

(19)



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11)

EP 1 637 455 A2

(12)

EUROPEAN PATENT APPLICATION

(43) Date of publication:

22.03.2006 Bulletin 2006/12

(51) Int Cl.:

B65B 43/26 (2006.01)

B31B 5/78 (2006.01)

(21) Application number: **05076916.5**

(22) Date of filing: **19.08.2005**

(84) Designated Contracting States:

**AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
HU IE IS IT LI LT LU LV MC NL PL PT RO SE SI
SK TR**

Designated Extension States:

AL BA HR MK YU

(30) Priority: **19.08.2004 NL 1026875**

(71) Applicant: **Systemate Group B.V.
3281 NC Numansdorp (NL)**

(72) Inventors:

- **Blokland, Cornelis Jacob
3248 XC Melissant (NL)**
- **Middelkoop, Gerrit
3291 LN Strijen (NL)**

(74) Representative: **Ferguson, Alexander
Octrooibureau Vriesendorp & Gaade B.V.
P.O. Box 266
2501 AW Den Haag (NL)**

(54) **Unfolding device for crates**

(57) Device for unfolding folding crates, particularly in a continuous process, wherein the folding crates comprise a crate bottom, two opposite first walls that are hinged to the crate bottom and two opposite second walls that are hinged to the crate bottom, that can all be placed in a flat folded position and an unfolded position, respectively, wherein the device comprises a frame, as well as

conveying means provided on the frame for conveying folding crates through the device in conveyance direction according to a continuous conveyance path, as well as unfolding means for unfolding the first and second walls, wherein the conveying means comprise first engagement means for on both sides of a crate engaging onto a folding crate in a clamping manner during conveyance and treatment by the unfolding means.

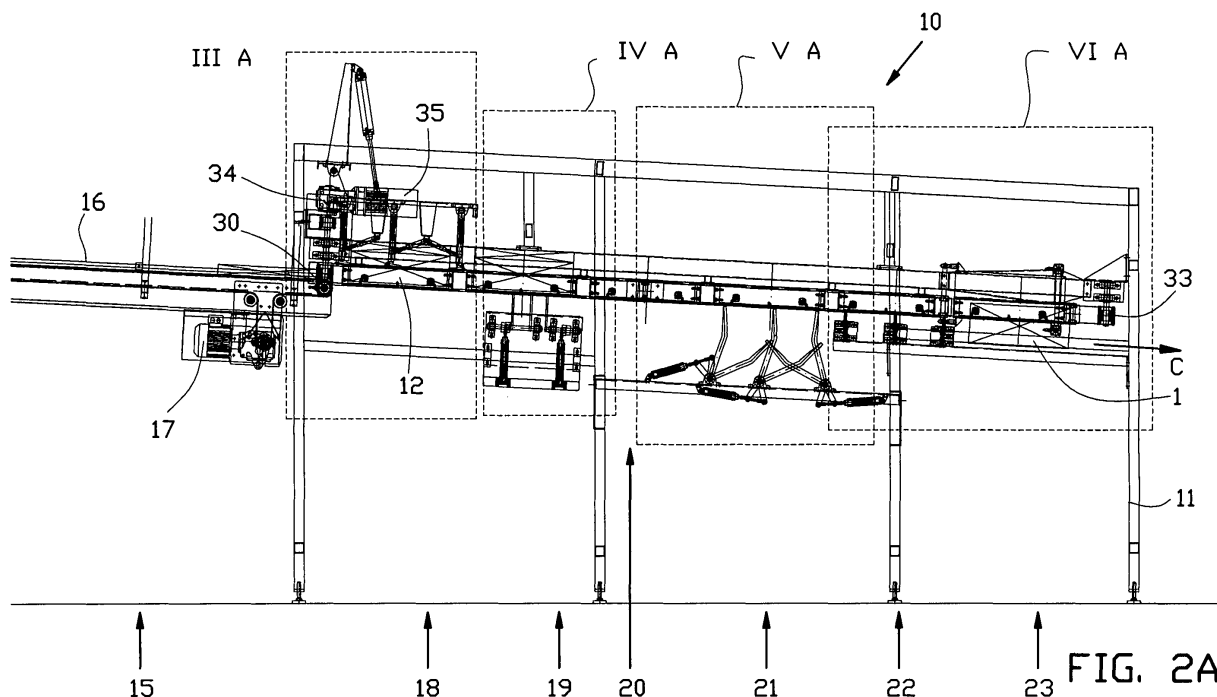


FIG. 2A

EP 1 637 455 A2

Description

[0001] The invention relates to a device for unfolding folding crates in a continuous process.

[0002] A device for unfolding folding crates is known that is provided with two horizontal conveyor belts, namely an upper conveyor belt and a narrower lower conveyor belt situated underneath it in a stepped manner. When the upper conveyor belt supplies folded folding crates standing upright on their side, said crates make a free fall at the transition from the upper to the lower conveyor belt, wherein the folding crates end up on the lower conveyor belt with their bottoms facing upwards. The width of the lower conveyor belt is chosen such that in the free fall two of the four folded walls of the folding crate may become unfolded. If, however, the folding crates fall slightly inclined onto the lower conveyor belt, their unfolding fails. The unfolding process optionally has to be interrupted in order to clear away folding crates that have fallen inclined and disrupt the further unfolding process.

[0003] It is an object of the invention to provide a device for unfolding folding crates with which folding crates are accurately positioned during the unfolding process.

[0004] It is a further object of the invention to provide a device for unfolding folding crates with which folding crates can be unfolded with an improved reliability.

[0005] It is a further object of the invention to provide a device for unfolding folding crates with which folding crates can be unfolded with an increased capacity.

[0006] It is a further object of the invention to provide a device for unfolding folding crates wherein the unfolding process is only hindered to a limited extent by dirt that may be released from the crates.

[0007] It is a further object of the invention to provide a device for unfolding folding crates with which folding crates of various crate sizes, particularly crate heights, can be unfolded.

[0008] The invention provides a device for unfolding folding crates, particularly in a continuous process, wherein the folding crates comprise a crate bottom, two opposite first walls that are hinged to the crate bottom and two opposite second walls that are hinged to the crate bottom, that can all be placed in a flat folded position and an unfolded position, respectively, wherein the device comprises a frame, as well as conveying means provided on the frame for conveying folding crates through the device in conveyance direction according to a continuous conveyance path, as well as unfolding means for unfolding the first and second walls, wherein the conveying means comprise first engagement means for on both sides of a crate engaging onto a folding crate in a clamping manner during conveyance and treatment by the unfolding means. The folding crates can be clamped firmly and particularly uninterruptedly by the first engagement means, as a result of which during the unfolding process deviations from a desired position of the crate can be avoided.

[0009] In a simple embodiment the first engagement

means are adapted for effecting a surface contact between surfaces of the first engagement means and a clamped folding crate, respectively.

[0010] When the first engagement means are adapted for engaging onto opposite sides of the crate bottom of a folding crate, a proper clamping of a folding crate can be achieved irrespective of possible dirt that may have been left at an inside of the folding crate. Moreover a successful clamping of a folding crate in this case does not depend on the height of an (unfolded) crate, as a result of which folding crates of various sizes can be conveyed and unfolded by the device.

[0011] Preferably the device comprises adjustment means for during conveyance through the device varying a clamping force exerted by the first engagement means on a clamped crate. An advantage thereof is that the clamping force can be set depending on the desired clamping force for instance during conveyance or during treatment of the folding crates.

[0012] The unfolding of the first and second walls may be successively carried out when the device comprises first unfolding means for unfolding the first walls and second unfolding means for unfolding the second walls, wherein the first and second unfolding means preferably are provided at stations which in conveyance direction are situated successively at the conveyance path.

[0013] Preferably the adjustment means are adapted for increasing the clamping force at the location of the stations, as the necessary clamping force for an accurate positioning of a folding crate may be larger when the unfolding means are operative than during conveyance of a folding crate between the stations.

[0014] When the clamping force is adjustable per station, successive clamping forces on a folding crate can be set independent from each other for a proper action of the first and second unfolding means.

[0015] Undesired collisions between active parts of the first and/or second unfolding means and clamped folding crates can be limited when the conveying means are adapted for keeping a clamped crate still while the first and/or second unfolding means are operative.

[0016] In a simple embodiment the conveying means comprise two endless conveyor belts that are parallel to each other, wherein the first engagement means are formed by facing first support surfaces of the conveyor belts.

[0017] When each conveyor belt comprises a counter surface that is situated counter the first support surface, wherein each counter surface is situated against a second support surface such that with the second support surfaces pressure force can be exerted via the first support surfaces onto a clamped folding crate, the conveyor belts can be used substantially for the conveyance, of the folding crates through the device, whereas the clamping forces are provided by the second support surfaces.

[0018] For the above-mentioned variation of the clamping forces the conveying means may comprise first movement means with which at least one of the second

support surfaces is movable on both sides of the conveyance path and in a direction transverse to the first support surfaces.

[0019] For the above-mentioned variation of the pressure forces per station, a second support surface may be provided per station of the device which second support surface is individually movable by means of the first movement means.

[0020] Preferably the device comprises first drive means, particularly a servomotor or stepping motor, for one of the conveyor belts. By means of the first drive means, particularly the servomotor or stepping motor, the conveyance of the folding crate can be carried out accurately with respect to the first and/or second folding means for the purpose of a proper positioning of a clamped folding crate.

[0021] For improvement of the positioning with respect to the first and/or second unfolding means, at least one, preferably both conveyor belts may be provided with substantially equidistantly positioned stops at the first support surfaces for abutting a front side of a clamped folding crate. The substantially equidistant stops moreover improve the mutual positioning of clamped folding crates and counteracts clamped folding crates colliding with each other.

[0022] In a simple embodiment the second support surface is provided by a support roller.

[0023] Unfolding the first and/or second walls is enhanced due to gravity when the device comprises feeding means for feeding folded folding crates towards the conveyance path with their crate bottoms facing upwards with respect to gravity, wherein the feeding means preferably are adapted for pressing folding crates between conveyor belts and/or against stops situated at the conveyor belts, so that a proper abutment of the front sides of the folding crates against the stops is ensured.

[0024] The first and/or second walls of a folding crate that is clamped on both sides of the crate bottom can at least be partially unfolded when the device comprises a first station that is situated at the conveyance path, wherein the first unfolding means comprise second engagement means which at the first station are movably connected with the frame and which are movable in a first direction transverse to the conveyance direction from above the crate bottom against a portion of a first or second wall of a clamped folding crate which portion with respect to the vertical projection of the crate bottom is approachable or protruding.

[0025] In a simple embodiment the second engagement means comprise deformable fingers that are provided at second movement means for moving the distal end of the fingers against the approachable or protruding portion of the first or second wall and retracting the fingers at a distance from a clamped folding crate. Due to the fingers being deformable, little deviations of the position of a folding crate with respect to the position desired for the first station only have a limited disadvantageous influence on the operation of the first station.

[0026] Undesired folding of the first and/or second walls after partially unfolding them is avoided when the second movement means are adapted for in the first direction and in a second direction transverse thereto moving the fingers from and towards the approachable or protruding portion.

[0027] Preferably the fingers comprise rubbery material, so that they have a grip on the walls of the folding crates that have usually been made of plastic, metal or wood.

[0028] Unfolding the at least partially unfolded first walls can be completed when the device comprises a second station situated at the conveyance path, wherein the unfolding means comprise third engagement means which at the second station are movably connected with the frame and which from underneath a folding crate clamped at its crate bottom are movable against an inner side of the first walls of the clamped folding crate.

[0029] The second walls may be partially unfolded due to gravity, when the third engagement means are adapted for moving the first wall(s) with respect to the crate bottom through their upright position, so that the second wall(s) can move freely with respect to the first walls.

[0030] In a simple embodiment the third engagement means are provided at the ends of first swivelling arms swivelling about first axles that are situated substantially parallel to each other on both sides with respect to a folding crate position of the second station.

[0031] Accumulation of dirt on the first swivelling arms, which dirt may originate from the folding crates, is counteracted when the first axles and preferably the swivel point are situated beyond the vertical projection of the crate bottom of a crate clamped at the folding crate position of the second station.

[0032] Preferably the device comprises third movement means for the movement of the third engagement means.

[0033] Preferably the device comprises a third station situated at the conveyance path, wherein the unfolding means comprise first checking means for checking the unfolded position of the first walls of a clamped crate, wherein the first checking means are provided at the third station. An advantage thereof is that in case of an incompletely unfolded first wall, follow-up treatment that may be damaging to the folding crate can be skipped in time.

[0034] Unfolding at least partially unfolded second walls can be completed when the device comprises a fourth station situated at the conveyance path, wherein the unfolding means comprise fourth engagement means which at the fourth station are movably connected with the frame and which from underneath a folding crate clamped at its crate bottom are movable against an inner side of a second wall of the clamped folding crate. Moreover an optional interconnection of locking means at the first and second walls of a folding crate can be effected here.

[0035] In a simple embodiment the fourth engagement means are provided at the ends of second swivelling

arms swivelling about second axles that are situated substantially parallel to each other on both sides of a folding crate position of the fourth station.

[0036] Accumulation of dirt on the second swivelling arms, which dirt may originate from the folding crates, is counteracted when the second axles and preferably the swivel point of the second swivelling arms are situated beyond the vertical projection of the crate bottom of a crate clamped at the folding crate position of the fourth station.

[0037] Preferably the device comprises fourth movement means for the movement of the fourth engagement means.

[0038] Folding crates that can be used and that cannot be used can be distinguished when the device comprises a fifth station situated at the conveyance path, wherein the unfolding means comprise second checking means for checking the unfolded position of the second walls, wherein the second checking means are provided at the fifth station.

[0039] The position of the second walls can be checked when the second checking means comprise fifth engagement means that are movable against an inner or outer side of a second wall of a clamped folding crate.

[0040] In a simple embodiment the fifth engagement means are provided at the ends of third swivelling arms swivelling about third axles that are situated substantially transverse to a crate bottom of a clamped crate beyond the vertical projection of the crate bottom on both sides of a folding crate position of the fifth station. Accumulation of dirt on the third swivelling arms, which dirt may originate from the folding crates, may moreover be counteracted in this way.

[0041] Preferably the device comprises fifth movement means for the movement of the fifth engagement means.

[0042] In a simple embodiment the swivelling arms are able to swivel about a swivel angle of which the size is a measure for the position of the second walls and/or a measure for a correct mutual attachment of locking means at the first and second walls of a clamped crate.

[0043] Incompletely unfolded crates that cannot be used can automatically be ejected prior to being used when the device comprises a sixth station provided with ejection means for incompletely unfolded folding crates.

[0044] In this case incompletely unfolded clamped folding crates can simply be ejected when the conveyor belts can be moved apart at the position of the sixth station.

[0045] In an efficient embodiment the first up to and including the sixth station, when used, are situated successively in conveyance direction at the conveyance path.

[0046] When the first and/or second and/or third and/or fourth and/or fifth movement means comprise a pneumatic or hydraulic cylinder, the movement means are able to move quickly between two desired ultimate positions.

[0047] Preferably the device comprises an electronic

operating unit for operating the actuation of drive means and movement means of the device. An advantage thereof is that the device is thus able to operate automatically.

[0048] In addition the electronic operating unit may comprise a shift register for the registration and transmission of specific information about each individual folding crate for the successive stations, such as information about the dimensions and/or the (in)complete unfolding of clamped folding crates.

[0049] Preferably the device is adapted for passing folding crates at first sides of the crate bottom, that are situated near the first walls, through the conveyance path in a clamped manner.

[0050] The invention furthermore provides, according to a further aspect, a device for unfolding folding crates, particularly in a continuous process, wherein the folding crates comprise a crate bottom, two opposite first walls that are hinged to the crate bottom and two opposite second walls that are hinged to the crate bottom, that can all be placed in a flat folded position and an unfolded position, respectively, wherein the device comprises a frame, as well as conveying means provided on the frame for conveying folding crates through the device in conveyance direction according to a conveyance path, wherein the conveying means comprise first engagement means for clampingly engaging a folding crate using clamping force either exclusively or not.

[0051] The invention will be elucidated on the basis of a number of exemplary embodiments shown in the attached drawings, in which:

Figures 1 A-D show an example of a folding crate to be treated with an unfolding device according to the invention;

Figures 2A-B show a front view and a bottom view, respectively, of a device for unfolding folding crates according to the invention, having a number of stations in a row;

Figures 3A-B show a front view and a bottom view, respectively, of a first station of the device according to figures 2A-B;

Figure 3C shows an enlargement of a part of figure 3A;

Figures 3D-E show a front view and a top view, respectively, of a part of the first station according to figures 3A-B;

Figures 4A-C show a front view, a bottom view and a side view, respectively, of a second station of the device according to figures 2A-B;

Figures 5A-B show a front view and a bottom view, respectively of a fourth station of the device according to figures 2A-B; and

Figures 6A-B show a front view and a bottom view, respectively, of a fifth and sixth station of the device according to figures 2A-B.

[0052] The folding crate 1 shown in the figures 1 A-D has a bottom 2, two longitudinal walls 3 and two transverse walls 4, which walls are hinged to the bottom 2. The crate 1 shown in this example is of the Europool type, having a bottom size of 400 x 600 mm. Europool crates are also available with a bottom size of 400 x 300 mm. In both cases the longitudinal walls 3 have a length of 400 mm and they are provided with operable closing means 5, which can be pulled towards each other for ending a locking between the upright edges of the walls 3 and 4 that meet each other. The closing means 5 are designed to become automatically active, by snapping, when the said edges of the walls 2 and 3 are correctly brought together. Europool folding crates are available in various bottom sizes in various crate heights.

[0053] In figure 1 A the folding crate 1 is shown in flat folded condition, wherein the transverse walls 4 are situated over the longitudinal walls 3 and upright edges or side edges 6 of the transverse walls 4, considered from above, protrude over the bottom 2 of the folding crate 1. In figure 1 B the transverse walls 4 are almost fully erected in direction A, yet the longitudinal walls 3 are still situated at the bottom 2. In this figure the parts 5A of the closing means can be seen, which are formed at the protruding side edges 6 of the transverse walls. In figure 1 C the longitudinal walls 3 are erected in direction B, wherein the longitudinal walls 3 are able to move freely when the transverse walls 4 are pulled further in direction A beyond their upright position. In figure 1 D the erected folding crate 1 can be seen.

[0054] The exemplary embodiment of the unfolding device 10 according to the invention shown in the figures 2A-B and further, has a frame 11 at which two conveyor belts 13 are situated around two conveyor belt guides 12 with which crates 1 can be clamped at their bottom 2 and passed onwards in conveyance direction C. By means of supply means that are not shown folded folding crates 1, with their bottoms 2 facing upwards, can be passed via driven supply belts 16 of a feeding station 15 between the conveyor belts 13 of the unfolding device 10. The supply belts 16 are in this case driven by means of an electromotor 17. In order to improve friction between the supply belts 16 and a folding crate 1 situated thereon a brush roller that is not shown is positioned above the supply belts 16 at the location of the transition of the supply belts 16 and the conveyor belts 13, which brush roller is able to press the folded crates 1 additionally on the supply belts 16 during the transition.

[0055] The conveyor belts 13 are situated around driven rollers 30 and tension rollers 33, and along bending rollers 31 and two displacement rollers 32. The driven rollers 30 and the conveyor belts 13 are provided with teeth that are not shown in order to counteract mutual slipping. One of the driven rollers 30 is in driving connec-

tion with a servomotor 35 via a right-angled transmission 34 that is known per se, and the driven rollers 30 are interconnected by means of a toothed-belt transmission 36 with which the driven rollers 30 have an opposite sense of rotation with respect to each other. The toothed-belt transmission 36 is shown in more detail in figure 3B. Due to the toothed-belt transmission the driven rollers 30 and as a result the conveyor belts 13 run synchronously.

[0056] Stoppers 37 are attached at the conveyor belts 13, wherein the mutual distance between consecutive stoppers is approximately 750 mm.

[0057] When fed between the conveyor belts 13 the two front vertices of the fed folding crates 1 will abut the stoppers 37. Due to the mutual distance of 750 mm between the stoppers 37 it is possible to pass both Europool crates of 400 x 600 mm and of 400 x 300 mm through the unfolding device 10, wherein the bottoms of the folding crates 1 are always clamped between conveyor belts 13 at the sides of the transverse walls 4. The crates 1 are passed further through the unfolding device 10 with their bottoms facing upwards. Strips of friction material are situated between the stoppers 37 on the circulation surface of the conveyor belts 13, so that slipping between the conveyor belts 13 and a clamped folding crate 1 is counteracted. The mutual distance between the circulation surfaces or grip sides, of the conveyor belts 13 with friction material is adapted to at least 400 mm. Due to the clamping a slip-free passage-force can be exerted on the crates 1, particularly on the side 7 of the bottom 2.

[0058] Six stations are situated along the conveyor belts 13 in conveyance direction C, namely a first unfolding station 18 for transverse walls 4, a second unfolding station 19 for transverse walls 4, a checking station 20 for transverse walls 4, an unfolding station 21 for longitudinal walls 3, a checking station 22 for longitudinal walls 3, and an ejection station 23. The successive stations will be further elucidated below.

[0059] At the location of the first and the other stations pneumatic cylinders 38 are attached to both conveyor belt guides 12 having a bearing surface 39 at each piston rod which bearing surface 39 abuts the side of the conveyor belt 13 that faces away from the grip side, which conveyor belt 13 is situated around each conveyor belt guide 12. Depending on the air pressure provided to the pneumatic cylinders 38, variable between 2 and 6 bars, the conveyor belts 13 can be moved away from and towards each other to a greater or lesser degree transverse to the conveyance direction C, as a result of which the pressure force exerted on the sides 7 of the bottom 2 of a clamped folding crate 1 can be adjustable. In this way a crate when standing still at the stations can be clamped more firmly than during its conveyance, so that it is prevented that a folding crate 1 catapults away or shifts as a result of treatment forces exerted thereon.

[0060] Figures 3A-D show the first unfolding station 18 for the transverse walls 4 of a folding crate 1 in more detail. Figure 3A shows a holder 49 that is hinged to the

frame 11. The holder 49 can be pulled up in the direction D by means of a pneumatic cylinder 48. In figure 3B the holder 49 with a folding crate 1 below it is drawn entirely adjacent to the conveyor belt guides 12 for the sake of clarity of the figure, the holder being drawn in full lines and the crate 1 in broken lines. In reality the folding crate 1 is clamped between the conveyor belts 13 as shown and the holder 49 is positioned straight above it. Said clamping of a crate is shown in more detail in figure 3C. By pulling up in direction D the first station can be deactivated.

[0061] In conveyance direction C the first unfolding station 18 has a first, a second and a third telescopic arm 50, 51, 52 that are hinged in direction E to the frame 11. At the ends of the telescopic arms 50, 51, 52 a transverse profile 53 with rubber fingers 54 is attached transverse to the conveyance direction C. In conveyance direction C and transverse to the conveyance direction C, the mutual distance between the free ends of the rubber fingers 54 per transverse profile 53 is such that the ends 14 of the rubber fingers 54 are able to abut the edges 6 of the transverse walls 4 that protrude with respect to the bottom 2 of folded Europool crates 1 having various bottom sizes, as shown in figure 3E. In this case the fingers 54 at the first and third 50, 52, and the second and third 51, 52 telescopic arm aligned with the conveyance direction 14 point towards each other.

[0062] Per transverse profile 53 two pair of fingers 54 have been attached. Depending on the crate height and as a result the degree to which the protruding edges 6 of a folded crate 1 continue further towards the centre of the bottom 2 of the crate 1, the outermost or both the outermost and the innermost fingers abut the edges 6. In figure 3E two possible heights of the walls 4 are shown in broken lines, for two sizes of crates 1.

[0063] Pneumatic cylinders 55 are situated in the first, second and third telescopic arm 50, 51, 52, by which means the telescopic motion of the arms can be actuated. The stroke of the telescopic arms 50, 51, 52 in the direction F is dimensioned such that the fingers 54 are able to extend from above the bottom 2 to one crate height under the bottom 2 of a clamped crate 1 in order to erect the transverse walls 4 at least partially from the bottom 2 in direction A as shown in figures 1B and 1C. Pneumatic cylinders 56 are situated between the frame 11 and the first, second and third telescopic arm 50, 51, 52, with which cylinders 56 the telescopic arms 50, 51, 52 can be reciprocally swivelled in conveyance direction C and in direction E, so that the fingers 54 can be moved away from and towards a clamped crate 1. Due to the rubber fingers 54 being deformable small deviations in position of a crate 1 between the conveyor belts 13 hardly affect the operation of the first unfolding station 19 for the transverse walls 4. The rubber fingers 54 are for instance plucking fingers that are used in plucking machined for poultry.

[0064] The second unfolding station 19 for the transverse walls 4 of a folding crate is shown in more detail in

figures 4A-C. On both sides, below the conveyor belts 13, an attachment plate 60 is attached at the frame 11, to which attachment plate considered in conveyance direction C a first and second and a third slightly curved swivelling arm 61, 62, 63 have been attached at a first and second, journalled axle 64, 65, respectively. The first and second swivelling arm 61, 62 can simultaneously be moved upwards in direction C from a retracted position to the position shown in figure 4C by means of a first pneumatic cylinder 66, and the third swivelling arm 63 is movable in direction L by means of a second pneumatic cylinder 67.

[0065] Both pneumatic cylinders 66, 67 are eccentrically connected with the first and second bearing mounted axles 64, 65, respectively. The first, second and third swivelling arms 61, 62, 63 are dimensioned such that with their free end they are able to abut an inside of a transverse wall 4 of a clamped crate 1, and the motion of the swivelling arms 61, 62, 63 is dimensioned such that the swivelling arms 61, 62, 63 are able to pull a transverse wall 4 of a clamped crate 1 in direction A through its upright position as shown in figure 1C, so that the longitudinal walls 3 due to gravity are able to at least partially erect downwards in direction B with respect to the bottom 2. Depending on the size of Europool crate 1 the second cylinders 67 or both the first and second cylinders 66 can be activated.

[0066] Considered in conveyance direction C, a checking station 20 is situated adjacent to the second unfolding station 19 for transverse walls 4, with which with means that are not shown, such as feelers, it can be checked whether the transverse walls 4 are downwardly fully erect with respect to the crate bottom 2.

[0067] Figures 5A and 5B show the unfolding station 21 for the longitudinal walls 3 in more detail. The unfolding station 21, considered in conveyance direction C has two pair of first, second and third slightly curved swivelling arms 70, 71, 72 which considered from above have been attached to the frame 11 in between and below the conveyor belt 13. The first, second and third swivelling arms 70, 71, 72 are each attached to journalled axles 73, 74, 75, respectively, to which axles pneumatic cylinders 76 are eccentrically connected. The swivelling arms 70, 71, 72 are dimensioned such that from a retracted position they are able with their free ends in direction M to stop at an inside of a partially erected longitudinal wall 3 of a clamped crate 2 in order to fully erect the longitudinal walls 5 in direction B and snap the longitudinal walls 4 and transverse walls 5 forcefully into each other. Depending on the size of Europool crate 1 the first and third swivelling arms 70, 72 or the second and third swivelling arms 71, 72 are activated.

[0068] Figures 6A and 6B show the checking station 22 for the longitudinal walls 3 in more detail. On both sides of the conveyor belts 13 a first, a second and a third measuring arms 80, 81, 82 have been attached to journalled vertical axles 83. The vertical axles 83 are situated beyond the conveyor belts 13. The measuring

arms 80, 81, 82 can be swivelled in direction N from a retracted position under the conveyor belt guide 12 by means of pneumatic cylinders 84 that are eccentrically connected to the vertical axles 83. The length and the swinging motion of the first, second and third measuring arms 80, 81, 82 is dimensioned such that the measuring arms are able to move from the outside against and beyond an outside of a longitudinal wall 3 of a folding crate 1. Depending on the size of Europool crate 1 the first and third measuring arms 80, 82 or the second and third measuring arms 81, 82 can be activated. If the walls are not properly snapped into each other the measuring arms 80, 81, 82 will swivel further in direction N than would be the case when the walls had been properly snapped into each other indeed. Based on the size of swivel motion, registered by means of a reed contact that is not shown, it can therefore be determined whether the walls have been successfully attached to each other.

[0069] Figures 6A-B show the ejection station 23 situated adjacent to the checking station 22 for the longitudinal walls 3, and having a folding crate 1 clamped in between the conveyor belts 13, in more detail. The displacement rollers 32 against the conveyor belts 13 can be moved with respect to the conveyor belt guides 12 transverse to the conveyance direction C from and towards each other in direction P by means of pneumatic cylinders 90. By operating the pneumatic cylinders the part of the conveyor belt 13 that is situated between the bending rollers 31 and the displacement rollers 32 of a clamped (rejected) folding crate 1, can be pulled away from the folding crate 1 so that it falls from the conveyor belts 13. The two displacement rollers 32 per conveyor belt 13 here move simultaneously in direction P so that the conveyor belts 13 during the movement of the displacement rollers 32 remain at a constant tension and the conveyor belts 14 slipping about the driven rollers 30 is counteracted.

[0070] The unfolding device 10 is provided with an electronic operating unit that is not shown with which the electromotor 17, the servomotor 35 and the pneumatic cylinders 38, 55, 56, 66, 67, 76, 84 can be actuated. For a proper operation of the unfolding device the operating unit is connected to unshown sensors of the device, such as reed contacts that are situated at the first, second and third measuring arms 80, 81, 82 of the checking station 22 for longitudinal walls 3. The electronic operating unit is provided with a memory having a shift register, so that crate specific information about folding crates 1 passed through, such as information about the dimensions and/or the (in)complete unfolding of a folding crate that passes the various stations 18, 19, 20, 21, 22, 23, can be used for controlling said stations.

[0071] The operation of the crate unfolding device, elucidated on the basis of a Europool folding crate 1 having a bottom size of 400 x 300 mm is as follows.

[0072] When becoming operative Europool crates 1 with their bottoms 2 facing upwards and transverse walls 4 parallel to the conveyance direction C are supplied over

the supply belts 16 to the stationary conveyor belts 13, wherein two stoppers 37 are stand-by in front of the first unfolding station 18 for abutting the front of the bottom 2 of a first folding crate 1. The cylinders 38 at the conveyor belt guides 12 during reception are under an air pressure of approximately 2 bars as a result of which the bottom 2 is slightly clamped in between the conveyor belts 13.

[0073] When the bottom 2 of the first folding crate 1 is situated with a front part between the conveyor belts 13 and against the standby stoppers 37, the conveyor belts 13 are driven until the stoppers 37 in conveyance direction C have rotated one position and the bottom 2 of the first folding crate 1 is fully clamped between the conveyor belts 13 at the first unfolding station 18.

[0074] Subsequently the air pressure on the cylinders 38 at the conveyor belt guides 12 is increased to 6 bars, so that the bottom 2 of the folding crate 1 during standstill of the conveyor belts 13 is firmly clamped between the conveyor belts 13.

[0075] Subsequently the second and third telescopic arms 51, 52 extend in direction F, as a result of which the fingers 54, particularly the front part of the free ends of the fingers 54, in direction G engage the edges 6 of the transverse walls 4 that protrude with respect to the bottom 2 and at least partially downwardly erect the transverse walls 4 in direction A with respect to the bottom 2. The fingers 54 are able to bend back in a direction opposite direction G and subsequently during the further course of the downward stroke in direction G sweep over and beyond the protruding edges 6. The protruding edges 6 can then still be at an inclined angle to the bottom 2 of the crate if the transverse walls 4 are not yet fully downwards.

[0076] By extending the pneumatic cylinders 56 transverse to the telescopic arms 51, 52 the fingers 54 are moved away from the crate 1 in direction H, after which the second and third arm 51, 52 and subsequently the pneumatic cylinders 56 are retracted again, so that the fingers move back to the initial position in directions J and K, respectively. After this stroke the air pressure on the pneumatic cylinders 38 at the conveyor belt guides 12 is lowered, so that the first folding crate 1 can be passed to the second unfolding station 19 while it is still clamped by the conveyor belts 13, and a next folding crate 1 can be brought between the conveyor belts for the first unfolding station 18.

[0077] After arriving at the second unfolding station 19, wherein the conveyor belts 13 have been stopped again, the air pressure on the cylinders 38 is increased again and the first and second swivelling arms 61, 62 with the first pneumatic cylinders 66 are activated, as a result of which they swivel upwards in direction L and the free ends erect and overstretch the partially erected transverse walls 4 in direction A and the longitudinal walls 3 due to gravity at least partially erect downwards with respect to the bottom 2 in direction B, after which while lowering and increasing the air pressure on the pneumatic cylinders 38 and optionally a transverse wall check

at the checking station 20 for transverse walls the crate is passed to the unfolding station 21 for longitudinal walls 3. To that end the drive of the conveyor belts 13 is started and stopped again.

[0078] At this station 21 the longitudinal walls 3 are fully erected in direction B with respect to the bottom 2 by swivelling the second and third swivelling arms 62, 63 upwards in direction M, and due to the force exerted by the free ends of the swivelling arms 62, 63 are snapped onto the transverse walls 4, after which the swivelling arms 62, 63 swivel back to their retracted position and the folding crate 1 while lowering and increasing the air pressure on pneumatic cylinders 38 is passed to the checking station 22 for longitudinal walls 3.

[0079] At the checking station 22 for longitudinal walls 3 the second and third measuring arms 81, 82 are swivelled under a slight force from the with respect to the folding crate 1 retracted stand-by position beyond the conveyor belts 13 in direction N against the longitudinal walls 3 of the stationary crate 1, after which it is determined by means of the reed contact whether the measuring arms about the correctly locked longitudinal walls 3 or whether they have been swivelled onwards in direction N due to incomplete locking of the longitudinal walls 3. After checking the measuring arms swivel back to their stand-by position.

[0080] After passing through to the ejection station 23 a folding crate 1 depending on the measurement or other parameters is ejected or passed on to the end of the conveyor belts 13 to be picked up to be used. Ejection takes place by moving the displacement rollers 32 on both sides of a crate 1, and as a result the conveyor belts 13 in the direction P away from the crate 1. As a result the crate 1 will fall down.

[0081] As the folding crates 1 are clamped at their bottoms 2 between the conveyor belts 13, as a result of which the longitudinal walls 3 and transverse walls 4 are able to unfold downwards unimpededly, it is possible to pass folding crates 1 of various crate heights through the unfolding device 10. Folding crates 1 that are not sorted may also due to the shift register in the electronic operation be unfolded by the unfolding device 10, due to which the sorting out and the making of separate stacks of sorted folded crates 1 may no longer be necessary.

[0082] Due to the provided air pressure of at least 2 bars on the cylinders 38 during the unfolding process in the unfolding device 10, the folding crates 1 are continuously clamped, as a result of which the folding crates are reliably positioned with respect to the conveyor belts and the stations. Because of the stepwise or on-off drive by the servomotor 35 the successive folding crates 1 are always correctly positioned for the successive stations.

Claims

1. Device for unfolding folding crates, particularly in a continuous process, wherein the folding crates com-

prise a crate bottom, two opposite first walls that are hinged to the crate bottom and two opposite second walls that are hinged to the crate bottom, that can all be placed in a flat folded position and an unfolded position, respectively, wherein the device comprises a frame, as well as conveying means provided on the frame for conveying folding crates through the device in conveyance direction according to a continuous conveyance path, as well as unfolding means for unfolding the first and second walls, wherein the conveying means comprise first engagement means for on both sides of a crate engaging onto a folding crate in a clamping manner during conveyance and treatment by the unfolding means.

2. Device according to claim 1, wherein the first engagement means are adapted for effecting a surface contact between surfaces of the first engagement means and a clamped folding crate, respectively.
3. Device according to claim 1 or 2, wherein the first engagement means are adapted for engaging onto opposite sides of the crate bottom of a folding crate.
4. Device according to any one of the preceding claims, comprising adjustment means for during conveyance through the device varying a clamping force exerted by the first engagement means on a clamped crate.
5. Device according to any one of the preceding claims, comprising first unfolding means for unfolding the first walls and second unfolding means for unfolding the second walls, wherein the first and second unfolding means preferably are provided at stations which in conveyance direction are situated successively at the conveyance path.
6. Device according to claim 4 and 5, wherein the adjustment means are adapted for increasing the clamping force at the location of the stations, wherein the clamping force preferably is adjustable per station.
7. Device according to claim 5 or 6, wherein the first unfolding means are adapted for unfolding the first walls that are parallel to the conveyance direction.
8. Device according to any one of the preceding claims, wherein the conveying means are adapted for keeping a clamped crate still while the unfolding means are operative.
9. Device according to any one of the preceding claims, wherein the conveying means comprise two endless conveyor belts that are parallel to each other, wherein the first engagement means are formed by facing first support surfaces of the conveyor belts, wherein

each conveyor belt preferably comprises a counter surface that is situated counter the first support surface, wherein each counter surface is situated against a second support surface such that with the second support surfaces pressure force can be exerted via the first support surfaces onto a clamped folding crate, wherein the conveying means preferably comprise first movement means with which at least one of the second support surfaces is movable on both sides of the conveyance path and in a direction transverse to the first support surfaces, wherein preferably per station of the device a second support surface is provided that is individually movable by means of the first movement means, wherein the second support surface preferably is provided by a support roller.

10. Device according to claim 9, comprising first drive means, particularly a servomotor or stepping motor, for a circulating drive of the conveyor belts.

11. Device according to claim 9 or 10, wherein at least one, preferably both conveyor belts are provided with substantially equidistantly positioned stops at the first support surfaces for abutting a front side of a clamped folding crate.

12. Device according to any one of the preceding claims, comprising feeding means for feeding folded folding crates towards the conveyance path with their crate bottoms facing upwards with respect to gravity, wherein the feeding means preferably are adapted for pressing folding crates between conveyor belts and/or against stops situated at the conveyor belts, wherein the device preferably comprises a first station that is situated at the conveyance path, wherein the first unfolding means comprise second engagement means which at the first station are movably connected with the frame and which are movable in a first direction transverse to the conveyance direction from above the crate bottom against a portion of a first or second wall of a clamped folding crate which portion with respect to the vertical projection of the crate bottom is approachable or protruding, wherein the second engagement means preferably comprise deformable fingers that are provided at second movement means for moving the distal end of the fingers against the approachable or protruding portion of the first or second wall and retracting the fingers at a distance from a clamped folding crate, wherein the second movement means preferably are adapted for in the first direction and in a second direction transverse thereto moving the fingers from and towards the approachable or protruding portion, wherein the fingers preferably comprise rubbery material.

13. Device according to claim 12, comprising a second

station situated at the conveyance path, wherein the unfolding means comprise third engagement means which at the second station are movably connected with the frame and which from underneath a folding crate clamped at its crate bottom are movable against an inner side of the first walls of the clamped folding crate, wherein the third engagement means preferably are adapted for moving the first wall(s) with respect to the crate bottom through their upright position.

14. Device according to claim 13, wherein the third engagement means are provided at the ends of first swivelling arms swivelling about first axles that are situated substantially parallel to each other on both sides with respect to a folding crate position of the second station, wherein preferably the first axles and preferably the swivel point are situated beyond the vertical projection of the crate bottom of a crate clamped at the folding crate position of the second station, wherein the device preferably comprises third movement means for the movement of the third engagement means.

15. Device according to any one of the preceding claims, comprising a third station situated at the conveyance path, wherein the unfolding means comprise first checking means for checking the unfolded position of the first walls of a clamped crate, wherein the first checking means are provided at the third station.

16. Device according to any one of the claims 12-14, comprising a fourth station situated at the conveyance path, wherein the unfolding means comprise fourth engagement means which at the fourth station are movably connected with the frame and which from underneath a folding crate clamped at its crate bottom are movable against an inner side of a second wall of the clamped folding crate, wherein the fourth engagement means preferably are provided at the ends of second swivelling arms swivelling about second axles that are situated substantially parallel to each other on both sides of a folding crate position of the fourth station, wherein preferably the second axles and preferably the swivel point of the second swivelling arms are situated beyond the vertical projection of the crate bottom of a crate clamped at the folding crate position of the fourth station, wherein the device preferably comprises fourth movement means for the movement of the fourth engagement means.

17. Device according to any one of the preceding claims, comprising a fifth station situated at the conveyance path, wherein the unfolding means comprise second checking means for checking the unfolded position of the second walls, wherein the second checking means are provided at the fifth station, wherein the

- second checking means preferably comprise fifth engagement means that are movable against an inner or outer side of a second wall of a clamped folding crate, wherein the fifth engagement means preferably are provided at the ends of third swivelling arms swivelling about third axes that are situated substantially transverse to a crate bottom of a clamped crate beyond the vertical projection of the crate bottom on both sides of a folding crate position of the fifth station, wherein the device preferably comprises fifth movement means for the movement of the fifth engagement means, wherein the swivelling arms preferably swivel about a swivel angle of which the size is a measure for the position of the second walls and/or a measure for a correct mutual attachment of locking means at the first and second walls of a clamped crate.
18. Device according to any one of the claims 12-17, comprising a sixth station provided with ejection means for incompletely unfolded folding crates, wherein the device preferably comprises conveyor belts which at the position of the sixth station can be moved apart.
19. Device according to any one of the claims 12-17, wherein the first up to and including the sixth station, when used, are situated successively in conveyance direction at the conveyance path.
20. Device according to claims 12-19, wherein the first and/or second and/or third and/or fourth and/or fifth movement means comprise a pneumatic or hydraulic cylinder.
21. Device according to any one of the preceding claims, comprising an electronic operating unit for operating the actuation of drive means and movement means of the device.
22. Device according to any one of the preceding claims, wherein the electronic operating unit comprises a shift register for the registration and transmission of specific information about each individual folding crate for the successive stations, such as information about the dimensions and/or the (in)complete unfolding of clamped folding crates.
23. Device according to any one of the claims 12-22, adapted for passing folding crates at first sides of the crate bottom, that are situated near the first walls, through the conveyance path in a clamped manner.
24. Device according to any one of the preceding claims, wherein the conveying means are adapted for having the first engagement means engage onto the sides of a folding crate along which the walls are situated that are the first to be erected or unfolded.
25. Device for unfolding folding crates, particularly in a continuous process, wherein the folding crates comprise a crate bottom, two opposite first walls that are hinged to the crate bottom and two opposite second walls that are hinged to the crate bottom, that can all be placed in a flat folded position and an unfolded position, respectively, wherein the device comprises a frame, as well as conveying means provided on the frame for conveying folding crates through the device in conveyance direction according to a conveyance path, wherein the conveying means comprise first engagement means for clampingly engaging a folding crate using clamping force only.
26. Device according to any one of the preceding claims, wherein the conveying means are adapted for passing the folding crates through the device according to a linear or straight path and preferably for unfolding the crates in said path.
27. Device according to any one of the preceding claims, wherein the conveying means are adapted for passing crates in one and the same conveyance direction along a treatment station or unfolding station.

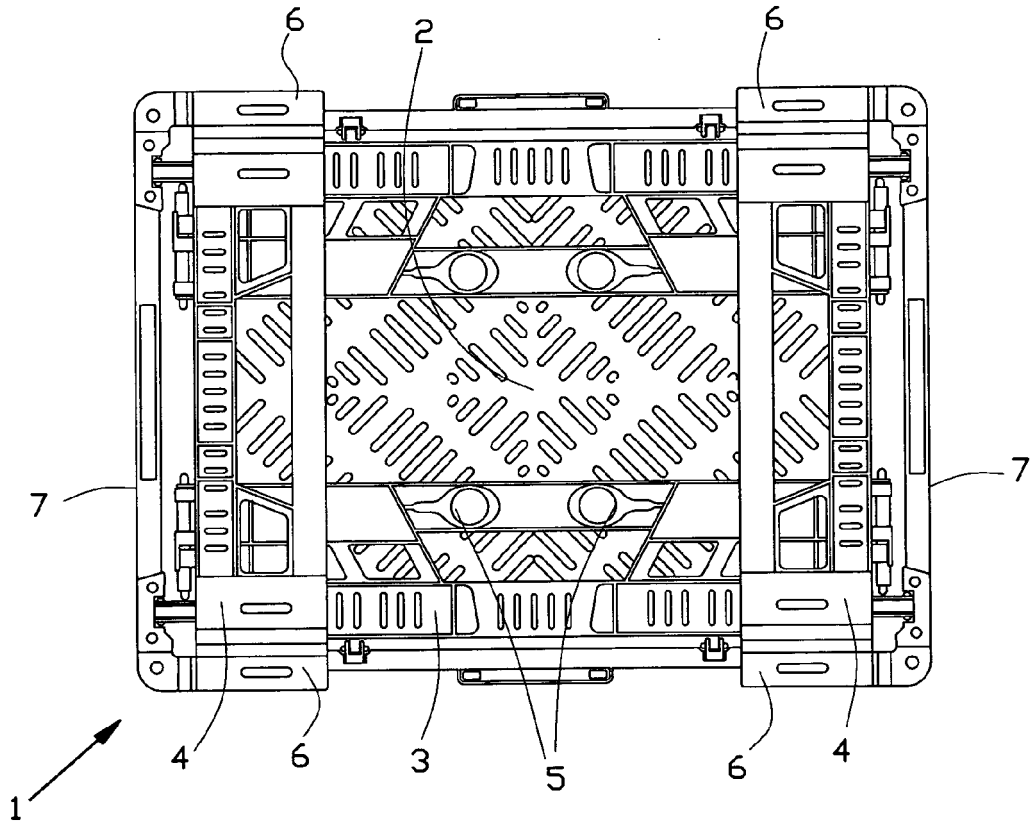


FIG. 1A

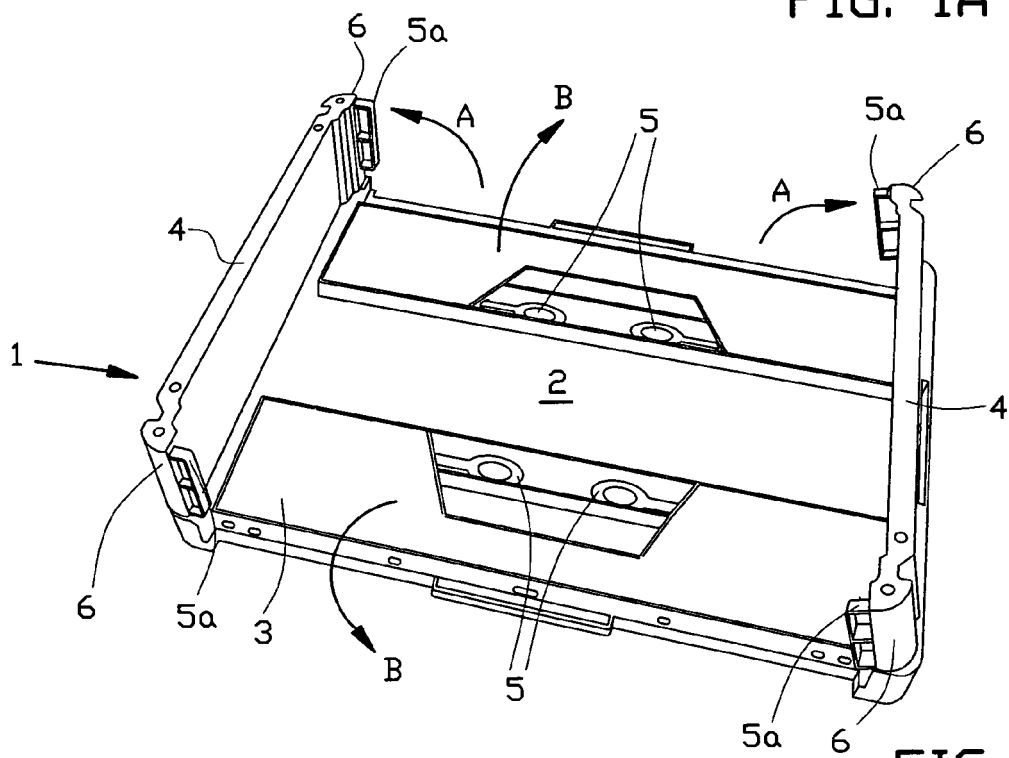


FIG. 1B

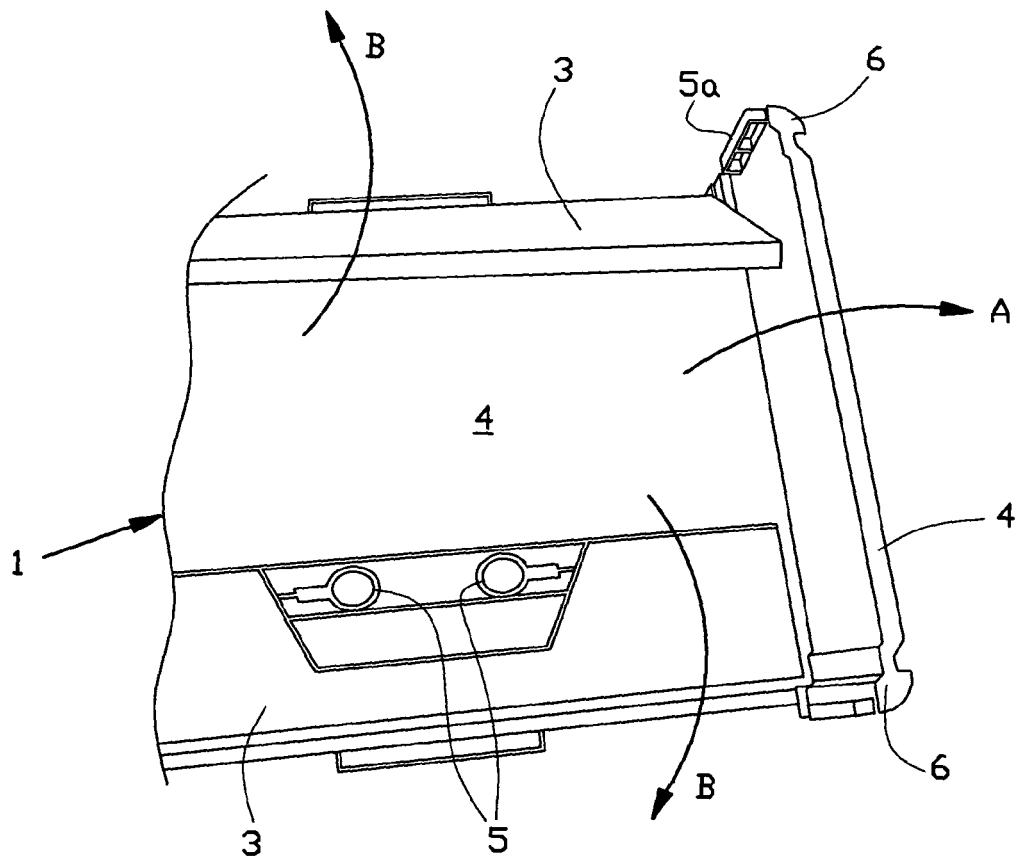


FIG. 1C

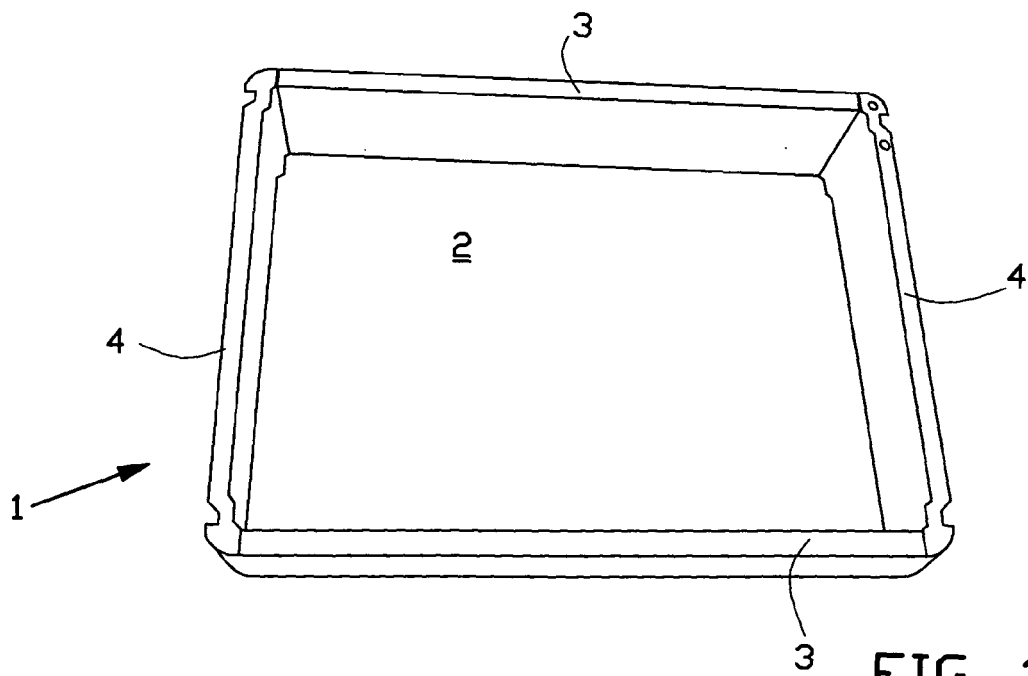
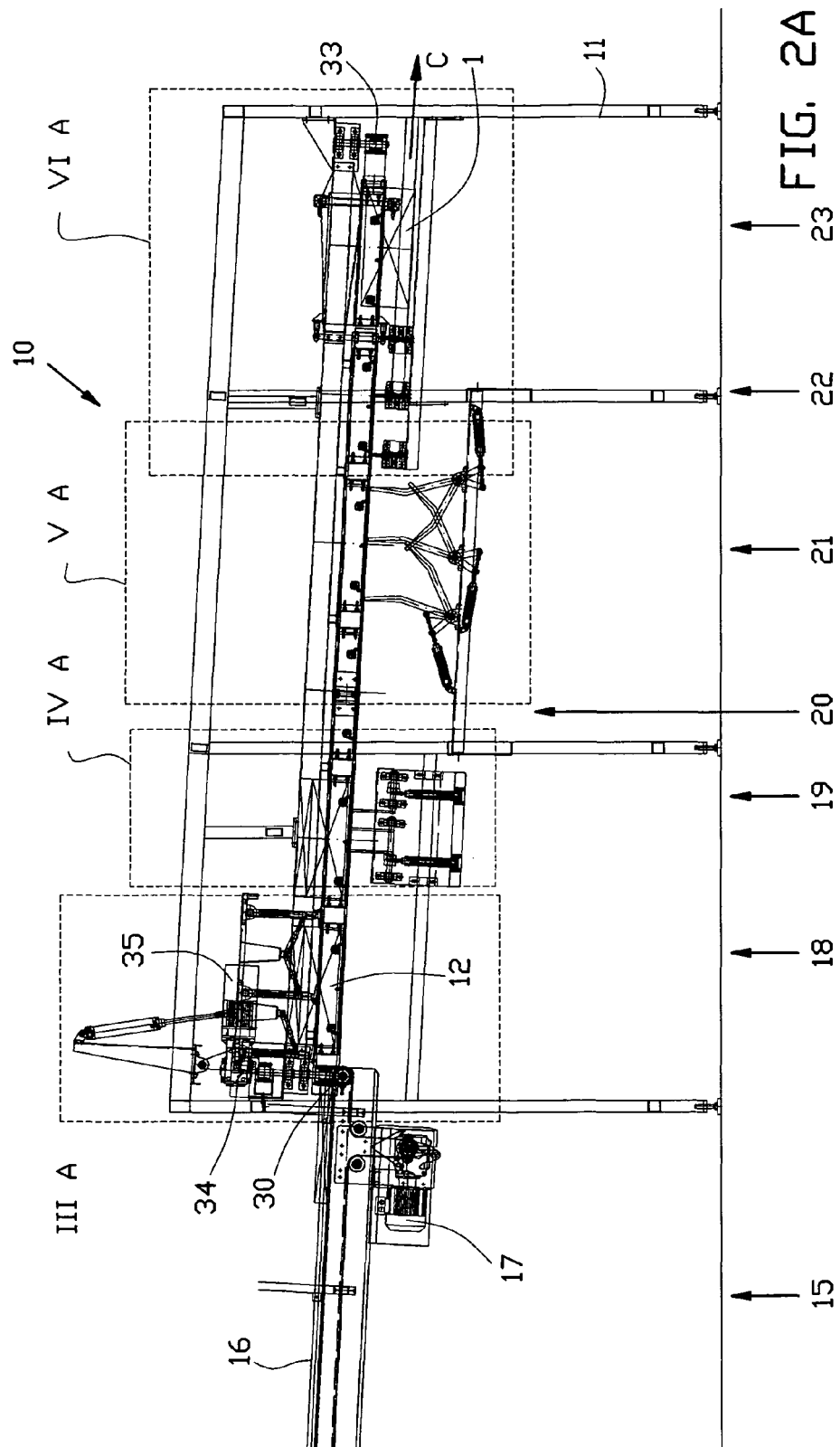


FIG. 1D



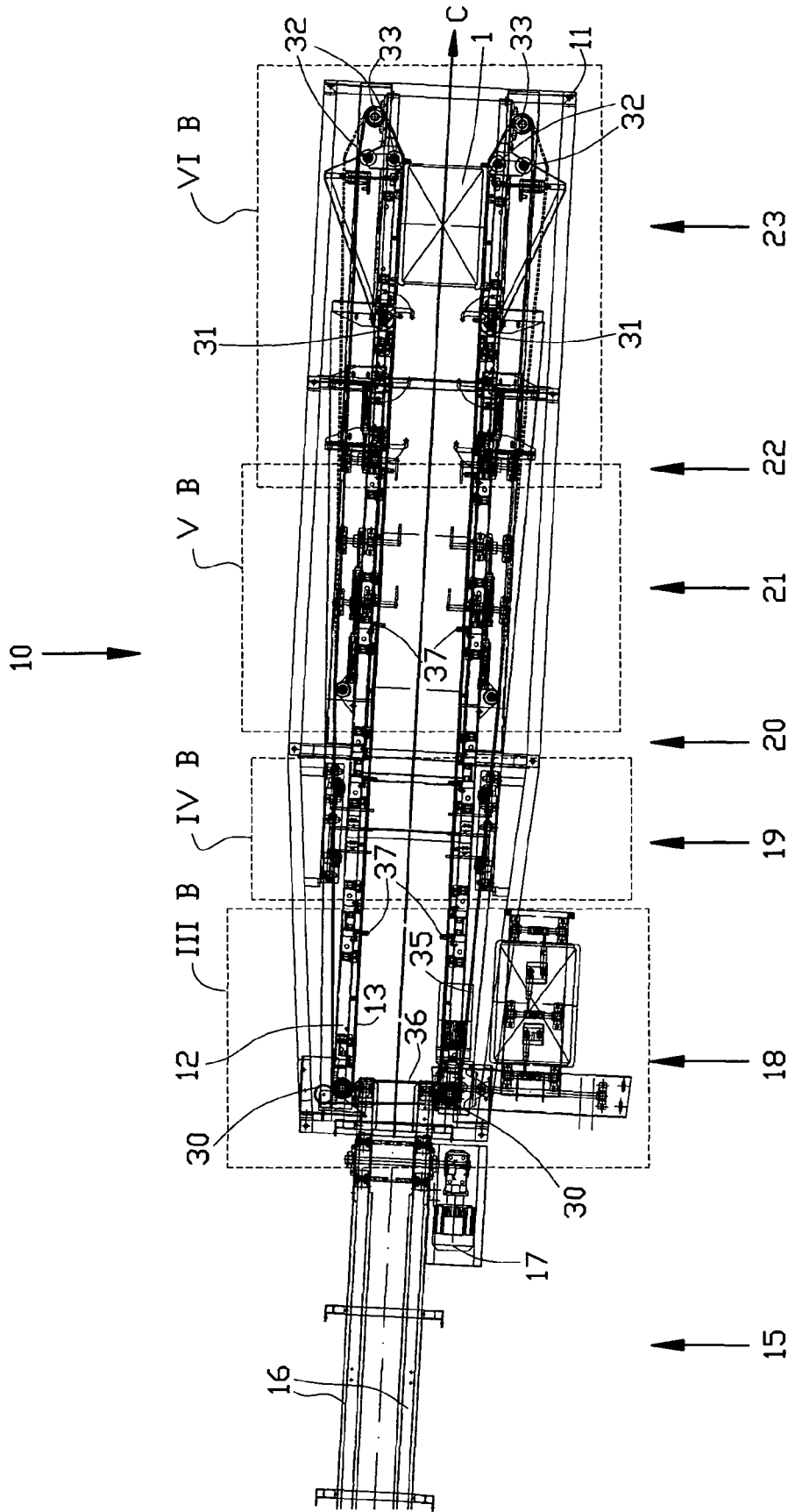
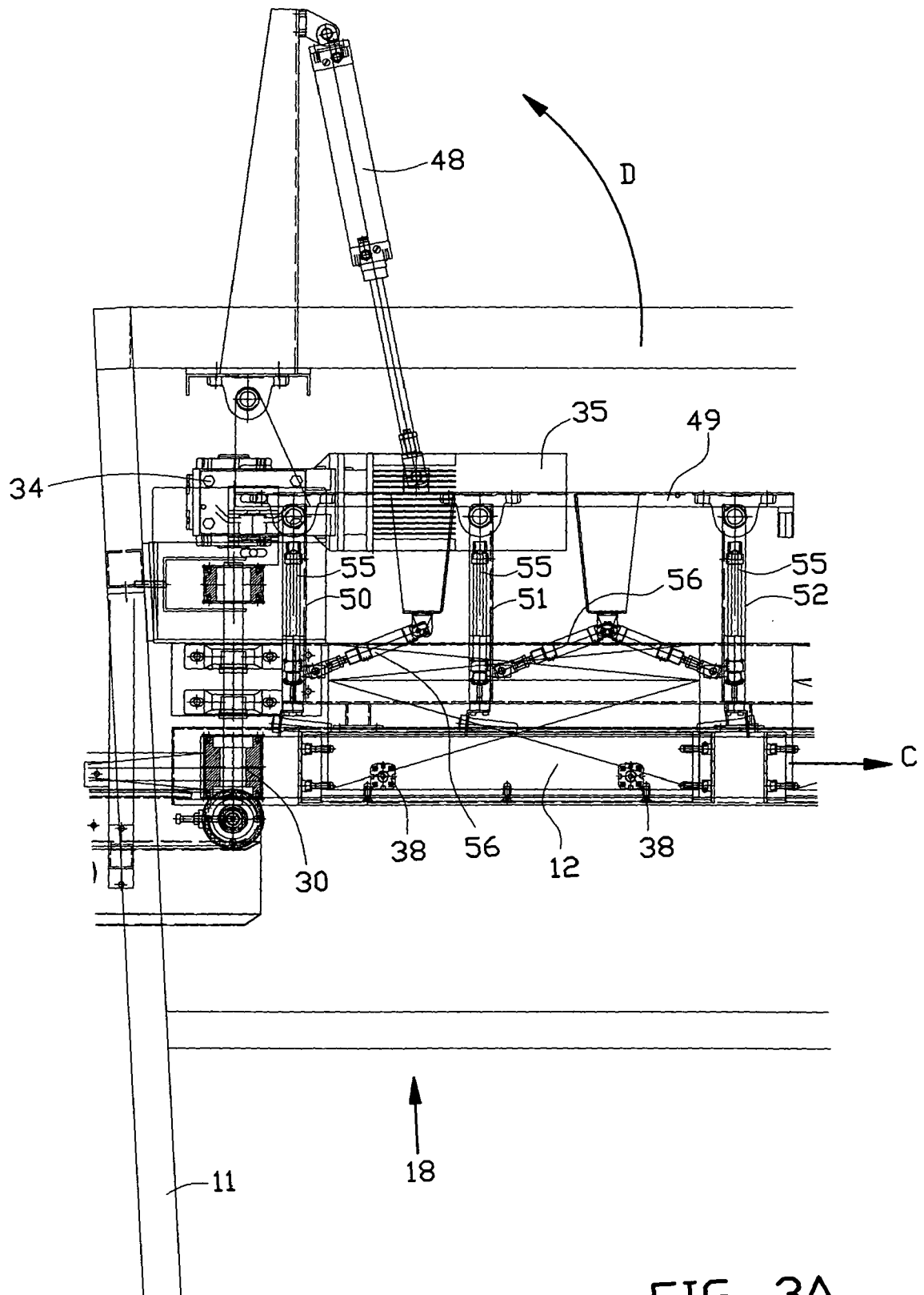


FIG. 2B



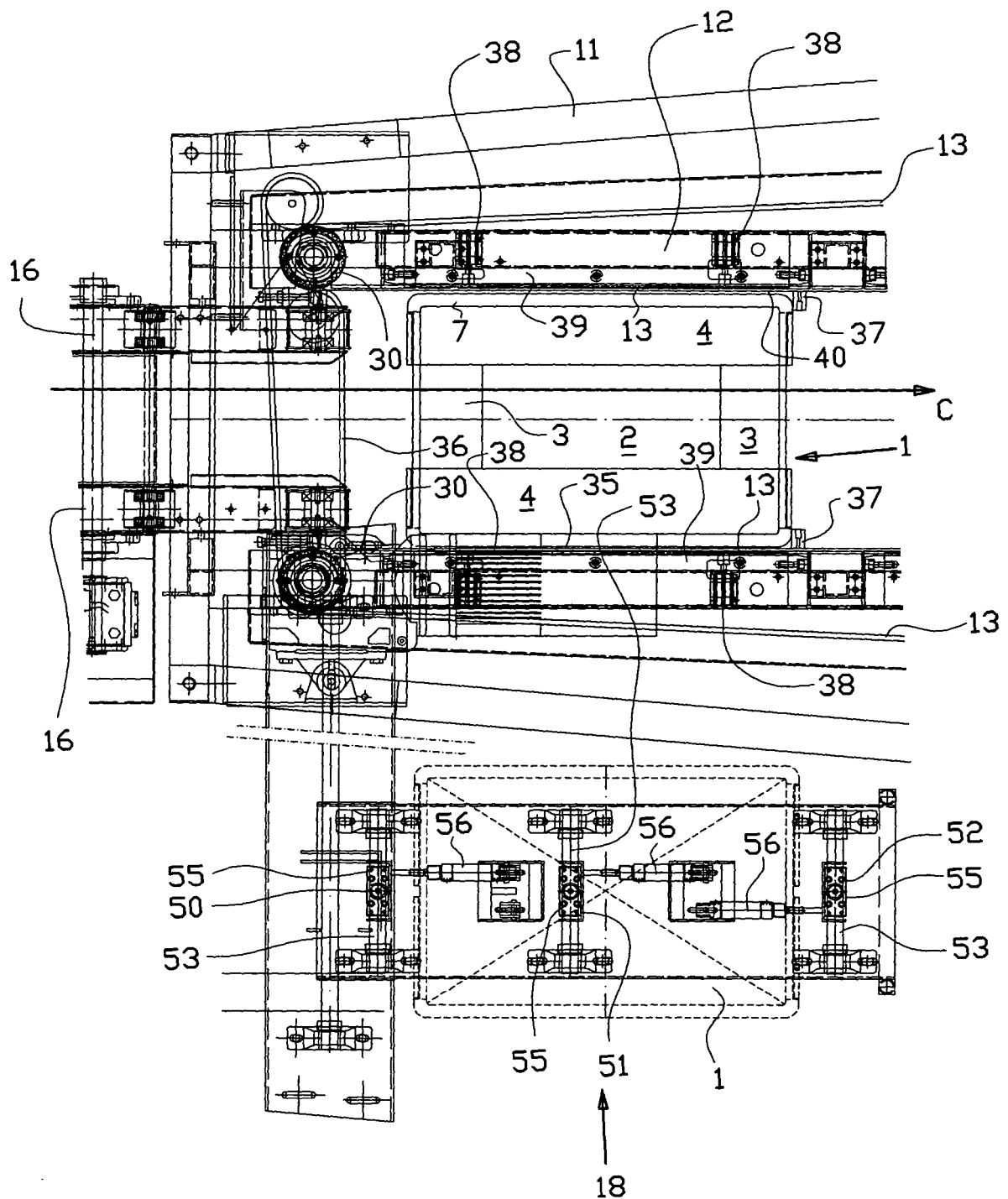
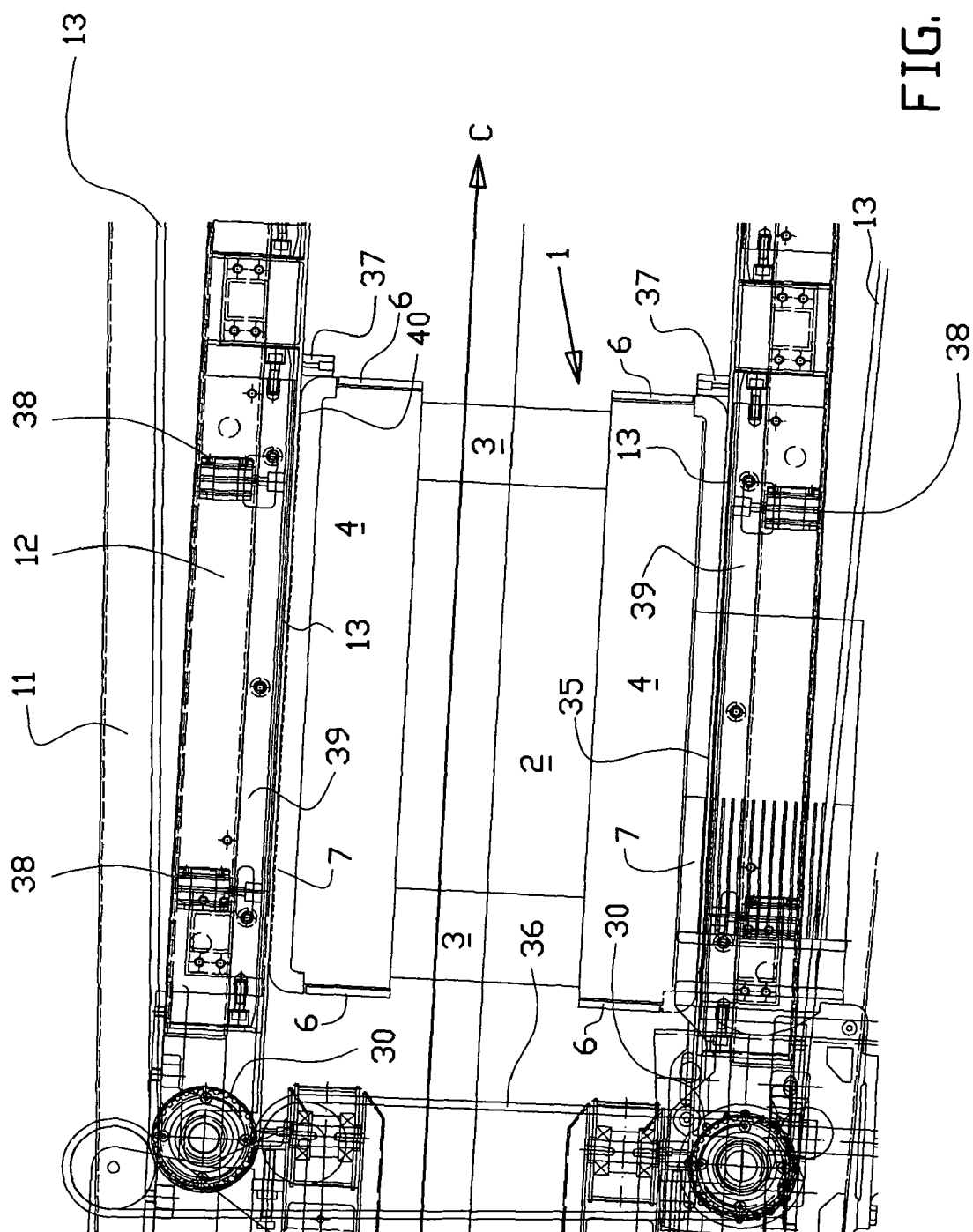


FIG. 3B



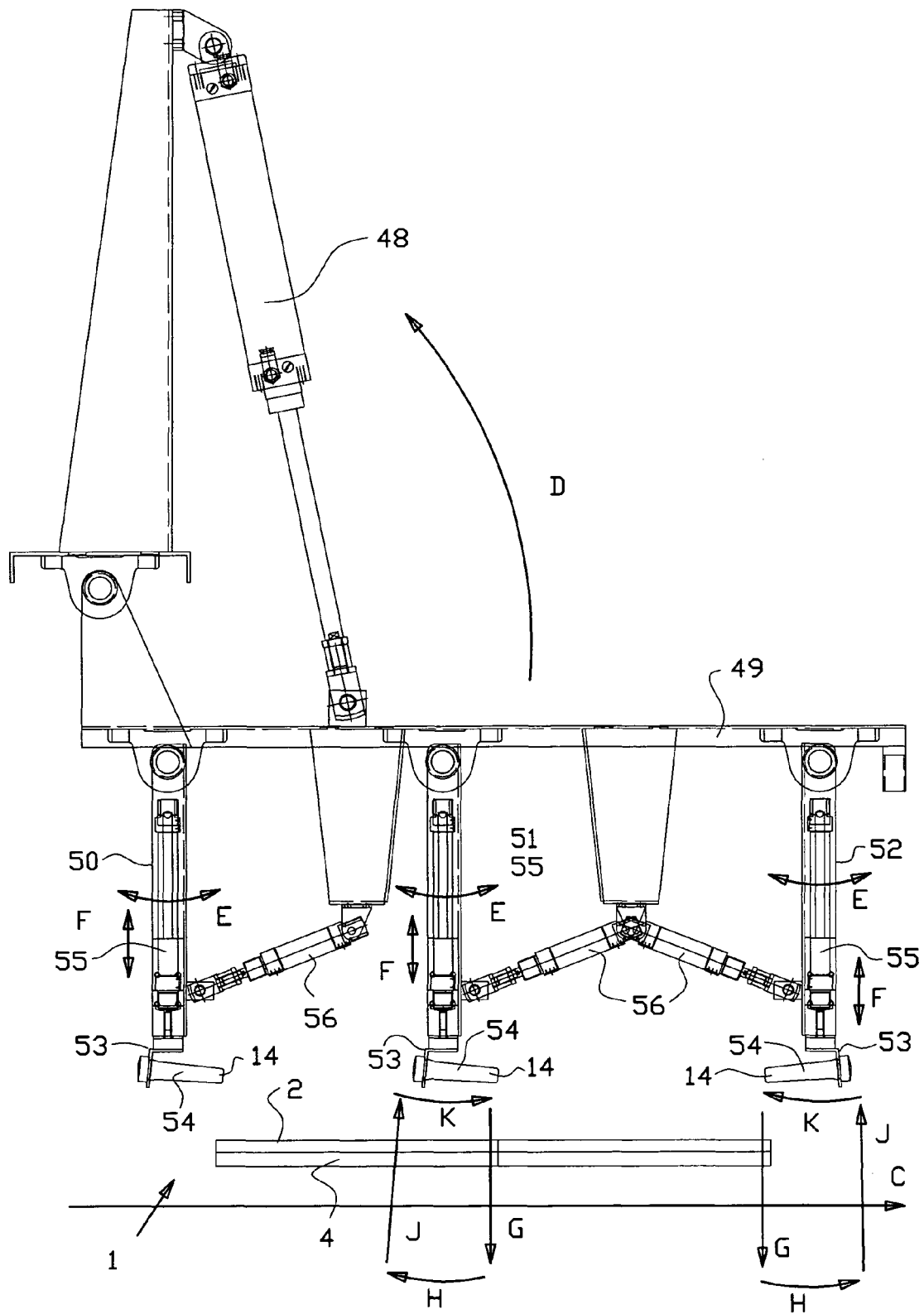


FIG. 3D

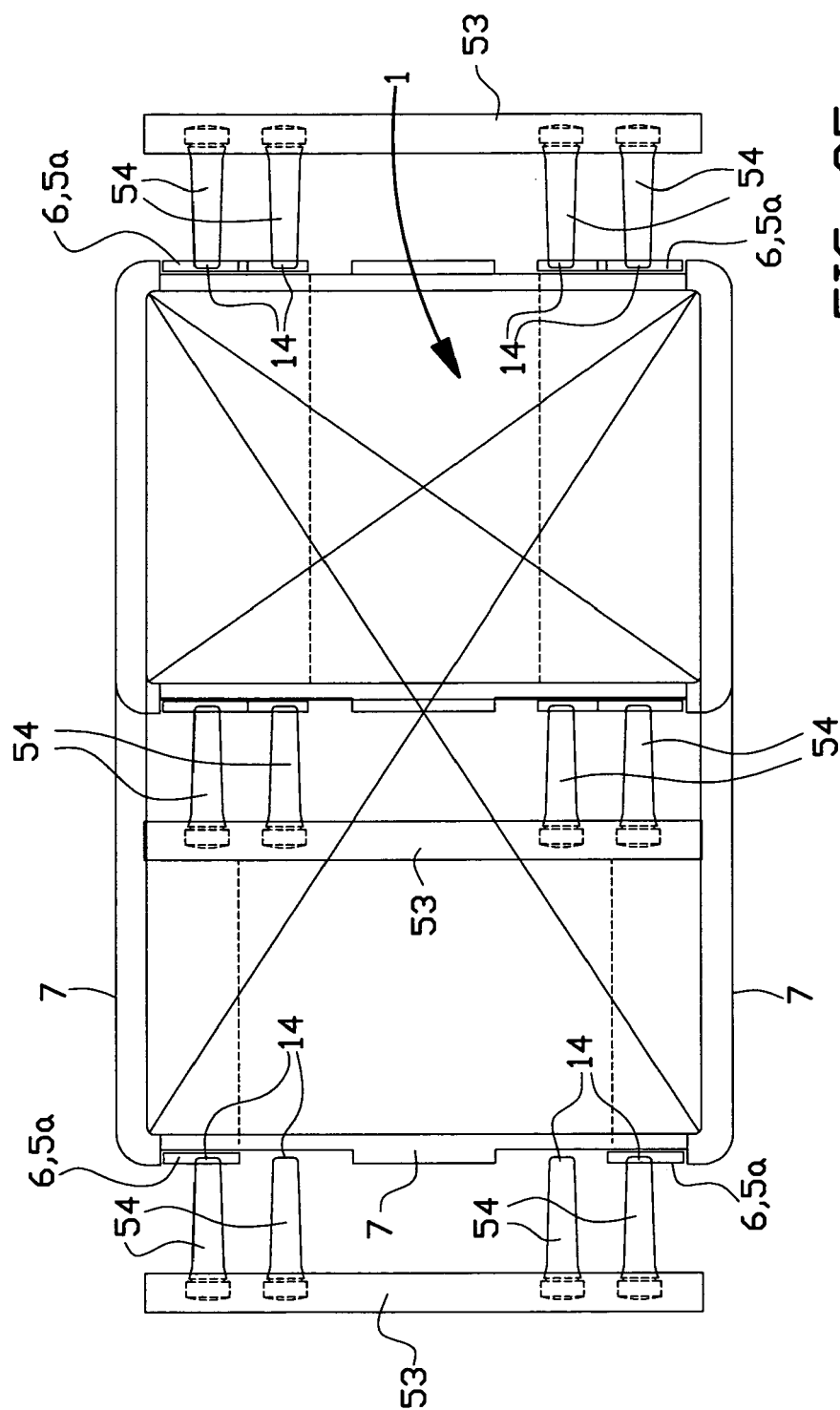


FIG. 3E

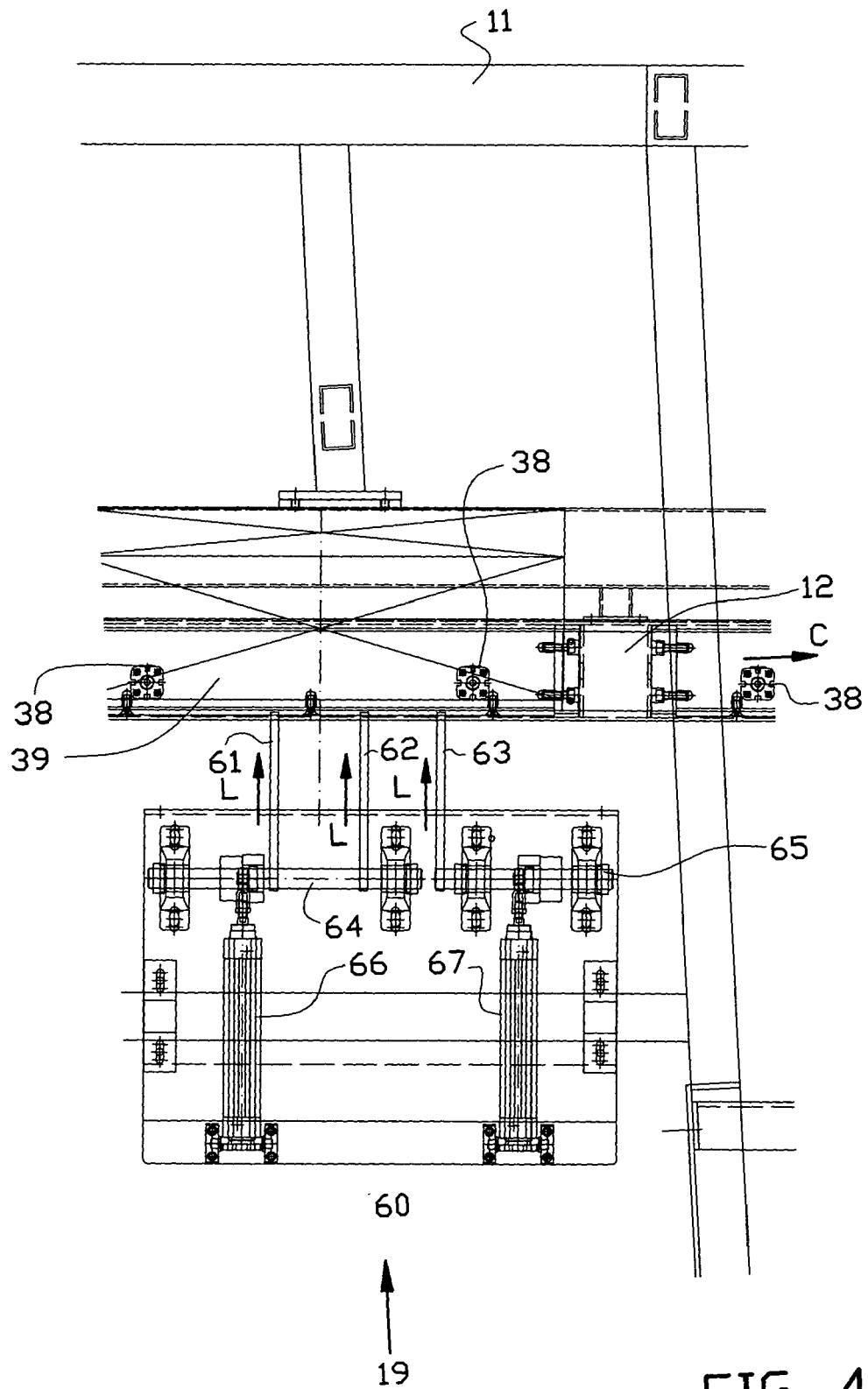


FIG. 4A

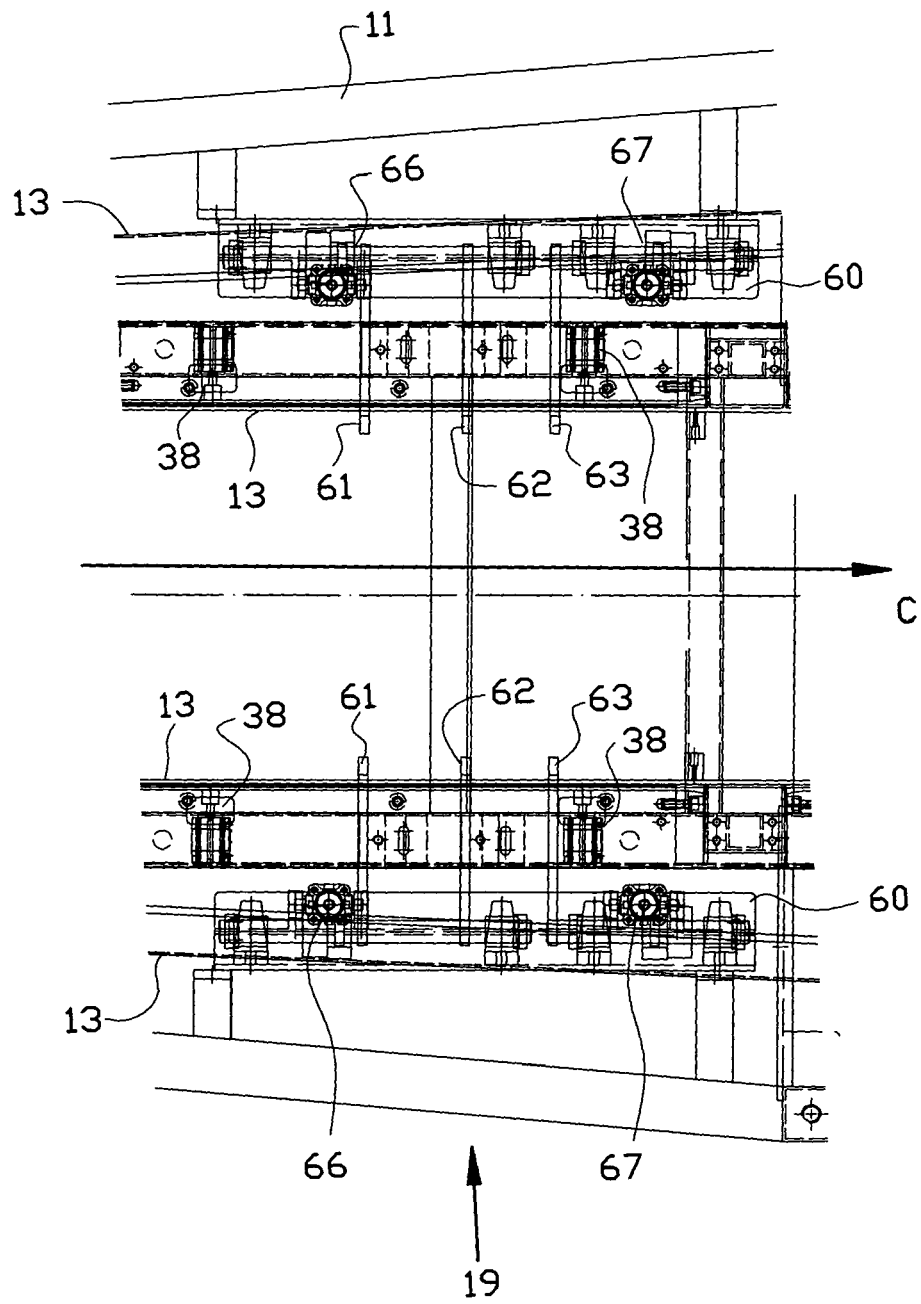


FIG. 4B

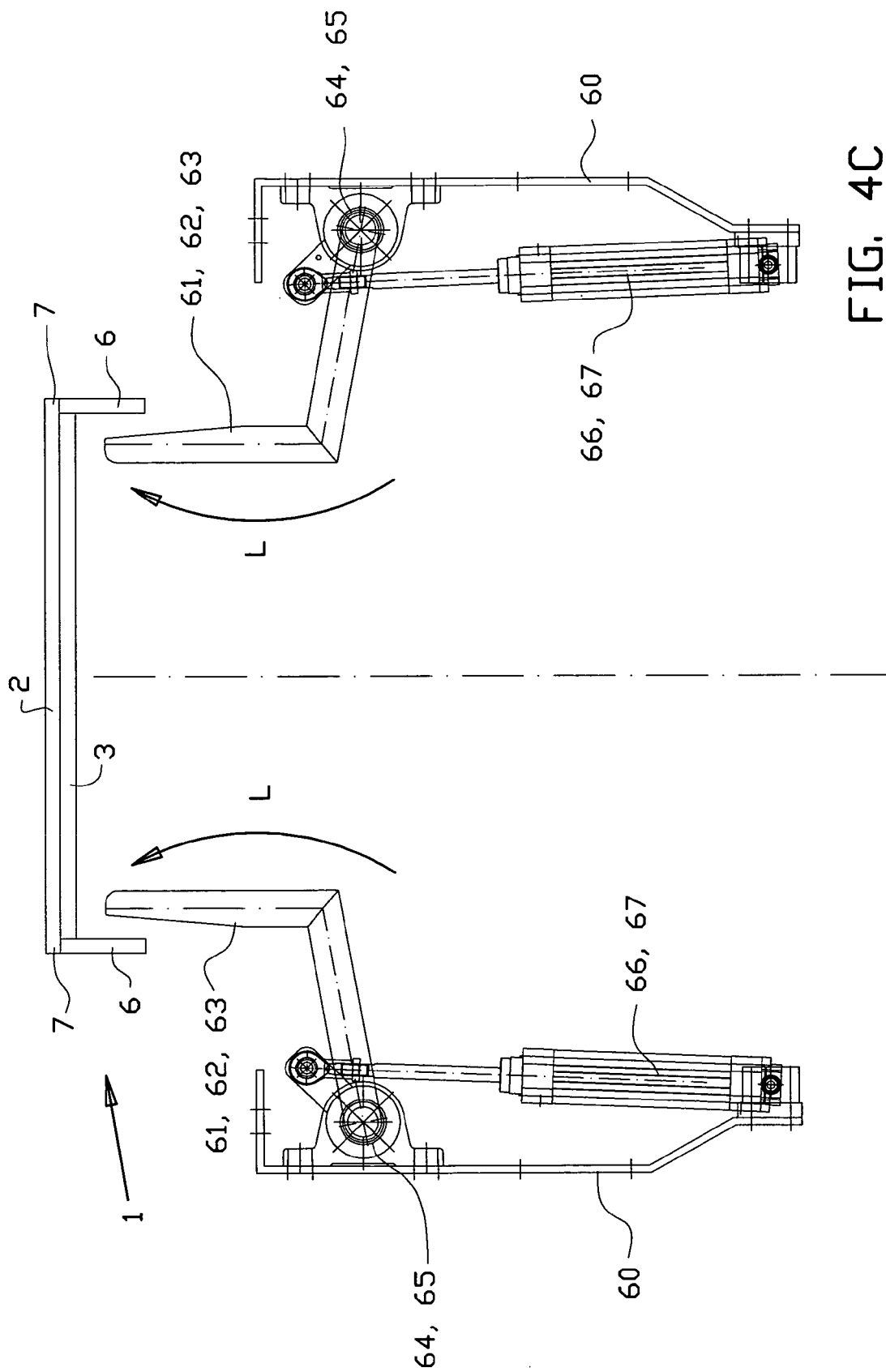


FIG. 4C

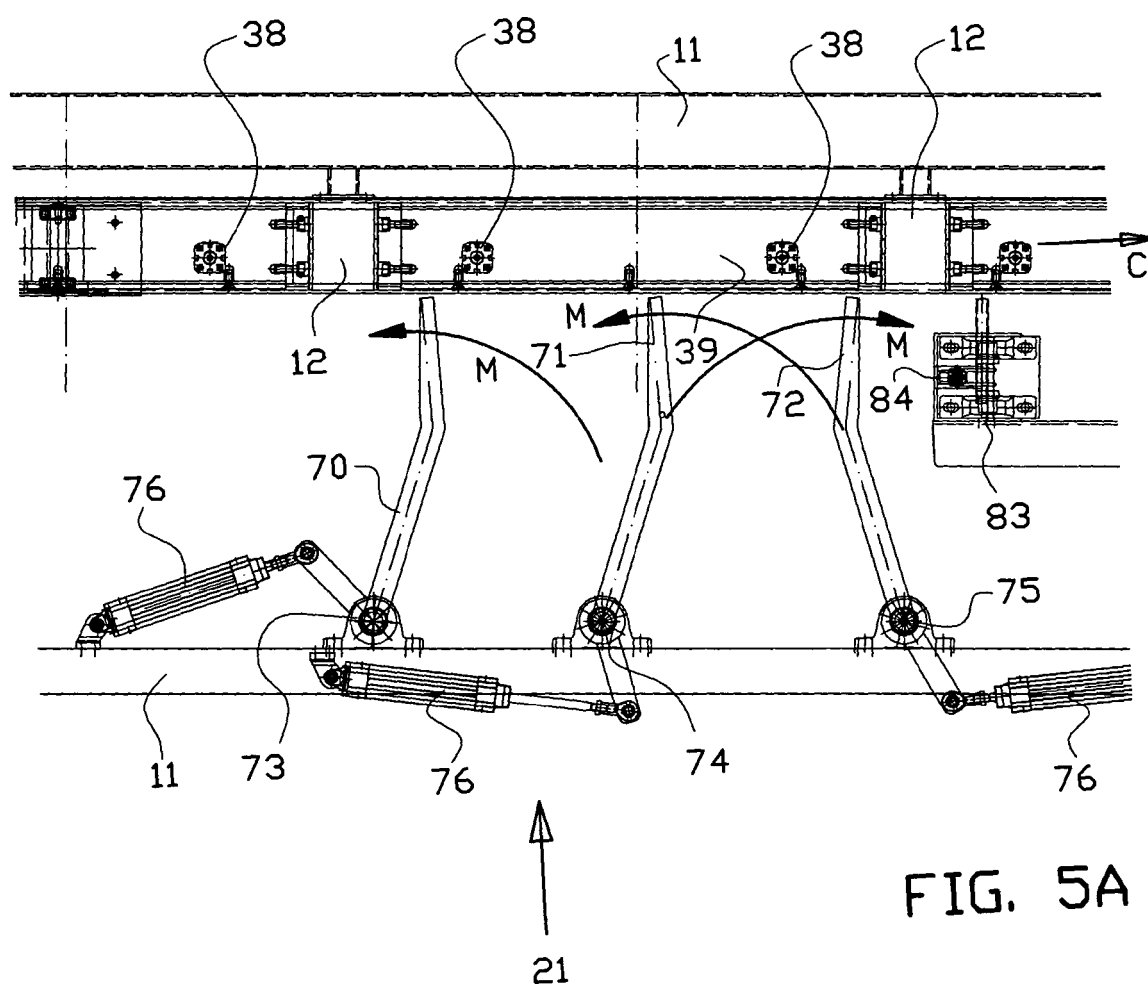


FIG. 5A

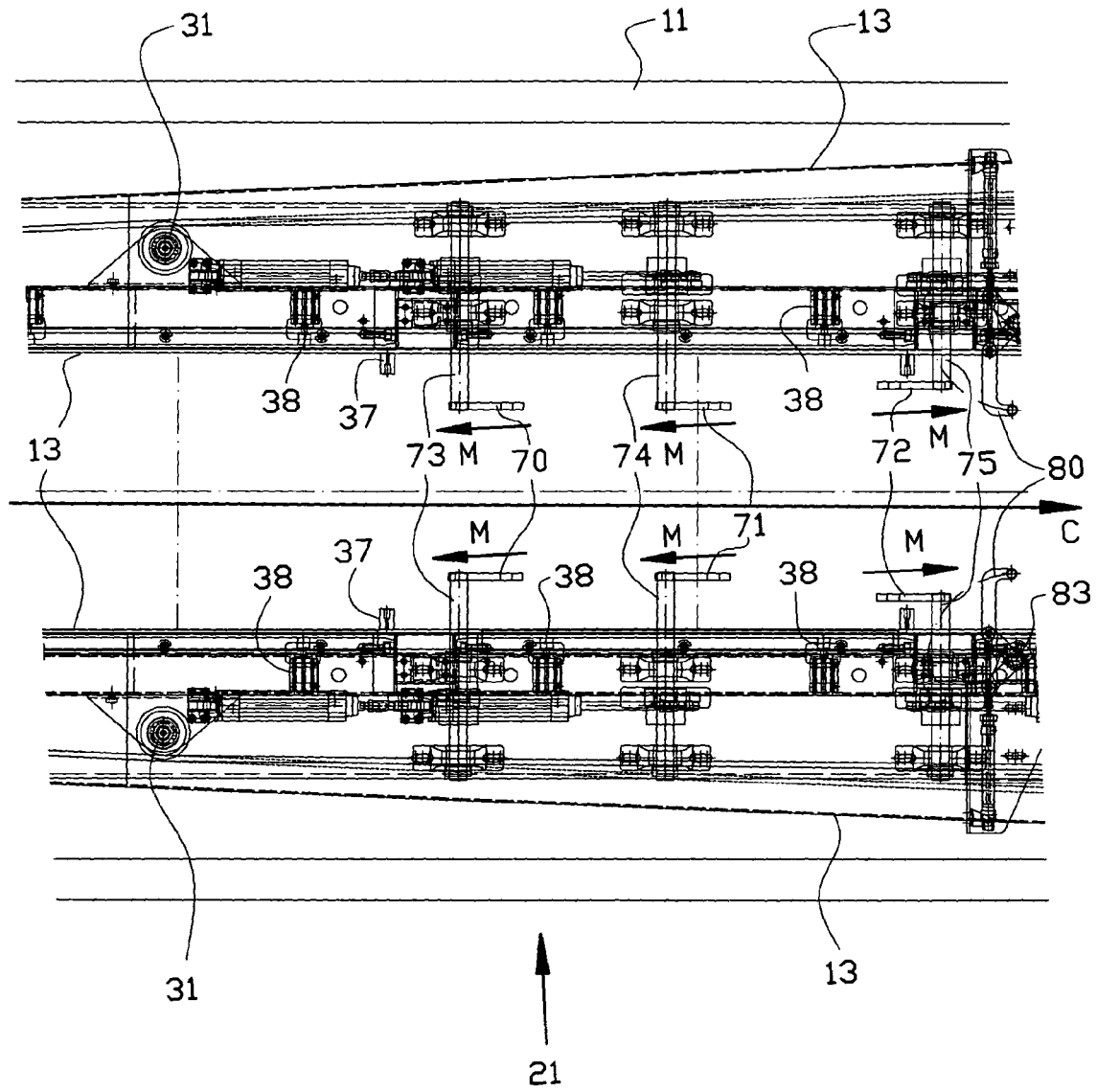


FIG. 5B

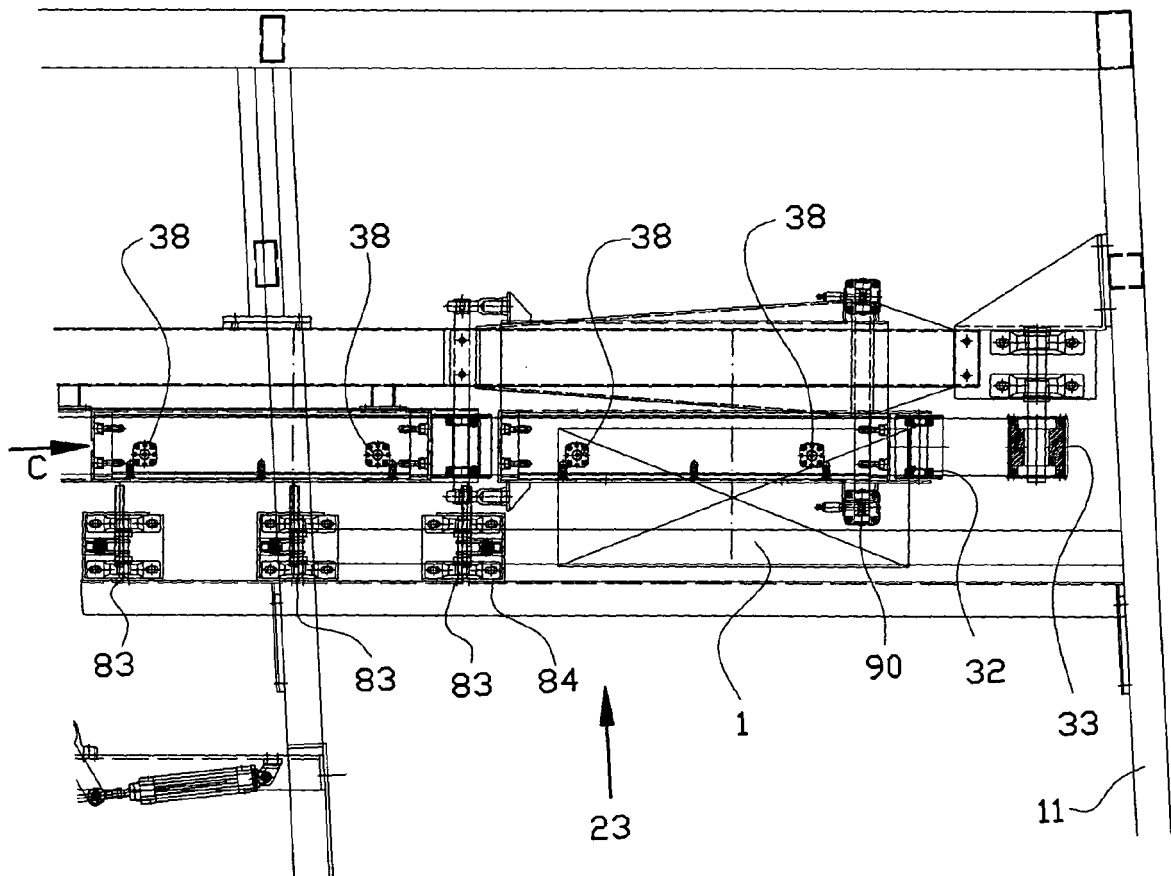


FIG. 6A

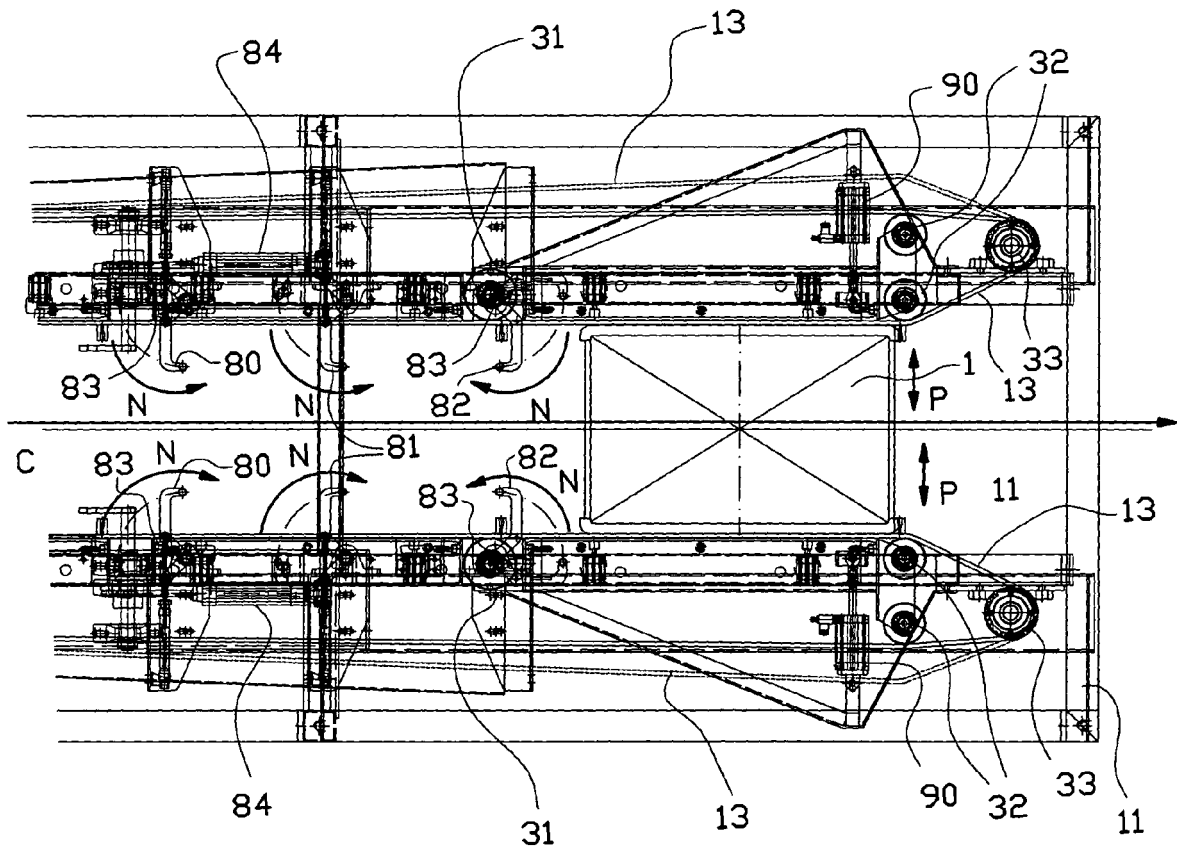


FIG. 6B