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(54) **Folding unit for producing folded packages from sealed packs**

(57) A folding unit (1) for producing a package (2) from a sealed pack (3) having a main portion (7), an end portion (9) and a fin (18) projecting from said end portion (9), said folding unit (1) comprises a conveyor (60) that is fed with said pack (3) and that feeds said pack (3) along a forming path (B), folding means (24) that interact with said pack (3) along said forming path (B) to fold said end fin (18) onto said end portion (9), said conveyor (60) comprising at least one first link (35a) and one second link (35b) articulated to each other, said second link (35b) being arranged downstream of said first link (35a) with respect to a first direction, along which said conveyor (60) advances along said forming path (B), said folding means (24) comprising a slot (40) that is defined by said first link (35a) and is adapted to receive said end fin (18), said folding means (24) further comprising a slide (72) operatively connected to said second link (35b) and movable between a first position in which said slide (72) at least partially engages said slot (40), so as to fold said end fin (18) onto said end portion (9) and in a second direction opposite to said first direction, and a second position in which said slide (72) is detached from said slot (40), characterized in that said folding means (24) further comprise holding means (180) arranged for holding said package (2) while said slide (72) moves from said first position to said second position.

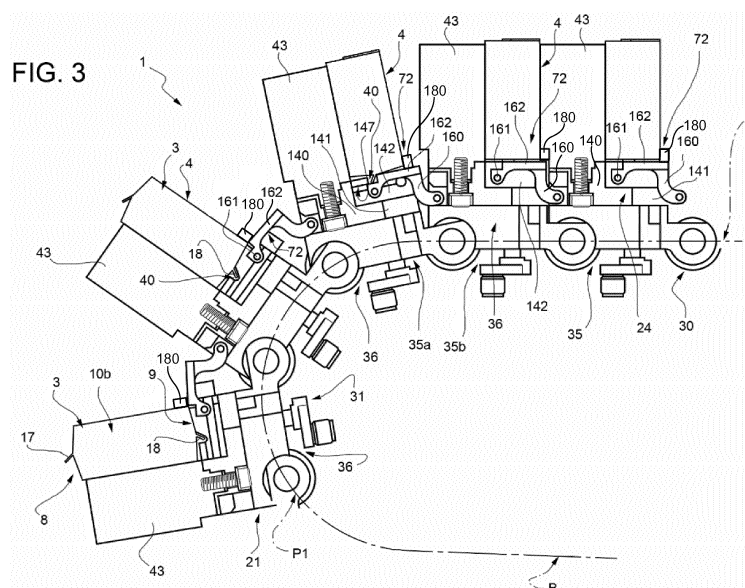
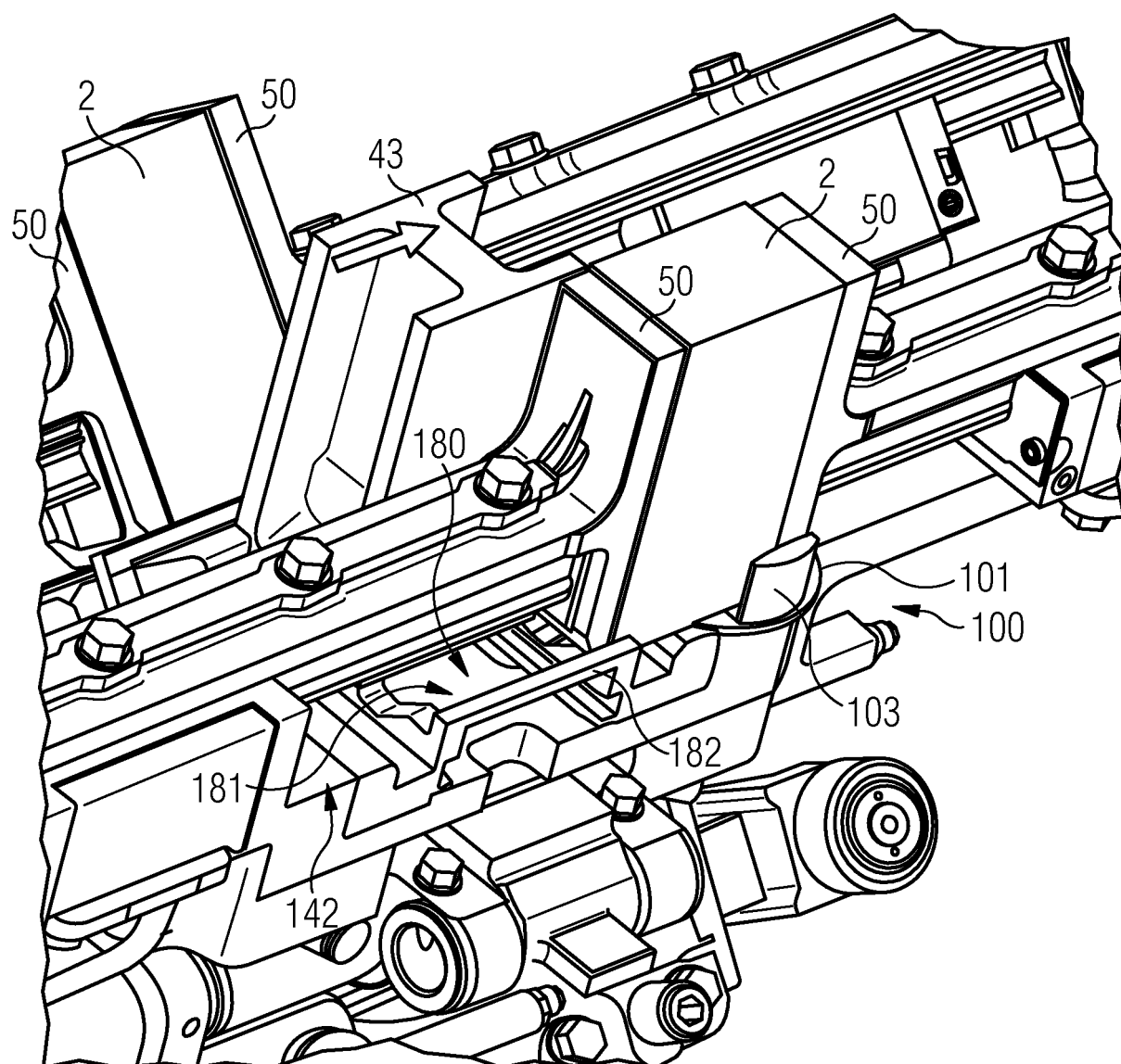


FIG. 17



Description

[0001] The present invention relates to a folding unit for producing folded packages from sealed packs.

[0002] As is known, many food products, such as fruit juice, pasteurized or UHT (ultra-high-temperature treated) milk, wine, tomato sauce, etc., are sold in packages made of sterilized packaging material.

[0003] A typical example of this type of package is the parallelepiped-shaped package for liquid or pourable food products known as Tetra Brik Aseptic (registered trademark), which is made by folding and sealing laminated strip packaging material.

[0004] The packaging material has a multilayer structure substantially comprising a base layer for stiffness and strength, which may comprise a layer of fibrous material, e.g. paper, or of mineral-filled polypropylene material; and a number of layers of heat-seal plastic material, e.g. polyethylene film, covering both sides of the base layer.

[0005] In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material may also comprise a layer of gas- and light-barrier material, e.g. an aluminium foil or an ethyl vinyl alcohol (EVOH) foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package eventually contacting the food product.

[0006] As is known, packages of this sort are produced on fully automatic packaging machines, on which a continuous tube is formed from the web-fed packaging material. The web of packaging material is sterilized on the packaging machine, e.g. by applying a chemical sterilizing agent, such as a hydrogen peroxide solution, which, once sterilization is completed, is removed from the surfaces of the packaging material, e.g. evaporated by heating. The web of packaging material so sterilized is maintained in a closed, sterile environment, and is folded and sealed longitudinally to form a vertical tube.

[0007] The tube is filled continuously downwards with the sterilized or sterile-processed food product, and is sealed and then cut along equally spaced cross sections to form pillow packs, which may be fed to a folding unit to form the finished packages.

[0008] The pillow packs comprise a main portion. The pillow packs also comprise a top end portion and a bottom end portion opposite to each other and tapering from the main portion towards, respectively, a top sealing band and a bottom sealing band which extend substantially orthogonal to a longitudinal axis of the pack. In detail, the top end portion (bottom end portion) is defined by a pair of respective trapezoidal walls which extend between the main portion of the pack and the top sealing band (bottom sealing band).

[0009] Each pillow pack also comprises, an elongated substantially rectangular top fin (bottom fin) formed by the top sealing band (bottom sealing band) and a pair of substantially triangular flaps projecting from opposite

sides of the top end portion (bottom end portion) and defined by end portions of the respective trapezoidal walls and by corresponding triangular portions which project from the main portion.

[0010] The top end portion and the bottom end portion are pressed towards each other by the folding unit to form flat opposite end walls of the pack, while at the same time folding the triangular flaps of the top portion onto respective lateral walls of the main portion and the triangular flaps of the bottom end portion onto the bottom sealing band.

[0011] Packaging machines for producing packages of the above type are known, typically comprising an in-feed conveyor and a folding unit receiving the pillow packs from the in-feed conveyor and adapted to fold these pillow packs to form the parallelepiped-shaped packages. The packaging machines further comprise a transfer unit for transferring and up-ending the sealed folded packages, which is arranged downstream of the folding unit and receives the sealed packages from the folding unit, and an out-feed conveyor, which receives the folded packages from the transfer unit and moves them away from the packaging machine.

[0012] The folding unit comprises an endless conveyor for feeding the packs continuously along a forming path from a supply station to an output station and folding devices for folding the top end portion and bottom end portion, the triangular flaps, and the top fin and bottom fin.

[0013] In particular, the folding devices comprise folding means for folding the top fin onto the respective flattened top end portion.

[0014] In a known type of filling machines, the endless conveyor is a chain conveyor and the folding means are defined by links of the chain conveyor. In particular, the folding means are defined by a pair of links consecutive to each other along the chain conveyor.

[0015] The folding means comprise, for each pair of links:

- a slot defined by the upstream link and adapted to receive the top fin of a pack;
- a slide operatively connected to the downstream link and movable between a first position in which it engages the slot, so as to fold the top fin housed therein, and a second position in which it is arranged outside of the slot.

[0016] In particular, the expressions "upstream link" and "downstream link" indicates a pair of consecutive links which are arranged respectively upstream and downstream with reference to an advancing direction of the chain conveyor.

[0017] The chain conveyor is shaped as a loop and comprises a linear upper active branch, a linear lower return branch, and a first curved connecting branch and a second curved connecting branch arranged at opposite end portions of the upper active branch and lower return branch and interposed between the upper active branch

and the lower return branch.

[0018] When the chain conveyor is actuated, the links move along a path defined by the above-mentioned loop. The links of the upper active branch receive the packs at the first curved portion and release the packages to the transferring unit at the second curved portion.

[0019] Each link comprises a paddle that supports and conveys a corresponding pack. In addition, the paddle cooperates with the folding devices to fold the pack to obtain a respective folded package.

[0020] At the second curved portion the slide of the folding means move from the first position to the second position.

[0021] In this way, it may happen that the pack is unintentionally dragged by the slide. The pack, therefore, slides on the link and changes its position with respect to the paddle.

[0022] This may result in the fact that the pack is not properly removed from region of the link where it has been folded, in particular from the paddle.

[0023] In some machines, each link comprises a turning device for turning the packs by 90 degrees along their longitudinal axis, before the packs are delivered to the transferring device. In this case, during the removal step, the pack - since it moves from an "incorrect" initial position, i.e. a position that differs from the theoretical position - may collide with the turning device and result damaged.

[0024] It is an object of the invention to improve the folding units for producing folded packages from packs.

[0025] It is another object of the invention to provide a folding unit for producing folded packages from packs in which the packages are properly removed from a folding zone of the folding unit and transferred to other operative zones in which additional operations are carried out on the packages.

[0026] It is another object of the invention to provide a folding unit for producing folded packages from packs, which allows reducing - or even eliminating - the risk of damaging the packages, while the packages are moved away from a folding zone of the folding unit.

[0027] It is another object of the invention to provide a folding unit for producing folded packages from packs, in which the packages are maintained in a desired position until they are removed from a folding zone of the folding unit.

[0028] According to the present invention, there is provided a folding unit for producing a folded package from a sealed pack as claimed in claim 1.

Figure 1 shows a side view, with parts removed for clarity, of a folding unit for producing folded packages of pourable food products from sealed packs;
Figure 2 is an enlarged side view of the folding unit of Figure 1, with parts removed for clarity;
Figure 3 is an enlarged view of some components of the folding unit of Figure 2, with parts removed for clarity;
Figures 4 to 18 show some components of the folding

unit of Figure 1 to 3, with parts removed for clarity; and

Figure 19 shows in a perspective enlarged view a pack the folding unit of Figures 1 to 18 is fed with.

[0029] Number 1 in Figure 1 indicates as a whole a folding unit for a packaging machine (not shown) for continuously producing sealed packages 2 of a pourable food product, such as pasteurized or UHT milk, fruit juice, wine, etc., from a known tube of packaging material (not shown).

[0030] The tube is formed in known manner upstream from the folding unit 1 by longitudinally folding and sealing a known web (not shown) of heat-seal sheet material that may comprise a base layer for stiffness and strength, which may be formed by a layer of fibrous material, e.g. paper, or of mineral-filled polypropylene material, and a number of layers of heat-seal plastic material, e.g. polyethylene film, covering both sides of the base layer. In the case of an aseptic package 2 for long-storage products, such as UHT milk, the packaging material may also comprise a layer of gas- and light-barrier material, e.g. an aluminium foil or an ethyl vinyl alcohol (EVOH) foil, which is superimposed on a layer of heat-seal plastic material, and is in turn covered with another layer of heat-seal plastic material forming the inner face of the package 2 eventually contacting the food product.

[0031] The tube of packaging material is then filled with the food product, and is sealed and cut along equally spaced cross sections to form a number of pillow-shaped packs 3 (Figure 19), which are then transferred to the folding unit 1 where they are folded mechanically to form respective parallelepiped-shaped packages 2.

[0032] In detail, the folding unit 1 receives the packs 3 from an in-feed conveyor 41 and feeds the folded package 2 to an out-feed conveyor 42 (Figure 1).

[0033] With reference to Figure 19, an embodiment of a pack 3 is shown which has a longitudinal sealing band 4, formed to produce the tube of packaging material from the web folded into a cylinder, extends along one side of the pack 3, which is closed at the opposite ends by a first transverse sealing band 5 and a second transverse sealing band 6 perpendicular to and joined to the longitudinal sealing band 4.

[0034] The pack 3 has an axis A, and comprises a main body 7. The pack 3 further comprises a first end portion 8 and a second end portion 9 opposite to each other and tapering from the main body 7 towards the first transverse sealing band 5 and the second transverse sealing band 6, respectively.

[0035] The main body 7 is bounded laterally by two first lateral walls 10a and two second lateral walls 10b which are alternate to each other.

[0036] Each of the first end portion 8 and second end portion 9 is defined by two walls 12, each substantially in the form of an isosceles trapezium, which slope slightly towards each other with respect to a plane perpendicular to axis A, and have minor edges defined by respective

top end edges and bottom end edges of respective first lateral walls wall 10a, and major edges joined to each other by the first transverse sealing bands 5 and second transverse sealing band 6, respectively.

[0037] The longitudinal sealing band 4 extends between the first transverse sealing bands 5 and the second transverse sealing band 6, and along the whole of one the first lateral walls 10a and the corresponding walls 12 on the same side as the first lateral wall 10a.

[0038] The pack 3 also comprises, a substantially elongated rectangular first end fin 17 formed by the first transverse sealing bands 5 and a substantially elongated rectangular second end fin 18 formed by the second transverse sealing bands 6. The first end fin 17 and the second end fin 18 project in the direction of axis A from the pack 3. The first end portion 8 comprises two substantially triangular flaps 19 projecting laterally on opposite sides of the main body 7, and defined by end portions of the walls 12 and by corresponding triangular end portions of the second lateral walls 10b. The second end portion 9 comprises two substantially triangular flaps 20 projecting laterally on opposite sides of the main body 7, and defined by end portions of the walls 12 and by corresponding triangular end portions of the second lateral walls 10b.

[0039] More precisely, each of the first end fin 17 and second end fin 18 extends along a direction orthogonal to axis A.

[0040] To form a package 2, unit 1 presses the first end portion 8 and the second end portion 9 down flat towards each other, and at the same time folds the first end fin 17 onto the flattened first end portion 8 and the second end fin 18 onto the flattened second end portion 9. In particular, the second end fin 18 is folded onto the first end portion 9 on the opposite side of the sealing band 4.

[0041] Furthermore, unit 1 folds each of the flaps 20 onto a respective second wall 10b towards the first end portion 8 and folds the flaps 19 onto the previously folded first end fin 17, on the opposite side of the second end portion 9.

[0042] With reference to Figures 1, 2, 8 and 9, the folding unit 1 substantially comprises:

- a frame 29;
- an endless conveyor 34 for feeding the packs 3 continuously along a forming path B from a supply station 21 to an output station 22 (both shown only schematically);
- folding means 23 which cooperate cyclically with each pack 3 to flatten the first end portion 8, fold the first end fin 17 onto the first end portion 8, and fold the flaps 19 onto the previously flattened first end portion 8 on the opposite side of the second end portion 9;
- folding means 24 for folding the second end fin 18 onto the previously flattened second end portion 9;
- folding means 37 for bending the flaps 20 towards

axis A and first end portion 8;

- a heating device 27 acting on bent flaps 19 and bent flaps 20 to melt the external layer of the packaging material of flaps 19 and flaps 20 before they are pressed and sealed against the first end portion 8 and the second walls 10b, respectively; and
- a pressing device 28 cooperating with each pack 3 to hold the flaps 19 onto the flattened first end fin 17 as the flaps 19 cool.

[0043] As the packs 3 advance along path B, the first lateral wall 10a with the longitudinal sealing band 4 is arranged downstream of the first lateral wall 10a without the longitudinal sealing band 4.

[0044] The heating device 27 is, in particular, arranged between the folding means 23 and the pressure device 28 along the forming path B.

[0045] With particular reference to Figures 2, 4, 5 and 6, the endless conveyor 34 basically comprises an endless transport element, in the example shown a chain 60, formed by a plurality of mutually hinged rigid modules or links 35 and looped about a pair of coaxial driving sprockets 26 and a cam 25.

[0046] The chain 60 comprises a straight horizontal top branch 30, a straight horizontal a bottom branch 31 substantially parallel to the top branch 30, and a curved first C-shaped portion 32 and a curved second C-shaped portion 33, which are positioned with their concavities facing each other and connect the top branch 30 and the bottom branch 31. More specifically, the first C-shaped portion 32 cooperates with the driving sprockets 26, whilst the second C-shaped portion 33 cooperates with the cam 25.

[0047] Each link 35 comprises a substantially flat plate 36 adapted to receive a respective pack 3, and a paddle 43, which projects perpendicularly from the plate 36 on the opposite side of the driving sprockets 26 and the cam 25 and which cooperates with and pushes a corresponding first wall 10a of a respective pack 3 to feed it along path B.

[0048] In particular, the paddle 43 of each link 35 cooperates with the first wall 10a without the longitudinal sealing band 4.

[0049] The folding unit 1 comprises (Figures 5 and 9 to 14) a plurality of pairs of shells 50 which are integrally movable along path B and are movable along a direction C transversal to path B; the shells 50 of each pair may be arranged in:

- a fully closed position in which they exert a pressure onto a respective pack 3, so as to complete a folding operation thereon; and
- an open position in which they are detached from a folded package 2.

[0050] Furthermore, the shells 50 may be arranged also in a closed position, in which they grip the folded package 2, but substantially do not exert any pressure there-

eon.

[0051] In detail, the supply station 21 is defined by the first C-shaped portion 32 and the output station 22 is defined by the bottom branch 31.

[0052] Path B comprises (Figure 2), proceeding from the supply station 21 to the output station 22:

- a portion P starting from the supply station 21, comprising a curved stretch P1 and a straight stretch P2, along which the packs 3 are folded into respective packages 2;
- a curved portion Q along which the folded packages 2 are overturned of 180 degrees; and
- a straight portion R arranged downstream from the curved portion Q and upstream from the output station 22.

[0053] In detail, the curved stretch P1 is defined by a part of the first C-shaped portion 32 and the straight stretch P2 is defined by the top branch 30. The curved portion Q is defined by the second C-shaped portion 33, and the straight portion R is defined by part of the bottom branch 31.

[0054] The folding means 23 cooperate cyclically with each pack 3 along the portion P.

[0055] The folding means 24 are defined by the links 35 and, therefore, move together with the chain 60 along path B.

[0056] In detail, the folding means 24 flatten the second end portion 9 and fold the second end fin 18 onto the second end portion 9.

[0057] The folding means 37 bend the flaps 20 towards axis A and first end portion 8, as the respective pack 3 is carried along the curved stretch P1 (Figures 8 and 9).

[0058] The heating device 27 acts on the bent flaps 19 and bent flaps 20 to melt the external layer of the packaging material of the flaps 19 and the flaps 20 before they are pressed and sealed against the first end portion 8 and ends of respective second walls 10b respectively, as pack 3 is carried along straight stretch P2 (Figure 9).

[0059] In detail, the shells 50 of each pair cyclically move according to the following work cycle.

[0060] The shells 50 of each pair are arranged in the open position at the supply station 21, move from the open position to the fully closed position along the curved stretch P1 and an initial part of the straight stretch P2, and reach the fully closed position along a remaining part of the straight stretch P2. In the embodiment shown, the shells 50 reach the fully closed position downstream from the heating device 27 and upstream from the pressing device 28, proceeding according to the advancing direction of the chain 60.

[0061] When the shells 50 are arranged into the fully closed position they exert a certain pressure on the respective second lateral walls 10b adjacent thereto.

[0062] More precisely, as moving between the open position and the fully closed position along the straight stretch P2, the shells 50 of each link 35 perform two func-

tions:

- firstly, the shells 50 complete the bending of the flaps 20 onto the second walls 10b; and
- then, the shells 50 press the flaps 20, which have been previously bent and heated, onto end portions of respective second lateral walls 10b.

[0063] Furthermore, the shells 50 of each pair move from the fully closed position to the closed position at the beginning of the curved portion Q.

[0064] Along the curved portion Q, the shells 50 integrally move parallel to direction C and with respect to the paddle 43 (Figure 6).

[0065] In the embodiment shown, the shells 50 move away from each other for a distance, for example of 2-4 mm, when they move from the fully closed to the closed position.

[0066] In the following of the present description, only one link 35 will be described in detail, being clear that all links 35 are identical to each other.

[0067] The link 35 comprises (Figures 10 to 14):

- the plate 36;
- the paddle 43;
- a pair of shells 50 which may move with respect to the paddle 43 along direction C;
- a pair of arms 51 connected to the respective shells 50, elongated parallel to direction C and comprising each a respective slide 53; and
- a pair of guides 54 which extend on opposite sides of the paddle 43 along direction C, the slides 53 moving on the guides 54 parallel to direction C.

[0068] Referring again to Figures 1 and 2, the plate 36 is arranged below, and then supports, the pack 3 (or package 2) along the portion P and a first part of curved portion Q.

[0069] Conversely, the plate 36 is arranged above the package 2 along straight portion R. Accordingly, at the output station 22 the folded package 2 is released to the out-feed conveyor 42, under the gravity action.

[0070] The shells 50 define, on their sides opposite to the arms 51, surfaces 52 which are adapted to cooperate with the pack 3 and which face each other.

[0071] The surfaces 52 are flat, so as to control the final shape of the packages 2.

[0072] Each arm 51 comprises, on its end opposite to the respective shell 50, a roller 55.

[0073] Each slide 53 is arranged between the respective shell 50 and the roller 55 of the respective arm 51. Furthermore, each slide 53 may slide parallel to direction C with respect to the guide 54.

[0074] In the embodiment shown, each arm 51 is integral with the respective shell 50.

[0075] In the embodiment shown, the paddles 43 are flat.

[0076] The folding means 24 comprise, for each pair

of links 35a, 35b consecutive to each other:

- a slot 40 defined by the upstream link 35a and adapted to receive the second end fin 18 of a pack 3;
- a slide 72 operatively connected to the downstream link 35b and movable between a first position (shown in Figures 2 and 3 with reference to links 35 moving along the straight stretch P2) in which it engages the slot 40, so as to fold the second end fin 18 housed therein, and a second position (shown in Figures 2 and 3 with reference to links 35 moving along the curved stretch P1) in which it leaves free the slot 40.

[0077] In particular, the expressions "upstream link 35a" and "downstream link 35b" indicates a pair of consecutive links 35 which are arranged respectively upstream and downstream with reference to the advancing direction of the chain 60 along path B (Figure 3).

[0078] Accordingly, it should be clear that each link 35 comprises, with respect to the advancing direction of chain 60 along path B:

- a slide 72 adapted to engage a slot 40 of an upstream further consecutive link 35; and
- a slot 40 adapted to be engaged by a slide 72 of a downstream further consecutive link 35.

[0079] In greater detail, each link 35 comprises a slide 72 which is arranged upstream of the slot 40, proceeding according the advancing direction of the link 35 along path B.

[0080] The plate 36 of each link 35 comprises (Figures 2 and 3):

- an upstream portion 140 from which the respective paddle 43 protrudes on the opposite side of the cam 25 and the sprockets 26; and
- a downstream portion 141 to which a body 142 is connected.

[0081] The body 142 defines the slot 40 together with the portion 140.

[0082] In particular, the body 142 comprises (Figure 16) :

- a pair of plates 143 connected to the portion 140; and
- a C-shaped bridge 144 protruding from the plate 143 on the opposite side of the plate 36.

[0083] Bridge 144 comprises, in turn:

- a pair of side arms 145 tangential to path B and connected to the respective plates 143; and
- an arm 146 orthogonal to path B and extending between the side arms 145.

[0084] The side arms 145 and the plates 143 define corresponding grooves 147 tangential to path B.

[0085] Each groove 147 is open on the side thereof that is opposite to the respective plate 143. In other words, the open sides of grooves 147 face each other.

[0086] In particular, the arm 146 supports the second end portion 9 of the pack 3 being folded while the second end fin 18 is housed with room inside the slot 40.

[0087] Each side arm 145 comprises, on the side thereof that is opposite to the plate 143, a recess 148 which is open on the side opposite to the plate 36.

[0088] The recesses 148 laterally delimit the slot 40 and are adapted to cooperate with opposite respective lateral ends of the second end fin 18.

[0089] The slide 72 comprises, starting from the upstream portion 140 of downstream link 35b towards upstream link 35a, (Figures 7 and 9 to 15):

- a lever 160 hinged to the upstream portion 140 about an axis which is orthogonal to the plane of path B;
- a plate 162 lying on a plane which is tangential to path B and an end of which enters into the slot 40, when the slide 72 reaches the first position; and
- a pair of pins 161 which protrude from the plate 162 on the opposite side of the lever 160 and slide inside the respective grooves 147 of the body 142 connected to the upstream link 35a.

[0090] In detail, the plate 162 protrudes from the plate 36 on the opposite side of the body 142.

[0091] With reference to Figures 16 and 17 the folding unit 1 comprises holding means 180 arranged for holding the folded packages 2 while the slides 72 moves from the first position to the second position.

[0092] The holding means 180 comprise a retaining element 181 arranged transversely to the advancing direction of the links 35 along path B, i.e. the advancing direction of the chain 60.

[0093] In particular, the retaining element 181 is arranged substantially perpendicularly to the advancing direction of the links 35 along path B. The retaining element 181 is arranged in a substantially horizontal direction.

[0094] The retaining element 181 comprises a retaining bar 182 is fixed, at opposite ends thereof, to the side arms 145.

[0095] The retaining bar 182 is connected to the side arms 145 on the opposite side of the arm 146 with respect to the recesses 148.

[0096] The retaining bar 182 interacts with a part of the first lateral wall 10a that is arranged downstream with respect to the advancing direction of the links 35 along path B, i.e. the advancing direction of the chain 60.

[0097] The retaining element 181, therefore, prevents the slide 72 from dragging the package 2 when the slide 72 moves from the first position to the second position. In other words, the retaining element 181 keeps the pack 3 in contact with the respective paddle 43.

[0098] The folding means 37 comprise a pair of raising elements 170 (Figures 8 and 18) having respective ends 171 interacting with the flaps 20, as the packs 3 move

along the straight stretch P2.

[0099] In detail, the raising elements 170 are shaped as cylinders.

[0100] The raising elements 170 are stationary with respect to path B, and are, in the embodiment shown, fitted to the frame 29.

[0101] As shown in Figures 2 and 3, the slide 72 is arranged in the second position at the supply station 21, moves from the second position to the first position along the curved stretch P1, remains in the first position along the straight stretch P2, moves from the first position to the second position along the curved portion Q.

[0102] In detail, the movement of the slide 72 from the second position to the first position along the curved stretch P1 is due to the fact, that the angular distances between two consecutive links 35 (i.e. the upstream link 35a and the downstream links 35b) decreases, as these links 35 move along the curved stretch P1 in the advancing direction of the chain 60.

[0103] More precisely, the second end fin 18 of the pack 3 is arranged within the open slot 40 of the link 35 at the supply station 21

[0104] Due to the fact that the slide 72 is carried by the downstream link 35b and the slot 40 is carried by the upstream link 35a, the slide 72 folds the second end fin 18 onto the end portion 9 towards the upstream link 35a. In addition, the pack 3 is positioned so that the first lateral wall 10a on which the longitudinal sealing band 4 is formed is arranged downstream proceeding according to the advancing direction of the links 35 along path B. Therefore, the slide 72 folds the second end fin 18 on the opposite side of the longitudinal sealing band 4.

[0105] At this stage, the ends 171 raise the flaps 20 towards the end portion 8 and bend the flaps 20 with respect to axis A, up to when they reach the position shown in Figure 8.

[0106] In the very same way, the movement of the slide 72 from the first position to the second position along the curved portion Q is due to the fact that the angular distances between two consecutive links (i.e. the upstream link 35a and the downstream link 35b) increases, as these links 35 move along the curved portion Q in the advancing direction of the chain 60.

[0107] The corresponding shells 50, as moving from the open position to the fully closed position, press the flaps 20 against ends of the second lateral walls 10b, downstream from the folding means 23 and the heating device 17, proceeding according to the advancing direction of the chain 60.

[0108] The folding unit 1 also comprises a pair of cams 61 (Figures 4 and 5) adapted to control the movement of each pair of shells 50 between the fully closed position, the closed position and the open position, as each pair of shells 50 advances along path B.

[0109] Furthermore, the cams 61 also control the movement of each pair of shells 50 integrally to each other along the direction C and with respect to the paddle 43 of the corresponding link 35.

[0110] In detail, the cams 61 are arranged on opposite lateral sides of the chain 60.

[0111] One cam 61 comprises a groove 62 which is engaged by the rollers 55 of the first shell 50 of the pair of shells.

[0112] The other cam 61 comprises a further groove 62 which is engaged by the rollers 55 of the second shell 50 of the pair of shells.

[0113] With reference to Figures 4 and 5, the grooves 62 comprise, proceeding from the supply station 21 to the output station 22:

- respective straight portions 63 which are adapted to keep the shells 50 of each pair in the open position;
- respective converging portions 64 which are adapted to move the shells 50 from the open position to the fully closed position along the straight stretch P2;
- respective straight portions 65 which are adapted to keep the shells 50 of each pair in the fully closed position;
- respective curved portions 66 which are adapted to move the shells 50 of each pair from the fully closed position to the closed position; the respective curved portions 66 are also adapted to integrally move the shells 50 of each pair with respect to the paddle 43 and parallel to the respective directions C; and
- respective curved portions 67 which are adapted to move the shells 50 of each pair from the closed position to the open position.

[0114] The folding means 23 comprise a guide member 45 fitted in a fixed position between the supply station 21 and the heating device 27 (Figure 1).

[0115] The guide member 45 defines a contrast surface 46 converging towards the chain 60 and cooperating in a sliding manner with the end portion 8 of each pack 3 to compress and flatten the end portion 8 towards the chain 60.

[0116] The frame 29 also comprises a pair of fixed sides 68 (only one shown in Figure 1) for laterally containing the packs 3 along path B, located on opposite sides of the chain 60, and extending between the supply station 21 and the heating device 27.

[0117] The heating device 27 comprises (Figures 1, 8 and 9):

- an air supply device 69 fitted to frame 29;
- a pair of first nozzles 70 connected to the air supply device 69 and adapted to direct hot air onto the flaps 20 of each pack 3 before each pack 3 reaches the pressing device 28; and
- a pair of second nozzles 71 connected to the air supply device 69 and adapted to direct hot air onto the flaps 19 of each pack 3 before a respective pair of shells 50 reaches the fully closed position.

[0118] The pressure device 28 comprises (Figure 1) a belt 80 wound onto a drive wheel 81 and a driven wheel

82. The belt 80 comprises, on its outer surface opposite to the drive wheel 81 and the driven wheel 82, a plurality of projections 83 which are adapted to press the flaps 19 of each pack 3 onto the respective first end fin 17.

[0119] The volume of each package 2 in formation is controlled, downstream from the heating device 27, within a compartment bounded by:

- the paddles 43 of the respective link 35 and of the link 35 arranged immediately downstream proceeding according to the advancing direction of the chain 60;
- the shells 50 of the respective link 35 which are arranged in the fully closed position;
- the slide 72 of the respective link 35, which is arranged in the first position; and
- the belt 80.

[0120] Operation of the folding unit 1 will be described with reference to one pack 3 and to the respective link 35 as of an initial instant, in which the pack 3 is fed from the in-feed conveyor 41 to the chain 60 at the supply station 21.

[0121] In this condition, the link 35 is moving at the beginning of the curved stretch P1 and therefore the slot 40 is open. Furthermore, the shells 50 are arranged in the open position.

[0122] In detail, the pack 3 is positioned with the second end fin 18 facing the slide 72 of the link 35, and slides on one first lateral wall 10a along the respective paddle 43, so that the second end fin 18 is parallel to the paddle 43, until when the second end fin 18 enters into the open slot 40.

[0123] In this condition, the pack 3 is arranged above and, therefore, supported by the side arms 145 of the body 142 carried by the link 35.

[0124] More precisely, the paddle 43 cooperates with the first lateral wall 10a opposite to the sealing band 4.

[0125] As the link 35 moves along the curved stretch P1 and a portion of the straight stretch P2, the contrast surface 46 cooperates in a sliding manner with the first end portion 8 of the pack 3. In this way, the first end portion 8 and the second end portion 9 are flattened towards each other, the first end fin 17 is folded onto the flattened first end portion 8 and the flaps 19 are bent with respect to the first end portion 8 towards axis A and on the opposite side of the second end portion 9, as shown in Figure 9.

[0126] In this condition, the second end fin 18 is housed with room inside the slot 40.

[0127] At the same time, each pair of consecutive links 35 (i.e. the upstream link 35a and the downstream link 35b) move towards each other along the curved stretch P1. In this way, the angle between the consecutive upstream link 35a and downstream link 35b decreases along the curved stretch P1.

[0128] Accordingly, the lever 160 rotates about the portion 140 of the downstream link 35b, and the plate

162 moves towards the slot 40 of the upstream link 35a while the pins 161 slide inside the respective grooves 147 of the body 142 of the upstream link 35a.

[0129] At the end of the curved stretch P1, the slide 72 of the upstream link 35a is in the first position in which it engages the slot 40.

[0130] As the slide 72 engages the slot 40, the second end fin 18 is folded onto the second end portion 9. In particular, the second end fin 18 is folded on the opposite side of the sealing band 4, i.e. towards the first lateral wall 10a arranged upstream with respect to the advancing direction of the chain 60.

[0131] Simultaneously, the fixed raising elements 170 raise the flaps 20 towards the first end portion 8 and bend the flaps 20, as shown in Figures 8 and 9.

[0132] As the downstream link 35b moves along the straight stretch P2, the shells 50 move from the open position to the fully closed position and the slide 72 is arranged in the first position.

[0133] Before the shells 50 reach the pack 3, the first nozzles 70 and the second nozzles 71 direct air onto the flaps 19 and the flaps 20 of the pack 3, to partly and locally melt the packaging material of the flaps 19 and the flaps 20 (Figure 9) and of the parts of the main portion 7 facing the flaps 19 and the flaps 20.

[0134] Immediately after, the shells 50 contact the second lateral walls 10b and press the flaps 20 onto respective ends of the second lateral walls 10b as the flaps 20 cool. In this condition, the shells 50 are arranged in the fully closed position.

[0135] Subsequently, the pack 3 is arranged below the belt 80 and the projections 83 press the flaps 20 onto the second end portion 9, as the flaps 20 cool.

[0136] In this condition, the volume of the folded package 2 is controlled by two paddles 43 of respective consecutive links 35 (i.e. the upstream link 35a and the downstream link 35b), by the shells 50 arranged in the fully closed position, and by the projections 83 of belt 80.

[0137] Then the folded packages 2 then move along the curved portion Q.

[0138] Along the curved portion Q, the upstream link 35a and the downstream link 35b move away from each other, as shown in Figure 1.

[0139] Accordingly, the slide 72 of the downstream link 35b moves back from the first position to the second position, in which the slide 72 leaves free the slot 40 of the upstream link 35a.

[0140] The holding means 180 hold the folded package 2 while the slide 72 moves from the first position to the second position. The retaining element 181 prevents the package 2 from sliding on the link 35. In particular, the retaining element 181 keeps the package 2 in contact with the paddle 43.

[0141] Along the curved portion Q, the shells 50 move with respect to each other from the fully closed position to the closed position, in which they grip the package 2 but substantially do not exert any pressure thereon.

[0142] Furthermore, the shells 50 move together with

the package 2 with respect to paddle 43 parallel to the direction C, along the curved portion Q.

[0143] In this way, the shells 50 together with the folded package 2 are staggered from paddle 43, at the end of the curved portion Q, so that the package 2 may be released from the link 35 without interference with the paddle 43 (Figure 10).

[0144] Furthermore, along the curved portion Q and with the shells 50 in the fully closed position, the package 2 engages a rotating device 100 shown in Figures 7, 10, 11, 12, 13 and 17.

[0145] The rotating device comprises a disk-shaped portion 101 arranged into a seat (not shown) formed in the respective plate 36, and a pair of protruding flaps 103 (only one of which is visible in Figure 17) extending from diametrically opposite edge portions of the disk-shaped portion 101 and adapted to cooperate with the pack 3 to produce rotation thereof. In particular, each of the protruding flaps 103 cooperates with a corresponding first side wall 10a.

[0146] The rotating device 100 is described in more detail in the European application filed by the Applicant with the number EP11187350.1.

[0147] Finally, the folded package 2 and the shells 50 arranged in the closed position are conveyed along the straight portion R.

[0148] During the descending part of the curved portion Q and along the straight portion R, the folded package 2 is arranged below the plate 36 and is supported by the shells 50 arranged in the closed position.

[0149] At the output station 22, the shells 50 move back to the open position and the package 2 is released, under the gravity action, to the out-feed conveyor 42.

[0150] Being staggered with respect to the shells 50 and the package 2, the paddle 43 does not interfere with the release of the package 2.

[0151] Subsequently, the shells 50 are conveyed by chain the 60 towards the supply station 21.

[0152] Owing to the holding means 180, the slide 72 is prevented from dragging the package 2 while the slide 72 moves from the first position to the second position.

[0153] In this way, the package 2 does not slide on the body 42 (particularly on the side arms 145) and is therefore maintained in the right position with respect to the link 35. In particular, the first lateral wall 10a that is arranged upstream with respect to the advancing direction of the links 35 is maintained in contact with the respective paddle 35.

[0154] Therefore, when the shells 50 move along direction C the package 2 is moved away from the paddle 43 without interfering with parts, or components, of the folding unit 1.

[0155] In the embodiment shown, the package 2 is properly delivered to the rotating device 100, in particular is received between the protruding flaps 103, without interfering with the protruding flaps 103.

[0156] Clearly, changes may be made to unit 1 without, however, departing from the protective scope defined in

the accompanying Claims.

[0157] The folding unit 1 could comprise only one cam 61.

[0158] The folding unit 1 could form packages 2 having a round or polygonal cross-section.

Claims

1. A folding unit (1) for producing a package (2) from a sealed pack (3), said pack (3) having a main portion (7), an end portion (9) and a fin (18) projecting from said end portion (9), said folding unit (1) comprising a conveyor (60) that is fed with said pack (3) and that feeds said pack (3) along a forming path (B), folding means (24) that interact with said pack (3) along said forming path (B) to fold said end fin (18) onto said end portion (9), said conveyor (60) comprising at least one first link (35a) and one second link (35b) articulated to each other, said second link (35b) being arranged downstream of said first link (35a) with respect to a first direction along which said conveyor (60) advances along said forming path (B), said folding means (24) comprising a slot (40) that is defined by said first link (35a) and is adapted to receive said end fin (18), said folding means (24) further comprising a slide (72) operatively connected to said second link (35b) and movable between a first position in which said slide (72) at least partially engages said slot (40), so as to fold said end fin (18) onto said end portion (9) and in a second direction, opposite to said first direction, and a second position in which said slide (72) is detached from said slot (40), **characterized in that** said folding means (24) further comprise holding means (180) arranged for holding said package (2) while said slide (72) moves from said first position to said second position.
2. A folding unit according to claim 1, wherein said holding means (180) comprise a retaining element (181) arranged transversely to said first direction.
3. A folding unit according to claim 1, or 2, wherein said retaining element (181) is arranged substantially perpendicularly to said first direction.
4. A folding unit according to any one of the preceding claims, wherein said retaining element (181) extends in a substantially horizontal direction.
5. A folding unit according to any one of claims 2 to 4, and further comprising a body (142) connected to said first link (35a) and which defines said slot (40) together with said first link (35a), said body (142) comprising a pair of side arms (145) arranged along said first direction and an arm (146) arranged transversal to said first direction and extending between said side arms (145), and wherein said retaining el-

ement (181) comprises a retaining bar (182), said retaining bar (182) being fixed, at opposite ends thereof, to said side arms (145).

6. A folding unit according to claim 5, wherein said body (142) defines a pair of recesses (148) that laterally delimit said slot (40), said recesses (148) being open on the opposite side of said first link (35a) and being adapted to house lateral portions of said fin (18), said retaining bar (182) being connected to said side arms (145) on the opposite side of said arm (146) with respect to said recesses (148). 5
7. A folding unit according to any one of claim 5, or 6, wherein said slide (72) comprises a pair of pins (161) and said body (142) defines a pair of grooves (147) arranged on respective lateral sides of said slot (40) and adapted to guide said pins (161), when said slide (72) moves between said first position and said second position. 10
8. A folding unit according to claim 7, wherein said slot (40) extends transversally to said forming path (B) and said grooves (147) extend tangentially to said forming path (B). 15
9. A folding unit according to any one of the preceding claims, wherein said slide (72) is hinged to said second link (35b). 20
10. A folding unit according to any one of the preceding claims, wherein said slide (72) comprises a plate (162) adapted to interact with said end fin (18) and to fold said end fin (18) and an arm (160) integral with said plate (162) and hinged to said second link (35b). 25
11. A folding unit according to any one of the preceding claims, wherein each said first link (35a) and said second link (35b) comprises a respective said slot (40) and a respective said slide (72). 30
12. A folding unit according to any one of the foregoing claims, wherein each said first link (35a) and said second link (35b) comprises said slot (40) and said slide (72) that is arranged upstream of said slot (40), proceeding according to the advancing direction of said first link (35a) and said second link (35b) along said forming path (B). 35
13. A folding unit according to any one of the preceding claims, wherein said forming path (B) is a closed loop path (B) comprising a first curved portion (P1) along which said first link (35a) and said second link (35b) are fed, in use, with a respective said pack (3) to be fold, and along which said first link (35a) and said second link (35b) move towards each other and a second rectilinear portion (P2) arranged down- 40

stream from said inlet portion (P1) along which said first link (35a) and said second link (35b) move substantially integrally to each other, said slide (72) moving, in use, from said second position to said first position along said first curved portion (P1), said slide (72) being arranged, in use, in said first position along said second rectilinear portion (P2).

14. A folding unit according to claim 13, wherein said forming path (B) further comprises a second curved portion (Q) arranged downstream from said rectilinear portion (P2) proceeding along an advancing direction of said first link (35a) and said second link (35b) along said forming path (B), and along which said first link (35a) and said second link (35b) move, in use, away from each other, said slide (72) moving, in use, from said first position to said second position, along said second curved portion (Q). 45

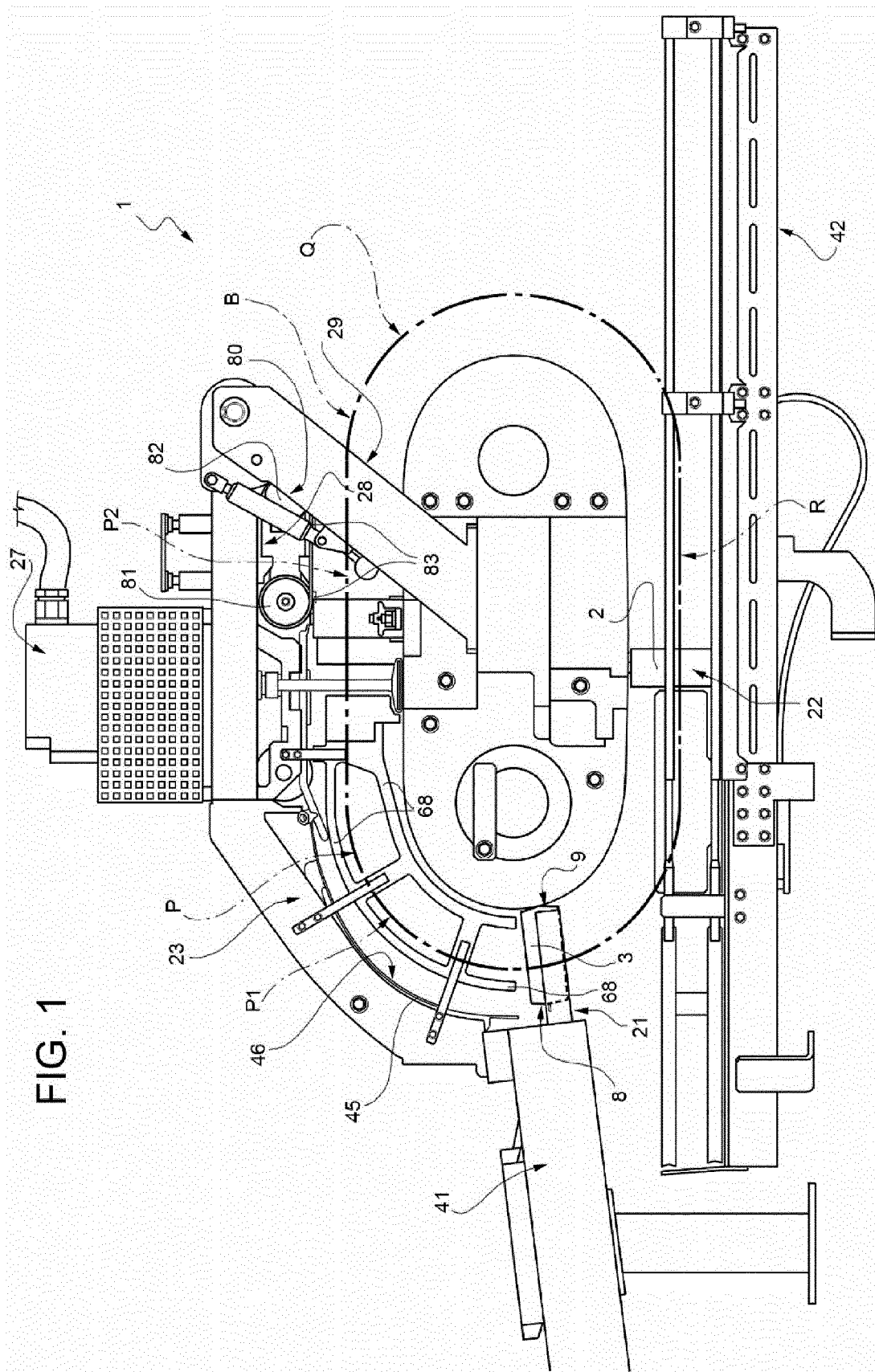
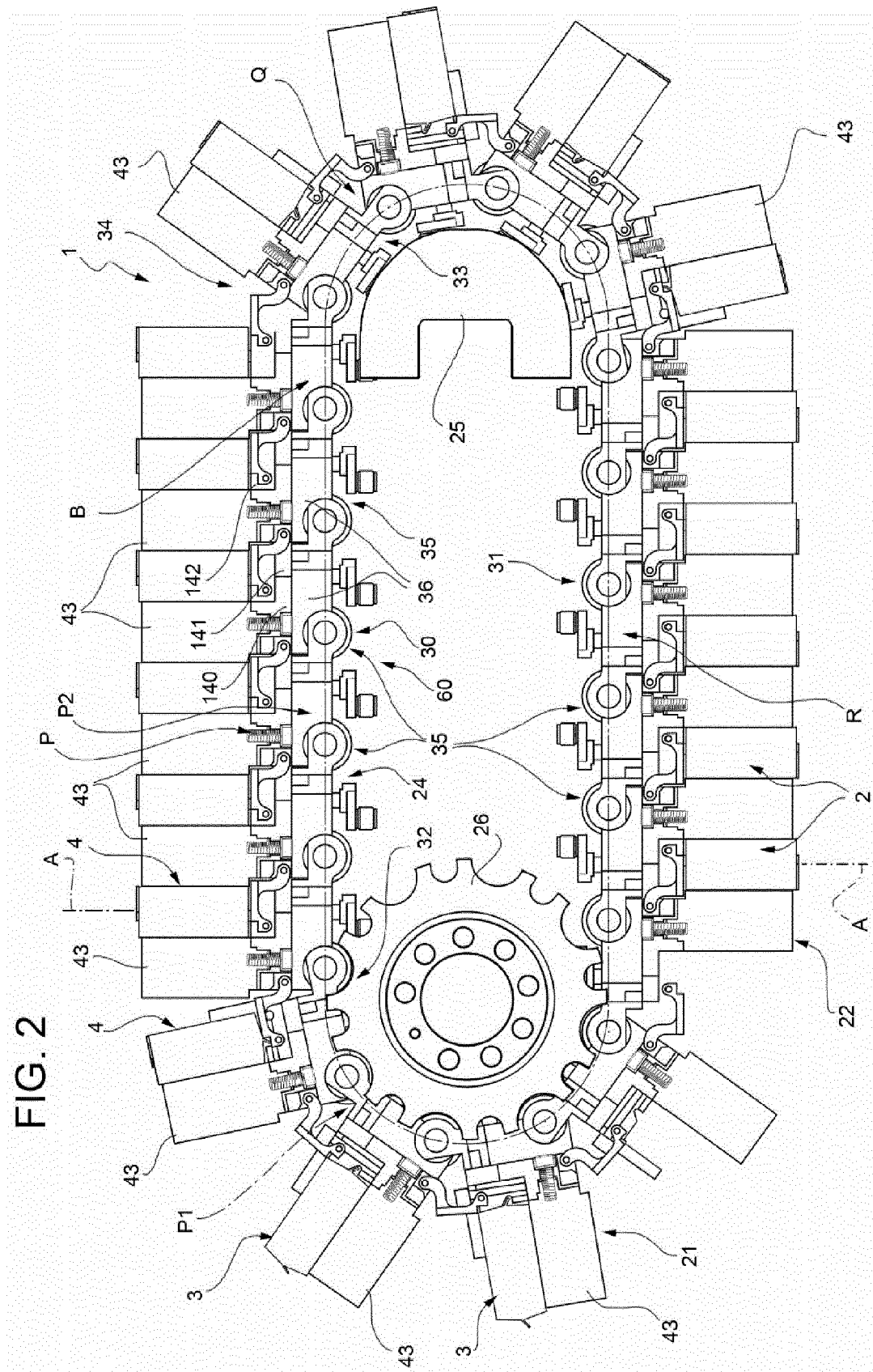
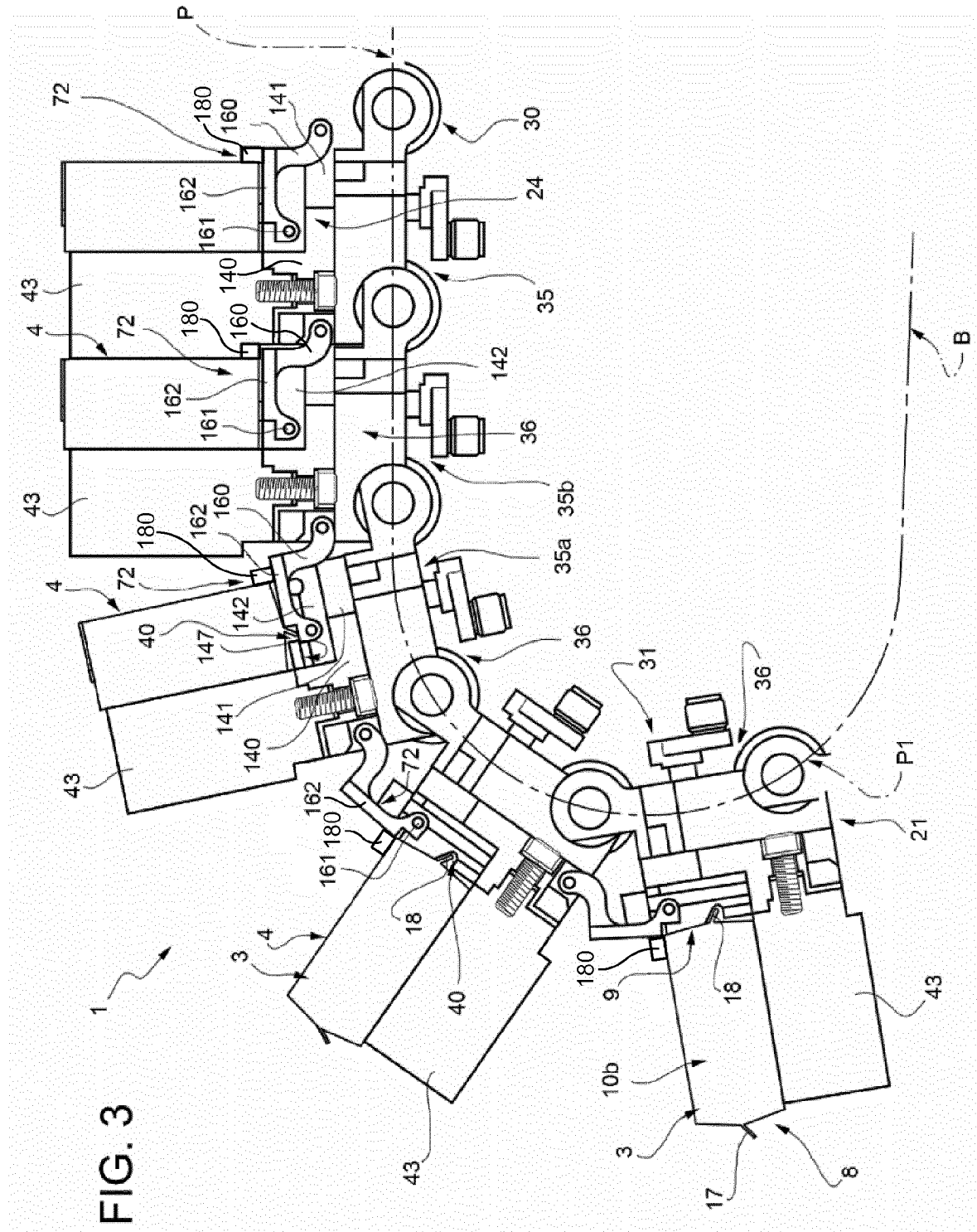
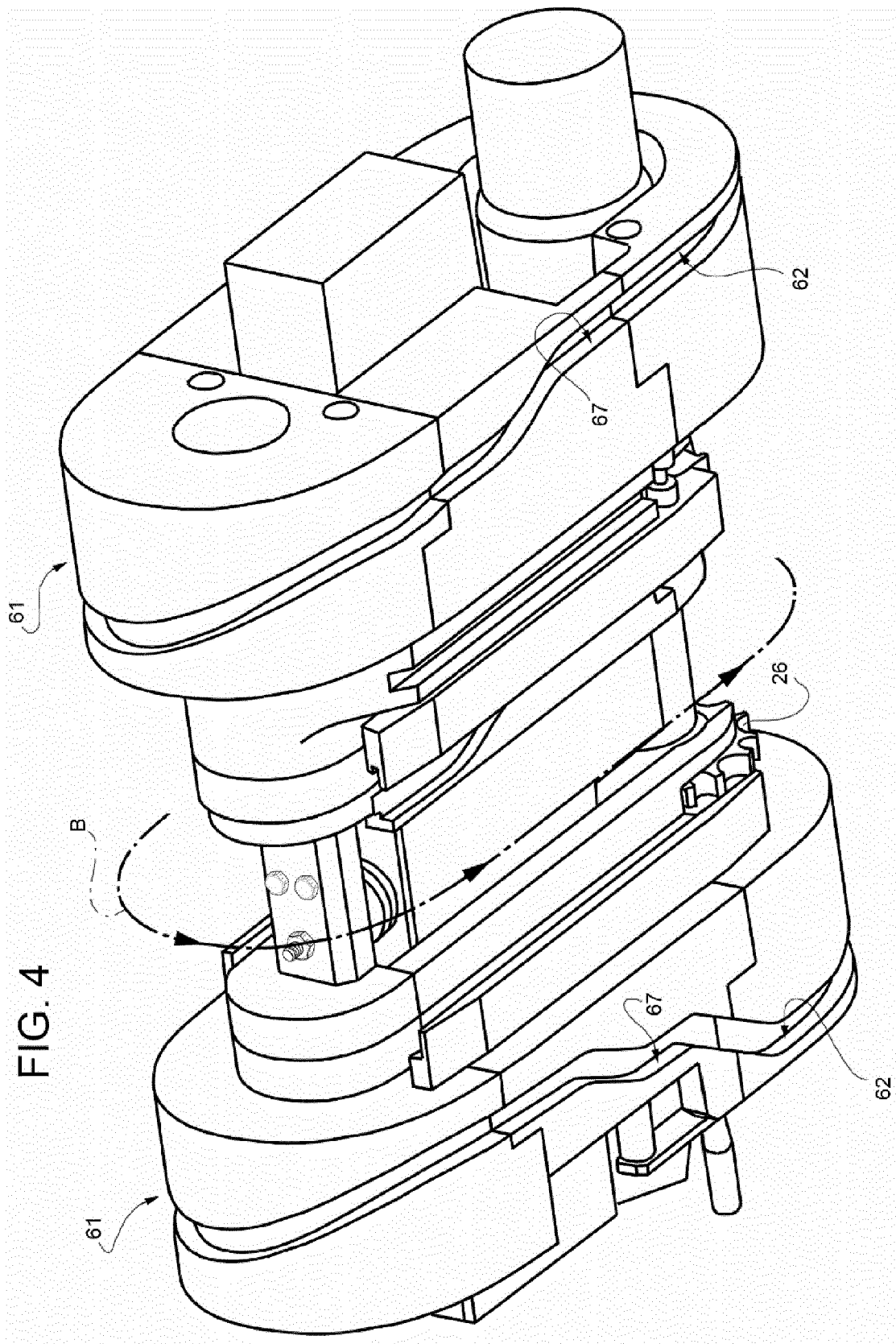


FIG. 2







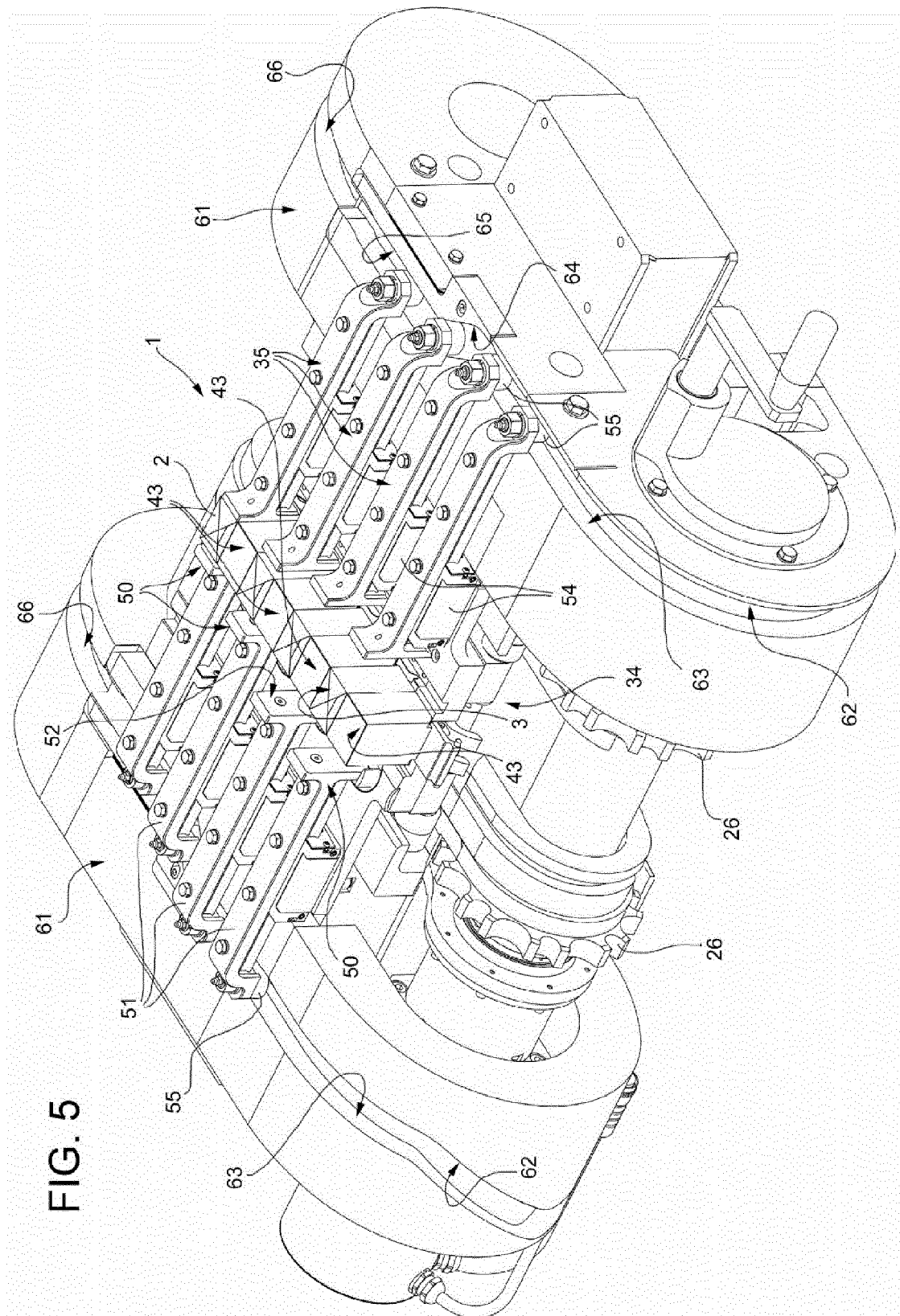
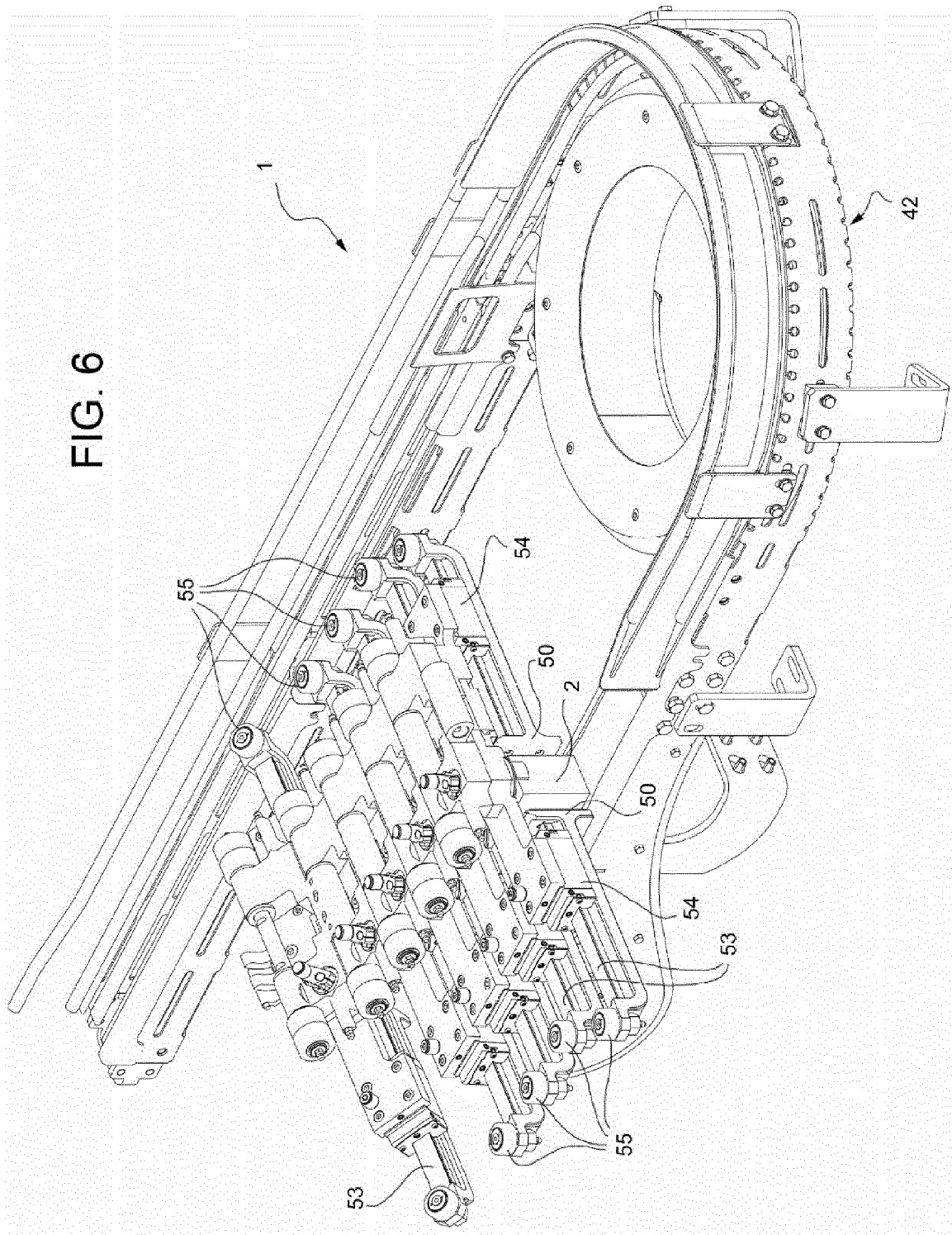


FIG. 6



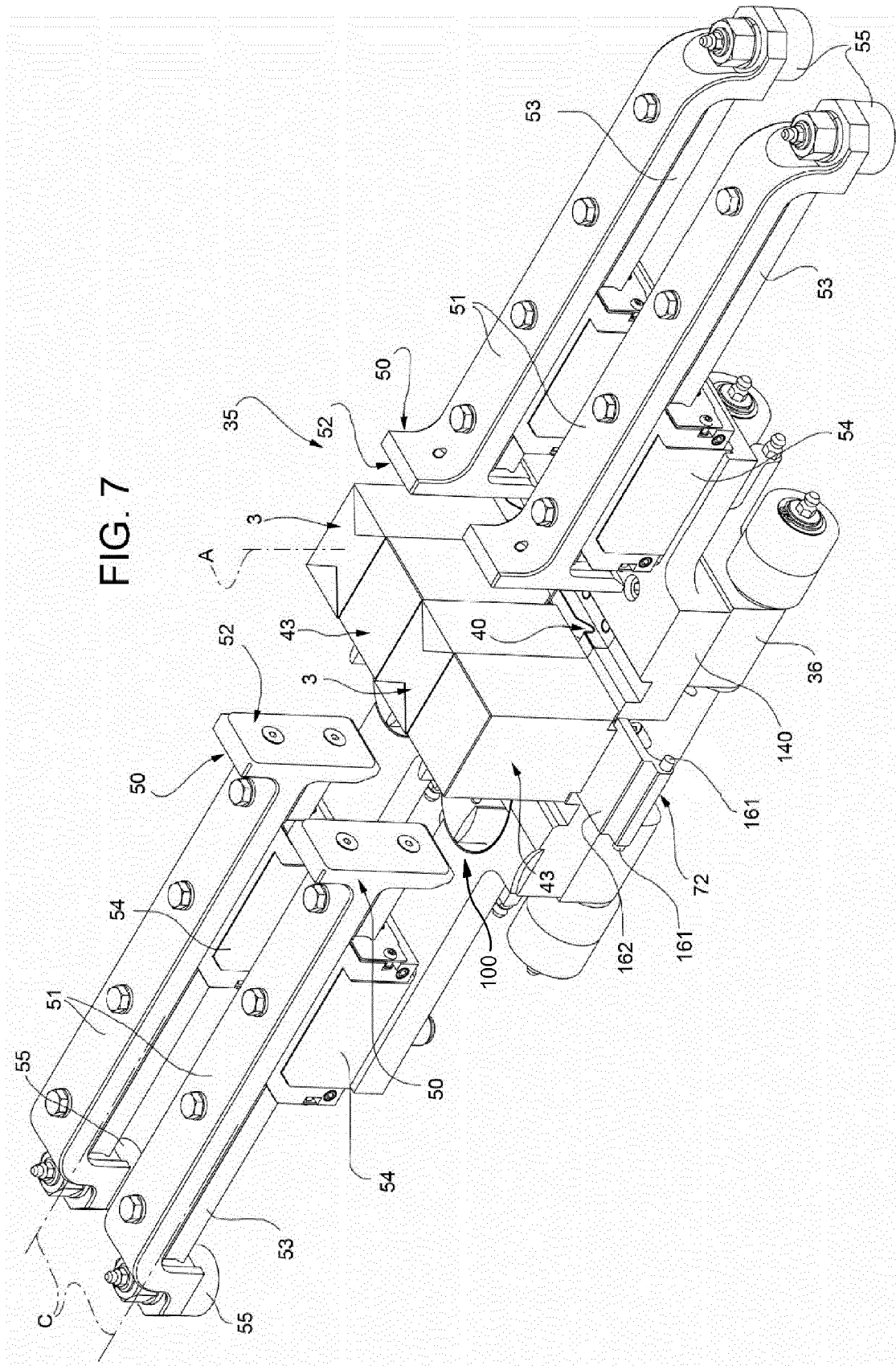
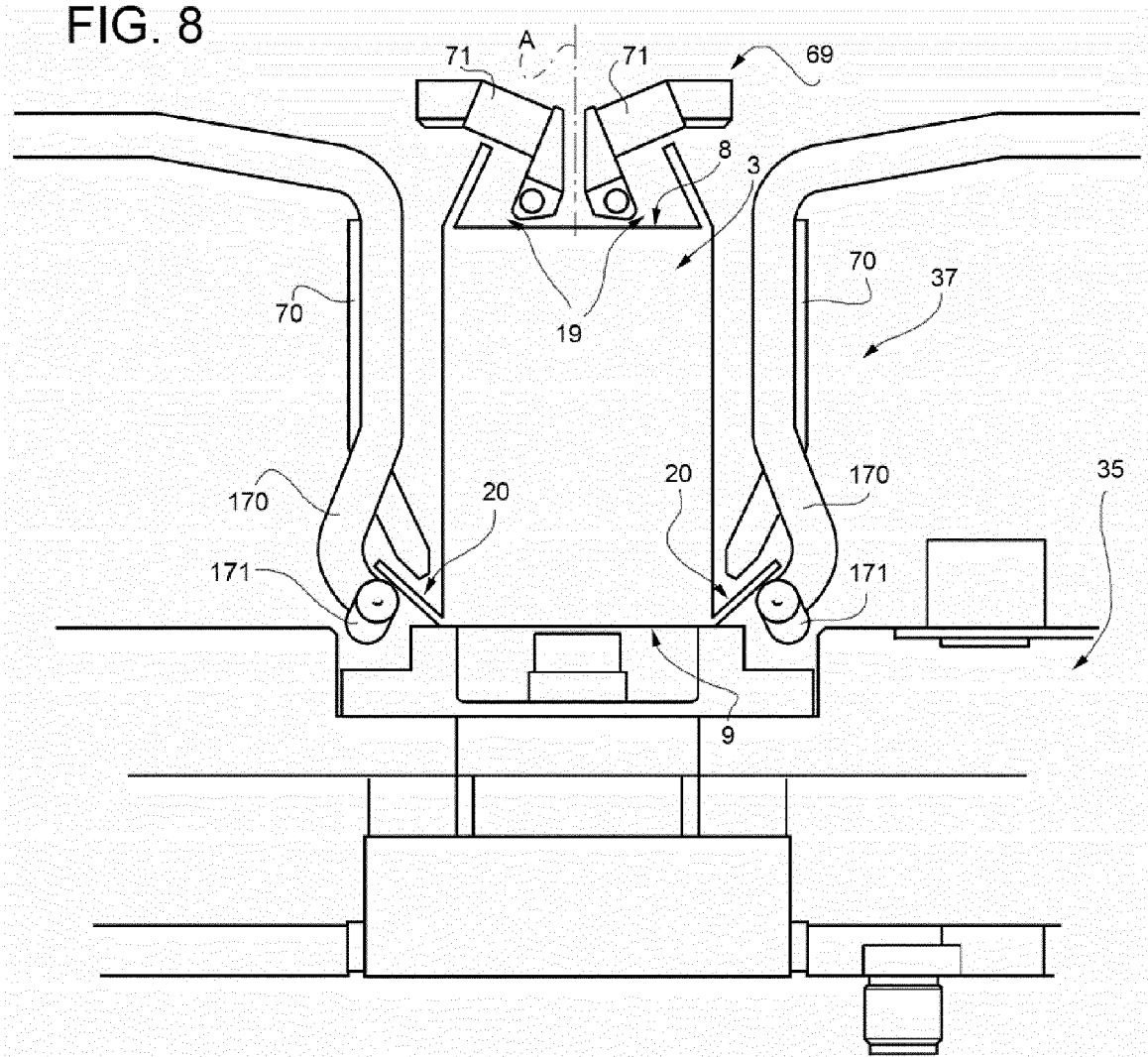


FIG. 8



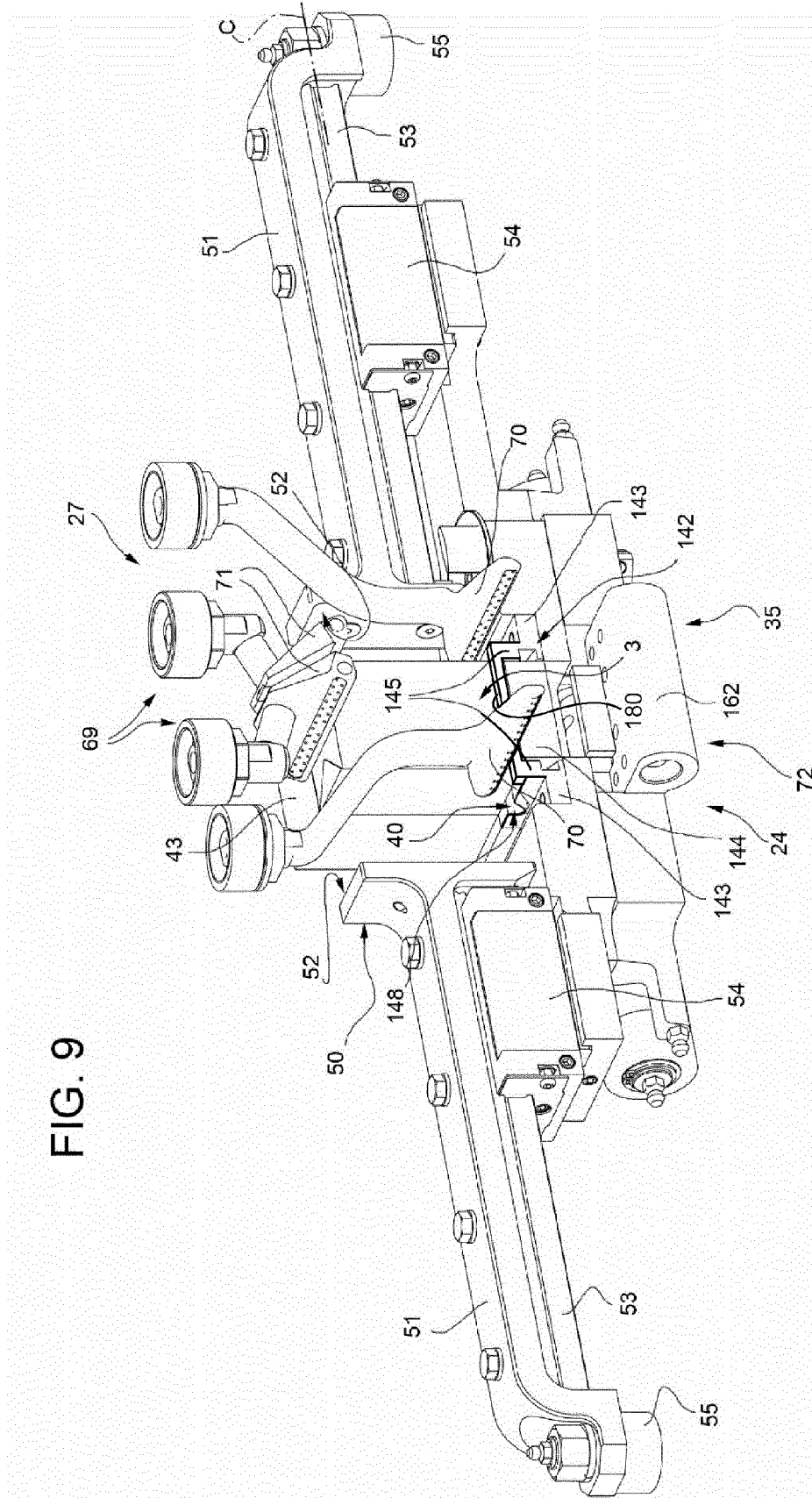
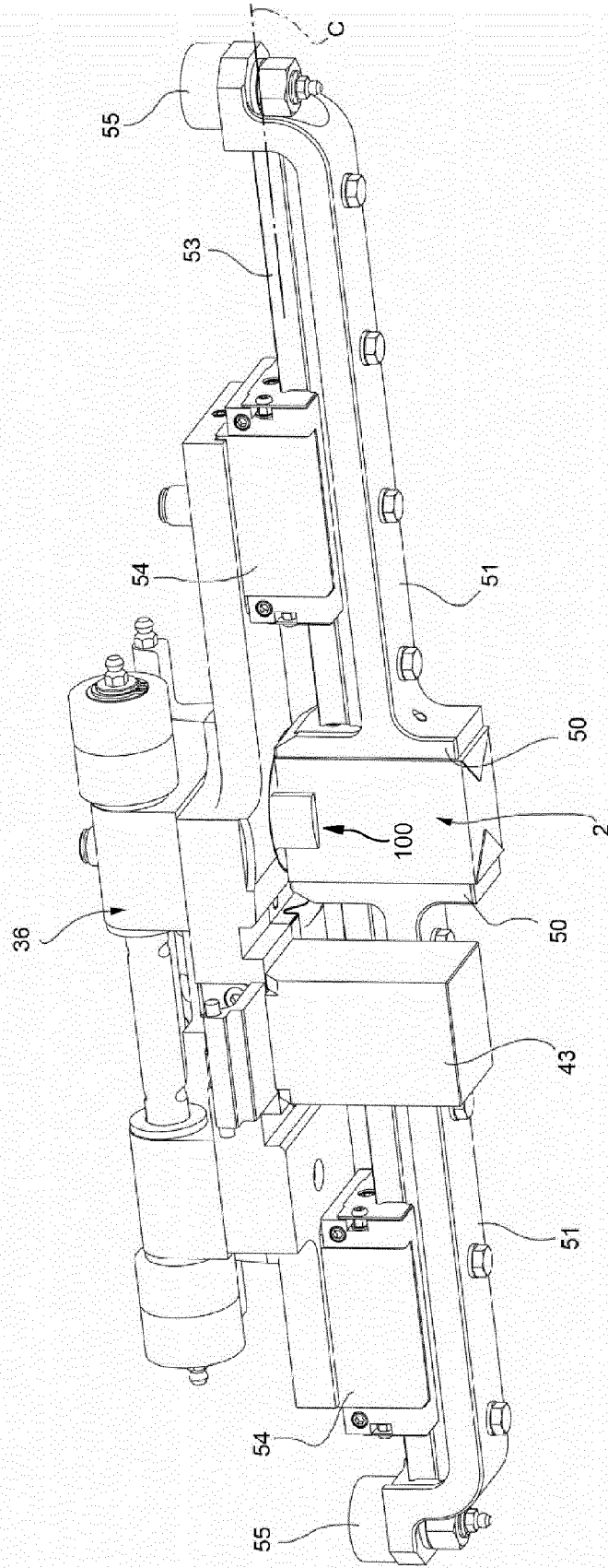
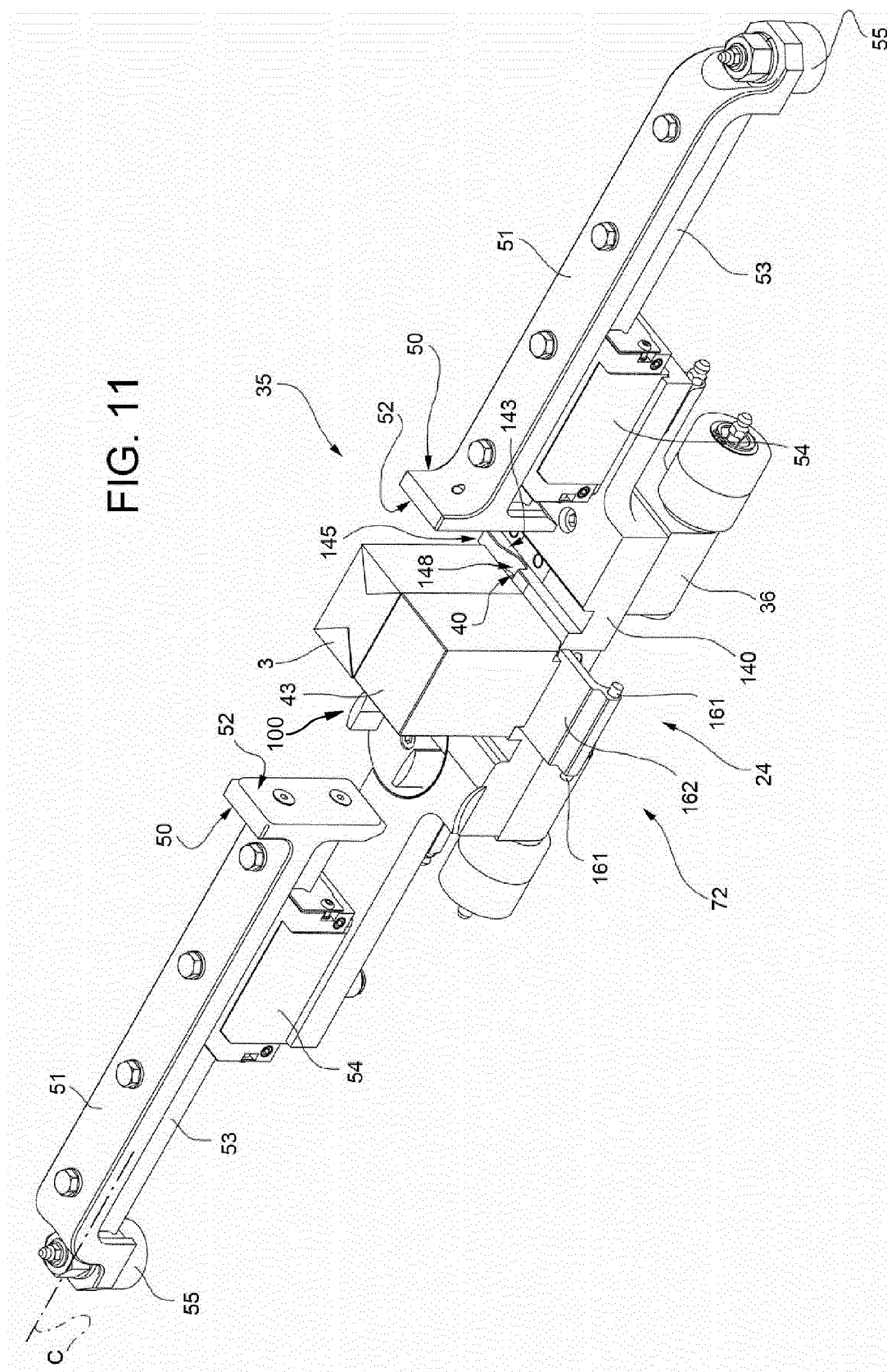
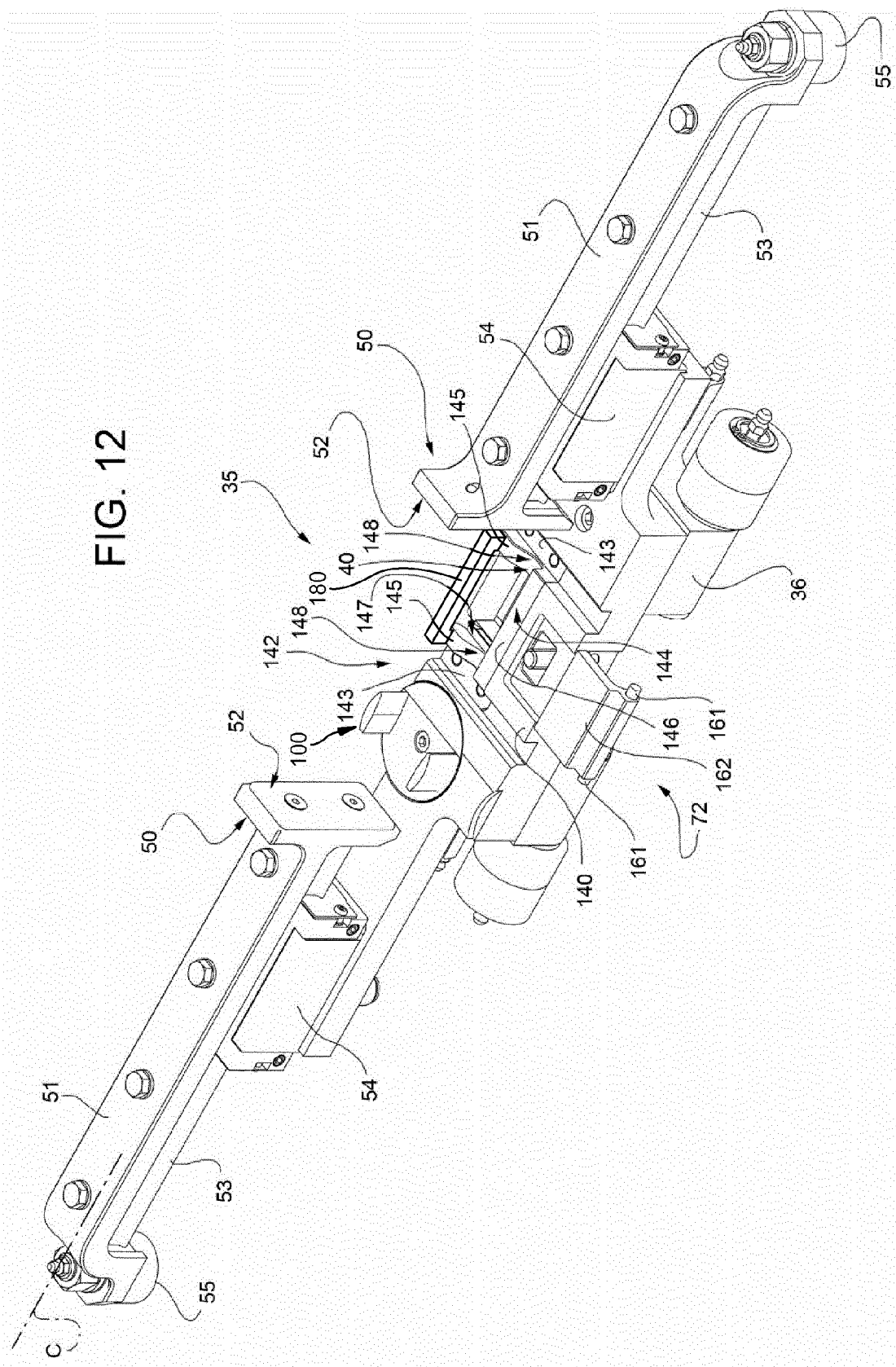


FIG. 10







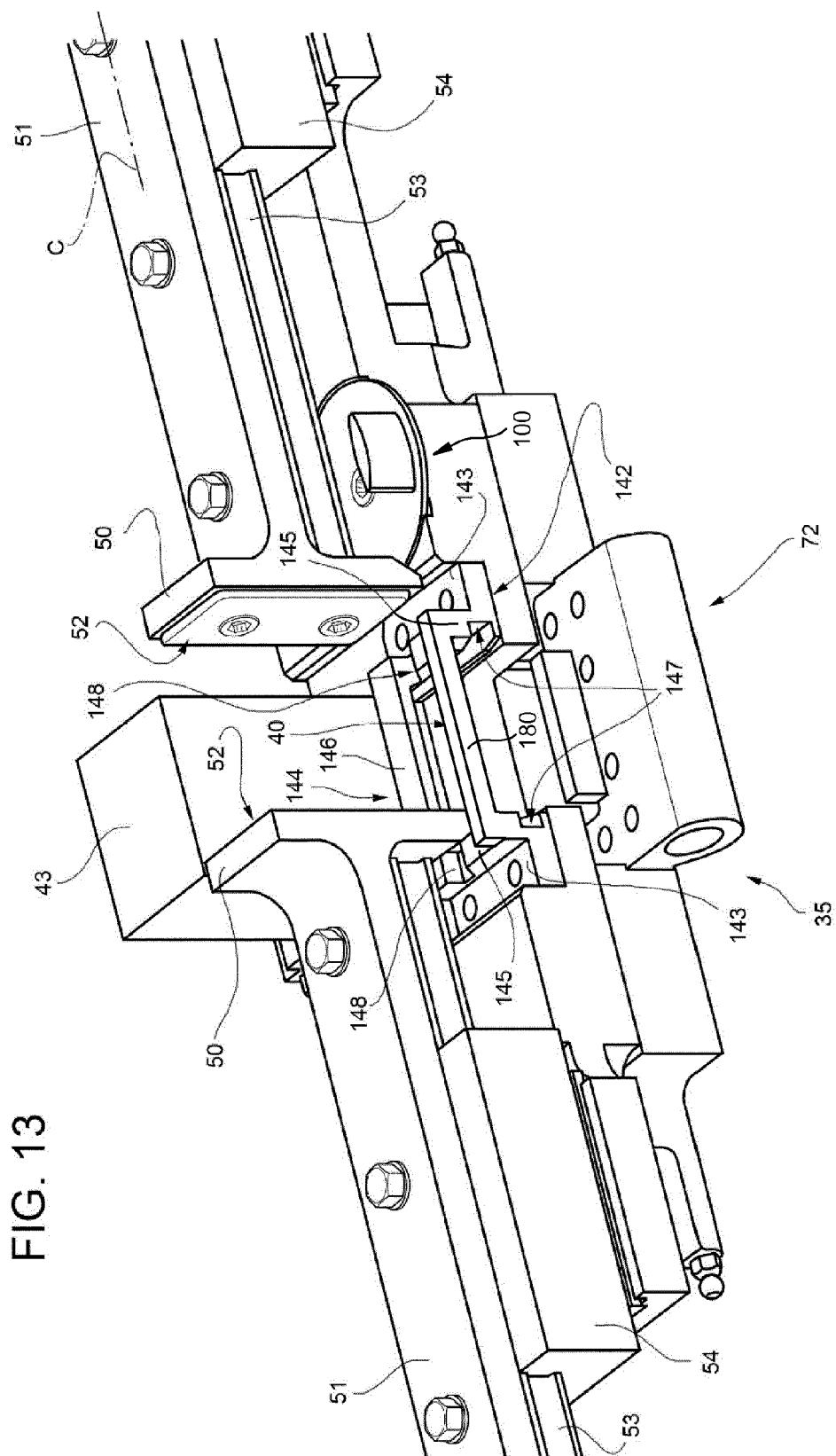


FIG. 13

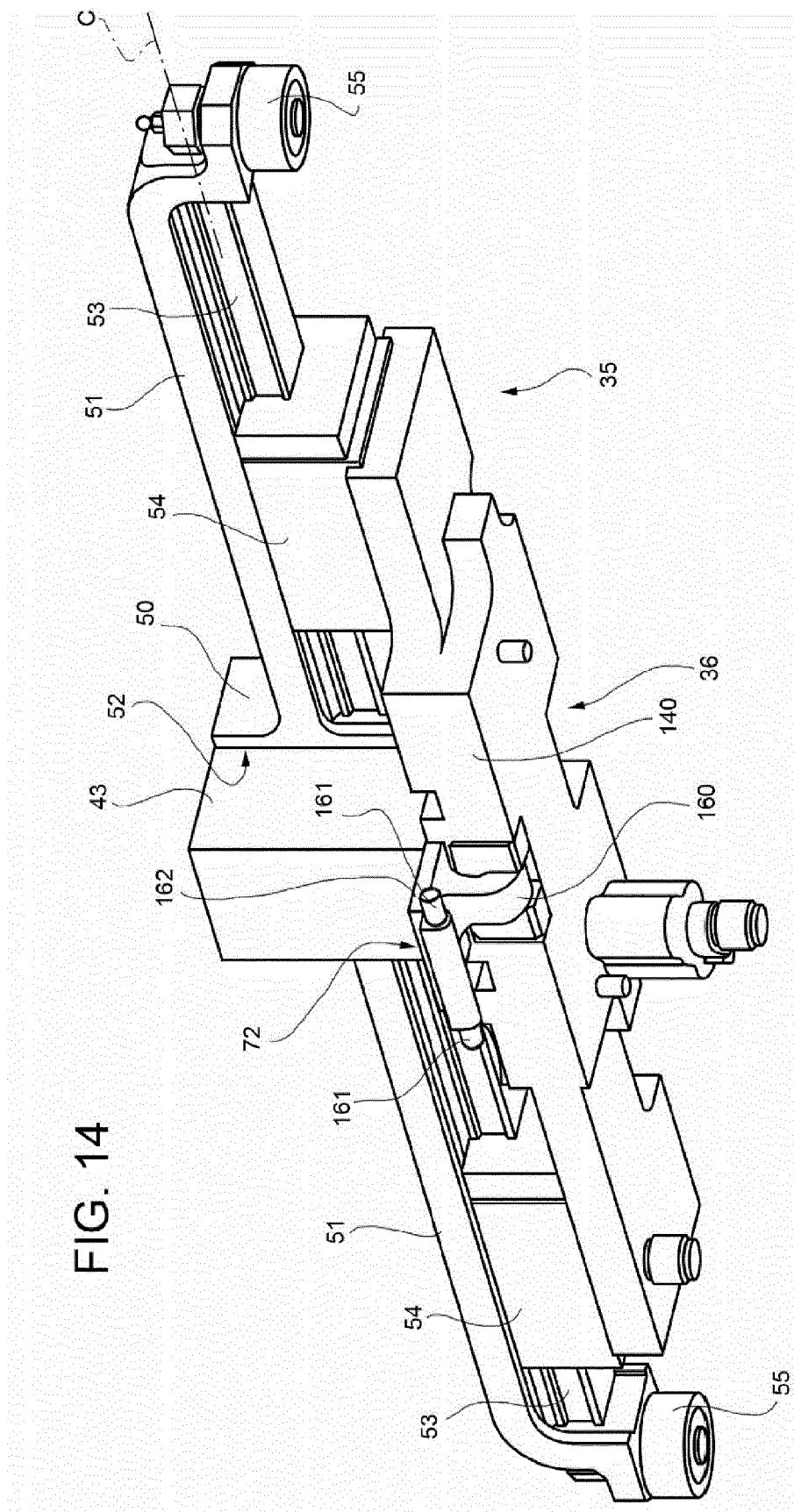


FIG. 15

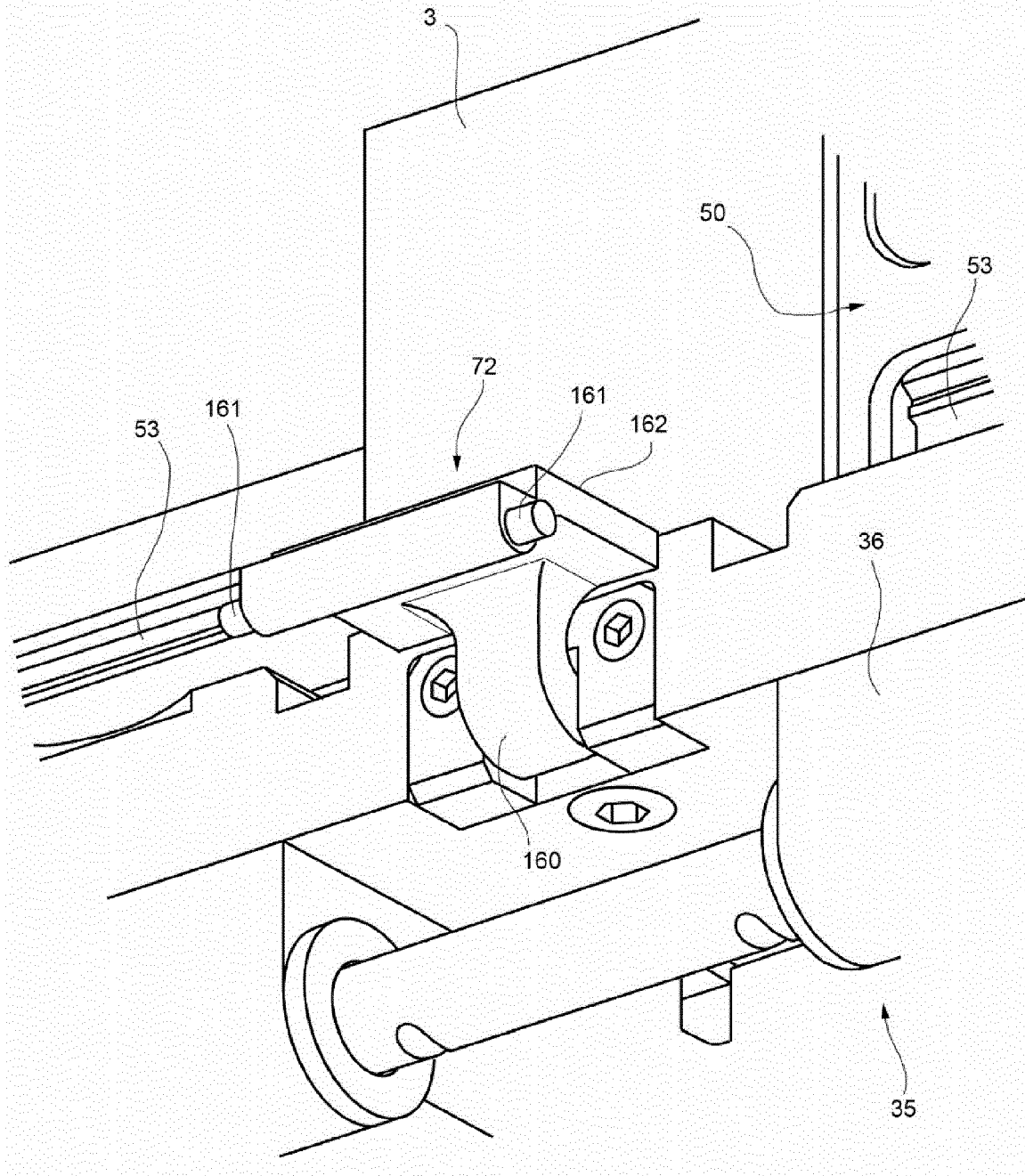


FIG. 16

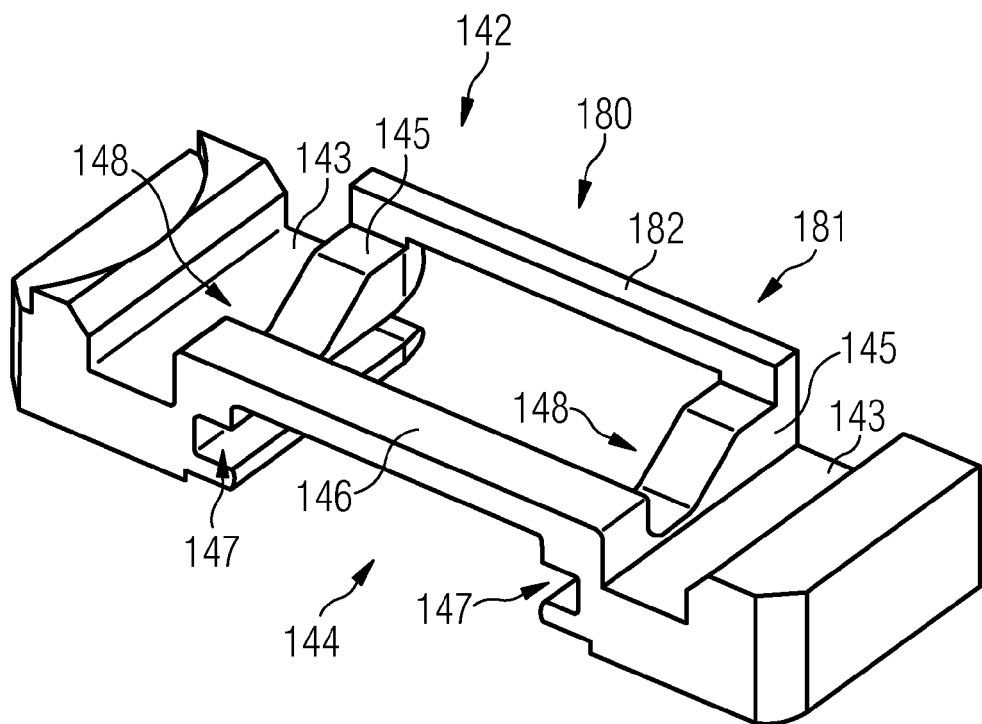
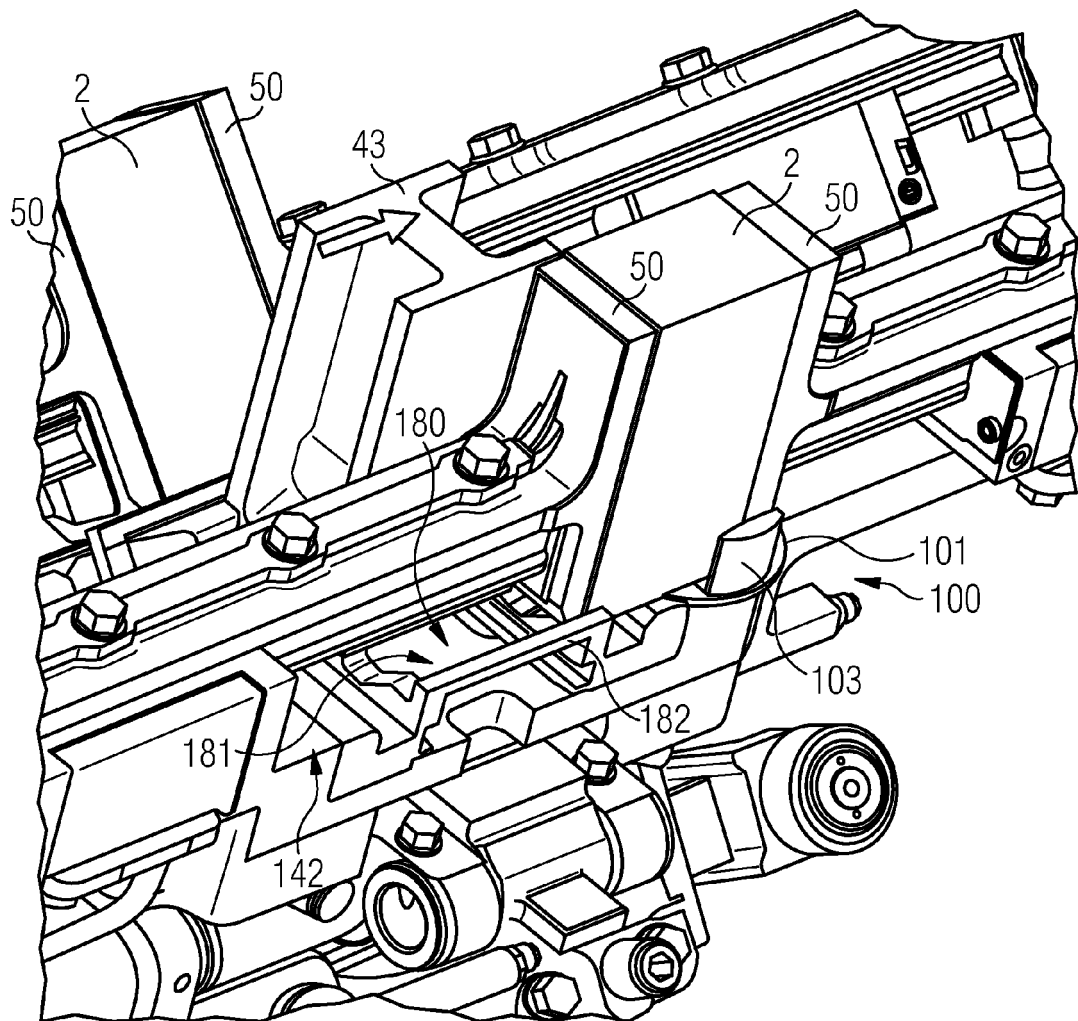


FIG. 17



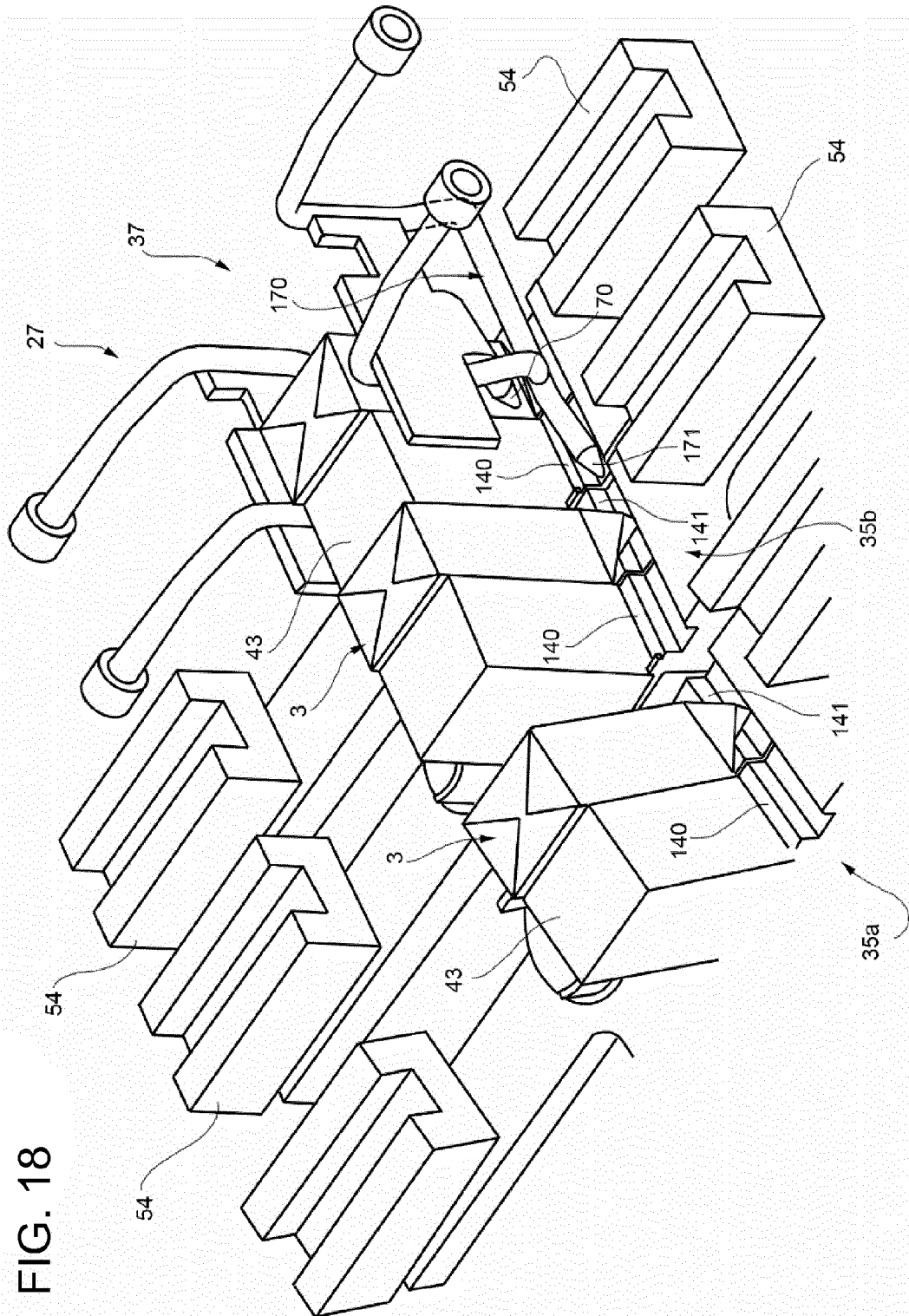
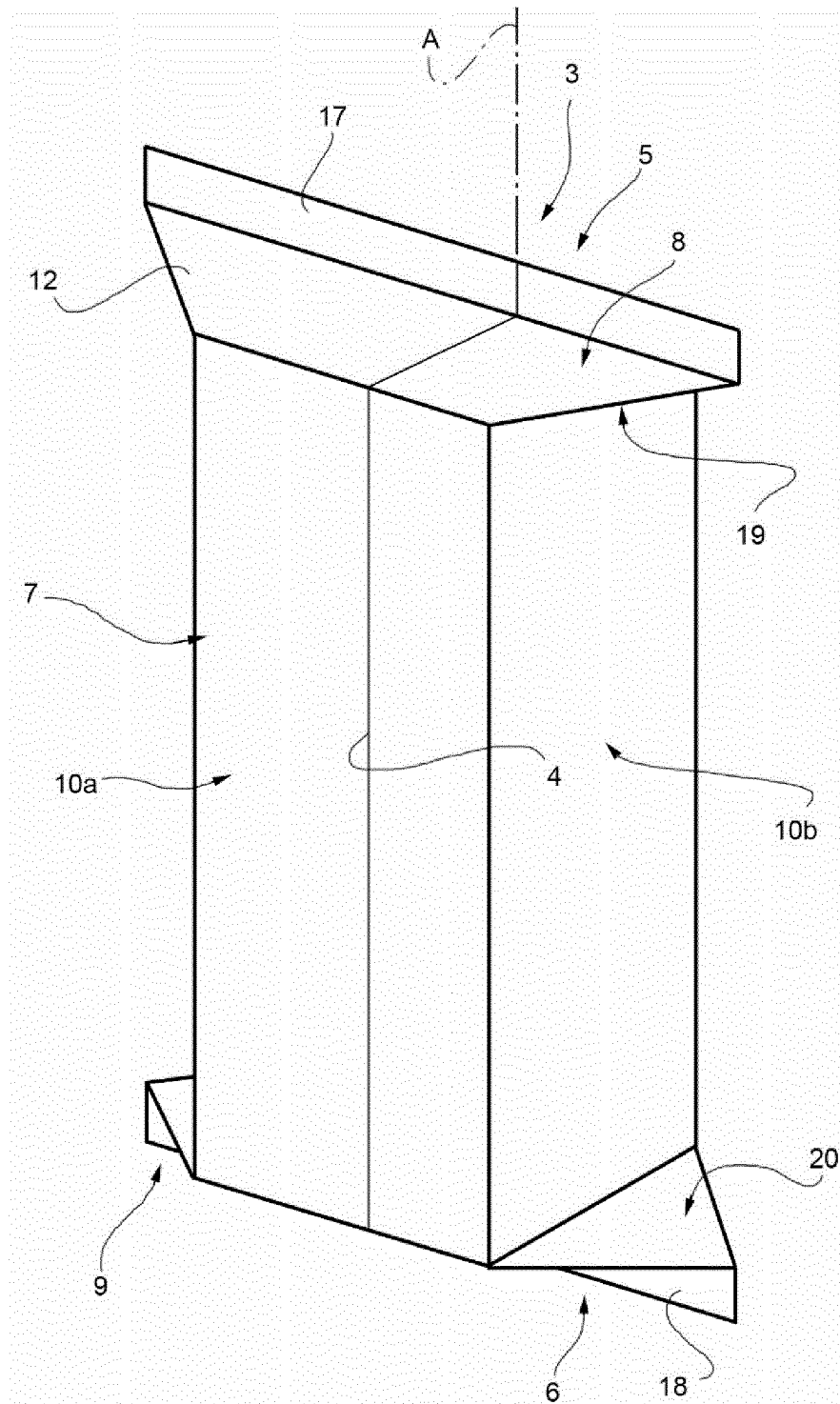


FIG. 18

FIG. 19





EUROPEAN SEARCH REPORT

Application Number
EP 14 19 2679

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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	EP 2 631 188 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 28 August 2013 (2013-08-28) * paragraphs [0076] - [0080]; claims 1-12; figures 1, 2, 3, 12- 16, 18 *	1-14	INV. B65B61/24 B65B7/20
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			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 6 February 2015	Examiner Vassoille, Philippe
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06-02-2015

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