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(54) DEVICE FOR OPENING COLLAPSIBLE CRATES

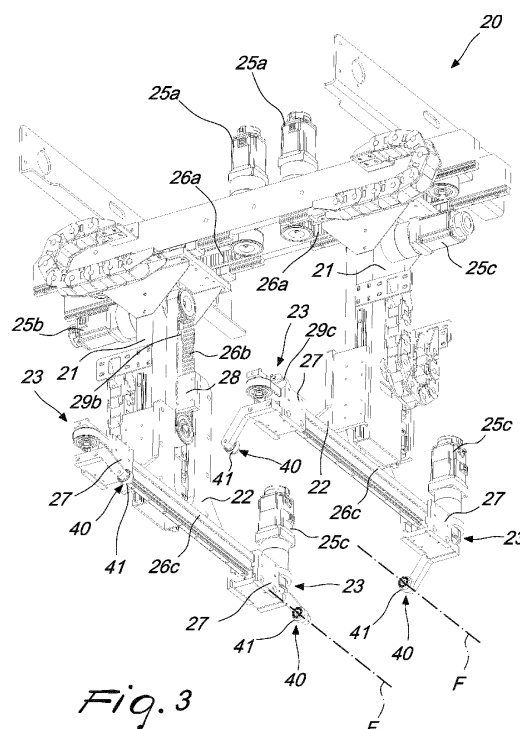
(57) A device for opening collapsible crates (100) which are substantially box-shaped and of the type comprising a bottom (101) and four side walls (102, 103), which are mutually independently articulated to the bottom (101) about respective main axes of rotation (A, B).

The device (100) comprises at least:

- a frame (2), which defines a seat (3) for receiving a crate (100), in a predefined orientation according to which a first pair of mutually opposite longitudinal walls (102) is parallel to a first, longitudinal predefined direction (C),

and a second pair of mutually opposite transverse walls (103) is parallel to a second, transverse predefined direction (D);

- a first opening assembly (20), provided with means (40) for clamping the flanks of each longitudinal wall (102), and configured for the automated rotation of the longitudinal walls (102) about the respective main axes (A),
- a second opening assembly (50), configured for the automated rotation of the transverse walls (103) about the respective main axes (B).

*Fig. 3***EP 4 491 525 A1**

Description

[0001] The present invention relates to a device for opening collapsible crates, i.e. crates in which the side walls can be folded onto the bottom in order to reduce the overall bulk.

[0002] As known, in the fruit and vegetable sector (and other sectors) the use is widespread of containers of the type of crates or cases of various dimensions, in which the products of interests are placed for conservation and shipment, from the wholesalers' distribution and sorting centers to end sales points.

[0003] The crates are shaped like a box in which four perpendicular side walls rise up from a rectangular bottom panel, and in the traditional configuration for use these crates are used for containing products. Such crates can be made of wood, cardboard, polymeric materials, or the like, and they can have on the bottom, and/or on the side walls, slots or handles of various kinds, to facilitate gripping and/or transport.

[0004] In the vast range of crates available on the market, a very important role is played by collapsible crates (or folding/closeable crates), in which each side wall can rotate with respect to the bottom about a hinge arranged along the respective edge in common: thus it is possible to reversibly pass from the traditional configuration for use to a configuration of minimum space occupation, in which the walls are lying on the bottom (possibly mutually overlapping), in so as to appreciably reduce the overall bulk.

[0005] Evidently, when the crates are not filled with fruit or vegetables (for example when they are supplied to the centers where they are filled and the products are distributed on the market), the configuration of minimum space occupation makes it possible to store or ship these crates in a manner that is appreciably more practical (and cheaper).

[0006] This has made the use of this type of crate particularly widespread, with consequent proliferation of the formats offered, which differ from each other by dimension, thickness, position and type of hinges and/or of elements for coupling/uncoupling between the walls, etc.

[0007] The proliferation of formats has led to considerable difficulty for companies that design and sell devices for automatically opening the walls (in order to pass from the configuration of minimum space occupation to the configuration for use), and which are particularly appreciated owing to the widely-felt need to speed up operation and relieve human operators from having to manually open the walls of each and every crate.

[0008] In fact, the different dimensions of the parts of the crate (or in any case the different formats) impose the need to adopt contrivances that are often complex and sometimes not completely effective, to ensure in any case the usability of each crate by the designated automated device.

[0009] The aim of the present invention is to solve the

above-mentioned problems, by providing a device that is versatile and capable of effectively handling various different formats of collapsible crates.

[0010] Within this aim, an object of the invention is to provide a device that can easily open the walls of collapsible crates of different formats, with a solution that is structurally simple.

[0011] Another object of the invention is to provide a device that can open the walls of different crates safely, without running the risk of damaging them.

[0012] Another object of the invention is to provide a device that ensures high reliability in use.

[0013] Another object of the invention is to provide a device that adopts an alternative technical and structural configuration to that of conventional devices.

[0014] Another object of the invention is to provide a device that is of low cost and safely applied.

[0015] Another object of the invention is to provide a device that can be easily implemented using elements and materials that are readily available on the market.

[0016] This aim and these and other objects which will become better apparent hereinafter are all achieved by a device according to claim 1.

[0017] Further characteristics and advantages of the invention will become better apparent from the description of two preferred, but not exclusive, embodiments of the device according to the invention, illustrated by way of non-limiting example in the accompanying drawings wherein:

Figure 1 is a perspective view of the device according to the invention, with the second assembly shown in dotted lines and some elements of the frame removed;

Figures 2 and 3 are two perspective views of the first assembly of the device of Figure 1;

Figure 4 is a side view of the first assembly of the device of Figure 1;

Figures 5 and 6 are two perspective views of the second assembly of the device of Figure 1;

Figures I and II show a collapsible crate, respectively before and after being opened by the device according to the invention.

[0018] With reference to the figures, the reference numeral 1 generally designates a device for opening collapsible crates 100, i.e. crates 100 like the one in the accompanying Figures I and II: such crates 100 are substantially box-shaped (or parallelepiped-shaped) and are of the type that comprises a bottom 101 and four side walls 102, 103 (for example but not necessarily made of polymeric material), which are mutually independently articulated to the bottom 101 about respective main axes of rotation A, B. Such crates 100 are also

known in the background art as crates with side walls (or just walls) that are folding, or foldable, or closeable. They can have various dimensions, and they can still be effectively handled by the device 1 proposed herein, as will become clear in the discussion below.

[0019] The crates 100 that the device 1 is capable of opening are therefore provided with hinges or other elements for articulating each wall 102, 103 to the bottom 101, so as to be able to pass from a configuration for use to a configuration of minimum space occupation, and vice versa. In the configuration for use (which is entirely traditional and well-known), the (mutually coupled) walls 102, 103 rise perpendicularly from the bottom 101 in order to (give the crate 100 a box-like shape and) be able to effectively contain products or goods of any type, and for example, in the preferred but not exclusive application, fruit and vegetable products.

[0020] From the configuration for use (Figure II), the walls 102, 103 can be mutually disengaged and then rotated (at least approximately) by 90°, in order to obtain the configuration of minimum space occupation (Figure I), in which they are laid on the bottom 101 (possibly at least partially overlapping), to reduce the overall bulk.

[0021] The crates 100 can be completed or fitted with other accessories or details that are traditionally used in the sector, but these are in any case of a type that is per se known, and they will not be discussed further.

[0022] According to the invention, the device 1 comprises first of all a seat 3 for receiving a crate 100, in a predefined orientation (i.e. determined solely by the shape and dimensions of the seat 3). In this orientation, a first pair of mutually opposite longitudinal walls 102 is parallel to a first, longitudinal predefined direction C, and a second pair of mutually opposite transverse walls 103 is parallel to a second, transverse predefined direction D (perpendicular to the previous direction). In other words, the seat 3 identifies the predefined directions C, D and therefore makes it possible to identify the "longitudinal" walls 102 and the "transverse" walls 103 as the walls that are parallel respectively to the first direction (longitudinal direction) C or to the second direction (transverse direction) D, when the crate 100 is received in the seat 3 in the orientation imposed thereby. Typically, but not exclusively, the longitudinal direction C is the direction along which the crates 100 can be advanced and made to slide, in order to place them in the seat 3 and then remove them once the operation is finished.

[0023] For example, as shown in the accompanying figures, the seat 3 can comprise a pair of L-shaped rails 4, which effectively constitute a form of track and which define, with their orientation, the longitudinal direction C (and therefore the transverse direction) and on which the crates 100 to be opened can be advanced and optionally made to slide.

[0024] The seat 3 can in any case also be provided in another manner.

[0025] In the discussion below (and in Figures I and II) the letter "A" identifies the main axes of rotation of the

longitudinal walls 102 (parallel to the longitudinal direction C), and the letter "B" identifies the main axes of rotation of the transverse walls 103 (at right angles to the longitudinal direction C).

[0026] The frame 2 also defines an ideal resting plane: typically, the crates 100 are placed in the seat 3 with the bottom 101 parallel to the supporting surface (and to the longitudinal direction C and to the transverse direction D); when in the discussion below mention is made of "horizontal" or "vertical" directions or arrangements, these should be understood as referring to this ideal resting plane or at least to the bottom 101, as unidirectionally oriented in the seat 3.

[0027] Furthermore, the device 1 according to the invention comprises at least one first opening assembly 20, which is provided with means 40 for clamping the flanks of each longitudinal wall 102 (the sides at right angles to the main axes A); the first assembly 20 is configured to impose (obviously, when clamped) the automated rotation of the longitudinal walls 102 about the respective main axes A (parallel to the longitudinal direction C).

[0028] In addition, the device 1 according to the invention comprises a second opening assembly 50, which is configured to impose the automated rotation of the transverse walls 103 about the respective main axes B (at right angles to the longitudinal direction C).

[0029] Thus, by virtue of the action of the first assembly 20 and of the second assembly 50, the device 1 according to the invention is capable of opening a collapsible crate 100 in an effective manner, even of varying formats or models, because the first assembly 20 and the second assembly 50 handle the opening of the respective side walls 102, 103 separately, the means 40 for clamping can grip longitudinal walls 102 of any length along the flanks, and the seat 3 can be easily adapted (by varying the distance between the rails 4 for example), to receive crates 100 with transverse walls 103 of different length.

[0030] Typically, the device 1 can also comprise a system for locking the crate 100 in place along the seat 3, which can be activated manually or automatically when the crate 100, during its sliding along the rails 4, reaches a predefined position, in which the first assembly 20 and the second assembly 50 can subsequently intervene. The system can be of a type that is per se known (and for this reason it is not shown in the accompanying figures), and it can for example comprise pneumatic actuators fitted with stems that can be moved along a straight (horizontal) line perpendicular to the longitudinal direction C, so as to protrude at the desired moment from the rails 4 in order to grip the flanks of the bottom 101 of the crate 100, when the crate has reached the position of interest.

[0031] According to the invention, the first assembly 20 comprises at least one pair of posts 21, which are supported by the frame 2 with the possibility to translate closer together or further apart, parallel to the transverse direction D.

[0032] Each post 21 supports, with the possibility of

vertical translation, a respective structure 22 for supporting a pair of carriages 23, which in turn are adapted to support the clamping means 40 which can slide with respect to the structure 22 closer together or further apart, parallel to the longitudinal direction C. Therefore, the carriages 23 can be translated with respect to the frame 2 along each one of the three Cartesian axes.

[0033] With further reference to the accompanying figures, the structure 22 can be substantially T-shaped, with a first, vertical portion directly associated with the respective post 21, and a second, horizontal portion which supports the carriages 23. The structure 22 can be made of aluminum, but the possibility is not ruled out of using other metals or materials.

[0034] Thus, the carriages 23 can be moved both upward and downward (because they are supported by the structure 22 which in turn can be moved vertically with respect to the posts 21) and also transversely to the longitudinal direction C (because the posts 21 can be moved in that direction with respect to the frame 2): having first gripped the longitudinal walls 102 with the clamping means 40, supported by the carriages 23, the two translation movements of these, just described, make it possible to open the longitudinal walls 102.

[0035] The two posts 21 (and all the components associated with them) can operate simultaneously or they can in any case be synchronized, in order to perform the simultaneous opening of the two longitudinal walls 102 of the crate 100, or they can alternatively act to open longitudinal walls 102 which, in the configuration of minimum space occupation (in which the crate 100 is supplied), are at least partially overlapping (as happens for some models of crate 100).

[0036] In particular, according to the invention the first assembly 20 comprises an electronic control and management unit 24, which is configured to command at least the translation of the posts 21 and of the structures 22 (and preferably also of the carriages 23): the unit 24 (shown only schematically in the accompanying Figure 1) can be a controller, a PLC or an electronic computer of any type, and typically (but not necessarily) is the same unit that manages the operation of the entire device 1.

[0037] The unit 24 is provided with instructions for generating a substantially rotational trajectory for each pair of carriages 23, which is obtained as a (polar) interpolation of the translation trajectories of the respective posts 21 and of the corresponding structures 22. This ensures an optimal opening, free from unwanted stresses, for the longitudinal walls 102, for any format, model and dimensions of the latter and of the crates 100 in general.

[0038] In particular, the unit 24 stores the various different models and formats of the crates 100 to be opened (in particular, the respective position of the main axes of rotation A of the longitudinal walls 102), so that they can be retrieved (automatically or manually) for each work cycle (each opening).

[0039] The movement of the posts 21, of the structures

22 and of the carriages 23 can be obtained in any manner, while remaining within the scope of protection claimed herein: the use of any type of actuator (including pneumatic) capable of generating the desired rotary motion by interpolation should in fact be considered as covered in the scope of protection claimed herein. In the solution proposed in the accompanying figures (purely for the purposes of example), the device 1 comprises first motors 25a, 25b, 25c (brushless or of another type) for each one of the translations listed above, which transmit motion respectively to the posts 21 (the first motors 25a), to the structures 22 (the first motors 25b) and to the carriages 23 (the first motors 25c) by means of toothed belts 26a, 26b, 26c. The two first motors 25a of the two posts 21 are controlled in a mutually independent manner (for example by the unit 24) and the motors of the two structures 22 and/or of the two pairs of carriages 23 are also mutually independently controlled. This choice is found to be of particular practical interest, in that it makes it possible to pass from one format to another without requiring the operator to adjust the actuators (of whatever type) that act in the opening of the longitudinal walls 102 by means of rotation.

[0040] In an embodiment of significant practical interest, which in any case does not limit the application of the invention, each carriage 23 comprises a longitudinal sliding block 27 (i.e. a block that is moved parallel to the longitudinal direction C), preferably of the recirculating-ball type. The two longitudinal sliding blocks 27 of the same pair of carriages 23 (on the same flank of the seat 3) are coupled to opposite sides of the same belt 26c (which is driven by a respective first motor 25c), so as to obtain the desired movements, closer together or further apart, by conveniently configuring the couplings and the directions of rotation.

[0041] The possibility of vertical translation of each structure 22 is also obtained (preferably) by means of vertical sliding blocks 28 (i.e., they can move vertically) associated with the respective belt 26b, which is driven by the corresponding first motor 25b which is anchored to the post 21 on which the structure 22 can translate.

[0042] The first motors 25a, 25b of the posts 21 and of the structures 22, which are designed to be in constant movement during the opening cycle of the longitudinal walls 102, can be connected electrically to respective energy sources by means of cable ducts.

[0043] In addition, the first assembly 20 will be fitted with stroke limiters 29a, 29b, 29c which define the maximum excursion respectively for the posts 21, the structures 22 and the carriages 23 (or the clamping means 40). In particular, the excursion of the posts 21 makes it possible to arrange the carriages 23 in the most appropriate position in order to enable the means 40 to clamp the longitudinal walls 102, in the various formats of crate 100.

[0044] In the preferred embodiment, the clamping means 40 can comprise a pair of mutually facing and opposite pressers 41, which are supported in a cantilever-

ered manner by respective carriages 23, with the possibility of rotation (ensured for example by a bearing) about auxiliary rotation axes F (Figures 3 and 8), which are parallel to the longitudinal direction C.

[0045] The second assembly 50 can first of all comprise a beam 51 which is oriented along the longitudinal direction C and which is supported by a fixed column 5 of the frame 2 with the possibility of vertical translation.

[0046] In addition, the second assembly 50 comprises two sliders 52 (for example two brackets) which are supported in a lower region by the beam 51 with the possibility of relative translation toward or away from each other, parallel to the longitudinal direction C. The sliders 52 are equipped with coupling elements 53 (for example hook-shaped, as in the accompanying figures) which are configured to be coupled with respective end flaps of the transverse walls 103 (at the opposite end from the respective hinges), so as to be able to lift them and rotate them, in order to obtain the opening of the transverse walls 103 through an interpolation of the translation trajectories of the sliders 52 along the beam 51 and of the latter with respect to the post 5 (similarly to what is described for the first assembly 20). This final interpolation can also be calculated by the electronic unit 24 or in any case by the electronic component that governs the operation of the entire device 1.

[0047] The drive units of the beam 51 and of the sliders 52 can be conventional and similar to the drive units adopted for the components of the first assembly 20.

[0048] The operation of the device according to the invention is the following.

[0049] A crate 100 is arranged and optionally made to slide (or in any case it is placed) in the seat 3, until it in any case assumes the position deemed most appropriate to execute the opening.

[0050] The opening of the longitudinal walls 102 is performed by the first assembly 20 (typically but not necessarily before the opening of the transverse walls 103): first of all the first motors 25a, 25b, 25c can be actuated so that the carriages 23 and the means 40 in particular come to be facing (outside) the flanks of the longitudinal walls 102; subsequently, the means 40 are actuated in order to clamp those same flanks (for example by activating the first motors 25c in order to move the carriages 23 closer together).

[0051] Once closing is complete, as previously mentioned the vertical translation of the structure 22 is commanded as well as the horizontal translation of the posts 21 (parallel to the transverse direction D), so as to generate a circular arc trajectory for the means 40 and therefore for the longitudinal walls 102, which is necessary for their opening.

[0052] Evidently, any format or dimension of the longitudinal walls 102 can be effectively handled in this manner, simply by conveniently arranging and translating the carriages 23 along the three Cartesian axes.

[0053] After completing the opening of the longitudinal walls 102, the second assembly 50 can be actuated for

the opening of the transverse walls 103.

[0054] In this regard, the beam 51 is lowered, until the sliders 52 are almost touching the bottom 101 of the crate 100: in this step, the sliders 52 are kept close together and substantially above a central region of the bottom 101, so that when they actually do touch the latter, they are interposed and facing the end flaps of the transverse walls 103, which in turn are lying on the bottom 101.

[0055] The opening cycle then entails translating the sliders 52 away from each other, so that the elements 53 can hook the end flaps of the transverse walls 103; once engaged, the sliders 52 are moved further apart from each other and simultaneously the beam 51 is lifted, so as to make each slider 52 describe (by interpolation of two translation motions) a rotation trajectory, which corresponds to the rotation imparted to the respective transverse wall 103, which can thus be opened.

[0056] When the transverse wall 103 has reached the vertical position, the elements 53 are disengaged (this can happen simply by making them translate toward each other, if in the meantime, manually or automatically, the transverse walls 103 have been coupled to the longitudinal walls 102 which were opened previously) and are returned (together with the beam 51) to the cycle start position.

[0057] In practice it has been found that the invention fully achieves the set aim and objects, in that the device 1 is capable of effectively handling different formats of collapsible crates 100.

[0058] This result is obtained with a solution that requires a low number of components and which is therefore structurally simple, thus ensuring reliability and low cost.

[0059] As seen, the closing in particular of the longitudinal walls 102 is performed in any case in a manner that is safe and free from risks for the crate 100, without running the risk of causing damage.

[0060] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

[0061] In the embodiments illustrated, individual characteristics shown in relation to specific examples may in reality be substituted with other, different characteristics, existing in other embodiments.

[0062] In practice, the materials employed, as well as the dimensions, may be any according to requirements and to the state of the art.

[0063] The disclosures in Italian Patent Application No. 102023000011550 from which this application claims priority are incorporated herein by reference.

[0064] Where the technical features mentioned in any claim are followed by reference numerals and/or signs, those reference numerals and/or signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference numerals and/or signs do not have any limiting effect on the inter-

pretation of each element identified by way of example by such reference numerals and/or signs.

Claims

1. A device for opening collapsible crates (100), said crates (100) being substantially box-shaped and of the type comprising a bottom (101) and four side walls (102, 103), which are mutually independently articulated to said bottom (101) about respective main axes of rotation (A, B), the device comprising at least:

- a frame (2), which defines a seat (3) for receiving a crate (100), in a predefined orientation according to which a first pair of mutually opposite longitudinal walls (102) is parallel to a first, longitudinal predefined direction (C), and a second pair of mutually opposite transverse walls (103) is parallel to a second, transverse predefined direction (D);
- a first opening assembly (20), provided with means (40) for clamping the flanks of each longitudinal wall (102), and configured for the automated rotation of the longitudinal walls (102) about the respective said main axes (A),
- a second opening assembly (50), configured for the automated rotation of the transverse walls (103) about the respective said main axes (B).

characterized in that said first assembly (20) comprises:

- at least one pair of posts (21), supported by said frame (2) with the possibility to translate closer together or further apart parallel to said transverse direction (D), each post (21) supporting, with the possibility of vertical translation, a respective supporting structure (22) for a pair of carriages (23), which support said clamping means (40) and can slide, with respect to said structure (22), closer together or further apart parallel to said longitudinal direction (C),
- an electronic control and management unit (24), configured to actuate the translation at least of said posts (21) and said structures (22), said unit (24) being provided with instructions for generating a substantially rotational trajectory for each pair of said carriages (23), as an interpolation of the translation trajectories of respective said posts (21) and corresponding said structures (22).

2. The device according to claim 1, **characterized in that** each carriage (23) comprises a longitudinal sliding block (27), preferably of the recirculating-ball

type.

3. The device according to claim 1 or 2, **characterized in that** said clamping means (40) comprise a pair of mutually facing and opposite pressers (41), which are supported in a cantilevered manner by respective said carriages (23), with the possibility of rotation about auxiliary rotation axes (F) which are parallel to said longitudinal direction (C).
4. The device according to one or more of the preceding claims, **characterized in that** said second assembly (50) comprises:

- a beam (51), which is oriented along said longitudinal direction (C) and is supported by a fixed column (5) of said frame (2) with the possibility of vertical translation,
- two sliders (52) supported in a lower region by said beam (51) with the possibility of relative translation toward or away from each other, parallel to said longitudinal direction (C), said sliders (52) being equipped with coupling elements (53) which are configured to be coupled with respective end flaps of the transverse walls (103).

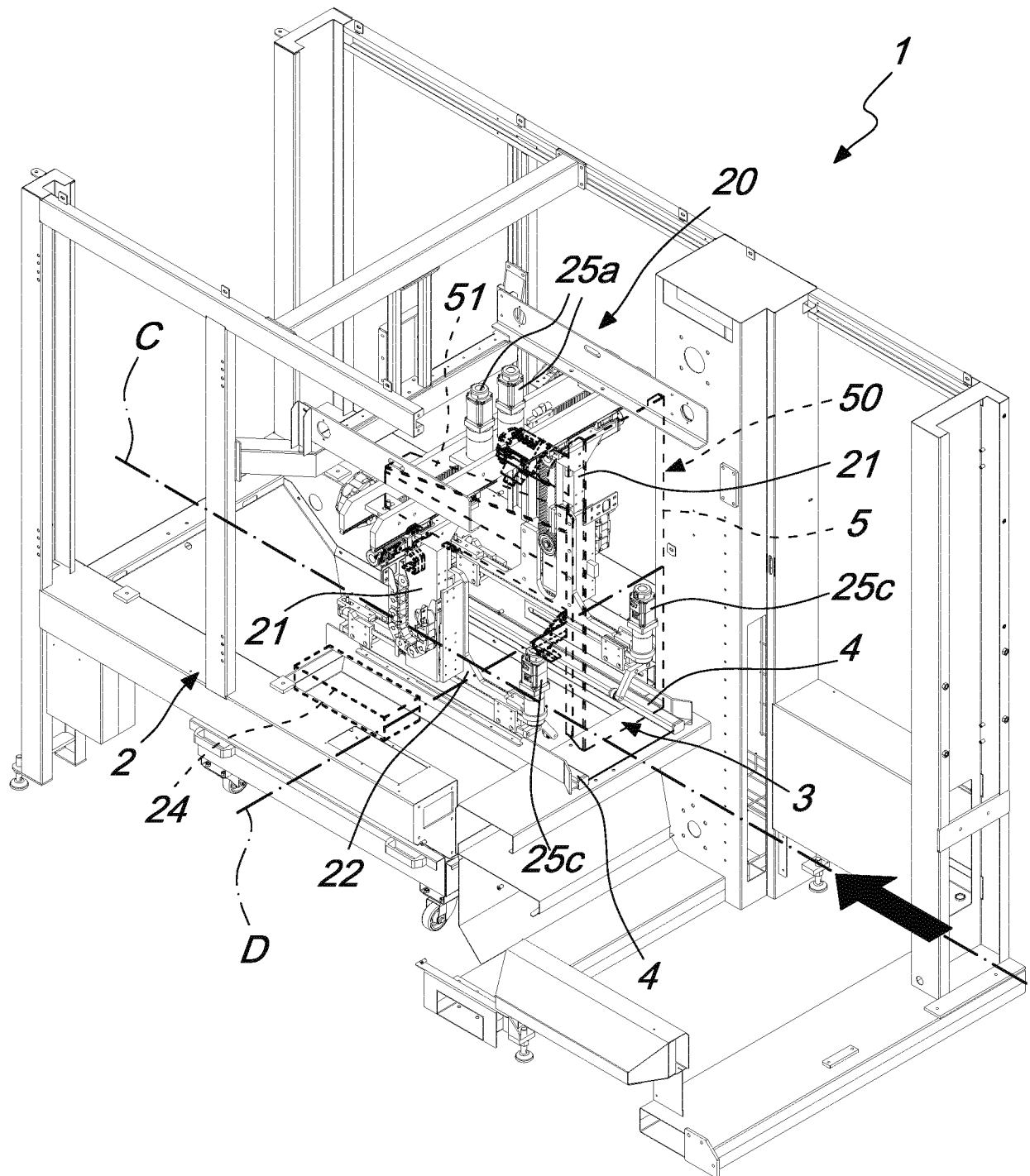


Fig. 1

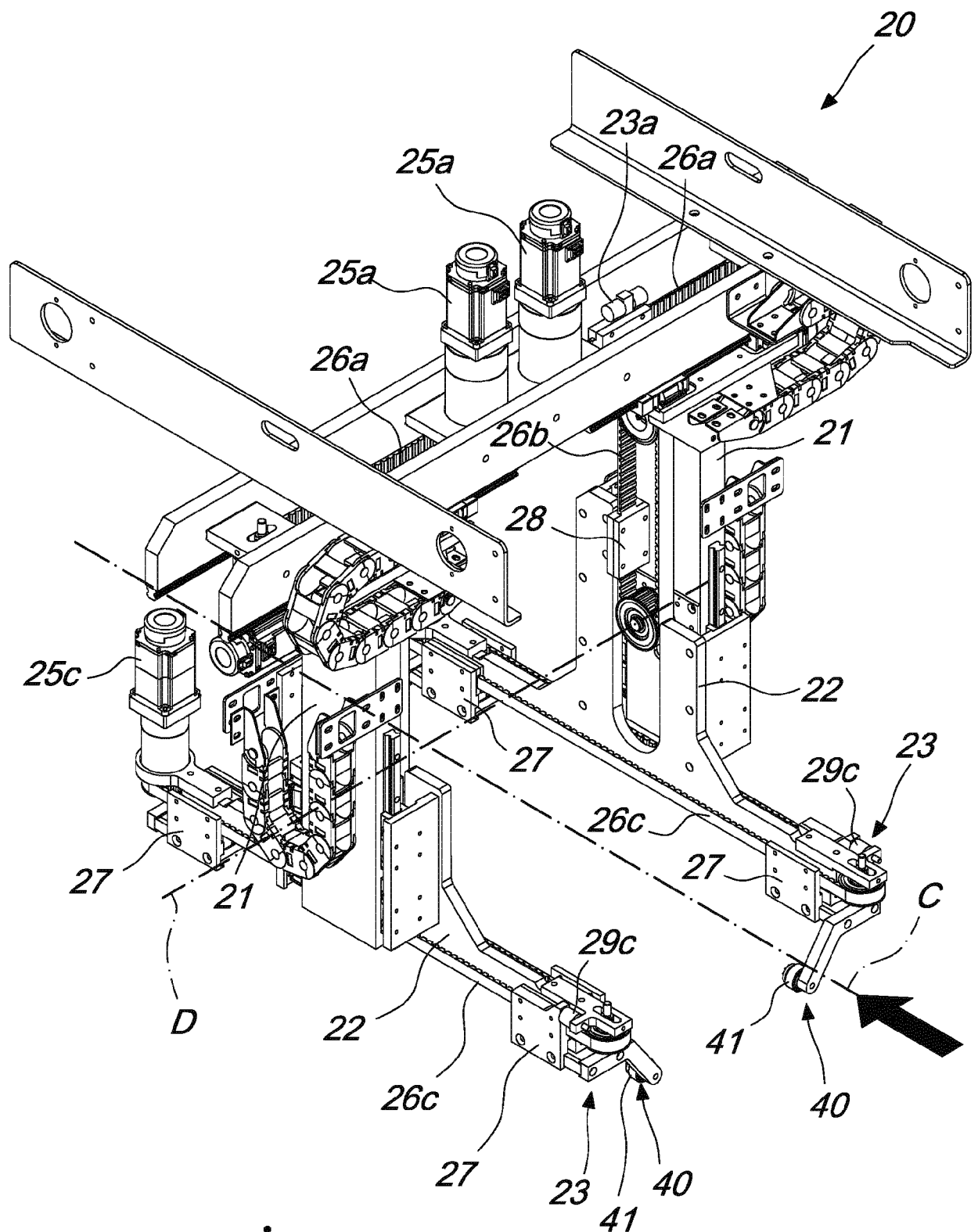
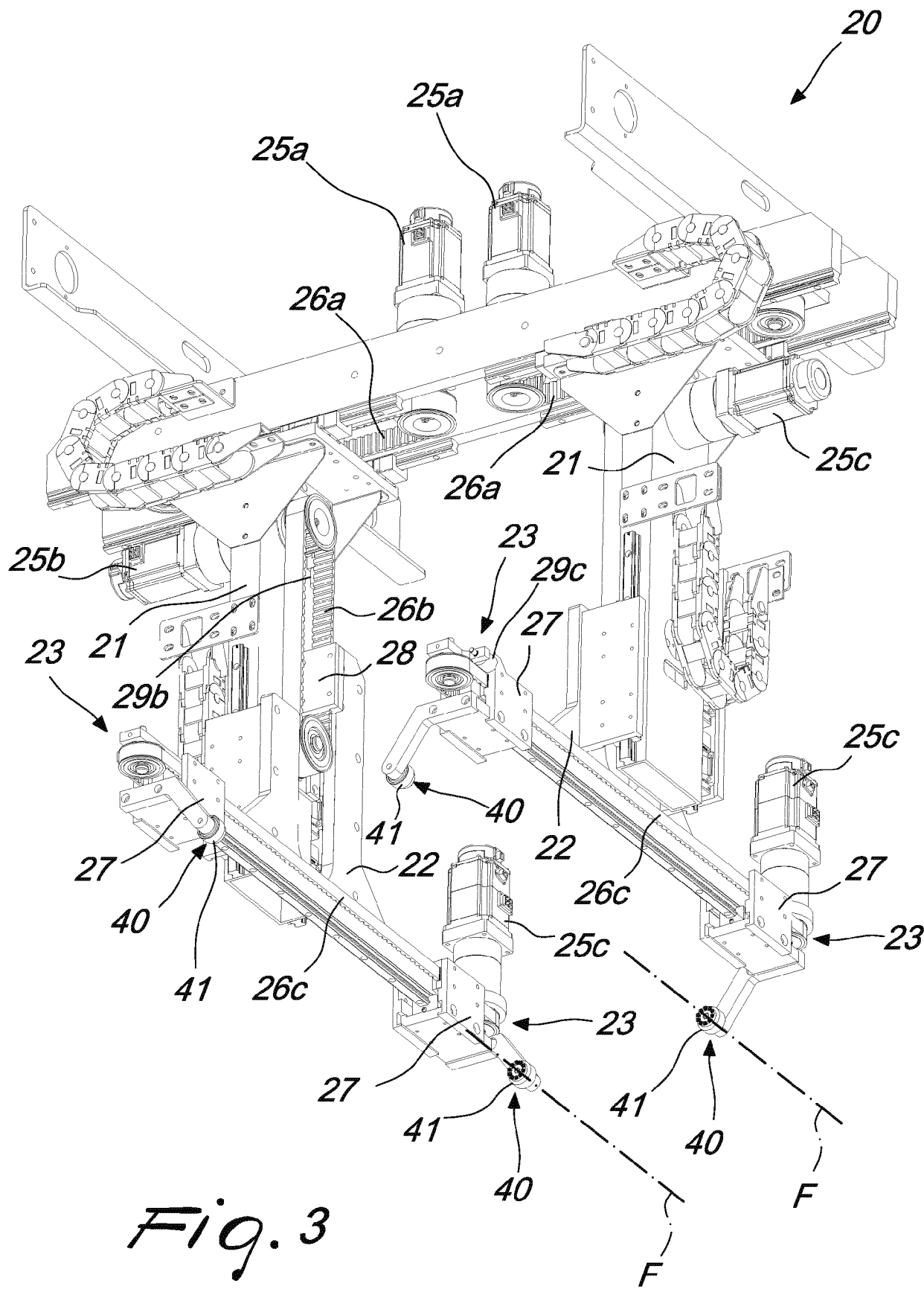


Fig. 2



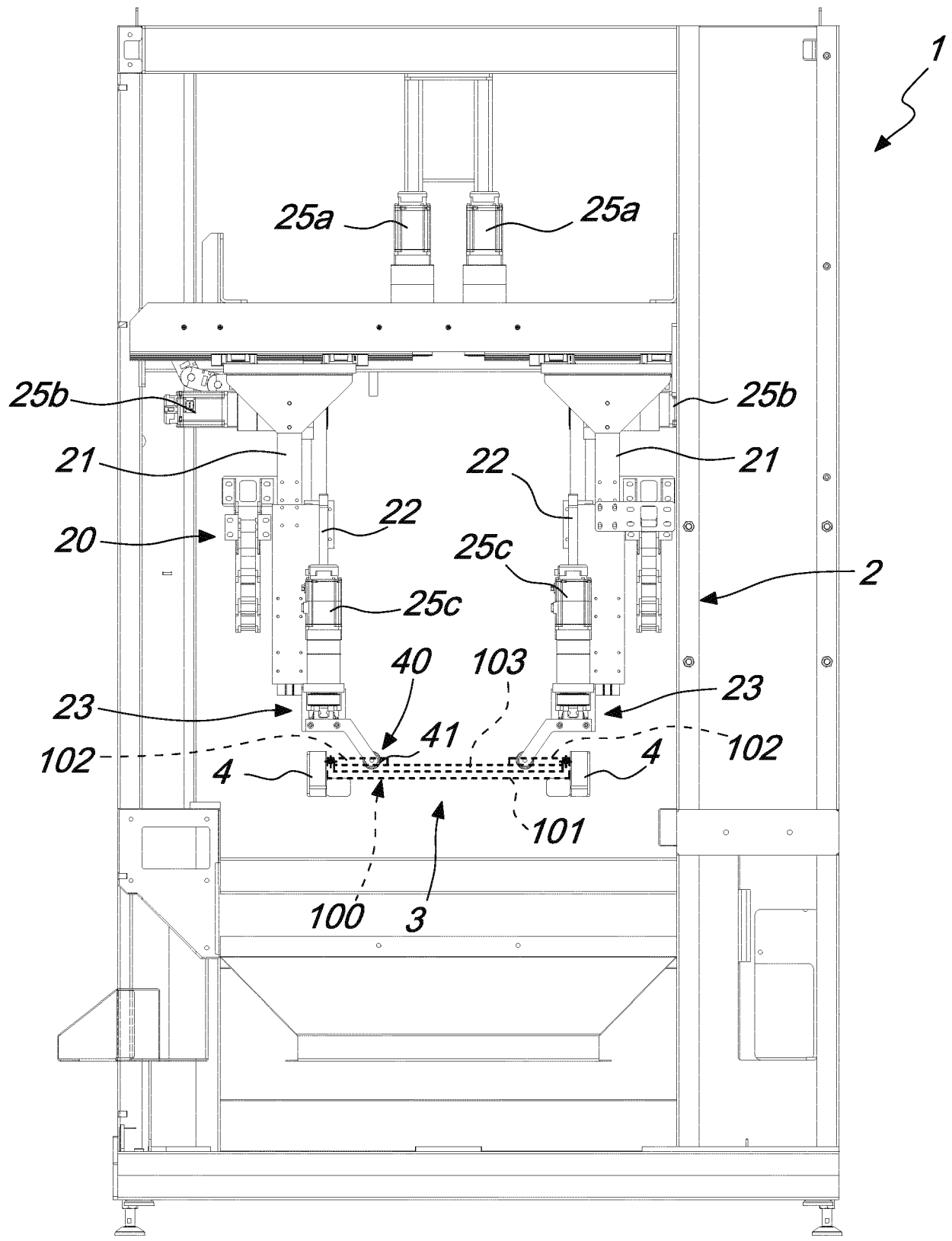
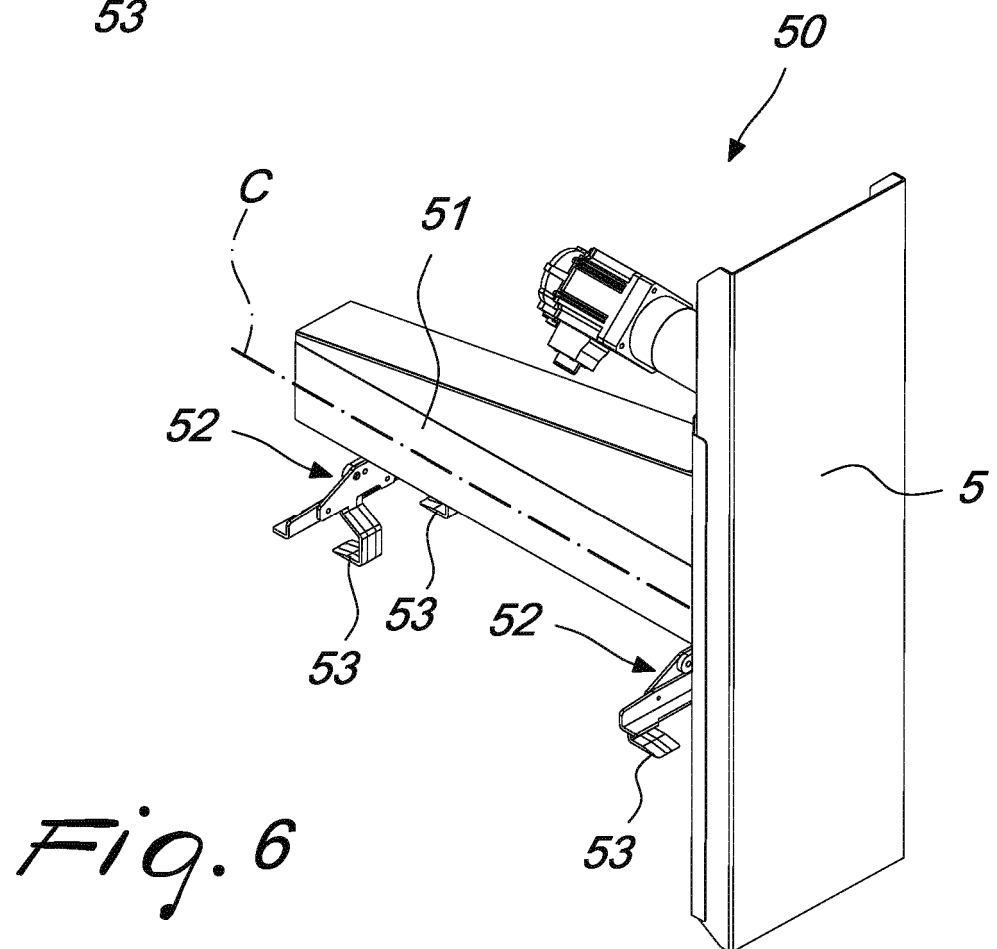
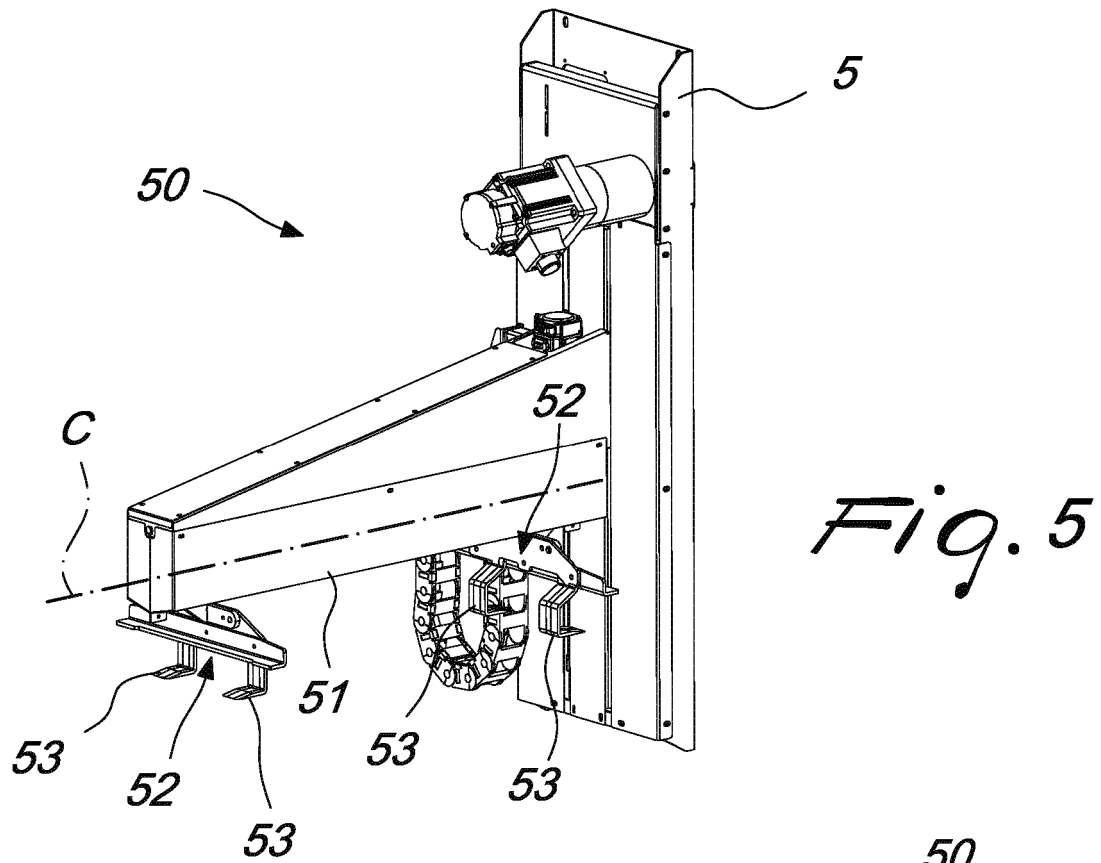
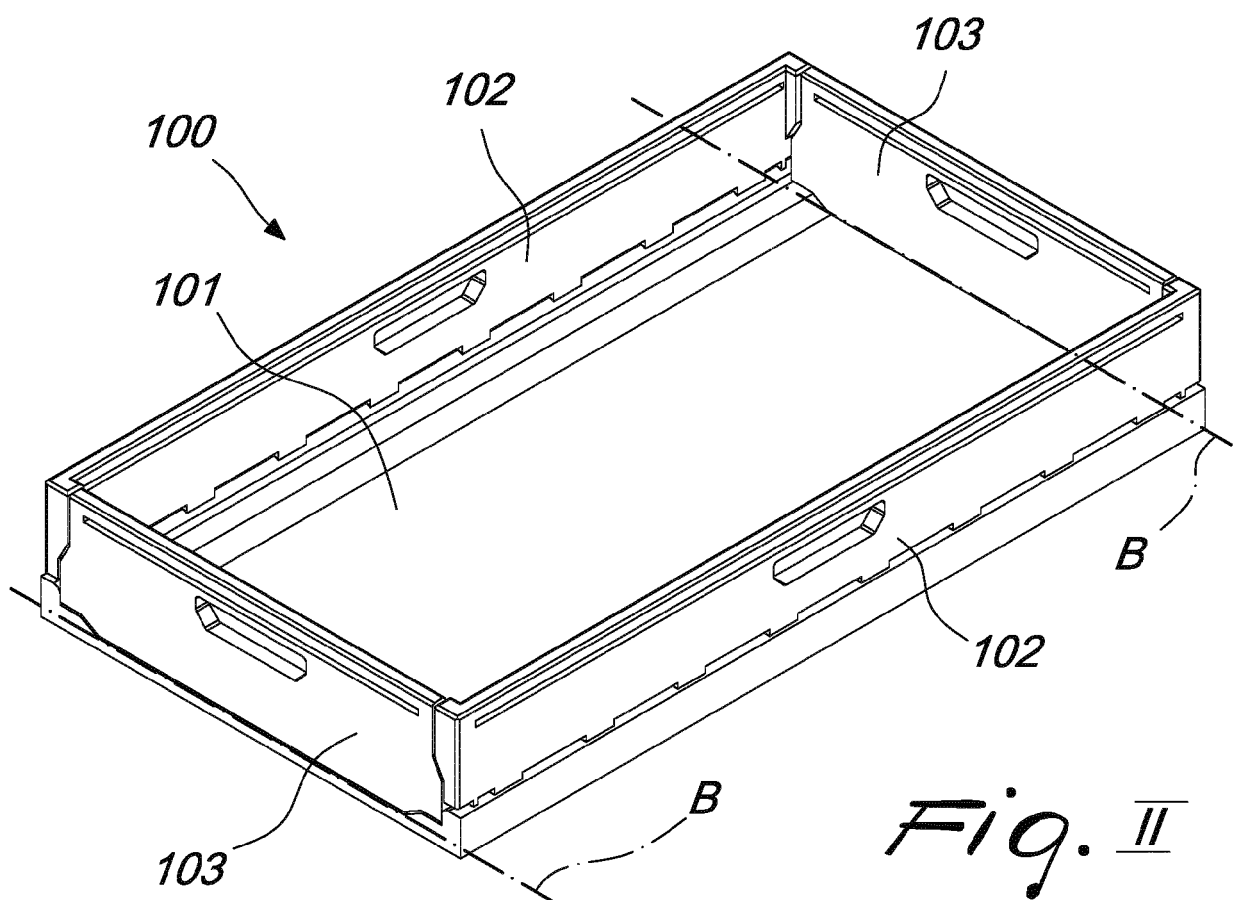
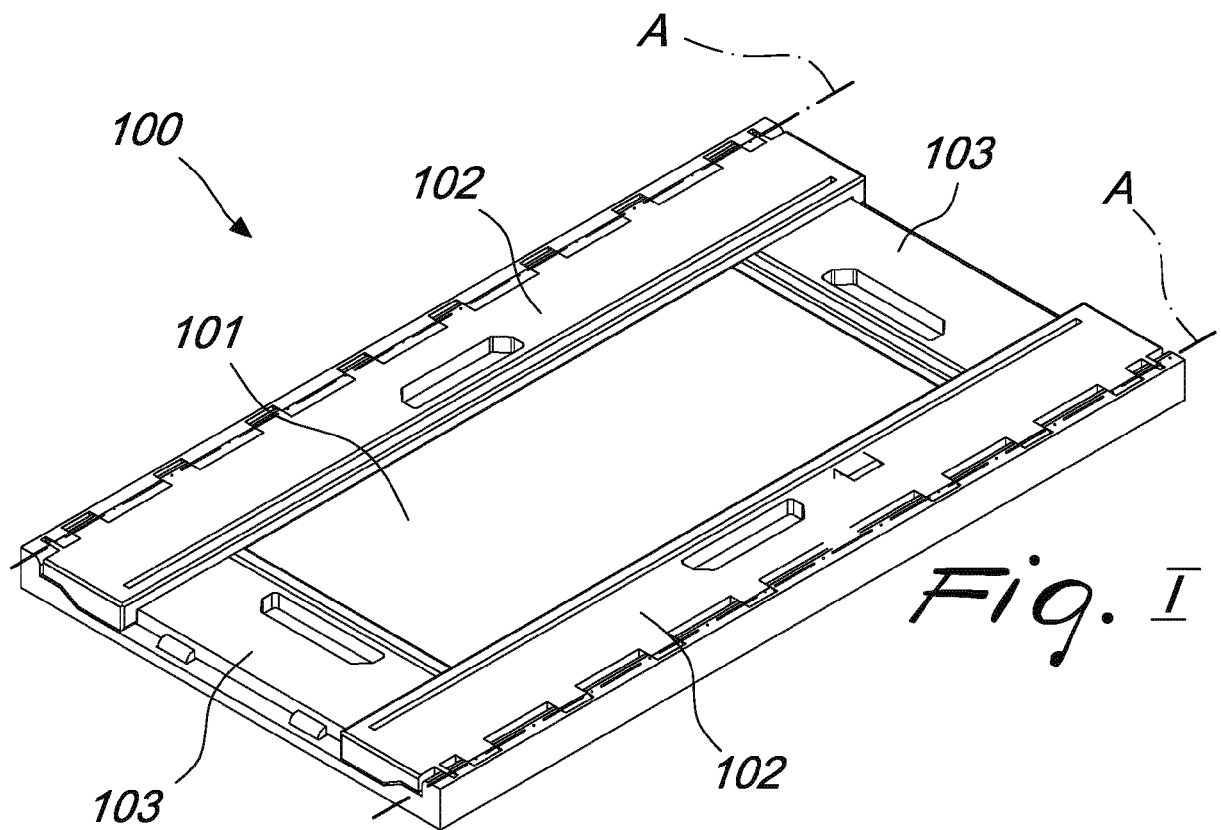


Fig. 4







EUROPEAN SEARCH REPORT

Application Number

EP 24 17 7866

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	EP 2 181 841 B1 (TANZER PETER MASCHB [IT]) 11 May 2011 (2011-05-11) * abstract * * figures 1, 4-7 *	1-4	INV. B65B43/26 B65B43/30 B65B43/34
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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		29 November 2024	Damiani, Alberto
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For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

REFERENCES CITED IN THE DESCRIPTION

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