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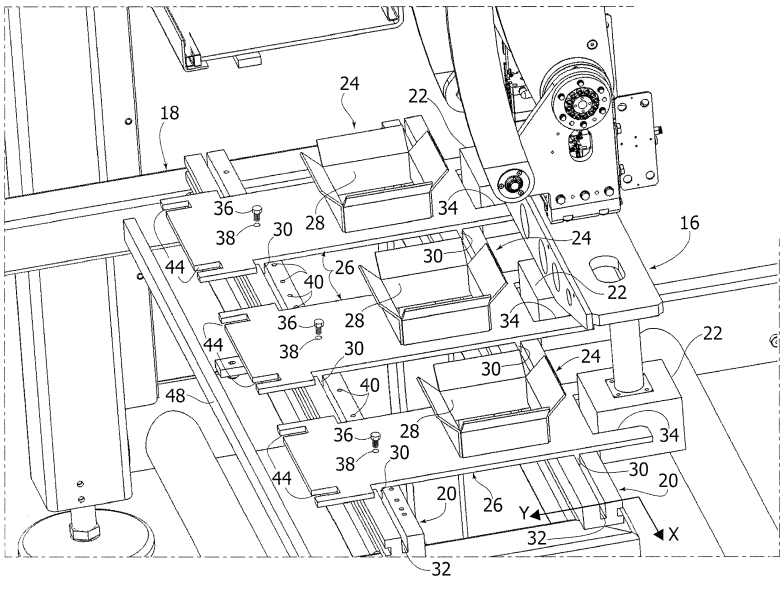
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(54) A MACHINE FOR FORMING BOXES

(57) A machine for forming boxes comprising
- a fixed frame (18) carrying at least one interchangeable die (24) having a forming section (28), and
- a manipulator (12) having a movable head (16) carrying at least one interchangeable punch (22) cooperating with the forming section (28) of the respective die (24),
wherein the fixed frame (18) comprises a pair of parallel guides (20) extending along a first horizontal direction (X), wherein said forming section (28) of said die (24) is fixed to a base plate (26) having a pair of positioning elements (30) that engage said guides (20) so as to precisely position the die (24) with respect to the fixed frame (18) along a second horizontal direction (Y) orthogonal to said first horizontal direction (X), and wherein the base plate (26) of said die (24) has a first reference formation (34) configured to engage the respective punch (22) for precisely positioning the die (24) with respect to the fixed frame (18) along said first horizontal direction (X).

FIG. 2



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Description

Field of the invention

[0001] The present invention relates to a machine for forming boxes.

[0002] In particular, the invention relates to a system for simplifying the change of shape in a box-forming machine with interchangeable punches and forming dies.

Description of the prior art

[0003] In the packaging sector, products are often placed in cardboard or plastic boxes. In packaging lines, therefore, machines are provided for forming boxes in which cardboard or plastic flat blanks are picked up from a pile and fed to a box-forming machine comprising at least one punch operated by a manipulator such as, for example, a robot or linear actuator, and at least one die carried by a fixed frame.

[0004] To produce boxes with different shapes on the same machine, usually the punches and the dies are replaced. In the case in which the machine is equipped with glue nozzles, it is also necessary to adjust the position of the glue nozzles after replacing the punches and the dies.

[0005] The shape-change operations require a precise positioning of the dies with respect to the frame. Box-forming machines can be provided with reference formations that facilitate the precise positioning of the dies with respect to the frame, but positioning errors are possible that compromise the correct operation of the machine.

Object and summary of the invention

[0006] The object of the present invention is to provide a machine for forming boxes with interchangeable punches and dies, which simplifies the shape-change operations, and eliminates the risks of misaligning the forming tools.

[0007] According to the present invention, this object is achieved by a box-forming machine having the characteristics forming the subject of claim 1.

[0008] The claims form an integral part of the disclosure provided here in relation to the invention.

Brief description of the drawings

[0009] The present invention will now be described in detail with reference to the attached drawings, given purely by way of non-limiting example, wherein:

- Figure 1 is a perspective view of a box-forming machine, with some components removed,
- Figure 2 is a perspective view on an enlarged scale of the part indicated by the arrow II in Figure 1, showing a step of assembling the dies,
- Figure 2A is a perspective view illustrating a variant of the chair of Figure 2,
- Figures 3 and 4 are perspective views illustrating a first method for positioning the glue nozzles, and
- Figure 5 is a perspective view illustrating a second method for positioning the glue nozzles.

Detailed description

[0010] With reference to Figure 1, numeral 10 indicates - in its entirety - a machine for forming boxes. The machine 10 comprises a manipulator 12 including a support structure 14 and a movable head 16.

[0011] The machine 10 comprises a fixed frame 18 on which the boxes are formed. The fixed frame 18 comprises two parallel guides 20 extending along a first horizontal direction X. The forming dies are intended to be assembled on the frame 18 in the manner described below. The movable head 16 of the robot 12 carries one or more interchangeable punches 22, which are intended to cooperate with respective dies fixed to the frame 18.

[0012] With reference to Figure 2, the machine 10 comprises one or more dies 24. Each die 24 comprises a base plate 26 and a forming section 28 fixed to the base plate 26.

[0013] The base plate 26 of each die 24 comprises two positioning elements 30 that engage the guides 20 in a sliding manner in the direction X. In the illustrated example, the positioning elements 30 consist of ribs projecting from the lower surface of the base plate 26 and which engage respective grooves 32 of the guides 20. The engagement between the positioning elements 30 and the guides 20 establishes a precise positioning of the dies 24 with respect to the frame 18 along a second horizontal Y direction Y, orthogonal to the first horizontal X direction X.

[0014] The base plate 26 of each die 24 has a first reference formation 34 configured for engaging a respective punch 22 to precisely position the die 24 with respect to the frame 18 along the first horizontal direction X. In the example illustrated in the figures, the first reference formation 34 is formed by a C-shaped cut on an end portion of the base plate 26. The cut has two edges 34, parallel to the direction Y, which are in contact with respective surfaces of the punch 22, parallel to each other. The reference formation 34 - from a constructional point of view - may assume different shapes, for example, it could be formed of a protruding rib parallel to the Y axis, which engages a corresponding groove formed on the punch 22.

[0015] The head 16 of the robot 12 is therefore used for the precise positioning of the dies 24 in the direction X. This solution is advantageous because it means there is always a precise alignment between the punches 22 and the respective dies 24, even in the case of slight misalignments of the head 16 of the robot due to tolerances, clearances, etc.

[0016] The shape-change operation envisages - in a first step - the replacement of the punches 22 of the head

16 of the robot 12. Then, the head 16 is positioned in a predetermined reference position for the change of shape, in which the punches 22 are arranged at precise coordinates in the direction X. Then, the dies 24 are assembled using the grooves 32 of the guides 20 and the punches 22 as geometric references for the assembly of the dies 24. More specifically, the operator carries out the assembly of the dies 24 by engaging the reference formations 34 with their respective punches 22, and inserting the positioning elements 30 into the grooves 32 of the guides 20. In this manner, the correct positioning of the dies 24 with respect to the frame 18 is ensured, both in the X direction and in the Y direction.

[0017] After having positioned the dies 24, the dies 24 are fixed to the frame 18. In the example illustrated in Figure 2 for fixing the dies 24 to the frame 18, screws 36 are used, which are inserted through holes 38 of the base plate 26 and engage corresponding threaded holes 40 formed on one of the guides 20. Alternatively, as illustrated in Figure 2A, the screws 36 engage respective T-nuts 41 inserted slidably into a T-slot 43 of one of the guides 20, parallel to the groove 32.

[0018] After having positioned and fixed the dies 24, the punches 22 are disengaged from the reference formations 34, by moving the head 16.

[0019] During operation, the flat sheets are positioned above the respective forming sections 28 of the dies 24 and, subsequently, the punches 22 are inserted with a vertical downwards movement into the respective forming sections 28. The cooperation between the punches 22 and the forming sections 28 of the dies 24 carries out the formation of the boxes.

[0020] With reference to Figures 3 to 5, the machine 10 can be provided with glue nozzles 42 for applying glue onto the flat sheets before they are positioned on the forming sections 28 of the dies 24. When the machine 10 is provided with glue nozzles 42 during the change of shape, it is necessary to precisely position the glue nozzles 42 with respect to the dies 24. To this end, the base plate 26 of each die 24 may be provided with at least one second reference formation 44 for positioning the respective glue nozzles 42. The glue nozzles 42 are provided with respective clamps 46 which engage a bar 48 parallel to the direction X. The glue nozzles 46 have respective reference portions 50 which engage respective second reference formations 44 of the base plate 36. The glue nozzles 42 are movable along the bar 48 to adjust the position of the glue nozzle 42 relative to the dies 24 in the direction X.

[0021] In the example illustrated in the figures, the second reference formations 44 of the base plates 26 are C-shaped cuts, and the reference portions 50 of the glue nozzles 42 have the shape of pins with a quadrangular cross-section that engage the cuts 44. The second reference formations 34 could, however, be produced in any other way suitable to establish the positioning of the glue nozzles 42 with respect to the base plate 26.

[0022] In the embodiment illustrated in Figures 3 and 4, the bar 48 is rotatable relative to its longitudinal axis between a disengaged position (Figure 3) and a working position (Figure 4). When the bar 48 is in the disengaged position, the glue nozzles 42 can be moved along the axis of the bar 48 to align the reference portions 50 of the glue nozzles 42 with their second reference formations 44 of the dies 24. After having aligned the glue nozzles 42, the bar 48 is rotated into the working position, in which the reference portions 50 of the glue nozzles 42 engage the respective second reference formations 44 and ensure the glue nozzles 42 are correctly positioned with respect to the dies 24.

[0023] In an alternative embodiment illustrated in Figure 5, the clamps 46 of the glue nozzles 42 may be opened to allow a movement in the vertical direction of the glue nozzles 42 with respect to the bar 48. The clamps 46 are closed after having positioned the reference portions 50 of the glue nozzles 42 into engagement with the respective second reference formations 44.

[0024] From the above description, it is apparent that the change of shape in a machine according to the present invention excludes the possibility that operators commit positioning errors of the dies and, if provided, the glue nozzles. This shape-change system determines the alignment of the punches 22 and of the dies 24, in a systematic manner, even in the presence of any clearances or tolerances of the robot head, because it uses the position of the punches already assembled on the head 16 as a reference position for assembling the dies 24. In addition, for positioning the glue nozzles 42, the same dies 24 are used, so that the precise positioning of the dies 24 is ensured, in cascade, with respect to the punches 22 and to the glue nozzles 42 with respect to the dies 24.

[0025] Of course, without prejudice to the principle of the invention, the details of construction and the embodiments can be widely varied with respect to those described and illustrated, without thereby departing from the scope of the invention as defined by the claims that follow.

Claims

1. A machine for forming boxes comprising

- a fixed frame (18) carrying at least one interchangeable die (24) having a forming section (28), and
- a manipulator (12) having a movable head (16) carrying at least one interchangeable punch (22) cooperating with the forming section (28) of the respective die (24), wherein the fixed frame (18) comprises a pair of parallel guides (20) extending along a first horizontal direction (X), wherein said forming section (28) of said die (24) is fixed to a base plate (26) having a pair of positioning elements (30) that engage said guides (20) so

as to precisely position the die (24) with respect to the fixed frame (18) along a second horizontal direction (Y) orthogonal to said first horizontal direction (X), and wherein the base plate (26) of said die (24) has a first reference formation (34) configured to engage the respective punch (22) for precisely positioning the die (24) with respect to the fixed frame (18) along said first horizontal direction (X).

2. A machine according to claim 1, wherein said reference formation (34) has the shape of a cut with two parallel edges orthogonal to said first horizontal direction (X).

3. A machine according to claim 1, wherein each die (24) is fixed to the frame (18) in the position defined by a screw (36) that passes through a hole (38) of said base plate (26) and engages a threaded hole (40) formed on one of said guides (20).

4. A machine according to claim 1, wherein each die (24) is fixed to the frame (18) in the position defined by a screw (36) that passes through a hole (38) of said base plate (26) and engages a T-nut (41) sliding in a T-slot (43) formed on one of said guides (20).

5. A machine according to claim 1, comprising at least one glue nozzle (46) movable along a bar (48) parallel to said first horizontal direction (X) and having a reference portion (50) that engages a second reference formation (44) of said base plate (26).

6. A machine according to claim 5, wherein said bar (48) carrying said at least one glue nozzle (42) oscillates around its longitudinal axis between a release position and a working position.

7. A machine according to claim 5, wherein said at least one glue nozzle (42) is connected to the respective bar (48) by means of an openable clamp (46), which - in the open position - allows a vertical movement of the glue nozzle (42).

FIG. 1

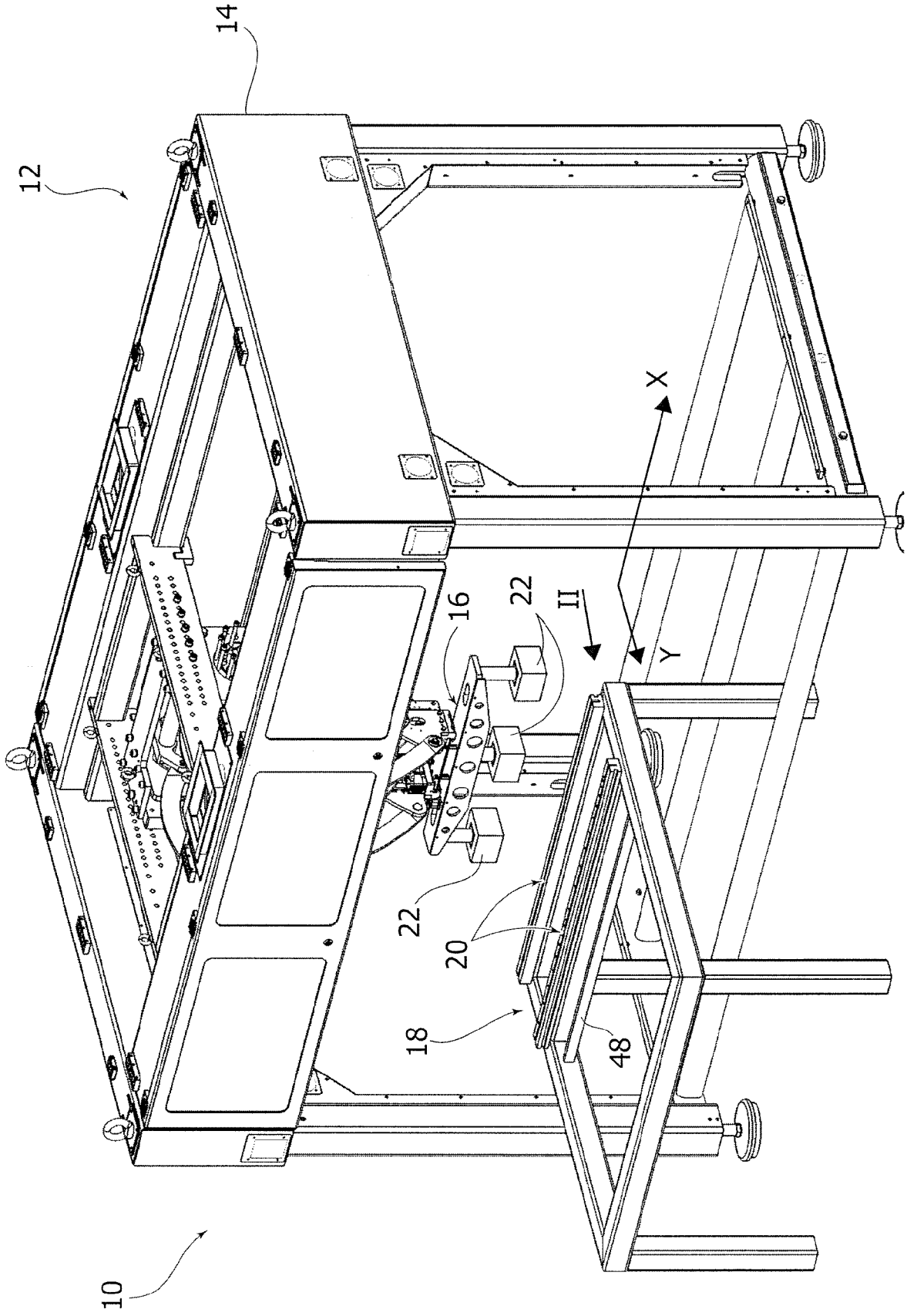


FIG. 2

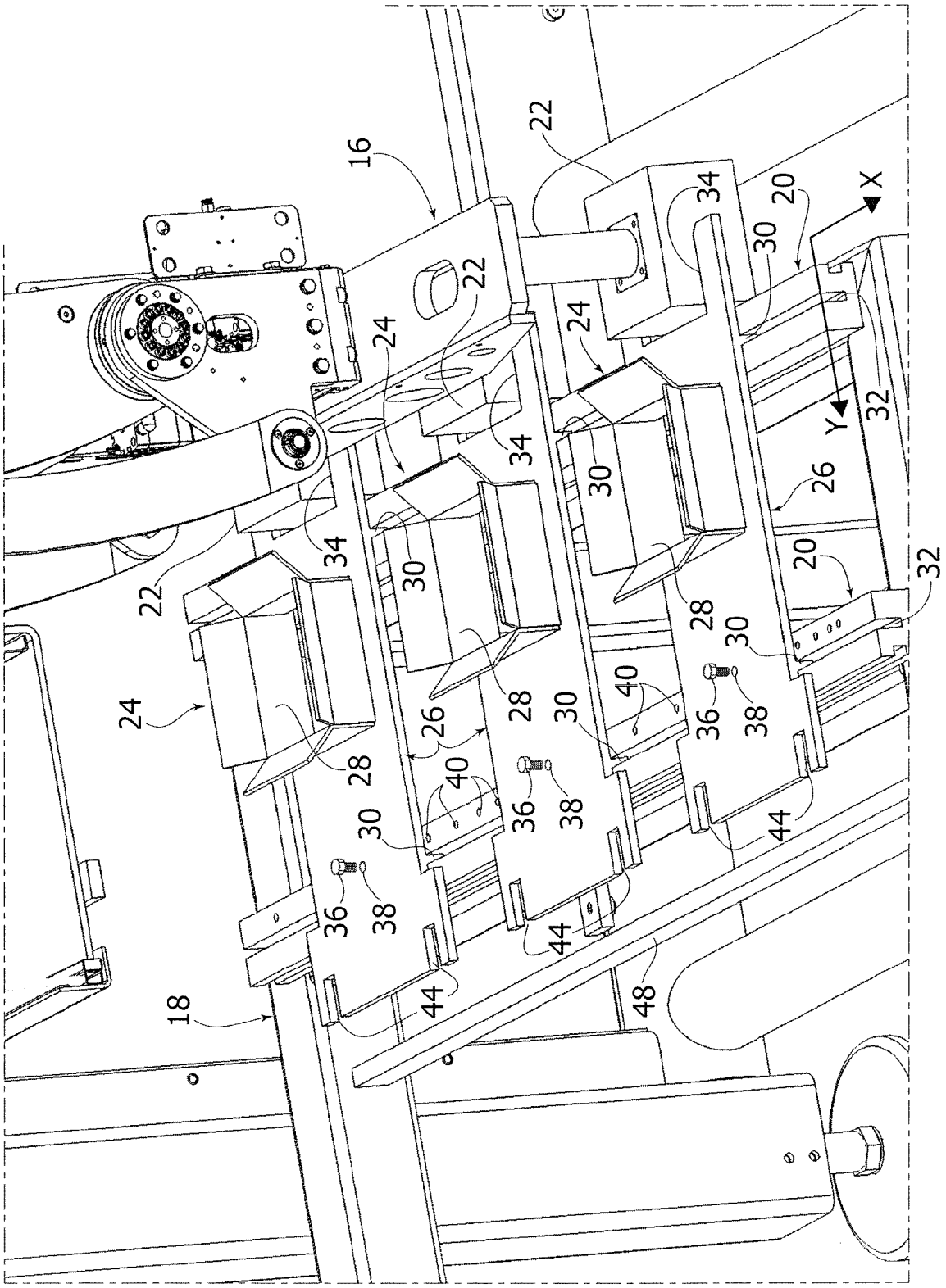
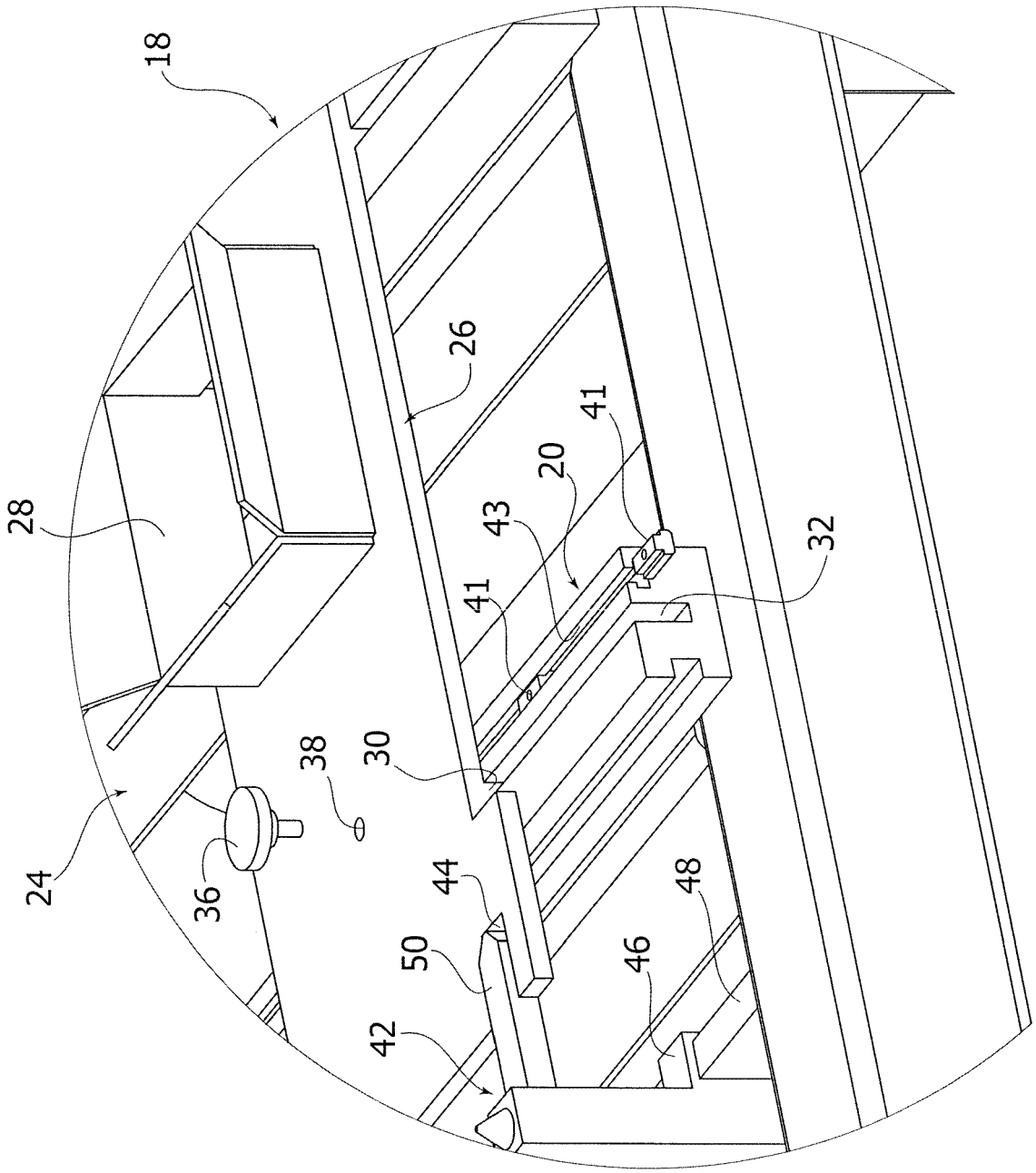


FIG. 2A



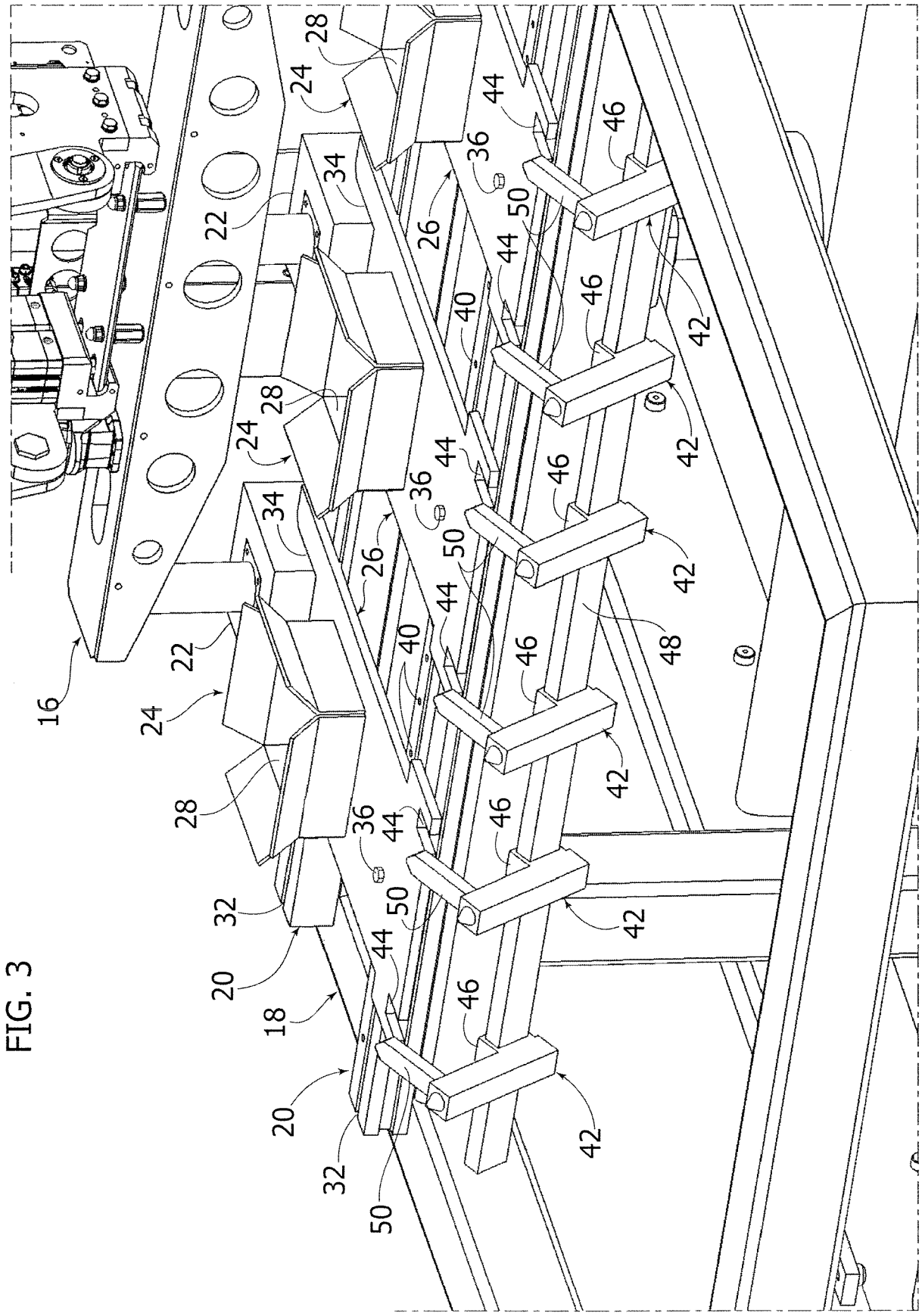


FIG. 3

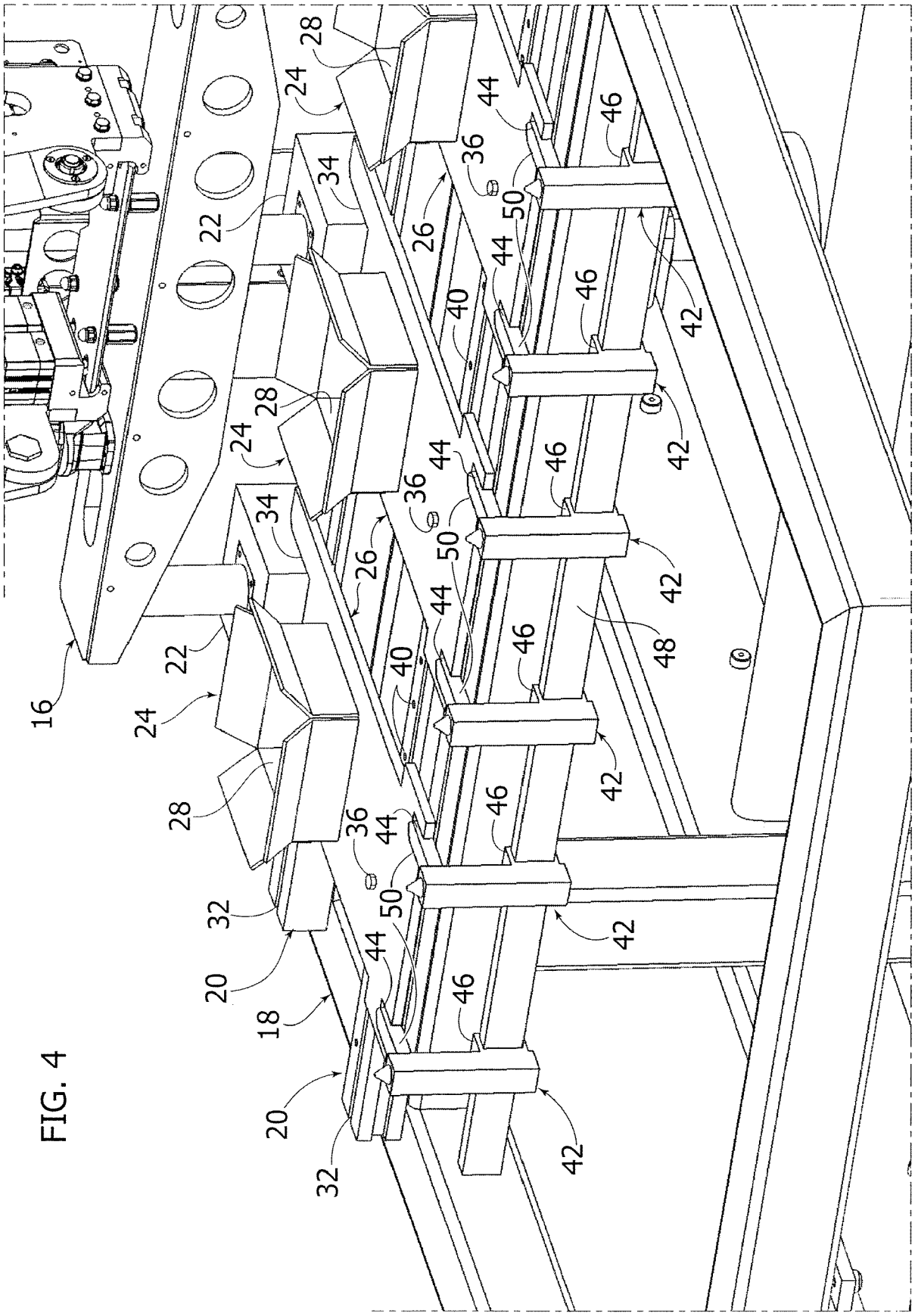


FIG. 4

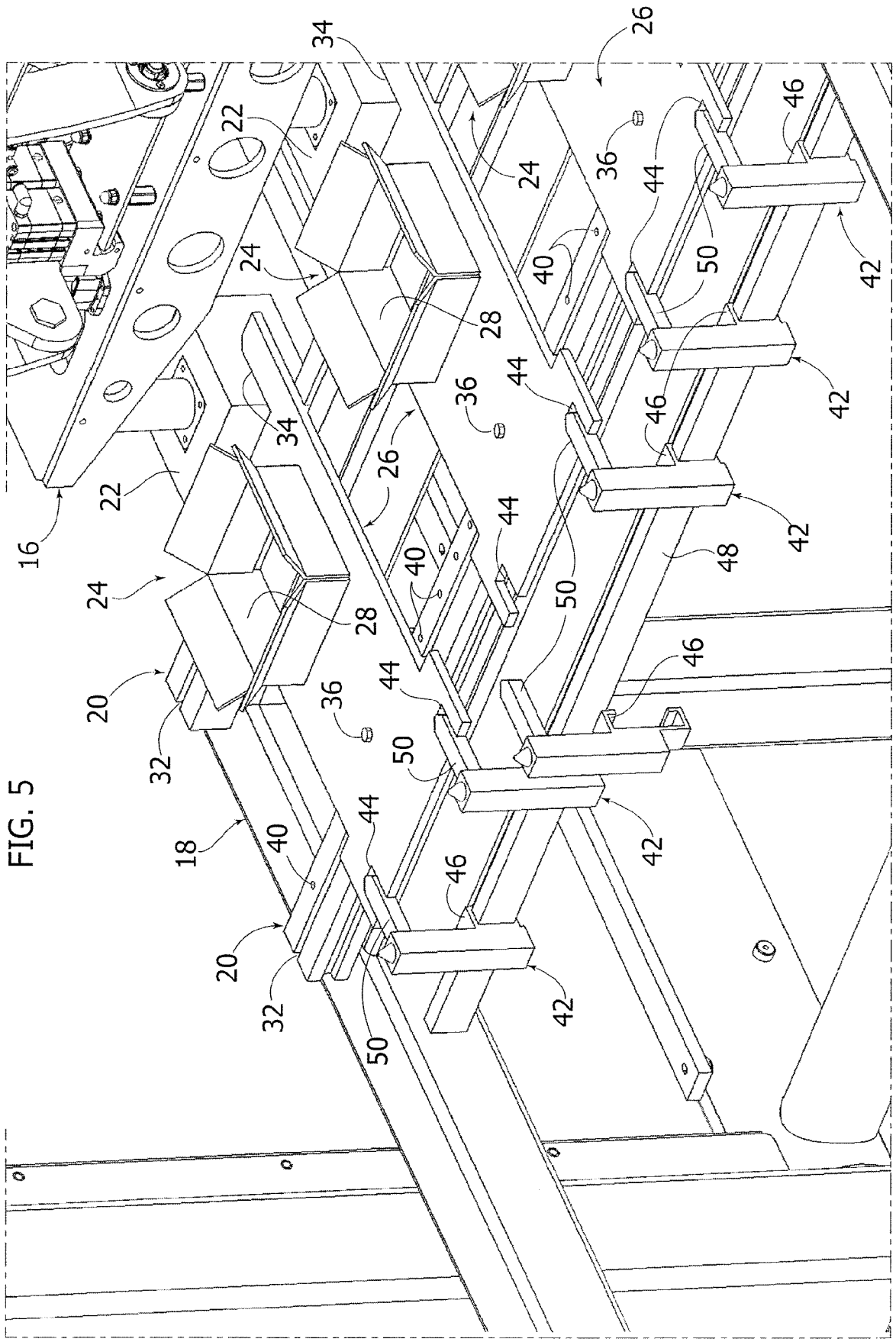


FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 17 17 4422

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	12 October 2017	Sundqvist, Stefan

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