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(54) APPARATUS FOR APPLYING A SEALING STRIP ONTO A WEB OF PACKAGING MATERIAL, REEL AND METHOD

(57) There is described an apparatus (8) for applying a sealing strip (10) onto a web (3) of packaging material for producing sealed packages (2) containing a pourable product, the apparatus (8) comprises: a rotatable support shaft (13) configured to support a reel (12) onto which the strip (10) is initially wound, and to rotate the reel (12) for progressively unwinding the strip (10) therefrom; an application device for applying the strip (10) unwound from the reel (12) onto the web (3); a sensor (16) configured for detecting a detectable element (15) carried by one of said shaft (13) or reel (12) and for producing a correlated detection signal; and a control unit configured to receive the detection signal from the sensor (16); the detectable element (15) is controllable in a first condition, in which it is covered by the strip (10) and thereby undetectable by the sensor (16), and in a second condition, in which it is uncovered from the strip (10) and thereby detectable by the sensor (16); the control unit is configured to trigger a splicing operation of the strip (10) upon receiving the detection signal by the sensor (16).

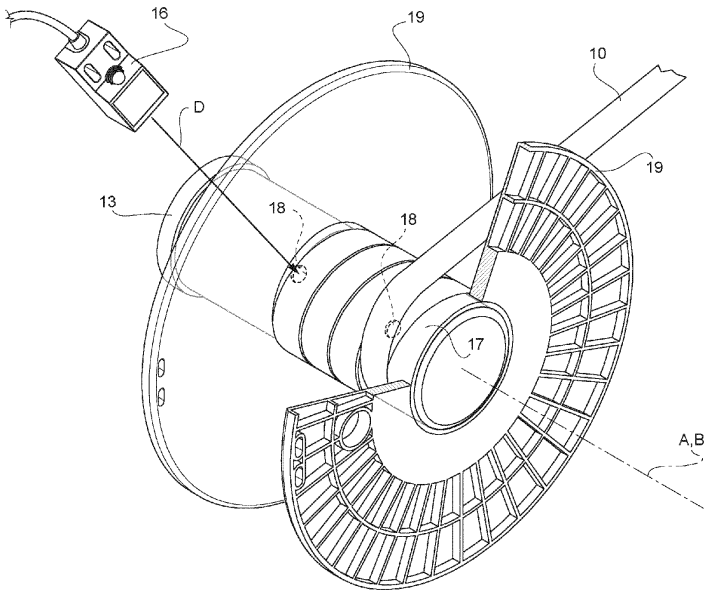

FIG. 6

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Description

TECHNICAL FIELD

[0001] The present invention relates to an apparatus for applying a sealing strip onto a web of packaging material, in particular a web of packaging material for producing sealed packages containing a pourable product, preferably a pourable food product.

[0002] The present invention further relates to a reel for supporting a sealing strip adapted to be applied onto a web of packaging material for producing sealed packages containing a pourable product, preferably a pourable food product.

[0003] The present invention also relates to a method for applying a sealing strip onto a web of packaging material for producing sealed packages containing a pourable product, preferably a pourable food product.

BACKGROUND ART

[0004] As it is generally known, many pourable food products, such as fruit juice, UHT (ultra-high temperature-treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0005] A typical example is the parallelepiped-shaped package for pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by folding and sealing a laminated web of packaging material. The packaging material has a multilayer structure comprising a base layer, e.g. made of paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene.

[0006] In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of oxygen-barrier material, e.g. an aluminum foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

[0007] Such packages are usually produced in fully automatic packaging assemblies, in which a continuous tube is formed starting from a web of packaging material initially wound in a reel and fed through a plurality of unwinding rollers of such packaging assembly. The web of packaging material is sterilized in the packaging assembly, e.g. by applying a chemical sterilizing agent, such as hydrogen peroxide solution, which, once the sterilization is completed, is removed from the surfaces of the packaging material, e.g. evaporated by heating. The web so sterilized is then maintained in a closed, sterile environment, and - being advanced by the aforementioned unwinding rollers - is folded and sealed longitudinally to form the tube by means of a known web folding device.

[0008] The tube is fed continuously along a first direction, normally a straight vertical direction, is filled with the sterilized food product from above and is formed, sealed and subsequently cut along equally spaced transversal cross-sections extending along a second direction, normally a direction orthogonal to the first direction. So-called pillow packs are obtained thereby, which have a longitudinal sealing band, a top transversal sealing band and a bottom transversal sealing band. The pillow packs are then cut at the cross-sections to be separated from one another and directed to a folding device of the packaging assembly for the final folding thereof.

[0009] In order to form the tube, the sterilized web of packaging material is vertically fed through a number of forming assemblies, which are part of said web folding device and which sequentially interact with the packaging material to fold it gradually from web form into a tube shape.

[0010] Before reaching the forming assemblies, the web of packaging material is fed through an apparatus for applying a sealing strip of heat-seal plastic material onto the packaging material.

[0011] More specifically, a first longitudinal portion of the sealing strip is applied and heat-sealed to a first longitudinal edge of the web at an applying station, in particular the sealing strip is applied on the face of the packaging material eventually forming the inside of the packages. After such application, a second longitudinal portion of the sealing strip projects from the first longitudinal edge.

[0012] The forming assemblies are arranged in succession, along a tube-forming path, and comprise respective folding members, in particular rollers, arranged to define a series of passages for the packaging material varying gradually in section from a C-shape to a substantially circular shape.

[0013] On interacting with the folding members, a second longitudinal edge of the web is laid on the outside of the first longitudinal edge with respect to the axis of the tube being formed. In detail, the sealing strip is located entirely within the tube, and the face of the second longitudinal edge facing the axis of the tube is superimposed partly on the second portion of the sealing strip and partly on the face of the first longitudinal edge located on the side opposite to the first portion of the sealing strip.

[0014] At this point, the second longitudinal portion of the sealing strip is applied to the web by performing a heating step and a pressing step.

[0015] More specifically, in the known apparatuses for applying a sealing strip, the heating step consists in melting the polyethylene layer of the second longitudinal edge, which transmits heat by conduction to the first longitudinal edge and to the sealing strip, so as to melt together the polyethylene of these layers.

[0016] During the pressing step, the sealing strip, the first longitudinal edge and the second longitudinal edge are pressed together, by means of at least two opposing rollers, so that the heat-seal plastic material of the sealing strip and of the polyethylene layers of the first longitudinal edge and the second longitudinal edge blend completely to form the longitudinal seal of the tube.

[0017] Hence, the sealing strip performs the following

functions:

- to prevent the first longitudinal edge of the packaging material to absorb the pourable product;
- to improve the gas barrier properties of the longitudinal seal; and
- to strengthen the longitudinal seal.

[0018] Typically, the sealing strip is initially wound on one or more support reels. Accordingly, the apparatus for applying a sealing strip comprises one or more motorized shafts defining respective spindles or mandrels for rotatably supporting each reel during the unwinding of the sealing strip and for driving such unwinding by rotation of the shafts.

[0019] During production, an exhausted, i.e. empty, reel needs to be replaced with a new reel without stopping the packaging assembly.

[0020] To this end, the known apparatuses for applying a sealing strip comprise at least two motorized shafts, each supporting one reel of sealing strip, and a splicing unit.

[0021] The splicing unit is configured to join the sealing strip unwinding from a first reel in exhaustion, supported by a first shaft, with the sealing strip wound on a second new reel, supported by a second shaft.

[0022] More precisely, the splicing unit is configured to splice the end portion of the sealing strip wound on first reel with the initial portion of the sealing strip wound on the second reel.

[0023] Normally, the splicing operation is triggered automatically.

[0024] According to a first known solution, the apparatus for applying a sealing strip comprises a strip end detection system of mechanical type: when the amount of the sealing strip still wound on the reel core is less than a predetermined threshold, a bracket is moved, which triggers the activation of the splicing unit and therefore of the splicing process.

[0025] According to a second known solution used in particular in connection with high-speed packaging assemblies, the splicing process is triggered based on the rotational speed of the spindle supporting the reel of sealing strip.

[0026] More specifically, each spindle is motorized by a servomotor. In use, the rotational speed of such servomotor increases as the diameter of the amount of sealing strip wound on the reel decreases. As soon as the speed reaches a predetermined threshold value, the apparatus triggers the beginning of the splicing process.

[0027] Although being functionally valid, the known apparatuses for applying a sealing strip onto a web of packaging material are still open for further improvements, in particular as for improving the splicing precision and for reducing unused sealing strip waste, especially for high-speed production assemblies.

DISCLOSURE OF INVENTION

[0028] It is therefore an object of the present invention to provide an apparatus for applying a sealing strip onto a web of packaging material which is designed to meet at least one of the above-mentioned needs in a straightforward and low-cost manner.

[0029] This object is achieved by an apparatus for applying a sealing strip onto a web of packaging material as claimed in claim 1.

[0030] It is a further object of the present invention to provide a reel for supporting a sealing strip to be applied onto a web of packaging material which is designed to meet at least one of the above-mentioned needs in a straightforward and low-cost manner.

[0031] This object is achieved by a reel as claimed in claim 12.

[0032] It is a further an object of the present invention to provide a method for applying a sealing strip onto a web of packaging material which is designed to meet at least one of the above-mentioned needs in a straightforward and low-cost manner.

[0033] This object is achieved by a method for applying a sealing strip onto a web of packaging material as claimed in claim 15.

BRIEF DESCRIPTION OF THE DRAWINGS

[0034] Non-limiting embodiments 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 assembly for producing packages filled with a pourable product and comprising an apparatus for applying a sealing strip onto a web of packaging material according to the present invention;

Figure 2 is a larger-scale, schematic perspective view of the apparatus for applying a sealing strip according to the present invention;

Figure 3 is a larger-scale, schematic, partially sectioned top view, with parts removed for clarity, of part of the packaging assembly of Figure 1;

Figure 4 is a larger-scale, schematic side view, with parts removed for clarity, of part of the apparatus for applying a sealing strip according to the present invention;

Figure 5 is a larger-scale, exploded perspective view, with parts removed for clarity, of a detail of the apparatus for applying a sealing strip shown in Figure 4; and

Figures 6 and 7 are larger-scale, perspective views, with parts removed for clarity, of the detail shown in Figure 5, in assembled condition and during two distinct operative conditions.

BEST MODE FOR CARRYING OUT THE INVENTION

[0035] With reference to Figure 1, number 1 indicates as a whole a packaging assembly for producing a plurality of sealed packages 2 containing a pourable product, preferably a pourable food product such as pasteurized UHT milk, water, fruit juice, wine, peas, beans, etc. starting from a web 3 of packaging material.

[0036] Preferably, web 3 is initially stored in a reel 4 and, in use, is unwound off reel 4 and fed along a forming path.

[0037] In detail, packaging assembly 1 is configured to form and seal a plurality of pillow packs 2a containing the pourable product starting from web 3 and then to fold pillow packs 2a for obtaining the aforementioned formed, sealed and folded packages 2 containing the pourable product.

[0038] Preferably, the packaging material has a multilayer structure (not shown), and comprises a layer of fibrous material, e.g. paper, covered on both sides with respective layers of heat-seal plastic material, e.g. polyethylene.

[0039] In the case of aseptic packages 2 for long-storage products, such as UHT milk, the packaging material also comprises a layer of gas-and-light barrier material, e.g. aluminum foil or ethylene vinyl alcohol (EVOH) film, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material, the latter forming the inner face of package 2 eventually contacting the pourable product.

[0040] Along the forming path, web 3 is formed into a tube 5, according to a manner known and not described in detail.

[0041] Conveniently, after being unwound off reel 4 and before being formed into tube 5, web 3 of packaging material is sterilized, e.g. by applying a chemical sterilizing agent, such as hydrogen peroxide solution, which, once sterilization is completed, is removed from the surfaces of the packaging material, e.g. evaporated by heating.

[0042] Then, packaging assembly 1 is configured to perform, sequentially, the following operations:

- longitudinally folding web 3 of packaging material to obtain tube 5 by means of folding means 6 and longitudinally sealing tube 5 to form a known longitudinal sealing band thereon;
- filling tube 5 (from above) with the pourable product;
- forming tube 5 at successive portions thereof to impart (give) a predetermined external shape to such portions;
- transversally and repeatedly sealing tube 5 at equally-spaced cross sections, so that pillow packs 2a are obtained;
- cutting tube 5 at the above-mentioned cross sections to separate pillow packs 2a from one another;
- folding pillow packs 2a to obtain fully folded packages 2.

[0043] To this end, packaging assembly 1 comprises a known forming device, a known sealing device and a known cutting device, which will be not described in detail herein.

[0044] In order to form tube 5, web 3 is fed through folding means 6 which comprise a number of folding devices, each preferably including a plurality of forming rollers 7.

[0045] In detail, forming rollers 7 are arranged to define a series of passages for the packaging material, varying gradually in section from a C-shape to a substantially circular shape.

[0046] In greater detail, forming rollers 7 sequentially interact with web 3 to fold it gradually from web form into a tube shape, according to a manner known and not described in detail.

[0047] Before reaching the forming rollers 7, web 3 is fed through an apparatus 8 for applying a sealing strip 10 onto the web 3 itself.

[0048] In particular, packaging assembly 1 comprises such apparatus 8.

[0049] Conveniently, strip 10 is made of heat-seal plastic material, and preferably comprises the same material of the outer layers of the packaging material, i.e. polyethylene.

[0050] Packaging assembly 1 further comprises a longitudinal sealing device 58 configured to heat seal strip 10 onto web 3, subsequently to the application of strip 10 onto web 3 by apparatus 8, to form tube 5.

[0051] More specifically, as schematically shown in Figure 2, by means of apparatus 8 a first longitudinal portion 10a of strip 10 is applied and heat-sealed to a first longitudinal edge 3a of web 3, in particular on the face of the packaging material eventually forming the inside of each package 2. After such application, a second longitudinal portion 10b of strip 10 projects from first longitudinal edge 3a.

[0052] By interacting with the forming rollers 7, a second longitudinal edge 3b of web 3 is laid on the outside of first longitudinal edge 3a with respect to an axis X of tube 5 being formed. In detail, strip 10 is located entirely within tube 5, and the face of second longitudinal edge 3b facing axis X is superimposed partly on second portion 10b of strip 10, and partly on the face of first longitudinal edge 3a located on the side opposite to first portion 10a of strip 10. This situation is shown in Figure 3.

[0053] At this point, strip 10 is heat sealed to web 3 by performing a heating step and a pressing step.

[0054] More specifically, longitudinal sealing device 58 comprises a known heating device which is configured to melt the polyethylene layer of second longitudinal edge 3b, which transmits heat by conduction to first longitudinal edge 3a and to strip 10, so as to melt together the polyethylene of these layers.

[0055] Longitudinal sealing device 58 further comprises a pressure device for pressing strip 10 and first longitudinal edge 3a and second longitudinal edge 3b together, so that the heat-seal plastic material of strip 10

and of the polyethylene layers of first longitudinal edge 3a and second longitudinal edge 3b blend completely to form a longitudinal seal of tube 5.

[0056] Conveniently, such pressure device comprises a pressure roller 11 arranged inside tube 5 in formation and opposing one of the forming rollers 7.

[0057] In practice, strip 10 and first longitudinal edge 3a and second longitudinal edge 3b are pressed together between one forming roller 7 and pressure roller 11, as shown in Figure 3.

[0058] Strip 10 performs the following functions:

- to prevent first longitudinal edge 3a of web 3 to absorb the pourable product;
- to improve the gas barrier properties of the longitudinal seal of tube 5; and
- to strengthen the longitudinal seal of tube 5.

[0059] Strip 10 is initially wound onto (i.e. around) one or more reels 12.

[0060] Accordingly, apparatus 8 comprises at least one rotatable support shaft 13, two in the example shown, configured to support one reel 12 at a time and to rotate reel 12 for progressively unwinding strip 10 therefrom.

[0061] In detail, each shaft 13 is motorized, e.g. it is equipped with a servomotor, for being rotated at a predetermined feeding speed.

[0062] In the example shown, apparatus 8 includes two shafts 13, each supporting one reel 12, onto which one respective strip 10 is wounded.

[0063] In greater detail, each shaft 13 extends along a longitudinal axis A.

[0064] Preferably, apparatus 8 comprises reels 12.

[0065] In particular, each reel 12 comprises a central hollow core 17 having a longitudinal axis B that defines an axis of rotation for reel 12.

[0066] Core 17 is configured to support, in particular supports, strip 10 for defining a winding thereof about axis B.

[0067] Each shaft 13 supports the respective reel 12 on an outer wall 13a thereof by coaxially engaging core 17 of such reel 12.

[0068] Each reel 12 further comprises a pair of flanges 19 extending radially from opposite axial ends of core 17.

[0069] Apparatus 8 further comprises:

- a splicing device 14, known per se and not described nor illustrated in detail, for splicing the two strips 10 together, in particular an end portion of a first strip 10 unwinding from a first reel 12 to an initial portion of a second strip 10 wound in a second reel 12; and
- a control unit (not shown) configured to trigger (i.e. to control) a splicing operation to be performed by splicing device 14.

[0070] More specifically, when in use one reel 12 is exhausting, i.e. when the strip 10 wound thereon is finishing, splicing device 14 joins, in a known manner, such strip 10 with the strip 10 wound in the other reel 12. In this way, a reel change is performed without stopping packaging assembly 1, and therefore without stopping the production of packages 2.

[0071] According to an aspect of the present invention, apparatus 8 comprises at least one sensor 16, two in the example shown, one for each shaft 13, configured for detecting a detectable element 15 carried by one of the shafts 13 or the respective reel 12 supported by such shaft 13, and for producing a correlated detection signal.

[0072] In this preferred embodiment shown, each shaft 13 carries one detectable element 15 on its outer wall 13a.

[0073] Preferably, as shown in Figure 5, detectable element 15 is defined by an annular band fixed onto wall 13a and made of a material capable of reflecting electromagnetic radiation, for example a material capable of reflecting light.

[0074] For the sake of brevity, reference will be made in the following to a single shaft 13 carrying its respective detectable element 15 and rotatably supporting one respective reel 12, and to a single sensor 16 for detecting such detectable element 15. However, the features described herein in connection with the above components are equally applicable to the other shaft 13, reel 12, sensor 16 and detectable element 15.

[0075] According to an aspect of the present invention, detectable element 15 is controllable (or available) in a first condition, in which it is covered by strip 10 and thereby undetectable by sensor 16, and in a second condition, in which it is uncovered from strip 10 and thereby detectable by sensor 16.

[0076] Accordingly, the control unit is configured to receive the detection signal from sensor 16 and to trigger the splicing operation upon receiving (or based on) the detection signal by sensor 16.

[0077] In particular, as schematically shown in Figures 6 and 7, detectable element 15 is controllable from the first condition (Figure 6) to the second condition (Figure 7) by unwinding of strip 10 from an initial unwound state (Figure 6), in which most of strip 10 is wound onto reel 12, to a reel exhaustion state (Figure 7), in which most of strip 10 is unwound from reel 12.

[0078] Preferably, in said reel exhaustion state, a length of strip 10 still wound onto reel 12 is between 0.5 m and 3 m, in particular between 0,75 m and 2 m, in particular is about 1 m.

[0079] According to an aspect of the present invention, reel 12 has at least one through hole 18 obtained on core 17 and through which detectable element 15 is detectable by sensor 16.

[0080] In particular, through hole 18 is obtained on an outer wall 17a of core 17 which is parallel to wall 13a when reel 12 is supported coaxially on shaft 13.

[0081] Hence, through hole 18 has a respective axis (not shown) transversal, in particular orthogonal, to axis B.

[0082] More specifically, according to this preferred

embodiment of the present invention, detectable element 15 is controllable in the first condition by covering through hole 18 with strip 10, and in the second condition by uncovering through hole 18 from strip 10 by progressively unwinding strip 10 off core 17.

[0083] According to a further aspect of the present invention, sensor 16 is configured to emit a detecting beam D along the axis of through hole 18 to reach and detect detectable element 15 in the second condition, when through hole 18 is uncovered from strip 10.

[0084] In particular, it is specified that detecting beam D is arranged along the axis of through hole 18 once per rotation of reel 12 about axis A.

[0085] In other words, in use through hole 18 is initially covered by the part of strip 10 which is wound around core 17. This configuration determines detectable element 15 to be in the first condition (Figure 6).

[0086] Sensor 16 emits detecting beam D, which is cyclically aligned with the axis of through hole 18. However, such detecting beam D does not reach detectable element 15, because detectable element 15 is (still) covered by strip 10.

[0087] As strip 10 is progressively unwound from reel 12, i.e. off core 17, at a predetermined length of strip 10 left on the core 17, through hole 18 is uncovered.

[0088] Advantageously, strip 10 is wound onto core 17 in such a way that through hole 18 is uncovered at a predetermined threshold remaining length of strip 10 onto the core 17 itself.

[0089] As soon as through hole 18 is uncovered, detecting beam D emitted by sensor 16 is free to reach detectable element 15 carried onto wall 13a of shaft 13.

[0090] In particular, detecting beam D reaches detectable element 15 cyclically, namely every time detecting beam D is aligned with the axis of the through hole 18, upon rotation of reel 12.

[0091] Detecting beam D is then reflected by the peculiar material of detectable element 15, thereby returning to sensor 16.

[0092] Consequently, sensor 16 produces or generates the detection signal and sends it to the control unit, which triggers the splicing of the two strips 10 to one another by splicing device 14.

[0093] In practice, according to an aspect of the present invention, core 17 is configured to support strip 10 in a winding manner such that strip 10 covers through hole 18 at said initial unwound state, and that strip 10 uncovers through hole 18 at said reel exhaustion state.

[0094] Thanks to the above configuration, a simple, precise and reliable detection of the end of strip 10, and its consequent splicing to the initial portion of the strip 10 of the other reel 12 can be performed.

[0095] Accordingly, apparatus 8 comprises:

- a pair of shafts 13, as already mentioned;
- a pair of detectable elements 15, each one arranged on the respective wall 13a; and
- a pair of sensors 16, each one associated with one respective shaft 13 for detecting the respective detectable element 15 thereby triggering, according to the above-described manner, the splicing of the two strips 10.

[0096] More precisely, each sensor 16 is advantageously arranged in a position adjacent to the respective shaft 13, and therefore to the respective reel 12 (as shown in Figure 4), so as to be able to detect the respective detectable element 15 once the respective through hole 18 has been uncovered by the respective strip 10 being unwound.

[0097] Advantageously, through hole 18 is arranged in a position adjacent to one of the flanges 19.

[0098] This is particularly advantageous, insofar as the axial ends of core 17 near flanges 19 are the parts of core 17 which are first (completely) uncovered from strip 10.

[0099] Conveniently, reel 12 comprises a pair of through holes 18 arranged on opposite axial sides of core 17, symmetrically with respect to a center plane of core 17 orthogonal to axis B thereof.

[0100] In particular, each through hole 18 is arranged adjacent to one respective flange 19.

[0101] In this way, apparatus 8 according to the invention can operate no matter of which of its axial sides reel 12 is loaded onto a respective shaft 13, thereby minimizing the possible errors by the user, and/or facilitating an automation of the loading operation.

[0102] According to alternative embodiment not shown, detectable element 15 is carried by the reel 12 at wall 17a of core 17, for being selectively covered or uncovered by strip 10 thereby passing from the first condition to the second condition.

[0103] In practice, according to this alternative embodiment, each reel 12 has one detectable element 15.

[0104] In light of the foregoing, it is clear how apparatus 8 according to the invention allows to implement a method for applying strip 10 onto web 3 of packaging material, the method comprising the steps of:

- unwinding a first strip 10 from a first reel 12;
- applying the unwound first strip 10 to web 3;
- splicing the first strip 10 to a second strip 10 initially wound on a second reel 12 upon exhaustion of the first reel 12;
- controlling detectable element 15 from an undetectable condition, in which it is covered by the first 10, to a detectable condition, in which it is uncovered from the first strip 10, by the step of unwinding;
- detecting detectable element 15 in the detectable condition;
- triggering the step of splicing based on the detection of detectable element 15.

[0105] It is further clear how the apparatus 8 according to the invention allows to implement a use of through hole 18 obtained on core 17 of reel 12 as a passage for de-

tecting beam D emitted by sensor 16 arranged on one side of through hole 18 for detecting detectable element 15 which is arranged on the other side of through hole 18.

[0106] The operation of apparatus 8 is described hereinafter starting from a condition in which one reel 12 is in exhaustion.

[0107] In this condition, the respective through hole 18 is uncovered from the relative strip 10, thereby causing detectable element 15 carried by the relative shaft 13 to be in the second condition, i.e. detectable.

[0108] Consequently, the relative sensor 16 detects detectable element 15 and sends the detection signal to the control unit, which triggers splicing device 14 for performing the splicing operation.

[0109] The above operation is repeated for each exhausting reel 12 and for each strip 10 to be spliced with another strip 10.

[0110] The advantages of apparatus 8 according to the present invention will be clear from the foregoing description.

[0111] In particular, a simple, precise and reliable detection of the end of strip 10, and its consequent splicing to the initial portion of the strip 10 of the other reel 12 can be performed.

[0112] More in particular, the Applicant has observed that the detection system and the splicing triggering system defined by the invention results in an improved splicing precision, especially in the case of a high-speed packaging assembly 1, and, most importantly, in a consistent reduction of unused strip 10.

[0113] In fact, the Applicant has noted that thanks to the presence of a detectable element 15 which is able to pass from a detectable condition based on the unwinding of strip 10, a reduction of the remaining length of strip 10 on the reel 12, once the splicing operation is completed, can be obtained. Hence, the overall waste of strip material is reduced.

[0114] Clearly, changes may be made to apparatus 8 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. Apparatus (8) for applying a sealing strip (10) onto a web (3) of packaging material for producing sealed packages (2) containing a pourable product, the apparatus (8) comprising:

   - a rotatable support shaft (13) configured to support a reel (12) onto which the strip (10) is initially wound, and to rotate the reel (12) for progressively unwinding the strip (10) therefrom;
   - an application device for applying the strip (10) unwound from the reel (12) onto the web (3);
   - a sensor (16) configured for detecting a detectable element (15) carried by one of said shaft (13) or reel (12) and for producing a correlated detection signal; and
   - a control unit configured to receive the detection signal from the sensor (16);

   wherein the detectable element (15) is controllable in a first condition, in which it is covered by the strip (10) and thereby undetectable by the sensor (16), and in a second condition, in which it is uncovered from the strip (10) and thereby detectable by the sensor (16) ;
   and wherein the control unit is configured to trigger a splicing operation of the strip (10) upon receiving the detection signal by the sensor (16).

2. Apparatus as claimed in claim 1, wherein the detectable element (15) is controllable from the first condition to the second condition by unwinding of the strip (10) from an initial unwound state of the strip (10), in which most of the strip (10) is wound onto the reel (12), to a reel exhaustion state, in which most of the strip (10) is unwound from the reel (12).

3. Apparatus as claimed in any of the foregoing claims, wherein the apparatus (8) comprises said reel (12) .

4. Apparatus as claimed in claim 3, wherein the shaft (13) has a rotation axis (A), the detectable element (15) being carried by the shaft (13) on an outer wall (13a) thereof;

   wherein the reel (12) comprises a central hollow core (17) having a longitudinal axis (B) defining an axis of rotation for the reel (12), the core (17) being configured to support the strip (10) for defining a winding thereof about the longitudinal axis (B), the shaft (13) coaxially engaging the core (17) to support the reel (12) on said outer wall (13a);
   and wherein the reel (12) has at least one through hole (18) obtained on the core (17) and through which the detectable element (15) is detectable by the sensor (16) .

5. Apparatus as claimed in claim 4, wherein the detectable element (15) is controllable in the first condition by covering the through hole (18) with the strip (10), and in the second condition by uncovering the through hole (18) from the strip (10) by progressively unwinding the strip (10) off the core (17) .

6. Apparatus as claimed in claim 4 or 5, wherein the through hole (18) has a respective axis transversal with respect to the longitudinal axis (B) of the core (17) ;
   and wherein the sensor (16) is configured to emit a

detecting beam (D) along the axis of the through hole (18) to reach and detect the detectable element (15) in the second condition, when the through hole (18) is uncovered from the strip (10).

7. Apparatus as claimed in any of claims 4 to 6, wherein the reel (12) comprises a pair of through holes (18) arranged on opposite axial sides of the core (17), symmetrically with respect to a center plane of the core (17) orthogonal to the longitudinal axis (B) thereof.

8. Apparatus as claimed in any of claims 4 to 7, wherein the reel (12) comprises a pair of flanges (19) extending radially from opposite axial ends of the core (17) ; and wherein said through hole (18) is arranged in a position adjacent to one of said flanges (19).

9. Apparatus as claimed in claim 3, wherein the shaft (13) has a rotation axis (A),

wherein the reel (12) comprises a central hollow core (17) having a longitudinal axis (B) defining an axis of rotation for the reel (12), the core (17) being configured to support the strip (10) for defining a winding thereof about the longitudinal axis (B), the shaft (13) coaxially engaging the core (17) to support the reel (12) on an outer wall (13a) of the shaft (13),
and wherein the detectable element (15) is carried by the reel (12) at an outer wall (17a) of the core (17), for being selectively covered or uncovered by the strip (10) thereby passing from the first condition to the second condition.

10. Apparatus as claimed in any of the foregoing claims, and comprising:

- a pair of said shafts (13), each one configured to support one respective reel (12) and to rotate such reel for unwinding a respective said strip (10) therefrom;
- a pair of said detectable elements (15);
- a splicing device (14) for splicing the strips (10) together; and
- a pair of said sensor (16), each one associated with one of said shafts (13) for detecting one respective detectable element (15) thereby triggering the splicing of the strips (10).

11. Packaging assembly (1) for forming and sealing a plurality of packages (2) containing a pourable product starting from a web (3) of packaging material, the packaging assembly (1) comprising:

- a folding device (6) for folding the web (3) into a tube (5);
- an apparatus (8) for applying a sealing strip (10) onto the web (3) as claimed in any of the foregoing claims;
- a sealing device for repeatedly sealing the tube (5) at successive transversal cross-sections thereof;
- a forming device for forming successive portions of the tube (5) to impart a predetermined shape thereon.

12. A reel (12) for supporting a sealing strip (10) adapted to be applied onto a web (3) of packaging material for producing sealed packages (2) containing a pourable product, the reel (12) comprising a central core (17) having a longitudinal axis (B) defining an axis of rotation for the reel (12), the core (17) being configured to support the strip (10) for defining a winding thereof about the longitudinal axis (B);

wherein the reel (12) has at least one through hole (18) obtained on the core (17), the through hole (18) having a respective axis transversal with respect to the longitudinal axis (B);
and wherein the core (17) is configured to support the strip (10) in a winding manner such that the strip (10) covers the through hole (18) at an initial unwound state of the strip (10), in which most of the strip (10) is wound onto the reel (12), and that the strip (10) uncovers the through hole (18) at a reel exhaustion state, in which most of the strip (10) is unwound from the reel (12).

13. A combination of the reel (12) according to claim 12 and a sealing strip (10) wound onto said core (17) .

14. Use of a through hole (18) obtained on a core (17) of a reel (12), the reel (12) being adapted to support a sealing strip (10) adapted to be applied onto a web (3) of packaging material for producing sealed packages (2) containing a pourable product, as a passage for a detecting beam (D) emitted by a sensor (16) arranged on one side of the through hole (18) for detecting a detectable element (15) arranged on the other side of the through hole (18).

15. Method for applying a sealing strip (10) onto a web (3) of packaging material for producing sealed packages (2) containing a pourable product, the method comprising the steps of:

- unwinding a first strip (10) from a first reel (12) ;
- applying the unwound first strip (10) to the web (3) ;
- splicing the first strip (10) to a second strip (10) initially wound on a second reel (12) upon exhaustion of the first reel (12);
- controlling a detectable element (15) from an undetectable condition, in which it is covered by the first strip (10), to a detectable condition, in

which it is uncovered from the first strip (10), by the step of unwinding;
- detecting the detectable element (15) in the detectable condition;
- triggering the step of splicing based on the detection of the detectable element (15).

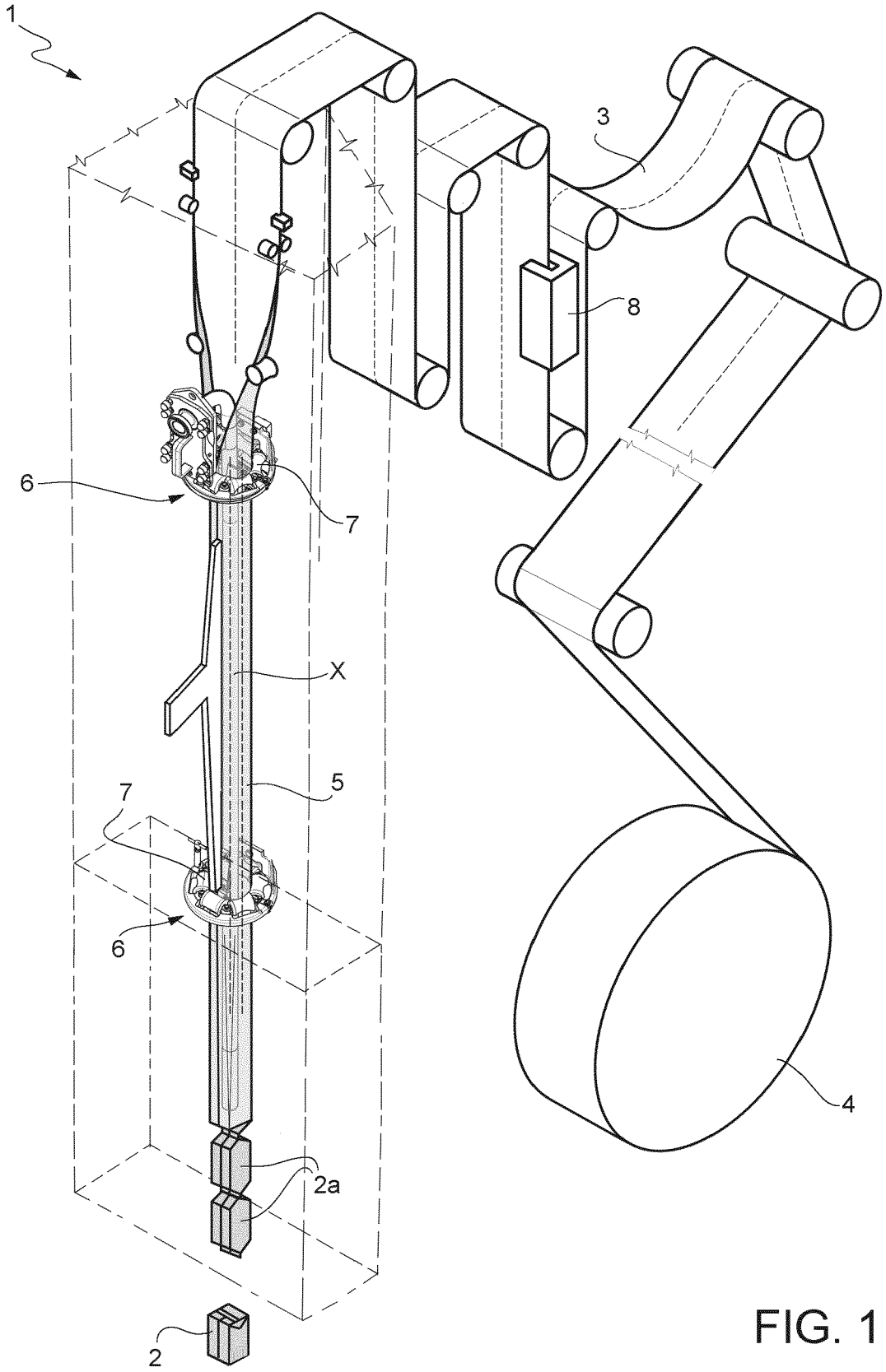


FIG. 1

FIG. 2

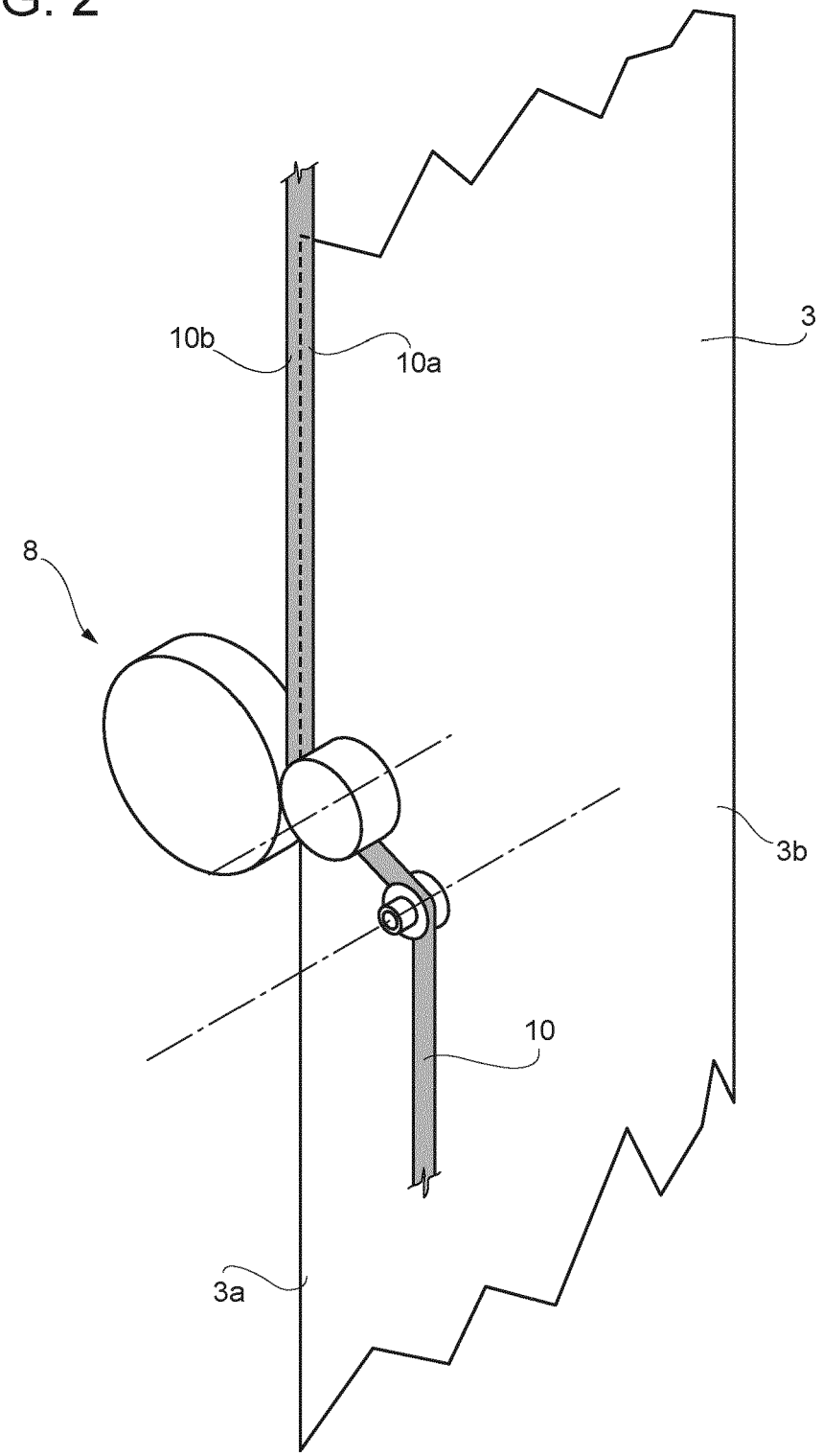
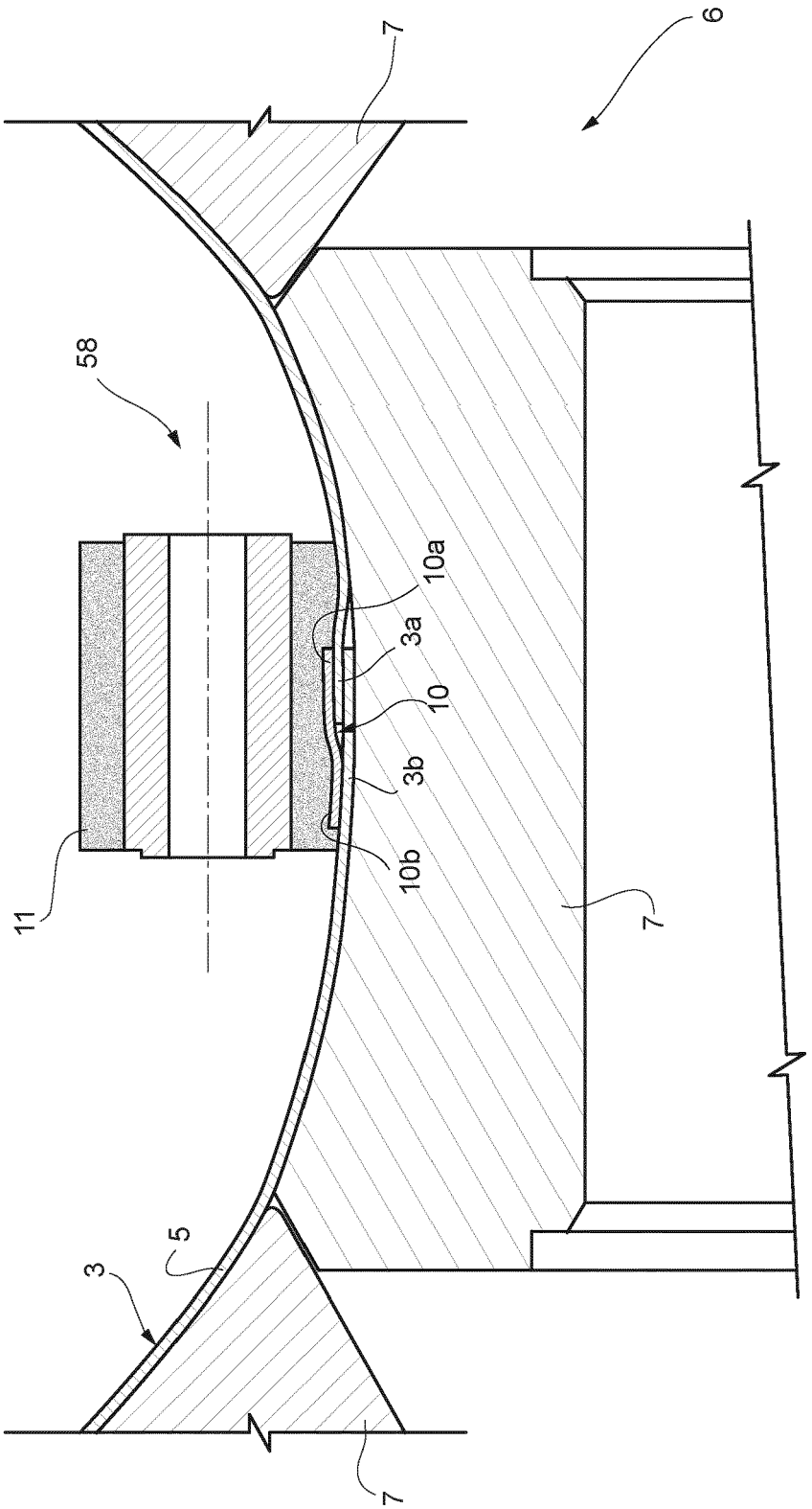


FIG. 3



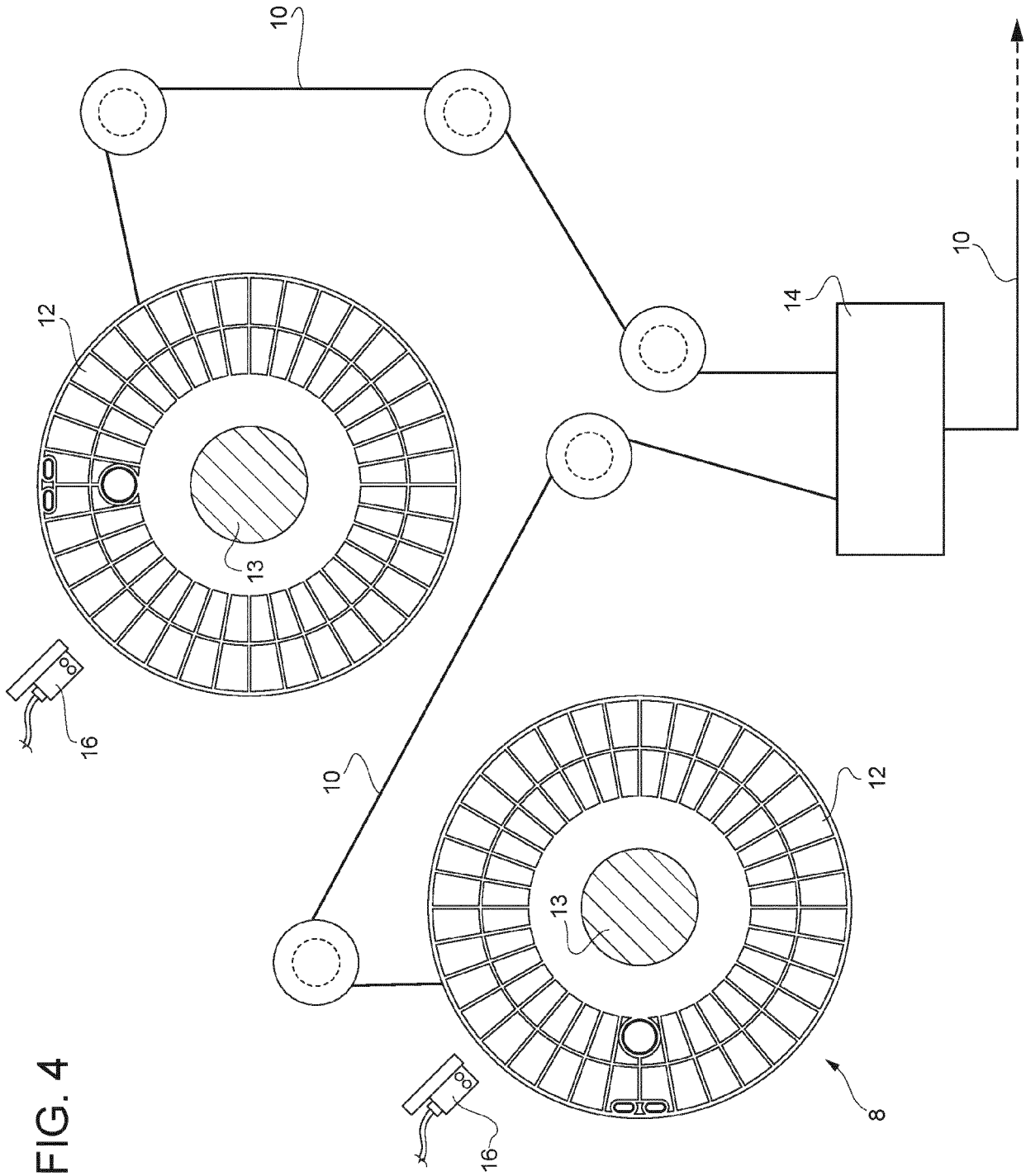


FIG. 4

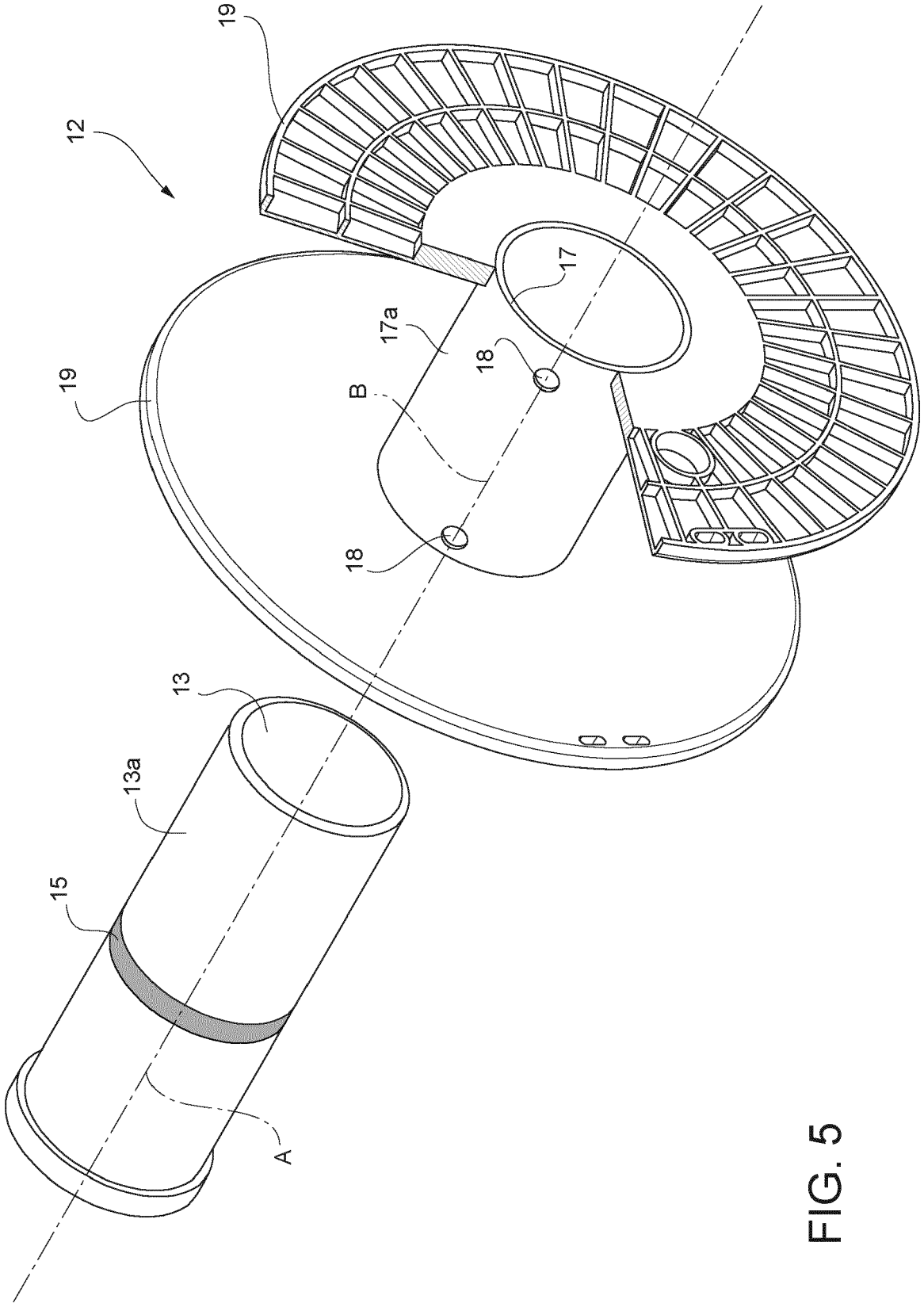


FIG. 5

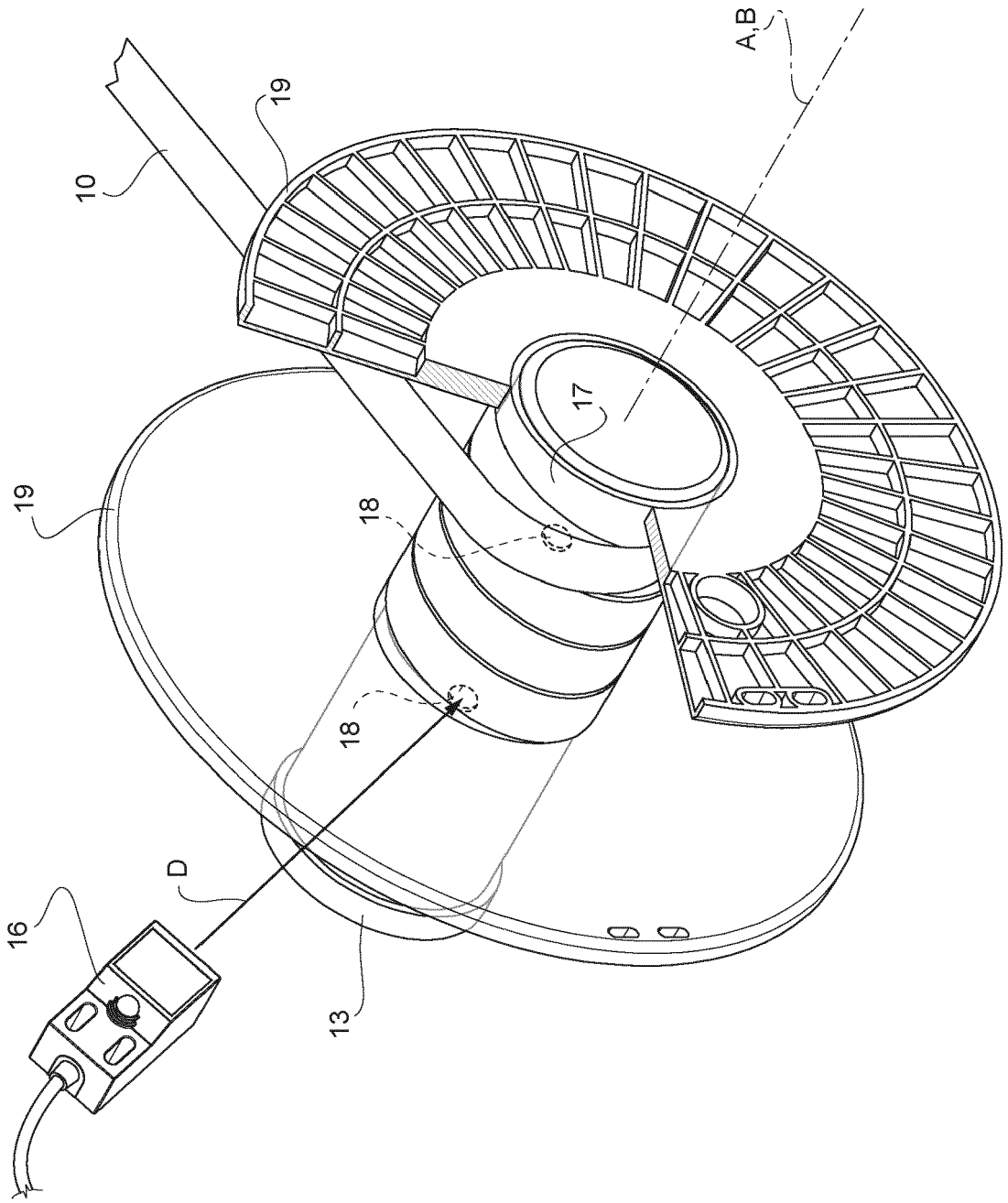


FIG. 6

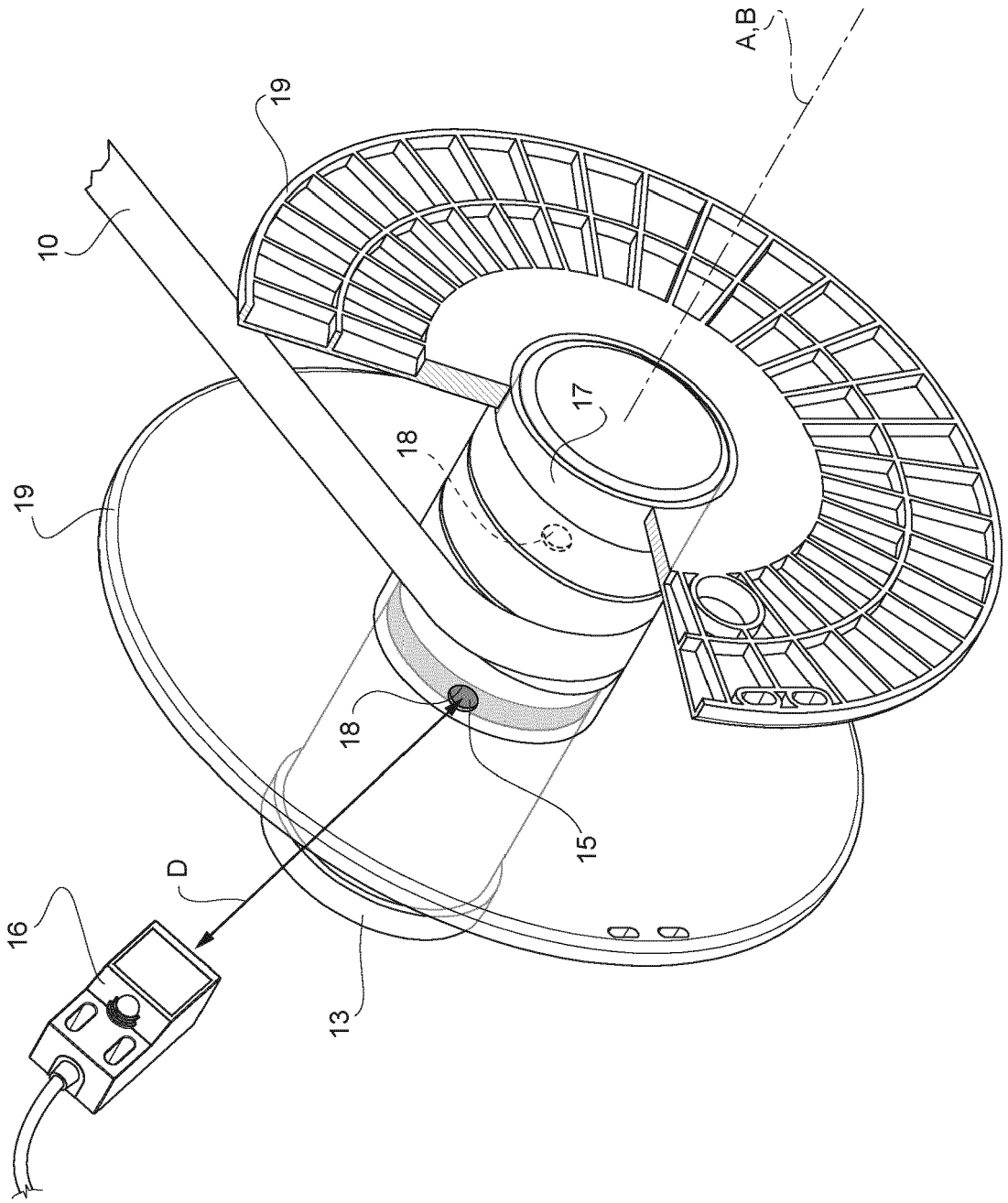


FIG. 7

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EUROPEAN SEARCH REPORT

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Place of search	Date of completion of the search	Examiner
The Hague	20 June 2023	Haaken, Willy

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