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(54) **PACKAGING MACHINE**

(57) Packaging machine (1) comprising: a ground-resting and self-supporting framework (2); a linear conveyor (3) which is located on the self-supporting framework (2) and is adapted to move forward the load (100) in a substantially horizontal, first direction (d); at least a first pair of movable shoulders (4, 74) that are arranged one in front of the other above the linear conveyor (3), extend parallel to said first direction (d), and are horizontally movable above the linear conveyor (3) substantially perpendicular to said first direction (d); and at least a first moving device (5, 75) which is adapted to move said movable shoulders (4, 74) towards and away

from one another; at least one section-bar magazine (40) which is adapted to contain a plurality of rectilinear section-bars (104), each of which is structured so as to cover and protect a vertical edge of the item to be packaged (101); and an insertion assembly (41) which is movable over the linear conveyor (3) and is adapted to pick up at least one rectilinear section-bar (104) from the section-bar magazine (40) and then to arrange/place said rectilinear section-bar (104) in abutment against at least one of the vertical edges of the item to be packaged (101) stationary between said movable shoulders (4, 74).

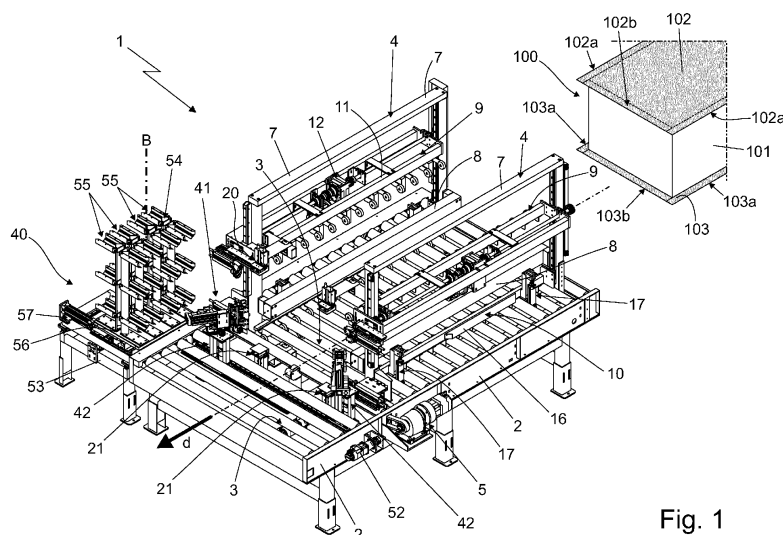


Fig. 1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This patent application claims priority from Italian patent application no. 102017000143644 filed on 13/12/2017.

TECHNICAL FIELD

[0002] The present invention relates to a packaging machine.

[0003] More in detail, the present invention relates to a packaging machine capable of folding, in a completely automatic manner, the large rectangular sheets of honeycomb cardboard that are arranged to cover the base and the top of a stack of substantially parallelepiped-shaped wooden panels. Use to which the following section will make explicit reference without however losing in generality.

BACKGROUND ART

[0004] As is known, packaging machines used to package a succession of stacks of large wooden panels presently comprise: a linear roller conveyor, which is capable of moving forward, in a given horizontal direction, the load to be palletized formed by the stack or pack of wooden panels and by two large, substantially rectangular-shaped, honeycomb cardboard sheets which are arranged to cover the base and the top of the pack of panels and furthermore cantileverly jut out over the four vertical sides of the pack of panels; two movable shoulders that are arranged one in front of the other immediately above the linear conveyor, extend parallel to the load advancing direction and are capable of moving on the linear conveyor perpendicular to the load advancing direction; and an electrically-operated moving device which, on command, is capable of moving the two movable shoulders on the linear conveyor one towards the other, orthogonally to the load advancing direction, to put the two movable shoulders in abutment against the two lateral sides of pack of panels.

[0005] Each movable shoulder of the machine, in turn, is provided with a first folding assembly, which is arranged at the height of the upper cardboard sheet and is capable of L-folding the facing lateral protruding flap of the upper cardboard sheet downwardly and against the lateral sidewall of the pack of panels; and with a second folding assembly, which is arranged at the height of the lower cardboard sheet and is capable of L-folding the facing lateral protruding flap of the lower cardboard sheet upwardly and against the lateral sidewall of the pack of panels.

[0006] In the most sophisticated packaging machines, each movable shoulder of the machine is moreover provided with a third folding assembly, which is arranged near the protruding flap of the upper cardboard sheet that

juts out from the front or the rear sidewall of the pack of panels and is capable of L-folding said protruding flap downwardly and against the front or the rear sidewall of the pack of panels; and with a fourth folding assembly, which is arranged near the protruding flap of the lower cardboard sheet that juts out from the front or the rear sidewall of the pack of panels, and is capable of L-folding said protruding flap upwardly and against the front or the rear sidewall of the pack of panels.

[0007] While operating very well, the packaging machines currently on the market are not able to automatically put protections on the vertical edges of the pack of wooden panels, with all the problems that this entails. In fact, the staff in charge of placing the honeycomb cardboard protections on the vertical edges of the pack of panels very often cannot work at a speed compatible with the one of the palletizing line.

DISCLOSURE OF INVENTION

[0008] Aim of the present invention is to improve operation of the packaging machines currently on the market so as to minimize the presence of staff and to increase the hourly productivity of the entire palletizing line.

[0009] In compliance with these aims, according to the present invention there is provided a packaging machine as defined in Claim 1 and preferably, though not necessarily, in any one of the dependent claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] The present invention will now be described with reference to the appended drawings showing an example of a non-limiting embodiment, in which:

- Figure 1 is an axonometric view of a packaging machine made according to the teachings of the present invention, with parts removed for clarity's sake;
- Figure 2 is a front view of the end part of the packaging machine shown in Figure 1, with parts removed for clarity's sake;
- Figure 3 is an enlarged view of the end part of the packaging machine shown in Figure 1, with parts removed for clarity's sake;
- Figure 4 is an axonometric view of a movable shoulder of the packaging machine shown in Figure 1, with parts removed for clarity's sake;
- Figure 5 is an axonometric view of the end part of the packaging machine shown in Figure 2, with parts removed for clarity's sake and with the corner-holding members in the picking position;
- Figure 6 is an axonometric view of the end part of the packaging machine shown in Figure 2, with parts removed for clarity's sake and with the corner-holding members in the release position; whereas
- Figure 7 is an axonometric view of a second embodiment of the packaging machine shown in Figure 1, with parts removed for clarity's sake.

BEST MODE FOR CARRYING OUT THE INVENTION

[0011] With reference to Figure 1, number 1 denotes as a whole a packaging machine particularly suitable for folding, in automatic manner, at least one of the flat sheets of honeycomb cardboard or any other similar semi-rigid protective material, belonging to a load to be palletized that preferably comprises: a substantially parallelepiped-shaped item and one or more flat sheets of honeycomb cardboard or any other similar protective material, which are arranged to cover the base and/or the top of said item and furthermore jut out from the four vertical sidewalls or faces of the same item.

[0012] More in detail, the packaging machine 1 is particularly suitable for packaging, in succession, large stacks or packs of panels made of wood or other material, so as to form large, easily transportable blocks substantially parallelepiped in shape, traditionally called pallets or palletized loads.

[0013] In the example shown, in particular, each palletized load preferably comprises: a pack of panels 101 made of wood or other material, which is preferably substantially parallelepiped in shape; two large rectangular trays made of honeycomb cardboard or any other semi-rigid protective material, which respectively cover the base and the top of the pack of panels 101 and are obtained by suitably folding respective, preferably substantially rectangular-shaped, flat sheets 102 and 103 made of honeycomb cardboard or any other similar protective material; and four rectilinear section-bars 104 made of honeycomb cardboard or any other similar protective material, which are structured so as to cover and protect the vertical edges of the pack of panels 101 and are arranged to cover the four vertical edges of the pack of panels 101.

[0014] More in detail, each rectilinear section-bar 104 preferably has an L-shaped cross-section and a length preferably slightly smaller (generally 1-2 cm less) than the height of the stack or pack of panels 101.

[0015] Obviously, the stack or pack of panels 101 can be replaced by any other substantially parallelepiped-shaped item having large dimensions.

[0016] With reference to Figures 1, 2 and 3, the packaging machine 1 firstly comprises: a rigid self-supporting framework 2, which is preferably made of metal beams and is adapted to firmly rest on and optionally be also anchored to the ground; and a linear conveyor 3, which is arranged on the upper part of the self-supporting framework 2 and is adapted to move forward, in a substantially horizontal direction d, a load to be palletized 100 which is preferably arranged roughly astride of the midplane M of linear conveyor 3.

[0017] Preferably, the load to be palletized 100 moreover comprises the pack of panels 101 and the two large flat sheets 102 and 103 made of honeycomb cardboard or any other protective material, which are substantially rectangular in shape, cover the base and the top of the pack of panels 101 and finally cantileverly jut out from the four vertical sidewalls of the pack of panels 101.

[0018] In the example shown, in particular, the linear conveyor 3 is preferably an electrically-operated motorized roller conveyor of known type, but it could also be a succession of belt conveyors.

[0019] The packaging machine 1 moreover comprises: a pair of movable shoulders 4 that are arranged one in front of the other immediately above the feeding plane of linear conveyor 3, preferably in a substantially specular position on opposite sides of the midplane M of the conveyor, extend parallel to the advancing direction d of the load to be palletized 100 and are fixed to the self-supporting framework 2 so as to be able to move horizontally, over the linear conveyor 3, substantially perpendicularly to the advancing direction d of the load to be palletized 100; and a preferably electrically-operated, moving device 5 which is adapted to move the two movable shoulders 4 towards and away from one another, orthogonally to the direction d.

[0020] More in detail, the moving device 5 is selectively adapted to arrange the two movable shoulders 4 in abutment against the two opposite sidewalls of the pack of panels 101 that is temporarily stationary between the two movable shoulders 4, preferably so as to centre the load to be palletized 100 on the midplane M of linear conveyor 3.

[0021] Preferably, the moving device 5 is additionally capable of moving/displacing the two movable shoulders 4 in a synchronized manner, so as to be able to arrange the two movable shoulders 4 substantially concurrently in abutment against the two opposite sidewalls of the pack of panels 101 that is temporarily stationary between the two movable shoulders 4.

[0022] With reference to Figures 1, 2 and 4, preferably each movable shoulder 4 in turn comprises: a rigid frame 7 with a substantially gantry-like structure, which is fixed directly to the self-supporting framework 2, preferably beneath the linear conveyor 3, with the capability of freely moving in a direction horizontal and perpendicular to direction d, cantileverly raises upwards over the linear conveyor 3 in a substantially vertical direction, and finally extends parallel to the advancing direction d of the load to be palletized 100 and to the midplane M of the conveyor; and preferably a longitudinal beam 8 which is firmly fixed to the rigid frame 7 in a substantially horizontal position and above the feeding plane of linear conveyor 3, so as to be substantially parallel to the advancing direction d of the load to be palletized 100, and is adapted to be arranged in abutment against the lateral sidewall of the pack of panels 101 temporarily stationary between the two movable shoulders 4.

[0023] Preferably, each movable shoulder 4 moreover comprises at least one folding assembly, which is fixed to the rigid frame 7 at the height of the upper flat sheet 102 or of the lower flat sheet 103, and is adapted to selectively fold the facing/fronting lateral protruding flap of the flat sheet 102, 103 against the adjacent vertical face or sidewall of the pack of panels 101.

[0024] More in detail, the folding assembly is preferably

fixed to the rigid frame 7 with the capability of autonomously moving in the vertical direction, and so as to be able, on command, to reach and L-fold downwardly or upwardly the corresponding lateral protruding flap of the flat sheet 102 or 103.

[0025] In the example shown, in particular, each movable shoulder 4 is preferably provided with a first folding assembly 9, which is adapted to fold downwardly the protruding flap 102a of the upper flat sheet 102 that juts out cantileverly from the lateral sidewall of the pack of panels 101 directly fronting/facing the movable shoulder 4; and/or with a second folding assembly 10, which is adapted to fold upwardly the protruding flap 103a of the lower flat sheet 103 that juts out cantileverly from the lateral sidewall of the pack of panels 101 directly fronting/facing the movable shoulder 4.

[0026] More in detail, the folding assembly 9 is preferably fixed to the rigid frame 7 at the height of the upper flat sheet 102, so as to be facing the protruding flap 102a, and is adapted to selectively L-fold the aforementioned protruding flap 102a downwardly and against the lateral sidewall of the pack of panels 101. Analogously, the folding assembly 10 is preferably fixed to the rigid frame 7 at the height of the lower flat sheet 103, so as to be facing the protruding flap 103a, and is adapted to selectively L-fold the aforementioned protruding flap 103a upwardly and against the lateral sidewall of the pack of panels 101.

[0027] The folding assembly 9 and the folding assembly 10 are therefore arranged respectively above and beneath the longitudinal beam 8.

[0028] Preferably, the folding assembly 9 and the folding assembly 10 are moreover capable of moving on the rigid frame 7 in a substantially vertical direction.

[0029] With reference to Figures 1, 2 and 4, in the example shown, in particular, the folding assembly 9 preferably comprises: a longitudinal beam 11 which extends parallel to the advancing direction d of the load to be palletized 100, i.e. substantially horizontally, and is butt fixed to the two vertical uprights of rigid frame 7 with the capability of moving in the vertical direction; an electrically-operated, moving device 12 which is preferably fixed directly to the longitudinal beam 11, and is adapted to move the longitudinal beam 11 along the vertical uprights of rigid frame 7, obviously in vertical direction; a comb-like structure that juts out cantileverly from longitudinal beam 11 towards the midplane of the conveyor M; and finally a series of vertical idle wheels 14 which lie on planes orthogonal to the conveyor midplane M, and are fixed in axially rotatable manner each to the distal end of a respective tooth/prong of the comb-like structure.

[0030] Preferably, the folding group 10, on the other hand, comprises: a longitudinal beam 16, which extends parallel to the advancing direction d of the load to be palletized 100 skimmed over the linear conveyor 3, i.e. substantially horizontally, and is butt fixed to the two vertical uprights of rigid frame 7 with the capability of moving in a vertical direction; an electrically- or pneumatically-

operated moving device 17, which is preferably interposed between the longitudinal beam 16 and the rigid frame 7, and is adapted to move the longitudinal beam 16 along the vertical uprights of rigid frame 7, obviously in vertical direction; a comb-like structure that juts out cantileverly from the longitudinal beam 16 towards the conveyor midplane M, immediately beneath the feeding plane of linear conveyor 3; and finally a series of vertical idle wheels 19, which lie on planes orthogonal to the conveyor midplane M, and are fixed in axially rotatable manner each to the distal end of a respective tooth/prong of the comb-like structure.

[0031] With reference to Figures 1, 2, 3 and 4, furthermore each movable shoulder 4 is preferably provided with a third folding assembly 20 which is adapted to fold downwardly the protruding flap 102b of the upper flat sheet 102 that cantileverly juts out over the front or the rear sidewall of the pack of panels 101; and/or with a fourth folding assembly 21 which is adapted to fold upwardly the protruding flap 103b of the lower flat sheet 103 that cantileverly juts out over the front or the rear sidewall of the pack of panels 101.

[0032] More in detail, the folding assembly 20 is preferably fixed to the rigid frame 7 so as to be arranged immediately above of the protruding flap 102b of upper flat sheet 102, and is designed to selectively L-fold the protruding flap 102b downwardly and against the front or the rear sidewall of the pack of panels 101. The folding assembly 21, in turn, is preferably fixed to the rigid frame 7 so as to be arranged directly underneath the protruding flap 103b of lower flat sheet 103, and is adapted to selectively L-fold the protruding flap 103b upwardly and against the front or the rear sidewall of the pack of panels 101.

[0033] With particular reference to Figures 2 and 4, in the example shown, in particular, the folding assembly 20 is preferably rigidly fixed to an end of the longitudinal beam 11 by means of a support bracket 22 that cantileverly protrudes from the longitudinal beam 11 towards the conveyor midplane M, and is structured so as to keep the folding assembly 20 stationary above the protruding flap 102b of the upper flat sheet 102. Preferably, the folding assembly 20 furthermore comprises: a double-acting piston 23 or similar linear actuator, which is fixed to the support bracket 22 in a vertical position, with the movable rod facing downwardly; and a folding head 24 which is fixed to the distal end of the movable rod and is shaped so as to L-fold downwardly the protruding flap 102b of upper flat sheet 102 when the piston 23 lowers the folding head 24 and brings it beneath the lying plane of the upper flat sheet 102.

[0034] Preferably, on the other hand, the folding assembly 21 is rigidly fixed to the lower end of one of the vertical uprights of rigid frame 7 by means of a support bracket 25 that cantileverly protrudes towards the conveyor midplane M while remaining beneath the linear conveyor 3, and is structured so as to keep the folding assembly 21 stationary underneath the protruding flap

103b of the lower flat sheet 103.

[0035] Likewise the folding assembly 20, the folding assembly 21 preferably comprises: a double-acting piston 26 or similar linear actuator, which is fixed to the support bracket 25 in a vertical position, with the movable rod facing upwards; and a folding head 27 that is fixed to the distal end of the movable rod and is shaped so as to L-fold upwardly the protruding flap 103b of lower flat sheet 103 in when the piston 26 lifts the folding head 27 and brings it above the lying plane of the lower flat sheet 103 that obviously rests on linear conveyor 3.

[0036] With particular reference to Figures 1 and 4, each protruding flap 102a, 103a of flat sheet 102, 103 is preferably provided with two foldable end fins, each of which can be L-folded against the front or the rear sidewall of the pack of panels 101, preferably also arranging itself beneath the adjacent protruding flap 102b, 103b of the flat sheet 102, 103.

[0037] In other words, each end fin of the protruding flap 102a, 103a is preferably L-folded against the front or the rear sidewall of the pack of panels 101, before the adjacent protruding flap 102b, 103b.

[0038] Moreover, each movable shoulder 4 is preferably additionally provided with a fifth folding assembly 28 which is adapted to L-fold, the front or the rear end fin of the fronting/facing protruding edge 102a of upper flat sheet 102 towards the front or the rear sidewall of the pack of panels 101, preferably even firmly gluing said end fin onto the adjacent protruding flap 102b of the same flat sheet; and/or with a sixth folding assembly 29 which is adapted to L-fold the front or the rear end fin of the fronting/facing protruding flap 103a of the lower flat sheet 103 towards the front or the rear sidewall of the pack of panels 101, preferably even firmly gluing said end fin on the adjacent protruding flap 103b of the same flat sheet.

[0039] In more detail, the folding assembly 28 is preferably rigidly fixed to one end of longitudinal beam 11, so as to face the front or rear end fin of the protruding flap 102a of the upper flat sheet 102.

[0040] Preferably, the folding assembly 28 moreover comprises: a double-acting piston 30 or similar linear actuator, which is fixed to the longitudinal beam 11 in a position both horizontal and perpendicular to the conveyor midplane M, with the movable rod facing the end fin of the protruding flap 102a; and a folding head 31, which is fixed to the distal end of the movable rod and is shaped so as to be able to L-fold the end fin of the protruding flap 102a against the front or the rear sidewall of the pack of panels 101, preferably above the end of the adjacent protruding edge 102b of the flat sheet 102, when the piston 30 pushes the folding head 31 in abutment against the facing vertex of the pack of panels 101.

[0041] Preferably, the folding assembly 28 furthermore comprises a glue-applicator device 32 which is arranged beside the piston 30 and is provided with a glue-spraying head 33 that is movable substantially horizontally to and from the load to be palletized 100, and is adapted to spray a given amount of glue on the portion of the protruding

flap 102b that will overlap the front or the rear end fin of the protruding flap 102a, and/or on the face of the front or the rear end fin that will be covered by the protruding flap 102b of the upper flat sheet 102.

[0042] The folding assembly 29, on the other hand, is preferably rigidly fixed to a vertical upright of rigid frame 7, immediately above the feeding plane of linear conveyor 3, so as to face the front or the rear end fin of the protruding flap 103a of the lower flat sheet 103.

[0043] Preferably, the folding assembly 29 furthermore comprises: a double-acting piston 34 or similar linear actuator, which is fixed to the vertical upright of rigid frame 7 in a position both horizontal and perpendicular to the conveyor midplane M, with the movable rod facing the end fin of the protruding flap 103a; and a folding head 35 which is fixed to the distal end of the movable rod, and is shaped so as to be able to L-fold the end fin of the protruding flap 103a against the front or the rear sidewall of the pack of panels 101, preferably above the end of the adjacent protruding flap 103b of the flat sheet 103, when the piston 34 pushes the folding head 35 in abutment against the facing vertex of the pack of panels 101.

[0044] Preferably, the folding assembly 29 moreover comprises a glue-applicator device 36 which is arranged beside the piston 34 and is provided with a glue-spraying head 37 that is movable horizontally to and from the load to be palletized 100, substantially skimming over the feeding plane of linear conveyor 3, and is adapted to spray a given amount of glue on the portion of the protruding flap 103b that will overlap the front or the rear end fin of the protruding flap 103a, and/or on the face of the front or the rear end fin that will be covered by the protruding flap 103b of the lower flat sheet 103.

[0045] With reference to Figures 1 to 6, the packaging machine 1 additionally comprises: a section-bar magazine 40 which is adapted to contain a plurality of rectilinear section-bars 104 preferably arranged substantially vertically, and is preferably located beside the linear conveyor 3; and an insertion assembly 41 which is movable over the linear conveyor 3 and is adapted to pick up at least one rectilinear section-bar 104 from the section-bar magazine 40, and then to place/arrange said rectilinear section-bar 104 in abutment against one of the four vertical edges of the package of panels 101 stationary between the two movable shoulders 4.

[0046] Preferably, the insertion assembly 41 is furthermore adapted to place/arrange the rectilinear section-bar 104 in abutment against one of the four vertical edges of the pack of panels 101 stationary between the two movable shoulders 4, before the corresponding protruding flaps 102a and 102b of the upper flat sheet 102 and/or the corresponding protruding flaps 103a and 103b of the lower flat sheet 103 are L-folded against the sidewalls of the pack of panels 101.

[0047] More in detail, in the example shown the insertion assembly 41 is preferably arranged at one of the two ends of the rectilinear aisle laterally delimited by the two movable shoulders 4, whereas the section-bar magazine

40 is preferably arranged beside the linear conveyor 3, aligned with the same end of the rectilinear aisle, so as to be directly aligned/facing the insertion assembly 41.

[0048] Preferably, the insertion assembly 41 is additionally structured so as to be able to pick up, more or less at the same time, a pair of rectilinear section-bars 104 from the section-bar magazine 40, and then to arrange the same rectilinear section-bars 104, more or less at the same time, in abutment against the two vertical edges of the front or the rear sidewall of the pack of panels 101 stationary between the two movable shoulders 4.

[0049] With reference to Figures 3, 5 and 6, in particular the insertion assembly 41 preferably comprises: two movable gripping units 42 which are provided with respective gripping members adapted to grip and stably hold a rectilinear section-bar 104, and are fixed side by side to one another on the self-supporting framework 2 with the capability of moving horizontally with respect to the linear conveyor 3, while keeping the respective gripping members above the linear conveyor 3; and a preferably electrically-operated, moving device 43 which is adapted to move the two gripping units 42 on the self-supporting framework 2, preferably separately and independently from one another, so as to be able to arrange the two mobile gripping units 42 alternatively in a first operating position (see Figure 5) in which the two gripping units 42 are adjacent to the section-bar magazine 40, and in a second operating position (see Figures 2 and 6) in which each of the two gripping units 42 face each a respective vertical edge of the pack of panels 101 stationary between the two movable shoulders 4.

[0050] More in detail, each movable gripping unit 42 is preferably fixed to the self-supporting framework 2 with the capability of moving backwards and forwards in a straight line, in a direction substantially perpendicular to the advancing direction d of the load to be palletized 100; and is preferably provided with a gripping head which, in turn, is movable horizontally autonomously and is adapted to selectively grasp and firmly hold a rectilinear section-bar 104, preferably while arranging and/or permanently keeping the same rectilinear section-bar 104 in a substantially vertical position.

[0051] With particular reference to Figures 5 and 6, in the example shown each movable gripping unit 42 is preferably fixed in sliding manner on a transversal rectilinear beam 44 of self-supporting framework 2 that preferably extends horizontally and perpendicularly to the load advancing direction d (i.e. is orthogonal to the conveyor midplane M), beneath the linear conveyor 3, and preferably has a substantially tubular structure.

[0052] The self-supporting framework 2, therefore, is preferably provided with two parallel and side-by-side rectilinear beams 44 that extend beneath the linear conveyor 3 orthogonally to the conveyor midplane M.

[0053] Preferably, each movable gripping unit 42 furthermore comprises: a supporting column or turret 45 which is fixed in sliding manner on the rectilinear beam 44 of the self-supporting framework 2 with the capability

of freely moving parallel to the longitudinal axis of the beam, and rises upwards cantileverly above the linear conveyor 3 in a substantially vertical direction, preferably engaging the space between two adjacent rollers of the linear conveyor 3; an oblong movable arm 46 which cantileverly extends from the top of the self-supporting column 45, preferably more or less parallel to the feeding plane of the underlying linear conveyor 3, i.e. in a substantially horizontal direction; and a preferably electrically- or pneumatically-operated, gripping head 47 which is arranged on the distal end of the movable arm 46 and is adapted to selectively grip and stably hold a single rectilinear section-bar 104, preferably while arranging and/or permanently keeping the same rectilinear section-bar 104 in a substantially vertical position.

[0054] More in detail, the movable arm 46 is preferably fixed on the top of self-supporting column 45 with the capability of swinging around a substantially vertical reference axis A, and the gripping unit 42 preferably additionally comprises a preferably electrically-operated, moving device 48 which is preferably housed inside the self-supporting column 45, and is adapted to selectively rotate the movable arm 46 about the axis A so as to vary, as desired, the angular position of the movable arm 46.

[0055] Preferably, the movable arm 46 furthermore has an on-command extendable/extendible structure, so as to vary the distance of the gripping head 47 from the top of the self-supporting column 45.

[0056] More in detail, with particular reference to Figure 6, in the example shown the movable arm 46 preferably includes an electronically-controlled electric cylinder or any other, preferably electrically-operated, linear actuator which is fixed to the top of the self-supporting column 45 substantially horizontally and with the capability of rotating/swinging around an axis A substantially perpendicular to its longitudinal axis.

[0057] Preferably, on the other hand, the gripping head 47 is fixed to the distal end of the movable rod of the electric cylinder, so as to be movable between a retracted position (see Figures 1, 2, 3 and 5) in which the gripping head 47 is at the minimum distance from the swinging axis A, and an extracted position (see Figure 6) in which the gripping head 47 is at the maximum distance from the swinging axis A.

[0058] Obviously, when in the extracted position (see Figure 6), the gripping head 47 is able to reach and abut against the facing vertical edge of the pack of panels 101 stationary between the two movable shoulders 4.

[0059] With reference to Figures 5 and 6, the moving device 43, in turn, is preferably divided into two independent motorized modules, each of which is designed to move a respective gripping unit 42 along the corresponding transversal rectilinear beam 44 of the self-supporting framework 2.

[0060] Each additional motorized module preferably comprises: a toothed belt 50, which is wound in a loop around two return pulleys 51 fixed in axially rotatable manner on the transversal beam 44, preferably roughly

at the two ends of the transversal beam 44; and an electric motor 52 which is preferably cantileverly fixed onto the transversal beam 44, and is mechanically connected to one of the two return pulleys 51 so as to drive it into rotation in both directions.

[0061] Each gripping unit 42 is preferably rigidly fixed to one of the two rectilinear branches of the corresponding toothed belt 50 by means of a clamp arranged at the base of the self-supporting column 45.

[0062] According to an alternative embodiment, the toothed belt 50 could be replaced by a recirculating ball screw extending parallel to the longitudinal axis of transversal beam 44, preferably substantially along the entire length of the transversal beam 44.

[0063] With reference to Figures 1, 2, 3 and 5, finally the section-bar magazine 40 preferably comprises: a second rigid self-supporting framework 53, preferably discrete and separated from the self-supporting framework 2, which is preferably made of metal beams and is adapted to stably rest on and optionally also be anchored to the ground; and at least a rack 54 which is fixed/arranged on the self-supporting framework 53 immediately above the feeding plane of linear conveyor 3, and is preferably provided with at least two section-bar lodgings 55 that are arranged side by side to one another, directly facing the linear conveyor 3 so that each of them is easily reachable and accessible by a respective movable gripping unit 42. Each section-bar lodgings 55 is structured so as to house/accommodate a single pack 105 of rectilinear section-bars 104, preferably arranged in a substantially vertical position.

[0064] More in detail, in the example shown, the rack 54 is preferably fixed/arranged above a support platform 56 that, in turn, is preferably fixed on the top of the self-supporting framework 53 with the capability of rotating around a substantially vertical reference axis B and/or with the capability of moving horizontally on the self-supporting framework 53 in a direction parallel to the advancing direction d of the load to be palletized 100 and/or in a direction orthogonal to the advancing direction d of the load to be palletized 100.

[0065] Moreover, the rack 54 is preferably provided with a plurality of pairs of adjacent section-bar lodgings 55 that are preferably aligned in rows arranged on the opposite sides of rotation axis B, facing/turned towards opposite sides of the support platform 56, so as to be alternatively faced/faceable to the linear conveyor 3.

[0066] Preferably, the section-bar magazine 40 furthermore comprises a preferably electrically- or pneumatically-operated, moving device 57 which is adapted to selectively rotate the support platform 56 about axis B and/or to move horizontally the support platform 56 on the self-supporting framework 53 in a direction parallel to the advancing direction d of the load to be palletized 100 and/or in a direction orthogonal to the advancing direction d of the load to be palletized 100. The moving device 57 is therefore able to arrange, on command, any pair of adjacent section-bar lodgings 55 in front of the

linear conveyor 3, in a position such as to be easily reachable and accessible by the two movable gripping units 42 that are stationary in the first operating position (see Figure 5).

[0067] Finally, the packaging machine 1 is provided with an electronic control unit (not shown) adapted to drive the various devices.

[0068] Operation of packaging machine 1 will be described below while assuming, for simplicity's sake, that the packaging machine 1 has to fold only the front protruding flap 102b, 103b and the two lateral protruding flaps 102a, 103a of the flat sheets 102 and 103, while arranging at the same time two rectilinear section-bars 104 at cover of the two vertical edges that delimit the front face or sidewall of the pack of panels 101.

[0069] In other words, the linear conveyor 3 moves forward the load to be palletized 100 in direction d until the load to be palletized 100 is arranged between the two movable shoulders 4, preferably with the front face/sidewall of the pack of panels 101 substantially aligned to the vertical upright of rigid frame 7 that supports the folding assemblies 20, 21, 28 and 29.

[0070] Subsequently, the two movable shoulders 4 close on the load to be palletized 100, centring the pack of panels 102 and the cardboard sheets 102 and 103 on the midplane M of linear conveyor 3.

[0071] When the load to be palletized 100 is blocked by the two movable shoulders 4, the insertion assembly 41 picks up two rectilinear section-bars 104 from the section-bar magazine 40 and arranges them in abutment against the two vertical edges of the pack of panels 101 delimiting the front face or sidewall of the same pack.

[0072] Finally, the folding assemblies 20, 21, 28 and 29 fold both the two lateral protruding flaps 102a, 103a and the front protruding flap 102b, 103b of the flat sheets 102 and 103, so as to form the front portion of the two large rectangular trays made of honeycomb cardboard or any other semi-rigid protective material.

[0073] The advantages connected to the presence of the insertion assembly 41 are remarkable.

[0074] Since it does not require the active and constant presence of several operators, the packaging machine 1 has a much higher hourly productivity than the other packaging machines currently on the market.

[0075] Moreover, the particular structure of the rack 54 allows the section-bar magazine 40 to simultaneously accommodate a series of packs 105 of rectilinear section-bars 104 of different length, thus allowing the packaging machine 1 to rapidly adapt to differently sized loads to be palletized 100.

[0076] Finally, it is clear that modifications and variations can be made to the packaging machine 1 described above without however departing from the scope of the present invention.

[0077] For example, the insertion assembly 41 may optionally be provided with a single movable gripping unit 42 which is moved on the linear conveyor 3 so as to be able to arrange the rectilinear section-bars 104 in rapid

succession on the vertical edges of the pack of panels 101, preferably by picking them up from the section-bar magazine 40 one at a time.

[0078] Moreover, the packaging machine 1 can be provided with two separate section-bar magazines 40 that are arranged on opposite sides of the linear conveyor 3, both facing/ aligned with the insertion assembly 41. In this case, each of the two movable gripping units 42 of insertion assembly 41 picks up the rectilinear section-bars 104 inside a respective section-bar magazine 40.

[0079] With reference to Figure 7, in a more sophisticated embodiment, furthermore, the insertion assembly 41 is preferably arranged immediately downstream of the two movable shoulders 4, in the advancing direction d of the load to be palletized 100, and the packaging machine 1 additionally comprises: a second pair of movable shoulders 74, which is arranged on the linear conveyor 3 downstream of the insertion assembly 41 in the advancing direction d of the load to be palletized 100; and a preferably electrically-operated, second moving device 75 which is adapted to move the two movable shoulders 74 towards and away from one another, orthogonally to the direction d, so as to selectively arrange the two movable shoulders 74 in abutment against the two opposing sidewalls of the pack of panels 101 temporarily stationary between the two movable shoulders 74.

[0080] In other words, likewise the two movable shoulders 4, also the two movable shoulders 74 are arranged one opposite the other immediately above the feeding plane of the linear conveyor 3, preferably in a substantially specular position on opposite sides of the conveyor midplane M, extend parallel to the advancing direction d of the load to be palletized 100, and are fixed to the self-supporting framework 2 so as to be able to move horizontally over the linear conveyor 3, substantially perpendicularly to the advancing direction d of the load to be palletized 100.

[0081] In this embodiment, each movable shoulder 4 preferably includes: a folding assembly 9 adapted to fold downwardly the facing lateral protruding flap 102a of the upper flat sheet 102; a folding assembly 10 adapted to fold upwardly the facing lateral protruding flap 103a of the lower flat sheet 103; a folding assembly 20 adapted to fold downwardly the front protruding flap 102b of the upper flat sheet 102; and a folding assembly 21 adapted to fold upwardly the front protruding flap 103b of the lower flat sheet 103.

[0082] Optionally, each movable shoulder 4 also includes a folding assembly 28 adapted to L-fold, over the front sidewall of the pack of panels 101, the front end fin of the fronting/facing lateral protruding flap 102a of the upper flat sheet 102; and a folding assembly 29 adapted to L-fold, over the front sidewall of the pack of panels 101, the front end fin of the fronting/facing lateral protruding flap 103a of the lower flat sheet 103.

[0083] Each movable shoulder 74 has a structure substantially specular to that of the adjacent movable shoulder 4, and preferably includes: a folding assembly 9

adapted to fold downwardly the facing lateral protruding flap 102a of the upper flat sheet 102; a folding assembly 10 adapted to fold upwardly the facing lateral protruding flap 103a of the lower flat sheet 103; a folding assembly 20 adapted to fold downwardly the rear protruding flap 102b of the upper flat sheet 102; and a folding assembly 21 adapted to fold upwardly the rear protruding flap 103b of the lower flat sheet 103.

[0084] Optionally, each movable shoulder 74 additionally includes a folding assembly 28 adapted to L-fold, over the rear sidewall of the pack of panels 101, the rear end fin of the front/facing lateral protruding flap 102a of the upper flat sheet 102; and a folding assembly 29 adapted to L-fold, over the rear sidewall of the pack of panels 101, the rear end fin of the front/facing lateral protruding flap 103a of the lower flat sheet 103.

[0085] Preferably, the insertion assembly 41 is finally provided with four distinct movable gripping units 42 that are fixed to the self-supporting framework 2 side-by-side to one another, with the ability of moving horizontally on the linear conveyor 3 in a direction substantially perpendicular to the advancing direction d of the load to be palletized 100.

[0086] A first pair of movable gripping units 42 is adapted to pick up two rectilinear section-bars 104 from the section-bar magazine 40 and then to arrange said rectilinear section-bars 104 on the two vertical edges of the front face or sidewall of the pack of panels 101 stationary between the movable shoulders 4. A second pair of movable gripping units 42 is adapted to pick up two rectilinear section-bars 104 from the section-bar magazine 40 and then to arrange said rectilinear section-bars 104 on the two vertical edges of the rear face or sidewall of the pack of panels 101 stationary between the movable shoulders 74.

[0087] Obviously, the moving device 43 is structured so as to be able to move each movable gripping unit 42 on the self-supporting framework 2, preferably separately and independently from the others, so to arrange the same mobile gripping unit 42 alternately in a first operating position in which the gripping unit 42 is adjacent to the section-bar magazine 40 and can pick up a rectilinear section-bar 104 from the section-bar magazine 40, and in a second operating position in which the gripping unit 42 is instead located in front of a corresponding vertical edge of the pack of panels 101 stationary between the two movable shoulders 4 or 74.

Claims

1. A packaging machine (1) adapted to fold at least one of the protective-material flat sheets (101, 102) of a load (100) that preferably comprises: a substantially parallelepiped-shaped, item to be packaged (101), and one or more protective-material flat sheets (101, 102) that are placed to cover the base and/or the top of said item to be packaged (101) and furthermore

cantileverly jut out from the sidewalls of said item to be packaged (101);

said packaging machine comprising: a ground-resting and self-supporting framework (2); a linear conveyor (3) which is placed on the self-supporting framework (2) and is adapted to move forward the load (100) in a substantially horizontal, first direction (d); at least a first pair of movable shoulders (4, 74) that are arranged one in front of the other above the linear conveyor (3), extend parallel to said first direction (d), and are horizontally movable above the linear conveyor (3) substantially perpendicular to said first direction (d); and at least a first moving device (5, 75) which is adapted to move said movable shoulders (4, 74) towards and away from one another; said packaging machine being **characterized by** additionally comprising: at least one section-bar magazine (40) which is adapted to contain a plurality of rectilinear section-bars (104), each of which is structured so as to cover and protect a vertical edge of the item to be packaged (101); and an insertion assembly (41) which is movable over the linear conveyor (3) and is adapted to pick up at least one rectilinear section-bar (104) from the section-bar magazine (40) and then to arrange/place said rectilinear section-bar (104) in abutment against at least one of the vertical edges of the item to be packaged (101) stationary between said movable shoulders (4, 74).

2. Packaging machine according to claim 1, **characterized in that** the insertion assembly (41) is located at one of the two ends of the aisle laterally delimited by said movable shoulders (4, 74).
3. Packaging machine according to claim 1 or 2, **characterized in that** the section-bar magazine (40) is located alongside the linear conveyor (3), aligned with/ facing the insertion assembly (41).
4. Packaging machine according to any one of the preceding claims, **characterized in that** each movable shoulder (4, 74) comprises: a rigid frame (7) with a substantially gantry-like structure, which is fixed on the self-supporting framework (2) with the capability of freely moving in a second horizontal direction perpendicular to said first direction (d), and cantileverly stands above the linear conveyor (3), substantially parallel to the midplane (M) of the linear conveyor (3); and at least one folding assembly (9, 10, 20, 21, 28, 29) which is fixed to the rigid frame (7) at the height of one of said protective-material flat sheets (102, 103) and is selectively adapted to L-fold the facing/fronting protruding flap (102a, 103a, 102b, 103b) of the flat sheet (102, 103) against the adjacent vertical sidewall of the item to be packaged (101).
5. Packaging machine according to claim 4, **characterized in that** each movable shoulder (4, 74) addi-

tionally comprises a longitudinal beam (8) which is firmly fixed to said rigid frame (7) substantially horizontally and above the linear conveyor (3) so as to be substantially parallel to said first direction (d), and is adapted to be arranged in abutment against a vertical sidewall of the item to be packaged (101) stationary between the two movable shoulders (4, 74).

6. Packaging machine according to claim 4 or 5, **characterized in that** each movable shoulder (4, 74) comprises at least a first folding assembly (9) which is adapted to fold downwardly a first protruding flap (102a) of the flat sheet (102) covering the top of the item to be packaged (101) and which cantileverly juts out over the vertical sidewall of the item to be packaged (101) immediately facing/fronting to the same movable shoulder (4, 74); and/or at least a second folding assembly (10) which is adapted to fold upwardly a first protruding flap (103a) of the flat sheet (103) covering the base of the item to be packaged (101) and which cantileverly juts out over the vertical sidewall of the item to be packaged (101) immediately fronting/facing said movable shoulder (4, 74).
7. Packaging machine according to claim 4, 5 or 6, **characterized in that** each movable shoulder (4, 74) comprises at least a third folding assembly (20) which is adapted to fold downwardly a second protruding flap (102b) of the flat sheet (102) covering the top of the item to be packaged (101) and which cantileverly juts out over the front or the rear sidewall of said item to be packaged (101); and/or a fourth folding assembly (21) which is adapted to fold upwardly a second protruding flap (103b) of the flat sheet (103) covering the base of the item to be packaged (101) and which cantileverly juts out over the front or rear sidewall of said item to be packaged (101).
8. Packaging machine according to any one of the preceding claims, **characterized in that** the insertion assembly (41) comprises: at least one movable gripping unit (42) which is provided with gripping members (47) adapted to firmly grip and stably hold a rectilinear section-bar (104), and is fixed to the self-supporting framework (2) with the capability of moving horizontally with respect to the linear conveyor (3) while keeping the gripping members (47) above the linear conveyor (3); and a second moving device (43) which is adapted to move/displace said movable gripping unit (42) onto the self-supporting framework (2) in order to arrange said movable gripping unit (42) alternatively in a first operating position in which said movable gripping unit (42) is adjacent to the section-bar magazine (40), and in a second operating position in which said movable gripping unit (42) is arranged in front of a corresponding vertical edge

of the item to be packaged (101) stationary between the movable shoulders (4, 74).

ceding claims, **characterized in that** the linear conveyor (3) is a motorized roller conveyor.

9. Packaging machine according to claim 8, **characterized in that** said at least one movable gripping unit (42) is fixed on the self-supporting framework (2) with the capability of moving backwards and forwards in a straight line, in a direction substantially perpendicular to said first direction (d), and is moreover provided with gripping members (47) that are movable horizontally in an autonomous manner and are adapted to selectively grasp and firmly hold a rectilinear section-bar (104). 5 10
10. Packaging machine according to claim 9, **characterized in that** said at least one movable gripping unit (42) is fixed in sliding manner on a transversal rectilinear beam (44) of said self-supporting framework (2) which extends underneath the linear conveyor (3) horizontally and perpendicularly to said first direction (d). 15 20
11. Packaging machine according to claim 9 or 10, **characterized in that** said at least one movable gripping unit (42) comprises: a self-supporting column (45) that rises upwards cantileverly over the linear conveyor (3); a movable arm (46) that cantileverly extends over the top of the self-supporting column (45), roughly parallel to the feeding plane of the underlying linear conveyor (3); and a gripping head (47) which is located on the distal end of the movable arm (46) and is adapted to selectively grasp and firmly hold a single rectilinear section-bar (104). 25 30
12. Packaging machine according to claim 11, **characterized in that** the movable arm (46) is fixed on the top of the self-supporting column (45) with the capability of swinging around a substantially vertical reference axis (A); and **in that** the gripping unit (42) additionally comprises a third moving device (48) which is adapted to rotate the movable arm (46) about said reference axis (A) in order to vary as desired the angular position of the movable arm (46). 35 40
13. Packaging machine according to claim 11 or 12, **characterized in that** the movable arm (46) has an on-command extendable/extendible structure in order to vary the distance of the gripping head (47) from the top of the self-supporting column (45). 45 50
14. Packaging machine according to any one of the claims from 8 to 13, **characterized in that** the insertion assembly (41) comprises at least two movable gripping units (42) which are arranged side-by-side to one another and are movable with respect to the linear conveyor (3) independently to one another. 55
15. Packaging machine according to any one of the pre-

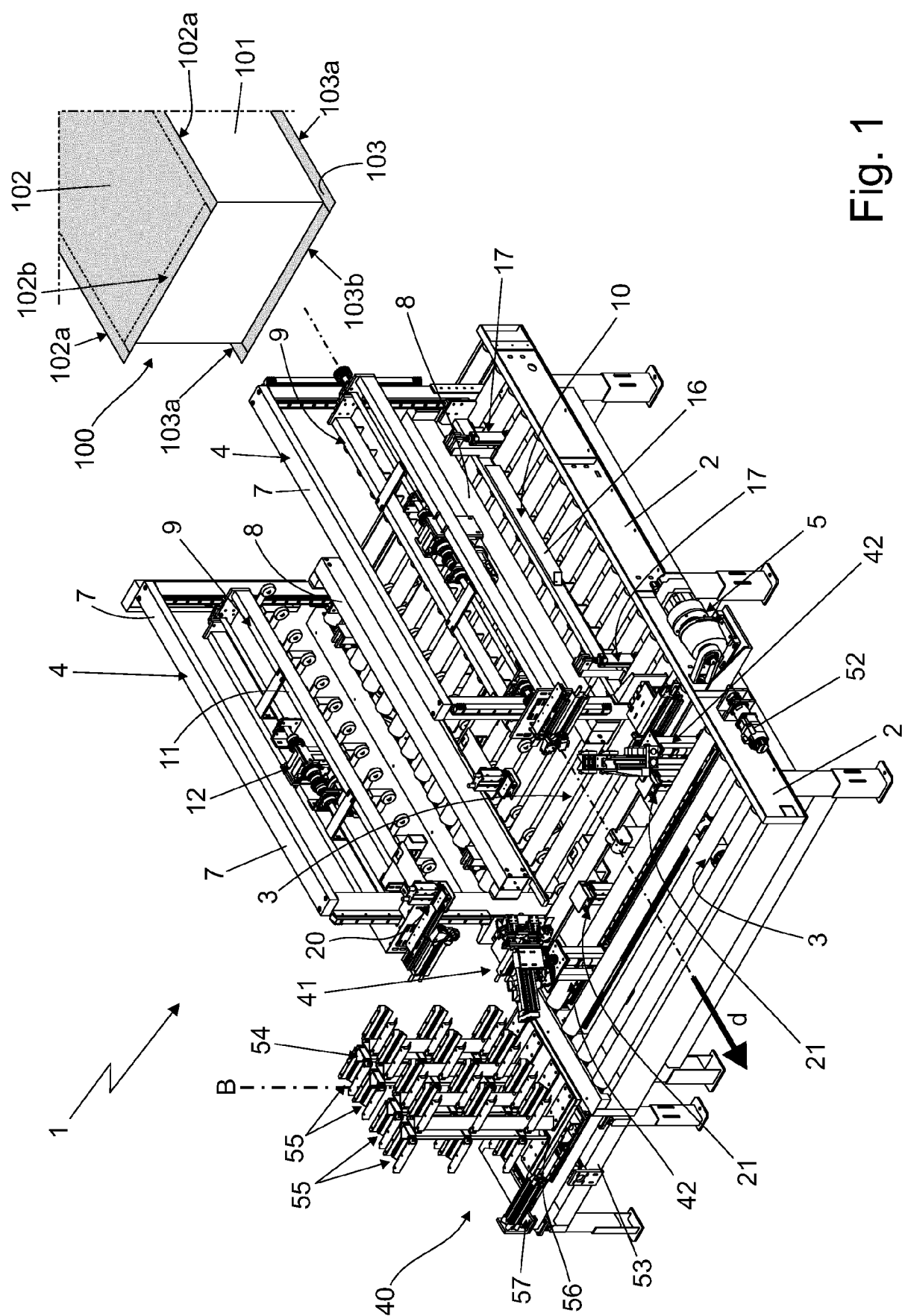


Fig. 1

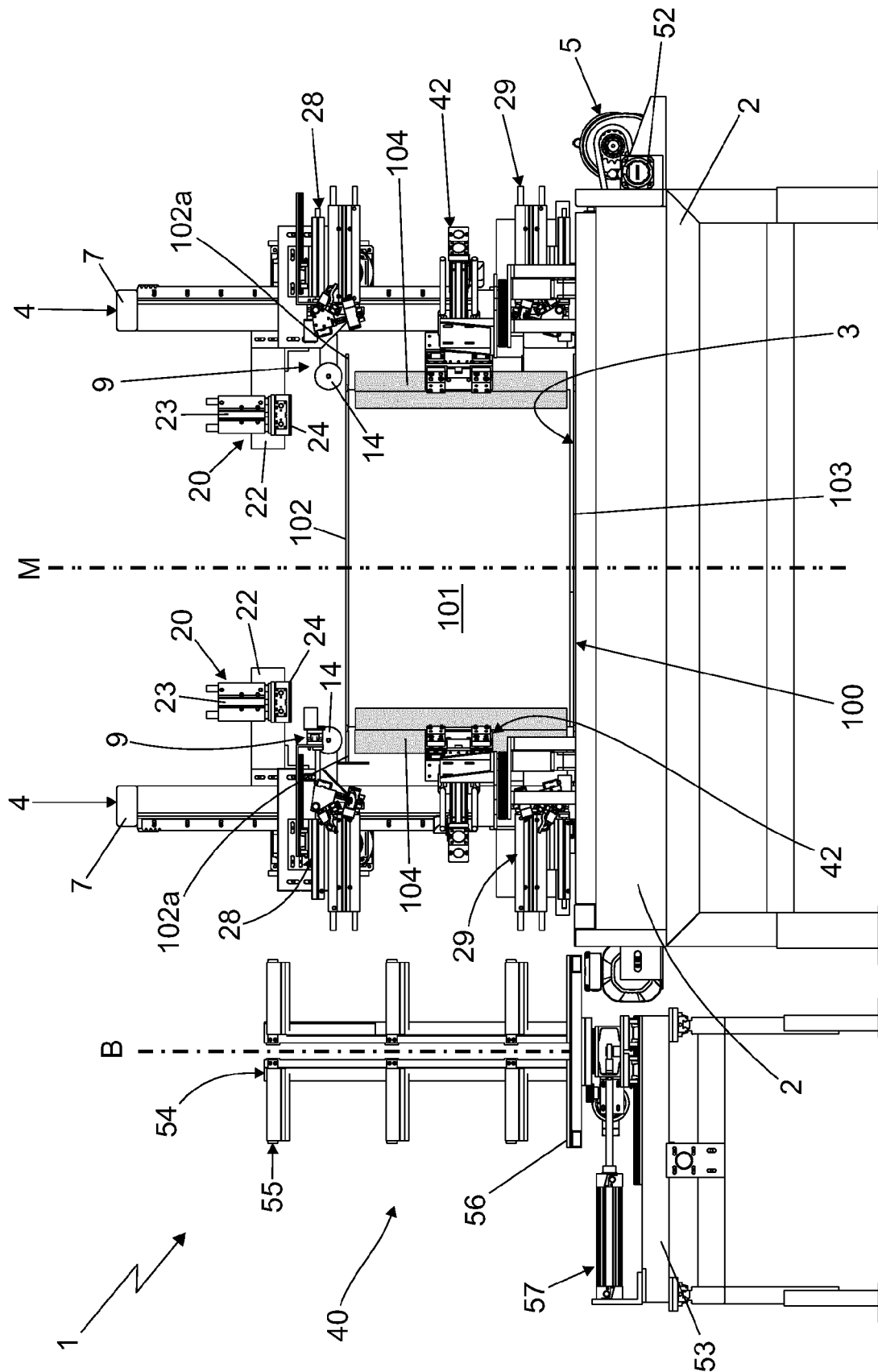


Fig. 2

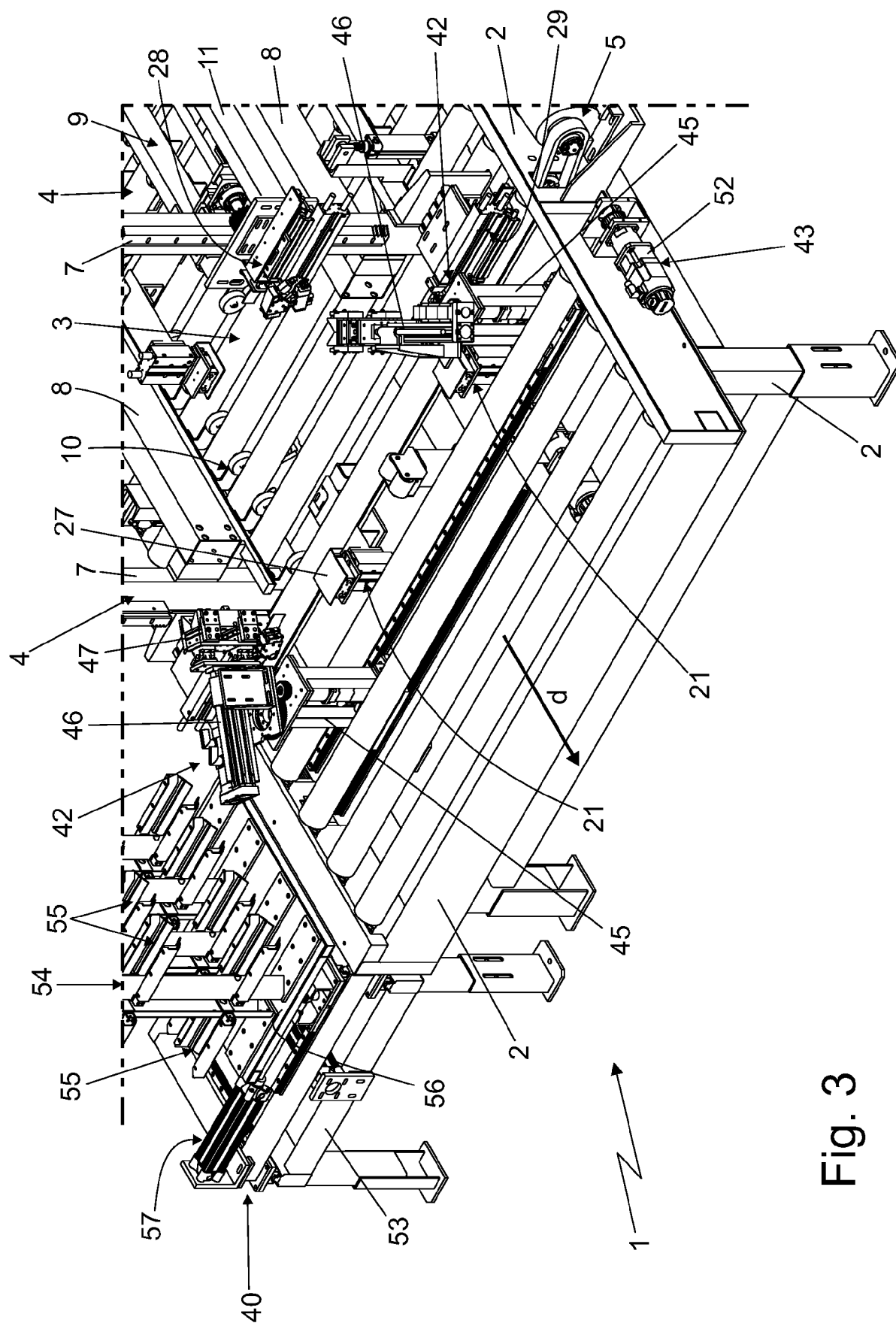


Fig. 3

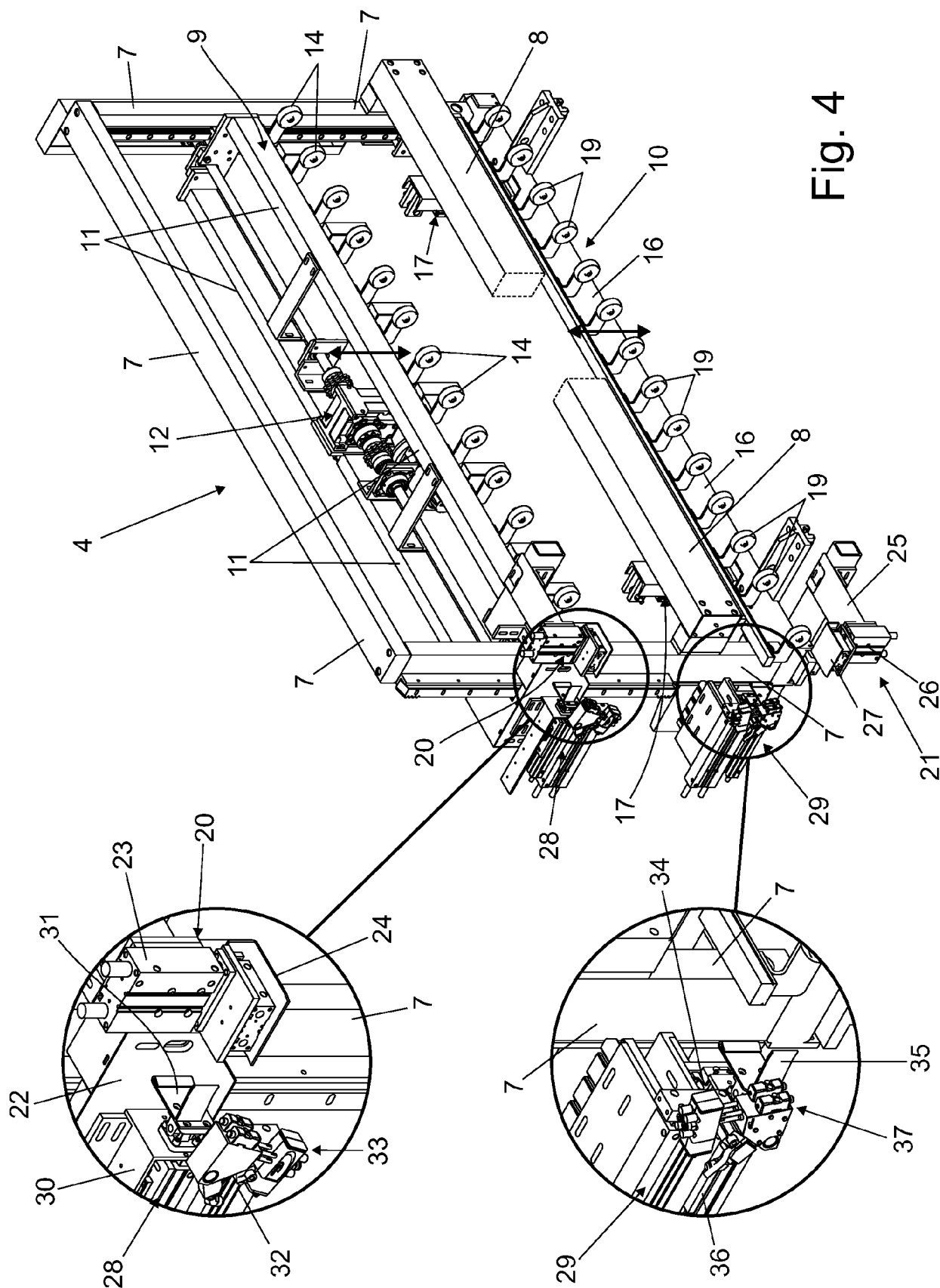
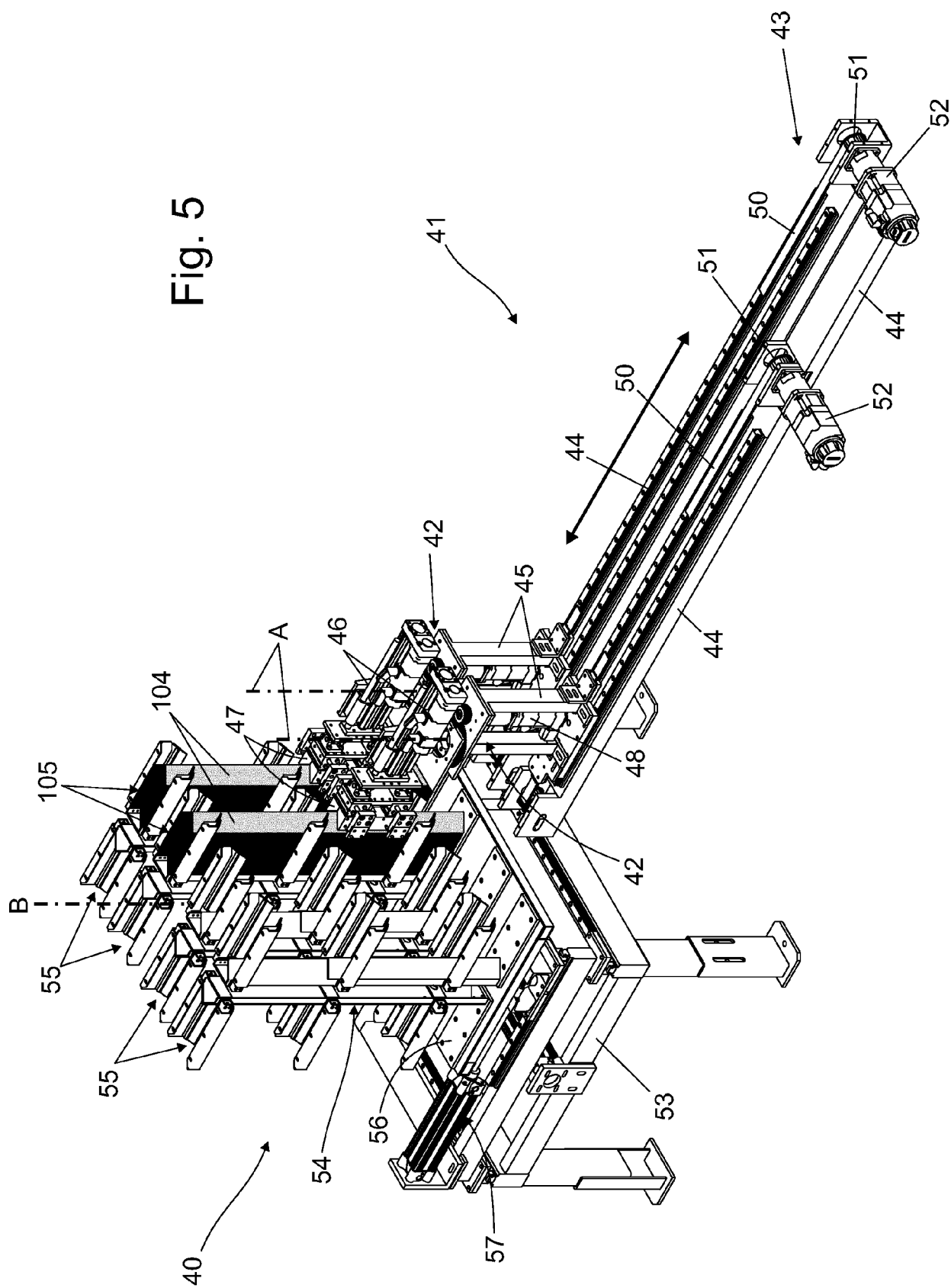


Fig. 4

Fig. 5



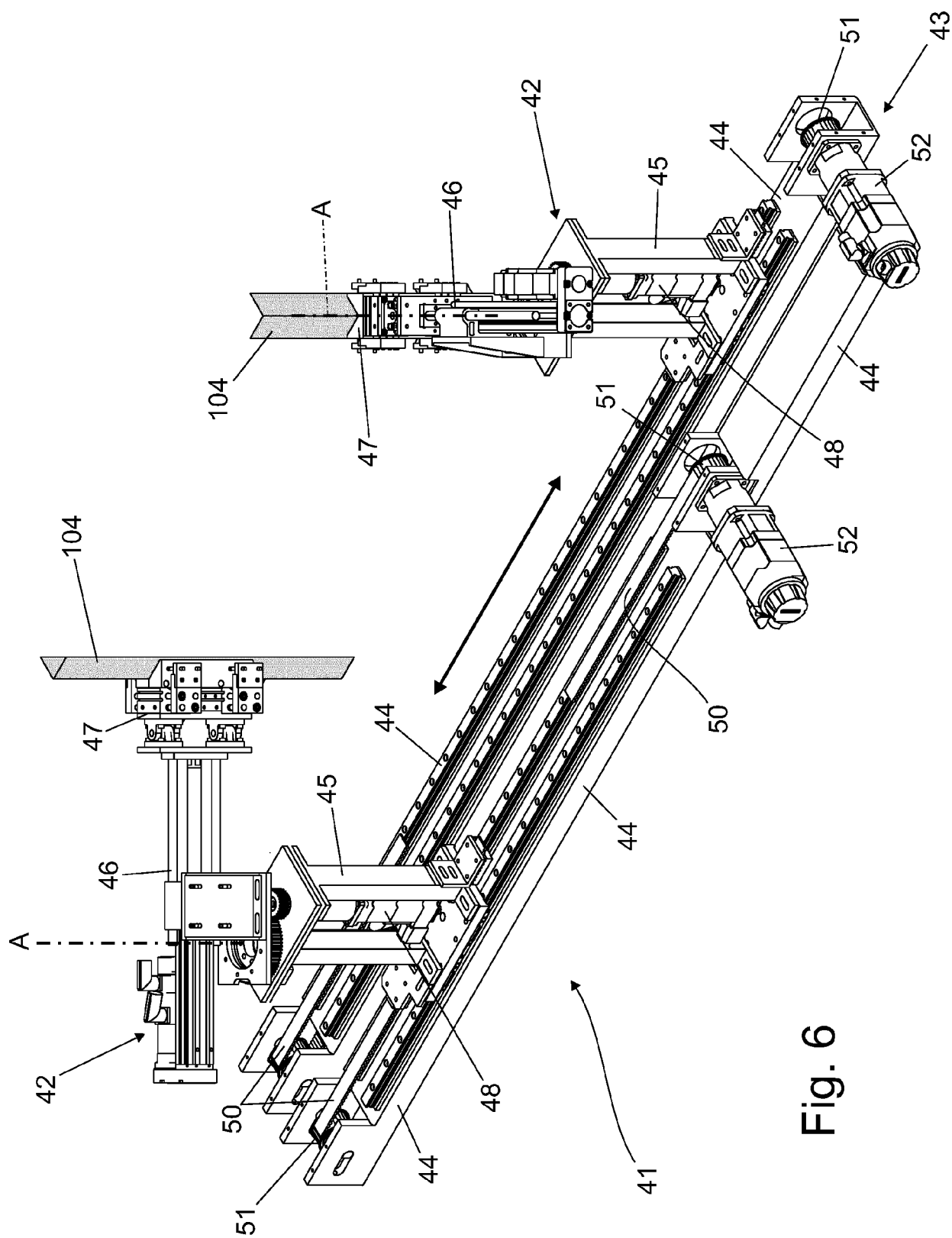


Fig. 6

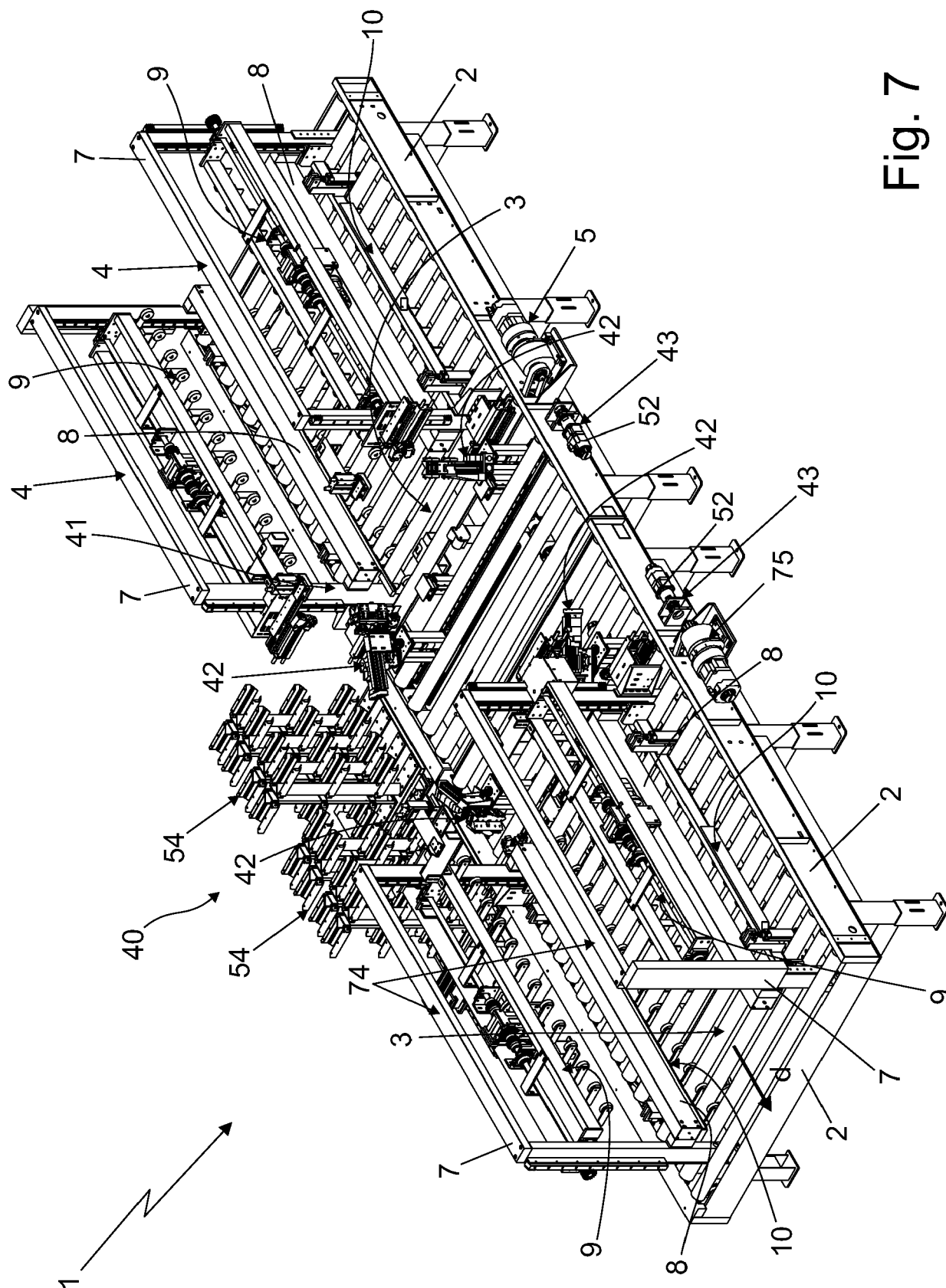


Fig. 7



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Application Number
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