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(54) Title: FORMING ASSEMBLY AND METHOD FOR FORMING A PLURALITY OF SEALED PACKS FOR POURABLE FOOD PRODUCTS STARTING FROM A TUBE OF PACKAGING MATERIAL

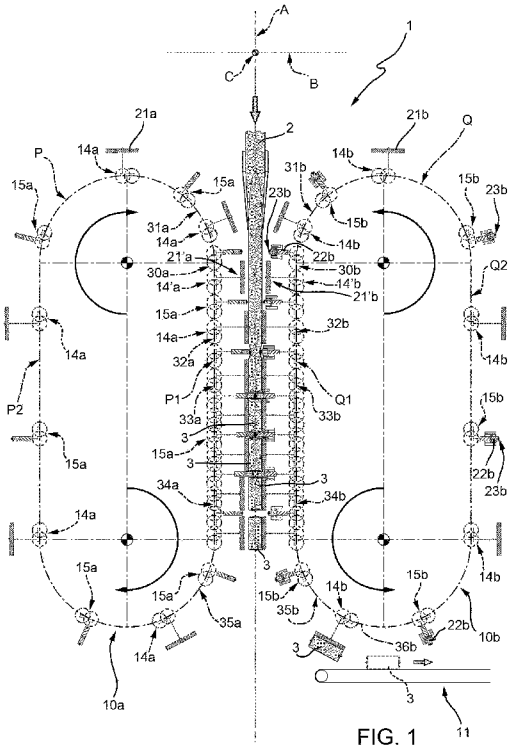

FIG. 1

(57) Abstract: There is described a forming assembly (10a, 10b) for forming a plurality of sealed packs (3) starting from a tube (2) of packaging material, comprising: a track (13a, 13b); a first element (15a, 15b), which is cyclically movable along the track (13a, 13b) and comprises, in turn, one of a sealing element (22b) or a counter-sealing element (22a) adapted to seal the pack (3); and a second element (14a, 14b), which is cyclically movable along the track (13a, 13b) and comprises, in turn, a first half-shell (21a, 21b; 21a', 21b') adapted, in use, contact the tube (2) so as to bound at least part of a respective pack (3) and control the shape of the pack (3) during the formation thereof; the first element (15a, 15b) and the second element (14a, 14b) are self- movable along the track (13a, 13b) independently of one another.

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FORMING ASSEMBLY AND METHOD FOR FORMING A PLURALITY OF SEALED PACKS FOR POURABLE FOOD PRODUCTS STARTING FROM A TUBE OF PACKAGING MATERIAL

Technical field

The present invention relates to a forming assembly and to a method for forming a plurality of sealed packs for pourable food products starting from a tube of packaging material.

Background of Invention

As is known, many liquid or 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.

A typical example 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. The packaging material has a multilayer structure comprising a base layer, e.g. of paper, covered on both sides with layers of heat-seal plastic material, e.g. polyethylene. In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of oxygen-barrier material, e.g. an aluminium 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.

Packages of this sort are normally produced on fully automatic packaging units, on which a continuous tube is formed from the web-fed packaging material; the web of packaging material is sterilized on the packaging

unit, 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 so sterilized is then maintained in a closed, sterile environment, and is folded and sealed longitudinally to form a tube, which is fed along a vertical advancing direction.

In order to complete the forming operations, the tube is filled with the sterilized or sterile-processed food product, and is sealed and subsequently cut along equally spaced transversal cross sections.

Pillow packs are so obtained, which have a longitudinal sealing band and a pair of top and bottom transversal sealing bands.

Packaging units are known, as described for example in European Patent EP-B-0887265, which comprise two chain conveyors defining respective endless paths.

In greater detail, the first conveyor is fitted with a plurality of first jaws, each comprising a respective sealing element and a respective extractable cutting element.

The second conveyor is fitted with a plurality of second jaws, each associated to a relative first jaw and comprising a respective counter-sealing element and a respective seat.

In particular, each sealing element is a heating element and corresponding counter-sealing element is made of elastomeric material, which provides the necessary mechanical support to grip the tube to the required pressure.

The paths of the chain conveyors comprise:

- respective operative branches substantially

facing and parallel to each other, and between which the tube of packaging material is fed, so that the first jaws cooperate with the second jaws on the other conveyor to grip the tube at a number of successive cross sections and to heat-seal the tube and cut the packs; and

- respective return branches, along which the first jaws and the second jaws are spaced apart from the tube.

In greater detail, the first jaws and the corresponding second jaws at first move away from each other and then move towards each other, as they move along return branches downstream of the operative branches with respect to the advancing direction of the chain conveyors.

As each first jaw cooperates with the corresponding second jaw along the operative branches, the respective sealing element cooperates with the respective counter-sealing element to heat-seal the tube at a corresponding transversal section.

Furthermore, as each first jaw cooperates with the corresponding second jaw, the respective cutting element is extracted to cut the formed sealed packs at the transversal section, so as to form corresponding sealed packages.

Each first jaw and second jaw also comprises respective forming half-shells, which are hinged with respect to the relative sealing element or the counter-sealing element, so as to control the volume of the relative packs in formation.

The half-shells of each first jaw and of the corresponding second jaw move cyclically between:

- an open position, in which they are detached from the tube; and

- a closed position, in which they contact the tube and fold the portion of the tube between two consecutive sealing sections to define and control the volume of the packs being formed.

In this way, as the sealing element of each first jaw seals the pack in formation, the half-shells of the same first jaw and of the corresponding second jaw control the volume of the pack in formation.

Furthermore, each first jaw comprises a pair of lateral fingers, which are arranged immediately above the sealing element.

The fingers are adapted to pull down the tube when the half-shells are closing on the tube, so as to arrange the tube in a desired position with respect to the sealing element of the same first jaw.

In this way, it is ensured that the packs are transversally sealed in the desired position with respect to the images repeatedly printed on the packaging material forming the tube. The images must be arranged in given position with respect to the transversal sealed sections of the formed packs.

Furthermore, it is important to consider that the pack comprises a substantially parallelepiped main portion and a pair of opposite trapezoidal fins projecting from the main portion. Each fin comprises a pair of opposite triangular flaps, which laterally extends beyond the main portion on respective opposite lateral sides.

In order to correctly form the packs, the fingers press and fold the triangular flaps orthogonally to the axis of the tube and on the sealing element of the relative first jaw, when the latter cooperates with relative second jaw.

In other words, as the tube is constrained by the first jaw and second jaw cooperating with one another the fingers fold the triangular flaps, thus completing the formation of the relative pack.

More specifically, the half-shells may be spring-loaded by respective springs into the respective open position, and have respective rollers, which cooperate with respective cams designed to move the half-shells into the respective closed position by the time the forming assembly reaches a predetermined position as it moves down.

Each half-shell has a C-shaped cross section, and comprises, integrally: a main wall, and two parallel lateral flaps projecting towards the axis of the tube of packaging material from respective opposite end edges of the main wall.

In the closed position, the main walls are located on opposite sides of the tube axis, are parallel to each other, and cooperate with respective first portions of the tube.

In the closed position, the flaps of one half-shell cooperate with respective second portions of the tube to completely control the volume of the pack being formed, and, on the opposite side to the relative main wall, face corresponding flaps of the other half-shell.

Finally, the packaging unit comprises a pair of fixed cam assemblies arranged on respective sides of the tube.

The cam assemblies cooperate in rolling manner with respective rollers carried by the first jaws and the second jaws.

The profiles of the cam assemblies are so designed to move the first jaws and the second jaws along the

respective return branches and operative branches, and to ensure the smoothest transition between the various positions assumed by the first jaws and the second jaws, so as to prevent undesired stress on the materials.

Though performing excellently on the whole, the packaging units of the type described still leave room for further improvement.

In particular, it has been proposed, in the embodiment shown in Figure 17 of WO00/64741, to replace the conveyor chains with:

- a first track and a second track, which are arranged on respective opposite lateral sides of the tube; and

- a plurality of first carriages self-movable on the first track and a plurality of respective second carriages movable on the second track.

In particular, the first carriages are movable independently of one another along the first track and the second carriages are movable independently of one another along the second track.

Each first carriage is fitted with a relative sealing element and a relative half-shell, while each corresponding second carriage is fitted with a respective counter-sealing element and with a relative half-shell.

Being the first carriage and the respective second carriage movable independently from one another, it is no longer necessary to provide the cumbersome chain conveyors.

However, the packaging unit shown in Figure 17 of WO00/64741 leaves room for improvement, especially as regards to the precise and repeatable sealing of the pillow packs in the desired position.

As a matter of fact, the packaging unit shown in Figure 17 of WO00/64741 fails to disclose any solution for the folding of the triangular top flaps of the packs in formation.

A need is therefore felt within the industry to improve the precision and the repeatibility with which the tube is arranged in the desired position with respect to the sealing element and counter-sealing element.

Furthermore, the solution shown in Figure 17 of WO00/64741 leaves room for improvement, especially as regard to the possibility of forming sealed packs having different height and the diameter varying in a narrow range, without wholly re-designing the packaging unit.

As a matter of fact, in order to adjust the height of the formed sealed packs, it is necessary to replace the whole first carriages and second carriages with differently-sized ones that fit with the new packs.

A need is felt within the industry to improve the flexibility of the packaging units, with respect to the possibility of forming sealed packs having different heights and with diameter varying in a narrow range.

Disclosure of Invention

It is therefore an object of the present invention to provide a forming assembly for forming a plurality of sealed packs for pourable food products starting from a tube of packaging material, which meets at least one of the above-identified needs.

According to the present invention, there is provided a forming assembly for forming a plurality of sealed packs for pourable food products starting from a tube of packaging material, as claimed in claim 1.

The present invention also relates to a method for

forming a plurality of sealed packs for pourable food products starting from a tube of packaging material, as claimed in claim 13.

Brief description of the drawings

One preferred, non-limiting embodiments of the present invention will be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a frontal view of a packaging unit for forming a plurality of sealed packages comprising a pair of forming assemblies according to the present invention;

Figure 2 shows, in an enlarged view, first components of the packaging unit of Figure 1, with parts removed for clarity;

Figure 3 shows in an enlarged perspective view of further components of the packaging unit of Figure 1, with parts removed for clarity;

Figure 4 is a top view of the packaging unit of Figures 1 to 3, with parts removed for clarity;

Figure 5 is a schematic view of different operative position of the packaging unit of Figures 1 to 4, with parts removed for clarity;

Figure 6 is an enlarged perspective view of the forming assembly of Figures 1 to 5; and

Figure 7 is a perspective view of the packaging unit of Figures 1 to 6.

Detailed description of preferred embodiments

With reference to Figures 1 to 7, number 1 indicates as a whole a packaging unit for producing sealed packs 3 of a pourable food product, such as pasteurized milk or fruit juice, from a tube 2 of sheet packaging material.

The packaging material has a multilayer structure

(not shown), and comprises a layer of fibrous material, normally paper, covered on both sides with respective layers of heat-seal plastic material, e.g. polyethylene.

In the case of aseptic packages for long-storage products, such as UHT milk, the packaging material also comprises a layer of gas- and light-barrier material, e.g. aluminium foil or ethylene vinyl alcohol (EVOH) film, 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.

Tube 2 is formed in known manner by longitudinally folding and sealing a web (not shown) of heat-seal sheet material, is filled by a pipe (not shown) with the sterilized or sterile-processed food product for packaging, and is fed, in known manner not shown, along a vertical path having an axis A.

Axis A is vertical in the embodiment shown.

It is also possible to identify:

- a direction B, which is orthogonal to axis A and horizontal in the embodiment shown; and

- a direction C, which is orthogonal to both axis A and direction B and is horizontal in the embodiment shown.

In greater detail, unit 1 comprises:

- a pair of forming assemblies 10a, 10b, which are arranged on respective lateral sides with respect to axis A and are spaced apart with respect to one another along direction B, and which are adapted to interact with tube 2, so as to form a number of pillow packs 3 separated from one another; and

- an outlet conveyor 11, which is arranged below

forming assembly 10a, 10b and is staggered from axis A along direction B, and which is adapted to receive formed packs 3 discharged by forming assembly 10b.

Forming assemblies 10a, 10b interact with tube 2 to heat seal it at equally spaced cross sections and form a number of pillow packs 3 (Figure 1) connected to tube 2 by transversal sealing bands crosswise to axis A.

Furthermore, forming assemblies 10a, 10b interact with tube 2 to cut pillow packs 3 along respective sealing bands, so as to separate pillow pack 3 from one another.

Outlet conveyor 11 conveys packs 3 towards a not-shown folding unit, in which packs 3 are folded into corresponding not-shown packages.

Forming assembly 10a substantially comprises:

- a frame 12a, which defines a plurality, two in the embodiment shown, of tracks 13a spaced along direction C with respect to one another; and

- a plurality of groups of carriages 14a', 15a, 14a consecutive and immediately adjacent to one another.

Forming assembly 10b substantially comprises:

- a frame 12b, which defines a plurality, two in the embodiment shown, of tracks 13b spaced along direction C with respect to one another; and

- a plurality of groups of carriages 14b', 15b, 14b consecutive and immediately adjacent to one another.

Each frame 12a, 12b comprises:

- two oval planar end surfaces 16a, 16b opposite to another, lying on respective planes parallel to axis A and vertical in the embodiment shown; and

- a curved continuous surface 17a, 17b, which extends between surfaces 16a, 16b along a direction B, orthogonal to axis A.

Furthermore, each track 13a, 13b comprises (Figure 3):

- a rectilinear portion 18a, 18b, which extends parallel to axis A and faces tube 2;
- a rectilinear portion 19a, 19b, which extends parallel to axis A and is opposite to respective portion 18a, 18b; and
- a pair of curved portions 20a, 20b, which are interposed between portions 18a, 18b; and 19a, 19b.

Each carriage 14a, 14a' of forming assembly 10a is associated to a corresponding carriage 14b, 14b' of forming assembly 10b.

In the very same way, each carriage 15a of forming assembly 10a is associated to a corresponding carriage 15b.

Each pair of corresponding carriages 14a, 14b (or 14a', 14b') and the pair of immediately precedent and subsequent carriages 15a, 15b form and seal a relative pack 3.

In the following of the present description, only one group of corresponding carriages 14a', 15b, 14a and the respective group of corresponding carriages 14b', 15b, 15a will be described, being all the carriages 14a', 14b'; 15a, 15b; 14a, 14b identical to one another.

Each carriage 14a', 14a and corresponding carriage 14b', 14b comprises respective half-shells 21a', 21a; 21b', 21b.

In detail, half-shell 21a, 21b; 21a', 21b' has a C-shaped cross section and comprises (Figures 2, 4 and 6):

- a main wall 28; and
- a pair of lateral flaps 29, which project from wall 28 towards axis A from respective opposite edges of wall 28 and are hinged to respective opposite edges of

wall 28 about respective axes.

Carriage 15b comprises a sealing element 22b and an extractable cutting element 23b.

Corresponding carriage 15a comprises a counter-sealing element 22a and a not-shown seat, which is adapted to receive cutting element 23b, when the latter is extracted.

In the embodiment shown, sealing elements 22b are heating elements. Counter-sealing elements 22a are made of elastomeric material, which provides the necessary mechanical support to grip tube 2 to the required pressure.

Advantageously, carriages 14a', 14b'; 14a, 14b and carriages 15a, 15b are self-movable on respective tracks 13a, 13b independently from one another.

In this way, half-shells 21a'; 21a and counter-sealing elements 22a of forming assembly 10a are movable independently of one another.

Half-shells 21b'; 21b and sealing elements 22b are movable independently of one another.

With particular reference to Figures 1 and 5, half-shells 21a', 21b'; 21a, 21b, counter-sealing elements 22a and sealing elements 22b are driven by respective carriages 14a' 14b'; 14a, 14b; 15a 15b along a cyclic endless path P, Q.

In particular, carriage 14a', 14b' is arranged upstream of carriage 15a, 15b and carriage 15a, 15b is arranged upstream of carriage 14a, 14b, proceeding along path P, Q according to the advancing direction of carriages 14a', 14b'; 15a, 15b; 14a, 14b.

Path P, Q comprises, proceeding along the advancing direction of carriages 14a', 14a; 14b', 14b; 15a, 15b (shown in Figure 1):

- an operative branch P1, Q1, along which half-shells 21a', 21b'; 21a, 21b, counter-sealing elements 22a and sealing elements 22b downwardly move parallel to axis A and are arranged on respective opposite sides of tube 2; and

- a return branch P2, Q2, along which half-shells 21a', 21b'; 21a, 21b, counter-sealing elements 22a and sealing elements 22b subsequently move away from axis A, upwardly move parallel to axis A on the opposite side of tube 2, and moves back towards axis A.

In greater detail, half-shells 21a', 21b'; 21a, 21b, counter-sealing elements 22a and sealing elements 22b are driven along operative branch P1, Q1, as respective carriages 14a', 14b'; 14a, 14b; 15a, 15b move along respective rectilinear portion 18a, 18b of relative tracks 13a, 13b.

Counter-sealing elements 22a and sealing elements 22b are driven along return branch P2, Q2, as respective carriages 15a, 15b move along respective rectilinear portion 19a, 19b and curved portions 20a, 20b of relative tracks 13a, 13b.

When they are driven by respective carriages 14a', 14a, 14b', 14b along respective operative branch P1, Q1 of path P, Q, half-shell 21a', 21b' are arranged above counter-sealing element 22a and sealing element 22b and above respective half-shell 21a, 21b.

Furthermore, counter-sealing element 22a and sealing element 22b are arranged above respective half-shell 21a, 21b.

When they are driven by respective carriages 14a', 14b'; 14a, 14b along respective operative branch P1, Q1 of path P, Q, half-shells 21a', 21b'; 21a, 21b, counter-sealing elements 22a and sealing elements 22b are

cyclically moved back and forth parallel to direction B (Figure 5) and between:

- respective closed positions, in which they cooperate with tube 2 during the formation of packs 3 and with formed packs 3 after the formation thereof; and
- respective open positions, in which they are detached from tube 2.

In other words, the movement of half-shells 21a', 21b'; 21a, 21b and counter-sealing element 22a and sealing element 22b along direction B between the respective open positions and closed positions is superimposed to the movement along operative branch P1, Q1.

When half-shells 21a', 21b'; 21a, 21b are both in the respective closed position, they define a substantially parallelepiped cavity (Figures 1, 4 and 5) and accordingly control the volume of relative pack 3 in formation.

In particular, when half-shells 21a', 21b'; 21a, 21b are in respective closed positions, respective walls 28 are located on opposite sides of axis A, are parallel to each other, and cooperate with tube 2. In the closed position, flaps 29 of one half-shell 21a', 21b'; 21a, 21b cooperate with tube 2 to completely control the volume of pack 3 in formation, face flaps 29 of the other half-shells 21a', 21b'; 21a, 21b and are substantially orthogonal to respective wall 28.

On the contrary, when half-shells 21a', 21b'; 21a, 21b are in respective open positions, walls 28 are detached from tube 2 and walls 29 diverge from relative walls 28.

When counter-sealing element 22a and sealing element 22b are in the respective closed position, they

heat-seal tube, so as form the transversal sealing band of pack 3.

At the same time, cutting element 23b is extracted, so as to separate the formed pack 3 from one another.

Along operative branches P1, Q1 of path P, Q:

- at first, half-shells 21a', 21b' reach the respective closed positions;

- then, half-shells 21a, 21b reach the respective closed positions; and

- finally, counter-sealing element 22a and sealing element 22b reach the respective closed position.

Furthermore, half-shells 21a', 21b'; 21a, 21b remain in the respective closed position for a certain length parallel to axis A before corresponding counter-sealing elements 22b and sealing elements 22b reach the respective closed positions.

With particular reference to Figures 1 and 5, each operative branches P1, Q1 of path P, Q comprises, proceeding according to the advancing direction of carriages 14a', 14b'; 15a, 15b; 14a, 15a:

- a respective initial portion 31a, 31b, along which both half-shells 21a', 21b'; 21a, 21b and counter-sealing element 22a and sealing element 22b are in respective open positions;

- a respective portion 30a, 30b, along which half-shell 21a, 21b are in respective closed positions while half-shells 21a', 21b' and counter-sealing element 22a and sealing element 22b remain in respective open positions;

- a respective portion 32a, 32b, along which half-shells 21a, 21b remain in respective closed position, half-shells 21a', 21b' are in respective closed position, and counter-sealing element 22a and sealing

element 22b are still in respective open positions;

- a respective portion 33a, 33b, along which both half-shells 21a, 21b, both half-shells 21a', 21b' and sealing element 22b and counter-sealing element 22a are in respective closed positions; and

- a respective end portion 34a, 34b, along which half-shell 21a is in the respective open position while half-shell 21b is in the respective closed position and counter-sealing element 22a and sealing element 22b are in respective open positions.

Along portions 30a, 30b and portions 31a, 31b, tube 2 is constrained by half-shells 21a, 21b while counter-sealing element 22a and sealing element 22b are still in respective open positions. Accordingly, half-shells 21a', 21b' can be controlled to move along relative portion P1, Q1 towards half-shell 21a, 21b so as to complete the folding of pack 3 before the latter is sealed by counter-sealing element 22a and sealing element 22b.

Along portions 33a, 33b, sealing element 22b and counter-sealing element 22a reach the respective closed positions, in which they heat seal tube 2 and form transversal sealing band of pack 3. In the meanwhile, half-shells 21a', 21b'; 21a, 21b cooperate with respective pack 3 in formation, so as to control the volume of that respective pack 3 and cutting element 23b is extracted to cut formed pack 3 along the transversal sealing band.

Furthermore, return branch P2 comprises, proceeding according to the advancing direction of carriages 14a, 15a, a portion 35a, which is immediately adjacent to portion 34a and along which half-shell 21a', 21a and counter-sealing element 22a are in respective open

positions.

Furthermore, return branch Q2 comprises, proceeding according to the advancing direction of carriages 14b, 14b', a portion 35b, which is immediately adjacent to portion 34b, and along which half-shell 21b', 21b are in the closed position and firmly grip formed pack 3 and counter-sealing element 22b is in the open position.

Portion 35b comprises an end 36b, which is opposite to operative branch Q1, according to the advancing direction of carriages 14a', 14b', 14a, 14b.

At end 36b, half-shell 21b moves back in the open position, so as to release formed pack 3 on conveyor 11.

Portion 35b is superimposed to outlet conveyor 11, proceeding along axis A.

Portion 35b is, at end 36b, tangential to direction B and to conveyor 11, so as to smoothly release formed pack 3 on conveyor 11 tangentially to direction B and same conveyor 11.

Carriage 14a', 14b'; 14a, 14b substantially comprises (Figures 2, 4 and 6):

- a motor element 40, which extends parallel to direction C;
- an arm 41, which protrudes laterally on one side of element 40 and is firmly fixed to element 40;
- a plate 42 which is movable along direction B with respect to arm 41 along guides 43; and
- a plate 44 which is movable with respect to plate 42 parallel to direction B and along guides (not shown).

Motor element 40 comprises a bar, which is provided at opposite axial ends thereof, with a pair of wheels 39, which roll inside relative endless slots defined by relative tracks 13a, 13b.

In the embodiment shown, wheels 39 rotate about

relative axes thereof parallel to direction C.

Motor element 40 is, in the embodiment shown, magnetically coupled with magnetic field sources 55 (Figures 3 and 6) which are carried in fixed position by respective surfaces 17a, 17b, so that carriage 14a', 14b'; 14a, 14b is self-movable along tracks 13a, 13b.

Plate 42 is fixed, on one side thereof, to wall 28 of half-shell 21a', 21b'; 21a, 21b and comprises, on the opposite side, a pair of rollers 46 (Figure 4).

Plate 44 comprises, on the side of rollers 46, a roller 47 and is fixed, on the side of half-shell 21a', 21b', 21a, 21b, to a cross-bar 48.

Roller 47 is interposed between rollers 46 along direction C.

Rollers 46 and roller 47 roll about relative axes thereof parallel to direction C.

Cross-bar 48 is parallel to arm 41 and defines a pair of opposite slots 49 (Figure 4) inclined with respect to arm 41.

Slots 49 are slidably engaged by relative rollers 50 connected to respective flaps 29 of half-shells 21a', 21b'; 21a, 21b.

Carriage 15a, 15b substantially comprises (Figures 2 and 6):

- a motor element 60, which extends parallel to direction C;

- an arm 61, which protrudes laterally on one side of element 60 and is firmly fixed to element 60;

- a plate 62, which is movable along direction B with respect to arm 61 along guides 63 and supports relative sealing element 22b or counter-sealing element 22a on the side of axis A and, therefore, of tube 2.

Motor element 60 comprises a bar, which is provided

at opposite axial ends thereof, with a pair of wheels 64 which roll inside relative endless slots defined by relative tracks 13a, 13b.

In the embodiment shown, wheels 64 rotate about relative axes thereof parallel to direction C.

Motor element 60 is, in the embodiment shown, magnetically coupled with magnetic field sources 55 (Figures 3 and 6) which are carried in fixed position by respective surfaces 17a, 17b, so that carriage 15a, 15b is self-movable along tracks 13a, 13b.

Plate 62 is fixed, on one side thereof, to sealing element 22b or counter-sealing element 22a and comprises, on the opposite side, a pair of rollers 65.

Rollers 46 and roller 47 are interposed between rollers 65 along direction C.

Each forming assembly 10a, 10b further comprises (Figures 2 to 4) a relative cam assembly 70a, 70b which is arranged on the opposite side of end surface 16a with respect to end surface 16b.

Each cam assembly 70a, 70b comprises:

- a pair of cam surfaces 71a, 71b in rolling contact with rollers 46 of carriages 14a', 14b'; 14a, 14b travelling along operative branches P1, Q1 of path P, Q;
- a cam surface 72a, 72b in rolling contact with rollers 47 of carriages 14a', 14b'; 14a, 14b travelling along operative branches P1, Q1 of path P, Q; and
- a pair of cam surfaces 73 which are in rolling contact with rollers 65 of carriages 15a, 15b travelling along operative branches P1, Q1 of path P, Q.

Cam surfaces 73 extend in correspondence of operative branches P1, Q1 of path P, Q.

Cam surfaces 71a, 71b and cam surfaces 72a, 72b

extend in correspondence of operative branches P1, Q1 of path P, Q and of initial portion 35b of return branch Q2 (Figure 6).

Cam surface 72a, 72b is interposed between cam surfaces 71a, 71b.

Cam surfaces 71a, 71b and cam surfaces 72a, 72b are interposed between cam surfaces 73.

Cam surfaces 71a, 72a and cam surfaces 71b, 72b extend at different distances from axis A and are shaped in such a way that half-shells 21a', 21b'; 21a, 21b:

- remain in respective open position along respective portions 31a, 31b of operative branches P1, Q1; and

- are arranged in respective closed positions along respective portions 32a, 32b; 33a, 33b of respective operative branches P1, Q1.

Furthermore, cam surfaces 71a, 72a are shaped in such a way that half-shell 21a', 21a is arranged in the open position along portion 34a of operative branches P1.

Cam surfaces 71b, 72b comprise, in particular, (Figures 3 and 6):

- respective main portions 75, which have a length parallel to axis A and are shaped to keep half-shell 21b', 21b in the closed positions along portion 34b of operative branch Q1 and along initial portion 35b of return branch Q2; and

- respective end portions 76, which extend as of respective main portions 75 at increasing distances from axis A, proceeding according to the advancing direction of carriage 15a, 15b along path Q and are shaped to keep half-shell 21b in the closed positions along initial portion 35b of return branch Q2 and to displace half-

shell 21b in the open position at end 36b of initial portion 35b.

Conveyor 11 comprises (Figure 7):

- an inlet station 85, which receives, under gravity action, packs 3 which are discharged by half-shells 21b at end 36b;

- an outlet station (not-shown), which is opposite to station 85 and feeds the not-shown folding unit; and

- an operative branch 87, which extends parallel to direction B from inlet station 85 to outlet station and is tangential to portion 35b at end 36b.

In the embodiment shown, conveyor 11 is a belt conveyor.

In use, tube 2 is advanced along axis A and carriages 14a', 15a, 14a, and 14b', 15b, 14b advance independently of one another along tracks 13a, 13b, as indicated by the arrows in Figure 1.

In particular, carriages 14a', 15a, 14a and 14b', 15b, 14b are self-movable on tracks 13a; 13b along respective paths P, Q.

The operation of unit 1 is described hereinafter with reference to only one group of carriages 14a', 14b, 14a and only one group of corresponding carriages 15a', 15b, 15a and to the only one pack 3 formed by using half-shells 21a', 21b', sealing element 22b and counter-sealing element 22a and half-shell 21a, 21b carried by respective carriages 14a', 14b', 15a, 15b; 14a, 14b.

Carriages 14a', 14b'; 15a, 15b; 14a, 14b move at first along respective return branches P2, Q2 of respective path P, Q and then along respective operative branches P1, Q1 of respective paths P, Q.

As carriages 14a', 14b'; 14a, 14b move along operative branches P1, Q1, respective half-shells 21a',

21b'; 21a, 21b move back and forth parallel to direction B and between the respective open positions and the respective closed positions.

In the very same way, as carriages 15a, 15b move along operative branches P1, Q1 respective and counter-sealing element 22a and sealing element 22b move back and forth parallel to direction B and between the respective open positions and the respective closed positions.

In particular, along operative branches P1, Q1, half-shell 21a', 21b' are arranged above counter-sealing element 21a and sealing element 21b, which are, in turn, arranged above half-shell 21a, 21b.

The operation of unit 1 is now described starting from a position, in which, along portions 31a, 31b, half-shells 21a', 21b'; 21a, 21b, counter-sealing element 22a and sealing element 22b are in respective open positions along respective portions 31a, 31b of respective operative branches P1, Q1.

In this situation, half-shells 21a', 21b', 21a, 21b, counter-sealing element 22a and counter-sealing element 22b are detached from tube 2. Furthermore, flaps 29 of half-shells 21a, 21b diverge from wall 28, proceeding from the latter towards axis A.

Along portions 30a, 30b of respective operative branch P1, Q1, half-shells 21a, 21b are in respective closed position, while half-shells 21a', 21b', counter-sealing element 22a and sealing element 22b remain in respective open positions.

Along portions 32a, 32b of respective operative branches P1, Q1, half-shells 21a, 21b remain in the respective closed positions, whereas half-shells 21a', 21b' reach the respective closed position. In the

meanwhile, counter-sealing element 22a and sealing element 22b remain in the respective open positions.

Furthermore, along portion 32a, 32b, tube 2 is constrained by half-shells 21a, 21b - arranged in a bottom position - and moved by half-shells 21a', 21b' - arranged in a top position - towards half-shells 21a, 21b, with sealing element 22b and counter-sealing element 22a still in the respective open positions.

Accordingly, the action of half-shells 21a', 21b is effective in completing the folding of packs 3.

Along portions 33a, 33b of respective operative branches P1, Q1, counter-sealing element 22a and sealing element 22b are in the closed position, with half-shells 21a', 21b'; 21a, 21b still kept in the respective closed positions.

Accordingly, flaps 29 of opposite half-shells 21a', 21b'; 21a, 21b face one another and define a parallelepiped cavity, which houses a portion of tube 2 destined to form pack 3.

Sealing element 22b is activated to heat-seal tube 2 in the desired sealing area thereof, so as to form transversal sealing band of pack 3 in the desired area with respect to the images repeatedly printed on tube 2.

During the sealing of the transversal sealing band, half-shells 21a', 21b'; 21a, 21b control the volume of pack 3.

Furthermore, cutting element 23b is extracted up to engage the seat, so as to cut the transversal sealing band of pack 3, so as to separate the latter from the remaining part of tube 2.

Along portions 34a, 34b, counter-sealing element 22a and sealing element 22b are in the respective open positions, half-shell 21a', 21a is in the open position,

while half-shell 21b', 21b remains in the closed position.

As a result, formed, sealed and cut pack 3 is gripped and held by half-shell 21b.

The further movement of carriage 14b along track 13b causes the corresponding movement of half-shell 21b along initial portion 35b of path Q1.

As half-shell 21b reaches end 36b of portion 35b of Q1, it is moved from the closed position to the open position, thus releasing pack 3 tangentially to direction B on inlet station 85 of conveyor 11, which feeds pack 3 to the not-shown folding unit.

The movement of half-shells 21a', 21b'; 21a, 21b between the respective open positions and closed positions is determined by the rolling of rollers 46, 47 of carriages 14a, 14b over respective cam surfaces 71a, 71b; 72a, 72b.

This movement is described starting from the open positions of half-shells 21a', 21b'; 21a, 21b, when carriages 14a, 14b move along respective portions 31a, 31b of operative branches P1, Q1.

Due to the rolling movement of rollers 46 on cam surfaces 71a, 71b, plates 42 move towards axis A and tube 2 along respective guides 43 with respect to respective motor elements 40 and respective arms 41.

As a result, plates 42 move parallel to direction B, thus causing the displacement of the relative whole half-shells 21a', 21b'; 21a, 21b towards tube 2 up to a position in which walls 28 contact tube 2.

Then, the rolling movement of rollers 47 on relative cam surfaces 72a, 72b causes the movement of relative plates 44 with respect to corresponding plates 42 parallel to direction B, towards axis A and on not-

shown guides.

As a result, slots 49 move towards axis A, causing the rotation of rollers 50 and of flaps 29 from a position in which they diverge with respect to wall 28 proceeding towards tube 2 up to reach a position, in which they are orthogonal to wall 28 and grip tube 2 or sealed pack 3.

At this stage, the half-shells 21a', 21b'; 21a, 21b are arranged in the respective closed positions.

The movement of half-shells 21a', 21b'; 21a, 21b from the respective closed position to the respective open positions is determined by the fact that at first respective plate 44 move away from respective plates 42 and slide on respective not-shown guides parallel to direction B, In this way, flaps 29 rotate back up to a position in which they diverge from respective walls 28, proceeding from walls 28 towards axis A.

The movement of half-shells 21a', 21b'; 21a, 21b is completed, thanks to the fact that plates 42 moves away from tube 2 and slide parallel to direction B along relative guides 43 with respect to relative arm 41.

These movements of half-shells 21a', 21b'; 21a, 21b towards respective closed positions are eased by not-shown springs which act on plate 42 and plate 44.

In this way, the whole half-shells 21a', 21b'; 21a, 21b are moved away from tube 2, up to reach again the respective open positions.

The movement of counter-sealing element 22a and sealing element 22b between the respective open positions and closed positions is determined by the rolling of rollers 65 of carriages 14a, 14b over respective cam surfaces 73.

That movement is described starting from the open

positions of counter-sealing element 22a and sealing element 22b, when respective carriages 15a, 15b move along respective operative branches P1, Q1.

Due to the rolling of rollers 65 onto respective cam surfaces 73, plates 62 move along respective guides 63 parallel to direction B and towards tube 2 with respect to arm 61 and motor element 60, up to contact tube 2 in the desired position for forming the transversal sealing band of pack 3.

At this stage, sealing element 22b and counter-sealing element 22a are arranged in the respective closed positions.

The movement of sealing element 22b and counter-sealing element 22a from the respective closed position to the respective open positions is determined by the fact that plates 62 move back along respective guide 63 parallel to direction B and on the opposite side of tube 2.

This movement is eased by not-shown springs, which act on plates 62.

The advantages of forming assembly 10a, 10b and the method according to the present invention will be clear from the above description.

In particular, carriages 14a', 15a'; 14b, 15b; 14a, 15a are self-movable independently of one another along relative tracks 13a, 13b.

Accordingly, forming assembly 10a, 10b can form packs 3 with a greater flexibility when compared with the solution described in Figure 17 of WO00/64711 and discussed in the introductory part of the present description.

In particular, being carriages 14a', 15a'; 14b, 15b; 14a, 15a self-movable independently of one another,

half-shells 21a, 21b - arranged below half-shells 21a', 21b' - are set in the respective closed positions along portions 30a, 30b and 32a, 32b of branches P1, Q1, whereas half-shells 21a', 21b' are in the respective open positions along portions 30a, 30b and reach the respective closed position along portions 32a, 32b of branches P1, Q1.

Due to the fact that sealing element 22b and counter-sealing element 22a remain in the respective open positions along portions 32a, 32b of branches P1, Q1, half-shells 21a', 21b' can be effectively controlled to downwardly move tube 2 towards half-shells 21a, 21b which constrain tube 2 itself.

In other word, half-shells 21a', 21b' can efficiently fold the triangular flaps of pack 3, while sealing element 22b and counter-sealing element 22a are in the respective closed positions and tube 2 is constrained by half-shells 21a, 21b set in the respective closed positions.

Furthermore, being carriage 14a, 14b; 14a', 14b' movable independently of carriage 15a, 15b, half-shells 21a', 21b' can control precisely and in a repeatable way the shape and the dimension of packs 3.

Furthermore, forming assembly 10a, 10b can be adapted to form packs 3 of different heights and with a narrow variation in the diameter, by simply replacing half-shells 21a, 21b with differently-sized half-shells and by suitably adjusting the movement of carriages 14a, 14b.

Finally, half-shells 21b are kept in respective closed position along portion 34b of portion Q2 of path Q diverging from axis A, and are displaced in respective open position at end 36b, so as to discharged packs 3 on

conveyor 11.

In this way, it is ensured a higher degree of precision in the feeding of packs 3 to conveyor 11 with respect to the known solutions, which substantially rely on the gravity action.

As a matter of fact, there is substantially no longer the risk that the accidental adhesion between residues of heat-sealed packaging material affects the separation of packs 3 from one another.

Clearly, changes may be made to forming assembly 10a, 10b and the method as described and illustrated herein without, however, departing from the scope defined in the accompanying claims.

CLAIMS

1.- A forming assembly (10a, 10b) for forming a plurality of sealed packs (3) starting from a tube (2) of packaging material, comprising:

- a track (13a, 13b);

- a first element (15a, 15b), which is cyclically movable along said track (13a, 13b) and comprises, in turn, one of a sealing element (22b) or a counter-sealing element (22a) adapted to seal said pack (3); and

- a second element (14a, 14b; 14a', 14b'), which is cyclically movable along said track (13a, 13b) and comprises, in turn, a first half-shell (21a, 21b; 21a', 21b') adapted, in use, to contact said tube (2) so as to bound at least part of a respective said pack (3) and control the shape of said pack (3) during the formation thereof;

characterized in that said first element (15a, 15b) and said second element (14a, 14b; 14a', 14b') are self-movable along said track (13a, 13b) independently of one another.

2.- The forming assembly of claim 1, characterized in that said sealing element (22b) or counter-sealing element (22a) is cyclically drivable by said first element (15a, 15b) along a cyclic path (P, Q) and, as it moves along said cyclic path (P, Q), is further cyclically movable between:

- a first operative position, in which it contacts, in use, said tube (2), so as to seal said pack (3); and

- a first rest position, in which it is, in use, detached from said tube (2) or said formed pack (3);

said first half-shell (21a, 21b) being cyclically drivable by said second element (14a, 14b) along said cyclic path (P, Q) and, as it moves along said cyclic

path (P, Q), being further movable between:

- a second operative position, in which it contacts, in use, said tube (2), so as to control the shape of said pack (3); and

- a second rest position, in which said it is detached, in use, from said tube (2) or said formed pack (3);

said second element (14a, 14b) being arranged downstream of said first element (15a, 15b) with respect to said path (P, Q);

said path (P, Q) comprising respective operative branches (P1, Q1) having a main extension direction, which is parallel to an advancing first direction (A) of said tube (2);

said operative branch (P1, Q1) comprising, in turn:

- a first portion (32a, 32b), in which said first half-shell (21a, 21b) is in said second operative position, and in which said one of a sealing element (22b) or a counter-sealing element (22a) is in said first rest position; and

- a second portion (33a, 33b), in which said first half-shell (21a) is in said second operative position, and in which said sealing element (22b) or counter-sealing element (22a) is in said first operative position;

said second portion (33a, 33b) being arranged downstream of said first portion (32a, 32b) proceeding along said path (P, Q), according to the advancing direction of said first element (15a, 15b) and said second element (14a, 14b).

3. - The forming assembly of claim 2, characterized by comprising a third element (14a', 14b'), which is cyclically movable along said track (13a, 13b) and

comprises, in turn, a second half-shell (21a', 21b') adapted, in use, to contact said tube (2);

said third element (14a', 14b') being arranged upstream of said second element (15a, 15b) with respect to said path (P, Q);

said third element (14a', 14b') being self-movable along said track (13a, 13b) independently of said first element (15a, 15b) and said second element (14a, 14b);

said second half-shell (21a', 21b') being cyclically drivable by said third element (14a', 14b') along said cyclic path (P, Q) and, as it moves along said path (P, Q) being further movable between:

- a third operative position, in which it contacts said tube (2), so as to control the shape of said pack (3); and

- a third rest position, in which it is detached, in use, from said tube (2) or said formed pack (3);

said operative branch (P1, Q1) comprising, in turn, a third portion (30a, 30b), in which said second half-shell (21a', 21b') is in said third rest position, and in which said one of a sealing element (22b) or a counter-sealing element (22a) is in said first rest position and in which said first half-shell (21a, 21b) is in said first operative position;

said second half-shell (21a', 21b') being arranged in said third operative position along said first portion (32a, 32b) and said second portion (33a, 33b);

said third portion (30a, 30b) being arranged upstream of said first portion (32a, 32b), proceeding along said path (P, Q) along said advancing first direction (A).

4.- The forming assembly of claim 2 or 3, characterized in that said first portion (32a, 32b)

extends for a certain length parallel, in use, to said advancing first direction (A).

5.- The forming assembly of claims 2 to 4, characterized in that said path (Q) further comprises a fourth portion (34b), in which said first half-shell (21b) is in said second operative position, and in which said one of a sealing element (22b) or a counter-sealing element (22a) is in said first rest position;

said fourth portion (34b) being arranged downstream of said second portion (33b), proceeding along said path (Q) according to the advancing direction of said first element (14b) and said second element (15b);

said fourth portion (34b) diverging from said advancing first direction (A), proceeding along said path (Q) according to the advancing direction of said first element (14b) and said second element (15b).

6.- The forming assembly of any one of the foregoing claims, characterized in that said one of a sealing element (22b) or a counter-sealing element (22a) is movable between said first operative position and said first rest position parallel to a rectilinear second direction (B) orthogonal, in use, to said advancing first direction (A); and/or in that said first half-shell (21a, 21b; 21a', 21b') is movable between said second operative position and said second rest position parallel to said rectilinear second direction (B).

7.- The forming assembly of any one of the foregoing claims, characterized in that said first element (15a, 15b) comprises, in turn,:

- a first self-movable driving body (60), which contacts said track (13a, 13b) and moves along said track (13a, 13b); and

- a first driven body (62), which protrudes from said first self-movable driving body (60), is staggered from said track (13a, 13b), and carries said one of a sealing element (22b) or a counter-sealing element (22a).

8.- The forming assembly of claim 7, when depending on claims 2 to 6, characterized in that said first driven body (62) is slidably mounted parallel to said second direction (B) with respect to said first self-movable driving body (60);

said forming assembly (10a, 10b) further comprising a first cam surface (73), which cooperates with a first cam follower (65) movable together with said first driven body (62), so as to displace said one of a sealing element (22b) or a counter-sealing element (22a) between said first operative position and said rest position.

9.- The forming assembly of any one of claims 2 to 8, characterized in that said first half-shell (21a, 21b; 21a', 21b') comprises, in turn,:

- a main wall (28); and

- a pair of flaps (29) hinged to said main wall (28);

said second element (14a, 14b) comprising, in turn:

- a second self-movable body (40), which contacts said track (13a, 13b) and moves along said track (13a, 13b);

- a second driven body (42), which protrudes from said second self-movable body (40), is staggered from said track (13a, 13b), carries said wall (28) of said first half-shell (21a, 21b), and comprises a second cam follower (46);

- a third driven body (44), which is movable with

respect to said second driven body (42) parallel to said second direction (B), is operatively connected to said flaps (29), and comprises at least one third cam follower (47);

said forming assembly (10a, 10b) further comprising:

- a second cam surface (71a, 71b), which cooperates with said second cam follower (46), so as to move said wall (28) towards or away from said tube (2); and

- a third cam surface (72a, 72b), which cooperates with said third cam follower (47), so as to move said flaps (29) with respect to said wall (28).

10.- The forming assembly of claim 9, when depending on any one of claims 5 to 8, characterized in that said second cam surface (71b) and said third cam surface (72b) comprise:

- a main portion (75), which is substantially parallel to said advancing first direction (A) and which is configured to keep said first half-shell (21b) in said second operative position as said second element (15b) moves along said first portion (32b) and said second portion (33b); and

- a curved end portion (76), which extends as of said main portion (75) at increasing distances from said advancing first direction (A), proceeding according to the advancing direction of said second self-movable (15b) element on said track (13b), and which is configured to keep said first half-shell (21b) in respective said second operative position as said second element (15b) moves along said fourth portion (34b) of said path (Q) and to displace said first half-shell (21b, 21b') in said first rest position at an end (36b) of said fourth portion (34b).

11.- A packaging unit (1) for producing a plurality of sealed packs (3) starting from a tube (2) of packaging material, comprising a forming assembly (10a, 10b) according to any one of the foregoing claims;

said unit (1) further comprising an additional forming assembly (10b), which cooperates with said forming assembly (10a);

said additional forming assembly (10b) comprising, in turn:

- an additional track (13b);

- an additional first element (15b), which is cyclically movable along said additional track (13b) and comprises, in turn, said other of said a sealing element (22b) or said counter-sealing element (22a);

- an additional second element (14b), which is cyclically movable along said additional track (13b) and comprises, in turn, a second half-shell (21b) adapted, in use, to contact said tube (2), so as to bound at least an additional part of said pack (3) and to cooperate with said first half-shell (21a) in controlling the shape of said pack (3) during the formation thereof;

characterized in that said first additional element (15b) and said additional second element (14b) are self-movable along said additional track (13b) independently from one another.

12.- The unit of claim 11, when depending on claim 10, characterized by comprising a discharge conveyor (11), which is arranged at an end point of said end curved portion (76) of said third cam surface (71a, 71b) and said fourth cam surface (72a, 72b) opposite to said main portion (75), and is adapted to directly receive said formed packs (3) discharged from said first half-

shell (21a).

13.- A method for forming a plurality of sealed packs (3) starting from a tube (2) of packaging material, comprising the steps of:

i) advancing said tube (2) along an advancing first direction (A);

ii) moving a first element (15a, 15b) along a track (13a, 13b); said first element (15a, 15b) comprising, in turn, one of a sealing element (22b) or a counter-sealing element (22a); and

iii) moving a second element (14a, 14b, 14a', 14b') along said track (13a, 13b); said second element (14a, 14b, 14a', 14b') comprising, in turn, a first half-shell (21a, 21b; 21a', 21b');

characterized by comprising the step of:

iv) moving said first element (15a, 15b) and said second element (14a, 14b) independently from one another.

14.- The method of claim 13, characterized in that step ii) comprises the steps of:

v) cyclically driving said one of a sealing element (22b) or a counter-sealing element (22a) along a cyclic path (P, Q); and

vi) cyclically moving said one of a sealing element (22b) or a counter-sealing element (22a) during said step v) between:

- a first operative position, in which it contacts, in use, said tube (2) so as to seal said packs (3); and

- a first rest position, in which it is, in use, detached from said tube (2) or said formed packs (3);

said step iii) comprising the steps of:

vii) cyclically driving said first half-shell (21a, 21b) along said cyclic path (P, Q); and

viii) cyclically moving said first half-shell (21a, 21b) during said step vii) between:

- a second operative position, in which it contacts, in use, said tube (2) so as to control the shape of said packs (3); and

- a second rest position, in which it is detached, in use, from said tube (2) or said formed packs (3);

said first element (15a, 15b) being arranged upstream of said second element (14a, 14b, 14a', 14b') with respect to a common advancing direction thereof along said track (13a, 13b);

said method further comprising the steps of:

ix) keeping said first half-shell (21a, 21b) in said second operative position along a first portion (32a, 32b) of an operative branch (P1, Q1) of said path (P, Q); said operative branch (P1, Q1) having a main extension direction parallel to said advancing first direction (A);

x) keeping said one of a sealing element (22b) or a counter-sealing element (22a) in said first rest position along said first portion (32a, 32b);

xi) keeping said first half-shell (21a, 21b) in said second operative position along a second portion (33a, 33b) of said operative branch (P1, Q1); and

xii) displacing said one of a sealing element (22a) or a counter-sealing element (22b) in said first operative position along said second portion (33a, 33b) of said operative branch (P1, Q1);

said second portion (33a, 33b) being arranged downstream of said first portion (32a, 32b) proceeding along said path (P, Q), according to the advancing direction of said first element (15a, 15b) and said second element (14a, 14b, 14a', 14b').

15.- The method of claim 14, characterized by comprising the steps of:

xiii) moving a third element (14a, 14b) along said track (13a, 13b) independently of said first element (15a, 15b) and said second element (14a, 14b); said third element (14a, 14b) comprising, in turn, a second half-shell (21a', 21b');

said step xiii) comprising the steps of:

xiv) cyclically driving said second half-shell (21a', 21b') along said cyclic path (P, Q); and

xv) cyclically moving said second half-shell (21a', 21b') during said step vii) between:

- a third operative position, in which it contacts, in use, said tube (2) so as to control the shape of said packs (3); and

- a third rest position, in which it is detached, in use, from said tube (2) or said formed packs (3);

said third element (14a', 14b') being arranged upstream of said first element (15a, 15b) with respect a common advancing direction thereof along said track (13a, 13b);

said method further comprising the steps of:

xvi) keeping said second half-shell (21a', 21b') in said third rest position along a third portion (30a, 30b) of said operative branch (P1, Q1) and moving said second half-shell (21a', 21b') in said third operative position along said first portion (32a, 32b) of said operative branch (P1, Q1);

xvii) keeping said first half-shell (21a, 21b) in said second operative position, and said one of a sealing element (22b) or a counter-sealing element (22a) in said first rest position along said third portion (30a, 30b);

said third portion (30a, 30b) being arranged upstream of said first portion (32a, 32b) proceeding along said path (P, Q), according to the advancing direction of said first element (14a, 15a) and said second element (14b, 15b).

16.- The method of claim 15, characterized in that said step ix) comprises the step xviii) of keeping said first half-shell (21a, 21b) in said second operative position for a certain length parallel to said advancing first direction (A).

17.- The method of claim 15 or 16, characterized by comprising the steps of:

xix) keeping said first half-shell (21b) in said second operative position along a fourth portion (34b) defined by a return branch (Q2) of said path (Q); and

xx) displacing said first half-shell (21b) in said second rest position at an end (36b) of said fourth portion (34b) opposite to said second portion (33b), so as to directly discharge said formed packs (3) in a staggered position with respect to said advancing first direction (A);

said fourth portion (34b) being arranged downstream of said second portion (33b), proceeding along said path (Q) according to the advancing direction of said first element (14b) and said second element (15b);

said fourth portion (34b) diverging from said advancing first direction (A), proceeding along said path (Q) according to the advancing direction of said first element (14b) and said second element (15b).

18.- The method of any one of claims 15 to 17, characterized by comprising the steps of:

xxi) moving said one of a sealing element (21b) or a counter-sealing element (21a) between said first

operative position and said first rest position parallel to a rectilinear second direction (B) orthogonal to said advancing first direction (A) of said tube (2); and/or

xxii) moving said first half-shell (21a, 21b) between said second operative position and said second rest position parallel to said rectilinear second direction (B).

19.- The method of any one of claims 14 to 18, characterized by comprising the steps of:

xxiii) moving said one of a counter-sealing element (22a) and a sealing element (22b) along said track (13a) by using said first element (15a);

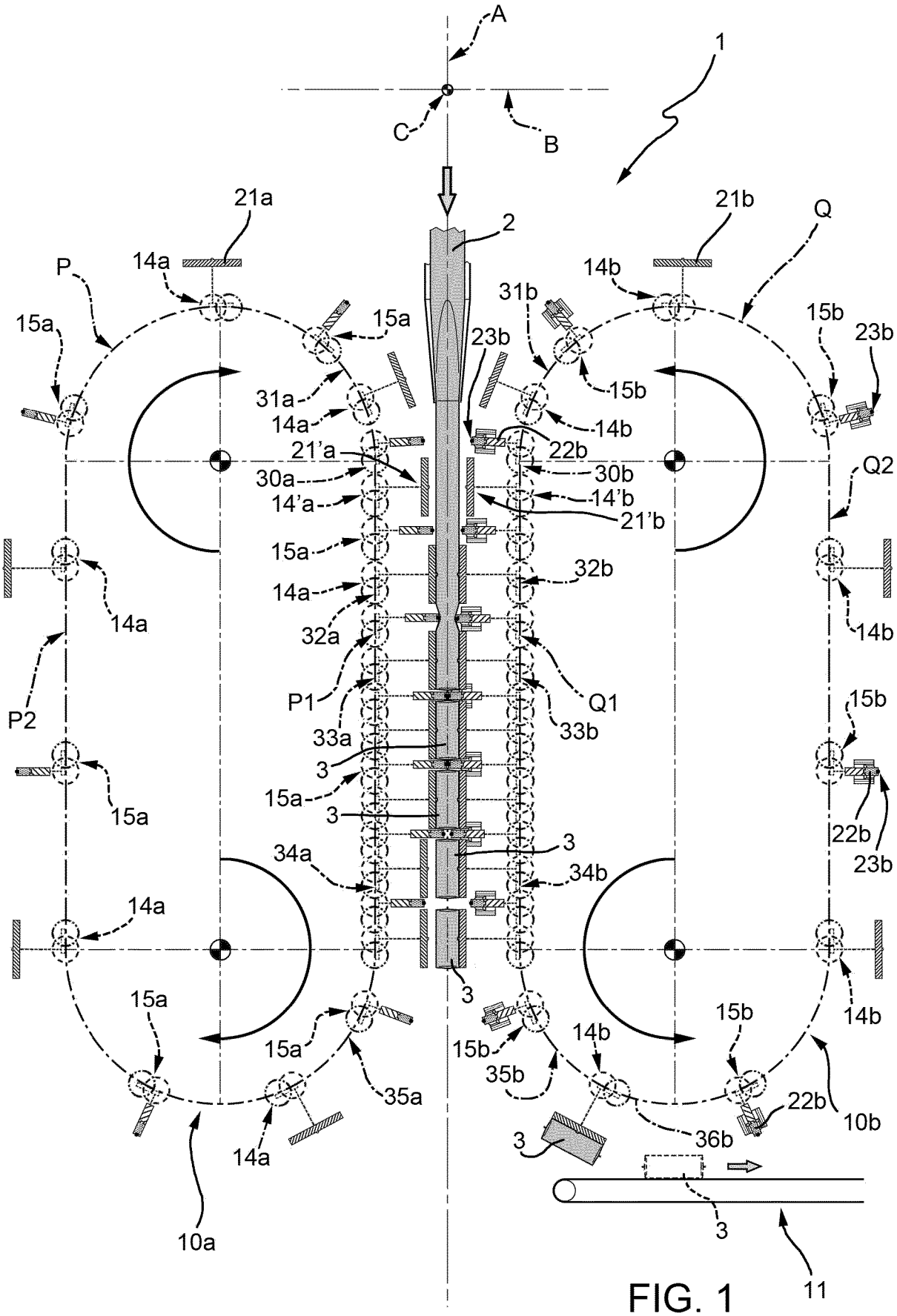
xxiv) moving an additional first element (15b) along an additional track (13b); said additional first element (15b) comprising the other one of a counter-sealing element (22a) and a sealing element (22b); said sealing element (22b) and said counter-sealing element (22a) cooperating with one another to seal said tube (2), when set in said first operative positions;

xxv) moving an additional second element (14b) along said additional track (13b); said additional second element (14b) comprising an additional first half-shell (21b); said first half-shell (21a) and said additional first half-shell (21b) cooperating with one another to control the volume of said pack (3) in formation, when set in said second operative positions; and

xxvi) moving said additional first element (15b) and said additional second element (14b) independently from one another.

20.- The method of any one of the claims 16 to 19, characterized by comprising the step xxvii) of directly receiving discharged packs (3) on a discharge conveyor

(11) in said staggered position with respect to said advancing first direction (A).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B
C
1
2
21a
21b
Q
P
14a
14b
15a
15b
23b
31a
31b
21'a
22b
30a
30b
14'a
14'b
21'b
Q2
32b
32a
P1
Q1
33a
33b
3
34a
34b
35a
35b
36b
10a
10b
11
P2

FIG. 1

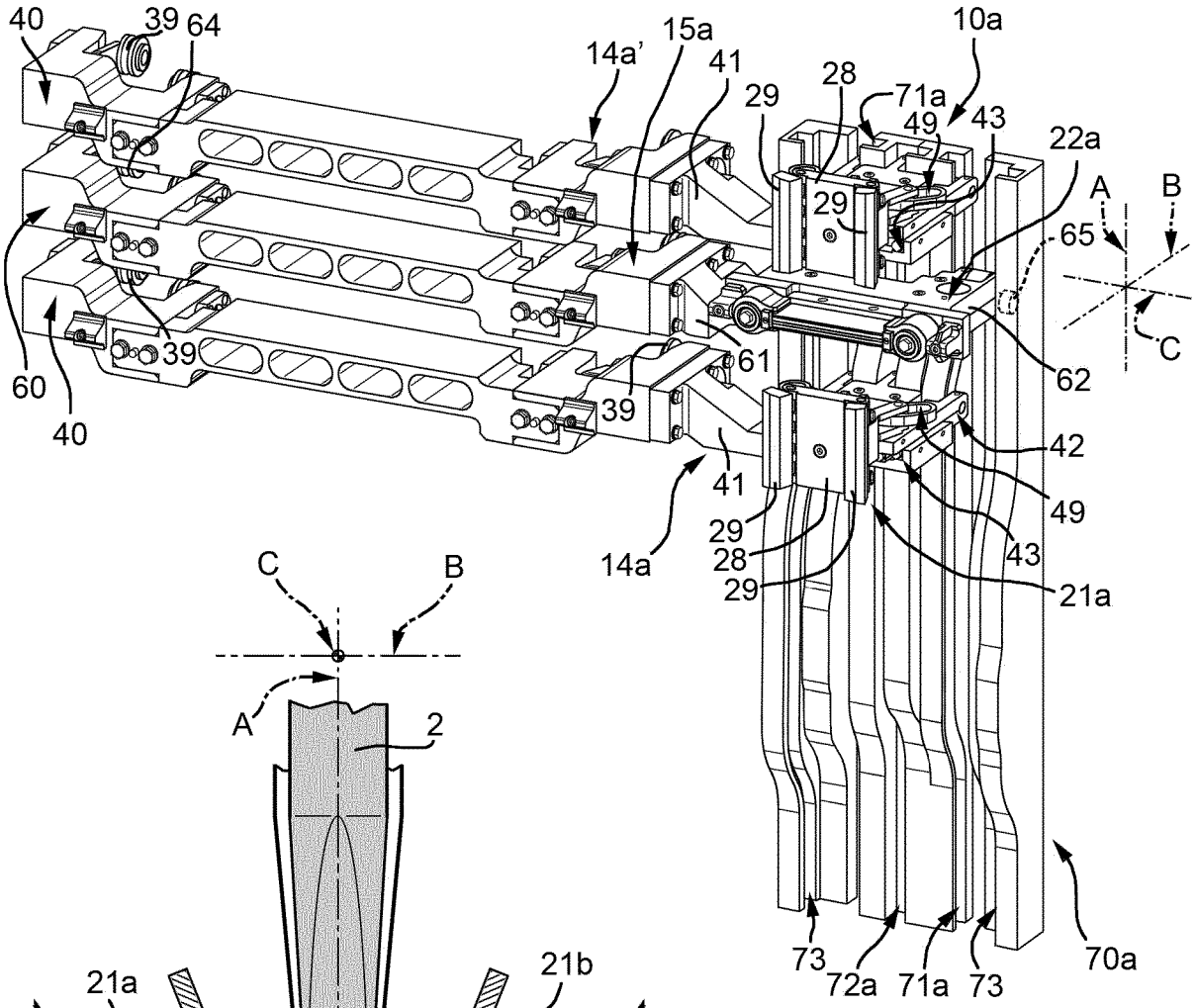

40
39
64
14a'
15a
41
29
28
71a
49
43
10a
22a
A
B
65
C
62
42
49
43
21a
29
28
29
14a
41
61
39
39
60
40
73
72a
71a
73
70a

FIG. 2

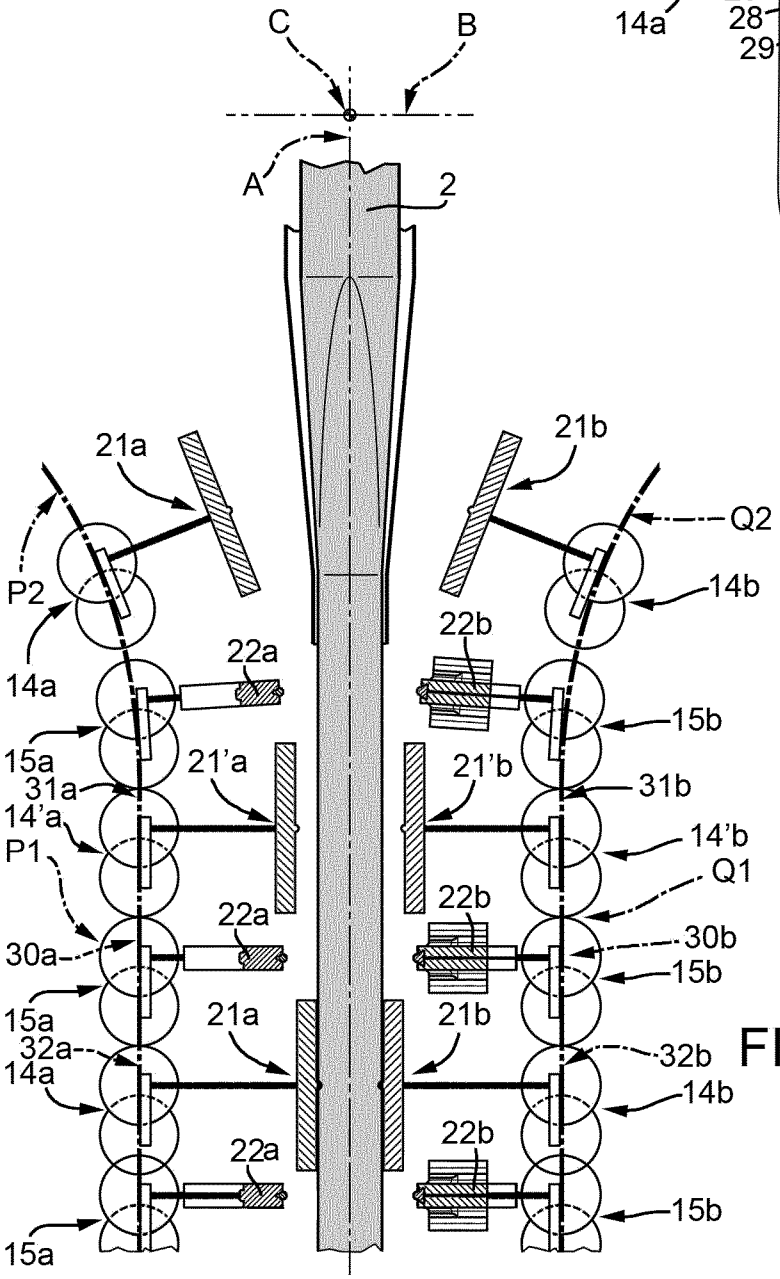

C
B
A
2
21a
21b
Q2
P2
14a
14b
22a
22b
15a
15b
21'a
21'b
31a
31b
14'a
14'b
P1
Q1
22a
22b
30a
30b
15a
15b
21a
21b
32a
32b
14a
14b
22a
22b
15a
15b

FIG. 5

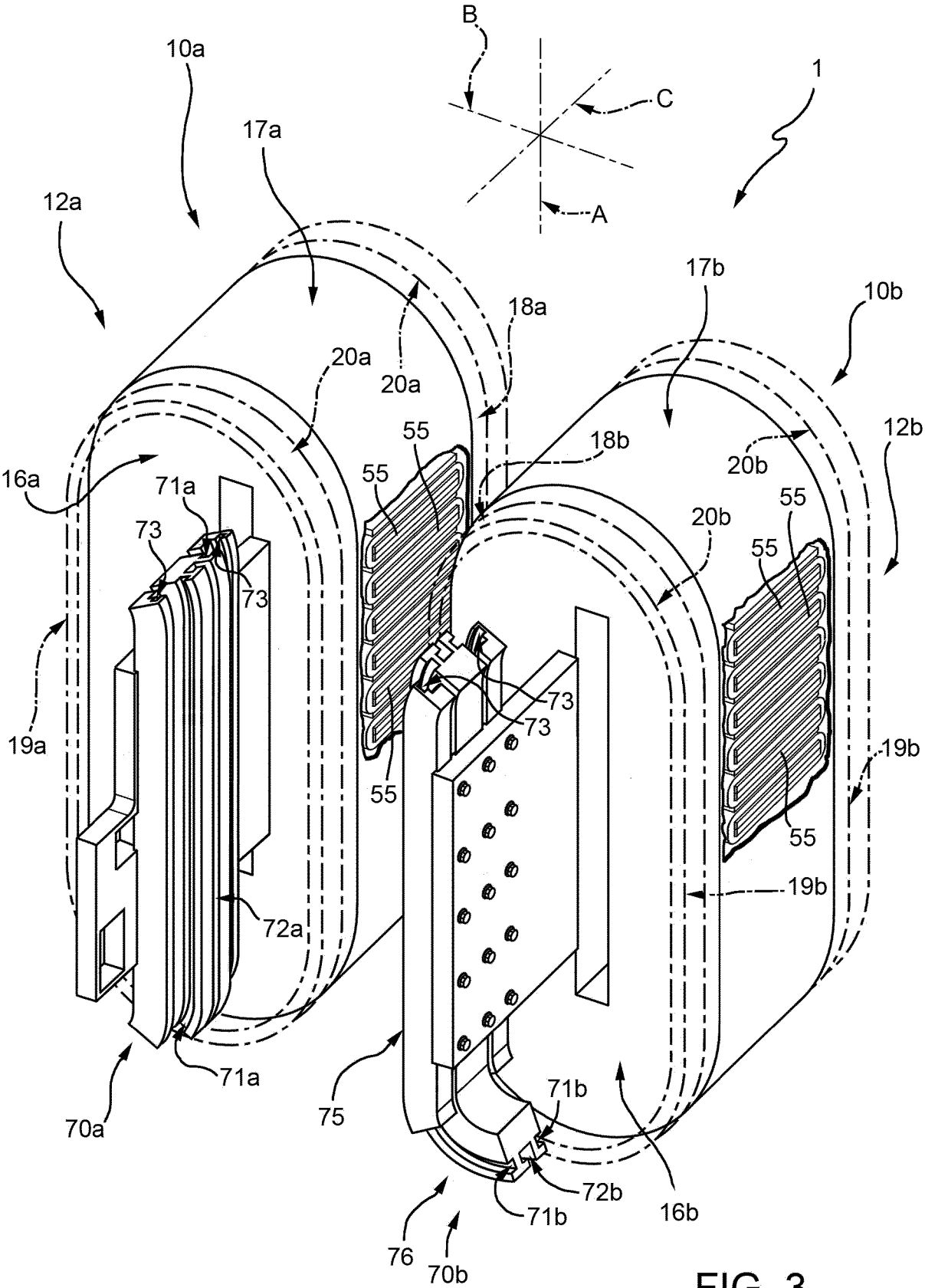

B
C
A
1
10a
17a
12a
17b
10b
18a
20a
20a
18b
20b
12b
55
55
55
55
55
55
16a
71a
73
73
73
73
19a
19b
19b
72a
71a
70a
75
71b
72b
71b
16b
76
70b

FIG. 3

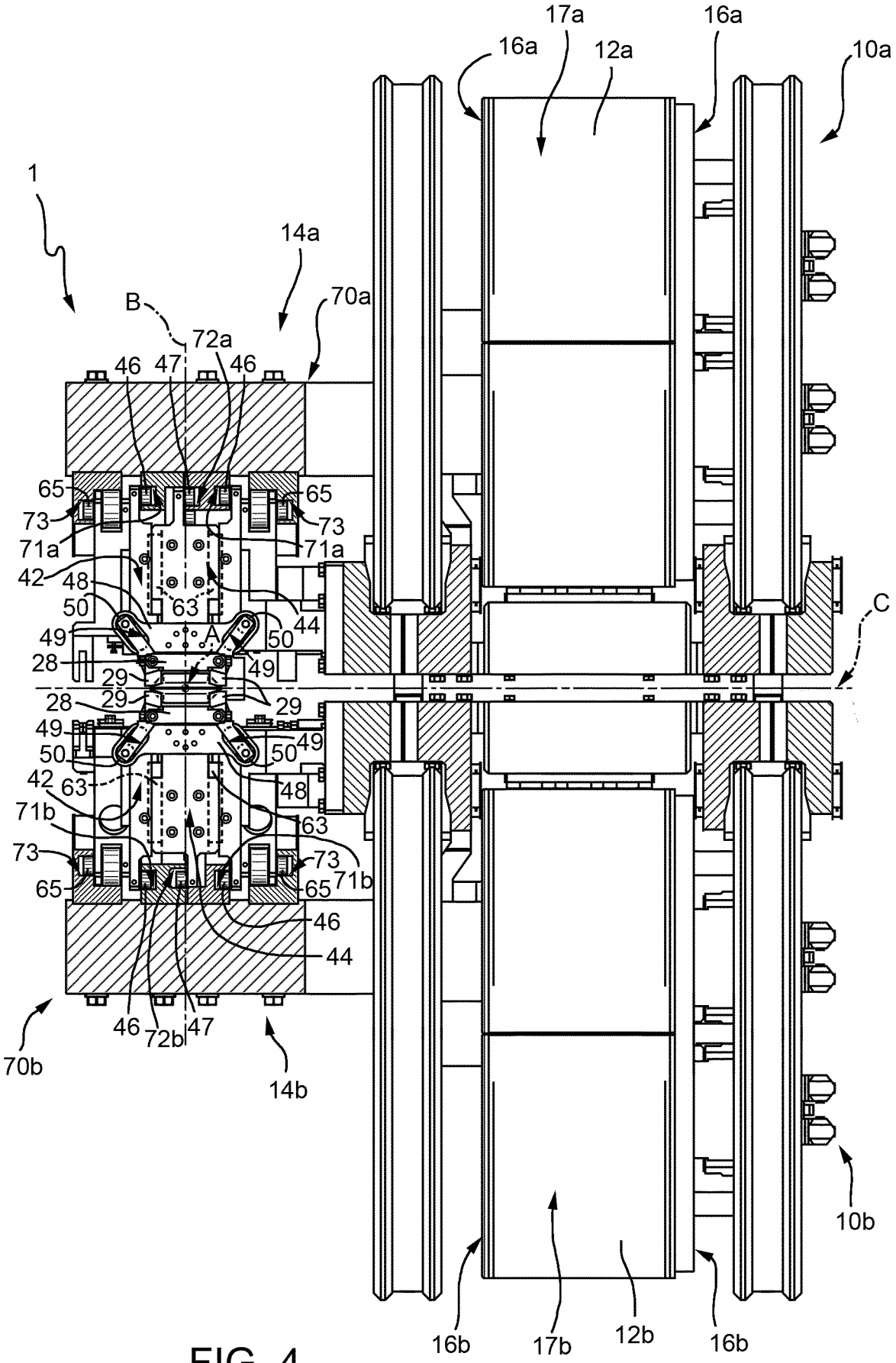
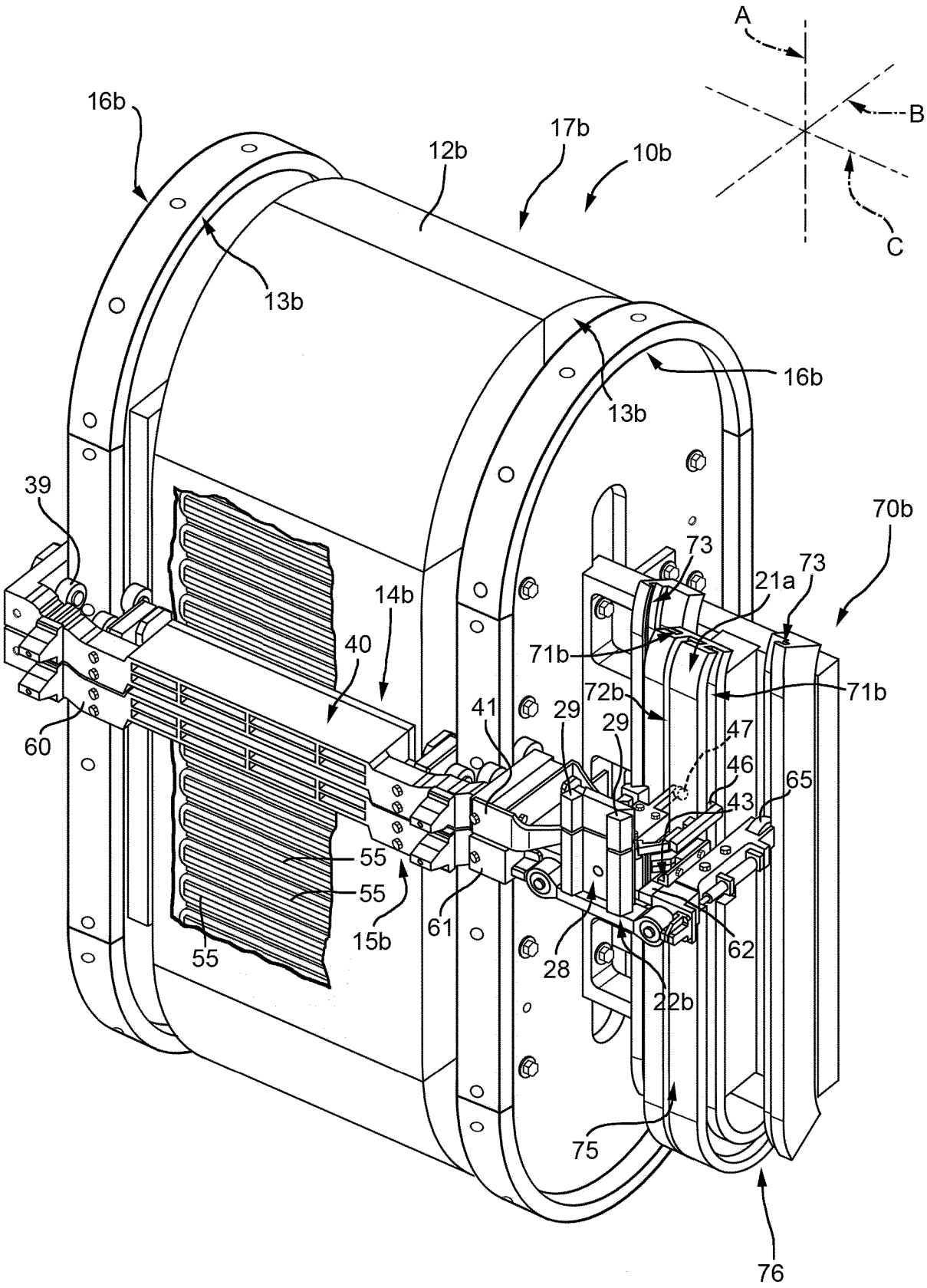

17a
16a
16a
12a
10a
1
14a
70a
B
72a
46
47
46
65
73
71a
42
48
50
63
44
A
49
28
29
C
10b
16b
17b
12b
16b
71b
73
65
46
72b
47
70b
14b

FIG. 4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B
C
16b
12b
17b
10b
13b
16b
13b
39
70b
73
21a
73
14b
40
71b
72b
71b
41
29
29
47
46
43
65
60
55
55
55
15b
61
28
62
22b
75
76

FIG. 6

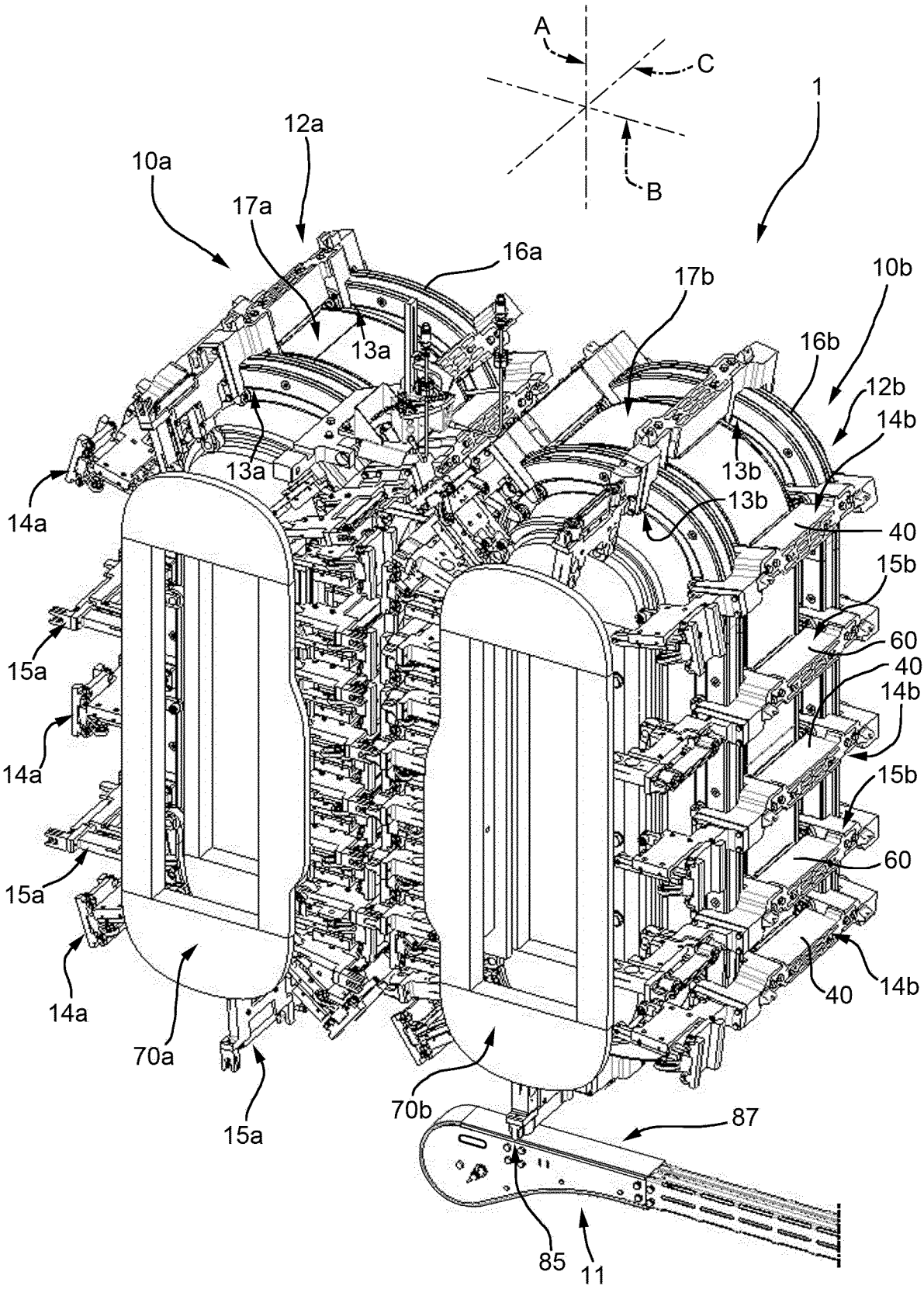
A
C
B
1
12a
10a
17a
16a
17b
10b
16b
12b
14b
13a
13a
13b
13b
14a
40
15b
60
15a
40
14b
14a
15b
60
15a
14a
40
14b
70a
70b
87
15a
85
11

FIG. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/052112

A. CLASSIFICATION OF SUBJECT MATTER
INV. B65B9/10 B65B51/30 B65B61/24 B65B61/28 B29C65/00
B29C65/02 B65B9/20
ADD.
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B29C B65B

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

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 401 422 A1 (ITALPACK SRL [IT]) 12 December 1990 (1990-12-12) abstract column 5, line 49 - column 9, line 9; figures 1,5,8,9	1-20
A	WO 01/02249 A1 (TETRA LAVAL HOLDINGS & FINANCE [CH]; OTSUKA YUZO [JP]; ONO KAZUYA [JP]) 11 January 2001 (2001-01-11) abstract figures 1,2 page 4, line 14 - page 12, line 22	1-20
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[X] Further documents are listed in the continuation of Box C.

[X] See patent family annex.

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

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

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
18 April 2016	26/04/2016

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

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INTERNATIONAL SEARCH REPORT

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 887 265 B1 (TETRA LAVAL HOLDINGS & FINANCE [CH]) 20 November 2002 (2002-11-20) cited in the application abstract figures 1-4 columns 3-9	1-20
A	WO 00/64741 A2 (INT PAPER CO [US]) 2 November 2000 (2000-11-02) cited in the application abstract figures 1-25 pages 5-30	1-20

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International application No
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Information on patent family members

International application No
PCT/EP2016/052112

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		WO 0064791 A1	02-11-2000
