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

(11) **EP 3 666 413 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
21.07.2021 Bulletin 2021/29

(21) Application number: **19214468.1**

(22) Date of filing: **09.12.2019**

(51) Int Cl.:
B21D 43/06 *(2006.01)* ***B21D 51/44*** *(2006.01)*
B21D 43/04 *(2006.01)* ***B65G 25/02*** *(2006.01)*
B65H 5/16 *(2006.01)* ***B21D 43/02*** *(2006.01)*

(54) METHOD AND APPARATUS FOR ADVANCING PRODUCTS TO BE FORMED

VERFAHREN UND VORRICHTUNG ZUM VORSCHIEBEN VON ZU FORMENDEN PRODUKTEN

PROCÉDÉ ET APPAREIL POUR FAIRE AVANCER DES PRODUITS DEVANT ÊTRE FORMÉS

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

(30) Priority: **13.12.2018 IT 201800011062**

(43) Date of publication of application:
17.06.2020 Bulletin 2020/25

(73) Proprietor: **SACMI COOPERATIVA MECCANICI IMOLA SOCIETA' COOPERATIVA**
40026 Imola (BO) (IT)

(72) Inventors:
- **MIRRI, Marco**
  48024 Massalombarda (RA) (IT)
- **VILLA, Fabrizio**
  40026 Imola (BO) (IT)

(74) Representative: **Villanova, Massimo et al**
Luppi Intellectual Property Srl
Viale Corassori, 54
41124 Modena (IT)

(56) References cited:
EP-A1- 1 779 941
EP-A1- 3 031 753
JP-U- S6 296 930
US-A- 2 196 240
US-A- 3 542 359
US-A- 5 878 640

EP 3 666 413 B1

Description

Background of the invention

[0001] The invention relates to a method and/or an apparatus for advancing products to be formed.

[0002] Specifically but not exclusively, the invention can be applied for advancing metal alloy or aluminum alloy products in sheet form to be formed.

Prior art

[0003] In the technical sector of forming, for the production for example of components intended for making caps used for closing the opening of a container or of a bottle, crown caps, threaded caps and so on, the different markets face constantly the impelling need to "produce more with less", i.e. to improve productivity and productive efficiency.

[0004] In the context of forming machines, production lines are known comprising apparatuses for advancing sheet metal products in sheet form that are connectable to equally known forming apparatuses. The sheet metal sheets have a dimension that is substantially less than the other dimensions, for example the thickness (of the order of a tenth of a millimeter) substantially less than the width (comprised for example between 200 and 300 millimetres) and the length (comprised for example between 800 and 900 millimetres).

[0005] US-A-5878640 discloses a method for advancing products in the form of sheet metal comprising the steps of: a) transporting a first product of a plurality of products in a first zone of an advancing apparatus; b) in said first zone abutting first pushing means against said first product; c) by means of said first pushing means , advancing said first product from said first zone to a second zone of said advancing apparatus along a second direction, with continuous motion and subsequently with intermittent motion; d) transporting a second product of said plurality of products in said first zone; e) abutting second pushing means, movable along said at least a first direction, against said second product; f) by means of said second pushing means advancing said second product towards said second zone along said second direction initially with continuous motion and subsequently with intermittent motion, said step f) being carried out at least partly simultaneously with said step c); g) in said second zone moving away said first pushing means from said first product; h) continuously shifting said first pushing means along a fourth direction parallel and opposite to said second direction to take said first pushing means back to said first zone, whereas said second pushing means keep advancing with said second product along said second direction. US-A-5878640 discloses also the apparatus features corresponding to the above method features.

[0006] Some known production lines comprise a press driven cyclically to press a sheet of sheet metal, a first handling device that is movable along a first substantially horizontal translation direction to approach and/or move away from the press and a second handling device that is movable along the first translation direction and along a second transverse direction that is orthogonal to the first translation direction. The first handling device comprises a gripper fitted at a first end thereof to grasp an edge of the sheet and translate the sheet by steps along the first direction, whilst the second handling device also comprises a gripper fitted at a first end thereof to grasp the edge of the sheet in a portion that is different from that grasped by the first handling device, and translate the edge of the sheet by steps along the first and the second direction. A metal sheet is supplied to the die through the first handling device to perform a first part of the pressing cycles; the metal sheet is then transferred from the first handling device to the second handling device to perform a second part of the pressing cycles. In the first part of the pressing cycle at the end of each advancing or retracting step of the first handling device pressing is performed on the sheet, pressing a series of shapes. In the second step of the pressing cycle the first handling device frees the sheet from the grip and the second handling device grasps and translates the aforesaid sheet by performing a movement given by the combination of step movements both along the first (advancing and/or retraction) direction (one side and/or the other).

[0007] Other known production lines comprise a conveying unit comprising in turn two rails that are parallel spaced apart from one another so as to act as sliding guides for a workpiece to be transferred, a bar positioned between the two rails and suitable for ensuring support during sliding of the workpiece. The conveying unit further comprises a carriage that is slidable along a guide bar consisting of a substantially trapezium frame. The carriage is moved by a chain that is in turn moved by a sprocket that is integral with a shaft of a gear motor. At the ends of the carriage a first rod and a second rod are fitted, on the first rod a first crosspiece is fitted and on the second rod a second crosspiece is fitted. Each of the crosspieces has shaped elements at the end that are suitable for abutting on the edges of the workpiece and translating the workpiece forwards. In use, the carriage can advance from an initial position to take the shaped elements of the first crosspiece to abut on a first workpiece and advance the first workpiece from a preset first position to a preset second position. The carriage is retracted to be returned to the first position, leaving the first workpiece in the second position; the carriage is then advanced again to take the shaped elements of the first crosspiece to abut on a second workpiece and to take the shaped elements of the second crosspiece to abut on the first workpiece remaining stationary in the aforesaid second position. Owing to the structural configuration of the carriage and the movements thereof, it is possible to achieve advancing of several workpieces with reciprocating movement to a machine tool, for example

a forming machine.

[0008] One drawback of the use of the manipulators and of the conveying unit that have just been disclosed consists in that advancing of the products is decidedly slow, the products being brought towards and inserted into the forming machine only with intermittent motion. Also the structure of the production lines that has just been disclosed is complex and the operation is not very reliable: in fact, if one of the two manipulators or the conveying unit were to get damaged or break, the operation of the entire production line would be compromised and stopped. The production time for the finished product has thus increased.

[0009] Further known production lines comprise a conveying device comprising a feed screw connected to and driven by a stepper servomotor for conveying objects, for example bottles, both in continuous/continuous mode and in intermittent/step mode.

[0010] Advancing products in the form of sheets of sheet metal by a feed screw is nevertheless extremely critical because of the geometry and dimensions of the sheet metal sheet product to be conveyed.

[0011] In the light of what has been set out above, there is thus ample scope for improvements to be made to current systems for advancing products to be formed.

Summary of the invention

[0012] One object of the present invention is to provide a method and/or an apparatus that is able to overcome one or more of the aforesaid limits of the prior art.

[0013] One object of the invention is to improve the methods and/or the advancing apparatuses for advancing sheet metal alloy or aluminum alloy products in sheet form.

[0014] One object of the invention is to advance a product in sheet metal form rapidly and precisely.

[0015] One object of the invention is to release the product in metal sheet form in a forming apparatus simply and precisely.

[0016] One advantage is to reduce the time for supplying a forming apparatus.

[0017] One advantage is to avoid the productive cycle stalling if a fault state of an advancing apparatus occurs.

[0018] One advantage is to provide a constructionally simple advancing apparatus and a cheap advancing method that is easy to implement.

[0019] Such objects and advantages, and still others, are achieved by a method and an apparatus according to the features of independent claims 1 and 9.

[0020] According to the invention, the method for advancing sheet metal products in sheet form to be formed comprises the steps of conveying a first product of a plurality of products to a first zone of an advancing apparatus; taking first movable pushing means at least along a first direction to abut on the first product; advancing said first product from the first zone to a second zone of the advancing apparatus along a second direction, transverse to said at least one first direction, first with continuous motion and subsequently with intermittent motion; conveying a second product to the first zone; taking second pushing means, which is movable along the at least one first direction, to abut on the second product; advancing the second product to the second zone along the second direction initially with continuous motion and subsequently with intermittent motion at least partly simultaneously to the advancing of the first product; in the second zone moving the first pushing means away from the first product, by moving the first pushing means along at least one third direction, transverse to the second direction; moving with continuous motion the first pushing means along a fourth direction parallel to and opposite the second direction to return the first pushing means to the first zone, whilst the second pushing means continues to push the second product along the second direction.

[0021] According to the invention, the advancing apparatus for advancing a plurality of sheet metal products in sheet form to be formed comprises first pushing means that is movable along at least one first direction to abut on a first product in a first zone of the advancing apparatus, along a second direction, transverse to the first direction, to advance the first product of the first zone to a second zone of said advancing apparatus, along at least one third direction, which is transverse to said direction, to move away from the first product, and along a fourth direction, parallel to and opposite the second direction, to move again to the first zone; first motor means connected to the first pushing means and drivable for moving the first pushing means along the second direction with continuous motion and/or with intermittent motion and for moving the first pushing means along the fourth direction with continuous motion; first actuating means connected to the first pushing means to move the first pushing means along the at least one first direction and/or along the at least one third direction; second pushing means which are movable along the at least one first direction to abut on a second product in the first zone, along said second direction to advance the second product from the first zone to the second zone, along the at least one third direction to move away from the second product, and along the fourth direction to move again to the first zone; second motor means connected to the second pushing means and drivable to advance the second pushing means along the second direction with continuous motion or with intermittent motion at least in part whilst the first motor means advances the first pushing means, and for moving the second pushing means along the fourth direction with continuous motion; and second actuating means connected to the second pushing means to move the second pushing means along the at least one first direction and along the at least one third direction.

[0022] Owing to the invention, it is possible to advance a sheet product made of material to be formed to a forming station by performing simply, rapidly and effectively

an abutment and/or moving away the pushing means from the product.

Brief description of the drawings

[0023] Further features and drawings of the invention will be clearer from the description that follows with the help of the attached drawings that show an embodiment of the invention by way of non-limiting example, in which:

Figure 1 is a perspective view of the advancing apparatus according to the invention;
Figures 2A and 2B are lateral schematic views of the advancing apparatus of Figure 1 that show the first pushing means in the low position and in the high position;
Figure 3 is a section view of an actuating unit of the advancing apparatus of Figure 1;
Figures 4 to 7 are detailed views of Figure 1;
Figures 8 to 15 are schematic plan views that show the supply steps of a supplying a plurality of sheets to a forming machine according to the invention.

Detailed description

[0024] With reference to the attached figures, an advancing apparatus 1 is shown schematically for advancing sheet metal products in sheet form made of a deformable material, in particular of metal alloys or aluminum alloys that can be cyclically subjected to plastic deformation operations, such as forming or drawing operations, so as to take on a desired shape at the end of a processing cycle, for example the shape of a cap. The advancing apparatus 1, couplable with a forming apparatus S illustrated in the attached figures, has the function of advancing a plurality of products P1, P2, P3,... in sheet metal sheet form to the aforesaid forming apparatus.

[0025] Each product can comprise a first edge Pa and a second edge Pb that are mutually opposite, a third edge Pc and a fourth edge Pd that are also mutually opposite and arranged transversely to the first edge Pa and to the second edge Pb.

[0026] The thickness of the products can be variable but nevertheless suitable for the operation of forming/pressing for obtaining final geometry that is free of defects.

[0027] At least one of the first edge Pa, the second edge Pb, the third edge Pc or the fourth edge Pd can be shaped; for example in Figures 8 to 15 a product is shown in which the third edge Pc and the fourth edge Pd comprise an edge portion in the form of a circumference arch and a linear edge portion.

[0028] On each portion of the plurality of products P1, P2, P3 a plurality of portions can be provided with notches made to facilitate positioning of the product in the forming machine S. These portions are in fact intended to be cut at the inlet of the forming machine to obtain a plurality of openings; into the aforesaid openings a plurality of movable guide pins can then be inserted, which are not illustrated, and arranged in the forming machine S. The plurality of pins can be movable in a direction transverse to the advancing direction of the product inside the forming machine S. In the forming machine S it is known to advance the general product with intermittent motion, alternating a step in which the product is stationary and a step thereof in which the product advances to take another portion of product to the forming area. When the product is stationary, the plurality of guide pins is inserted into the openings; in this manner correct positioning of the sheet inside the forming machine S is ensured and an accidental movement is prevented.

[0029] In Figure 1 the advancing apparatus 1 is shown in schematic form; the advancing apparatus 1 can comprise a support frame, which for the sake of simplicity is not shown in the attached figures, resting on a support plane. At least one first actuator unit 11 known to expert persons can be fitted to the support frame.

[0030] The first actuator unit 11 can comprise an actuator of electromechanical type, for example a screw/nut unit, screw/nut screw combinations or ball screw, rack and pinion, belt or chain, or linear motors, or pneumatic, magnetic, hydraulic actuators and so on.

[0031] If the first actuator unit 11 is arranged for converting rotary motion into linear motion, it can be connected to first motor means 6 of commercially known type, i.e. comprising an electric motor, speed reducing members (if provided), an electronic module and angular position transducing means, for example an encoder. If on the other hand the first actuator unit 11 is not arranged for converting rotary motion into linear motion, it can be connected to first motor means 6 of linear type provided with linear position transducing means.

[0032] The first motor means 6 can be fitted to an end of the first actuator unit 11.

[0033] The first motor means 6 can be connected to an outer source that is not illustrated (for example a computer) by using cables or WiFi, NFC, Bluetooth network.

[0034] The angular or linear transducing means, which is not illustrated, is able to measure the aforesaid angular or linear movement of the first motor means 6 and to send an (electric) position signal to the outer source.

[0035] In use, the outer source can be configured to process the received position signal and send an (electric) drive signal to the first motor means 6, for example for driving the first motor means 6 with continuous motion for a first interval of time or with intermittent motion for a second interval of time. With the first interval of time and with the second interval of time, an angular or set linear, continuous or intermittent movement of the first motor means 6 can be associated.

[0036] The outer source can also be configured to send an (electric) inversion signal to the first motor means 6 to change the rotation direction or advancing direction of the aforesaid first motor means 6.

[0037] In the embodiment illustrated in Figure 1, also a second actuator unit 13 that is structurally identical to

the first actuator unit 11 can be fitted to the support frame. The second actuator unit 13 can be connected to the second motor means 7, which is structurally identical to the first motor means 6.

[0038] The second motor means 7 can be driven independently of the first motor means 6. In other words, the second motor means 7 can be connected to the outer source, can be provided with linear or angular position transducing means arranged for measuring the movement of the second motor means and sending another positioning signal to the aforesaid outer source. The outer source is thus configured to send another (electric) drive signal to the second motor means 7 to drive the second motor means 7 with continuous motion for a first interval of time or with intermittent motion for a second interval of time; and/or to send another (electric) inversion signal to the second motor means 7 to change the rotation direction or the advancing direction thereof. The drive signal and the other drive signal can also be sent simultaneously to the first motor means 6 and to the second motor means 7.

[0039] The second actuator unit 13 is arranged on the support frame parallel to the first actuator unit 11, at a distance from the latter that is substantially comparable with the width of the sheet metal products in sheet form, for example with the first edge Pa.

[0040] On the first actuator unit 11 and on the second actuator unit 13 guide means can be fitted for the plurality of products P1, P2, P3, for example a first guide fitted to the first actuator unit 11 and a second guide fitted to the second actuator unit 13. The guide means is not shown in detail in the attached figures in order not to hide other components of the advancing apparatus 1 that will be disclosed below. The guide means defines an advancing plane 16 for the plurality of products P1, P2, P3, shown schematically and with lines shown in Figure 1. The advancing plane 16 can comprise a first zone 1a positioned substantially near a first end of the first actuator unit 11, and a second zone 1b positioned substantially near a second end of the first actuator unit 11 and opposite the aforesaid first end.

[0041] The first zone 1a can be arranged near a loading zone, which for the sake of simplicity is not shown, in which the plurality of products P1, P2,P3 can be arranged.

[0042] The second zone 1b can on the other hand be opposite an inlet zone of the forming machine S, not shown in Figure 1.

[0043] The advancing apparatus 1, can be provided in the second zone 1b with a position sensor, which is not shown, arranged for detecting the position of a general portion of the plurality of products P1, P2, P3 before the product is inserted into the forming machine S. The position sensor can be of the inductive, capacitive, magnetic, ultrasound or optical type.

[0044] On the first actuator unit 11 a first portion L1 and a second portion L2 adjacent to the first portion L1 can be defined, as shown in Figures 2A and 2B. The first portion L1 and the second portion L2 connect the first end to the second end of the first actuator 11. On the second actuator unit 13, a third portion L3 and a fourth portion L4 adjacent to the third portion L3 can be defined. The first portion L3 and the second portion L4 connect the first end to the second end of the second actuator 13.

[0045] On the first actuator unit 11, in particular between the actuator unit 11 and the advancing plane 16, a first carriage 10 can be arranged that is connected to the movable element of the first actuator unit 11 (for example connected to the nut if a nut-screw actuator unit is provided, or connected to the belt or piston, and so on). The first carriage 10 can slide on a base surface 11a of the first actuator unit 11 to move between the first end and the second end of the aforesaid first actuator unit 11.

[0046] When the first actuator unit 11 is driven, the first carriage 10 moves to advance a first product P1 of the plurality of products P1, P2, P3 from first zone 1a to the second zone 1b.

[0047] On the second actuator unit 13, in particular between the second actuator unit 13 and the advancing plane 16, a second movable carriage 12 can be arranged, connected to the movable element of the second actuator unit 13, as explained previously. The second carriage 12 can slide on a base surface 13a of the second actuator unit 13 to move between the first end and the second end thereof.

[0048] When the second actuator unit 13 is driven, the second carriage 12 moves to advance a second product P2 of the plurality of products P1, P2, P3 from the first zone 1a to the second zone 1b.

[0049] In Figure 1, merely by way of example, the advancing apparatus 1 is shown in which the first carriage 10 is positioned at a first end of the first actuator unit 11 and the second carriage 12 is positioned at a second end of the second actuator unit 13.

[0050] Conveying means can be provided that are known to an expert person and which is not illustrated, for example a mechanical arm or a pushing device, to convey one product at a time of the plurality of products P1, P2, P3 from the loading zone to the first zone 1a of the advancing device 1. In particular the conveying means can be configured to push an edge of the product, for example the first edge Pa.

[0051] The first carriage 10 and the second carriage 12 are structurally similar.

[0052] The first actuator unit 11 can be provided with a limit switch 4 that is able to detect the presence of the first carriage 10. The limit switch 4 is shown in Figure 5, and can be fitted to the side wall of the first actuator unit 11 at a set distance from the end of the aforesaid actuator unit 11. The limit switch 4 is arranged for checking that everything that is measured by the (linear or rotary) position transducing means corresponds to the actual position of the movable part of the actuator, and thus of the first carriage 10. In this manner, it is possible to detect possible (undesired) problems during the driving of the first actuator unit 11, for example sliding of the locking

elements by friction, or incorrect meshing between the timing belt and the toothed pulley.

[0053] Similarly, the second actuator unit 13 can be provided with a limit switch 4' that is structurally and functionally identical to the limit switch 4, and is also fitted to the side wall of the second actuator unit 13 at a set distance from the end of the aforesaid actuator unit 13. The limit switch 4, 4' can be of the magnetic type.

[0054] The first carriage 10 can be provided with an abutting element 19 and the second carriage 12 can be provided with an abutting element 19'. The abutting element 19, 19' can be made of ferrous material, arranged for interacting and/or cooperating with the first limit switch 4, 4'. The elongated element 19 can be fixed to the first carriage 10 and the abutting element 19' can be fixed to the second carriage 12 by known fixing means, for example by screws or bolts. The abutting element 19 extends substantially parallel to the side wall of the first actuator unit 11 (likewise, the abutting element 19' extends substantially parallel to the side wall of the second actuator unit 13) so as to be able to face the limit switch 4 (or the limit switch 4') when the first carriage 10 (or the second carriage 12) reaches the vicinity.

[0055] The abutting element 19, 19' is thus designed to interact with the limit switch 4, 4' to enable the aforesaid limit switch 4 to perform the previously explained control function.

[0056] It must be understood that the limit switch 4, 4' can be of inductive, optical type and so on. In embodiments that are not illustrated the advancing apparatus need not be provided with the aforesaid limit switch.

[0057] A support bracket 14 is fitted and fixed to the first carriage 10. Actuating means of known type can be connected to the support bracket 14, for example pneumatic actuators.

[0058] In the embodiment shown in Figures 3 to 6, the support bracket 14 can substantially take on an "S" shape, comprise in this manner a base portion 14a fixed to the base of the first carriage 10, a side portion 14b to which the first actuating means 8 can be fixed (disclosed below), and a further base portion 14c to which a first cable-holder chain 17 can be connected in a fixed manner, that is arranged for housing a plurality of connecting cables between the outer source and the first motor means 6.

[0059] Similarly, a support bracket 14' can be fitted and fixed to the second carriage 12 that can adopt a substantially "S" shape so as to comprise a base portion 14a' that is fixed to the base of the second carriage 12, a side portion 14b' to which second actuating means 9 can be fixed (disclosed below), and a further base portion 14c' to which a second cable-holder chain 18 can be connected in a fixed manner, that is arranged for housing a plurality of connecting cables between the outer source and the second motor means 7.

[0060] The first actuating means 8 and the second actuating means 9 are structurally similar and can comprise actuators of pneumatic type. The first actuating means 8 and the second actuating means 9 can comprise pneumatic actuators of linear type.

[0061] Each of the actuators can comprise a hollow cylinder 8a, 9a that acts as a guide for a piston 8b, 9b inserted inside the aforesaid hollow cylinder 8a, 9a.

[0062] The first actuating means 8 and the second actuating means 9 are placed in fluid connection with pressure means, for example compressors of known type, arranged for dispensing a flow of pressurized air to move the piston 8b, 9b inside the hollow cylinder 8a, 9a, in particular from an upper end 22 to a lower end 23 of the hollow cylinder 8a or vice versa, as will be explained in detail below.

[0063] First pushing means 2 can be connected by fixing means of known type, for example screws or bolts, to the first actuating means 8, in particular to the piston 8b. The first pushing means 2 can comprise a support plate 2c to which a first pushing element 2a and a second pushing element 2b are fitted.

[0064] The piston 8b can be driven to move inside the hollow cylinder 8a along at least one first direction D1, in particular from the lower end 23 to the upper end 22 of the hollow cylinder 8a (from the bottom to the top) so as to move the first pushing element 2a and the second pushing element 2b along the at least one first direction D1, taking the first pushing element 2a and the second pushing element 2b to abut on the first product P1 arranged on the advancing plane 16 in the first zone 1a. The first pushing element 2a and the second pushing element 2b can be taken to abut in particular on the third edge Pc.

[0065] Also second pushing means 3 can be connected to the second actuating means 9, in particular to the piston 9b, by fixing means, for example screws or bolts. The second pushing means 3 can comprise a support plate 3c to which a first pushing element 3a and a second pushing element 3b are fitted.

[0066] The second pushing means 3 is movable along the at least one first direction D1 to abut, in the first zone 1a, on a second product P1.

[0067] The piston 9b can be driven to move inside the hollow cylinder 9a along the at least one first direction D1 in particular from the lower end 23 to the upper end 22 of the hollow cylinder 9a (from the bottom to the top) so as to move the first pushing element 3a and the second pushing element 3b along the at least one first direction D1 taking the first pushing element 3a and the second pushing element 3b to abut on the second product P2 arranged on the advancing plane 16 in the first zone 1a. The first pushing element 3a and the second pushing element 3b can be taken to abut in particular on the third edge Pc.

[0068] The first pushing element 2a, 3a, and the second pushing element 2b, 3b can be shaped polyhedrons, for example parallelepipeds that have an undercut 20, as shown in Figures 4 to 6. The undercut 20 is so dimensioned as to permit a simple contact, without blows or undesired collisions, between the pushing element and

the third edge Pc of the general product. The first pushing element 2a, 3a and the second pushing element 2b, 3b are arranged parallel to one another on the respective support plates 2c, 3c.

[0069] The first pushing element 2a and the second pushing element 2b are spaced apart from one another so as to abut on the linear edge portion of the third edge Pc, the same applies to the first pushing element 3a and the second pushing element 3b.

[0070] The first motor means 6 is driven to advance the first carriage 10 along a second direction D2 from the first end to the second end of the first actuator unit 11. The first motor means 6 is driven to advance the first carriage 10 with continuous motion for the first interval of time, and with intermittent motion for the second interval of time.

[0071] The second motor means 7 is also driven to advance the second carriage 12 (and thus also the second pushing means 3) along the second direction D2 from the first end to the second end of the second actuator unit 13. In particular, the second motor means 7 is driven to advance the second carriage 12 with continuous motion for the first interval of time, and with intermittent motion for the second interval of time.

[0072] The second direction D2 is a substantially horizontal direction, is oriented parallel to the support plane on which the advancing apparatus 1 rests. The aforesaid at least one first direction D1 can be transverse to the second direction D2. The at least one first direction D1 can be tilted by an angle comprised between 40° and 45°, in particular 42°, with respect to the aforesaid second direction D2.

[0073] The first motor means 6 is driven with intermittent motion to advance the first carriage 10 (and thus also the first pushing means 2 and the first product P1) to the forming machine S in coordination with the intermittent movements of the tools of the aforesaid forming machine S. In the same manner, the second motor means 7 is driven with intermittent motion to advance the second carriage 12 (and thus also the second pushing means 3 and the second product P2) to the forming machine S in coordination with the intermittent movements of the tools of the aforesaid forming machine S.

[0074] When the first carriage 10 is advanced along the second direction D2, the first pushing means 2 is arranged for pushing the first product P1, in particular the third edge Pc thereof, on the advancing plane 16 from the first zone 1a to the second 1b.

[0075] Similarly, when the second carriage 12 is advanced along the second direction D2, the second pushing means 3 is arranged for pushing the second product P2, in particular the third edge Pc thereof, on the advancing plane 16 from the first zone 1a to the second 1b.

[0076] The first motor means 6 is driven with intermittent motion to advance the first carriage 10 (and thus also the first pushing means 2) with continuous motion for the first portion L1 and with intermittent motion for the second portion L2.

[0077] In the same manner, the second motor means 7 is drivable to advance the second carriage 12 (and thus also the second pushing means 3) with continuous motion for a third portion L3 and with intermittent motion for the fourth portion L4.

[0078] The first portion L1 and the second portion L2 extend in a parallel direction to the second direction D2 to connect the first end to the second end of the first actuator unit 11.

[0079] Also the third portion L3 and the fourth portion L4 extend in a parallel direction to the second direction D2 to connect the first end to the second end of the second actuator unit 13.

[0080] The first portion L1 (or the third portion L3) corresponds to the space traversed by the first pushing means 2 (or by the second pushing means 3) with continuous motion in the first interval of time, before the first product P1 (or the second product P2), in particular the fourth edge Pd of the first product P1 (or of the second product P2), reaches the vicinity of the forming machine. The term "in the vicinity of the forming machine" can mean a portion of the second zone 1b of the advancing apparatus 1 before the inlet zone of the forming machine S, or also the inlet of the aforesaid forming machine S.

[0081] The second portion L2 (or the fourth portion L4) corresponds to the space traversed by the first pushing means 2 (or by the second pushing means 3) with intermittent motion in the second preset interval of time, before the third edge Pc of the first product P1 (or of the second product P2) has reached the vicinity of the forming machine S.

[0082] The first portion L1 can be substantially the same in extent as the third portion L3, whilst the second portion L2 can be substantially the same in extent as the fourth portion L4.

[0083] In the second zone 1b, the piston 8b can be driven to move inside the hollow cylinder 8a, in particular from the upper end 22 to the lower end 23 of the hollow cylinder 8a (from top to bottom) so as to move the first pushing element 2a and the second pushing element 2b along at least one third direction D3 to move the first pushing element 2a and the second pushing element 2b away from the first product P1, in particular from the third edge Pc.

[0084] In the same manner, in the second zone 1b the piston 9b can be driven to move inside the hollow cylinder 9a, in particular from the upper end 22 to the lower end 23 of the hollow cylinder 8a (from top to bottom) so as to move the first pushing element 3a and the second pushing element 3b along the at least one third direction D3 to move the first pushing element 3a and the second pushing element 3b away from the second product P2 in particular from the third edge Pc. The at least one third direction D3 can be transverse to the aforesaid second direction D2.

[0085] Owing to the undercut 20, the first pushing element 2a, 3a and the second pushing element 2b, 3b can be moved away simply from the third edge Pc of the

general product, without blows or undesired gouging.

[0086] It remains understood that at any moment (not necessarily in the first zone 1a or in the second zone 1b), for example during a forced stop and/or fault of the advancing apparatus 1, the possibility of moving the first pushing means 2 and/or second pushing means 3 along the at least one first direction D1 and along the at least one third direction D3 enables the first pushing means 2 and/or second pushing means 3 to be moved away easily from the edge of the product, to then be able to take the first pushing means 2 and/or second pushing means 3 to abut again.

[0087] The at least one third direction D3 can be parallel to and opposite the at least one first direction D1, i.e. the at least one third direction D3 and can be tilted by an angle comprised between 40° and 45°, in particular 42°, with respect to the aforesaid second direction D2.

[0088] It obviously remains understood that the at least one third direction D3 need not be parallel to the at least one first direction D1.

[0089] The first motor means 6 is also drivable to move the first carriage 10 from the second end to the first end of the first actuator unit 11 along a fourth direction D4, parallel to and opposite the second direction D2. Similarly, the second motor means 7 is drivable to move the second carriage 12 from the second end to the first end of the second actuator unit 13 along a fourth direction D4.

[0090] Along the fourth direction D4, the first motor means 6 is drivable to move the first carriage 10 (and thus also the first pushing means 2) with continuous motion. In the same manner, along the fourth direction D4 the second motor means 7 is drivable to move with continuous motion the second carriage 12 (and thus also the second pushing means 3). The first carriage 10 and the second carriage 12 along the second direction D2 can advance with continuous motion at a speed that is similar to or different from the speed at which they move along the fourth direction D4.

[0091] The first pushing means 2 and the second pushing means 3 can advance along the second direction D2 to a "high position", i.e. with the piston 8b, 9b positioned on the upper end 22 of the cylinder 8a, 9a. The aforesaid first pushing means 2 and the aforesaid second pushing means 3 can be moved along the fourth direction D4 to the "low position" i.e. with the piston 8b, 9b positioned on the lower end 23 of the cylinder 8a, 9a.

[0092] This enables the movements to be optimized, thus preventing the first pushing means 2, whilst they are moved along the fourth direction D4, being able to hamper the movements of the second pushing means 3 that advance along the second direction D2, or vice versa.

[0093] Driving of the second motor means 7 occurs at least partially simultaneously to the driving of the first motor means 6; in other words, the outer source is configured to drive the second motor means 7 to advance the second pushing means 3 along the second direction D2 with continuous motion and/or with intermittent motion at least partially simultaneously with the drive of the first motor means 6 to advance the first pushing means 2 along from a second direction D2 with continuous motion and/or with intermittent motion.

[0094] The at least one first direction D1, the second direction D2, the at least one third direction D3 and the fourth direction D4 can define a closed path in which the first pushing means 2 and the second pushing means 3 can be moved. In particular, the at least one first direction D1, the second direction D2, the at least one third direction D3 and the fourth direction D4 define a first closed path on which the first pushing means 2 of the first actuator unit 11 are movable. The aforesaid directions D1, D2, D3, D4 also define a second closed path on which the second pushing means 3 of the second actuator unit 13 moves independently of the first pushing means 2.

[0095] The first pushing means 2 is movable along the first closed path so as to be constantly nonaligned with the second pushing means 3 that is movable along the second closed path. In this manner, it is possible to supply the forming machine with one product at a time, as will be disclosed in detail below.

[0096] The advancing apparatus 1 further comprises brake means which is not illustrated, positioned on the advancing plane 16, in particular in the second zone 1b. The brake means can comprise for example a roller or a block element intended to make contact with a face of the product. The brake means is arranged for increasing the force of friction that acts on the inertia of the product advanced along the second direction D2 so as to ensure precise positioning of the product in the zone 1b, so as to prevent undesired detachment of the third edge Pc from the first pushing means 2 or from the second pushing means 3 during the advancing with intermittent motion.

[0097] Providing brake means enables the product to be advanced precisely to the zone 1b. The brake means is used in combination with the guide pins provided in the inlet of the forming machine, as explained previously.

[0098] In one embodiment that is not shown of the advancing apparatus on the first carriage 10 and on the second carriage 12, grasping means can be fitted that is arranged for grasping an edge of the product to be conveyed to the zone 1a, remaining in a closed position during advancing along the second direction D2 and releasing the aforesaid edge in the zone 1b.

[0099] With reference to Figures 8 to 15, the detailed operation is disclosed of the advancing apparatus 1 that has just been disclosed and thus the method according to the invention actuated by the method.

[0100] The method comprises a first step of providing a plurality of products P1, P2, P3, each of which can comprise a first edge Pa and a second edge Pb that are mutually opposite, a third edge Pc and a fourth edge Pd that are mutually opposite and arranged transversely to the first edge Pa and to the second edge Pb. The aforesaid plurality of products P1, P2, P3 can be temporarily arranged in a loading zone positioned near the advancing apparatus 1. A first product P1 of the plurality of products

P1, P2, P3 can be conveyed to a first zone 1a of a support plane 16 of the advancing apparatus 1. Conveying the first product P1 to the first zone 1a comprises pushing one of the edges thereof by using conveying means, for example a mechanical arm or a pushing device.

[0101] A second step is provided in which, in the first zone 1a, first pushing means 2, which is movable at least along a first direction D1, is made to abut on the first product P1. The first pushing means 2 is made to abut on the third edge Pc of the first product P1. The first pushing means 2 thus adopts a high position, i.e. is moved from the bottom to the top along the at least one first direction D1 to abut on the third edge Pc, owing to the drive of the first actuating means 8 to which the first pushing means 2 is connected.

[0102] The first pushing means 2 can comprise a support plate 2c to which a first pushing element 2a and a second pushing element 2b are fitted.

[0103] A third step of advancing the aforesaid first product P1 on the advancing plane 16 is thus present, pushing the first product P1 with the first pushing means 2 to the high position, in particular from the first zone 1a to a second zone 1b of the advancing apparatus 1, as shown in Figure 8. Advancing can occur along a second direction D2 that is transverse to the at least one first direction D1. The at least one first direction D1 can be tilted with respect to the second direction D2 by an angle comprised between 40° and 45°, in particular 42°.

[0104] The advancing of the first product P1 along the second direction D2 is achieved by pushing with the first pushing means 2 the third edge Pc of the first product P1.

[0105] The aforesaid third step comprises advancing the first product P1 and the first pushing means 2 with continuous motion for a first set interval of time, and with intermittent motion for a second set interval of time.

[0106] In particular, the first pushing means 2 can advance with continuous motion in a first portion L1 during the first interval of time, and with intermittent motion in a second portion L2 during the second interval of time. The first portion L1 and the second portion L2 extend parallel to the aforesaid second direction D2 between the first zone 1a to the second zone 1b.

[0107] In other words, the first product P1 is advanced with continuous motion for the first interval of time, until the fourth edge Pd reaches the vicinity of the entrance of the forming machine S. In this first interval of time, the first pushing means 2 travels along the first portion L1. In Figure 9, the instant is shown in which the aforesaid fourth edge Pd reaches near the entrance of the forming machine S. From this moment, the first pushing means 2 advances with intermittent motion in the second portion L2.

[0108] A fourth step of the method comprises conveying a second product P2 of the plurality of products P1, P2, P3 in the first zone 1a. As illustrated in Figure 10, the aforesaid fourth step can be performed only if the aforesaid first zone 1a is free, i.e. if the first product P1 has advanced on the advancing plane 16 along the second direction D2 by a quantity that is at least equal to the first edge Pa.

[0109] In Figure 10, the first product P1 advances with intermittent motion because the fourth edge Pd has entered the forming machine S. It remains understood that in this fourth step the first product P1 can advance with continuous motion if the fourth edge Pd has not yet reached the inlet zone of the forming machine S.

[0110] A fifth step is provided of taking second pushing means 3, which is also movable along the at least one first direction D1, to abut on the second product P2. The second pushing means 3 can be taken to abut on the third edge Pc of the second product P2. The second pushing means 3 adopts a high position, i.e. is moved from the bottom to the top by driving second actuating means 9 to which the second pushing means 3 is connected.

[0111] The second pushing means 3 can comprise a support plate 3c on which a first pushing element 3a and a second pushing element 3b are fitted.

[0112] A sixth step is provided of advancing the second product P2 by pushing the second product P2 with the second pushing means 3 to the high position, from the first zone 1a to the second zone 1b along the second direction D2. In particular, the second pushing means 3 pushes the third edge Pc of the second product P1.

[0113] The second product P2 can also advance with continuous motion for a first interval of time, and with intermittent motion for a second interval of time. The sixth step occurs at least partially simultaneously with the aforesaid third step, i.e. with the step of advancing the first product P1 along the second direction D2 with continuous motion and/or with intermittent motion.

[0114] The second pushing means 3 can advance with continuous motion for a third portion L3 during the first interval of time, and with intermittent motion for a fourth portion L4 during the second interval of time. The third portion L3 and the fourth portion L4 extend parallel to the aforesaid second direction D2 between the first zone 1a to the second zone 1b.

[0115] The first portion L1 can be substantially the same in extent as the third portion L3, and this also applies to the second portion L2, which can be substantially the same in extent as the fourth portion L4.

[0116] Also the second product P2 is advanced with continuous motion for a first interval of time, until the fourth edge Pd reaches the vicinity of the entrance of the forming machine S. In this first interval of time the second pushing means 3 travels along the first portion L3. Subsequently, the second product will enter the forming machine S and the second pushing means 3 will travel along the second portion L4 with intermittent motion.

[0117] Between the fifth and the sixth step, a step can be provided in which the second product P2 remains stationary in the first zone 1a whilst the first product P1 advances along the second direction D2 with continuous motion or alternatively with intermittent motion.

[0118] The second product P2 can remain stationary

for a period that is sufficient and necessary to reach, during advancing along the second direction D2, the first product P1, as explained below.

[0119] In Figure 11, the first product P1 is shown that advances along the second direction D2 pushed by the first pushing means 2 with intermittent motion, the fourth edge Pd already being inside the forming machine S, whilst the second product P2 is still stationary in the zone 1a. The third edge Pc of the first product P1 is spaced apart from the fourth edge Pd of the second product by a first distance X1 along the second direction D2.

[0120] In Figure 12, the first product P1 is advanced further along the second direction D2 pushed by the first pushing means 2 with intermittent motion, whilst the second product P2 continues to be stationary. The third edge Pc of the first product P1 is spaced apart from the fourth edge Pd of the second product by a second distance X2, along the second direction D2, which is greater than the first distance X1.

[0121] In Figure 13, the first product P1 is advanced still further along the second direction D2 pushed with intermittent motion, whilst the second product P2 advances along the aforesaid second direction D2 pushed by the second pushing means 3 with continuous motion.

[0122] In Figure 14 the third edge Pc of the first product P1 has reached the vicinity of the forming machine S, i.e. the portion of the second zone 1b of the advancing apparatus 1 before the inlet zone of the forming machine S, whilst the second product P2 continues to advance along the aforesaid second direction D2 pushed by the second pushing means 3 with continuous motion.

[0123] A seventh step is provided of moving, in the second zone 1b, the first pushing means 2 away from said first product P1. The aforesaid step is achieved by moving the first pushing means 2 along at least one third direction D3 transverse to the second direction D2. In this step, the first pushing means 2 adopts a low position, i.e. is taken from top to bottom along the at least one third direction D3 by driving first actuating means 8 so as to avoid hampering the subsequent transit of the second product P2, which continues to advance to the second zone 1b. The at least one third direction D3 can be tilted with respect to the second direction D2 by an angle comprised between 40° and 45°, in particular 42°. The at least one third direction D3 is parallel to and opposite the at least one first direction D1.

[0124] An eighth step is provided of moving the first pushing means 2 along a fourth direction D4 parallel to and opposite the second direction D2 with continuous motion whilst the second product P2 continues to advance along the second direction D2.

[0125] In particular, in Figure 15 it is shown that the fourth edge Pd of the second product P2 has reached the vicinity of the forming machine S, whilst the first product P1 has entered completely the aforesaid forming machine S. In this step, the distance between the third edge Pc of the first product P1 and the fourth edge Pd of the second product P2 is equal to the value X3. X3 can be equal to the distance X1, or alternatively greater or less than X1, depending on circumstances.

[0126] The first pushing means 2 is moved along the fourth direction D4 to the first zone 1a where, in the meantime, a third product P3 of the plurality of products P1, P2, P3 has been conveyed. The advancing cycle then recommences.

[0127] In the aforesaid eighth step, the first pushing means 2 is moved along the fourth direction D4 whilst it is in the low position, simultaneously, the second pushing means 3 advances along the second direction D2 to the high position. In this manner, it is ensured that there are no undesired collisions or blows between the first pushing means 2 and the second pushing means 3.

[0128] The at least one first direction D1, the second direction D2, the at least one third direction D3 and the fourth direction D4 define at least one closed loop in which the first pushing means 2 and the second pushing means 3 can move. In particular, the aforesaid directions define a first closed path in which the first pushing means 2 and a second closed path move in which the second pushing means 3 moves.

[0129] It is noted from what has just been written that between two consecutive products that are supplied to the forming machine, a variable safety distance (X1, X2, X3) is present. The safety distance ensures an absence of collisions between the products during the normal advancing to the forming machine S, and, in the case of a forced stop and/or fault of the advancing apparatus 1 (or also of the forming machine S), enables the first pushing means 2 and/or the second pushing means 3 to be moved away from the aforesaid products, in order to be able to take the first pushing means 2 and/or the second pushing means 3 to abut again.

[0130] As can be seen from what has been disclosed, the apparatus and the corresponding method according to the invention enable the objects declared above to be achieved.

[0131] Owing to the invention, high optimization and speeding up of the operations of transferring and handling the products to be formed are obtained.

[0132] The operations of releasing the sheet product and/or taking the sheet product to abut are also simplified.

[0133] The apparatus disclosed above is distinguished by great versatility of use, which is indicated for handling any format of plates/sheets that are suitable for being formed owing to the easy adaptability of the various components.

[0134] It is possible to configure and dimension the apparatus 1 in a desired manner in function of the dimensions/types of the products to be advanced and variations on and/or additions to what has been disclosed in the attached drawings are possible.

Claims

1. Method for advancing products in the form of sheet

metal comprising the steps of:

a) transporting a first product (P1) of a plurality of products (P1, P2, P3) in a first zone (1a) of an advancing apparatus (1);
b) in said first zone (1a) abutting first pushing means (2), movable along at least one first direction (D1), against said first product (P1);
c) by means of said first pushing means (2), advancing said first product (P1) from said first zone (1a) to a second zone (1b) of said advancing apparatus (1) along a second direction (D2), transverse to said at least one first direction (D1), with continuous motion and subsequently with intermittent motion;
d) transporting a second product (P2) of said plurality of products (P1, P2, P3) in said first zone (1a);
e) abutting second pushing means (3), movable along said at least one first direction (D1), against said second product (P2);
f) by means of said second pushing means (3) advancing said second product (P2) towards said second zone (1b) along said second direction (D2) initially with continuous motion and subsequently with intermittent motion, said step f) being carried out at least partly simultaneously with said step c);
g) in said second zone (1b) moving away said first pushing means (2) from said first product (P1), moving said first pushing means (2) along at least one third direction (D3), transverse to said second direction (D2), so as to avoid hampering the subsequent passage of said second product (P2);
h) continuously shifting said first pushing means (2) along a fourth direction (D4) parallel and opposite to said second direction (D2) to take said first pushing means (2) back to said first zone (1a), whereas said second pushing means (3) keep advancing with said second product (P2) along said second direction (D2);
i) moving said first pushing means (2) along said at least one first direction (D1) to abut said first pushing means (2) against a third product (P3) of said plurality of products (P1, P2, P3) which in the meantime has been transported in said first zone (1a);

wherein said at least one first direction (D1), said second direction (D2), said at least one third direction (D3) and said fourth direction (D4) define a closed path in which said first pushing means (2) and said second pushing means (3) are movable.

2. Method according to claim 1, wherein said at least a first direction (D1), said second direction (D2), said at least one third direction (D3) and said fourth direction (D4) define a first closed path in which said first pushing means (2) is movable and a second closed path in which said second pushing means (3) is movable.

3. Method according to claim 2, wherein said step c) and/or said step f) comprises pushing at least an edge (Pa, Pb, Pc, Pd) of said first product (P1) by means of said first pushing means (2), and at least an edge (Pa, Pb, Pc, Pd) of said second product (P2) by means of said second pushing means (3).

4. Method according to claim 3, wherein said step c) comprises advancing said first pushing means (2) with continuous motion for a first tract (L1) and with intermittent motion for a second tract (L2), said first tract (L1) and said second tract (L2) extending parallel to said second direction (D2) between said first zone (1a) and said second zone (1b); and wherein said step f) comprises advancing said second pushing means (3) with continuous motion for a third tract (L3) and with intermittent motion for a fourth tract (L4), said third tract (L3) and said fourth tract (L4) extending parallel to said second direction (D2) between said first zone (1a) and said second zone (1b); said first tract (L1) being substantially equal in extension to said third tract (L3), and said second tract (L2) being substantially equal in extension to said fourth tract (L4).

5. Method according to any one of the preceding claims, wherein said step f) comprises advancing said first product (P1) with intermittent motion while said second product (P2) is still in said first zone (1a), or advances with continuous motion.

6. Method according to any one of the preceding claims, wherein in said steps f) and g) at least a safety distance (X1, X2, X3) between said first product (P1) and said second product (P2) is maintained.

7. Method according to any one of the preceding claims, wherein said at least one first direction (D1) is parallel and opposite to said at least one third direction (D3), said at least one first direction (D1) and said at least one third direction (D3) being tilted with an angle comprised between 40° and 45° with respect to said second direction (D2), in particular with an angle of 42°.

8. Method according to any of the preceding claims, wherein said step g) comprises moving downwards said first pushing means (2) along said at least one third direction (D3), and wherein said steps b) or i) comprise moving upwards said first pushing means (2) along said at least one first direction (D1).

9. Advancing apparatus (1) for advancing a plurality of

products (P1, P2, P3) in the form of sheet metal, in particular for carrying out a method according to any one of the preceding claims, said advancing apparatus (1) comprising:

- first pushing means (2) movable along at least one first direction (D1) to abut against a first product (P1) in a first zone (1a) of said advancing apparatus (1); along a second direction (D2), transverse to said first direction (D1), to advance said first product (P1) from said first zone (1a) to a second zone (1b) of said advancing apparatus (1); along at least one third direction (D3), transverse to said direction (D2), to move away from said first product(P1); and along a fourth direction (D4), parallel and opposite to said second direction (D2), to shift towards said first zone (1a);
- first motor means (6) connected to said first pushing means (2) and drivable for advancing said first pushing means (2) along said second direction (D2) with continuous motion and/or with intermittent motion, and for shifting said first pushing means (2) along said fourth direction (D4) with continuous motion;
- first actuating means (8) connected to said first pushing means (2) for moving said first pushing means (2) along said at least one first direction (D1) and/or along said at least one third direction (D3);
- second pushing means (3) movable along said at least one first direction (D1) to abut against a second product (P2) in said first zone (1a); along said second direction (D2) for advancing said second product (P2) from said first zone (1a) to said second zone (1b); along said at least one third direction (D3) to move away from said second product (P2); and along said fourth direction (D4) to shift towards said first zone (1a);
- second motor means (7) connected to said second pushing means (3) and drivable for advancing said second pushing means (3) along said second direction (D2) with continuous motion or with intermittent motion at least partly while said first motor means (6) advances said first pushing means (2), said second motor means (7) being also drivable to shift said second pushing means (3) along said fourth direction (D4) with continuous motion;
- second actuating means (9) connected to said second pushing means (3) for moving said second pushing means (3) along said at least one first direction (D1) and/or along said at least one third direction (D3);

wherein said at least one first direction (D1), said second direction (D2), said at least one third direction (D3) and said fourth direction (D4) define a closed path in which said first pushing means (2) and said second pushing means (3) are movable.

10. Advancing apparatus (1) according to claim 9, wherein said at least one first direction (D1), said second direction (D2), said at least one third direction (D3) and said fourth direction (D4) define a first closed path in which said first pushing means (2) is movable and a second closed path in which said second pushing means (3) is movable.

11. Advancing apparatus (1) according to claim 9 or 10, wherein each of said first pushing means (2) and said second pushing means (3) comprises a support plate (2c, 3c) on which a first pushing element (2a, 3a) and a second pushing element (2b, 3b) are mounted; said first pushing element (2a, 3a) and said second pushing element (2b, 3b) being sized to abut against at least an edge (Pa, Pb Pc, Pd) of said first product (P1) and/or of said second product (P2).

12. Advancing apparatus (1) according to any one of claims 9 to 11, wherein said first motor means (6) is driven for advancing said first pushing means (2) with continuous motion for a first tract (L1) and with intermittent motion for a second tract (L2), said first tract (L1) and said second tract (L2) extending parallel to said second direction (D2) between said first zone (1a) and said second zone (1b); and wherein said second motor means (7) is driven for advancing said second pushing means (3) with continuous motion for a third tract (L3), and with intermittent motion for a fourth tract (L4), said third tract (L3) and said fourth tract (L4) extending parallel to said second direction (D2) between said first zone (1a) and said second zone (1b); said first tract (L1) being substantially equal in extension to said third tract (L3), and said second tract (L2) being substantially equal in extension to said fourth tract (L4).

13. Advancing apparatus (1) according to any one of claims 9 to 12, wherein said first motor means (6) is driven with intermittent motion while said second motor means (7) is still or is driven with continuous motion.

14. Advancing apparatus (1) according to any one of claims 9 to 13, wherein said first motor means (6) and said second motor means (7) are driven for advancing said first pushing means (2) and said second pushing means (3) along said second direction (D2) keeping at least a safety distance (X1, X2, X3) between said first product (P1) and said second product (P2).

15. Advancing apparatus (1) according to any one of claims 9 to 14, wherein:

- said at least one first direction (D1) is parallel to and opposite to said at least one third direction (D3), said at least one first direction (D1) and said at least one third direction (D3) being tilted with an angle comprised between 40° and 45° with respect to said second direction (D2), in particular with an angle of 42°; and/or wherein
- said first actuating means (8) is driven to move said first pushing means (2) downwards along said at least one third direction (D3) and to move towards said first pushing means (2) along said at least one first direction (D1); and/or wherein
- said second actuating means (9) is driven to move downwards said second pushing means (3) along said at least one third direction (D3) and to move upwards said second pushing means (3) along said at least one first direction (D1).

Patentansprüche

1. Verfahren zum Vorrücken von Erzeugnissen in Form von Flachmaterial mit den Schritten:

a) Transportieren eines ersten Erzeugnisses (P1) einer Mehrzahl von Erzeugnissen (P1, P2, P3) in eine erste Zone (1a) einer Vorrückvorrichtung (1);
b) in der ersten Zone (1a), Anlegen erster Drückmittel (2), die entlang zumindest einer ersten Richtung (D1) beweglich sind, gegen das erste Erzeugnis (P1);
c) mittels der ersten Drückmittel (2), Vorrücken des ersten Erzeugnisses (P1) von der ersten Zone (1a) zu einer zweiten Zone (1b) der Vorrückvorrichtung (1) entlang einer zweiten Richtung (D2), die quer zu der zumindest einen ersten Richtung (D1) verläuft, mit kontinuierlicher Bewegung und anschließend mit intermittierender Bewegung;
d) Transportieren eines zweiten Erzeugnisses (P2) der Mehrzahl von Erzeugnissen (P1, P2, P3) in die erste Zone (1a);
e) Anlegen zweiter Drückmittel (3), die entlang der zumindest einen ersten Richtung (D1) beweglich sind, gegen das zweite Erzeugnis (P2);
f) mittels der zweiten Drückmittel (3), Vorrücken des zweiten Erzeugnisses (P2) zu der zweiten Zone (1b) hin entlang der zweiten Richtung (D2), anfänglich mit kontinuierlicher Bewegung und anschließend mit intermittierender Bewegung, wobei der Schritt f) zumindest teilweise gleichzeitig mit dem Schritt c) ausgeführt wird;
g) in der zweiten Zone (1b), Wegbewegen der ersten Drückmittel (2) von dem ersten Erzeugnis (P1), Bewegen der ersten Drückmittel (2) entlang zumindest einer dritten Richtung (D3) quer zu der zweiten Richtung (D2), um eine Behinderung des anschließenden Durchgangs des zweiten Erzeugnisses (P2) zu vermeiden;
h) kontinuierliches Verschieben der ersten Drückmittel (2) entlang einer vierten Richtung (D4) parallel und entgegengesetzt zu der zweiten Richtung (D2), um die ersten Drückmittel (2) zu der ersten Zone (1a) zurückzunehmen, wogegen die zweiten Drückmittel (3) weiterhin mit dem zweiten Erzeugnis (P2) entlang der zweiten Richtung (D2) vorrücken;
i) Bewegen der ersten Drückmittel (2) entlang der zumindest einen ersten Richtung (D1), um die ersten Drückmittel (2) gegen ein drittes Erzeugnis (P3) der Mehrzahl von Erzeugnissen (P1, P2, P3) anzulegen, die in der Zwischenzeit in die erste Zone (1a) transportiert worden sind;

wobei die zumindest eine erste Richtung (D1), die zweite Richtung (D2), die zumindest eine dritte Richtung (D3) und die vierte Richtung (D4) einen geschlossenen Pfad definieren, in dem die ersten Drückmittel (2) und die zweiten Drückmittel (3) beweglich sind.

2. Verfahren nach Anspruch 1, wobei die zumindest eine erste Richtung (D1), die zweite Richtung (D2), die zumindest eine dritte Richtung (D3) und die vierte Richtung (D4) einen ersten geschlossenen Pfad definieren, in dem die ersten Drückmittel (2) beweglich sind, und einen zweiten geschlossenen Pfad, in dem die zweiten Drückmittel (3) beweglich sind.

3. Verfahren nach Anspruch 2, wobei der Schritt c) und/oder der Schritt f) ein Drücken zumindest eines Randes (Pa, Pb, Pc, Pd) des ersten Erzeugnisses (P1) mittels der ersten Drückmittel (2), und zumindest eines Randes (Pa, Pb, Pc, Pd) des zweiten Erzeugnisses (P2) mittels der zweiten Drückmittel (3) aufweist.

4. Verfahren nach Anspruch 3, wobei der Schritt c) ein Vorrücken der ersten Drückmittel (2) mit kontinuierlicher Bewegung für einen ersten Teilbereich (L1) und mit intermittierender Bewegung für einen zweiten Teilbereich (L2) aufweist, wobei der erste Teilbereich (L1) und der zweite Teilbereich (L2) sich parallel zu der zweiten Richtung (D2) zwischen der ersten Zone (1a) und der zweiten Zone (1b) erstrecken; und wobei der Schritt f) ein Vorrücken der zweiten Drückmittel (3) mit kontinuierlicher Bewegung für einen dritten Teilbereich (L3) und mit intermittierender Bewegung für einen vierten Teilbereich (L4) aufweist, wobei der dritte Teilbereich (L3) und der vierte Teilbereich(L4) sich parallel zu der zweiten Richtung (D2) zwischen der ersten Zone (1a) und der zweiten Zone (1b) erstrecken; wobei der erste Teilbereich (L1) in der Erstreckung im Wesentlichen gleich dem

dritten Teilbereich (L3) ist, und wobei der zweite Teilbereich (L2) in der Erstreckung im Wesentlichen gleich dem vierten Teilbereich (L4) ist.

5. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei der Schritt f) ein Vorrücken des ersten Erzeugnisses (P1) mit intermittierender Bewegung aufweist, während das zweite Erzeugnis (P2) in der ersten Zone (1a) stillsteht, oder mit kontinuierlicher Bewegung vorrückt.

6. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei in den Schritten f) und g) zumindest ein Sicherheitsabstand (X1, X2, X3) zwischen dem ersten Erzeugnis (P1) und dem zweiten Erzeugnis (P2) eingehalten wird.

7. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei die zumindest eine erste Richtung (D1) parallel und entgegengesetzt zu der zumindest einen dritten Richtung (D3) ist, wobei die zumindest eine erste Richtung (D1) und die zumindest eine dritte Richtung (D3) unter einem Winkel zwischen 40° und 45° bezüglich der zweiten Richtung (D2) gekippt sind, insbesondere unter einem Winkel von 42°.

8. Verfahren nach irgendeinem der vorhergehenden Ansprüche, wobei der Schritt g) ein Abwärtsbewegen der ersten Drückmittel (2) entlang der zumindest einen dritten Richtung (D3) aufweist, und wobei die Schritte b) oder i) ein Aufwärtsbewegen der ersten Drückmittel (2) entlang der zumindest einen ersten Richtung (D1) aufweisen.

9. Vorrückvorrichtung (1) zum Vorrücken einer Mehrzahl von Erzeugnissen (P1, P2, P3) in der Form von Flachmaterial, insbesondere zum Ausführen eines Verfahrens nach irgendeinem der vorhergehenden Ansprüche, wobei die Vorrückvorrichtung (1) aufweist:

- erste Drückmittel (2), die beweglich sind: entlang zumindest einer ersten Richtung (D1), um gegen ein erstes Erzeugnis (P1) in einer ersten Zone (1a) der Vorrückvorrichtung (1) anzuliegen; entlang einer zweiten Richtung (D2), quer zu der ersten Richtung (D1), um das erste Erzeugnis (P1) von der ersten Zone (1a) zu einer zweiten Zone (1b) der Vorrückvorrichtung (1) vorzurücken; entlang zumindest einer dritten Richtung (D3), quer zu der zweiten Richtung (D2), um sich von dem ersten Erzeugnis (P1) wegzubewegen; und entlang einer vierten Richtung (D4) parallel und entgegengesetzt zu der zweiten Richtung (D2), um sich zu der ersten Zone (1a) hin zu verschieben;
- erste Motormittel (6), die mit den ersten Drückmitteln (2) verbunden und zum Vorrücken der ersten Drückmittel (2) entlang der zweiten Richtung (D2) mit kontinuierlicher Bewegung und/oder mit intermittierender Bewegung und zum Verschieben der ersten Drückmittel (2) entlang der vierten Richtung (D4) mit kontinuierlicher Bewegung antreibbar sind;
- erste Betätigungsmittel (8), die mit den ersten Drückmitteln (2) zum Bewegen der ersten Drückmittel (2) entlang der zumindest einen ersten Richtung (D1) und/oder entlang der zumindest einen dritten Richtung (D3) verbunden sind;
- zweite Drückmittel (3), die beweglich sind: entlang der zumindest einen ersten Richtung (D1), um gegen ein zweites Erzeugnis (P2) in der ersten Zone (1a) anzuliegen; entlang der zweiten Richtung (D2) zum Vorrücken des zweiten Erzeugnisses (P2) von der ersten Zone (1a) zu der zweiten Zone (1b); entlang der zumindest einen dritten Richtung (D3), um sich von dem zweiten Erzeugnis (P2) wegzubewegen; und entlang der vierten Richtung (D4), um sich zu der ersten Zone (1a) hin zu verschieben;
- zweite Motormittel (7), die mit den zweiten Drückmitteln (3) verbunden und zum Vorrücken der zweiten Drückmittel (3) entlang der zweiten Richtung (D2) mit kontinuierlicher Bewegung oder mit intermittierender Bewegung antreibbar sind, zumindest teilweise, während die ersten Motormittel (6) die ersten Drückmittel (2) vorrücken, wobei die zweiten Motormittel (7) außerdem antreibbar sind, um die zweiten Drückmittel (3) entlang der vierten Richtung (D4) mit kontinuierlicher Bewegung zu verschieben;
- zweite Betätigungsmittel (9), die mit den zweiten Drückmitteln (3) zum Bewegen der zweiten Drückmittel (3) entlang der zumindest einen ersten Richtung (D1) und/oder entlang der zumindest einen dritten Richtung (D3) verbunden sind;

wobei die zumindest eine erste Richtung (D1), die zweite Richtung (D2), die zumindest eine dritte Richtung (D3) und die vierte Richtung (D4) einen geschlossenen Pfad definieren, in dem die ersten Drückmittel (2) und die zweiten Drückmittel (3) beweglich sind.

10. Vorrückvorrichtung (1) nach Anspruch 9, wobei die zumindest eine erste Richtung (D1), die zweite Richtung (D2), die zumindest eine dritte Richtung (D3) und die vierte Richtung (D4) einen ersten geschlossenen Pfad definieren, in dem die ersten Drückmittel (2) beweglich sind, und einen zweiten geschlossenen Pfad, in dem die zweiten Drückmittel (3) beweglich sind.

11. Vorrückvorrichtung (1) nach Anspruch 9 oder 10, wo-

bei jede der ersten Drückmittel (2) und der zweiten Drückmittel (3) eine Trägerplatte (2c, 3c) aufweisen, auf dem ein erstes Drückelement (2a, 3a) und ein zweites Drückelement (2b, 3b) angebracht sind; wobei das erste Drückelement (2a, 3a) und das zweite Drückelement (2b, 3b) in der Größe bemessen sind, um gegen zumindest einen Rand (Pa, Pb Pc, Pd) des ersten Erzeugnisses (P1) und/oder des zweiten Erzeugnisses (P2) anzuliegen.

12. Vorrückvorrichtung (1) nach irgendeinem der Ansprüche 9 bis 11, wobei die ersten Motormittel (6) zum Vorrücken der ersten Drückmittel (2) mit kontinuierlicher Bewegung für einen ersten Teilbereich (L1) und mit intermittierender Bewegung für einen zweiten Teilbereich (L2) angetrieben sind, wobei der erste Teilbereich (L1) und der zweite Teilbereich (L2) sich parallel zu der zweiten Richtung (D2) zwischen der ersten Zone (1a) und der zweiten Zone (1b) erstrecken; und wobei die zweiten Motormittel (7) zum Vorrücken der zweiten Drückmittel (3) mit kontinuierlicher Bewegung für einen dritten Teilbereich (L3) und mit intermittierender Bewegung für einen vierten Teilbereich (L4) angetrieben sind, wobei der dritte Teilbereich (L3) und der vierte Teilbereich(L4) sich parallel zu der zweiten Richtung (D2) zwischen der ersten Zone (1a) und der zweiten Zone (1b) erstrecken; wobei der erste Teilbereich (L1) in der Erstreckung im Wesentlichen gleich dem dritten Teilbereich (L3) ist, und wobei der zweite Teilbereich (L2) in der Erstreckung im Wesentlichen gleich dem vierten Teilbereich(L4) ist.

13. Vorrückvorrichtung (1) nach irgendeinem der Ansprüche 9 bis 12, wobei die ersten Motormittel (6) mit intermittierender Bewegung angetrieben sind, während die zweiten Motormittel (7) stillstehen oder mit kontinuierlicher Bewegung angetrieben werden.

14. Vorrückvorrichtung (1) nach irgendeinem der Ansprüche 9 bis 13, wobei die ersten Motormittel (6) und die zweiten Motormittel (7) zum Vorrücken der ersten Drückmittel (2) und der zweiten Drückmittel (3) entlang der zweiten Richtung (D2) unter Einhaltung zumindest eines Sicherheitsabstandes (X1, X2, X3) zwischen dem ersten Erzeugnis (P1) und dem zweiten Erzeugnis (P2) angetrieben sind.

15. Vorrückvorrichtung (1) nach irgendeinem der Ansprüche 9 bis 14, wobei:

- die zumindest eine erste Richtung (D1) parallel zu und entgegengesetzt der zumindest einen dritten Richtung (D3) ist, wobei die zumindest eine erste Richtung (D1) und die zumindest eine dritte Richtung (D3) unter einem Winkel zwischen 40° und 45° bezüglich der zweiten Richtung (D2) gekippt sind, insbesondere unter einem Winkel von 42°; und/oder wobei
- die ersten Betätigungsmittel (8) angetrieben sind, um die ersten Drückmittel (2) entlang der zumindest einen dritten Richtung (D3) nach unten zu bewegen und die ersten Drückmitteln (2) entlang der zumindest einen ersten Richtung (D1) nach oben zu bewegen; und/oder wobei
- die zweiten Betätigungsmittel (9) angetrieben sind, um die zweiten Drückmittel (3) entlang der zumindest einen dritten Richtung (D3) nach unten zu bewegen und die zweiten Drückmittel (3) entlang der zumindest einen ersten Richtung (D1) nach oben zu bewegen.

Revendications

1. Procédé pour avancer des produits en forme de tôles comprenant les étapes de :

a) transport d'un premier produit (P1) d'une pluralité de produits (P1, P2, P3) dans une première zone (1a) d'un appareil d'avance (1) ;
b) dans ladite première zone (la), amenée de premiers moyens de poussée (2), mobiles le long d'au moins une première direction (D1), en butée contre ledit premier produit (P1) ;
c) à l'aide desdits premiers moyens de poussée (2), avance dudit premier produit (P1) de ladite première zone (1a) à une deuxième zone (1b) dudit appareil d'avance (1) le long d'une deuxième direction (D2), transversale par rapport à ladite au moins une première direction (D1), avec un mouvement continu et ensuite un mouvement intermittent ;
d) transport d'un deuxième produit (P2) de ladite pluralité de produits (P1, P2, P3) dans ladite première zone (1a) ;
e) amenée de deuxièmes moyens de poussée (3), mobiles le long de ladite au moins une première direction (D1), en butée contre ledit deuxième produit (P2);
f) à l'aide desdits deuxièmes moyens de poussée (3), avance dudit deuxième produit (P2) vers ladite deuxième zone (1b) le long de ladite deuxième direction (D2) initialement avec un mouvement continu et ensuite avec un mouvement intermittent, ladite étape f) étant exécutée au moins en partie simultanément par rapport à ladite étape c) ;
g) dans ladite deuxième zone (1b), éloignement desdits premiers moyens de poussée (2) dudit premier produit (P1), en déplaçant lesdits premiers moyens de poussée (2) le long d'au moins une troisième direction (D3), transversale par rapport à ladite deuxième direction (D2), de manière à éviter de gêner le passage suivant dudit deuxième produit (P2) ;

h) bouger de manière continue lesdits premiers moyens de poussée (2) le long d'une quatrième direction (D4) parallèle et opposée à ladite deuxième direction (D2) pour ramener lesdits premiers moyens de poussée (2) à ladite première zone (la), tandis que lesdits deuxièmes moyens de poussée (3) continuent d'avancer avec ledit deuxième produit (P2) le long de ladite deuxième direction (D2) ;
i) déplacer lesdits premiers moyens de poussée (2) le long de ladite au moins une première direction (D1) pour amener lesdits premiers moyens de poussée (2) en butée contre un troisième produit (P3) de ladite pluralité de produits (P1, P2, P3) qui a été transporté entre-temps dans ladite première zone (1a) ;

dans lequel ladite au moins une première direction (D1), ladite deuxième direction (D2), ladite au moins une troisième direction (D3) et ladite quatrième direction (D4) définissent une trajectoire fermée dans laquelle lesdits premiers moyens de poussée (2) et lesdits deuxièmes moyens de poussée (3) sont mobiles.

2. Procédé selon la revendication 1, dans lequel ladite au moins une première direction (D1), ladite deuxième direction (D2), ladite au moins une troisième direction (D3) et ladite quatrième direction (D4) définissent une trajectoire fermée dans laquelle lesdits premiers moyens de poussée (2) sont mobiles et une deuxième trajectoire fermée dans laquelle lesdits deuxièmes moyens de poussée (3) sont mobiles.

3. Procédé selon la revendication 2, dans lequel ladite étape c) et/ou ladite étape f) comprennent la poussée d'au moins un bord (Pa, Pb, Pc, Pd) dudit premier produit (P1) à l'aide desdits premiers moyens de poussée (2), et d'au moins un bord (Pa, Pb, Pc, Pd) dudit deuxième produit (P2) à laide desdits deuxièmes moyens de poussée (3).

4. Procédé selon la revendication 3, dans lequel l'étape c) comprend l'avance desdits premiers moyens de poussée (2) avec un mouvement continu pour une première voie (L1) et avec un mouvement intermittent pour une deuxième voie (L2), ladite première voie (L1) et ladite deuxième voie (L2) s'étendant parallèlement à ladite deuxième direction (D2) entre ladite première zone (1a) et ladite deuxième zone (1b) ; et dans lequel ladite étape f) comprend l'avance desdits deuxièmes moyens de poussée (3) avec un mouvement continu pour une troisième voie (L3) et avec un mouvement intermittent pour une quatrième voie (L4), ladite troisième voie (L3) et ladite quatrième voie (L4) s'étendant parallèlement à ladite deuxième direction (D2) entre ladite première zone (1a) et ladite deuxième zone (1b) ; ladite première voie (L1) étant sensiblement égale en extension à ladite troisième voie (L3), et ladite deuxième voie (L2) étant sensiblement égale en extension à ladite quatrième voie (L4).

5. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite étape f) comprend l'avance dudit premier produit (P1) avec un mouvement intermittent alors que le deuxième produit (P2) est toujours dans ladite première zone (la), ou avance avec un mouvement continu.

6. Procédé selon l'une quelconque des revendications précédentes, dans lequel dans lesdites étapes f) et g) au moins une distance de sécurité (X1, X2, X3) entre ledit premier produit (P1) et ledit deuxième produit (P2) est maintenue.

7. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite au moins une première direction (D1) est parallèle et opposée à ladite au moins une troisième direction (D3), ladite au moins une première direction (D1) et ladite au moins une troisième direction (D3) étant inclinées suivant un angle compris entre 40° et 45° par rapport à ladite deuxième direction (D2), en particulier suivant un angle de 42°.

8. Procédé selon l'une quelconque des revendications précédentes, dans lequel ladite étape g) comprend le déplacement vers le bas desdits premiers moyens de poussée (2) le long de ladite au moins une troisième direction (D3), et dans lequel lesdites étapes b) ou i) comprennent le déplacement vers le haut desdits premiers moyens de poussée (2) le long de ladite au moins une première direction (D1).

9. Appareil d'avance (1) pour avancer une pluralité de produits (P1, P2, P3) en forme de tôles, en particulier pour exécuter un procédé selon l'une quelconque des revendications précédentes, ledit appareil d'avance (1) comprenant :

- des premiers moyens de poussée (2) mobiles le long d'au moins une première direction (D1) pour venir en butée contre un premier produit (P1) dans une première zone (1a) dudit appareil d'avance (1) ; le long d'une deuxième direction (D2), transversale par rapport à ladite première direction (D1), pour avancer ledit premier produit (P1) de ladite première zone (1a) à une deuxième zone (1b) dudit appareil d'avance (1) ; le long d'au moins une troisième direction (D3), transversale par rapport à ladite direction (D2), pour s'éloigner dudit premier produit (P1) ; et le long d'une quatrième direction (D4), parallèle et opposée à ladite deuxième direction (D2), pour

bouger vers ladite première zone (1a) ;
- des premiers moyens à moteur (6) reliés auxdits premiers moyens de poussée (2) et aptes à être entraînés pour avancer lesdits premiers moyens de poussée (2) le long de la deuxième direction (D2) avec un mouvement continu et/ou avec un mouvement intermittent, et pour bouger lesdits premiers moyens de poussée (2) le long de ladite quatrième direction (D4) avec un mouvement continu ;
- des premiers moyens d'actionnement (8) reliés auxdits premiers moyens de poussée (2) pour déplacer lesdits premiers moyens de poussée (2) le long de ladite au moins une première direction (D1) et/ou le long de ladite au moins une troisième direction (D3) ;
- des deuxièmes moyens de poussée (3) mobiles le long de ladite au moins une première direction (D1) pour venir en butée contre un deuxième produit (P2) dans ladite première zone (1a) ; le long de ladite deuxième direction (D2) pour avancer ledit deuxième produit (P2) de ladite première zone (1a) à ladite deuxième zone (1b) ; le long de ladite au moins une troisième direction (D3) pour s'éloigner dudit deuxième produit (P2) ; et le long de ladite quatrième direction (D4) pour bouger vers ladite première zone (1a) ;
- des deuxièmes moyens à moteur (7) reliés auxdits deuxièmes moyens de poussée (3) et aptes à être entraînés pour avancer lesdits deuxièmes moyens de poussée (3) le long de ladite deuxième direction (D2) avec un mouvement continu ou avec un mouvement intermittent au moins en partie alors que les premiers moyens à moteur (6) avancent lesdits premiers moyens de poussée (2), lesdits deuxièmes moyens à moteur (7) étant également aptes à être entraînés pour bouger lesdits deuxièmes moyens de poussée (3) le long de la quatrième direction (D4) avec un mouvement continu ;
- des deuxièmes moyens d'actionnement (9) reliés auxdits deuxièmes moyens de poussée (3) pour déplacer lesdits deuxièmes moyens de poussée (3) le long de ladite au moins une première direction (D1) et/ou le long de ladite au moins une troisième direction (D3) ;

dans lequel ladite au moins une première direction (D1), ladite deuxième direction (D2), ladite au moins une troisième direction (D3) et ladite quatrième direction (D4) définissent une trajectoire fermée dans laquelle lesdits premiers moyens de poussée (2) et lesdits deuxièmes moyens de poussée (3) sont mobiles.

10. Appareil d'avance (1) selon la revendication 9, dans lequel ladite au moins une première direction (D1), ladite deuxième direction (D2), ladite au moins une troisième direction (D3) et ladite quatrième direction (D4) définissent une trajectoire fermée dans laquelle lesdits premiers moyens de poussée (2) sont mobiles et une deuxième trajectoire fermée dans laquelle lesdits deuxièmes moyens de poussée (3) sont mobiles.

11. Appareil d'avance (1) selon la revendication 9 ou 10, dans lequel chacun desdits premiers moyens de poussée (2) et desdits deuxièmes moyens de poussée (3) comprend une plaque de support (2c, 3c) sur laquelle sont montés un premier élément de poussée (2a, 3a) et un deuxième élément de poussée (2b, 3b), ledit premier élément de poussée (2a, 3a) et ledit deuxième élément de poussée (2b, 3b) étant dimensionnés pour venir en butée contre au moins un bord (Pa, Pb, Pc, Pd) dudit premier produit (P1) et/ou dudit deuxième produit (P2).

12. Appareil d'avance (1) selon l'une quelconque des revendications 9 à 11, dans lequel lesdits premiers moyens à moteur (6) sont entraînés pour avancer lesdits premiers moyens de poussée (2) avec un mouvement continu pour une première voie (L1) et avec un mouvement intermittent pour une deuxième voie (L2), ladite première voie (L1) et ladite deuxième voie (L2) s'étendant parallèlement à ladite deuxième direction (D2) entre ladite première zone (1a) et ladite deuxième zone (1b) ; et dans lequel lesdits deuxièmes moyens à moteur (7) sont entraînés pour avancer lesdits deuxièmes moyens de poussée (3) avec un mouvement continu pour une troisième voie (L3), et avec un mouvement intermittent pour une quatrième voie (L4), ladite troisième voie (L3) et ladite quatrième voie (L4) s'étendant parallèlement à ladite deuxième direction (D2) entre ladite première zone (1a) et ladite deuxième zone (1b) ; ladite première voie (L1) étant sensiblement égale en extension à ladite troisième voie (L3), et ladite deuxième voie (L2) étant sensiblement égale en extension à ladite quatrième voie (L4).

13. Appareil d'avance (1) selon l'une quelconque des revendications 9 à 12, dans lequel lesdits premiers moyens à moteur (6) sont entraînés avec un mouvement intermittent alors que lesdits deuxièmes moyens à moteur (7) sont arrêtés ou sont entraînés avec un mouvement continu.

14. Appareil d'avance (1) selon l'une quelconque des revendications 9 à 13, dans lequel lesdits premiers moyens à moteur (6) et lesdits deuxièmes moyens à moteur (7) sont entraînés pour avancer lesdits premiers moyens de poussée (2) et lesdits deuxièmes moyens de poussée (3) le long de ladite deuxième direction (D2) en maintenant au moins une distance de sécurité (X1, X2, X3) entre ledit premier produit

(P1) et ledit deuxième produit (P2).

15. Appareil d'avance (1) selon l'une quelconque des revendications 9 à 14, dans lequel :

- ladite au moins une première direction (D1) est parallèle et opposée à ladite au moins une troisième direction (D3), ladite au moins une première direction (D1) et ladite au moins une troisième direction (D3) étant inclinées suivant un angle compris entre 40° et 45° par rapport à ladite deuxième direction (D2), en particulier suivant un angle de 42° ; et/ou dans lequel
- lesdits premiers moyens d'actionnement (8) sont entraînés pour déplacer lesdits premiers moyens de poussée (2) vers le bas le long de ladite au moins une troisième direction (D3) et pour se déplacer vers lesdits premiers moyens de poussée (2) le long de ladite au moins une première direction (D1) ; et/ou dans lequel
- lesdits deuxièmes moyens d'actionnement (9) sont entraînés pour déplacer vers le bas lesdits deuxièmes moyens de poussée (3) le long de ladite au moins une troisième direction (D3) et pour déplacer vers le haut lesdits deuxièmes moyens de poussée (3) le long de ladite au moins une première direction (D1). deuxièmes moyens à moteur (7).

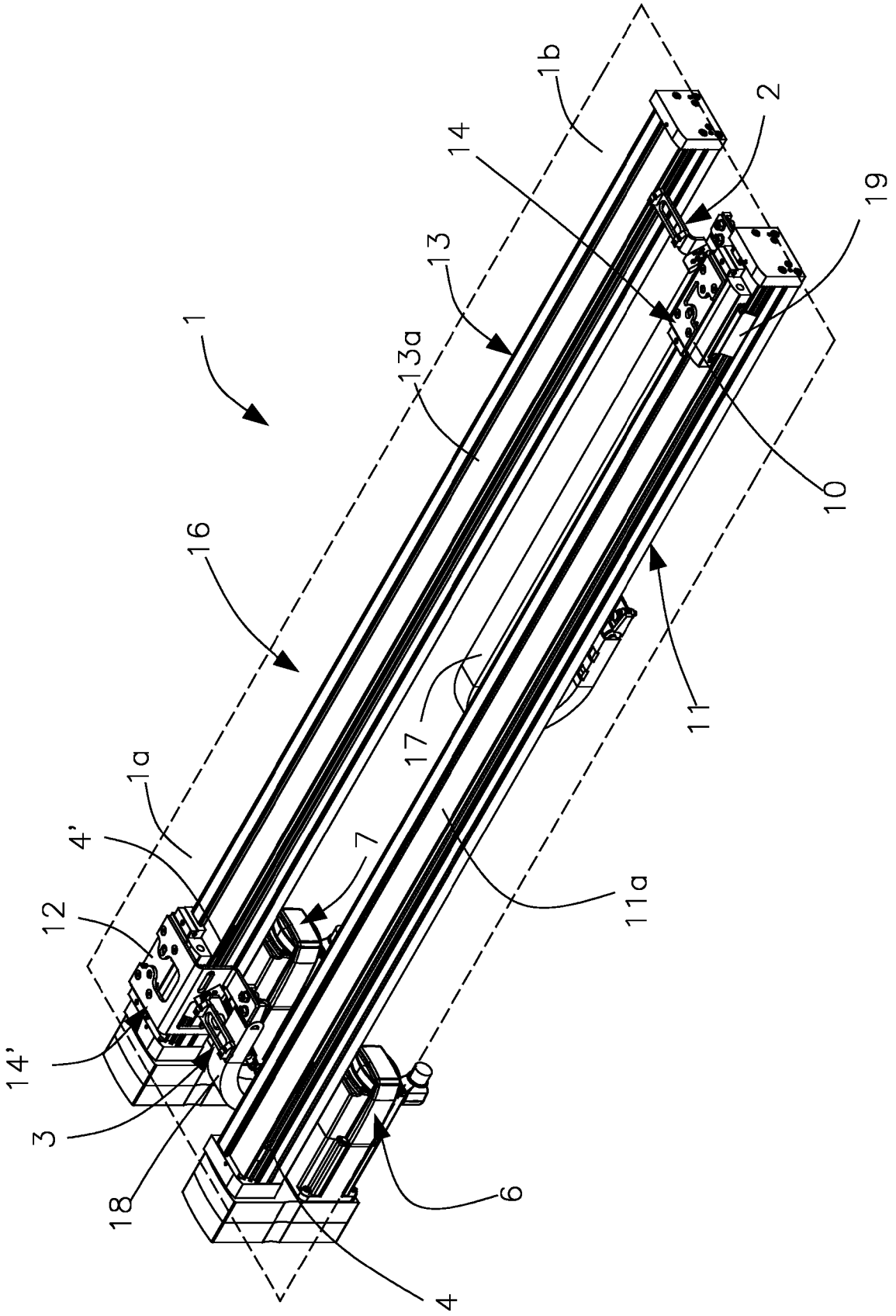

Fig. 1

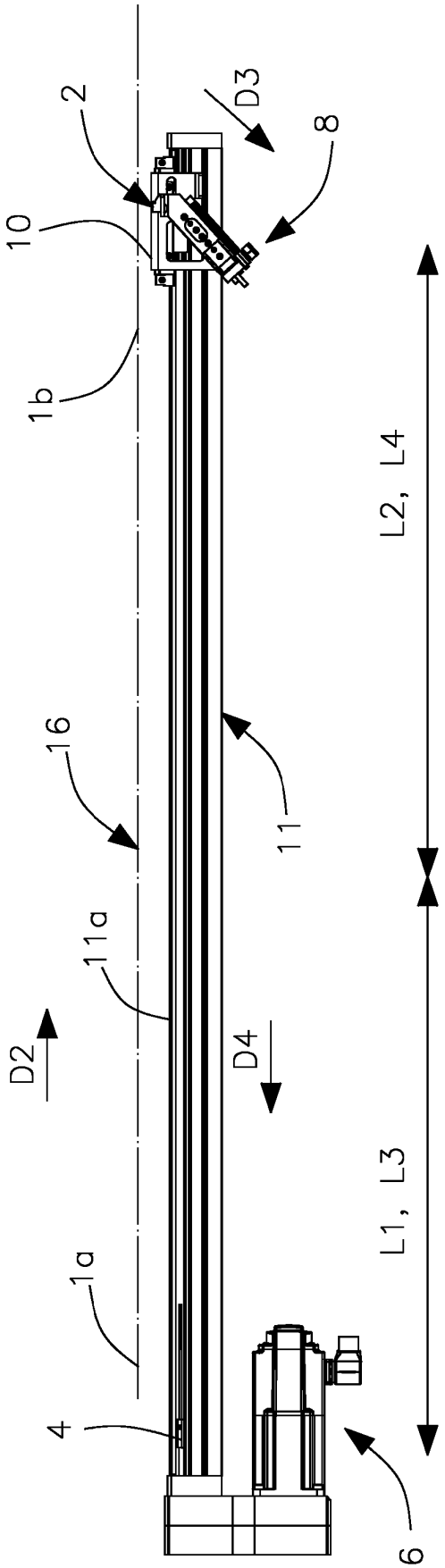
2
D3
8
10
1b
16
11
11a
D2
D4
1a
4
6
L2, L4
L1, L3

Fig. 2A

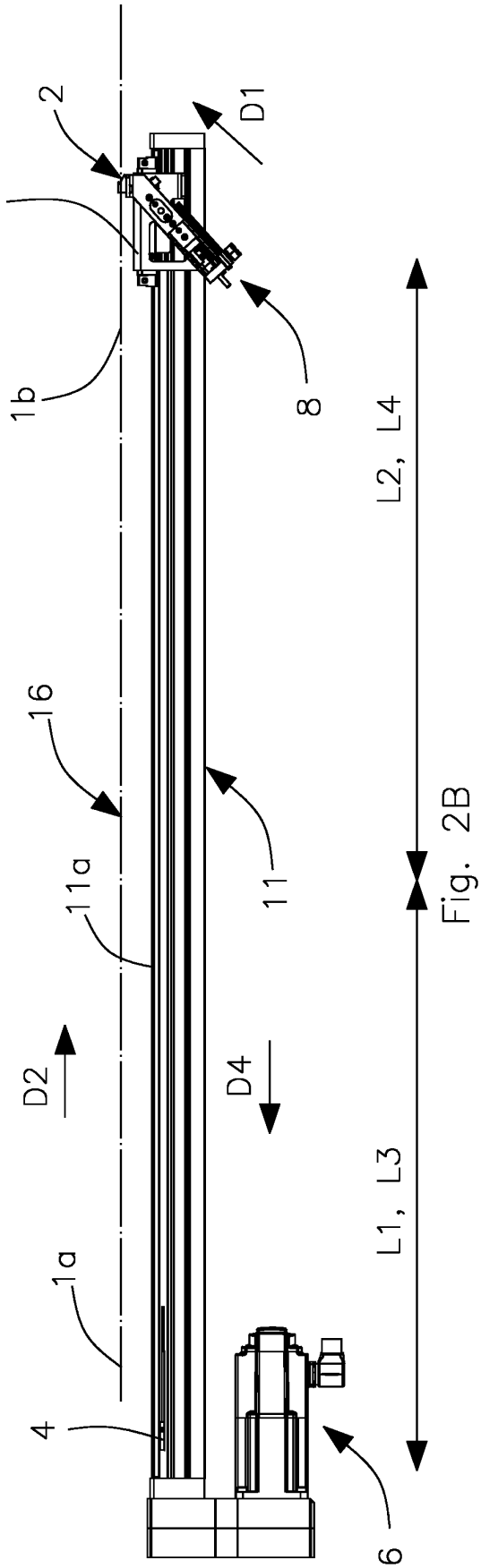
2
D1
10
1b
8
16
11
11a
D2
D4
1a
4
6
L2, L4
L1, L3

Fig. 2B

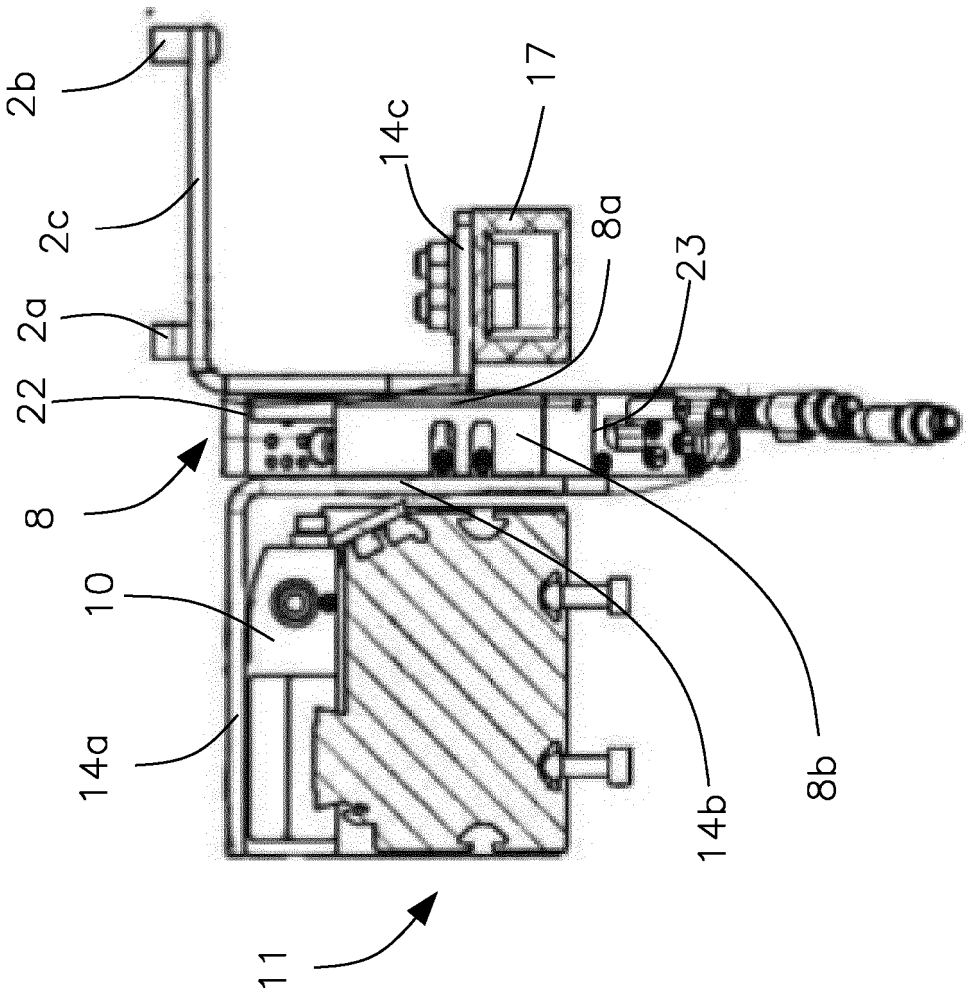

Fig. 3

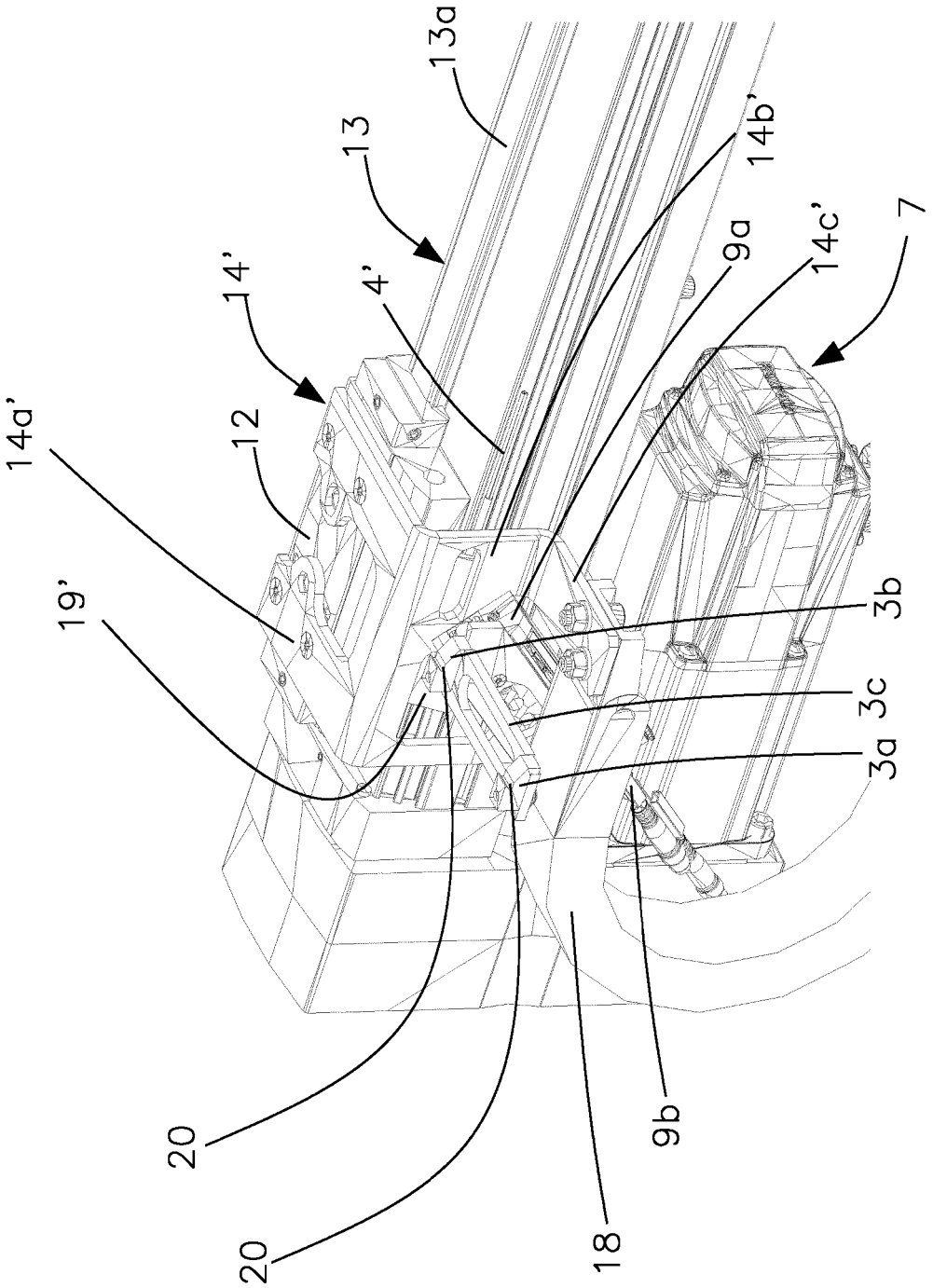

Fig. 4

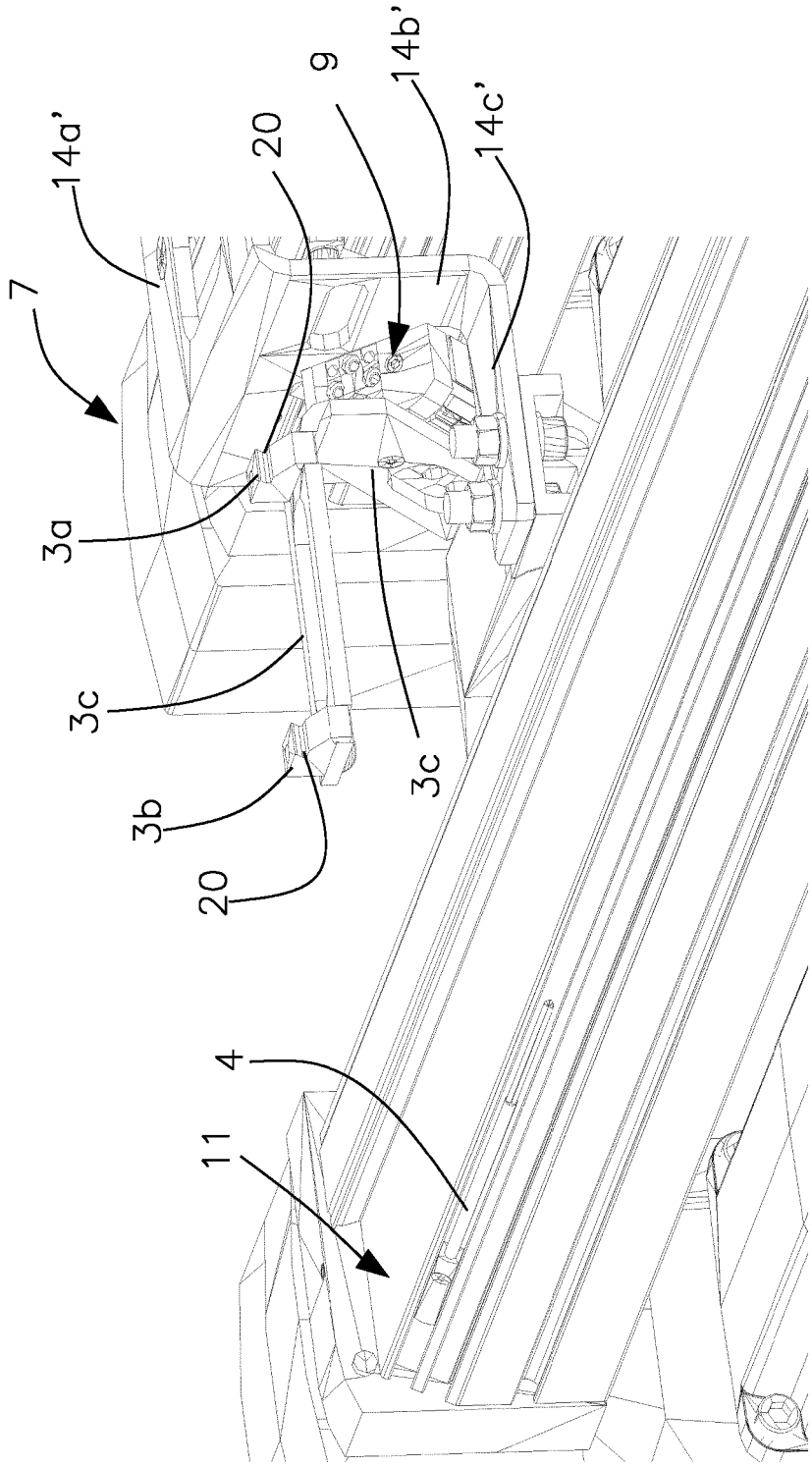

Fig. 5

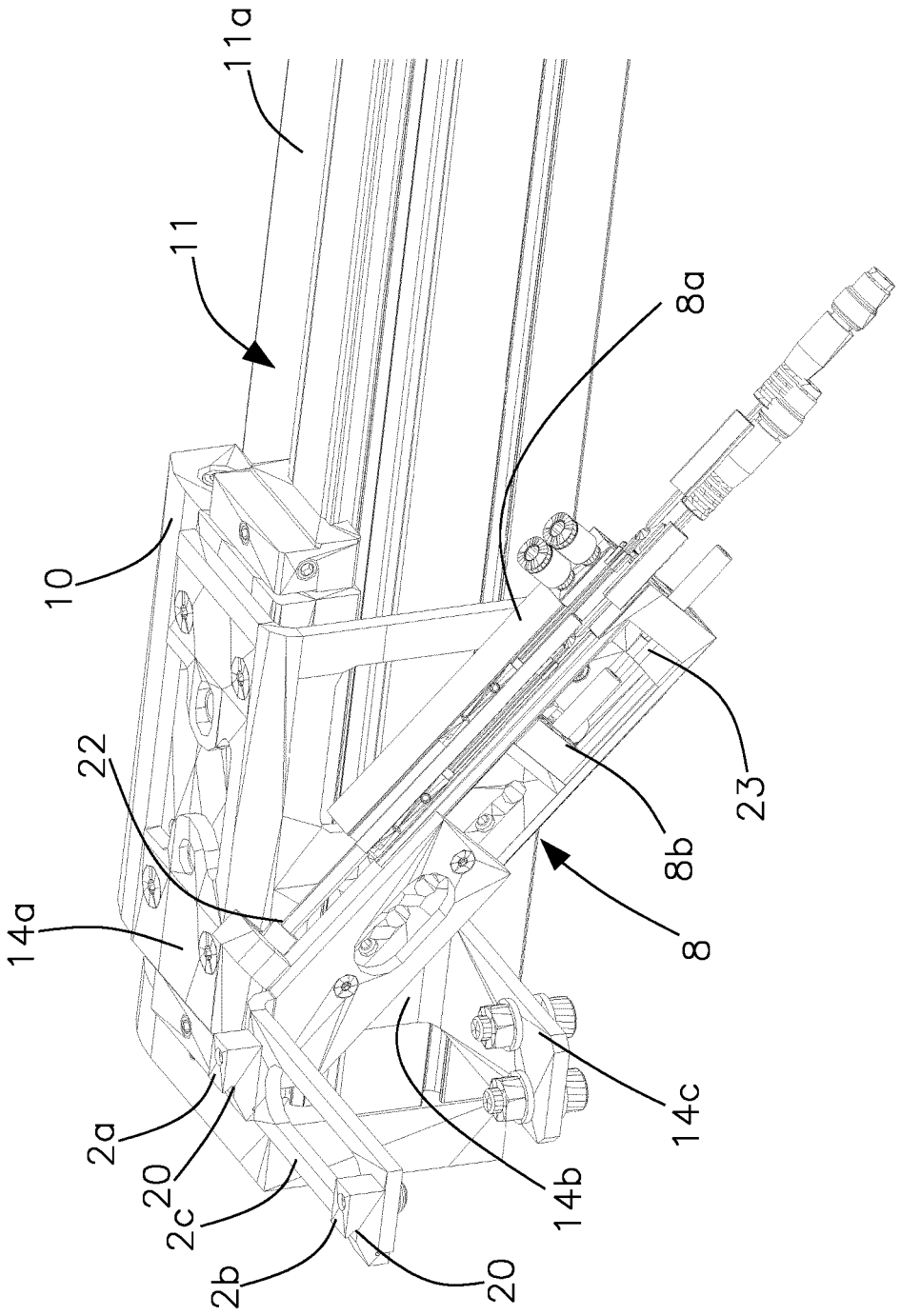

Fig. 6

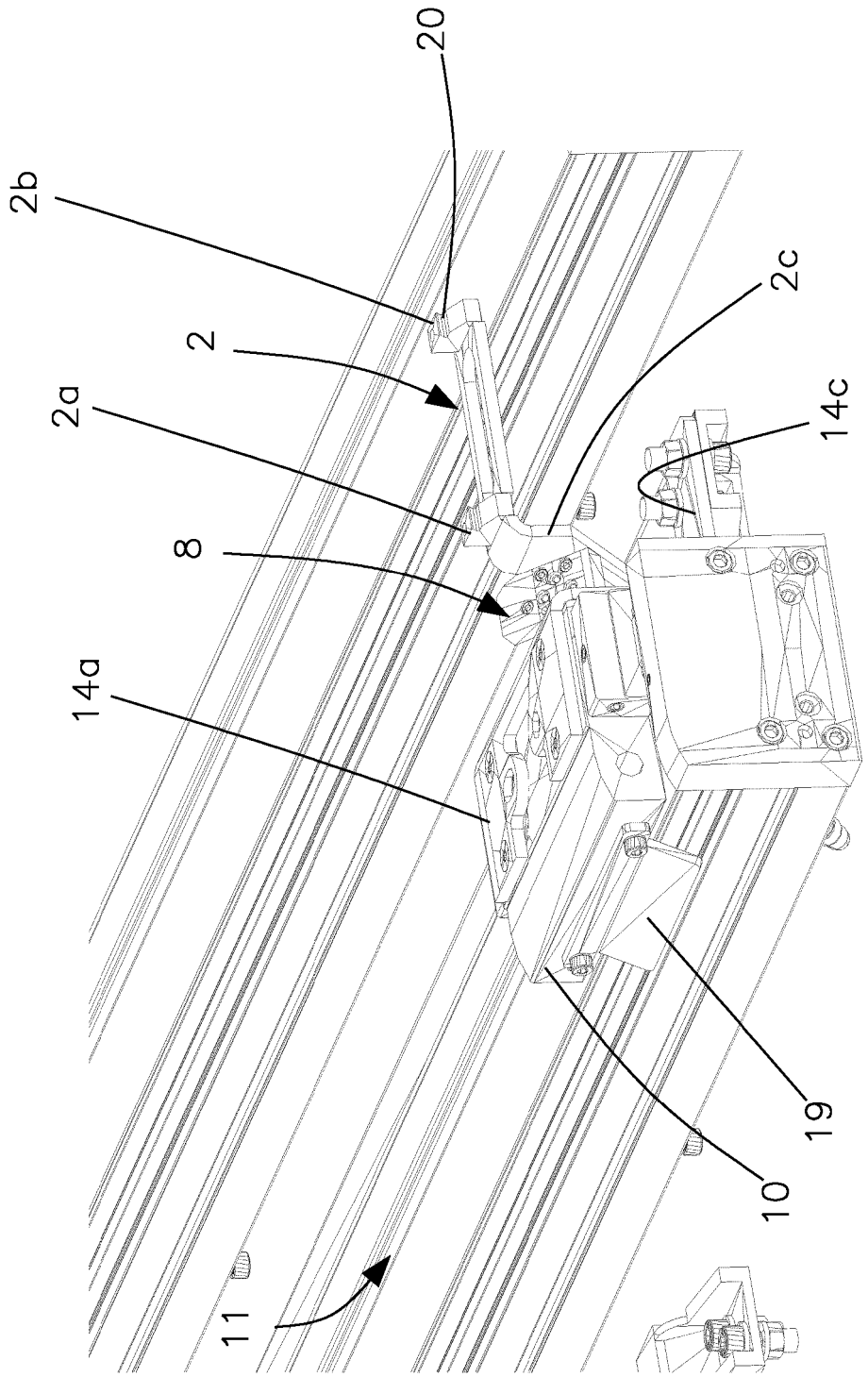

Fig. 7

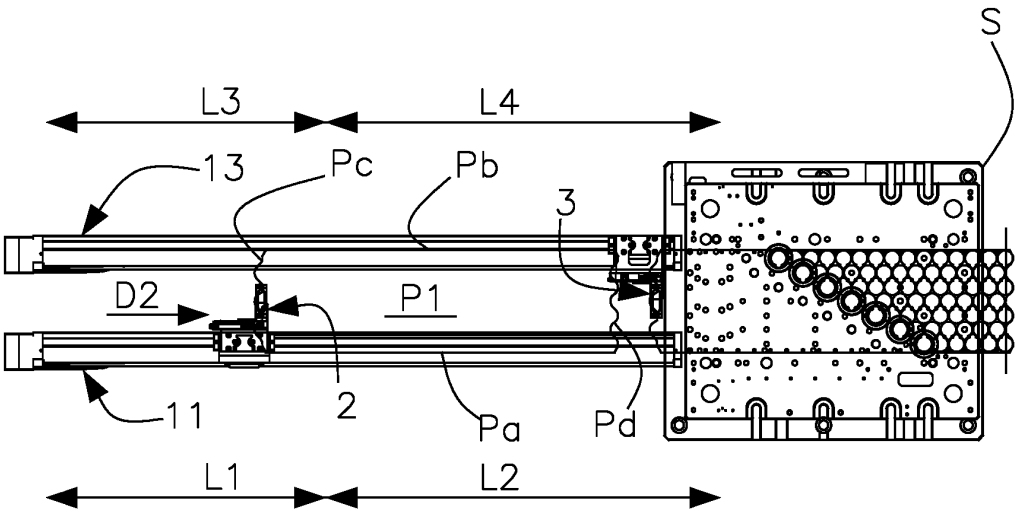

Fig. 8

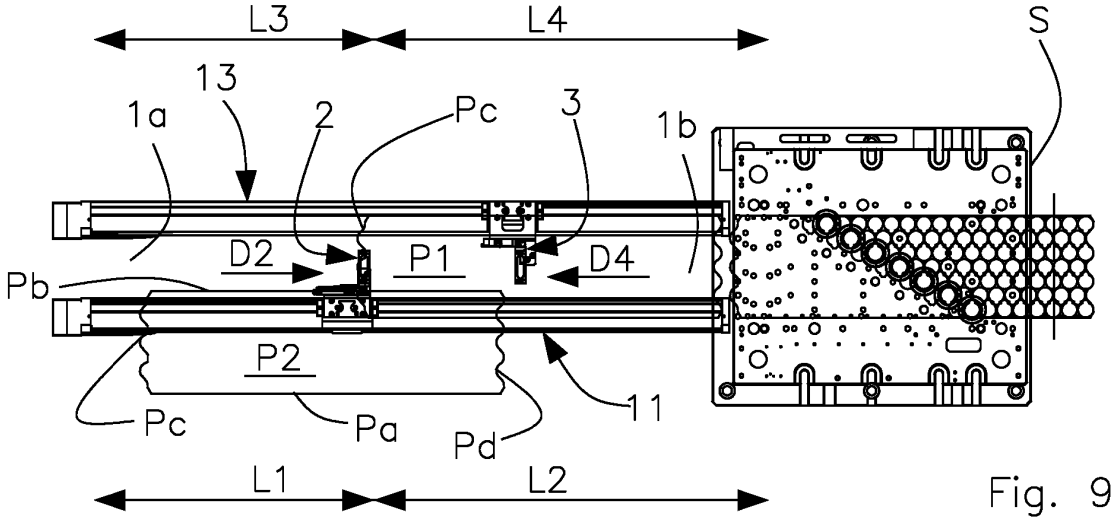

Fig. 9

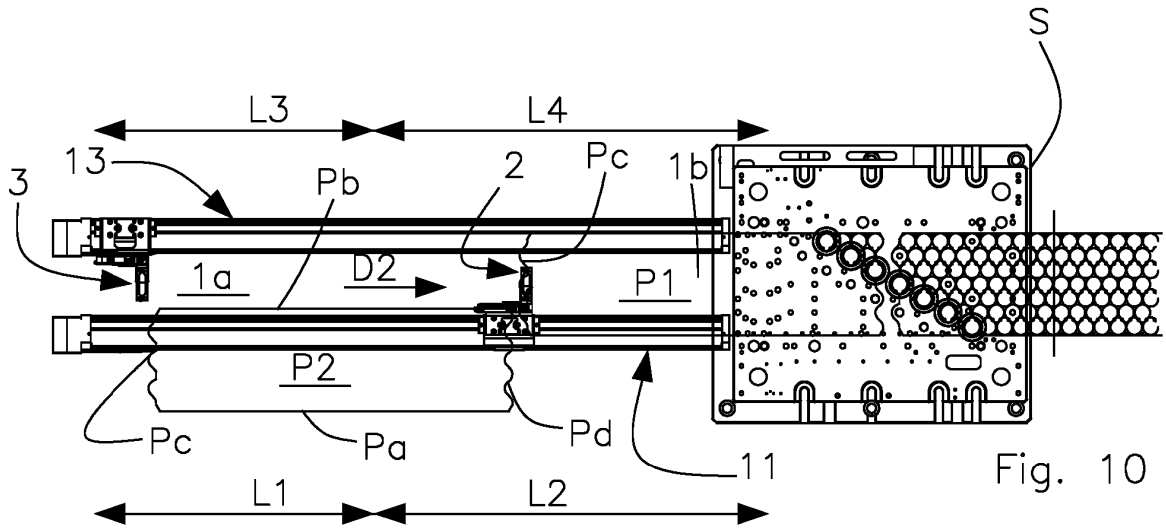

Fig. 10

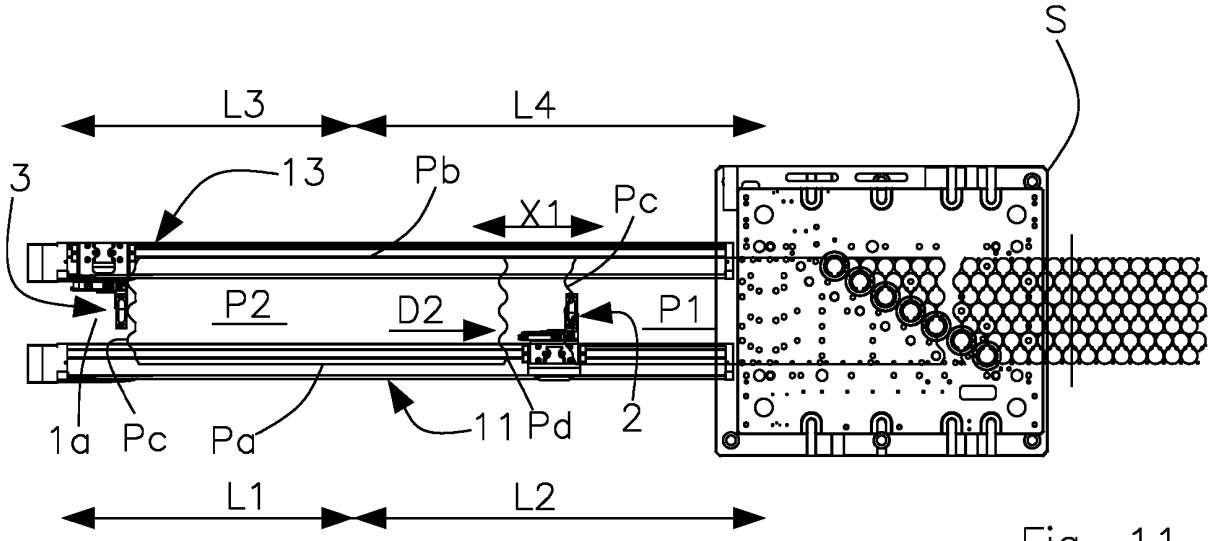

Fig. 11

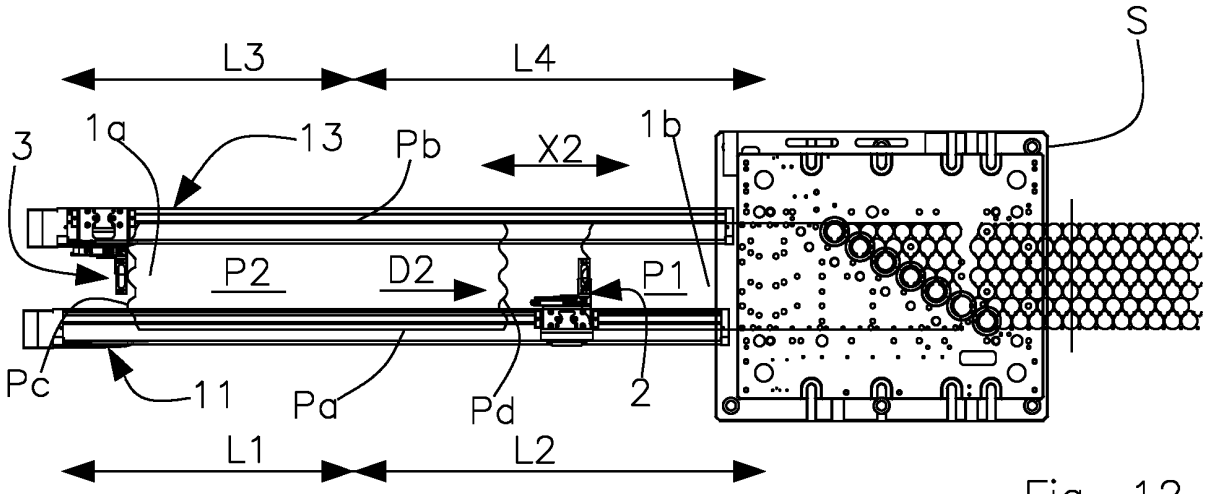

Fig. 12

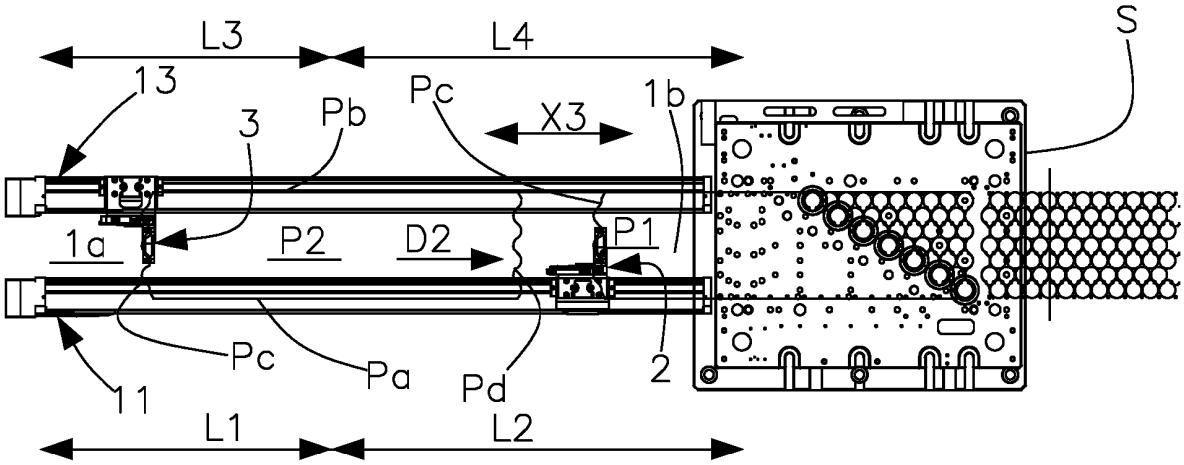

Fig. 13

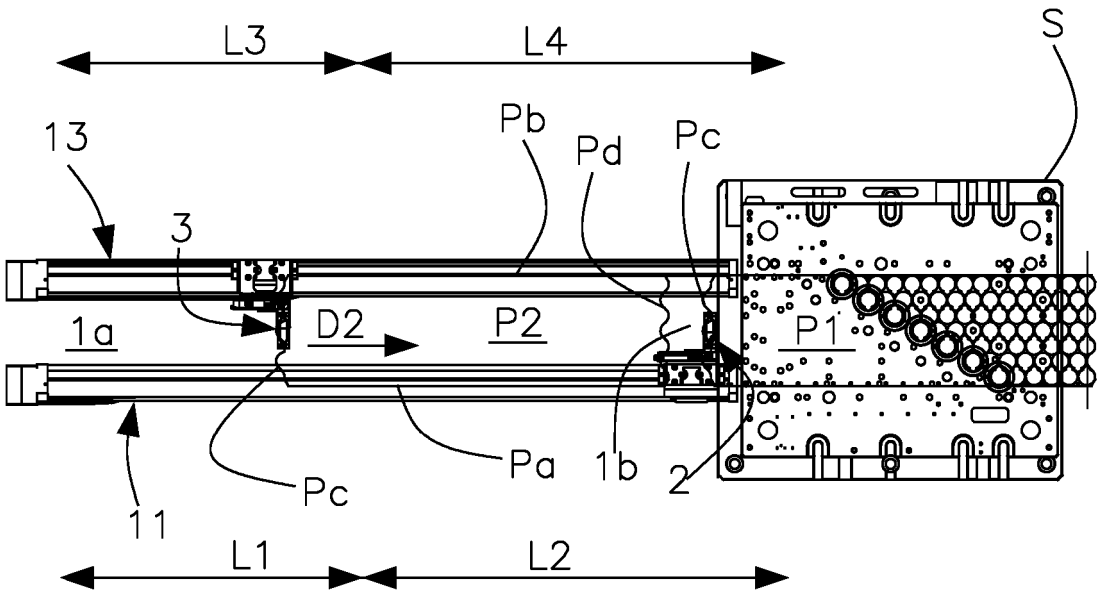
L3
L4
S
13
Pb
Pd
Pc
3
1a
D2
P2
P1
Pa
1b
2
Pc
11
L1
L2

Fig. 14

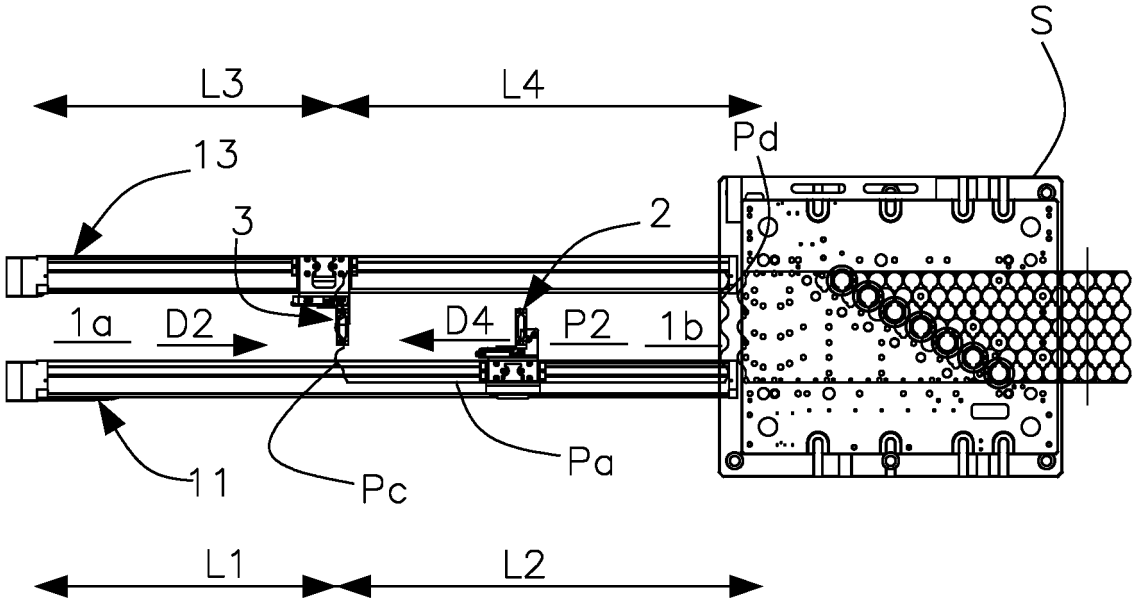
S
L3
L4
Pd
13
3
2
1a
D2
D4
P2
1b
Pa
11
Pc
L1
L2

Fig. 15

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- US 5878640 A **[0005]**