

(19)



(11)

EP 2 674 269 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:
18.03.2015 Bulletin 2015/12

(51) Int Cl.:
B27M 3/00 (2006.01)

(21) Application number: **13171184.8**

(22) Date of filing: **10.06.2013**

(54) Feeder of boards for machines for assembling pallets having a perimetric base

Zuführer von Platten für Maschinen zur Montage von Paletten mit umkreisendem Sockel

Dispositif d'alimentation de planches pour machines d'assemblage de palettes ayant une base périmétrique

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

(30) Priority: **14.06.2012 IT MI20121026**

(43) Date of publication of application:
18.12.2013 Bulletin 2013/51

(73) Proprietor: **CORALI S.p.A.
24060 Carobbio degli Angeli BG (IT)**

(72) Inventors:
• **Trovenzi, Giuseppe
24060 CAROBBIO DEGLI ANGELI BG (IT)**
• **Wegher, Marco
24068 SERIATE BG (IT)**

(74) Representative: **Modiano, Micaela Nadia et al
Modiano & Partners (IT)
Via Meravigli, 16
20123 Milano (IT)**

(56) References cited:
**DE-A1- 19 642 859 FR-A1- 2 949 701
GB-A- 2 005 181 GB-A- 2 361 466**

EP 2 674 269 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

[0001] The present invention relates to a feeder of boards for machines for assembling pallets having a perimetric base. Such a feeder is known from FR-A-2949701.

[0002] As is known, wood pallets are composed generally of a loading surface, having a rectangular or square shape, constituted by a plurality of upper side-by-side boards mutually joined by means of lower boards that are oriented at right angles to the upper boards and are fixed to the lower face thereof usually by means of nails or the like. The loading surface, which defines the surface on which the goods to be transported or stored must be arranged, rests on three rows of feet or "plugs", which are nailed to the lower face of the boards of the loading surface and are mutually connected by means of other boards that constitute the resting base of the pallet. The feet are arranged so as to be aligned along three rows both longitudinally and transversely. This solution allows the pallet to be straddled, i.e., engaged by the fork of fork-lift trucks, at any one of its four sides.

[0003] In the more general type of pallets, the resting base is constituted by three mutual parallel boards, each one of which is joined to the feet of a same row, usually by means of nails, by suitable nailing machines. This type of pallet with a resting base composed of three parallel boards is called "skid".

[0004] In recent years, another type of pallet has become increasingly widespread wherein the resting surface, termed "perimeter base", is composed of five boards: two boards that define two opposite perimetric sides of the resting base and three boards that are arranged at right angles to the first two boards and define respectively the other two opposite perimetric sides of the resting base and an intermediate beam arranged at the center of the resting base.

[0005] These types of pallets, too, are assembled generally by means of nailing machines that fix the five boards, which constitute the resting base, to the lower face of the feet already preassembled to the loading surface, which is fed to the nailing machine conveniently overturned so that the boards of the resting base rest on the feet and are then nailed thereto.

[0006] In order to perform the automated assembly of perimeter base pallets, currently two nailing machines are used which are arranged in succession one after the other and are oriented at 90° with respect to each other so that the first nailing machine loads and nails the three mutually parallel boards and the second nailing machine loads and nails the remaining two boards.

[0007] This method has the drawback of requiring the use of two nailing machines with the corresponding feeders, with a great expenditure of capital for the purchase of the machines and of space for their installation.

[0008] Portal feeders also exist which are capable of feeding the five boards of the perimeter base in an automatic manner to a carriage on which the loading surface

preassembled with the feet is arranged beforehand. By means of these portal feeders it is possible to complete the assembly of the pallet by means of the application of the boards of the resting base by using a single nailing machine, with considerable savings in purchase of the necessary machinery.

[0009] In these feeders, the boards are fed from two different directions, at right angles to each other, and there is a station for forming the resting base in which the boards are arranged side by side according to the geometry of the resting base. The boards are therefore gripped and transferred on the carriage, on which the loading surface preassembled with the feet is arranged beforehand, which feeds the nailing machine.

[0010] These feeders have the drawback of requiring a station for forming the resting base that is complex and requires generally the use of two operators in order to perform the correct arrangement of the boards that compose the resting base.

[0011] The aim of the present invention is to solve the problems and obviate the drawbacks cited above, providing a feeder of boards for machines for assembling pallets having a perimetric base that does not require a station for forming the perimetric base and can be fed with the boards coming from a single direction.

[0012] Within this aim, an object of the invention is to provide a feeder capable of supplying the boards of the perimetric base to the assembling machine in a completely automated manner.

[0013] Another object of the invention is to provide a feeder that can be managed by an extremely limited number of operators.

[0014] A further object of the invention is to provide a feeder that ensures high precision and reliability in operation.

[0015] This aim and these and other objects that will become more apparent hereinafter are achieved by a feeder of boards for machines for assembling pallets having a perimetric base, **characterized in that** it comprises:

- a pickup station;
 - a release station, which is spaced laterally from said pickup station along a transfer direction;
 - means for positioning two groups of boards at said pickup station in a substantially horizontal position;
 - means for transferring said two groups of boards from said pickup station to said release station in a substantially horizontal position;
- said transfer means comprising:
- first transfer means, which can engage the boards of a first group of boards and can be transferred, along said transfer direction, from said pickup station to said release station and vice versa;
 - second transfer means, which can engage the boards of a second group of boards; said second transfer means being able to be transferred, along said transfer direction, from said pickup station to said release station and vice versa and being rotat-

able about a substantially vertical rotational axis so as to vary the orientation of said second group of boards with respect to said first group of boards.

[0016] Further characteristics and advantages of the invention will become more apparent from the description of a preferred but not exclusive embodiment of the feeder according to the invention, illustrated by way of non-limiting example in the accompanying drawings, wherein:

Figure 1 is a perspective view of the feeder according to the invention, with some elements omitted for the sake of greater clarity;

Figure 2 is a lateral elevation view of the feeder of Figure 1;

Figure 3 is a schematic sectional view of Figure 2 along the plane III-III;

Figure 4 is a schematic sectional view of Figure 2 along the plane IV-IV;

Figures 5 to 8 are lateral elevation views of the operation of the means for transferring the boards from the pickup station to the release station;

Figure 9 is a perspective view of the feeder according to the invention from a different angle than in Figure 1, with some elements omitted for the sake of greater clarity;

Figure 10 is a perspective view of a detail of the transfer means from a different angle than in Figures 1 and 9;

Figures 11 to 18 are perspective views of details of the transfer means;

Figures 19 to 22 are schematic views of the sequence of the transfer of the boards of a perimetric base from the pickup station to the release station by means of the feeder according to the invention.

[0017] With reference to the cited figures, the feeder according to the invention, generally designated by the reference numeral 1, comprises: a pickup station 2, a release station 3, which is spaced laterally from the pickup station 2 along a transfer direction 4, means 5 for positioning two groups of boards 80a, 80b, 80c, 80d, 80e at the pickup station 2 in a substantially horizontal position, and means 6 for transferring the two groups of boards 80a, 80b, 80c, 80d, 80e from the pickup station 2 to the release station 3 in a substantially horizontal position.

[0018] The transfer means 6 comprise: first transfer means 7, which can engage the boards 80a, 80b of the first group of boards and can be transported, along the transfer direction 4, from the pickup station 2 to the release station 3 and vice versa, and second transfer means 8, which can engage the boards 80c, 80d, 80e of the second group of boards. These second transfer means 8 are able to be transferred, along the transfer direction 4, from the pickup station 2 to the release station 3 and vice versa and are rotatable about a substantially vertical rotational axis 9 so as to vary the orientation of

the second group of boards 80c, 80d, 80e with respect to the first group of boards 80a, 80b, as will be explained in more detail hereinafter.

[0019] More particularly, the positioning means 5 comprise a chain conveyor 10 of a known type, which forms a substantially horizontal resting surface 11 along which the boards 80a, 80b, 80c, 80d, 80e move forward, as a consequence of their resting on the chains of the conveyor 10 and of the actuation of said chains, along an advancement direction 12. Along the resting surface 11 there are stopping abutments 13 that can be actuated on command, for example by means of pneumatic actuators of a known type, so as to pass from an inactive position, in which they are arranged below the resting surface 11, to an active position, in which they protrude upward from the resting surface 11 so as to stop, in a preset position, the boards 80a, 80b, 80c, 80d, 80e moved by the chains of the conveyor 10. The actuation of the stopping abutments 13 is controlled by sensor elements 14 of the boards 80a, 80b, 80c, 80d, 80e, constituted for example by photocells, which detect the arrival of a board 80a, 80b, 80c, 80d, 80e along the resting surface 11 and actuate accordingly the corresponding stopping abutment 13 at which said board 80a, 80b, 80c, 80d, 80e must stop.

[0020] Advantageously, the positioning means 5 comprise mutually opposite lateral abutments 15 for the longitudinal ends of the boards 80a, 80b, 80c, 80d, 80e that in each instance are placed on the resting surface 11 and arrive at the pickup station 2. These lateral abutments 15 are constituted substantially by L-shaped elements that are fixed, with the possibility of adjustment, to bars 16a, 16b that are arranged parallel to the advancement direction 12 and laterally, on mutually opposite sides, with respect to the chain conveyor 10. Each one of these bars 16a, 16b is connected to the upper end of a corresponding arm 17a, 17b. Each arm 17a, 17b is pivoted, at its lower end, to the supporting structure 18 of the machine about a corresponding pivoting axis 19a, 19b, which is parallel to the advancement direction 12 of the chain conveyor 10. The two arms 17a, 17b are, simultaneously, cyclically rotated with respect to the supporting structure 18 of the machine about the corresponding pivoting axis 19a, 19b so as to engage, by means of the lateral abutments 15, the longitudinal ends of the boards 80a, 80b, 80c, 80d, 80e placed on the chains of the conveyor 10 at the pickup station 2 in order to arrange correctly, and with high precision, each board 80a, 80b, 80c, 80d, 80e along its longitudinal extension with respect to the chain conveyor 10, once the boards 80a, 80b, 80c, 80d, 80e have been stopped by the corresponding stopping abutments 13.

[0021] In this manner it is possible to arrange at the pickup station 2, correctly and with high precision, the boards 80a, 80b, 80c, 80d, 80e that have to compose the perimetric base of a pallet 100.

[0022] It should be noted that in Figures 1, 2, 3 and 4, the lateral abutments 15 are illustrated in adjustment positions with respect to the bars 16a, 16b in the case of

provision of pallets with a perimetric base composed of boards of three different lengths, while in Figures 19 and 20 the lateral abutments 15 are in adjustment positions with respect to the bars 16a, 16b in the case of provision of pallets with a perimetric base composed of boards of the same length.

[0023] The feeder 1 according to the invention, for the sake of simplicity and greater clarity, is described hereinafter under the assumption that, as occurs in most cases, one has to provide a perimetric base of a pallet composed of five boards 80a, 80b, 80c, 80d, 80e divided into a first group, constituted by two mutually parallel boards 80a, 80b, and a second group, constituted by three mutually parallel boards 80c, 80d, 80e that have to be arranged, in the finished pallet 100, at right angles to the two boards 80a, 80b of the first group.

[0024] The two boards 80a, 80b of the first group define two opposite perimetric sides of the perimetric base of the pallet 100, while the three boards 80c, 80d, 80e of the second group define the other two opposite perimetric sides of the perimetric base of the pallet 100 and an intermediate board arranged at the center of the pallet 100.

[0025] The boards 80a, 80b, 80c, 80d, 80e are stacked in the magazines of a loader 73, of a known type, which is not described in detail for the sake of simplicity. In each instance, depending on the pallet to be provided, the loader 73 unloads one board onto the chain conveyor 10, which arranges it, by means of the intervention of the stopping abutments 13, as already described, at the pick-up station 2.

[0026] The transfer means 6 comprise a carriage 20, which is supported by the supporting structure 18 of the feeder 1 and is coupled slidingly with guides 21, which are fixed to the supporting structure 18 and extend in parallel to the transfer direction 4. These guides 21, as well as the carriage 20, are arranged above the pickup station 2 and the release station 3. The carriage 20 can be transferred along the guides 21 so as to pass from a first position, in which it is arranged above the pickup station 2, to a second position, in which it is arranged above the release station 3, and vice versa.

[0027] The transfer of the carriage 20 is achieved by first actuation means 22, which can be constituted by an electric motor 23 that is supported by the supporting structure 18 of the feeder 1 and is connected, with its output shaft, to an arm 24 which is provided, at its end opposite to the electric motor 23, with a pivot 25 that engages in a slot 26 defined in a bar 27, which is fixed to the carriage 20 and is oriented transversely to the transfer direction 4. In practice, the coupling between the pivot 25, which is integral with the arm 24, and the slot 26 of the bar 27 has the effect of converting the rotation of the output shaft of the electric motor 23 into a translation of the bar 27, and therefore of the carriage 20 that is fixed thereto, along the guides 21 in order to actuate the transfer of the carriage 20 from the first position to the second position and vice versa.

[0028] The first transfer means 7 comprise a first group

of grippers 40a, 40b, which are associated with the carriage and can engage on command the boards 80a, 80b of the first group of boards. Said first group of grippers 40a, 40b is movable with respect to the carriage 20 along a substantially vertical direction.

[0029] More particularly, the first group of grippers comprises two external lateral grippers 40a, 40b, each of which is supported by a corresponding articulated double quadrilateral structure 28a, 28b. Each articulated double quadrilateral structure 28a, 28b, as shown in particular in Figure 12, is pivoted, by means of the corresponding pair of linkages 29, 30, to a support 31, 32 that is fixed below the carriage 20. A fluid-operated cylinder 33 is interposed between the carriage 20 and the articulated double quadrilateral structure 28a, 28b and can be actuated in order to cause the rotation of the two linkages 29, 30 in relation to the supporting element 31, 32 so as to cause the lifting and lowering of the corresponding external lateral gripper 40a, 40b carried by the corresponding articulated double quadrilateral structure 28a, 28b.

[0030] Each one of the external lateral grippers 40a, 40b, as shown in particular in Figure 14, is composed of a fixed abutment 43, which is fixed to the corresponding articulated double quadrilateral structure 28a, 28b, and a movable abutment 44, which faces the fixed abutment 43 and can slide, along a guide 71, which is fixed to the corresponding articulated double quadrilateral structure 28a, 28b and integral with the fixed abutment 43. The movable abutment 44 can slide along the guide 71, thanks to the action of a fluid-operated cylinder 72, toward the fixed abutment 43 so as to grip a board 80a, 80b of the first group of boards interposed between the fixed abutment 43 and the movable abutment 44, and away from the fixed abutment 43 so as to allow the arrangement of the corresponding external lateral gripper 40a, 40b astride a board 80a, 80b of the first group of boards to be engaged or to be disengaged from a board 80a, 80b engaged previously.

[0031] The second transfer means 8 comprise a second group of grippers 41a, 41b, 41c, 41d, which are associated with a secondary structure 34 supported rotatably by the carriage 20 about the rotation axis 9. The grippers 41a, 41b, 41c, 41d, 41e of the second group of grippers can engage on command the boards 80c, 80d, 80e of the second group of boards. These second transfer means 8 comprise second actuation means 35, which are connected to the secondary structure 34 and can be activated in order to cause the rotation of the secondary structure 34 with respect to the carriage 20 about the rotation axis 9 through an angle of rotation of preset breadth. Moreover, the second group of grippers 41a, 41b, 41c, 41d, 41e is movable on command with respect to the carriage 20 along a substantially vertical direction.

[0032] More particularly, the secondary structure 34, as illustrated in particular in Figures 11 and 13, is fixed by means of a flange 36 to the lower end of a shaft 37, the axis of which defines the rotation axis 9, and is sup-

ported, so that it can rotate about said rotation axis 9, by a bar 38 that is fixed below the carriage 20. The upper end of the shaft 37 is fixed to an arm 39, which in turn is connected to the end of a lever 45 on which the second actuation means 35 operate, said means being constituted, in the illustrated embodiment, by a fluid-operated cylinder 46, which is mounted with its body on the carriage 20 and acts with the stem of its piston on said lever 45 in order to cause the rotation, through an angle of preset breadth, of the shaft 37 and therefore of the secondary structure 34 fixed below it.

[0033] The secondary structure 34 is constituted by a double scissor-like structure composed of two surfaces, respectively a lower surface 47 and an upper surface 48, each one of which is defined by bars that are rigidly fixed to each other. The lower surface 47 is connected to the upper surface 48 by means of two pairs of lateral levers, each pair of lateral levers being composed of two levers 49, 50 that are pivoted to each other in an intermediate region thereof. In each pair of lateral levers, one lever 49 is pivoted with one of its ends to the upper surface 48 and is coupled, so that it can slide, to a guide 51 fixed to the lower surface 47, while the other lever 50 is pivoted with one of its ends to the lower surface 47 and is coupled, so that it can slide, to a guide 52 fixed to the upper surface 48. For each pair of lateral levers, between the ends of the levers 49, 50 that are connected to the upper surface 48, a fluid-operated cylinder 53, 54 is interposed which can be actuated to cause the approach or spacing of the end of a lever 50 that is connected, so that it can slide, to the upper surface 48 with respect to the end of the other lever 49, which is pivoted to the same upper surface 48 so as to actuate the lifting or lowering of the lower surface 47 with respect to the upper surface 48 and therefore so as to actuate the lowering or lifting of the second group of grippers 41a, 41b, 41c, 41d, 41e associated with said lower surface 47 of the secondary structure 34.

[0034] The upper surface 48 of the secondary structure is fixed, for example by means of bolts, to the flange 36.

[0035] Advantageously, the second actuation means 35 can be actuated together with the first actuation means 22 in order to vary the orientation of the boards 80c, 80d, 80e of the second group of boards with respect to the boards 80a, 80b of the first group of boards during the transfer of the two groups of boards from the pickup station 2 to the release station 3, as will be more apparent hereinafter.

[0036] The preset breadth of the angle of rotation of the secondary structure 34 in relation to the carriage 20 about the rotation axis 9 is preferably substantially 90° so as to obtain an arrangement of the boards 80c, 80d, 80e of the second group of boards that is substantially perpendicular to the boards 80a, 80b of the first group of boards when the boards arrive at the release station 3.

[0037] The second group of grippers comprises a central gripper 41a, which is adapted to grip a central board 80d, and two pairs of internal lateral grippers 41b, 41c, 41d, 41e which are arranged laterally and on mutually

opposite sides with respect to the central gripper 41a and are adapted to grip two lateral boards 80c, 80e which are arranged in parallel to the central board 80d. The central board 80d and the two lateral boards 80c, 80e constitute the second group of boards.

[0038] The central gripper 41a, as shown in particular in Figures 15 and 16, comprises two opposite abutments 55, 56, which are associated, so that they can slide, with a bar 57 that is fixed to the lower surface 47 of the secondary structure 34. Each one of these two abutments 55, 56 is fixed to a corresponding rack 58, 59, which is associated, so that it can slide along its extension, with the bar 57 and the two racks 58, 59 mesh with two diametrically opposite regions of a pinion 60 that is supported, so that it can rotate about its own axis, by the bar 57. One of the two abutments 55, 56 is connected to the stem of a fluid-operated cylinder 61, the body of which is fixed to the lower surface 47 of the secondary structure 34. The actuation of this fluid-operated cylinder 61 causes the movement of the abutment 55 along the bar 57 and, following the connection provided by the racks 58, 59 and by the pinion 60, causes the mutual approach or spacing of the two abutments 55, 56 so as to engage these two abutments 55, 56 with the two opposite sides of the central board 80d or disengage the two abutments from the central board 80d.

[0039] The two pairs of internal lateral grippers 41b, 41c and 41d, 41e also are fixed to the lower surface 47 of the secondary structure 34. More precisely, as shown in particular in Figures 17, 18 each one of these internal lateral grippers 41b, 41c, 41d, 41e is composed of a first abutment 62 and a second abutment 63, which are mounted, so that they can slide, along a bar 64 which is fixed to the lower surface 47 of the secondary structure 34. The second abutment 63 is connected to the stem of a fluid-operated cylinder 65, which is fixed, with its body, to the same bar 64 or directly to the lower surface 47 of the secondary structure 34 so that the actuation of this fluid-operated cylinder 65 causes the sliding of the second abutment 63 along the bar 64 toward or away from the first abutment 62 so as to engage the first abutment 62 and the second abutment 63 with the two opposite sides of a board 80c, 80e or disengage the first abutment 62 and the second abutment 63 from said board 80c, 80e. The first abutment 62 can be fixed along the bar 64 or, as shown, may be connected to the stem of another fluid-operated cylinder 66 that can be actuated in order to allow varying the position of the first abutment 62 along the bar 64 as a function of the position of the board 80c, 80e to be engaged with said gripper 41b, 41c, 41d, 41e according to the type of pallet to be provided.

[0040] Conveniently, at the release station 3, there are means 67 for compacting the boards in order to move the two boards 80a, 80b, of the first group against the longitudinal ends of the three boards 80c, 80d, 80e of the second group.

[0041] More particularly, the release station 3 is arranged along a conveyor 68 that feeds a nailing machine.

This conveyor 68, which can be constituted by a chain conveyor of a known type, is capable of positioning, in each instance, a loading surface 81 of a pallet preassembled with the feet or plugs 82 and overturned so as to be arranged on a substantially horizontal plane with the feet 82 facing upward.

[0042] The compacting means 67, in the illustrated embodiment, are constituted by two bars 69, 70, which are horizontal and parallel to the advancement direction 74 of the conveyor 68, are arranged in mutually opposite regions at two opposite sides of the pallet 100 and can move, for example by means of the action of fluid-operated actuators of the known type not illustrated for the sake of simplicity, toward or away from each other.

[0043] The operation of the feeder 1 according to the invention is as follows.

[0044] In each instance, the boards 80a, 80b, 80c, 80d, 80e are unloaded from the loader 73 onto the conveyor 10 that causes their advancement along the advancement direction 12, which is substantially parallel to the translation direction 4. The stopping abutments 13, controlled by the sensor elements 14, stop the boards 80a, 80b, 80c, 80d, 80e in a preset position at the pickup station 2, conveniently mutually spaced so as to allow the insertion, between them, of the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e.

[0045] In each instance, the carriage 20 is arranged above the pickup station 2 with the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e in the raised position. Subsequently, the fluid-operated cylinders 33, 53, 54 are actuated and cause the lowering of the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e until they are inserted between the boards 80a, 80b, 80c, 80d, 80e so that the two abutments of each gripper face the two opposite sides of the board to be gripped (Figure 19).

[0046] At this point, the fluid-operated cylinders 72, 61, 65 are actuated and cause the engagement of the grippers with the two opposite sides of the corresponding board to be gripped. More particularly, the central gripper 41a engages the central board 80d of the second group of boards by means of a mutual approach, from mutually opposite regions, of the abutments 55, 56 of the central gripper 41a. The internal lateral grippers 41b, 41c, 41d, 41e engage the two opposite sides of the two lateral boards 80c, 80e of the second group of boards by means of the approach of an abutment 63 with respect to the other abutment 62, which remains fixed. The pair of internal lateral grippers 41b and 41c engages the board 80c, while the pair of internal lateral grippers 41d, 41e engages the board 80e. It should be noted that in this manner the two lateral boards 80c, 80e of the second group of boards are moved respectively closer to the board 80a and to the board 80b of the first group of boards. The two external lateral grippers 40a, 40b engage a corresponding board 80a, 80b of the first group of boards by means of the approach of the movable abutment 44 to the fixed abutment 43. After this, the two boards 80a, 80b of the first group of boards are moved

closer to the two lateral boards 80c, 80e of the second group of boards (Figure 20 and Figure 5).

[0047] Once the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e have engaged the boards 80a, 80b, 80c, 80d, 80e, the fluid-operated cylinders 33, 53, 54 are actuated and cause the lifting of the first group of grippers 40a, 40b and of the second group of grippers 41a, 41b, 41c, 41d, 41e. It should be noted that the first group of grippers 40a, 40b is lifted higher than the second group of grippers 41a, 41b, 41c, 41d, 41e so as not to hinder the subsequent rotation of the second group of grippers 41a, 41b, 41c, 41d, 41e about the rotation axis 9 (Figure 6).

[0048] Subsequently, the fluid-operated cylinder 46 is actuated and causes the rotation, by an angle of substantially 90°, of the second group of grippers 41a, 41b, 41c, 41d, 41e in relation to the carriage 20 and therefore in relation to the first group of grippers 40a, 40b.

[0049] This rotation has the effect of arranging the boards 80c, 80d, 80e of the second group of boards at right angles to the boards 80a, 80b of the first group of boards. It should be noted that while the rotation of the second group of grippers 41a, 41b, 41c, 41d, 41e is performed, the motor 23 is activated so as to cause also the transfer of the carriage 20 from the pickup station 2 to the release station 3 (Figure 21, Figure 7).

[0050] Once the second group of grippers 41a, 41b, 41c, 41d, 41e has been rotated and the carriage 20 has arrived above the release station 3, the fluid-operated cylinders 33, 53, 54 are actuated and cause the lowering of the first group of grippers 40a, 40b and of the second group of grippers 41a, 41b, 41c, 41d, 41e.

[0051] In the meantime, a loading surface 81 of a pallet preassembled with the feet 82, arranged horizontally with the feet 82 facing upward so that the lowering of the first group of grippers 40a, 40b and of the second group of grippers 41a, 41b, 41c, 41d achieves the positioning of the boards 80a, 80b, 80c, 80d, 80e on the feet 82 preassembled with the loading surface 81 of the pallet 100 (Figure 22 and Figure 8), has been positioned at the release station 3. The grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e are therefore disengaged from the boards 80a, 80b, 80c, 80d, 80e and lifted again in order to be carried, by transfer of the carriage 20 along the guides 21, above the pickup station 2, at which, in the meantime, two new groups of boards 80a, 80b, 80c, 80d, 80e have been arranged.

[0052] After the boards 80a, 80b, 80c, 80d, 80e have been released by the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e on the feet 82 of the loading surface 81, the compacting means 67 are actuated and move the two boards 80a, 80b of the first group against the longitudinal ends of the boards 80c, 80d, 80e of the second group.

[0053] At this point, the conveyor 68 that feeds the nailing machine advances the pallet 100 toward a nailing station, of a known type and not illustrated for the sake of simplicity, and arranges at the release station 3 a new loading surface 81 with the feet 82 preassembled, ready to receive the boards 80a, 80b, 80c, 80d, 80e that will be

deposited by the grippers 40a, 40b, 41a, 41b, 41c, 41d, 41e.

[0054] The operating cycle then continues as already described.

[0055] In practice it has been found that the feeder according to the invention fully achieves the intended aim, since by performing a rotation of one group of boards with respect to another group of boards it can be supplied with the boards by means of a single conveyor that makes the boards advance along an advancement direction without requiring a station for the prior formation of the perimetric base. Thanks to this, the feeder according to the invention is easier to provide and manage than feeders of the known type and requires fewer operators. In practice, the operation of the feeder according to the invention requires a single operator in order to supply boards to the loader that supplies the pickup station.

[0056] The feeder thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims.

[0057] In practice, the materials used, as well as the dimensions, may be any according to the requirements and the state of the art.

[0058] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A feeder (1) of boards for machines for assembling pallets having a perimetric base, **characterized in that** it comprises:

- a pickup station (2);
 - a release station (3), which is spaced laterally with respect to said pickup station (2) along a transfer direction (4);
 - means (5) for positioning two groups of boards (80a, 80b, 80c, 80d, 80e) at said pickup station (2) in a substantially horizontal position;
 - means (6) for transferring said two groups of boards (80a, 80b, 80c, 80d, 80e) from said pickup station (2) to said release station (3) in a substantially horizontal position;
- said transfer means (6) comprising:
- first transfer means (7), which can engage the boards (80a, 80b) of a first group of boards and can be transferred, along said transfer direction (4), from said pickup station (2) to said release station (3) and vice versa;
 - second transfer means (8), which can engage the boards (80c, 80d, 80e) of a second group of boards; said second transfer means (8) being

able to be transferred, along said transfer direction (4), from said pickup station (2) to said release station (3) and vice versa and being rotatable about a substantially vertical rotational axis (9) so as to vary the orientation of said second group of boards (80c, 80d, 80e) with respect to said first group of boards (80a, 80b).

2. The feeder (1) according to claim 1, **characterized in that** said transfer means (6) comprise a carriage (20), which is supported by a supporting structure (18) and coupled slidably with guides (21) which are fixed to said supporting structure (18) and extend in parallel to said transfer direction (4), said guides (21) being arranged above said pickup station (2) and said release station (3), first actuation means (22) being provided which are connected to said carriage (20) for its transfer along said guides (21) from said pickup station (2) to said release station (3) and vice versa.
3. The feeder (1) according to claims 1 and 2, **characterized in that** said first transfer means (7) comprise a first pair of grippers (40a, 40b) which are associated with said carriage (20) and can engage on command the boards (80a, 80b) of said first group of boards, said first group of grippers (40a, 40b) being movable with respect to said carriage (20) along a substantially vertical direction.
4. The feeder (1) according to one or more of the preceding claims, **characterized in that** said second transfer means (8) comprise a second group of grippers (41a, 41b, 41c, 41d, 41e) which are associated with a secondary structure (34) supported in a rotatable manner by said carriage (20) about said substantially vertical rotation axis (9), the grippers (41a, 41b, 41c, 41d, 41e) of said second group of grippers being able to engage on command with the boards (80c, 80d, 80e) of said second group of boards; second actuation means (35) being provided which are connected to said secondary structure (34) for its rotation with respect to said carriage (20) about said rotation axis (9) through an angle of rotation of preset breadth; said second group of grippers (41a, 41b, 41c, 41d, 41e) being movable on command with respect to said carriage (20) in a substantially vertical direction.
5. The feeder (1) according to one or more of the preceding claims, **characterized in that** said positioning means (5) define a substantially horizontal resting surface (11) for said two groups of boards (80a, 80b, 80c, 80d, 80e), said positioning means (5) being adapted to arrange the boards of said two groups of boards (80a, 80b, 80c, 80d, 80e) so that they are mutually parallel, side-by-side and spaced at said pickup station (2).

6. The feeder (1) according to one or more of the preceding claims, **characterized in that** said second actuation means (35) can be actuated together with said first actuation means (22) so as to vary the orientation of the boards (80c, 80d, 80e) of said second group of boards with respect to the boards (80a, 80b) of said first group of boards in the transfer of said two groups of boards (80a, 80b, 80c, 80d, 80e) from said pickup station (2) to said release station (3).
7. The feeder (1) according to one or more of the preceding claims, **characterized in that** the preset breadth of said rotation angle is substantially 90° for an arrangement of the boards (80c, 80d, 80e) of said second group of boards substantially at right angles to the boards (80a, 80b) of said first group of boards in said release station (3).
8. The feeder (1) according to one or more of the preceding claims, **characterized in that** said first group of grippers comprises two outer lateral grippers (40a, 40b), which can be actuated to grip two boards (80a, 80b) which constitute said first group of boards.
9. The feeder (1) according to one or more of the preceding claims, **characterized in that** said second group of grippers (41a, 41b, 41c, 41d, 41e) comprises a central gripper (41a), which is adapted to grip a central board (80d) and two pairs of internal lateral grippers (41b, 41c, 41d, 41e) which are arranged laterally and on mutually opposite sides with respect to said central gripper (41a) and are adapted to grip two lateral boards (80c, 80e) which are parallel to said central board (80d); said central board (80d) and said lateral boards (80c, 80e) constituting said second group of boards.
10. The feeder (1) according to one or more of the preceding claims, **characterized in that** said positioning means (5) comprise a chain conveyor (10), which forms said resting surface (11), and abutments (13) for stopping the boards (80a, 80b, 80c, 80d, 80e) deposited transversely on the chains of said chain conveyor (10) and entrained by them along an advancement direction (12).
11. The feeder (1) according to one or more of the preceding claims, **characterized in that** said advancement direction (12) is substantially parallel to said transfer direction (4).
12. The feeder (1) according to one or more of the preceding claims, **characterized in that** said positioning means (5) comprise mutually opposite lateral abutments (15) for the longitudinal ends of said boards (80a, 80b, 80c, 80d, 80e) which are arranged on said resting surface (11) in said pickup station (2).

13. The feeder (1) according to one or more of the preceding claims, **characterized in that** it comprises means (67) for compacting said boards (80a, 80b, 80c, 80d, 80e) in said release station (3).

Patentansprüche

1. Zuführer (1) von Platten für Maschinen zum Montieren von Paletten mit einer umlaufenden Basis, **dadurch gekennzeichnet, dass** der Zuführer umfasst:
- eine Aufnahmestation (2);
 - eine Ausgabestation (3), die bezüglich der Aufnahmestation (2) entlang einer Förderrichtung (4) seitlich beabstandet ist;
 - Mittel (5) zum Positionieren von zwei Gruppen von Platten (80a, 80b, 80c, 80d, 80e) an der Aufnahmestation (2) in einer im Wesentlichen horizontalen Lage;
 - Mittel (6) zum Fördern der zwei Gruppen von Platten (80a, 80b, 80c, 80d, 80e) von der Aufnahmestation (2) zu der Ausgabestation (3) in einer im Wesentlichen horizontalen Lage;
- wobei die Fördermittel (6) umfassen:
- erste Fördermittel (7), die an den Platten (80a, 80b) einer ersten Gruppe von Platten angreifen können und welche entlang der Förderrichtung (4) von der Aufnahmestation (2) zu der Ausgabestation (3) sowie umgekehrt befördert werden können;
 - zweite Fördermittel (8), die an den Platten (80c, 80d, 80e) einer zweiten Gruppe von Platten angreifen können; wobei die zweiten Fördermittel (8) fähig sind, entlang der Förderrichtung (4) von der Aufnahmestation (2) zu der Ausgabestation (3) und umgekehrt befördert zu werden, und um eine im Wesentlichen vertikale Drehachse (9) drehbar sind, um die Ausrichtung der zweiten Gruppe von Platten (80c, 80d, 80e) bezüglich der ersten Gruppe von Platten (80a, 80b) zu verändern.
2. Zuführer (1) nach Anspruch 1, **dadurch gekennzeichnet, dass** die Fördermittel (6) einen Schlitten (20) aufweisen, der durch eine Stützstruktur (18) getragen ist und gleitend mit Führungen (21) gekoppelt ist, die an der Stützstruktur (18) befestigt sind und sich parallel zu der Förderrichtung (4) erstrecken, wobei die Führungen (21) oberhalb der Aufnahmestation (2) und der Ausgabestation (3) angeordnet sind, wobei erste Betätigungsmittel (22) vorgesehen sind, die mit dem Schlitten (20) für dessen Verschiebung entlang der Führungen (21) von der Aufnahmestation (2) zu der Ausgabestation (3) und umgekehrt verbunden sind.
3. Zuführer (1) nach den Ansprüchen 1 und 2, **dadurch**

- gekennzeichnet, dass** die ersten Fördermittel (7) ein erstes Paar Greifer (40a, 40b) aufweisen, die dem Schlitten (20) zugeordnet sind und auf Anweisung an den Platten (80a, 80b) der ersten Gruppe von Platten angreifen können, wobei die erste Gruppe von Greifern (40a, 40b) bezüglich des Schlittens (20) entlang einer im Wesentlichen vertikalen Richtung bewegbar ist.
4. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Fördermittel (8) eine zweite Gruppe von Greifern (41a, 41b, 41c, 41d, 41e) aufweisen, die einer Nebenstruktur (34) zugeordnet sind, welche durch den Schlitten (20) in einer um die im Wesentlichen vertikale Drehachse (9) drehbaren Weise getragen ist, wobei die Greifer (41a, 41b, 41c, 41d, 41e) der zweiten Gruppe von Greifern fähig sind, auf Anweisung an den Platten (80c, 80d, 80e) der zweiten Gruppe von Platten anzugreifen; wobei zweite Betätigungsmittel (35) vorgesehen sind, die mit der Nebenstruktur (34) für deren Verdrehen bezüglich des Schlittens (20) um die Drehachse (9) über einen Drehwinkel von vorbestimmter Weite verbunden sind; wobei die zweite Gruppe von Greifern (41a, 41b, 41c, 41d, 41e) auf Anweisung bezüglich des Schlittens (20) in einer im Wesentlichen vertikalen Richtung bewegbar ist.
5. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Positionierungsmittel (5) eine im Wesentlichen horizontale Auflagefläche (11) für die zwei Gruppen von Platten (80a, 80b, 80c, 80d, 80e) definieren, wobei die Positionierungsmittel (5) angepasst sind, die Platten der zwei Gruppen von Platten (80a, 80b, 80c, 80d, 80e) anzuordnen, so dass sie an der Aufnahmestation (2) zueinander parallel, Seite an Seite und beabstandet sind.
6. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweiten Betätigungsmittel (35) zusammen mit den ersten Betätigungsmitteln (22) betätigt werden können, um die Ausrichtung der Platten (80c, 80d, 80e) der zweiten Gruppe von Platten bezüglich der Platten (80a, 80b) der ersten Gruppe von Platten beim Transport der zwei Gruppen von Platten (80a, 80b, 80c, 80d, 80e) von der Aufnahmestation (2) zu der Ausgabestation (3) zu verändern.
7. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass**, für eine Anordnung der Platten (80c, 80d, 80e) der zweiten Gruppe von Platten im Wesentlichen rechtwinklig zu den Platten (80a, 80b) der ersten Gruppe von Platten in der Ausgabestation (3), die vorbestimmte Weite des Drehwinkels im Wesentlichen 90° beträgt.
8. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die erste Gruppe von Greifern zwei äußere seitliche Greifer (40a, 40b) aufweist, die zum Greifen von zwei Platten (80a, 80b) betätigt werden können, welche die erste Gruppe von Platten bilden.
9. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die zweite Gruppe von Greifern (41a, 41b, 41c, 41d, 41e) einen zentralen Greifer (41a), der angepasst ist, eine mittlere Platte (80d) zu greifen, und zwei Paare von inneren seitlichen Greifern (41b, 41c, 41d, 41e) aufweist, die seitlich und auf einander gegenüberliegenden Seiten bezüglich des zentralen Greifers (41a) angeordnet und angepasst sind, zwei seitliche Platten (80c, 80e) zu greifen, welche parallel zu der mittleren Platte (80d) sind; wobei die mittlere Platte (80d) und die seitlichen Platten (80c, 80e) die zweite Gruppe von Platten bilden.
10. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Positionierungsmittel (5) einen Kettenförderer (10), der die Auflagefläche (11) bildet, und Widerlager (13) zum Stoppen der Platten (80a, 80b, 80c, 80d, 80e) aufweisen, die quer auf den Ketten des Kettenförderers (10) abgelegt und von diesen entlang einer Vorschubrichtung (12) mitgenommen werden.
11. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Vorschubrichtung (12) im Wesentlichen parallel zu der Förderrichtung (4) verläuft.
12. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** die Positionierungsmittel (5) einander gegenüberliegende seitliche Widerlager (15) für die Längsenden der Platten (80a, 80b, 80c, 80d, 80e) aufweisen, die auf der Auflagefläche (11) in der Aufnahmestation (2) angeordnet sind.
13. Zuführer (1) nach einem oder mehreren der vorhergehenden Ansprüche, **dadurch gekennzeichnet, dass** er Mittel (67) zum Zusammenschieben der Platten (80a, 80b, 80c, 80d, 80e) in der Ausgabestation (3) aufweist.

Revendications

1. Dispositif d'alimentation (1) de planches pour machines d'assemblage de palettes ayant une base périmétrique, **caractérisé en ce qu'il** comprend :

- une station de ramassage (2) ;
 - une station de libération (3), qui est espacée latéralement par rapport à ladite station de ramassage (2) le long d'une direction de transfert (4) ;
 - des moyens (5) destinés à positionner deux groupes de planches (80a, 80b, 80c, 80d, 80e) au niveau de ladite station de ramassage (2) dans une position essentiellement horizontale ;
 - des moyens (6) destinés à transférer lesdits deux groupes de planches (80a, 80b, 80c, 80d, 80e) de ladite station de ramassage (2) vers ladite station de libération (3) dans une position essentiellement horizontale ;
 - lesdits moyens de transfert (6) comprenant :
 - des premiers moyens de transfert (7), qui peuvent s'engager avec les planches (80a, 80b) d'un premier groupe de planches et peuvent être transférés, le long de ladite direction de transfert (4), de ladite station de ramassage (2) vers ladite station de libération (3) et vice-versa ;
 - des deuxièmes moyens de transfert (8), qui peuvent s'engager avec les planches (80c, 80d, 80e) d'un deuxième groupe de planches ; lesdits deuxièmes moyens de transfert (8) pouvant être transférés, le long de ladite direction de transfert (4), de ladite station de ramassage (2) vers ladite station de libération (3) et vice-versa et pouvant tourner autour d'un axe de rotation essentiellement vertical (9) de manière à faire varier l'orientation dudit deuxième groupe de planches (80c, 80d, 80e) par rapport audit premier groupe de planches (80a, 80b).
2. Dispositif d'alimentation (1) selon la revendication 1, **caractérisé en ce que** lesdits moyens de transfert (6) comprennent un chariot (20), qui est supporté par une structure de support (18) et couplé de manière coulissante à des guides (21) qui sont fixés à ladite structure de support (18) et s'étendent parallèlement à ladite direction de transfert (4), lesdits guides (21) étant agencés au-dessus de ladite station de ramassage (2) et de ladite station de libération (3), des premiers moyens d'actionnement (22) qui sont reliés audit chariot (20) pour son transfert le long desdits guides (21) de ladite station de ramassage (2) vers ladite station de libération (3) et vice-versa, étant prévus.
3. Dispositif d'alimentation (1) selon les revendications 1 et 2, **caractérisé en ce que** lesdits premiers moyens de transfert (7) comprennent une première paire de pinces (40a, 40b) qui sont associées audit chariot (20) et peuvent s'engager, sur commande, avec les planches (80a, 80b) dudit premier groupe de planches, ledit premier groupe de pinces (40a, 40b) étant mobile par rapport audit chariot (20) le long d'une direction essentiellement verticale.
4. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits deuxièmes moyens de transfert (8) comprennent un deuxième groupe de pinces (41a, 41b, 41c, 41d, 41e) qui sont associées à une structure secondaire (34) supportée de manière rotative par ledit chariot (20) autour dudit axe de rotation essentiellement vertical (9), les pinces (41a, 41b, 41c, 41d, 41e) dudit deuxième groupe de pinces étant capables de s'engager, sur commande, avec les planches (80c, 80d, 80e) dudit deuxième groupe de planches ; des deuxièmes moyens d'actionnement (35) qui sont reliés à ladite structure secondaire (34) pour sa rotation par rapport audit chariot (20) autour dudit axe de rotation (9) selon un angle de rotation de largeur prédéterminée, étant prévus ; ledit deuxième groupe de pinces (41a, 41b, 41c, 41d, 41e) étant mobile, sur commande, par rapport audit chariot (20) dans une direction essentiellement verticale.
5. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits moyens de positionnement (5) définissent une surface de repos essentiellement horizontale (11) pour lesdits deux groupes de planches (80a, 80b, 80c, 80d, 80e), lesdits moyens de positionnement (5) étant adaptés pour agencer les planches desdits deux groupes de planches (80a, 80b, 80c, 80d, 80e) de sorte qu'elles soient mutuellement parallèles, côte-à-côte et espacées au niveau de ladite station de ramassage (2).
6. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits deuxièmes moyens d'actionnement (35) peuvent être actionnés conjointement avec lesdits premiers moyens d'actionnement (22) de manière à faire varier l'orientation des planches (80c, 80d, 80e) dudit deuxième groupe de planches par rapport aux planches (80a, 80b) dudit premier groupe de planches lors du transfert desdits deux groupes de planches (80a, 80b, 80c, 80d, 80e) de ladite station de ramassage (2) vers ladite station de libération (3).
7. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** la largeur prédéterminée dudit angle de rotation est essentiellement 90° pour un agencement des planches (80c, 80d, 80e) dudit deuxième groupe de planches essentiellement à angle droit par rapport aux planches (80a, 80b) dudit premier groupe de planches dans ladite station de libération (3).
8. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit premier groupe de pinces comprend deux pinces latérales extérieures (40a, 40b), qui peuvent

être actionnées pour saisir deux planches (80a, 80b) qui constituent ledit premier groupe de planches.

9. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ledit deuxième groupe de pinces (41a, 41b, 41c, 41d, 41e) comprend une pince centrale (41a), qui est adaptée pour saisir une planche centrale (80d) et deux paires de pinces latérales internes (41b, 41c, 41d, 41e) qui sont agencées latéralement et sur des côtés mutuellement opposés par rapport à ladite pince centrale (41a) et sont adaptées pour saisir deux planches latérales (80c, 80e) qui sont parallèles à ladite planche centrale (80d) ; ladite planche centrale (80d) et lesdites planches latérales (80c, 80e) constituant ledit deuxième groupe de planches.

5
10
15

10. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits moyens de positionnement (5) comprennent un convoyeur à chaîne (10) qui forme ladite surface de repos (11), et des butées (13) pour arrêter les planches (80a, 80b, 80c, 80d, 80e) déposées transversalement sur les chaînes dudit convoyeur à chaîne (10) et entraînées par celles-ci le long d'une direction d'avancement (12).

20
25

11. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** ladite direction d'avancement (12) est essentiellement parallèle à ladite direction de transfert (4).

30

12. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce que** lesdits moyens de positionnement (5) comprennent des butées latérales mutuellement opposées (15) pour les extrémités longitudinales desdites planches (80a, 80b, 80c, 80d, 80e) qui sont agencées sur ladite surface de repos (11) dans ladite station de ramassage (2).

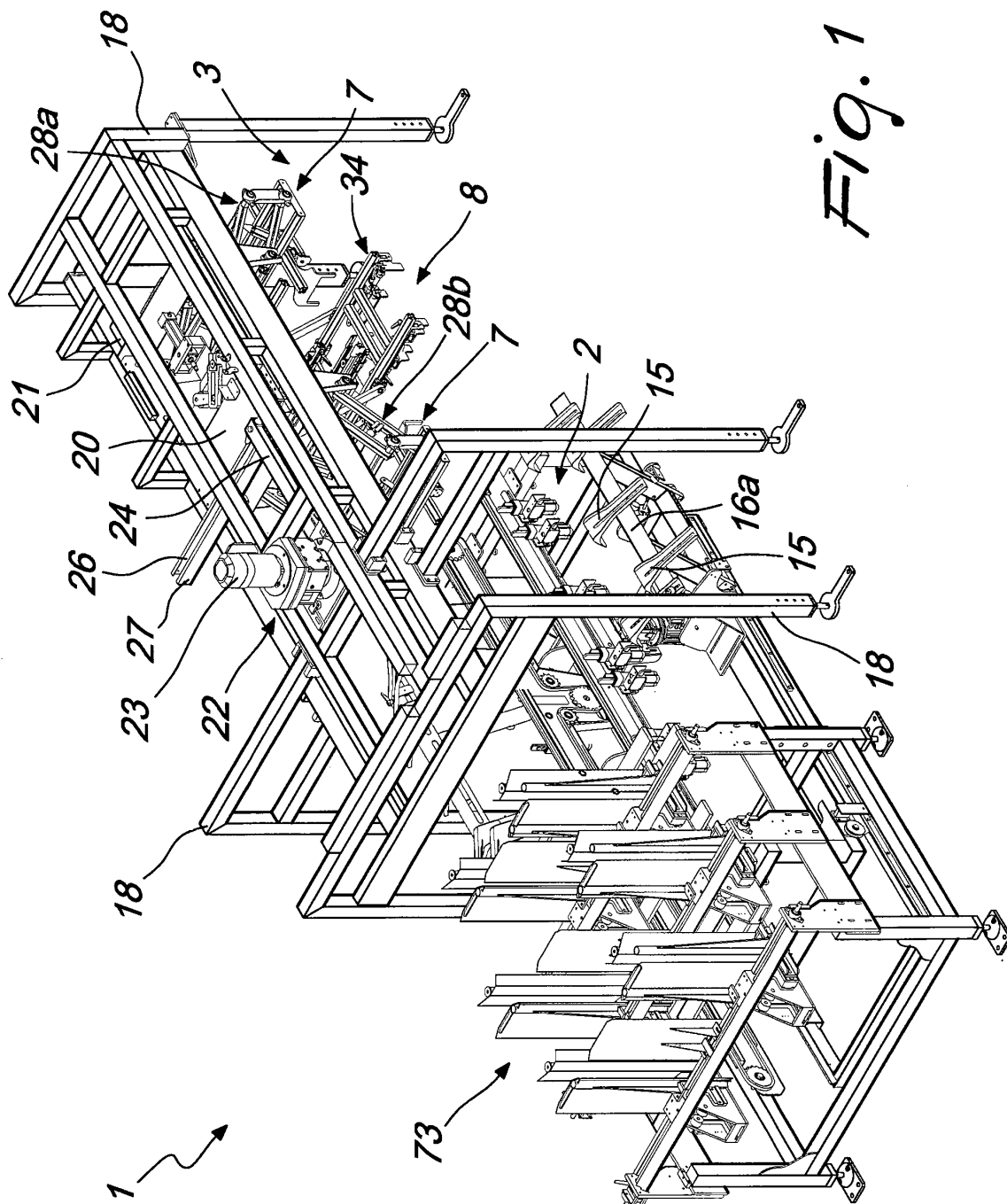
35
40

13. Dispositif d'alimentation (1) selon l'une ou plusieurs des revendications précédentes, **caractérisé en ce qu'il** comprend des moyens (67) pour compacter lesdites planches (80a, 80b, 80c, 80d, 80e) dans ladite station de libération (3).

45

50

55



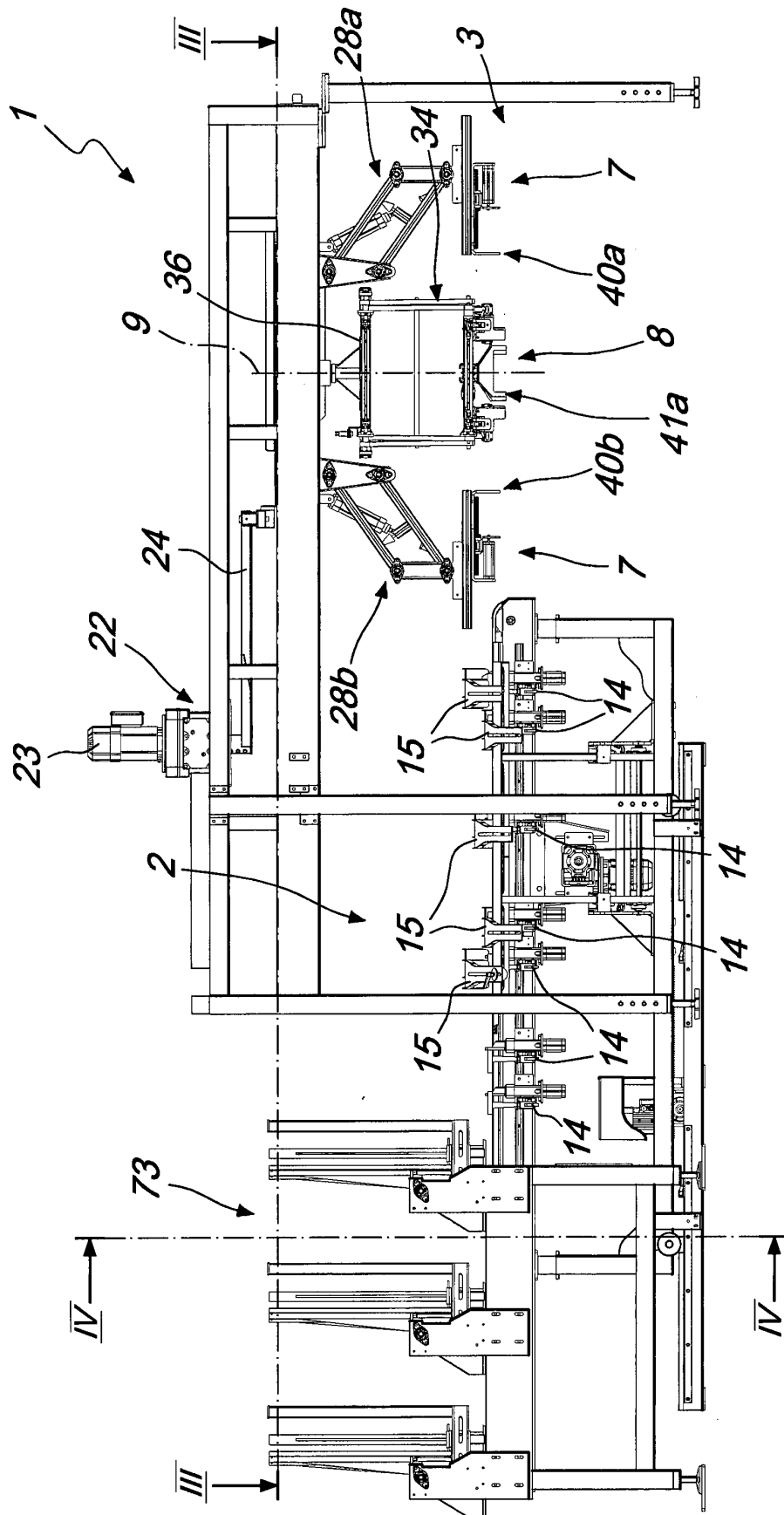
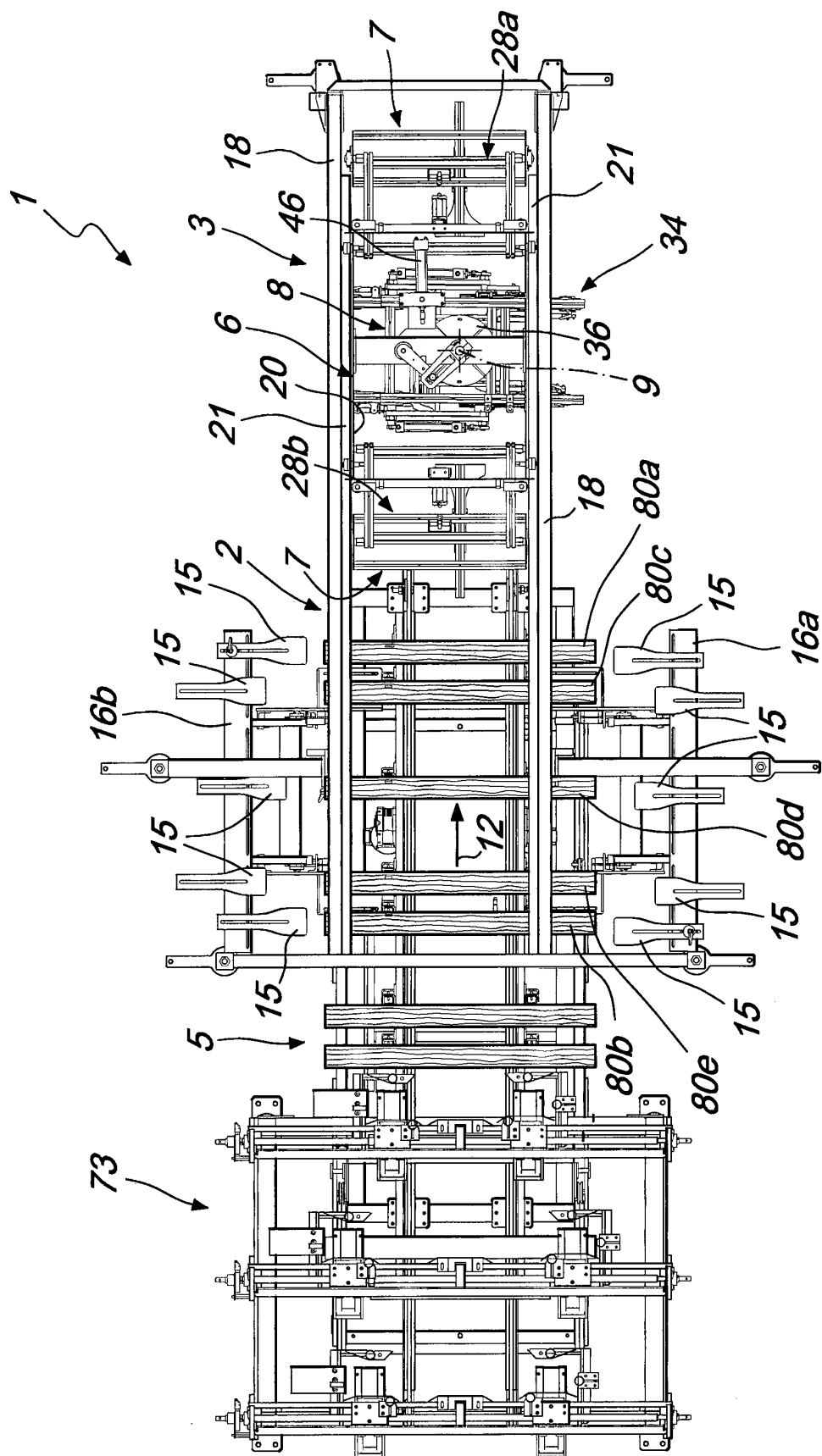


Fig. 2



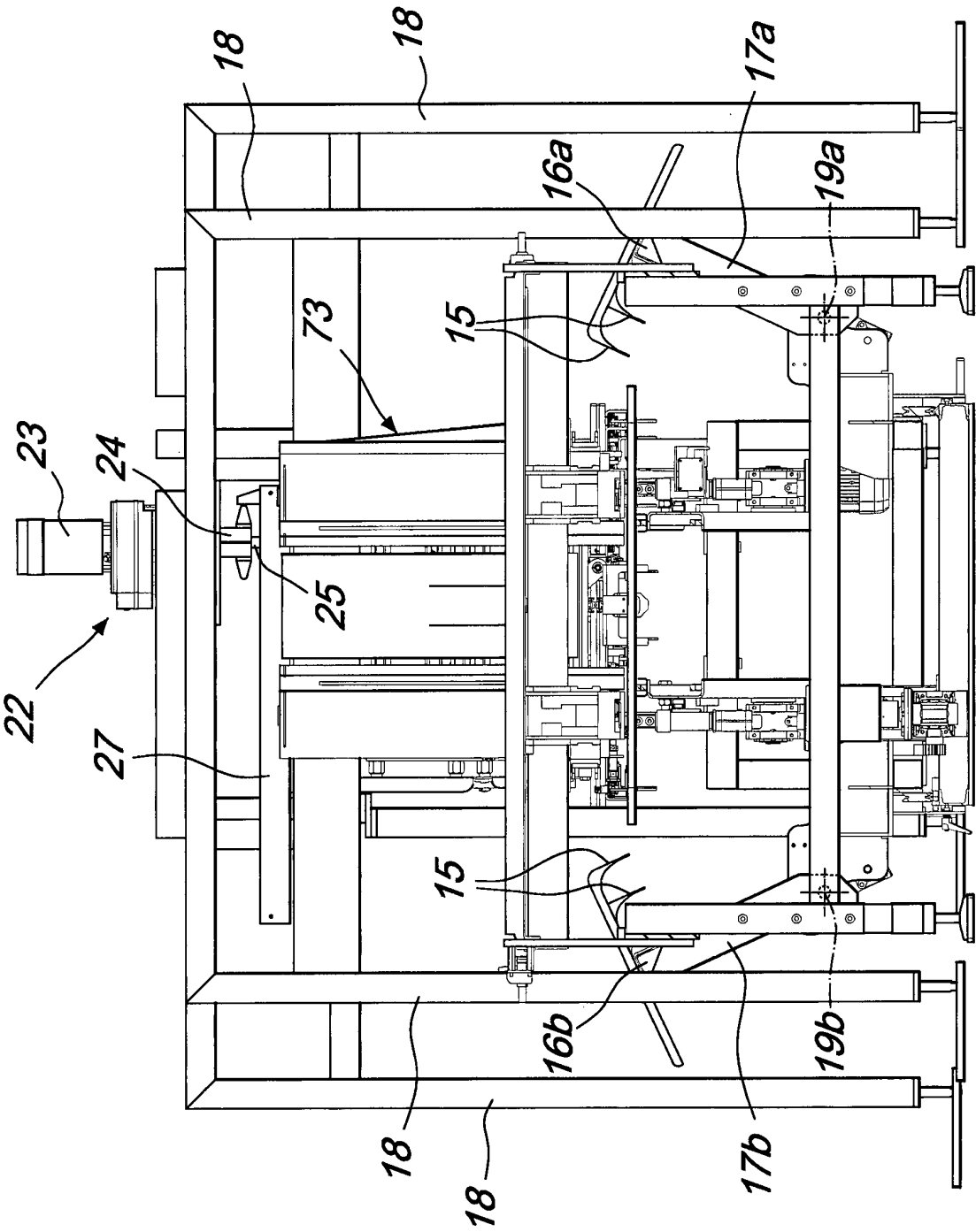


Fig. 4

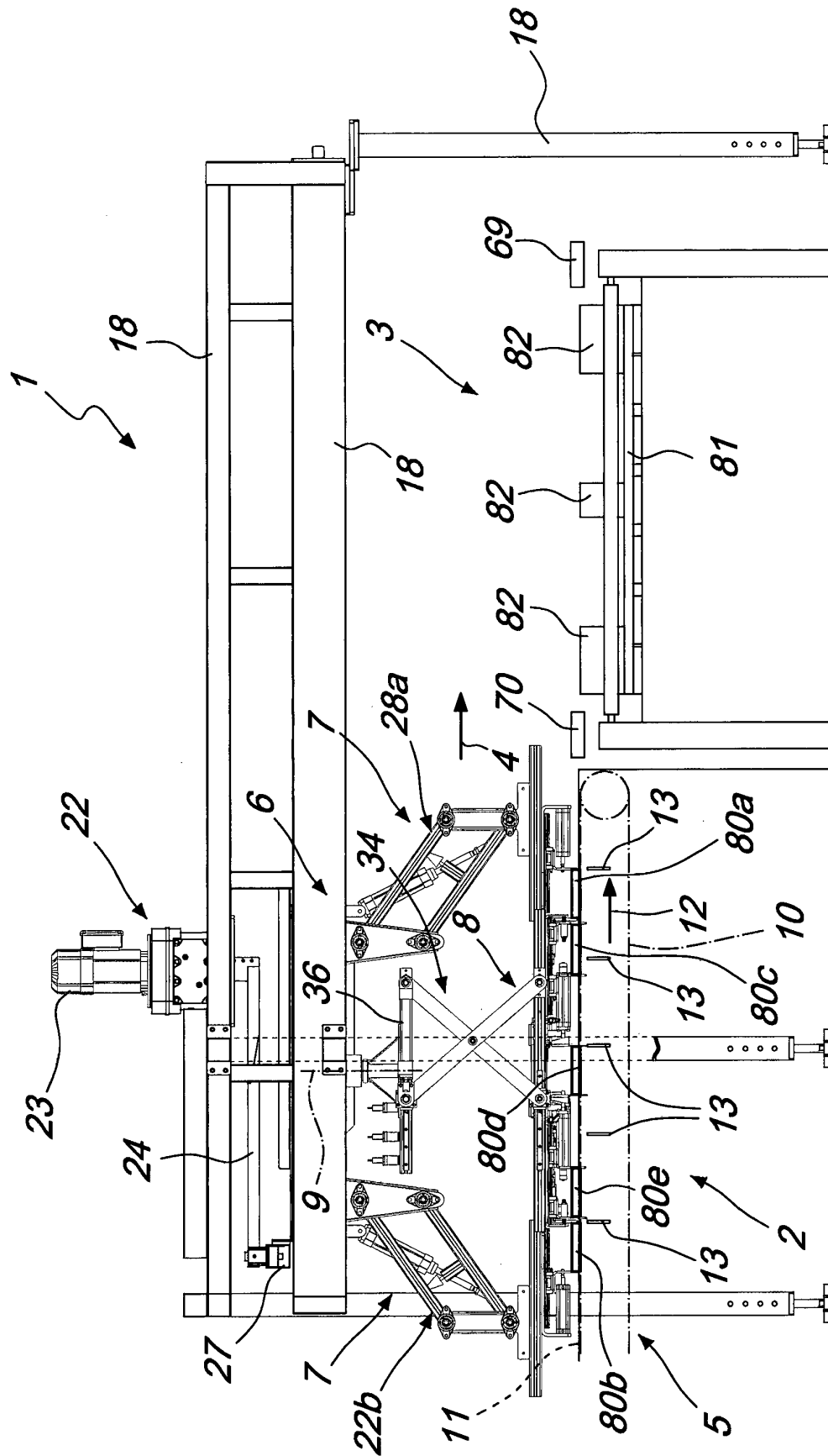


Fig. 5

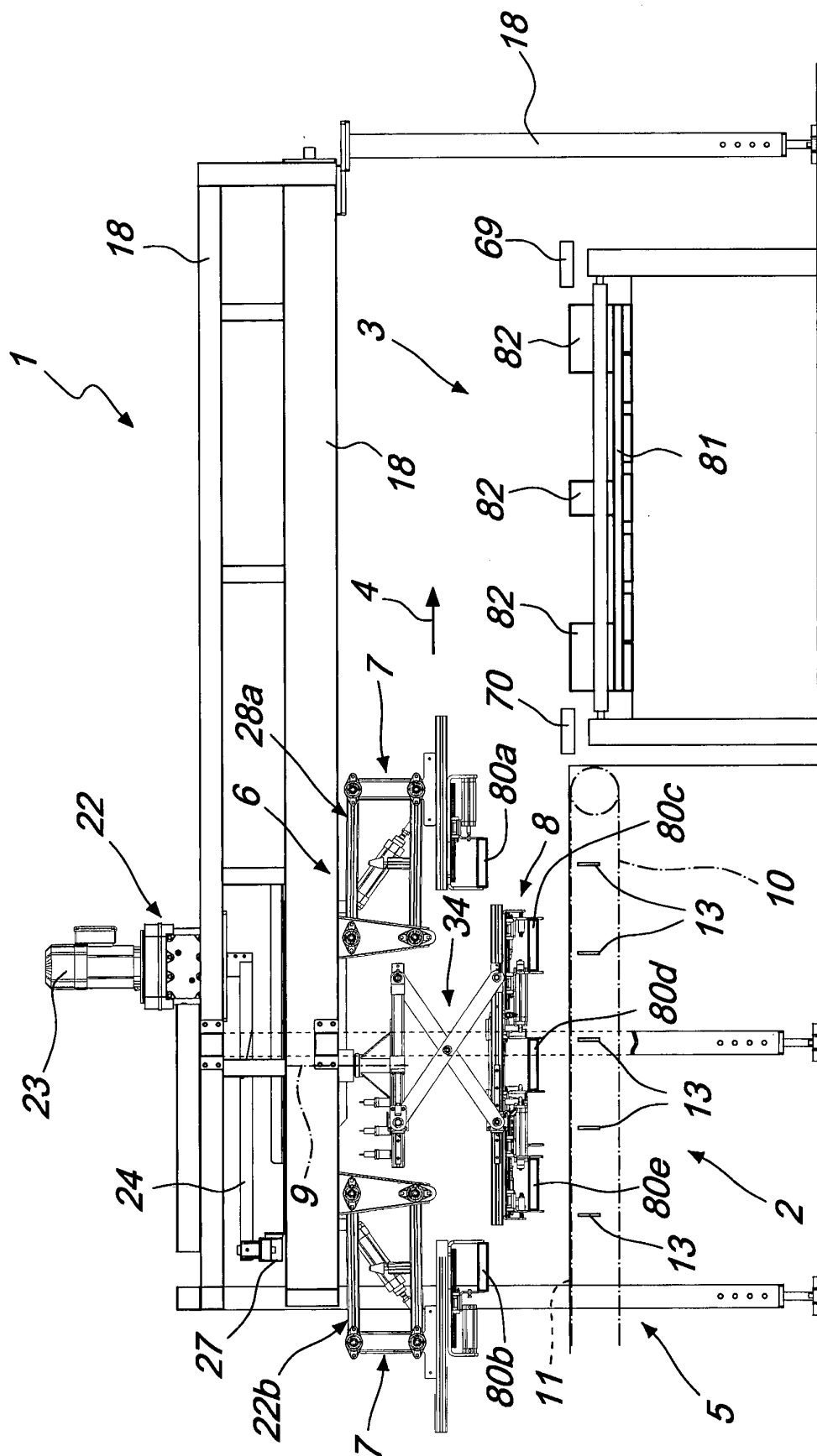


Fig. 6

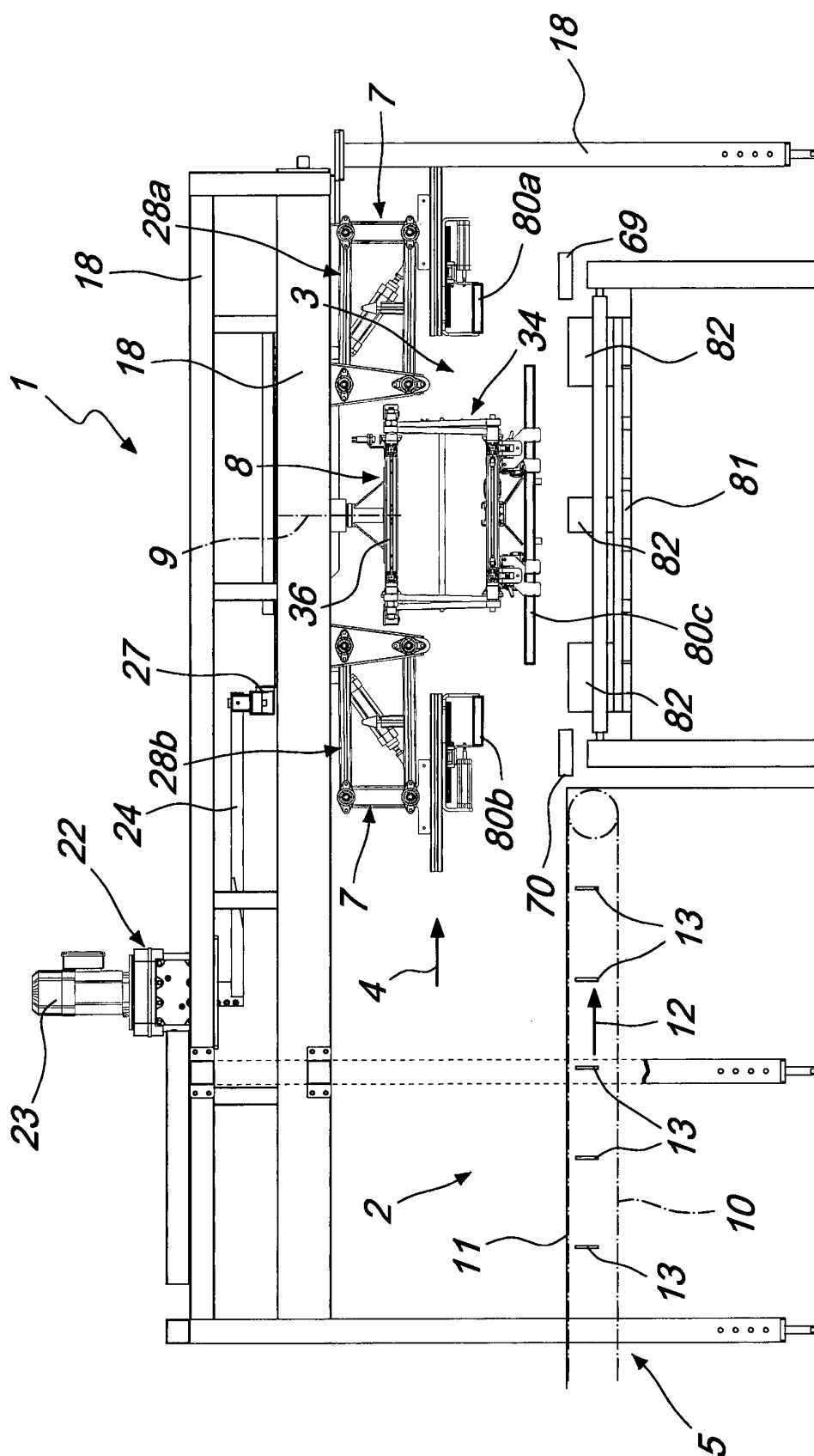


Fig. 7

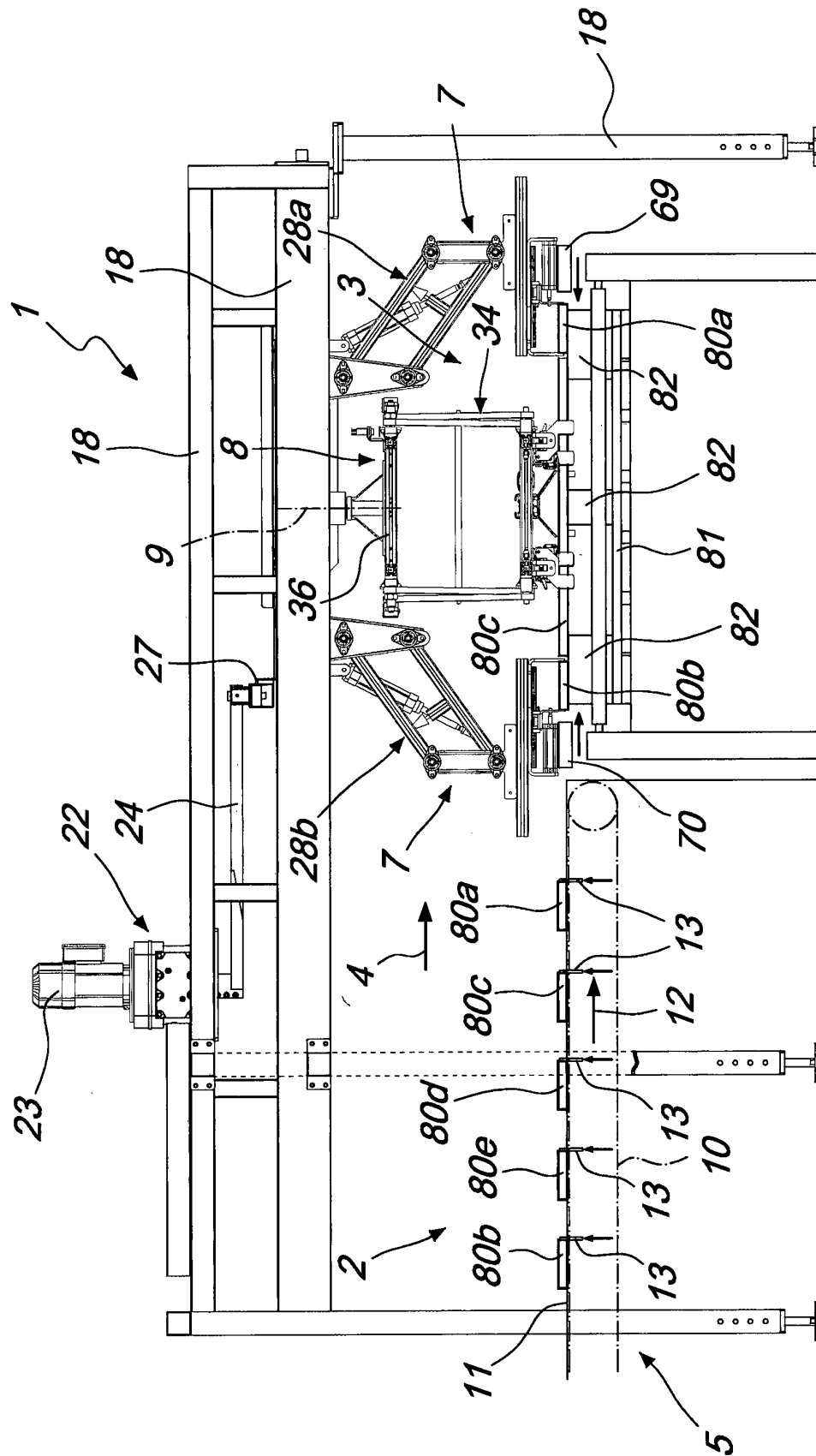
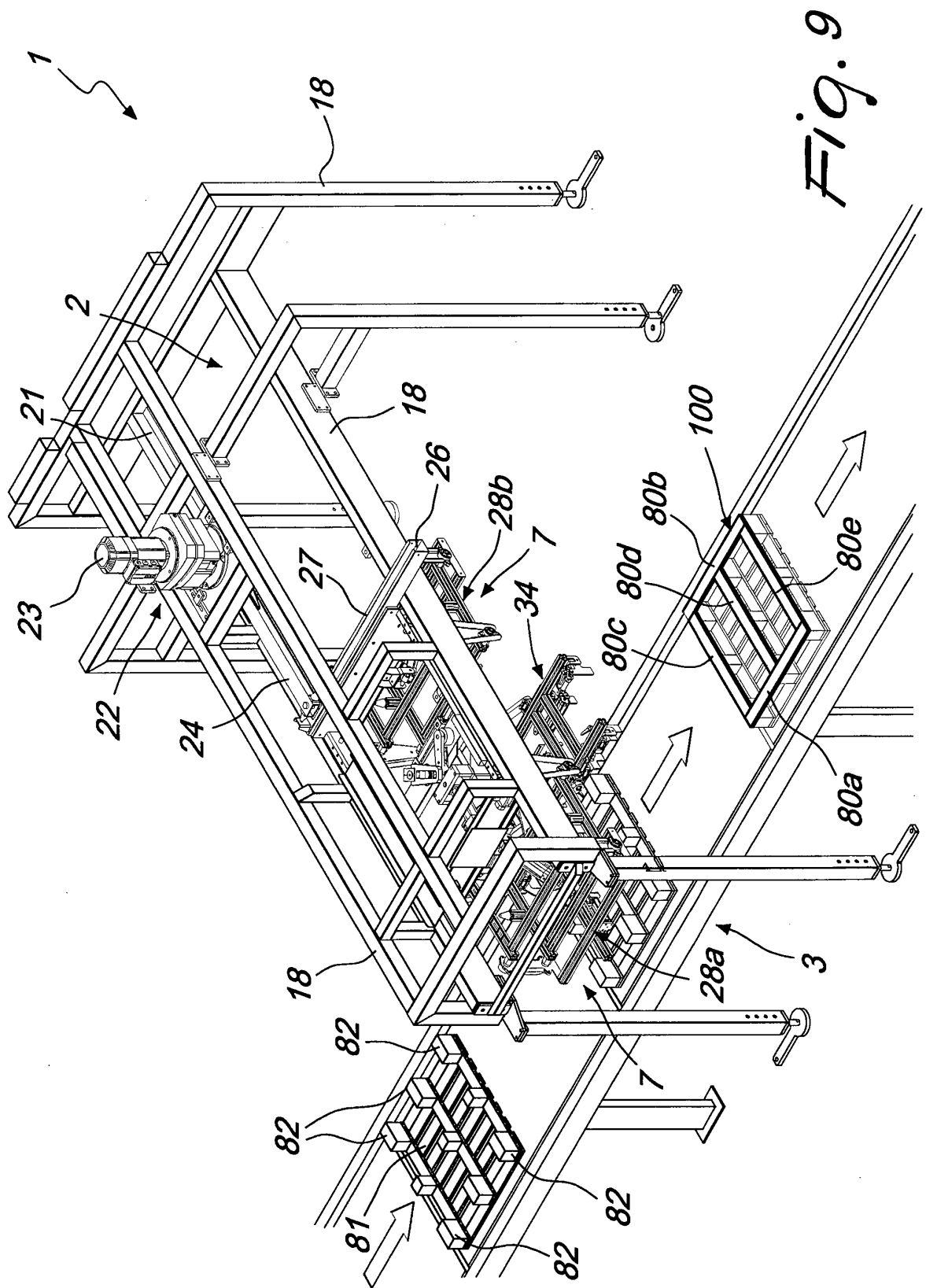
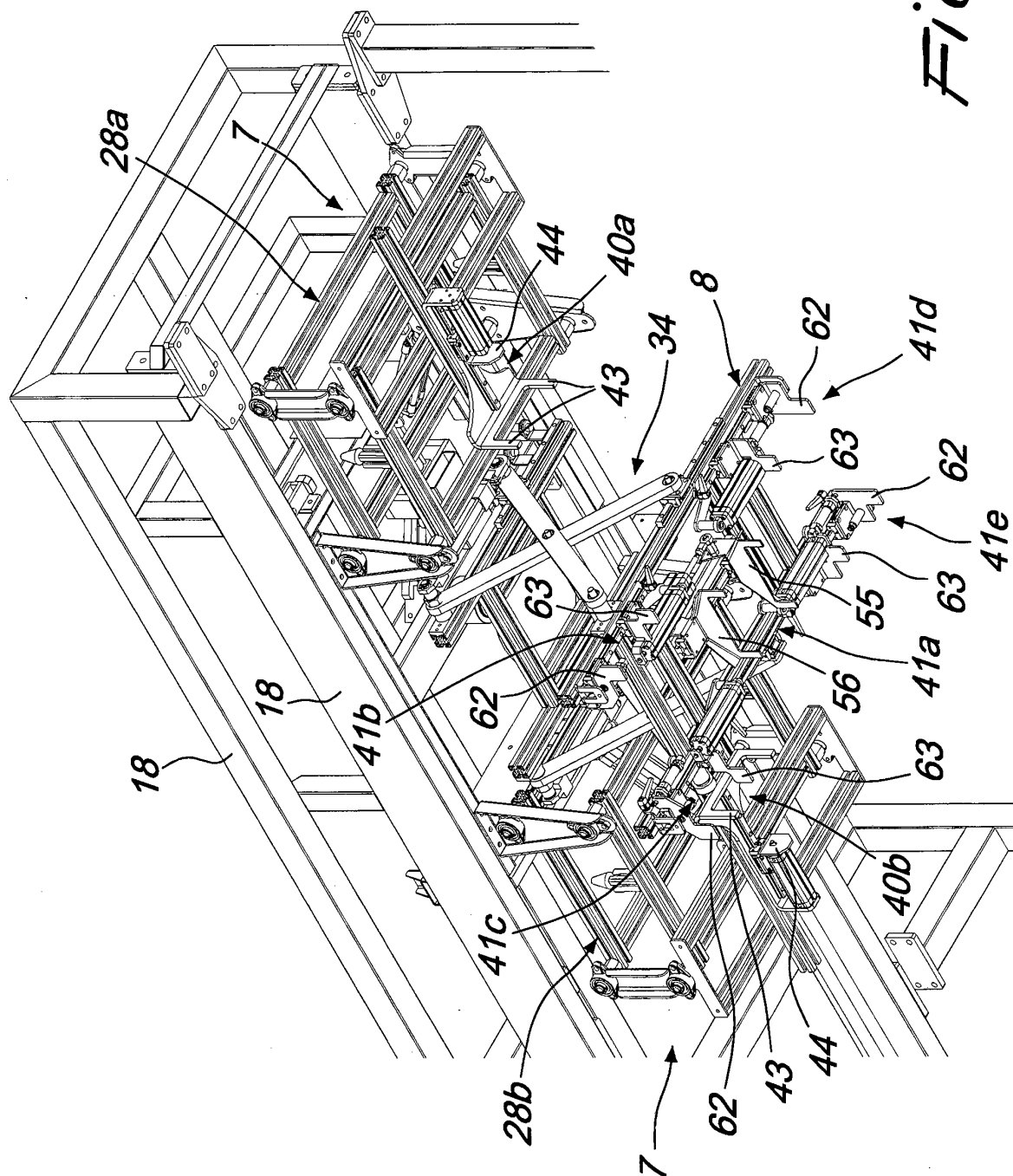


Fig. 8





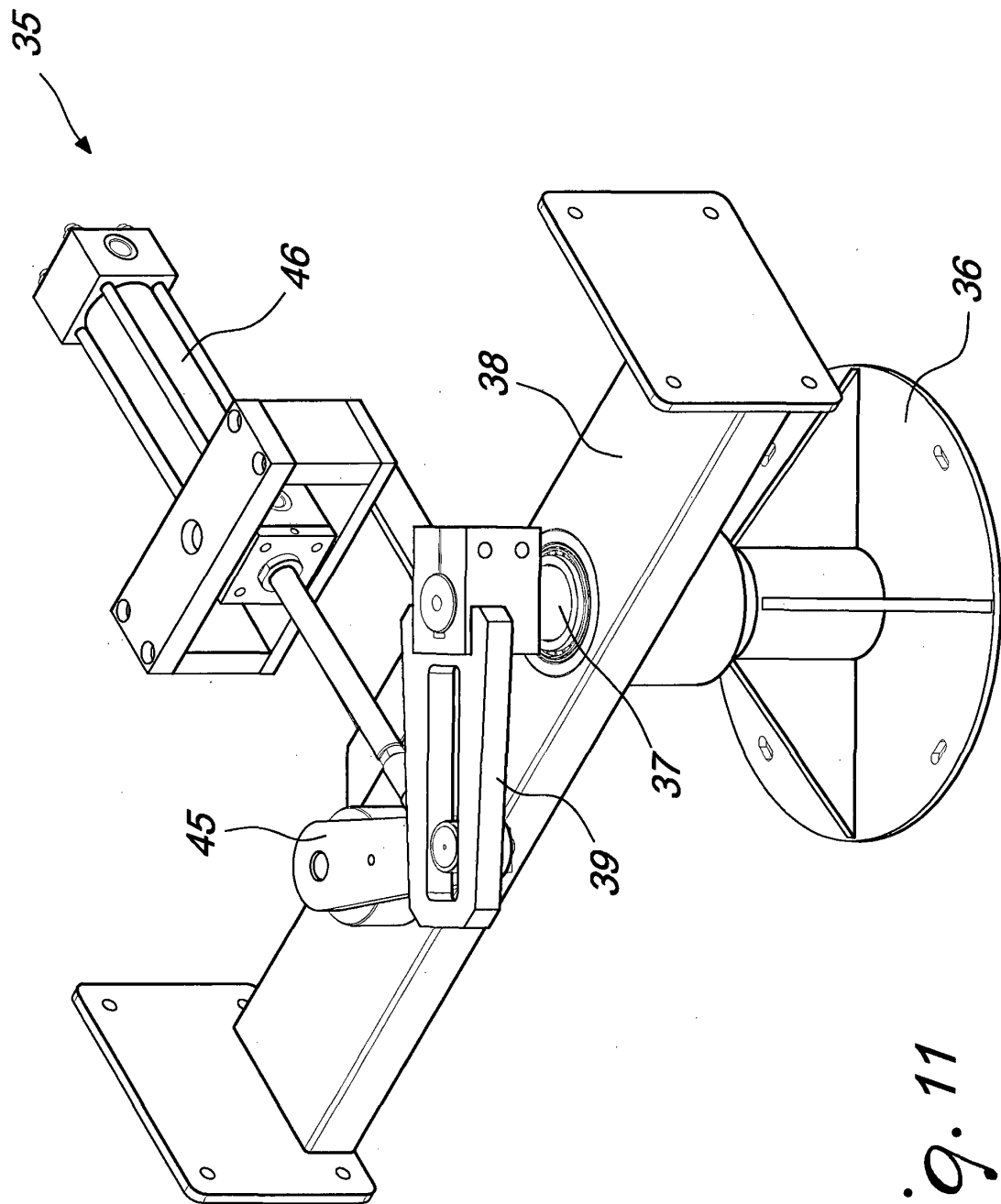


Fig. 11

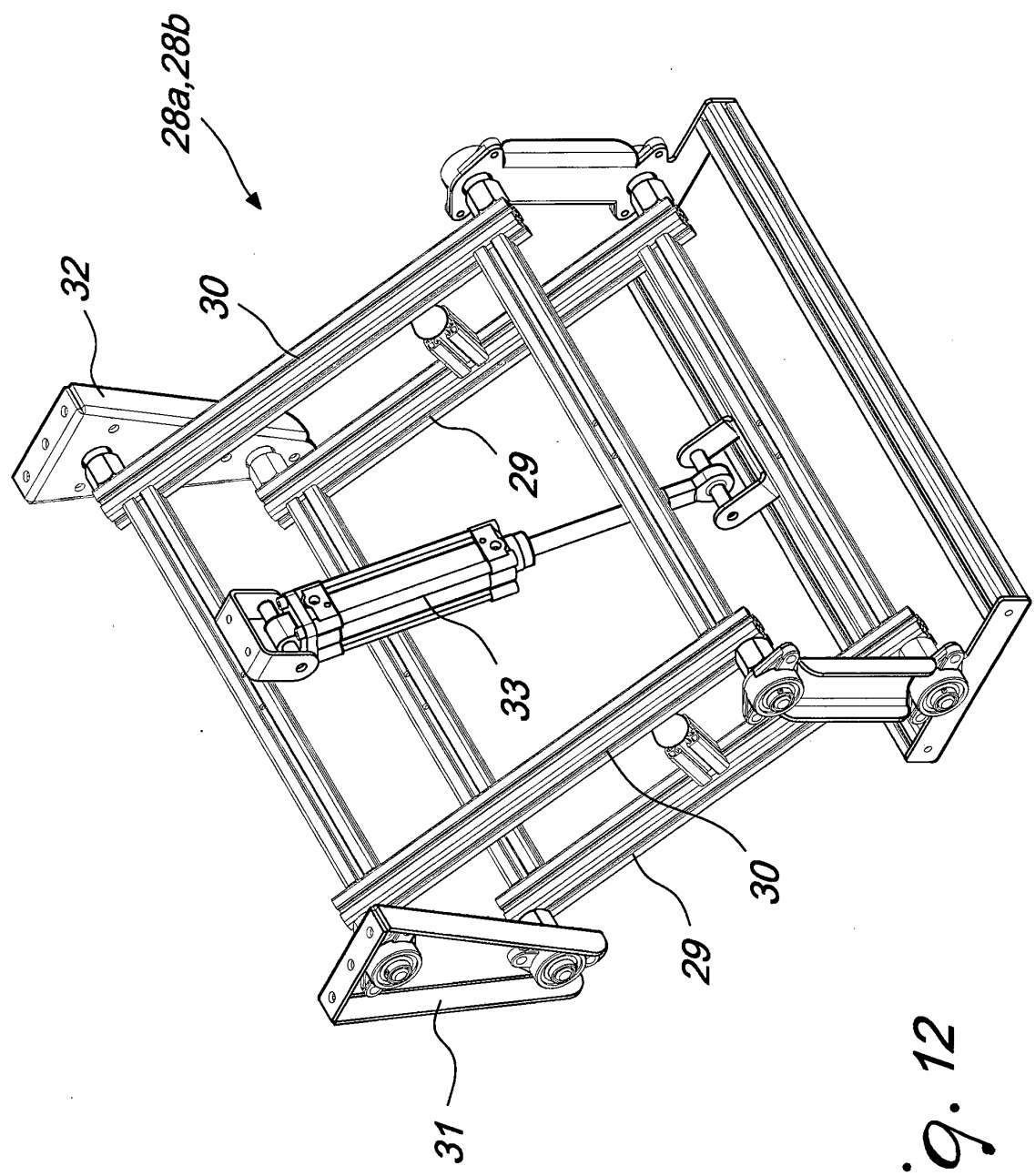


Fig. 12

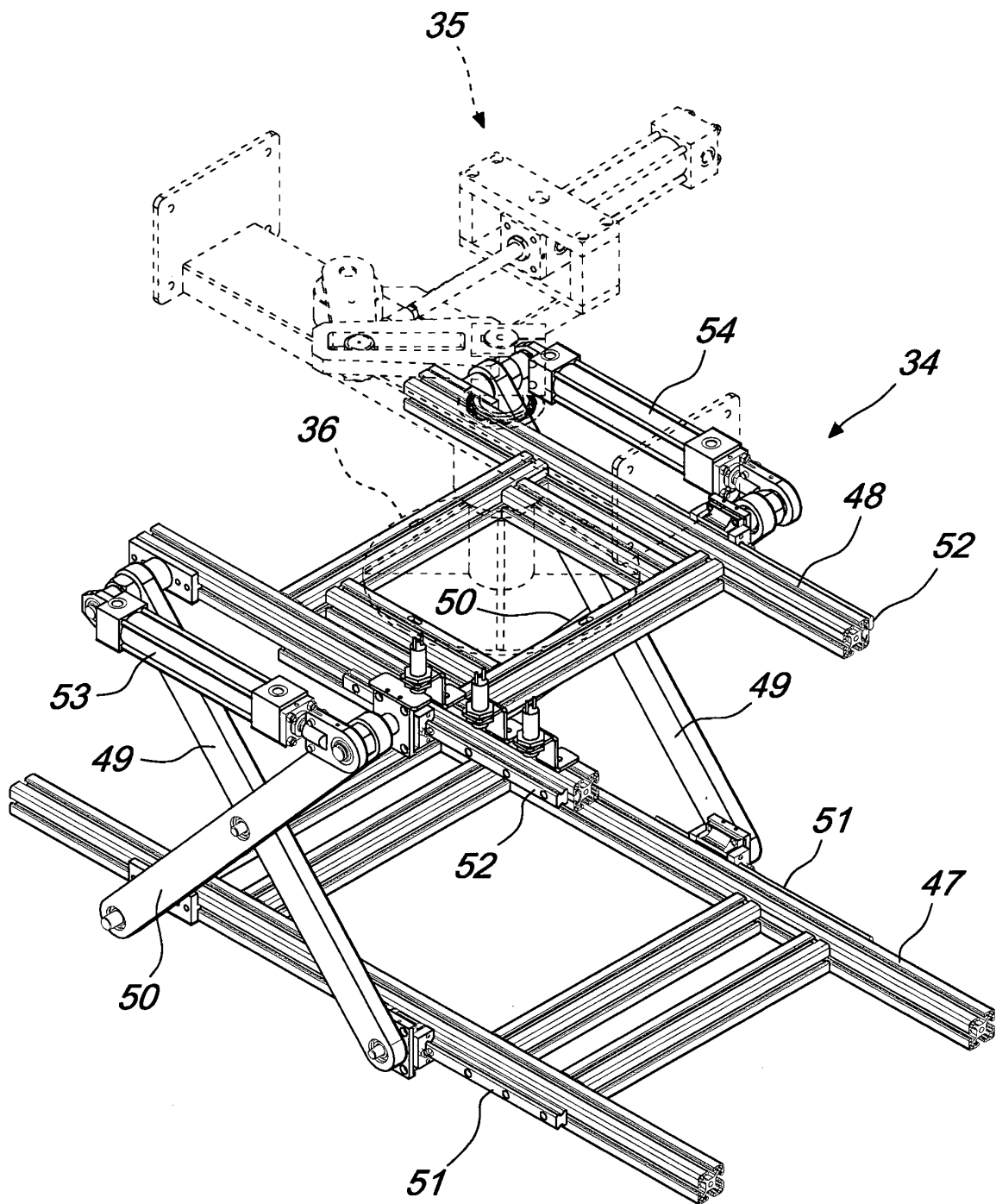


Fig. 13

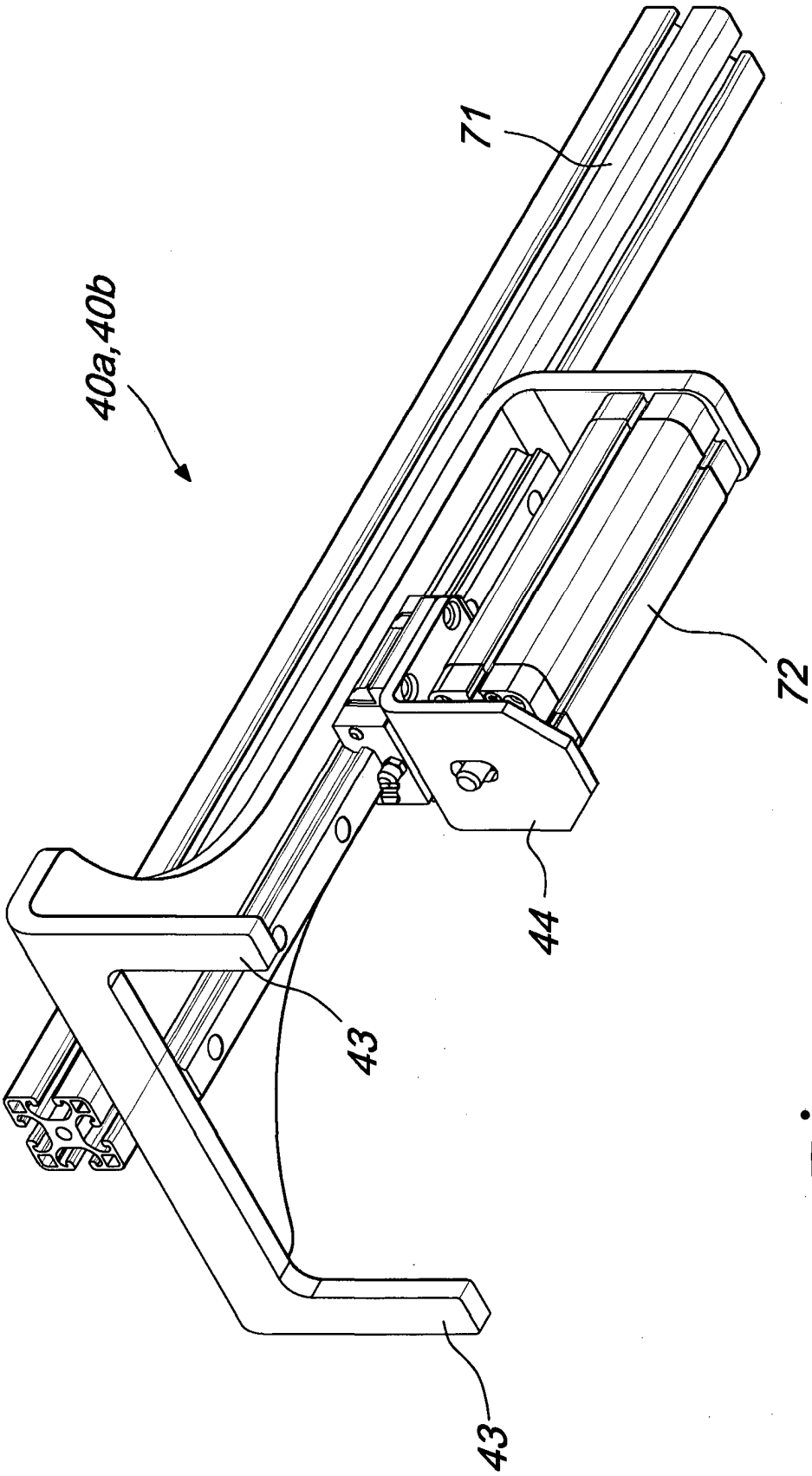
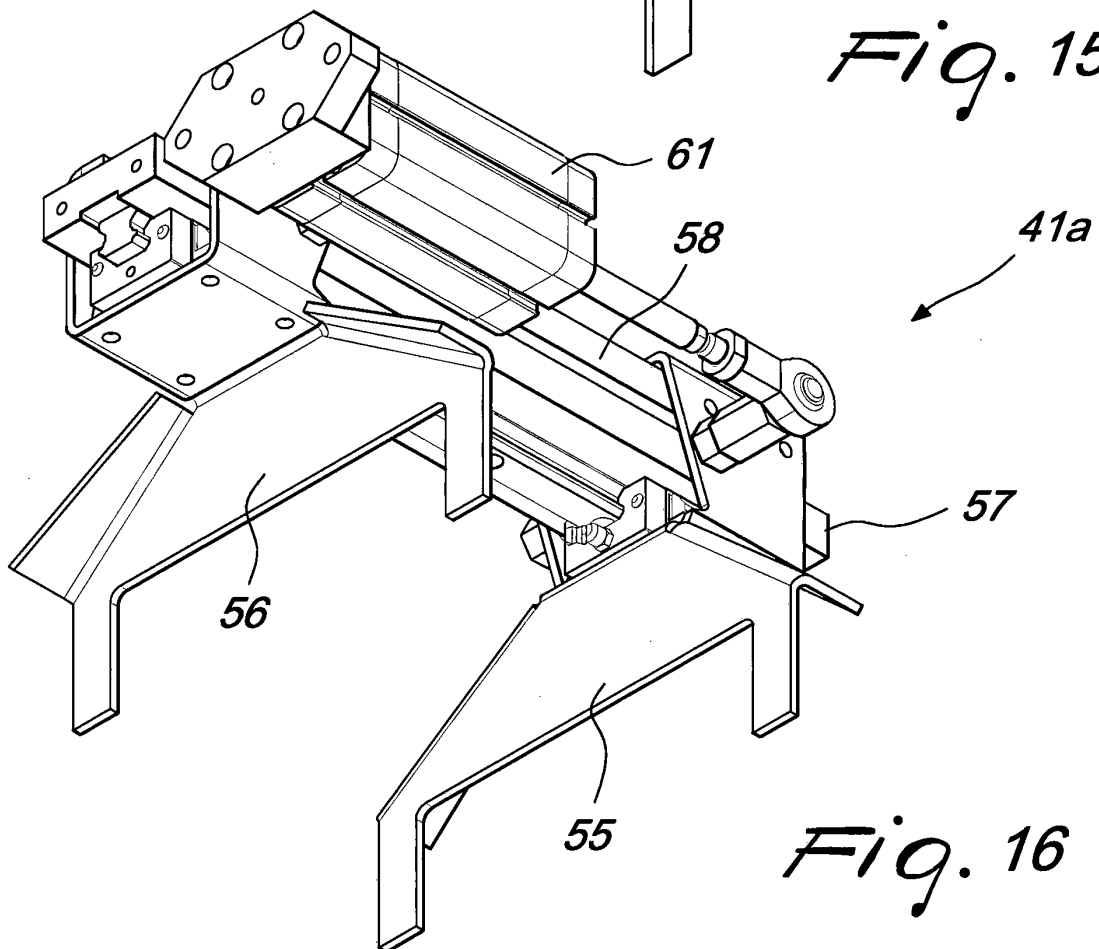
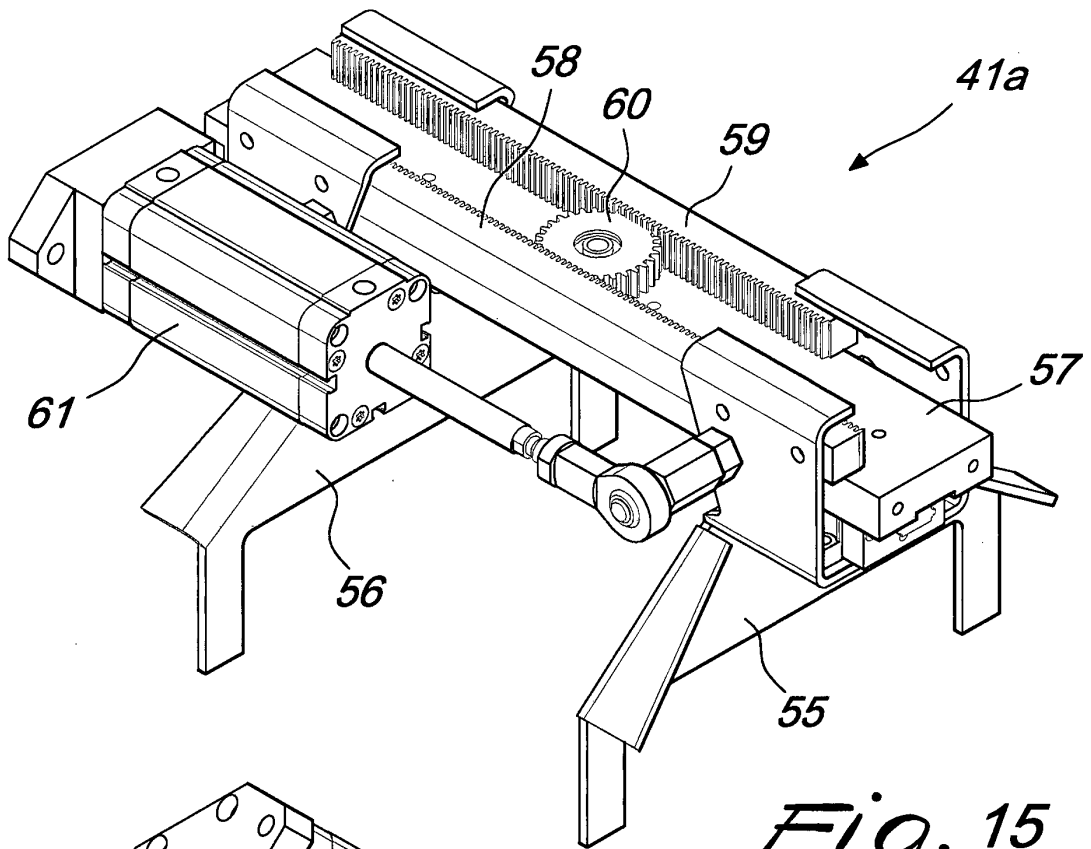


Fig. 14



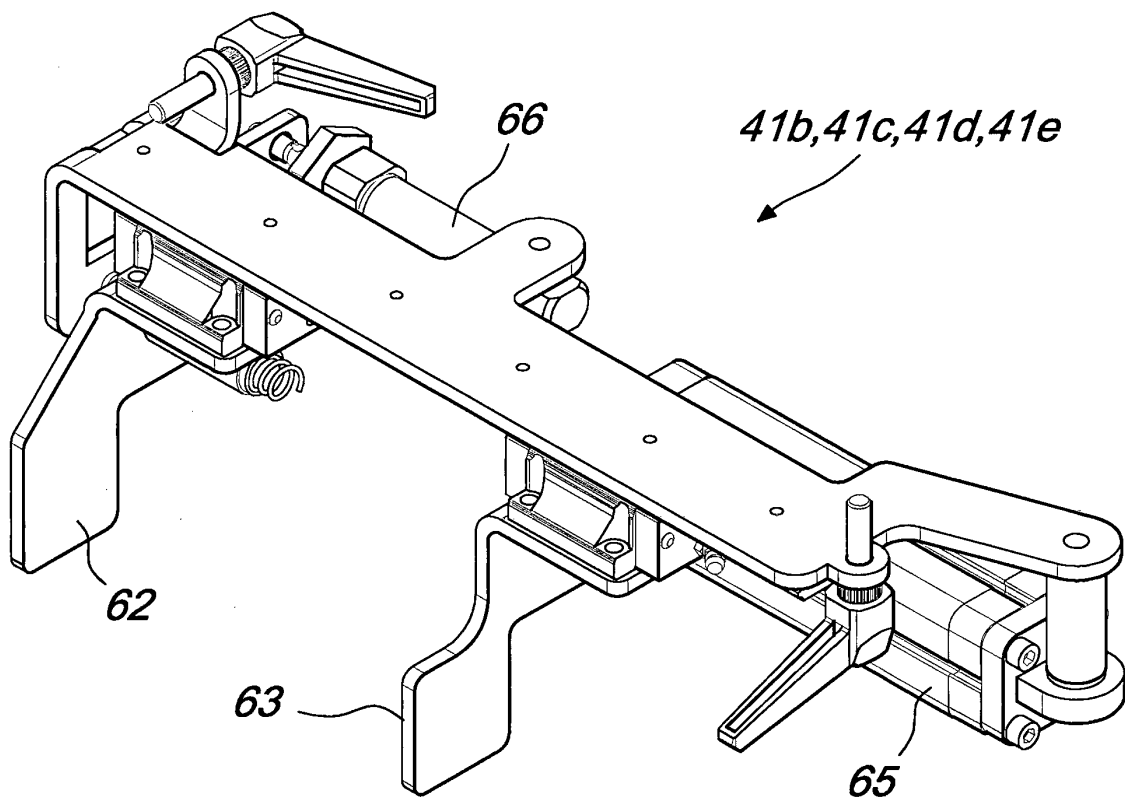


Fig. 17

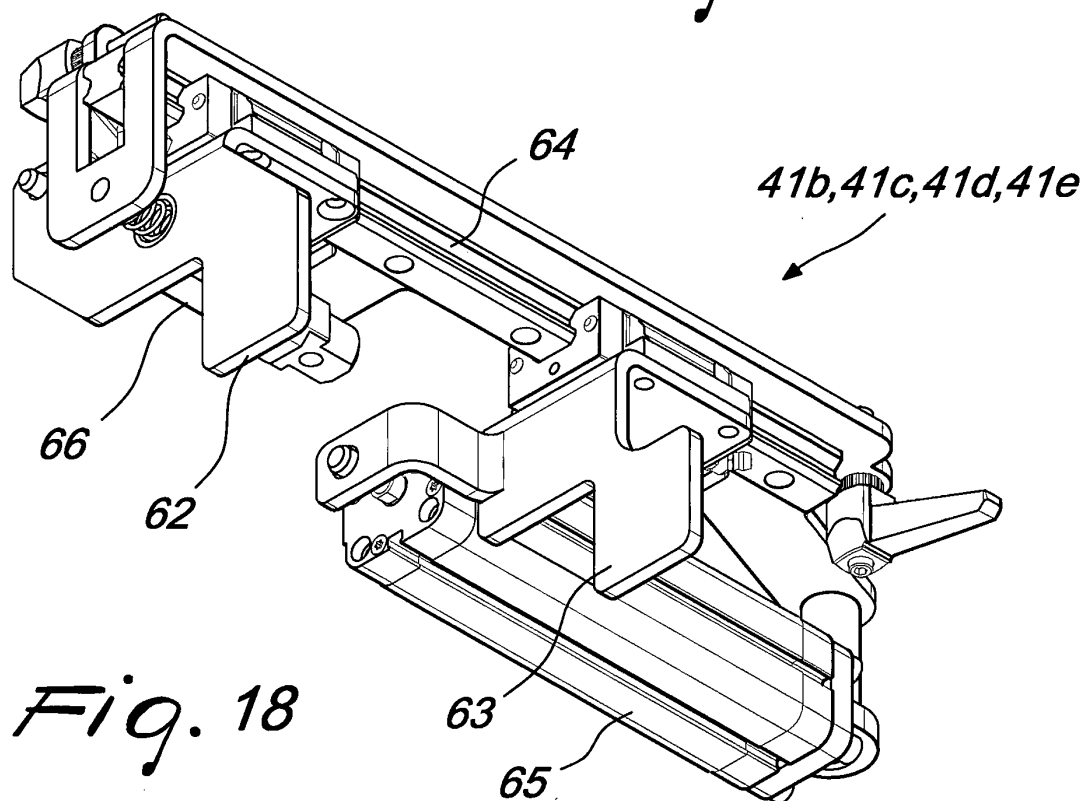


Fig. 18

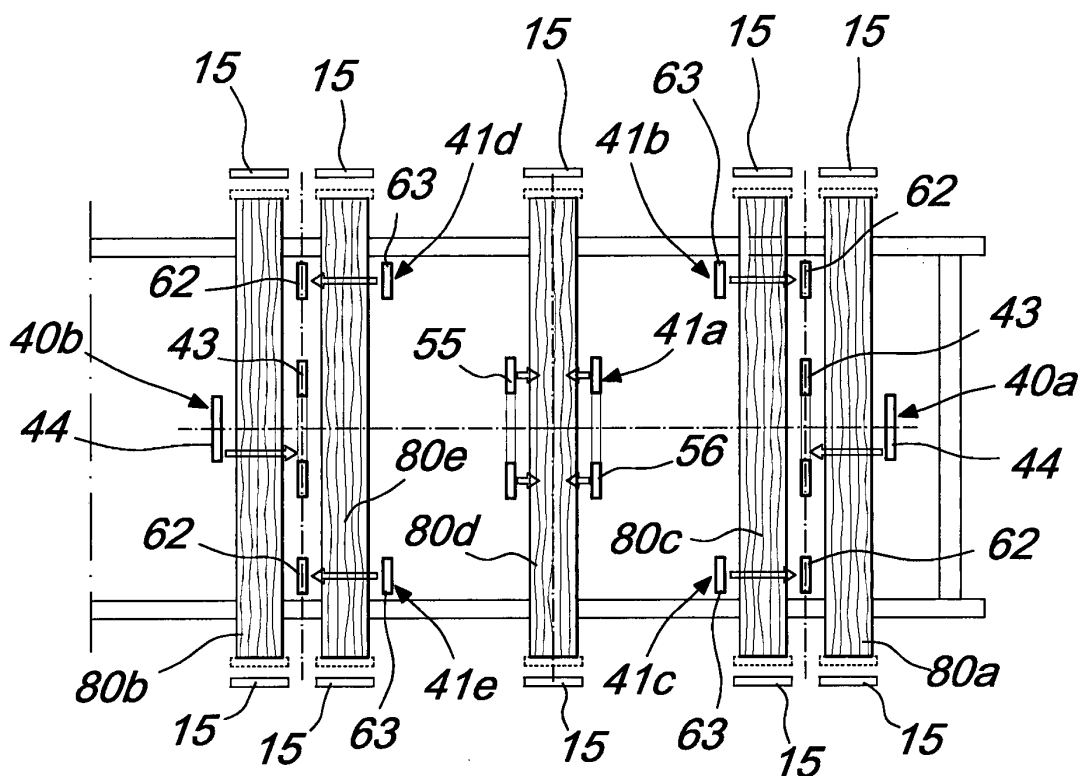


Fig. 19

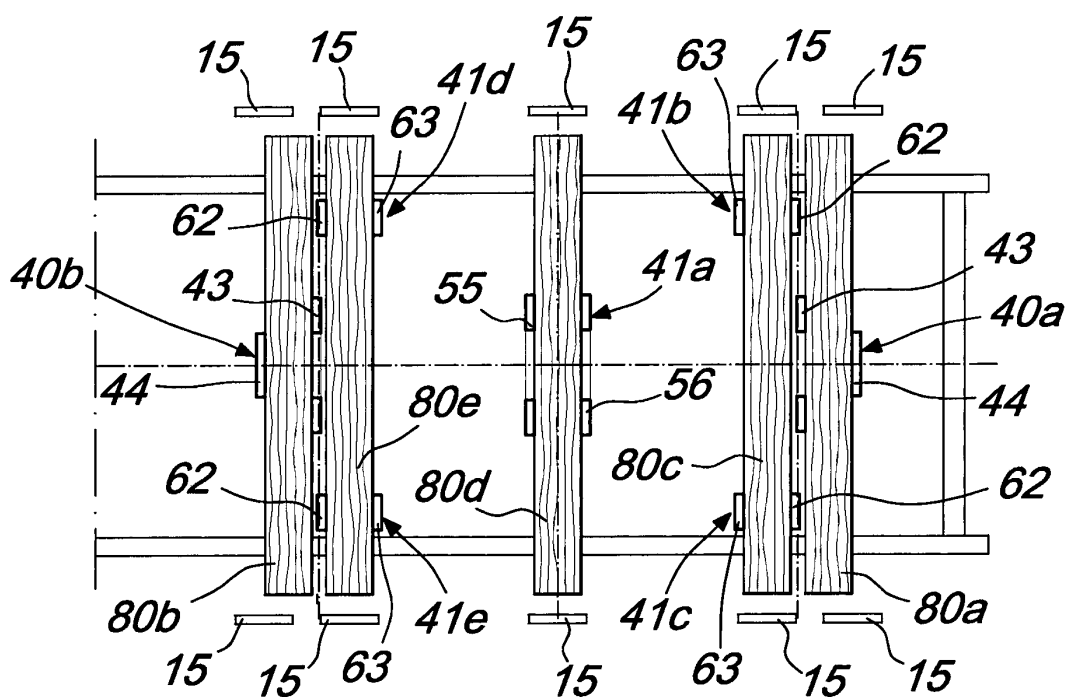
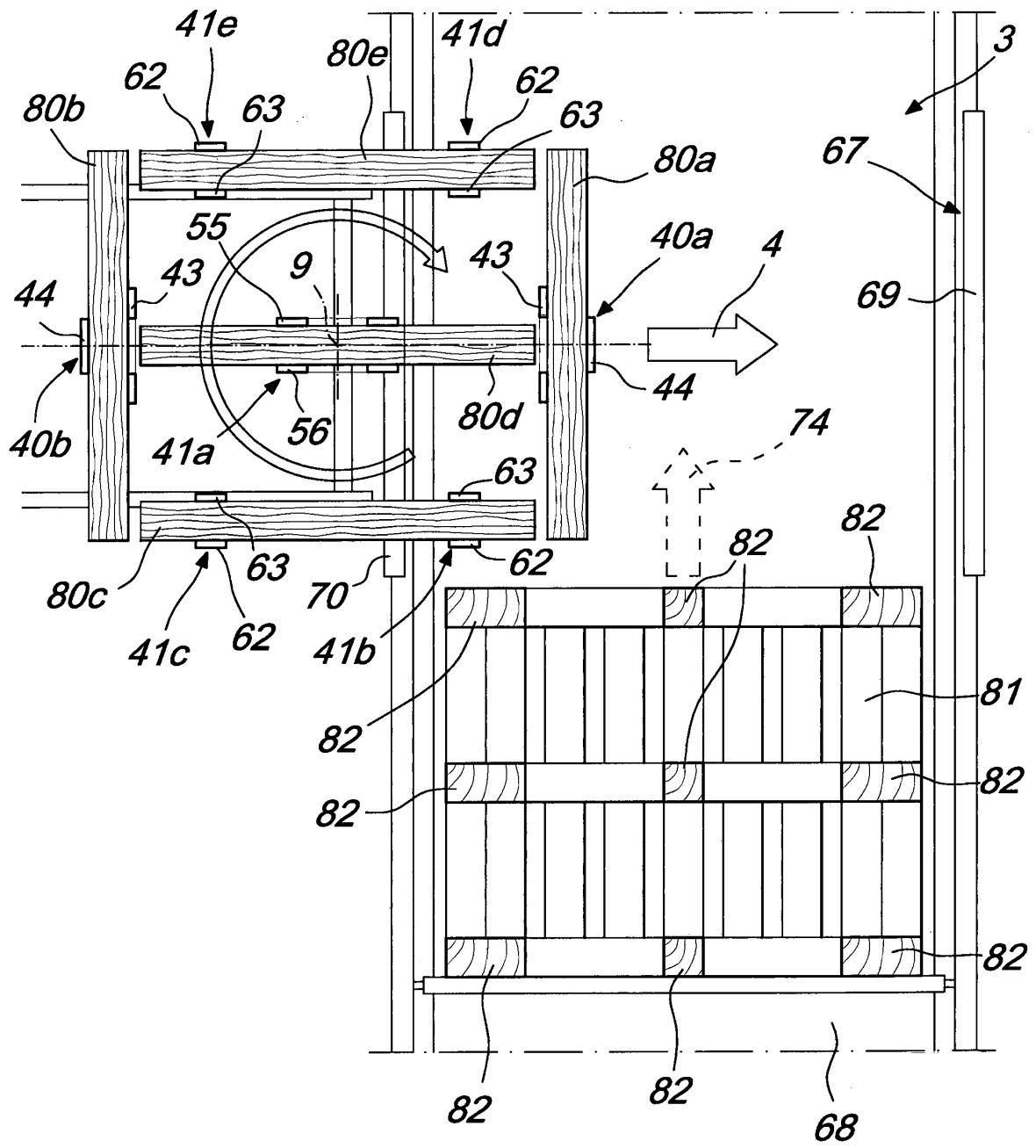


Fig. 20



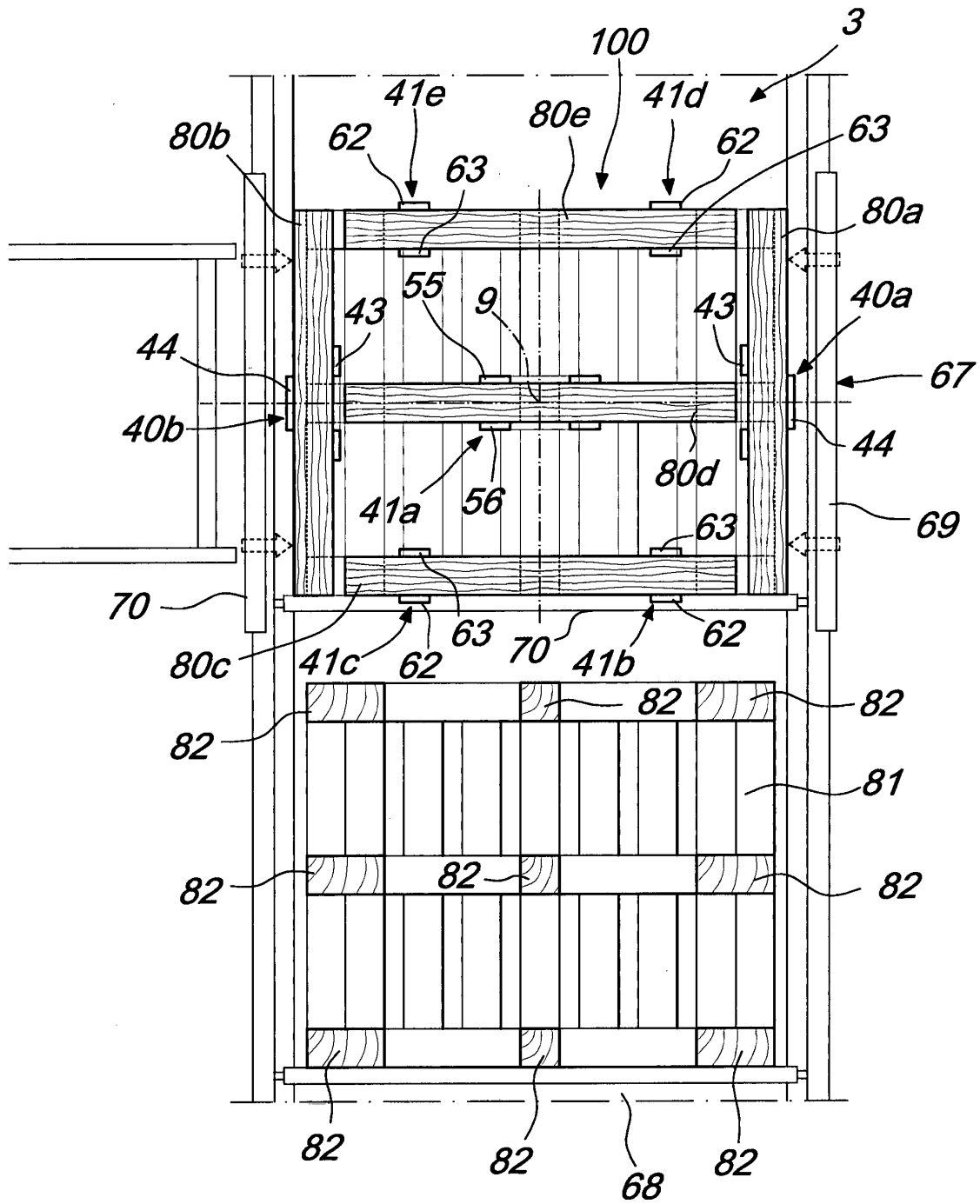


Fig. 22

REFERENCES CITED IN THE DESCRIPTION

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

Patent documents cited in the description

- FR 2949701 A [0001]