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(54) A PACKAGING MACHINE FOR PRODUCING SEALED PACKAGES FROM A WEB OF PACKAGING MATERIAL

(57) It is described a packaging machine (1) for producing sealed packages from a web (4) of packaging material fed along a conveying path (P) with a tube forming and sealing unit (9) arranged along said conveying path (P) for folding said web (4) of packaging material from a planar shape into a tube (10) and for longitudinally sealing said tube (10); an isolation chamber (C) delimiting an inner sterile/aseptic environment (IE) from an outer environment (OE), wherein the tube forming and sealing unit (9) is at least partially arranged within the isolation chamber (C); and a control apparatus (19) having a first sensor device (20) arranged along said conveying path (P) upstream of the isolation chamber (C) and configured to detect a splice (S) of packaging material and a second sensor device (23) arranged along said conveying path (P) in the area of the isolation chamber (C) and configured to detect the splice (S) of packaging materials.

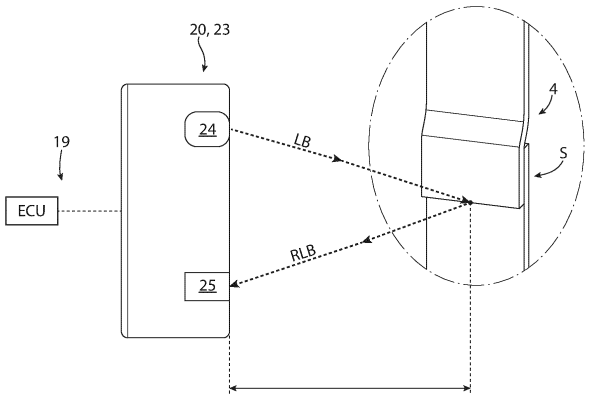

FIG.3

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Description

TECHNICAL FIELD

[0001] The present invention relates to a packaging machine for producing sealed packages from a web of packaging material.

BACKGROUND ART

[0002] As it is known, many liquid or pourable food products, such as for example pasteurized or long-life (UHT) milk, tomato sauce, wine, fruit juice are sold in packages made of sterilized packaging material.

[0003] Packages of this sort are normally produced with automatic packaging machines, which feed a web of packaging material through a sterilizing unit by means of known guiding elements (like for example rollers) for sterilizing the web of packaging material alternatively by means of chemical sterilization in a sterilizing bath (e.g. by applying a chemical sterilizing agent, such as a hydrogen peroxide solution) or by means of physical sterilization (e.g. by means of an electron beam).

[0004] The packaging machine further comprises a folding unit arranged downstream of the sterilizing unit, extending substantially vertically and designed to fold the web of packaging material for producing a continuous tube. Inside the folding unit, the web of packaging material is folded from a continuous planar shape to a continuous tubular shape with a vertical axis. The web of packaging material with a planar shape is folded into a cylinder that is successively subdivided into a plurality of pillow packs which are subjected to successive mechanical folding operations to obtain the finished sealed packages.

[0005] The folding unit is preferably arranged within a fixed structure in which the web of packaging material is maintained in a sterile-air environment. The folding unit further comprises a number of folding devices placed in succession (one after the other); by interacting with the folding devices, opposite lateral portions (or edges) of the web of packaging material are placed one on top of the other so as to form the tube and so as to define an overlapping area. The packaging machine further comprises a sealing unit for sealing overlapping lateral portions of the web of packaging material to finally obtain a fluid-tight longitudinal seal in the tube.

[0006] Finally, the packaging machine comprises a control apparatus to supervise the operation of the different units in the packaging machine and having at least a sensing element which is configured to detect a splice of packaging material, i.e., where the ends of two webs of packaging material are superimposed and connected to one another with a width which is substantially twice the width of the single web of packaging material. When a splice is detected, the control apparatus is configured to adjust operation of the tube forming and sealing device and/or of the sterilizing unit. Even though the known sensing elements to detect the splice of packaging material work satisfactorily well, a desire is felt in the sector to further improve and simplify the detection of the splices of packaging material.

DISCLOSURE OF INVENTION

[0007] The object of the invention is to provide a packaging machine for producing sealed packages from a web of packaging material addressing the drawbacks of the state of the art and, in particular, being easy and economical to be manufactured.

[0008] According to the present invention, there is provided a packaging machine for producing sealed packages from a web of packaging material according to the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] 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 perspective view, with parts removed for clarity, of a packaging machine for producing packages from a packaging material, in accordance with the present invention;
- figure 2 is a schematic side view of the packaging machine of figure 1; and
- figure 3 is a schematic view of a sensor device of figure 2.

BEST MODE FOR CARRYING OUT THE INVENTION

[0010] Figures 1 and 2 disclose, as a whole, a packaging machine 1 for continuously producing sealed packages, containing a pourable food product, such as for example pasteurized or long-life (UHT) milk, tomato sauce, wine, fruit juice. The sealed packages are obtained from a packaging material unwound from a reel 3 and fed along a conveying path P. When unwound from the reel 3, the packaging material has the shape of a continuous planar web 4 of packaging material.

[0011] Typically, the packaging material has a multilayer structure. More specifically, the packaging material may comprise at least a layer of fibrous material, such as for example a paper or cardboard layer, and at least two layers of heat-seal plastic material, e.g. polyethylene, with the layer of fibrous material interposed between them. One of these two layers of heat-seal plastic material may define the inner face of the packages eventually contacting the pourable product.

[0012] According to some possible non-limiting embodiments, the packaging material may also comprise a layer of gas- and light-barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, which, in particular, is arranged between one of the layers of heat-seal plastic material and the layer of fibrous material. Preferably, the

packaging material may also comprise a further layer of heat-seal plastic material interposed between the layer of gas- and light-barrier material and the layer of fibrous material.

[0013] The web 4 of packaging material is fed to a sterilizing unit 5 by means of guiding elements 6, in particular by a number of rollers 6 (one of said rollers is illustrated in figure 2). The sterilizing unit 5 may comprise a sterilizing bath 7, in which a chemical sterilizing agent, such as a hydrogen peroxide solution, is applied to the web 4 of packaging material. The web 4 of packaging material is fed through the sterilizing unit 5 by means of known guiding elements 8, like for example rollers 8 or similar elements.

[0014] Moreover, packaging machine 1 comprises:

- a tube forming and sealing device 9 configured to form a tube 10 from the advancing web 4 of packaging material and to longitudinally seal the tube 10; and
- a filling device 17 for filling the tube 4 with the pourable product.

[0015] In further detail, the packaging machine 1 comprises an isolation chamber C, preferentially delimiting an inner environment IE from an outer environment OE. Preferentially, the inner environment IE is a sterile (aseptic) environment, preferably containing a controlled atmosphere. Preferentially, the tube forming and sealing device 9 is at least partially arranged within the isolation chamber C, in particular within the inner environment IE, and is configured to fold and longitudinally seal the tube 10 within the isolation chamber C, in particular within the inner environment IE.

[0016] The tube forming and sealing device 9 is arranged downstream of the sterilizing unit 5 along the conveying path P. The tube forming and sealing device 9 extends substantially vertically along the conveying path P for producing a continuous tube 10. In particular, inside the tube forming and sealing device 9, the web 4 of packaging material is folded from a continuous planar shape to a continuous tubular shape with a longitudinal axis Y. In particular, the longitudinal axis Y is arranged along a vertical direction.

[0017] The tube forming and sealing device 9 is defined within a fixed structure 11. The tube forming and sealing device 9 further comprises a number of forming/folding devices 12 placed along the conveying path P in succession (one after the other).

[0018] Advantageously, each of said folding devices 12 may comprise a ring-like shape, e.g. at least partially enclosing the web 4 of packaging material. For example, the folding device 12 may comprise a forming ring 13 surrounding the web 4 of packaging material. The supporting device 12 may be configured for supporting a number of rollers 14 cooperating to fold the web 4 of packaging material.

[0019] In particular, the tube forming and sealing device 9 comprises a (first) folding device 12A and a (second) folding device 12B placed along the conveying path P in succession (one after the other) carried by the fixed structure 11, and interacting with the web 4 of packaging material to fold the web 4 of packaging material gradually into a tube (cylinder) and superimpose a (first) lateral portion of the web 4 of packaging material to a (second) lateral portion of the web 4 of packaging material, opposite the (first) lateral portion, to form the continuous tube 10.

[0020] The folding device 12B is placed downstream of the folding device 12A along the conveying path P.

[0021] With particular reference to figures 1 and 4, the first folding device 12A comprises the first folding ring 13A supporting a plurality of first folding rollers 14A; said first folding rollers 14A have respective axes perpendicular to the axis Y. Said first folding rollers 14A have respective lateral surfaces with concave shape (i.e. the web 4 of packaging material encounters a diameter at the ends greater than a diameter at the center of the first folding rollers 14A). The lateral surfaces of the first folding rollers 14A define a first compulsory passage for the web 4 of packaging material being folded.

[0022] Similarly, the second folding device 12B comprises the second folding ring 13B supporting a plurality of second folding rollers 14B; said second folding rollers 14B have respective axes perpendicular to the axis Y. Said second folding rollers 14B have respective lateral surfaces with concave shape (i.e. the web 4 of packaging material encounters a diameter at the ends greater than a diameter at the center of the second folding rollers 14B) . The lateral surfaces of the second folding rollers 14A define a second compulsory passage for the web 4 of packaging material being folded.

[0023] The tube forming and sealing device 9 comprises a sealing unit 15 for sealing overlapping lateral portions of the web 4 of packaging material to obtain a fluid-tight longitudinal seal in the tube 10. The sealing unit 15 is arranged downstream of the first folding devices 12A along the conveying path P. Advantageously, the sealing unit 15 is interposed between the two folding devices 12A, 12B.

[0024] The sealing unit 15 comprises a heating element 16. According to a first embodiment, the heating element 16 may comprise an induction heating element 16 for inductively heating the internal surface of the lateral portion to be superimposed the facing surface of the second lateral portion. The internal surface of the lateral portion is the surface facing the second lateral portion.

[0025] As a possible alternative, the heating element 16 may comprise a hot air heating element 16 having a number of nozzles for directing hot air onto the internal surface of the lateral portion to be superimposed the facing surface of the second lateral portion. Along the conveying path P it is defined a sealing region in correspondence of the sealing unit 15. More in detail, the sealing region is defined along the conveying path P in the area wherein the heating element 16 is interposed

between the two lateral portions the web 4 of packaging material.

[0026] The tube 10 is continuously filled with the pourable food product through the filling device 17 comprising a pour conduit 18, which partially extends inside the tube 10 and is part of a filling circuit. The tube 10 is sent to a transverse forming sealing unit (not shown), in which the tube 10 is gripped to transversely seal the tube and form pillow packs 2. Finally, the pillow packs 2 are subjected to successive mechanical folding operations to obtain the finished sealed packages.

[0027] The packaging machine 1 comprises a control apparatus 19 having at least an electronic control unit ECU configured to supervise the operation of the packaging machine 1.

[0028] The control apparatus 19 comprises a (first) sensing element 20, which is connected to the electronic control unit ECU arranged along the conveying path P and is configured to detect a splice S of packaging material. The splice S of packaging material is defined where the ends of two webs 4 of packaging material are superimposed and connected to one another. Therefore, in the area of the splice S, the packaging material has a width (for example, of 2 mm) which is larger than the width of the single web 4 of packaging material (for example, of 1 mm) .

[0029] The control unit ECU may be configured to receive the signals from the first and/or second sensing element 20, 23 and determine whether a splice S is present. In particular, the control unit ECU may be configured to perform the steps of the method described herein, e.g. detecting the splice S by processing the signals from the first and/or second sensing elements 20, 23.

[0030] The sensing element 20 is arranged along the conveying path P upstream of the tube forming and sealing device 9. Advantageously, the sensing element 20 is arranged along the conveying path P upstream of the isolation chamber C. Even more advantageously, the sensing element 20 is arranged along the conveying path P upstream of the sterilizing unit 5. In other words, the sensing element 20 is arranged in an area of the packaging machine 1 wherein a contact with the web 4 of packaging material is still allowed because the web 4 of packaging material is not yet sterilized.

[0031] The control apparatus 19 may preferably comprise a (second) sensing element 23, which is connected to the electronic control unit ECU and arranged along the conveying path P and is configured to detect the splice S of packaging material. Advantageously, the sensing element 23 may be arranged along the conveying path P at the area of the isolation chamber C.

[0032] Advantageously, the presence of two sensing element 20, 23 positioned before the isolation chamber C and at the isolation chamber C, allows for an improved control of the packaging machine 1. In particular, between the first and second sensing element 20, 23 the web 4 of packaging material can create a so-called loop, i.e. a buffer of the web 4 of packaging material to avoid that a sudden pull of the web 4 of packaging material by the tube forming and sealing device 9 damages the web 4 of packaging material. Accordingly, the control apparatus 19 with the (first) sensing element 20 can only approximately determine the position of the splice S at the forming and sealing device 9. Thanks to the presence of the (second) sensing element 23, positioned (immediately) upstream of the tube forming and sealing device 9, an exact position of the splice S can be calculated and the operation of the packaging machine 1improved.

[0033] Preferably, the sensing element 23 is arranged along the conveying path P at the isolation chamber C. More in detail, the sensing element 23 is arranged in the outer environment OE. Advantageously, the sensing element 23 is arranged along the conveying path P upstream of the tube forming and sealing device 9. In particular, the sensing element 23 is arranged along the conveying path P downstream of the sterilizing unit 5. In other words, the sensing element 23 is arranged in an area of the packaging machine 1 wherein a contact with the web 4 of packaging material is not allowed because the web 4 of packaging material has been sterilized.

[0034] Thus, the sensing element 23 comprises a contactless (optic) sensing element 23.

[0035] Preferably, the sensing element 23 may comprise a ToF (time of flight) sensing element 23. Preferably, the sensing element 23 comprises a profilometer. Advantageously, the sensing element 23 may comprise a CCD image sensor 23 or a CMOS image sensor 23. As shown as non-limiting example in figure 3, the contactless sensing element 23 comprises a beam emitter 24 and a receiver 25 cooperating with one another to detect the splice S. The beam emitter 24 is configured for transmitting (or emitting) a (e.g. visible or non-visible) light beam LB focused on the web 4 of packaging material to detect the splice S. The receiver 25 is configured for detecting the reflected light beam RLB.

[0036] The light beam LG travels from the beam emitter 24 to the web 4 of packaging material and then bounces off the web 4 of packaging material back to the receiver 25. In other words, the receiver 25 is configured to detect the light beam reflected from the web 4 of packaging material after the light beam LB hit the web 4 of packaging material. In particular, the beam emitter 24 is configured for transmitting (or emitting) a beam LB focused on the web 4 of packaging material to detect the splice S.

[0037] The sensing element 23 may be positioned in the outer environment OE; in particular the sensing element 23 may be positioned wherein the inner environment OE and the outer environment OE are separated by a light permeable barrier, e.g. a glass barrier.

[0038] Advantageously, the contactless sensing element 23may allow for a precise measurement without a direct contact with the web 4 of packaging material.

[0039] The sensing 23 element is configured to measure the distance between the beam emitter 24 and the

web 4 of packaging material and to detect the splice S, based on the time difference between the emission of the light beam and its return to the receiver 25, after being reflected by the web 4 of packaging material. In other words, the sensing element 23 is configured to calculate how long it takes for the light beam to travel to and from the web 4 of packaging material to determine the distance between the beam emitter 24 and the web 4 of packaging material and to detect the splice S.

[0040] More in detail, if the time difference between the emission of the light beam and its return to the receiver 25 falls within a predetermined range, the sensing element 23 is configured to generate a signal indicative of the presence of the splice S of packaging material and to transmit the signal to the electronic control unit ECU. The control unit ECU is configured to check whether the splice S of packaging material is present as a function of the received signal.

[0041] Advantageously, the sensing element 23 is configured to determine the time difference between the emission of the light beam and its return to the receiver 25. In particular, the sensing element 23 is configured to determine the time difference between the emission of the light beam and its return to the receiver 25 a plurality of (multiple) times. The signal is indicative of the presence of the splice S. In particular, the presence of the splice S is determined if the current (or actual) time difference between the emission of the light beam and its return to the receiver 25 is greater than the previous (or preceding) time difference between the emission of the light beam and its return to the receiver 25.

[0042] If a splice S is detected, the control apparatus 19 is configured to adjust operation of the tube forming and sealing device 9. Moreover, if a splice S is detected, the control apparatus 19 is configured to adjust the operation of the sterilizing unit 5.

[0043] According to a first embodiment, the sensing element 20 comprises a contact element 21 and a counter-element 22 (in particular a counter roller 22); the contact element 21 is configured to contact the web 4 of packaging material sliding on the counter-element 22 and detect the splice S.

[0044] According to a further embodiment, the sensing element 20 comprises a contactless (optic) sensing element 20.

[0045] Preferably, the sensing element 20 may comprise a ToF (time of flight) sensing element 20. Preferably, the sensing element 20 comprises a profilometer. Advantageously, the sensing element 20 may comprise a CCD image sensor 20 or a CMOS image sensor 20. As shown as non-limiting example in figure 3, the contactless sensing element 20 comprises a beam emitter 24 and a receiver 25 cooperating with one another to detect the splice S. The beam emitter 24 is configured for transmitting (or emitting) a (e.g. visible or non-visible) light beam LB focused on the web 4 of packaging material to detect the splice S. The receiver 25 is configured for detecting the reflected light beam RLB.

[0046] The light beam LG travels from the beam emitter 24 to the web 4 of packaging material and then bounces off the web 4 of packaging material back to the receiver 25. In other words, the receiver 25 is configured to detect the light beam reflected from the web 4 of packaging material after the light beam LB hit the web 4 of packaging material. In particular, the beam emitter 24 is configured for transmitting (or emitting) a laser beam LB focused on the web 4 of packaging material to detect the splice S.

[0047] The sensing 20 element is configured to measure the distance between the beam emitter 24 and the web 4 of packaging material and to detect the splice S, based on the time difference between the emission of the light beam and its return to the receiver 25, after being reflected by the web 4 of packaging material. In other words, the sensing element 20 is configured to calculate how long it took for the light beam to travel to and from the web 4 of packaging material to determine the distance between the beam emitter 24 and the web 4 of packaging material and, finally, to detect (or not) the presence of the splice S.

[0048] More in detail, if the time difference between the emission of the light beam and its return to the receiver 25 falls within a predetermined range, the sensing element 20 is configured to detect the presence of the splice S of packaging material and to transmit a signal to the electronic control unit ECU indicative of the splice S being detected.

[0049] Advantageously, the sensing element 20 is configured to determine the time difference between the emission of the light beam and its return to the receiver 25 a number of times. In particular, the sensing element 20 is configured to determine the time difference between the emission of the light beam and its return to the receiver 25 a plurality of (multiple) times. If the current (or actual) time difference between the emission of the light beam and its return to the receiver 25 is greater than the previous (or preceding) time difference between the emission of the light beam and its return to the receiver 25, the sensing element 20 is configured to check the presence of the splice S of packaging material and to transmit a signal to the electronic control unit ECU indicative of the splice S being detected.

[0050] If a splice S is detected, the control apparatus 19 is configured to adjust operation of the tube forming and sealing device 9. Moreover, if a splice S is detected, the control apparatus 19 is configured to adjust the operation of the sterilizing unit 5.

[0051] Advantageously, the sensing elements 20, 23 described above are configured to detect the presence of possible defects in the splice S of packaging material. More in detail, the sensing elements 20, 23 describe above are configured to detect the presence of possible misalignments in the splice S of packaging material.

[0052] The control apparatus 19, e.g. the control unit ECU thereof, may be configured to perform the steps of the following method.

[0053] The present description describes a method of

detecting a splice S on a web 4 of packaging material fed along a conveying path P, wherein the method comprises:

- transmitting a light beam LB towards the web 4 of packaging material, preferably a laser beam;
- detecting the light beam RLB reflected from the web 4 of packaging material; and
- detecting the splice S as a function of the received light beam RLB.

[0054] The method may comprise detecting the splice S as a function of the received light beam RLB.
[0055] The method may comprise calculating a time interval passing between the transmittal and the reception of said light beam LB, RLB; and detect the splice S based on the time interval.
[0056] The method may comprise transmitting a signal indicative of the splice S being detected, if said time interval falls within a predetermined range.
[0057] The method may comprise:

- transmitting and receiving the light beam LB, RLB a number of times; and
- transmitting a signal indicative of the splice S being detected if the difference between the current time interval and the previous time interval is greater than a predetermined amount.

[0058] The method may comprise adjusting operation of the packaging machine 1, preferably the tube forming and sealing unit 9, if a splice S is detected.
[0059] The method may comprise detecting the presence of anomalies, like misalignments, in the splice S of packaging material.

LIST OF REFERENCE NUMBERS

[0060]

1	packaging machine
2	pillow packs
3	reel
4	web of packaging material
5	sterilizing unit
6	guiding elements
7	sterilizing bath
8	guiding elements
9	tube forming and sealing device
10	tube
11	structure
12,12A,12B	forming/folding device
13,13A,13B	forming ring
14,14A,14B	roller
15	sealing unit
16	heating element
17	filling device
18	pour conduit
19	control apparatus
20	sensing element
21	contact element
22	counter-element
23	sensing element
24	beam emitter
25	receiver
P	conveying path
Y	axis
C	isolation chamber
IE	inner environment
OE	outer environment
S	splice
LB	light beam
RLB	reflected light beam
ECU	electronic control unit

Claims

1. A packaging machine (1) for producing sealed packages from a web (4) of packaging material fed along a conveying path (P), the packaging machine (1) comprising:

- a tube forming and sealing unit (9) arranged along said conveying path (P) for folding said web (4) of packaging material from a planar shape into a tube (10) and for longitudinally sealing said tube (10);
- an isolation chamber (C) delimiting an inner sterile/aseptic environment (IE) from an outer environment (OE), wherein the tube forming and sealing unit (9) is at least partially arranged within the isolation chamber (C); and
- a control apparatus (19) comprising a first sensor device (20) arranged along said conveying path (P) upstream of the isolation chamber (C) and configured to detect a splice (S) on the web (4) of packaging material;

the packaging machine (1) is **characterized in that** the control apparatus (19) comprises a second sensor device (23) arranged along said conveying path (P) at the area of the isolation chamber (C) and configured to detect the splice (S).

2. The packaging machine (1) according to claim 1, wherein the second sensor device (23) is arranged in the outer environment (OE).

3. The packaging machine (1) according to claim 1 or 2 and comprising a sterilizing unit (5) for the packaging material arranged upstream of the tube forming and sealing unit (9) with respect to an advancement direction of the web (4) of packaging material along the conveying path (P); the first (20) and second (23) sensor device being placed upstream and downstream, respectively, of the sterilizing unit (5) with

respect to an advancement direction of the web (4) of packaging material.

4. The packaging machine (1) according to any of the previous claims, wherein the first and/or the second sensor device (20, 23) comprise a contactless sensor element (23).

5. The packaging machine (1) according to any previous claims, wherein the first and/or the second sensor device (20, 23) comprise an optic sensor element (23) .

6. The packaging machine (1) according to any previous claims, wherein the first and/or the second sensor device (20, 23) comprise a beam emitter (24) for transmitting a light beam (LB) towards the web (4) of packaging material, preferably a laser beam, and a receiver (25) for detecting the light beam (RLB) reflected from the web (4) of packaging material.

7. The packaging machine (1) according to claim 6, wherein the control apparatus (19) is configured to detect the splice (S) as a function of the received light beam (RLB) .

8. The packaging machine (1) according to claim 6 or claim 7, wherein the control apparatus (19) is configured to calculate a time interval passing between the transmittal and the reception of said light beam (LB, RLB); and detect the splice (S) based on said time interval.

9. The packaging machine (1) according to claim 8, wherein the control apparatus (19) is configured to transmit a signal indicative of the splice (S) being detected, if said time interval falls within a predetermined range.

10. The packaging machine (1) according to any of claims 6 to 9, wherein the control apparatus (19) is configured to:

- transmit and receive the light beam (LB, RLB) a number of times; and
- transmit a signal indicative of the splice (S) being detected if the difference between the current time interval and the previous time interval is greater than a predetermined amount.

11. The packaging machine (1) according to anyone of the previous claims, wherein the control apparatus (19) is configured to adjust operation of the packaging machine (1), preferably the tube forming and sealing unit (9), if a splice (S) is detected.

12. The packaging machine (1) according to anyone of the previous claims, wherein the control apparatus (19) is configured to detect the presence of anomalies, like misalignments, in the splice (S) of packaging material.

13. A method of detecting a splice (S) on a web (4) of packaging material fed along a conveying path (P), the method comprising:

- transmitting a light beam (LB) towards the web (4) of packaging material, preferably a laser beam;
- detecting the light beam (RLB) reflected from the web (4) of packaging material; and
- detecting the splice (S) as a function of the received light beam (RLB).

14. The method according to claim 13 and comprising adjusting operation of a packaging machine (1) for producing sealed packages from the web (4) of packaging material if a splice (S) is detected.

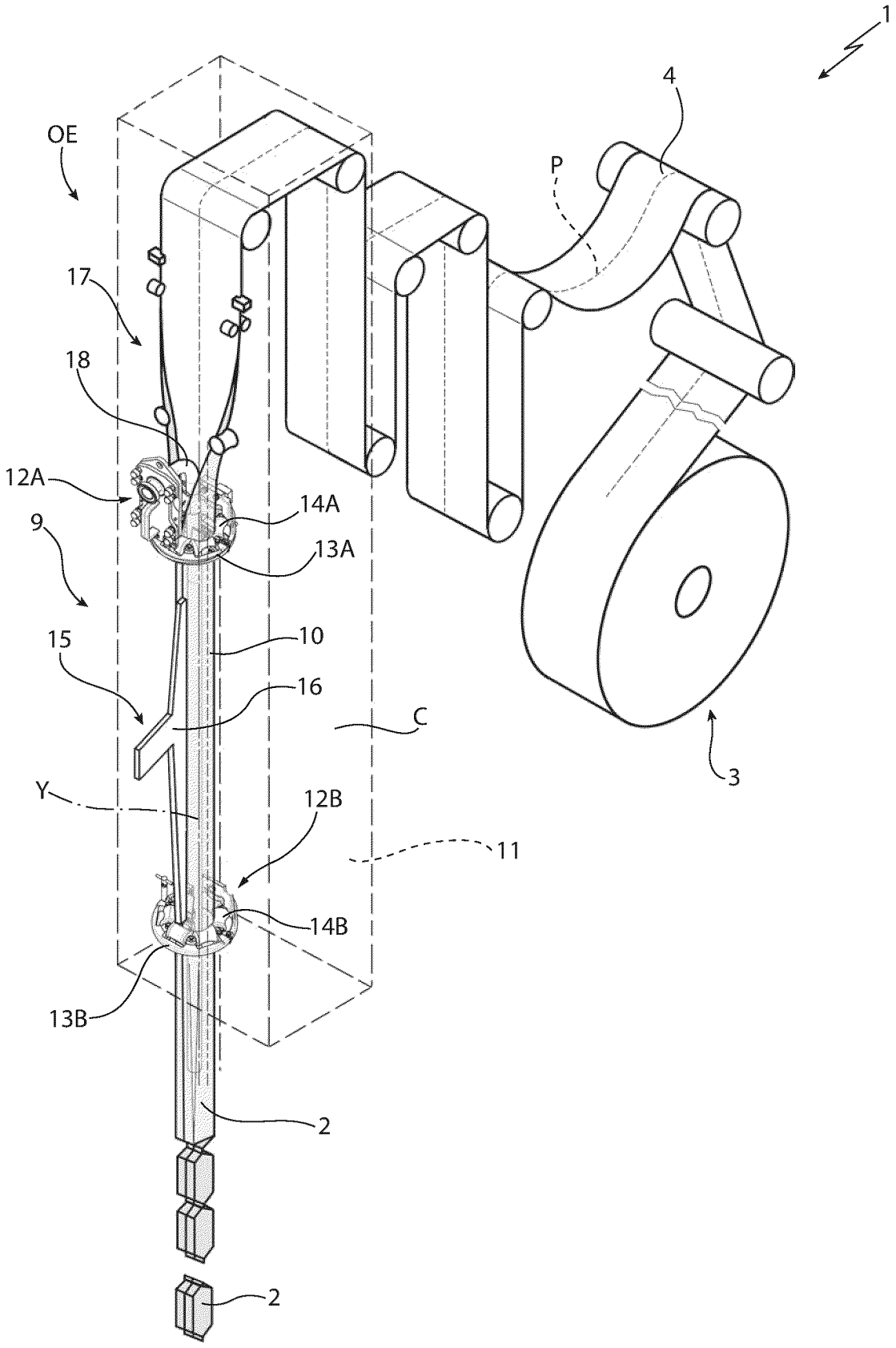

FIG. 1

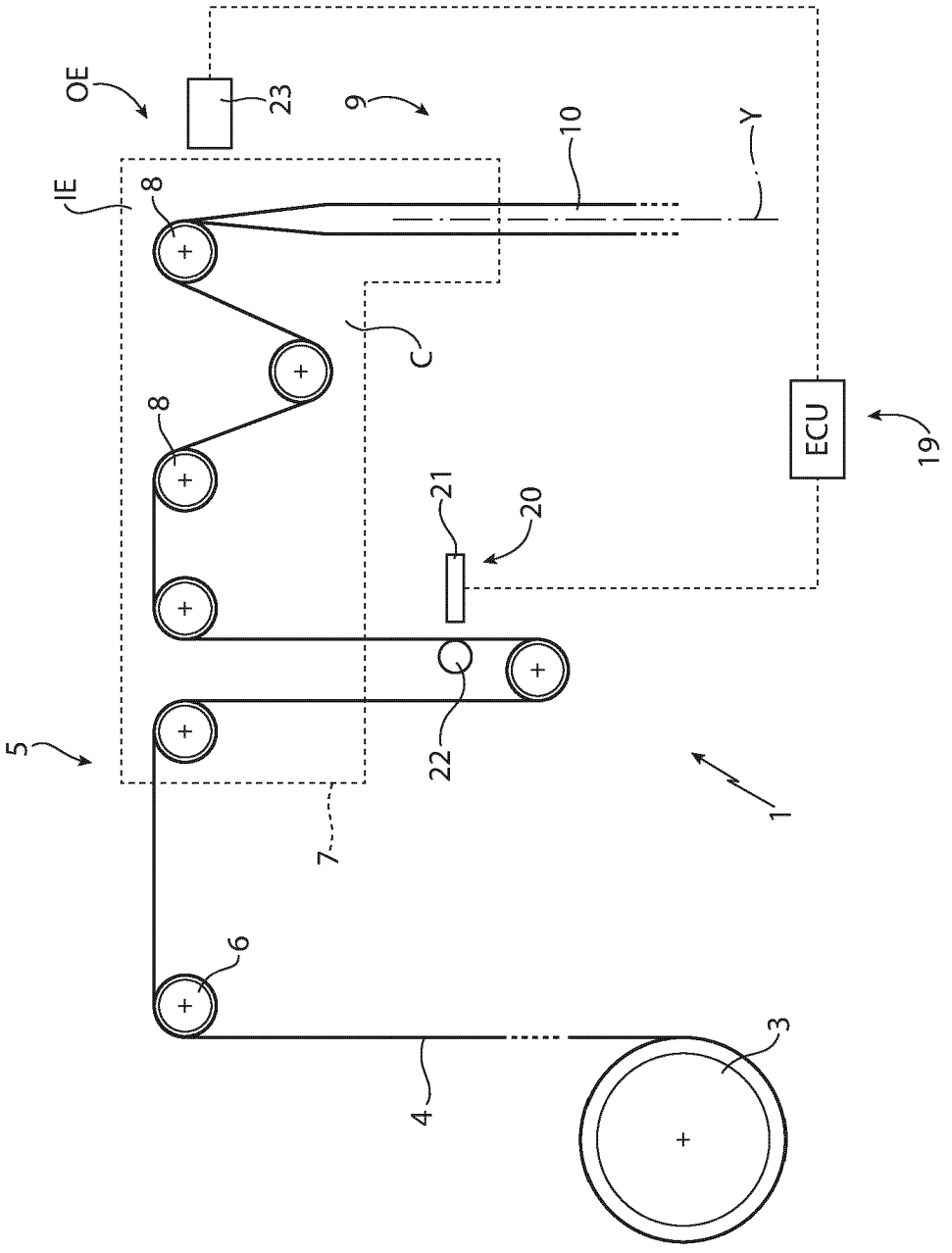

FIG. 2

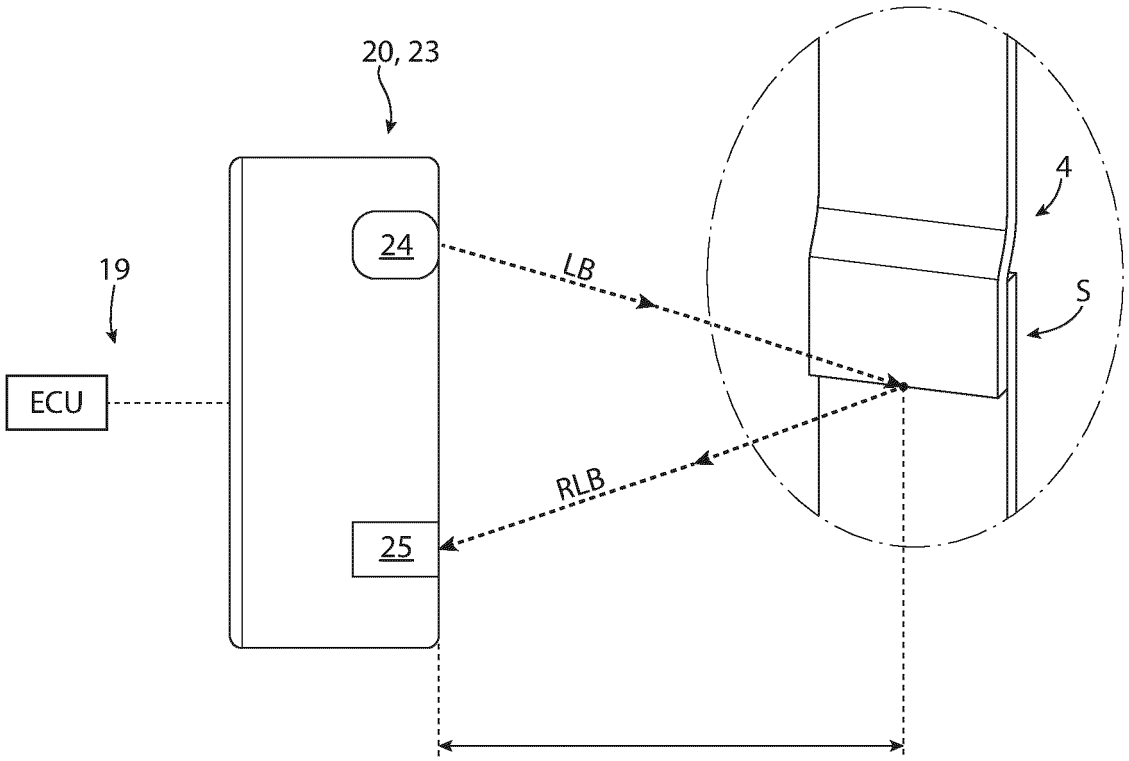

FIG.3

Europäisches Patentamt
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EUROPEAN SEARCH REPORT

Application Number
EP 24 21 9887

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Place of search	Date of completion of the search	Examiner
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