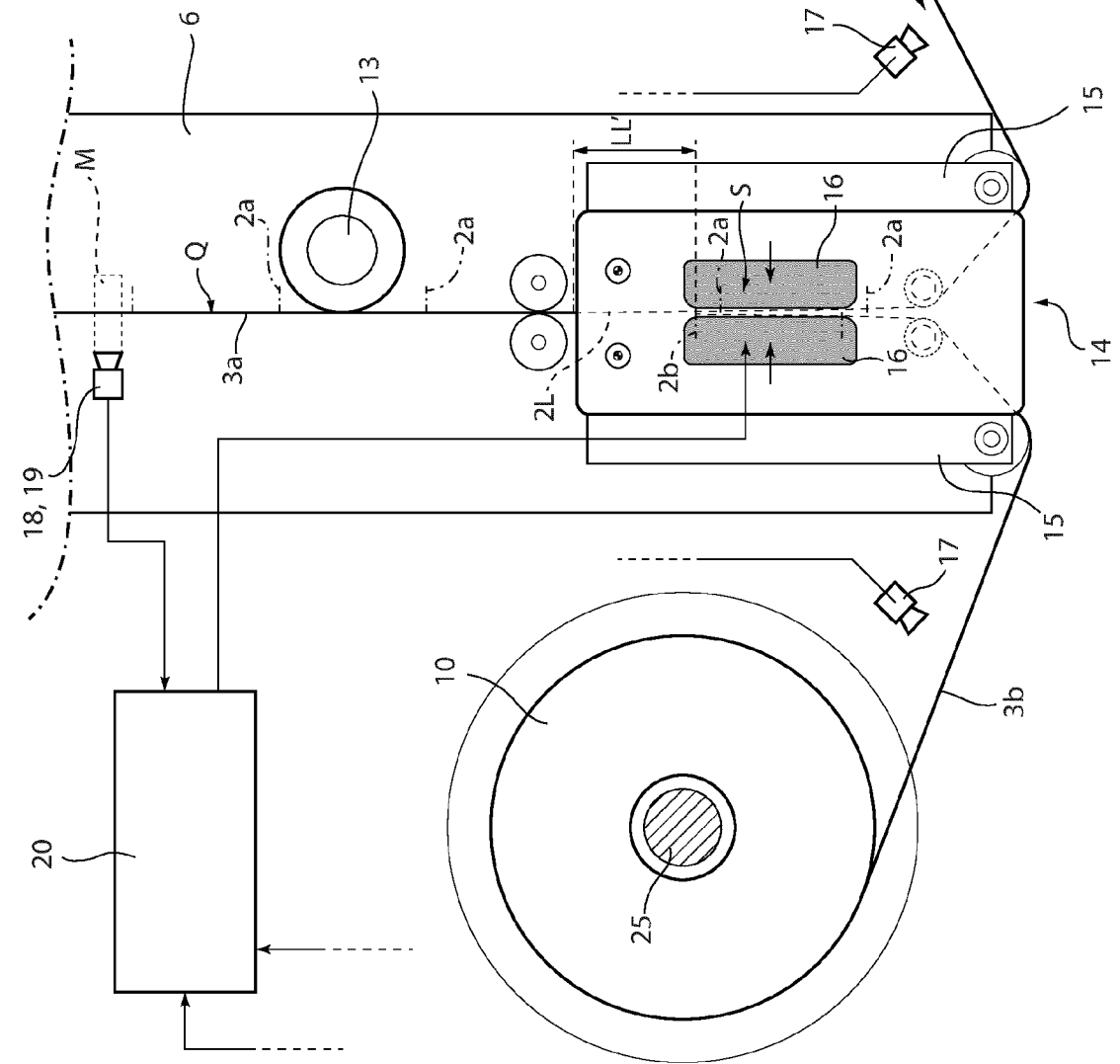


FIG. 2C



EUROPEAN SEARCH REPORT

Application Number

EP 22 18 5654

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X	DE 39 23 163 A1 (KRONSEDER MASCHF KRONES [DE]) 17 January 1991 (1991-01-17)	1, 2, 11-13, 15	INV. B65H19/18
Y	* column 1, lines 1-5 *	1	B65H26/06
A	* column 6, line 65 - column 7, line 29 * * column 8, lines 25-26 * * column 9, lines 22-37 * * column 9, line 67 - column 10, line 42 * * column 10, line 66 - column 11, line 40 * * column 11, line 61 - column 12, line 12 * * figures 1-4, 7A-7D *	3-10, 14, 16	B65C9/18
Y	WO 2021/079312 A1 (MAKRO LABELLING SRL [IT]; BELLINI MARCO) 29 April 2021 (2021-04-29) * page 11, line 31 - page 12, line 15 * * figure 1 *	1	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65H B65C
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
The Hague		9 February 2023	Cescutti, Gabriel
CATEGORY OF CITED DOCUMENTS		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ..... & : member of the same patent family, corresponding document	
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document			

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.  
The members are as contained in the European Patent Office EDP file on  
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09-02-2023

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