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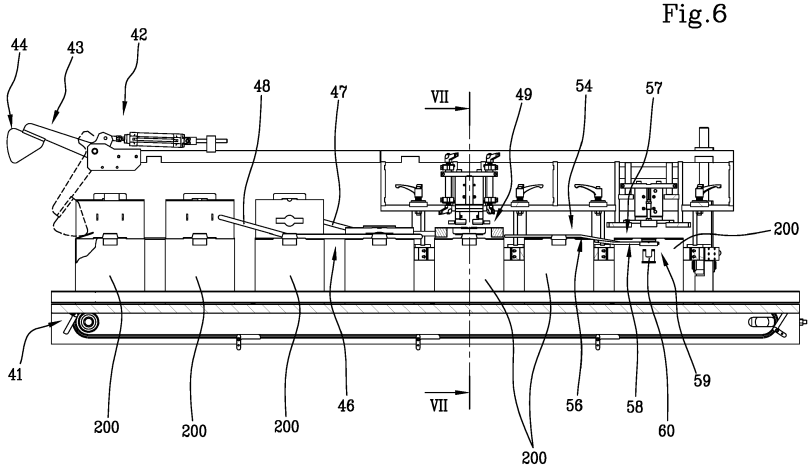
(54) APPARATUS FOR CLOSING A BOX

(57) An apparatus for closing a box (200) comprises:
- a first folding equipment (42) and a second folding equipment (46) located along a feed path and active on four upper flaps (206, 207, 208, 209) of each box (200) to fold down the four upper flaps (206, 207, 208, 209);
- a third folding equipment (49) located along the feed path to act on an extension flap (210) protruding from an upper flap (206) of one the four upper flaps (206, 207, 208, 209), so as to fold the extension flap (210) at an angle with respect to the upper flap (206);
- a closing equipment (52) located at, or downstream of, the third folding equipment (49) to completely close the upper flap (206) by inserting the folded extension flap (210) into a closing slit (213);
- a fourth folding equipment (54) located along the feed path to fold a stabilizing flap (212) in a position allowing the stabilizing flap (212) to be partially inserted in a stabilizing slit (214), so as to stabilize the box (200) in a closed configuration.

Fig.6



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Description

[0001] The present invention relates to an apparatus for closing a box, in particular for closing the upper opening of a carton box by folding an upper closing lid thereof.

[0002] In more detail, the invention relates to devices configured to obtain boxes of the type having an upper hinged lid or flap that has, on its free front edge, an extension flap. The latter may engage in a corresponding slit obtained between an opposite underlying closing flap and a vertical wall to which the underlying closing flap is attached. The box further comprises a stabilizing L-shaped flap formed in the underlying closing flap and in the vertical wall (and usually formed by a U-shaped notch defining a lower hinge line for the stabilizing flap) and engageable in a corresponding slit obtained between the upper hinged lid and the extension flap.

[0003] In this way, when a handle is attached to the underlying closing flap and protrudes from a corresponding opening in the upper hinged lid, a user can grasp and hold the box with its content without any risk that the box opens. This occurs owing to the blocking action of the stabilizing flap that keeps the upper hinged lid in the closed position.

[0004] The boxes referred to above are commonly used for the so-called "gift-boxes", which are defined by an outer box containing an inner box filled with products or articles. The articles contained in the inner box can be, for example, containers for liquid or pourable food drinks.

[0005] According to a known method for manufacturing gift-boxes, a group of containers is placed on a blank, in particular on a base panel element thereof. The blank is then wrapped around the group of containers to form the inner box. The filled inner box is then placed on a further blank and the latter is wrapped around the inner box so as to form the outer box.

[0006] The method that has been disclosed above allows a gift box to be successfully folded and filled. However, such a method can be further improved, especially as far as closing the outer box is concerned.

[0007] An object of the invention is to improve the known apparatuses for closing a box, in particular for closing an upper opening of a carton box.

[0008] A further object is to provide an apparatus that allows a box to be safely closed.

[0009] Another object is to provide an apparatus for closing a box in a fully automated manner.

[0010] A further object is to provide an apparatus for closing a box that achieves a high production rate.

[0011] According to the invention, there is provided an apparatus for closing a box, the box being of a kind comprising:

- a first lateral wall and a second lateral wall parallel to one another;
- a front wall and a rear wall each connecting the first lateral wall to the second lateral wall,
- an upper opening,
- a first lateral flap, a second lateral flap, a front flap and a back flap respectively connected to the first lateral wall, the second lateral wall, the front wall and the rear wall,
- an extension flap extending from a free edge of the first lateral flap,
- a stabilizing flap hinged to the second lateral wall so as to be rotatable about a hinge axis, the stabilizing flap being defined by a cut made partly in the second lateral wall and partly in the second lateral flap,

the apparatus comprising conveying means, configured to advance a sequence of boxes along a feed path in a displacement direction with the first lateral wall of each box being parallel to the displacement direction and with the opening of each box facing upwardly, the apparatus further comprising:

- a first folding equipment located along the feed path and active on the front flap and on the rear flap to fold down the front flap and the rear flap;
- a second folding equipment located along the feed path and active on the first lateral flap and on the second lateral flap to fold down the first lateral flap and the second lateral flap;
- a third folding equipment located along the feed path for acting on the extension flap to fold the extension flap at an angle with respect to the first lateral flap;
- a closing equipment for closing the first lateral flap by inserting the extension flap into a closing slit obtained between the second lateral flap and the second lateral wall;
- a fourth folding equipment located along the feed path for folding the stabilizing flap in a position allowing insertion of the stabilizing flap in a stabilizing slit defined between the extension flap and the first lateral flap;
- a stabilizing equipment for inserting an end part of the stabilizing flap into the stabilizing slit.

[0012] Owing to the invention, the boxes can be closed in a fully automated manner at high production rates.

[0013] The fourth folding equipment and the stabilizing equipment, which act on the stabilizing flap, allow the boxes to be closed in a safe and reliable manner, because the stabilizing flap makes difficult an undesired and accidental opening of the boxes.

[0014] The invention further allows the box to be completely closed without using any glue. In other words, the folding and/or closing of the box is performed only by folding or bending steps which can be reversed, in particular to allow the box to be re-opened and re-closed an indefinite number of times, whilst any use of glue would render the box unsuitable to be re-closed and re-opened.

[0015] A preferred, non-limiting embodiment of the present invention will be described by way of example with reference to the accompanying drawings, in which:

- Figures 1 and 2 show different views of a part of a machine for forming boxes equipped with a closing device according to the invention;
- Figures 2A to 2D are schematic top views of a sequence of forming steps performed in the machine of Figures 1 and 2;
- Figures 3 and 4 are different views of a closing device according to the invention;
- Figure 5 is an enlarged view of a part of the device of Figures 3 and 4 with the boxes removed;
- Figure 6 is a lateral view, with some parts in section, of the device of Figures 3 and 4;
- Figure 7 is a sectional view of the device of Figure 6 taken along plane VII-VII;
- Figure 7A is an enlarged detail of the sectional view of Figure 7;
- Figure 7B is a sectional view of the device of Figure 7, taken along plane VIII-VIII;
- Figure 8 is a view of an end part of the device of Figures 3 and 4;
- Figure 8A is an enlarged detail of the view of Figure 8;
- Figure 8B is an enlarged detail like Figure 8A, in a different configuration,
- Figure 9 is a perspective view of a box suitable for being processed by the device of Figures 3 and 4.

[0016] With reference to the Figures, reference 1 shows a part of a machine for the production of a box, in particular a "gift box" of the kind previously disclosed.

[0017] In more detail, the part of the machine shown in the Figures is the part configured to form, fill and close the outer box.

[0018] As shown in Figures 1 and 2, the part of machine 1 has, along a flow direction, a blank magazine 10, a box-forming device 20, a filling station 30 and a box closing device 40.

[0019] The blank magazine 10 is configured to support a plurality of blanks 100, each of which is conformed as a carton having a tubular portion interposed between a pre-closed end, intended to form a bottom wall of a box 200, and an open end, intended to define an upper opening of the box 200. Each blank 100 has been transversely flattened so that the volume enclosed between its longitudinal walls is substantially zero. The blanks 100 have been compacted, i.e. brought in mutual contact, along a feed direction F to define a single block 11, as can be seen in Figures 1 and 2. The blanks 100 can be pushed to a foremost position so that the first blank 100 of the block 11 remains always positioned in a position suitable for being processed by the box-forming device 20.

[0020] The box-forming device 20 comprises a pick-up unit 21, shown in Figures 2A to 2D, for picking up the foremost blank 100 of the block 11, and an expanding unit 22 configured to expand the picked-up, flattened blank 100 to obtain therefrom a box 200, having a closed bottom wall and an open upper end. The expanding unit 22 is preferably also configured to move the box 200 obtained from the blank 100 to a further unit or station (filling station 30).

[0021] For example, as shown in the sequence of movements of Figures 2A-2D, the pick-up unit 21 grasps the front surface of the foremost blank 100 to shift the foremost blank 100 laterally so that a part of the blank 100 (protruding part) protrudes laterally from the block 11. In this position, the expanding unit 22 (which is shown twice in Figure 2, in two different operative positions) can engage and hold a rear portion of the protruding part of the blank 100. The terms "front", "rear" and "lateral", when referred to the blank 100 processed by the pick-up unit 21, have to be construed while taking the feed direction F as a reference direction.

[0022] Moreover, the expanding unit 22 has an expanding arm 23 able to engage and hold a front portion, for example at the protruding part, of the blank 100 so that a return movement of the expanding arm 23 opens the tubular carton defined by the blank 100 to obtain a rectangular box 200, open at the upper end thereof.

[0023] The configuration of the box is shown in Figure 9. In more detail, the box 200 has a rectangular or square cross-section and comprises a first lateral wall 201 and a second lateral wall 202, which are parallel to each other. The box 200 further comprises a front wall 203 and a rear wall 204 connecting the first lateral wall 201 to the second lateral wall 202. Moreover, the box 200 is provided with an upper opening 205. The box 200 further comprises a first lateral flap 206 and a second lateral flap 207, each of which is interposed between a front flap 208 and a back flap 209. The first lateral flap 206, the second lateral flap 207, the front flap 208 and the rear flap 209 are connected to, respectively, the first lateral wall 201, the second lateral wall 202, the front wall 203 and the rear wall 204, near the upper opening 205.

[0024] The terms "front", "rear", and "lateral" have been and will be used in this description, in connection with the box 200, taking an advancement direction of the box 200 as a reference direction. The advancement direction may be a displacement direction D shown in Figures 1 and 3, which will be described in more detail hereinbelow.

[0025] The box 200 further has an extension flap 210, extending from a free edge 211 of the first lateral flap 206, and a stabilizing flap 212 that is hinged to the second lateral wall 202 so as to be rotatable about a (horizontal) hinge axis. The stabilizing flap 212 may be obtained for example by a concave cut made partly in the second lateral wall 202 and partly in the second lateral flap 207. The stabilizing flap 212 has a first part or connecting part 212a and a second part or end part 212b, which may be separated by a crease line. The first part 212a is hinged to the second lateral wall 202 and is interposed between the second part 212b and the hinge axis.

[0026] The extension flap 210 may be centered along the edge of the first lateral flap 206 to which it is attached, i.e. the free edge 211. The extension flap 210 has a length, measured along the edge of the first lateral flap 206 to which it is attached, less than the length of said

edge.

[0027] The flaps and walls of the blank 100 that have been previously described are connected to each other along respective crease lines which define folding lines or hinges during the folding process aimed at obtaining the box.

[0028] The expanding unit 22 is equipped with a carriage that is movable back and forth so that the box 200 grasped by the expanding unit 22 is moved to the filling station 30 while the box 200 is kept in an upright position.

[0029] Preferably, the blank 100 is pre-configured with a lower structure which is pre-closed so that, when the blank 100 is expanded, the lower part of the resulting box 200 is already closed. This can be obtained for example by providing lower closing flaps (not shown) overlapped and pre-engaged with each other, so that during expanding of the blank 100, said flaps remain engaged and form a bottom wall of the box 200. This arrangement of the lower closing flaps is well known in the art and will not be described in more detail.

[0030] In the filling station 30, a supporting member 31 holds a pre-filled inner box 300 above a conveyor 32 on which the box 200 travels.

[0031] The inner box 300 is intended to be inserted inside the outer box 200 to form a package known as a "gift box". This kind of package comprises an outer box that defines an internal space and an inner box that houses a group of containers and is arranged inside the internal space of the outer box.

[0032] The inner box 300 that arrives in the filling station 30 already contains the desired number and arrangement of containers, particularly containers filled with a pourable food product.

[0033] A filling head 33, located above the supporting member 31, is vertically movable between a pick-up position in which it grasps and holds the filled inner box 300 and a release position in which it releases the filled inner box 300 in an upper opening of an underlying box 200 supported by the conveyor 32.

[0034] After the box 200 has received the filled inner box 300, the conveyor 32 further advances the box 200 to the closing device 40, which is better shown in Figures 3 and 4. The conveyor 32 is configured to advance the box 200 along a movement direction G that is arranged transversely, in particular perpendicularly, to the feed direction F.

[0035] In detail, the closing device 40 has a lower feed conveyor 41 which has the function of feeding a succession of open-top boxes 200 along a feed path through a plurality of working stations. The feed path can extend along a displacement direction D that is arranged transversely, in particular perpendicularly, to the advancement direction G. The displacement direction D can be parallel to the feed direction F and opposite the feed direction F.

[0036] The boxes 200 are fed along the conveyor 41 in an upright position and with the first lateral wall 201 and the second lateral wall 202 parallel to the feed path, i.e. parallel to the displacement direction D.

[0037] Preferably, the conveyor 41 has a stepwise movement.

[0038] The closing device 40 comprises a first folding equipment 42 located along the feed path and active on the front flap 208 and on the rear flap 209 to fold down the front flap 208 and the rear flap 209, in particular until these flaps reach a substantially horizontal position.

[0039] The first folding equipment 42 comprises a movable member 43 configured to engage the rear flap 209 of a box 200 while the movable member 43 is moving in a forward direction along the feed path, to forwardly fold the rear flap 209 in a substantially horizontal position at least partially covering the upper opening 205 of the box 200.

[0040] In the embodiment shown in the drawings, the movable member 43 is a pivoting member hinged to rotate about a fixed horizontal axis and having a folding head 44 delimited by an arcuate profile to gently engage the upper surface of the rear flap 209 during folding thereof.

[0041] The first folding equipment 43 further comprises a fixed folding plate 45 located downstream of the movable member 43 so as to engage the front flap 208 of the box 200 during an advancing movement of the box 200 on the conveyor 41. The fixed folding plate 45 is configured to bend down the front flap 208 until the latter reaches a substantially horizontal position in alignment with, or lying on the top of, the previously folded rear flap 209 (which is kept in the horizontal position by the movable member 43).

[0042] Preferably, as shown in Figure 5, the fixed folding plate 45 has an inlet part 45a having an upwardly bent edge which serves for easily guiding the flap to be bent.

[0043] Preferably, as can be seen in Figures 3 to 5, the folding head 44 is defined by two parallel plates 44a that are spaced apart from one another. The folding head 44 is movable between an inoperative position and an operative position. In the inoperative position, shown by a continuous line in Figure 6, the folding head 44 does not interfere with any box 200. In the operative position, shown by a dashed line in Figure 6, the head 44 is moved downwardly to fold the rear flap 209 of a box 200. In the operative position, the fixed folding plate 45 is housed between the parallel plates 44a so that there is an overlap between the folding action of the head 44 and the folding action of the fixed folding plate 45.

[0044] Downstream of the first folding equipment 42, the closing device 40 comprises a second folding equipment 46 active on the first lateral flap 206 and on the second lateral flaps 207 to fold down the first lateral flap 206 and the second lateral flap 207 on the folded front flap 208 and rear flap 209.

[0045] The second folding equipment 46 comprises a pair of folding rails 47, 48 each of which has a folding portion that is oblique relative to the displacement direction D and a further portion that is substantially parallel

to the displacement direction D. The folding rails 47, 48 are configured to fold down respectively the second lateral flap 207 and the first lateral flap 206 during an advancing movement of the box 200 on the conveyor 41 along the displacement direction D.

[0046] The folding portions of the folding rails 47, 48 are spaced apart from one another along the displacement direction D, i.e. the folding portion of the folding rail 47 is located downstream of the folding portion of the folding rail 48. In this manner, the second lateral flap 207 is first folded down to a substantially horizontal position above the folded front flap 208 and the folded rear flap 209. Subsequently, the first lateral flap 206 is folded down above the folded second lateral flap 207.

[0047] In the embodiment in the drawings, the folding rails 47, 48 are defined by tubular guides preferably having a round or circular cross section.

[0048] The second folding equipment 46 is configured to fold the first lateral flap 206 to a position in which it forms an angle with the (horizontally) folded second lateral flap 207, so as to allow the extension flap 210 to be folded before the first lateral flap 206 is positioned in contact with the second lateral flap 207, which lies horizontally.

[0049] As shown in Figure 6, downstream of the second folding equipment 46, the closing device 40 comprises a third folding equipment 49 acting on the extension flap 210 to fold it at an angle of preferably 90° with respect to the first lateral flap 206, which is still maintained detached from the second lateral flap 207, i.e. at an angle relative to a horizontal plane.

[0050] As can be seen in Figures 7, 7A and 7B, the third folding equipment 49 comprises two folding members or blades 50, aligned along the feed path and spaced apart from each other. The folding blades 50 are capable of performing a downward movement (preferably but not necessarily in a vertical direction) to engage and downwardly bend the extension flap 210.

[0051] The third folding equipment 49 further comprises a couple of wedges 51 located externally of a travel trajectory of the folding blades 50. The wedges 51 are movable horizontally between an active position and an inactive position. In the active position, which is not shown, the wedges 51 are located between the first lateral flap 206 and the second lateral flap 207, so as to support the first lateral flap 206 and keep it at an angle relative to the second lateral flap 207 while the folding blades 51 are folding the extension flap 210 downwards. In the inactive position, shown in Figures 7 and 7A, the wedges 51 are retracted so as not interfere with the second lateral flap 207 and with the first lateral flap 206, so that the first lateral flap 206 can be further folded over the second lateral flap 207 to reach a substantially horizontal configuration.

[0052] As shown in Figure 7B, the wedges 51 are located at opposite ends of the free edge 211 of the first lateral flap 206 so as not to interfere with the extension flap 210 while the latter is being folded.

[0053] Preferably, the wedges 51 are defined by a single fork-shaped member horizontally movable between the active position and the inactive position.

[0054] The wedges 51 may have a tapered outline so that they can be easily inserted between the first lateral flap 206 and the second lateral flap 207 in the active position.

[0055] Downstream of, or preferably at, the third folding equipment 49, the closing device 40 comprises a closing equipment 52, shown for example in Figure 7A, configured to completely close the first lateral flap 206 and insert the folded extension flap 210 into a first closing slit 213 obtained between the second lateral flap 207 and the second lateral wall 202 of the box 200.

[0056] The closing equipment 52 can comprise at least one downwardly pushing member 53, shown in Figures 7A and 7B, acting on the first lateral flap 206 during or after folding of the extension flap 210 by the third folding equipment 49. Preferably, the downwardly pushing member 53 is located at the third folding equipment 49. The downwardly pushing member 53 is movable independently of the folding blades 50 of the third folding equipment 49.

[0057] The downwardly pushing member 53 is configured to act on the first lateral flap 206 while the wedges 50 are in the inactive position. The downwardly pushing member 53 is configured to fold the first lateral flap 206 downwards until the first lateral flap 206 reaches a position in which it is in contact with the second lateral flap 207. Due to the downwards movement of the first lateral flap 206, pushed by the downwardly pushing member 53, the extension flap 210 is inserted in the first closing slit 213.

[0058] As shown in Figure 6, downstream of the third folding equipment 49, the closing device 40 comprises a fourth folding equipment 54 intended to fold or shape the stabilizing flap 212 according to a conformation in which the stabilizing flap 212 can be partially inserted in a second stabilizing slit 214 defined between the extension flap 210 and the first lateral flap 206.

[0059] As shown in Figure 8A, the fourth folding equipment 54 comprises a bending device 55 for outwardly bending the flat stabilizing flap 212 by rotating the stabilizing flap 212 about its hinge axis, i.e. about the axis at which the stabilizing flap 212 is hinged to the first lateral wall 202. When bending the stabilizing flap 212, the bending device 55 moves the stabilizing flap 212 away from the upper opening 205.

[0060] Indeed, when a box 200 enters the box closing apparatus 40, the stabilizing flap 212 is coplanar with the second lateral wall 202 and with the second lateral flap 207. After bending the second lateral flap 207, the stabilizing flap 212 protrudes from the upper surface of the horizontally folded second lateral flap 207 and can therefore be engaged by the bending device 55. In other words, after the second lateral flap 207 has been bent, the stabilizing flap 212 is in an initial position P1 shown in Figure 7A, i.e. it is in a flat, substantially vertical posi-

tion. In the initial position P1, the first part 212a and the second part 212b of the stabilizing flap 212 are substantially coplanar. Furthermore, in the initial position P1, the stabilizing flap 212 is substantially coplanar with the second lateral wall 202.

[0061] As shown in Figures 7A and 8A, the bending device 55 comprises a first bending rail 56 having a bending portion that diverges relative to the displacement direction D along the feed path. The bending portion of the first bending rail 56 is configured to engage with the stabilizing flap 212 and to bend the latter outwardly relative to the box 200, by rotating the stabilizing flap 212 about its hinge axis. To this end, the bending rail 56 engages an upwardly protruding part of the stabilizing flap 212 during advancement of the box 200 by means of the conveyor 41.

[0062] An intermediate position P2, shown in Figure 7A, is thus reached. In the intermediate position P2, the stabilizing flap 212 is tilted outwardly relative to the second lateral wall 202. Therefore, the stabilizing flap 212 is no more coplanar with the second lateral wall 202. However, the first part 212a and the second part 212b of the stabilizing flap 212 are still coplanar, i.e. the stabilizing flap 212 is still flat.

[0063] Moreover, the fourth folding equipment 54 also comprises a shaping device 57 located downstream of the bending device 56, as shown in Figure 6. The shaping device 57 is configured to act on the outwardly bent stabilizing flap 212, i.e. on the stabilizing flap 212 arranged in a position of the kind of the intermediate position P2, to fold the stabilizing flap 212 into a folded or substantially L-shaped configuration, in which the first part 212a and the second part 212b are no longer coplanar. In the L-shaped configuration, the first part 212a forms an angle with the second lateral wall 202. Furthermore, in the L-shaped configuration, the second part 212b forms relative to the first part 212a, said angle being for example of 90°.

[0064] In more detail, as shown in Figures 7A and 8A, the shaping device 57 comprises a second bending rail 58 cooperating with the first bending rail 56 and having a respective bending portion configured to engage the second part 212b of the stabilizing flap 212 and to bend the second part 212b towards the box 200 so as to define the aforementioned L-shaped configuration of the stabilizing flap 212.

[0065] The shaping device 57 folds the stabilizing flap 212 in a bended position P3 shown in Figure 7a.

[0066] At or preferably downstream of the fourth folding equipment 54, the closing device 40 comprises a stabilizing equipment 59 intended to insert the second part 212b of the previously folded stabilizing flap 212 into the second stabilizing slit 214.

[0067] Preferably, as can be seen in Figures 6, 7A and 8A, the stabilizing equipment 59 comprises a vertically movable pusher 60 configured to act on the first part 212a of the stabilizing flap 212, which has previously been folded into the L-shaped configuration. As shown in Figure 8B, during an upward stroke of the vertically movable pusher 60, the stabilizing flap 212 is rotated about its hinge axis towards the second lateral flap 202. The second part 212b is thus allowed to enter into the stabilizing slit 214.

[0068] To aid this movement, the stabilizing equipment 59 may further comprise an interacting element 60a having a tilted lower surface capable of interacting with the second part 212b of the stabilizing flap 212. The interacting element 60a is arranged in a stationary position. For example, the interacting element 60a may be fastened to an end region of the second bending rail 58.

[0069] While the stabilizing flap 212 is rotated towards the second inner wall 202 by the pusher 60, which is moving upwardly, an upper surface of the second part 212b contacts the interacting element 60a, which folds the second part 212b relative to the first part 212a, thereby guiding the second part 212b of the stabilizing flap 212 during its rotational movement under the action of the pusher 60. The second part 212b may be thus more easily inserted inside the second stabilizing slit 214, whereas the first part 212a is brought in a substantially vertical position, coplanar with the second lateral wall 202.

[0070] At least one of the said equipments 42, 46, 49, 52, 54, 59, and preferably the third folding equipment 49 and the fourth folding equipment 54, may comprise a plurality of corner box positioning elements 61, particularly four corner box positioning elements 61. Each corner box positioning element 61 acts as an angular abutting element and is movable between a forwarded operative position and a retracted non operative position. In the forwarded operative position, each box positioning element 61 engages a respective vertical corner of a box 200, so as to keep the box 200 in a precise and stationary position as the box 200 interacts with the operative devices of the corresponding equipment. In the retracted non operative position, the box positioning elements 61 are retracted to allow feeding/removal of a box 200 to/from the corresponding equipment.

[0071] Moreover, at least one of said equipments 42, 46, 49, 52, 54, 59 and/or said box positioning elements 61 can be adjustable to allow operation on boxes having different sizes or formats.

[0072] The specific embodiment according to the above description and shown in the drawings is a possible way of carrying out the invention. Anyway, the invention encompasses several modifications to the disclosed embodiment without departing from the scope of the invention. For example, the conveyor can be replaced with different solutions, generically configured as "conveying means". Moreover, the sequence of the stations can be different from the exact order above identified. For example, the closing equipment can be located at the third folding equipment to completely close the first lateral flap while the extension flap is being folded and/or the third folding equipment can be located at the second folding equipment to fold down the extension flap during folding

down of the first lateral flap.

[0073] The invention as disclosed overcomes the drawbacks of the prior art, since the automatic device according to the invention can increase the speed of the closing process therefore increasing the production ratio of the machine in which the closing device is installed.

Claims

1. Apparatus for closing a box (200), the box (200) being of a kind comprising:

- a first lateral wall (201) and a second lateral wall (202) parallel to one another;
- a front wall (203) and a rear wall (204) each connecting the first lateral wall (201) to the second lateral wall (202),
- an upper opening (205),
- a first lateral flap (206), a second lateral flap (207), a front flap (208) and a back flap (209) respectively connected to the first lateral wall (201), the second lateral wall (202), the front wall (203) and the rear wall (204),
- an extension flap (210) extending from a free edge (211) of the first lateral flap (206),
- a stabilizing flap (212) hinged to the second lateral wall (202) so as to be rotatable about a hinge axis, the stabilizing flap (212) being defined by a cut made partly in the second lateral wall (202) and partly in the second lateral flap (207),

the apparatus comprising conveying means (41), configured to advance a sequence of boxes (200) along a feed path in a displacement direction (D) with the first lateral wall (201) of each box (200) being parallel to the displacement direction (D) and with the opening (205) of each box (200) facing upwardly, the apparatus further comprising:

- a first folding equipment (42) located along the feed path and active on the front flap (208) and on the rear flap (209) to fold down the front flap (208) and the rear flap (209);
- a second folding equipment (46) located along the feed path and active on the first lateral flap (206) and on the second lateral flap (207) to fold down the first lateral flap (206) and the second lateral flap (207);
- a third folding equipment (49) located along the feed path for acting on the extension flap (210) to fold the extension flap (210) at an angle with respect to the first lateral flap (206);
- a closing equipment (52) for closing the first lateral flap (206) by inserting the extension flap (210) into a closing slit (213) obtained between the second lateral flap (207) and the second lateral wall (202);
- a fourth folding equipment (54) located along the feed path for folding the stabilizing flap (212) in a position allowing insertion of the stabilizing flap (212) in a stabilizing slit (214) defined between the extension flap (210) and the first lateral flap (206);
- a stabilizing equipment (59) for inserting an end part (212b) of the stabilizing flap (212) into the stabilizing slit (214).

2. Apparatus according to claim 1, wherein the fourth folding equipment (54) comprises a bending device (55) for bending the stabilizing flap (212) by rotating the stabilizing flap (212) about the hinge axis towards the outside of the box (200), the fourth folding equipment (54) further comprising a shaping device (57) located downstream of the bending device (55) for shaping the stabilizing flap (212) according to a folded configuration, in which the end part (212b) of the stabilizing flap (212) forms an angle with a connecting part (212a) of the stabilizing flap (212), the connecting part (212a) being hinged to the second lateral wall (202) at the hinge axis.

3. Apparatus according to claim 2, wherein the bending device (55) comprises a first bending rail (56) arranged along the feed path and having a bending portion diverging from the displacement direction (D), so as to engage with and outwardly bend the stabilizing flap (212) by rotating the stabilizing flap (212) about the hinge axis while keeping the stabilizing flap (212) in a flat configuration, and wherein the shaping device (57) comprises a second bending rail (58) cooperating with the first bending rail (56) and having a respective bending portion configured to engage the end part (212b) of the stabilizing flap (212) and to bend the end part (212b) towards the box (200), so as to define the folded configuration of the stabilizing flap (212).

4. Apparatus according to claim 2 or 3, wherein the stabilizing equipment (59) comprises a pusher (60) configured to act on the connecting part (212a) of the stabilizing flap (212) in order to rotate the stabilizing flap (212) about the hinge axis, so as to allow the end part (212b) of the stabilizing flap (212) to enter into the stabilizing slit (214).

5. Apparatus according to claim 4, wherein the stabilizing equipment (59) comprises an interacting element (60a) arranged in a stationary position, the interacting element (60a) having a tilted surface capable of interacting with the end part (212b) of the stabilizing flap (212) while the stabilizing flap (212) is pushed upwards by the pusher (60), so as to guide the end part (212b) towards the stabilizing slit (214).

6. Apparatus according to any preceding claim, wherein the first folding equipment (42) comprises a movable member (43) pivotable about an axis in order to engage the rear flap (209) of a box (200) and fold the rear flap (209) into a substantially horizontal position at least partially covering the upper opening (205).

7. Apparatus according to claim 6, wherein the first folding equipment (42) further comprises a fixed folding element (45) located downstream of the movable member (43) so as to engage the front flap (208) during an advancement movement of the box (200) on the conveying means (41), thereby bending down the front flap (208) into a substantially horizontal position at least partially covering the upper opening (205).

8. Apparatus according to any preceding claim, wherein the second folding equipment (46) comprises a pair of folding rails (47, 48) located at opposite sides of the feed path and having respective folding portions converging towards the feed path in the displacement direction (D), so as to fold down the first lateral flap (206) and the second lateral flap (207) of each box (200) while the box (200) is advanced in the displacement direction (D).

9. Apparatus according to any preceding claim, wherein the second folding equipment (46) is configured to first fold the second lateral flap (207) into a substantially horizontal position above the front flap (208) and the rear flap (209), and then to fold the first lateral flap (206) at an angle relative to the second lateral flap (207), so as to allow the extension flap (210) to be subsequently folded.

10. Apparatus according to any preceding claim, wherein the third folding equipment (49) comprises at least one folding member (50), capable of performing a downward movement to engage and downwardly bend the extension flap (210) with respect to the first lateral flap (206), the third folding equipment (49) further comprising at least one wedge (51) having an active position in which the at least one wedge (51) is located below the first lateral flap (206) to support the first lateral flap (206) at an angle relative to the second lateral flap (207), while the at least one folding member (50) is bending downwardly the extension flap (210).

11. Apparatus according to any preceding claim, wherein the closing equipment (52) comprises a downwardly pushing member (53) configured to act on the first lateral flap (206) during or after folding of the extension flap (210) by the third folding equipment (49), until the first lateral flap (206) reaches a position in which the extension flap (210) is inserted into the closing slit (213).

12. Apparatus according to any preceding claim, wherein the first folding equipment (42), the second folding equipment (46), the third folding equipment (49) and the fourth folding equipment (54) are located in sequence along the feed path.

13. Apparatus according to any preceding claim, wherein the closing equipment (52) is located at the third folding equipment (49).

14. Apparatus according to any preceding claim, wherein the stabilizing equipment (59) is located at the fourth folding equipment (54).

15. Machine for producing boxes (200) filled with products, the machine comprising a box forming unit (20) for forming a box (200), an apparatus (40) according to any preceding claim for closing the boxes (200), and an inserting device (30) located between the box forming unit (20) and the apparatus (40), the inserting device (30) having a filling head (33) configured to insert an inner container (300), filled with products, into a respective box (200) through the upper opening (205) of the box (200) .

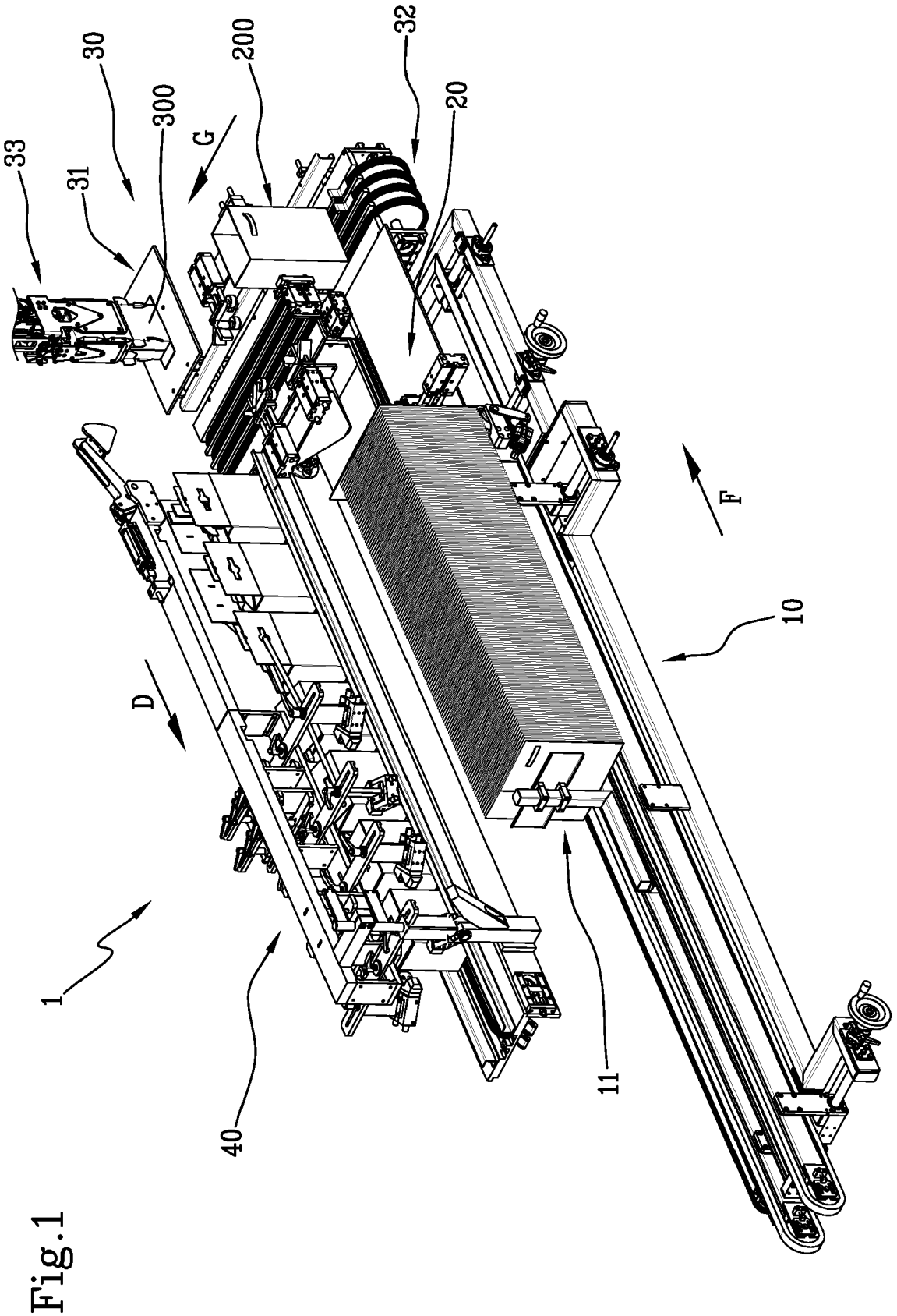


Fig.1

Fig.2

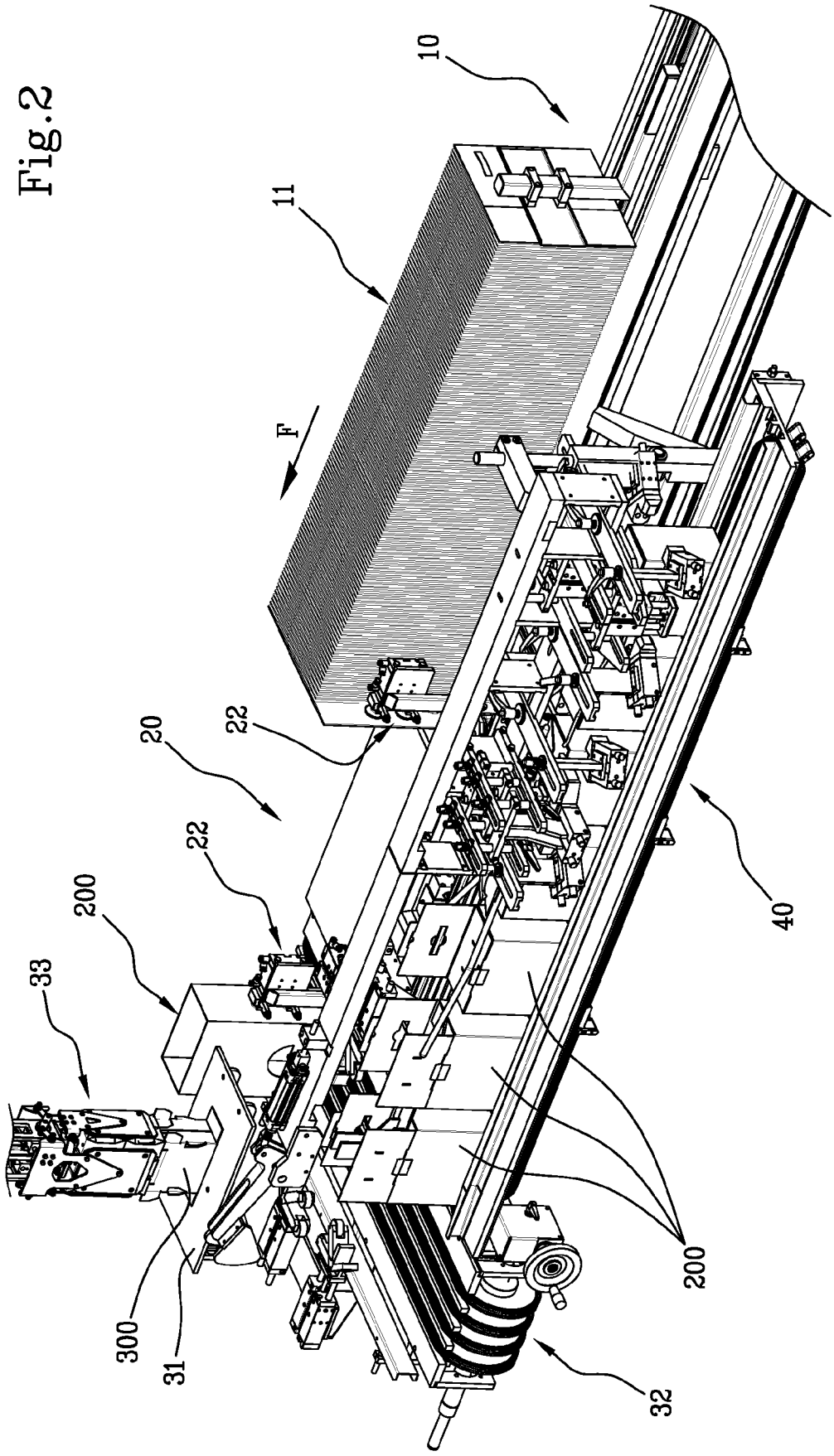
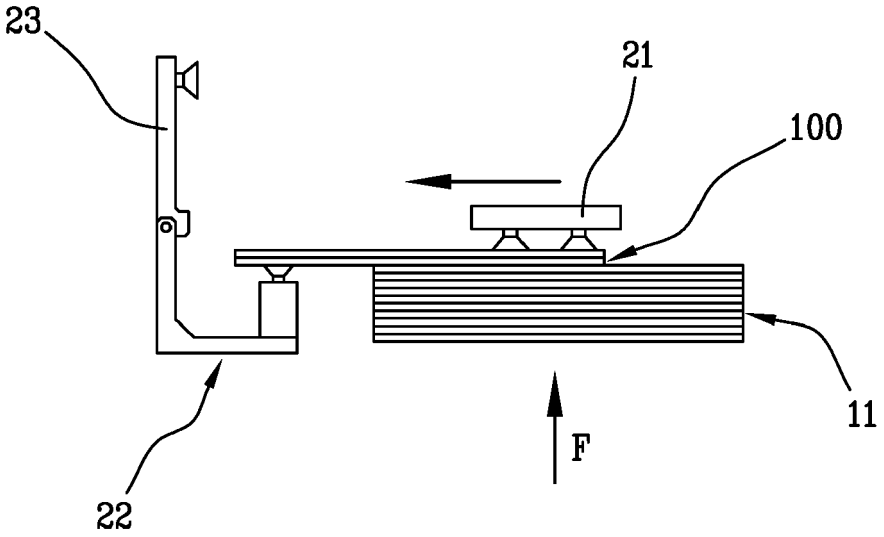


Fig.2A



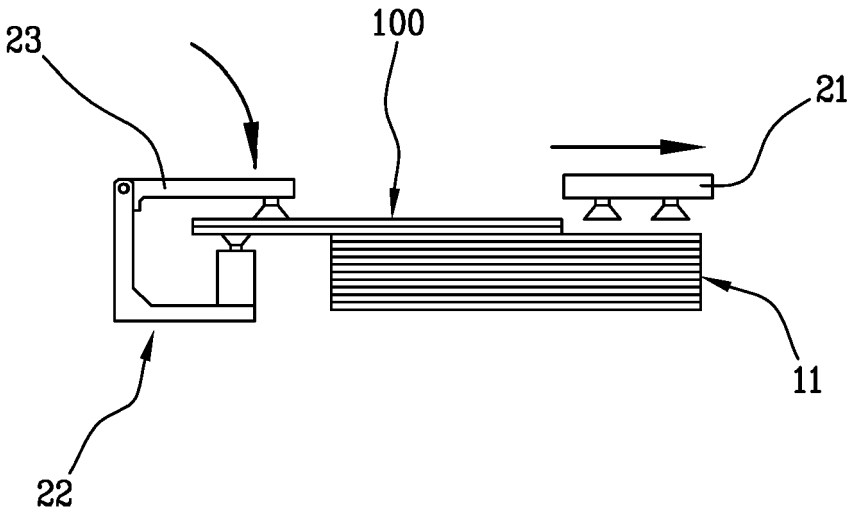
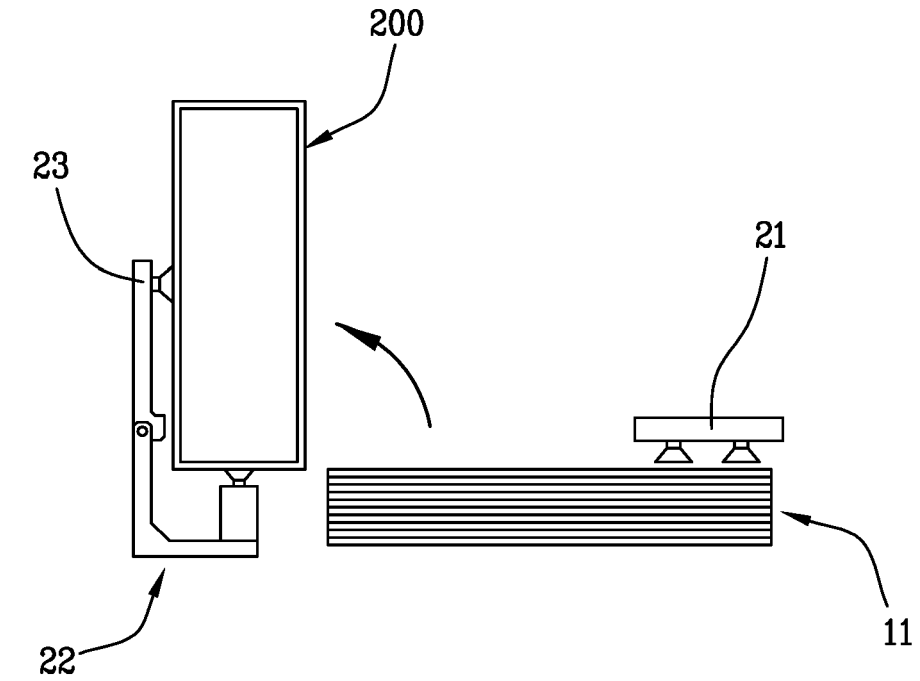


Fig.2B

Fig.2C



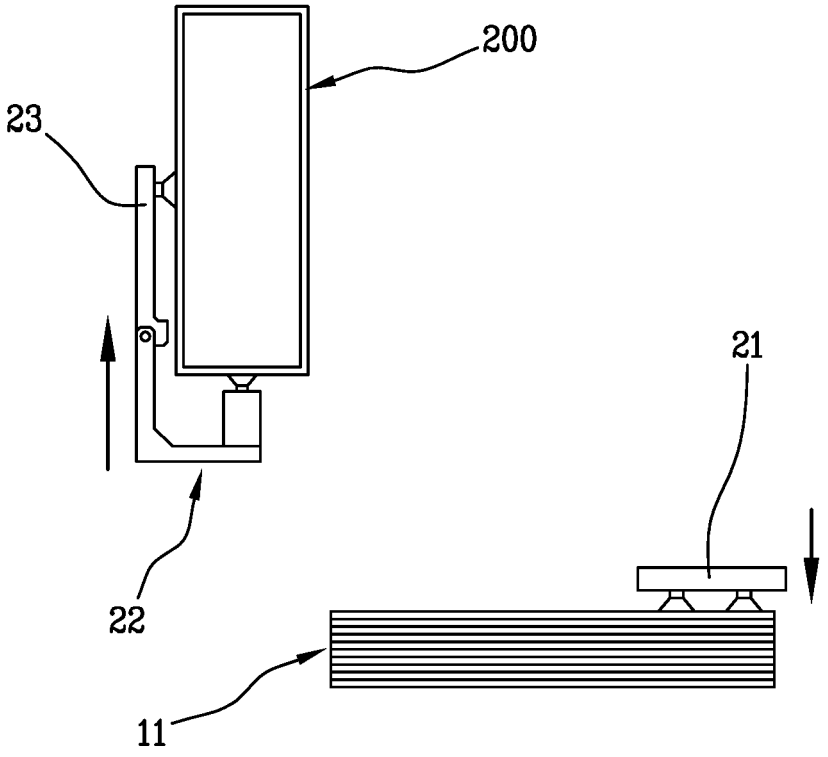


Fig.2D

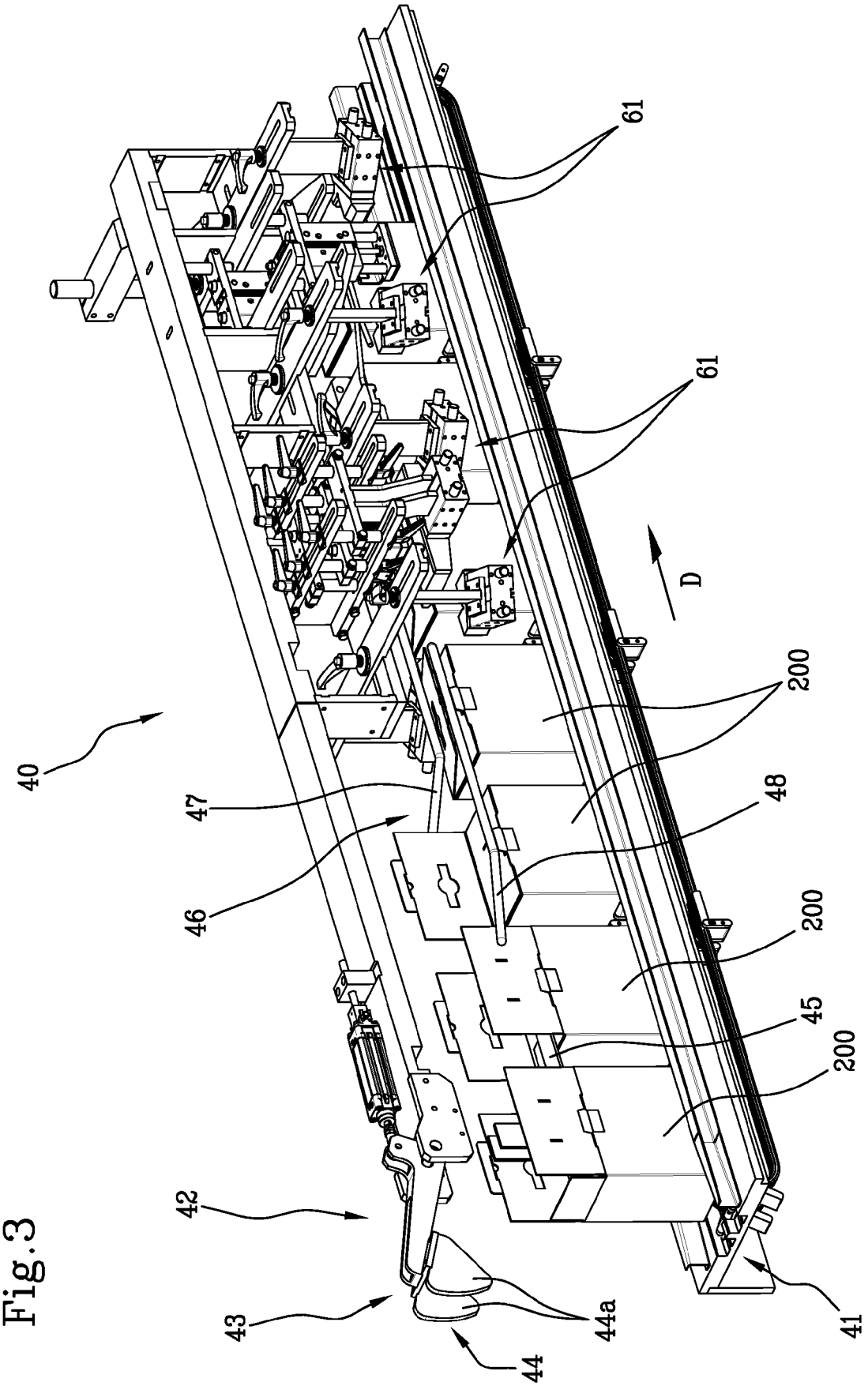


Fig.3

Fig.4

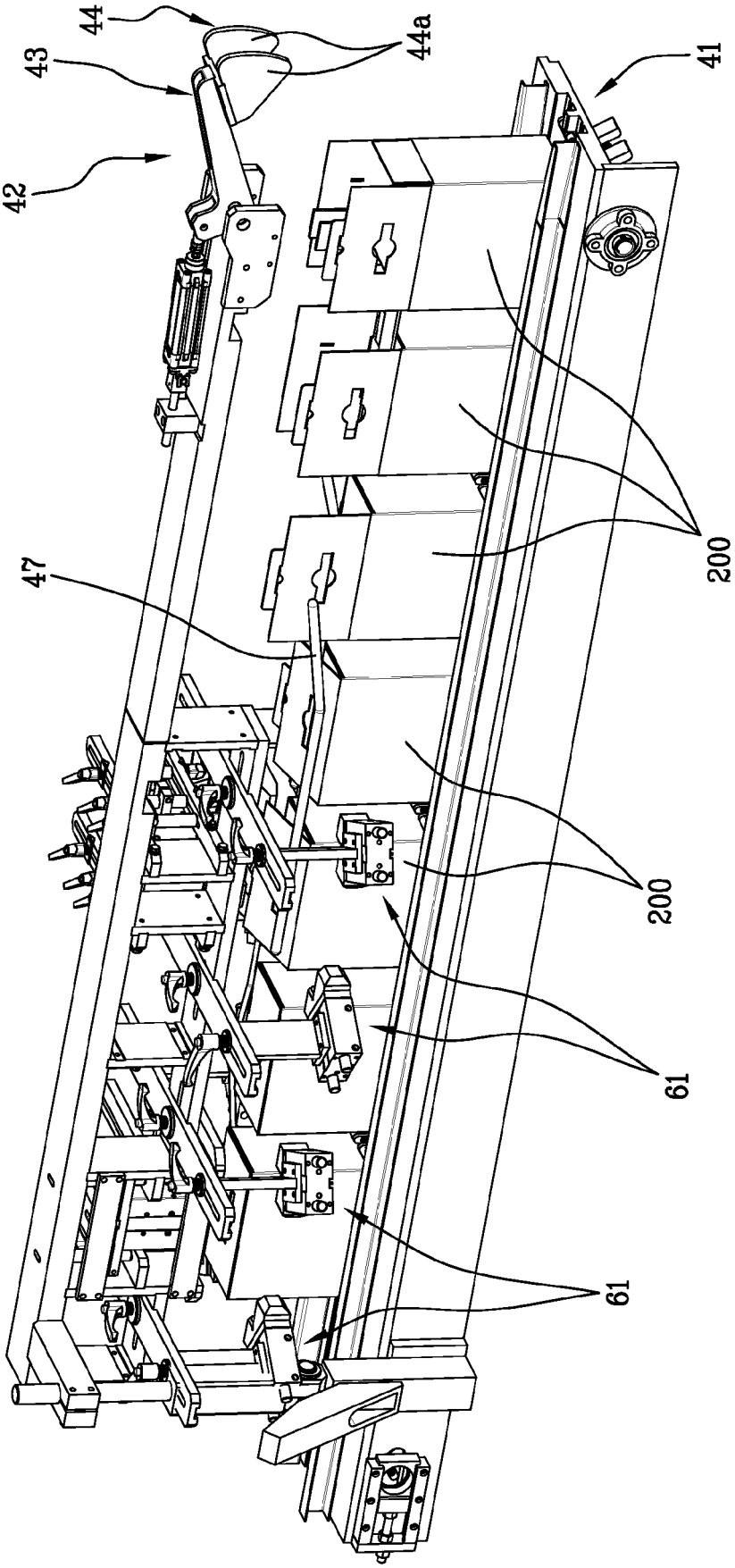


Fig.5

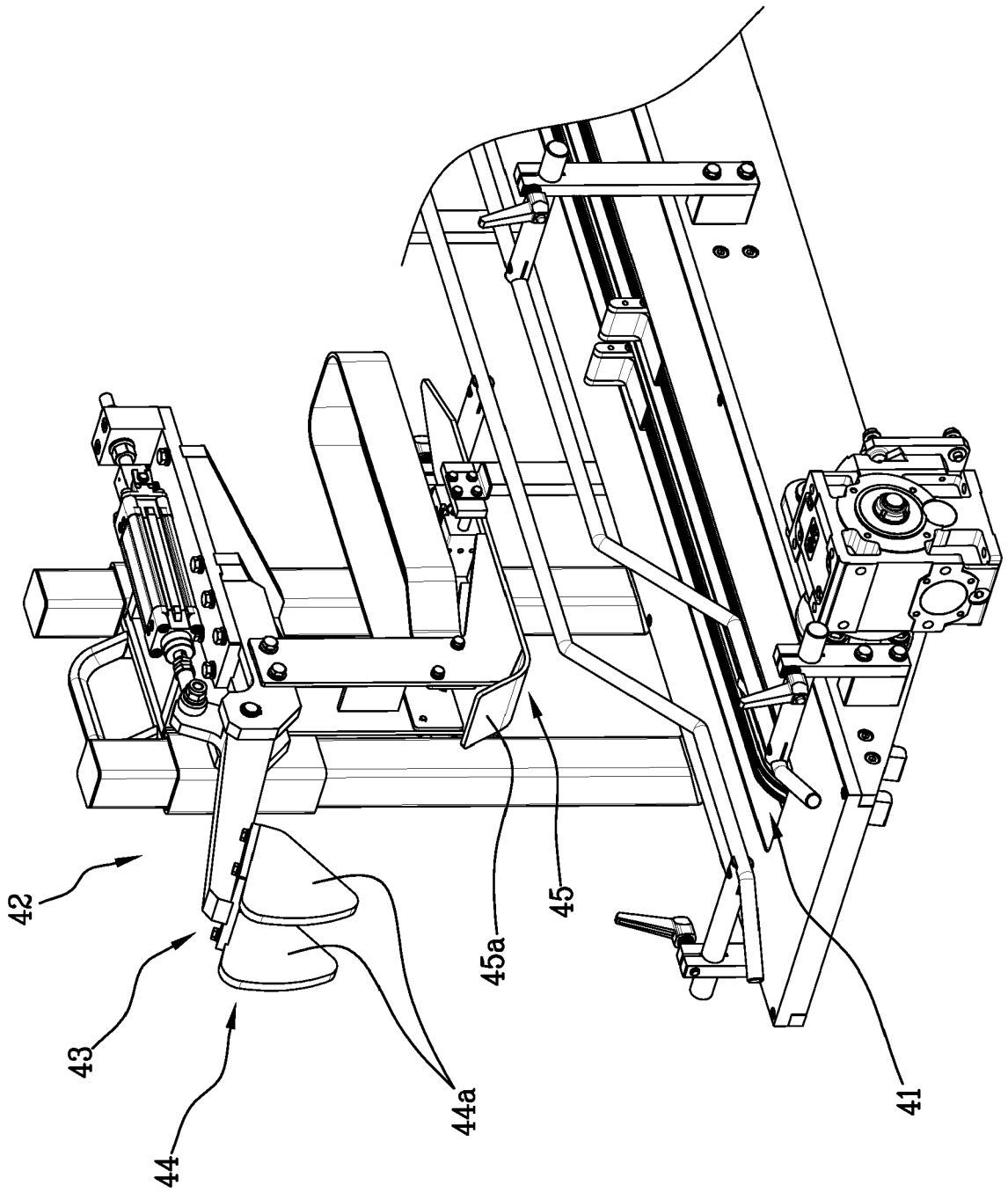


Fig.6

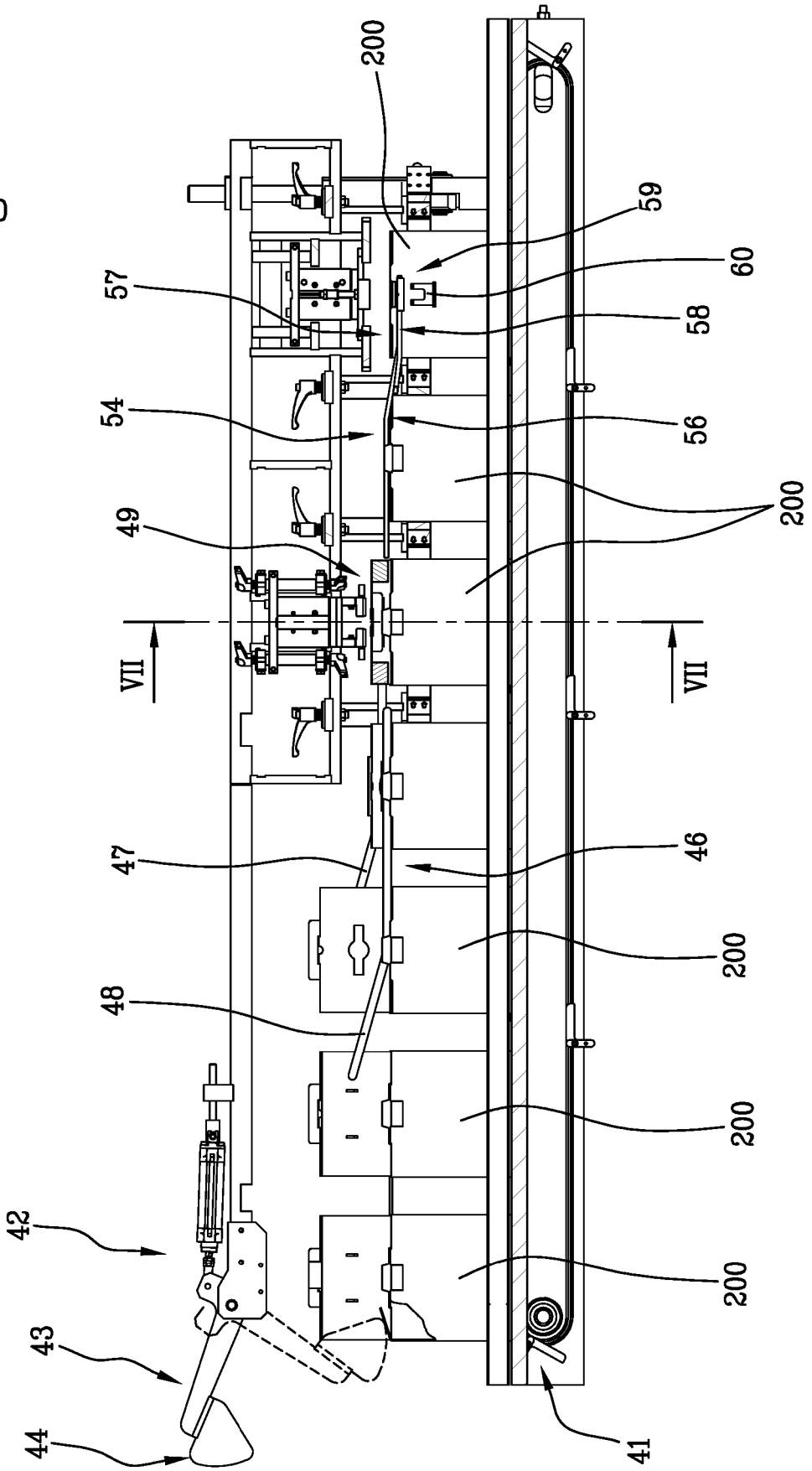
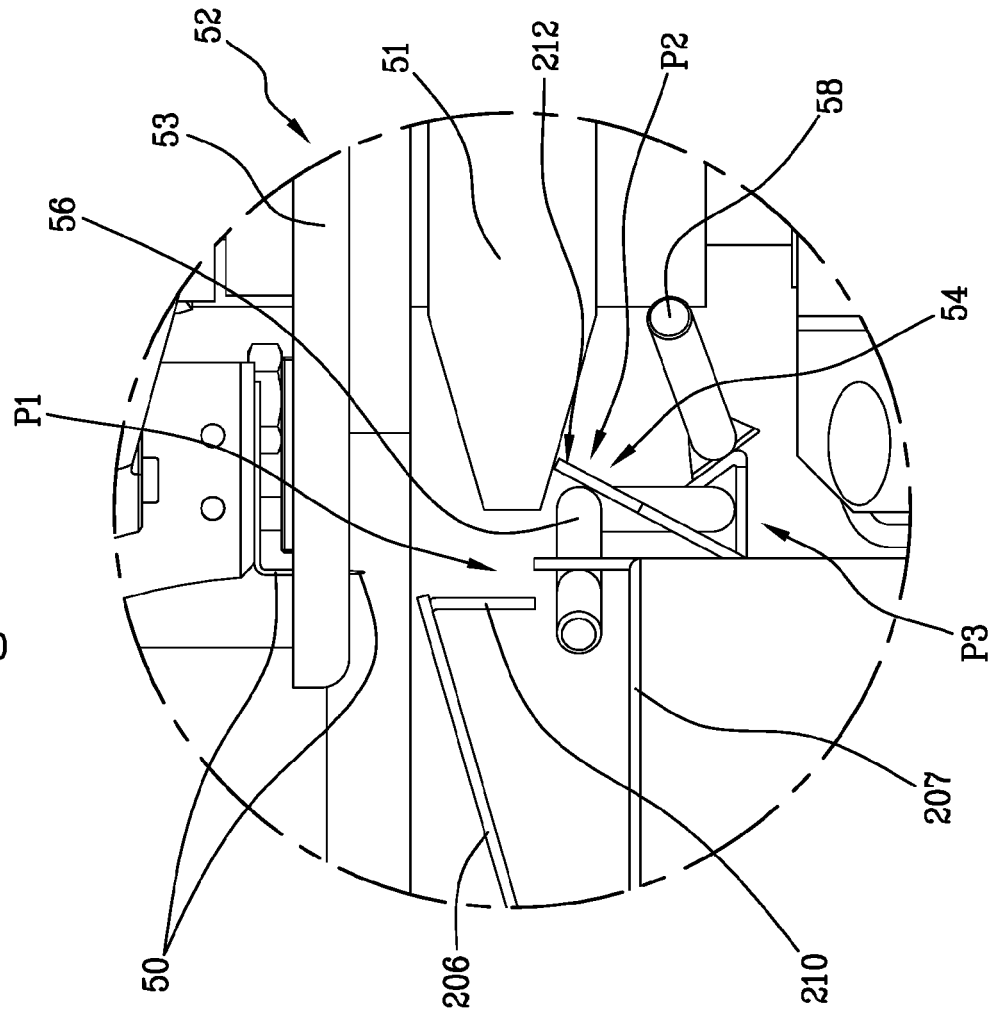


Fig.7A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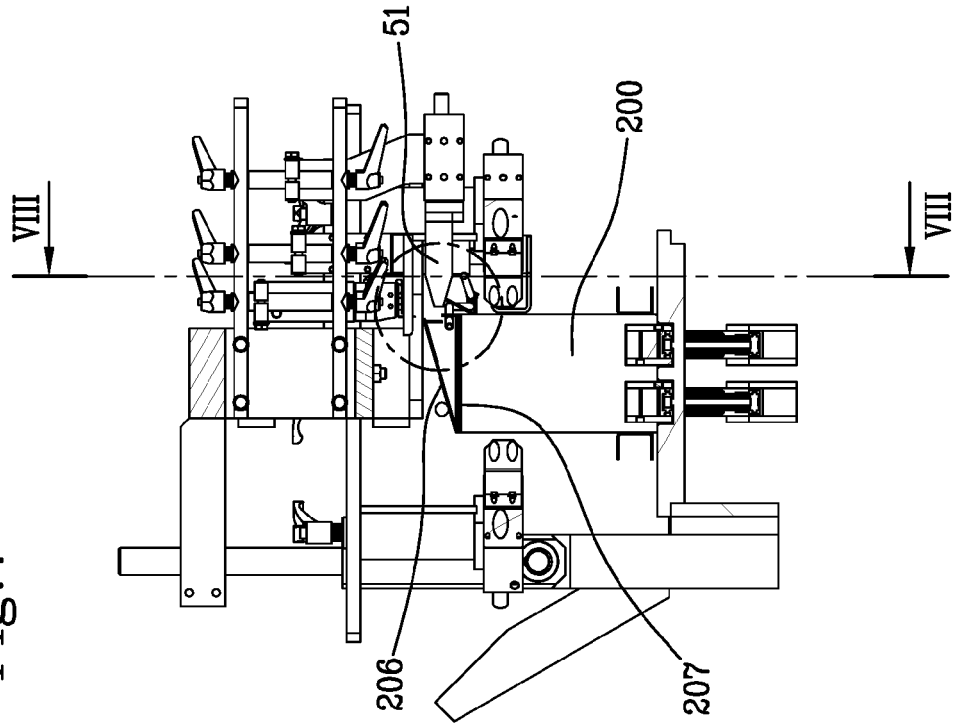
51
212
P2
58
53
56
54
P1
P3
207
50
206
210

Fig.7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200
VIII
VIII
206
207

Fig.7B

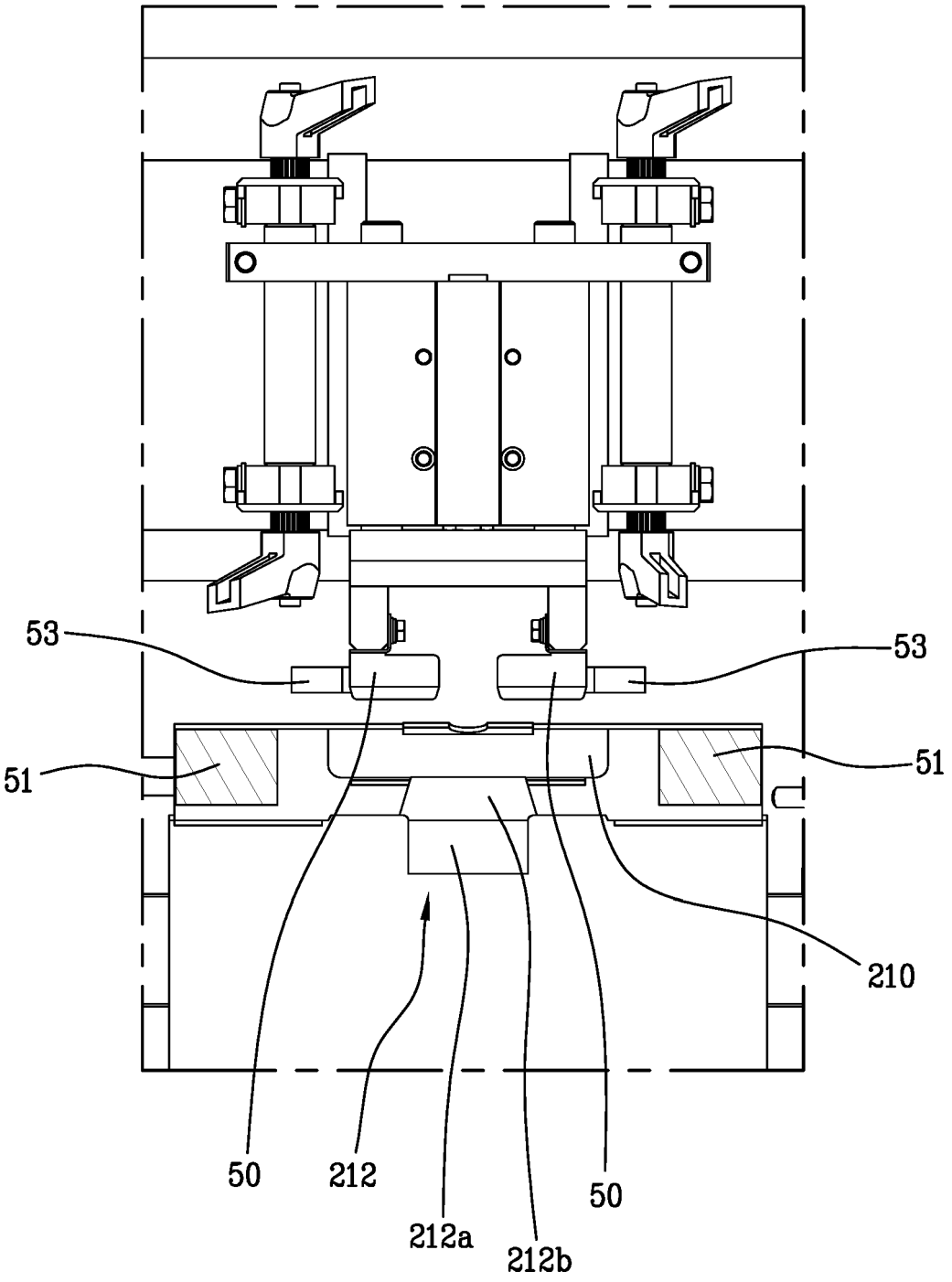
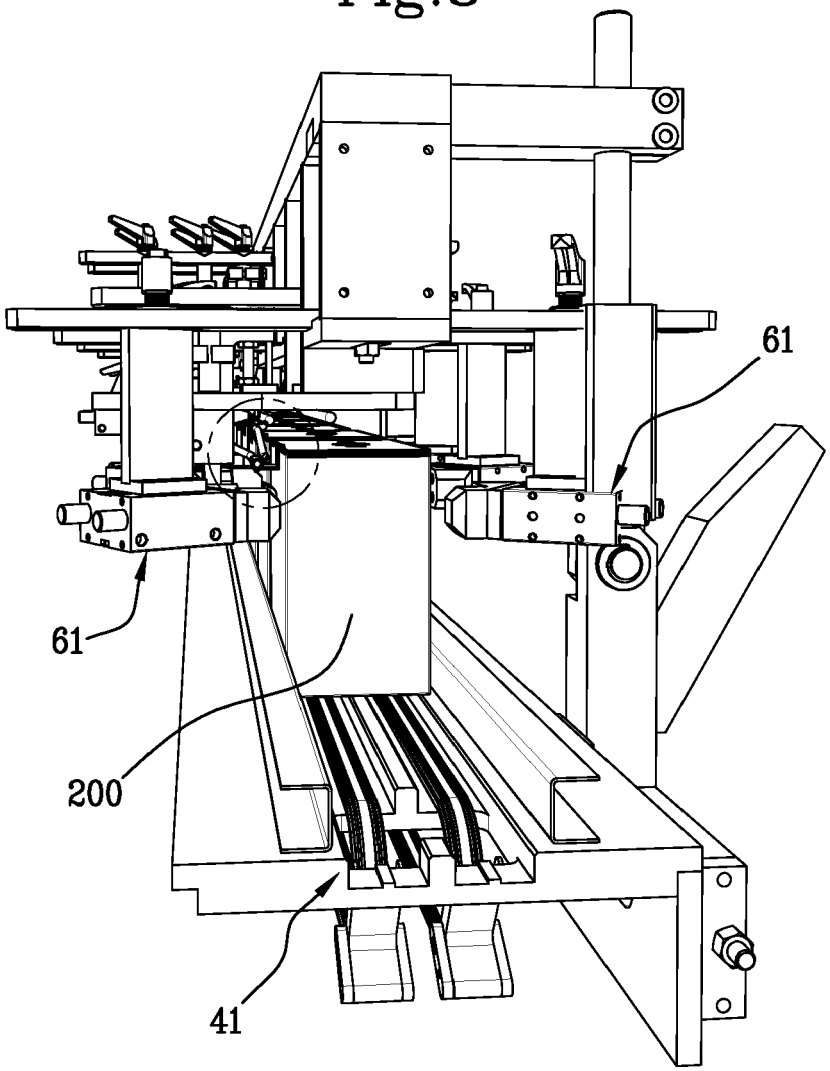
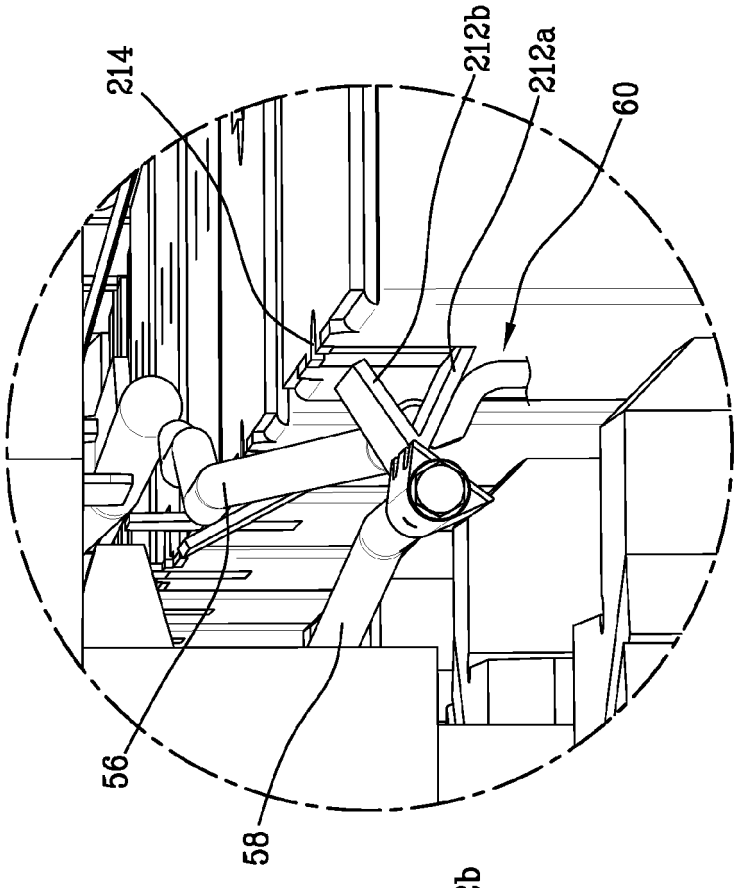


Fig.8

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212b
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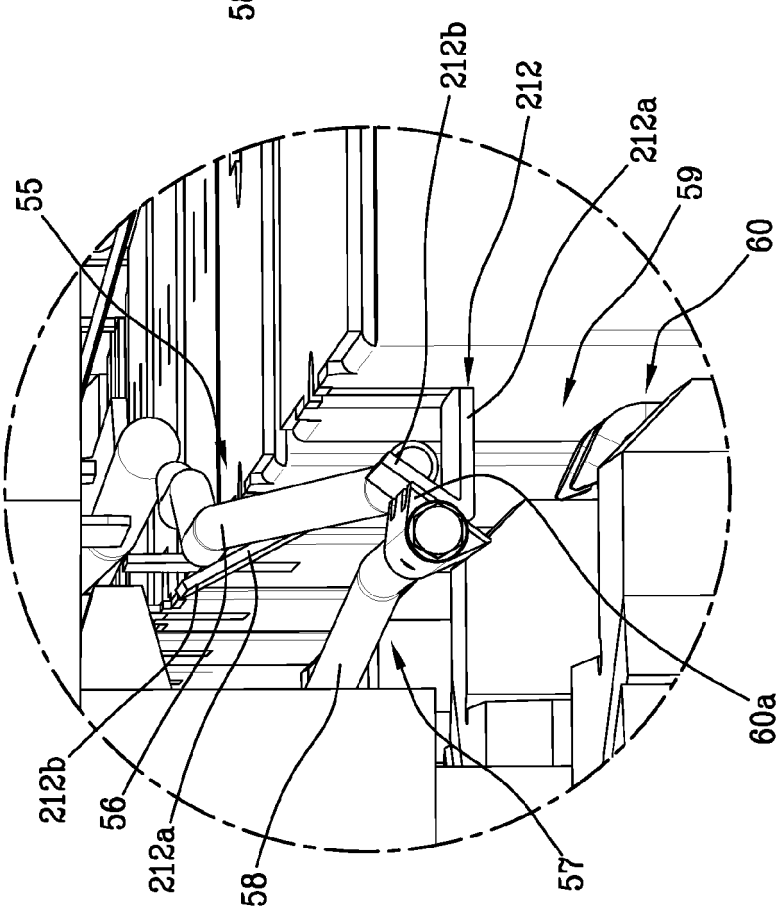
Fig.8B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212b
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212a
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60a
212b
56
212a
58
57

Fig.8A

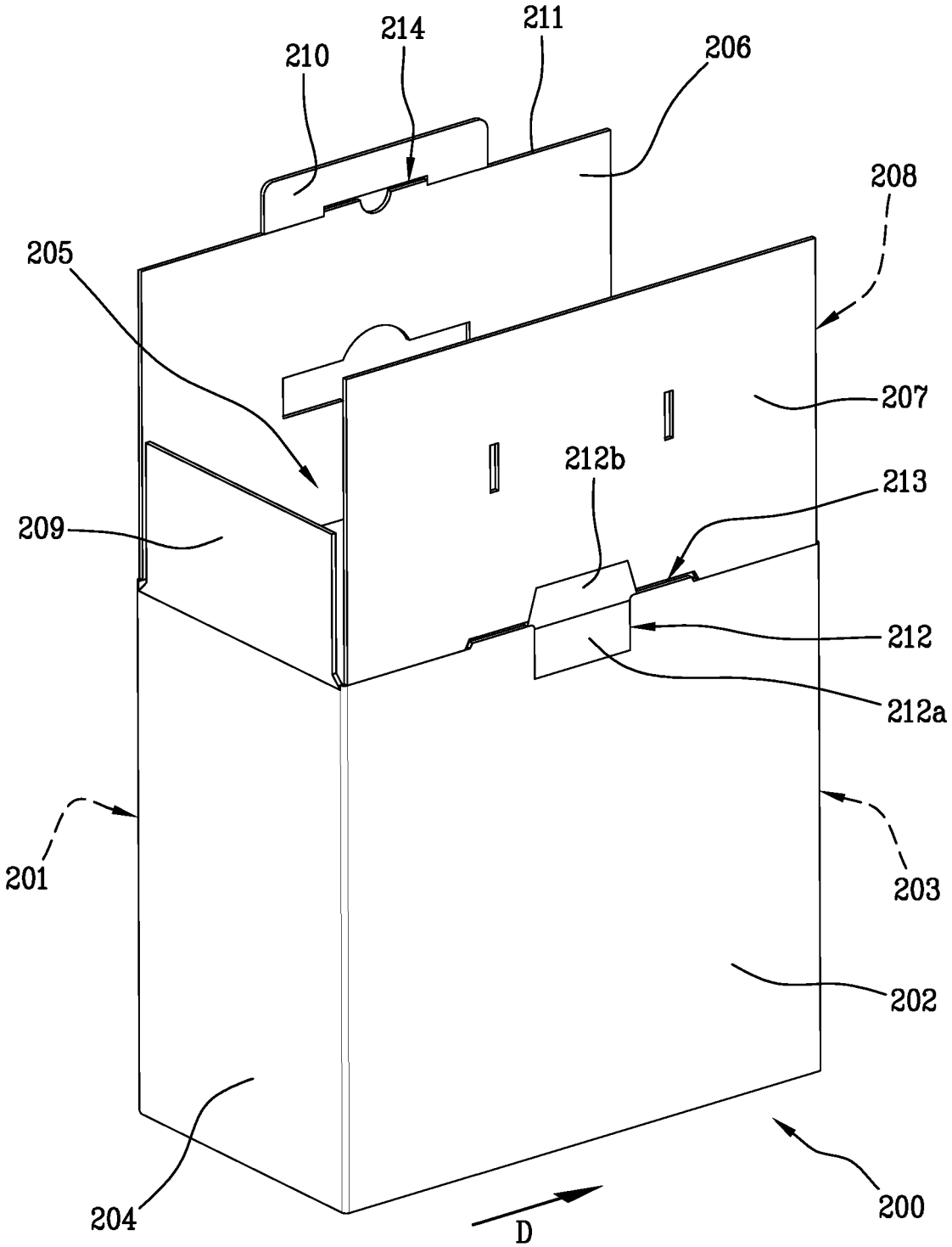
210
214
211
206
208
205
207
212b
213
209
212
212a
201
203
202
204
D
200

Fig.9

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EUROPEAN SEARCH REPORT

Application Number
EP 18 16 1760

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	8 May 2018	Ngo Si Xuyen, G

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