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(54) **A LOADING MACHINE AND METHOD FOR LOADING A PLURALITY OF PACKAGES INTERNALLY OF A CRATE**

(57) A loading machine (1) for loading a plurality of packages (2) internally of a crate (3), comprising: a first conveyor (4); a second conveyor (5); a support (6) arranged at a loading zone (C) for restingly receiving the crate (3) conveyed by the second conveyor (5); the support (6) is rotatable with respect to an axis of rotation (Z) in order to rotate between a first position (A) and a second position (B), wherein it can arrange the crate (3) inclined with respect to a horizontal plane (XY) by an angle (α); gripping and loading means (9) which are arranged so as to pick up the packages of the plurality of packages (2) and to load the packages internally of the crate (3) so

as: to load the first package (2a) internally of the crate (3) so as to be stably resting against the first lateral wall (3b) and the bottom (3a) of the crate (3); to load the second package (2e) internally of the crate (3) so as to be stably resting against the second face (2c) of the first package (2a) and against the bottom (3a) of the crate (3); and to load the remaining packages of the plurality of packages (2) internally of the crate (3) in order to be stably resting against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3).

EP 3 757 022 A1

Description

DESCRIPTION OF THE INVENTION

[0001] The present invention relates to the technical sector concerning the loading of packages internally of a crate. In particular, the present invention relates to a loading machine for loading a plurality of packages internally of a crate. A crate comprises a bottom and lateral walls which rise from the bottom, while a package comprises one or more articles internally thereof, two opposite faces and a plurality of flanks interposed between the faces. A loading machine is known for loading a plurality of packages internally of a crate. This loading machine can load the packages in the crate so that: in a first operating mode, the packages are orientated horizontally and are arranged in flanked stacks; or, in a second operating mode, the packages are orientated vertically and are in flanked stacks. The known loading machine comprises: a first conveyor for conveying a plurality of packages; a second conveyor for conveying a crate to be loaded with the packages of the plurality of packages; gripping and loading means, for example, an anthropomorphic robot, which are arranged to pick up the packages of the plurality of packages from the first conveyor and to load the packages in the crate arranged on the second conveyor.

[0002] In the first operating mode, the second conveyor moves the crate, keeping it horizontally orientated, up to reaching a loading zone where the crate is halted and loaded with the packages in arrival from the first conveyor.

[0003] In order to pass to the second operating mode, it is necessary to halt the loading machine and predispose guides for the crate (known as "Toboggans") which enable the crate to reach an inclined position at the loading zone. In this way, the gripping and loading means, owing to gravitational action, can operate as follows: they load a first package internally of the crate so as to be stably resting, on a relative first face and a flank thereof, respectively against a first lateral wall of the crate and against the bottom of the crate; they load a second package internally of the crate so that the crate is stably resting, on a relative first face and a flank thereof, respectively against a second face, opposite the first face, of the first package and against the bottom of the crate; and they load the remaining packages internally of the crate in such a way that they are stably resting, by means of a relative face and a flank, respectively against a face of a package previously arranged internally of the crate and against the bottom of the crate.

[0004] The guides are configured in such a way that: the crate, initially horizontally orientated relative to the inlet of the second conveyor, gradually reaches, progressively as it nears the loading zone, the inclined position; and the crate, once loaded, returns to assume, still gradually, its original horizontal orientation at the outlet of the second conveyor. The crate must reach the inclined po-

sition and then a horizontal position in a gradual way, with the aim of preventing jamming, malfunctioning or tilting of the crate. The guides are however complex, expensive and require that the second conveyor has a significant extension so that the crate can pass from a horizontal orientation to an inclined position, and vice versa, in a gradual way.

[0005] A further drawback of this loading machine consists in the fact that in order to pass from one mode to the other the loading machine must be halted for a certain time, precisely due to the fact that the mounting or demounting of the guides is a laborious task.

[0006] The aim of the present invention consists in obviating the above-mentioned drawbacks.

[0007] The above aims are attained by means of a loading machine of a plurality of packages internally of a crate, according to claim 1 and by means of a loading method of a plurality of packages internally of a crate according to claim 11.

[0008] The crate can travel maintained in a horizontal orientation on the second conveyor until it reaches the support, i.e. the loading zone described in the foregoing, where it is halted: at this point, if the loading machine is to operate according to the second operating mode, then the support, which is rotatable, can be activated in rotation to pass from the first position to the second position, wherein it can arrange the crate to be inclined with respect to a horizontal plane. The crate can thus be loaded with the packages. The support can then be activated in rotation to return the crate, loaded packages, to the previous horizontal orientation, i.e. the first position. The crate can then be newly moved by the second conveyor.

[0009] It is advantageously no longer necessary to use the guides described in the foregoing with reference to the loading machine of known type. Further, also the length of the second conveyor can be significantly reduced with respect to the prior art. Further, the passage of the first operating mode to the second operating mode, and vice versa, is simple and rapid and can be managed from a computer.

[0010] The first abutment and the first pusher member advantageously ensure the locking of the crate on the support, when restingly received by the support, when the support assumes either the first position or the second position.

[0011] Specific embodiments of the invention will be described in the following part of the present description, according to what is set down in the claims and with the aid of the accompanying tables of drawings, in which:

figures 1, 3, 5, 7, 9, 11 and 13 are perspective views, taken from a side of the loading machine of the present invention, according to different operating steps;

figures 2, 4, 6, 8, 10, 12 and 14 are perspective views, taken from another side of the loading machine alike to what is illustrated in figures 1, 3, 5, 7, 9, 11 and 13; figure 15 is a view of detail K of figure 6, where some

components have been removed in order better to evidence others;

figures 16-18 are lateral and perspective views of the detail J of figure 6, where some components have been removed in order better to evidence others, during an operating step;

figures 19-21 are lateral and perspective views of the detail J of figure 6, where some components have been removed in order better to evidence others, during an operating step;

figures 22-24 are lateral and perspective views of the detail J of figure 6, where some components have been removed in order better to evidence others, during a further operating step.

[0012] With reference to the appended tables of drawings, reference numeral (1) denotes a loading machine for loading a plurality of packages (2) internally of a crate (3).

[0013] Each package (2a) comprises one or more articles internally thereof, two opposite faces (2b, 2c) and a plurality of flanks (2d) interposed between the faces (2b, 2c) (see figures 5-8).

[0014] A crate (3) can comprise a bottom (3a) and lateral walls (3b) which rise from the bottom (3a) (see figures 1-4).

[0015] The loading machine (1) comprises: a first conveyor (4) configured for conveying a plurality of packages (2); a second conveyor (5) configured for conveying a crate (3) to be loaded with the packages (2a) of the plurality of packages (2); it comprises a support (6) arranged at a loading zone (C) for restingly receiving the crate (3) conveyed by the second conveyor (5); the support (6) being rotatable with respect to an axis of rotation (Z) in order to rotate between a first position (A), in which it can restingly receive the crate (3) from the second conveyor (5), and a second position (B), in which it can arrange the crate (3) inclined with respect to a horizontal plane (XY) by an angle (α) such that by action of the force of gravity: a first package (2a) of the plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting, on a relative first face (2b) and a flank (2d) thereof, respectively against a first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3); a second package (2e) of the plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting on a first face (2b) and a flank (2d) thereof, respectively against a second face (2c), opposite the first face (2b) of the first package (2a) and against the bottom (3a) of the crate (3); and the remaining packages of the plurality of packages (2) can each be loaded internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3) (see figures 1, 3-6 and 9).

[0016] Further, the loading machine (1) comprises ac-

tuator means (7) configured to command rotation of the support (6); it comprises stabilising means (8) which are arranged so as to stabilise the crate (3) when the crate (3) is resting on the support (6); gripping and loading means (9) which are arranged so as to pick up the packages (2a) of the plurality of packages (2) from the first conveyor (4) and so as to load the packages internally of the crate (3), when the support (6) is in the second position (B) and the crate (3) is resting on the support (6), so as: to load the first package (2a) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3); to load the second package (2e) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the second face (2c) of the first package (2a) and against the bottom (3a) of the crate (3); and to load the remaining packages of the plurality of packages (2) internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3) (see figures 1, 3-6 and 9).

[0017] Further, the second conveyor (5) is configured to convey the crate (3) along an advancement direction (W1), and the stabilising means (8) comprise: a first abutment (31) which is borne by the support (6) and which is movable between an active position (E), in which it can abut the crate (3) when the crate (3) is restingly received on the support (6), and an inactive position (D) in which it can disengage from the second conveyor (5) so as to enable the crate (3), once loaded with packages of the plurality of packages (2), to leave the support (6); and a first pusher member (32) which is borne by the support (6), which is arranged upstream of the first abutment (31) with respect to the advancement direction (W1) and which is movable between an active position (E), wherein it can push the crate (3) against the first abutment (31), determining a consequent locking, when the crate (3) is resting on the support (6) and the first abutment (31) is in the active position (E), and an inactive position (D) in which it can disengage from the second conveyor (5) so as to enable the crate (3), to be loaded with packages of the plurality of packages (2), to reach the support (6) (see figures 16-24).

[0018] By loading is meant positioning the plurality of packages (2) internally of the crate (3).

[0019] By way of example, the articles can be fruit and vegetables, for example salads. Alternatively, the articles can be products for agriculture, such as fertilisers.

[0020] The loading machine (1) is preferably suitable for loading the plurality of packages (2) internally of a plurality of crates (3c), arranged one following another (see figures 1-14).

[0021] The first conveyor (4) can be a conveyor belt (see figure 1).

[0022] The second conveyor (5) is preferably a flights conveyor (see figures 2 and 3).

[0023] The first conveyor (4) and the second conveyor (5) can be arranged flanked to one another.

[0024] The actuator means (7) can comprise an electric motor (10) (see figure 15).

[0025] The stabilising means (8) can be arranged at the support (6).

[0026] The support (6) is preferably configured in such a way that when the support is in the first position (A) and the crate (3) is restingly received on the support (6), the crate (3) is in a horizontal position (see figures 3 and 4).

[0027] When the support (6) is in the first position (A) it is advantageously adjacent to the second conveyor (5) so as to simplify the passage of the crate (3) from the second conveyor (5) to the support (6).

[0028] The second conveyor (5) preferably is configured to convey the crate (3) along an advancement direction (W); the support (6) is configured so that the relative axis of rotation (Z) is parallel to the advancement direction (W); the gripping and loading means (9) are arranged by a side of the second conveyor (5) (see figures 1-6).

[0029] The support (6) can be configured to rotate with respect to the relative rotation axis (Z) towards the first conveyor (4).

[0030] As the axis of rotation (Z) is advantageously parallel to the advancement direction (W) of the second conveyor (5), the loading machine (1) is compact and of limited size.

[0031] The second conveyor (5) can comprise a relative development axis (S1) which is parallel to the advancement direction (W).

[0032] The first conveyor (4) can have a relative development axis (S2) which is parallel to the relative development axis of the second conveyor (5).

[0033] The development axis (S2) of the first conveyor (4) can face the development axis (S1) of the second conveyor (5) (see figures 1-4).

[0034] The support (6) is preferably arranged to restingly receive the bottom (3a) of the crate (3); the stabilising means (8) comprise an abutment (11) which is arranged so as to abut a first lateral wall (3b) of the crate (3), when the crate (3) is restingly received on the support (6) and the support (6) is in the second position (B) (see figures 6, 8, 10, 12 and 14).

[0035] The abutment (11) advantageously ensures that, when the support (6) assumes the second position (B), the crate (3) does not slide along the support (6) and, therefore, leaves the loading zone (C).

[0036] The abutment (11) can be shaped as a rest plane (see figures 6, 8, 10, 12 and 14).

[0037] The abutment (11) can be arranged by a side of the second conveyor (5) (see figures 6, 8, 10, 12 and 14).

[0038] The abutment (11) can be arranged between the first conveyor (4) and the second conveyor (5).

[0039] The loading machine (1) can comprise a frame

(12) and the abutment (11) can be solidly constrained to the frame (12).

[0040] According to a variant that is not illustrated, the abutment (11) can be solidly constrained to the support (6) and rotate therewith.

[0041] The gripping and loading means (9) preferably comprise a depression source (13) and a plurality of suction cups (14) for picking up the packages of the plurality of packages (2) from the first conveyor (4) and loading the packages in the crate (3) arranged on the support (6) (see figures 5 and 6).

[0042] The plurality of suction cups (14) advantageously creates a depression on a face (2b) of each package (2a) ensuring the relative gripping and loading internally of the crate (3).

[0043] The gripping and loading means (9) can be delta robots or anthropomorphic robots (not illustrated).

[0044] If the loading machine (1) of the present invention is used for loading the plurality of packages (2) internally of a plurality of crates (3c), arranged one following another, then the gripping and loading means (9) can comprise two gripping heads (9a, 9b) arranged flanked to one another, each comprising a relative depression source (13) and a relative plurality of suction cups (14) (see figures 5 and 6).

[0045] The loading machine (1) preferably comprises a compacting unit (15) configured to compact an assembly of packages (2f) of the plurality of packages (2), once the packages have been loaded internally of the crate (3), and to enable subsequent loading of at least a further package (2g) of the plurality of packages (2) internally of the crate (3); the compacting unit (15) in turn comprising a pusher member (16) which is movable: so as to insert in a compartment (17) of the crate (3) which is delimited, on one side, by the second lateral wall (3d) of the crate (3), which is opposite the relative first lateral wall (3b), and which is delimited, on the other side, by the last package of the assembly of packages (2f) which has been loaded into the crate (3); and so as to contact the last package and push it towards the first lateral wall (3b), in such a way as to compact the assembly of packages (2f) and consequently increase the volume of the compartment (17) so as to facilitate loading of the at least a further package (2g) of the plurality of packages (2) internally of the crate (3) (see figures 1-4 and 10-14).

[0046] The compacting unit (15) advantageously ensures complete filling of the crate (3) that is being loaded.

[0047] In other words, by compacting the assembly of packages (2f) of the plurality of packages (2), already loaded internally of the crate (3), the volume of the compartment (17) increases so that it is easy to insert a further package (2g) of the plurality of packages (2) and in this way it is possible to complete the filling of the crate (3). Owing to the compacting unit (15) it is possible to contact and push the last package towards the first lateral wall (3b) and, at the same time, to load the at least a further package (2g) of the plurality of packages (2).

[0048] The pusher member (16) preferably comprises

a paddle (18).

[0049] As the paddle (18) has a flat face, once inserted in the compartment (17), this advantageously facilitates the insertion of the at least a further package (2g) into the crate (3): in fact, the at least a further package (2g) slides along the flat face of the paddle (18) so as to house in the compartment (17) of the crate (3).

[0050] The compacting unit (15) preferably comprises a first arm (19) which is constrained to the frame (12); a first guide (20) which is borne by the first arm (19); a first carriage (21) which is slidable along the first guide (20); a second arm (22) which is borne by the first carriage (21); a second guide (23) which is borne by the second arm (22); a second carriage (24) which is slidable along the second guide (23) and which bears the pusher member (16).

[0051] The first carriage (21) and the second carriage (24) advantageously ensure the translation of the pusher member (16) along the first guide (20) and the second guide (23), so as to be able to translate and reach the compartment (17) of the crate (3) in which it is to be inserted.

[0052] The first guide (20) and the second guide (23) can be arranged transversally with respect to one another.

[0053] In detail, the pusher member (16) can bear the paddle (18) with the purpose of nearing or distancing the paddle (18) to the crate (3).

[0054] In detail, the compacting unit (15) can comprise a third arm (25) which is constrained to the frame (12) and which can extend opposite to the first arm (19).

[0055] The first arm (19) and the third arm (25) can extend laterally to the support (6), when the support (6) assumes the second position (B).

[0056] Further, the compacting unit (15) can comprise a third guide (26) borne by the third arm (25); a third carriage (27) which is slidable along the third guide (26).

[0057] The second arm (22) can extend starting from the first arm (19) towards the third arm (25) so as to have a transversal extension with respect to the first arm (19) and the third arm (25).

[0058] The compacting unit (15) can comprise a fourth guide (28) borne by the second arm (22) and a fourth carriage (29) which is slidable along the fourth guide (28) and which bears the pusher member (16).

[0059] The second carriage (24) and the fourth carriage (29) can slide along the second guide (23) and the fourth guide (28) in order to near or distance the pusher member (16) from the crate (3).

[0060] The paddle (18) can be orientated by means of clamps, with the purpose of being correctly inserted in the correct position in the compartment (17).

[0061] The pusher member (16) can be a pneumatic cylinder.

[0062] The first carriage (21) and the third carriage (27) can be activated to slide along the first guide (20) and the third guide (26) by means of a pair of cogged belts (30) activated by a drive pulley.

[0063] During the functioning of the loading machine (1), when the last package in the crate (3) is to be loaded, the first carriage (21) and the third carriage (27) will be activated to slide along the first guide (20) and the third guide (26) with the aim of translating the pusher member (16), and therefore the paddle (18), in proximity of the crate (3). At this point, the paddle (18) will insert in the compartment (17) by means of the activation of the second carriage (24) and the fourth carriage (29) which slide along the second guide (23) and the fourth guide (28) towards the compartment (17) of the crate (3). Once the paddle (18) is in the compartment (17), the gripping and loading means (9) load the last package of the plurality of packages (2) to be inserted in the crate (3), by causing the last package to slide on the flat face of the paddle (18).

[0064] Lastly, the second carriage (24) and the fourth carriage (29) can be activated to move the paddle (18) away from the compartment (17) and the first carriage (21) and the third carriage (27) can be activated to slide along the first guide (20) and the third guide (26) in order to move the paddle (18) away from the crate (3) (see figures 10-14).

[0065] The last package is advantageously loaded into the crate (3) when the paddle (18) is compacting the assembly of packages (2f) loaded into the crate (3) and this ensures insertion of the at least a further package (2g) into the compartment (17).

[0066] The assembly of packages (2f) loaded into the crate (3) tends to occupy a greater volume inside the crate (3), due to the air present in each package.

[0067] In order to load the at least a further package (2g) inside the crate (3), the compacting unit (15) reduces the volume occupied by the assembly of packages (2f) already loaded, by compressing the assembly of packages (2f).

[0068] In other words, the compacting unit (15) enables creating the space required for loading the at least a further package (2g) inside the crate (3).

[0069] However, when the compacting action is released, the assembly of packages (2f) newly occupies the volume that it occupied prior to the compacting action. In other words, if the action of the paddle (18) were to be removed, the assembly of packages (2f) would no longer be compacted and the space available for the at least a further package (2g) would be newly reduced.

[0070] If the loading machine (1) of the present invention is used for loading the plurality of packages (2) internally of a plurality of crates (3c), arranged one following another, then the compacting unit (15) can comprise a plurality of paddles (18a) which are arranged on the second arm (22) to insert each in the crates (3) arranged one following another.

[0071] The second conveyor (5) preferably comprises a plurality of chains (33) which are looped, which are distanced from one another and which bear a plurality of flights (34) for moving the crate (3); the support (6) comprises a first rest base (35) for restingly receiving the crate (3) and which is arranged in such a way as to be

interposed between a first chain (33a) of the plurality of chains (33) and a second chain (33b) of the plurality of chains (33) which are adjacent to one another when the support (6) is in the first position (A) (see figure 15).

[0072] The loading machine (1) of the present invention is advantageously compact and of limited size.

[0073] This embodiment of the second conveyor (5) can be a preferred but not limiting embodiment.

[0074] Alternatively, by way of example, the second conveyor (5) can be a conveyor belt.

[0075] The support (6) preferably comprises a second rest base (36) for restingly receiving the crate (3), which second rest base (36) is solidly constrained to the first rest base (35) and which is arranged in such a way as to be interposed between the second chain (33b) of the plurality of chains (33) and a third chain (33c) of the plurality of chains (33) which are adjacent to one another when the support (6) is in the first position (A) (see figure 15).

[0076] The first rest base (35) can comprise a slot (37) (see figures 16-24).

[0077] The stabilising means (8) can comprise a second abutment (38) arranged opposite the first abutment (31).

[0078] With particular reference to figures 16-24, the support (6) can comprise a first pneumatic cylinder (39) which moves the first abutment (31) and the second abutment (38) along the advancement direction (W) so as to position them at the crate (3) to be loaded, when restingly received on the support (6), delineating a fixed row.

[0079] Further, the support (6) can comprise a second pneumatic cylinder (40), which is arranged transversally to the first pneumatic cylinder (39), in order to raise the first abutment (31) and the second abutment (38) in order to insert them, respectively, into the slot (37) of the first rest base (35) and into the space between the first rest base (35) and the second rest base (36) in order to assume the active position (E) (see figures 19-21). The second pneumatic cylinder (40) can lower the first abutment (31) and the second abutment (38) in such a way as to assume the inactive position (D) (see figures 22-24).

[0080] It is specified that figures 16-18 relate to the operating step in which the first pneumatic cylinder (39) moves the first abutment (31) and the second abutment (38) in order to delineate the fixed row.

[0081] Figures 19-21, relate to the operating step in which the second pneumatic cylinder (40) moves the first abutment (31) and the second abutment (38) in order to rise and project from the first rest base (35) and the second rest base (36).

[0082] Figures 22-24 relate to the operating step in which the second pneumatic cylinder (40) moves the first abutment (31) and the second abutment (38) in order to lower and be arranged inferiorly of the first rest base (35) and the second rest base (36).

[0083] In detail, with particular reference to figure 15, the loading machine (1) comprises two pairs of arms (41, 41a), which are solidly constrained to one another, which

are fixed to the frame (12). Each pair of arms (41) can bear the first rest base (35) and the second rest base (36).

[0084] Further, the loading machine (1) comprises a drive wheel (42) for activating the support (6) in rotation.

[0085] Still with reference to figure 15, the loading machine (1) comprises a pair of racks (43), each arranged on an arm of the pair of arms (41) which bears the first rest base (35); a pair of cogged wheels (44), each arranged on an arm of the pair of arms (41) which bears the first rest base (35) so as to oppose each rack of the pair of racks (43); a transmission shaft (45) of the drive. The support (6) can be activated in rotation by means of the drive wheel (42) which couples with the cogged wheel (44) arranged on one of the arms of the pair of arms (41) which bears the first rest base (35). The transmission shaft (45) of the drive transmits drive to the other cogged wheel (44a) arranged on the other arm of the pair of arms (41) which bears the first rest base (35) so that a coupling between the two cogged wheels (44, 44a) and the two racks (43) is possible.

[0086] Further, each arm of the two pairs of arms (41, 41 a) is provided with a curved guide (46) and the frame (12) is provided with four groups of four idle rollers (47) which are arranged in such a way as to slide along the curved guide (46).

[0087] The four groups of four idle rollers (47) advantageously ensure the enmeshing between the pair of cogged wheels (44, 44a) and the pair of racks (43), preventing any lateral displacement of two pairs of arms (41, 41 a).

[0088] In the following a description is made of a loading method for loading a plurality of packages (2) internally of a crate (3), also an object of the present invention. The steps of the loading method described in the following can be carried out with the loading machine (1) described in the foregoing.

[0089] Each package (2a) comprises one or more articles internally thereof, two opposite faces (2b, 2c) and a plurality of flanks (2d) interposed between the faces (2b, 2c) (see figures 5-8).

[0090] A crate (3) can comprise a bottom (3a) and lateral walls (3b) which rise from the bottom (see figures 1 and 2).

[0091] The loading method comprises steps of:

moving a crate (3) into a loading zone (C);
once the crate (3) has reached the loading zone (C), stabilising the crate (3) in position using the stabilising means (8) which comprise: a first abutment (31) which is movable between an active position (E), in which it can abut the crate (3) and an inactive position (D) in which it can disengage so as to enable the crate (3), once loaded with packages of the plurality of packages (2), to leave the loading zone (C); and a first pusher member (32) which is movable between an active position (E), in which it can push the crate (3) against the first abutment (31), determining a consequent locking, when the crate (3) is in the

loading zone (C) and the first abutment (31) is in the active position (E), and an inactive position (D) in which it can disengage so as to enable the crate (3), to be loaded with packages of the plurality of packages (2), to reach the loading zone (C);

rotating the crate (3) from a first position (A) to a second position (B), wherein the crate (3) is inclined with respect to a horizontal plane (XY) by an angle (α) that is such that by action of the force of gravity: a first package (2a) of a plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting, on a first face (2b) and a flank (2d) thereof, respectively against a first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3); a second package (2e) of the plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting on a first face (2b) and a flank (2d) thereof, respectively against a second face (2c), opposite the first face (2b) of the first package (2a) and against the bottom (3a) of the crate (3); and the remaining packages of the plurality of packages (2) can each be loaded internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3);

to load the first package (2a) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3);

to load the second package (2e) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the second face (2c) of the first package (2a) and against the bottom (3a) of the crate (3);

to load the remaining packages of the plurality of packages (2) internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3) (see figures 1-10).

[0092] The loading of the remaining packages of the plurality of packages (2) internally of the crate (3) preferably includes: loading an assembly of packages (2f) of the plurality of packages (2) internally of the crate (3); pushing the last package of the assembly of packages (2f) which has been loaded into the crate (3) towards the first lateral wall (3b), in such a way as to compact the assembly of packages (2f) and consequently increase the volume of the compartment (17) which is delimited, on one side, by a second lateral wall (3d) of the crate (3), which is opposite the relative first lateral wall (3b), and which is delimited, on the other side, by the last package

of the assembly of packages (2f) which has been loaded into the crate (3); loading at least a further package (2g) of the plurality of packages (2) internally of the crate (3) at the compartment (17) (see figures 11-14). The step of pushing the last package of the assembly of packages (2f) which has been loaded into the crate (3) towards the first lateral wall (3b), advantageously ensures complete filling of the crate (3) that is being loaded.

[0093] The loading of the at least a further package (2g) of the plurality of packages (2) internally of the crate (3) at the compartment (17) preferably takes place during the pushing of the last package of the assembly of packages (2) towards the first lateral wall (3b) of the crate (3). Once the at least a further package (2g) and, therefore, the assembly of packages (2f), is pushed towards the first lateral wall (3b), the assembly of packages (2f) undergoes a slight deformation such as to enable the assembly to occupy a smaller space, with respect to the space occupied when not subjected to the pushing action. When the pushing force is removed, the assembly of packages (2f) returns into the initial shape and thus newly occupies the space that it occupied without the action of the pushing force. Therefore, the step of loading the at least a further package (2f) of the plurality of packages (2) internally of the crate (3) during the pushing ensures the loading of the at least a further package (2f) into the crate (3).

[0094] In the following, with particular reference to figures 1-14 which illustrate the operating steps of the loading machine (1) of the present invention, the functioning of the loading machine (1) is described.

[0095] The operating steps can be descriptive of the steps of the loading method, also object of the present invention.

[0096] Initially a plurality of crates (3c) is conveyed by the second conveyor (5) on the support (6) and, therefore, on the first rest base (35) and on the second rest base (36) (see figures 1 and 2). At this point, the first pneumatic cylinder (39) moves the first abutment (31) and the second abutment (38) along the advancement direction (W) in order to position them at a lateral end of a crate (3) of the plurality of crates (3c) and the second pneumatic cylinder (40) raises the first abutment (31) and the second abutment (38) in order to project from the support (6) so as to assume the active position (E) (see figures 19-21). At the same time, the first pusher member (32) is activated to assume the active position (E) (see figures 19-21). In this way, the plurality of crates (3c) is gripped between the first abutment (31) and the first pusher member (32) (see figures 3, 4).

[0097] At this point the electric motor (10) activates the support (6) in rotation to assume the second position (B) (see figures 5 and 6).

[0098] Thereafter, the gripping and loading means (9) pick up each package of the plurality of packages (2) from the first conveyor (4) in order to load the package in each crate (3) of the plurality of crates (3c) (see figures 7-10).

[0099] When the at least a further package (2f) of the plurality of packages (2) is to be inserted, the first carriage (21) and the third carriage (27) slide along the first guide (20) and the third guide (26) in order to take the pusher member (16) in proximity of the crates (3c) (see figures 11 and 12). At this point, the second carriage (24) and the fourth carriage (29) is neared to each paddle (18) of the pusher member (16) at the compartment (17) of each crate (3) so as to push the assembly of packages (2f) already loaded into the crate (3) against the first lateral wall (3b) (see figures 11 and 12). Once the assembly of packages (2f) already loaded has been compacted, the gripping and loading means (9) pick up the at least a further package (2g) to be loaded internally of each crate (3) (see figures 13 and 14). Once the at least a further package (2g) is loaded in each crate (3), the second carriage (24) and the fourth carriage (29) slide along the second guide (23) and the fourth guide (28) in order to distance each paddle (18) of the pusher member (16) from the compartment (17) of each crate (3) and the first carriage (21) and the third carriage (27) slide along the first guide (20) and the third guide (26) in order to distance the pusher member (16) from the plurality of crates (3c) and in order to enable the actuator means (7) to activate the support (6) in rotation so as to newly assume the first position (A).

Claims

1. A loading machine (1) for loading a plurality of packages (2) internally of a crate (3), in which each package (2a) comprises one or more articles internally thereof, two opposite faces (2b, 2c) and a plurality of flanks (2d) interposed between the faces (2b, 2c), wherein:
 - it comprises a first conveyor (4) configured for conveying a plurality of packages (2);
 - it comprises a second conveyor (5) configured to convey a crate (3) to be loaded with the packages of the plurality of packages (2);
 - it comprises a support (6) arranged at a loading zone (C) for restingly receiving the crate (3) conveyed by the second conveyor (5);
 - the support (6) is rotatable with respect to an axis of rotation (Z) in order to rotate between a first position (A), in which it can restingly receive the crate (3) from the second conveyor (5), and a second position (B), in which it can arrange the crate (3) inclined with respect to a horizontal plane (XY) by an angle (α) such that by action of the force of gravity: a first package (2a) of the plurality of packages (2) can be loaded internally of a crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the first lateral wall (3b) of the crate (3) and against the bottom (3a) of the

crate (3); a second package (2e) of the plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against a second face (2c), opposite the first face (2b) of the first package (2a) and against the bottom (3a) of the crate (3); and the remaining packages of the plurality of packages (2) can each be loaded internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3);

it comprises actuator means (7) configured to command rotation of the support (6);

it comprises stabilising means (8) which are arranged so as to stabilise the crate (3) when the crate (3) is resting on the support (6);

it comprises gripping and loading means (9) which are arranged so as to pick up the packages of the plurality of packages (2) from the first conveyor (4) and to load the packages in the crate (3), when the support (6) is in the second position (B) and the crate (3) is resting on the support (6), so as: to load the first package (2a) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3); to load the second package (2e) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the second face (2c) of the first package (2a) and against the bottom (3a) of the crate (3); and to load the remaining packages of the plurality of packages (2) internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3);

characterised in that:

the second conveyor (5) is configured to convey the crate (3) along an advancement direction (W1);

the stabilising means (8) comprise: a first abutment (31) which is borne by the support (6) and which is movable between an active position (E), in which it can abut the crate (3) when the crate (3) is restingly received on the support (6), and an inactive position (D) in which it can disengage from the second conveyor (5) so as to enable the crate (3), once loaded with packages of the

- plurality of packages (2), to leave the support (6); and a first pusher member (32) which is borne by the support (6), which is arranged upstream of the first abutment (31) with respect to the advancement direction (W1) and which is movable between an active position (E), where-
in it can push the crate (3) against the first abutment (31), determining a consequent locking, when the crate (3) is restingly received on the support (6) and the first abutment (31) is in the active position (E), and an inactive position (D) in which it can disengage from the second conveyor (5) so as to enable the crate (3), to be loaded with packages of the plurality of packages (2), to reach the support (6).
2. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to the preceding claim, wherein: the support (6) is configured in such a way that when the support (6) is in the first position (A) and the crate (3) is restingly received on the support (6), the crate (3) is in a horizontal position.
 3. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to any one of the preceding claims, wherein: the second conveyor (5) is configured to convey the crate (3) along an advancement direction (W); the support (6) is configured so that the relative axis of rotation (Z) is parallel to the advancement direction (W); the gripping and loading means (9) are arranged by a side of the second conveyor (5).
 4. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to any one of the preceding claims, wherein: the support (6) is arranged to restingly receive the bottom (3a) of the crate (3); the stabilising means (8) comprise an abutment (11) which is arranged so as to abut a first lateral wall (3b) of the crate (3), when the crate (3) is restingly received on the support (6) and the support (6) is in the second position (B).
 5. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to any one of the preceding claims, wherein: the gripping and loading means (9) comprise a depression source (13) and a plurality of suction cups (14) for picking up the packages of the plurality of packages (2) from the first conveyor (4) and loading the packages in the crate (3) arranged on the support (6).
 6. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to any one of the preceding claims, comprising a compacting unit (15) configured for compacting an assembly of packages (2f) of the plurality of packages (2), once the packages have been loaded internally of the crate (3), and for enabling subsequent loading of at least a further package (2g) of the plurality of packages (2) internally of the crate (3); the compacting unit (15) in turn comprising a pusher member (16) which is movable so as to insert in a compartment (17) of the crate (3), which is delimited, on one side, by the second lateral wall (3d) of the crate (3), which is opposite the relative first lateral wall (3b), and which is delimited, on the other side, by the last package of the assembly of packages (2f) which has been loaded into the crate (3); and so as to contact the last package and push it towards the first lateral wall (3b), in such a way as to compact the assembly of packages (2f) and consequently increase the volume of the compartment (17) so as to facilitate loading of the at least a further package (2g) of the plurality of packages (2) internally of the crate (3).
 7. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to the preceding claim, wherein the pusher member (16) comprises a paddle (18).
 8. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to claim 6 or 7, wherein the compacting unit (15) comprises a first arm (19) which is constrained to the frame; a first guide (20) which is borne by the first arm (19); a first carriage (21) which is slidable along the first guide (20); a second arm (22) which is borne by the first carriage (21); a second guide (23) which is borne by the second arm (22); a second carriage (24) which is slidable along the second guide (23) and which bears the pusher member (16).
 9. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to any one of the preceding claims, wherein: the second conveyor (5) comprises a plurality of chains (33) which are looped, which are distanced from one another and which bear a plurality of flights (34) for moving the crate (3); the support (6) comprises a first rest base (35) for restingly receiving the crate (3) and which is arranged in such a way as to be interposed between a first chain (33a) of the plurality of chains (33) and a second chain (33b) of the plurality of chains (33) which are adjacent to one another when the support (6) is in the first position (A).
 10. The loading machine (1) of a plurality of packages (2) internally of a crate (3), according to the preceding claim, wherein: the support (6) comprises a second rest base (36) for restingly receiving the crate (3), which second rest base (36) is solidly constrained to the first rest base (35) and which is arranged in such a way as to be interposed between the second chain (33b) of the plurality of chains (33) and a third chain (33c) of the plurality of chains (33) which are

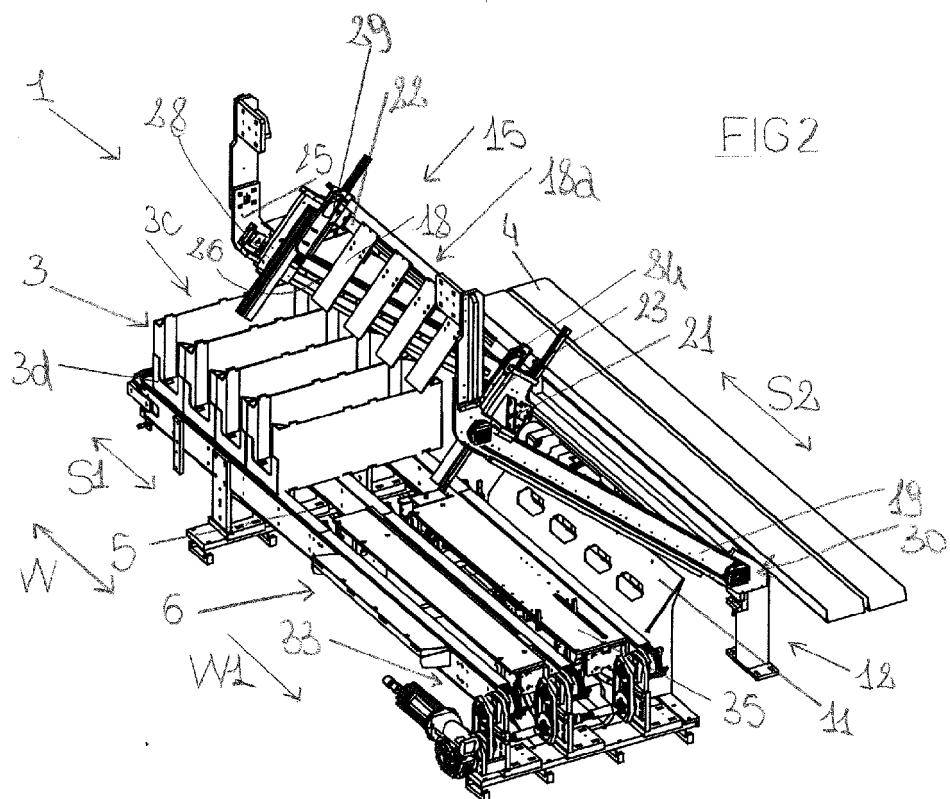
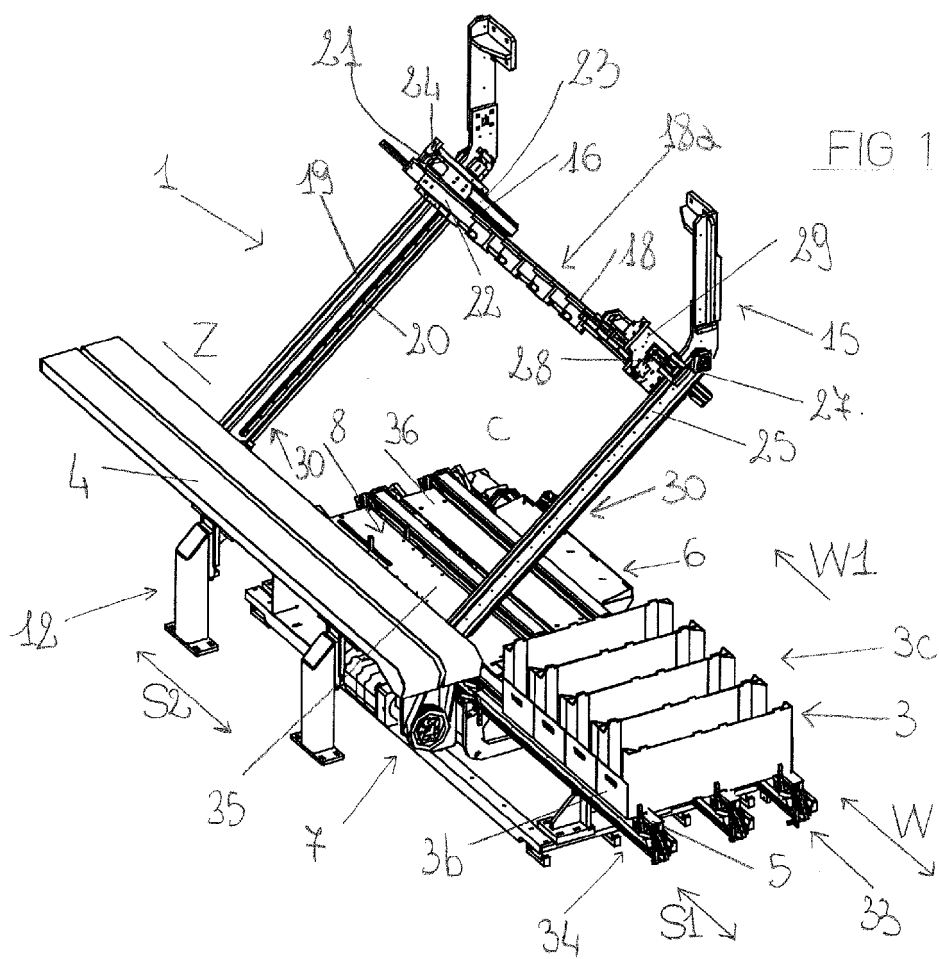
adjacent to one another when the support (6) is in the first position (A).

11. A loading method for loading a plurality of packages (2) internally of a crate (3), in which each package (2a) comprises one or more articles internally thereof, two opposite faces (2b, 2c) and a plurality of flanks (2d) interposed between the faces (2b, 2c), comprising steps of:

moving a crate (3) into a loading zone (C);
once the crate (3) has reached the loading zone (C), stabilising the crate (3) in position using the stabilising means (8) which comprise: a first abutment (31) which is movable between an active position (E), in which it can abut the crate (3) and an inactive position (D) in which it can disengage so as to enable the crate (3), once loaded with packages of the plurality of packages (2), to leave the loading zone (C); and a first pusher member (32) which is movable between an active position (E), wherein it can push the crate (3) against the first abutment (31), determining a consequent locking, when the crate (3) is resting on the loading zone (C) and the first abutment (31) is in the active position (E), and an inactive position (D) in which it can disengage so as to enable the crate (3), to be loaded with packages of the plurality of packages (2), to reach the loading zone (C); rotating the crate (3) from a first position (A) to a second position (B), wherein the crate (3) is inclined with respect to a horizontal plane (XY) by an angle (α) that is such that by action of the force of gravity: a first package (2a) of a plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting, on a first face (2b) and a flank (2d) thereof, respectively against a first lateral wall (3b) of the crate (3) and against the bottom (3a) of the crate (3); a second package (2e) of the plurality of packages (2) can be loaded internally of the crate (3) so as to be stably resting on a first face (2b) and a flank (2d) thereof, respectively against a second face (2c), opposite the first face (2b) of the first package (2a) and against the bottom (3a) of the crate (3); and the remaining packages of the plurality of packages (2) can each be loaded internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3);
loading the first package (2a) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the first lateral wall (3b) of the crate

(3) and against the bottom (3a) of the crate (3); loading the second package (2e) internally of the crate (3) so as to be stably resting, on the relative first face (2b) and a flank (2d) thereof, respectively against the second face (2c) of the first package (2a) and against the bottom (3a) of the crate (3);
loading the remaining packages of the plurality of packages (2) internally of the crate (3) in order to be stably resting, by means of a relative face (2b) and a flank (2d), respectively against a face (2c) of a package of the plurality of packages (2) already previously arranged internally of the crate (3) and against the bottom (3a) of the crate (3).

12. The loading method for loading a plurality of packages (2) internally of a crate (3), according to the preceding claim, wherein the loading of the remaining packages of the plurality of packages (2) internally of the crate (3) includes: loading an assembly of packages (2f) of the plurality of packages (2) internally of the crate (3); pushing the last package of the assembly of packages (2f) which has been loaded into the crate (3) towards the first lateral wall (3b), in such a way as to compact the assembly of packages (2f) and consequently increase the volume of the compartment (17) which is delimited, on one side, by a second lateral wall (3d) of the crate (3), which is opposite the relative first lateral wall (3b), and which is delimited, on the other side, by the last package of the assembly of packages (2f) which has been loaded into the crate (3); loading at least a further package (2g) of the plurality of packages (2) internally of the crate (3) at the compartment (17).
13. The loading method for loading a plurality of packages (2) internally of a crate (3), according to the preceding claim, wherein the loading of the at least a further package (2g) of the plurality of packages (2) internally of the crate (3) at the compartment (17) takes place during the pushing of the last package of the assembly of packages (2f) towards the first lateral wall (3b) of the package (3).



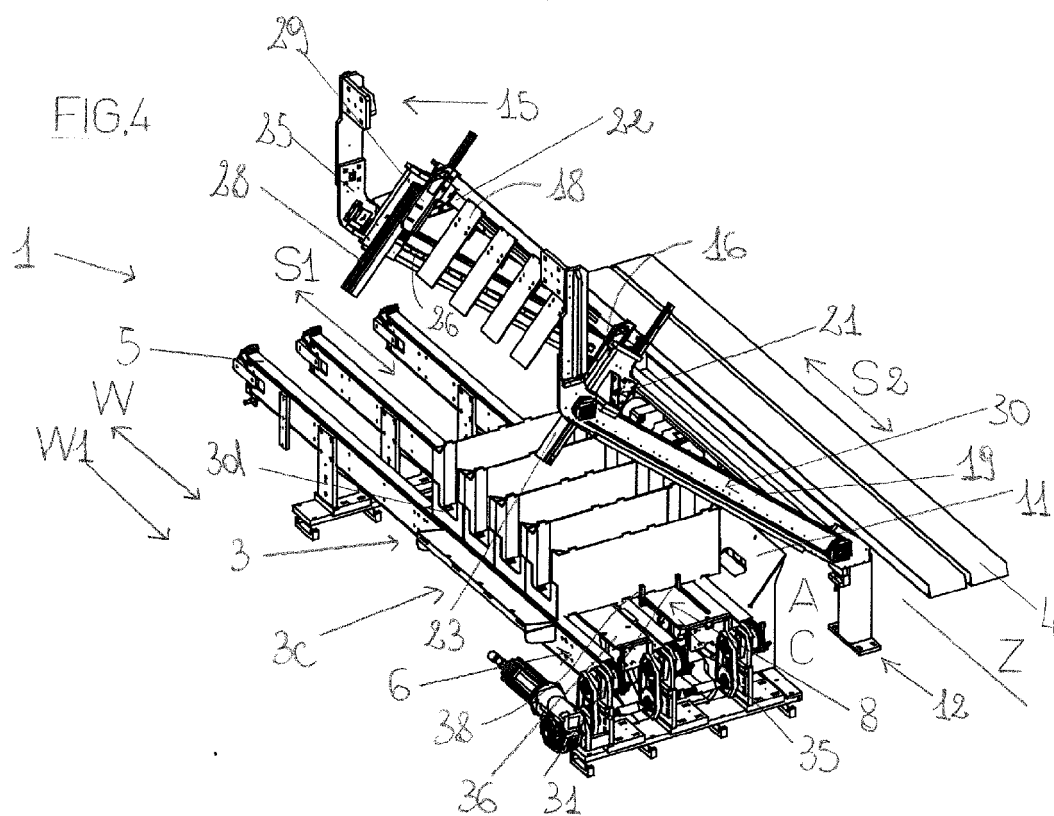
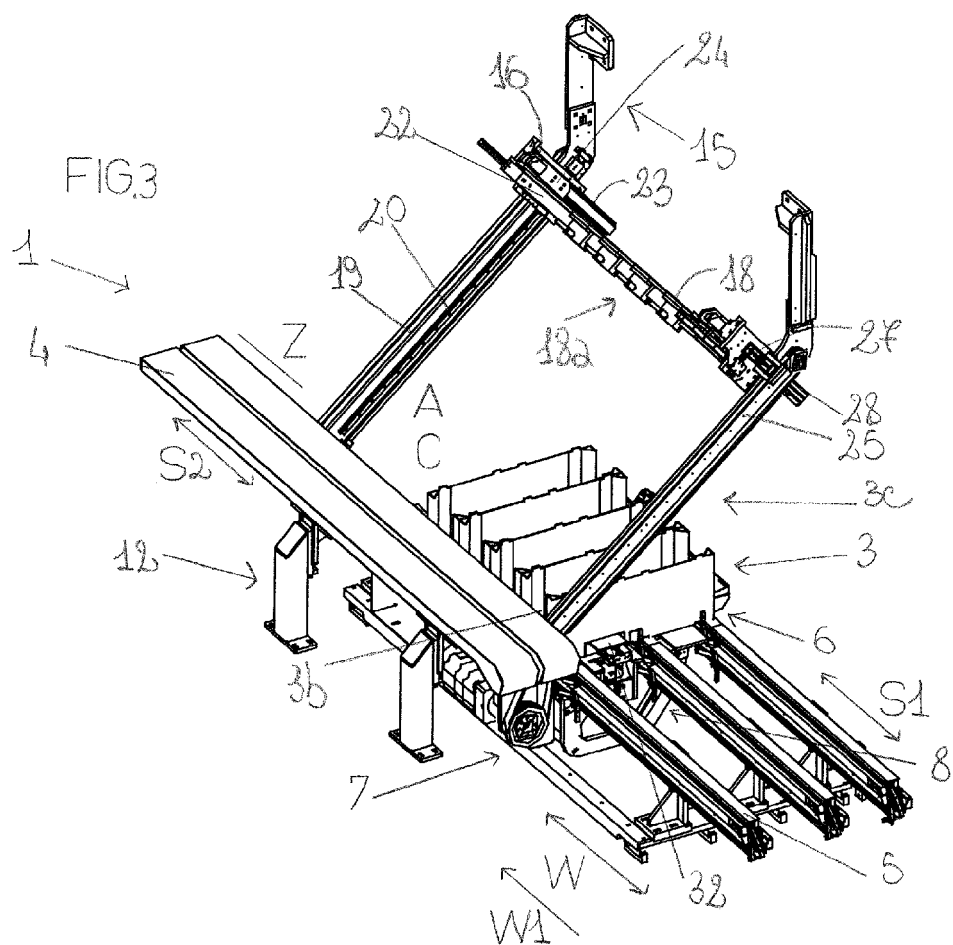


FIG 5

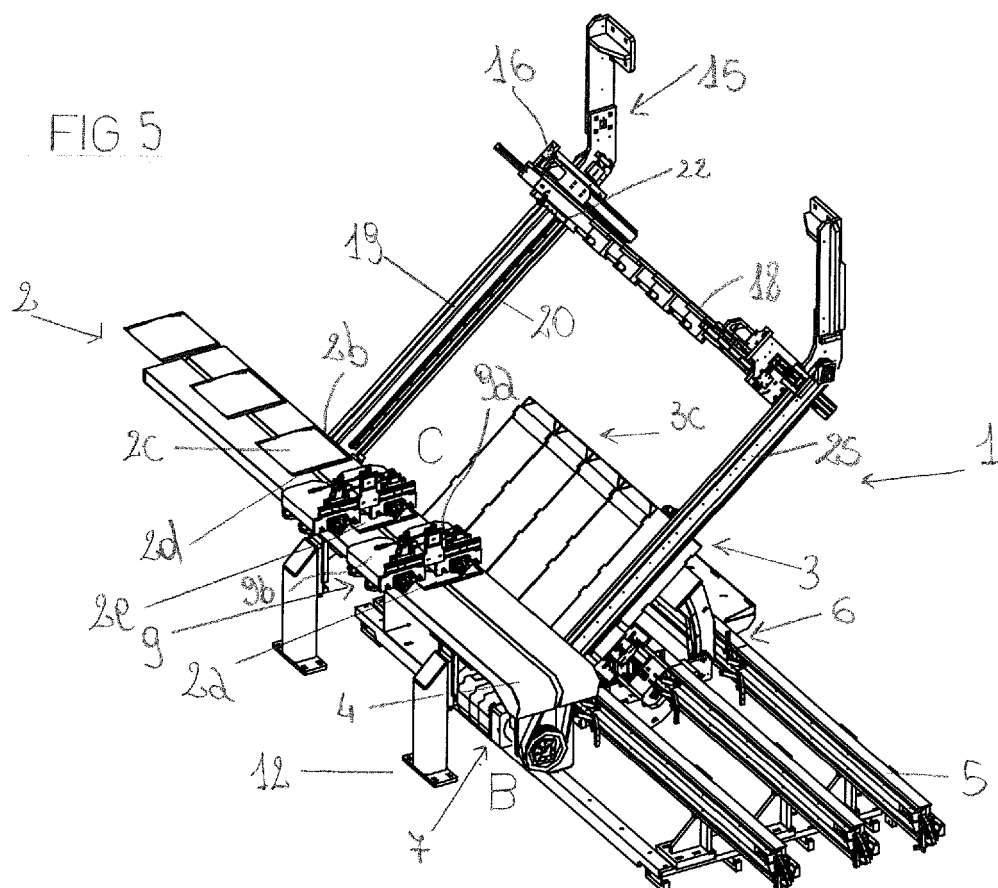


FIG 6

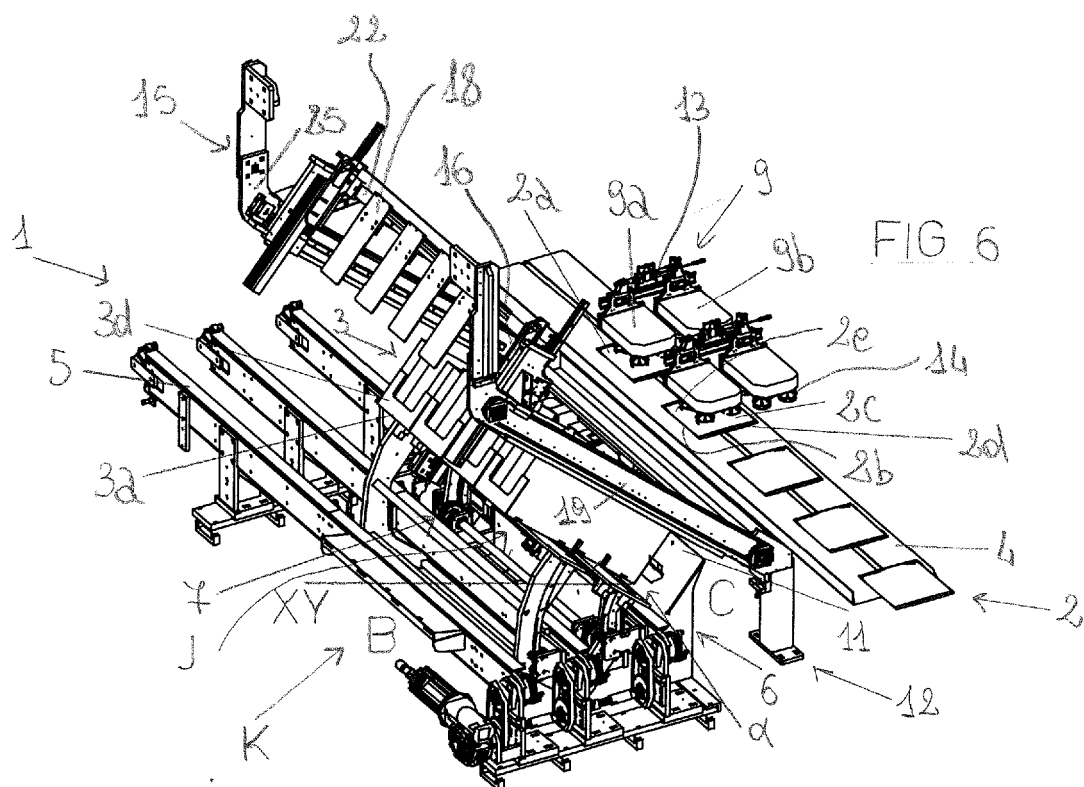


FIG 7

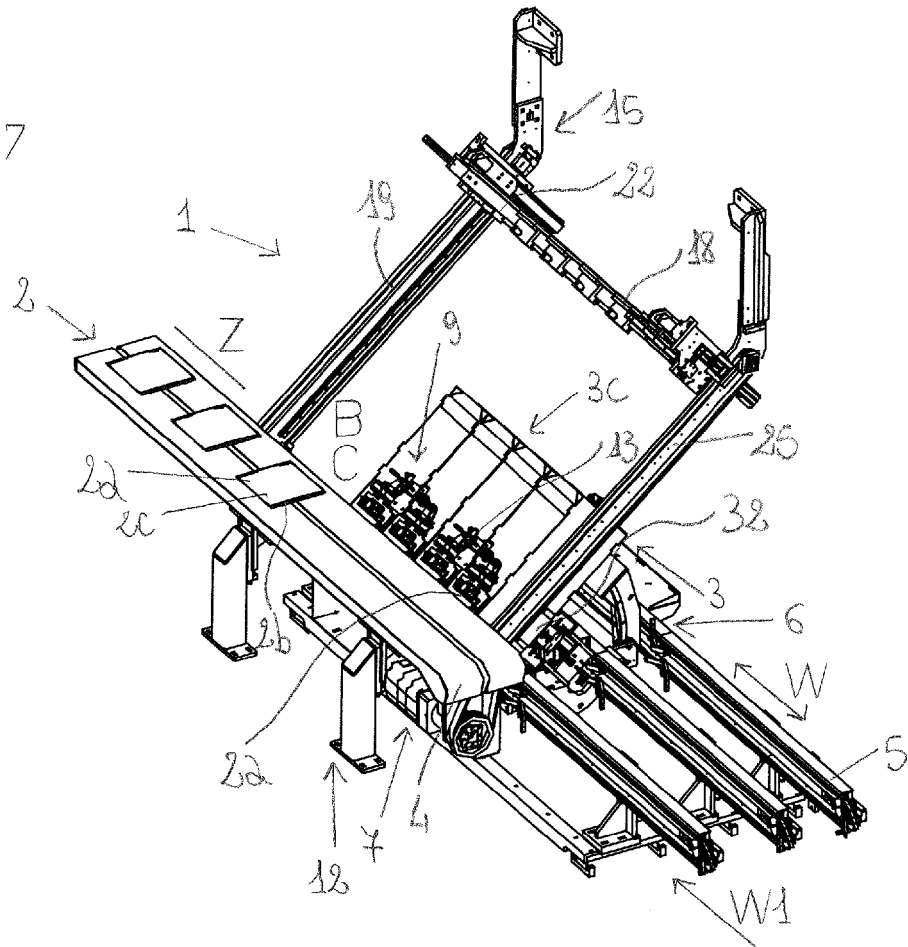


FIG 8

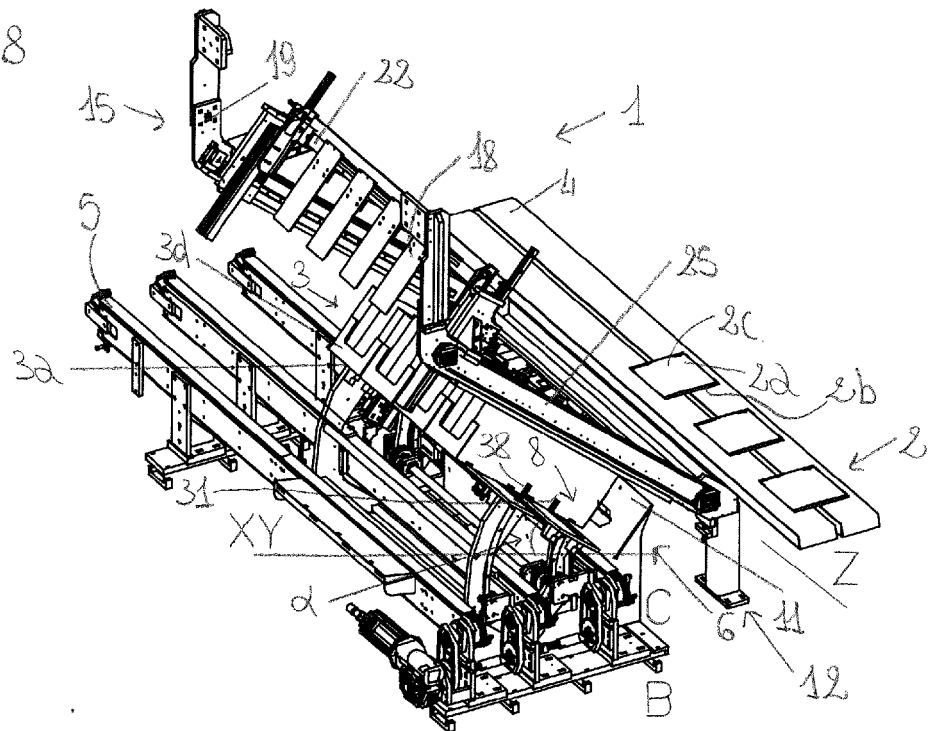


FIG 9

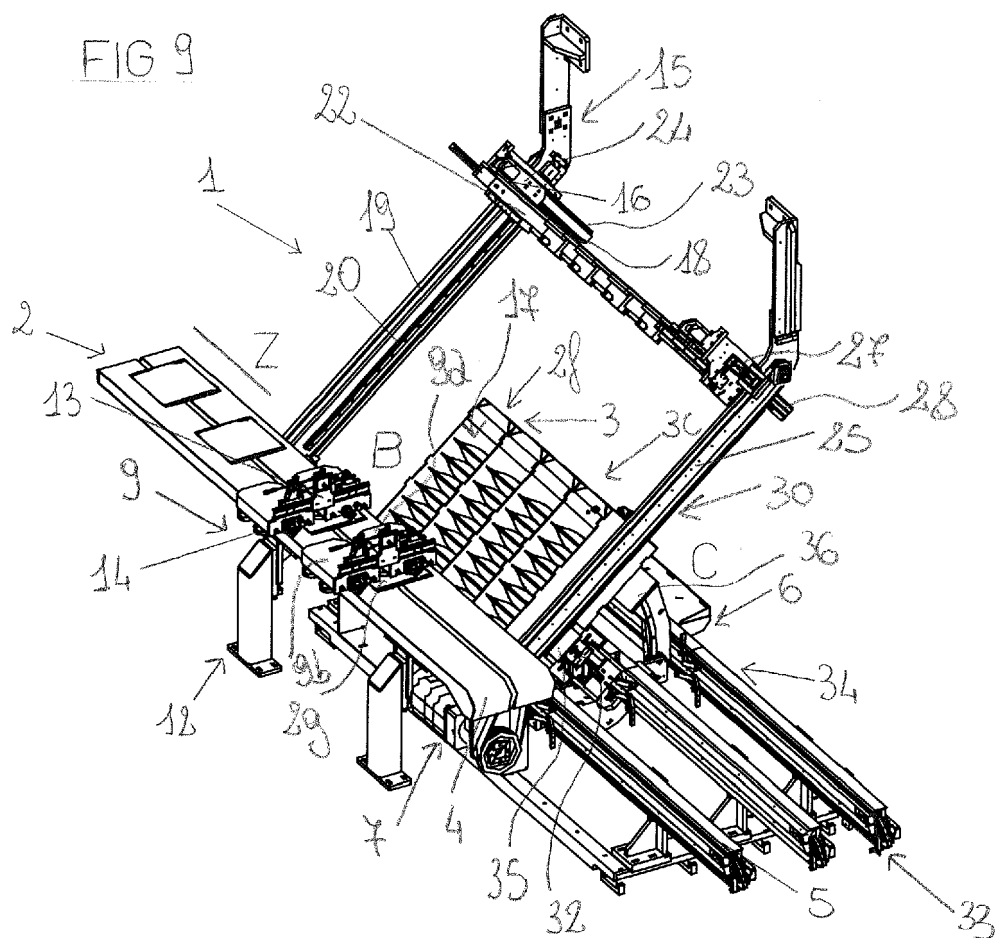


FIG 10

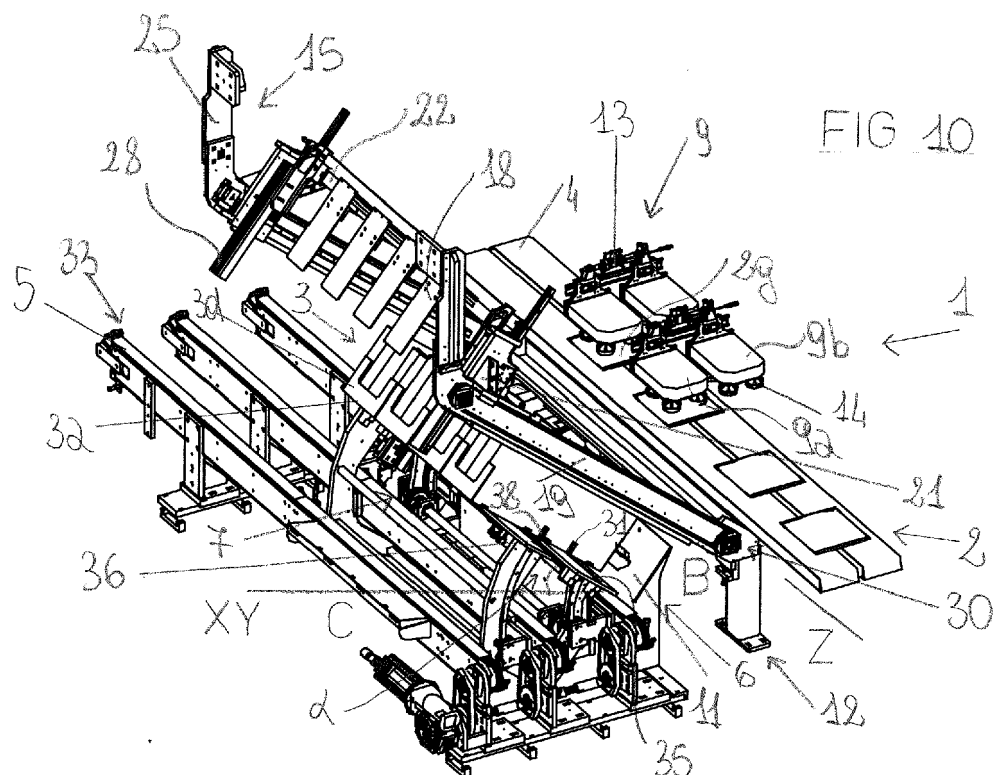


FIG 11

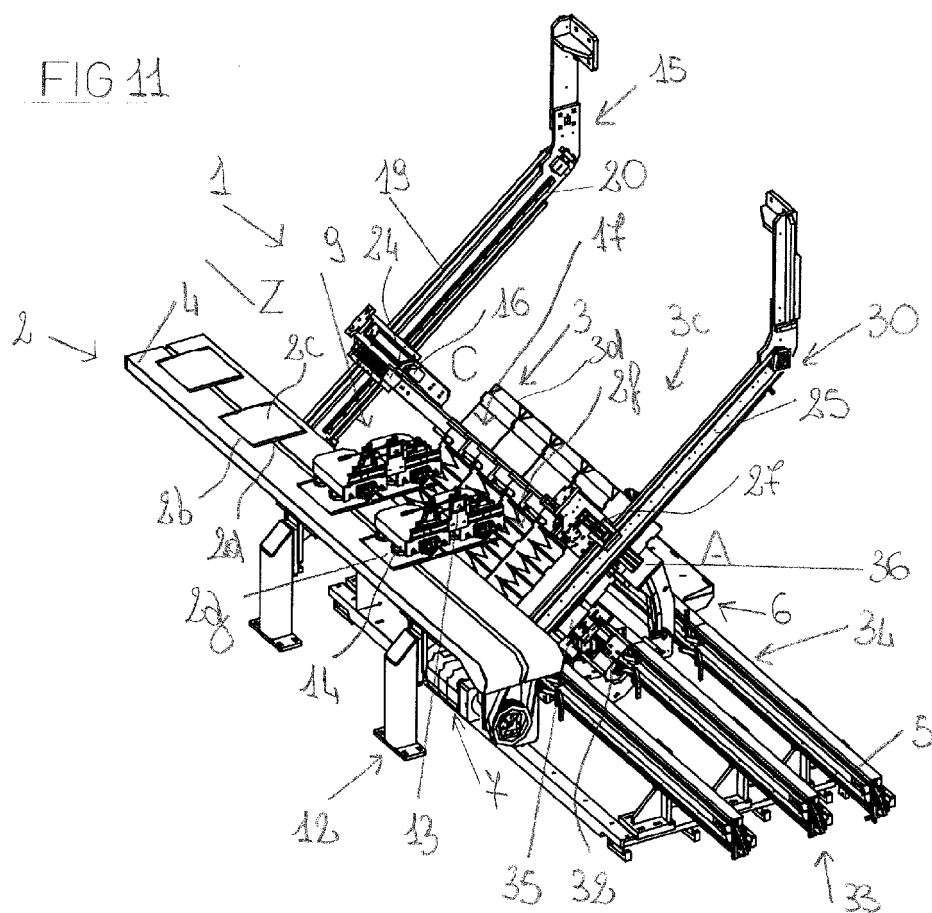
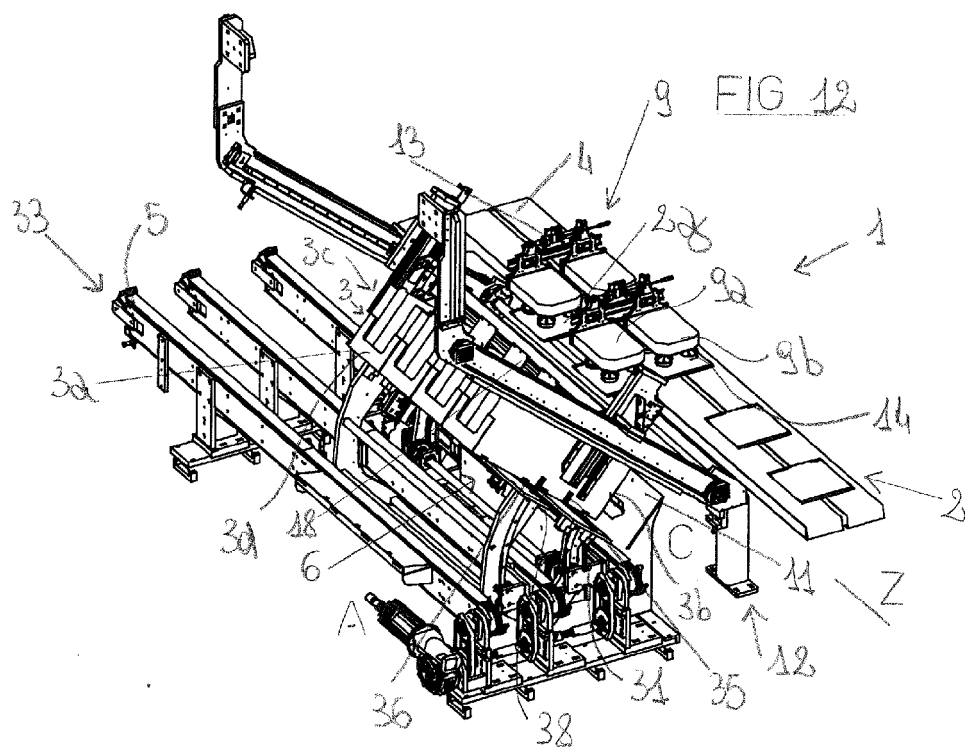
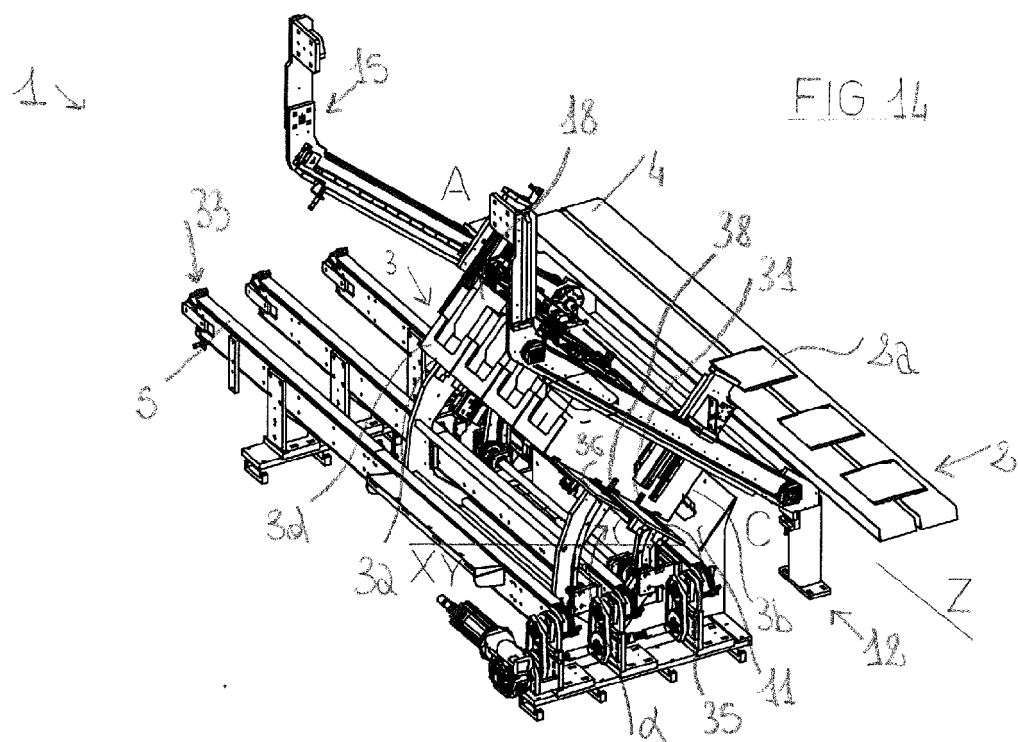
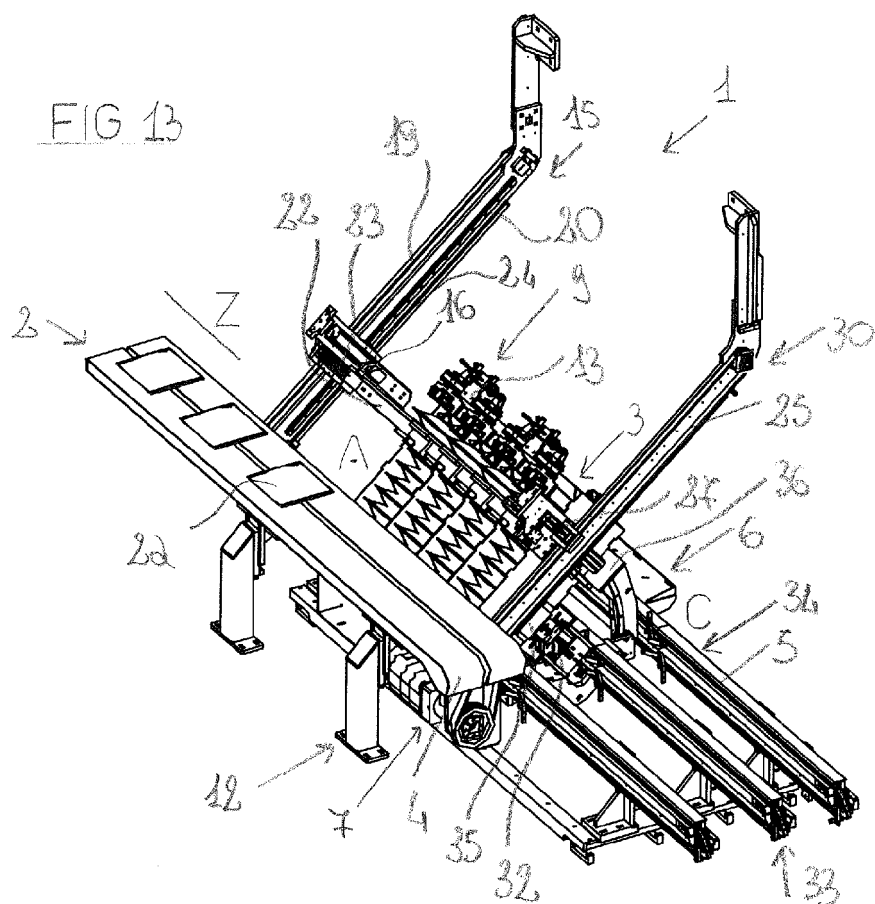
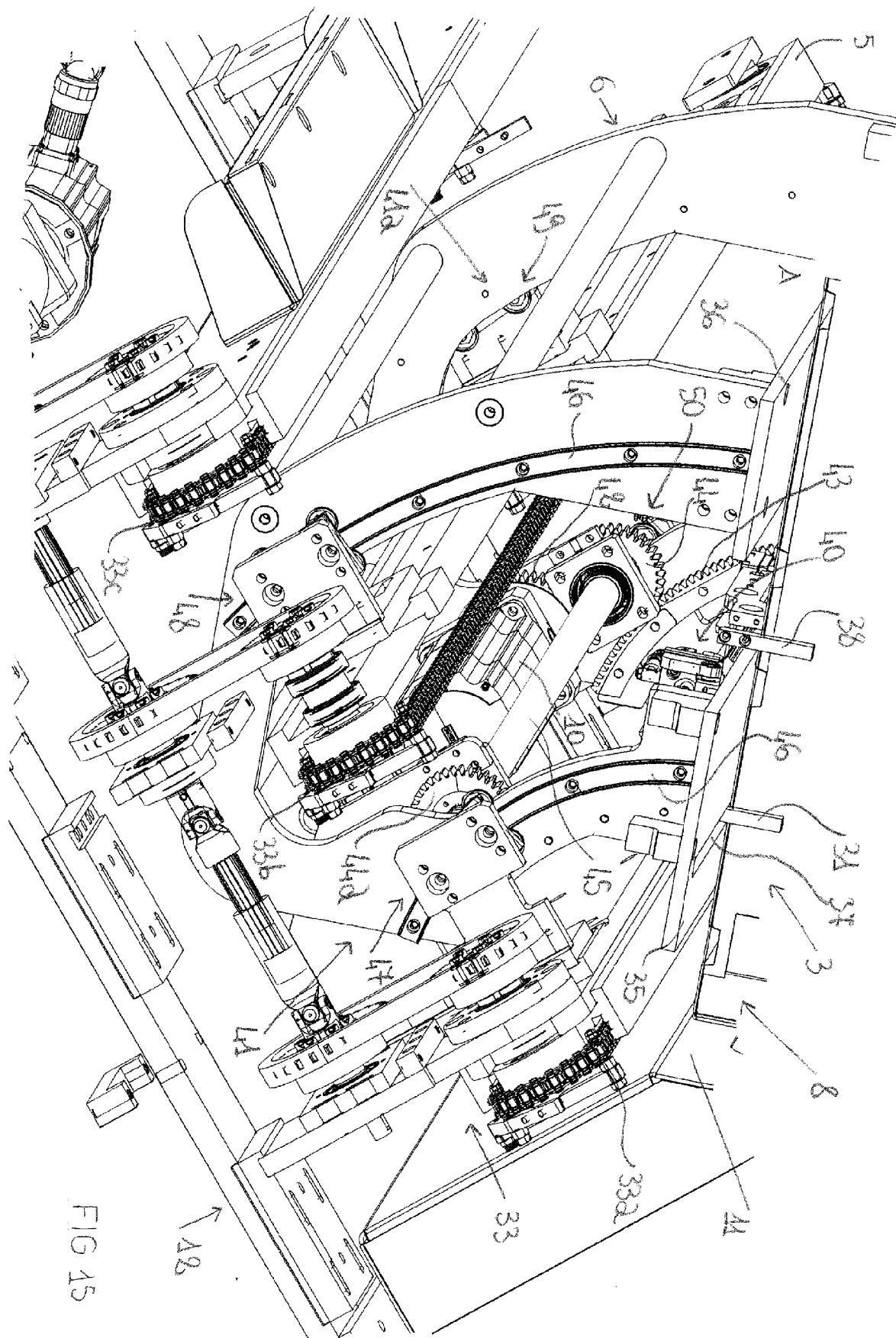


FIG 12







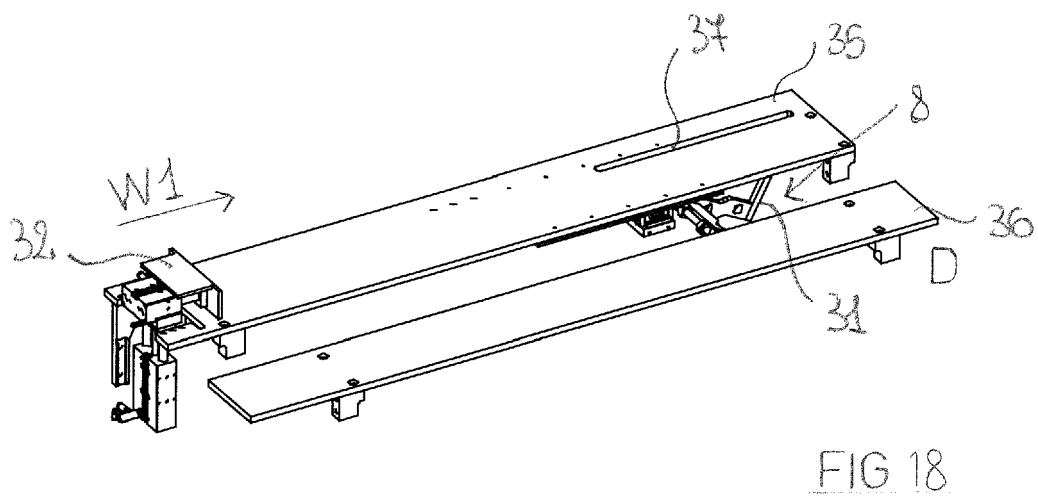
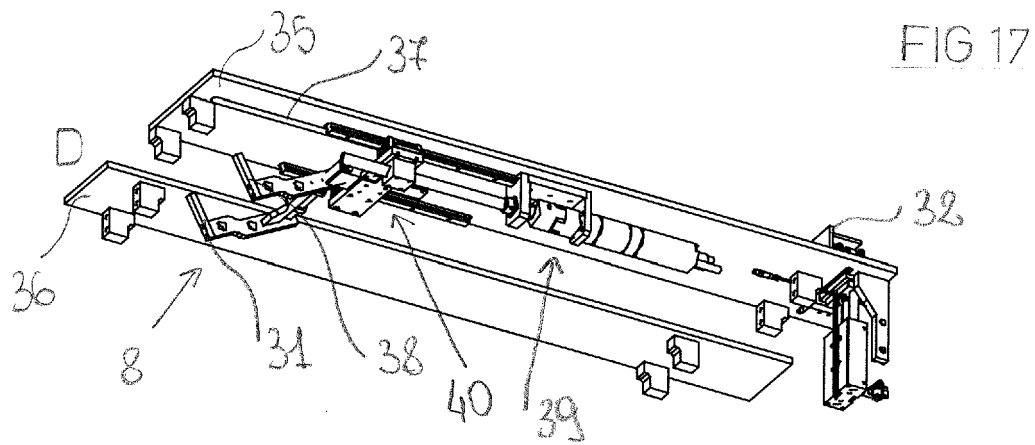
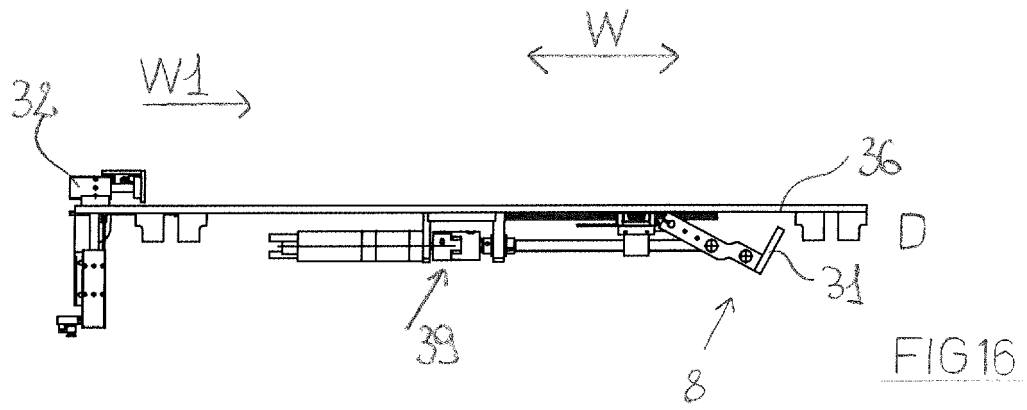


FIG 19

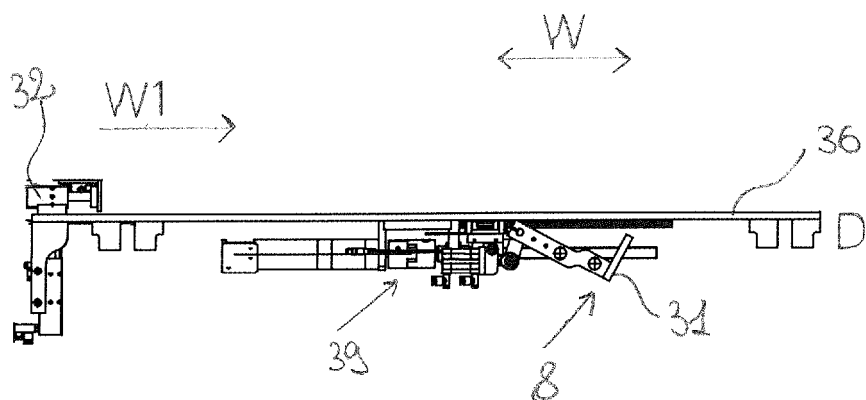


FIG 20

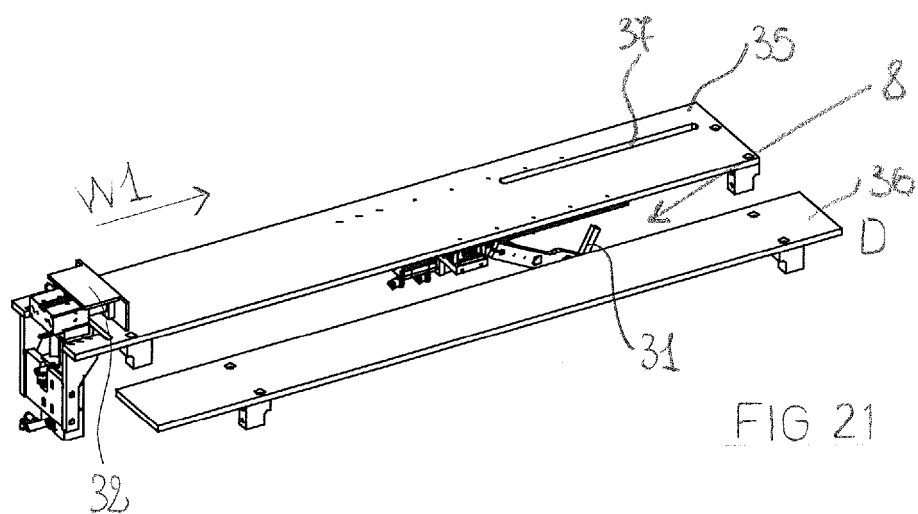
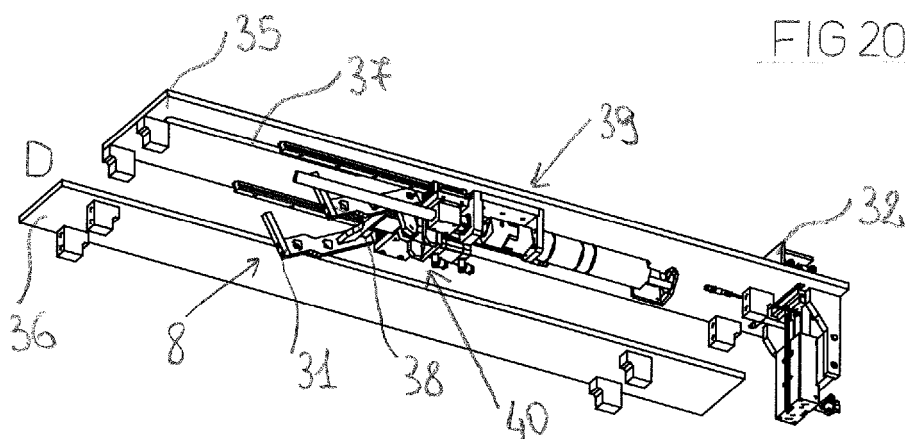


FIG 21

FIG 22

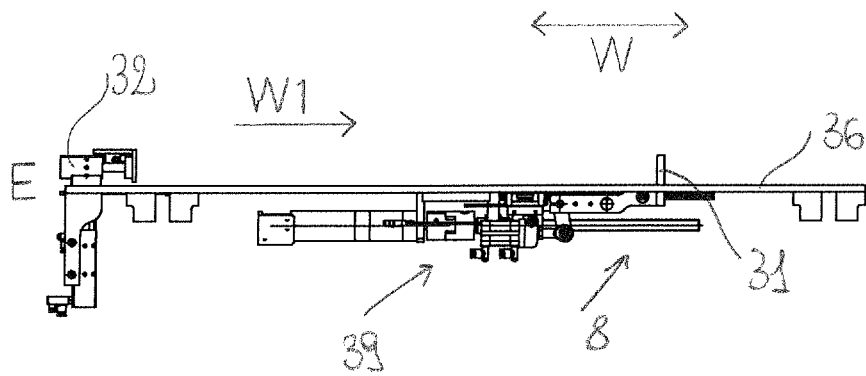


FIG 23

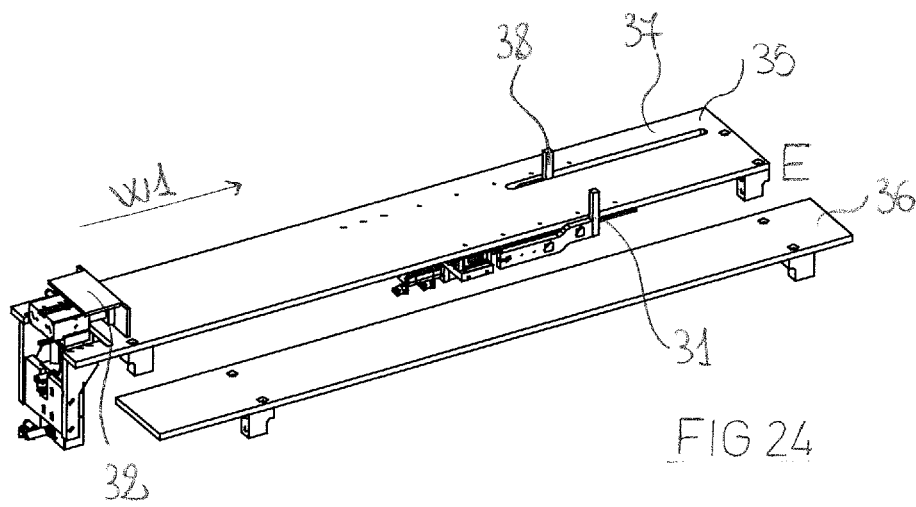
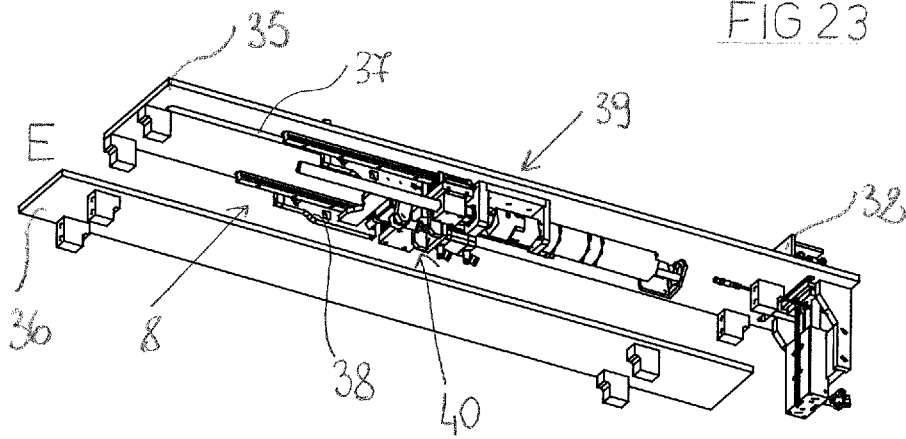


FIG 24



EUROPEAN SEARCH REPORT

 Application Number
 EP 20 18 0903

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EPO FORM 1503 03.82 (P04C01)

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 778 640 A (PRAKKEN NICHOLAAS MARTIN [US] ET AL) 14 July 1998 (1998-07-14) * the whole document *	1-13	INV. B65B5/04 B65B43/56 B65B43/62 B65B35/18 B65B5/10
A	US 2006/070353 A1 (VAN DAM AALDERT CHRISTIAAN [US]) 6 April 2006 (2006-04-06) * figures 6,7 *	1-13	
A	US 9 399 529 B2 (DERBY STEPHEN [US]; MCFADDEN JOHN [US] ET AL.) 26 July 2016 (2016-07-26) * figures 8-10 *	1-13	
A	US 5 611 193 A (FARRELLY PHILIP J [US]) 18 March 1997 (1997-03-18) * figures 1,2 *	1-13	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 13 November 2020	Examiner Paetzke, Uwe
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