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(57) Sammendrag:
This invention relates to a system and a method for filling containers with food items. The system can freely choose how long a specific container remains in a food processing position, without hindering the flow of other containers on the container conveyor(s). Further, an arbitrary mix of different containers may be processed by the system without changes to mechanical devices.

Fortsættes...

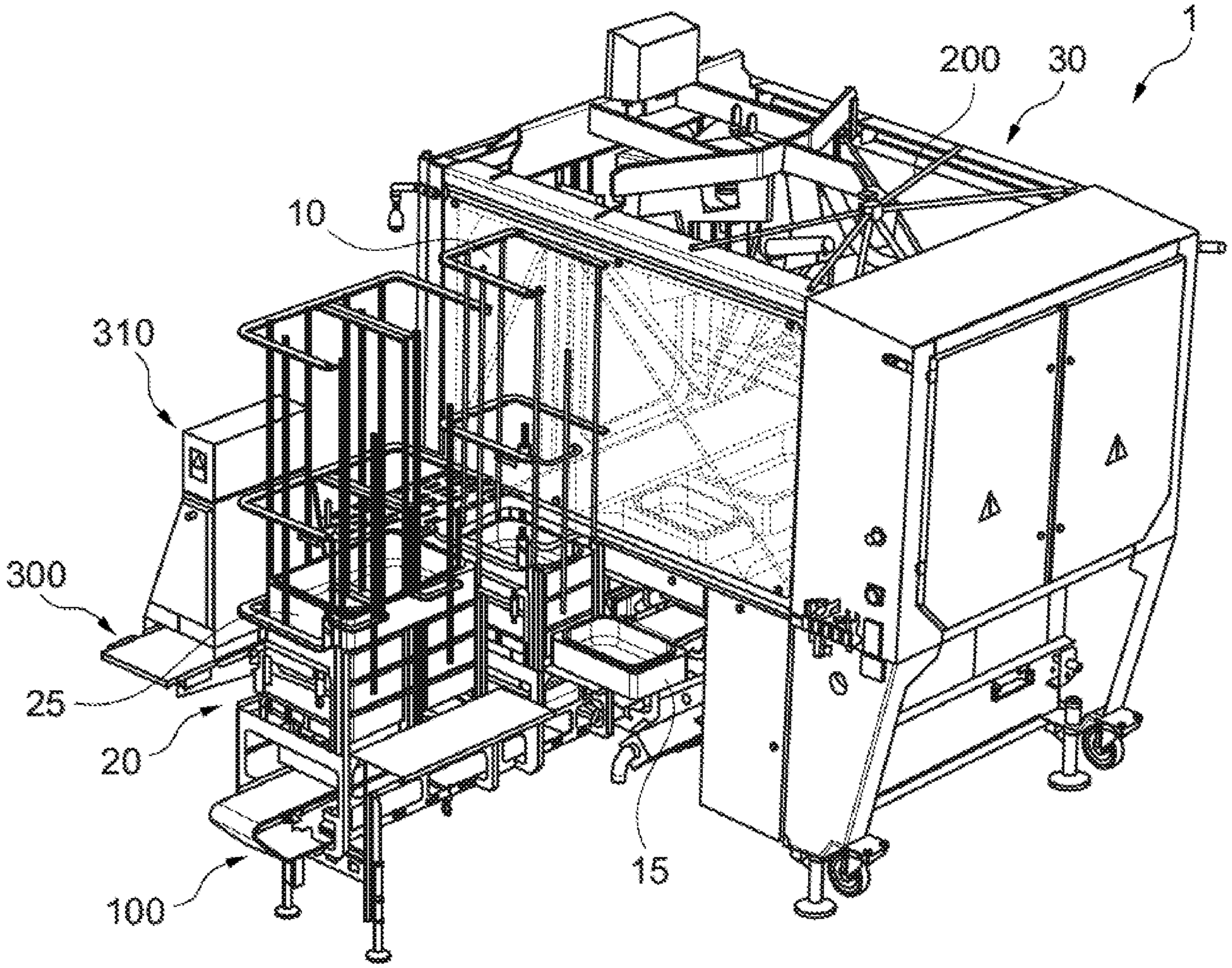


Fig. 1A

A METHOD AND A SYSTEM FOR FILLING CONTAINERS WITH FOOD ITEMS

FIELD OF THE INVENTION

The present invention relates to a system and a method for placing multiple food items into containers to fulfil different criteria on item properties in each container.

BACKGROUND OF THE INVENTION

Known systems and methods for placing food items into containers all share one perceived drawback: a container entering the system first also leaves the system first, the so called First In First Out principle or FIFO. This introduces limitations in flexibility, the progress of available food items and their properties dictate how the containers may be filled at any certain time period. For example, if there are no suitable combinations of items available to reach a certain total target weight in one container and in the time slot from the time a container enters the system, until it leaves the system, it might be necessary to compromise on the target weight in at least one container. When e.g. this container is the last container in the sequence of containers, it will have to be filled to an overweight status or, worse, and underweight status, otherwise it will block the upstream containers and thus seriously affect the throughput of the system.

Neither of these options is acceptable. Furthermore, the sequence of containers is set once the containers enter the system. If there are different size containers used, the flexibility to fill larger containers with larger items, for example, is also dictated by the progress of available food items and their properties at the allotted time period for filling.

There exists a need for a system and method for placing food items into containers that is more flexible.

SUMMARY OF THE INVENTION

On the above background it is an object of the present invention to provide a system and method for placing food items into containers which system is more flexible and which presents a larger selection of food items for filling a specific container to a certain desired status, and at the same time provides a high capacity for the system and method.

In general, the invention preferably seeks to mitigate, alleviate or eliminate one or more of the above mentioned disadvantages of the prior art singly or in any combination. In particular, it may be seen as an object of embodiments of the present invention to provide a system and method for placing food items into containers that solves the above mentioned problems, or other problems.

To better address one or more of these concerns, in a first aspect of the invention a system for placing multiple food items into containers such that the containers fulfil at least one criterion, comprising:

- A food processing system arranged for placing the multiple food items into containers,
- a conveyor system comprising a conveyor belt arranged to transport containers from a container input on the conveyor belt to a container output on the conveyor belt,
- at least two handling devices arranged along the conveyor system at a first and at least one second location,
- a position tracker for obtaining position data indicative of at least partly tracking positions of containers resting on the conveyor belt while being conveyed by the conveyor system, and
- a control unit connected to the position tracker for controlling the at least two handling devices using position data from the position tracker, the controlling including:
  - instructing an available handling device selected from the at least two handling devices to temporarily move a selected container from the conveyor system and move the container to a food processing position where the container is retained while the food processing system places food items into the container, the food processing position being selected such that it allows remaining containers resting on the conveyor belt to be conveyed by the conveyor system past the first and the at least one second position,
  - identifying, after the at least one criterion is fulfilled, available free space on the conveyor belt for the selected container, and
  - instructing the handling device to place the selected container into the available space on the conveyor belt.

The multiple food items may be conveyed by an infeed conveyor comprising item conveyor belt where the food items are resting on the item conveyor belt. As an example, the food items may be fed onto the item conveyor belt at an infeed position upstream in relation

to the first and at least one second location, by e.g. feeding the items preferably such that the food items are in a none intermingled way. Another example is where the infeed position is coupled to a cutting apparatus that cuts incoming food object into multiple food items.

The at least two handling devices may be arranged to grab at least two sides of the selected containers, which typically have a height, a width and a length, and at least partly move the selected container upwards from the conveyor belt, where the food processing position is at a height position exceeding the height of the containers so as to allow remaining containers on the conveyor system to be conveyed under the selected and retained container while the food processing system places multiple food items into the selected and retained container. Each of the at least two handling devices may have opposingly arranged gripper devices arranged across the conveyor system. The height level of the item conveyor belt on which the food items are resting is in one embodiment higher than the height level of conveyor belt on which the containers are resting. This will thus shorten or minimize the distance from where the food items are e.g. picked up and the processing position of the containers.

Alternatively, or in combination, the at least two handling devices may be arranged to move the selected container sideways from the conveyor belt, where the food processing position is at a sideways position exceeding the width of the containers so as to allow remaining containers on the conveyor system to be conveyed next to the selected and retained container while the food processing system places multiple food items into the selected and retained container. Each of the at least two handling devices may comprise opposingly arranged gripper devices arranged to reciprocally grip and slide the selected container sideways from the conveyor belt. The height level of the item conveyor belt on which the food items are resting is in one embodiment the same as the height level of the conveyor belt on which the containers are resting. This will thus shorten or minimize the distance from where the food items are e.g. picked up and the processing position of the containers

In a further alternative, or in combination, the at least two handling devices may be arranged to grip and move the selected container sideways and upwards from the conveyor belt, where the food processing position is at a sideways and elevated position exceeding the width and the height of the containers so as to allow remaining containers on the conveyor system to be conveyed next to and below the selected and retained container while the food processing system places multiple food items into the selected and retained container. Each of

the at least two handling devices may have opposingly arranged gripper devices arranged to reciprocally grip, lift and slide the selected container sideways and upwards from the conveyor belt.

In yet a further alternative, or in combination, the at least two handling devices may be arranged to grab a bottom side of the selected containers and at least partly move the selected container upwards from the conveyor belt, where the food processing position is at a height position exceeding the height of the containers so as to allow remaining containers on the conveyor system to be conveyed under the selected and retained container while the food processing system places multiple food items into the selected and retained container.

The food processing system further may have at least one robotic picker arm arranged to move items from at least one item transport conveyor to the selected and retained container.

The conveyor system may have at least two conveyor belts for containers, running in the same direction or opposite directions to a food item transport direction. In one embodiment, the conveyor system comprises two conveyor belts placed opposite to the food item conveyor that conveys the food items. The two conveyor belts for the containers may be running in the same direction, or in opposite directions. In the embodiment where the conveyor system may have at least two conveyor belts, the food processing system may be adjusted accordingly to cope with the increase of food items, e.g. by having two or more robotic picker arms.

The containers may have lengths chosen from one modular length, two modular lengths and three modular lengths etc., the length being measured in the container transport direction. In this manner, one or more handling devices may interact with one container depending upon if the container length is one, two, three or more modular lengths. Thus, the one modular length container may be arranged to cooperate with one handling device, the two modular length container may be arranged to cooperate with two handling devices simultaneously and the three modular length container may be arranged to cooperate with three handling devices simultaneously, etc.. In one embodiment, the containers are rectangular and have fixed width and either fixed lengths or different lengths (e.g. boxtype 1: width1=30cm, length1=50cm; boxtype2: width2=30cm, length2=100cm), where the position of the containers is such that a longitudinal axis of the length is parallel to the conveying direction of the containers.

The at least two gripper devices may be attached to a movable arm, the movable arm being selectively movable between a first position and a second position. The first position is a passive position where the opposingly arranged gripper devices are in a passive position

without contact with a selected container on the conveyor belt, and the second position being an active position where the opposingly arranged gripper devices have engaged with the container and moved it to the food processing position. The movable arm may be pivotable about a rotation axis, for example using a rotating drive or a linear actuator, or the movable arm may be reciprocably linearly movable between the first and second positions, for example using a linear actuator.

The at least one robotic picker arm may pick food items from at least one food item conveyor, each food item conveyor may be travelling in the same direction as an adjacent container conveyor belt or in an opposite direction.

The food items may be scanned using a scanning device to determine at least one food item property selected from the food item position on the food item conveyor, food item dimensions, colour, surface topography and/or weight and combinations thereof. Also, a scale such as a flow scale may be implemented to weigh the food items as they are being conveyed. Another alternative is where the food items originate from a portion cutter device where e.g. the food items have originated from a food object that is cut into smaller pieces, i.e. food items, where the weight is known.

The scanning device may be a scanner using electromagnetic waves, any type of weigh scale (e.g. the flow scale), and combinations thereof.

Accordingly, a system is provided that is based on First In First Out principle (FIFO) meaning that the throughput of the system is greatly increased, since those containers that are in the food processing position do not block the remaining containers resting on the conveyor belt of the conveyor system, but these containers (resting on the conveyor belt of the conveyor system) may e.g. be containers that have been filled up to the at least one target, and/or empty containers, and/or containers partially filled with food items.

Another advantage of the system according to the present invention is the flexibility, where multiple criterion may be achieved simultaneously. As an example, containers having the same and/or different geometrical shapes/volumes may have different criterion, e.g. different weight target. This means that one container in food processing position may be assigned to one (or more) criterion including e.g. 4kg weight target, whereas another identical container may have another criterion, e.g. 5kg target.

Also, as discussed previously, the containers may have modular lengths, e.g. 20cm, 30cm and 40cm, that may be suitable for receiving different types of food items (e.g. three modular

size for whole fish), or fish pieces (e.g. one modular size), where e.g. different criterion may be based on different customer orders. Some customers may e.g. be a restaurant asking for 300g cod fillets, whereas another customer can be a supermarket asking for 200g cod fillets. Thus, the flexibility of the system is greatly enhanced.

As will be discussed below, the term criterion may also be understood as a target, and where the system according to the present invention may be considered as a batching system (e.g. making batches in the containers of fixed target weight), or a grading system (e.g. food items having specific characteristics, e.g. x number of pieces having similar colors or e.g. similar sizes), or a combination of both.

In a second aspect of the invention a method for operating a system for placing multiple food items into containers by a food processing system such that the containers fulfil at least one criterion, has the steps of:

- transporting containers using a conveyor system comprising a conveyor belt arranged to transport containers from a container input on the conveyor belt to a container output on the conveyor belt, the containers having a height, a width and a length,
- obtaining position data indicative of at least partly tracking positions of containers resting on the conveyor belt while being conveyed by the conveyor system using a position tracker, and
- controlling the system using a control unit connected to the position tracker for controlling the at least two handling devices using position data from the position tracker, the controlling including:
  - instructing an available handling device selected from the at least two handling devices to temporarily move a selected container from the conveyor system and move the container to a food processing position where the container is retained while the food processing system places at least one food item into the container, the food processing position being selected such that it allows remaining containers resting on the conveyor belt to be conveyed by the conveyor system past the first and the at least one second position,
  - identifying, after the at least one criterion is fulfilled, available free space on the conveyor belt for the selected container, and
  - instructing the handling device to place the selected container into the available space on the conveyor belt.

The at least one criterion comprises, a weight target, a number target, a geometrical or volume target, a color target, a number of species target, a combination of one or more the above. The at least one criterion should however not be construed as being limited to this.

In an embodiment, the step of at least partly tracking positions of containers resting on the conveyor belt while being conveyed by the conveyor system using a position tracker further comprises tracking the containers after the at least one criterion has been reached and the containers have been placed into the available space on the conveyor belt. In that way, different orders from different customers may be accumulated together, i.e. order 1 goes to a specific place (e.g. a specific pallet) where order 2 (order n) goes to another place (e.g. another pallet).

The containers may have two or more different geometrical shapes/volumes, meaning that different orders of e.g. different target weight, and/or different sizes (or any other criterion) may be handled simultaneously.

The different at least one criterion may in one embodiment be assigned to two or more different containers such that one or more of the following applies:

containers of same geometrical shapes/volumes have different at least one criterion,

containers of different geometrical shapes/volumes have different at least one criterion

wherein the step of at least partly tracking positions of containers resting on the conveyor belt while being conveyed by the conveyor system using a position tracker further comprises tracking the two or more different containers after the different at least one criterion has been reached and the containers have been placed into the available space on the conveyor belt.

The step of moving the container by the at least two handling devices may be performed by grabbing at least two sides of the selected containers and at least partly moving the selected container upwards from the conveyor belt, where the food processing position is at a height position exceeding the height of the containers so as to allow remaining containers on the conveyor system to be conveyed under the selected and retained container while the food processing system places multiple food items into the selected and retained container.

To this end, each of the at least two handling devices may have opposingly arranged gripper devices arranged across the conveyor system.

The step of moving the container by the at least two handling devices may be performed by moving or pushing the selected container sideways from the conveyor belt, where the food processing position is at a sideways position exceeding the width of the containers so as to

allow remaining containers on the conveyor system to be conveyed next to the selected and retained container while the food processing system places multiple food items into the selected and retained container.

Each of the at least two handling devices may have opposingly arranged gripper devices arranged to reciprocally grip and slide the selected container sideways from the conveyor belt.

The step of moving the container by the at least two handling devices may alternatively, or in combination, be performed by gripping and pushing the selected container sideways and upwards from the conveyor belt, where the food processing position is at a sideways and elevated position exceeding the width and the height of the containers so as to allow remaining containers on the conveyor system to be conveyed next to and below the selected and retained container while the food processing system places multiple food items into the selected and retained container.

Each of the at least two handling devices may have opposingly arranged gripper devices arranged to reciprocally grip and lift and slide the selected container sideways and upwards from the conveyor belt.

Further, alternatively or in combination, the step of moving the container by the at least two handling devices may be performed by grabbing a bottom side of the selected containers and at least partly moving the selected container upwards from the conveyor belt, where the food processing position is at a height position exceeding the height of the containers so as to allow remaining containers on the conveyor system to be conveyed under the selected and retained container while the food processing system places multiple food items into the selected and retained container.

The method may further have the step of moving food items using at least one robotic picker arm of the food processing system, the arm being arranged to move items from at least one item transport conveyor to the selected and retained container.

The conveyor system may have at least two conveyor belts for containers.

The containers may have lengths chosen from one modular length, two modular lengths and three modular lengths, etc. In this case, the one modular length container may be arranged to cooperate with one handling device, the two modular length container may be arranged to cooperate with two handling devices simultaneously and the three modular length container may be arranged to cooperate with three handling devices simultaneously, etc..

The step of moving a selected container by the at least two handling devices may be performed by each of the at least two handling devices being attached to a movable arm, the movable arm being selectively movable between a first position and a second position, wherein in the first position a selected container rests on the conveyor belt and in the second position the selected container is removed off the conveyor belt such that containers on the conveyor belt are freely transportable on the conveyor belt. The movable arm may be pivotable about a rotation axis, for example using a rotating drive or a linear actuator, or alternatively, the movable arm may be reciprocably linearly movable between the first and second positions, for example using a linear actuator.

The at least one robotic picker arm may pick food items from at least one item conveyor.

The method further may have the step of scanning the food items using a scanning device to determine at least one food item property selected from the group consisting of position on the at least one item conveyor, dimensions, colour, surface topography, weight and combinations thereof. The scanning device may be selected from the group consisting of at least one of a scanner using electromagnetic waves, a weigh scale, and combinations thereof.

The method according to the present invention may also be understood as a grading method and/or a batching method. The term grading may e.g. include steps of sorting food items into containers (based of certain criterion, e.g. size, shape, quality, color). The term batching may include making batches in the containers having pre-defined target weight. Different target weights may be assigned to different containers, e.g. containers having same sizes/shapes (e.g. modular size x), or containers having different sizes/shapes (e.g. modular size y, where $x \neq y$).

Accordingly, a method is provided that enhances the throughput of the system because no blocking occurs with a container where the target has not been reached since it will be positioned in the food processing position. Also, multiple criterion may be processed at the same time, e.g. different weight targets, different sorting criterion etc..

Thus, a system and method according to the invention brings the advantage of enabling the system to freely choose how long a specific container remains in the food processing position, without hindering the flow of other containers on the container conveyor(s). Further, an arbitrary mix of different containers may be processed by the system without changes to mechanical devices. The control unit (e.g. any type of computer device comprising a processor and memory) may be programmed on-the-fly (dynamically) taking into account the

scan of actual items entering the system to create bespoke batches in each individual container. For example, and as mentioned above, containers of the same size may be filled to different item weights, or composition of items. Further to tracking container positions on the container conveyor, the position tracker and control system also stores information defining positions of handling devices. Thus, a passive position handling device is ready to receive a container and an active position handling device holds a container to be filled. That container which is held by a handling device is also tracked by the control system to indicate fill grade, i.e. empty, partly filled or full according to the desired criteria.

The system and method according to the invention provides a higher total throughput due to no or minimized queuing of containers and flexible item batching in same size or different size containers.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be described, by way of example only, with reference to the drawings, in which

figure 1A is an elevated schematic perspective view of a system according to an embodiment of the invention, having one robotic picker arm, one container conveyor belt and one item conveyor belt;

figure 1B is an elevated schematic perspective view of a system according to figure 1, having two robotic picker arms, two container conveyor belts and one item conveyor belt;

figure 1C is a schematic top view of the system of figure 1B;

figure 1D is a schematic side view of the system of figure 1B;

figure 2C is an elevated schematic perspective view of the system of figure 1B, showing only the container conveyor belts, the item conveyor belt and one of the robotic picker arms;

figure 2A is a schematic top view of the system of figure 2C;

figure 2B is a schematic side view of the system of figure 2C;

figure 2D is an elevated schematic perspective view of the system of figure 2C, in a different situation regarding container location;

figure 3G is an elevated schematic perspective view of the system of figure 1B, showing only one container conveyor belt, the item conveyor belt and one of the robotic picker arms, where one container is being moved towards its food processing position;

figure 3H is an elevated schematic perspective view of the system of figure 3G, where the one container from Fig 3G is in its food processing position and only one container conveyor belt is used;

figure 3E is a schematic side view of the system of figure 3H;

figure 3F is a schematic side view of the system of figure 3H;

figure 2E is an elevated schematic perspective view of the system of figure 2C, showing the manipulation of a larger container;

figure 3B is a schematic side view of the system of figure 3E, showing large containers being transported on the container conveyor;

figure 3C is a schematic side view of the system of figure 3E, showing a large container on the container conveyor being gripped by two selected handling devices;

figure 3A is a schematic side view of the system of figure 3E, showing a large container being held in the food processing position by two selected handling devices;

figure 3D is a schematic top view of the system of figure 3A and only one container conveyor belt is used;

figure 4A is an elevated schematic perspective view of a container being transported on the container conveyor to a position adjacent one handling device;

figure 4B is an elevated schematic perspective view of a container being gripped on the container conveyor by one handling device; and

figure 4C is an elevated schematic perspective view of a container being held in the food processing position by one handling device.

DESCRIPTION OF EMBODIMENTS

Figure 1A shows an embodiment of a system 1 according to the invention. A first container input 10 for a first type of container 15 and a second container input 20 for a second type of container 25 supplies containers 15, 25 of the desired type to a conveyor system comprising a conveyor belt 100, which here below will be referred to as a container conveyor

belt 100. The containers 15, 25 have a height, a width and a length, and may be square, rectangular or round, for instance.

The containers 15, 25 are transported by the container conveyor belt 100 from the container input 10, 20 towards a food processing system, which in this embodiment comprises at least one robot picking arm 200 arranged on a frame 30, where food items are put into the containers until at least one criterion is obtained, where the containers are subsequently conveyed to a container output 50 (shown in Fig. 1B). This will be discussed in more details here below.

Food items 40 (see Fig. 2C etc.) are resting on a food item conveyor belt 300, and are e.g. scanned by a scanning device 310, for example an electromagnetic wave scanner, that detects and stores the positions, and/or dimensions and/or colour of the food items. The scanning data is processed to calculate locations and positions of the food items on the food item conveyor belt as well as estimating item weight and quality.

Figures 1B to 1D show a further embodiment of the invention, where the food system 1 comprises a first container conveyor belt 100a and a second container conveyor belt 100b. The containers for the first container conveyor belt 100a are supplied by a first container input 10a for the first type of container 15 and a second container input 20a for the second type of container 25. The containers for the second container conveyor belt 100b are supplied by a third container input 10b for the first type of container 15 and a fourth container input 20b for the second type of container 25.

Along and adjacent each container conveyor belt 100a, 100b are arranged at least two handling devices 400 at a first and at least one second location.

Figures 2A to 3H show details of the embodiment shown in Figs. 1A to 1D but with only one robotic arm 200. Food items 40 are transported on the food item conveyor belt 300. In such an embodiment, a single robot picking arm 200 may be sufficient to maintain maximum throughput, otherwise one or more additional robotic arms may be implemented as shown in figure 1.

At each handling device 400 the container conveyor 100a, 100b has a loop 110, e.g. a bypass loop created via an idle roller (not shown, placed below the upper surface of the conveyor belt), for creating a free space for a cross-bar 415 of the handling device. The cross-bar is attached to grippers 430 arranged at each end of the cross-bar. The handling device 400 is movable between a lowered position, in which the cross-bar 415 is lowered into the free

space of the loop 110, and a raised position (see further description below), i.e. the food processing position.

A position tracker (not shown) obtains position data indicative of at least partly tracking the positions of containers 15, 25 resting on the container conveyor belt 100, 100a, 100b. This may e.g. be done via a vision system that is capable of keeping track of the containers, or one or more sensors arranged along the conveyor belt, or e.g. via utilizing the speed of the conveyor belt by tracking the position of the containers. Different solutions for such tracking exist that are well known to a person skilled in the art.

A control unit (not shown) is connected to the position tracker for controlling the at least two handling devices 400 using position data from the position tracker. The control unit instructs an available handling device selected from the at least two handling devices 400 to temporarily move a selected container 15, 25 from the lowered position on the container conveyor system 100, 100a, 100b and move the container to the raised position at a food processing position 410 where the container 15, 25 is retained while the food processing system, i.e. the robotic arm shown here with number 200, places food items 40 into the container. The food processing position 410 is selected such that it allows remaining containers 15, 25 resting on the container conveyor belt 100, 100a, 100b to be conveyed by the conveyor system past the first and the at least one second position. Further, the control unit identifies available free space on the container conveyor belt for the selected container, after the at least one criterion is fulfilled, e.g. a target weight. Then, the control unit instructs the handling device 400 to place the selected container 15, 25 into the available space on the container conveyor belt.

In one embodiment, the at least two handling devices 400 are arranged to grab at least two sides of the selected containers 15, 25 and at least partly move the selected container upwards from the container conveyor belt 100, 100a, 100b to the food processing position, where the food processing position 430 is at a height position exceeding the height of the containers so as to allow remaining containers on the container conveyor belt to be conveyed under the selected and retained container while the robotic arm 200 places multiple food items into the selected and retained container.

Each of the at least one handling devices 400 comprises opposingly arranged gripper devices 430 arranged across the container conveyor belt.

Alternatively (not shown), the at least two handling devices 400 are arranged to move the selected container 15, 25 sideways from the container conveyor belt 100, 100a, 100b. Thus, the food processing position 410 is at a sideways position exceeding the width of the containers so as to allow remaining containers on the container conveyor to be conveyed past the selected and retained container while the food processing system 200 places multiple food items 40 into the selected and retained container. The at least two handling devices comprises opposingly arranged gripper devices 430 arranged to reciprocally grip and slide the selected container sideways from the conveyor belt.

Further and alternatively (not shown), the at least two handling devices 400 are arranged to grip and move the selected container 15, 25 sideways and upwards from the container conveyor belt 100, 100a, 100b. The food processing position 430 is at a sideways and elevated position exceeding the width and/or the height of the containers so as to allow remaining containers on the container conveyor belt 100, 100a, 100b, to be conveyed past and below the selected and retained container while the robotic arm 200 places multiple food items 40 into the selected and retained container.

The opposingly arranged gripper devices 430 may in one embodiment be arranged to reciprocally grip and lift and move the selected container sideways and upwards from the conveyor belt.

In a further embodiment (not shown), the at least two handling devices 400 are arranged to grab a bottom side of the selected containers 15, 25 and at least partly move the selected container upwards from the container conveyor belt 100, 100a, 100b. The food processing position 410 is at a height position exceeding the height of the containers so as to allow remaining containers on the container conveyor belt to be conveyed under the selected and retained container while the food processing system 200 places multiple food items 40 into the selected and retained container.

In one embodiment, the conveyor system transporting the containers comprises at least two conveyor belts 100a, b, for containers 15, 25.As shown in figure 2C as an example, the two conveyor belts 100a, b are arranged on opposite sides of the food item conveyor belt 300 and run parallel to the conveying direction of the food items 40.

In all embodiments, the containers 15, 25 may have lengths chosen from one modular length, two modular lengths, three modular lengths and so on. The length is the dimension seen along the direction of transport on the container conveyor belt 100, 100a, 100b. The one

modular length container is arranged to cooperate with one handling device, the two modular length container is arranged to cooperate with two handling devices simultaneously and the three modular length container is arranged to cooperate with three handling devices simultaneously.

In one embodiment, shown in Figs. 4A to 4C, the opposingly arranged gripper devices 430 are attached to a movable arm 440, the movable arm being selectively movable between a first position (see Fig. 4A) and a second position (see Fig. 4C). Fig. 4B shows an intermediate position of the movable arm 440 and thus the container 15. The first position is a passive position where the opposingly arranged gripper devices 430 are in a passive position without contact with a selected container 15 on the container conveyor belt 100, and the second position being an active position where the opposingly arranged gripper devices 430 have engaged with the selected container and moved the container to the food processing position 410 (see Fig. 2E, for example). A brake arm or brake tip 470 may be used to stop the progress of the container on the container conveyor before the gripper devices are deployed to grip the selected container. The movable arm 440 is pivotable about a rotation axis 450, for example using a rotating drive or a linear actuator 460. The movable arm 440 is further reciprocably movable, linearly, between the first and second positions, for example using a linear actuator 460.

In one embodiment, the food items 40 are scanned using a scanning device (not shown) to determine at least one food item property: position on the at least one food item, dimensions, colour, surface topography, weight and combinations thereof. The scanning device may be at least one of a scanner using electromagnetic waves, a weighing scale, sound waves, and combinations thereof.

In one embodiment, a method for placing multiple food items 40 into containers 15, 25 by a food processing system 200, 200a, 200b such that the containers fulfil at least one criterion, has the following steps:

- transporting containers 15, 25, using a container conveyor belt 100, 100a, 100b, to transport containers from a container input 10, 10a, 10b, 20, 20a, 20b on the container conveyor belt to a container output 30 (see Fig. 1B) on the container conveyor belt,
- obtaining position data, using the position tracker (not shown), indicative of at least partly tracking positions of containers resting on the container conveyor belt, and

- controlling the entire system 1 using a control unit (not shown) connected to the position tracker (not shown) for controlling the at least two container handling device 400 using position data from the position tracker, the controlling including:
  - instructing an available handling device selected from the at least two handling devices to temporarily move a selected container 15, 25 from the container conveyor system 100, 100a, 100b and moving the container to a food processing position 410 where the container is retained while the food processing system 200, 200a, 200b places at least one food item 40 into the container, the food processing position being selected such that it allows remaining containers resting on the container conveyor belt to be conveyed past the first and the at least one second position,
  - identifying, after the at least one criterion is fulfilled, available free space on the container conveyor belt for the selected container, and

instructing the handling device to place the selected container into the available space on the container conveyor belt.

While the invention has been illustrated and described in details in the drawings and foregoing description, such illustrations and description are to be considered illustrative or exemplary and not restrictive. The invention is not limited to the disclosed embodiments. Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of the drawings, the disclosure, and the appended claims. In the claims, the word "comprising" does not exclude other elements or steps, and the indefinite article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to advantage.

PATENTKRAV

1. System (1) til anbringelse af talrige fødevareprodukter i beholdere, således at beholderne (15, 25) opfylder mindst ét kriterium, hvilket system omfatter:

• et fødevareforarbejdningssystem, der er indrettet til anbringelse af de talrige fødevareprodukter i beholderne,

• et transportørsystem, der omfatter et transportbånd (100, 100a, 100b), der er indrettet til at transportere beholdere fra en beholderindgang (10, 20) på transportbåndet til en beholderudgang (50) på transportbåndet,

• mindst to håndteringsanordninger (400), der er anbragt langs transportbåndsystemet på et første og mindst ét andet sted,

• en positionssporingsenhed til opnåelse af positionsdata, der indikerer mindst delvis sporing af positioner for beholdere, der hviler på transportbåndet, mens de transporteres af transportørsystemet, og

• en styreenhed, der er forbundet med positionssporingsenheden, til styring af de mindst to håndteringsanordninger ved anvendelse af positionsdata fra positionssporingsenheden, kendetegnet ved, at styringen indbefatter:

• instruktion til en tilgængelig håndteringsanordning, der er udvalgt fra de mindst to håndteringsanordninger, om midlertidigt at bevæge en valgt beholder fra transportbåndsystemet og bevæge beholderen til en fødevareforarbejdningsposition hvor beholderen tilbageholdes, mens fødevareforarbejdningssystemet anbringer mindst et fødevareprodukt i beholderen, hvilken fødevareforarbejdningsposition er udvalgt således, at det er gjort muligt for resterende beholdere, der hviler på transportbåndet, at blive transporteret af transportbåndsystemet forbi den første og den mindst ene anden position,

• identificering, efter at det mindst ene kriterium er opfyldt, af tilgængelig fri plads på transportbåndet for den valgte beholder, og

• instruktion til håndteringsanordningen om at placere den valgte beholder på det tilgængelige sted på transportbåndet.

2. System ifølge krav 1, hvor beholderne (15, 25) har en højde, en bredde og en længde, hvor de mindst to håndteringsanordninger (400) er indrettet til at gribe fat i mindst to sider af de valgte beholdere og mindst delvist bevæge den valgte beholder opefter fra transportbåndet (100, 100a, 100b), hvor fødevareforarbejdningspositionen er ved en højdeposition, der overstiger højden på beholderne, for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret under den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

3. System ifølge krav 2, hvor hver af de mindst to håndteringsanordninger omfatter modsat anbragte griberanordninger (430), der er anbragt på tværs af transportøranordningen.

4. System ifølge et hvilket som helst foregående krav, hvor de mindst to håndteringsanordninger (400) er indrettet til at bevæge den valgte beholder sidelæns fra transportbåndet, hvor fødevareforarbejdningspositionen er ved en sidelæns position, der overstiger bredden på beholderne (15, 25), for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret forbi den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

5. System ifølge krav 4, hvor hver af de mindst to håndteringsanordninger (400) omfatter modsat anbragte griberanordninger (430), der er indrettet til gensidigt at gribe fat i og få den valgte beholder til at glide sidelæns fra transportbåndet.

6. System ifølge et hvilket som helst foregående krav, hvor de mindst to håndteringsanordninger (400) er indrettet til at gribe fat i og bevæge den valgte beholder sidelæns og opefter fra transportbåndet (100, 100a, 100b), hvor fødevareforarbejdningspositionen er ved en sidelæns og forhøjet position, der overstiger bredden og/eller højden på beholderne, for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret forbi og under den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

7. System ifølge krav 6, hvor hver af de mindst to håndteringsanordninger omfatter modsat anbragte griberanordninger, der er indrettet til gensidigt at gribe fat i og løfte og bevæge den valgte beholder sidelæns og opefter fra transportbåndet.

8. System ifølge krav 1, hvor de mindst to håndteringsanordninger er indrettet til at gribe fat i en bundside af de valgte beholdere og mindst delvist bevæge den valgte beholder opefter fra transportbåndet, hvor fødevareforarbejdningspositionen er ved en højdeposition, der overstiger højden på beholderne, for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret under den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

9. System ifølge et hvilket som helst af de foregående krav, hvor fødevareforarbejdningssystemet omfatter mindst én robotplukkerarm, der er indrettet til at bevæge fødevareprodukter fra mindst én fødevareprodukttransporttransportør til den valgte og tilbageholdte beholder.

10. System ifølge et hvilket som helst foregående krav, hvor transportbåndsystemet omfatter mindst to transportbånd (100, 100a, 100b) til beholdere.

11. System ifølge et hvilket som helst af kravene 3 til 10, hvor de modsat anbragte griberanordninger (430) er fastgjort til en bevægelig arm (440), hvilken bevægelig arm (440) selektivt kan bevæges mellem en første position og en anden position, hvor den første position er en passiv position, hvor de modsat anbragte griberanordninger (430) er i en passiv position uden kontakt med en valgt beholder på transportbåndet (100, 100a, 100b), og hvor den anden position er en aktiv position, hvor de modsat anbragte griberanordninger er gået i indgreb med beholderen og har bevæget den til fødevareforarbejdningspositionen.

12. System ifølge krav 11, hvor den bevægelige arm (440) kan dreje om en rotationsakse, for eksempel ved anvendelse af et roterende drev eller en lineær aktuator.

13. System ifølge krav 11, hvor den bevægelige arm (440) er lineært bevægelig mellem den første og den anden position, for eksempel ved anvendelse af en lineær aktuator (460).

14. System ifølge et hvilket som helst af de foregående krav, hvor fødevareforarbejdningssystemet omfatter en robotplukkerarm til plukning af fødevareprodukter fra mindst én produkttransportør.

15. System ifølge et hvilket som helst af de foregående krav, der er konfigureret til at scanne fødevareprodukter ved anvendelse af en scanneranordning til at bestemme mindst én fødevareproduktegenskab, der er udvalgt fra gruppen af: position på den ene produkttransportør, dimensioner, farve, overfladetopografi, vægt og kombinationer deraf.

16. System ifølge krav 15, hvor scanningsanordningen er udvalgt fra gruppen af: mindst én af en scanner, der anvender elektromagnetiske bølger, en vægt, og kombinationer deraf.

17. Fremgangsmåde til anvendelse af et system (1) til anbringelse af talrige fødevareprodukter i beholdere ved hjælp af et fødevareforarbejdningssystem, således at beholderne opfylder mindst ét kriterium, omfattende:

• transport af beholdere, ved anvendelse af et transportørsystem, omfattende et transportbånd, der er indrettet til at transportere beholdere fra en beholderindgang på transportbåndet til en beholderudgang på transportbåndet,

• håndtering af beholderne ved anvendelse af mindst to håndteringsanordninger, der er anbragt langs transportbåndsystemet på et første og mindst ét andet sted,

• opnåelse af positionsdata, ved anvendelse af en positionssporingsenhed, der indikerer mindst delvis sporing af positioner for beholdere, der hviler på transportbåndet, mens de transporteres af transportørsystemet, og

• styring af systemet (1) ved anvendelse af en styreenhed, der er forbundet med positionssporingsenheden til styring af de mindst to håndteringsanordninger ved anvendelse af positionsdata fra positionssporingsenheden, kendetegnet ved, at styringen indbefatter:

• instruktion til en tilgængelig håndteringsanordning, der er udvalgt fra de mindst to håndteringsanordninger, om midlertidigt at bevæge en valgt beholder fra transportbåndsystemet og bevæge beholderen til en fødevareforarbejdningsposition hvor beholderen tilbageholdes, mens fødevareforarbejdningssystemet anbringer mindst et fødevareprodukt i beholderen, hvilken fødevareforarbejdningsposition er udvalgt således, at den gør det muligt for resterende beholdere, der hviler på transportbåndet, at blive transporteret af transportbåndsystemet forbi den første og den mindst ene anden position,

• identificering, efter at det mindst ene kriterium er opfyldt, af tilgængelig fri plads på transportbåndet for den valgte beholder, og

• instruktion til håndteringsanordningen om at anbringe den valgte beholder på den tilgængelige frie plads på transportbåndet.

18. Fremgangsmåde ifølge krav 17, hvor beholderne har en højde, en bredde og en længde, hvor trinnet med bevægelse af beholderen ved hjælp af de mindst to håndteringsanordninger udføres ved følgende trin:

at gribe fat i mindst to sider af de valgte beholdere, mindst delvis at bevæge den valgte beholder opefter fra transportbåndet, hvor fødevareforarbejdningspositionen er ved en højdeposition, der overstiger højden på beholderne, for at gøre det muligt for resterende beholdere på transportbåndsystemet at blive transporteret under den udvalgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

19. Fremgangsmåde ifølge krav 17 eller 18, hvor det mindst ene kriterium omfatter,

et vægtmål,

et antalsmål,

et geometrisk eller volumenmål,

et farvemål,

et mål for antal arter,

en kombination af ét eller flere af ovenstående.

20. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 19, hvor trinnet med mindst delvis sporing af positioner for beholdere, der hviler på transportbåndet, mens de transporteres af transportbåndsystemet ved anvendelse af en positionssporingsenhed, endvidere omfatter

sporing af beholderne, efter at det mindst ene kriterium er opfyldt, og beholderne er anbragt på det tilgængelige sted på transportbåndet.

21. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 20, hvor beholderne har to eller flere forskellige geometriske former/volumener.

22. Fremgangsmåde ifølge krav 21, hvor mindst ét forskellige kriterium er tildelt to eller flere forskellige beholdere, således at én eller flere af følgende gælder:

- beholdere af samme geometriske former/volumener har mindst ét forskelligt kriterium,
- beholdere af forskellige geometriske former/volumener har mindst ét forskelligt kriterium,

hvor trinnet med mindst delvis sporing af positioner for beholdere, der hviler på transportbåndet, mens de transporteres af transportbåndsystemet, ved anvendelse af en positionssporingsenhed endvidere omfatter sporing af de to eller flere forskellige beholdere, efter at det forskellige mindst ene kriterium er opfyldt, og beholderne er placeret på den tilgængelige plads på transportbåndet.

23. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 22, hvor trinnet med bevægelse af beholderen ved hjælp af de mindst to håndteringsanordninger udføres ved at bevæge den valgte beholder sidelæns fra transportbåndet, hvor

fødevareforarbejdningspositionen er ved en sidelæns position, der overstiger bredden på beholderne, for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret ved siden af den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

24. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 23, hvor trinnet med bevægelse af beholderen ved hjælp af de mindst to håndteringsanordninger udføres ved at gribe fat i og skubbe den valgte beholder sidelæns og opefter fra transportbåndet, hvor fødevareforarbejdningspositionen er ved en sidelæns og forhøjet position, der overstiger bredden og højden på beholderne for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret hen til og under den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

25. Fremgangsmåde ifølge krav 24, hvor hver af de mindst to håndteringsanordninger omfatter modsat anbragte griberanordninger, der er indrettet til gensidigt at gribe fat i og løfte og få den valgte beholder til at glide sidelæns og opefter fra transportbåndet.

26. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 22, hvor trinnet med bevægelse af beholderen ved hjælp af de mindst to håndteringsanordninger sker ved at gribe

fat i en bundside af de valgte beholdere og mindst delvis bevæge den valgte beholder opefter fra transportbåndet, hvor fødevareforarbejdningspositionen er ved en højdeposition, der overstiger højden på beholderne, for således at gøre det muligt for de resterende beholdere på transportbåndsystemet at blive transporteret under den valgte og tilbageholdte beholder, mens fødevareforarbejdningssystemet anbringer talrige fødevareprodukter i den valgte og tilbageholdte beholder.

27. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 26, hvor fremgangsmåden endvidere omfatter trinnet med bevægelse af fødevareprodukter ved anvendelse af mindst én robotplukkerarm fra fødevareforarbejdningssystemet, hvilken arm er indrettet til at bevæge produkter fra én produkttransporttransportør til den valgte og tilbageholdte beholder.

28. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 27, hvor transportbåndsystemet omfatter mindst to transportbånd til beholdere.

29. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 28, hvor beholderne har længder, der er udvalgt fra én modullængde, to modullængder og tre modullængder.

30. Fremgangsmåde ifølge krav 29, hvor en-modullængde-beholderen er indrettet til at samvirke med én håndteringsanordning, to-modullængde-beholderen er indrettet til at samvirke med to håndteringsanordninger samtidigt og tre-modullængde-beholderen er indrettet til at samvirke med tre håndteringsanordninger samtidigt.

31. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 30, hvor trinnet med bevægelse af en valgt beholder ved hjælp af de mindst to håndteringsanordninger udføres ved at hver af de mindst to håndteringsanordninger er fastgjort til en bevægelig arm, hvor den bevægelige arm selektivt kan bevæges mellem en første position og en anden position, hvor i den første position en valgt beholder hviler på transportbåndet og i den anden position den valgte beholder fjernes fra transportbåndet, således at beholdere på transportbåndet frit kan transporteres på transportbåndet.

32. Fremgangsmåde ifølge krav 31, hvor den bevægelige arm kan dreje om en rotationsakse, for eksempel ved anvendelse af et roterende drev eller en lineær aktuator.

33. Fremgangsmåde ifølge krav 31 eller 32, hvor den bevægelige arm er gensidigt lineært bevægelige mellem den første og den anden position, for eksempel ved anvendelse af en lineær aktuator.

34. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 33, hvor den mindst ene robotplukkerarm plukker fødevareprodukter fra mindst én produkttransportør.

35. Fremgangsmåde ifølge et hvilket som helst af kravene 17 til 34, hvor fremgangsmåden endvidere omfatter trinnet med scanning af fødevareprodukterne ved anvendelse af en scanningsanordning for at bestemme mindst én fødevareproduktegenskab, der er udvalgt fra gruppen bestående af position på den mindst ene produkttransportør, dimensioner, farve, overfladetopografi, vægt og kombinationer deraf.

36. Fremgangsmåde ifølge krav 35, hvor scanningsanordningen er udvalgt fra gruppen bestående af mindst én af en scanner, der anvender elektromagnetiske bølger, en vægt og kombinationer deraf.

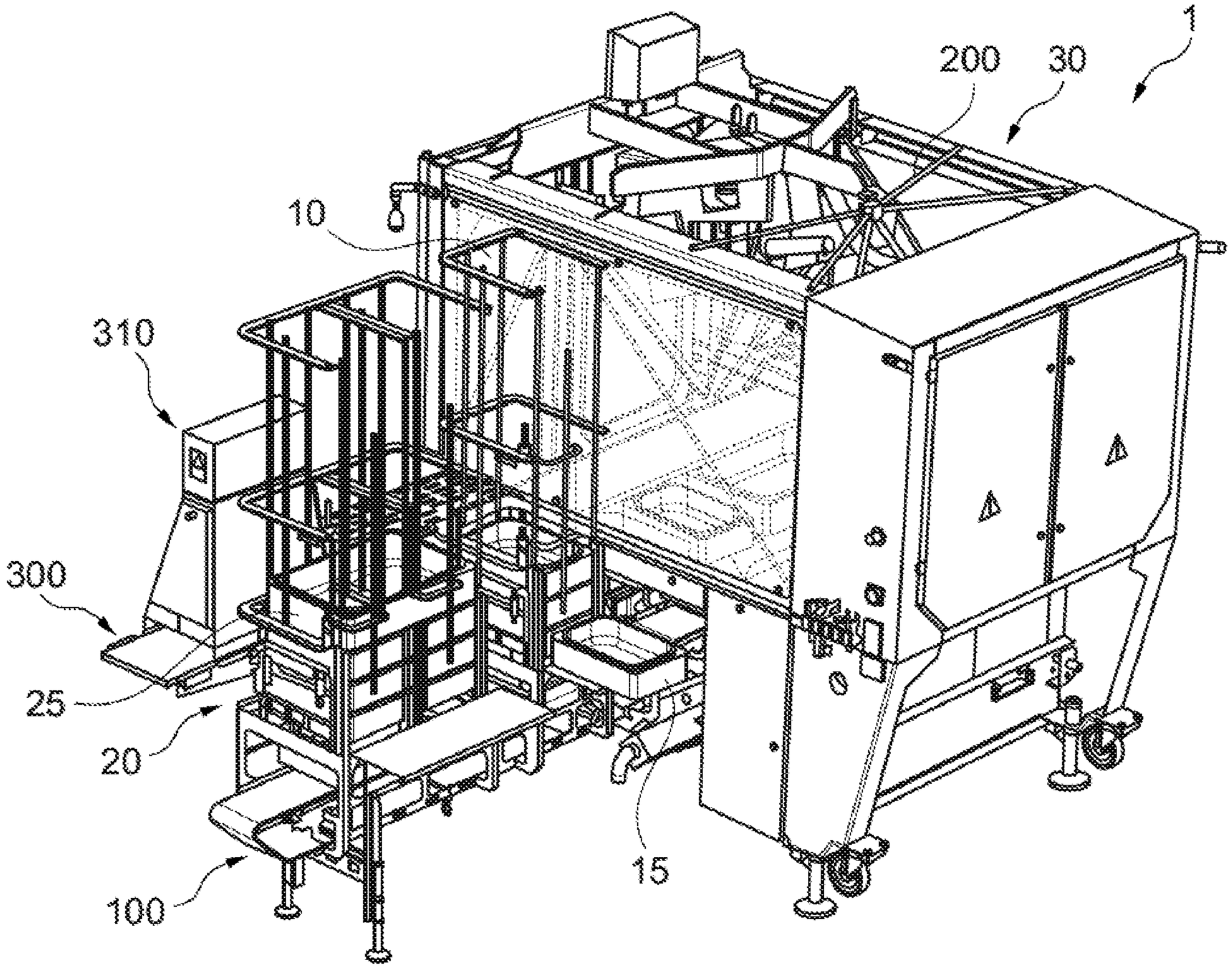


Fig. 1A

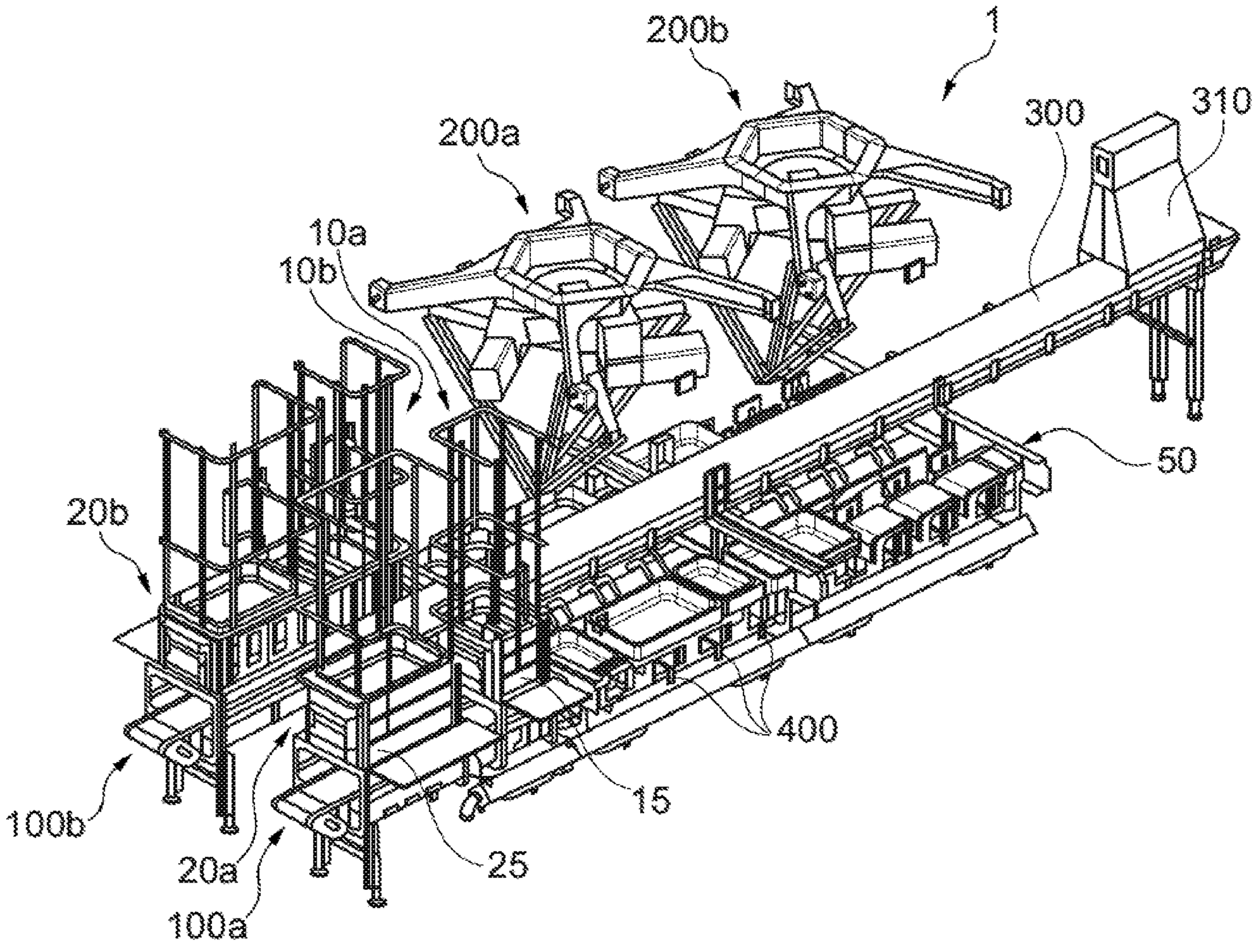


Fig. 1B

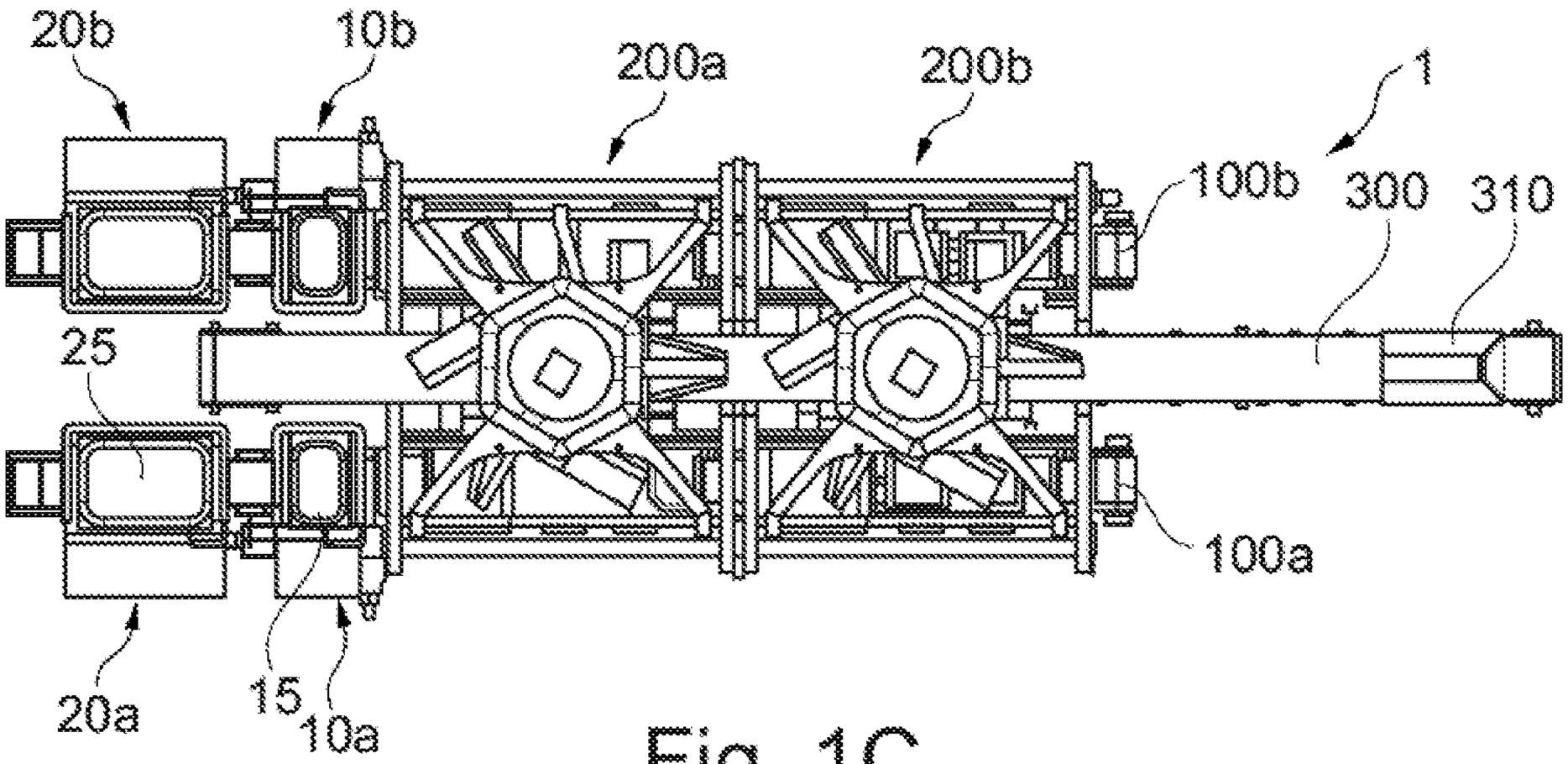

20b
10b
200a
200b
1
100b
300
310
25
100a
20a
15
10a

Fig. 1C

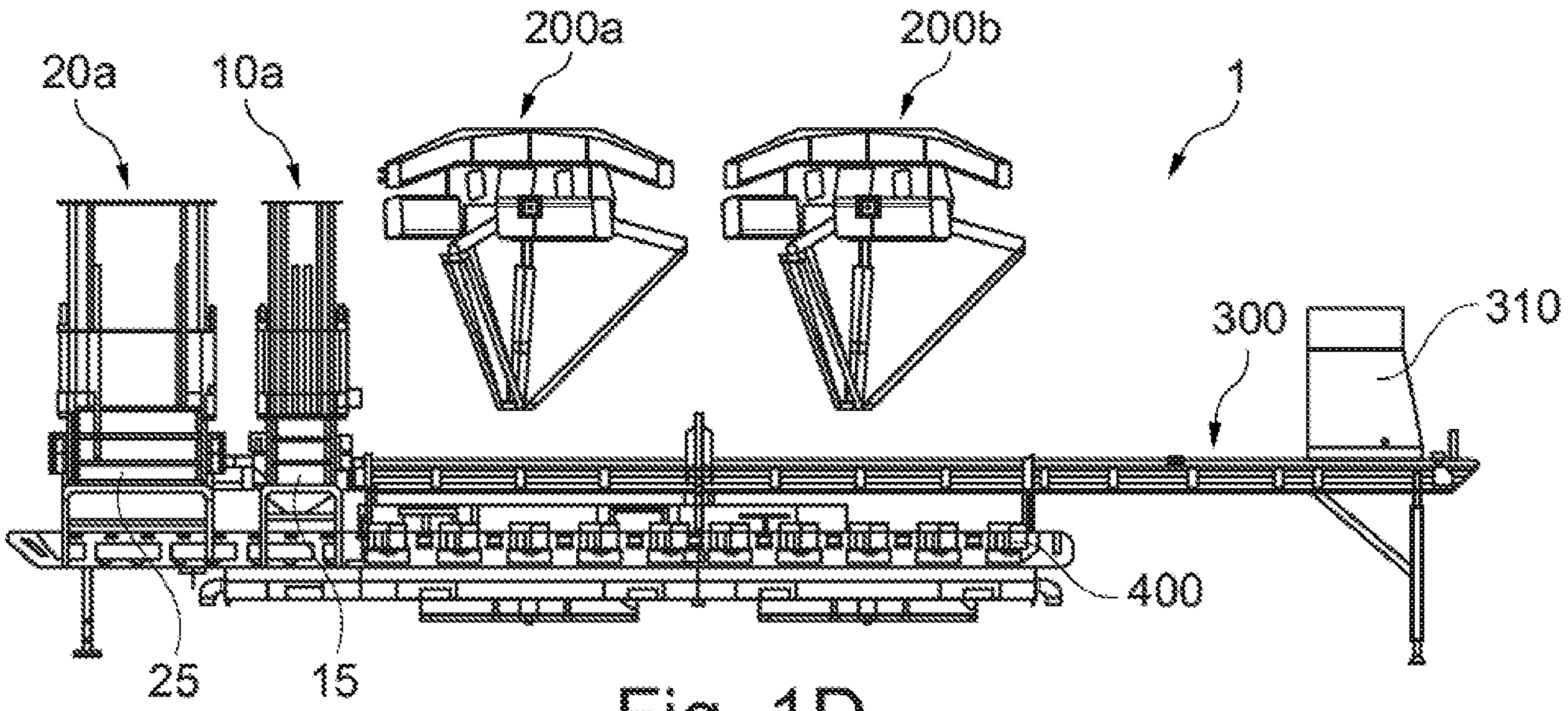

20a
10a
200a
200b
1
300
310
400
25
15

Fig. 1D

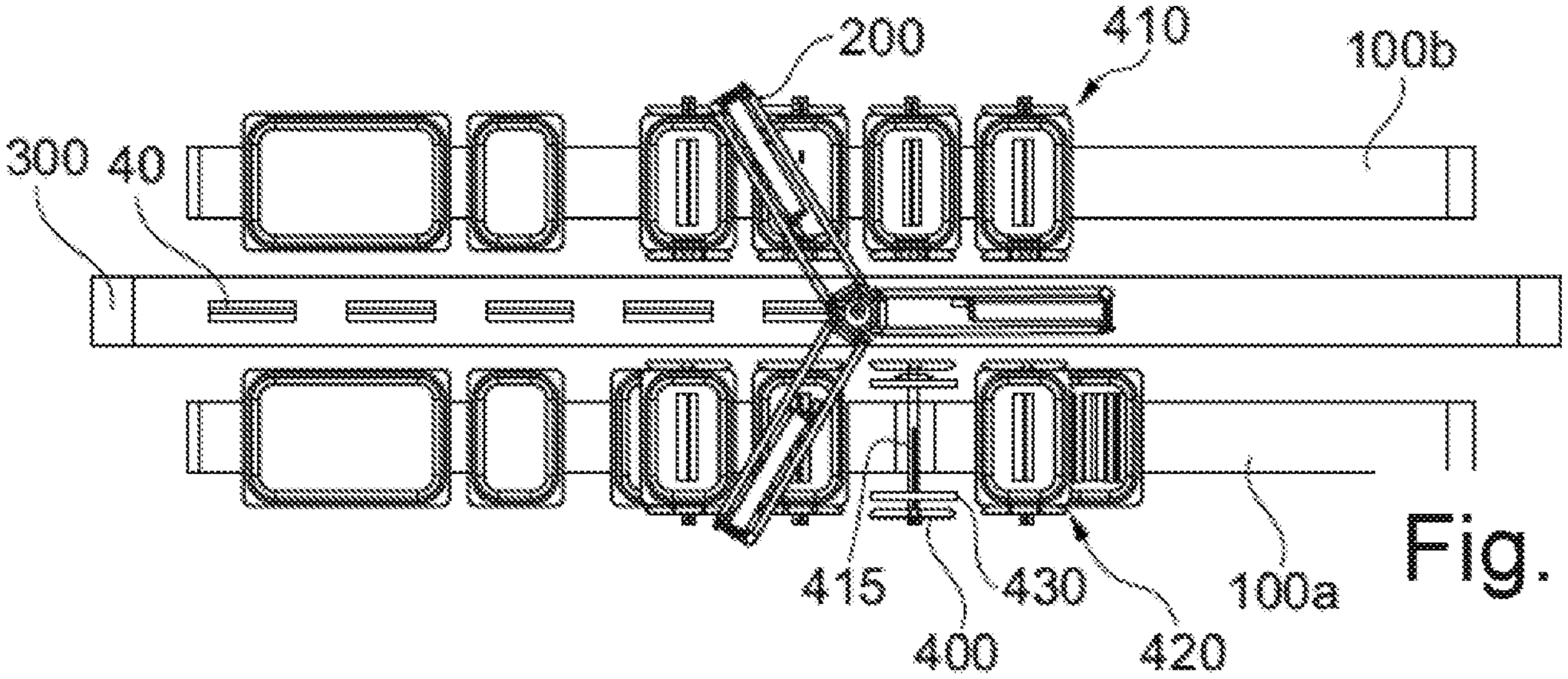
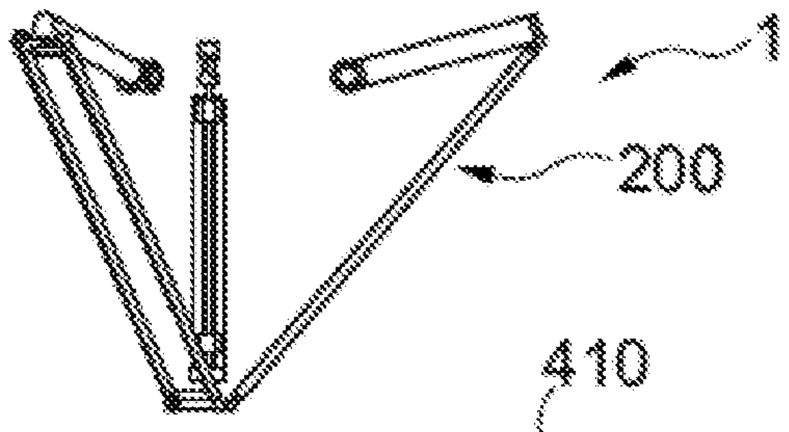


Fig. 2A



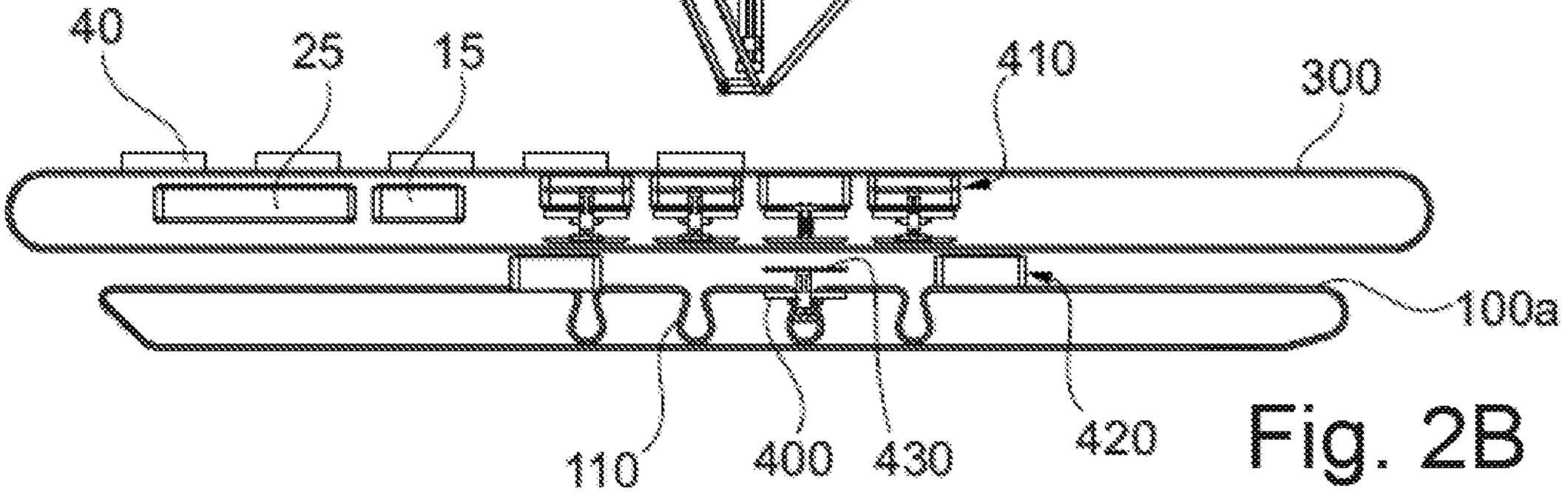


Fig. 2B

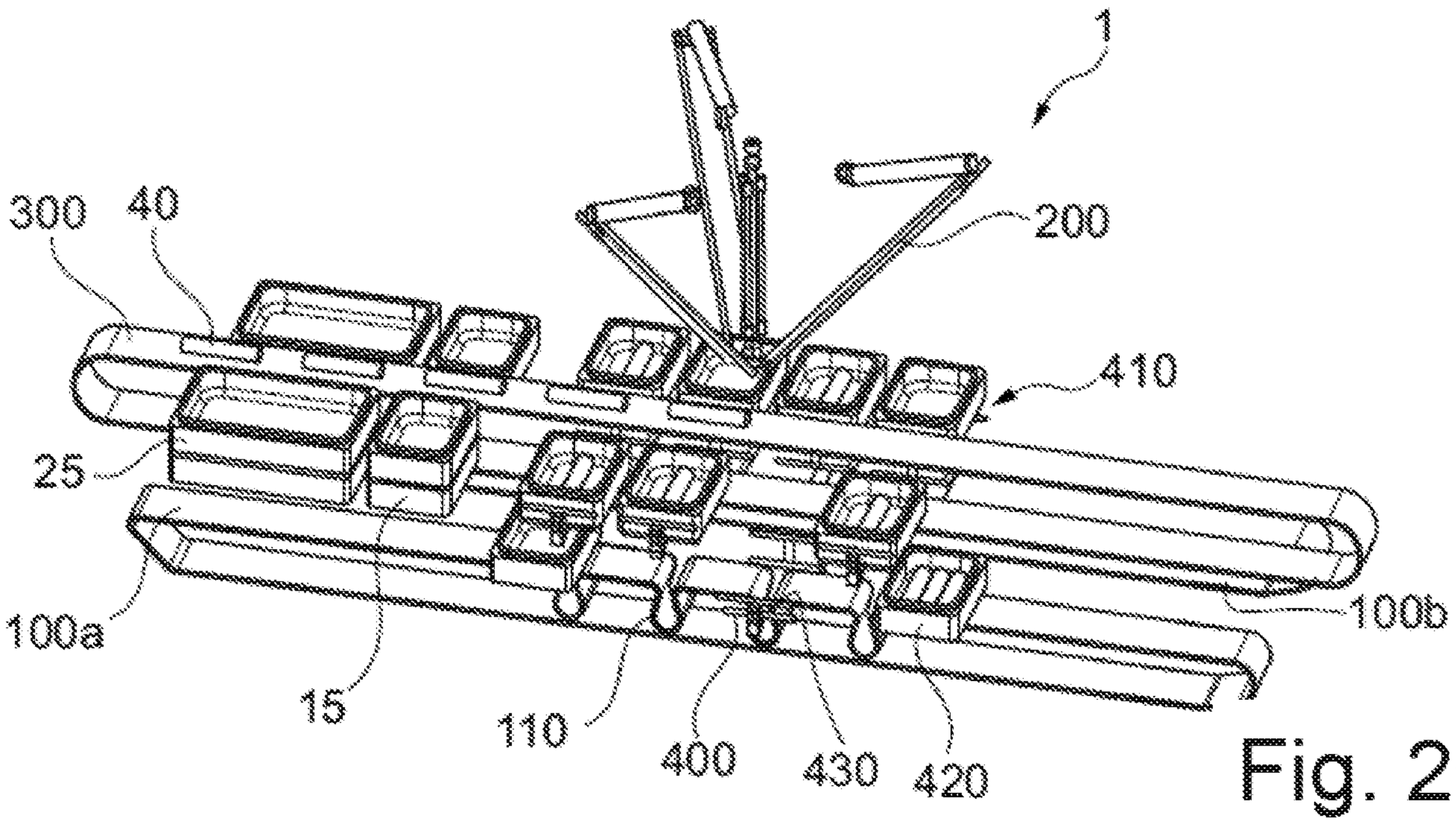


Fig. 2C

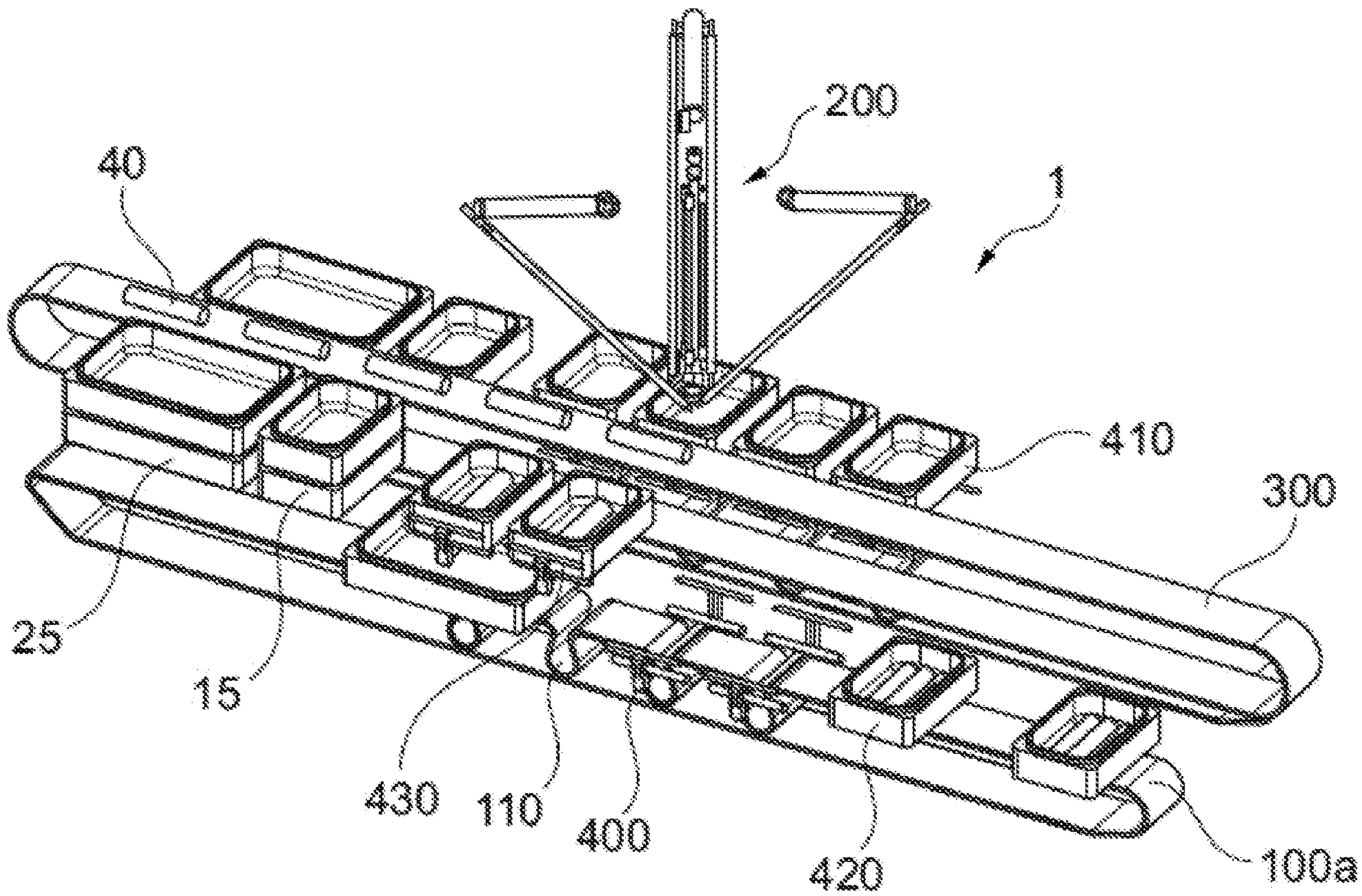


Fig. 2D

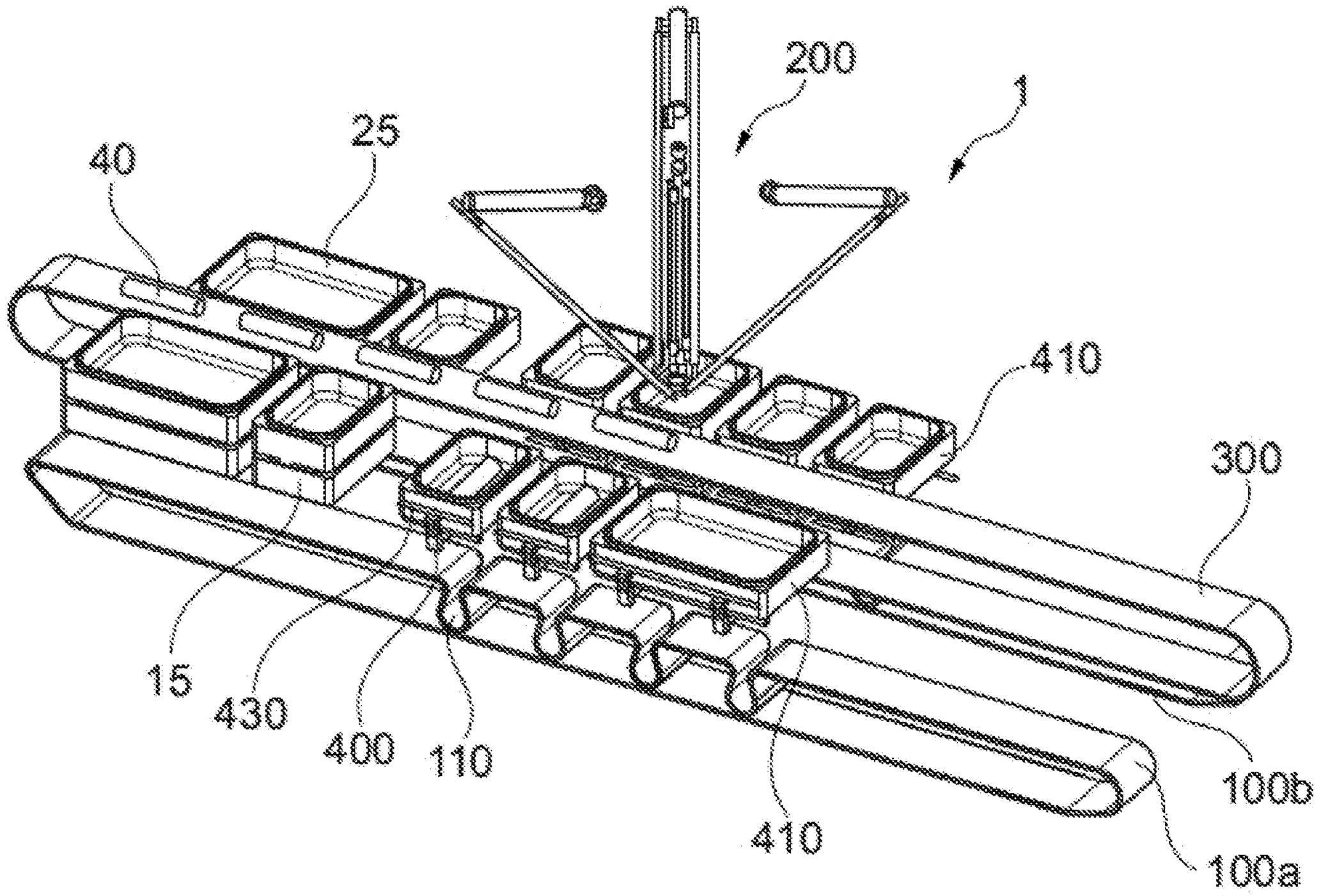


Fig. 2E

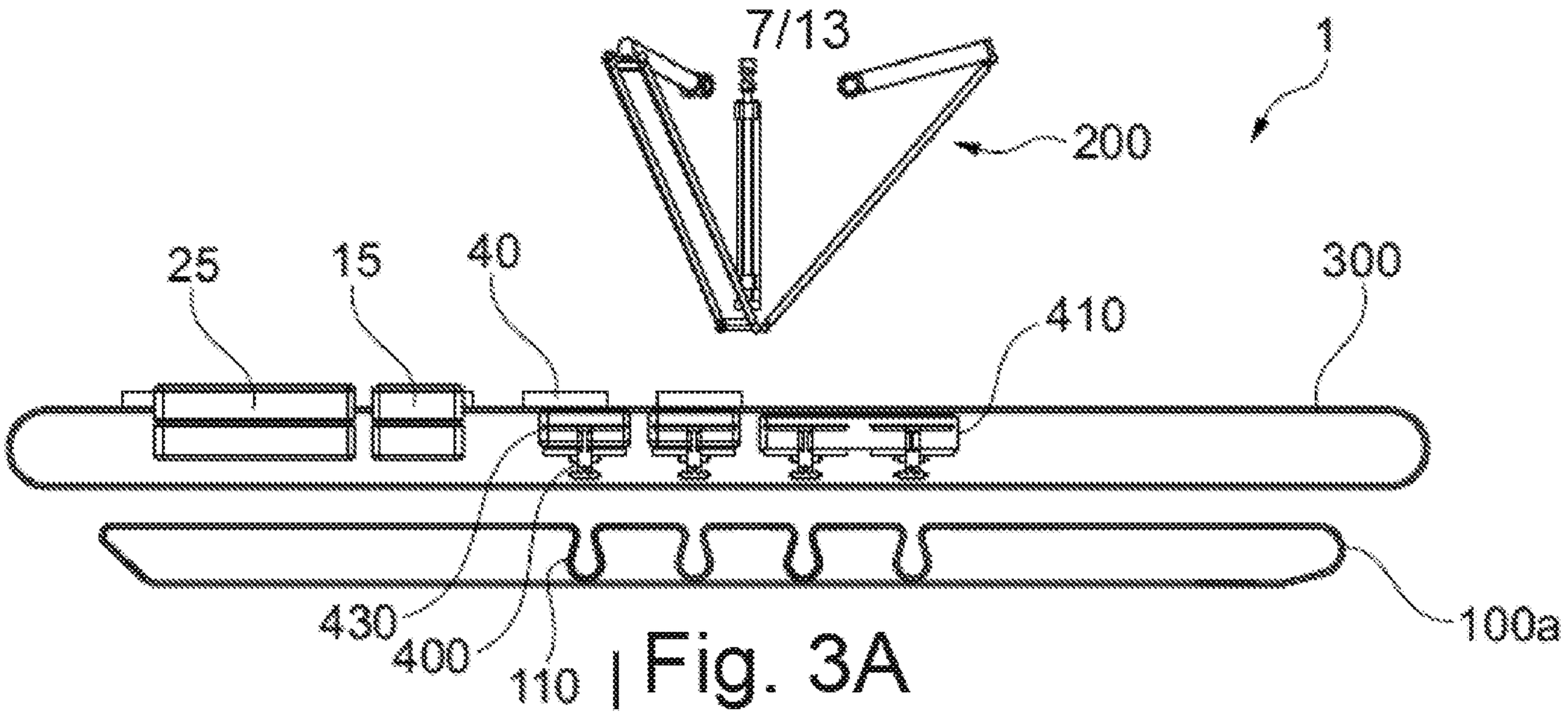


Fig. 3A

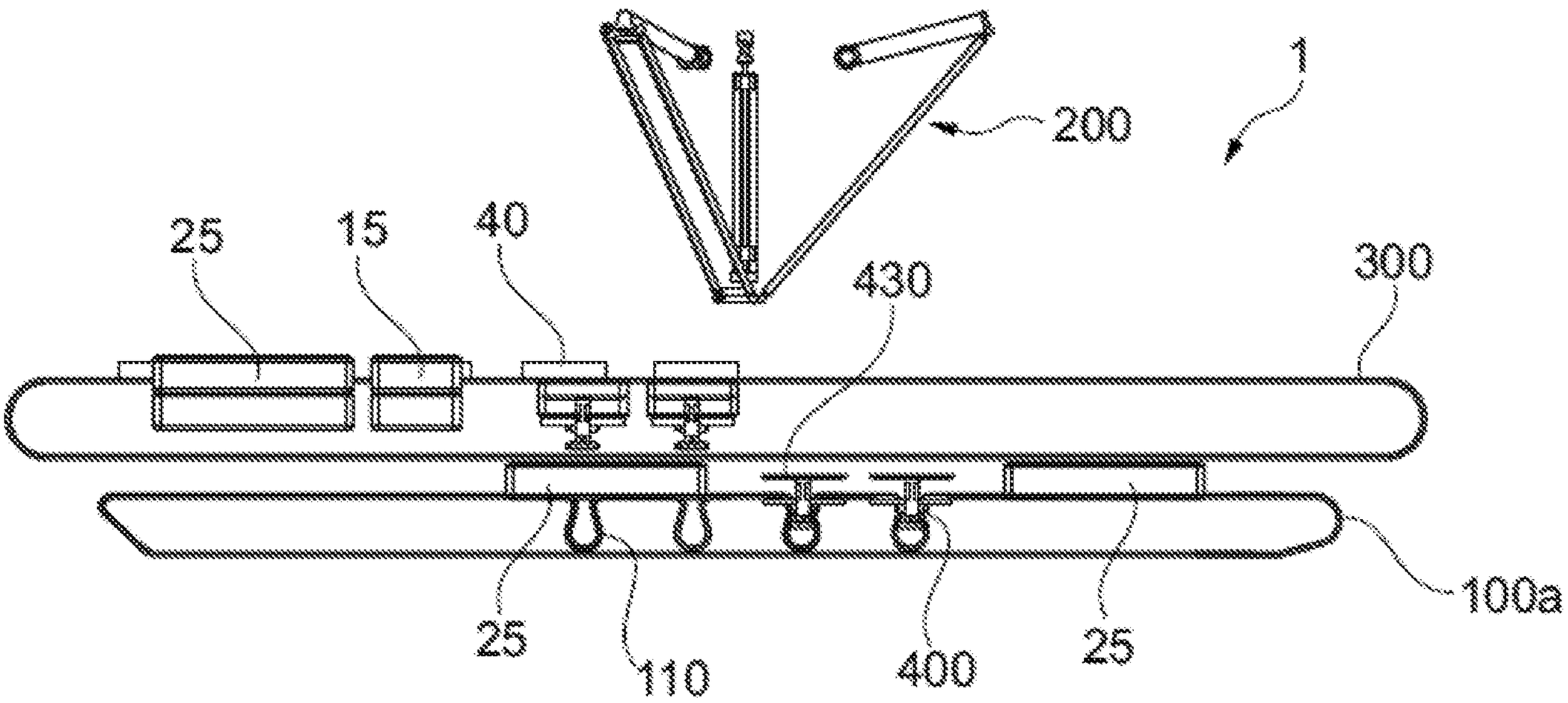


Fig. 3B

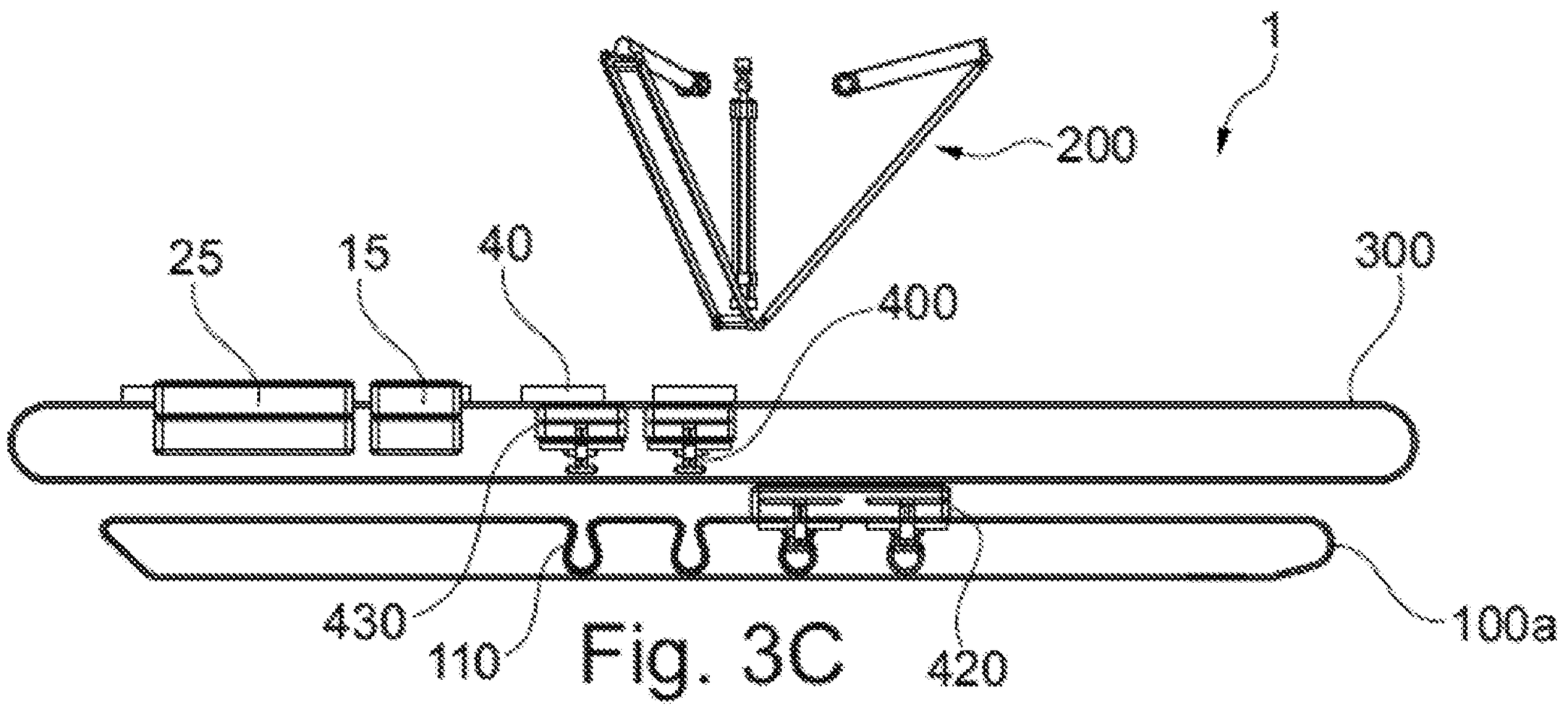


Fig. 3C

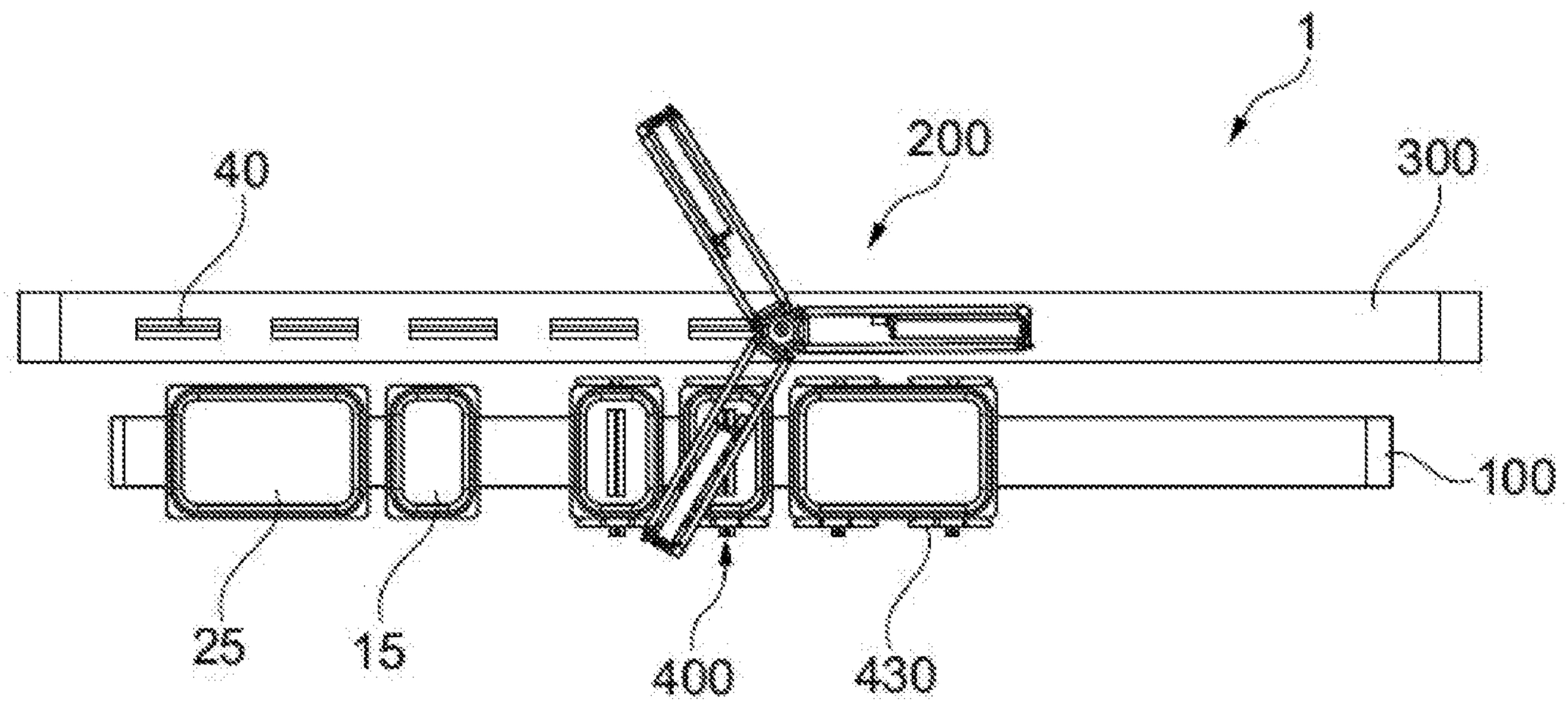


Fig. 3D

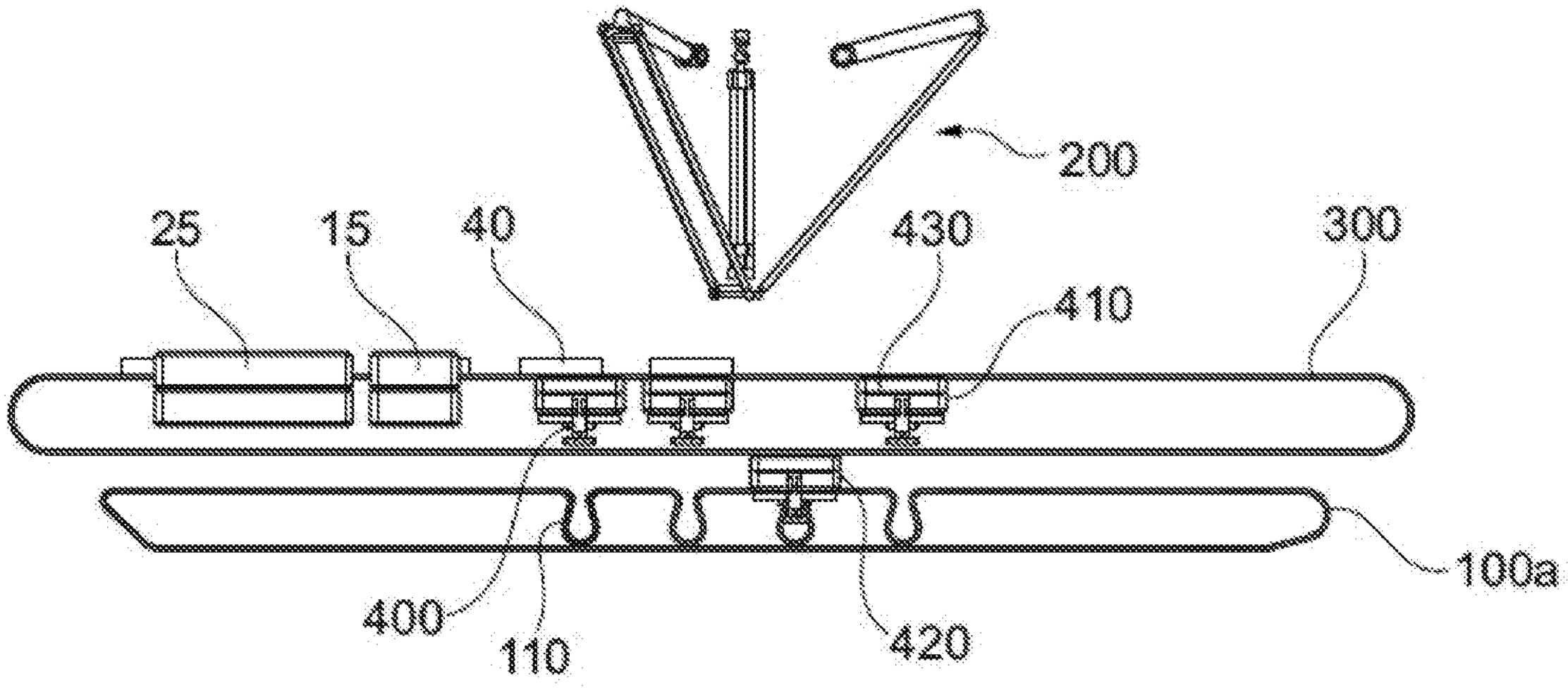

200
25
15
40
430
410
300
400
110
420
100a

Fig. 3E

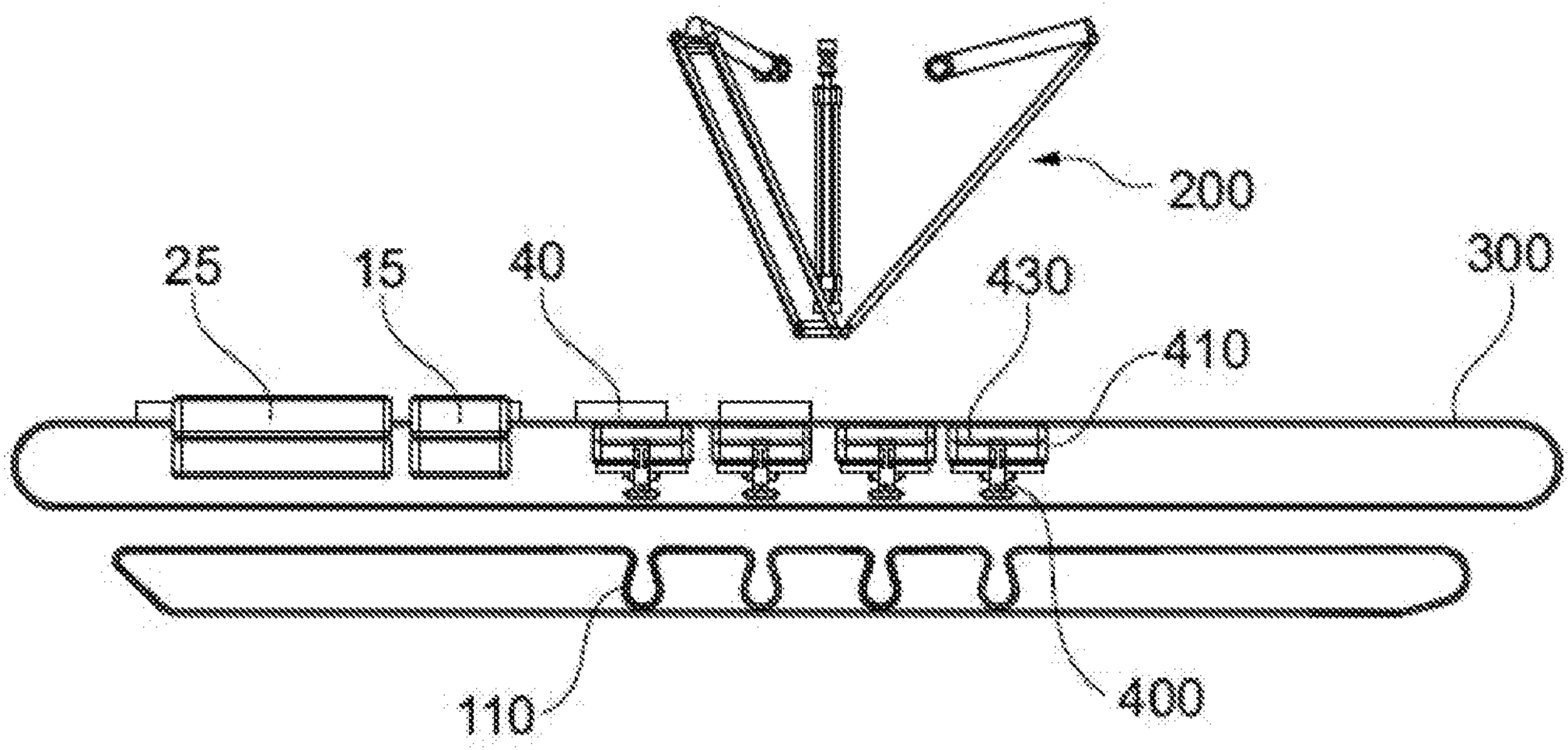

200
25
15
40
430
410
300
110
400

Fig. 3F

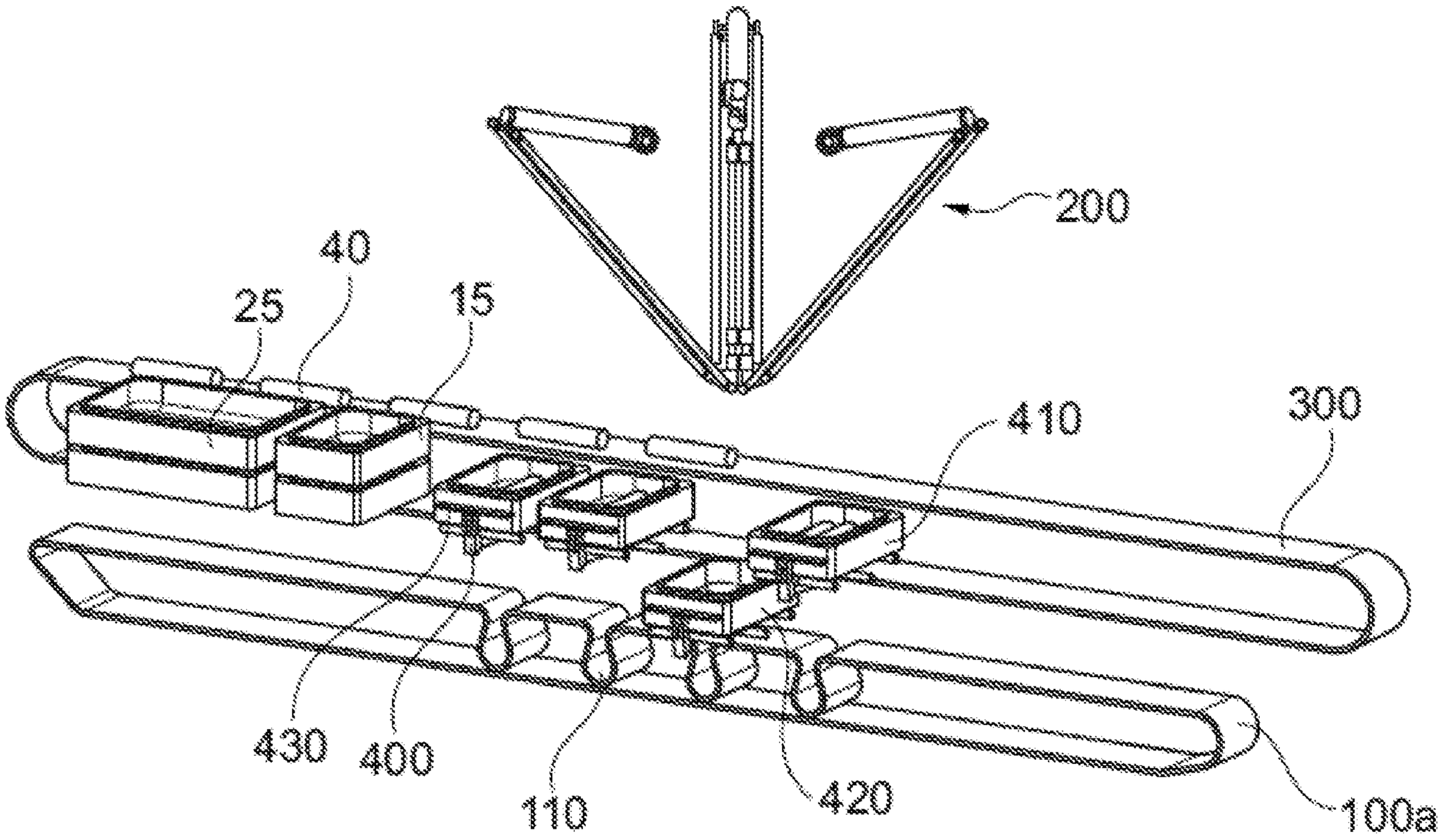

200
40
25
15
410
300
430
400
110
420
100a

Fig. 3G

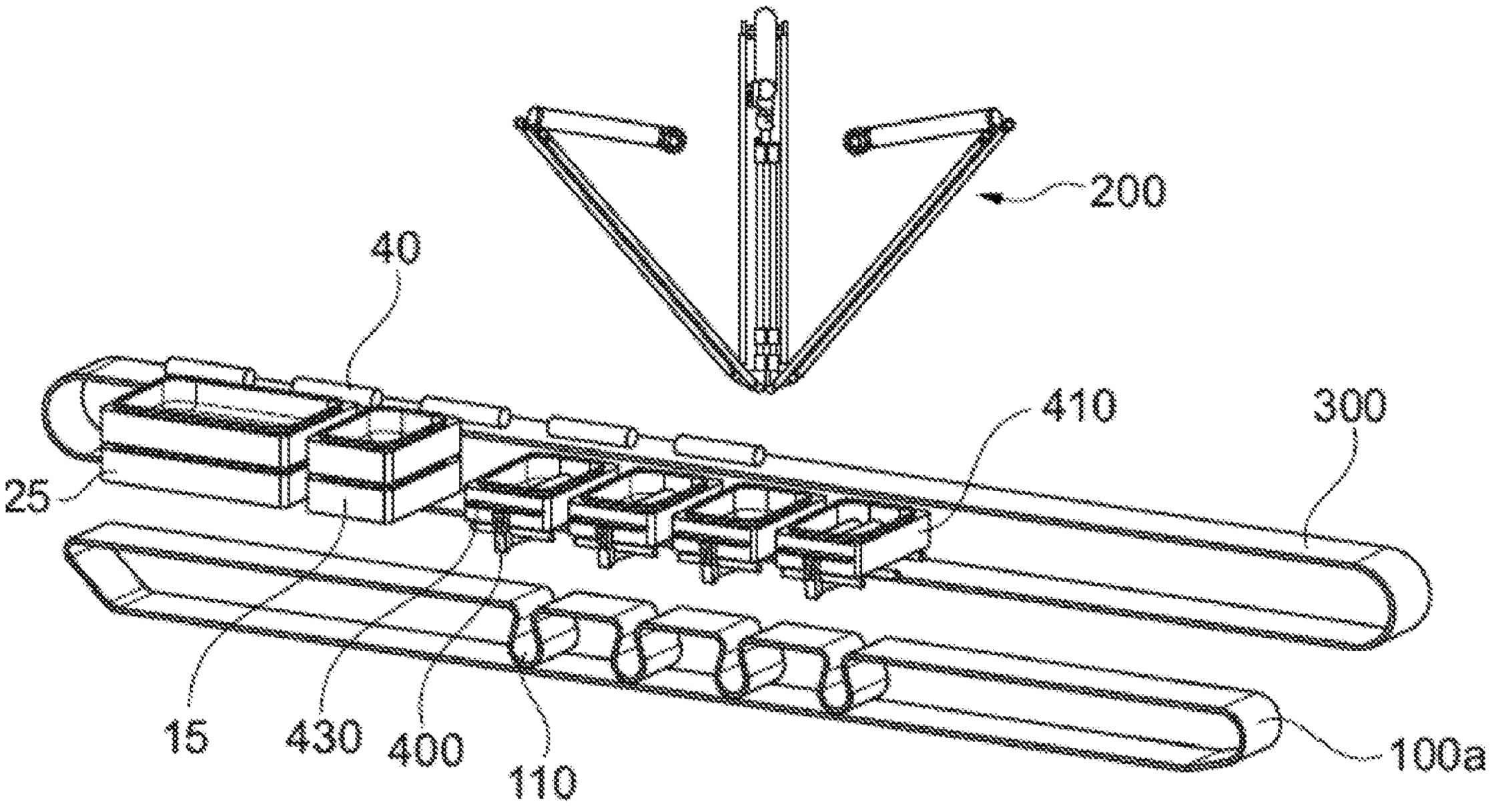

200
40
410
300
25
15
430
400
110
100a

Fig. 3H

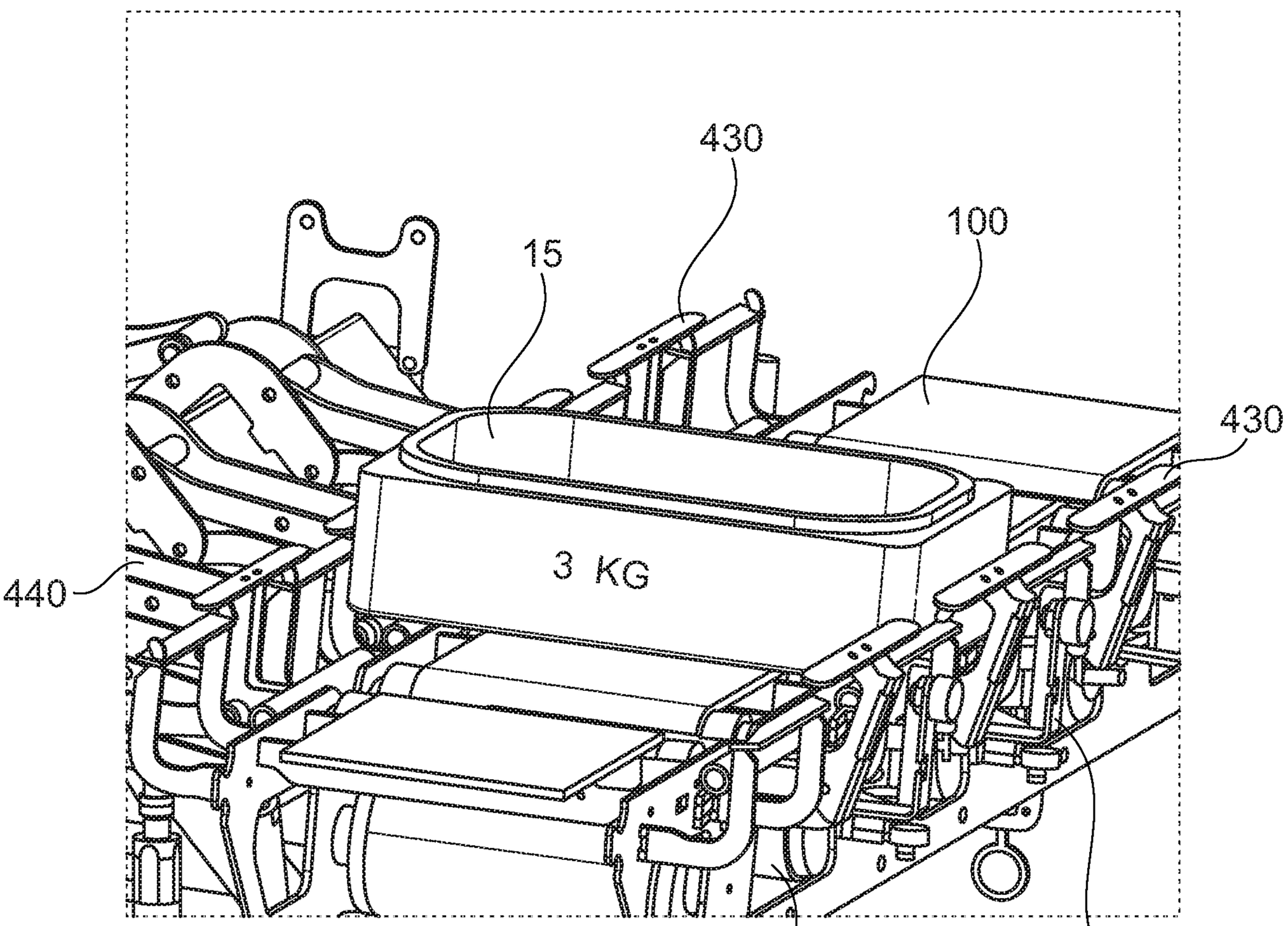


Fig. 4A

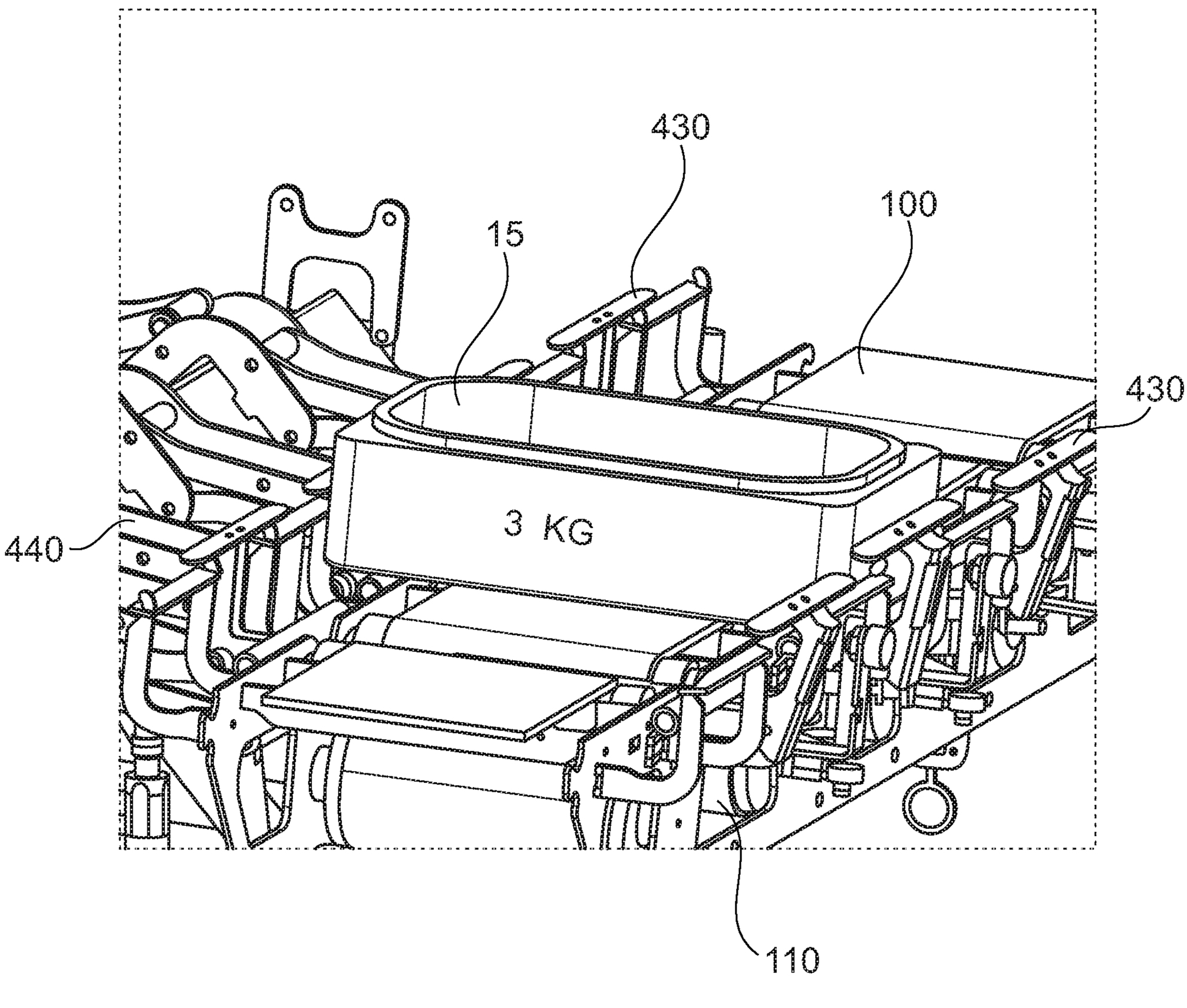


Fig. 4B

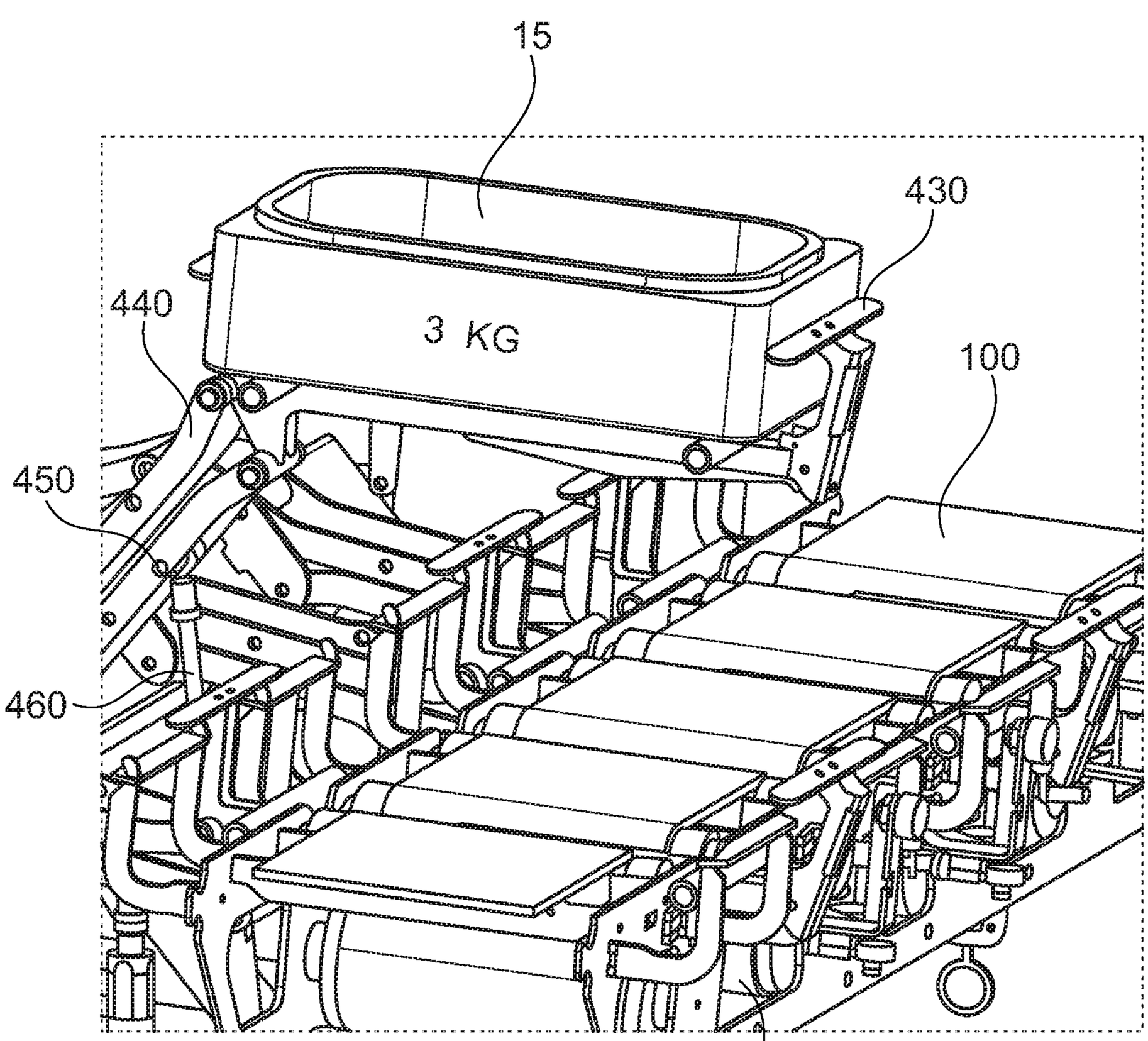


Fig. 4C

DANISH PATENT AND TRADEMARK OFFICE

SEARCH REPORT - PATENT	Application No. PA 2019 70674

1. ☒ Certain claims were found unsearchable (See Box No. I).

2. ☐ Unity of invention is lacking prior to search (See Box No. II).

A. CLASSIFICATION OF SUBJECT MATTER

B65G 47/90 (2006.01)

According to International Patent Classification (IPC)

B. FIELDS SEARCHED

PCT-minimum documentation searched (classification system followed by classification symbols)

CPC: B65G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

DK, NO, SE, FI: IPC-classes B65G 47/90 and B65G 47/91.

Electronic database consulted during the search (name of database and, where practicable, search terms used)

EPODOC, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant for claim No.
X A	EP 0774303 A2 (LICENTIA GMBH) 21 May 1997 See the whole document	1, 3-5, 9-10 and 13-18 2, 6-8 and 19-38
X A	WO 0112348 A1 (ATECS MANNESMANN AG) 22 October 2001 See the abstract and the figures	1-2 3-10 and 13-38
A	EP 3053860 A1 (CT PACK SRL) 10 August 2016 See the abstract and figure 1	1-10 and 13-38
A	CN 108750687 A (JIANG, M) 6 November 2018 See the abstract and figures 1-2	1-10 and 13-38
A	CN 108455272 A (HANGZHOU YOUNGSUN INTELLIGENT EQUIPMENT CO LTD) 28 August 2018 See the abstract and figure 1	1-10 and 13-38

☒ Further documents are listed in the continuation of Box C.

* Special categories of cited documents:	"P" Document published prior to the filing date but later than the priority date claimed.
"A" Document defining the general state of the art which is not considered to be of particular relevance.	"T" Document not in conflict with the application but cited to understand the principle or theory underlying the invention.
"D" Document cited in the application.	"X" Document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone.
"E" Earlier application or patent but published on or after the filing date.	"Y" Document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"L" Document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified).	"&" Document member of the same patent family.
"O" Document referring to an oral disclosure, use, exhibition or other means.	

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28 February 2020

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SEARCH REPORT - PATENT		Application No. PA 2019 70674
C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant for claim No.
A	EP 2457851 A1 (BEEWEN GMBH & CO KG) 30 May 2012 See the abstract and figure 1	1-10 and 13-38

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Box No. I Observations where certain claims were found unsearchable

This search report has not been established in respect of certain claims for the following reasons:

1. ☐ Claims Nos.:
because they relate to subject matter not required to be searched, namely:

2. ☒ Claims Nos.: 11-12
because they relate to parts of the patent application that do not comply with the prescribed requirements to such an extent that no meaningful search can be carried out, specifically:

Dependent claims 11-12 are unclear, since they seek to define the invention to which protection is sought by reference to a non-standardized object (modular containers) not being part of the invention, see the article "Definition af en enhed vha. en anden enhed" in our Guidelines for patents. Consequently, a novelty search could not be performed for these claims.

3. ☐ Claims Nos.:
because of other matters.

Box No. II Observations where unity of invention is lacking prior to the search

The Danish Patent and Trademark Office found multiple inventions in this patent application, as follows:

SEARCH REPORT - PATENT	Application No. PA 2019 70674
SUPPLEMENTAL BOX	

Continuation of Box [.]