(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
14 March 2019 (14.03.2019)

WIPO | PCT

(10) International Publication Number
WO 2019/048043 A1

(51) International Patent Classification:
B65H 21/02 (2006.01) *B65H 16/02* (2006.01)
B65H 19/18 (2006.01)

(21) International Application Number:
PCT/EP2017/072448

(22) International Filing Date:
07 September 2017 (07.09.2017)

(25) Filing Language: English

(26) Publication Language: English

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DJ, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JO, JP, KE, KG, KH, KN, KP, KR, KW, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA,

(54) Title: METHOD AND APPARATUS FOR SPLICING WEBS

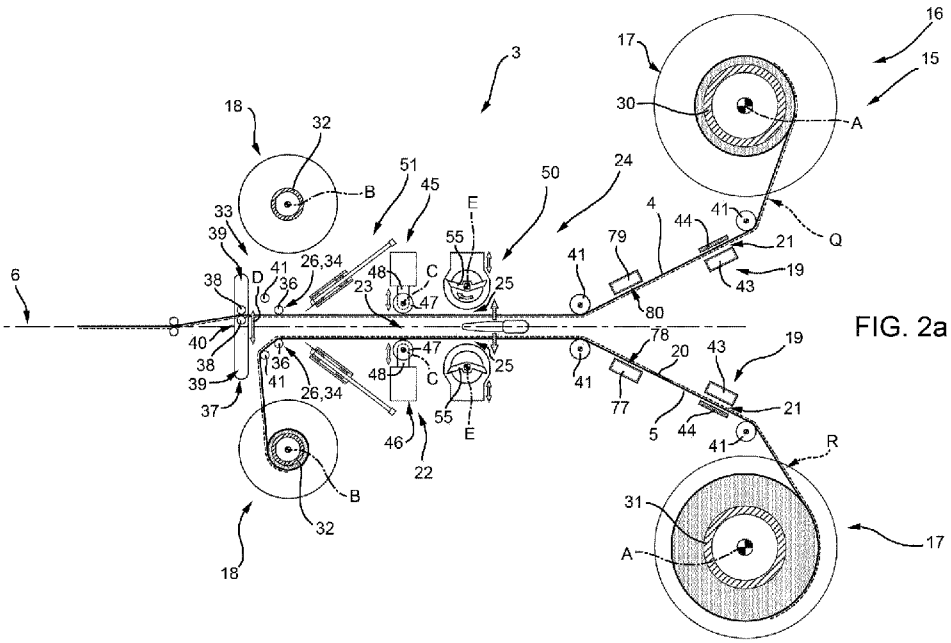

FIG. 2a

(57) Abstract: There is described a method of splicing a new web (5, 4, 90, 89) to a web in use (4, 5, 89, 90) comprising an advancement phase during which the web in use (4, 5, 89, 90) is advanced at a working advancement speed along a working advancement path (Q), an acceleration and advancement phase during which the new web (5, 4, 90, 89) is accelerated to a splicing advancement speed being substantially equal to the working advancement speed for advancing the new web (5, 4, 90, 89) along an auxiliary advancement path (R) distinct from the working advancement path (Q), a bonding phase during which the web in use (4, 5, 89, 90) and the new web (4, 5, 89, 90) are bonded to one another, a first cutting phase during which the web in use (4, 5, 89, 90) is cut at a first cutting station (25), a second cutting phase during which the new web (5, 4, 90, 89) of labeling material is cut at a second cutting station (26) downstream of the bonding station (23) along the auxiliary advancement path (R).

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SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) **Designated States** *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:

— *of inventorship (Rule 4.17(iv))*

Published:

— *with international search report (Art. 21(3))*

METHOD AND APPARATUS FOR SPLICING WEBS

TECHNICAL FIELD

The present invention relates to a method for splicing webs, in particular webs of labeling material. In particular, the present invention relates to a method for splicing a web in use with a new web without reducing the advancement speed of the web in use.

Furthermore, the present invention relates to an apparatus for splicing webs, in particular webs of labeling material. In particular, the present invention relates to an apparatus for splicing a web in use with a new web without reducing the advancement speed of the web in use.

BACKGROUND ART

It is known in the art, that there are different types of labeling machines for applying label sheets onto receptacles, such as bottles, containers or the like.

Furthermore, it is known that there are different kinds of label types.

One typical label type is the so called "self-stick label", which is directly wrapped around at least part of the respective receptacle and glued thereto. The application of this kind of label typically relies on advancing a web of labeling material towards a cutting station at which the single labels are obtained from the web of labeling material by cutting the web of labeling material at the cutting station. These labels are often also referred to as roll-fed-labels.

Another typical label type, used with in particular

beverage bottles or vessels, is the label commonly known as "sleeve label", which is formed in a tubular configuration and then applied onto the respective article. The "sleeve label" is obtained from cutting a web of labeling material at a respective cutting station. Finally, after application of the "sleeve label" a heat shrinking operation is carried out to make the labels adhere onto the respective receptacles.

A further typical label type, are the "pressure-sensitive labels" (PLS), which are removably attached on a base web and which are detached from the base web prior to being applied onto the respective receptacles.

Typically, independently of the label type, a labeling machine comprises a labeling apparatus adapted to receive the web of labeling material, adapted to obtain single label sheets from the web of labeling material and adapted to apply the single label sheets onto the receptacles and a web conveying apparatus for providing for and for conveying the web of labeling material to the labeling apparatus.

A typical web conveying apparatus comprises a first reel unit for containing a first reel of wound-up web of labeling material and a conveying device for conveying the web of labeling material along a web advancement path from the first reel to labeling apparatus. In other word, the conveying device is adapted to convey a web in use to the labeling apparatus.

During a typical labeling process the quantity of web of labeling material wound-up onto the first reel is sufficient for labeling receptacles for about 20 to 30 minutes. This is, why typically, a web conveying apparatus

also comprises a second reel unit for containing a second reel of wound-up web of labeling material and a splicing unit for splicing the web of labeling material in use (the web of labeling material from the first reel) with a new web of labeling material (the web of labeling material from the second reel).

A typical splicing unit comprises a cutting assembly for cutting the web in use at a cutting station and a bonding assembly for bonding the new web of labeling material and the web of labeling material in use with one another at a bonding station. The bonding station being arranged downstream from the cutting station along the web advancement path.

The bonding assembly comprises e.g. two pad elements one adapted to interact with the web in use and the other one adapted to interact with the new web. As well, each pad element is fluidically connected to an aspiration source. Furthermore, the pad elements are adapted to linearly move from a rest position to an operative position for bringing the web of labeling material in use and the new web of labeling material into contact with one another.

In use, prior to the actual bonding operation an operator fixes a bi-adhesive tape onto the trailing edge of the new web of labeling material and places the trailing edge of the new web onto the respective pad element, which retains the new web of labeling material in the area of the trailing edge by means of aspiration. Then, by moving simultaneously the two pad elements from the respective rest position to the respective operative position, the web in use and the new web are bonded to

one another by means of the bi-adhesive tape. After the bonding, the web in use is cut at the cutting station and the new web is advanced to the labeling apparatus (the new web becomes the web in use).

A drawback of such a splicing unit is that the manual placing of the new web onto the respective pad element is prone to errors. In particular, it must be considered that both the web in use and the new web carry a repeated pattern and the placing of the bi-adhesive tape and the new web on the respective pad element must be such that after the bonding of the web in use and the new web, the respective patterns correspond to one another in order to avoid any further problems for the labeling process.

A further drawback is that frequent interventions by a trained operator are required for guaranteeing a continuous labeling process over a couple of hours. This also means that the operator removes the reel, which carried the former web in use and to place a new reel carrying a new wound-up web of labeling material.

An even further drawback is that it is required to slow down the advancement of the web in use (and therewith the labeling process) for executing the bonding of the web in use and the new web with one another.

The slowing down is undesired as the overall production time increases.

This becomes even more critical with respect to the new compact receptacle processing machines, which have become popular in the recent years. Typically, such machines comprise a blow molding apparatus for producing the receptacles, a filling apparatus for filling the receptacles, a labeling apparatus for labeling the

receptacles and a capping apparatus for closing the receptacles, all of which operating at the same processing speed (they are in a blocked configuration).

The latter drawback has been intended to be circumvented by providing for that the pad elements are adapted to rotate around a respective rotation axis so that, in use, the pad elements perform an arc-shaped movement when getting into contact with the web in use and the new web during the bonding.

Even though such an approach allows higher web advancement speeds during web splicing, there is the need to achieve even higher web advancement speeds.

DISCLOSURE OF INVENTION

It is therefore an object of the present invention to provide a method to overcome, in a straightforward and low-cost manner, at least one of the aforementioned drawbacks.

It is also an object of the present invention to provide an apparatus to overcome, in a straightforward and low-cost manner, at least one of the aforementioned drawbacks.

According to the present invention, there is provided a method as claimed in claim 1. According to the present invention, there is provided an apparatus according to claim 14.

According to another aspect of the present invention, there is provided an apparatus as claimed in claim 29.

Preferred embodiments of the present invention are claim in the respective dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

Three 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 schematic top view of a labeling machine having a web advancement and splicing apparatus according to a first embodiment and according to the present invention, with parts removed for clarity;

Figure 2a to 2e is a schematic view of the web advancement and splicing apparatus of Figure 1 during differing operational phases, with parts removed for clarity;

Figure 3 is a perspective view of a detail of the web advancement and splicing apparatus of Figure 1 and Figures 2a to 2e, with parts removed for clarity;

Figure 4 is a perspective view of a further detail of the web advancement and splicing apparatus of Figure 1 and Figures 2a to 2e, with parts removed for clarity;

Figures 5a and 5b are a perspective view of a second embodiment of a web advancement and splicing apparatus according to the present invention, with parts removed for clarity;

Figure 6 is a perspective view of a labeling machine having a web advancement and splicing apparatus according to another embodiment of the present invention, with parts removed for clarity.

BEST MODES FOR CARRYING OUT THE INVENTION

Number 1 in Figure 1 indicates as a whole a labeling machine adapted to apply label sheets onto receptacles 2 advancing along an advancement path P.

The labeling machine 1 comprises:

- a web conveying and splicing apparatus 3 adapted to convey a web of labeling material 4 or a web of labeling

material 5 to a delivery station 6 and being adapted to splice, in particular in the case of exhaustion of respectively web 4 or web 5, web 5 to web 4 or web 4 to web 5;

- a labeling apparatus 7 adapted to receive web 4 or web 5 at delivery station 6 and adapted to obtain single label sheets from web 4 or web 5 and for applying, in use, the single label sheets onto receptacles 2 during their advancement along path P.

In the present case, web 4 and web 5 each comprises a repeated pattern (not shown), in particular the repeated pattern defining the single label sheets obtainable from respectively web 4 and web 5. More specifically, web 4 and web 5 are provided with the same repeated pattern. In other words, web 4 and web 5 allow for application of the same label sheets onto receptacles 2.

Furthermore, in the present description, web 4 and web 5 are of the type for providing for label sheets of the self-stick type, which become applied to receptacles 2 by means of an adhesive applied directly onto the label sheets and/or onto receptacles 2.

However, it must be understood that the description will refer to this kind of web without any limitative scope. It must be further understood, that the present invention can be executed also with any other kind of web, in particular any kind of web of labeling material, such as e.g. a web of labeling material having a base layer and a plurality of label sheets removably attached to the base layer (commonly known as "pressure-sensitive labels") or with a web of labeling material being of a heat-shrinkable material (for "sleeve lables").

In more detail, labeling apparatus 7 comprises:

- a conveyor device, in particular a conveying carousel 8 adapted to advance receptacles 2 along path P, in particular path P being arc-shaped;
- a cutting unit 9 for cutting the label sheets from web 4 or web 5; and
- a transfer device 10 adapted to transfer the label sheets to a label application station at which the label sheets are applied onto respective receptacles 2; and
- a glue application unit 11 adapted to apply a pattern of glue onto the backside of the label sheets and/or onto the outer surface of receptacles 2 prior to the application of the label sheets onto the receptacles 2.

With particular reference to Figures 2a to 2e, web conveying and splicing apparatus 3 is adapted to splice a web in use and a new web to one another. In the particular example shown in Figures 2a to 2e, web 4 is the web in use and web 5 is the new web. However, it must be understood that after any splicing process the new web becomes the web in use, as specifically shown in Figure 2e.

In the following, we refer for reasons of simplicity to web in use 4 and new web 5. However, it must be considered that the description also refers to web 5 being the web in use and web 4 being the new web.

In more detail, web conveying and splicing apparatus 3 comprises:

- a web magazine unit 15 for providing for web in use 4 and new web 5;
- an advancement device 16 adapted to at least

continuously advance the web in use 4 at a working advancement speed along a working advancement path Q from a respective storing station 17 to delivery station 6 and being adapted to advance new web 5 along an auxiliary path R, in particular from the respective storing station 17 to a collection station 18; and

- an application device 19 adapted to apply a bonding element 20, in particular a bi-adhesive tape, onto (a segment of) new web 5 at an application station 21, in particular application station 21 being interposed between the respective storing station 17 and collection station 18 along path R;

- a bonding device 22 adapted to adhesively bond web in use 4 together with new web 5 at a bonding station 23 by attaching bonding element 20 also to (a segment of) web in use 4, in particular bonding station 23 being arranged between station 17 and respectively station 6 and station 18 along respectively path Q and path R, even more particular station 23 is positioned downstream of application station 21 along path R;

and

- a cutting device 24 adapted to cut web in use 4 at a first cutting station 25, in particular cutting station 25 being arranged upstream of bonding station 23 along path Q; and being adapted to cut new web 5 at a second cutting station 26, in particular second cutting station 26 being positioned downstream of bonding station 23 along path R and/or path Q.

Preferentially, apparatus 3 also comprises a control unit 27 adapted to control at least operation of apparatus 3 itself.

In particular, control unit 27 is at least adapted to detect the respective pattern and/or a respective mark

provided on web in use 4 and new web 5. Furthermore, control unit 27 is adapted to detect bonding element 20 applied to new web 5. As will be explained in more detail further below, control unit 27 is also adapted to activate bonding device 22 in function of an analysis on whether a possible activation of bonding device 22 leads to a correct or incorrect bonding of new web 5 with web in use 4.

With particular reference to Figures 2a to 2e, web magazine unit 15 is adapted to removably receive a first reel 30 carrying wound-up web 4 and a second reel 31 carrying wound-up web 5. In particular, unit 15 is adapted to receive and to house reel 30 and reel 31 at the respective station 17 and such that reel 30 and reel 31 are rotatable around respective central axes A, in particular axes A having a vertical orientation.

With particular reference to Figures 2a to 2e, advancement device 16 is configured such that path R is distinct from path Q, in particular prior to bonding new web 5 with web in use 4. In other words, path R and path Q are distinct from one another, in particular prior to activation of bonding device 22.

Preferably, path R and path Q are parallel to each other at least in the area of bonding station 23.

Preferentially, advancement device 16 is adapted to advance web in use 4 at a working advancement speed of 20 to 320 meters per minute, in particular of 60 to 280 meters per minute.

Advancement device 16 is furthermore adapted to accelerate, in use, new web 5 to a splicing advancement speed equal to the working advancement speed of web in use 4. In particular, device 16 is adapted to accelerate, in use, new web 5 to the splicing advancement speed equal

to the working advancement speed from a resting position of new web 5 as will be described in more detail further below. Even more particular, device 16 is adapted to accelerate, in use, new web 5 to the advancement speed equal to the working advancement speed so that, in use, during activation of bonding device 22 web in use 4 and new web 5 advance at the same speed, in particular at the same speed and the same pitch, along respectively path Q and path R.

Preferably, advancement device 16 is also configured to advance web in use 4 and new web 5 at the same pitch (i.e. once new web 5 and web in use 4 are bonded to one another, the patterns provided on web in use 4 and new web 5 overlap one another).

Preferentially, advancement device 16 is also configured such that prior or during acceleration of new web 5 to the respective advancement speed the working advancement speed of web in use 4 is (substantially) not altered. In particular, by accelerating, in use, new web 5 to the splicing advancement speed equal to the unaltered working advancement speed it is possible to splice, in use, new web 5 to web in use 4 without influencing operation of labeling apparatus 7.

In further detail, advancement device 16 comprises at least a first drive unit, in particular an electrical motor (not shown) and at least a second drive unit, in particular an electrical motor (not shown), each one adapted to actuate rotation of respectively reel 30 and reel 31 around the respective axis A.

Furthermore, device 16 comprises at least one collection device arranged at station 18 and being adapted to advance new web 5, in particular in collaboration with unit 15, along path R and to collect new web 5.

In particular, the collection device comprises a wind-up roller 32 arranged at station 18 and being rotatable around a central axis B. The collection device also comprises at least one drive assembly, in particular an electrical motor (not shown), adapted to actuate rotation of roller 32 around axis B.

More specifically roller 32 is adapted to receive a new web 5, in particular a leading edge of new web 5. Roller 32 is also adapted to, in use, wind-up new web 5 with new web 5 advancing along path R.

In particular, new web 5 extends from reel 30 positioned at the respective station 17 to roller 32. In other words, reel 31 positioned at the respective station 17 and roller 32 at least partially define in collaboration path R.

Preferably, the drive assembly and the second drive unit are adapted to control and/or actuate advancement of new web 5 along path R, in particular by simultaneously actuating rotation of respectively roller 32 around axis B and reel 31 around axis A.

Preferentially, advancement device 16 also comprises a deflection assembly 33 adapted to deviate/deflect web in use 4 at a deflection station 34 downstream of bonding station 23 along path Q.

In particular, deflection assembly 33 is adapted to deviate/deflect, in use, in particular prior to activation of cutting device 24 cutting new web 5 at station 26, web in use 4 so as to define a main portion Q1 of path Q and an auxiliary portion Q2 of path Q downstream of portion Q1 along path Q. Even more particular, portion Q2 and portion Q1 define an obtuse angle 35.

In further detail, deflection assembly 33 comprises a deflection roller 36, in particular being rotatably,

arranged at station 34; a control group 37, in particular a pair of deflection rollers 38; and an actuation group (not shown) adapted to move control group 37, in particular the pair of guide rollers 38 into a direction D. Preferably, direction D being transversal to axes A (and to axes B); and direction D being also transversal to web in use 4. In other words, direction D is also transversal to the direction of advancement of web in use 4.

More specifically, the actuation group is adapted to control control group 37, in particular the pair of deflection rollers 38 between at least two lateral positions 39 and at least a central position 40.

In other words, deflection assembly 33, in particular the actuation group, is adapted to at least partially define path Q, in particular to define portion Q2, by defining the exact position of control group 37.

In further detail, advancement device 16 also comprises a plurality of auxiliary rollers 41 interposed between stations 17 and respectively station 6 and station 18 along respectively path Q and path R.

With particular reference to Figures 2a to 2e, application device 19 is configured to apply the respective bonding element 20 onto new web 5 with new web 5 being at rest (i.e. new web 5 is not advanced along path R, but extends between the respective station 17 and station 18).

In more detail, application device 19 comprises a deposition assembly 43 containing or adapted to receive at least one, preferably a plurality, of bonding elements 20 and being adapted to place at least one bonding element 20 onto new web 5. In particular, deposition assembly 43 is adapted to be controlled between a rest configuration

at which deposition assembly 43 is idle (on rest) and an operative configuration at which deposition assembly 43 is designed to place the respective bonding element 20 onto new web 5.

Preferentially, application device 19 also comprises a counter surface 44 adapted to cooperate with deposition assembly 43 for securely applying the respective bonding element 20 onto new web 5. In particular, counter surface 44 and deposition assembly 43 are arranged such that new web 5 is interposed between counter surface 44 and deposition assembly 43. Furthermore, deposition assembly 43 when being in the operative configuration is adapted to apply bonding element 20 to new web 5 and to exert a force towards counter surface 44 so as to bring new web 5 into contact with counter surface 44.

With particular reference to Figures 2a to 2e, bonding device 22 comprises at least a first interaction assembly 45 adapted to interact with web in use 4 and at least a second interaction assembly 46 adapted to interact with new web 5.

More specifically, interaction assembly 45 and interaction assembly 46 are adapted to approach in collaboration with one another web in use 4 and new web 5 towards one another at station 23 and to sandwich web in use 4, bonding element 20 and new web 5 in between themselves for adhesively coupling web in use 4 and new web 5 to one another.

Even more specifically, interaction assembly 46 is adapted to move new web 5 towards web in use 4 and interaction assembly 45 is adapted to at least contact web in use 4 and, preferably, to also move web in use 4 towards new web 5, in particular for coupling, in use, bonding element 20 also to web in use 4.

In further detail, interaction assembly 45 and interaction assembly 46 each comprise a respective interaction roller 47 rotatable around a respective central axis C and a respective actuation group 48 adapted to move the respective interaction roller 47 to or away from bonding station 23, in particular for moving respectively web in use 4 and new web 5 towards bonding station 23.

Preferably, interaction assembly 45 and interaction assembly 46 each comprise a respective driving assembly configured to rotate the respective interaction roller 47 around the respective axis C, in particular such that the surface speed of the respective interaction roller 47 (substantially) equals the working advancement speed of web in use 4 (and the advancement speed of new web 5).

With particular reference to Figures 2a to 2e, 3 and 4; cutting device 24 comprises:

- a first cutting assembly 50 adapted to cut web in use 4 at cutting station 25; and
- a second cutting assembly 51 adapted to cut new web 5 at cutting station 26.

In more detail, with particular reference to Figure 3, cutting assembly 50 comprises:

- at least one carrier structure 55 rotatable around a rotation axis E;
- at least one blade element 56 connected to carrier structure 55 and extending at least partially parallel to axis E; and
- a respective actuation group (not shown) adapted to actuate rotation of carrier structure 55 around axis E so as to actuate rotation of blade element 56 around axis E.

In further detail, actuation group is adapted to accelerate blade element 56 to a speed (substantially) equal to the working advancement speed, in particular so that blade element 56 cuts web in use 4 when advancing at a speed substantially identical to the working advancement speed of web in use 4. In this way, unwanted forces possibly acting on web in use 4 during the cutting are significantly reduced.

Preferentially, cutting assembly 50 also comprises a counter surface element 57, in use, arranged in the area of cutting station 25 and adapted to cooperate with blade element 56 for cutting, in use, web in use 4 at cutting station 25.

In more detail, carrier structure 55 comprises a rotatable shaft portion 58 being coaxially arranged to axis E and being coupled to the actuation group of assembly 24; and

- at least one wing portion 59 carrying blade element 56 and being connected to and protruding radial away from shaft portion 58 (i.e. wing portion 56 protrudes away from axis E).

Preferentially, carrier structure 55 also comprises a further wing portion 60 connected to shaft portion 58 and protruding away from shaft portion 58. In particular, wing portion 60 is similar to wing portion 59 and is designed such to guarantee that the center of gravity of carrier structure 55 is substantially positioned along axis E.

In more detail, blade element 56 comprises a plurality of jaws 61 defining a jaw-like structure of blade element 53.

In further detail, counter surface element 57 comprises a plurality of grooves 62 adapted to cooperate with jaws 61. In particular, grooves 62 are complementary to jaws 61. In other words, grooves 61 define a grooved structure of surface element 57 complementary to the jaw-like structure of blade element 56. Thus, in use, when blade element 56 cuts web in use 4 each jaw 61 at least partially enters one respective groove 62.

Preferentially, cutting assembly 50 also comprises a displacement assembly (not shown) adapted to move carrier structure 55 to or away from cutting station 25 for moving carrier structure 55 between a base position and a cutting position. In particular, the displacement assembly of cutting assembly 50 is adapted to move, in use, carrier structure 55 into a direction transversal, even more particular perpendicular, to web in use 4.

In more detail, control unit 27 is adapted to control cutting assembly 50 at least into an active configuration, at which cutting assembly 50 is configured to cut web in use 4, or into an inactive configuration, at which cutting assembly 50 is detached from cutting station 25 (i.e. blade 56 is, in use, spaced apparat from web in use 4, so as not to cut web in use 4) by controlling the displacement assembly cutting assembly 50. In particular, cutting assembly 50 is controlled into its active configuration with carrier structure 55 being positioned at the cutting position; and cutting assembly 50 being controlled into its inactive configuration with carrier structure 55 being positioned at the base position.

Preferably, cutting assembly 50 also comprises a positioning assembly (not shown) adapted to move counter

surface element 57 to or away from cutting station 25, in particular into a direction transversal, even more particular perpendicular, to web in use 4. In other words, positioning assembly 64 is adapted to move counter surface element 57 to or away from web in use 4. In particular, the positioning assembly is activated for defining the (correct) relative position between counter surface element 57 and blade element 56, in particular so that, in use, each jaw 61 penetrates into one respective groove 62 during the cutting of web in use 4.

Preferentially, control unit 27 is adapted to set cutting assembly 50 into at least a first operation mode and into a second operation mode.

In a first operation mode, control unit 27 is configured to control cutting assembly 50 into the inactive configuration prior to activation of cutting assembly 50 and into an intermediate configuration prior to controlling cutting assembly 50 into the active configuration. When cutting assembly 50 is controlled into the intermediate configuration, the actuation assembly of cutting assembly 50 is activated for rotating blade element 56 around axis E and blade element 56 is still distanced from web in use 4. In other words, blade element 56 rotates, but does not cut web in use 4. This allows, in use, to accelerate blade element 56 to the respective advancement speed being at least equal to the working advancement speed while allowing for continuously rotating blade element 56 around axis E.

In more detail, in the first operation mode, cutting assembly 50 is controlled such that prior to the cutting carrier structure 55 is moved to the base position, the

actuation assembly actuates rotation of carrier structure 55, in particular so that the advancement speed of blade 56 substantially equals the working advancement speed, and then carrier structure 55 is moved to the cutting position so that blade 56 cuts web in use 4.

In the second operation mode, control unit 27 is configured to control cutting assembly 50 such that prior to activation of rotation of blade element 56 (and of carrier structure 55), carrier structure 55 is arranged at the cutting position. Then, control unit 27 controls the actuation assembly to actuate rotation of blade element 56 around axis E. In particular, when carrier structure 55 is arranged at the cutting position, blade element 56 is arranged at an axial position (at a rest position), which allows to accelerate blade element 56 to the advancement speed substantially equal to the working advancement speed.

Preferably, control unit 27 is also configured such that after cutting web in use 4 at cutting station 25 (both in the first operation mode and the second operation mode; i.e. independent of the operation mode) blade element 56 is decelerated, in particular blade element 56 is set to rest, even more preferably blade element 56 is decelerated by reducing the rotation speed of blade element 56 around axis E until the complete interruption of rotation of blade element 56 around axis E.

With particular reference to Figures 2c, 2d and 4, cutting assembly 51 is configured such to cut new web 5 in the area of, in particular at, deflection station 34. In other words, cutting station 26 is arranged in the area of deflection station 34, in particular cutting station

26 and deflection station 34 are substantially identical.

It must be noted, that, in use, (shortly) prior to cutting assembly 51 cutting new web 5 at cutting station 26, new web 5 being spliced to web in use 4 at bonding station 23 comprises a main web portion 67, in particular extending from bonding station 23 (main web portion 67 being substantially parallel to web in use 4), and an auxiliary web portion 68, which is transversally oriented with respect to web in use 4.

In particular, auxiliary web portion 68 extends from main web portion 67 to collection station 18. Even more particular, in use, at the moment of cutting assembly 51 cutting new web 5 at cutting station 26, auxiliary web portion 68 extends from cutting station 26 to collection station 18 and main web portion 67 extends between bonding station 23 and cutting station 26.

In other words, main web portion 67 and auxiliary web portion 68 define a respective angle and the respective vertex is positioned at station 26.

It must be further noted, that as a result of the splicing of web in use 4 and new web 5, path R of new 5 is dynamic (i.e. path R varies due to the advancement of web in use 4 along path Q, the coupling of new web 5 to web in use 4 and to the collection device, in particular to roller 32.

In more detail, cutting assembly 51 comprises:

- at least one blade member 69 adapted to cut new web 5 at cutting station 26; and

- an acceleration assembly 70 adapted to accelerate blade member 69 from a rest position towards and through cutting station 26 for cutting new web 5.

In particular, acceleration assembly 70 is adapted to accelerate blade member 69 such that blade member 69

cuts, in use, new web 5 tangential to deflection roller 36 at deflection station 34 and/or cutting station 26.

Even more particular, acceleration assembly 70 is configured such that the advancement speed of blade member 69 is larger than the advancement speed of new web 5 at the moment of cutting new web 5. Preferably, acceleration assembly 70 is also adapted to decelerate blade member 69 after cutting of new web 5.

In even more detail, acceleration assembly 70 comprises:

- a linear motor 71 adapted to accelerate and advance blade member 69 along a rectilinear path S; and

- a support structure 72, in particular having an L-like shape, coupled to linear motor 71 and carrying blade member 69.

In particular, linear motor 71 is adapted to accelerate and to advance support structure 72 for accelerating and advancing blade member 69.

Preferably, support structure 72 comprises a longitudinal main portion 73 extending parallel to a main body 74 of linear motor 71; and a transversal portion 75 transversally arranged to main portion 73 and carrying blade member 69.

Furthermore, control unit 27 comprises at least a first detection sensor 77 adapted to detect a pattern and/or a mark provided on new web 5 at a detection station 78 upstream of bonding station 23 along path R.

Preferentially, control unit 27 also comprises at least a second detection sensor 79 adapted to detect a pattern and/or a mark provided on web in use at a detection station 80 upstream of bonding station 23 along path Q.

In further detail, detection sensor 77 is also adapted to detect bonding element 20 applied onto new web

5.

Preferentially, control unit 27 is adapted to calculate and/or to predict:

- based on the pattern and/or mark detected by detection sensor 77 and the bonding element 20 detected by detection sensor 77, in particular the relative position of bonding element 20 with respect to the pattern and/or the mark;

- the working advancement speed of web in use 4; and

- the advancement speed of new web 5;

whether activation of bonding device 22 would result in a correct or incorrect splicing of new web 5 and web in use 4.

It must be noted that preferably a correct splicing is a splicing of new web 5 and web in use 4 so that the respective patterns of web in use 4 and new web 5 correctly or incorrectly overlap. The correct overlap is when the respective patterns substantially match each other and the incorrect overlap is when the patterns do not match each other. In other words, web in use 4 and new web 5 have the same pitch.

Control unit 27 is also adapted to calculate and/or to predict the correct or incorrect splicing based on the pattern and/or mark detected, in use, by detection sensor 79.

Furthermore, control unit 27 is adapted to activate bonding device 22 for splicing web in use 4 and new web 5 with one another in case of calculating and/or to predicting a correct splicing and it is adapted not to activate bonding device 22 in the case of calculating and/or to predicting an incorrect splicing. In this way, it is ensured that, in use, no erroneous splicing occurs.

Preferentially, control unit 27 is also adapted not

to activate cutting device 24, in particular cutting assembly 50 and cutting assembly 51, in the case of control unit 27 calculating and/or to predicting, in use, an incorrect splicing.

In use, machine 1 applies label sheets onto receptacles 2 advancing along path P. In particular, apparatus 7 advances receptacles 2 along path P and simultaneously receives web in use 4 at station 6, cuts web in use 4 into single label sheets and applies the single label sheets on the respective receptacles 2.

In particular, apparatus 3 advances web in use 4 to delivery station 6. Even more particular, web in use 4 advances along path Q from station 17 to station 6.

Web in use 4 is provided within magazine unit 15, in particular web in use 4 is wound-up onto reel 30. As after a given time web in use 4 exhausts, in order to extend operation of machine 1 without interruption, a splicing process of new web 5 to web in use 4 is activated.

Advantageously, with particular reference to Figures 2a to 2e, the splicing process of new web 5 to web in use 4 comprises:

- an advancement phase during which web in use 4 is continuously advanced at the working advancement speed along advancement path Q, in particular from the respective station 17 to station 6;

- an arrangement phase during which new web 5 is arranged, in particular between the respective station 17 and station 18, such that at least a portion of new web 5 is spaced apart and adjacent to the advancing web in use 4 in the area of bonding station 23;

- an application phase during which bonding element 20 is applied onto new web 5 at application station 21;

- an acceleration and advancement phase during which

new web 5 is accelerated to the splicing advancement speed being substantially equal to the working advancement speed and during which new web 5 is advanced along path R towards station 18;

- a bonding phase, in particular executed with the splicing advancement speed being substantially identical to the working advancement speed, during which web in use 4 and new web 5 are bonded to one another by attaching bonding element 23 also to web in use 4 at bonding station 23;

- a first cutting phase during which web in use is cut at cutting station 25; and

- a second cutting phase during which new web 5 is cut at cutting station 26.

In more detail, during the advancement phase, advancement device 16 advances web in use 4 along path Q. In particular, the first drive unit of advancement device 16 actuates rotation of reel 30 around the respective axis A.

Preferentially, during the advancement phase the working advancement speed remains substantially unvaried.

Furthermore, during the advancement phase also a deflection phase is executed during which deflection assembly 33 is controlled such that web in use 4 is deflected at station 34 so that web in use 4 advances portions Q1 and Q2 which define an obtuse angle 35. In particular, the deflection phase is at least executed prior to the second cutting phase.

In further detail, during the deflection phase control group 37 is positioned such that web in use 4 is in contact with deflection roller 36 at deflection station 34.

During the acceleration and advancement phase

advancement device 16 accelerates new web 5 to the splicing advancement speed which is substantially identical to the working advancement speed and advancement device 16 advances new web 5 along path R.

In particular, during the acceleration and advancement phase new web 5 is wound-up from reel 31 and is wound-on onto roller 32.

In even more detail, the second drive unit of advancement device 16 actuates rotation of reel 31 around the respective axis A and the drive assembly of the collection device actuates rotation of roller 32 around axis B.

During the acceleration and advancement phase and prior to the bonding phase new web 5 is continuously advanced at the splicing advancement speed being identical to the working advancement speed.

Preferably, the splicing advancement speed equals the working advancement speed during the execution of the bonding phase.

In more detail, the bonding phase is executed such that the respective patterns of new web 5 and web in use 4 match one another after bonding of new web 5 and web in use 4.

In particular, with particular reference to Figure 2b, during the bonding phase bonding device 22 approaches web in use 4 and new web 5 at bonding station 23 to one another until bonding element 20 also adheres to web in use 4.

In further detail, during the bonding phase interaction assembly 45 and interaction assembly 46 move web in use 4 and new web 5 towards one another, in particular interaction assembly 45 moves web in use 4 towards new web 5 and interaction assembly 46 moves new

web 5 towards web in use 4.

In even further detail, during the bonding phase the respective interaction rollers 47 rotate around the respective axes C and the respective actuation group 48 moves the respective interaction rollers 47 towards one another. In particular, interaction rollers 47 rotate at speeds so that the respective surface speeds equal the working advancement speed and the splicing advancement speed.

In more detail, with particular reference to Figure 2c, the first cutting phase is executed during or after the bonding phase.

In particular, during the first cutting phase cutting assembly 51 cuts web in use 4 at cutting station 25.

More specifically, during the first cutting phase blade element 56 rotates around axis E. Even more specifically, during the first cutting phase the actuation assembly of cutting assembly 50 actuates rotation of carrier structure 55 around axis E so that blade element 56 cuts web in use 4, in particular in cooperation with counter surface element 57.

In particular, during the first cutting phase cutting assembly 50 is controlled by control unit 27 to operate in the first operation mode or the second operation mode.

In the first operation mode, cutting assembly 50 is controlled such that prior to the cutting carrier structure 55 is moved to the base position, the actuation assembly actuates rotation of carrier structure 55 (cutting assembly 50 is set into the intermediate configuration), in particular so that the advancement speed of blade 56 substantially equals the working advancement speed, and then carrier structure 55 is moved to the cutting position so that blade 56 cuts web in use

4.

In the second operation mode, control unit 27 controls cutting assembly 50 such that prior to activation of rotation of blade element 56 (and of carrier structure 55), carrier structure 55 is arranged at the cutting position. Then, control unit 27 controls the actuation assembly to actuate rotation of blade element 56 around axis E. In particular, when carrier structure 55 is arranged at the cutting position, blade element 56 is arranged at an axial position so that the acceleration of blade element 56 leads to an advancement speed of the blade element 56 substantially equal to the working advancement speed in the moment of cutting.

After cutting of web in use 4, rotation of blade element 56, in particular carrier structure 55 is interrupted.

Preferably, after cutting web in use 4 at cutting station 25 (both in the first operation mode and the second operation mode; i.e. independent of the operation mode) blade element 56 is decelerated, in particular blade element 56 is set to rest, even more preferably blade element 56 is decelerated by reducing the rotation speed of blade element 56 around axis E until the complete interruption of rotation of blade element 56 around axis E.

In more detail, with particular reference to Figures 2b and 2c, the second cutting phase is executed during or after the bonding phase, preferentially after the bonding phase.

In particular, during the second cutting phase cutting assembly 51 cuts new web 5 at cutting station 26.

Even more particular, during the second cutting phase blade member 69 is accelerated, in particular by

acceleration assembly 70, from the respective rest position towards and through cutting station 26, in particular so that blade member 69 advances at a speed higher than the splicing advancement speed of new web 5 (and the working advancement speed of web in use 4) at the moment of cutting new web 5 at station 26.

In particular, during the second cutting phase at the moment of blade member 69 cutting new web 5, main web portion 67 and auxiliary web portion 68 define the respective angle with one another and the respective vertex is positioned at cutting station 26 (and at deflection station 34). I.e. blade member 69 cuts new web 5 at the respective vertex from which auxiliary web portion 68 and main web portion 67 extend.

Preferably, blade member 69 cuts new web 5 tangential to roller 36 at deflection station 34. In other words, blade member 69 cuts new web 5 at deflection station 34 when auxiliary web portion 68 extends from station 34 to collection station 18.

More specifically, linear motor 71 accelerates and advances blade member 69 along path S, in particular path S being substantially parallel to portion Q2 of path Q. Even more specifically, linear motor 71 accelerates blade member 69 by accelerating support structure 72.

Preferably, the splicing operation further comprises an analyzes phase, in particular executed prior to the bonding phase, during which it is calculated and/or predicted whether after execution of the bonding phase the new web and the web in use would result in a correct or incorrect splicing.

In particular, during the analyzes phase control unit 27 calculates and/or predicts whether the respective patterns of new web 5 and web in use 4 would match if the

bonding phase is executed (correct splicing) or they would not match if the bonding phase is executed (incorrect splicing).

In more detail, during the analyzes phase at least detection sensor 77 detects the pattern and/or the mark on new web 5 and bonding element 20, in particular the relative positioning of bonding element 20 with respect to the pattern and/or the mark.

Furthermore, preferentially, during the analyzes phase control unit 27 calculates and/or predicts whether execution of the bonding phase would result in a correct or incorrect splicing, in particular whether the respective patterns of web in use 4 and new web 5 would match one another or not:

- based on the pattern and/or the mark detected by detection sensor 77 and the bonding element 20 detected by the detection sensor 77, in particular the relative position between bonding element 20 and the pattern and/or the mark;
- the working advancement speed of web in use 4; and
- the splicing advancement speed of new web 5.

Preferably, the calculation and/or the prediction is also based on the pattern and/or mark detected by detection sensor 79.

Preferably, if during the analysis phase it is predicted and/or calculated that the execution of the bonding phase would result in an incorrect splicing, the bonding phase will not be executed. In such a case also the first and the second cutting phases will not be executed. Then, the splicing operation will be repeated until web in use 4 and new web 5 are bonded to one another.

In the case that a correct splicing is predicted and/or calculated, the bonding phase and the first and

the second cutting phases are regularly executed.

Preferentially, the splicing operation also comprises a positioning phase executed after the application phase and prior to the acceleration and advancement phase during which new web 5 is advanced to position bonding element 20 at a starting position, in particular upstream of bonding station 23, even more particular interposed between bonding station 23 and the respective station 17, along path R.

Preferably, control unit 27 controls positioning of bonding element 20, in particular based on the relative position of the pattern and/or the mark on new web 5 and bonding element 20 as detected by detection sensor 77.

In more detail, the starting position is chosen such to guarantee that the respective patterns of web in use 4 and new web 5 match once web in use 4 and new web 5 are bonded to one another. Preferably, the starting position is also chosen such that the splicing advancement speed of new web 5 is identical to the working advancement speed of web in use 4 when executing the bonding phase.

In other words, positioning of bonding element 20 is such that execution of the bonding phase and the execution of the acceleration and advancement phase lead to a bonding of web in use 4 and new web 5 such that the respective patterns match.

In even other words, positioning of bonding element 20 is to ensure that the risk that the calculation and/or prediction of an incorrect splicing during the prediction phase is limited.

With particular reference to Figure 2e, after splicing of new web 5 to web in use 4, web 4 becomes the web in use and is further advanced to station 6.

Preferably, a loading phase is executed during which

a new reel 30 having a wound-up web 4 is placed at the respective station 17. Then web 4 is arranged in the manner as described above between station 17 and station 18 so that web 4 is ready to be spliced to web 5. In other words, web 4 becomes the new web. The splicing of web 4 to web 5 is then executed according to the above described phases at the appropriate moment.

With reference to Figures 5a and 5b, number 3' indicates a second embodiment of a web conveying and splicing apparatus according to the present invention; as apparatus 3' is similar to apparatus 3, the following description is limited to the differences between them, and using the same references, where possible, for identical or corresponding parts.

In particular, apparatus 3' differs from apparatus 3 in comprising magazine unit 15' and in comprising advancement device 16'.

With particular reference to Figures 5a and 5b, web magazine unit 15' comprises a first reel unit 86 and at least a second reel unit 88.

In more detail, reel unit 86 is adapted to receive a plurality of first reels 89 at respective storing stations 17' and reel unit 88 is adapted to receive a plurality of second reels 90 at respective storing stations 17'.

Each reel 89 carries in a wound-up manner a respective web 91 and being rotatable around a respective rotation axis A'; and

each reel 90 carries in a wound-up manner a respective web 92 and being adapted to rotate around a respective rotation axis A'.

In particular, axis A' having a vertical orientation.

It must be noted that the type of web of webs 91 and 92 is identical to the type of web of web 4 and web 5.

Thus, each web 91 and each web 92 is provided with a repeated pattern, in particular the repeated pattern defining label sheets to be obtained from webs 92 and webs 92.

In more detail, reel unit 86 and reel unit 88 are adapted to respectively arrange reels 89 and 90 such that the respective axes A' are parallel to one another.

In even further detail, reel unit 86 and reel unit 88 are adapted to coaxially arrange respectively reels 89 and reels 90 to one another. In other words, respectively reels 89 and reels 90 are arranged on top of one another.

Preferentially, advancement device 16' is adapted to selectively advance at least one of webs 91 and web 92 as the web in use along working advancement path Q and to selectively advance the other one of webs 91 and webs 92 as the new web along splicing advancement path R.

In particular, advancement device 16' is adapted to actuate rotation of each one of reels 89 around the respective rotation axis A' independently from the other reels 89 and is adapted to actuate rotation of each one of reels 90 around the respective rotation axis A' independently from the other reels 90.

Preferentially, advancement device 16' comprises a driving group adapted to selectively actuate rotation of reels 89 and reels 90.

In more detail, the driving group comprises a plurality of drive motors (not shown) each one associated to one respective reel 89 or reel 90 and being adapted to actuate rotation of the respective reel 89 or reel 90 around the respective axis A'.

Alternatively, the driving group could comprise two drive motors one associated to reel unit 86 and the other one associated to reel unit 88 and two respective clutch

assemblies, one associated to reel unit 86 and the other one to reel unit 88 and each one adapted to interact with the respective drive motor. Each clutch assembly could be controlled such to couple only one respective reel 89 or only one respective reel 90 to the respective drive motor for actuating rotation of only the one reel 89 or only the one reel 90 coupled to the respective drive motor by means of the respective clutch assembly.

Preferably, advancement device 16' also comprises a plurality of wind-up rollers 94, each one being arranged at a respective collection station 18', being adapted to rotate around a respective rotation axis B' and being adapted to receive web 91 or web 92 from one respective reel 89 or one respective reel 90. In particular, wind-up rollers 94 serve, for the same purpose as wind-up roller 32 of apparatus 3, for one respective web 91 or one respective web 92.

Thus, in use, webs 91 or webs 92 are spanned between the respective storing station 17' and the respective station 18' thereby defining the respective splicing advancement path R.

In particular, wind-up rollers 94 are arranged so that the respective rotation axes B' are parallel to one another.

Even more particular, wind-up rollers 94 are coaxially arranged to one another. In other words, wind-up rollers 94 are arranged on top of one another.

Preferably, advancement device 16' also comprises a driving assembly configured to selectively and independently actuate rotation of one wind-up roller 94 around the respective rotation axis B' at a time so as to advance one respective web 91 or one respective web 92 as the new web at a time.

In particular, the driving assembly comprises a plurality of drive motors, each one associated to one respective wind-up roller 94 and adapted to actuate rotation of the respective wind-up roller 94.

Alternatively, the driving assembly could comprise two pairs of an electrical motor and a clutch assembly. One pair being associated to the wind-up rollers 94 cooperating, in use, with the respective reels 89 and the other pair being associated to the wind-up rollers 94 cooperating, in use, with the respective reels 90. The respective clutch assembly could selectively couple one respective wind-up roller 94 to the respective electrical motor so as to selectively actuate rotation of the respective wind-up roller 94.

Apparatus 3' further differs from apparatus 3 in comprising a displacement device 101 adapted to selectively move reel unit 86, in particular reels 89, into a first displacement direction D1 parallel to the respective rotation axes A' and to selectively move reel unit 88, in particular reels 90, into a second displacement direction D2 parallel to the respective rotation axes A'.

In particular, displacement device 101 is adapted to respectively place, in particular after activation by control unit 27, one respective reel 89 or one respective reel 90 into a splicing position at which the respective reel 89 or the respective reel 90 is ready to be spliced to the web in use.

In other words, displacement device 101 is adapted to respectively place, in particular after activation by control unit 27, one respective reel 89 or one respective reel 90 so that it replaces respectively a respective empty reel 89 or a respective empty reel 90.

In particular, control unit 27 activates displacement device 101 to e.g. move reels 89 into direction D1 after web 91 of one respective reel 89 was advanced as the web in use, the new web (one of webs 92) was spliced to the web in use and is afterwards advanced as the web in use. The respective reel 89 does not carry any web 91 anymore or only carries some residual web 91 and, hence, a new web 91 must be provided so as to be spliced to the web in use at the appropriate moment. The latter is achieved by positioning the respective reel 89.

Even more particular, displacement device 101 is adapted to position one web 89 and one web 90 between interaction assemblies 45 and 46.

In more detail, displacement device 101 comprises:

- at least a first support platform 102 adapted to rotatably carry reels 89; and
- at least a second support platform 103 adapted to rotatably carry reels 90;
- at least a first linear displacement member (not shown) adapted to move support platform into displacement direction D1; and
- at least a second linear displacement member (not shown) adapted to move support platform into displacement direction D2.

Preferentially, wind-up rollers 94 are also arranged on respectively support platform 102 and support platform 103, in particular so that the respective wind-up rollers 94 are positioned, in use, together with the respective reel 89 or the respective reel 90 into the splicing position.

Preferably, also the respective drive motors are arranged together with the respective wind-up rollers 94 onto respectively platform 102 and platform 103.

Operation of apparatus 3' is similar to operation of apparatus 3. Therefore, the following description is limited to the differences between them.

In particular, operation of apparatus 3' comprises a loading phase, which is executed prior to the advancement phase. During the loading phase reels 89 and 90 carrying respectively wound-up webs 91 and 92 are arranged within respectively reel unit 86 and reel unit 88.

Furthermore, during the loading phase one web 91 or one web 92 is guided to station 6 so as to be used as the web in use. The other webs 91 and webs 92 are coupled to the respective wind-up roller 94 and are subsequently tensioned.

Then, the advancement phase is activated so as to advance the web in use to station 6, in particular to apparatus 7.

Shortly prior to the exhaustion of the web in use, the splicing of the new web is to be executed according to the phase as described with respect to operation of apparatus 3.

In particular, depending on whether one web 91 or one web 92 is the web in use, one web 92 or one web 91 is to be spliced to the web in use as the new web.

Once the new web has been spliced to the web in use, the new web becomes the web in use and is advanced along the working advancement path for feeding the web in use to station 6, in particular to apparatus 7.

As the respective reel 89 or reel 90, which carried the previous web in use, is exhausted or only comprises some residual web 91 or web 92, a displacement phase must be activated so that respectively a new reel 92 or a new reel 91 is arranged in the splicing position. This is done, by moving reels 92 or reels 91 into respectively

direction D2 or direction D1. This guarantees that the respective web 91 or 92 is arranged between interaction assemblies 45 and 46.

In more detail, displacement device 101 is activated so as to displace reels 89 or reels 90.

In even more detail, the first linear displacement member is activated to move platform 102 into direction D1 for positioning one respective reel 89 at the splicing position or the second linear displacement member is activated to move platform 103 into direction D2 for positioning one respective reel 90 at the respective splicing position.

The phases are continuously repeated. In particular, if one of reel units 86 and 88 is fully exhausted (i.e. none of the respective reels 89 or 90 comprises a sufficient quantity of respective wound-up web 91 or 92) the respective reel unit 86 or the respective reel unit 88 can be newly loaded with new respective reels 89 and respective reels 90 carrying respectively wound-up web 91 or 92.

With reference to Figure 6, number 3'' indicates a third embodiment of a web conveying and splicing apparatus according to the present invention; as apparatus 3'' is similar to apparatus 3', the following description is limited to the differences between them, and using the same references, where possible, for identical or corresponding parts.

In particular, apparatus 3'' differs from apparatus 3' in comprising magazine unit 15'' and advancement device 16''.

In particular, advancement device 16'' differs from advancement device 16' in the arrangement of the respective drive motors, wind-up rollers 94 and the

respective drive assemblies. The details will become clear from the following description.

In more detail, magazine unit 15'' differs from magazine unit 15' in comprising reel unit 86'' and reel unit 88''.

In particular, reel unit 86'' and reel unit 88'' each comprises a plurality of respective reel modules 106, each of which being adapted to carry one respective reel 89 or one respective reel 90. More specifically, each reel module 106 is adapted to rotatably carry one respective reel 89 or one respective reel 90, in particular such that the respective rotation axis A' is vertically oriented.

Preferentially, the respective reel module 106 is also adapted to carry one respective drive group, in particular one respective drive motor of advancement device 16'' for actuation of rotation of the respective reel 89 or the respective reel 90 around the respective rotation axis A'.

Preferably, each reel module 106 is also adapted to rotatably carry one respective wind-up roller 94 and one respective drive assembly, in particular one respective electrical motor.

Furthermore, each reel module 106 is adapted to be controlled between at least a loading configuration at which it is adapted to receive the respective reel 89 or the respective reel 90 and an operative configuration at which it is adapted to allow for the actuation of the rotation of the respective reel 89 or the respective reel 90 around the respective rotation axis A' for advancing the respective web 91 or 92 along the working advancement path or the splicing advancement path.

Preferentially, each reel module 106 is also adapted to be controlled into a waiting configuration distinct

from the respective loading configuration and the respective operative configuration. In particular, each reel module 106 is adapted to be controlled into the respective waiting configuration prior to being controlled into the operative configuration and after having been loaded. Even more particular, each reel module 106 is adapted to be controlled into the respective waiting configuration so that the respective reel module 106 does not interfere with the operation of any other reel module 106 and the other functional components of apparatus 3'' if the reel module 106 is not needed to supply the respective web 91 or 92.

Preferably, magazine unit 15'' further comprises a base support 107 carrying reel modules 106.

In more detail, each reel module 106 comprises a respective support arm 108 adapted to rotatably receive and/or carry the respective reel 89 or the respective reel 90. Each support arm 108 also carries the respective drive motor 93.

Preferably, each support arm 108 is pivotably mounted onto base support 107 so as to pivot around a respective pivot axis F, in particular for moving each support arm 108 at least into a loading position for placing the respective reel 89 or the respective reel 90 in a rotatable manner onto the respective support arm 108 and at least an operative position at which the respective reel 89 or the second reel 90 can be actuated to rotate around the respective axis A' so as to advance the respective web along the working advancement path or the splicing advancement path.

In particular, each respective reel module 106 is set into its respective loading configuration with the respective support arm 108 being controlled into its

respective loading position and into its respective operative position with the respective support arm 108 being controlled into its respective operative position.

Preferentially, each support 108 is also adapted to be moved into a waiting position interposed between the loading position and the operative position. In particular, each respective reel module 106 is set into its respective waiting configuration with the respective support arm 108 being placed at the respective waiting position.

Each support arm 108 also carries the respective drive group, in particular the respective drive motor, the respective wind-up roller 94 and the respective drive assembly, in particular the respective electrical motor.

More specifically, each support arm 108 is pivotally connected to base support 107 at a respective first end portion 109 of support arm 108.

Furthermore, each respective wind-up roller 94 is arranged in the proximity of a second end portion 110 of support arm 108, opposite of end portion 109, as is the respective drive assembly, in particular the respective electrical motor.

Each respective support arm 108 is adapted to rotatably carry the respective reel 89 or the respective reel 90 at a respective intermediate portion arranged between the respective end portions 109 and 110.

Preferably, magazine unit 15'' also comprises a plurality of pivoting assemblies 112, each one being associated to one respective support arm 108 and being adapted to control movement of the respective support arm 108 between the loading position and the operative position.

In particular, each pivoting assembly 112 is mounted

onto base support 107 and to the respective support arm 108.

In more detail, base support 107 comprises at least two track assemblies 113 arranged parallel and spaced apart from one another. One carrying the plurality of reel modules 106 of reel unit 86'' and one carrying the plurality of reel modules 106 of reel unit 88''.

Each support assembly 113 comprises a track bar 114 longitudinally extending parallel to rotation axes A' and a plurality of coupling members 115 adapted to linearly move along track bar 114 and adapted to pivotally carry one respective support arm 108.

Preferably, magazine unit 15'' also comprises a displacement device 116 for selectively moving reel modules 106, in particular support arms 108, into a splicing position at which the respective web 91 or 92 can be advanced as the new web and then as the web in use.

In particular, device 116 is adapted to move the coupling members 115 along the respective track bar 114.

Operation of apparatus 3' is similar to operation of apparatus 3''. Therefore, the following description is limited to the differences between them.

In particular, operation of apparatus 3'' differs from operation of apparatus 3' in the operation of magazine unit 15''.

In particular, the loading phase can be done prior or the advancement of one of webs 91 or 92 as the web in use.

In particular, each reel module 106 can be loaded independently from the other reel modules 106. Each reel module 106 can be even loaded during operation of one reel module 106 of the same reel unit 86'' or 88''.

In particular, during loading the respective reel

module 106 is set into the loading configuration and after loading (i.e. after placing the respective reel 89 or 90) the reel module 106 is moved to the waiting configuration. In order that the respective web 91 or 92 can be spliced as the new web to the web in use, the respective reel module 106 must be controlled into the respective operative position and in the splicing position.

In more detail, during the loading phase the respective support arm 108 is set into the respective loading position, in particular by activation of the respective pivot assembly 112. Then the respective reel 89 or 90 is placed on the respective support arm 108. As well, the respective web 91 or 92 is connected to wind-up roller 94 and is tensioned. After that the respective support arm 108 is controlled into the respective waiting position, in particular by activating the respective pivot assembly 112.

Shortly prior to setting a reel module 106 into the splicing position, the respective reel module 106 is controlled into the respective operative position by placing the respective support arm 108 into the respective operative position, in particular by activation of the respective pivot assembly 112.

Then, by activation of the displacement device 116 reel modules 106, in particular support arms 108 are moved so as to position one respective reel module 106, in particular one respective support arm 108 into the splicing position.

The advantages of apparatuses 3, 3′ and 3′′ according to the present invention will be clear from the foregoing description.

In particular, apparatuses 3, 3′ and 3′′ allow to bond new web 5 and web in use 4 to one another without

reducing the working advancement speed of web in use 4. This is particularly advantageous in the new compact receptacle processing machines, which are known to operate in a blocked configuration (i.e. the varying treatment machines of the compact receptacle processing machine operate at the same processing speed), as in these machines a reduction of the working advancement speed of web in use 4 would have significant influence on operation of the other treatment machines.

Another advantage of apparatuses 3, 3′ and 3′′ is that the error margins are significantly reduced as alignment of the new web between the respective stations 17, 17′ and 18, 18′ is facilitated and no operator is required to precisely apply manually the bonding element onto new web 5. Furthermore, control unit 27 controls bonding device 22 for avoiding any falsely splicing of web in use 4 and new web 5.

An even other advantage is that interaction rollers 47 rotating at a rotation speed so that the outer surface speed equals the working advancement speed and the splicing advancement speed limiting thereby the possibility of the evolution of unwanted tensions within web in use 4 and new web 5.

A further advantage of apparatuses 3, 3′ and 3′′ resides in cutting of web in use 4 and new web 5 by respectively cutting assembly 50 and cutting assembly 51, which reduce tensional forces acting on respectively web in use 4 and new web 5 at the moment of cutting. This is a result of blade element 56 of cutting assembly 50 cutting web in use 4 when advancing at the same speed as web in use 4; and of blade member 69 advancing at a speed higher than the splicing advancement speed of new web 5.

Another advantage of apparatus 3′ and 3′′ lies in

increasing the time prior to the need that an operator needs to intervene for exchanging the reels carrying the wound of web of labeling material. Apparatus 3'' offers thereby an increased flexibility with respect to apparatus 3' as each reel module 106 operates fully independently from the other and can be loaded independently.

Clearly, changes may be made to apparatus 3, 3' and 3'' as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

CLAIMS

1.- Method of splicing a new web (5, 4, 90, 89) to a web in use (4, 5, 89, 90) comprising:

- an advancement phase during which the web in use (4, 5, 89, 90) is advanced at a working advancement speed along a working advancement path (Q);

- an arrangement phase for arranging the new web (5, 4, 90, 89) such that at least a portion of the new web (5, 4, 90, 89) is spaced apart and adjacent to the advancing web in use (4, 5, 89, 90) in the area of a bonding station (23);

- an application phase during which a bonding element (20) is applied onto the new web (5, 4, 90, 89) at an application station (21);

- an acceleration and advancement phase during which the new web (5, 4, 90, 89) is accelerated to a splicing advancement speed being substantially equal to the working advancement speed for advancing the new web (5, 4, 90, 89) along an auxiliary advancement path (R) distinct from the working advancement path (Q);

- a bonding phase during which the web in use (4, 5, 89, 90) and the new web (4, 5, 89, 90) are bonded to one another by attaching the bonding element (21) also to the web in use (4, 5, 89, 90) at the bonding station (21);

- a first cutting phase during which the web in use (4, 5, 89, 90) is cut at a first cutting station (25);

- a second cutting phase during which the new web (5, 4, 90, 89) of labeling material is cut at a second cutting station (26) downstream of the bonding station (23) along the auxiliary advancement path (R);

- wherein the first cutting phase and the second cutting phase are done after or during the phase of

bonding.

2.- The method according to claim 1, wherein during the execution of the bonding phase the working advancement speed and the splicing advancement speed are identical.

3.- The method according to claim 1 or 2 further comprising a positioning phase executed after the application phase and prior to the acceleration and advancement phase during which the new web (5, 4, 90, 89) is advanced to position the bonding element (20) at a starting position upstream of the bonding station (23) along the auxiliary advancement path (R).

4.- The method according to any one of the previous claims, wherein during the bonding phase the new web (5, 4, 90, 89) and the web in use (4, 5, 89, 90) are bonded to one another such that the corresponding patterns of respectively the new web (5, 4, 90, 89) and the web in use (4, 5, 89, 90) match one another.

5.- The method according to any one of the preceding claims, wherein during the bonding phase a first interaction assembly (45) interacts with the web in use (4, 5, 89, 90) and a second interaction assembly (46) interacts with the new web (5, 4, 90, 89) in such a manner to approach the web in use (4, 5, 89, 90) and the new web (5, 4, 90, 89) towards one another; in particular the first interaction assembly (45) moves the web in use (4, 5, 89, 90) towards the new web (5, 4, 90, 89) and the second interaction assembly (46) moves the new web (5, 4, 90, 89) towards the web in use (4, 5, 89, 90) so that the bonding element (20) couples the web in use (4, 5, 89, 90) and the new web (5, 4, 90, 89) with one another.

6.- The method according to claim 5, wherein the first interaction assembly (45) and the second interaction assembly (45) each comprise a respective roller (47)

interacting with respectively the web in use (4, 5, 89, 90) and the new web (5, 4, 90, 89); wherein each roller (47) rotates around a respective rotation axis (C) and the rotation speed is such that the outer surface speed of each roller (47) substantially equals the working advancement speed.

7.- The method according to any one of the preceding claims, wherein during the phase of arrangement a reel (30, 31, 89, 90) carrying the wound-up new web (5, 4, 90, 89) is placed within a web magazine unit (15, 15', 15'') and the new web (5, 4, 90, 89) is then guided from the web magazine unit (15, 15',15'') to a collection device (32) arranged at a collection station (18, 18') downstream of the bonding station (23) along the auxiliary advancement path (R) and through the bonding station (23) and then the new web (5, 4, 90, 89) is tensioned.

8.- The method according to any one of the preceding claims, wherein the working advancement speed is in the range of 20 to 320 meters per minute, in particular 60 to 280 meters per minute.

9.- The method according to any one of the preceding claims further comprising an analyzes phase executed prior to the bonding phase during which it is calculated and/or predicted whether execution of the bonding phase would result in a correct or incorrect splicing;

wherein if the execution of the bonding phase would result in an incorrect splicing the bonding phase is not executed.

10.- The method according to claim 9, wherein during the analyzes phase at least a first detection sensor (77, 79) detects a pattern and/or a mark on the new web (5, 4, 90, 89) and the bonding element (20) applied to the new web (5, 4, 90, 89); and

a control unit (27) calculates and/or predicts whether execution of the bonding phase would result in the respective patterns of the web in use (4) and the new web (5) matching one another or not based on the pattern and/or mark detected by the detection sensor (77), the bonding element (20) detected by the detection sensor (77, 79); the working advancement speed of the web in use (4, 5, 89, 90); and the advancement speed of the new web (5, 4, 90, 89).

11.- The method according to any one of the preceding claims, wherein during the first cutting phase a blade element (56) rotates around a respective rotation axis (E) and cuts the web in use (4, 5, 89, 90) at a speed substantially identical to the working advancement speed.

12.- The method according to any one of the preceding claims, wherein during the advancement phase the web in use (4, 5, 89, 90) is deflected at a deflection station (34) downstream of the bonding station (23) along the web advancement path by a deflection roller (36); and

wherein during the second cutting phase a blade member (69) is accelerated towards and through the deflection station (34) so that the blade member (69) cuts the new web (5, 4, 90, 89) tangential to the deflection roller (36) at the deflection station (34).

13.- The method according to claim 12, wherein during the second cutting phase the speed of the blade member (69) is higher than the working advancement speed at the moment of cutting the new web (5, 4, 90, 89).

14.- A web conveying and splicing apparatus (3, 3', 3'') for splicing a new web (5, 4, 90, 89) to a web in use (4, 5, 89, 90) comprising:

- a web magazine unit (15, 15', 15'') adapted to provide for the web in use (4, 5, 89, 90) and the new web

5,4);

- an advancement device (16, 16',16'') for advancing the web in use (4, 5, 89, 90) at a working advancement speed along a working advancement path (Q);

- an application device (19) adapted to apply a bonding element (20) onto the new web (5, 4, 90, 89) at an application station (21);

- a bonding device (22) adapted to adhesively bond the web in use (4, 5, 89, 90) together with the new web (5, 4, 90, 89) at a bonding station (23) by attaching the bonding element (20) also to the web in use (4, 5, 89, 90);

and

- a first cutting assembly (50) adapted to cut the web in use (4, 5, 89, 90) at a first cutting station (25);

characterized in that the advancement device (16,16',16'') is also adapted to advance the new web (5, 4, 90, 89) along an auxiliary advancement path (R) through the bonding station (23) and the splicing advancement path (R) being distinct from the working advancement path (Q);

wherein the advancement device (16, 16', 16'') is also configured to accelerate, in use, the new web (5, 4, 90, 89) to an advancement speed equal to the working advancement speed of the web in use (4, 5, 89, 90); and

in comprising a second cutting assembly (51) adapted to cut the new web (5, 4, 90, 89) at a second cutting station (26) downstream of the bonding station (23) along the auxiliary advancement path (R).

15.- The web conveying and splicing apparatus according to claim 14, wherein the advancement device (16, 16', 16'') comprises a wind-up roller (32) arranged at the collection station (18, 18') and being adapted to receive the new web (5, 4, 90, 89); and

wherein the advancement device (16, 16', 16'') also comprises a drive member adapted to rotate the wind-up roller (32).

16.- The web conveying and splicing apparatus according to claim 14 or 15, wherein the web magazine unit (15, 15', 15'') is adapted to rotatably carry at a first station (6) at least a first reel (30, 31, 89, 90) carrying the wound-up web in use (4, 5, 89, 90) and is adapted to rotatably carry at least a second reel (31, 30; 90, 89) carrying the wound-up new web (5, 4, 90, 89).

17.- The web conveying and splicing apparatus according to any one of claims 14 to 16, wherein the bonding device (22) comprises a first interaction assembly (45) adapted to interact with the web in use (4, 5, 89, 90) and a second interaction assembly (46) adapted to interact with the new web (5, 4, 90, 89); the first interaction assembly (45) and the second interaction assembly (46) being adapted to approach in collaboration the web in use (4, 5, 89, 90) and the new web (5, 4, 90, 89) towards one another; in particular the first interaction assembly (45) is adapted to move the web in use (4 5) towards the new web (5, 4, 90, 89) and the second interaction assembly (46) is adapted to move the new web (5, 4, 90, 89) towards the web in use (4, 5, 89, 90) so that the bonding element (20) couples the web in use (4, 5, 89, 90) and the new web (5, 4, 90, 89) with one another.

18.- The web conveying and splicing apparatus according to claim 17, wherein the first interaction assembly (45) and the second interaction assembly (46) comprise each a respective interaction roller (47) rotatable around a respective rotation axis (C) and a respective actuation group (48) adapted to move the

respective interaction roller (47) to or away from the bonding station (23).

19.- The web conveying and splicing apparatus according to 16 or 17, wherein the first interaction assembly (45) and the second interaction assembly (46) comprise each one a respective driving assembly configured to rotate the respective interaction roller (47) around the respective rotation axis (C) such that the surface speed of the interaction roller (47) substantially equals the working advancement speed.

20.- The web conveying and splicing apparatus according to any one of claims 14 to 20 further comprising a control unit (27) having at least one detection sensor (77, 79) adapted to detect a pattern and/or a mark provided on the new web (5, 4, 90, 89) at a detection station (78, 80) upstream of the bonding station (23) along the auxiliary advancement path (R);

wherein the detection sensor (77, 79) is further adapted to detect the bonding element (20) applied onto the new web (5, 4, 90, 89); and

wherein the control unit (27) is adapted to calculate based on the detected pattern and/or mark provided on the new web (5, 4, 90, 89) and the detection of the bonding element (20), the working advancement speed of the web in use (4, 5, 89, 90) and the splicing advancement speed of the new web (5, 4, 90, 89), whether the bonding of the web in use (4, 5, 89, 90) with the new web (5, 4, 90, 89) will be correct or incorrect in case of execution.

21.- The web conveying and splicing apparatus according to any one of claims 14 to 20, wherein the second cutting assembly (51) comprises a cutting blade member (69) and an acceleration assembly (70) adapted to accelerate and to advance the cutting blade member (69)

along a rectilinear cutting path.

wherein the acceleration assembly (70) is configured to accelerate the cutting blade member (69) to an advancement speed which is larger than the working speed of the web in use.

22.- The web conveying and splicing apparatus according to any one of claims 14 to 21, wherein the advancement device (16, 16' ,16'') comprises a deflection assembly (33) adapted to deflect, in use, the web in use (4, 5, 89, 90) at the second cutting station (26) so that the working advancement path (Q) comprises a main portion (Q1) and an auxiliary portion (Q2), the main portion (Q1) and the auxiliary portion (Q2) defining an obtuse angle (35).

23.- The web conveying and splicing apparatus according to claim 22, wherein the deflection assembly (33) comprises a deflection roller (36) arranged at the second cutting station (26);

wherein the second cutting assembly (51) is adapted to cut the new web (5, 4, 90, 89) tangential to the deflection roller (36).

24.- The web conveying and splicing apparatus according to any one of claims 14 to 23, wherein the first cutting assembly (50) comprises at least a blade element (56) rotatable around a respective rotation axis (E) and the blade element (56) extending parallel to the rotation axis.

25.- The web conveying and splicing apparatus according to claim 24, wherein the first cutting assembly (50) also comprises a carrier structure (55) rotatable around the rotation axis (E) and carrying the blade element (56).

26.- The web conveying and splicing apparatus

according to claim 24 or 25, wherein the first cutting assembly (50) also comprises a positioning group adapted to approach or to withdraw the blade element (56) from the first cutting station (25).

27.- The web conveying and splicing apparatus according to any one of claims 14 to 26, wherein the web magazine unit (15', 15'') comprises a first reel unit (86, 86'') for providing for a first web (91) and at least a second reel unit (88, 88'') for providing for a second web (92);

wherein the first reel unit (86, 86'') is adapted to receive a plurality of first reels (89) each one carrying in a wound-up manner a respective web (91) and each one being rotatable around a respective rotation axis (A'); and

wherein the second reel unit (88, 88'') is adapted to receive a plurality of second reels (90) each one carrying in a wound-up manner a respective web (92) and each one being adapted to rotate around a respective rotation axis (A');

wherein the advancement device (16', 16'') is adapted to actuate rotation of each one of the first reels (89) around the respective rotation axis (A') independently from the other first reels (89);

wherein the advancement device (16', 16'') is also adapted to actuate rotation of each one of the second reels (90) around the respective rotation axis (A') independently from the other second reels (90); and

wherein the advancement device (16', 16'') is also adapted to selectively advance one of the webs wound-up on the respective first reels (89) as the first web (91) and to selectively advance respectively one of the webs wound-up on the respective second reels (90) as the second

web (92); and

wherein the advancement device is also adapted to selectively advance at least one of the first web (91) and the second web (92) as the web in use and to selectively advance the other one of the first web (91) and the second web (92) as the new web.

28.- A labeling machine (1) comprising a web conveying and splicing apparatus (3, 3', 3'') according to any one of claims 14 to 27 being adapted to feed a web of labeling material; and

a labeling apparatus (7) for applying label sheets onto receptacles (2), in particular bottles, adapted to receive the web of labeling material from the web conveying and splicing apparatus (3, 3', 3'') , adapted to obtain single label sheets from the web of labeling material and adapted to apply the single label sheets onto the receptacles (2).

29.- A web conveying and splicing apparatus (3', 3'') for splicing a web in use and a new web with one another comprising:

- a web magazine unit (15', 15'') comprising a first reel unit (86, 86'') for providing for a first web (91) and at least a second reel unit for providing for a second web;

- an advancement device (16', 16'') adapted to selectively advance at least one of the first web (91) and the second web (92) as the web in use along a working advancement path (Q) through a bonding station (23) and to selectively advance the other one of the first web and the second web as the new web along a splicing advancement path (R);

- a bonding device (22) adapted to adhesively bond the new web to the web in use at the bonding station (23);

- at least one cutting device (24) adapted to cut at least the web in use at a respective cutting station (25) during advancement along the respective working advancement path (Q);

characterized in that the first reel unit (86, 86'') is adapted to receive a plurality of first reels (89) at respective storing stations (17') , wherein each first reel (89) carries in a wound-up manner a respective web (91) and being rotatable around a respective rotation axis (A'); and

the second reel unit (88, 88'') is adapted to receive a plurality of second reels (90) at respective storing stations (17'), wherein each second reel (90) carries in a wound-up manner a respective web (92) and being adapted to rotate around a respective rotation axis (A');

wherein the advancement device (16' 16'') is adapted to actuate rotation of each one of the first reels (89) around the respective rotation axis (A') independently from the other first reels (A');

wherein the advancement device (16', 16'') is also adapted to actuate rotation of each one of the second reels (90) around the respective rotation axis (A') independently from the other second reels (90); and

wherein the advancement device (16', 16'') is adapted to selectively advance one of the webs wound-up on the respective first reels (89) as the first web (91) and to selectively advance respectively one of the webs wound-up on the respective second reels (90) as the second web (92).

30.- The web conveying and splicing apparatus according to claim 29, wherein the first reel unit (86) is adapted to coaxially arrange the plurality of first reels (89) and the second reel unit (88) is adapted to

coaxially arrange the plurality of second reels (90).

31.- The web conveying and splicing apparatus according to claim 29 or 30, wherein the first reel unit (86) is adapted to arrange the first reels (89) such that the respective rotation axes are parallel to one another and wherein the second reel unit (88) is adapted to arrange the second reels (90) such that the respective rotation axes are parallel to one another; and

the web conveying and splicing apparatus (3') further comprises a displacement device (101) adapted to selectively move the first reel unit (89) into a first displacement direction (D1) parallel to the respective rotation axes and to selectively move the second reel unit (88) into a second displacement direction (D2) parallel to the respective rotation axes.

32.- The web conveying and splicing apparatus according to claim 31, wherein the displacement device (101) comprises:

- at least a first support platform (102) adapted to rotatably carry the plurality of first reels (89); and

- at least a second support platform (103) adapted to rotatably carry the plurality of second reels (90);

- at least a first linear displacement member adapted to move the first support platform (102) into the first displacement direction (D1); and

- at least a second linear displacement member adapted to move the second support platform (103) into the second displacement direction (D2).

33.- The web conveying and splicing apparatus according to claim 29 or 30, wherein the first reel unit (86'') and the second reel unit (88'') each comprises a plurality of respective reel modules (106);

wherein each reel module (106) is adapted to

rotatably carry one respective first reel (89) or one respective second reel (90); and

wherein each reel module (106) is controllable at least between a loading configuration at which the respective reel module (106) is adapted to receive the respective first reel (89) or the respective second reel (90) and an operative configuration at which the respective reel module (106) is adapted to allow for the actuation of the rotation of the respective first reel (89) or the respective second reel (90) around the respective rotation axis (A') for advancing the respective web along the working advancement path (Q) or the splicing advancement path (R).

34.- The web conveying and splicing apparatus according to claim 33, wherein the magazine unit (15'') further comprises a base support (107) carrying the plurality of reel modules (106);

wherein each reel module (106) comprises a respective support arm (108) adapted to rotatably receive the respective first reel (89) or the respective second reel (90); and

wherein the support arm (108) is pivotably mounted onto the base support (107) for moving the support arm (108) into a loading position for placing the respective first reel (89) or the respective second reel (90) in a rotatable manner onto the respective support arm (108) and an operative position at which the respective first reel (89) or the respective second reel (90) can be actuated to rotate around the respective rotation axis (A') so as to advance the respective web (91, 92) at least as the new web.

35.- The web conveying and splicing apparatus according to claim 34, wherein the advancement device

(16'') comprises for actuating the rotation of each one of the first reels (89) and for each one of the second reels (90) one respective drive motor;

wherein the respective drive motor is arranged on the respective support arm (108).

36.- The web conveying and splicing apparatus according to any one of claims 29 to 35, wherein the advancement device (16', 16'') comprises a plurality of wind-up rollers (94), each one being arranged at a respective collection station (18'), being adapted to rotate around a respective rotation axis (B') and being adapted to receive the web (91) from one respective first reel (89) or the web (92) from one respective second reel (90) so as to span the respective web (91, 92) between the respective storing station (17') and the respective collection station (18') and to define thereby the respective splicing advancement path (R);

wherein the advancement device (16', 16'') also comprises a driving assembly configured to selectively and independently actuate rotation of one wind-up roller (94) around the respective rotation axis (B') at a time so as to advance one respective web (91, 92) as the new web at a time.

37.- The web conveying and splicing apparatus according to claim 36 and any one of claims 34 and 35, wherein the advancement device (16'') comprises for actuating rotation of each one of the wind-up rollers (94) one respective actuation motor;

wherein the actuation motor is arranged on the respective support arm (108).

38.- The web conveying and splicing apparatus according to claim 36 and any one claims 32 and 33, wherein each wind-up roller (94) and the respective drive motor

are mounted onto respectively the first support platform (102) and the second support platform (103).

39.- The web conveying and splicing apparatus according to any one of claims 36 to 38, wherein the cutting device (24) is also adapted to cut the new web at a respective cutting station (26) downstream of the bonding station (23) along the splicing advancement path (R).

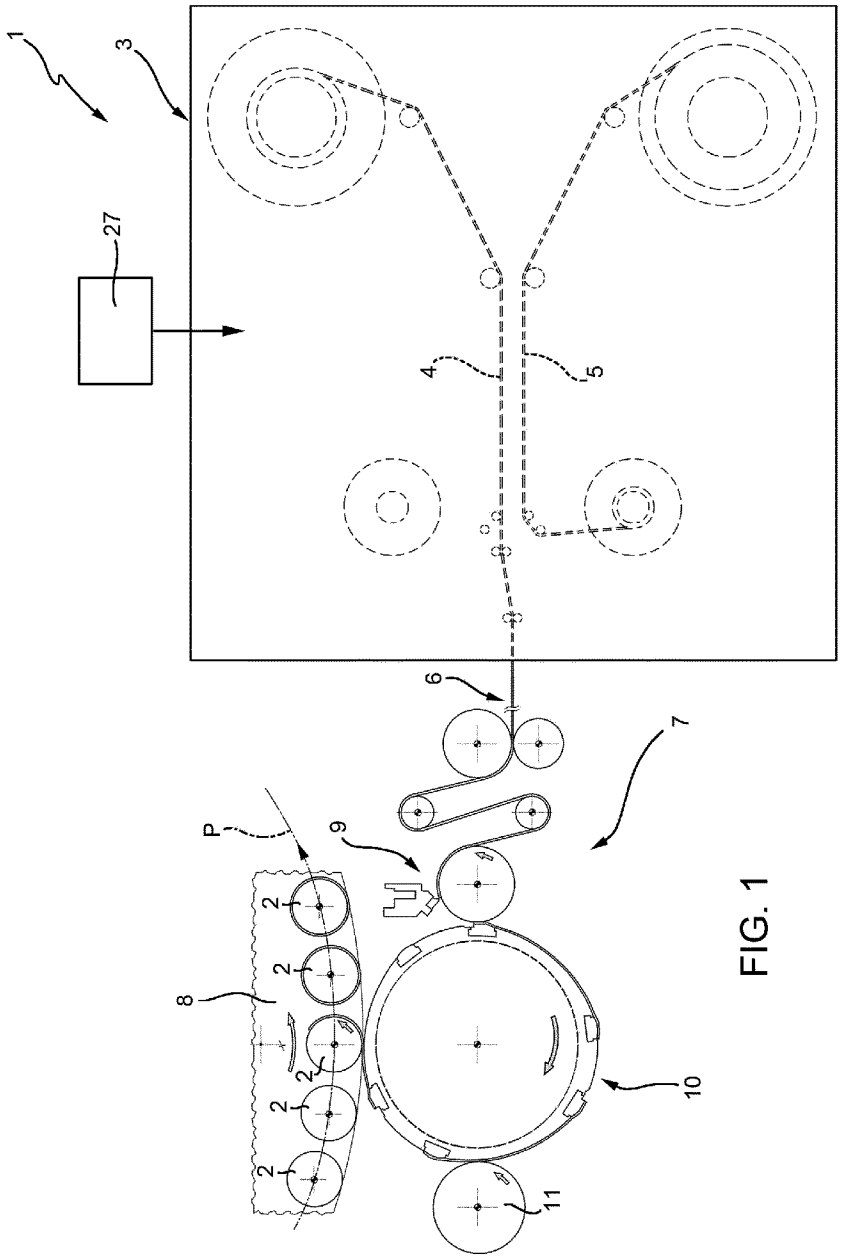
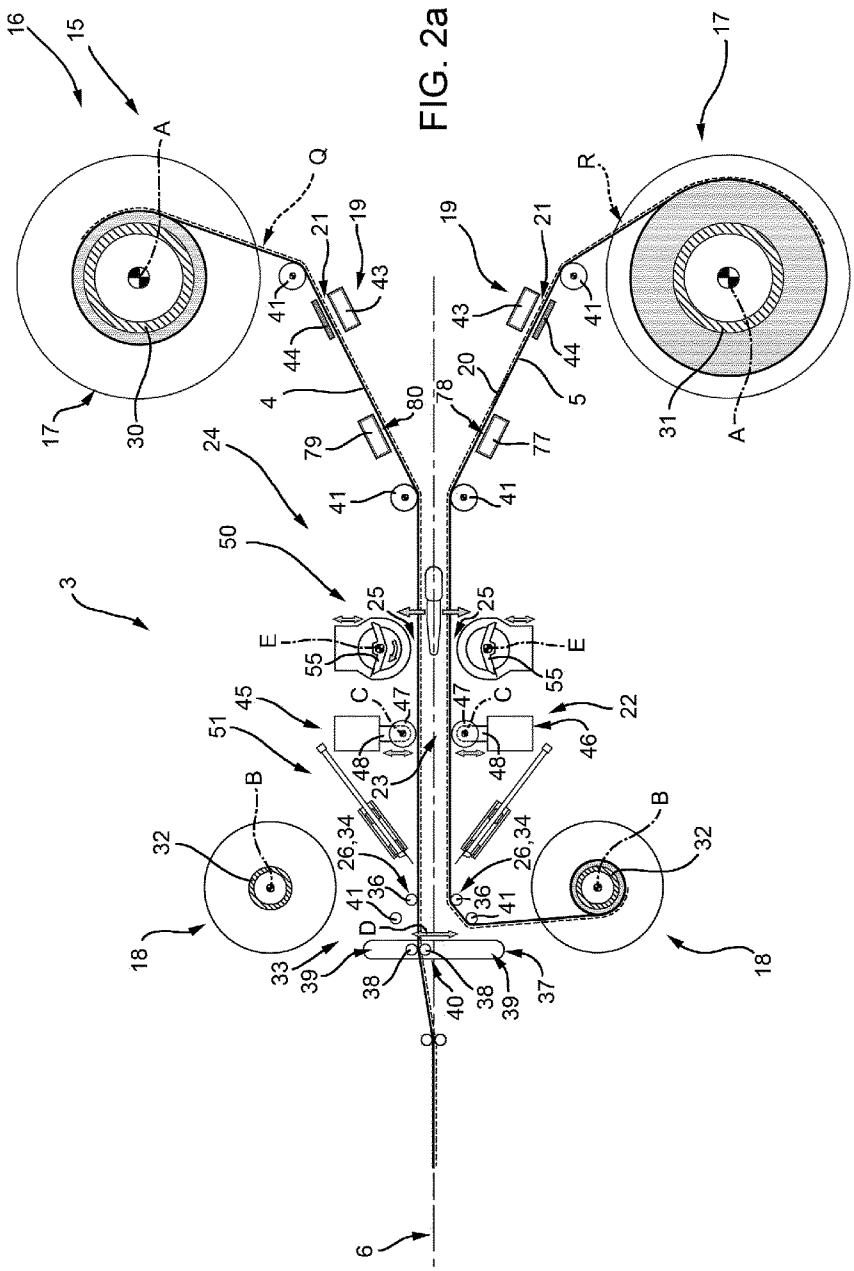


FIG. 1

FIG. 2a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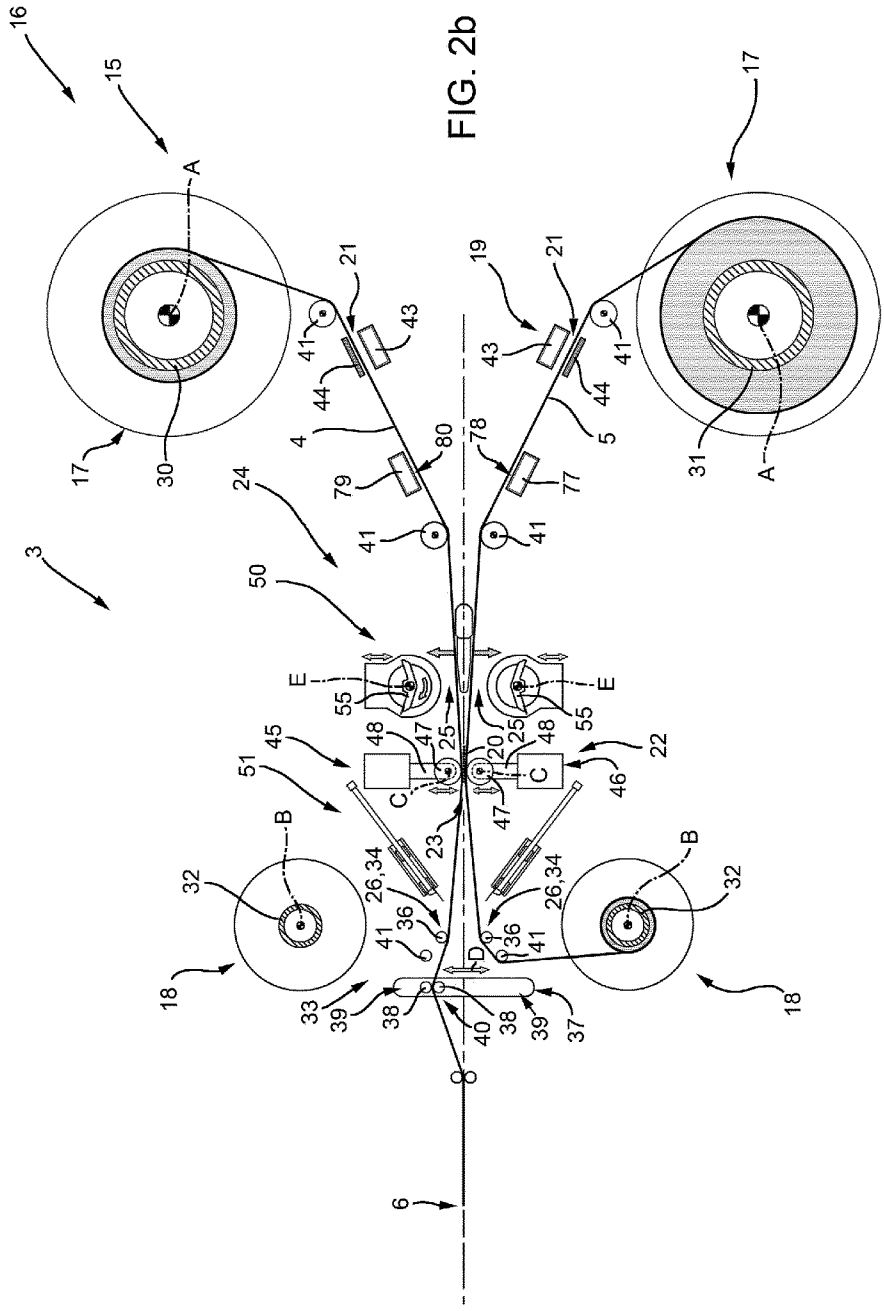
6

FIG. 2b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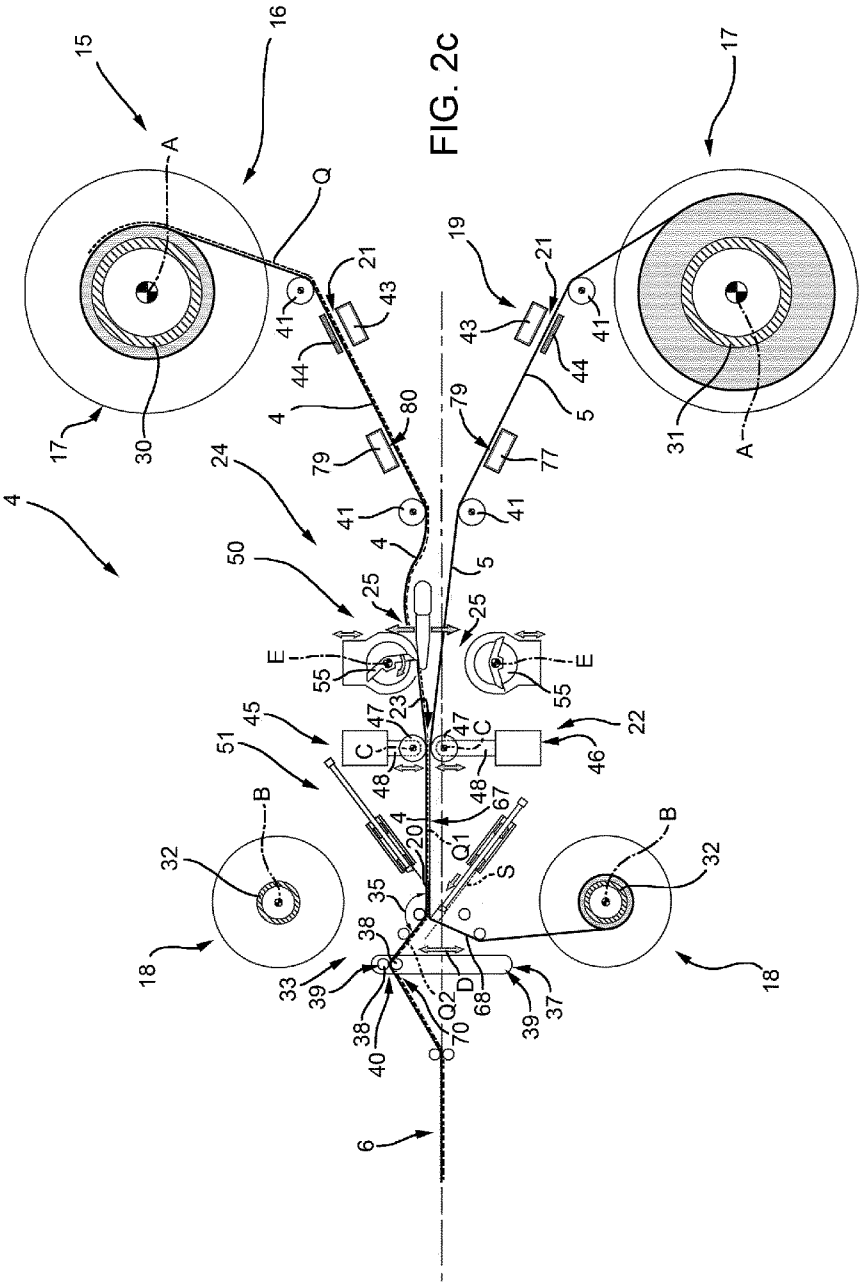
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33
39
Q2
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70
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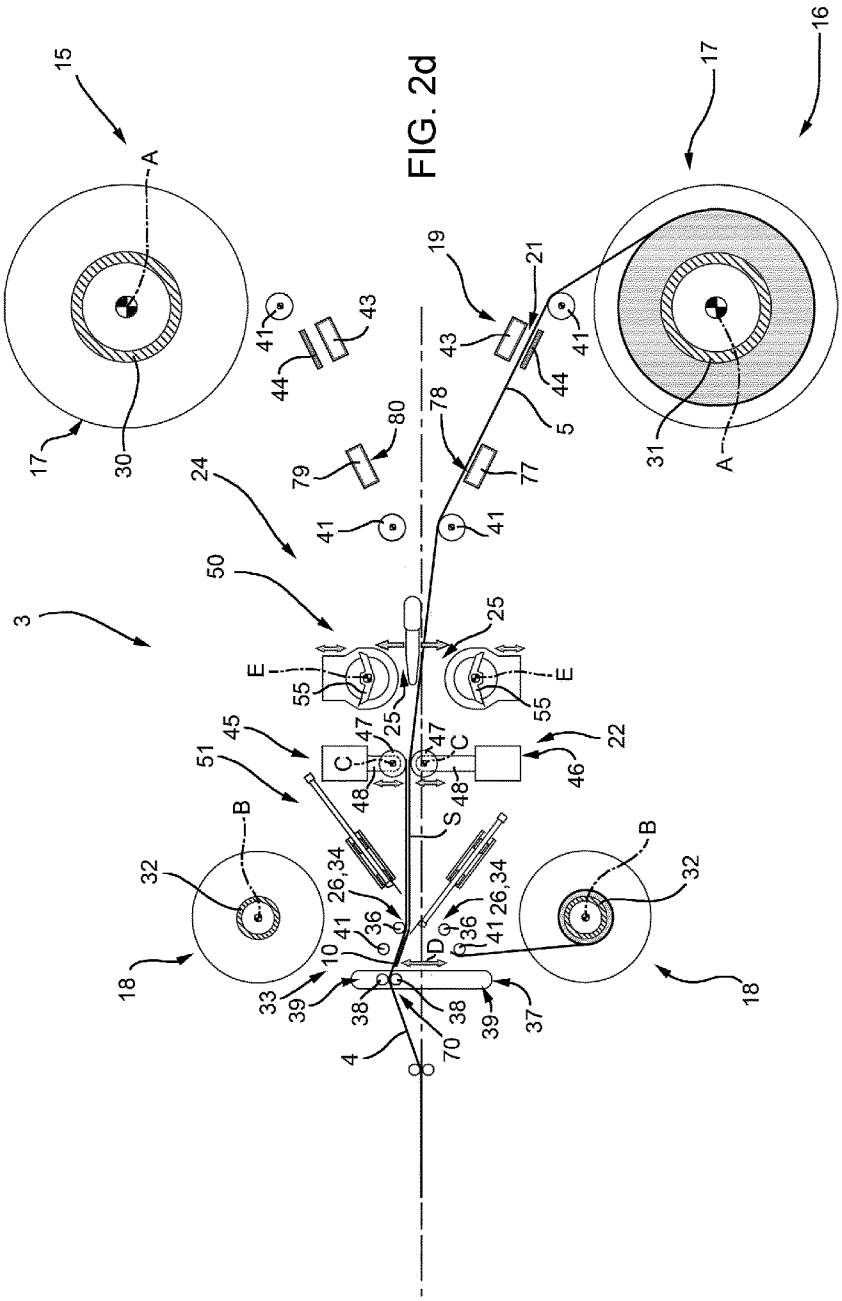
FIG. 2c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47
C
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4
70
D
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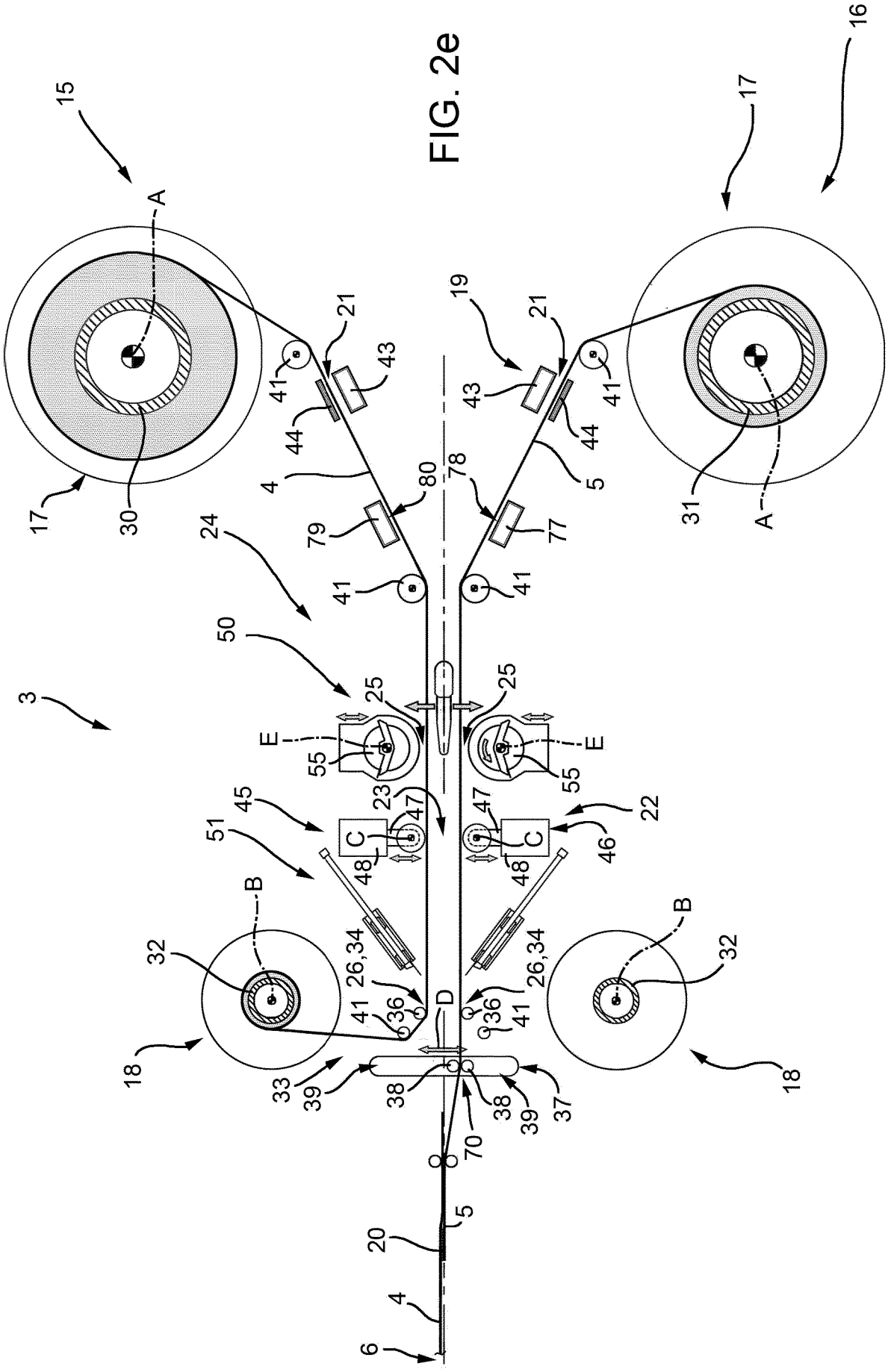
FIG. 2d

FIG. 2e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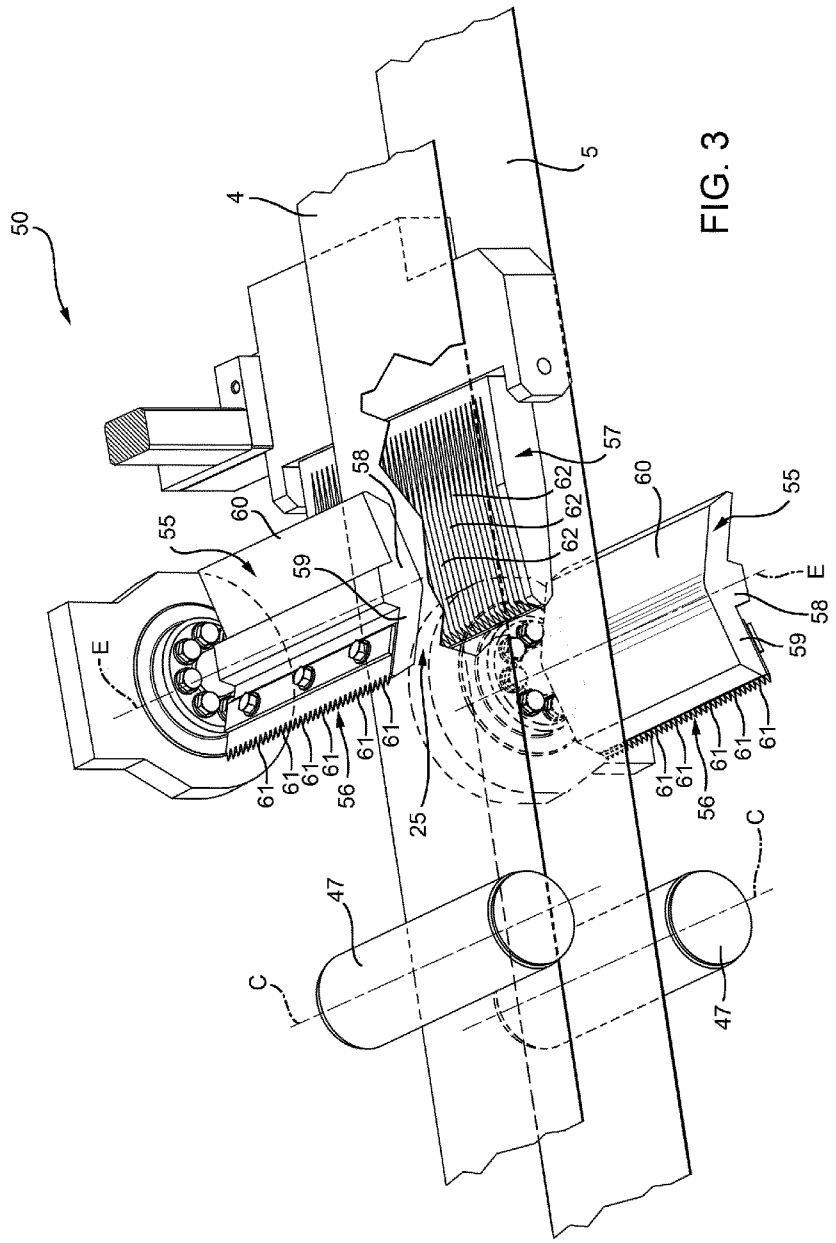


FIG. 3

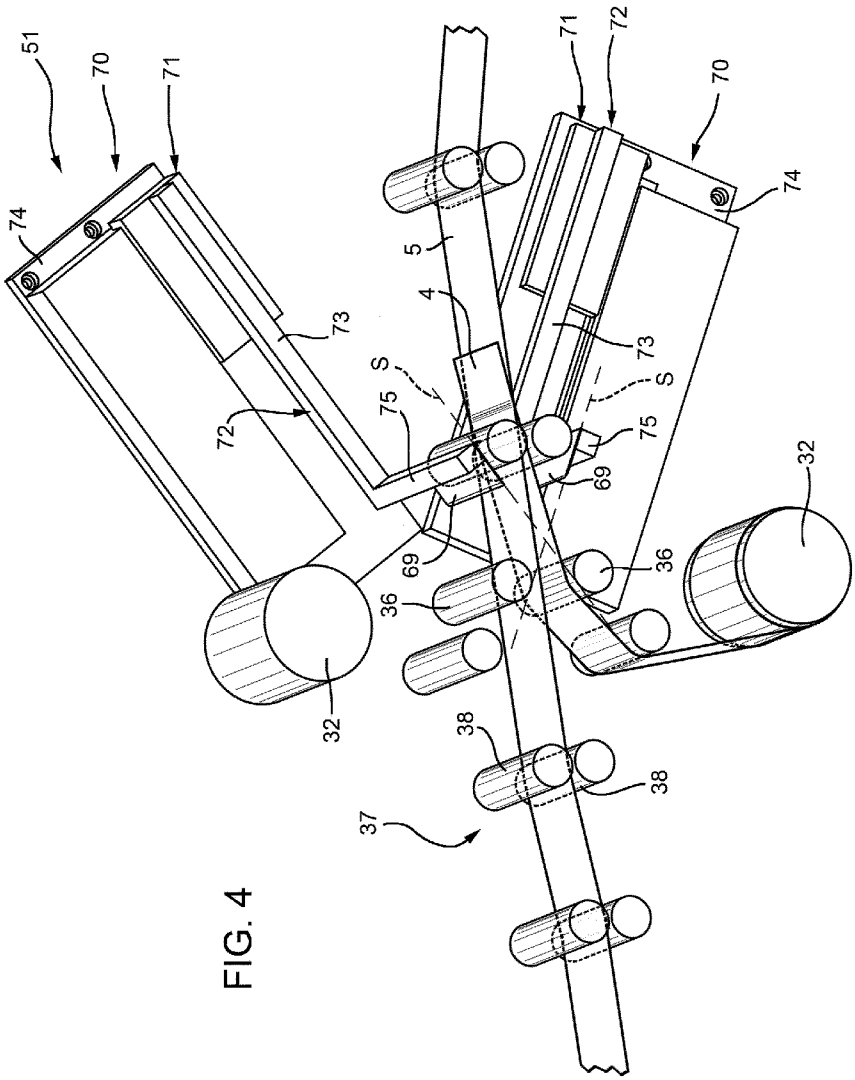
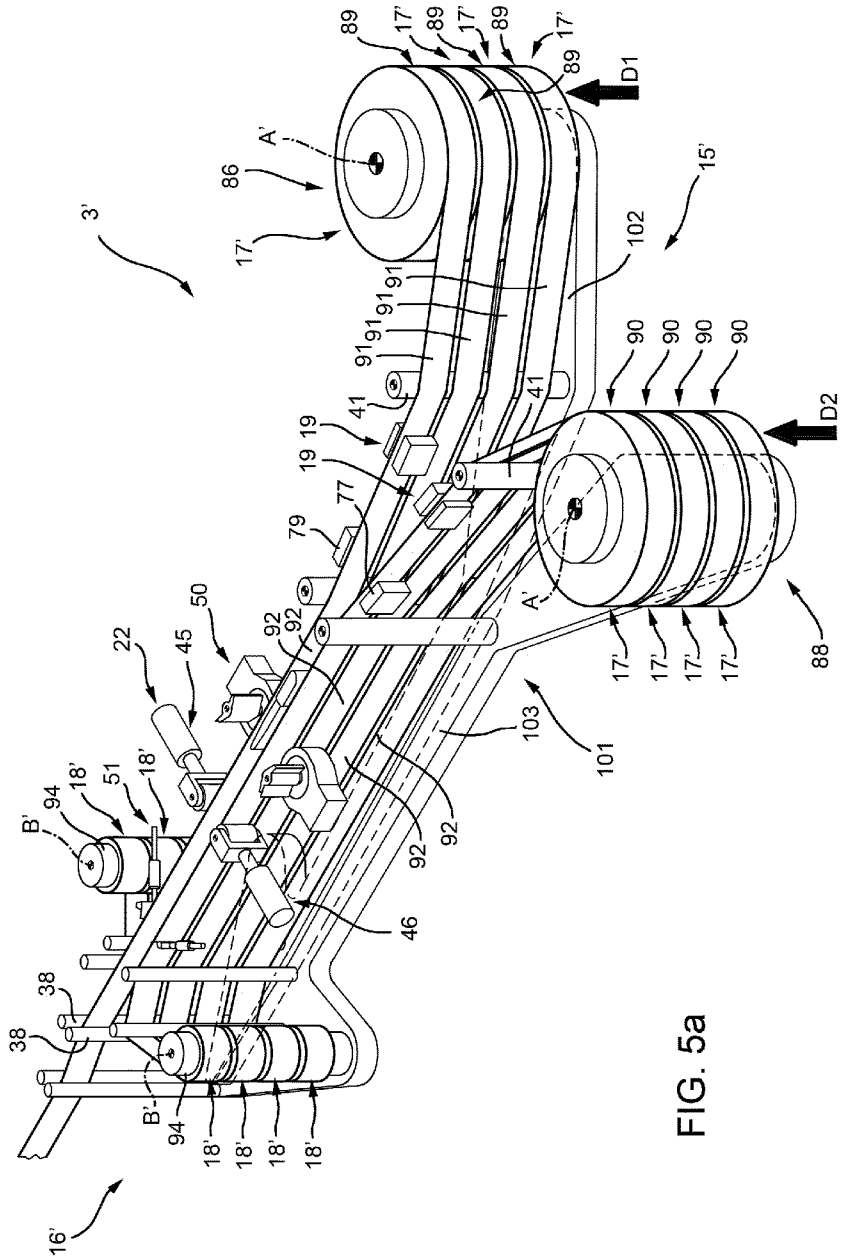


FIG. 4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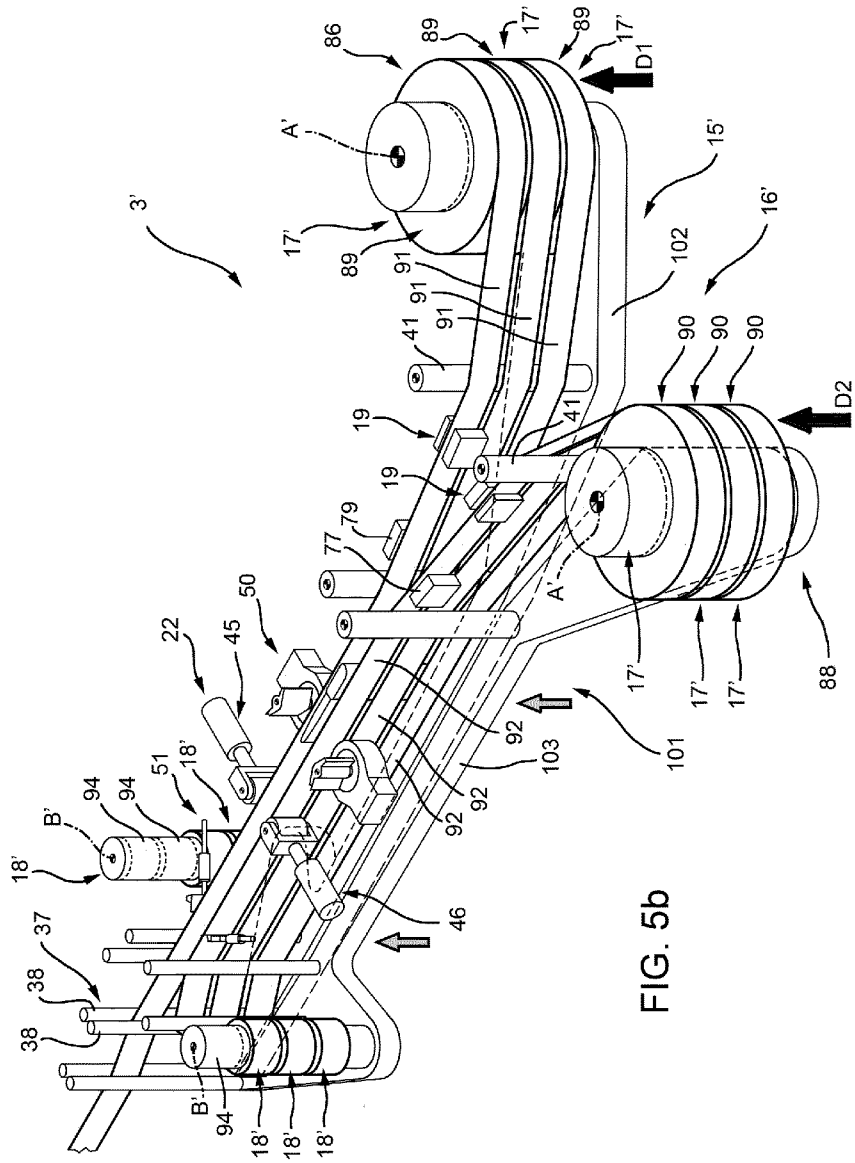
103
A'
B'
D1
D2

FIG. 5a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D2
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A'
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17'
88
92
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18'
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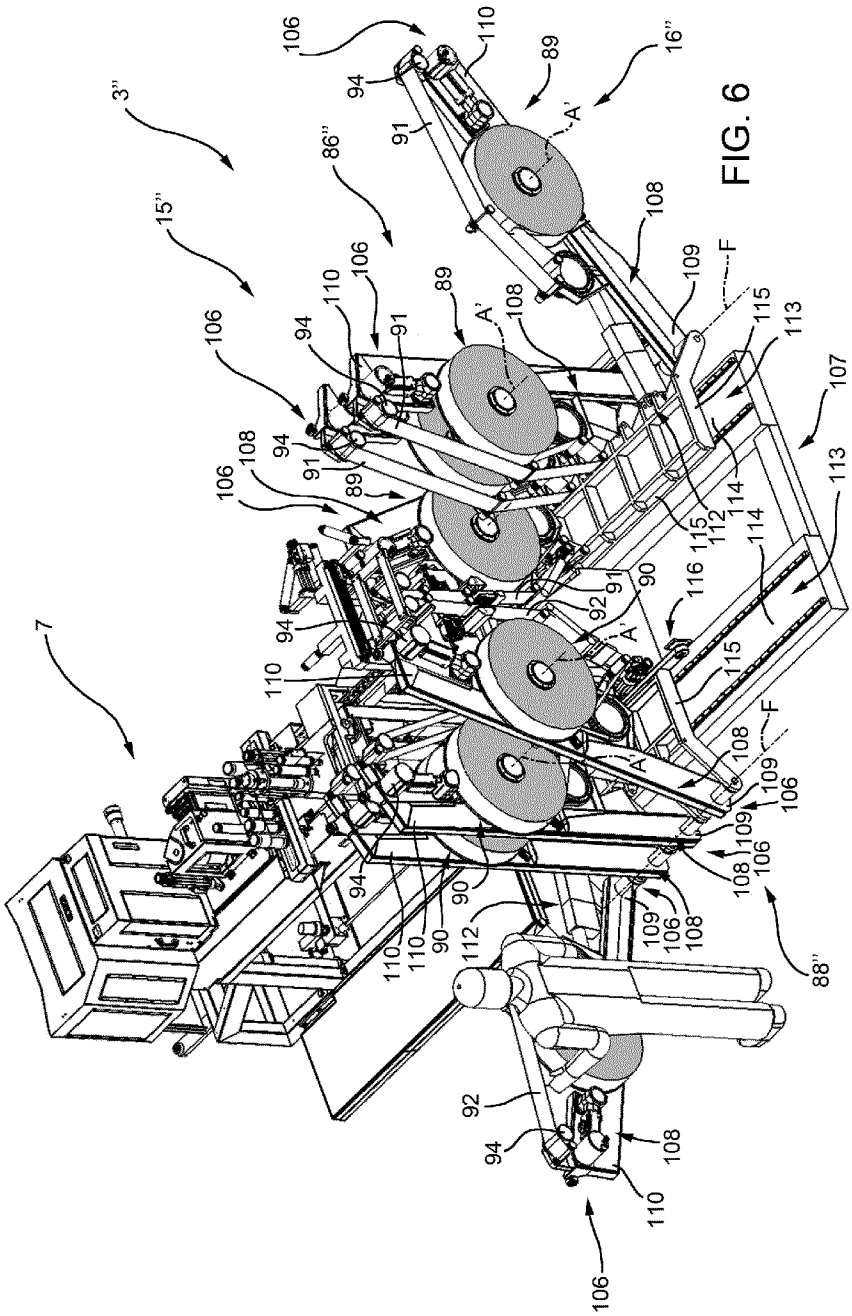
FIG. 5b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111

FIG. 6

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/072448

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65H21/02 B65H19/18 B65H16/02
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 064 488 A (DICKEY DANIEL M [US]) 12 November 1991 (1991-11-12) abstract; figure 1 the whole document	1-28

X	US 6 978 816 B1 (BYRNE THOMAS TIMOTHY [US] ET AL) 27 December 2005 (2005-12-27)	1-3,5-8, 11, 14-19, 22-25
A	abstract; figures 1,2 column 1, line 38 - column 2, line 13 column 2, line 66 - column 3, line 23 the whole document	4,9,10, 12,13, 20,21, 26-28

X	US 5 584 446 A (DELMORE MICHAEL D [US] ET AL) 17 December 1996 (1996-12-17)	29-32
A	abstract; figure all the whole document	33-39

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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
24 August 2018	04/09/2018

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Piekarski, Adam

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Form PCT/ISA/210 (second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2017/072448

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 2017/129730 A1 (RÖTTGER HENNING [DE]) 11 May 2017 (2017-05-11) abstract; figures 1-3 paragraph [0030] paragraph [0031] - paragraph [0032] -----	29-39

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INTERNATIONAL SEARCH REPORT

International application No.
PCT/EP2017/072448

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. ☐ Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically:

3. ☐ Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. ☒ As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims.

2. ☐ As all searchable claims could be searched without effort justifying an additional fees, this Authority did not invite payment of additional fees.

3. ☐ As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.:

4. ☐ No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

☐ The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.

☐ The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.

☒ No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. claims: 1-28

   Splicing method and apparatus for printed web.

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2. claims: 29-39

   Conveying and splicing apparatus for multi-roll system.

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2017/072448

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
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