(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 3 566 960 A1**

(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
13.11.2019 Bulletin 2019/46

(51) Int Cl.:
B65B 61/24 *(2006.01)* ***B65B 1/00*** *(2006.01)*
B65B 7/20 *(2006.01)*

(21) Application number: **18171763.8**

(22) Date of filing: **11.05.2018**

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR
Designated Extension States:
BA ME
Designated Validation States:
KH MA MD TN

(71) Applicant: **Tetra Laval Holdings & Finance S.A.**
1009 Pully (CH)

(72) Inventor: **MATTIOLI, Giorgio**
41125 Modena (IT)

(74) Representative: **Tetra Pak - Patent Attorneys SE**
AB Tetra Pak
Patent Department
Ruben Rausings gata
221 86 Lund (SE)

(54) FOLDING UNIT FOR A PACKAGING ASSEMBLY AND PACKAGING ASSEMBLY COMPRISING A FOLDING UNIT

(57) There is described a folding unit (1) for a packaging assembly configured to form, seal and fold a plurality of pillow packs (3) containing a pourable product; the folding unit (1) defines an endless folding path (P) comprising an input station (I), at which the folding unit (1) receives the pillow packs (3), and an output station (0), at which fully-folded finished packages (2) exit the folding unit (1); the folding unit (1) comprises folding means configured to displace an end fin (8) of each respective pillow pack (3) from an unfolded configuration to a folded configuration; the folding means comprises at least one moving member (17) configured to cyclically advance along the folding path (P), and configured to move between a first position, in which it does not interact with the end fin (8), and a second position, in which it cooperates in contact with the end fin (8) and has completed displacement of the same from the unfolded configuration to the folded configuration; the moving member (17) is configured to move from the first position towards the second position while advancing from the input station (I) to the output station (0) and is configured to move from the second position towards the first position while advancing from the output station (0) to the input station (I).

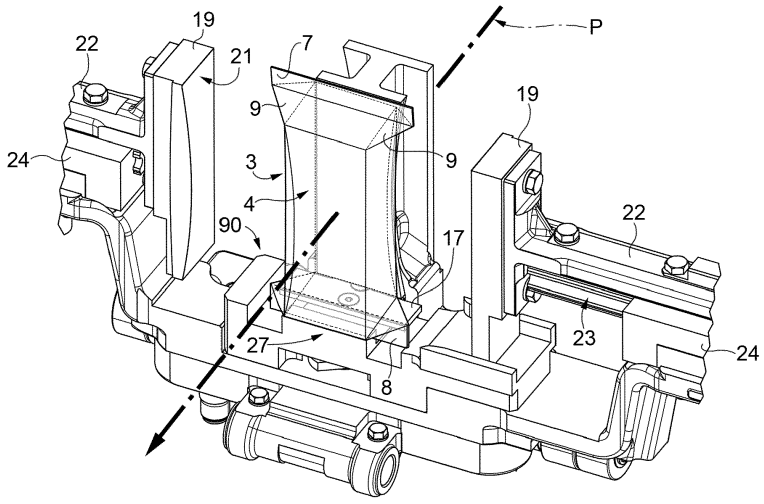


FIG. 5A

EP 3 566 960 A1

Description

TECHNICAL FIELD

[0001] The present invention relates to a folding unit for a packaging assembly configured to form, seal and fold a plurality of packages containing a pourable product, in particular a pourable food product.

[0002] The present invention also relates to a packaging assembly configured to form, seal and fold a plurality of packages containing a pourable product, in particular a pourable food product, and comprising a folding unit.

BACKGROUND ART

[0003] As it is generally known, many pourable food products, such as fruit juice, UHT (ultra-high temperature-treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0004] A typical example is the parallelepiped-shaped package for pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by folding and sealing a laminated web of packaging material.

[0005] In particular, the packaging material has a multilayer structure, known and not described in detail.

[0006] The packages are normally produced on fully automatic packaging assemblies, in which a continuous tube is formed from the web of packaging material.

[0007] Typically, the known packaging assemblies comprise a forming unit, a folding unit and an outfeed device.

[0008] In particular, the web of packaging material is folded and sealed longitudinally to form the tube, and then the tube is fed to the forming unit along a vertical direction.

[0009] In order to perform the forming operations, the tube is filled from above, by means of a pipe, with the pourable food product and is formed, sealed and subsequently cut along equally spaced transversal cross sections.

[0010] Pillow packs are obtained thereby, which have a longitudinal sealing band, a top transversal sealing band and a bottom transversal sealing band.

[0011] More specifically, each pillow pack usually comprises a prismatic main portion, which has a longitudinal axis, a top end portion and a bottom end portion opposite to one another. In detail, the top end portion and the bottom end portion define respective transitions from the main portion towards the top sealing band and the bottom sealing band, respectively.

[0012] Each pillow pack further comprises an elongated rectangular top end fin, arranged at the top end portion, and an elongated rectangular bottom end fin, arranged at the bottom end portion. In detail, the top end fin and the bottom end fin protrude orthogonally from the respective top end portion or bottom end portion.

[0013] Each pillow pack also comprises two pairs of substantially triangular flaps projecting from opposite sides of the respective top end portion or bottom end portion.

[0014] After being formed, sealed and cut, the pillow packs are typically fed to the folding unit, which is configured to perform a final folding operation on the pillow packs, so as to obtain respective finished packages.

[0015] Typically, the folding unit comprises an endless conveyor configured to advance the pillow packs (and then the folded packages) along an endless folding path defined by the endless conveyor.

[0016] In detail, the folding path comprises an input station, at which the folding unit receives a plurality of formed and sealed semi-finished pillow packs from the forming unit, and an output station, at which the fully-folded and finished packages are fed to the outfeed device.

[0017] In greater detail, the folding path generally comprises a top straight branch, a bottom straight branch and two curved branches, which are opposite to one another and connect, on respective opposite sides, the top straight branch and the bottom straight branch.

[0018] In particular, the input station is arranged at the curved branch adjacent to the forming unit, hereafter first curved branch, and the output station is arranged at the bottom straight branch, downstream of the curved branch opposite to the first curved branch, hereafter second curved branch.

[0019] Typically, the folding units of the known type further comprise a plurality of folding devices movably coupled to the endless conveyor so as to cyclically move, in use, along the folding path.

[0020] In detail, each folding device is configured to receive one pillow pack at a time at the input station, to carry such pillow pack along the folding path and to interact with such pillow pack to perform a relative folding operation thereon, thereby obtaining a respective finished package.

[0021] In greater detail, while each pillow pack is carried along the folding path:

- the top end portion and the bottom end portion of such pillow pack are pressed towards each other, so as to form a top end wall and a bottom end wall of the package being obtained from the pillow pack, the top end wall and the bottom end wall being opposite to each other;
- the top end fin and the bottom end fin are folded onto the top end wall and the bottom end wall, respectively; and
- the triangular flaps of the top end portion are folded outwards onto the respective lateral walls of the main portion and the triangular flaps of the bottom end portion are folded inwards onto the respective bottom end wall.

[0022] A folding device adapted to be implemented in the above-mentioned folding unit is known from EP-B-2586716, and substantially comprises:

- a plate adapted to receive and support one single pillow pack to be folded at a time;
- a paddle, which projects perpendicularly from the plate and is adapted to cooperate in contact with one lateral wall of the main portion of such pillow pack, so as to push this latter along the folding path; and
- a pair of shells which are integrally movable along the folding path, are also movable towards each other relatively to the paddle and transversally to the folding path, and are configured to fold the triangular flaps of the top end portion onto the lateral walls.

[0023] In detail, the plate is adapted to cooperate in contact with the top end portion of the pillow pack.

[0024] In light of the above, the pillow pack is carried along the first curved branch and the subsequent top straight branch of the folding path in an upside-down position, while being transformed into a folded finished package. Then, the package is turned by 180° along the second curved branch, so that the package is fed to the outfeed device, along the bottom straight branch, in an upright position.

[0025] In the configuration described in EP-B-2586716, the plate comprises a through slot, which is designed to be engaged by the top end fin of the pillow pack.

[0026] In particular, the top end fin is folded onto the top end wall of the package by a shaped plate located underneath the plate and movable, in a direction parallel to the folding path, between a first position, in which the shaped plate engages the slot, so as to fold the top end fin housed therein, and a second position, in which the shaped plate leaves free the slot.

[0027] In detail, the shaped plate carries two wedges designed to engage the slot and to cooperate with the top end fin when the shaped plate is in the first position, thereby pushing forward and folding the top end fin onto the top end wall of the package.

[0028] The shaped plate further comprises a pair of racks arranged upstream of the wedges, with respect to the advancing direction of the folding device along the folding path, the racks being arranged to drive the shaped plate.

[0029] According to the configuration described in EP-B-2586716, the folding device also comprises a pair of toothed sectors, which protrude from the folding device downstream of the plate, with respect to the advancing direction of the folding device along the folding path.

[0030] More specifically, the toothed sectors of one folding device are configured to mesh with the racks of the shaped plate of the following folding device on the conveyor. Such following folding device defines, together with the preceding folding device, a pair of cooperating folding devices.

[0031] When such pair of folding devices moves along the first curved branch of the folding path, a forward movement of the shaped plate from the second position towards the first position is obtained. Consequently, the wedges of the shaped plate engage the slot of the plate, thereby pushing forward and folding the top end fin onto the top end wall of the package carried by the following folding device.

[0032] In particular, when the pair of folding devices advances along the first curved branch of the folding path, the two folding devices move towards each other. In detail, the racks of the following folding device are moved forward by the toothed sectors of the preceding folding device, due to the curvature of the folding path. Accordingly, the shaped plate moves from the second position to the first position, and the folding of the top end fin by means of the wedges occurs.

[0033] However, the meshing between the racks of the following folding device and the toothed sectors of the preceding folding device causes a relative movement of these two folding devices not only along the first curved branch of the folding path, but also along the second curved branch of the folding path.

[0034] This relative movement occurring upstream of the output station may cause mispositioning of the packages, which could compromise the discharge of such packages to the outfeed device and lead to package jamming.

DISCLOSURE OF INVENTION

[0035] It is therefore an object of the present invention to provide a folding unit, which is designed to overcome the above-mentioned drawbacks in a straightforward and low-cost manner.

[0036] This object is achieved by a folding unit as claimed in claim 1.

[0037] It is a further object of the present invention to provide a packaging assembly, which is designed to overcome the above-mentioned drawbacks in a straightforward and low-cost manner.

[0038] This object is achieved by a packaging assembly as claimed in claim 14.

BRIEF DESCRIPTION OF THE DRAWINGS

[0039] A non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a top perspective view, with parts removed for clarity, of a folding unit according to the present invention;

Figure 2 is a bottom perspective view, with parts removed for clarity, of the folding unit of Figure 1;

Figure 3 is a schematic side view, with parts removed for clarity, of the folding unit of Figure 1;

Figure 4 is a perspective view, with parts removed for clarity, of a folding device of the folding unit of Figure 1;

Figure 5A and 5B are two perspective views, with parts removed for clarity, of a detail of the folding

device of Figure 4 in two different operating conditions;

Figure 6 is a perspective view of cooperating components of the folding device of Figure 4, with parts removed for clarity; and

Figure 7 is a perspective view of a pillow pack the folding unit of Figure 1 is fed with.

BEST MODE FOR CARRYING OUT THE INVENTION

[0040] With reference to Figure 1, number 1 indicates as a whole a folding unit for a packaging assembly (known per se and not shown) configured to form, seal and fold a plurality of pillow packs 3 containing a pourable product, in particular a pourable food product such as fruit juice, milk, wine, tomato sauce, etc.

[0041] In particular, pillow packs 3 may be obtained from a tube, which is formed in a known manner upstream of folding unit 1 by longitudinally folding and sealing a web (not shown) of packaging material.

[0042] After being formed, the tube is filled with the pourable food product and is fed to a forming unit (not shown) of the packaging assembly. In the forming unit, the tube is sealed and cut along equally spaced cross-sections to form the plurality of semi-finished pillow packs 3, which have a longitudinal sealing band, a top transversal sealing band and bottom transversal sealing band.

[0043] More specifically, as shown in particular in Figure 7, each pillow pack 3 comprises a prismatic main portion 4, having a longitudinal axis A and being defined by four lateral walls 4a (only two visible in Figure 7) and two shaped walls 4b (only one visible in Figure 7) interposed between two adjacent lateral walls 4a.

[0044] Each pillow pack 3 further comprises a top end portion 5 and a bottom end portion 6, axially opposite to one another. In detail, top end portion 5 and bottom end portion 6 define respective transitions from main portion 4 towards the top sealing band and the bottom sealing band.

[0045] Each pillow pack 3 also comprises an elongated rectangular bottom end fin 7, protruding from bottom end portion 6, and an elongated rectangular top end fin 8, protruding from top end portion 5.

[0046] In detail, top end fin 8 and bottom end fin 7 protrude axially from the respective top end portion 5 or bottom end portion 6, and define the top sealing band and the bottom sealing band of pillow pack 3, respectively.

[0047] More precisely, top end fin 8 and bottom end fin 7 extend along a direction orthogonal to axis A.

[0048] Furthermore, each pillow pack 3 comprises two pairs of substantially triangular flaps 9, which project from opposite sides of top end portion 5 and bottom end portion 6, respectively.

[0049] After being formed, sealed and cut, pillow packs 3 are fed to folding unit 1, which is configured to perform a final folding operation on pillow packs 3, so as to obtain respective fully-folded finished packages 2.

[0050] As visible in Figures 1 and 2, folding unit 1 comprises an endless conveyor 10 configured to advance semi-finished pillow packs 3 and finished packages 2 along an endless folding path P defined by endless conveyor 10.

[0051] In particular, folding path P comprises an input station I, at which folding unit 1 receives the plurality of pillow packs 3 from the forming unit, and an output station 0, at which the fully-folded and finished packages 2 are fed to an outfeed device (not shown) and subsequently exit the packaging assembly.

[0052] According to this non-limiting preferred embodiment shown, folding path P has a substantially oval-shaped profile and comprises a first curved branch P1, a top straight branch P2, a second curved branch P3 and a bottom straight branch P4.

[0053] In detail, first curved branch P1 and second curved branch P3 are opposite to one another and connect, on respective opposite sides, top straight branch P2 and bottom straight branch P4.

[0054] In greater detail, top straight branch P2 extends from first curved branch P1; second curved branch P3 extends from top straight branch P2; and bottom straight branch P4 extends from second curved branch P3 and is connected to first curved branch P1.

[0055] In particular, input station I is arranged at first curved branch P1, i.e. the one adjacent to the forming unit, and output station 0 is arranged at bottom straight branch P4, i.e. the one adjacent to outfeed device.

[0056] In light of the above, pillow packs 3 and packages 2 are advanced, from input station I, first along curved branch P1, then along top straight branch P2, subsequently along second curved branch P3 and eventually along bottom straight branch P4, along which packages 2 reach output station 0.

[0057] In particular, pillow packs 3 and packages 2 are advanced from input station I to output station 0 with their respective axes A orthogonal to folding path P.

[0058] As visible in Figure 1, folding unit 1 further comprises a plurality of folding devices 11 (only five shown in Figure 1) movably coupled to conveyor 10 so as to cyclically move along folding path P.

[0059] In detail, folding devices 11 form an endless transport element, in the example shown a chain 14 (Figure 3), formed by a plurality of consecutive links, each one defined by a single folding device 11. In greater detail, chain 14 is looped about a pair of driving members, preferably a pair of coaxial sprockets 15, and about a cam 16.

[0060] More precisely, chain 14 is driven by sprockets 15, so that the consecutive folding devices 11 can be moved on conveyor 10 and along folding path P.

[0061] Hence, chain 14 is configured to carry pillow packs 3 and packages 2 along folding path P, from input station I to output station 0.

[0062] Since all folding devices 11 are identical to one another, only one single folding device 11 according to one non-limiting preferred embodiment of the present invention will be described in the following, for the sake of

brevity.

[0063] However, all the features disclosed hereinafter for such folding device 11 are applicable to each folding device 11 of folding unit 1.

[0064] As shown in Figures 4 and 5A-5B, folding device 11 comprise:

- at least one supporting element 90, which is adapted to receive and support one single pillow pack 3 and/or package 2 at a time, from input station I to output station 0;
- a paddle 18, which projects orthogonally from supporting element 90 and is adapted to cooperate in contact with one lateral wall 4a of main portion 4 of pillow pack 3 and/or package 2, so as to push pillow pack 3 and/or package 2 along folding path P; and
- a pair of shells 19, which are movable along folding path P integrally with paddle 18, are also movable towards each other relatively to paddle 18 and transversally to folding path P, and are configured to fold triangular flaps 9 of top end portion 5 onto lateral walls 4a.

[0065] In detail, pillow pack 3 and/or package 2 is carried by folding device 11 with top end portion 5 facing supporting element 90.

[0066] In light of the above, pillow pack 3 is carried, from input station I, along first curved branch P1 and the subsequent top straight branch P2 of folding path P, in an upside-down position. Along first curved branch P1 and top straight branch P2, such pillow pack 3 is transformed into a package 2. Then, package 2 is turned by 180° along second curved branch P3, and eventually is fed to the outfeed device at output station 0 in an upright position.

[0067] After package 2 exits from folding unit 1, folding device 11 advances along bottom straight branch P4 until it reaches again first curved branch P1 and input station I.

[0068] As visible in Figures 4 to 6, paddle 18 mirrors the shape of lateral wall 4a it cooperates in contact with.

[0069] Similarly, shells 19 define respective surfaces 21, which are adapted to cooperate in contact with lateral walls 4a and shaped walls 4b of pillow pack 3.

[0070] In detail, surfaces 21 face one another and mirror lateral walls 4a of main portion 4, so as to control the final shape of pillow pack 3 to be folded.

[0071] In greater detail, surfaces 21 are configured to cooperate with triangular flaps 9 of top portion 5 so as to fold them onto corresponding lateral walls 4a of main portion 4.

[0072] According to a manner known and described in EP-B-2586716, in order to perform the folding operation of pillow pack 3, top end portion 5 and bottom end portion 6 are pressed towards each other, so as to form a top face and a bottom face of package 2 being obtained from pillow pack 3.

[0073] As shown in Figure 1, each shell 19 is connected to conveyor 10 of folding unit 1 by means of a relative arm 22 extending transversally, preferably orthogonally, to folding path P. In detail, arms 22 define corresponding slides 23 configured to engage respective guides 24 integrally carried by folding device 11 on opposite sides of paddle 18.

[0074] In greater detail, each arm 22 carries, on its end opposite to relative shell 19, a roller 25 configured to engage a relative endless cam 26 (Figures 1 and 2).

[0075] More precisely, folding unit 1 comprises two cams 26 arranged at opposite lateral sides of conveyor 10 and extending along a direction parallel to part of folding path P. In particular, cams 26 are configured to control, together with rollers 25, a movement of arms 22 transversal to folding path P and, hence, the movement of shells 19 towards each other and transversal to folding path P between:

- a fully closed position, in which shells 19 exert a pressure onto pillow pack 3, so as to perform the folding of triangular flaps 9 (as disclosed in EP-B-2586716 and not described in detail); and
- an open position, in which shells 19 are detached from pillow pack 3 or package 2.

[0076] In detail, shells 19 are arranged in the open position at input station I and move from the open position towards the fully closed position when folding device 11 is advancing along the top straight branch P2 of folding path P.

[0077] In greater detail, shells 19 move back towards the open position when folding device 11 is advancing along the bottom straight branch P4 of folding path P.

[0078] Furthermore, shells 19 may be also arranged in a closed position, in which shells 19 grip package 2 without exerting any pressure thereon.

[0079] In particular, each shell 19 moves between the fully closed position and the open position when the respective roller 25 engages corresponding operative portions of cam 26, converging towards or diverging from folding path P.

[0080] During operation, bottom end fin 7 is folded onto bottom face of package 2 being obtained from pillow pack 3.

[0081] According to this non-limiting preferred embodiment shown, folding unit 1 comprises folding means configured to displace top end fin 8 of pillow pack 3 from an unfolded configuration, in which top end fin 8 projects from top end portion 5, to a folded configuration, in which top end fin 8 rests on top face of package 2 being obtained from pillow pack 3.

[0082] Folding means comprise a moving member, preferably a flat plate 17 movably carried by folding device 11.

[0083] As visible in Figures 5A-5B, plate 17 is configured to move, preferably slide, between:

- a first position, in which plate 17 does not interact with top end fin 8; and

- a second position, in which plate 17 cooperates in contact with top end fin 8 and has completed displacement of top end fin 8 from the unfolded configuration to the folded configuration.

[0084] In other words, the folding of top end fin 8 occurs when plate 17 is moving from the first position towards the second position.

[0085] Preferably, plate 17 is detached from top end fin 8 when being in the first position.

[0086] According to this preferred embodiment, plate 17 is configured to move from the first position towards the second position while advancing along folding path P from input station I to output station 0.

[0087] Advantageously, plate 17 is configured to move back from the second position towards the first position while advancing along the folding path P from output station 0 to input station I.

[0088] In particular, the folding means further comprise at least one guiding track 28 having:

- a first operative portion 28b, arranged between input station I and output station 0 and diverging from folding path P;
- a second operative portion 28c, arranged between output station 0 and input station I and converging towards folding path P; and
- a main portion 28a extending parallel to part of folding path P.

[0089] Folding means further comprise at least one engaging element, preferably a roller 29, which is configured to engage track 28, is carried by plate 17, and is adapted to move away from folding path when engaging operative portion 28b, to move towards folding path P when engaging operative portion 28c, and to advance parallel to folding path P when engaging main portion 28a.

[0090] More precisely, the movement of roller 29 towards or away from folding path P causes the movement of plate 17 between the first position and the second position.

[0091] In detail, plate 17 is configured to move from the first position to the second position when roller 29 engages operative portion 28b.

[0092] Furthermore, plate 17 is configured to move from the second position to the first position when roller 29 engages operative portion 28c.

[0093] In addition, plate 17 is configured to stay in the first position or in the second position when roller 29 engages main portion 28a.

[0094] In particular, operative portion 28b is arranged along first curved branch P1 and/or along a first portion of top straight branch P2 and downstream of input station I, and operative portion 28c is arranged along bottom straight branch P4 and downstream of output station 0.

[0095] In light of the above, the movement of plate 17 from the first position to the second position occurs when folding device 11 is advancing along first curved branch P1 and/or along a first portion of top straight branch P2.

[0096] Conversely, the movement of plate 17 from the second position back to the first position occurs when folding device 11 is advancing along bottom straight branch P4, i.e. when folding device 11 has already discharged package 2.

[0097] In this way, any unwanted mispositioning of package 2 before it is fed to the outfeed device is avoided.

[0098] Preferably, plate 17 is configured to selectively move back and forth parallel to folding path P, when moving between the first position and the second position.

[0099] In detail, the first position is a retracted position for plate 17 with respect to the direction of advancement of pillow pack 3 and/or package 2 along folding path P, and the second position is an advanced position for plate 17 with respect to the direction of advancement of pillow pack 3 and/or package 2 along folding path P.

[0100] In greater detail, when plate 17 is in the first position, it is partly retracted underneath paddle 18.

[0101] Conversely, when plate 17 is in the second position, it is fully extracted from underneath paddle 18 and abuts against a stop element 27 integrally carried by folding device 11.

[0102] As visible in Figure 5A, pillow pack 3 is carried by folding device 11 so that top end fin 8 is arranged between plate 17 and stop element 27.

[0103] Hence, as plate 17 moves forward parallel to folding path P, it cooperates in contact with top end fin 8 and folds top end fin 8. When plate 17 abuts against stop element 27, the movement from the first position towards the second position is completed.

[0104] As visible in particular in Figure 6, roller 29 is carried by (coupled to) plate 17 by means of a lever mechanism 30.

[0105] In particular, lever mechanism 30 is configured to transform the movement of roller 29 towards and away from folding path P in the back and forth movement of plate 17 between the first position and the second position.

[0106] In detail, lever mechanism 30 comprises a first lever member 35, which is coupled to plate 17 by means of a pin 37, and a linear rod 31, which extends along an axis B, which is transversal to folding path P and eccentric with respect to pin 37.

[0107] In particular, pin 37 is received in a seat of a block element integral with plate 17. More in particular, the block element is located underneath plate 17.

[0108] In greater detail, linear rod 31 carries, in turn, roller 29, eccentrically with respect to axis B, by means of a second lever member 34.

[0109] According to this non-limiting preferred embodiment, lever member 34 and lever member 35 extend transversally, preferably orthogonally, to axis B and, hence, protrude transversally, preferably orthogonally, from linear rod 31.

[0110] In particular, linear rod 31 carries, at a first end portion 32 adjacent to plate 17, lever member 35 and, at

a second end portion 33 adjacent to roller 29, lever member 34.

[0111] In detail, lever member 34 is coupled to second end portion 33 of linear rod 31 at one end, transversally with respect to axis B, and carries roller 29 at another opposite end.

[0112] Since roller 29 is carried by linear rod 31 eccentrically with respect to axis B, the movement of roller 29 (towards and away from folding path P) causes a rotation of linear rod 31, by means of lever member 34. Such rotation of linear rod 31 causes, by means of lever member 35, a movement of pin 37 back and forth and, therefore, the movement of plate 17 between the first position and the second position.

[0113] Furthermore, plate 17 comprises a pair of slides 36 (Figure 6) extending parallel to folding path P and configured to engage a pair of not shown corresponding guides so as to guide the movement of plate 17 back and forth between the first position and the second position.

[0114] The operation of folding unit 1 is described hereinafter with reference to a single folding device 11 advancing on conveyor 10 and starting from a condition in which folding device 11 is advancing along first curved branch P1 and is receiving one respective pillow pack 3 at input station I.

[0115] More precisely, supporting element 90 receives and supports one pillow pack 3 and paddle 18 pushes lateral wall 4a of pillow pack 3 along folding path P.

[0116] In this condition, shells 19 are in the open position and roller 29 starts to engage operative portion 28b of track 28, which is arranged at first curved branch P1 and/or along a first portion of top straight branch P2 downstream of input station I, as mentioned above.

[0117] Consequently, roller 29 is moved away from folding path P and plate 17 moves, by means of lever mechanism 30, from the first position towards the second position.

[0118] In this way, plate 17 cooperates with top end fin 8, which is arranged between plate 17 and stop element 27, and folds top end fin 8 on top face of package 2 being obtained from pillow pack 3.

[0119] Subsequently, folding device 11 advances along top straight branch P2 of folding path P and shells 19 move, due to the interaction between rollers 25 and cams 26, from the open position towards the fully closed position (Figure 1), thereby completing the folding operation of pillow pack 3 and obtaining one package 2.

[0120] Then, folding device 11 advances along second curved branch P3, thereby turning package 2 by 180°, from an upside-down position to an upright position.

[0121] As folding device 11 leaves second curved branch P3 and enters bottom straight branch P4, it reaches output station 0, where package 2 is fed to the outfeed device.

[0122] Eventually, folding device 11 advances along the remaining portion of bottom straight branch P4, where roller 29 engages operative portion 28c and plate 17 moves, accordingly, back to the first position.

[0123] At this point, shells 19 move back to the open position and folding device 11 moves again along first curved branch P1, ready to pick another pillow pack 3 at input station I.

[0124] The operation is repeated cyclically for each pillow pack 3 to be folded and for each folding device 11 that may be present in folding unit 1.

[0125] The advantages of folding unit 1 according to the present invention will be clear from the foregoing description.

[0126] In particular, as plate 17 moves back from the second position to the first position after having discharged package 2 at output station 0, any mispositioning of such package 2 is avoided.

[0127] In this way, each package 2 is fed to the outfeed device in the nominal position and any production jamming is avoided.

[0128] Furthermore, as plates 17 of each folding device 11 which may be present in folding unit 1 are controlled independently from one another by means of the interaction between track 28 and roller 29, there is no mutual interaction between folding devices 11. More precisely, there is no mutual interaction between one folding device 11 and the following or the preceding folding device 11.

[0129] In this way, any relative movement between folding devices 11 is prevented, thereby avoiding any mispositioning of packages 2.

[0130] Clearly, changes may be made to folding unit 1 as described herein without, however, departing from the scope of protection as defined in the accompanying claims.

Claims

1. A folding unit (1) for a packaging assembly configured to form, seal and fold a plurality of pillow packs (3) containing a pourable product; said folding unit (1) defining an endless folding path (P) comprising an input station (I), at which said folding unit (1) receives said pillow packs (3), and an output station (0), at which fully-folded finished packages (2) exit said folding unit (1);
said folding unit (1) comprising folding means configured to displace an end fin (8) of each respective pillow pack (3) from an unfolded configuration to a folded configuration;
said folding means comprising at least one moving member (17) configured to cyclically advance along said folding path (P);
said moving member (17) being further configured to move between:

   - a first position, in which said moving member (17) does not interact with said end fin (8); and
   - a second position, in which said moving member (17) cooperates in contact with said end fin (8) and has completed displacement of said end

fin (8) from the unfolded configuration to the folded configuration;

said moving member (17) being configured to move from said first position towards said second position while advancing along said folding path (P) from said input station (I) to said output station (0);
characterized in that said moving member (17) is configured to move from said second position towards said first position while advancing along said folding path (P) from said output station (0) to said input station (I) .

2. The folding unit as claimed in claim 1, wherein said moving member (17) is detached from said end fin (8) when being in said first position.

3. The folding unit as claimed in any one of the foregoing claims, wherein said moving member (17) is configured to selectively move back and forth along a direction parallel to said folding path (P), when moving between said first position and said second position.

4. The folding unit as claimed in any one of the foregoing claims, wherein said folding means further comprise:

- at least one guiding track (28) having a main portion (28a) extending parallel to part of said folding path (P), a first operative portion (28b), arranged between said input station (I) and said output station (0), and a second operative portion (28c), arranged between said output station (0) and said input station (I); said first operative portion (28b) and said second operative portion (28c) converging towards or diverging from said folding path (P); and
- at least one engaging element (29) configured to engage said guiding track (28), carried by said moving member (17) and configured to be moved by said first operative portion (28b) and said second operative portion (28c) towards or away from said folding path (P), so as to cause the movement of said moving member (17) between said first position and said second position.

5. The folding unit as claimed in claim 4, wherein said first operative portion (28b) diverges from said folding path (P) and said second operative portion (28c) converges towards said folding path (P).

6. The folding unit as claimed in claim 5, wherein said engagement element (29) is configured to move away from said folding path (P) when engaging said first operative portion (28b), and to move towards said folding path (P) when engaging said second operative portion (28c) .

7. The folding unit as claimed in claim 5 or 6, wherein said moving member (17) is configured to move from said first position to said second position when said engaging element (29) engages said first operative portion (28b);
said moving member (17) being configured to move from said second position to said first position when said engaging element (29) engages said second operative portion (28c).

8. The folding unit as claimed in any one of the claims from 3 to 7, wherein said first position is a retracted position for said moving member (17), with respect to a direction of advancement of said pillow packs (3) and/or packages (2) along said folding path (P), and said second position is an advanced position for said moving member (17), with respect to said direction of advancement.

9. The folding unit as claimed in claim 8, wherein said engaging element (29) is carried by said moving member (17) by means of a lever mechanism (30); said lever mechanism (30) being configured to transform the movement of said engaging element (29) towards and away from said folding path (P) in the back and forth movement of said moving member (17) between said first position and said second position.

10. The folding unit as claimed in claim 9, wherein said lever mechanism (30) comprises a first lever member (35) coupled to said moving member (17) by means of a pin (37) and carrying a linear rod (31) extending along an axis (B), which is transversal to said folding path (P) and eccentric with respect to said pin (37);
said linear rod (31) carrying said engaging element (29), eccentrically with respect to said axis (B), by means of a second lever member (34).

11. The folding unit as claimed in claim 10, wherein said first lever member (35) and said second lever member (34) extend transversally with respect to said axis (B).

12. The folding unit as claimed in any one of the foregoing claims, and further comprising at least one folding device (11) configured to cyclically move along said folding path (P), to carry one single pillow pack (3) and/or package (2) at a time from said input station (I) to said output station (0) and to perform a folding operation on said pillow pack (3); said moving member (17) being movably carried by said folding device (11).

13. The folding unit as claimed in any one of the forego-

ing claims, wherein said folding path (P) comprises a first branch (P1), a second branch (P2) extending from said first branch (P1), a third branch (P3) extending from said second branch (P2), and a fourth branch (P4) extending from said third branch (P3) and linked to said first branch (P1);
said input station (I) being arranged at said first branch (P1) and said output station (0) being arranged at said fourth branch (P4);
said moving member (17) being configured to move from said first position to said second position while advancing along said first branch (P1) and/or along a first portion said second branch (P2) and downstream of said input station (I), and to move from said second position to said first position while advancing along said fourth branch (P4) and downstream of said output station (0).

14. A packaging assembly configured to form, seal and fold a plurality of pillow packs (3) containing a pourable product; said packaging assembly comprising:

- a forming unit configured to form and seal a plurality of said pillow packs (3);
- a folding unit (1) according to any one of the foregoing claims; said folding unit (1) being configured to receive said pillow packs (3) from said forming unit at an input station (I), to perform a folding operation on said pillow packs (3) so as to obtain respective fully-folded finished packages (2), and to release said packages (2) at an output station (0).

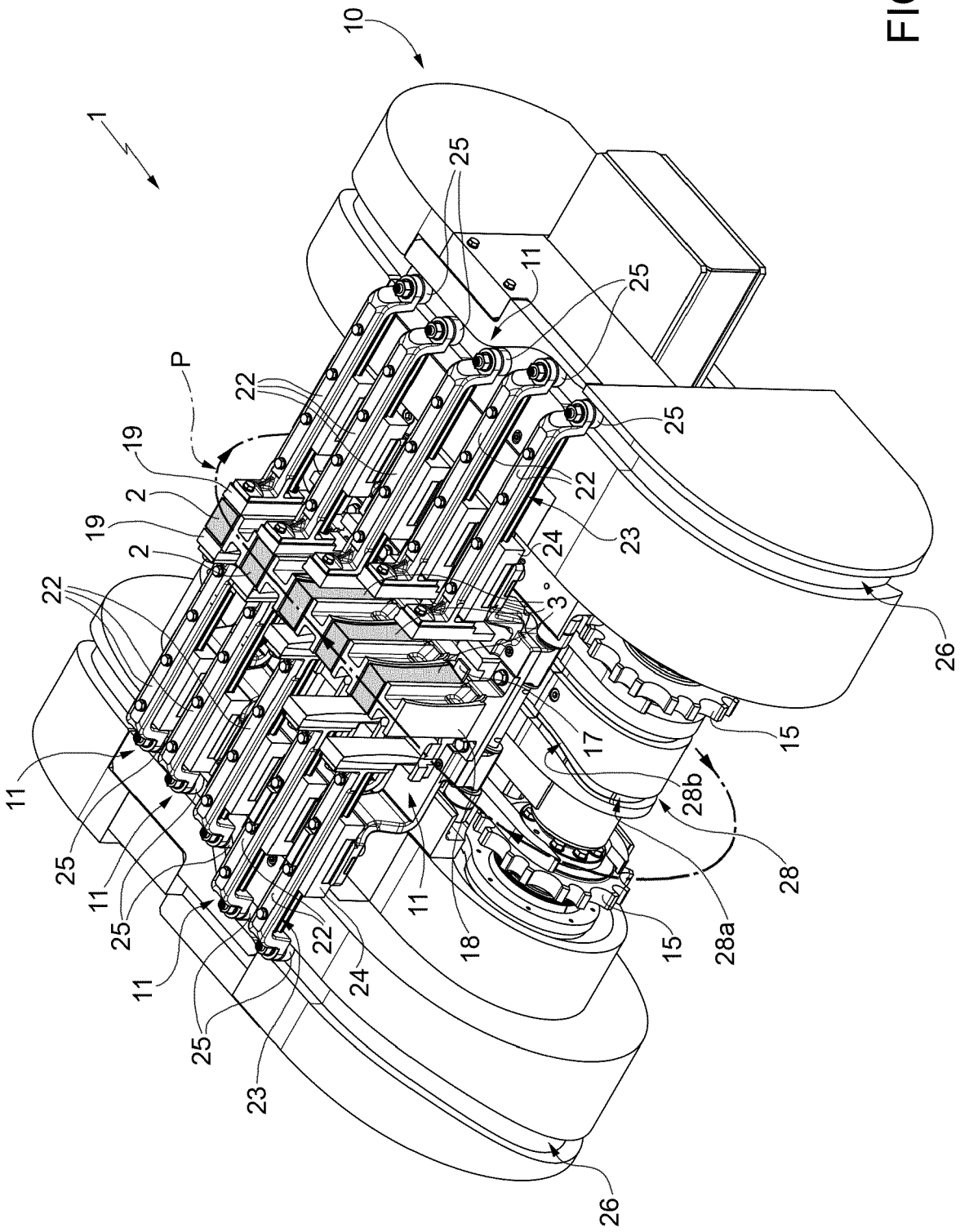

10
1
25
11
25
P
22
19
2
19
2
22
3°
24
23
22
25
26
15
17
28b
28
28a
18
15
11
11
25
11
25
11
25
22
24
23
26

FIG. 1

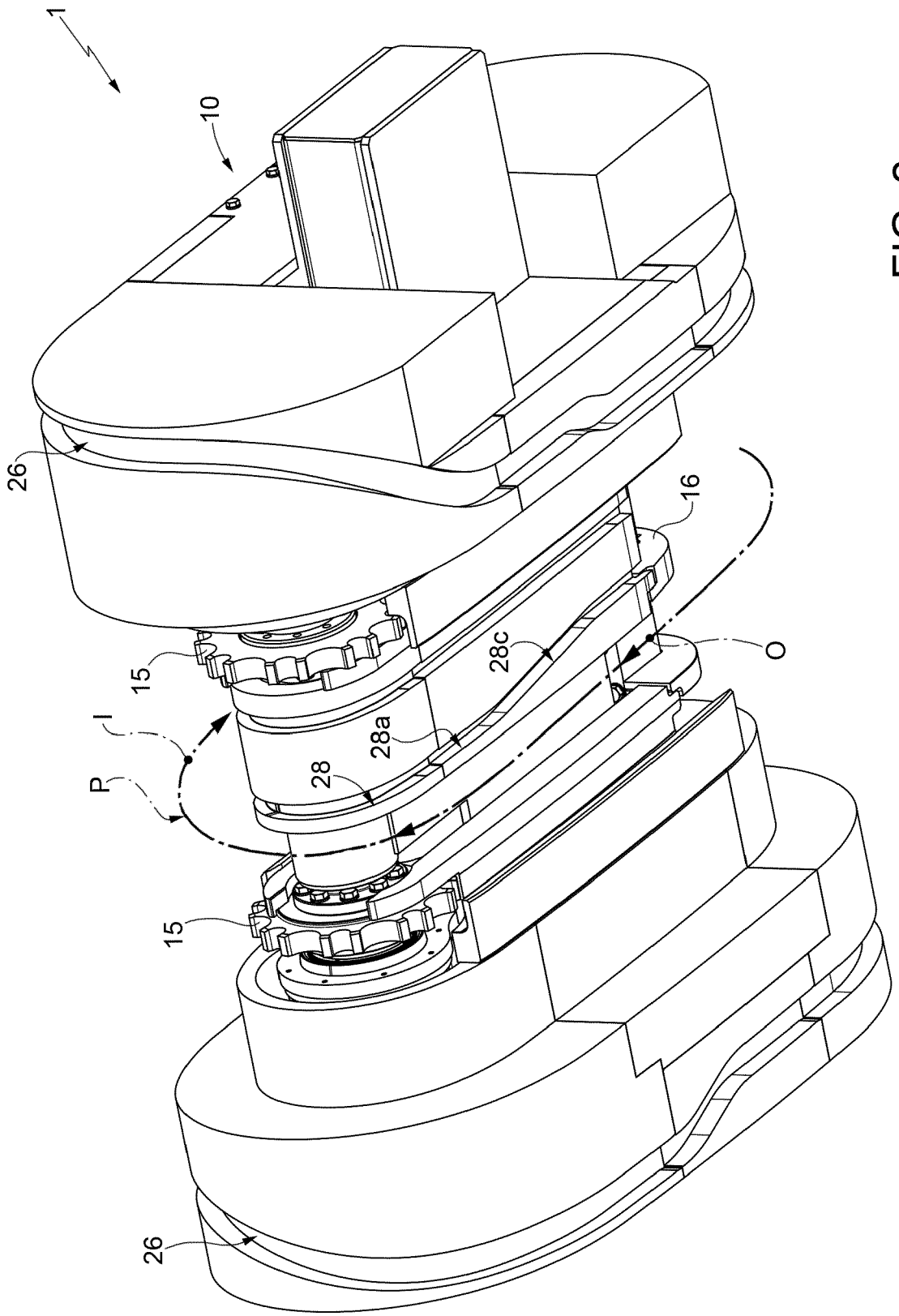
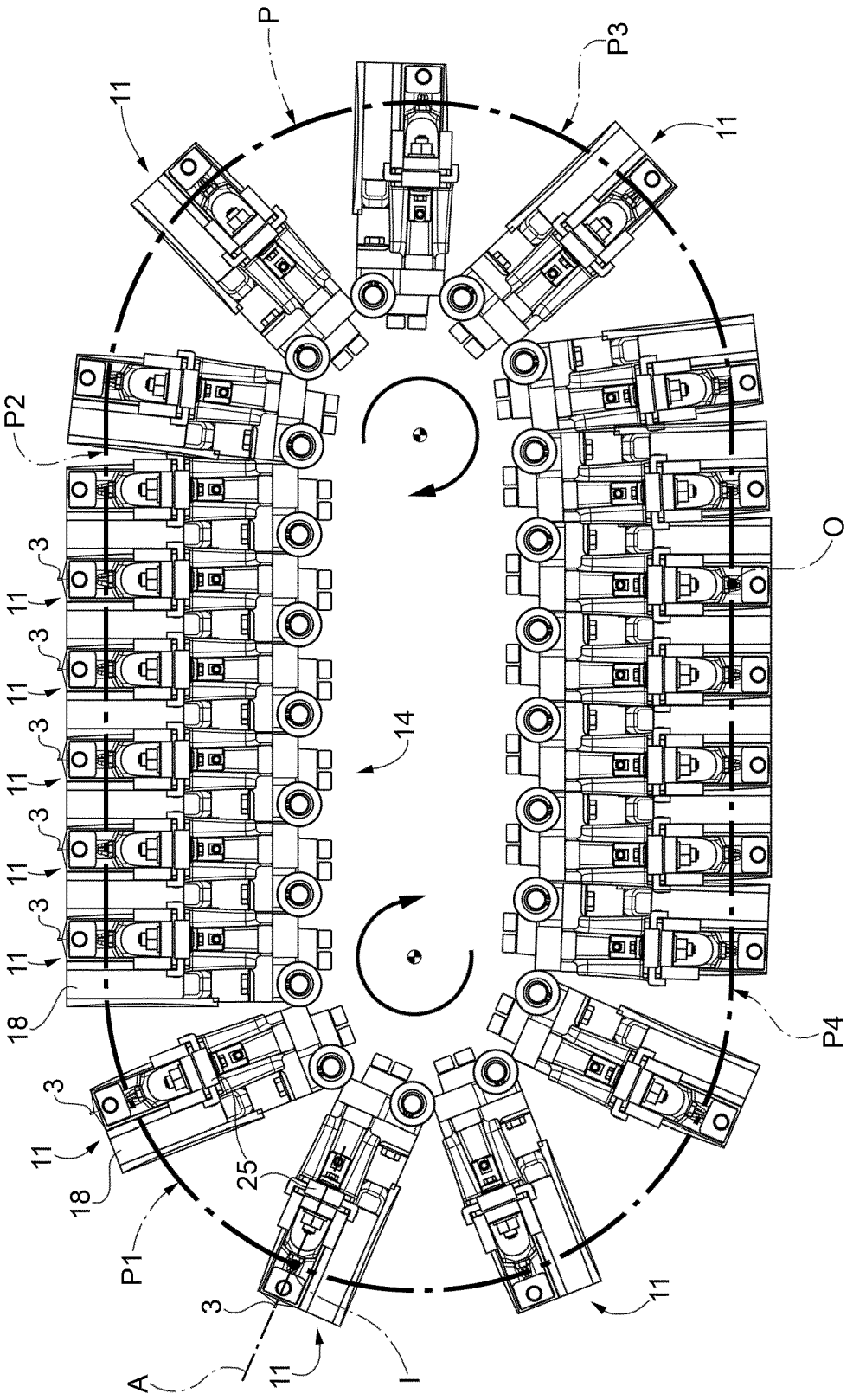


FIG. 2

FIG. 3



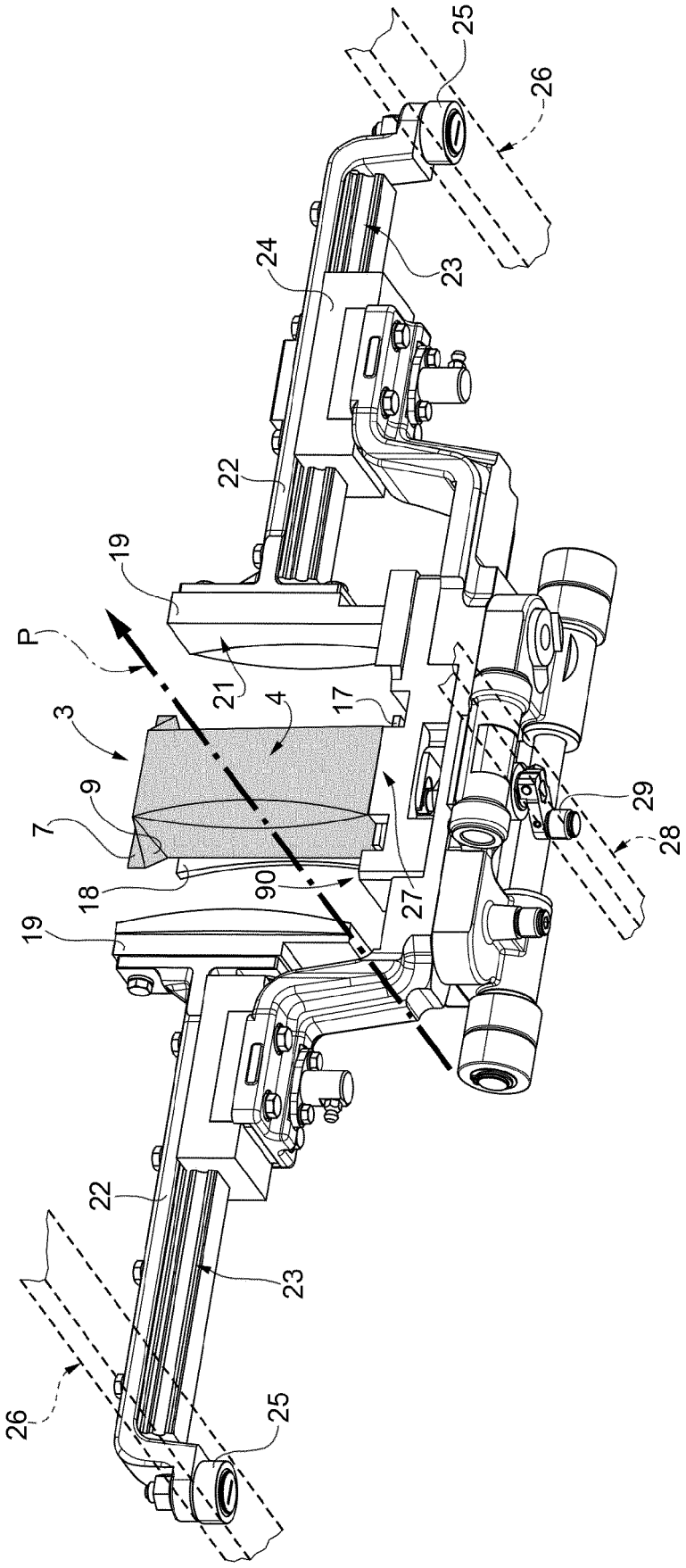


FIG. 4

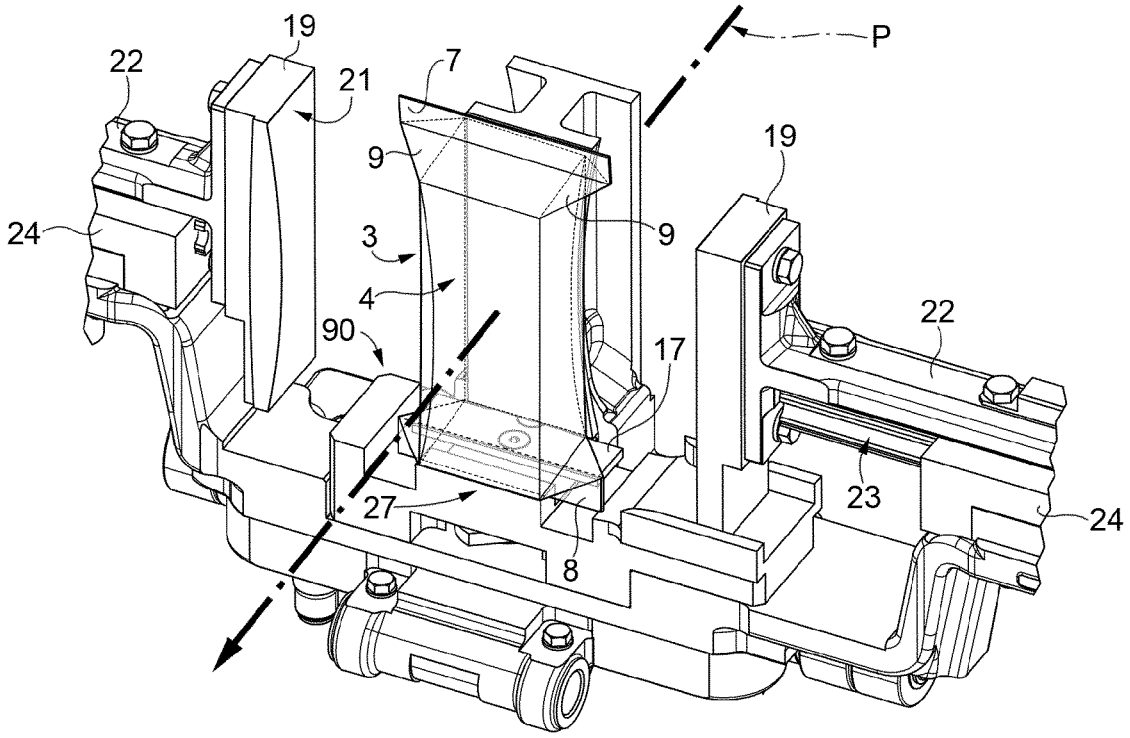

19
22
21
7
P
9
19
24
3
9
4
22
90
17
27
23
24
8

FIG. 5A

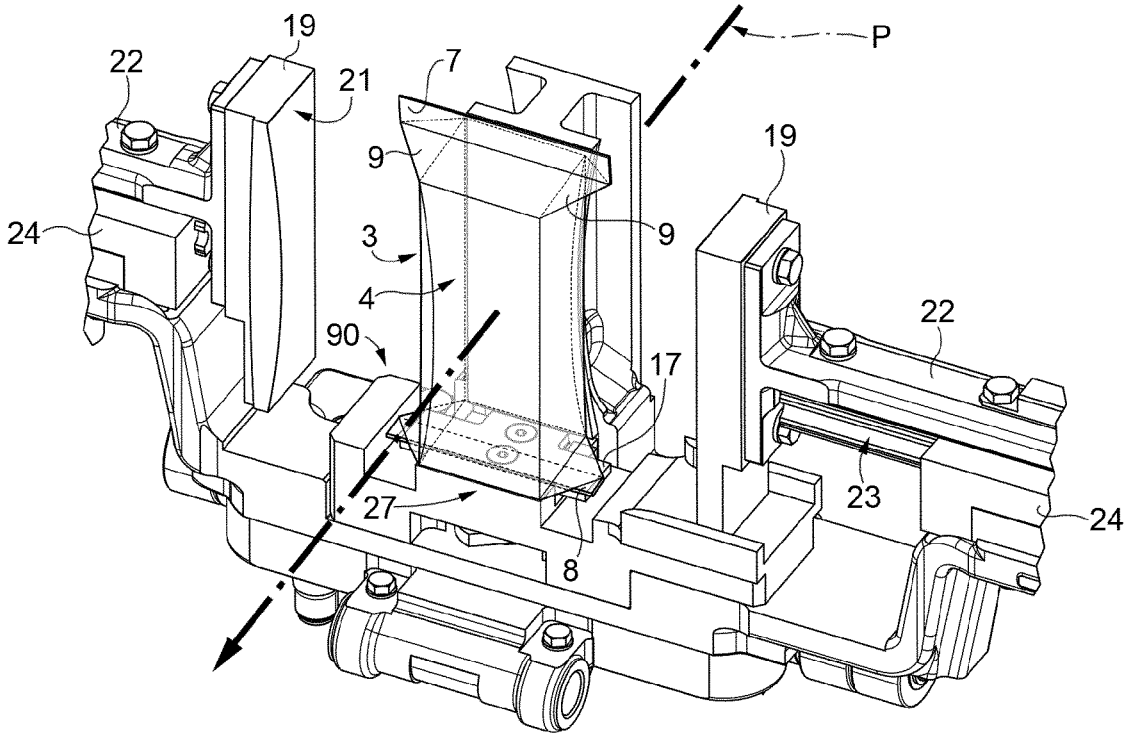

19
22
21
7
P
9
19
24
3
9
4
22
90
17
27
23
24
8

FIG. 5B

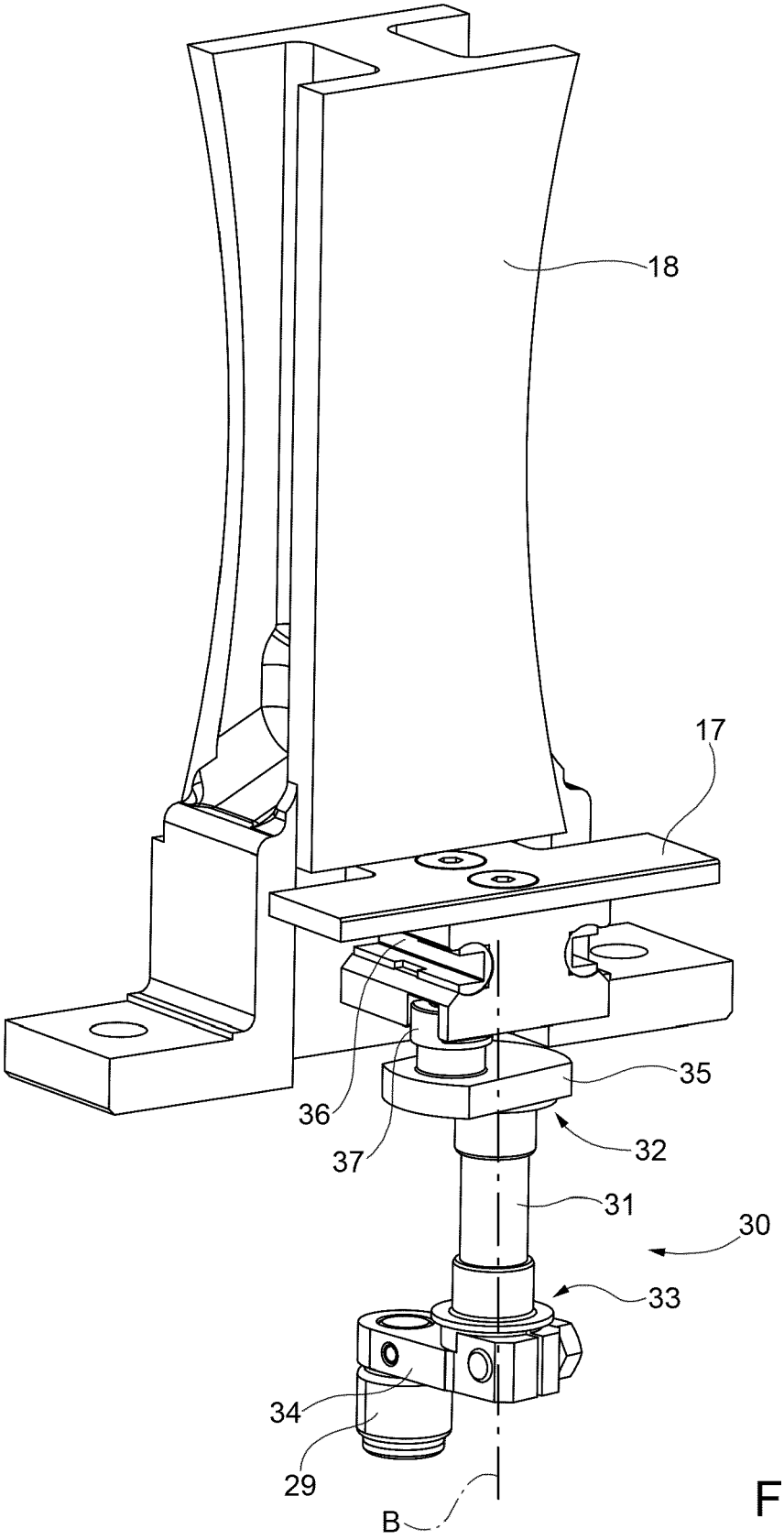


FIG. 6

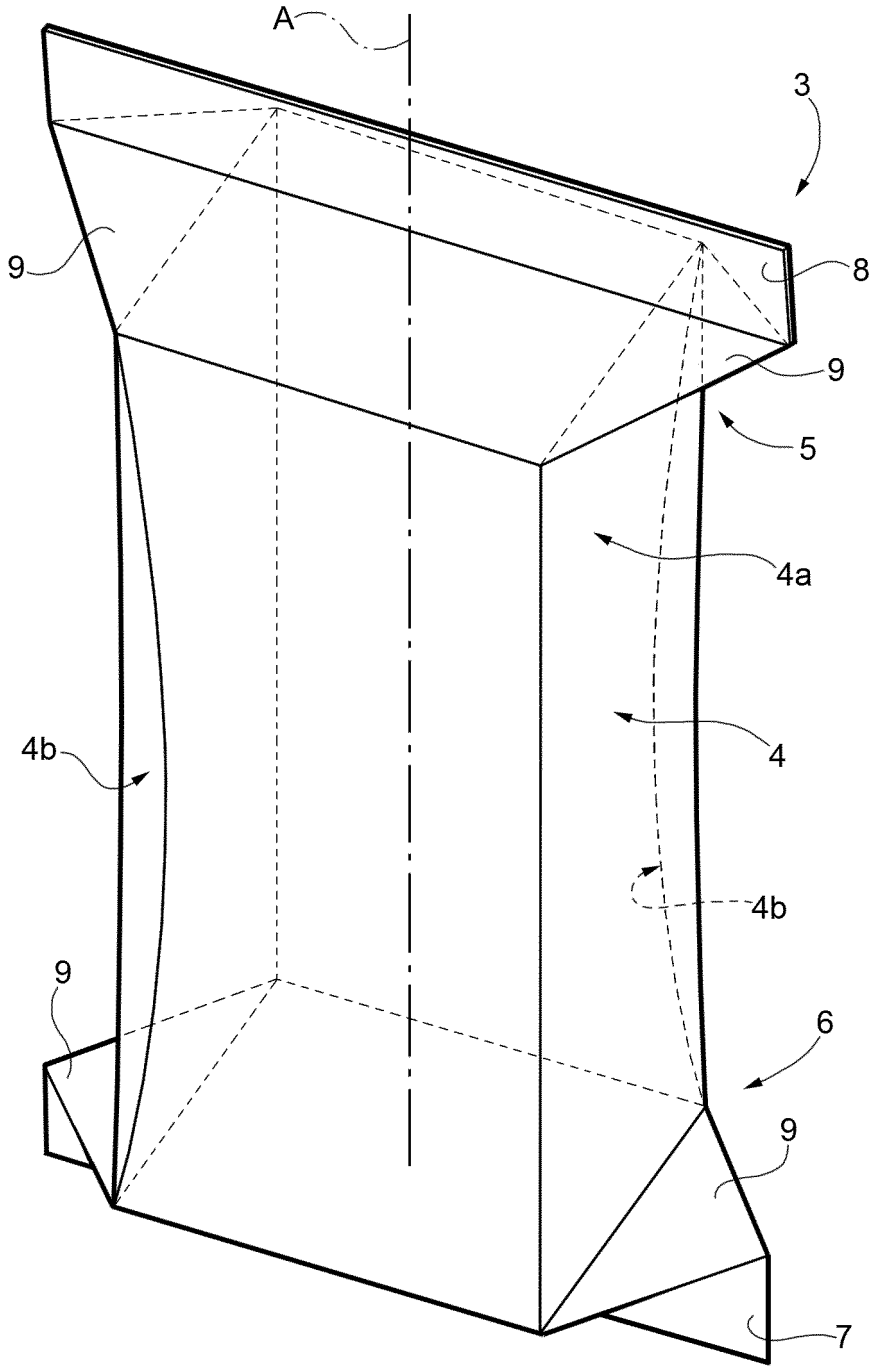


FIG. 7

Europäisches Patentamt
European Patent Office
Office européen des brevets

EUROPEAN SEARCH REPORT

Application Number
EP 18 17 1763

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X A	EP 3 020 642 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 18 May 2016 (2016-05-18) * column 0126 - column 0130; figures 3,11,12 * -----	1,2,14 3-13	INV. B65B61/24 B65B1/00 B65B7/20
A,D	EP 2 586 716 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 1 May 2013 (2013-05-01) * column 0089 - column 0100; figures 12,13 * -----	1,14	

TECHNICAL FIELDS SEARCHED (IPC)

B65B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	7 August 2018	Ungureanu, Mirela

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
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)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 17 1763

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
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

07-08-2018

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3020642 A1	18-05-2016	EP 3020642 A1	18-05-2016
		WO 2016074921 A1	19-05-2016
EP 2586716 A1	01-05-2013	BR 112014003440 A2	14-03-2017
		CN 103635392 A	12-03-2014
		EP 2586716 A1	01-05-2013
		ES 2508141 T3	16-10-2014
		JP 6054977 B2	27-12-2016
		JP 2014532591 A	08-12-2014
		KR 20140086963 A	08-07-2014
		MX 350113 B	28-08-2017
		RU 2014121993 A	10-12-2015
		US 2014228193 A1	14-08-2014
		WO 2013064288 A1	10-05-2013

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 2586716 B **[0022] [0025] [0029] [0072] [0075]**