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(54) **A LABELING MACHINE AND A LABELING PROCESS FOR APPLYING LABEL SHEETS ONTO ARTICLES**

(57) A labeling machine (1; 1') for applying label sheets (2) onto articles (3) includes a label transfer device (7) for receiving at an input station (8) a web (6) of labeling material comprising a series of label sheets (2) joined to each other and to feed separated label sheets (2) to the articles (3) at an application station (10), the label transfer device (7) including a conveyor member (18) for feeding the web (6) along a path (Q) toward the application station (10) and, in turn, including at least two separate label holders (20) that receive and retain the web (6), the label transfer device further including a separation station (9) between the input station (8) and the application station (10) at which the label sheets (2) are separated from the web once at a time, the label holders (20) being independently controllable and moving away from one another at the separation station (9) to tension the web (6), and/or moving towards one another upstream of the separation station (9) to loosen and fold back a local portion (21) of the web (6) between the label holders (20), so that the folded back local portion (21) is preserved from interaction with external agents (1; 1').

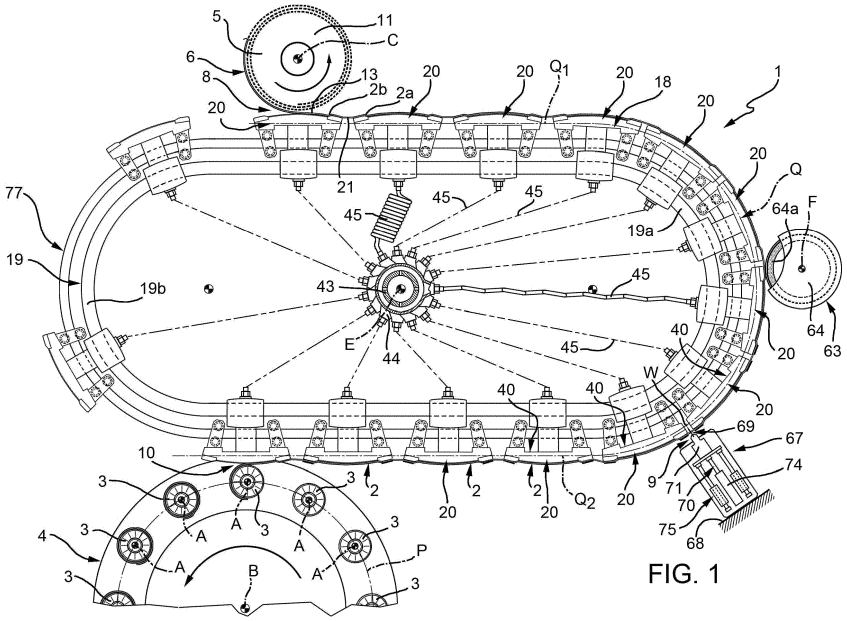

FIG. 1

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Description

[0001] The present invention relates to a labeling machine and a labeling process for applying label sheets onto articles.

[0002] As it is generally known, the packaging of food or non-food products into respective articles, such as containers, bottles, receptacles and the like, comes along with a labeling of the articles by means of respective label sheets, in particular paper or plastic label sheets, during a labeling process run with a labeling machine.

[0003] In one common kind of labeling machine, the articles are driven by a conveying carousel along a predetermined path, or track, which guides the articles towards an application station, at which each label sheet is transferred to the respective article.

[0004] The label sheets are cut from a web at an appropriate length before being glued by gluing means, such as a gluing roller, spray and injector system or the like, and are finally transferred to respective containers or articles.

[0005] During the cutting and gluing operations, the label sheets are typically retained on a vacuum drum by suction.

[0006] In particular, a conventional vacuum drum presents an outer lateral surface having an approximately cylindrical lobed configuration; the vacuum drum normally receives, on its outer lateral surface, a succession of label sheets at an input station and, after a given rotation about its axis, transfers the label sheets to the articles at the application station.

[0007] More specifically, the outer lateral surface of the vacuum drum comprises two or more sections, which are equally spaced angularly from each other around the vacuum drum axis, are provided with a series of ports and are adapted to cooperate in use with respective label sheets.

[0008] Each section is delimited, at the opposite angular ends, by respective damping pads, which are carried on the periphery of the vacuum drum at angularly spaced regions thereof, slightly protrude from the outer lateral surface and have the function to engage in use with the leading and the trailing end portions of the label sheets to be transferred, respectively. To this purpose, the pads are provided with a plurality of ports.

[0009] In practice, the pads define the zones of the periphery of the vacuum drum where the label sheet transfers occur.

[0010] The distance between each pad and the relative upstream pad is thus equal to the length of the label sheet to be processed.

[0011] While the label sheets are being glued, the vacuum drum retains the label sheets, already pre-cut by a rotating knife, using suction through its ports; this suction determines a negative pressure on the label sheets, which are thus retained on the outer lateral surface of the vacuum drum.

[0012] In particular, each label sheet is soaked with glue by means of a gluing roller; once arrived at the application station, the label sheet is released from the vacuum drum by applying a positive pressure through the ports concerned and then stuck onto the article to be labeled.

[0013] Typically, the web is wounded on a storing reel and is brought from the reel to the vacuum drum by means of a plurality of rollers and other support units for tensioning and supporting the web when being advanced.

[0014] The use of gluing rollers has the limitation that the glue is exposed to the ambient air over a large area; thus, when hot glue is used, the components volatilize and may precipitate on adjacent parts or functional elements of the labeling machine.

[0015] In particular, during the application of the glue on the web, some filaments of hot glue may deviate from the application direction and fall down onto portions of the outer surface of the vacuum drum between successive separated label sheets, thus soiling the latter vacuum drum and, therefore, preventing in operation a free sliding of the label sheets from the vacuum drum to the articles at the application station.

[0016] Moreover, the falling of the glue on the vacuum drum should be in any case avoided, since the vacuum drum is generally expensive, delicate, and of complex manufacture, being fabricated from a monolithic aluminum casting.

[0017] To preserve the vacuum drum from glue, US9174757 discloses a labeling machine for labeling articles with labels that are cut from a web of labeling material onto which glue is applied by means of gluing rollers before the vacuum drum receives the web.

[0018] The separation of labels is obtained through a cutting station comprising a blade not rotating with the drum and arranged on the periphery of the latter.

[0019] However, a need is still felt to improve further the labeling machine disclosed by document US9174757, in particular from the point of view of guaranteeing the cleanliness and efficiency of the components of the same machine.

[0020] Indeed, some undesired glue filaments could still fall and rest in an uncontrolled manner on portions of the web that should remain unglued, for instance the ones that have to be cut in order to separate the labels.

[0021] Such filaments may in fact meet the blade, hence reducing the efficiency of the latter, and then be transferred from the blade itself to following portions of the web.

[0022] Therefore, it is an object of the invention to provide a labeling machine and a labeling process for applying label sheets onto articles, which allow meeting the above-mentioned need in a straightforward and low-cost manner.

[0023] This object is achieved by a labeling machine and a labeling process according to the appended set of claims.

[0024] Non-limiting embodiments of the invention will be described by way of example with reference to the

accompanying drawings, in which:

- figure 1 shows a schematic top plan view of a labeling machine according to an embodiment of the invention;
- figure 2 shows a larger-scale perspective view of a portion of the labeling machine of figure 1;
- figures 3a, 3b, 3c, and 3d show respective larger-scale top plan views of a pair of label holders of the machine of figures 1 and 2, during distinct steps of a labeling process performed by the same labeling machine;
- figure 4 is analogous to figure 3c and shows a variant of the labeling machine of figure 1;
- figure 5 shows, in perspective view, an alternative solution for performing the steps of figures 3c and 3d;
- figures 6a, 6b, 6c, and 6d show respective smaller-scale top plan views of the solution of figure 5 during distinct steps of the abovementioned labeling process;
- figure 7 is analogous to figure 2 and shows a perspective view of a portion of a labeling machine according to another embodiment of the invention.
- figures 8a and 8b show respective larger-scale top plan views of a pair of label holders of the machine of figure 7, during distinct steps of a labeling process performed by the same labeling machine;
- figure 9 is analogous to figure 7 and shows a variant of the labeling machine of figure 9.

[0025] With reference to figure 1, number 1 indicates as a whole a labeling machine for applying label sheets 2 (figure 2) onto articles 3, for instance containers or bottles, having respective axes A and conveyed in a known manner along a path P, preferably by a carousel conveyor 4.

[0026] In the example shown in figure 1, carousel conveyor 4 is controlled to rotate continuously (anticlockwise in figure 1) about a vertical axis B and carry the articles 3 with the respective axes A parallel to axis B; the path P comprises, in particular, an arc of circumference extending horizontally about the axis B.

[0027] Labeling machine 1 comprises:

- a web feeding unit 5, which stores at least one web 6 being made of labeling material and comprising the label sheets 2 arranged in series along the web 6 and joined to each other; and
- a label transfer device 7 arranged and operable to receive the web 6 at an input station 8, separate each of the label sheets 2 from the web 6 itself at a separation station 9, and transfer each of the separated label sheets 2 to the respective articles 3 at an application station 10.

[0028] Input station 8, separation station 9, and application station 10 are arranged in sequence along a transfer path Q that begins at the input station 8 and ends at the application station 10.

[0029] Input station 8 is adjacent to web feeding unit 5 for allowing the passage of the web 6 from web feeding unit 5 itself to the label transfer device 7, while application station 10 is adjacent to the carousel conveyor 4 for allowing the transfer of the separated label sheets 2 to each of the articles 3.

[0030] In particular, web feeding unit 5 is arranged on the opposite side of the carousel conveyor 4, with respect to the label transfer device 7.

[0031] Still with reference to figure 1, web feeding unit 5 comprises a reel 11 of web 6, placed facing input station 8 and having an axis C extending vertically, and thus parallel to axes A and B.

[0032] The reel 11 is drivable to rotate about axis C (anticlockwise in figure 1) and accordingly unwind the web 6, so that a leading portion 13 of the web 6 itself is moved towards the input station 8, where the label transfer device 7 receives the same leading portion 13.

[0033] The label transfer device 7 comprises a conveyor member 18 being operable to convey the web 6 along a stretch Q1 of the transfer path Q; the stretch Q1 extends from the input station 8 to the separation station 9.

[0034] At separation station 9, at least one of the label sheets 2 is separated at a time from the conveyed web 6, so that the separated label sheet 2 is preferably conveyed by the same conveyor member 18 to the application station 10.

[0035] In particular, the separated label sheet 2 is conveyed along a stretch Q2 extending from separation station 9 to the application station 10 and, therefore, defining with the stretch Q1 the whole transfer path Q.

[0036] In the example shown, the conveyor member 18 comprises a fixed closed-loop track 19, preferably elliptical as in figure 1 or circular, which comprises:

- a transfer portion 19a, which extends along the transfer path Q and is tangent to the carousel conveyor 4 at the application station 10; and
- a return portion 19b, which extends from the application station 10 to the input station 8.

[0037] The conveyor member 18 further comprises at least two label holders 20 (in the embodiment shown, a plurality of label holders 20) that are aligned and movable along the path Q, in particular along the track 19, to convey the web 6 through the stretch Q1 and the separated label sheets 2 through the stretch Q2.

[0038] According to a possible not shown alternative, the label holders 20 may be movable along an outer surface of a rotating cylindrical vacuum drum, instead of along the fixed track 19. In this latter case, the vacuum drum would have an axis parallel to axes A and B and the outer surface thereof would extend along the path Q.

[0039] In use, each of the label holders 20 receives the web 6 at the input station 8 in such a manner to retain one respective label sheet 2 of the web 6.

[0040] Specifically, with reference to the direction of the transfer path Q (i.e. the advancing direction of the label holders 20), each label holder 20 has opposite side end portions 60a, 60b that respectively retain a trailing edge portion 2a and a leading edge portion 2b of the corresponding retained label sheet 2.

[0041] In this manner, the adjacent side end portions 60a, 60b of two consecutive label holders 20 respectively retain the trailing edge portion 2a of the corresponding upstream label sheet 2 and the leading edge portion 2b of the corresponding downstream label sheet 2.

[0042] Therefore, a portion 21 of the web 6 is placed between each pair of consecutive label holders 20 along the transfer path Q.

[0043] Each portion 21 comprises between two respective consecutive label sheets 2 a corresponding transition region 22 (figure 3b) that, in the embodiment shown, is defined by a line between the consecutive label sheets 2.

[0044] Therefore, each portion 21 comprises a tiny stretch of the corresponding trailing edge portion 2b and a tiny stretch of the corresponding leading edge portion 2a.

[0045] Alternatively, each transition region 22 may be defined by an area interposed between the respective consecutive label sheets 2.

[0046] According to an aspect of the invention, the label holders 20 are independently controllable to move away or toward one another along the transfer path Q for respectively tensioning or loosening the web 6.

[0047] As it will be explained with more details in the following, the tensioning of the web 6 and, in particular, of the portions 21 may facilitate separation of the label sheets 2 from the web 6; on the other hand, the loosening of the web 6 between consecutive label holders 20 allows folding back each respective portion 21 between the consecutive label holders 20 of the corresponding pair, so that portions 21 are preserved from interactions with devices or stations arranged along the path Q.

[0048] In the embodiments shown in enclosed figures, the label holders 20 comprise respective permanent magnets (known per se and not shown) that are arranged to cooperate magnetically with the track 19; accordingly, the latter track 19 houses a stator armature formed by a plurality of individually excitable solenoids (known per se and not shown) that can be powered to directly and independently drive the label holders 20 along the path Q via magnetic-inductive interaction with the respective permanent magnets.

[0049] Alternatively, the track 19 may be also provided with the permanent magnets and label holders 20 may house the individually excitable solenoids.

[0050] The label holders 20 have prismatic shapes with respective rear faces 40 facing toward the track 19 and respective opposite front faces 41 (figure 2).

[0051] At the side end portions 60a, 60b, the respective front faces 41 have an increased spacing from the corresponding rear faces 40, so that each of the label holders 20 has an intermediate portion 59 having decreased thickness with respect to end side portions 60a, 60b.

[0052] In such a manner, the trailing edge portions 2a and the leading edge portions 2b are more exposed than the rest of the respective label sheets 2 to possible treatments along the path Q.

[0053] Furthermore, as better visible in figure 3b, the front faces 41 of each two consecutive label holders 20 at the respective adjacent side end portions 60a, 60b are beveled toward each other along the path Q; in other words, such adjacent side end portions 60a, 60b of the two consecutive label holders 20 present corresponding bevels 61a, 61b that define a flared seat 62 therebetween.

[0054] Each flared seat 62 is intended to house, in use, the portion 21 folded back between the corresponding two consecutive label holders 20, when the latter holders 20 are moved toward one another.

[0055] More in detail, each flared seat 62 becomes narrower along the path Q once the corresponding two consecutive label holders 20 move toward each other along the path Q.

[0056] Accordingly, the side end portions 60a, 60b of such two consecutive label holders 20 allows folding back of the respective portion 21 during the approaching movement thereof along the path Q, thus easing the insertion of the portion 21 itself within the narrowing flared seat 62.

[0057] Preferably, front faces 41 are each provided with a corresponding plurality of ports 42 that are selectively exploitable to produce suction or a positive pressure on the web 6.

[0058] In particular, the ports 42 pass throughout the respective label holders 20 (figure 3b) and some of the ports 42 themselves are placed on the side end portions 60a, 60b, so that the latter portions 60a, 60b retain the trailing edge portions 2a and the leading edge portions 2b of the label sheets 2 by means of the produced suction.

[0059] Conveniently, some of the ports 42 are specifically placed on the bevels 61a, 61b in order to ease the insertion of the portions 21 within the respective flared seats 62.

[0060] To allow production of suction, the label transfer device 7 comprises an annular rotating tank 43 (figure 1) connected in a known manner to a vacuum source (not shown), such as a vacuum pump, and to a rotating distributor 44, in turn connected to each of the ports 42 by respective flexible pipes 45.

[0061] Tank 43 is further connected in a known manner to a compressor (not shown) in order to allow production of positive pressure through the distributor 44, flexible pipes 45 and ports 42.

[0062] Tank 43 and distributors 44 are mounted to rotate about a common vertical axis E parallel to axes A, B and C. In addition, tank 43 and distributor 44 are arranged substantially in the central area delimited by track 19.

[0063] According to the embodiment of figure 1, the

machine 1 further comprises a gluing station 63 arranged along the path Q, in particular along the stretch Q1, upstream of the separation station 9.

[0064] Gluing station 63 comprises a gluing module or device 64, in particular defined by a cylindrical glue roller 64a having a vertical axis F parallel to axes A, B, C, E, and being arranged substantially tangent to the path Q, such to touch and thus soak, in use, the label sheets 2 retained by the label holders 20.

[0065] In particular, the glue roller 64a is arranged to soak the trailing edge portions 2a and the leading edge portions 2b respectively retained by the side end portions 60a, 60b of the label holders 20 passing through the gluing station 63.

[0066] In other words, when a label holder 20 passes through the gluing station 63, the cylindrical glue roller cooperate with the respective front face 41 to spread layers 65 of gluing material over the trailing edge portion 2a and the leading edge portion 2b of the corresponding retained label sheet 2.

[0067] According to non-shown alternatives, the gluing module 64 may comprise, in addition or in replacement of the above described cylindrical glue roller, other kind of different glue spreaders, such as sprayers, extruders, appliers of adhesive portions and the like.

[0068] Again, with reference to the embodiment of figure 1, the separation station 9 comprises a cutting module or device 67 arranged along the path Q on the side of the front faces 41 and controllable to cut the web 6 between each consecutive two label holders 20, in particular at the respective transition regions 22.

[0069] The cutting module 67 (figures 1, 3c, and 3d) comprises a support base 68 fixed with respect to the conveyor member 18, a single blade 69, and a mechanism 70 that couples the blade 69 to the support base 68 in a movable manner between at least a resting position (figures 2 and 3d), in which the blade 69 is spaced apart from the path Q, and an operative position (figure 3c), in which the blade 69 comes in contact with the web 6, in use.

[0070] The mechanism 70 has a terminal member 71 from which the blade 69 extends, possibly planarly, up to end with a cutting portion 72 (figure 2) that, in the operative position of the blade 69, is orthogonal to the path Q in a point W (figure 1), in which crosses the path Q itself, so as to cut the web 6 in use.

[0071] In particular, the cutting portion 72 has a cutting edge 73 (figure 2) that is rectilinear and parallel to axes A, B, C, E, F.

[0072] The mechanism 70 is controllable through an actuator 74 (figure 1) that drives the member 71 to lead the blade 69 in the operative position when a transition region 22 approaches the point W. Here, the cutting portion 72 slips into the flared seat 62 between two consecutive label holders 20, thus cutting and separating the label sheets 2 retained by the two consecutive label holders 20.

[0073] In particular, the mechanism 70 further comprises a linear guide 75 that is fixed with respect to the support base 68, extends parallel to a direction orthogonal to the path Q in the point W, and constraints the member 71 to slide along such direction between two limit stops (not shown), respectively corresponding to the resting and operative position of the blade 69.

[0074] According to a variant of the machine 1, of which an example is provided in figure 4, one of the label holders 20 in each pair of adjacent label holders 20 carries in a respective fixed position a corresponding counterblade 79. In particular, the label holders 20 carrying the counterblades 79 are arranged alternately along the path Q with the other label holders 20.

[0075] The counterblades 79 may be respectively arranged at the side end portions 60a or at the side end portions 60b; in the example shown, the counterblades 79 are respectively carried by the side end portions 60a.

[0076] In detail, each counterblade 79 slightly protrudes toward the side end portion 60b of the adjacent label holder 20 without counterblade 79 and ends up with a cutting edge 80 within the flared seat 62. Alternatively, some or all counterblades 79 are carried by side end portions 60b and slightly protrude toward the side end portions 60a of the respective adjacent label holders 20 without counterblades 79.

[0077] Two consecutive label holders 20 are moved at separation station 9 so that the counterblade 79 carried by one of such two consecutive label holders 20 touches with the cutting edge 80 the corresponding transition region 22 at point W; in such a way, such counterblade 79 cooperates with the blade 69 in the operating position thereof to achieve a smooth cut of the transition region 22 at point W.

[0078] As an alternative or in addition to the cutting module 67, the separation station 9 comprises a different rotating cutting module 82 shown in figure 5 and having the same function of the cutting module 67.

[0079] The rotating cutting module 82 comprises a rotary actuator 83 arranged about an axis H, preferably vertical, at a fixed distance from the path Q, and a main shaft or body 84 that extends along the axis H, is coupled to the actuator 83 and is drivable by the actuator 83 to rotate about the axis H (anticlockwise in figures 5, 6a, 6b, 6c, and 6d).

[0080] Moreover, the rotating cutting module 82 comprises a blade 85 carried by the main body 84 and protruding from the main body 84 itself.

[0081] Preferably, the blade 85 extends along a radial direction from axis H up to a linear cutting edge 86 that, in particular, is parallel to the axis H. The latter edge 86 has a distance from the axis H at least equal to that of the same axis H from the path Q.

[0082] In use, the actuator 83 drives the main body 84 in a continuous manner so that the blade 85 assumes a plurality of angular positions about the axis H, among which at least an operating position (figure 6c) thereof is distinguished in that the cutting edge 86 is incident with the path Q for cutting the web 6 at transition regions 22.

[0083] Conveniently, the main body 84 is driven with a constant angular rate while the label holders 20 are coordinately moved based on such angular rate to ensure meeting between the cutting edge 86 and one transition region 22 at each complete revolution of the main body 84, starting from the operative position of the blade 85.

[0084] Preferably, the blade 85 is hinged to the main body 84 about an axis K, fixed and parallel to axis H, for allowing the orientation adjustment of the same blade 85. Moreover, the rotating cutting module 82 further comprises locking means 87, such as a locking screw, to fix in use the angular position of the blade 85 about the axis K or, in other words, the distance between the cutting edge 86 and the axis H.

[0085] Now, an exemplary operation of the labeling machine 1 will be described in the following with reference to only two consecutive label holders 20 starting from the input station 8.

[0086] The following consecutive label holders 20 operate exactly in the same manner as the first two, so a detailed description of their operation will be avoided for the sake of conciseness.

[0087] Since from the starting of the operation, the web feeding unit 5 feeds the web 6 to the conveyor member 18 at the input station 8.

[0088] Here, the two consecutive label holders 20 are preferably moved altogether with the same velocity along the path Q towards the gluing station 63, while the aforementioned vacuum pump connected to the tank 43 is activated to suck air from ports 42.

[0089] The velocity of the two consecutive label holders 20 is set in such a manner that each of the two consecutive label holders 20 meets at the input station 8 one corresponding label sheet 2 of the fed web 6.

[0090] In particular, the trailing edge portion 2a and the leading edge portion 2b of both the label sheets 2 are respectively received by the two consecutive label holders 20 at the side end portions 60a, 60b thereof.

[0091] Accordingly, the two consecutive label holders 20 retain the respective label sheets 2 at the input station 8 at least by means of the suction produced through ports 42 placed on the side end portions 60a, 60b.

[0092] Then, the two consecutive label holders 20 convey the web 6 along the path Q towards the gluing station 63 while the vacuum pump is still active (figure 3a).

[0093] Before the downstream label sheet 2 of the conveyed web 6 along the stretch Q1 reaches the gluing station 63, the two consecutive label holders 20 are advantageously moved toward one another, so that the respective portion 21 between such label holders 20 is loosened and accordingly folded back within the flared seat 62 defined by the label holders 20 themselves (figure 3b).

[0094] In particular, the above two consecutive label holders 20 are moved toward one another until they reach a relative distance along the path Q, such that the trailing edge portions 2a and the leading edge portions 2b can perfectly adhere on the respective bevels 61a, 61b, possibly with the easing contribution of the suction produced through ports 42.

[0095] In this manner, the folded back portion 21 between the two consecutive label holders 20 is inserted within the corresponding flared seat 62.

[0096] Moreover, the folded back portion 21 retracts with respect to the gluing module 64 and, therefore, cannot receive any layers 65 even at the passage of the two consecutive label holders 20 through the gluing station 63.

[0097] On the other hand, when the two consecutive label holders 20 pass through the gluing station 63, the exposed trailing edge portions 2a and leading edge portions 2b retained by the corresponding side end portions 60a, 60b are soaked with respective layers 65 deposited by the gluing module 64.

[0098] Nevertheless, the distance adjustment between the two consecutive label holders 20 may be unnecessary in case the same label holders 20 were already positioned at the input station 8 to receive the web 6 and to fold back here the portion 21 within the flared seat 62.

[0099] After the soaking with gluing material, the web 6 is conveyed by the two consecutive label holders 20 along the stretch Q1 from the gluing station 63 towards the separation station 9 with the vacuum pump being active.

[0100] Once the two consecutive label holders 20 overcome the gluing station 63 along the stretch Q1, the relative distance between such label holders 20 may be increased to unfold the respective portion 21 and thereafter provoke tensioning of the same portion 21.

[0101] Such tensioning is intended to ease the separation of the upstream label sheet 2 from the web 6, but such tensioning is not strictly necessary in view of the presence of the cutting module 67 or, alternatively, the rotating cutting module 82, which are both configured to cut the respective transition region 22, even if the corresponding portion 21 is slightly loosened (figure 3c).

[0102] Hence, when the two consecutive label holders 20 lead the transition region 22 to the point W of the path Q at the separation station 9, the cutting module 67 or the rotating cutting module 82 are operated so that the blade 69 or, respectively, the blade 85 cut the transition region 22 at the same point W with respective modes already mentioned in detail above, thus producing separation of the upstream label sheet 2 from the web 6.

[0103] Here, the upstream one of the two consecutive label holders 20 is conveniently accelerated toward the application station 10 along the stretch Q2. In such a manner, such upstream label holder 20 is distanced from the downstream label holder 20 still at the separation station 9 (figure 3d).

[0104] Moreover, while the vacuum pump is active, the upstream label holder 20 is moved to convey the separate label sheet 2 to the application station 10, where the same upstream label holder 20 meets an article 3 that has been already fed to the conveyor carousel 4 along the path P.

[0105] Here, the separated label sheet 2 is transferred

to the article 3, in particular by shutting down the vacuum pump and activating the aforementioned compressor connected to the tank 43.

[0106] The positive pressure produced by such compressor pushes the separated label sheet 2 away from the respective label holder 20 to the article 3. Thanks to the layers 65 on the trailing edge portion 2a and the leading edge portion 2b of the separated label sheet 2, the latter is attached in a known manner (not described further) to the article 3.

[0107] At the end of the labeling of the article 3, the label holder 20 conveying the separated label sheet 2 is further accelerated along the return portion 19b to reach again the input station 8 (figure 1).

[0108] With reference to figure 7, the number 1' indicates as a whole a labeling machine according to a further embodiment of the invention.

[0109] The labeling machine 1' is similar to labeling machine 1 and will be described hereinafter only as far as it differs therefrom; corresponding or equivalent parts of labeling machines 1, 1' will be indicated where possible by the same reference numbers.

[0110] In particular, labeling machine 1' differs from labeling machine 1 for having a weakening station 111 instead of cutting modules 67, 69. The weakening station 111 is arranged along the path Q on the side of the faces 41 and between the input station 8 and the gluing station 63.

[0111] The weakening station 111 is configured and controllable to create a weakening on each portion 21 at the corresponding transition region 22, such that the label sheets 2 are separable at separation station 9 simply by moving away the two consecutive label holders 20 straddling each portion 21 along the path Q.

[0112] Indeed, the portions 21, which are weakened by means of the weakening station 111, are less resistant to traction than the rest of the web 6, so that the transition regions 22 easily break.

[0113] In particular, the transition regions 22 are broken when the corresponding two consecutive label holders reach a predetermined distance (figure 8b) corresponding to a breaking traction load that is inferior to that necessary for breaking an intact transition region 22. In view of that, the separation station 9 does not need to comprise any kind of cutting element, such as a blade or the like.

[0114] Indeed, the separation of each label sheet 2 can conveniently occur only by means of the tension provoked by moving the corresponding upstream label holder 20 away from the following corresponding downstream label holder 20.

[0115] Preferably, the weakening station comprises a pre-perforation module 67' that has the same structure and components of the cutting module 67 except for the blade 69, which is replaced by a plurality of spines 69' protruding from the terminal member 71 of the mechanism 78 toward the path Q.

[0116] Similarly, the spines 69' are driven by the mechanism 78 between a resting position, in which are spaced apart from the path Q, and an operative position in which perforate the web 6 in use.

[0117] More in particular, the spines 69' extend along respective directions orthogonal to axes A, B, C, E, F. The spines 69' are spaced between each other, so to produce onto web 6 a plurality of perforations 113 that are separated between each other by bridges of the same labeling material of the web 6. Such perforations 113 define the weakening above.

[0118] More in detail, the spines 69' are arranged according to a single row so that the weakening is defined by a corresponding row of perforations 113. Alternatively, the pre-perforation station 111 may be provided with more rows of spines 69' to produce corresponding rows of perforations 113 on the web 6.

[0119] The row of spines 69' intersects in the operative position the path Q in a point V, while the mechanism 70 is controllable through the actuator 74 to lead the spines 69' to the operative position when a transition region 22 approaches the point V. Here, the spines 69' perforate the transition region 22 so to define a corresponding weakening on the respective portion 21.

[0120] The operation of labeling machine 1' is similar to machine 1 and is described only insofar as it differs from that of machine 1.

[0121] In particular, the two consecutive label holders 20 are moved in a coordinated manner with the spines 69', so that the latter reach the operative position when the transition region 22 reaches the point V (figure 7). In such a manner, the respective portion 21 is weakened when the transition region 22 thereof passes through the weakening station 111 towards the gluing station 63.

[0122] Moreover, the two consecutive label holders 20 are moved away one another at the separation station 9 until reaching a relative distance that corresponds to the breaking tension load of the weakened portion 21 between such two consecutive label holders 20 (figure 8b).

[0123] Therefore, the corresponding transition region 22 breaks so that the upstream label sheet 2 ends up separated by the web 6; then, the corresponding upstream label holder 20 accelerates toward the application station 10.

[0124] According to a variant of the machine 1' shown in figure 9, the weakening station 111 is lacking and the web feeding unit 5 stores a web 6 already provided with label sheets 2 joined each other through weakened portions 22'. Therefore, the above-described operation of perforating transition regions 22 by means of a pre-perforation module 67' becomes unuseful in this case.

[0125] According to a not shown further variant of the machine 1', the portions 21 could even lack any weakening. In this latter case, an increased tensioning of the web 6 will be needed.

[0126] From the above, the advantages of labeling machines 1, 1', made according to the invention, are apparent.

[0127] In particular, by moving the label holders 20 to-

wards one another along the path Q and thus folding back portions 21, it is possible to protect from glue filaments the latter portions 21 and, more in particular, the corresponding transition regions 22, so that soiling of blades 69, 85, track 19, and label holders 20 themselves is likely prevented.

[0128] The shapes of the label holders 20 that define the flared seats 62 allow the portions 21 to be folded back in an accurate and reliable manner. Contextually, the shape of side end portions 60a, 60b allows the correct soaking of only the trailing edge portions 2b and leading edge portions 2a of the label sheets 2.

[0129] On the other hand, a movement of two consecutive label holders along the path Q according to opposite directions produce a tensioning that ease the cutting of the transition regions 22 or even allow the direct separation of the label sheets 2 from the web 6, without using any cutting means that may be soiled by glue or other external agents.

[0130] In the case of absence of cutting means, the pre-perforation of each transition regions 22 greatly facilitate the separation of the label sheet 2 from the web 6. This can be easily obtained along the path Q before gluing the edge portions 2a, 2b by means of a simple device like the pre-perforation module 67'.

[0131] Between the exploitable existent cutting means, the rotating cutting module 82 is a very simple and reliable choice that might allow using the only actuator 83 for driving both the main body 84 and, for instance, the carousel 4, in view of the respective rotational motions thereof about parallel axes H, A.

[0132] On the other hand, the cutting module 67 allows the most effective separation of the label sheets 2 from the web 6 due to the orthogonality of the cutting portion 72 with respect to the web 6 in the operating position of the blade 69.

[0133] The counterblades 79 further increase the quality of the cutting and the linearity of the edges of the separated label sheets 2.

[0134] Eventually, it will be apparent to the skilled person that changes may be performed to labeling machines 1, 1' as described and illustrated herein without, however, departing from the scope of the accompanying claims.

[0135] In particular, the gluing station 63 may be absent in both labeling machines 1, 1', while the web feeding unit 5 may store a web already provided with pre-applied portions of adhesive at the trailing edge portions 2a and the leading edge portions 2b of the label sheets 2.

[0136] In such a manner, the operation of folding back the portions 21 may be conveniently waived and the probability of soling any component of the labeling machines 1, 1' is reduced at minimum.

[0137] Furthermore, the cutting modules 67, 68 may be functionally replaced in the labeling machine 1 by a laser-cutting module or, more in general, by other known kinds of cutting means suitable for cutting the web 6 at the transition regions 22.

[0138] Finally, the pre-perforation station 111 may be also arranged between the gluing station 63 and the separation station 9, instead of being arranged upstream of the gluing station 63.

Claims

1. A labeling machine (1; 1') configured to receive, at an input station (8), a web (6) of labeling material comprising a series of label sheets (2) joined to each other and to feed separated label sheets (2) to respective articles (3) at an application station (10); said machine (1; 1') comprising:

   - a conveyor member (18) configured to convey said web (6) along a path (Q) from said input station (8) toward said application station (10), said conveyor member (18) comprising at least two separate label holders (20) moving along said path (Q) and receiving, in use, said web (6) at said input station (8) such to cooperate in contact with respective successive label sheets (2) of the web (6) itself; and
   - a separation station (9) arranged along said path (Q) between said input station (8) and said application station (10), and at which at least one of said label sheets (2) at a time is separated from said web (6);

   characterized in that said label holders (20) are independently controllable along said path (Q) and:

   - move away from one another at said separation station (9) to tension said web (6) between said label holders (20); and/or
   - move towards one another upstream of said separation station (9) to loosen and fold back a local portion (21) of said web (6) between said label holders (20), so that said folded back local portion (21) is preserved from interaction with external agents or components of said labeling machine (1; 1').

2. The labeling machine according to claim 1, wherein said label holders (2) comprise respective suction pads (60a, 60b) for retaining, in use, said label sheets (2) by means of suction.

3. The labeling machine according to claim 1 or 2, wherein said conveyor member (18) comprises a transfer track (19), said label holders (20) being self-movable on said transfer track (19).

4. The labeling machine according to any one of the preceding claims, wherein said label holders (20) are controlled to move away from one another at said separation station (9) until the tension on said web (6) causes the separation of said at least one of said

label sheets (2) from said web (6).

5. The labeling machine according to any one of the preceding claims, further comprising a weakening station (111) arranged upstream of said separation station (9) or being part of said separation station (9) and configured to create, in use, a weakening on a transition region (22) of said web (6) between two successive label sheets (2), such to produce separation of said at least one of said label sheets (2) from said web (6) upon tensioning of said web between said label holders (20).

6. The labeling machine according to claim 5, wherein said weakening station (111) is arranged along said path (Q) between said input station (8) and said separation station (9).

7. The labeling machine according to any one of claims from 1 to 4, wherein said web (6) of labeling material is already provided, at said input station (8), with a weakening on a transition region (22) between two successive label sheets (2), such to produce separation of said at least one of said label sheets (2) from said web (6) upon tensioning of said web (6) between said label holders (20).

8. The labeling machine according to any one of claims from 5 to 7, wherein said weakening comprises a plurality of perforations (113) through said transition region (22) and separated by bridges of intact labeling material, said perforations (113) being preferably aligned to form a weakening line orthogonal to said path (Q).

9. The labeling machine according to any one of claims from 1 to 3, wherein said separation station (9) comprises a cutting device (67; 82) controllable to cut, in use, said local portion (21) of said web (6) between said label holders (20), such to separate said at least one of said label sheets (2) from said web (6).

10. The labeling machine according to claim 9, wherein said cutting device (67) comprises:

- a single blade (69) having an essentially planar cutting end portion (72); and
- a mechanism (70) coupled to said single blade (69) and controllable to move said single blade (69) at least between a resting position, in which said planar cutting end portion (72) is spaced apart from said path (Q), and an operating position, in which said planar cutting end portion (72) crosses orthogonally said path (Q) in a point (W), such to cut, in use, said local portion (21) of said web (6) at said point (W).

11. The labeling machine according to claim 10, wherein one of said label holders (20) carries in a fixed position a planar counterblade (79) facing towards the other one of said label holders (20) along said path (Q), said counterblade (79) being arranged to cooperate in contact with said planar cutting end portion (72) when said blade (69) is in the operating position.

12. The labeling machine according to claim 9, wherein said cutting device (82) comprises:

- a support shaft (84) rotatable about a central axis (H) that is fixed with respect to said path (Q); and
- a single blade (85) carried by said shaft (84), externally protruding from said shaft (84) and ending up with a linear cutting edge (86) that is incident with said path (Q) at least at a given angular position of said shaft (84) about said central axis (H), such to cut said local portion (21) of said web (6), in use, when said shaft (84) reaches said angular position;

13. The labeling machine according to claim 12, wherein said blade (85) is hinged to said shaft (84) about an eccentric axis (K) parallel to said central axis (H), said cutting device (82) further comprising locking means (87) configured to fix said blade (85) in an operative angular position about said eccentric axis (K), such that said cutting edge (86) is incident with said path (Q) at said angular position of said shaft (84).

14. The labeling machine according to any one of the preceding claims, further comprising a gluing station (63) arranged along said path (Q) between said input station (8) and said separation station (9) to deposit at least a layer of adhesive material onto each label sheet (2) of said web (6) .

15. The labeling machine according to claim 14, wherein said label holders (20) are controlled to reach a predetermined relative distance at which said local portion (21) of said web (6) is folded back between said label holders (20) and such that said relative distance is maintained at said gluing station (63).

16. The labeling machine according to claim 14 or 15, wherein said label holders (20) have respective adjacent beveled end portions (61a, 61b) that define along said path (Q) and between said label holders (20) a flared seat (62) for easing insertion of said local portion (21) within said flared seat (62), said seat (62) becoming narrower along said path (Q) as the label holders (20) move towards one another, such that said local portion (21) of said web (6) is folded back, in use, between said label holders (20) within said seat (62).

17. The labeling machine according to any one of claims from 1 to 13, wherein said web (6) of labeling material is already provided at the input station (8) with at least an adhesive layer applied on one face thereof at each of said label sheets (2).

18. A labeling process for applying label sheets onto articles (3), the process comprising the steps of:

- feeding at least one article (3) along a first path (P);
- providing a web (6) of labeling material to an input station (8), the web (6) comprising a series of label sheets (2) joined to each other;
- feeding said web (6) along a second path (Q) from said input station (8) toward an application station (10), in which said second path (Q) meets said first path (P);
- separating at least one of said label sheets (2) at a time from said web (6) at a separation station (9) arranged along said second path (Q) between said input station (8) and said application station (10); and
- feeding the separated label sheet (2) to said article (3) at said application station (10);

characterized by further comprising the step of tensioning said web (6) at said separation station (9) and/or the steps of loosening and folding back a local portion (21) of said web (6), such that said folded back portion is preserved from interaction with external agents.

19. The process according to claim 18, wherein the step of feeding said web (6) along said second path (Q) comprises retaining said web (6) at two successive label sheets (2) of the web (6) itself from said input station (8) by means of two separate label holders (20), said local portion (21) of said web (6) being placed between said label holders (20); and wherein the step of tensioning said web (6) comprises the further step of moving away said label holders (20) from one another at said separation station (9); and/or wherein the steps of loosening and folding back said local portion (21) comprises the further step of moving said label holders (20) towards one another upstream of said separation station (9).

20. The process according to claim 19, wherein said label holders (20) are moved towards one another until reaching a predetermined relative distance at which said local portion (21) of said web (6) is folded back between said label holders (20).

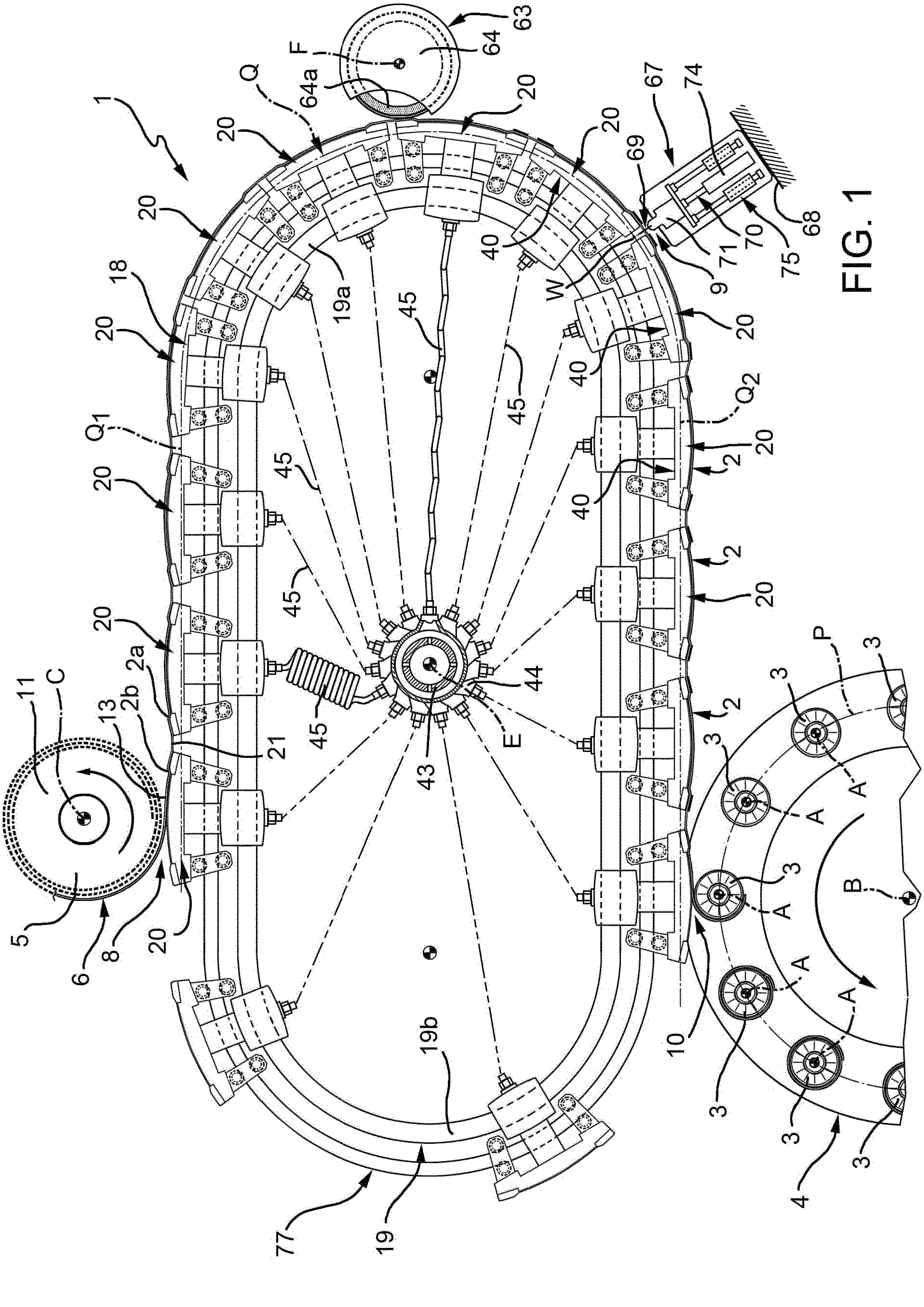
21. The process according to claim 20, wherein said relative distance is maintained at a gluing station (63) arranged along said second path (Q) between said input station (8) and said separation station (9).

22. The process according to claim 18, wherein the web (6) of labeling material is provided with at least an adhesive layer applied on one face thereof at each of said label sheets (2).

23. The process according to any one of claim from 18 to 22, wherein said label sheets (2) are separated only by tensioning said local portion (21)

24. The process according to claim 23, further comprising the step of creating or providing said web (2) with a weakening on a transition region (22) of said web (6) between two successive said label sheets (2), such to produce separation of said at least one of said label sheets (2) from said web (6) upon tensioning of said local portion (21) of said web (6).

25. The process according to any one of claims from 18 to 22, wherein said label sheets (2) are separated by cutting said local portion (21) of said web (6).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2b
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4
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6
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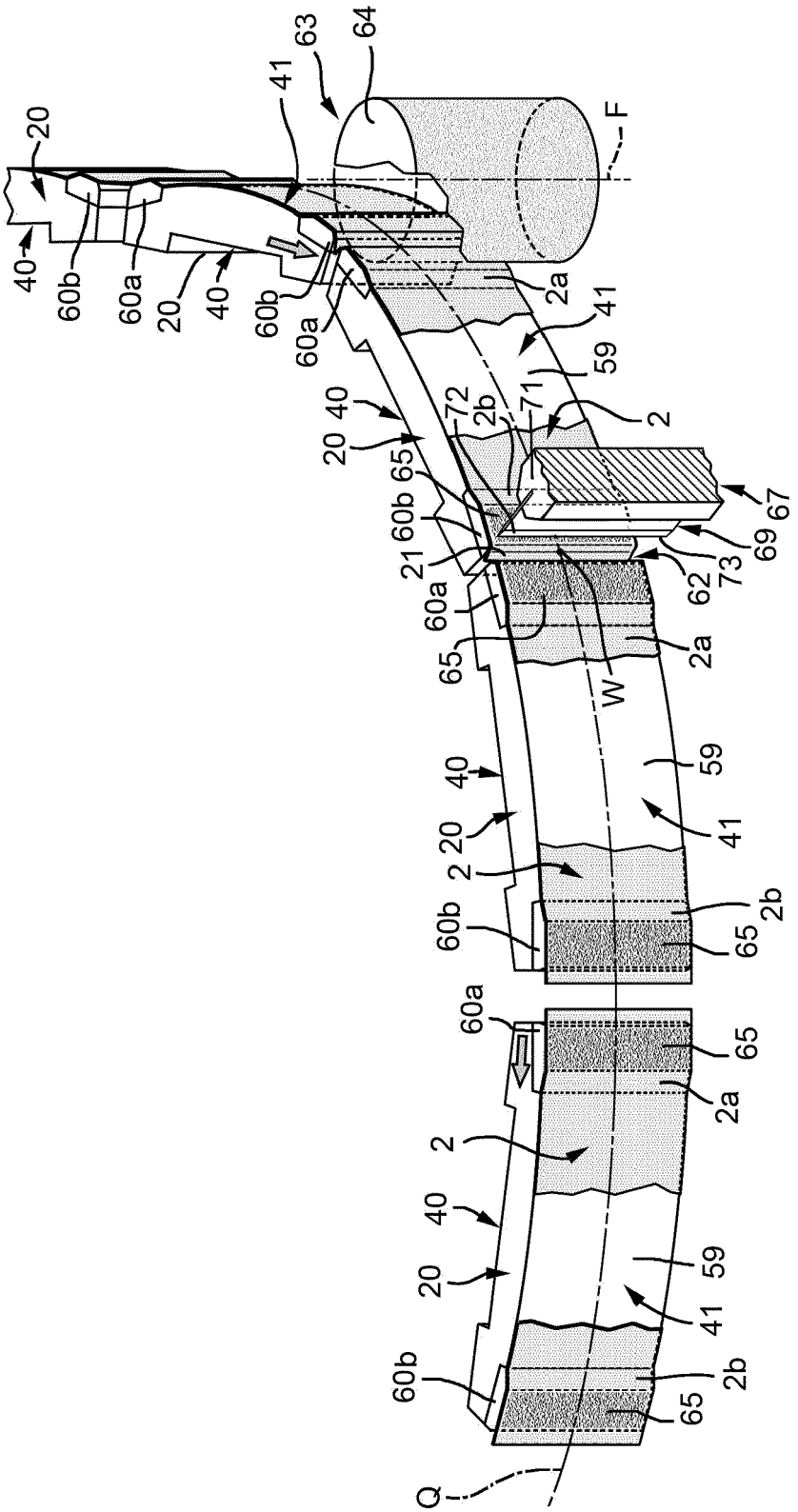
9
10
11
13
18
19
19a
19b
20
21
40
43
44
45
63
64
64a
67
68
69
70
71
74
75
77
A
B
C
E
F
P
Q
Q_1
Q_2
W

FIG. 1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F
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20
65
60b
21
60a
65
67
69
73
62
2a
W
40
20
2
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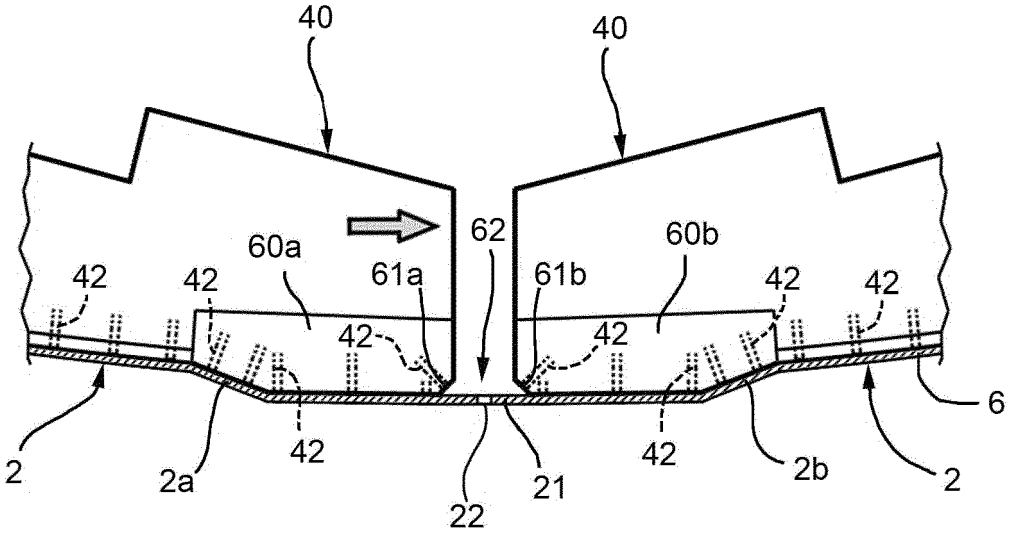
2b
65
Q

FIG. 2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40
62
60a
60b
61a
61b
42
42
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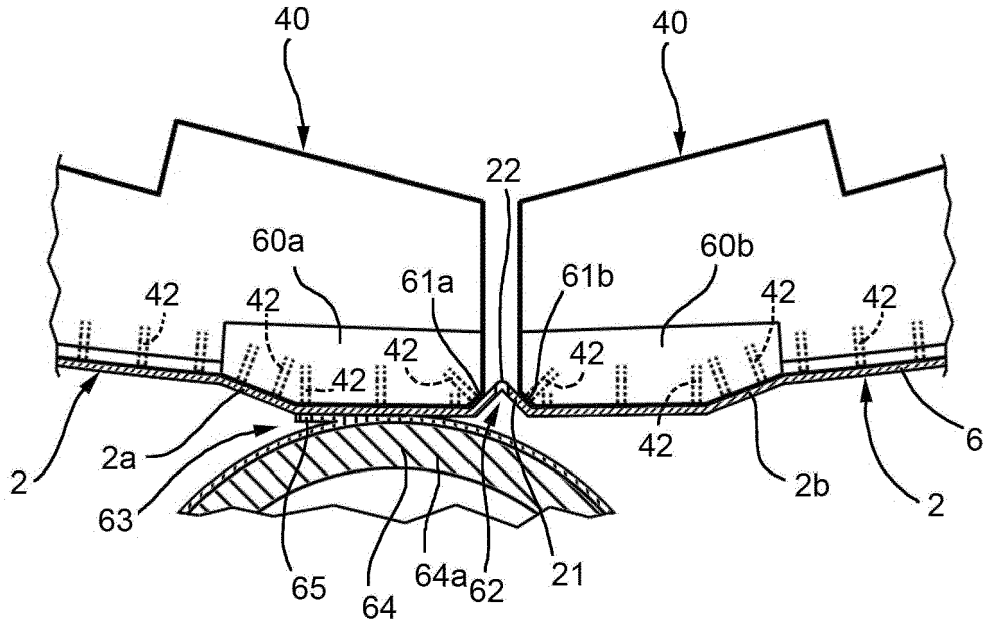
42
42
42
2
2a
42
22
21
42
2b
2
6

FIG. 3a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40
22
60a
60b
61a
61b
42
42
42
42
42
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42
42
2
2a
63
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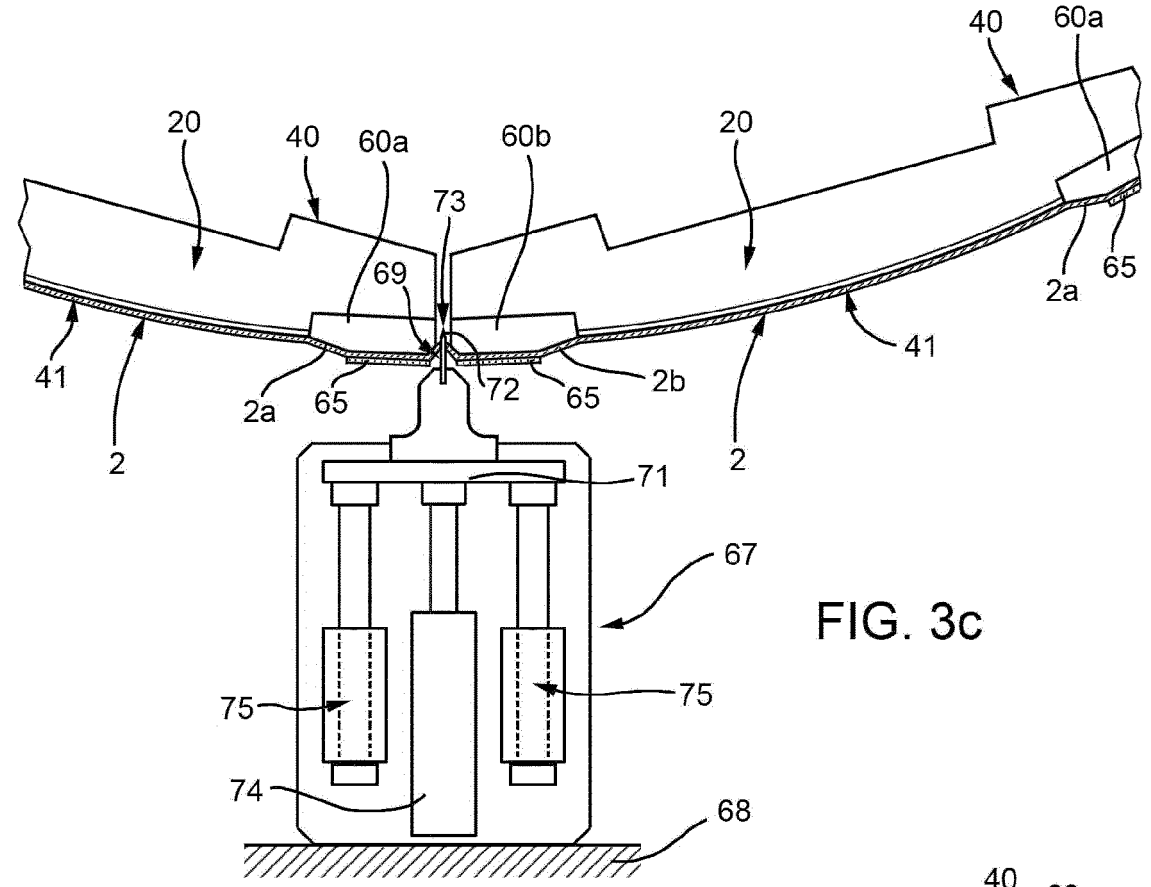
64
64a
62
21
42
2b
2
6

FIG. 3b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60a
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40
60a
60b
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73
69
65
2a
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72
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2b
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2a
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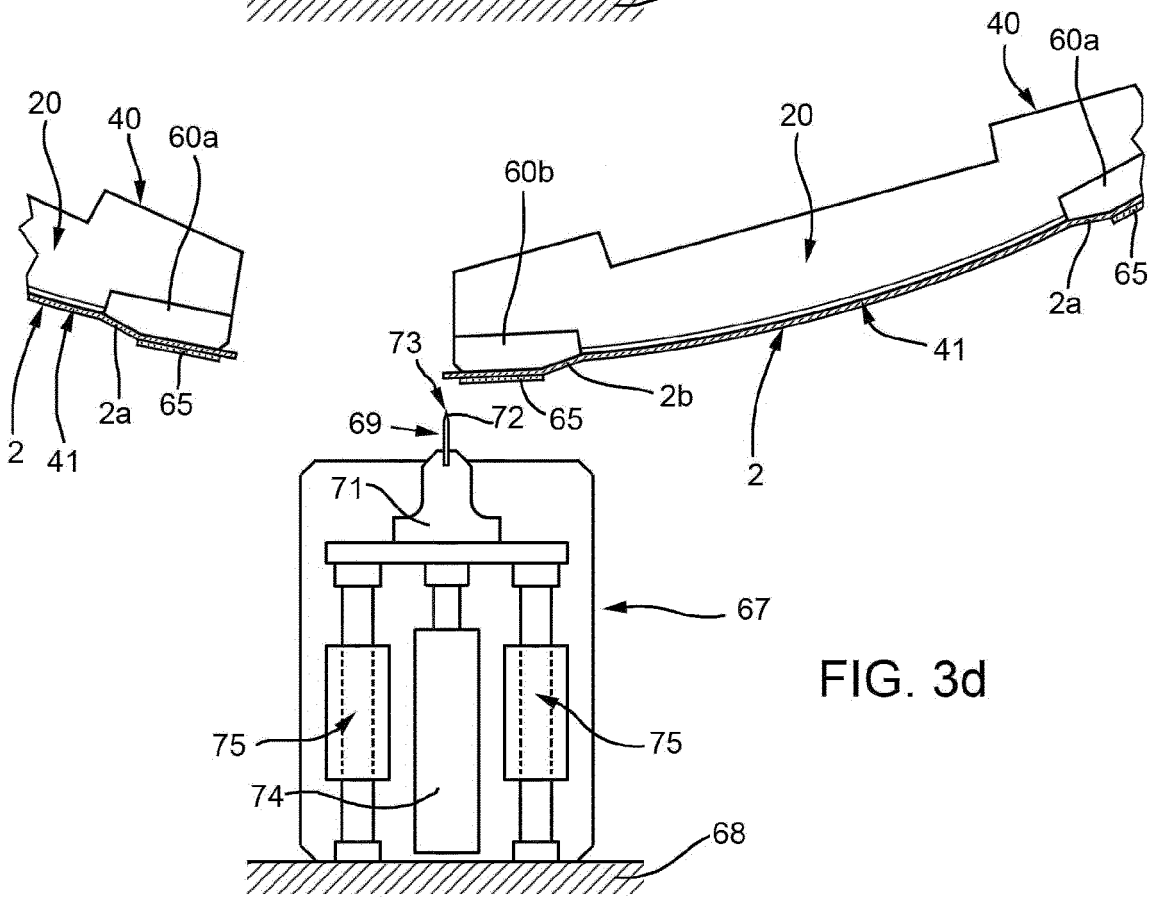
2
2
71
67
75
75
74
68

FIG. 3c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40
60a
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60b
65
2a
73
41
2b
69
72
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2a
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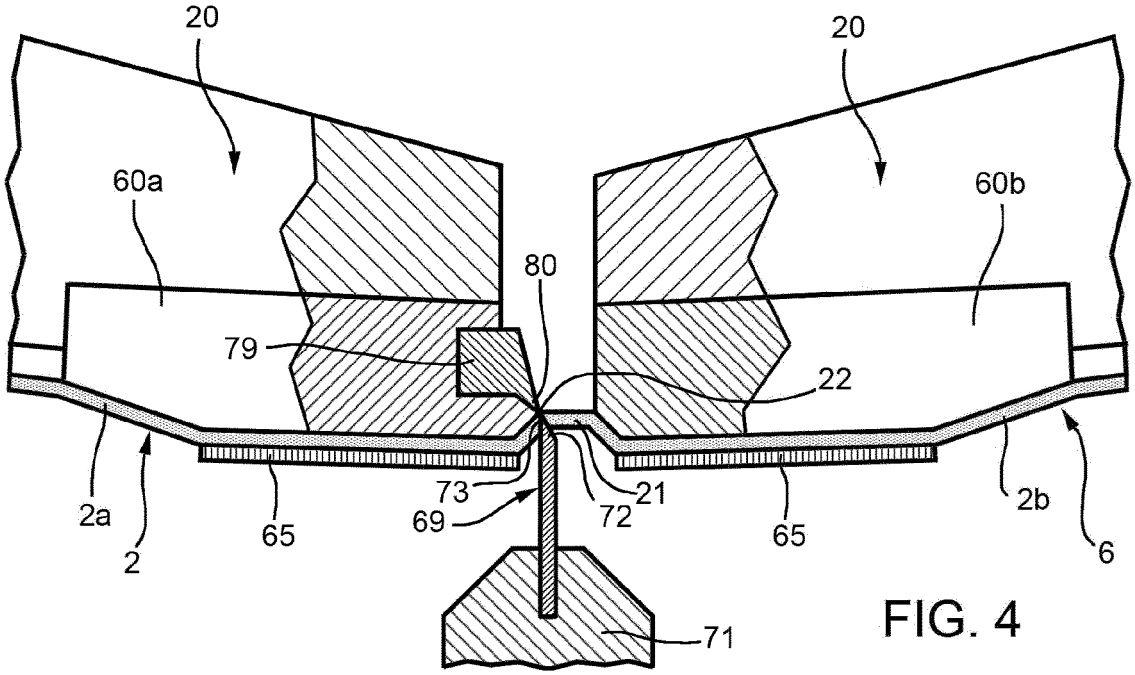
41
2
71
67
75
75
74
68

FIG. 3d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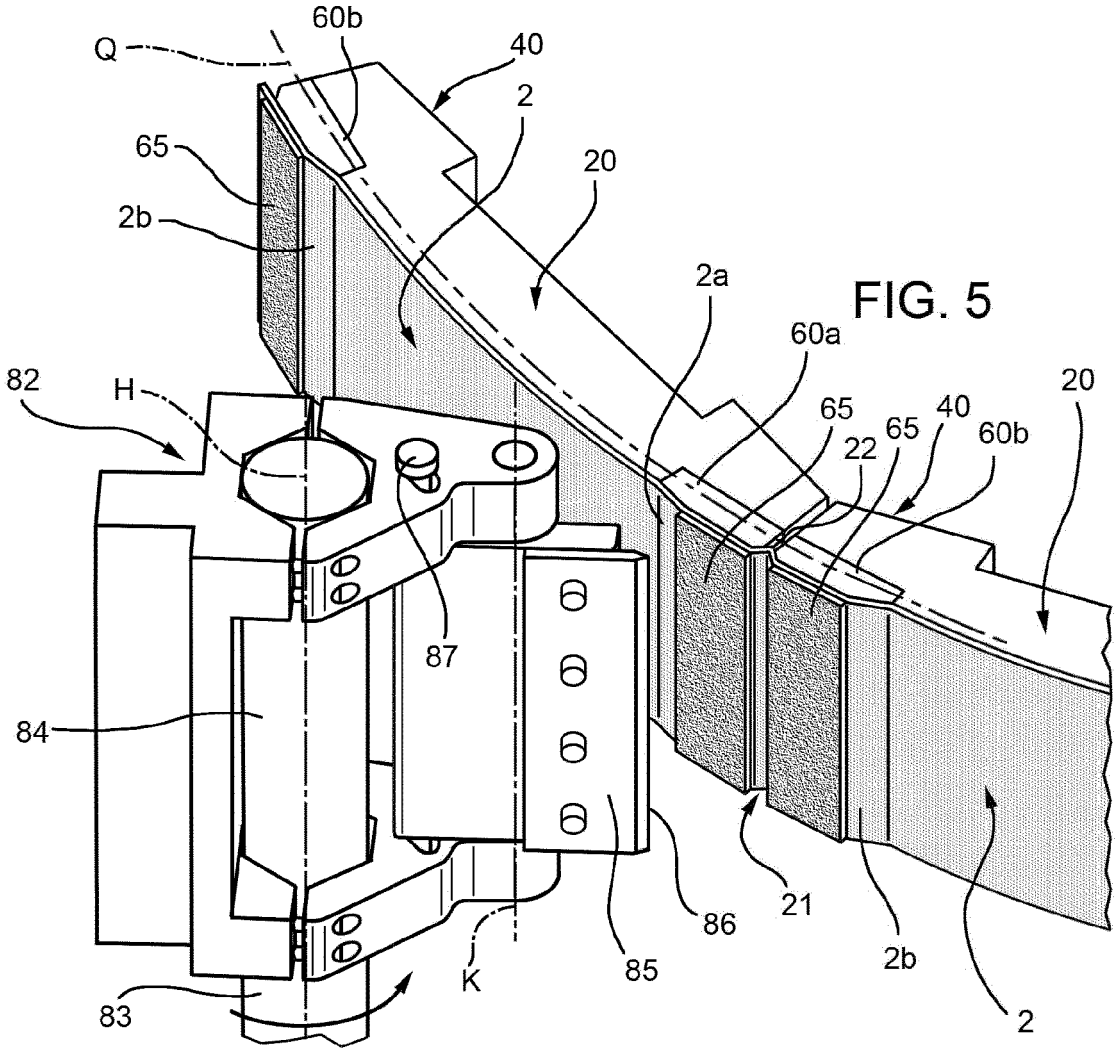
60a
60b
80
79
22
2a
2
65
73
69
72
21
65
2b
6
71

FIG. 4


Q
60b
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2
65
20
2b
2a
60a
82
H
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65
40
60b
22
20
87
84
86
21
85
2b
K
83
2

FIG. 5

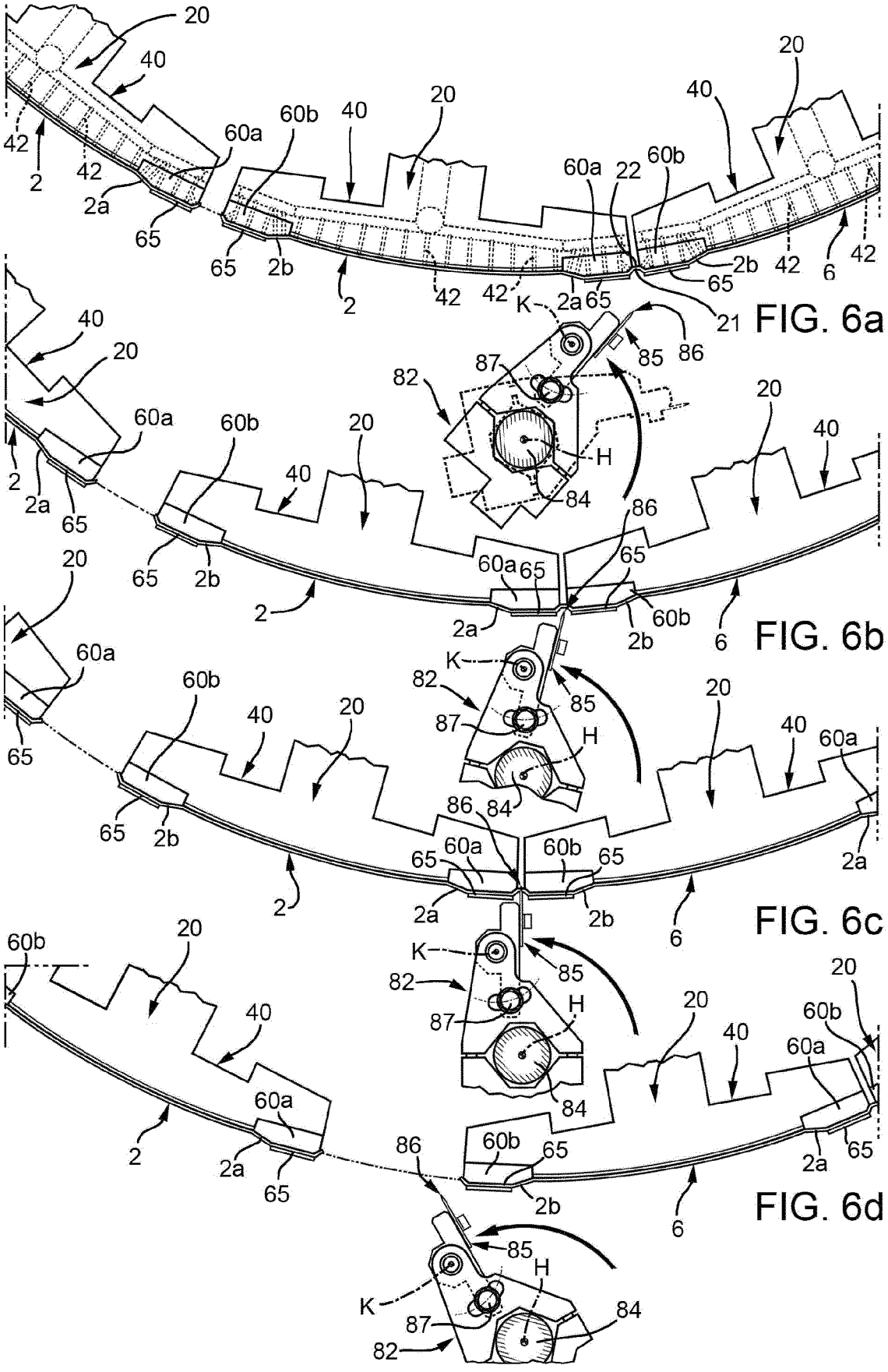


FIG. 6a

FIG. 6b

FIG. 6c

FIG. 6d

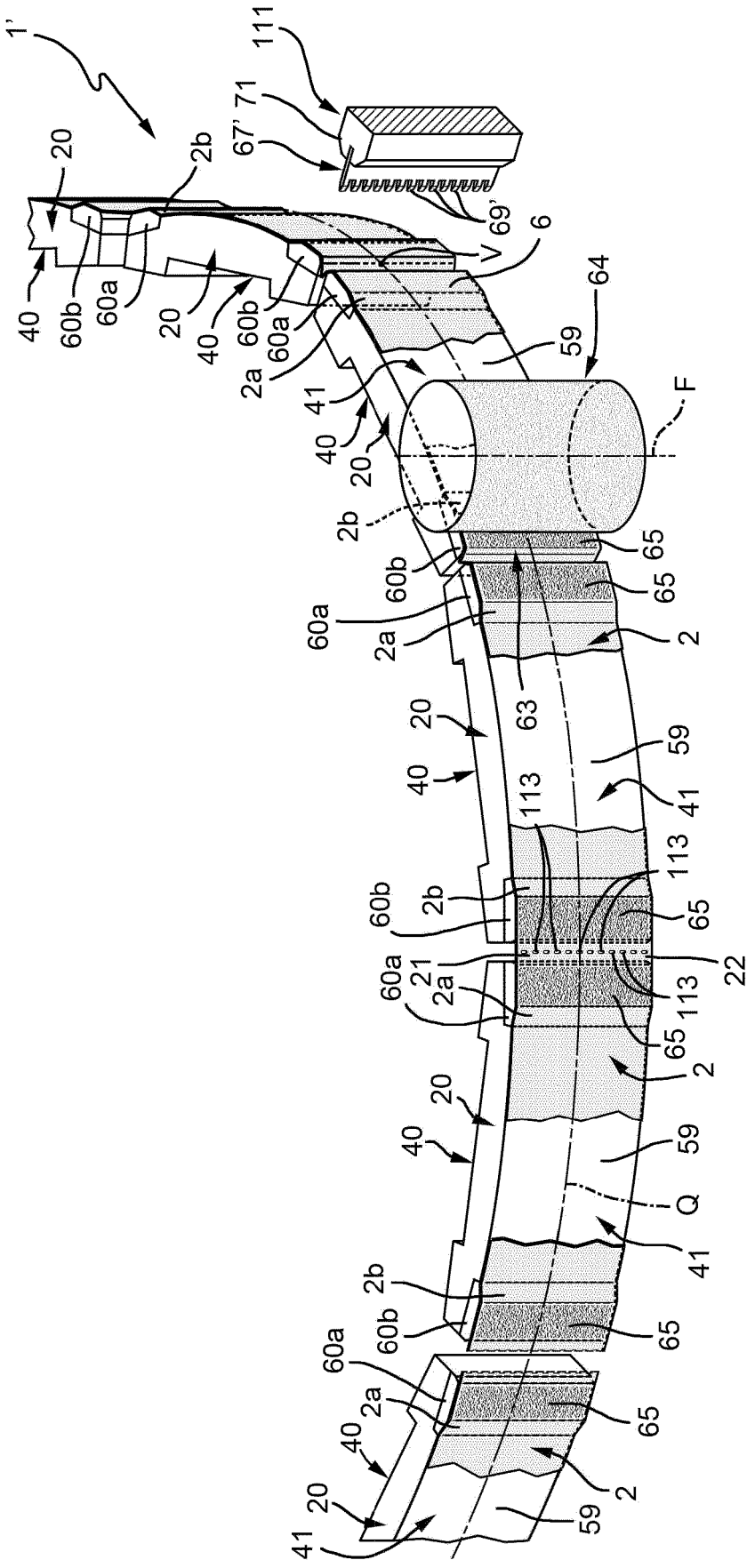
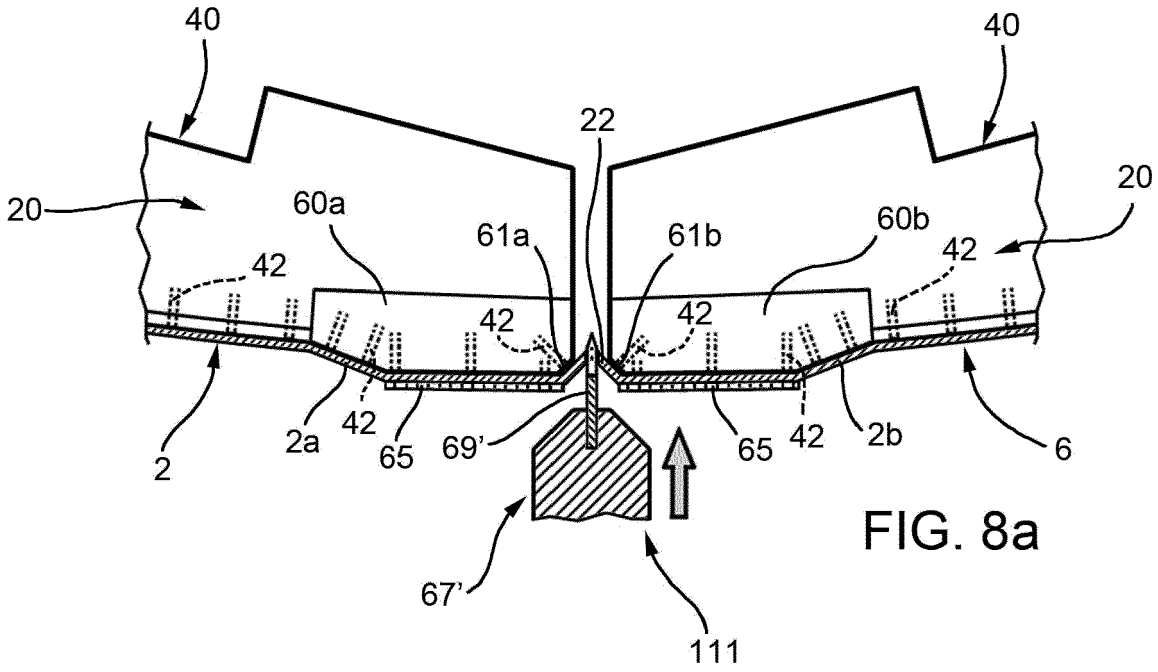


FIG. 7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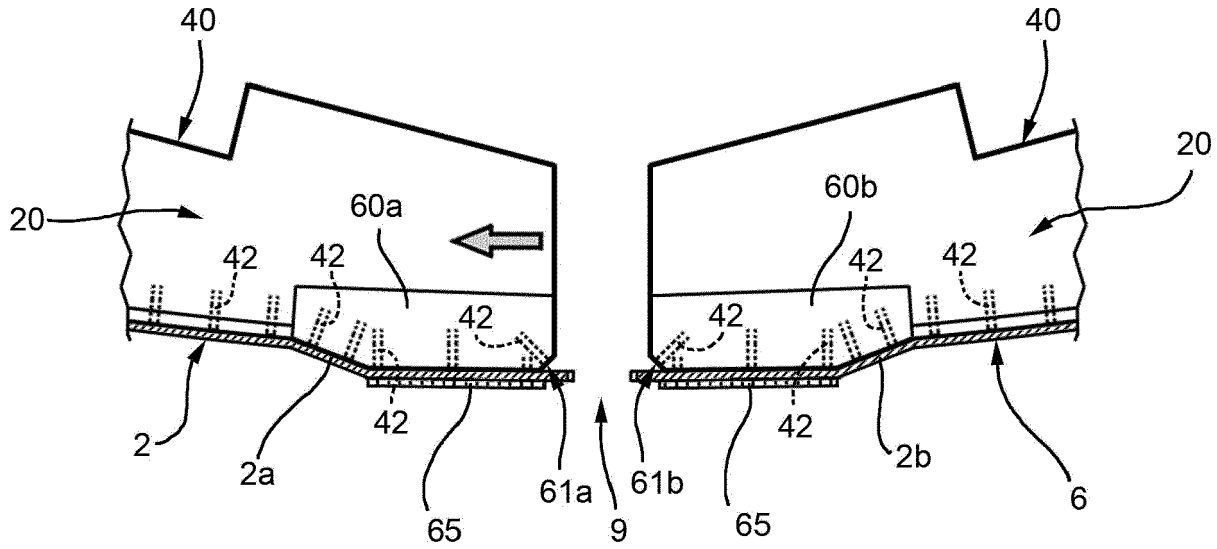
40
22
20
20
60a
61a
61b
60b
42
42
42
42
42
42
2
2a
42
65
69'
65
42
2b
6
67'
111

FIG. 8a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61a
9
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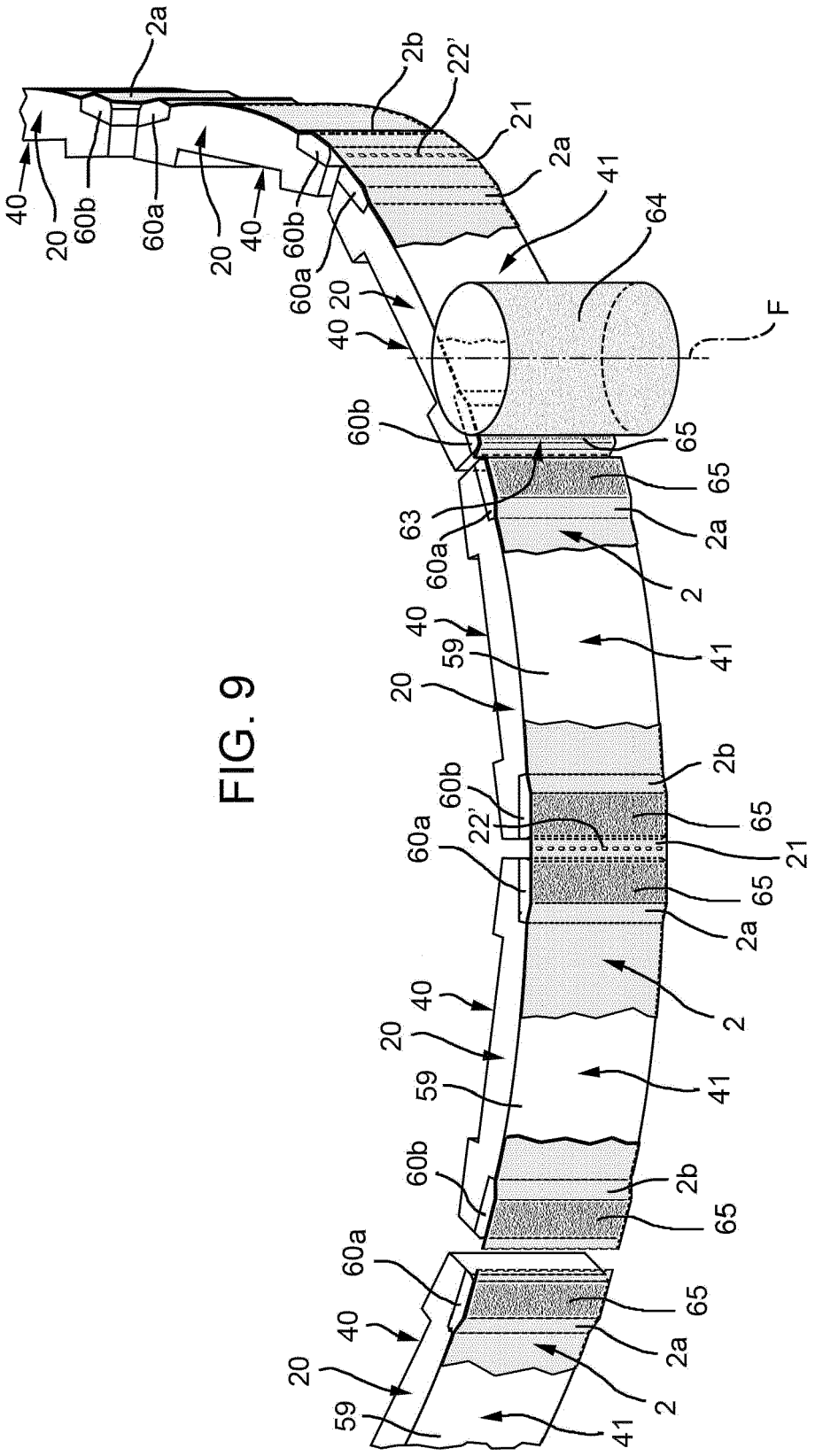
42
2b
6

FIG. 8b


2a
2b
22'
21
2a
41
64
F
40
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60b
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65
65
63
2a
60a
2
40
59
41
20
2b
60b
22'
65
60a
21
65
2a
2
40
20
59
41
60b
2b
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60a
65
40
2a
20
2
59
41

FIG. 9

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EUROPEAN SEARCH REPORT

Application Number
EP 18 30 6423

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	WO 00/34130 A1 (GERRO PLAST GMBH [DE]) 15 June 2000 (2000-06-15) * abstract * * figures 8, 9 * * page 13, lines 5-8 * * the whole document *	1-25	INV. B65C9/18 B65H35/10
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A	US 5 111 633 A (DRAGHETTI FIORENZO [IT]) 12 May 1992 (1992-05-12) * abstract; figure 1 * * the whole document *	1-25	
A	US 2009/078363 A1 (KRAMER KLAUS [DE] ET AL) 26 March 2009 (2009-03-26) * abstract * * paragraph [0011] - paragraph [0016]; figure 2 * * the whole document *	1-25	TECHNICAL FIELDS SEARCHED (IPC) B65C B67C B65H

~~The present search report has been drawn up for all claims~~

Place of search	Date of completion of the search	Examiner
The Hague	27 May 2019	Piekarski, Adam

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)

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Application Number
EP 18 30 6423

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):

☐ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

☒ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

1-25(partially)

☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

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LACK OF UNITY OF INVENTION
SHEET B

Application Number
EP 18 30 6423

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. claims: 1-25(partially)

   Tensioning the web with labels

   ---

2. claims: 1-25(partially)

   Protecting the label device from glue contamination

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 30 6423

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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27-05-2019

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