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(54) AUTOMATIC LOADER OF CARDBOARD BLANKS FOR CASE PACKERS

(57) A loader (100) comprises a handling station (1) suitable for receiving a stack (S) of cardboard blanks (B) and comprising a manipulator (M) with a picking head (5) suitable for picking a ream (R) of blanks from said stack (S), a magazine (3) suitable for storing the stacked blanks, a transfer station (2) suitable for receiving said reams (R) of blanks picked by the picking head (5) of the manipulator so as to form a second stack (S2) of blanks and transfer said second stack (S2) of blanks to said magazine (3), and a picking station (4) suitable for picking one blank at a time from the top of said second stacks (S2) of blanks stored in the magazine (3).

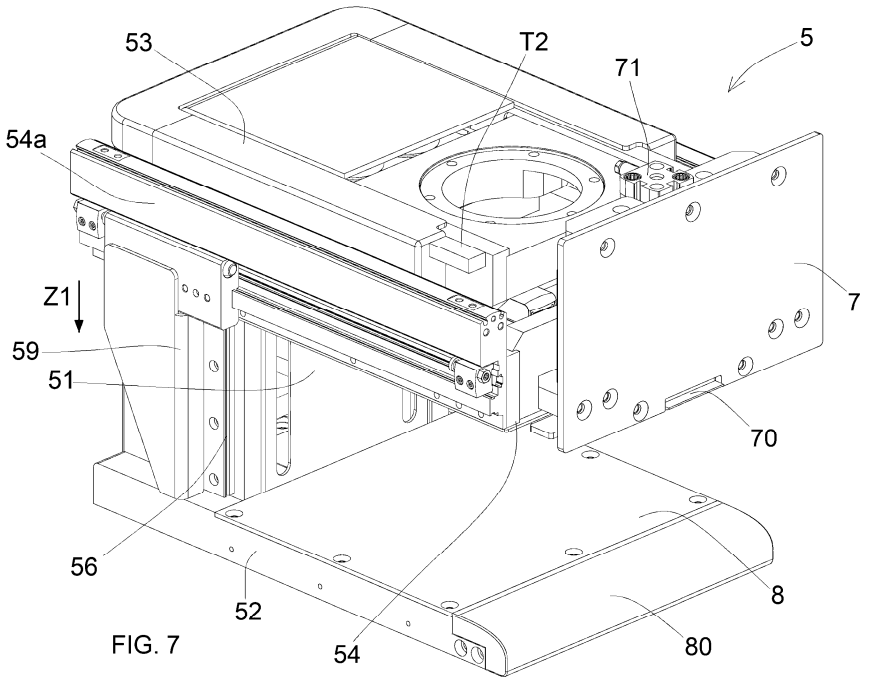


FIG. 7

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Description

[0001] The present invention relates to the field of case packers for the realization of product packages obtained from flat cardboard blanks that are appropriately folded, and in particular to an automatic loader for cardboard blanks.

[0002] Generally speaking, cardboard blanks are loaded manually in case packers, either horizontally or vertically.

[0003] Currently, automatic loading systems using sheet feeders, industrial robots, cobots, or gantry loaders are known.

[0004] In sheet feeders, the pallet with the cardboard blanks is raised from the ground so that a picking head can pick the cardboard blanks from above. Therefore, a special lifting device is required to lift the pallet, resulting in increased costs for the sheet feeder. Furthermore, the supply of a new pallet is a much more complex and time-consuming operation.

[0005] The stack of blanks on the pallet must be perfectly squared and centered relative to the pallet; otherwise, difficulties may be encountered in picking the blanks. Therefore, the pallet must be loaded manually, and not automatically; furthermore, the systems for squaring the stack of blanks on the pallet add further complexity to the sheet feeder.

[0006] Picking a blank at a time from the top of the stack creates a vacuum effect on the blank underneath that may cause the displacement of the blank.

[0007] Moreover, a sheet feeder is not very versatile, since a different format of the blanks requires the use of a different picking head.

[0008] An industrial robot has the following drawbacks:

- high costs due to the cost of the robot itself, of the structure that supports the robot, and of the picking head;
- large volume due to the need for a fully protected and sufficiently large maneuvering area;
- limited blank picking due to the shape of the picking head.

[0009] An industrial cobot has the following drawbacks:

- limited blank picking because the cobot cannot pick very heavy stacks of blanks because it would be unable to handle them, as it is unable to support heavy weights;
- high costs due to the management of 6 + 1 axes, whereas 3 + 1 axes may be sufficient from a kinematic standpoint.

[0010] A gantry loader has the following drawbacks:

- large volume due to the presence of the gantry;
- difficult blank picking because the gantry structure may experience deflection due to the long reach of the vertical axis of the gantry that may occur during picking.

[0011] EP3907163A1 describes a feeder for stacks of flat media comprising a distribution device to distribute one flat medium at a time from a stack, a first lifting device with a first receiving surface for supporting a stack, and a second lifting device with a second receiving surface for supporting a stack.

[0012] The purpose of the present invention is to eliminate the drawbacks of the prior art by providing an automatic loader of cardboard blanks for a case packer that is efficient, precise, reliable, space-saving, and inexpensive.

[0013] Another purpose is to provide such an automatic blank loader that is fully automatic and capable of picking a ream of blanks.

[0014] Yet another purpose is to provide such an automatic blank loader that is versatile and requires no modifications in the event of a different blank format.

[0015] These objectives are achieved in accordance with the invention by the features of the attached independent claim 1.

[0016] Advantageous embodiments of the invention are apparent from the dependent claims.

[0017] Further features of the invention will become clearer from the detailed description that follows, referring to a purely illustrative and therefore non-limiting embodiment illustrated in the attached drawings, wherein:

Fig. 1 is a perspective view illustrating the automatic loader according to the invention in an initial phase, wherein a stack of blank is moved toward the loader;
Fig. 2 is a view similar to Fig. 1, wherein the stack of blanks has been placed in the handling station of the loader;
Fig. 3 is a view similar to Fig. 2, wherein the manipulator of the handling station is picking a ream of blanks from the stack of blanks;
Fig. 4 is a view similar to Fig. 3, wherein the manipulator of the handling station has picked a ream of blanks;
Fig. 5 is a perspective view illustrating an arrangement of photocells in the handling station and in a transfer station;
Fig. 6 is a perspective view illustrating the manipulator of the handling station;
Fig. 7 is a perspective view of a picking head of the manipulator, wherein the upper jaw is in raised position;
Fig. 8 is a perspective rear view of the picking head shown in Fig. 7;
Fig. 9 is a perspective bottom view of the upper jaw of the picking head and the front abutment plate

with the lateral supporting elements in retracted position;

Fig. 10 is a perspective front view of the front abutment plate of the picking head with the lateral supporting elements in extended position;

Fig. 11 is a perspective view of the picking head with the lower plate of the lower jaw in extended position;

Fig. 12 is a perspective view illustrating a blank magazine and a picking station of the automatic loader according to the invention;

Figs. 13 to 36 are perspective rendering views illustrating the various sequences of picking and transferring a ream of blanks into the automatic loader according to the invention;

Figs. 37 to 40 are perspective rendering views illustrating various possible operating sequences of the automatic loader;

Figs. 41 to 43 are perspective rendering views illustrating different arrangements of stacks on a pallet.

[0018] With the aid of the Figures, an automatic loader according to the invention, which is collectively referred to by reference numeral 100, is described.

[0019] With reference to Figs. 1 to 4, the loader (100) comprises:

- a handling station (1) suitable for handling a ream (R) (Fig. 4) of cardboard blanks,
- a magazine (3) suitable for holding stacked blanks,
- a transfer station (2) suitable for transferring the reams (R) of blanks from the handling station (1) to the magazine (3), and
- a picking station (4) suitable for picking one blank at a time from a stack of blanks contained in the magazine (3).

[0020] Fig. 1 illustrates a stack (S) of blanks (B) arranged on a pallet (P). The pallet (P) is transported by a fork-type conveyor (200) that lifts and carries the pallet (P) to the handling station (1).

[0021] Fig. 2 shows the pallet (P) with the stack (S) of blanks (B) positioned in the handling station (1). The handling station (1) comprises a manipulator (M) with a picking head (5) suitable for picking a ream of blanks (B) from the stack (S) located in the handling station (1).

[0022] Fig. 3 shows the picking head (5) of the manipulator (M) approaching the top of the stack (S) of blanks to pick a ream of blanks from the top of the stack (S) of blanks.

[0023] Fig. 4 illustrates the picking head (5) of the manipulator (M) after picking a ream (R) of blanks from the top of the stack (S) of blanks. By way of example, the stack (S) may comprise one hundred blanks, and the ream (R) may comprise ten blanks.

[0024] With reference to Fig. 3, the transfer station (2) comprises a conveyor (20). By way of example, the conveyor (20) is a belt conveyor comprising two belts (21) arranged in parallel position to each other in an endless loop configuration.

[0025] The manipulator (M) places the ream (R) of blanks onto the conveyor (20), so as to form a second stack (S2) of blanks (Fig. 29) in the transfer station, and then the transfer station (2) transports the second stack (S2) to the magazine (3).

[0026] The magazine (3) comprises a base (30) whereon the second stack (S2) of blanks is positioned (Fig. 32). The base (30) of the magazine comprises a plurality of rollers (31) arranged in parallel position to one another. The rollers (31) may be motorized rollers.

[0027] The picking station (4) comprises a picker (40) suitable for picking the blanks (B) one at a time from the top of the second stack (S2). By way of example, the picker (40) may be a known sheet separator, comprising suction cups (41) suitable for adhering to the blank (B) located at the top of the second stack (S2) that rests on the base (30) of the magazine.

[0028] With reference to Fig. 5, the handling station (1) comprises two abutment sides (10, 11) in the form of vertical walls defining a rectangular perimeter that contains the pallet (P) whereon the stack (S) of blanks is located. The abutment sides (10, 11) of the handling station (1) comprise a front abutment side (10) and a right abutment side (11).

[0029] Two photocells (C1, C3) are arranged to detect when the stack (S) placed on the pallet (P) is in proximity to each abutment side (10, 11). For such a purpose, each photocells (C1, C3) has a detection range along a diagonal of the respective abutment side.

[0030] Two additional photocells (C2, C4) are positioned to verify that the stack of cardboard blanks remains inside the maximum occupied area, ensuring that the manipulator has freedom of movement around the pallet.

[0031] The abutment sides (10, 11) are fixed and serve as stops on two sides of the stack when the manipulator is in the process of removing a single ream from the stack.

[0032] The transfer station (2) comprises abutment sides (22, 23, 24, 25) that define a perimeter inside which the second stack (S2) of blanks is positioned. The abutment sides (22, 23, 24, 25) comprise a front abutment side (22), a rear abutment side (23), two right abutment side (24), and two left abutment sides (25).

[0033] The front abutment side (22) and the rear abutment side (23) are arranged between the two belts (21) of the conveyor (20). The right abutment side (24) and the left abutment side (25) are arranged outside and above the belts (21) of the conveyor. The right abutment side (24) and the left abutment side (25) are supported by respective supporting rods (26) arranged horizontally, parallel to the conveyor belts (21).

[0034] Two photocells (W1, W2) are positioned to verify the entry and exit of the stack of cardboard

blanks into the transfer station (2). Two additional photocells (W3, W4) are positioned to verify that the dimensions of the stack that is picked by the manipulator are comprised in the specified length and width limits. For such a purpose, each photocell (W1, W2, W3, W4) has a detection range. The transfer station (2) comprises:

- a front photocell (W1) positioned along the front abutment side (22);
- a rear photocell (W2) positioned along the rear abutment side (23);
- a first upper photocell (W3) positioned between the two right abutment sides (24); and
- a second upper photocell (W4) positioned between the two right abutment sides (24).

[0035] At least some of the abutment sides (22, 23, 24, 24) of the transfer station are moved to engage the sides of the second stack of blanks positioned on the conveyor (20) so as to compact the second stack, aligning the edges of the blanks (B) in the second stack.

[0036] A telemeter (T) is positioned in the transfer station (2) above the conveyor (20) to measure the height of the second stack of blanks on the conveyor (20).

[0037] With reference to Fig. 6, the manipulator (M) comprises a gantry (6) of the type having three axes (X, Y, Z) arranged in a Cartesian coordinate system. The gantry (6) supports the picking head (5) so that the picking head (5) can move in three-dimensional space along the three axes (X, Y, Z).

[0038] The gantry (6) comprises:

- a crossbeam (60) extending horizontally in the direction of the axis (X), i.e., a longitudinal direction of the loader,
- an upright (61) extending vertically in the direction of the axis (Z), and
- a transverse support (62) extending in the direction of the axis (Y), i.e., a transverse direction of the loader.

[0039] The upright (61) is slidably mounted on the crossbeam (60) so as to slide along the axis (X). The upright (61) has a slide (63) that runs in guide rails (64) of the crossbeam. A first actuator (A1) is mounted on the crossbeam (60) to move the upright (61). The first actuator (A1) may be a worm screw that engages with a nut formed in the slide (63) of the upright.

[0040] The transverse support (62) is mounted to slide on the upright (61) so as to slide along the axis (Z). The transverse support (62) has a slide (65) that runs in guide rails (66) of the upright. A second actuator (A2) is mounted on the upright (61) to move the transverse support (62). The second actuator (A2) may be a worm screw that engages with a nut formed in the slide (65) of the transverse support.

[0041] The picking head (5) is mounted slidably on the transverse support (62) so as to slide along the axis (Y). The picking head (5) has a slide (50) that runs in guide rails (67) of the transverse support. A third actuator (A3) is mounted on the transverse support (62) to move the picking head (5). The third actuator (A3) may be a worm screw that engages with a nut formed in the slide (50) of the picking head.

[0042] With reference to Figs. 7 and 8, the picking head (5) comprises:

- a central body (51),
- a lower jaw (52) projecting from the central body (51),
- an upper plate (53) projecting from the central body (51), parallel to the lower jaw (52), and
- an upper jaw (54) mounted slidably on the central body (51) so as to slide vertically between the lower jaw (52) and the upper plate (53), in the direction of a second vertical axis (Z1).

[0043] The slide (50) (Fig. 6) that runs in the transverse support (62) of the manipulator is mounted on the upper plate (53) of the picking head.

[0044] With reference to Fig. 8, the upper jaw (54) has slides (55) that run in guide rails (56) of the central body (51).

[0045] An actuator (57) mounted in the central body (51) moves the upper jaw (54) so that the upper jaw (54) can approach the lower jaw (52) to tighten a stack of blanks between the lower jaw (52) and the upper jaw (54). A metal plate (not shown in the Figures) is mounted beneath the upper jaw (54) with the interposition of springs and a photocell between the metal plate and the upper jaw (54). In such a way, when the ream of blanks is compressed between the lower jaw (52) and the upper jaw (54), the metal plate compresses the springs and the photocell detects the compression of the ream, signaling that the picking head is closed.

[0046] The actuator (57) comprises an electric motor (57a) that rotates two worm screws (57c) by means of a belt-and-pulley drive (57b), said worm screws (57c) being engaged with worm nuts (58) integral with the upper jaw (54).

[0047] A front abutment plate (7) is mounted at a front end of the upper jaw (54). The front abutment plate (7) has a separation tooth (70) that protrudes forward from a lower central portion of the front abutment plate (7).

[0048] The front abutment plate (7) is arranged along a vertical plane and can slide vertically relative to the upper jaw (54). An actuator (71) is mounted in the upper plate (53) to raise or lower the front abutment plate (7).

[0049] A telemeter (T2) is mounted in the upper plate (53) to measure the height of the ream picked by the picking head.

[0050] With reference to Figs. 9 and 10, two lateral supporting elements (72) are movably mounted in the front abutment plate (7). The lateral supporting elements (72) can move from a retracted position (Fig. 9), wherein they are behind the front abutment plate (7), to an extended position (Fig. 10), wherein they protrude anteriorly with respect to the front abutment plate (7), underneath the abutment plate, on either side of the separation tooth (70) of the abutment plate.

[0051] With reference to Fig. 8, respective actuators (73) drive the lateral supporting elements (72) so as to impart a rotational-translational motion to the lateral supporting elements (72).

[0052] With reference to Figs. 7 and 11, a lower plate (8) having a rounded front edge (80) is mounted in such a way to slide horizontally on the lower jaw (52), which is fixed and integral with the central body (51) of the picking head, The lower plate (8) can move from a retracted position (Fig. 7), wherein the front edge (80) of the lower plate is set back relative to the front abutment plate (7), to an extended position (Fig. 11), wherein the front edge (80) of the lower plate is forward relative to the front abutment plate (7).

[0053] An actuator (81) moves the lower plate (8) from the retracted position to the extended position and vice versa.

[0054] With reference to Figs. 7 and 8, the picking head (5) comprises two extractors (59) arranged on the sides of the picking head (5). The extractors (59) are mounted so as to slide on horizontal guides (54a) forming part of the upper jaw (54). The extractors (59) are moved by means of actuators. The extractors (59) can move from a retracted position (shown in Figs. 7 and 8), wherein they leave the space between the lower jaw (52) and the upper jaw (54) free to accommodate a ream of blanks, to an extended position, wherein they push the ream of blanks forward to eject it from the picking head (5).

[0055] With reference to Fig. 12, the magazine (3) comprises a lift (32) whereon the base (30) is mounted in such a way to be raised and lowered.

[0056] The magazine (3) has a photocell (38) that signals the position at which the blank at the top of the stack must be picked. In this way, the lift (32) raises the base (30) until the blank at the top of the stack reaches the photocell (38). At this point, the picker (40) can pick the blank at the top of the stack.

[0057] Above the base (30) are abutment sides (33, 34, 35, 36) that define a perimeter wherein the stack of blanks is arranged. The abutment sides (33, 34, 35, 36) comprise a front abutment side (33), a rear abutment side (34), a right abutment side (35), and a left abutment side (36). At least some of the abutment sides (33, 34, 35, 36) of the magazine are moved to abut against the sides of the stack of blanks arranged in the magazine (3) so as to compact the stack, aligning the edges of the blanks (B) in the stack. The front abutment side (33) may be fixed, and the abutment sides (25, 36) and the rear abutment side (34) may be movable.

[0058] Above the base (30) is a buffer (9) suitable for supporting the stacked blanks. The buffer (9) comprises two racks (90) mounted to move horizontally beneath the abutment sides (35, 36). The racks (90) may be disposed in a retracted, non-operating position (Fig. 12) wherein they do not interfere with the stack of blanks, and in an extended, operating position (Figs. 35, 36) wherein they support the stacked blanks.

[0059] With reference to Figs. 13 to 36, the operation of the loader (100) is hereinafter described.

[0060] With reference to Fig. 13, the stack (S) of blanks (B) is located in the handling station (1), abutting against the abutment sides (10, 11). The picking head (5) of the manipulator is positioned at a safety height above the stack (S). The lateral supporting elements (72) are in retracted position. The telemeter (T2) of the picking head detects the actual height of the stack (S).

[0061] With reference to Fig. 14, the picking head (5) of the manipulator is lowered vertically along the axis (Z) of the manipulator so that the front abutment plate (7) of the picking head is positioned opposite an upper part of the stack (S). The upper jaw (54) of the picking head is disposed in an intermediate position between the lower jaw (52) and the upper plate (53). The front abutment plate (7) is in a lowered position, such that the separation tooth (70) of the abutment plate is at a level capable of separating a ream of blanks from the top of the stack (S).

[0062] With reference to Fig. 15, the picking head (5) is moved forward along the axis (Y) of the manipulator, so that the front abutment plate (7) of the picking head abuts against an upper edge of the stack of blanks. In this way, the separation tooth (70) of the abutment plate penetrates between two blanks and separates a ream (R) of blanks at the top of the stack (S).

[0063] Referring to Fig. 16, the picking head (5) is raised vertically along the axis (Z) of the manipulator, by a distance of, for example, 20 mm, so that the separation tooth (70) of the abutment plate lifts one edge of the ream (R) located on top of the stack (S), forming an empty space (G) between the stack (S) and the ream (R).

[0064] With reference to Fig. 17, the actuators (73) of the lateral supporting elements (72) are activated so that the lateral supporting elements (72) move to the extended position, positioning themselves in the empty space (G) between the stack (S) and the ream (R).

[0065] With reference to Fig. 18, the picking head (5) is retracted horizontally along the axis (Y) of the manipulator, by a distance of, for example, 20 mm, so that the separation tooth (70) of the abutment plate disengages from the ream (R) that falls onto the lateral supporting elements (72). In this way, one edge of the ream (R) is supported by the lateral supporting elements (72).

[0066] With reference to Fig. 19, the picking head (5) is raised vertically along the axis (Z) of the manipulator, for a distance of, for example, 35 mm, so as to create a

space (G1) between the stack (S) and the ream (R) sufficient for the insertion of the front edge (80) of the lower plate of the lower jaw of the picking head.

[0067] With reference to Fig. 20, the actuator (81) of the lower plate of the lower jaw is activated, so that the lower plate (8) moves to its extended position and the front edge (80) of the lower plate enters the space (G1) between the stack (S) and the ream (R).

[0068] With reference to Fig. 21, the picking head (5) is retracted horizontally along the axis (Y) of the manipulator, by a distance of, for example, 15-20 mm, so that the lateral supporting elements (72) of the abutment plate exit the space (G1) between the stack (S) and the ream (R), while the front edge (80) of the lower plate remains in the space (G1) between the stack (S) and the ream (R), keeping the ream (R) separated from the stack (S).

[0069] With reference to Fig. 22, the actuator (57) of the upper jaw (54) is activated, and thus the upper jaw (54) is raised along the axis (Z1). The actuator (71) of the front abutment plate (7) is activated, and thus the front abutment plate (7) is also raised. The actuators (73) of the lateral supporting elements (72) are activated, and thus the lateral supporting elements (72) return to their retracted position. The front edge (80) of the lower plate remains at all times in the space (G1) between the stack (S) and the ream (R), keeping the ream (R) separated from the stack (S).

[0070] With reference to Fig. 23, the picking head (5) is moved forward horizontally along the axis (Y) of the manipulator, so that the lower jaw (52) of the picking head is positioned completely beneath the ream (R) that has been separated from the stack (S).

[0071] With reference to Fig. 24, the actuator (57) of the upper jaw (54) is activated, and thus the upper jaw (54) is lowered along the axis (Z1). The metal plate located beneath the upper jaw (54) compresses the ream and activates the photocell that detects the closing of the picking head (5). In this case, the ream (R) is compressed in sandwich configuration between the lower jaw (52) and the upper jaw (54).

[0072] With reference to Fig. 25, the picking head (5) is raised vertically along the axis (Z) of the manipulator until the picking head (5) is positioned above the front abutment side (10) of the handling station.

[0073] With reference to Fig. 26, the picking head (5) is translated horizontally along the axis (X) of the manipulator, i.e., in a longitudinal direction, so as to pass the front abutment side (10) and position itself above the perimeter defined by the abutment sides (22, 23, 23, 25) of the transfer station. It should be noted that the photocells (W1, W2, W3, W4) of the transfer station detect the perimeter defined by the abutment sides (22, 23, 23, 25).

[0074] With reference to Fig. 27, the picking head (5) is lowered along the axis (Z) of the manipulator so that the ream (R) held by the picking head is positioned in the transfer station between the abutment sides (22, 23, 23, 25), possibly above a still incomplete second stack (S2) of blanks located in the transfer station (2).

[0075] With reference to Fig. 28, the upper jaw (54) of the picking head is raised to untighten the ream (R). Subsequently, the picking head (5) is retracted along the axis (Y) of the manipulator. As a result, the ream (R) that was in the picking head abuts against the right abutment side (25) of the transfer station and thus remains in the transfer station (2). In this case, the right abutment side (25) comprises two sections, and the picking head (5) passes between the two sections of the right abutment side (25).

[0076] Fig. 29 shows the ream (R) that has been released onto the second stack (S2) located in the transfer station and the picking head (5) returning to its starting position in the handling station.

[0077] Referring to Fig. 30, the abutment sides (22, 23, 24, 25) of the transfer station are activated, and thus the second stack (S2) in the transfer station is compacted, aligning the edges of the blanks. The picking head (5) has returned to its starting position in the handling station.

[0078] Referring to Fig. 31, after the second stack (S2) has been compacted by the abutment sides (22, 23, 24, 25) of the transfer station, the front abutment side (22) is lowered so that the second stack (S2) can be transferred to the magazine (3). At this point, the conveyor (20) is activated and the second stack (S2) is transferred to the magazine (3).

[0079] Fig. 32 shows the second stack (S2) resting on the base (30) of the magazine. In such a case, the rollers (31) of the base have been activated to push the second stack (S2) onto the front abutment plate (33) of the magazine. It should be noted that the rear abutment plate (34) of the magazine is positioned above the base (30) to allow the second stack (S2) to pass through.

[0080] Referring to Fig. 33, the lift (32) of the magazine is activated to raise the base (30) until the top of the second stack (S2) reaches the photocell (38) of the magazine. At this point, the suction cups (41) of the picker adhere to the blank (B) at the top of the second stack, and the picking of the blank can begin. As the blanks (B) are picked, one by one, from the top of the second stack (S2), the lift (32) of the magazine raises the base (30) to bring the blank at the top of the second stack to the height of the photocell.

[0081] Fig. 34 illustrates the situation where the second stack (S2) has been consumed, as only a few blanks (B) are left. In such a case, the base (30) of the magazine has reached the height of the buffer (9). At this point, the buffer (9) is activated to support the remaining blanks.

[0082] Referring to Fig. 35, the racks (90) of the buffer are moved to the extended position so as to hold the remaining blanks of the second stack (S2). At this point, the lift (32) can be lowered to lower the base (30), since the remaining blanks of the second stack (S2) are held by the racks (90) of the buffer.

[0083] Referring to Fig. 36, the base (30) of the magazine has been lowered to the same height as the conveyor (20) of the transfer station, and a third stack of blanks (S3) placed on the conveyor (20) of the transfer station (2) can be transferred to the base (30) of the magazine, beneath the buffer (9) that holds the remaining blanks of the second stack (S2).

[0084] Finally, the buffer (9) is deactivated, and the remaining blanks of the second stack (S2) fall onto the third stack (S3) located on the base (30) of the magazine.

[0085] Fig. 37 illustrates a first case of manual feeding, wherein the operator feeds the loader (100) with a stack (S) of blanks placed on a pallet (P). The pallet with the stack of blanks enters the handling station (1); the manipulator (M) picks the reams (R) from the stack (P) and forms another stack in the transfer station (2), which transfers it to the magazine (3) where the blanks (B) are picked one by one.

[0086] Fig. 38 illustrates a second case of manual unloading in which an unfinished stack of blanks present on the magazine (3) is lowered and transferred back to the transfer station (2), where it is then manually retrieved by the operator.

[0087] Fig. 39 illustrates a third case of manual feeding of a small batch of blanks, in which the operator enters the transfer station (2) and manually creates a stack of blanks that is then compacted and automatically transferred by the conveyor belts of the transfer station (2) toward the magazine (3).

[0088] Fig. 40 illustrates a fourth case of feeding, unloading, and format change in a completely automatic mode. A conveyor (200), such as an autonomous shuttle, feeds the loader (100) with a pallet (P) supporting a stack of blanks. When a format change is signaled, the unused stack of cardboard blanks located in the magazine (3) is transferred from the magazine (3) to the transfer station (2), where it is compacted. The manipulator (M) then picks the reams from the stack located in the transfer station (2) and places them onto the empty or partially filled pallet located in the handling station (1) by means of the two extractor units (59) (Figs. 7 and 8) located on either side of the picking head (5). Once such an operation is completed, the conveyor (200) removes the pallet with the blanks of the old format and replaces it with a new pallet carrying a stack of blanks in the new format. The cycle can now resume normally until the next format change.

[0089] Fig. 41 illustrates a first arrangement of the blanks on the pallet, in which a single stack or multiple parallel stacks are created on the pallet in a longitudinal arrangement. In such a case, the reams can be picked from the stack without needing to rotate the picking head (5) that is moved horizontally along the axis (Y) to move from one stack to the next one.

[0090] Fig. 42 illustrates a second arrangement of blanks on the pallet, in which the blanks are arranged in multiple parallel stacks with multiple rows. To pick a ream, the picking head (5) does not require any rotation; instead, its position is adjusted by moving it along the horizontal axes (X) and (Y).

[0091] Fig. 43 illustrates a third arrangement of blanks on the pallet, in which the blanks are arranged in multiple parallel stacks, even in multiple rows, with a transverse arrangement. In such a case, to pick a stack, the picking head must rotate around a vertical axis and then move along the horizontal axes (X) and (Y).

[0092] Numerous variations and detailed modifications can be made to the present embodiment of the invention, within the reach of a person skilled in the art, however falling within the scope of the invention as expressed by the appended claims.

Claims

1. Loader (100) comprising:

- a handling station (1) suitable for receiving a stack (S) of cardboard blanks (B) and comprising a manipulator (M) with a picking head (5) suitable for picking a ream (R) of blanks from said stack (S),
- a magazine (3) suitable for storing the stacked blanks (B),
- a transfer station (2) suitable for receiving said reams (R) of blanks picked by the picking head (5) of the manipulator so as to form a second stack (S2) of blanks and transfer said second stack (S2) of blanks to said magazine (3), and
- a picking station (4) suitable for picking one blank at a time from the top of said second stack (S2) of blanks stored in the magazine (3);

characterized in that

said picking head (5) comprises:

- a central body (51),
- a lower jaw (52) that protrudes from the central body (51),
- an upper plate (53) that protrudes from the central body (51) in parallel direction to the lower jaw (52),
- an upper jaw (54) mounted on the central body (51) so as to slide vertically between the lower jaw (52) and the upper plate (53),
- an actuator (57) configured to move said upper jaw (54) so as to tighten said ream (R) of blanks between the lower jaw (52) and the upper jaw (54), and
- a front abutment plate (7) mounted at a

front end of the upper jaw (54) so as to abut against said stack (S) in the handling station;

said front abutment plate (7) being provided with a separation tooth (70) that protrudes anteriorly from a lower central portion of the front abutment plate (7) so as to be positioned between two blanks of the stack (S) in such a way to separate a ream (R) above the stack;
said front abutment plate (7) being mounted so as to slide vertically with respect to the upper jaw (54); and
said picking head (5) comprising an actuator (71) that moves said front abutment plate (7).

2. The loader (100) according to claim 1, wherein said handling station (1) comprises:

- abutment sides (10, 11) in the form of vertical walls defining a perimeter that contains the stack (S) of blanks; and
- photocells (C1, C2, C3, C4) arranged to detect when the stack (S) abuts against a side (10, 11) of the handling station.

3. The loader (100) according to claim 1 or 2, wherein said transfer station (2) comprises:

- abutment sides (22, 23, 24, 25) arranged so as to define a perimeter that contains said second stack (S2) obtained from the reams (R) picked by said handling station (1), wherein at least some of the abutment sides (22, 23, 24, 25) of the transfer station abut against the sides of the second stack (S2) so as to compact the second stack (S2) in the transfer station, and
- photocells (W1, W2, W3, W4) arranged to detect when the second stack (S2) abuts against an abutment side (22, 23, 24, 25) of the transfer station.

4. The loader (100) according to any one of the preceding claims, wherein said manipulator (M) comprises a gantry (6) with three axes (X, Y, Z) supporting said picking head (5).

5. The loader (100) according to claim 4, wherein said gantry (6) comprises:

- a crossbeam (60) that extends horizontally in a longitudinal direction of the axis (X),
- an upright (61) that extends vertically in a direction of the axis (Z) and is slidingly mounted in the crossbeam (60) along the axis (X),
- a first actuator (A1) to move the upright (61),
- a transverse support (62) that extends horizontally in a transverse direction of the axis (Y) and is slidingly mounted in the upright (61) along the axis (Z);
- a second actuator (A2) to move the transverse support (62),

wherein the picking head (5) is slidingly mounted in the transverse support (62) along the axis (Y); and
said gantry (6) comprises a third actuator (A3) to move the picking head (5).

6. The loader (100) according to any of the preceding claims, wherein said picking head (5) comprises:

- two lateral supporting elements (72) movably mounted in the front abutment plate (7) so as to go from a retracted position, wherein they are disposed behind the front abutment plate (7), to an extracted position, wherein they protrude anteriorly with respect to the front abutment plate, underneath the plate, on either side with respect to the separation tooth (70) of the abutment plate, and
- actuators (73) to move said lateral supporting elements (72).

7. The loader (100) according to any of the preceding claims, wherein said picking head (5) comprises:

- a lower plate (8) having a rounded front edge (80) suitable for being introduced in an empty space (G) between the stack (S) and the ream (R) of blanks; said lower plate (8) being mounted so as to slide horizontally on the lower jaw (52) in order to go from a retracted position, wherein the front edge (80) of the lower plate is set back with respect to the front abutment plate (7), to an extracted position, wherein the front edge (80) of the lower plate is set forward with respect to the front abutment plate (7) so as to separate the ream (R) from the stack (S) of blanks, and
- an actuator (81) to move the lower plate (8) from the retracted position to the extracted position and vice versa.

8. The loader (100) according to any of the preceding claims, wherein said transfer station (2) comprises a conveyor (20) comprising two belts (21) arranged in parallel position and suitable for receiving said second stack (S2) obtained from the reams (R) picked by the picking head (5) of the manipulator.

9. The loader (100) according to any of the preceding claims, wherein said magazine (3) comprises:

- a base (30) suitable for supporting said second stack (S2),
- a lift (32) that raises and lowers said base (30),
- a photocell (38) that indicates a position in which the blank at the top of said second stack (S2) is to be picked;
- abutment sides (33, 34, 35, 36) that define a perimeter in which said second stack (S2) is arranged; wherein at least some of the abutment sides (33, 34, 35, 36) of the magazine are moved, abutting against the sides of the second stack disposed in the magazine (3) so as to compact said second stack; and said picking station (4) comprises a picker (40) provided with suction cups (41) to pick one blank at a time from the top of said second stack (S) arranged in the magazine (3).

10. The loader (100) according to claim 9, wherein said magazine (3) comprises a buffer (9) arranged above the base (30) to support residual blanks of the second stack (S2); said buffer (9) comprising two racks (90) mounted in such a way to move horizontally in order to be disposed in a retracted non-operating position, wherein they do not interfere with the second stack (S2), and in an extracted operating position, wherein they support said residual blanks of the second stack (S2).

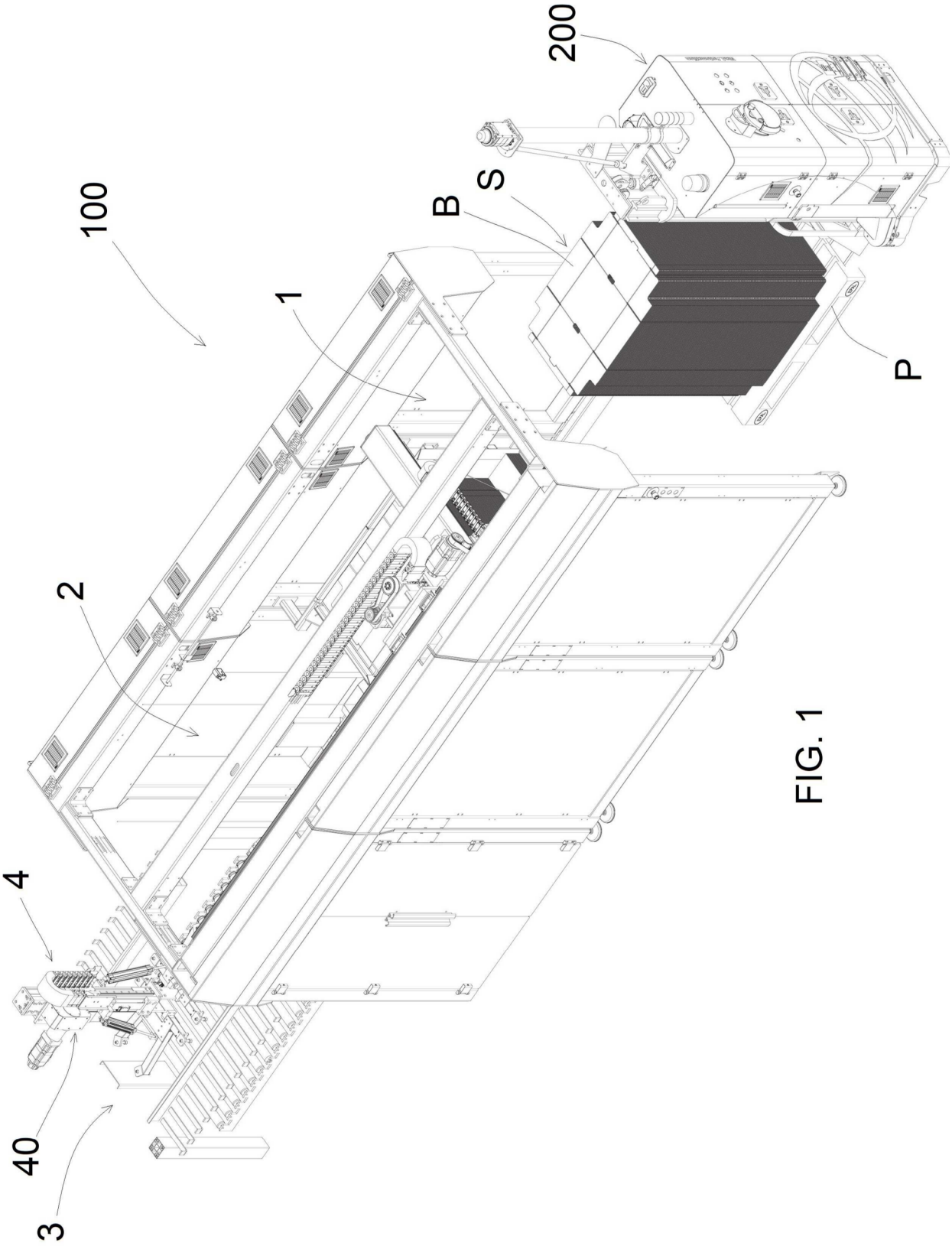


FIG. 1

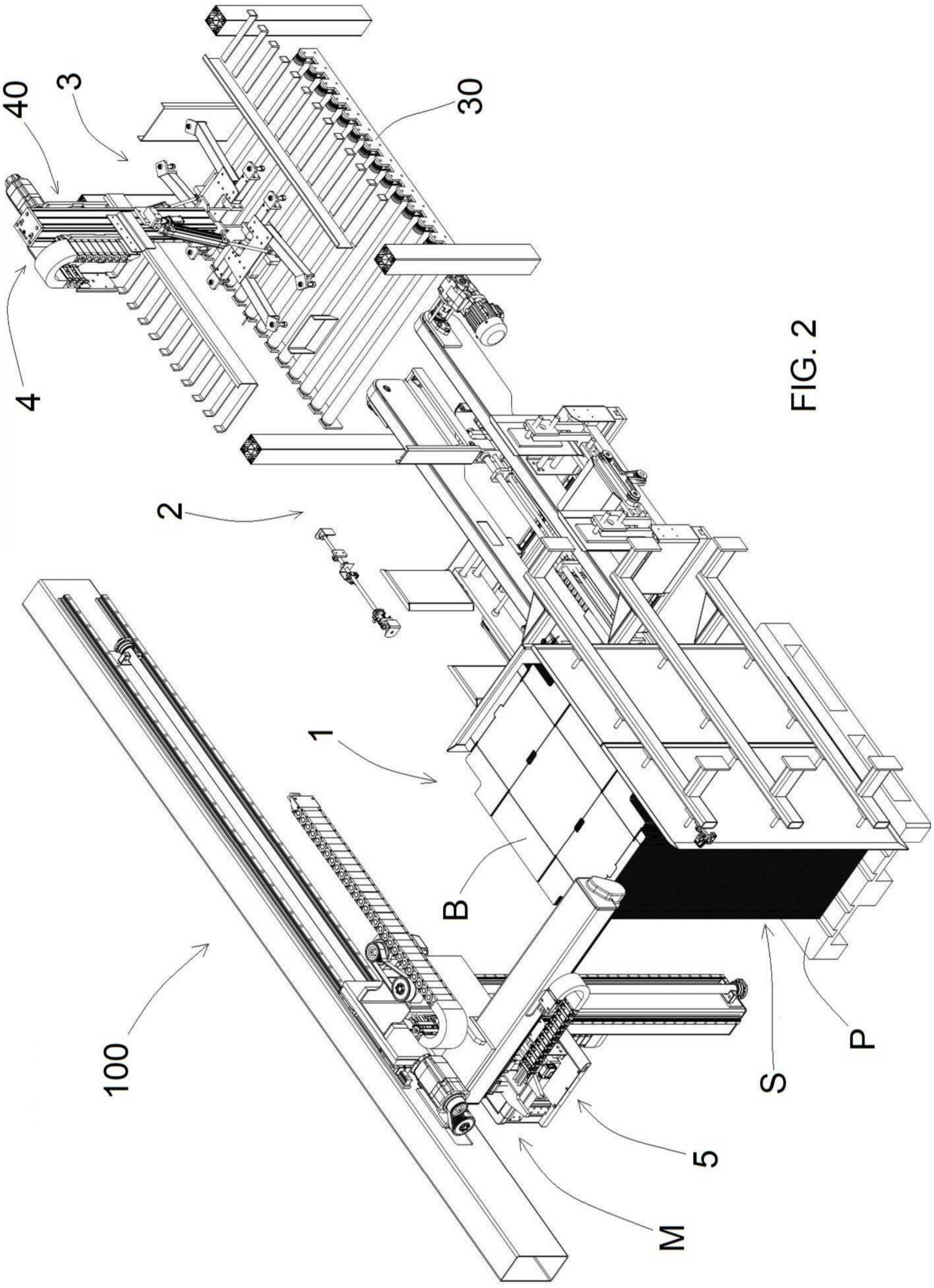


FIG. 2

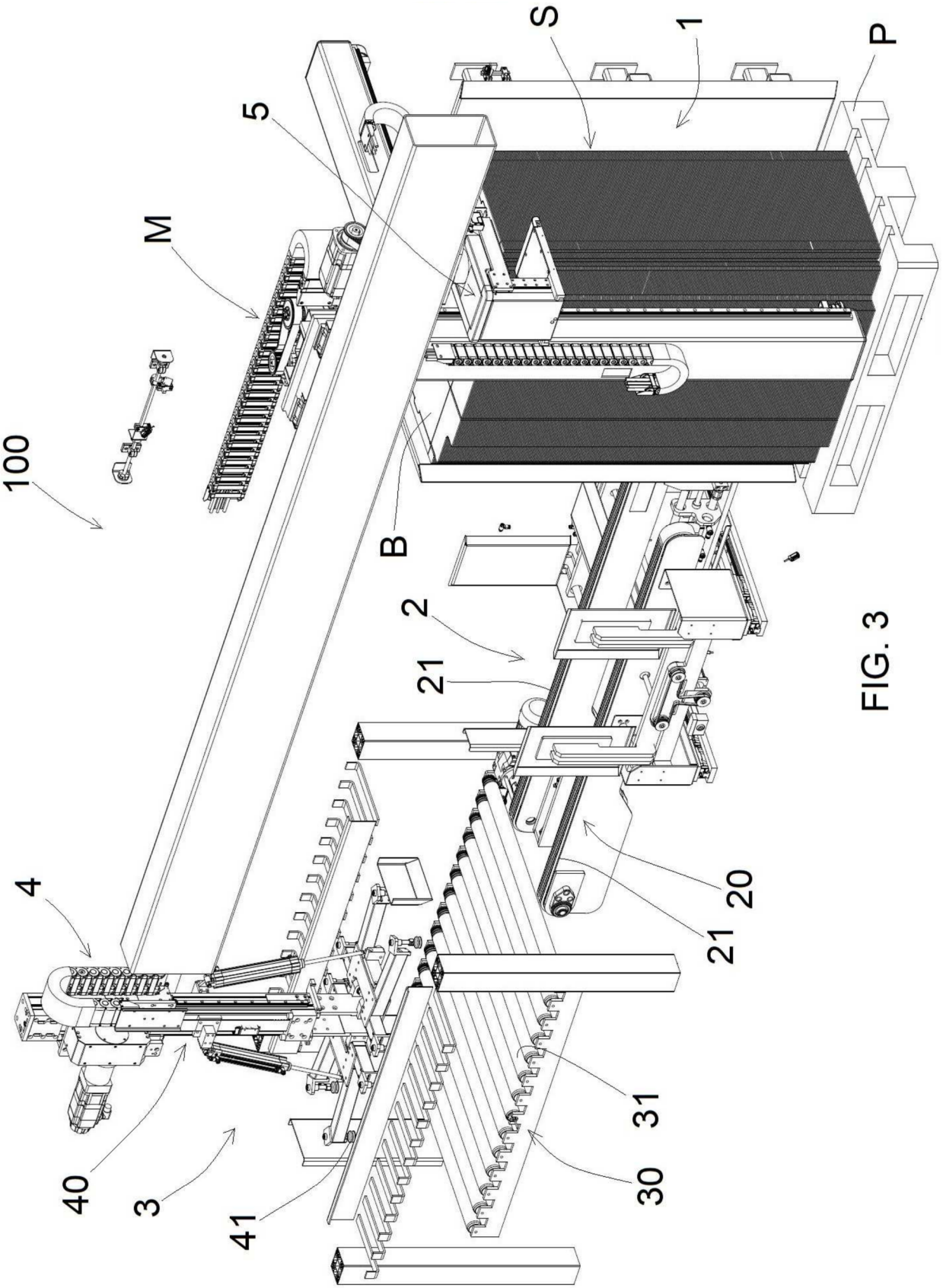


FIG. 3

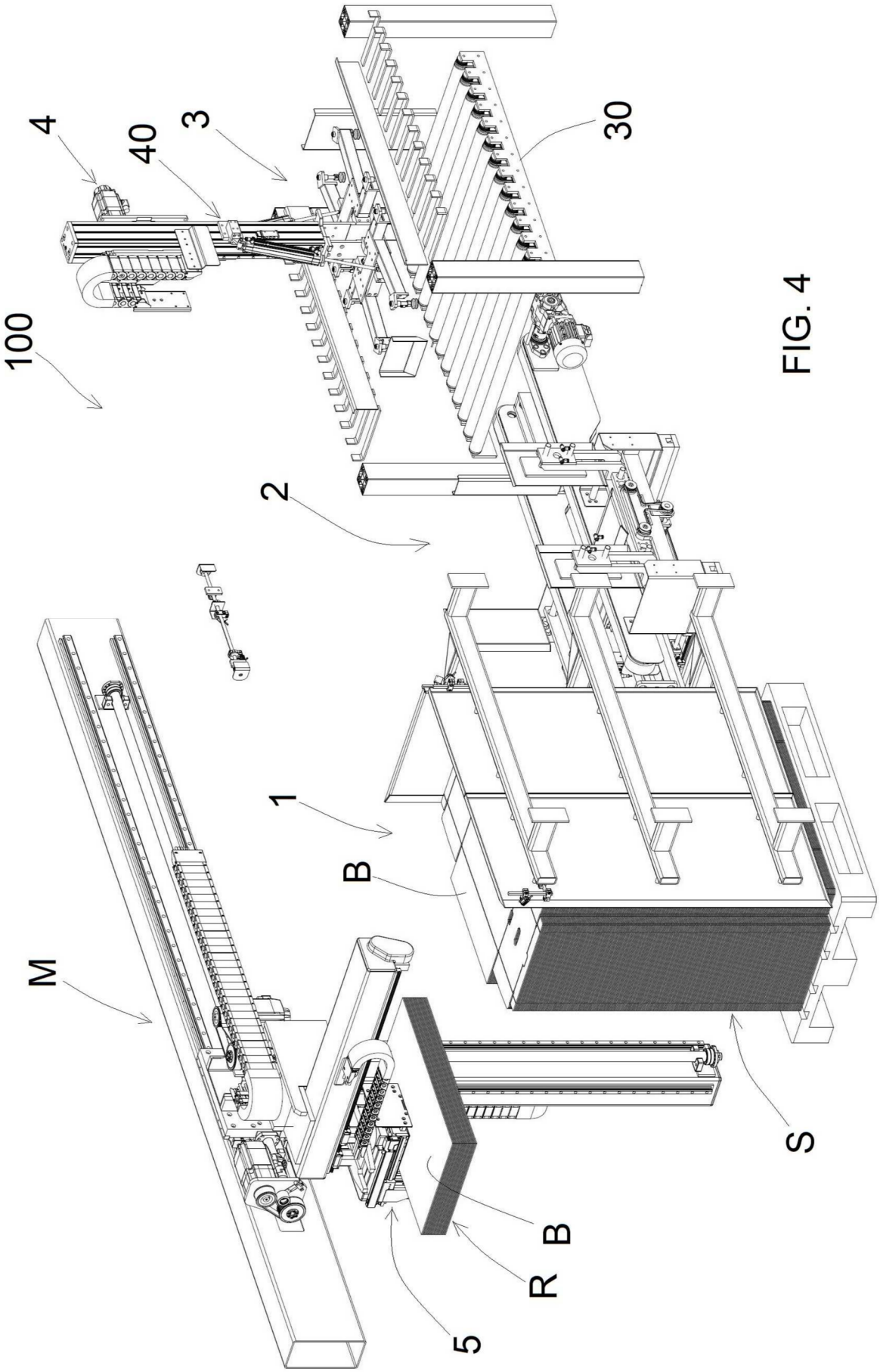


FIG. 4

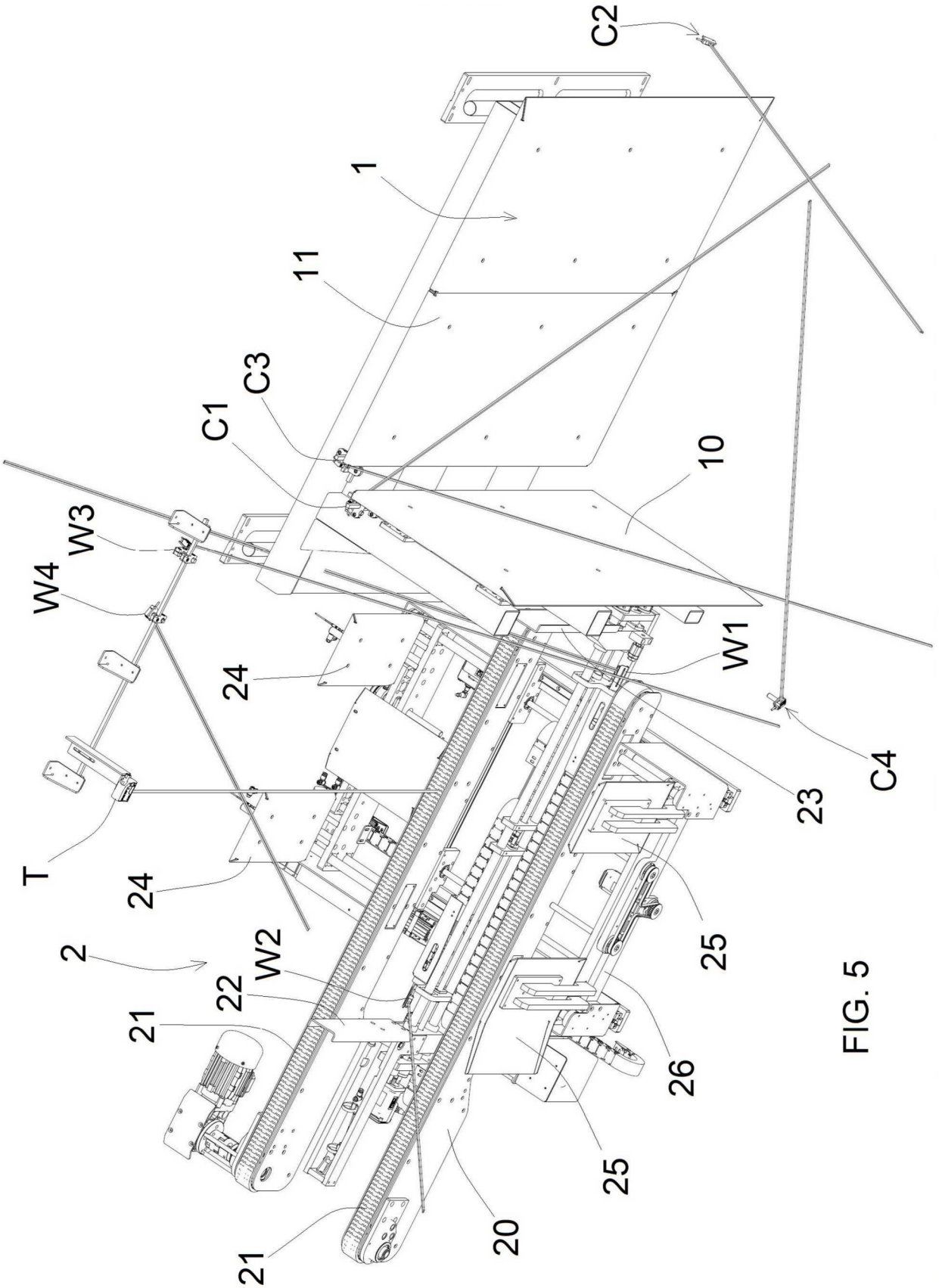


FIG. 5

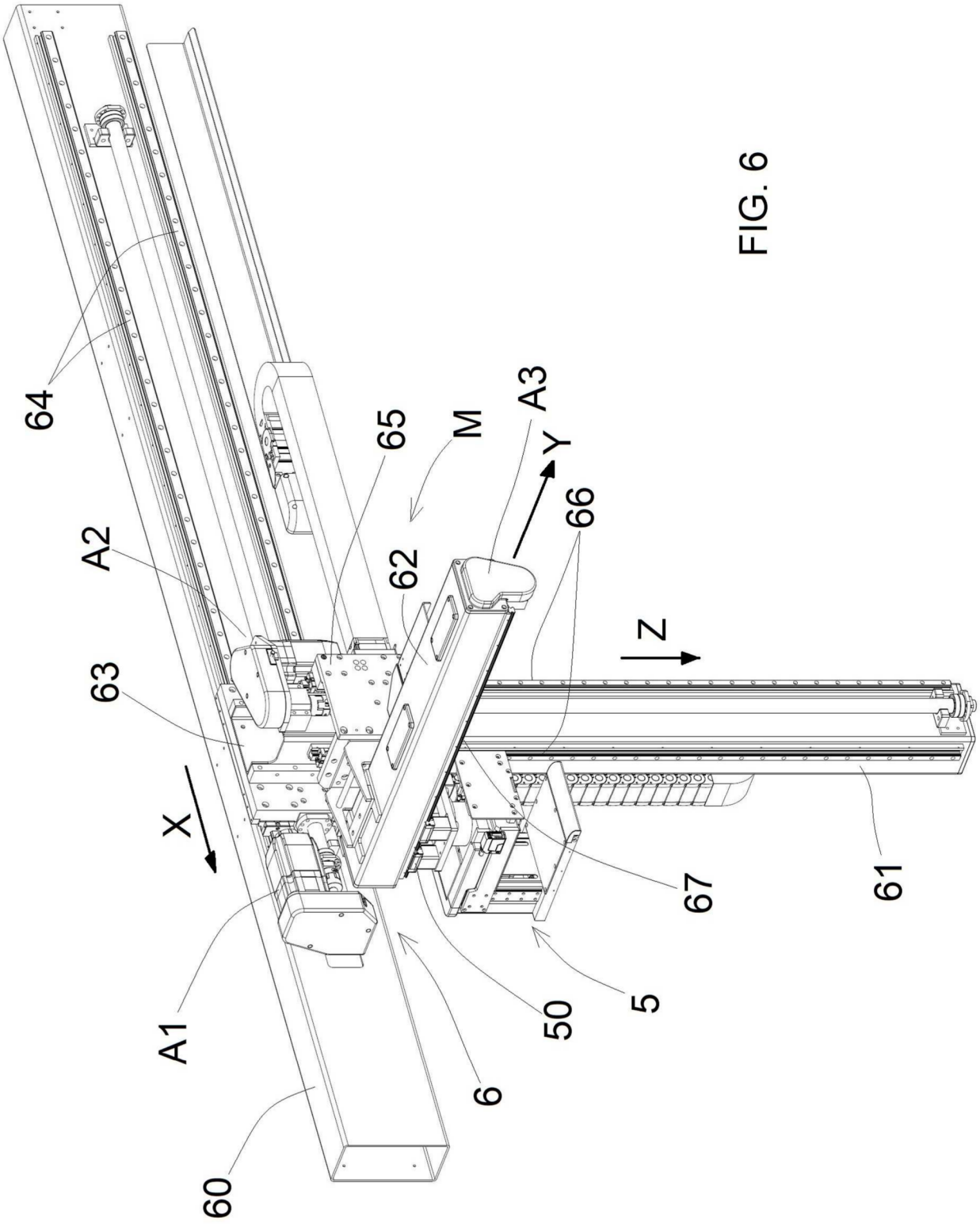


FIG. 6

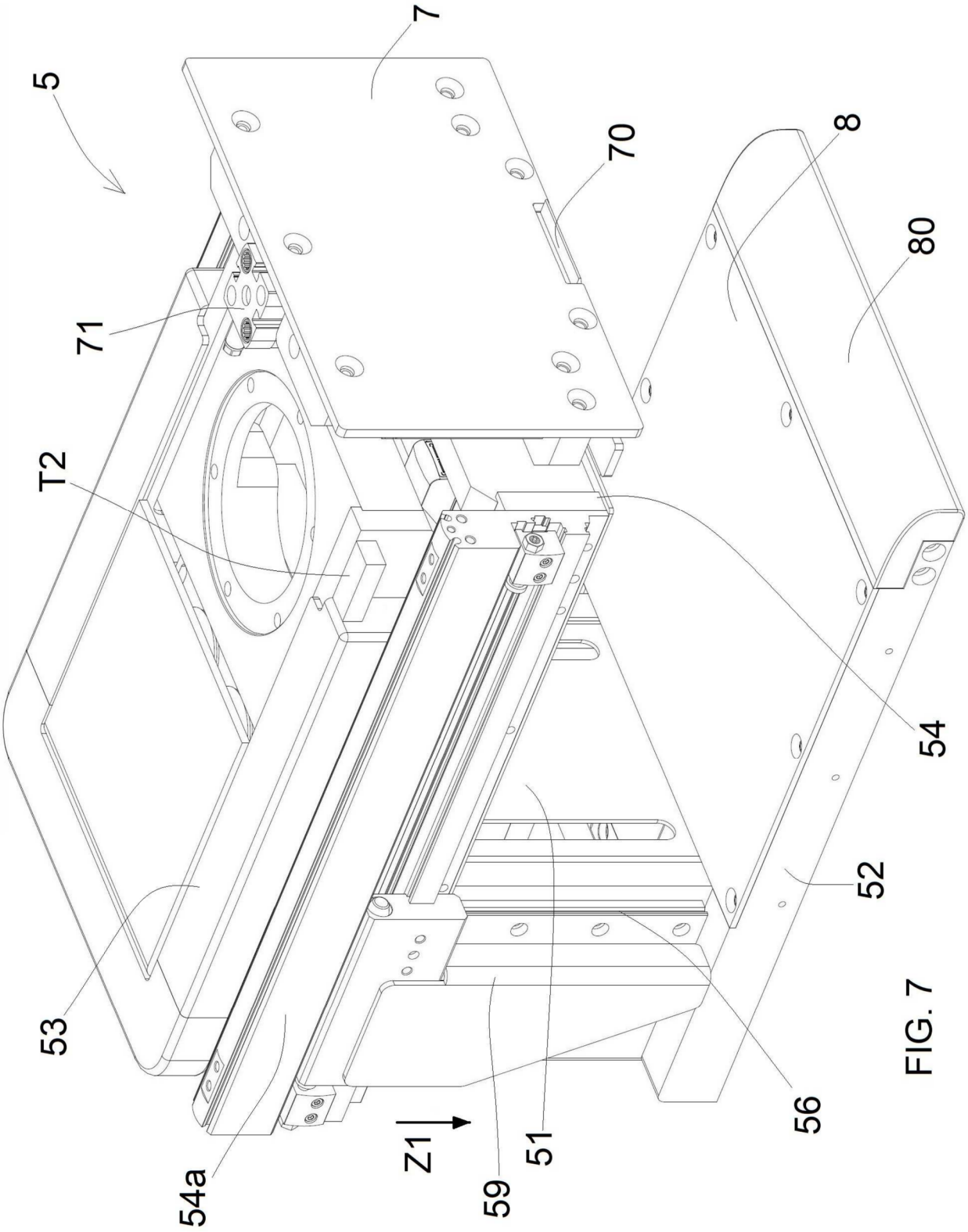


FIG. 7

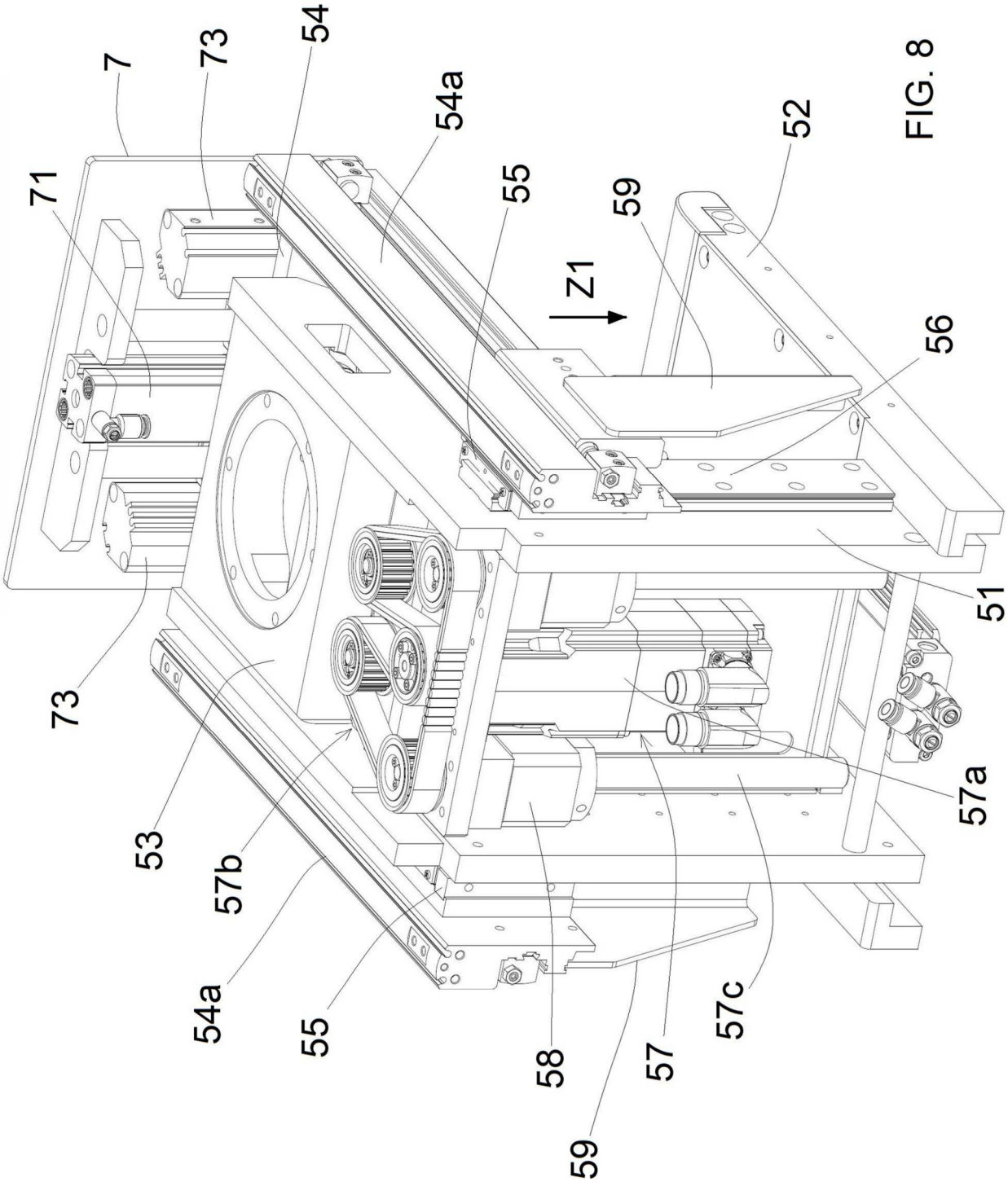


FIG. 8

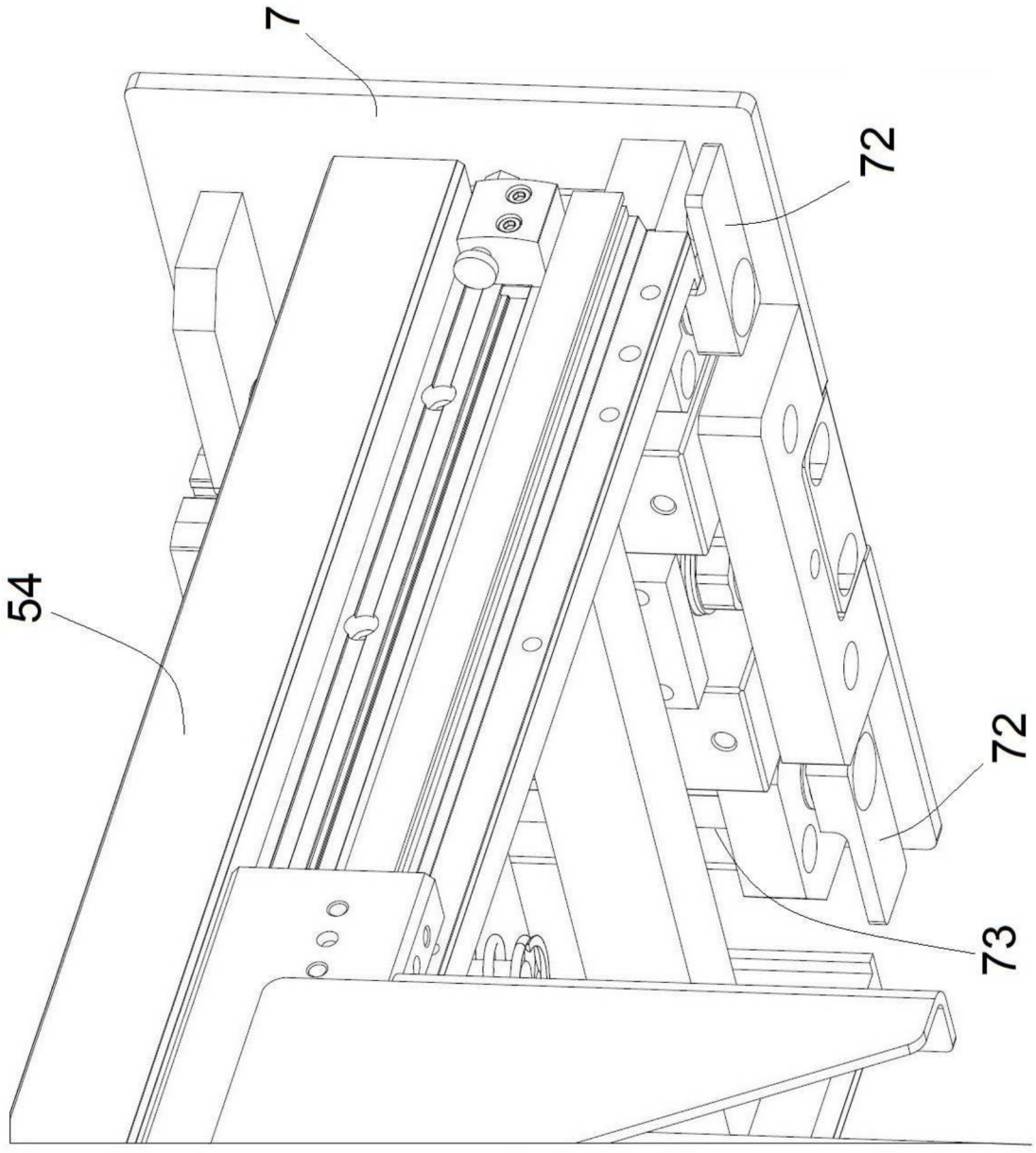


FIG. 9

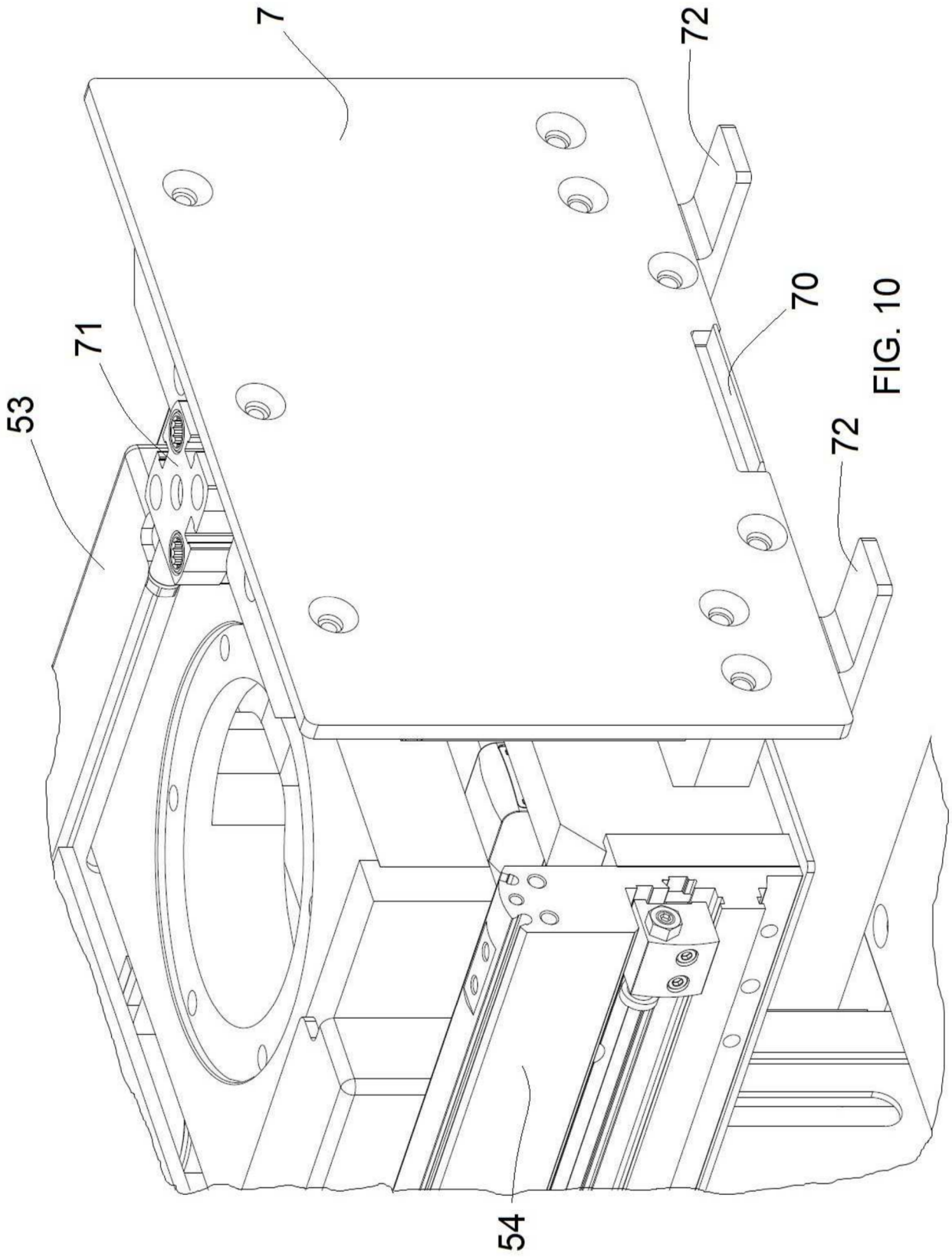


FIG. 10

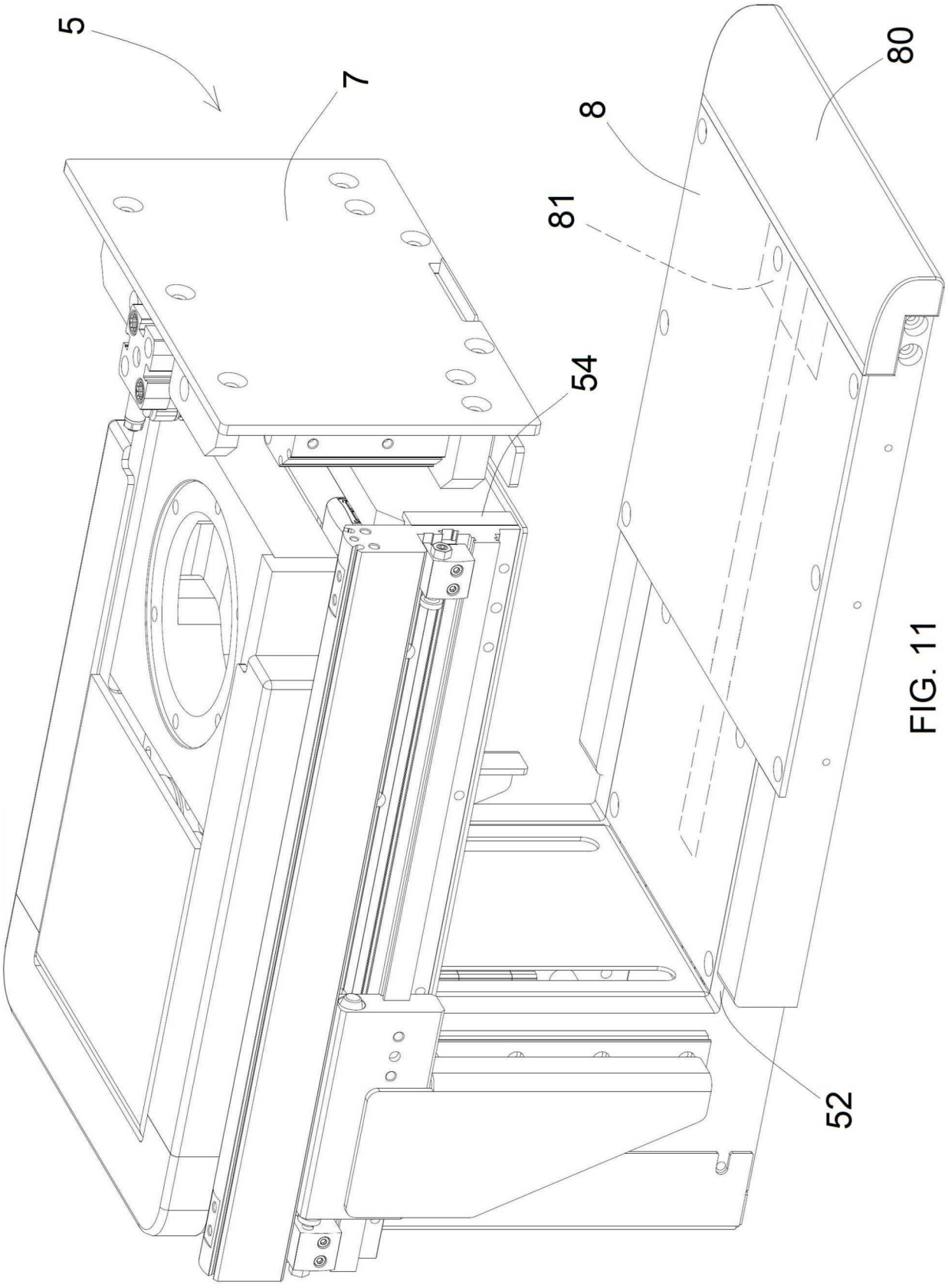


FIG. 11

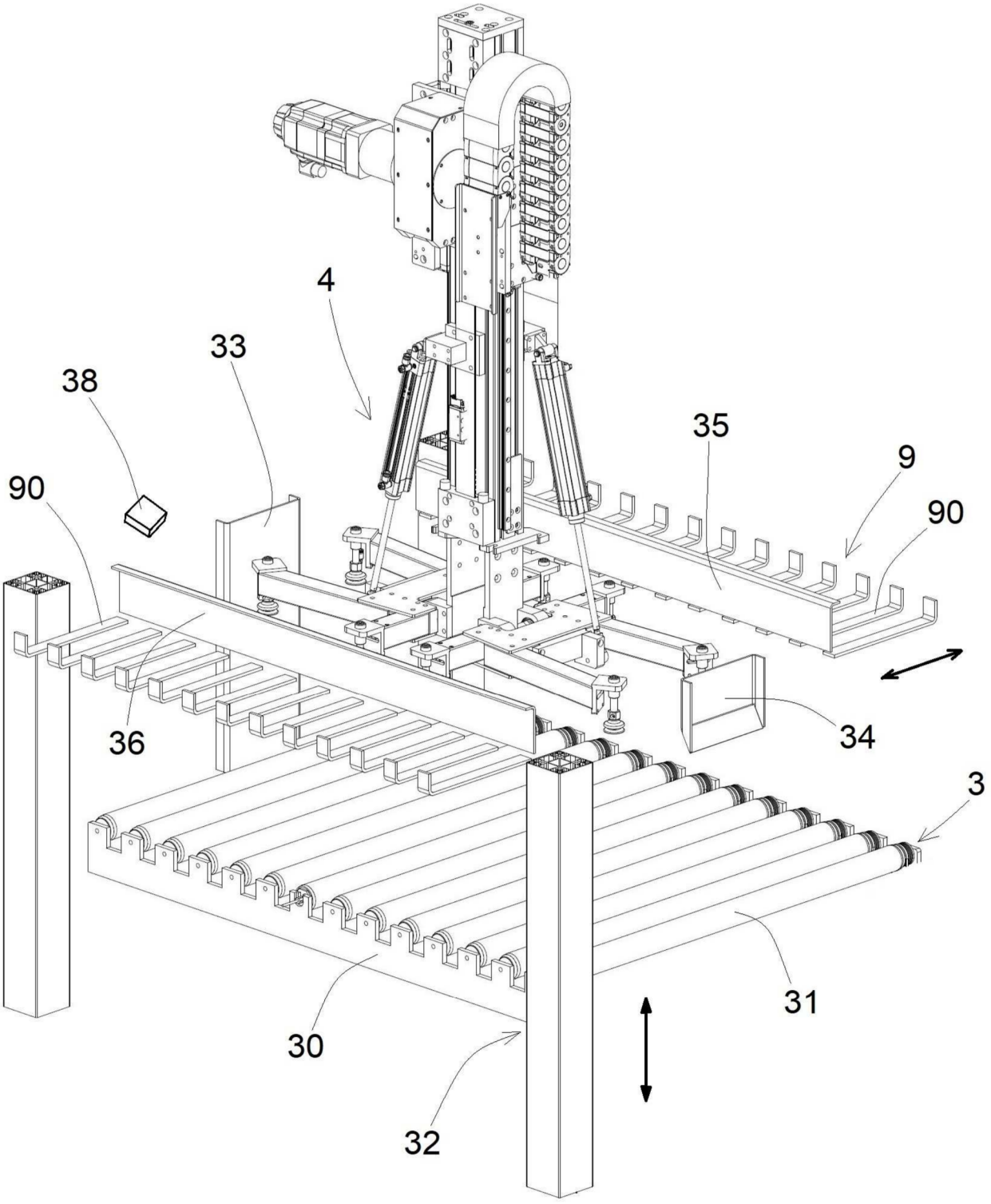


FIG. 12

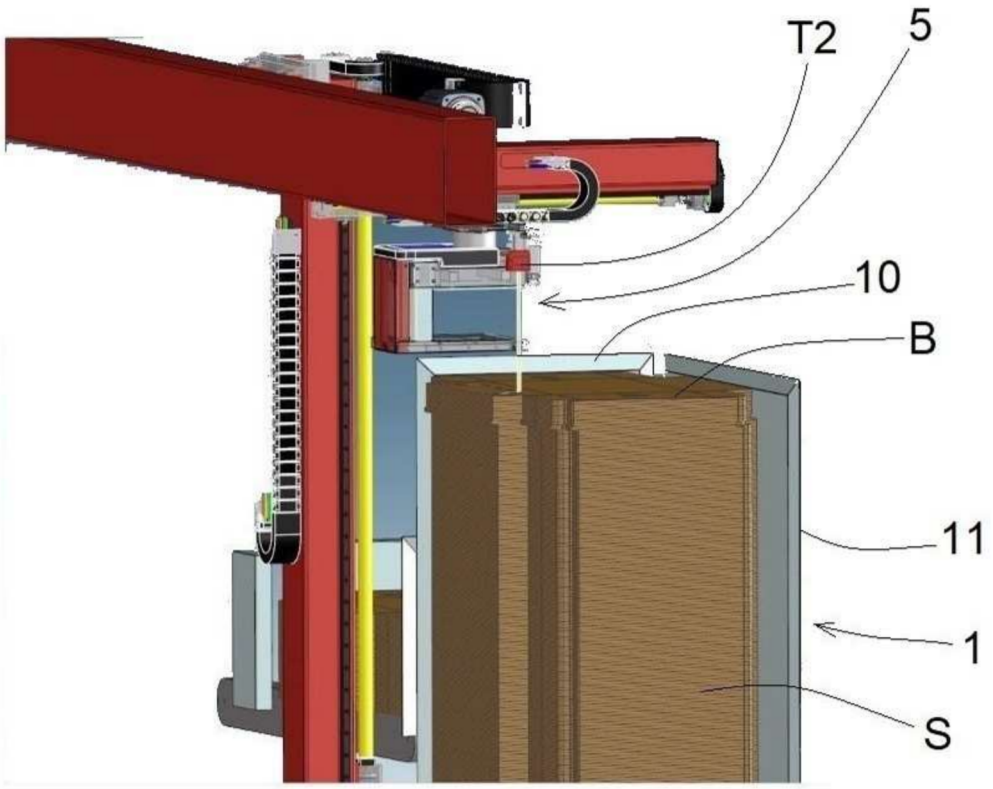


FIG. 13

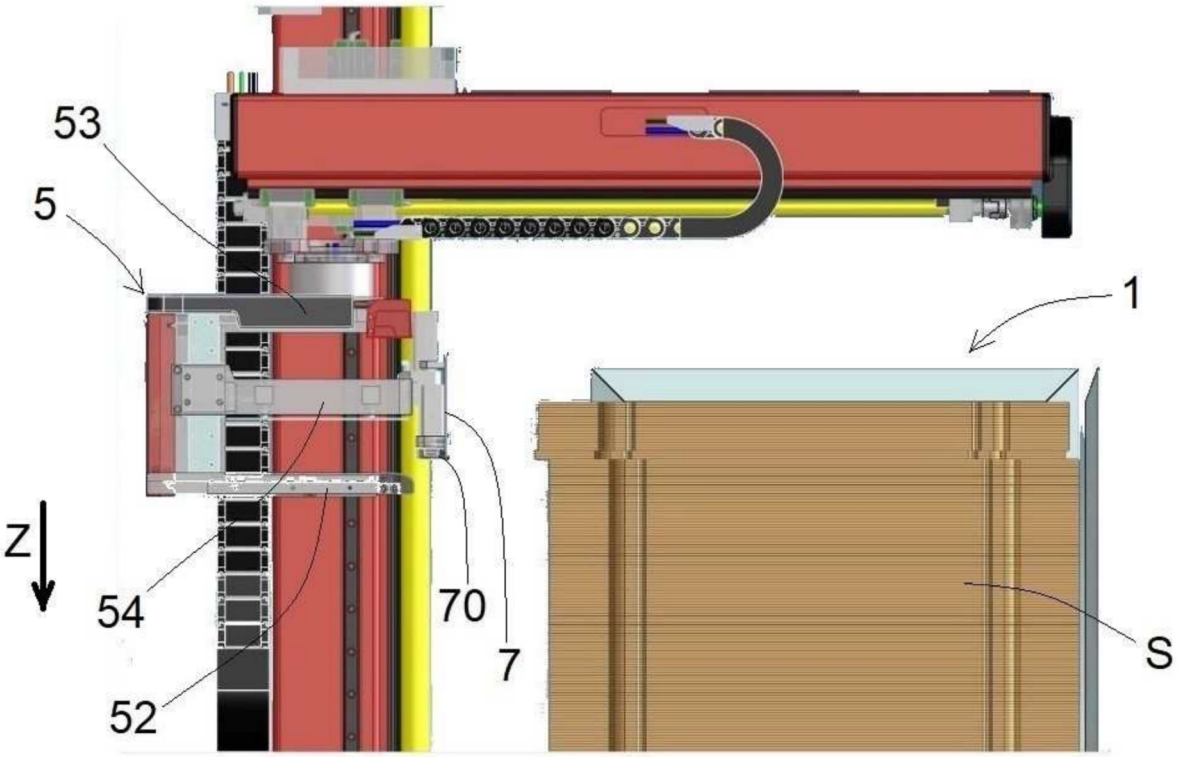


FIG. 14

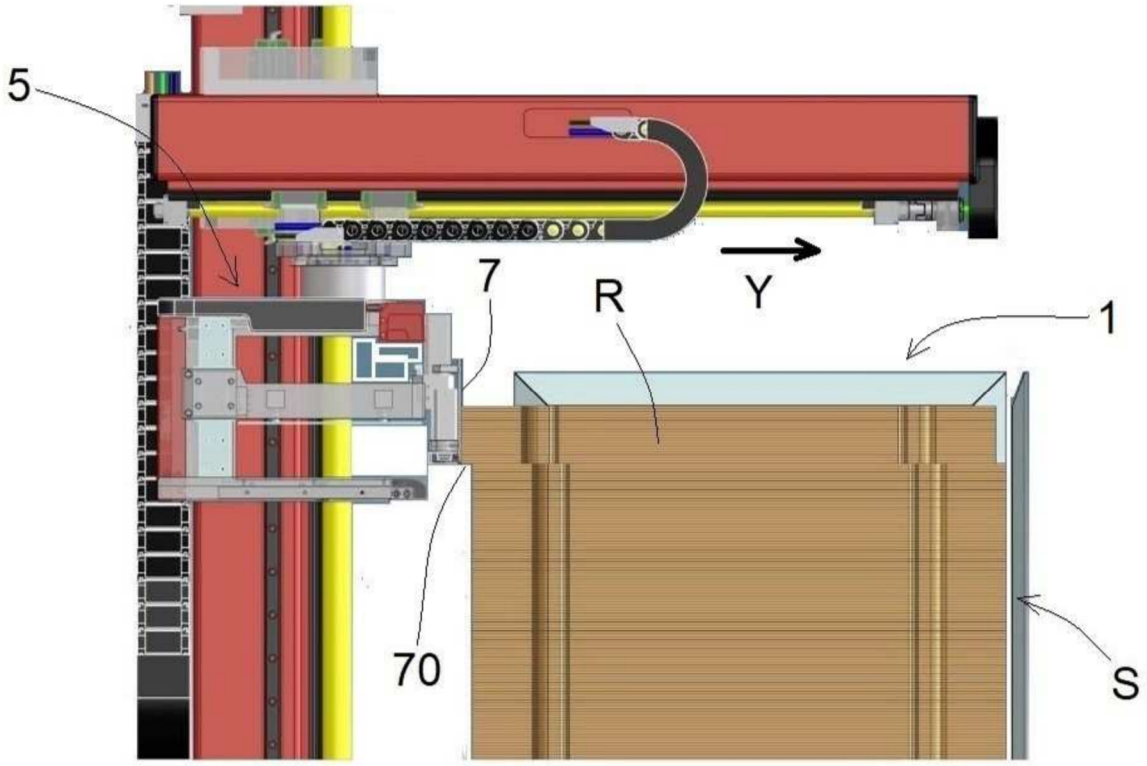


FIG. 15

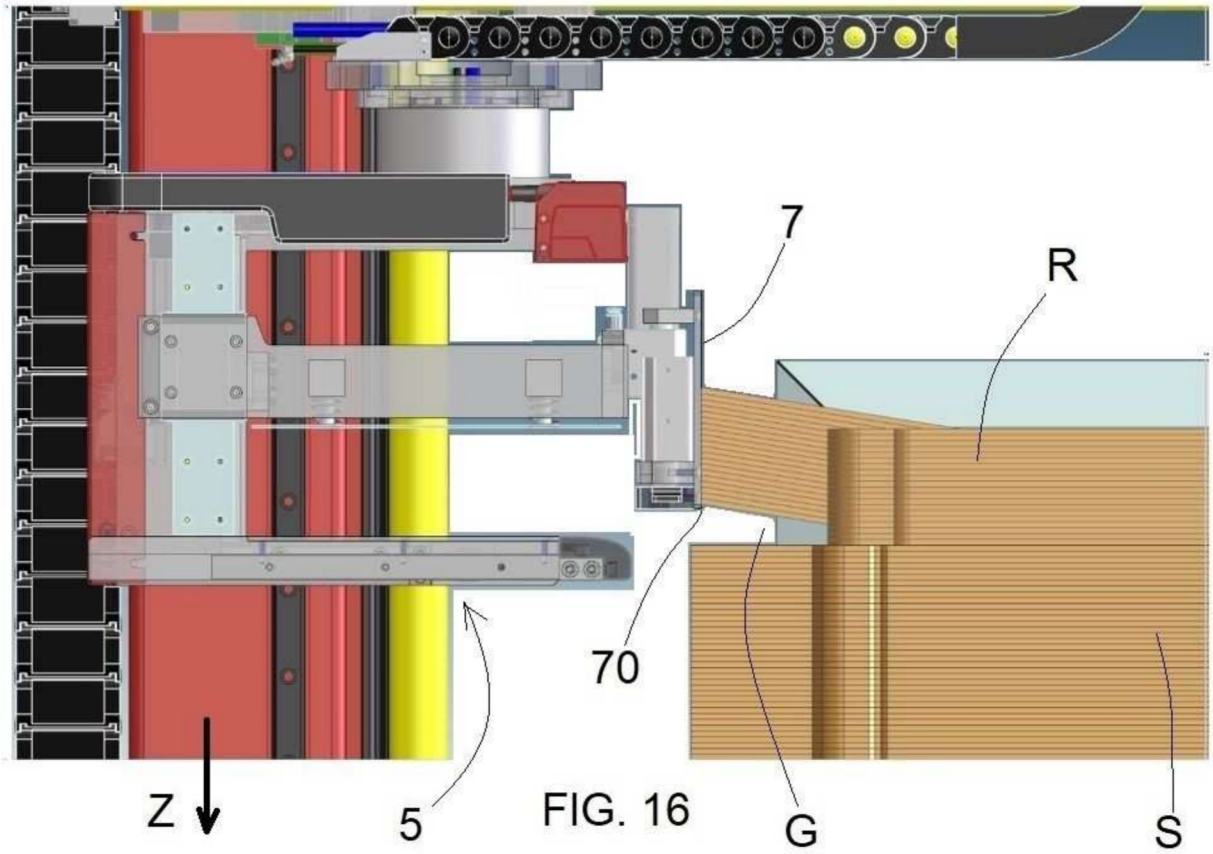


FIG. 16

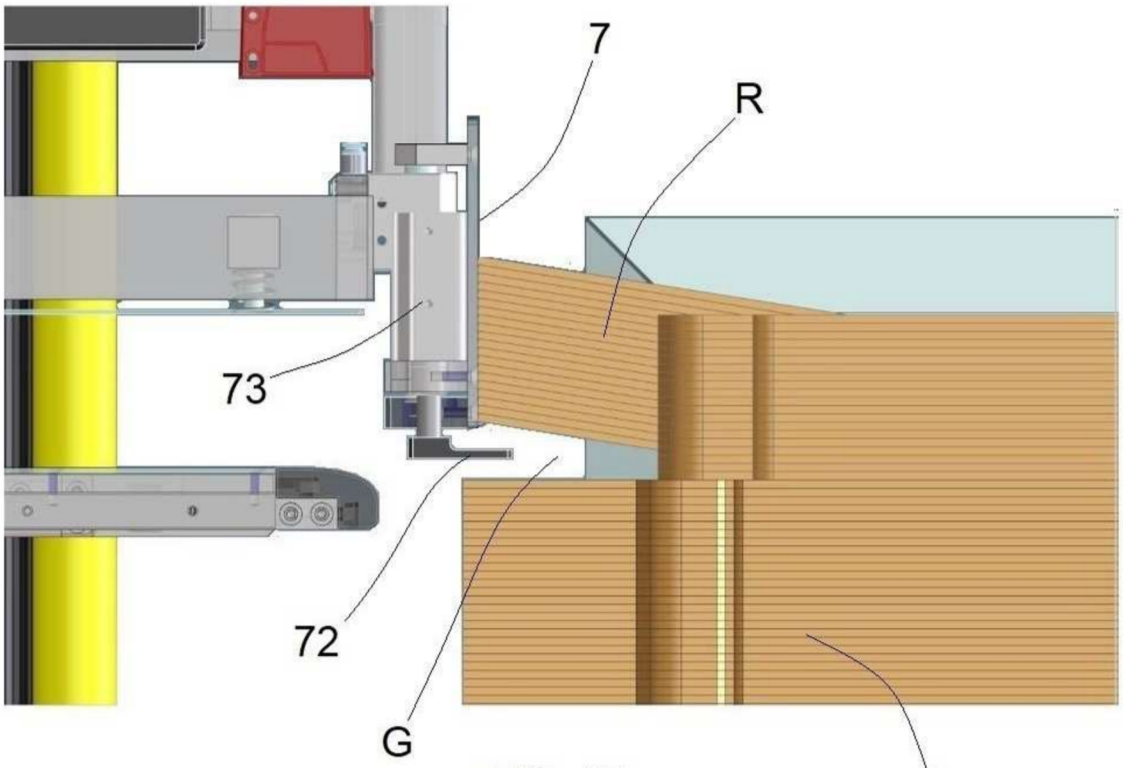


FIG. 17

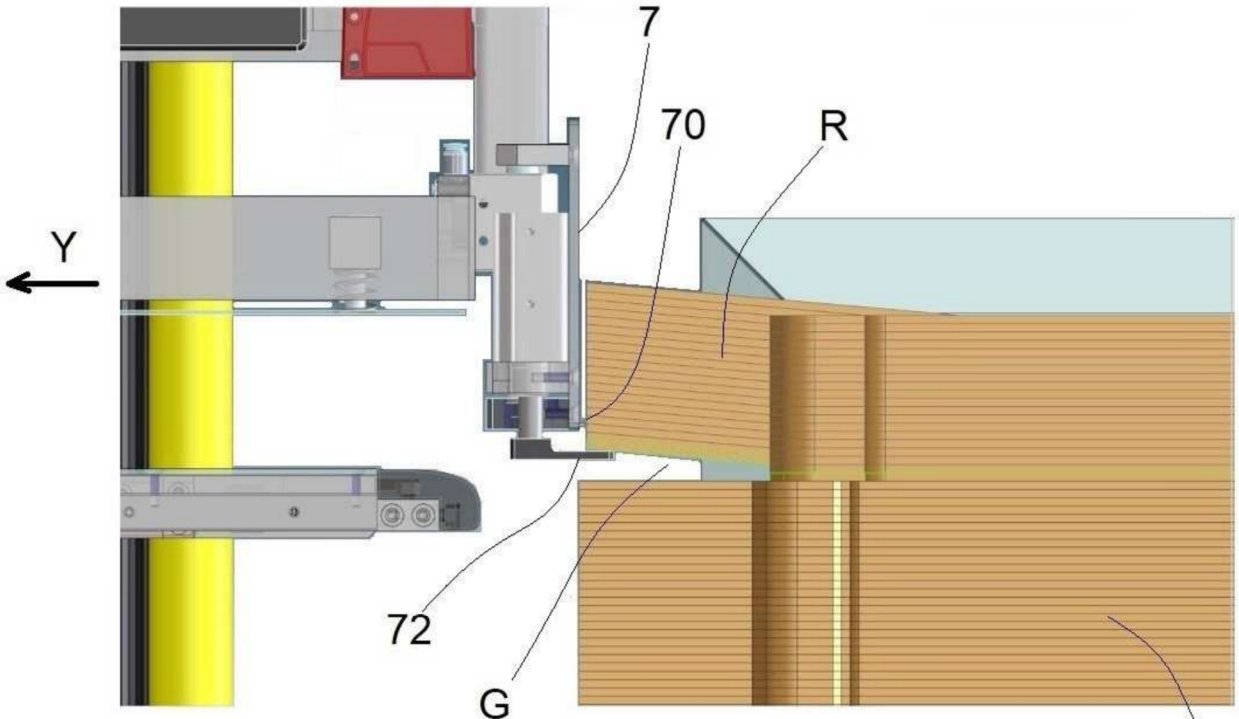


FIG. 18

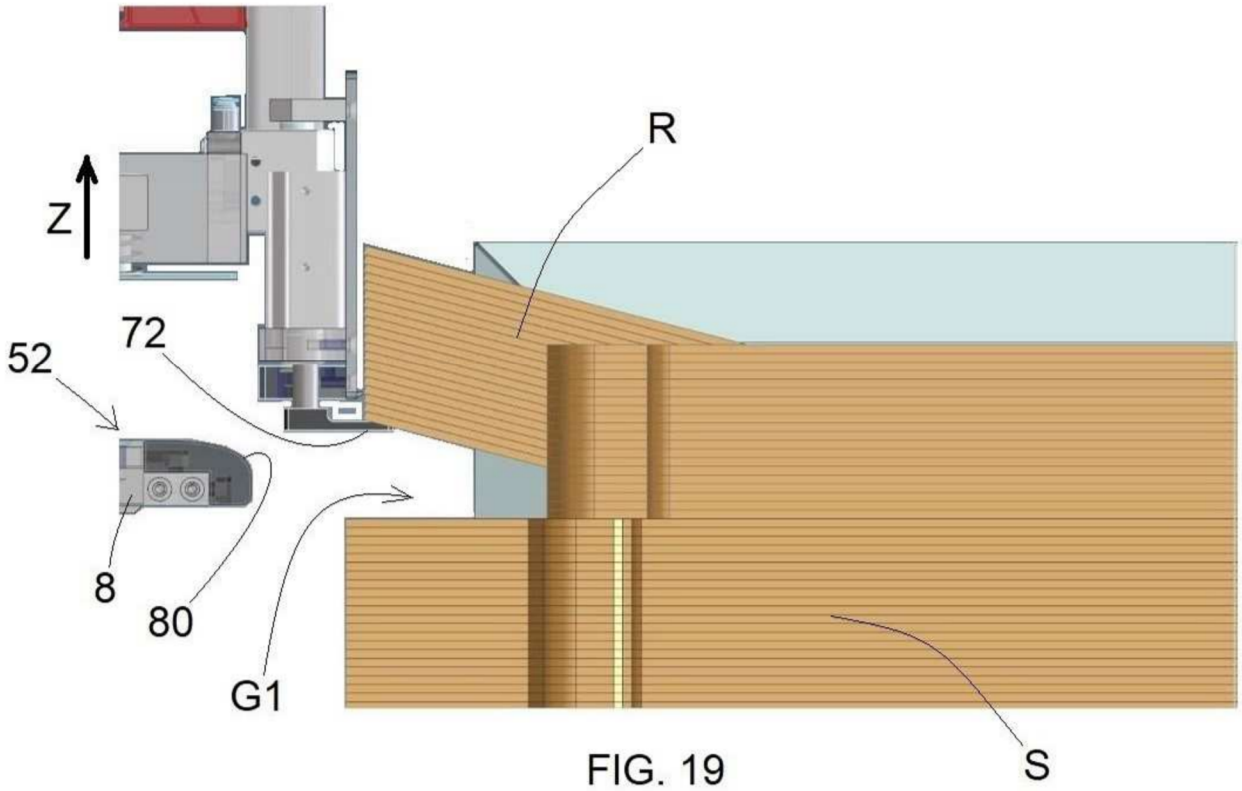


FIG. 19

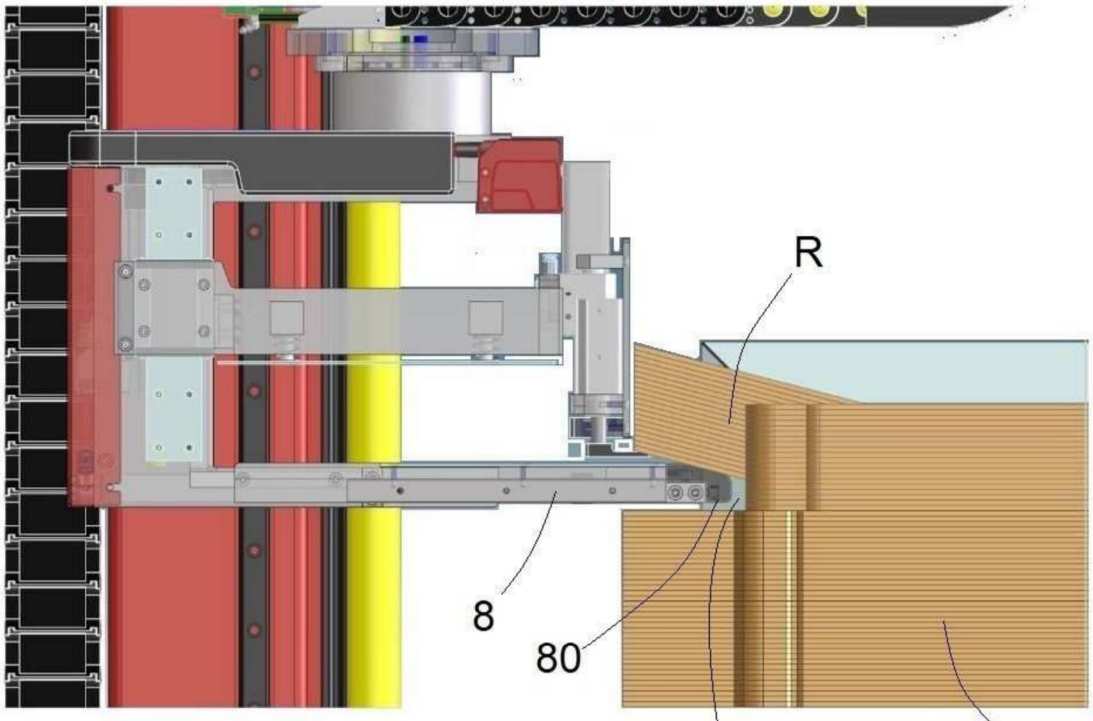


FIG. 20

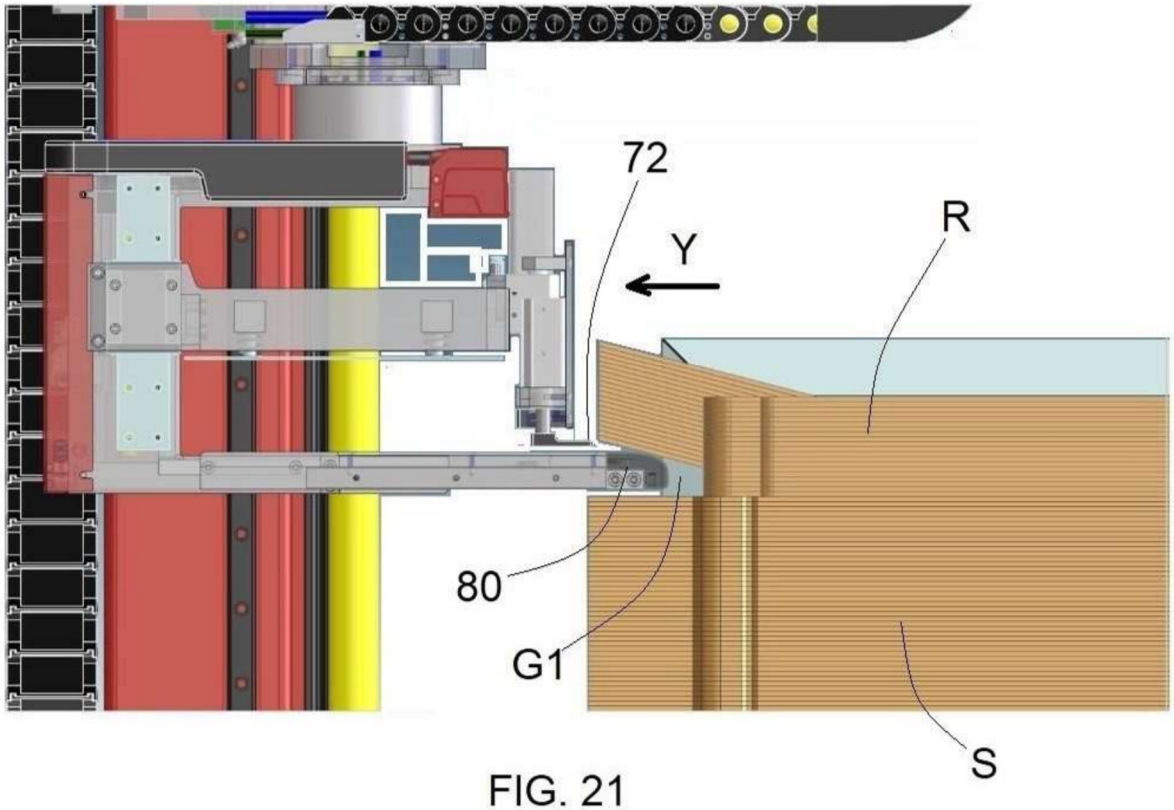


FIG. 21

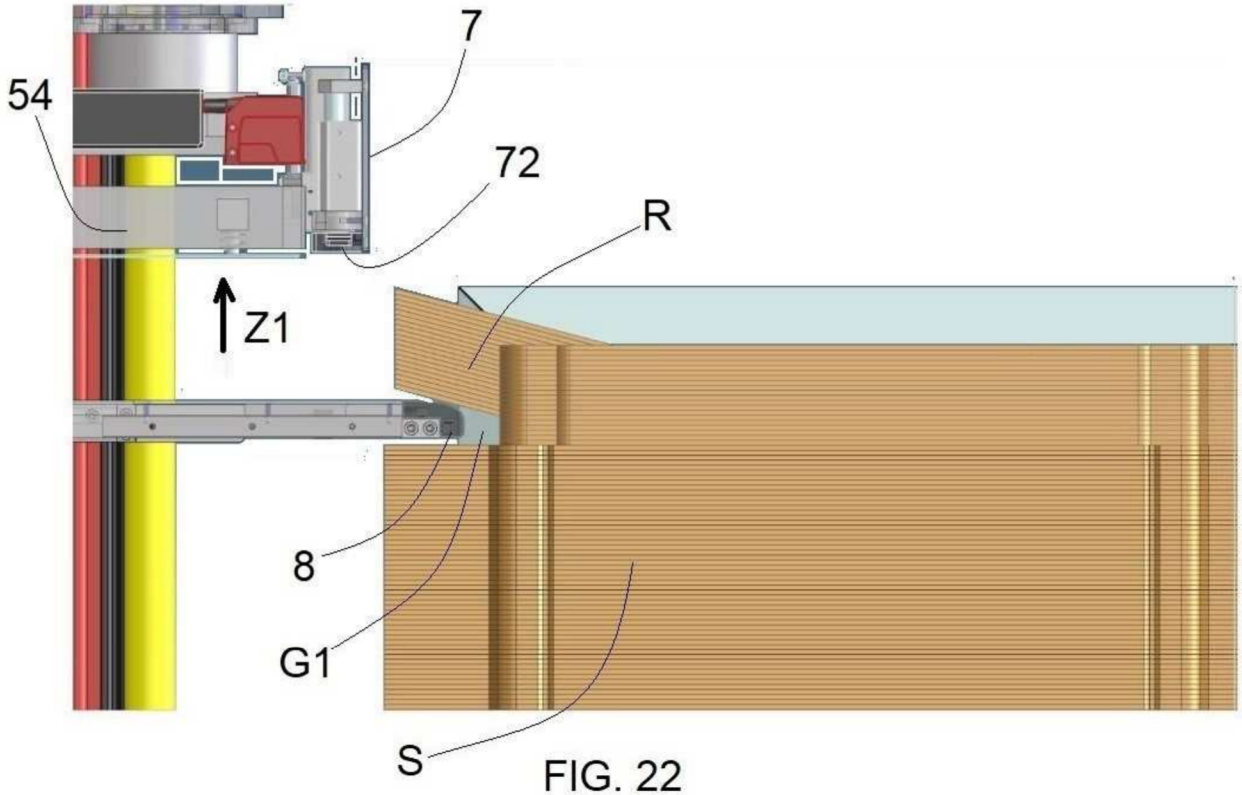


FIG. 22

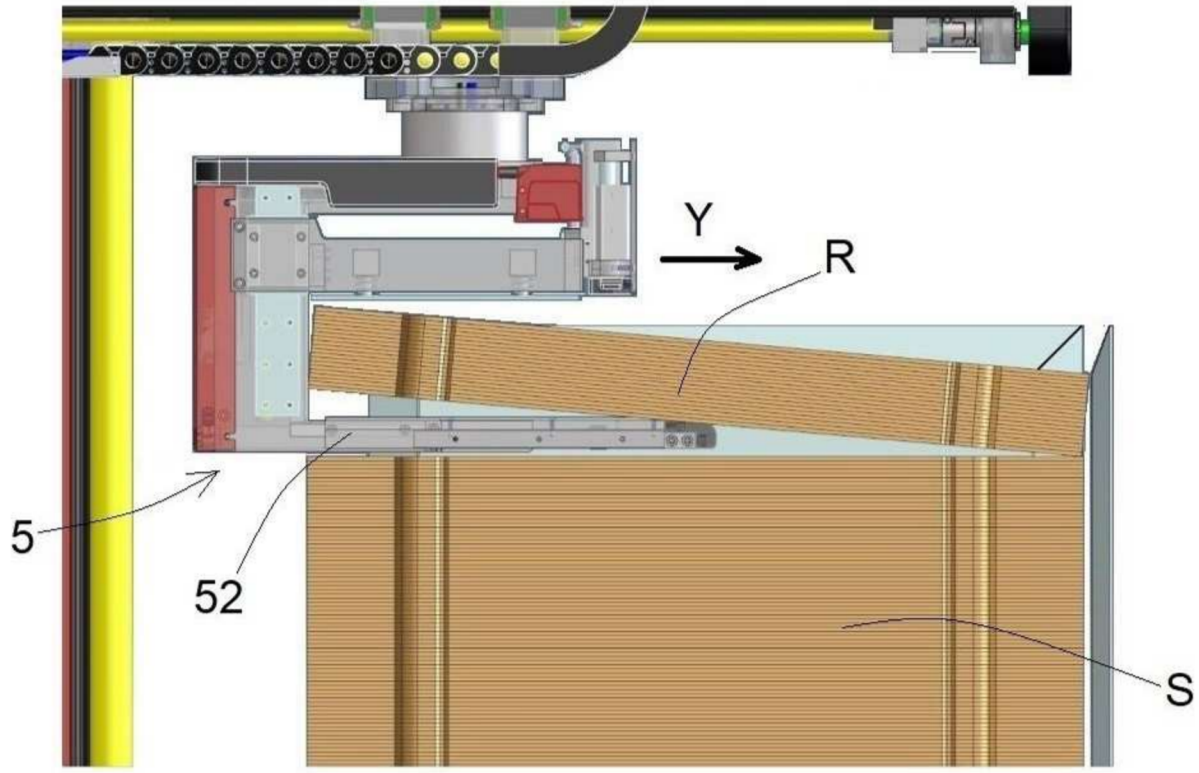


FIG. 23

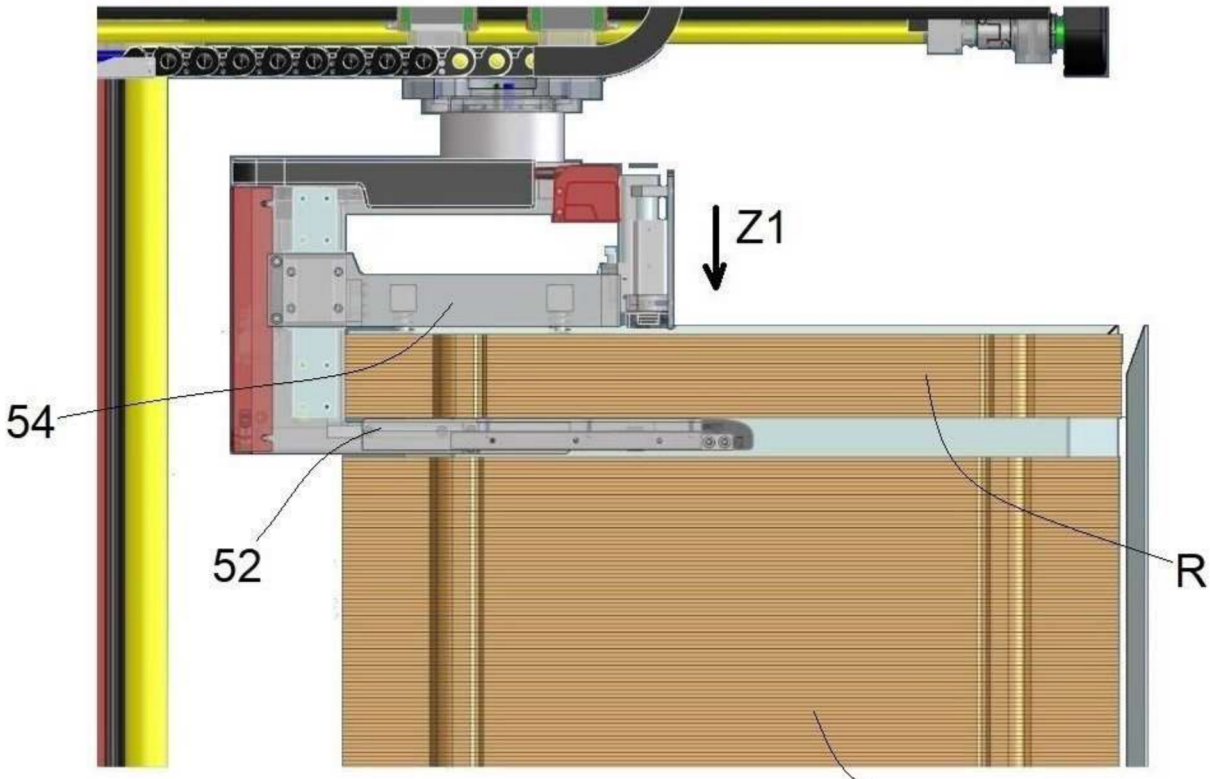


FIG. 24

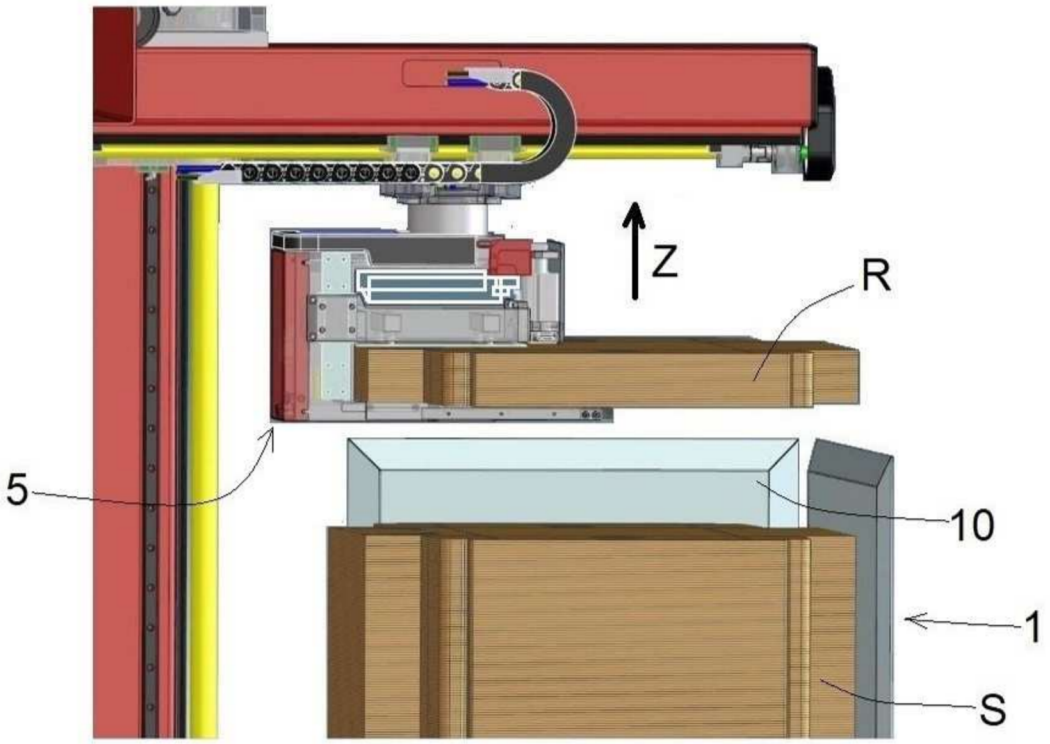


FIG. 25

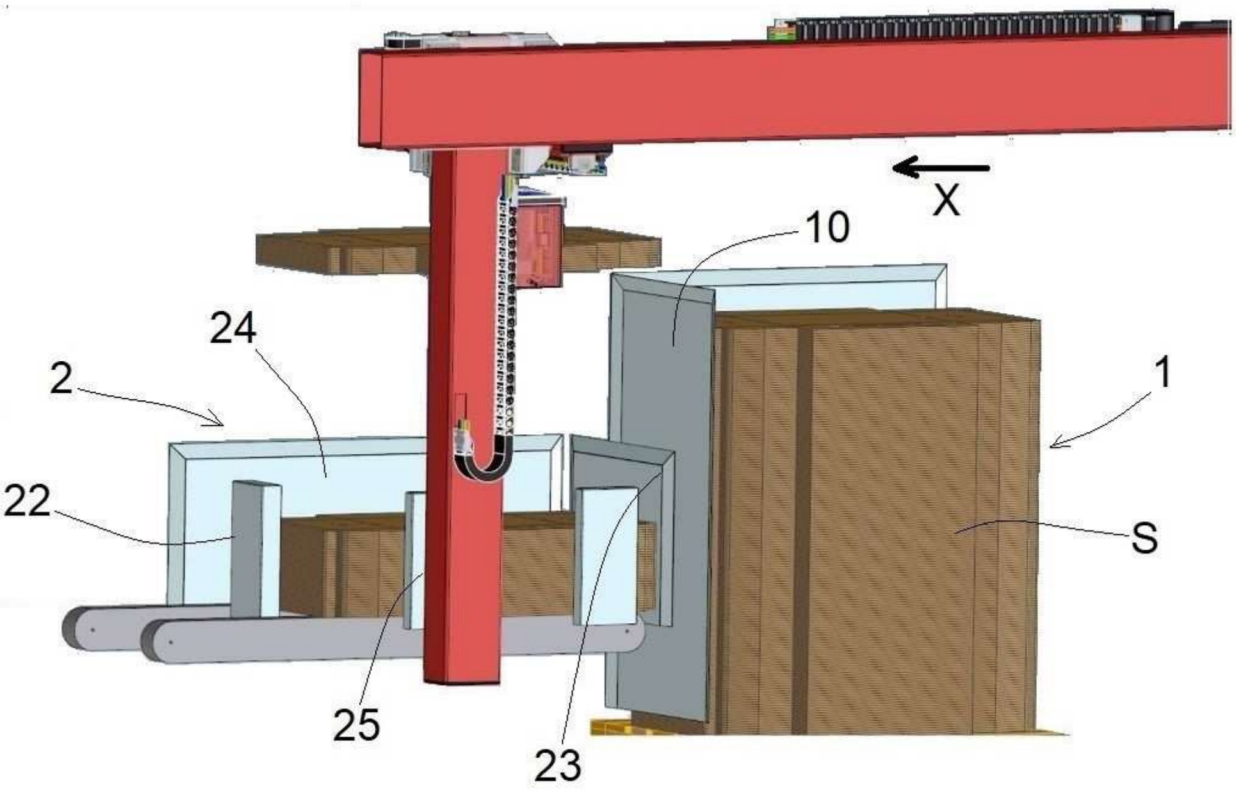


FIG. 26

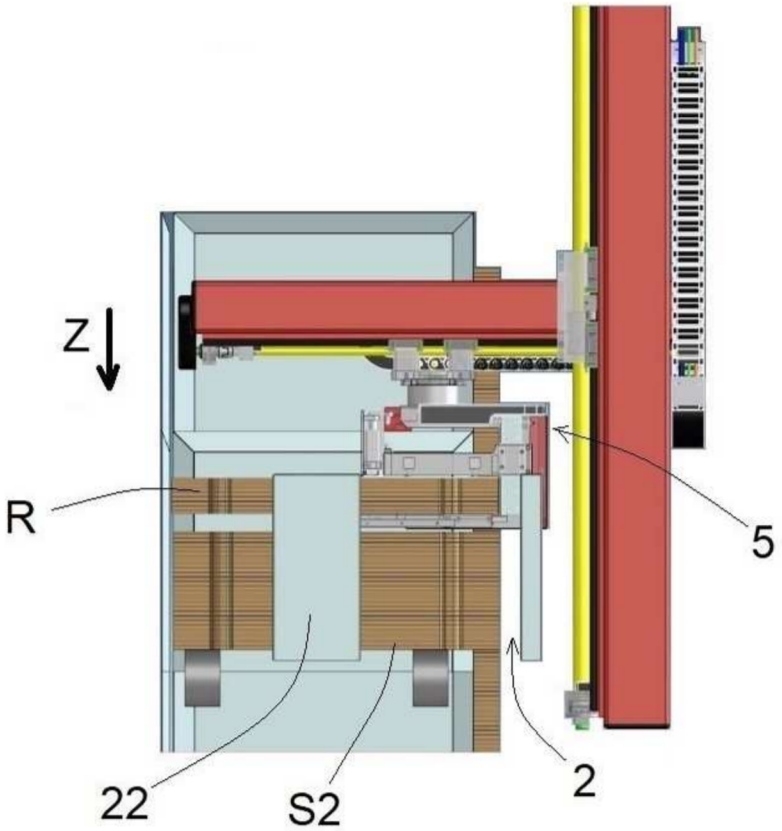


FIG. 27

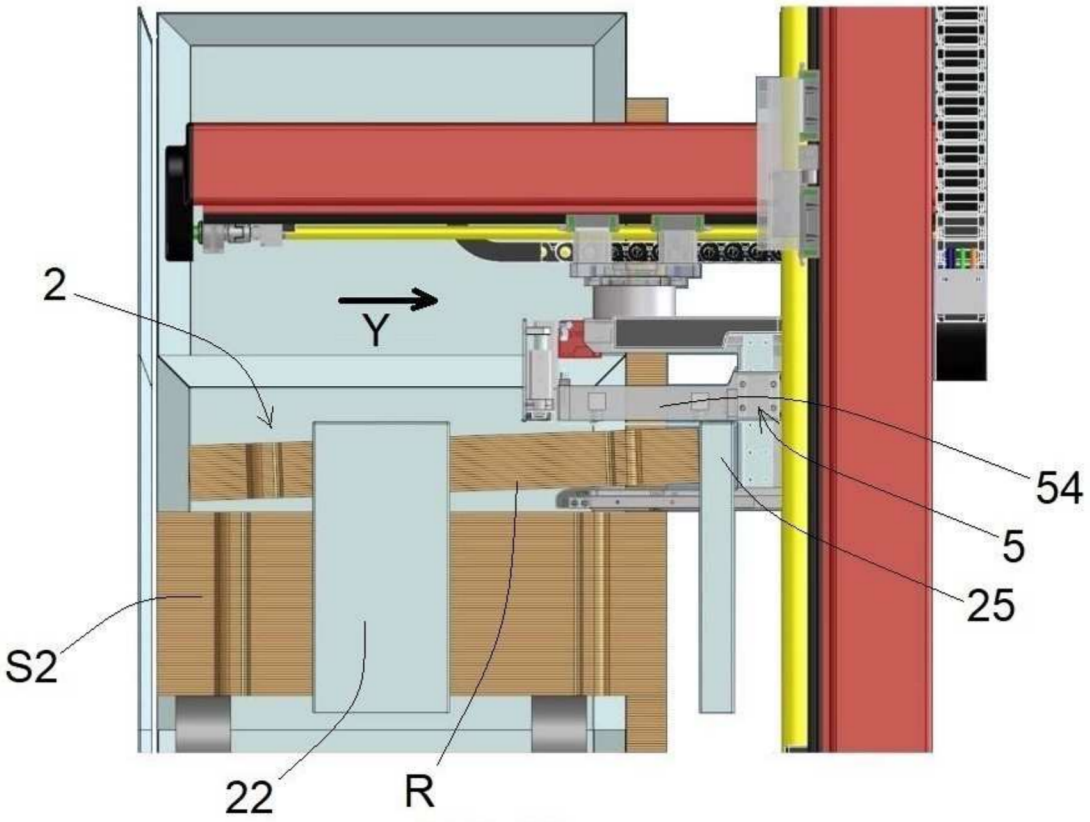


FIG. 28

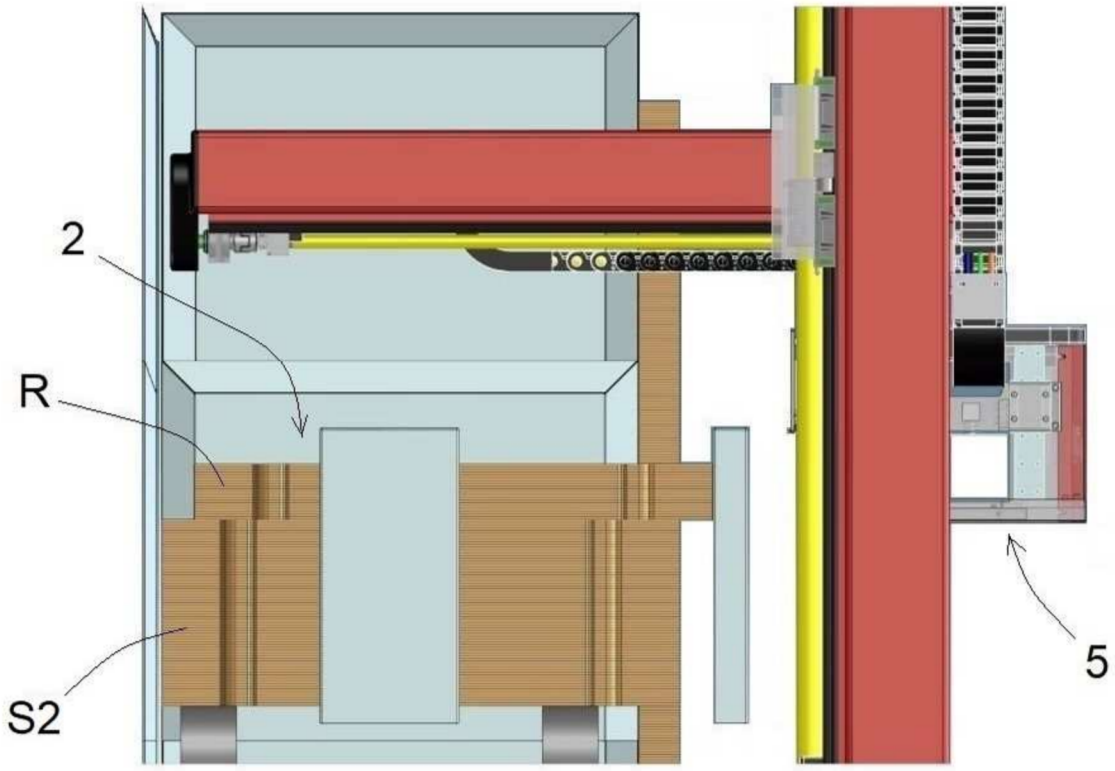


FIG. 29

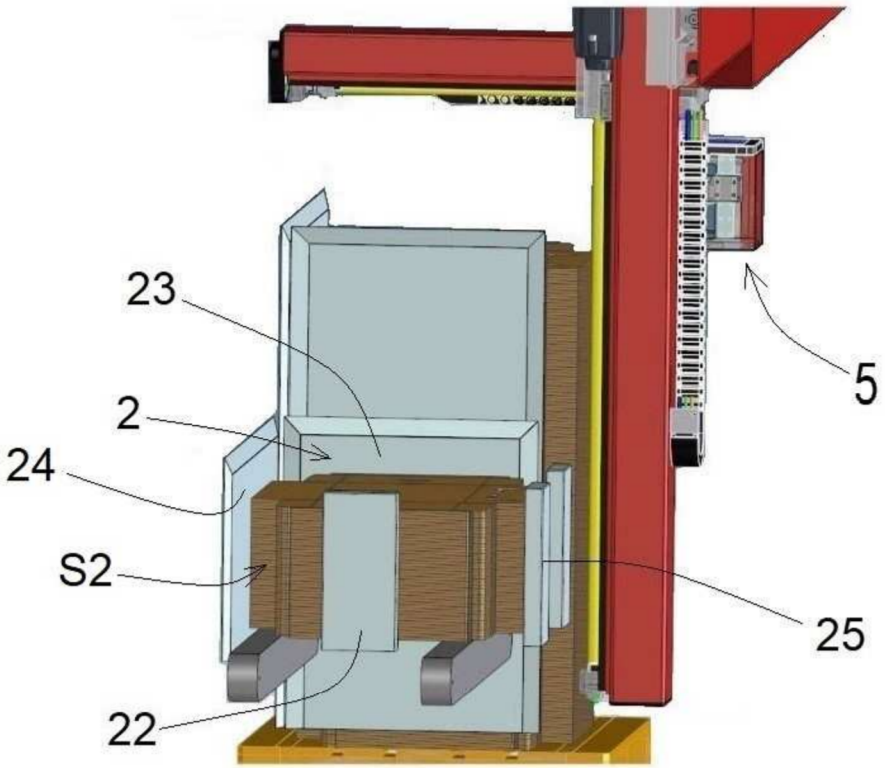


FIG. 30

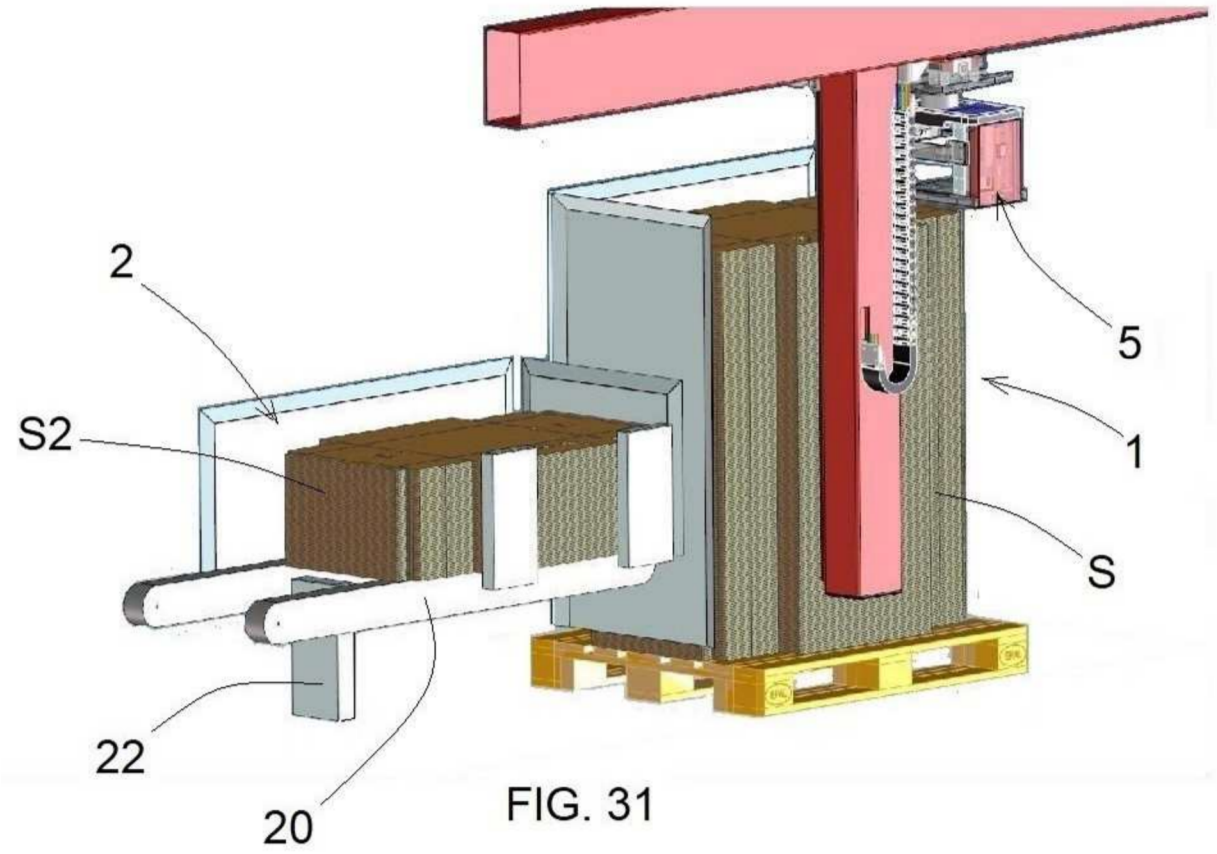


FIG. 31

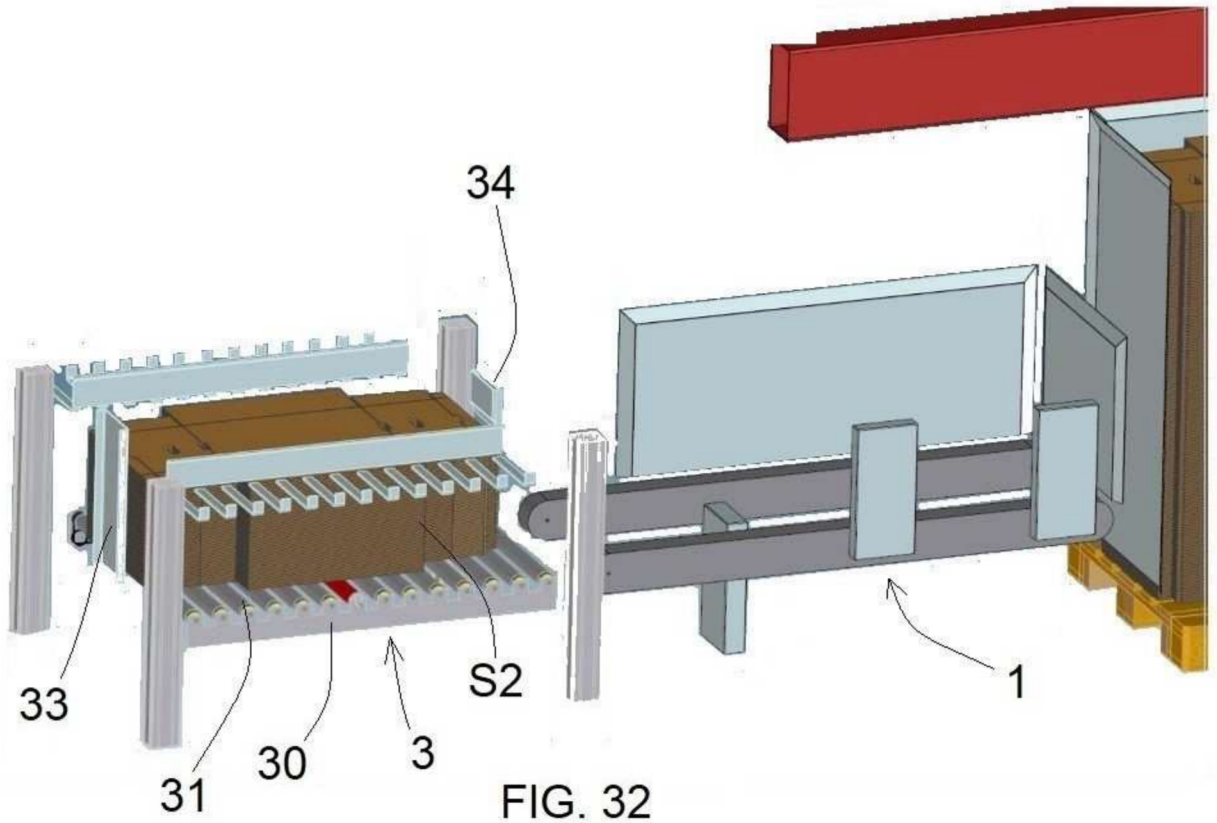


FIG. 32

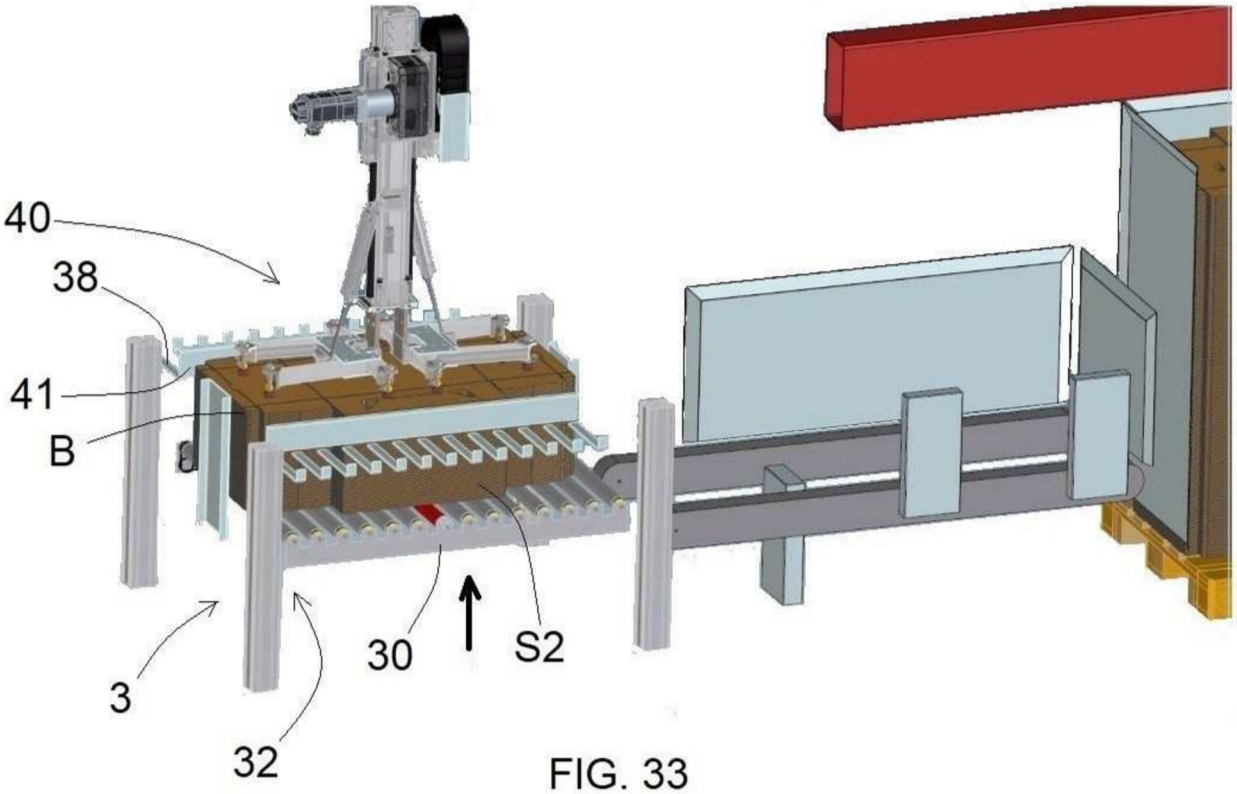


FIG. 33

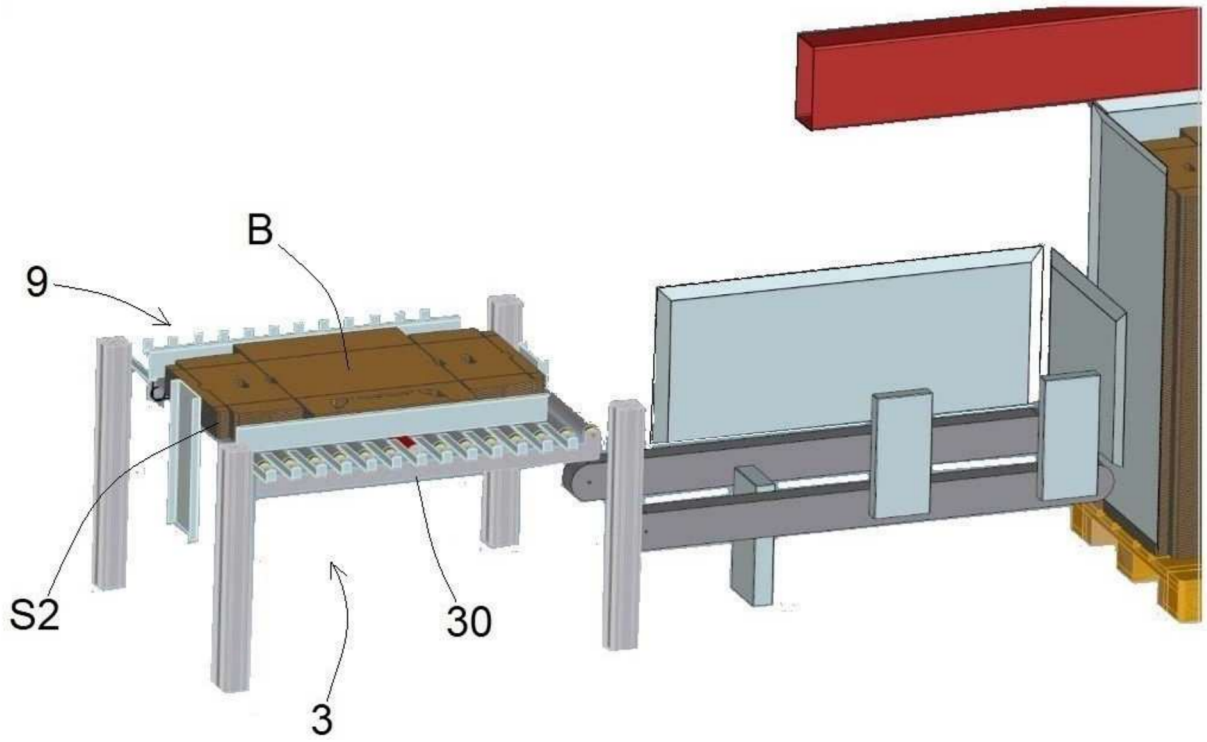


FIG. 34

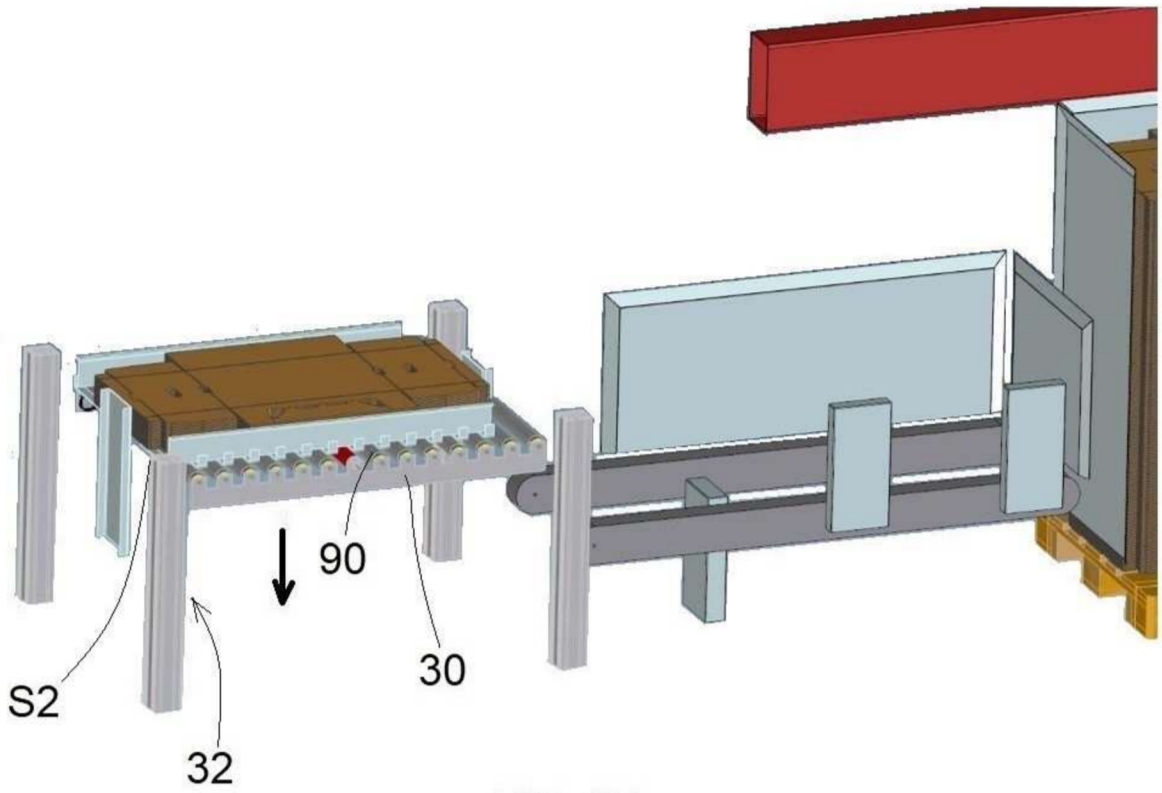


FIG. 35

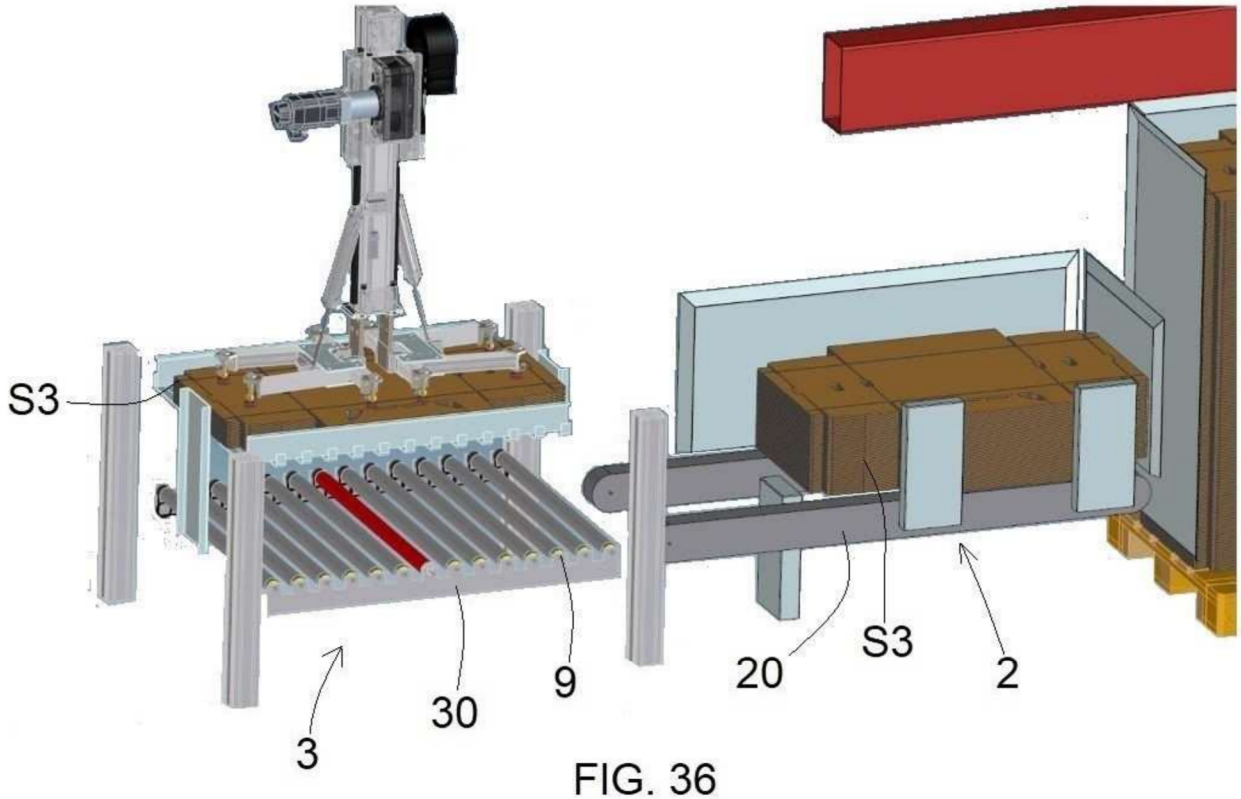


FIG. 36

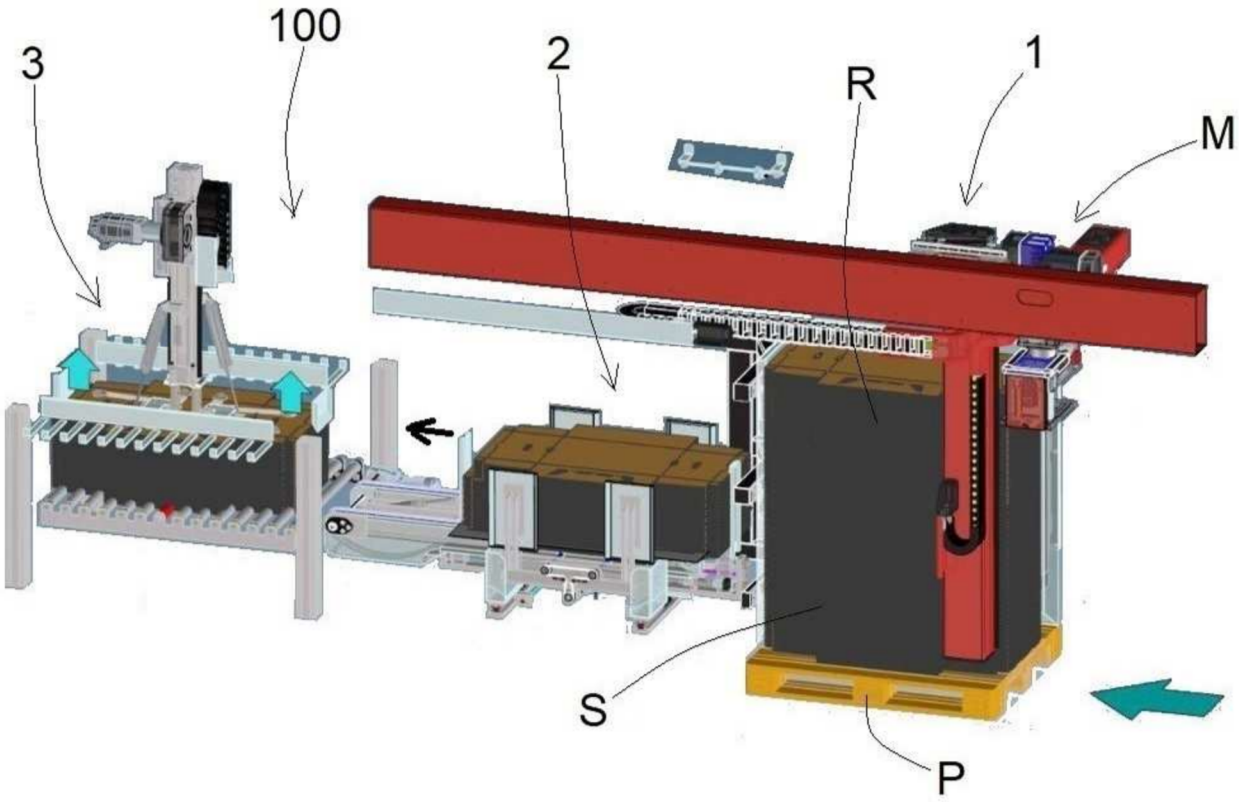


FIG. 37

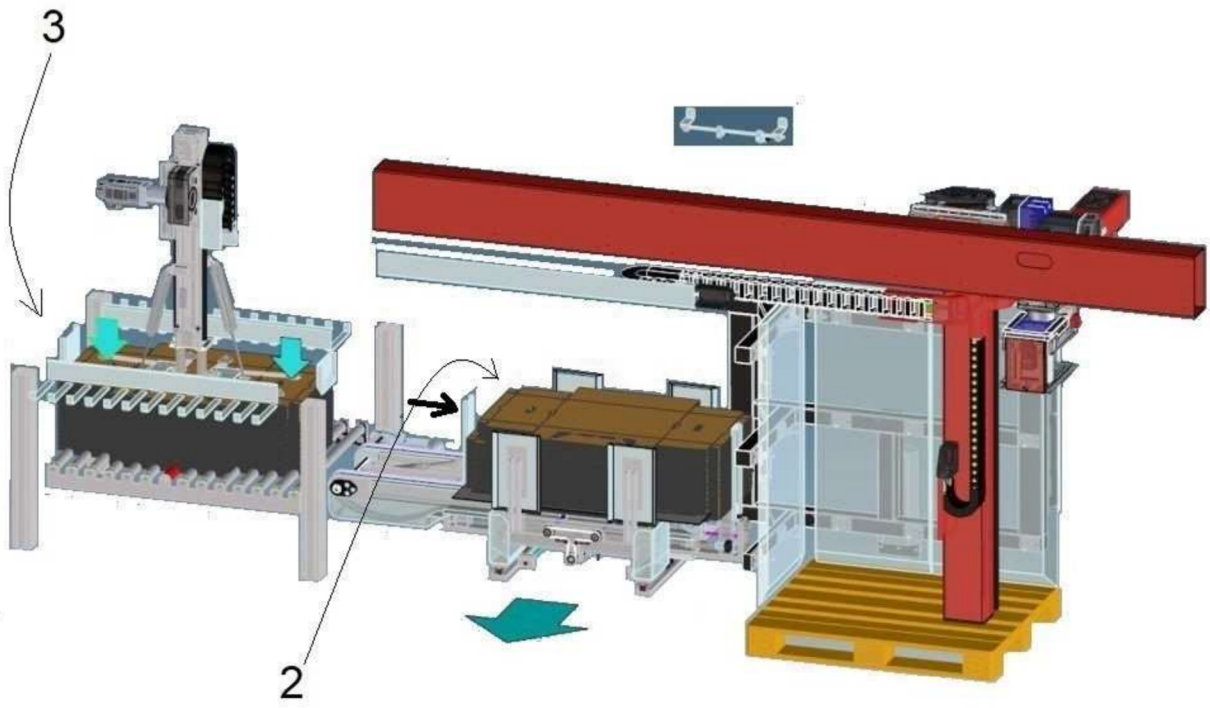


FIG. 38

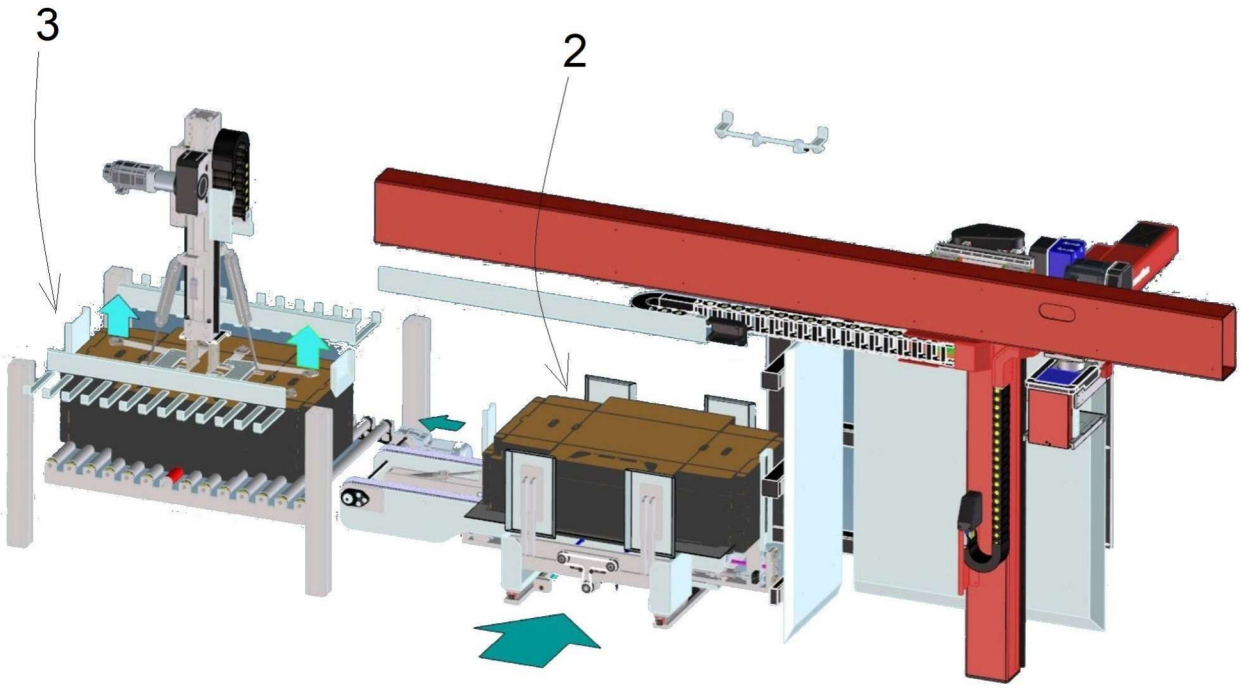


FIG. 39

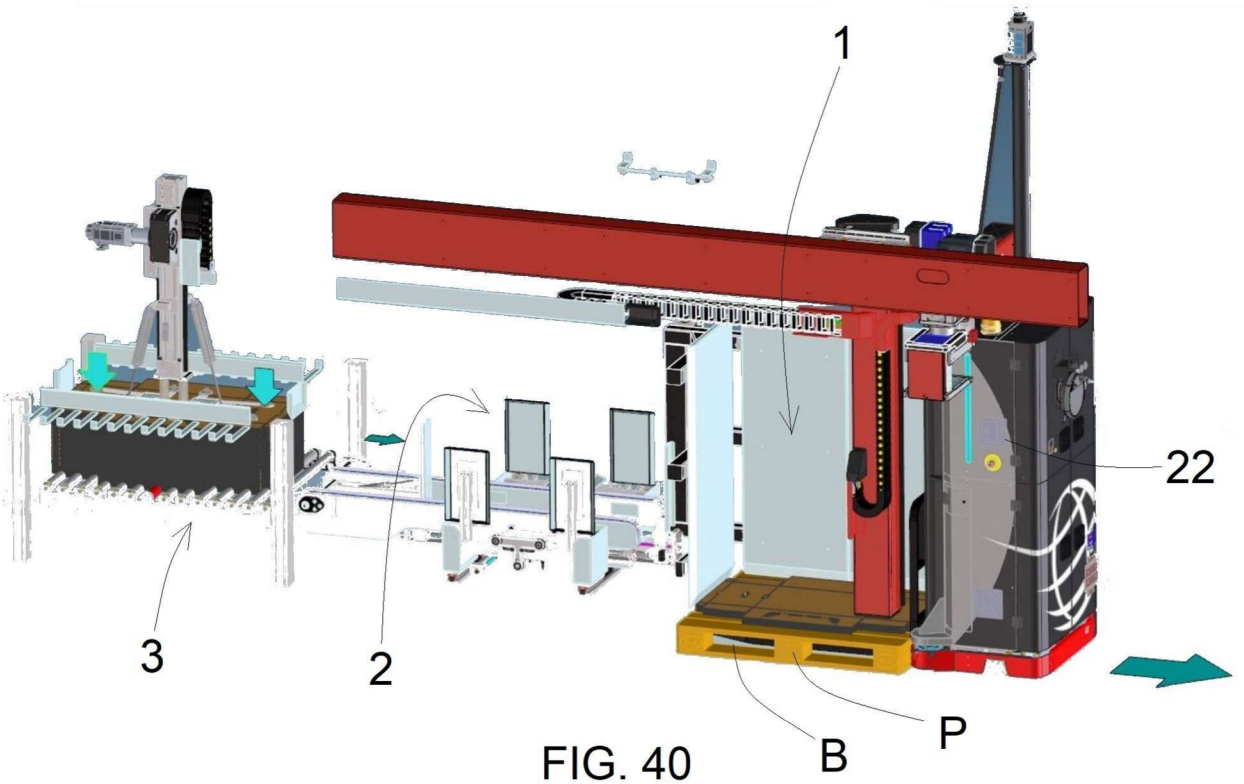


FIG. 40

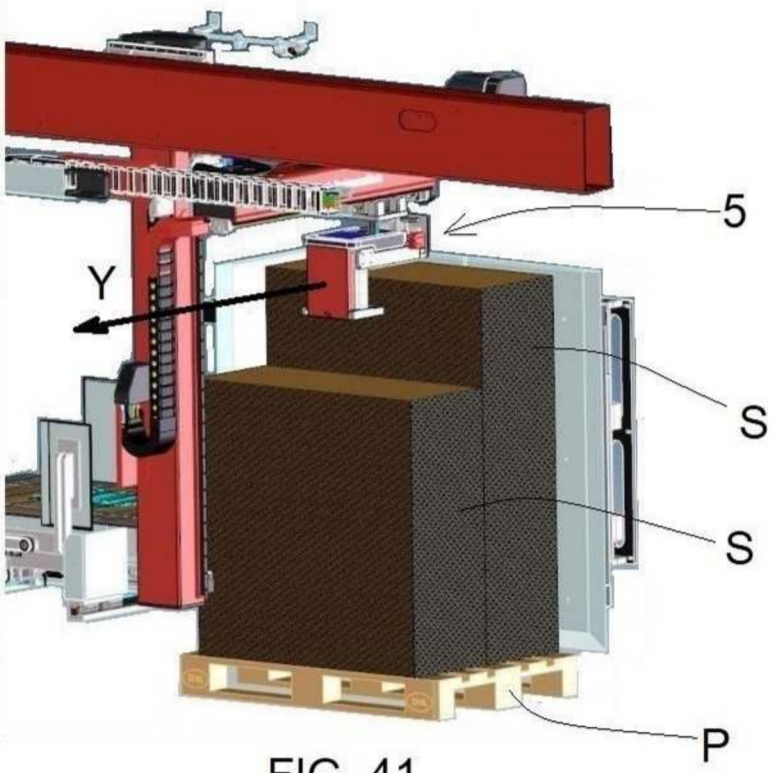


FIG. 41

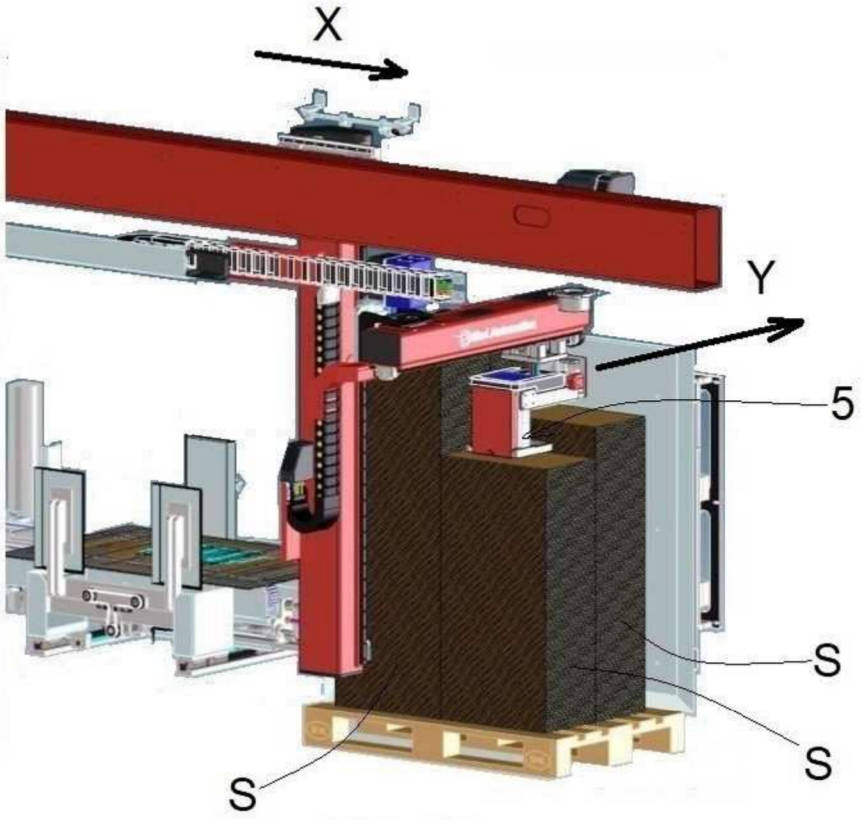


FIG. 42

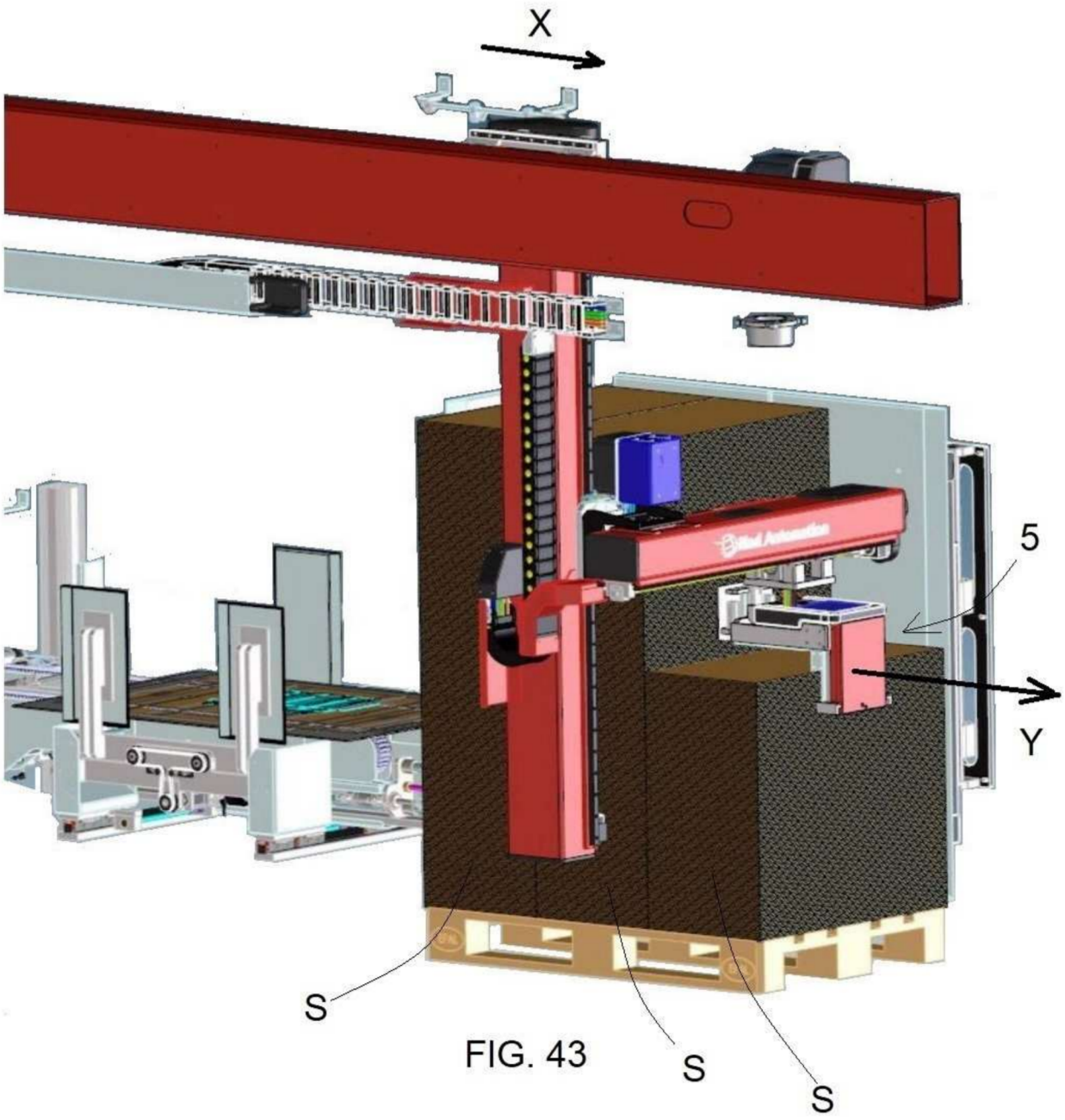


FIG. 43

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EUROPEAN SEARCH REPORT

Application Number
EP 26 16 9128

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,D	EP 3 907 163 A1 (MBO POSTPRESS SOLUTIONS GMBH [DE]) 10 November 2021 (2021-11-10) * the whole document *	1-10	INV. B65H1/30 B65H1/26 B65H3/08 B65H3/24 B65H3/32 B65H5/00 B65H5/10
A	EP 0 327 858 A1 (MINDA INDUSTRIEANLAGEN GMBH [DE]) 16 August 1989 (1989-08-16) * the whole document *	1-10	
A	US 3 908 836 A (IKEDA TAKASHI) 30 September 1975 (1975-09-30) * the whole document *	1-10	
A	EP 1 767 477 A1 (MUELLER HERMANN [DE]) 28 March 2007 (2007-03-28) * the whole document *	1-10	

TECHNICAL FIELDS SEARCHED (IPC)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	10 August 2026	Athanasiadis, A

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10-08-2026

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 3907163 A1	10-11-2021	NONE	
EP 0327858 A1	16-08-1989	DE 3803578 A1	17-08-1989
		EP 0327858 A1	16-08-1989
US 3908836 A	30-09-1975	NONE	
EP 1767477 A1	28-03-2007	AT E464259 T1	15-04-2010
		DE 102005045215 A1	05-04-2007
		EP 1767477 A1	28-03-2007

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Patent documents cited in the description

- EP 3907163 A1 **[0011]**