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Amended claims in accordance with Rule 137(2) EPC.

(54) **An apparatus and a method for splicing webs provided with repeated patterns**

(57) There is described an apparatus (1) for splicing a new web (3), provided with repeated patterns, to a web in use (2), also provided with repeated patterns and fed, at a working speed (W) and along a predetermined path (P), to a processing machine; the apparatus (1) comprises: a first and a second support hub (11, 10) respectively supporting in use a first and a second reel (5, 4) of the webs (2, 3) to be spliced and rotating about axes (E, D) parallel to one another; joining means (13) arranged adjacent to a working portion (P1) of the path (P) and selectively activated for adhesively bonding a segment (3a) of the new web (3) to a segment (2a) of the web in use

(2) in an overlapped position; and cutting means (14) to perform a cutting operation on the web in use (2) at an area thereof located upstream of the overlapped and bonded segments (2a, 3a); the first and second support hub (11, 10) are independently rotated about their axes (E, D) by first and second actuator means (27, 26), respectively; the joining means (13) comprise pressing means (75) selectively activated to press the segments (2a, 3a) onto one another while passing along the working portion (P1) itself and while the segment (3a) of the new web (3) is advanced by the first actuator means (27) at the working speed (W) of the web in use (2). (Figure 3)

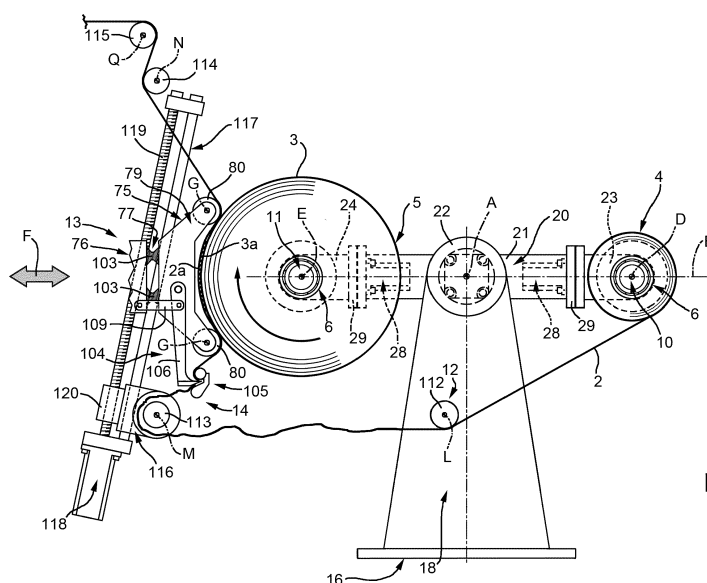


FIG. 3

Description

[0001] The present invention relates to an apparatus and to a method for splicing webs provided with repeated patterns, so as to generate an uninterrupted feeding of said webs to a processing machine.

[0002] In particular, the present invention has advantageous but not exclusive application in the labelling field, wherein the different patterns define respective labels adapted to be placed on containers, for example bottles or cans, in a labelling machine. In this specific context, each web may consist entirely in a succession of labels to be separated by means of repeated cutting of the web itself, or it may be constituted by a strip support on which a succession of adhesive labels is applied, also known as "pressure sensitive labels," spaced from each other by predetermined amounts.

[0003] The present invention may be also used in the packaging field; in this specific context, the web material has a multilayer structure and is adapted to be folded, welded and cut out for achieving sealed packages, for example containing pourable food products.

[0004] The following description will make explicit reference to the labelling field, although this is in no way intended to limit the scope of protection as defined by the accompanying claims.

[0005] As known, the splicing operation of a new web to an almost exhausted web in use is normally carried out without stopping the feeding of the web in use to the labelling machine, but only by slowing its progress.

[0006] In particular, a double-sided adhesive sheet element is previously attached upon a head segment of the new web. Said segment of the new web is then made to adhere, thanks to the action of the double-sided adhesive, on a corresponding segment of the web in use so as to obtain alignment of the corresponding labels. Simultaneously to the splicing operation, the web in use is cut in the area located immediately upstream of the segments of the two webs joined together by the double-sided adhesive sheet element. It is thus possible to restart the feeding of the labels to the labelling machine at normal working speed.

[0007] The apparatus and method described, while being widely used, however, have the following drawbacks.

[0008] In particular, due to the speed reduction required in conventional splicing apparatuses, it is necessary to provide a web buffer between such apparatuses and the following labelling machines; as an alternative, one or more container buffers have to be arranged between the labelling machine and the adjacent processing machines to compensate for the speed variations in the splicing apparatus.

[0009] In both cases, provision of these additional buffers does not allow to maximize production efficiency as well as production output rate.

[0010] Plus, the use of these buffers causes an increase of the overall space occupied by the container handling plant.

[0011] Furthermore, all conventional splicing apparatuses require a certain degree of human intervention, which should be minimized in order to achieve higher production speeds and efficiency as well as less risks of industrial accidents.

[0012] It is an object of the present invention to provide an apparatus for splicing webs with repeated patterns, which allows to overcome, in a straightforward and low-cost manner, the drawbacks associated with the splicing apparatuses of known type.

[0013] This object is achieved by an apparatus for splicing webs provided with repeated patterns, as defined in claim 1.

[0014] The present invention also relates to a method for splicing webs provided with repeated patterns, as defined in claim 20.

[0015] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 shows a top plan view, with parts removed for clarity, of an apparatus for splicing webs in accordance with the teachings of the present invention; Figures 2 to 7 show respective larger-scale side views of the apparatus of Figure 1, in different operative conditions;

Figure 8 shows a larger-scale side view, with parts removed for clarity, of a reel support hub of the apparatus of Figures 1 to 7;

Figure 9 shows a section along line IX-IX in Figure 8; Figure 10 shows a larger-scale side view, with parts removed for clarity, of a joining unit and a cutting unit of the apparatus of Figure 2;

Figure 11 shows a larger-scale side view, with parts removed for clarity, of the joining unit and the cutting unit of Figure 10 in the condition of Figure 3;

Figure 12 shows a smaller-scale side view of the entire joining and cutting units of Figure 10;

Figure 13 shows a top plan view of the joining and cutting units of Figure 12;

Figure 14 shows a larger-scale side view of a detail of the apparatus of Figure 2, in two different operative conditions; and

Figure 15 shows a larger-scale perspective view of a reel of web material used in the apparatus of Figures 1 to 7.

[0016] Number 1 in Figure 1 indicates as a whole an apparatus for splicing two webs 2, 3, both provided with repeated patterns (known per se and not shown), so as to generate an uninterrupted feeding of said webs 2, 3 to a processing machine (known per se and not shown).

[0017] Apparatus 1 can be advantageously used in the labelling field, wherein the repeated patterns of each web 2, 3 define respective labels adapted to be placed on containers (known per se and not shown), for example bottles or cans, in the cited processing machine, which in this case is constituted by a labelling machine.

[0018] In this specific context, each web 2, 3 consists entirely in a succession of labels to be separated by means of repeated cutting of the web itself; alternatively, each web 2, 3 may be constituted by a strip support on which a succession of adhesive labels are applied, also known as "pressure sensitive labels", spaced from each other by predetermined amounts.

[0019] According to another possible embodiment of the present invention, apparatus 1 can be also used in the packaging field; in this specific context, each web 2, 3 has a multilayer structure and is adapted to be folded, welded and cut out for achieving sealed packages, for example containing pourable food products. The repeated pattern of each web 2, 3 is therefore defined by a plurality of crease lines for forming a relative package and by images and written parts destined to be present on the package itself.

[0020] As visible in Figures 1 to 7, webs 2, 3 are unwound from respective reels 4, 5 each having a cylindrical configuration and provided with a through central hole 6.

[0021] It should be noted that, in the example illustrated in Figures 1 and 2, web 2, unwound from reel 4, represents the web in use fed, at a working speed W and along a predetermined path P, to the next processing machine, while web 3, unwound from the reel 5, represents the new web that must be spliced to the web 2 in use before the exhaustion of the latter.

[0022] As the splicing operation is completed, the new web 3 becomes the web in use (Figures 4 to 7) and a new reel 5 is loaded on apparatus 1 in a condition to allow its web 3 to be subsequently spliced to the web 3 in use when the relative reel 5 will be almost exhausted.

[0023] Reel 5 is shown in greater details in Figure 15; as clearly visible in such Figure, a head segment 3a of new web 3 has, on its outer side, i.e. on its side opposite the one facing hole 6 of reel 5, one or more adhesive strips 7 adapted to be bonded in use on a corresponding segment 2a of the web 2 in use by a pressing action.

[0024] Undesired unwinding of web 3 from reel 5 before the splicing operation is avoided by bonding the inner side of head segment 3a to the underlying portion of web 3 by one or more adhesive portions 8, having extensions greatly smaller than the ones of the respective adhesive strips 7 so as to exert in use less adhesion force than the latter; in this way, connection of head segment 3a to the underlying portion of web 3 can be easily broken when the web 3 itself is spliced to web 2 by adhesive strips 7.

[0025] With reference to Figure 1, apparatus 1 comprises:

- at least one reel magazine 9;
- two support hubs 10, 11 adapted to coaxially engage holes 6 of respective reels 4, 5 as well as to unwind the relative webs 2, 3 from the reels 4, 5 themselves and to feed them to the following processing machine;
- guiding means 12 configured to guide web 2 in use along path P;

- a joining unit 13 arranged adjacent to a working portion P1 of path P and selectively activated for adhesively bonding head segment 3a of new web 3 to segment 2a of web 2 in use in an overlapped position and with the corresponding patterns aligned;
- a cutting unit 14 also arranged adjacent to working portion P1 of path P and selectively activated to perform a cutting operation on web 2 in use at an area thereof located upstream of the overlapped and bonded segments 2a, 3a; and
- a discharge conveyor 15 adapted to receive the exhausted reels 2 and to move them to a discharge station (not shown).

[0026] As shown in Figure 1, support hubs 10, 11 are mounted on a central support device 16, whilst magazine 9, joining unit 13, cutting unit 14 and discharge conveyor 15 are all arranged around support device 16.

[0027] In particular (Figures 1 to 7), support device 16 comprises a fixed frame 18 and an oscillating arm 20, protruding from opposite sides of the frame 18 and centrally connected thereto in a rotatable manner about a horizontal axis A. In practice, axis A defines a fulcrum for an intermediate portion 21 of oscillating arm 20. In other words, intermediate portion 21 of oscillating arm 20 is connected to frame 18 through a pivot 22 of axis A.

[0028] More specifically, oscillating arm 20 has a longitudinal axis B, orthogonal to axis A, and carries, at its opposite end portions 23, 24 the respective support hubs 10, 11.

[0029] Rotation of oscillating arm 20 about axis A is controlled by an actuator assembly 25, for instance an electric motor, supported by frame 18.

[0030] Oscillating arm 20 is normally set in a horizontal configuration (Figures 1-4 and 7) and is rotated of 180° about axis A to exchange the positions of support hubs 10, 11 with respect to the axis A itself.

[0031] By considering the horizontal configuration of oscillating arm 20 of Figures 1 and 2, joining unit 13 and cutting unit 14 are located on one side of axis A and in a position adjacent to the support hub 11 carrying the reel 5 of the new web 3 to be spliced to the web 2 in use; discharge conveyor 15 is instead located on the opposite side of axis A with respect to joining unit 13 and cutting unit 14 as well as adjacent to the other support hub 10 carrying the reel 4 of the web 2 in use; discharge conveyor 15 is in particular located below such support hub 10 to receive from the latter the exhausted reel 4 (Figures 1 and 4).

[0032] Magazine 9 is placed on the same side as discharge conveyor 15 with respect to axis A but on one side of oscillating arm 20; in particular, magazine 9 carries a stack of new reels 5 arranged coaxially with an axis C parallel to axis A and facing the support hub 10 in the condition in which it has already discharged the exhausted reel 4 and is ready to receive a new reel 5, as it will be explained hereafter.

[0033] As visible in Figures 1 to 7, support hubs 10, 11

protrude orthogonally from respective end portions 23, 24 of oscillating arm 20. In particular, each support hub 10, 11 has a relative longitudinal axis D, E, orthogonal to axis B, and is mounted onto the respective end portion 23, 24 of oscillating arm 20 in a rotatable manner both about its relative axis D, E and about axis B.

[0034] More specifically, support hubs 10, 11 are independently rotated about their axes axis D, E by respective actuator assemblies 26, 27, each of which preferably comprises an electric motor carried by oscillating arm 20 and protruding from the latter on the opposite side of the relative support hub 10, 11; as already explained above, rotation of each support hub 10, 11 about its relative axis D, E allows to unwind the web 2, 3 from the relative reel 4, 5 and to feed it to the following processing machine.

[0035] Rotation of each support hub 10, 11 about axis B is controlled by a respective actuator assembly 28, preferably an electric motor, carried by a stirrup 29 protruding laterally from oscillating arm 20.

[0036] During its rotation about axis B of oscillating arm 20 arranged in the horizontal configuration, each support hub 10, 11 can be set in four different positions, two of which defining a horizontal configuration of the support hub 10, 11 itself and the other two defining a vertical configuration thereof.

[0037] In particular, in its horizontal configuration, each support hub 10, 11 has its relative axis D, E parallel to axis A and has its free end 30 arranged on one side of oscillating arm 20 or on the opposite side thereof.

[0038] Each support hub 10, 11 is set in a normal working position, i.e. in a position in which it supports, and allows unwinding of, the reel in use, in the present example reel 4, when said support hub 10, 11 is carried by oscillating arm 20 in its horizontal configuration and extends horizontally above discharge conveyor 15 and with its free end 30 facing magazine 9.

[0039] In the example shown, the normal working position of each support hub 10, 11 also corresponds to a loading position of the hub 10, 11 itself, in which it is adapted to receive a new reel 5 from magazine 9, as it will be explained later on.

[0040] Each support hub 10, 11 is set in a splicing position, i.e. in a position in which it is adapted to allow splicing of webs 2 and 3, when said support hub 10, 11 is carried by oscillating arm 20 in its horizontal configuration, extends horizontally and is rotated of 180° about axis A with respect to the other support hub 11, 10 set in the loading or normal working position. In particular, in the splicing position, each support hub 10, 11 is arranged adjacent to joining unit 13.

[0041] In view of the above, support device 16 (in particular oscillating arm 20 in its horizontal configuration) is configured to simultaneously set support hub 11, along with the reel 5 of the new web 3, in the splicing position, and support hub 10, along with the reel 4 of the web 2 in use, in the normal working position.

[0042] Rotation of oscillating arm 20 about axis A allows to exchange the positions of support hubs 10, 11,

i.e. to set support hub 10 in the splicing position and support hub 11 in the loading or normal working position.

[0043] Guiding means 12 are advantageously configured to guide the web 2 in use around, and spaced from, reel 5 mounted on support hub 11 in the splicing position so that working portion P1 of path P is located between joining unit 13 and the reel 5 itself.

[0044] In particular, in the example shown, working portion P1 of path P is substantially orthogonal to axes A, C as well as to axes D, E when support hubs 10, 11 are set in their horizontal configurations; in addition, working portion P1 of path P is also substantially orthogonal to axis B of oscillating arm 20.

[0045] In its vertical configuration, each support hub 10, 11 has its axis D, E orthogonal to axes A and B and its free end 30 arranged above (not shown) or below (Figure 4) oscillating arm 20 so respectively defining a reel seating position or a reel discharging position.

[0046] In particular, as it will be explained in greater details hereafter, in the reel seating position, the new reel, in the present case reel 5, can be arranged in its final condition with respect to the relative support hub 10, 11; in the reel discharging position (Figure 4), the exhausted reel, in the present case reel 4, can be discharged by gravity from the relative support hub 10 discharge conveyor 15.

[0047] With reference to Figure 1, magazine 9 comprises a support structure 31 externally supporting a stack of new reels 5 arranged coaxially with axis C and adjacent to one another.

[0048] Support structure 31 of magazine 9 comprises a base 32 and an upper supporting portion 33 carrying in use the relative stack of reels 5 and movable with respect to base 32 along axis C towards and away from the facing support hub 10 in its loading position.

[0049] In particular, supporting portion 33 of magazine 9 is movable along axis C between a rest position (Figure 1), in which the relative stack of new reels 5 is spaced from the facing support hub 10 in the loading position, and a working position (not shown), in which one free end reel 5 of the stack of reels 5 is engaged by the support hub 10 in the loading position so as to be withdrawn from the magazine 9.

[0050] Base 32 preferably comprises a pair of longitudinal bars 34, parallel to axis A, C, and two or more transverse bars 35, connecting longitudinal bars 34 to each other and extending orthogonally thereto.

[0051] Supporting portion 33 substantially has a cradle-like structure and comprises:

- a horizontal frame 36 superimposed on base 32, sliding with respect to the latter along axis C and including two longitudinal sides 37, parallel to axes A, C, and two transverse sides 38, orthogonal to axes A, C and connected to the longitudinal sides 37;
- a plate element 39 protruding vertically from the farthest transverse side 38 of frame 36 with respect to support device 16;

- a pair of horizontal supporting bars 40 protruding orthogonally from plate element 39 towards support device 16; and
- a pair of columns 41 connecting the respective supporting bars 40 to the closest transverse side 38 of frame 36 with respect to support device 16.

[0052] In the example shown, longitudinal sides 37 of frame 36 are coupled in a sliding manner with respective guiding rails 42 protruding from the upper surface of base 32 and extending parallel to axis C as well as on the opposite sides thereof.

[0053] Columns 41 are preferably slanted with respect to supporting bars 40 and converge to each other starting from frame 36.

[0054] As shown in Figure 1, the reels 5 of each stack are placed adjacent to one another and have respective lower portions resting on supporting bars 40.

[0055] The movement of supporting portion 33 is controlled by an actuator assembly (known per se and not shown), preferably an electric motor, supported by base 32 and having an externally threaded output shaft engaging a nut screw carried by plate element 39.

[0056] Magazine 9 further comprises an actuator assembly 43 to move the relative stack of reels 5 towards support device 16 along axis C and with respect to supporting portion 33 in order to recover the space previously occupied by the withdrawn reel 5. In practice, actuator assembly 43 is selectively activated to move forward the stack of reels 5 so that the free end reel 5 of the stack is carried to the same position as the one previously occupied by the end reel 5 withdrawn by the support hub 10. In the example shown, the movement of the stack of reels 5 with respect to the supporting portion 33 carries the free end reel 5 of the stack, destined to be withdrawn by the adjacent support hub 10, onto free end portions 45 of supporting bars 40.

[0057] Actuator assembly 43 basically comprises an actuator 46, preferably an electric motor (only partially shown in Figure 1), supported by plate element 39, and transmission means 47 to transform the rotational movement of an output shaft (known per se and not shown) of the actuator 46 into a translational movement, along axis C, of a pushing member 48 cooperating with an end reel 5 of the stack of reels 5, opposite to the free end reel 5 destined to be first withdrawn by the adjacent support hub 10.

[0058] Pushing member 48 comprises a plate element 49, cooperating with the stack of reels 5 and extending parallel to plate element 39, and a plurality of guiding rods 50 protruding orthogonally from plate element 49 and engaging, in a sliding manner parallel to axis C, respective through holes formed in the plate element 39 itself.

[0059] Transmission means 47 comprise a screw 51 having one end connected to plate element 49 of pushing member 48, and a nut screw 52 supported by plate element 39 and engaged by screw 51.

[0060] With reference to Figures 8 and 9, each support hub 10, 11 further comprises retaining means 55 selectively set between a release configuration (Figure 8 and 9, left sides), in which they allow engagement/disengagement of the support hub 10, 11 into/from a core of the reel 5 to be withdrawn from magazine 9, and a retaining configuration (Figure 8 and 9, right sides), in which they prevent disengagement of the engaged reel 5 from the support hub 10, 11.

[0061] As support hubs 10, 11 are identical to one another, only one of them, in particular support hub 10, will be described hereafter for the sake of simplicity; it is however clear that the following description will apply to both support hubs 10, 11.

[0062] Retaining means 55 are advantageously defined by an outer wall 56 of support hub 10, which is selectively expanded/retracted in a radial direction with respect to its axis D.

[0063] In particular, outer wall 56 of support hub 10 comprises a plurality of radially outer sectors 57, which are radially movable with respect to axis D between a retracted position (Figures 8 and 9, left sides), in which they define the minimum outer diameter of support hub 10 so allowing engagement/disengagement of the support hub 10 into/from the core of a respective reel 5, and an expanded position (Figures 8 and 9, right sides), in which they define the maximum outer diameter of the support hub 10 so retaining the reel 5 onto the outer surface of the support hub 10 itself.

[0064] Retracted position of sectors 57 corresponds to release configuration of retaining means 55, whilst expanded position of sectors 57 corresponds to retaining configuration of retaining means 55.

[0065] In greater details, support hub 10 comprises:

- a support shaft 58 of axis D;
- an inner core 60, mounted onto support shaft 58 in an axially displaceable manner along axis D and having one or more outer conical mating surfaces 61 of axis D, two in the example shown; and
- sectors 57, each of which has one or more inner conical mating surfaces 62 cooperating in a sliding manner with the respective outer conical mating surfaces 61 of inner core 60 to transform an axial movement of the inner core 60 along axis D and with respect to support shaft 58 into a radial movement of the sectors 57 themselves.

[0066] In order to allow rotational movement of the entire support hub 10 about axis D, inner core 60 is angularly coupled with support shaft 58, whilst sectors 57 are angularly coupled with inner core 60.

[0067] Axial displacements of inner core 60 along axis D are preferably achieved by feeding/removing a pressure fluid, such as air, into/from a sealed chamber 63 formed into support hub 10 between inner core 60 and support shaft 58.

[0068] In particular, pressure fluid is fed or removed

into/from sealed chamber 63 through an axial channel 64, formed into support shaft 58, and a plurality of radial passages 65, also formed into support shaft 58 and extending from one closed end of channel 64 to the sealed chamber 63.

[0069] As shown in Figure 9, support hub 10 also comprises a first radially-protruding annular flange 66, fitted to one end of support shaft 58 and defining free end 30 of the support hub 10 itself, and a second radially-protruding annular flange 68 secured to support shaft 58 in a position spaced from flange 66 and adapted to define in use an abutment surface for the relative reel 5 in its final condition.

[0070] In order to provide a guiding action for radial displacements of each sector 57 with respect to axis D, both flanges 66, 68 are provided with respective radial grooves 69, 70 engaged in a sliding manner by respective teeth 71 axially protruding from opposite axial ends of the sector 57 itself.

[0071] In practice, as a result of the coupling of teeth 71 with respective grooves 69, 70, each sector 57 is linked to flange 68 in an axially fixed position and in a radially movable manner.

[0072] Support hub 10 further comprises a helical spring 72, wound about support shaft 58, axially interposed between flange 68 and inner core 60 and exerting an elastic load on the inner core 60 itself to maintain it in a first axial position (Figure 9, left side) corresponding to the retracted position of sectors 57.

[0073] Inner core 60 is displaced in use, against the thrust of spring 72, into a second axial position (Figure 9, right side), corresponding to the expanded position of sectors 57, by feeding the pressure fluid into sealed chamber 63.

[0074] In the example shown, conical mating surfaces 61, 62 of support hub 10 converge towards flange 68, so that radial expansion of sectors 57 is achieved by axially displacing inner core 60 towards the flange 68 itself.

[0075] Support hub 10 also comprises one or more elastic rings 73 extending around sectors 57 and exerting an elastic load thereon to maintain them in their retracted positions.

[0076] In the reel seating position of support hub 10, annular flange 68 is placed below radially expandable sectors 57 so as to allow the relative reel 5 to be seated against the annular flange 68 itself by radially retracting and expanding the sectors 57.

[0077] In a completely different manner, in the reel discharging position (Figure 4), annular flange 68 is placed above radially expandable sectors so 57 as to allow to discharge the core of the exhausted reel 4 by gravity and by retracting the sectors 57.

[0078] With reference to Figures 1-7 and 10-13, joining unit 13 comprises pressing means 75, which contact the web 2 in use advancing along portion P1 of path P and are selectively activated to press segment 2a of the web 2 itself onto segment 3a of new web 3, while this latter segment is advanced by actuator assembly 27 at the

same working speed W as the web 2 in use.

[0079] Joining unit 13 further comprises actuator means 76 for moving pressing means 75 to and away from reel 5 of new web 3 along a direction F transversal to portion P1 of path P as well as orthogonal to axes A, C.

[0080] Actuator means 76 are connected to pressing means 75 by spring means 77 to allow a dampened action of the pressing means 75 on new reel 5 during the splicing operation as well as slight oscillations of the pressing means 75 themselves with respect to direction F so as to perfectly adapt to the profile of the new reel 5.

[0081] Actuator means 76, along with pressing means 75, are carried by a fixed support structure 78, partially shown in Figures 12 and 13.

[0082] Pressing means 75 comprise a holder element 79, connected to actuator means 76 through spring means 77, and two cylindrical rollers 80, carried by holder element 79 and adapted to cooperate respectively with a leading portion and a trailing portion of segment 2a of the web 2 in use during splicing of the latter on head segment 3a of the new web 3, unwound from reel 5 at working speed W.

[0083] In particular, rollers 80 have respective axes G parallel to axes A, C as well as to axes D, E of support hubs 10, 11 in their horizontal configurations.

[0084] Holder element 79 integrally comprises a rectangular plate-shaped body 81 and two pairs of protruding arms 82, each pair supporting a relative roller 80; in particular, as shown in Figure 13, each roller 80 is arranged between a relative pair of arms 82.

[0085] With particular reference to Figures 12 and 13, actuator means 76 comprise:

- a driving motor 83, in particular an electric motor, carried by support structure 78 and having an output shaft 84 rotating about an axis H, parallel to axes A, C as well as to axes D, E of support hubs 10, 11 in their horizontal configurations;
- a slider 85 guided by support structure 78 along direction F; and
- transmission means 86 for transforming the rotational movement of output shaft 84 about axis H into linear movement of slider 85 along direction F.

[0086] In particular, slider 85 comprises a first plate 87, connected to holder element 79 through spring means 77, a second plate 88, connected to transmission means 86, and a plurality of sliding rods 89, four in the example shown, connecting plates 87, 88 and engaging in a sliding manner respective through holes 90 formed in support structure 78 and having respective axes parallel to direction F.

[0087] Transmission means 86 comprise:

- a belt transmission 91 for transferring rotational motion of a first pulley 92, mounted on output shaft 84, to a second pulley 93 having an axis I parallel to axis H; and

- a rod-shaped member 94 having one end 95, hinged to pulley 93 at an eccentric position with respect to axis I and about an axis parallel to axes H, I, and one opposite end 96, hinged to plate 88 about another axis parallel to axes H, I.

[0088] In particular, belt transmission 91 further comprises a belt 97 wound about pulleys 92, 93; it should be noted that, in the example shown, pulley 93 has a larger diameter than the one of pulley 92.

[0089] Rod-shaped member 94 is configured to elastically vary its length in use so as to dampen impact of pressing means 75 on the webs 2, 3 to be spliced as well as on new reel 5.

[0090] In the example shown, rod-shaped member 94 is formed by a first hollow element 98, by a second element 99 partially engaging in a sliding manner element 98, and by a helical spring 100 wound about both elements 98, 99 and having opposite ends cooperating with respective facing external annular abutments 101, 102 of elements 98, 99; in absence of external actions, rod-shaped member 94 is maintained by spring 100 at a given overall length; during impact of pressing means 75 on new reel 5, spring 100 is compressed and rod-shaped member 94 reduces its length by increasing penetration of element 99 into element 98.

[0091] As visible in Figures 12 and 13, element 98 defines end 95 of rod-shaped member 94, whilst element 99 defines end 96.

[0092] As a possible alternative not shown, elements 98, 99 and spring 100 of rod-shaped member 94 may be replaced by bellows.

[0093] With reference to Figures 1-7 and 10-13, spring means 77 comprise a plurality of elastically compressible pads 103, four in the example shown, interposed between plate-shaped body 81 of holder element 79 and plate 87 of slider 85.

[0094] Pads 103 are made of an elastically deformable material, which is compressed during interaction of rollers 80 with new reel 5 so as to dampen impact.

[0095] In particular, each pad 103 is preferably defined by a rubber disk formed by two truncated-cone portions joined together at a common restricted central section.

[0096] Pads 103 are configured to allow slight oscillations of holder element 79 and rollers 80 with respect to direction F at the impact of pressing means 75 on new reel 5, if the latter is not perfectly cylindrical; in this way, rollers 80 may adapt to the profile of the reel 5.

[0097] As shown in Figures 2-7 and 10-12, cutting unit 14 comprises a cutting mechanism 104, directly supported by holder element 79 of pressing means 75 and by plate 87 of slider 85, and a fixed contrasting element 105, arranged on the opposite side of the portion of the web 2 in use to be cut with respect to cutting mechanism 104 and adapted to define a contrasting action against the cutting mechanism 104 itself during the cutting operation.

[0098] In particular, cutting mechanism 104 is activated as a result of the compression of pads 103 during

impact of rollers 80 on new reel 5.

[0099] As a matter of fact, cutting mechanism 104 comprises:

- 5 - a lever blade 106 defining a cutting edge 107 at one end and hinged at its opposite end 108 to plate-shaped body 81 of holder element 79 about an axis parallel to axes G, H, I; and
- 10 - an actuating lever 109 extending transversally to lever blade 106 and having one end 110, hinged to plate 87 about an axis parallel to axes G, H, I, and one opposite end 111, hinged to lever blade 106 about another axis parallel to axes G, H, I and at a point spaced from end 108 and from cutting edge 107 of the lever blade 106 itself.

[0100] As visible in Figures 2-7 and 10-13, hinge point of actuating lever 109 on lever blade 106 is closer to end 108 than cutting edge 107.

- 20 **[0101]** Thanks to the connection between actuating lever 109 and lever blade 106, compression of pads 103 during impact of rollers 80 on new reel 5, along with a consequent reduction of the distance between plate 87 and holder element 79 along direction F, produces a rotation of the lever blade 106 itself about its hinged end 108 towards the web 2 in use to be cut (counter-clockwise direction in Figures 2-7 and 10-13, see in particular Figures 3 and 11).

[0102] With particular reference to Figures 2-7, guiding means 12 comprise a plurality of guiding rollers, four in the example shown, indicated with 112, 113, 114, 115, about which the web 2 in use is wound to be fed along path P in turn extending around the new reel 5 mounted on support hub 11 in its splicing position.

- 35 **[0103]** Rollers 112, 113, 114, 115 have respective axes L, M, N, Q, parallel to axes A, C, G, H, I as well as to axes D, E of support hubs 10, 11 in their horizontal configurations.

[0104] Roller 112 protrudes from support device 16 to cooperate with the web 2 in use and is advantageously retractable along its axis L to avoid interference with support hubs 10, 11 and oscillating arm 20 during rotation of the latter about axis A to exchange the positions of the support hubs 10, 11 themselves.

- 45 **[0105]** In particular, roller 112 is axially movable between a rest position, in which it is at least partially retracted within support device 16 so as to not interact with the web 2 in use, and an operating position, in which it cooperates and guides the web 2 in use.

[0106] Displacements of roller 112 along its axis L are controlled by actuator means (known per se and not shown), such as a linear actuator carried by support device 16.

- 50 **[0107]** As shown in Figures 2-7, 10, 11 and 14, roller 113 is retractable along its axis M like roller 112 and is also movable between a first position, in which it is arranged upstream from joining unit 13 and cutting unit 14 along path P, and a second position, in which it is ar-

ranged downstream from joining unit 13 and cutting unit 14 along said path P.

[0108] The axial retraction of roller 113 along its axis M is used to avoid interference with joining and cutting units 13, 14 as well as with the webs 2, 3 during movement of the roller 113 itself from its first position to its second position.

[0109] In a different manner, the movement of roller 113 from the first position to the second position is performed after the splicing of webs 2, 3 and the cutting of web 2 to put the roller 113 itself in a condition ready to again interact with the new web 3, in the meanwhile become the web in use; the return of roller 113 from the second position to the first position is performed to accompany and guide the web 3, become the web in use, during transition of support hub 11 carrying the reel 5 from the splicing position to the normal working position.

[0110] Roller 113 is advantageously carried by a slider 116 movable along a fixed guide 117 extending on the opposite side of support hub 11 in the splicing position with respect to axis A.

[0111] In particular, guide 117 defines at its opposite end portions the first and second position of roller 113.

[0112] Displacements of slider 116 along guide 117 are controlled by a motor 118, preferably an electric motor, whose output shaft is defined by a screw 119 extending parallel to guide 117 and engaging a nut screw 120 provided on the slider 116 itself.

[0113] Displacements of roller 113 along its axis M are controlled by a linear actuator 121 carried by slider 116.

[0114] Rollers 114, 115 are of normal type and do not have the possibility to retract along their axes N, Q. Rollers 114, 115 are both arranged downstream of joining and cutting units 13, 14 along path P.

[0115] Operation of apparatus 1 will be described as of the condition of Figures 1 and 2 in which:

- oscillating arm 20 is in its horizontal configuration;
- support hub 10 carries almost exhausted reel 4 of the web 2 in use, is set in its normal working position, facing and coaxial with magazine 9, and is rotated by actuator assembly 26 about its axis D to unwind and feed the web 2 at working speed W;
- support hub 11 carries reel 5 of new web 3, is set in its splicing position and is still;
- rollers 112, 113 are both in their operating positions and interact with the web 2 in use to guide it around and spaced from reel 5;
- roller 113 is in its first position, upstream from joining and cutting units 13, 14;
- rollers 80 of joining unit 13 are both in contact with the web 2 in use advanced along portion P1 of path P; and
- magazine 9 carries a relative stack of new reels 5 and has its supporting portion 33 in the rest position.

[0116] By activating motor 83, rollers 80 start to move along direction F towards reel 5 bringing the web 2 in use

closer to the new web 3.

[0117] In particular, rotation of output shaft 84 of motor 83 about axis H (in a clockwise direction in Figure 12) produces a corresponding rotation of pulley 92 about the same axis and, through belt 97, a rotation of pulley 93 about axis I.

[0118] Due to eccentric connection of rod-shaped member 94 to pulley 93, rotation of this latter pulley in the clockwise direction in Figure 12 causes a linear movement of the rod-shaped member 94 and slider 95 towards the reel 5; in particular, slider 95, guided by holes 90 of support structure 78, moves along direction F and pushes holder element 79 and rollers 80 towards reel 5.

[0119] In the meanwhile, actuator assembly 27 is activated to rotate support hub 11 about its axis E and advancing the new web 3 unwound from reel 5 at the same working speed W as the web 2 in use.

[0120] When the two webs 2, 3 move at the same speed, rollers 80, advanced along direction F by actuator means 76, press segment 2a of the web 2 in use on head segment 3a of the new web 3 (Figures 3 and 11). Impact of rollers 80 on new reel 5 is dampened by the action of spring 100, which reduces length of rod-shaped member 94, and by compression of pads 103.

[0121] Possible misalignments between pressing means 75 and reel 5 may be corrected by a slight oscillation of holder element 79 with respect to direction F as allowed by pads 103.

[0122] During pressing action of segment 2a of the web 2 in use on head segment 3a of the new web 3, splicing of the two webs 2, 3 is achieved by means of adhesive strips 7.

[0123] It is worth mentioning that the new web 3 reaches working speed W of the web in use prior to starting the splicing operation; such speed is then maintained during the whole splicing operation.

[0124] As a result of compression of pads 103, the distance along direction F between holder element 79 and plate 87 reduces, so producing a pushing action of actuating lever 109 on lever blade 106, which rotates about its end 108 towards the web 2 in use (counterclockwise direction in Figures 3 and 11); this rotation of lever blade 106 produces interaction of its cutting edge 107 with the web 2 in use at a point located upstream of the bonded and overlapped segments 2a, 3a with respect to path P so as to cut the web 2 against contrasting element 105 (Figures 3 and 11).

[0125] At this point, new web 3 become the web in use, which is unwound from reel 5 and fed to the next processing machine by guiding rollers 114, 115 only (Figure 4), as guiding rollers 112, 113 are both disengaged by the web 2 as a result of the cutting action.

[0126] Support hub 10 is rotated by the relative actuator assembly 28 about axis B to the reel discharging position, wherein the exhausted reel 4 is released to discharging conveyor 15 by gravity (Figure 4).

[0127] In particular, when support hub 10 is in the reel discharging position, pressurized air is drawn from

sealed chamber 63 so producing radial movements of sectors 57 inwards to their retracted positions under the thrusts of spring 72 and elastic rings 73 (Figures 4, 8 and 9). More specifically, the action of spring 72 moves inner core 60 from the second axial position to the first axial position; during this axial displacement, inner core 60 slides with its conical surfaces 61 along corresponding conical surfaces 62 of sectors 57, so producing a radial movement of sectors 57 inwards to their retracted positions (release configuration of retaining means 55). The exhausted reel 4 can therefore fall under gravity on the discharging conveyor 15.

[0128] At this point, support hub 10 is again rotated about axis B by the relative actuator assembly 28 to return to its normal working position or loading position. A new reel 5 can therefore be loaded on support hub 10 from magazine 9.

[0129] In particular, supporting portion 33 of magazine 9 is advanced, together with the stack of new reels 5, towards the facing support hub 10, which still has its sectors 57 in the retracted position (Figures 8 and 9, left sides). This movement ends when supporting portion 33 reaches its working position, in which the free end reel 5 of the stack is engaged by support hub 10.

[0130] Pressurized air is then fed to sealed chamber 63 of support hub 10 through axial channel 64 and radial passages 65 formed through support shaft 58 (Figure 9). Pressurized air acts against the thrust of spring 72 and produces an axial displacement of inner core 60 towards flange 68 and its second axial position. During this axial displacement, inner core 60 slides with its conical surfaces 61 along corresponding conical surfaces 62 of sectors 57, so producing a radial movement of sectors 57 outwards to their expanded positions (retaining configuration of retaining means 55).

[0131] Supporting portion 33 of magazine 9 is then brought back to its initial rest position. During this movement, the free end reel 5 of the stack is retained by support hub 10 and therefore withdrawn from the stack.

[0132] At this point, support hub 10 is rotated by the relative actuator assembly 28 about axis B to the reel seating position, in which, by releasing retaining means 55, i.e. by displacing sectors 57 to their retracted positions, the reel 5 can go down under gravity to rest on flange 68.

[0133] A new displacement of sectors 57 to their expanded positions allows to firmly secure the reel 5 onto support hub 10, which can therefore return to its horizontal configuration, ready to be exchanged with the other support hub 11.

[0134] Prior to starting another loading operation, actuator 43 moves the relative stack of reels 5 towards support device 16 along axis C and with respect to supporting portion 33 to carry the free end reel 5 of the stack to the same position as the one previously occupied by the reel 5 withdrawn by support hub 10.

[0135] In the meanwhile, by activating linear actuator 121 and motor 118, roller 113 is retracted along its axis

M to its rest position and is moved by slider 116, in turn displaced along guide 117, from the first position to the second position, in which the roller 113 is arranged downstream from joining and cutting units 13, 14 and faces the side of web 3 facing reel 5 (Figure 4).

[0136] Motor 83 completes its rotation about axis H so as to detach rollers 80 from web 3 (Figures 4 and 5).

[0137] At this point, roller 113, again returned to its operating position, is moved from the second position to the first position along guide 117 so as to interact and guide web 3 to its normal working position.

[0138] At the same time, oscillating arm 20 is rotated about axis A by actuator assembly 25 to exchange the positions of support hubs 10, 11; in particular, support hub 11, carrying the reel 5 in use, is brought to the normal working position, while support hub 10, carrying the new reel 5, is brought to the splicing position.

[0139] During this rotation, roller 112 is retracted axially to its rest position so as to not interfere with oscillating arm 20 and reels 5 carried by the latter.

[0140] At the end of rotation of oscillating arm 20, roller 112 is again displaced to its operating position, in which it interacts with, and guides, the web 3 in use.

[0141] The advantages of the apparatus 1 and the method according to the present invention will be clear from the above description.

[0142] In particular, thanks to the fact that the reels 4, 5 of the webs 2, 3 are mounted on respective support hubs 10, 11, whose speeds can be controlled independently from one another, it is possible to perform the splicing of the two webs 2, 3 without any reduction of speed of the web in use 2 as well as with no need for additional buffers.

[0143] This allows to avoid accelerations and decelerations of the web in use, so eliminating the consequent web stress variations produced in conventional splicing apparatuses.

[0144] Plus, the splicing operation as well as the load and unload of the reels 4, 5 on/from the respective support hubs 10, 11 are performed in a completely automated way, without any need of human intervention.

[0145] Furthermore, as the support hubs 10, 11 are mounted on the opposite ends 23, 24 of oscillating arm 20 rotating about axis A, it is possible to maintain one support hub in a working condition and to use the other support hub to load a new reel, to unload the exhausted reel or to actuate the new reel so as to perform the splicing of the new web to web in use.

[0146] In view of the above, apparatus 1 allows:

- to maximize production efficiency as well as production output rate;
- to minimize the overall space occupied by the container handling plant including this kind of apparatus; and
- to reduce risks of industrial accidents.

[0147] Clearly, changes may be made to apparatus 1

and to the method as described and illustrated herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. An apparatus (1) for splicing a new web (3), provided with repeated patterns and adapted to be unwound from a first reel (5), to a web in use (2), also provided with repeated patterns, unwound from a second reel (4) and fed, at a working speed (W) and along a predetermined path (P), to a processing machine; said apparatus (1) comprising:

- a first and a second support hub (11, 10) respectively supporting in use said first and said second reel (5, 4) and rotating about respective axes (E, D) parallel to one another;
- joining means (13) arranged adjacent to a working portion (P1) of said path (P) and selectively activated for adhesively bonding a segment (3a) of said new web (3) to a segment (2a) of said web in use (2) in an overlapped position and with the corresponding patterns aligned; and
- cutting means (14) selectively activated to perform a cutting operation on said web in use (2) at an area thereof located upstream of said overlapped and bonded segments (2a, 3a) with respect to said path (P);

characterized in that said first and said second support hub (11, 10) are independently rotated about their axes (E, D) by first and second actuator means (27, 26), respectively; and

in that said joining means (13) comprise pressing means (75) acting transversally to said working portion (P1) of said path (P) and selectively activated to press said segments (2a, 3a) onto one another while both of them pass along the working portion (P1) itself and while said segment (3a) of said new web (3) is advanced by said first actuator means (27) at said working speed (W) of said web in use (2).

2. The apparatus as claimed in claim 1, further comprising:

- support means (16) configured to simultaneously set said first support hub (11), along with the first reel (5), in a splicing position, adjacent to said joining means (13), and said second support hub (10), along with the second reel (4), in a normal working position, located on the opposite side of the first reel (5) with respect to said joining means (13); and
- guiding means (12) configured to guide said web in use (2) around, and spaced from, said

first reel (5) mounted on the first support hub (11) in the splicing position so that said working portion (P1) of said path (P) is located between said joining means (13) and the first reel (5) itself.

3. The apparatus as claimed in claim 2, wherein said support means (16) comprise a frame (18) and an oscillating arm (20) carrying at its opposite end portions (24, 23) said first and said second support hub (11, 10) and connected at an intermediate portion (21) to said frame (18) in a rotatable manner about a fulcrum axis (A) to exchange the positions of said support hubs (10, 11) with respect to the fulcrum axis (A) itself.

4. The apparatus as claimed in claim 3, wherein said fulcrum axis (A) extends transversally to said working portion (P1) of said path (P).

5. The apparatus as claimed in claim 3 or 4, wherein said fulcrum axis (A) is horizontal and extends parallel to the axes (E, D) of said first and said second support hub (11, 10) respectively set in said splicing position and in said normal working position.

6. The apparatus as claimed in claims 3 to 5, wherein said oscillating arm (20) has a longitudinal axis (B) orthogonal to said fulcrum axis (A), and wherein said first and said second support hub (11, 10) protrude orthogonally from the respective end portions (24, 23) of said oscillating arm (20).

7. The apparatus as claimed in claim 6, wherein each of said first and second support hub (11, 10) is mounted onto the respective end portion (24, 23) of said oscillating arm (20) in a rotatable manner about said longitudinal axis (B).

8. The apparatus as claimed in claim 7, wherein said first and second support hub (11, 10) are selectively set in horizontal configurations parallel to said fulcrum axis (A) to define said splicing position and said normal working position; and wherein each of said first and second support hub (11, 10) is selectively set in a vertical configuration with its free end (30) alternatively arranged above or below said oscillating arm (20) to respectively define a reel seating position or a reel discharging position.

9. The apparatus as claimed in any one of the foregoing claims, wherein each of said first and second support hub (11, 10) includes retaining means (55) selectively set between a release configuration from the relative reel (5, 4) and a retaining configuration of the relative reel (5, 4).

10. The apparatus as claimed in claim 9, wherein said retaining means (55) comprise an outer wall (56) of

the relative first or second support hub (11, 10), which is selectively expanded/retracted in a radial direction with respect to the relative axis (E, D) of the first or second support hub (11, 10) itself.

11. The apparatus as claimed in any one of the foregoing claims, wherein said normal working position also defines a loading position for loading a new reel (5) on the relative first or second support hub (11, 10).

12. The apparatus as claimed in any one of the foregoing claims, wherein said joining means (13) further comprise actuator means (76) for moving said pressing means (75) to and away from said first reel (5) along a direction (F) transversal to said working portion (P1) of said path (P).

13. The apparatus as claimed in claim 12, wherein said actuator means (76) are connected to said pressing means (75) by spring means (77) configured to allow a dampened action of the pressing means (75) on said first reel (5) during the splicing operation as well as slight oscillations of the pressing means (75) themselves with respect to said direction (F) so as to perfectly adapt to the profile of said first reel (5).

14. The apparatus as claimed in claim 13, wherein said spring means (77) comprise a plurality of elastically compressible pads (103) interposed between respective plate elements (81, 87) of said pressing means (75) and said actuator means (76).

15. The apparatus as claimed in any one of the foregoing claims, wherein said cutting means (14) comprise a cutting mechanism (104), directly supported by said pressing means (75) and by said actuator means (76), and a fixed contrasting element (105), arranged on the opposite side of the portion of the web 2 in use (2) to be cut with respect to said cutting mechanism (104) and adapted to define a contrasting action against the cutting mechanism (104) itself during the cutting operation.

16. The apparatus as claimed in claim 15, wherein said cutting mechanism (104) is activated as a result of the compression of said pads (103) during impact of said pressing means (75) on said first reel (5).

17. The apparatus as claimed in claim 16, wherein said cutting mechanism (104) comprises:

- a lever blade (106) defining a cutting edge (107) at one end and hinged at its opposite end (108) to said pressing means (75); and
- an actuating lever (109) extending transversally to said lever blade (106) and having one end (110), hinged to said actuator means (76), and one opposite end (111), hinged to said lever

blade (106) at a point spaced from the hinged end (108) of said lever blade (106) and from said cutting edge (107) of the lever blade (106) itself.

18. The apparatus as claimed in any one of the foregoing claims, wherein said guiding means (12) comprise at least one guiding roller (112, 113), about which the web in use (2) is wound to be fed along said path (P) and which is retractable along its axis (L, M) to avoid interference with moving parts.

19. The apparatus as claimed in claim 18, wherein said guiding roller (113) is movable between a first position, in which it is arranged upstream from joining means (13) along said path (P), and a second position, in which it is arranged downstream from said joining means (13) along said path (P) and ready to again interact with the new web (3) after the splicing operation.

20. A method for splicing a new web (3), provided with repeated patterns and adapted to be unwound from a first reel (5), to a web in use (2), also provided with repeated patterns, unwound from a second reel (4) and fed, at a working speed (W) and along a predetermined path (P), to a processing machine; said method comprising the steps of:

- a) mounting said first and said second reel (5, 4) respectively on a first and a second support hub (11, 10);
- b) adhesively bonding, by joining means (13) arranged adjacent to a working portion (P1) of said path (P), a segment (3a) of said new web (3) to a segment (2a) of said web in use (2) in an overlapped position and with the corresponding patterns aligned; and
- c) cutting said web in use (2) at an area thereof located upstream of said overlapped and bonded segments (2a, 3a) with respect to said path (P);

characterized by further comprising the steps of:

- d) controlling the speed of said first support hub (11) independently from the speed of said second support hub (10) so as to advance said segment (3a) of said new web (3) at said working speed (W) of said web in use (2) during said step b); and
- e) during said step b), pressing said segments (2a, 3a) onto one another while both of them pass along said working portion (P1) of said path (P) at said working speed (W).

21. The method as claimed in claim 20, wherein, prior to the steps b) and c), it further comprises the steps of:

f) simultaneously arranging said first support hub (11), along with the first reel (5), in a splicing position, adjacent to said joining means (13), and said second support hub (10), along with the second reel (4), in a normal working position, located on the opposite side of the first reel (5) with respect to said joining means (13); and
 g) guiding said web in use (2) around, and spaced from, said first reel (5) mounted on the first support hub (11) in the splicing position so that said working portion (P1) of said path (P) is located between said joining means (13) and the first reel (5) itself.

22. The method as claimed in claim 20 or 21, wherein the new web (3) reaches said working speed (W) prior to starting said step b).

Amended claims in accordance with Rule 137(2) EPC.

1. An apparatus (1) for splicing a new web (3), provided with repeated patterns and adapted to be unwound from a first reel (5), to a web in use (2), also provided with repeated patterns, unwound from a second reel (4) and fed, at a working speed (W) and along a predetermined path (P), to a processing machine; said apparatus (1) comprising:
- a first and a second support hub (11, 10) respectively supporting in use said first and said second reel (5, 4) and rotating about respective axes (E, D) parallel to one another;
 - joining means (13) arranged adjacent to a working portion (P1) of said path (P) and selectively activated for adhesively bonding a segment (3a) of said new web (3) to a segment (2a) of said web in use (2) in an overlapped position and with the corresponding patterns aligned; and
 - cutting means (14) selectively activated to perform a cutting operation on said web in use (2) at an area thereof located upstream of said overlapped and bonded segments (2a, 3a) with respect to said path (P);
- wherein said first and said second support hub (11, 10) are independently rotated about their axes (E, D) by first and second actuator means (27, 26), respectively;
- wherein said joining means (13) comprise pressing means (75) acting transversally to said working portion (P1) of said path (P) and selectively activated to press said segments (2a, 3a) onto one another while both of them pass along the working portion (P1) itself and while said segment (3a) of said new web (3) is advanced by said first actuator means (27) at said working

speed (W) of said web in use (2);
 wherein said joining means (13) further comprise actuator means (76) for moving said pressing means (75) to and away from said first reel (5) along a direction (F) transversal to said working portion (P1) of said path (P);

characterized in that said cutting means (14) comprise a cutting mechanism (104), directly supported by said pressing means (75) and by said actuator means (76), and a fixed contrasting element (105), arranged on the opposite side of the portion of the web in use (2) to be cut with respect to said cutting mechanism (104) and adapted to define a contrasting action against the cutting mechanism (104) itself during the cutting operation.

2. The apparatus as claimed in claim 1, further comprising:

- support means (16) configured to simultaneously set said first support hub (11), along with the first reel (5), in a splicing position, adjacent to said joining means (13), and said second support hub (10), along with the second reel (4), in a normal working position, located on the opposite side of the first reel (5) with respect to said joining means (13); and
- guiding means (12) configured to guide said web in use (2) around, and spaced from, said first reel (5) mounted on the first support hub (11) in the splicing position so that said working portion (P1) of said path (P) is located between said joining means (13) and the first reel (5) itself.

3. The apparatus as claimed in claim 2, wherein said support means (16) comprise a frame (18) and an oscillating arm (20) carrying at its opposite end portions (24, 23) said first and said second support hub (11, 10) and connected at an intermediate portion (21) to said frame (18) in a rotatable manner about a fulcrum axis (A) to exchange the positions of said support hubs (10, 11) with respect to the fulcrum axis (A) itself.

4. The apparatus as claimed in claim 3, wherein said fulcrum axis (A) extends transversally to said working portion (P1) of said path (P).

5. The apparatus as claimed in claim 3 or 4, wherein said fulcrum axis (A) is horizontal and extends parallel to the axes (E, D) of said first and said second support hub (11, 10) respectively set in said splicing position and in said normal working position.

6. The apparatus as claimed in claims 3 to 5, wherein said oscillating arm (20) has a longitudinal axis (B) orthogonal to said fulcrum axis (A), and wherein said

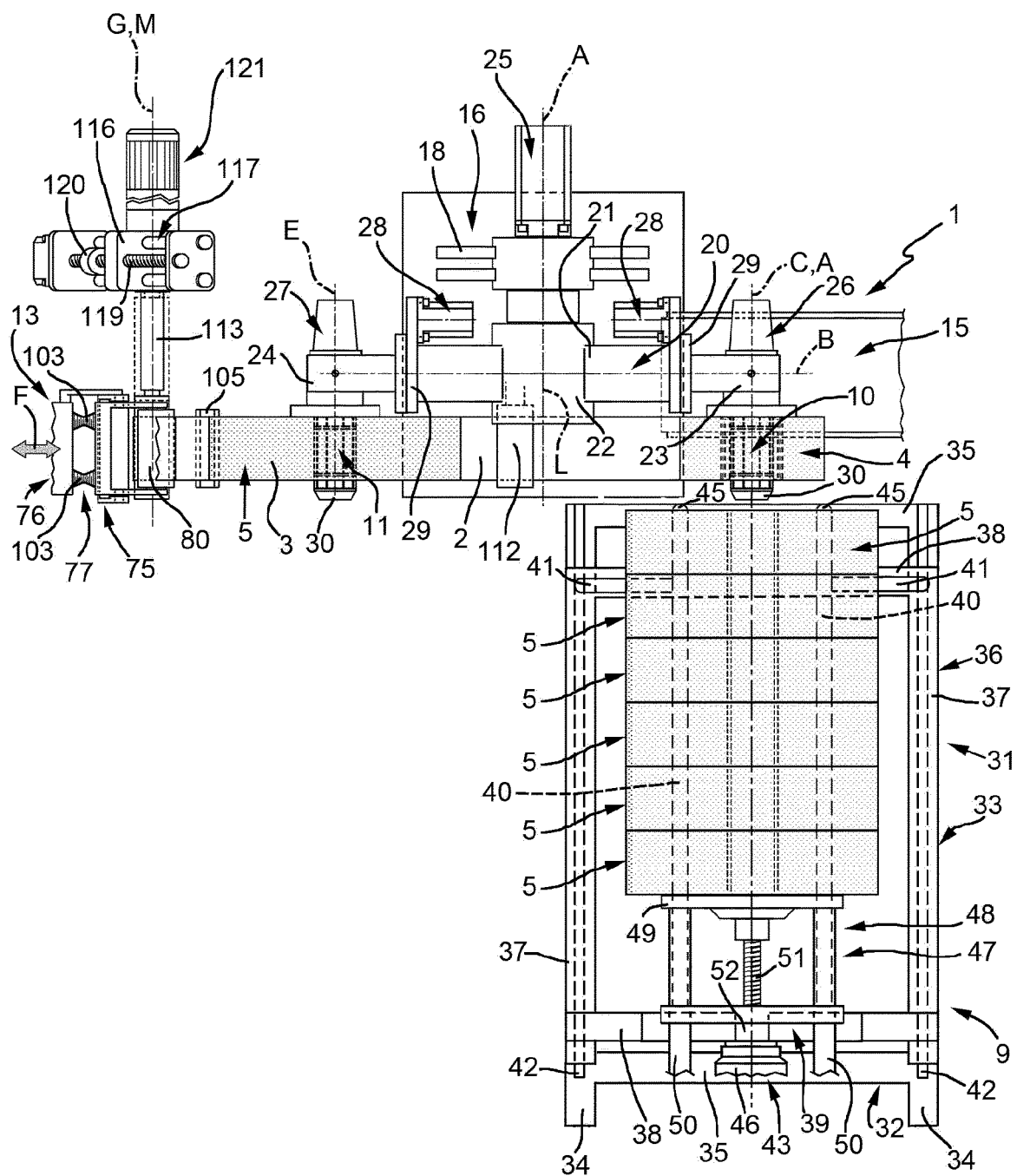
first and said second support hub (11, 10) protrude orthogonally from the respective end portions (24, 23) of said oscillating arm (20).

7. The apparatus as claimed in claim 6, wherein each of said first and second support hub (11, 10) is mounted onto the respective end portion (24, 23) of said oscillating arm (20) in a rotatable manner about said longitudinal axis (B).
8. The apparatus as claimed in claim 7, wherein said first and second support hub (11, 10) are selectively set in horizontal configurations parallel to said fulcrum axis (A) to define said splicing position and said normal working position; and wherein each of said first and second support hub (11, 10) is selectively set in a vertical configuration with its free end (30) alternatively arranged above or below said oscillating arm (20) to respectively define a reel seating position or a reel discharging position.
9. The apparatus as claimed in any one of the foregoing claims, wherein each of said first and second support hub (11, 10) includes retaining means (55) selectively set between a release configuration from the relative reel (5, 4) and a retaining configuration of the relative reel (5, 4).
10. The apparatus as claimed in claim 9, wherein said retaining means (55) comprise an outer wall (56) of the relative first or second support hub (11, 10), which is selectively expanded/retracted in a radial direction with respect to the relative axis (E, D) of the first or second support hub (11, 10) itself.
11. The apparatus as claimed in any one of the foregoing claims, wherein said normal working position also defines a loading position for loading a new reel (5) on the relative first or second support hub (11, 10).
12. The apparatus as claimed in any one of the foregoing claims, wherein said actuator means (76) are connected to said pressing means (75) by spring means (77) configured to allow a dampened action of the pressing means (75) on said first reel (5) during the splicing operation as well as slight oscillations of the pressing means (75) themselves with respect to said direction (F) so as to perfectly adapt to the profile of said first reel (5).
13. The apparatus as claimed in claim 12, wherein said spring means (77) comprise a plurality of elastically compressible pads (103) interposed between respective plate elements (81, 87) of said pressing means (75) and said actuator means (76).
14. The apparatus as claimed in claim any one of the foregoing claims, wherein said cutting mechanism

(104) is activated as a result of the compression of said pads (103) during impact of said pressing means (75) on said first reel (5).

15. The apparatus as claimed in claim 14, wherein said cutting mechanism (104) comprises:
 - a lever blade (106) defining a cutting edge (107) at one end and hinged at its opposite end (108) to said pressing means (75); and
 - an actuating lever (109) extending transversally to said lever blade (106) and having one end (110), hinged to said actuator means (76), and one opposite end (111), hinged to said lever blade (106) at a point spaced from the hinged end (108) of said lever blade (106) and from said cutting edge (107) of the lever blade (106) itself.
16. The apparatus as claimed in any one of the foregoing claims, wherein said guiding means (12) comprise at least one guiding roller (112, 113), about which the web in use (2) is wound to be fed along said path (P) and which is retractable along its axis (L, M) to avoid interference with moving parts.
17. The apparatus as claimed in claim 16, wherein said guiding roller (113) is movable between a first position, in which it is arranged upstream from joining means (13) along said path (P), and a second position, in which it is arranged downstream from said joining means (13) along said path (P) and ready to again interact with the new web (3) after the splicing operation.

FIG. 1



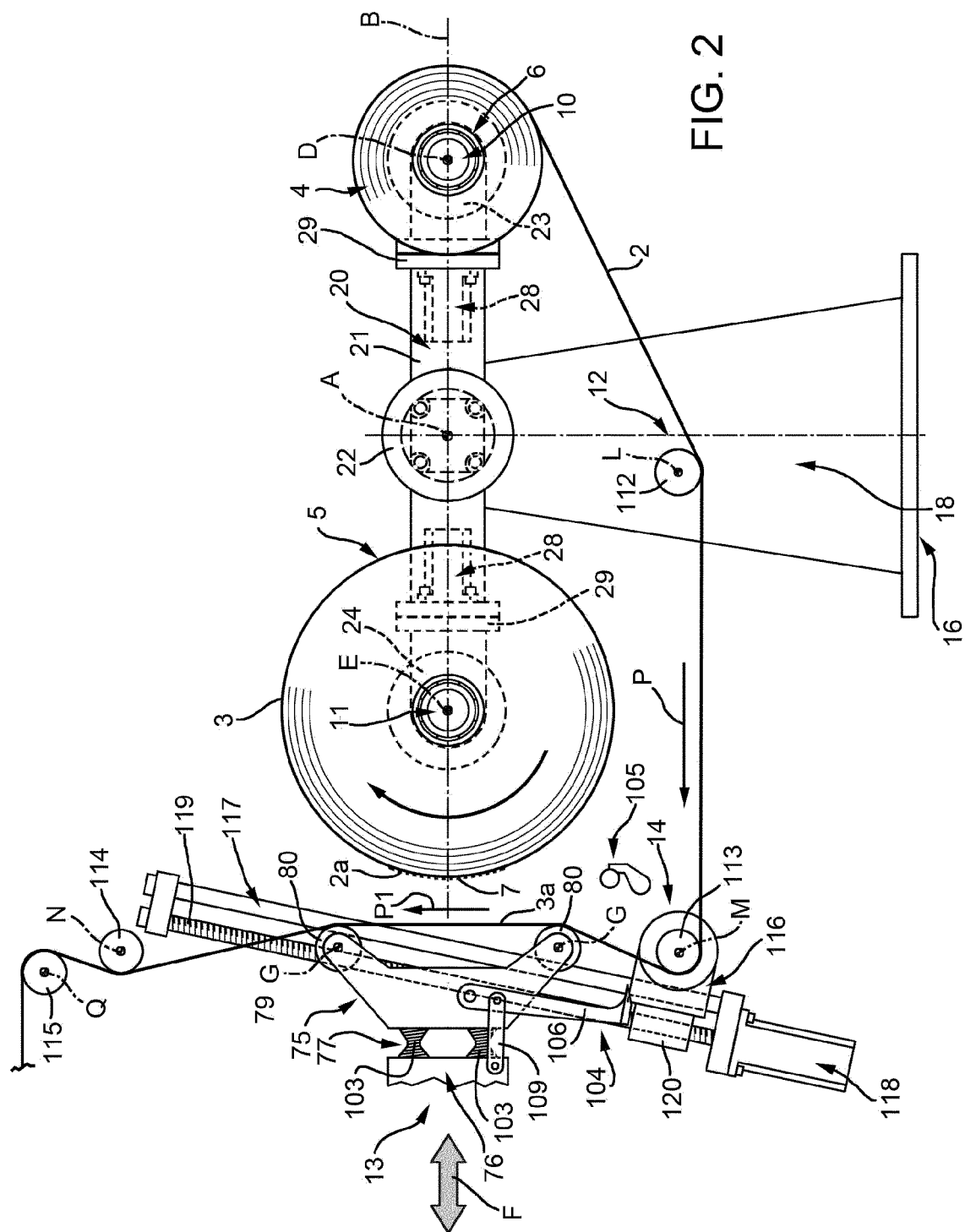


FIG. 2

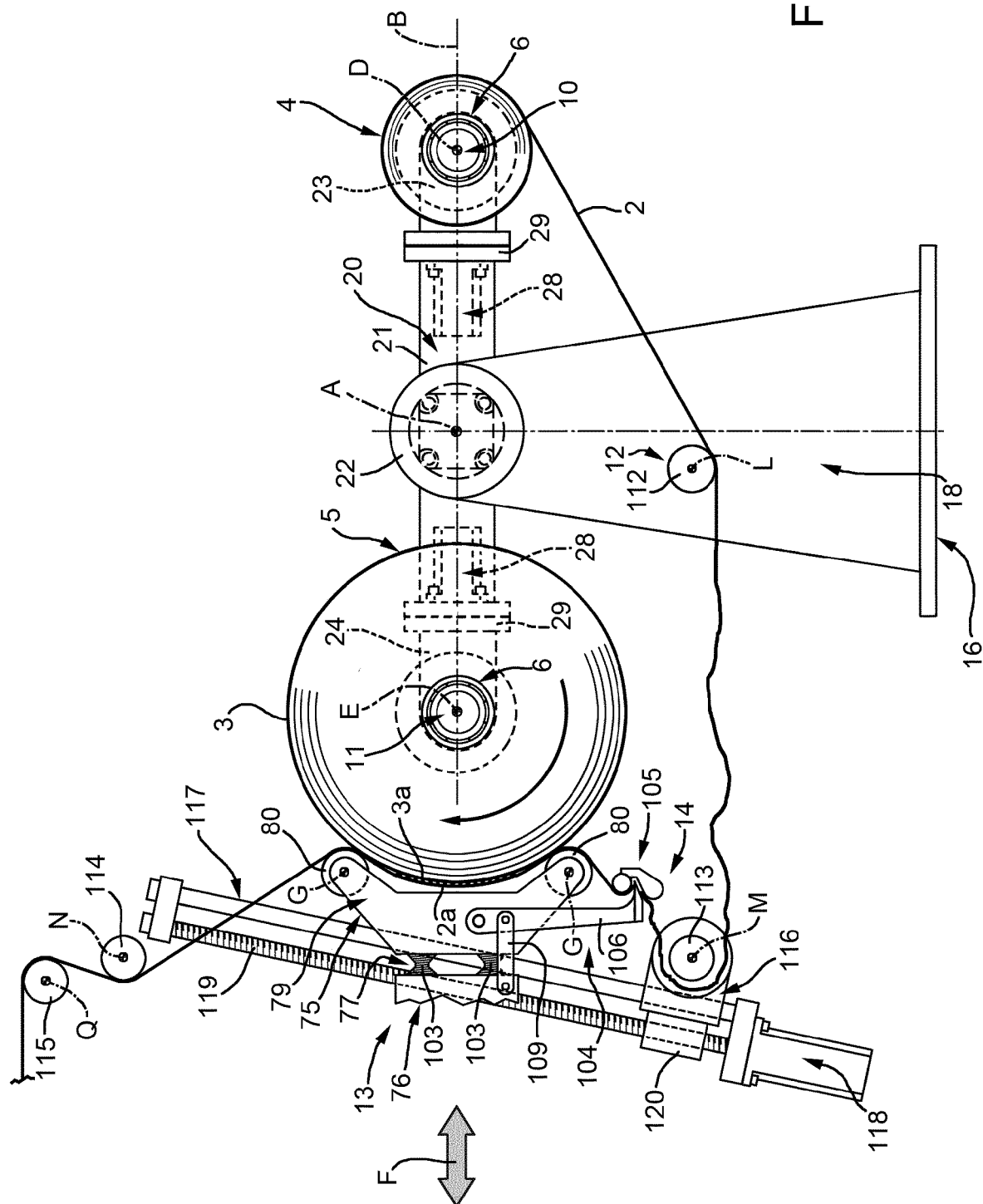
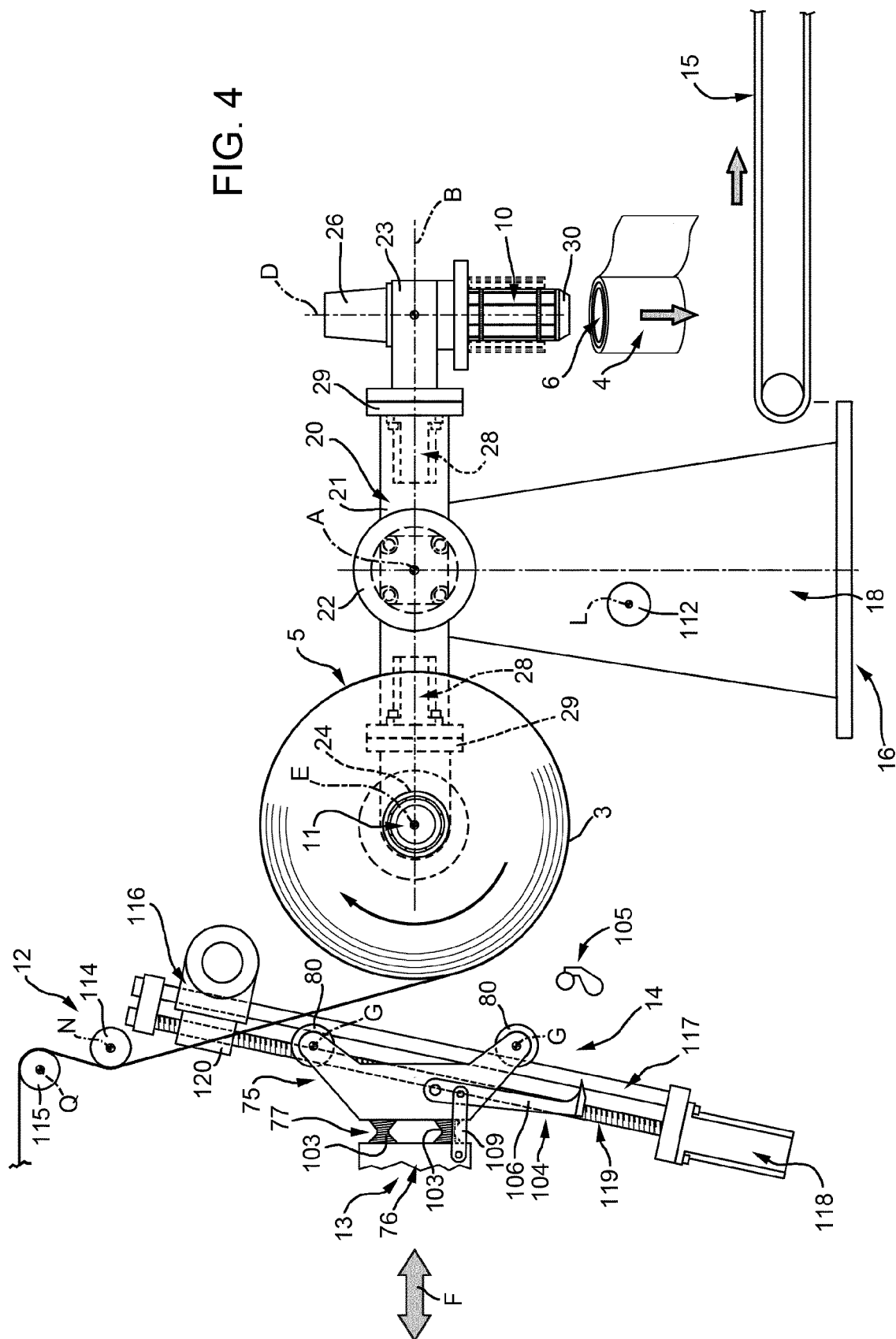


FIG. 3

FIG. 4



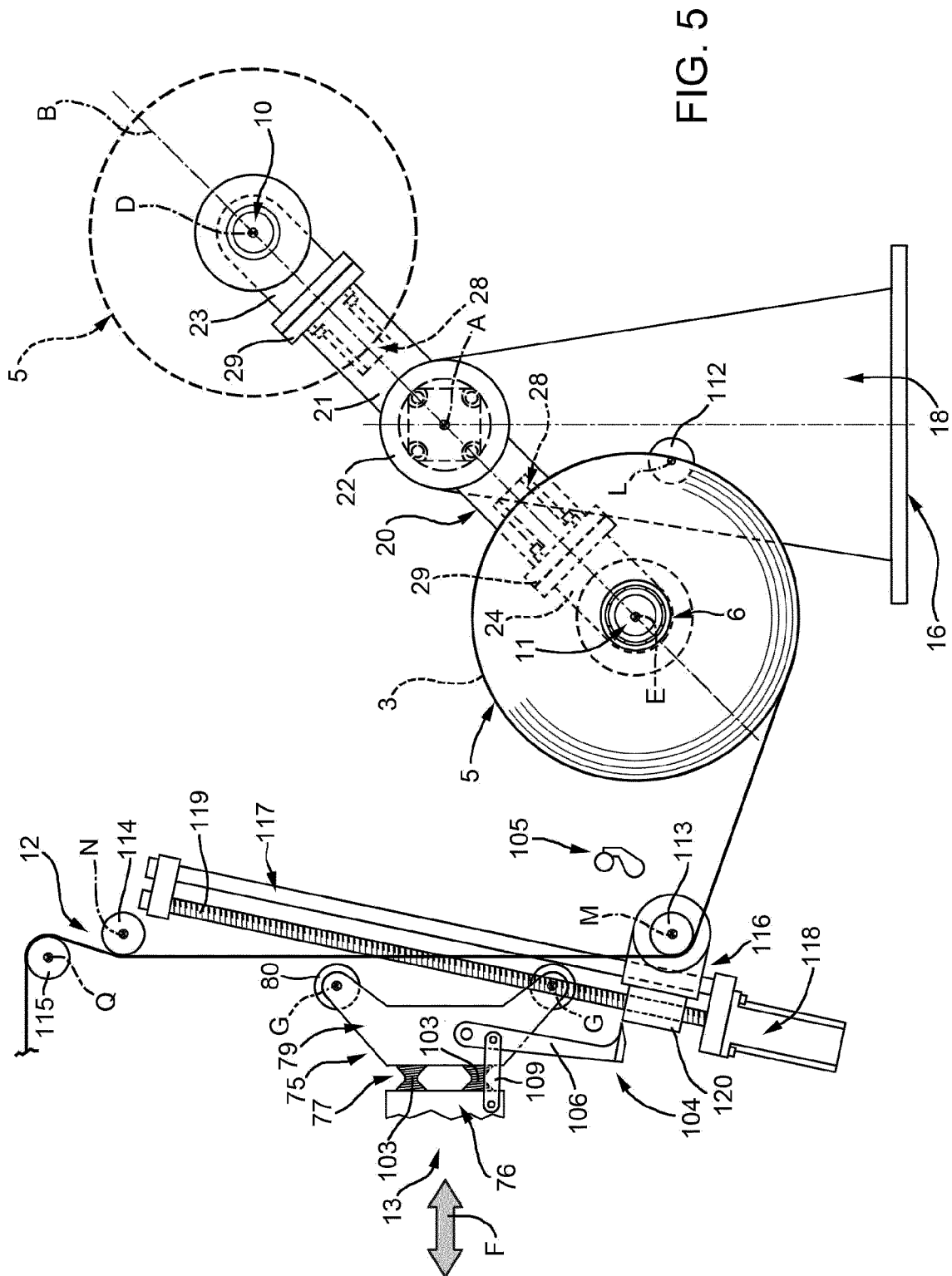
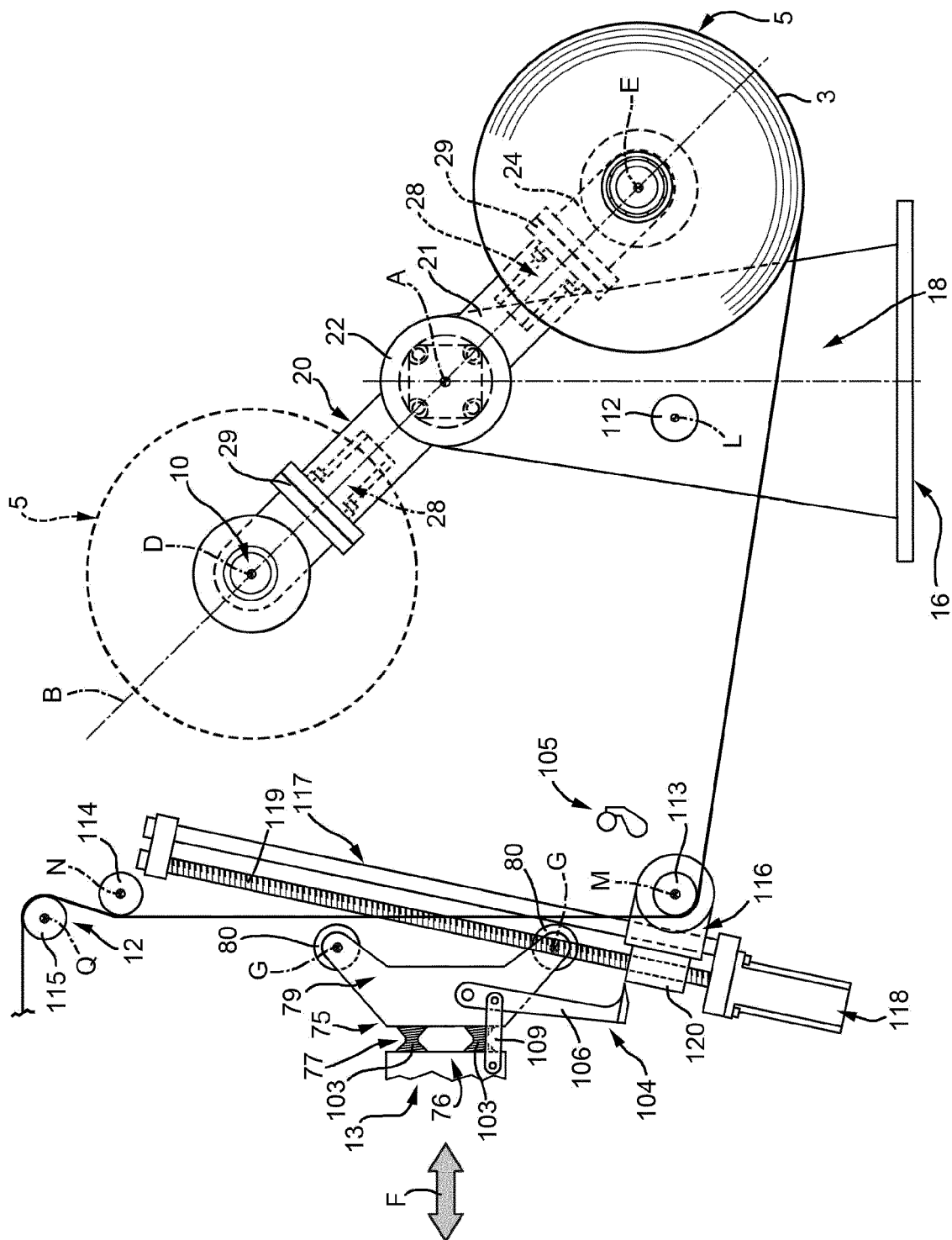


FIG. 5

FIG. 6



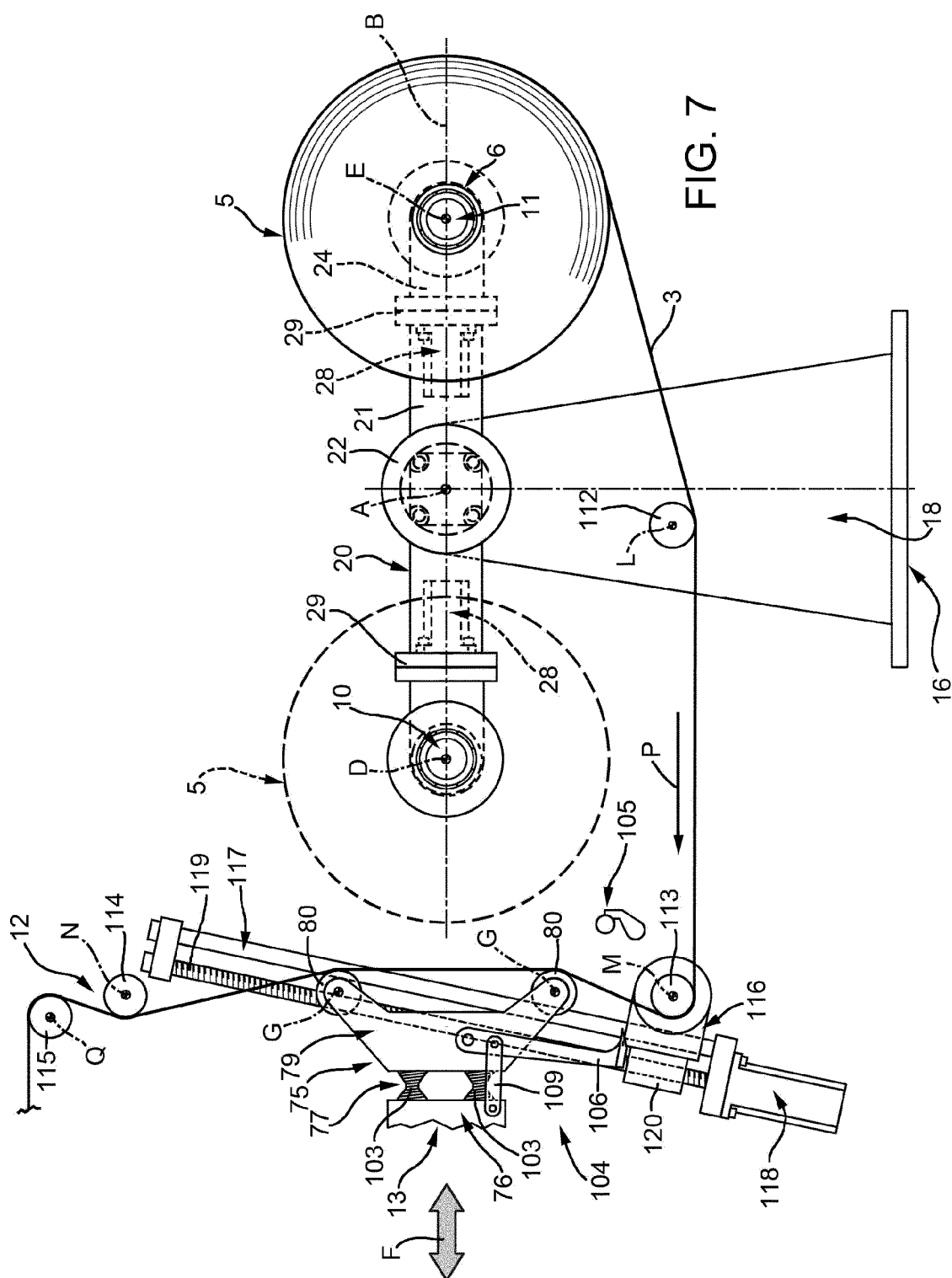


FIG. 7

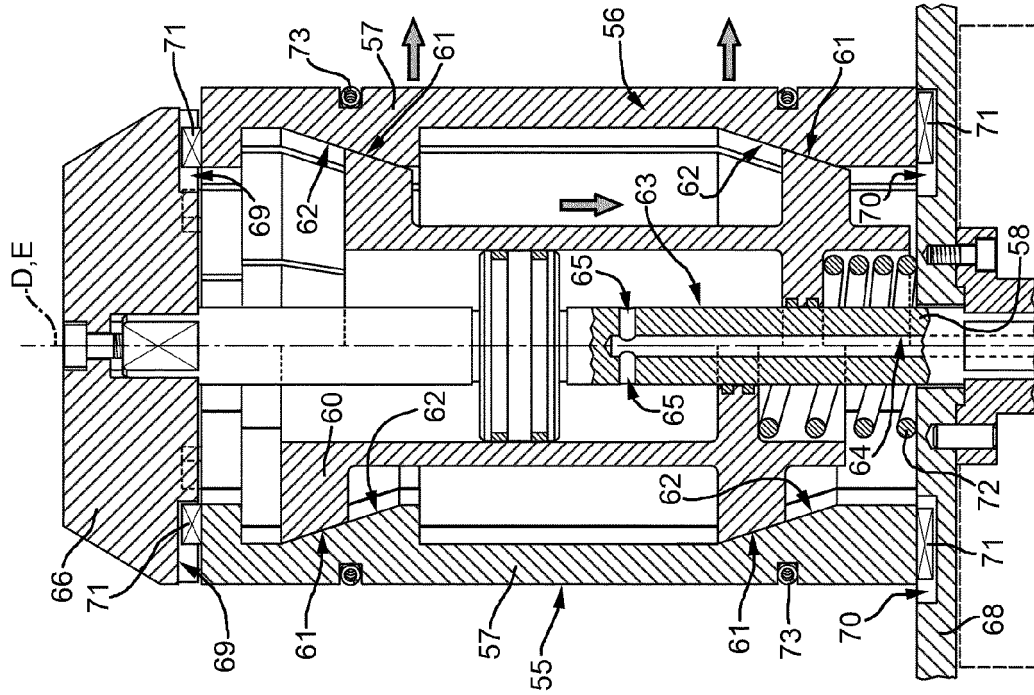


FIG. 9

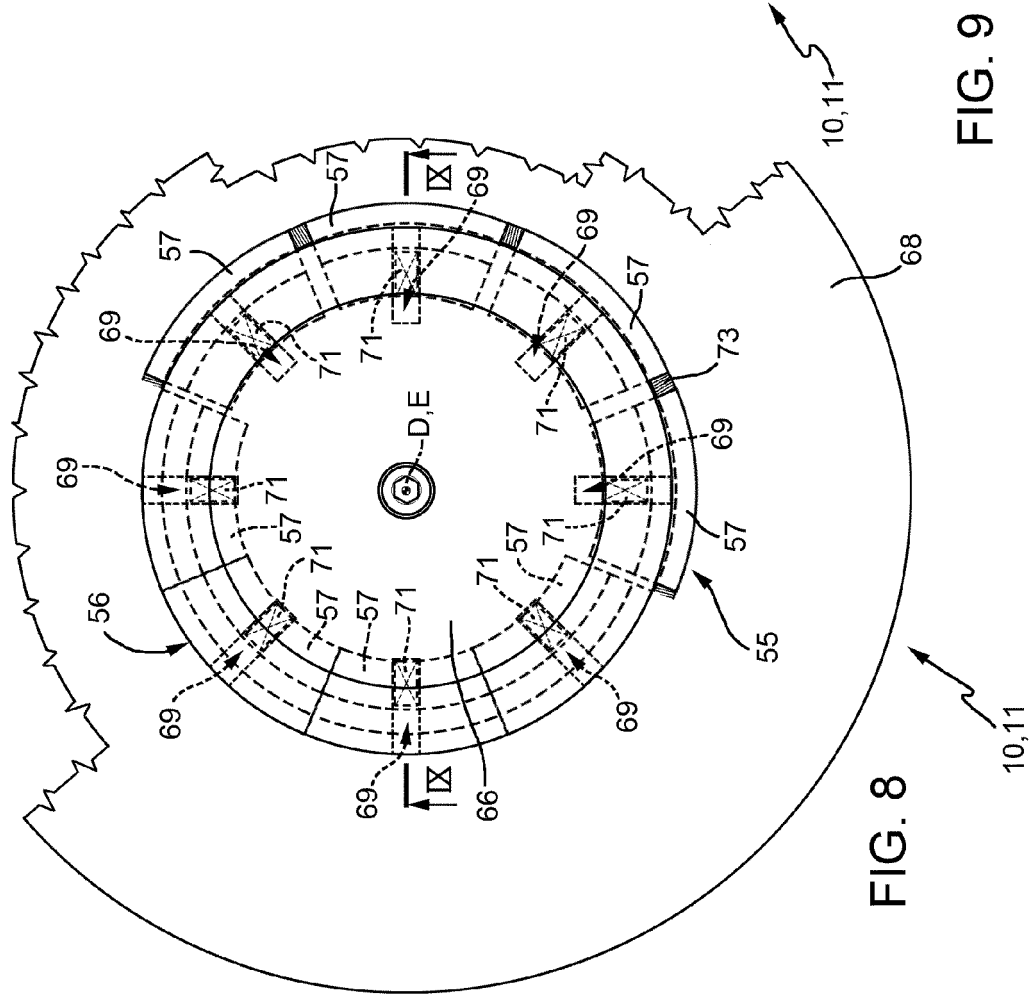


FIG. 8

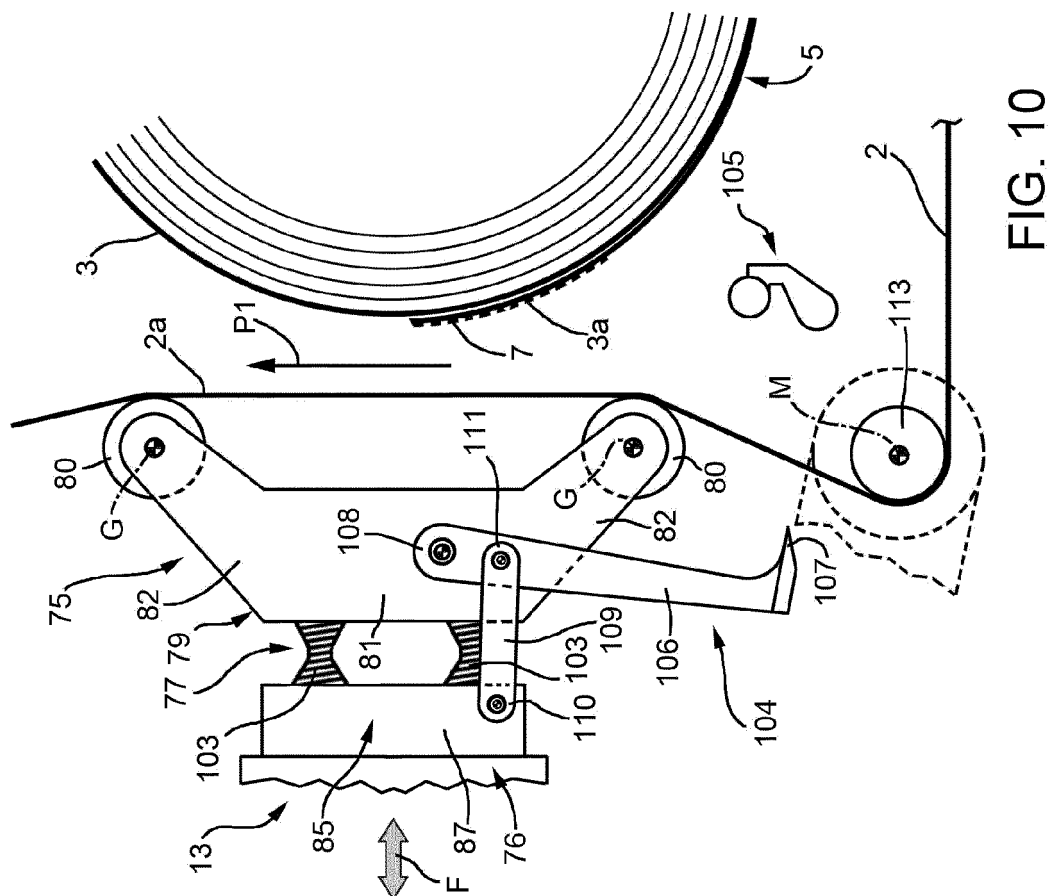
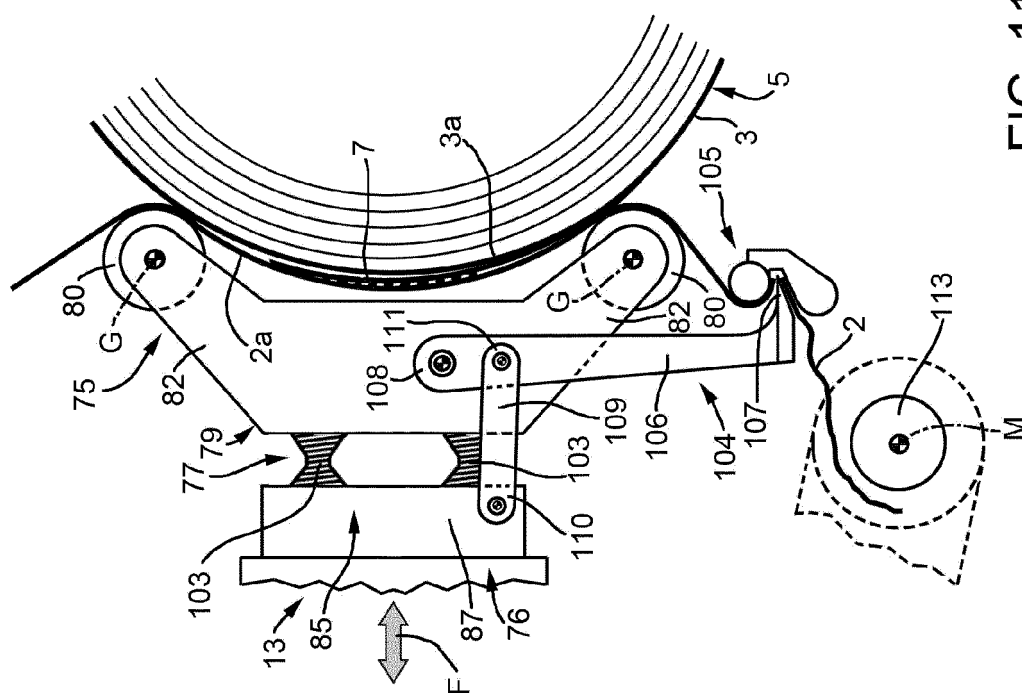


FIG. 12

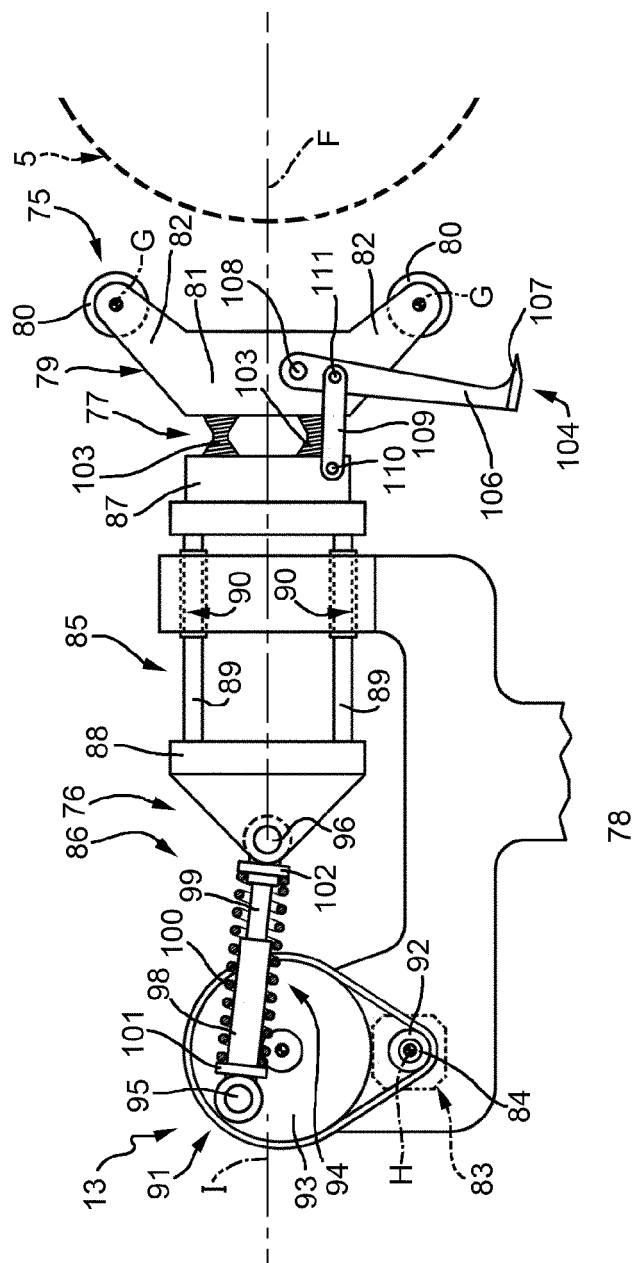
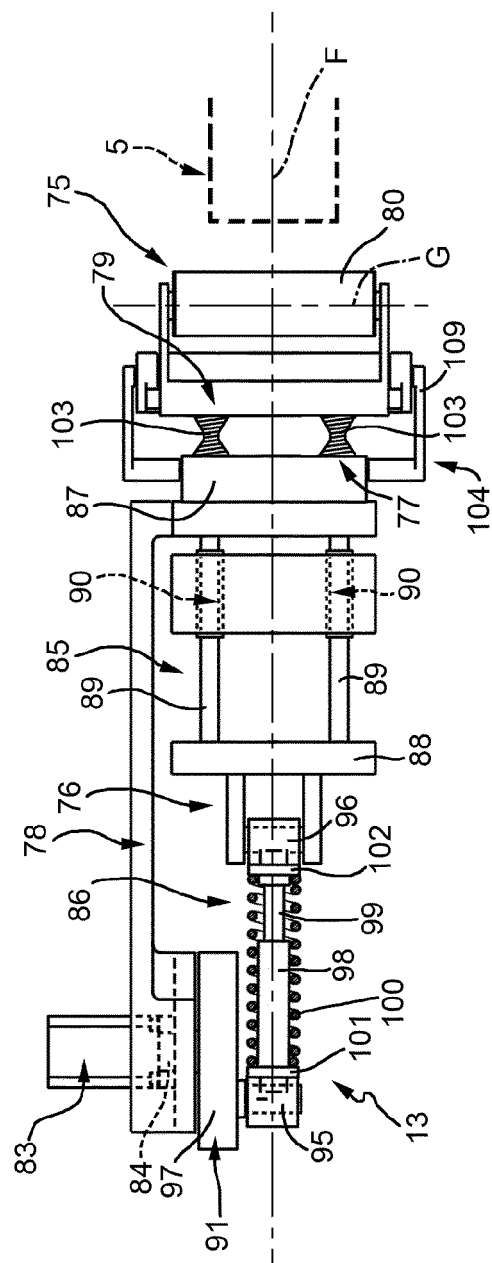


FIG. 13



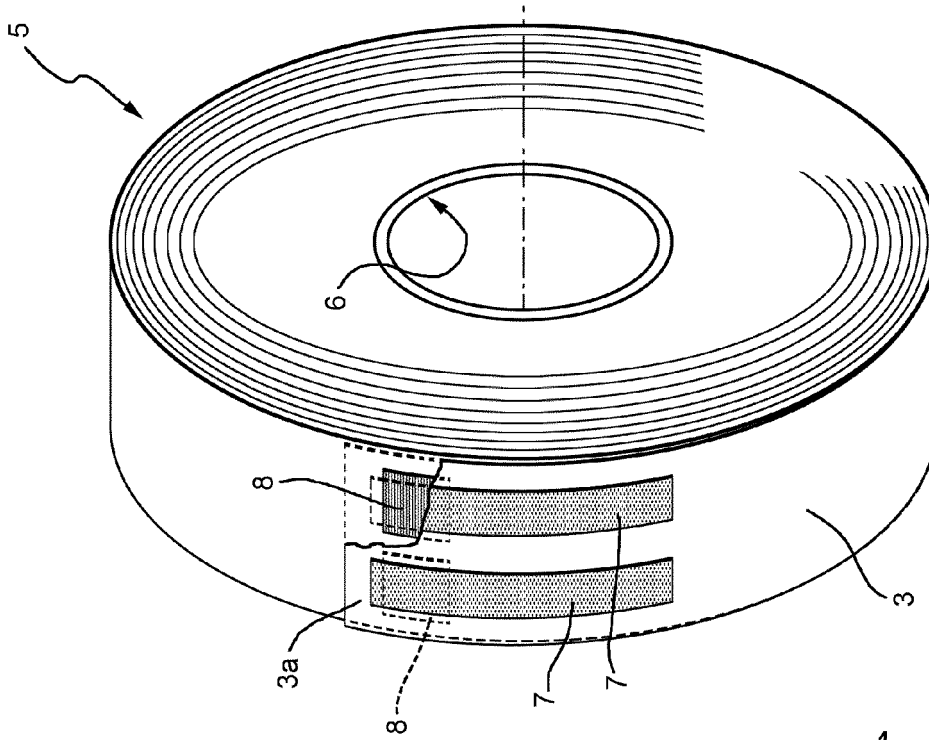


FIG. 15

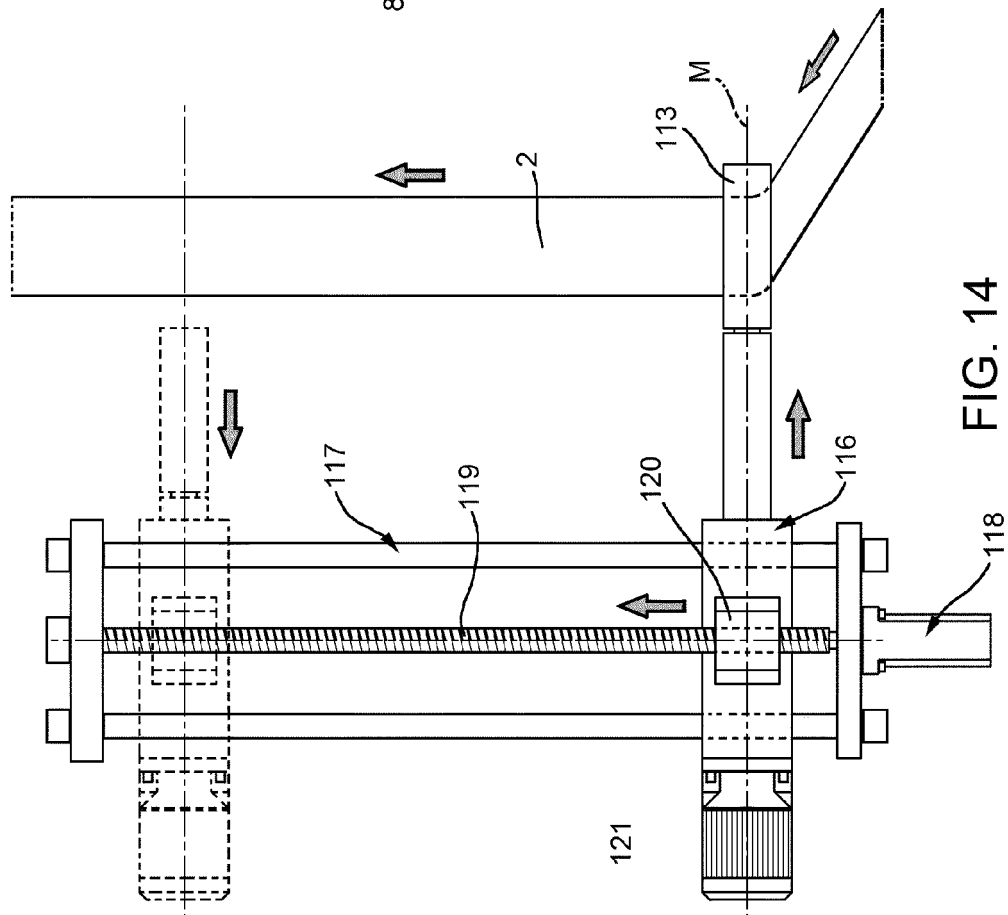


FIG. 14



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