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(54) **Packaging and weighing system**

(57) A packaging machine (1) discharges a plurality of packaged units of products (100) arranged in a plurality of rows in parallel in an X axial direction. The plurality of rows of products (100) discharged in parallel from the packaging machine (1) come to rest upon a rest (2). A weighing machine (3) has a rest surface (3a) disposed in line with the rest (2) in a Y axial direction, and weighs

each of the plurality of units of products (100) resting upon the rest surface (3a). A conveyor (4) conveys the products (100) resting thereupon in the X axial direction. A robot conveys the plurality of rows of products (100) resting on the rest (2) in rows in sequence to the rest surface (3a) of the weighing machine (3), and conveys the row of products (100) weighed by the weighing machine (3) from the rest surface (3a) to the conveyor (4).

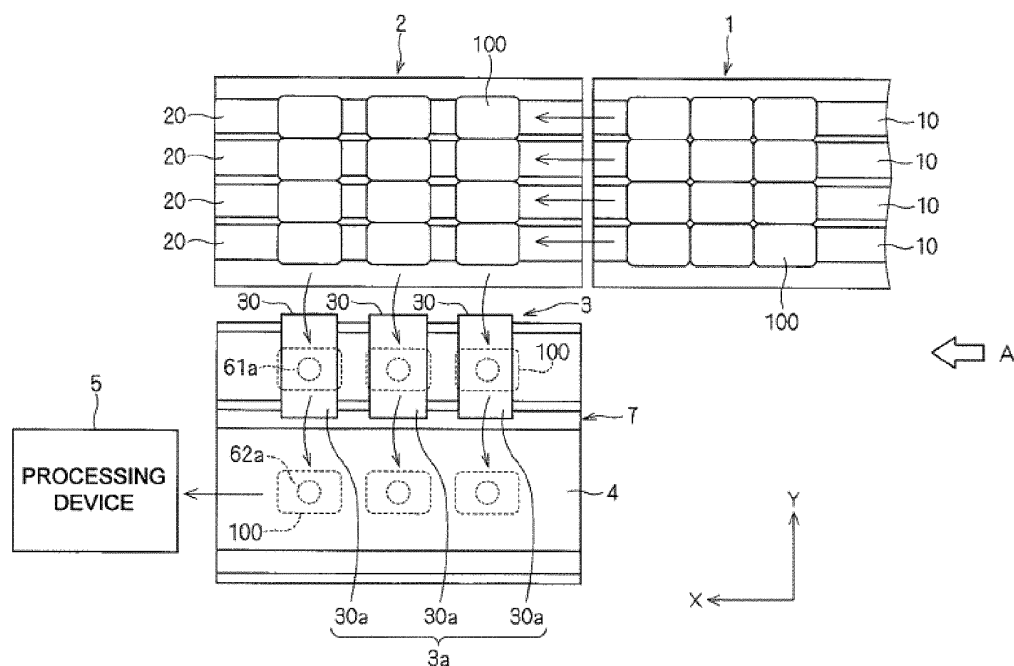


FIG. 1

Description

TECHNICAL FIELD

[0001] The present invention relates to a packaging and weighing system that packages objects and weighs the packaged objects.

BACKGROUND ART

[0002] A variety of techniques have been proposed for packaging and weighing systems in the past. For example, in the packaging and weighing system taught in JP2008-536768A (Translation of PCT Application), a plurality of packaged objects in a state of being arranged in a plurality of rows are discharged in parallel from a packaging machine. The objects that have been discharged in parallel rows from the packaging machine are weighed in a weighing machine and then serially conveyed in a conveyor of a downstream section.

SUMMARY OF THE INVENTION

[0003] In a packaging and weighing system wherein a plurality of objects discharged in parallel from a packaging machine are conveyed in a single row by a downstream conveyor, the length of the packaging and weighing system tends to increase because there is a need to rearrange the objects from being in a parallel arrangement to being in a serial arrangement as the objects are sent through a packaging machine, weighing machine, and conveyor in order. Thus, the latitude with which the packaging and weighing system can be arranged is extremely restricted.

[0004] The present invention was contrived in light of the above circumstances, it being an objective thereof to provide a technique enabling a plurality of objects discharged in parallel from a packaging machine to be conveyed serially by a subsequent conveyor while preventing the packaging and weighing system from being of excessive length.

<Solution to Problem>

[0005] In order to resolve the above problem, a preferred embodiment of the present invention is a packaging and weighing system including a packaging machine for packaging an object, and discharging a plurality of packaged objects arranged in a plurality of rows in parallel in a first direction; a rest upon which the plurality of rows of objects discharged in parallel from the packaging machine are placed; a weighing machine having a rest surface arranged in line with the rest in a second direction perpendicular to the first direction, the weighing machine individually weighing each of the plurality of objects resting on the rest surface; a conveyor for conveying the resting objects in the first direction; and a transporter for transporting the plurality of rows of objects resting on

the rest one row at a time in sequence to the rest surface, and transporting the rows of objects weighed on the weighing machine from the rest surface to the conveyor.

[0006] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the rest functions as a separator for separating two adjacent objects touching each other in the first direction within the plurality of rows of objects discharged in parallel from the packaging machine.

[0007] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the rest, rest surface, and conveyor are disposed in the stated order in the second direction.

[0008] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the transporter comprises a first gripper for gripping the objects on the rest in rows and a second gripper for gripping the objects in rows on the rest surface of the weighing machine; and the transporter repeatedly performs the processes of: (a) gripping objects on the rest using the first gripper; (b) gripping objects on the weighing machine using the second gripper while objects are gripped by the first gripper; and (c) conveying the objects being gripped by the first and second grippers to the weighing machine and the conveyor, respectively.

[0009] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the transporter comprises a first gripper for gripping the objects on the rest in rows and a second gripper for gripping the objects in rows on the rest surface of the weighing machine; the first and second grippers are aligned in the second direction so that the distance there between is equal to the distance between the rest surface and the conveyor; and the transporter repeatedly performs the processes of: (a) gripping objects on the rest using the first gripper; (b) gripping objects on the rest surface using the second gripper, the first gripper being in a state of gripping objects; and (c) conveying the objects being gripped by the first and second grippers to the rest surface and the conveyor, respectively.

[0010] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the weighing machine comprises a number N (≥ 3) of weighing sections having the rest surface, and calculates the weight of objects using the total of the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections.

[0011] Another preferred embodiment of the present invention is a packaging and weighing system; wherein the weighing machine comprises a number N (≥ 3) of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects using the total of the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections; the first gripper comprises a plurality of suction parts for applying suction to the objects on the rest, the suction parts being arranged in a row in the first direction; and when the first gripper is positioned directly over the

number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

[0012] Another preferred embodiment of the present invention is a packaging and weighing system; wherein the weighing machine comprises a number N (≥ 3) of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects using the total of the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections; the second gripper comprises a plurality of suction parts for applying suction to the objects on the rest surfaces of the weighing machine, the suction parts being arranged in a row in the first direction; and when the second gripper is positioned directly over the number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

[0013] Another preferred embodiment of the present invention is a packaging and weighing system, wherein the transporter has a gripper for gripping the objects on the rest in rows and a pusher for pushing the rows of objects upon the rest surfaces of the weighing machine onto the conveyor; and the transporter repeatedly performs the processes of: (a) gripping objects on the rest using the gripper, and (b) conveying objects being gripped by the gripper onto the rest surfaces while pushing the objects on the rest surfaces onto the conveyor using the pusher.

[0014] Another preferred embodiment of the present invention is a packaging and weighing system; wherein the weighing machine comprises a number N (≥ 3) of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects using the total of the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections; the gripper comprises a plurality of suction parts for applying suction to the objects on the rest, the suction parts being arranged in a row in the first direction; and when the gripper is positioned directly over the number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

<Advantageous effects of the preferred embodiment of the invention>

[0015] In the preferred embodiments of the present invention, because the rest surfaces of the weighing machine are arranged in a row along a second direction perpendicular to the first direction, which is the direction in which objects are discharged from the packaging machine, with respect to the rest upon which the objects discharged from the packaging machine rest; the plurality of rows of objects resting on the rest are transported in order by rows to the rest surface of the weighing machine; and the objects in rows are transported to the conveyor, which conveys the objects in the first direction, after being

weighed on the weighing machine; it is possible to convey a plurality of objects discharged in parallel from the packaging machine in sequential order on the conveyor while keeping down the length of the packaging and weighing system according to the present invention in the first direction.

[0016] In the preferred embodiments of the present invention, it is possible to weigh objects upon the weighing machine with high precision because two objects adjacent in the first direction are separated before being weighed upon the weighing machine.

[0017] In the preferred embodiments of the present invention, because the rest, rest surfaces of the weighing machine, and conveyor are disposed in the stated order in the second direction, it is possible to convey a plurality of objects discharged in parallel from the packaging machine in a serial manner on the conveyor while further keeping down the length of the packaging and weighing system according to the present invention in the first direction.

[0018] In the preferred embodiments of the present invention, processing efficiency is increased because it is possible to transport objects from the rest to the rest surfaces of the weighing machine and from the rest surfaces of the weighing machine to the conveyor simultaneously.

[0019] In the preferred embodiments of the present invention, processing efficiency is increased because it is possible to transport objects from the rest to the rest surfaces of the weighing machine and from the rest surfaces of the weighing machine to the conveyor in parallel. Moreover, because the first and second grippers are aligned in the second direction so that the distance therebetween is equal to the distance between the rest surfaces of the weighing machine and the conveyor, it is possible to simultaneously convey objects being gripped by the first and second grippers to the rest surfaces of the weighing machine and to the conveyor, respectively, by means of a simple position control of the first and second grippers.

[0020] In the preferred embodiments of the present invention, because the weighing machine calculates the weight of the objects by totaling the partial weights of the objects to be weighed resting on the plurality of weighing sections, the weighing machine can weigh objects resting upon the rest surface without the need to alter its physical configuration even when the arrangement or size of the objects being discharged from the packaging machine varies.

[0021] In the preferred embodiments of the present invention, because the weighing machine determines the weight of the objects by totaling the partial weights of the objects to be weighed resting on the plurality of weighing sections, the weighing machine can weigh objects resting upon the rest surface without the need to alter its physical configuration even when the arrangement or size of the objects being discharged from the packaging machine varies. Moreover, because suction parts are positioned directly over every gap formed between two adjacent weighing sections of the weighing machine when the first

gripper is located directly above the rest surfaces of the weighing machine, it is possible to grip the objects upon the rest with the first gripper without changing the configuration of the first gripper even when the arrangement or size of the objects being discharged from the packaging machine varies.

[0022] In the preferred embodiments of the present invention, because the weighing machine determines the weight of the objects by totaling the partial weights of the objects to be weighed resting on the plurality of weighing sections, the weighing machine can weigh objects resting upon the rest surface without the need to alter its physical configuration even when the arrangement or size of the objects being discharged from the packaging machine varies. Moreover, because suction parts are positioned directly over every gap formed between two adjacent weighing sections of the weighing machine when the second gripper is located directly over the rest surfaces of the weighing machine, it is possible to grip the objects upon the rest surfaces of the weighing machine with the second gripper without changing the configuration of the second gripper even when the arrangement or size of the objects being discharged from the packaging machine varies.

[0023] In the preferred embodiments of the present invention, processing efficiency is increased because it is possible to transport objects from the rest to the rest surfaces of the weighing machine and from the rest surfaces of the weighing machine to the conveyor simultaneously.

[0024] In the preferred embodiments of the present invention, because the weighing machine determines the weight of the objects by totaling the partial weights of the objects to be weighed resting on the plurality of weighing sections, the weighing machine can weigh objects resting upon the rest surface without the physical configuration needing to be altered even when the arrangement or size of the objects being discharged from the packaging machine varies. Moreover, because suction parts are positioned directly over every gap formed between two adjacent weighing sections of the weighing machine when the gripper is located directly over the rest surfaces of the weighing machine, it is possible to grip the objects upon the rest with the gripper without changing the configuration of the gripper even when the arrangement or size of the objects being discharged from the packaging machine varies.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is an overhead view of the configuration of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 2 is a side view of the configuration of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 3 is an illustration of the operation of a packaging

and weighing system according to a first embodiment of the present invention;

FIG. 4 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 5 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 6 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 7 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 8 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 9 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 10 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 11 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 12 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 13 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 14 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 15 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 16 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 17 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 18 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 19 is an illustration of the operation of a packaging and weighing system according to a first embodiment of the present invention;

FIG. 20 is a top view of the configuration of a packaging and weighing system for comparison with the packaging and weighing system according to the first embodiment of the present invention;

FIG. 21 is a top view of the configuration of a packaging and weighing system according to a second embodiment of the present invention;

FIG. 22 is a side view of the relative positions of a

plurality of suction parts and a plurality of weighing sections in a second embodiment of the present invention;

FIG. 23 is an illustration of a modification in the arrangement of products in a product unit group.

FIG. 24 is an illustration of a modification in the arrangement and size of products in a product unit group;

FIG. 25 is an illustration of a modification in the arrangement and size of products in a product unit group;

FIG. 26 is a side view of the configuration of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 27 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 28 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 29 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 30 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 31 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 32 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 33 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 34 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

FIG. 35 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention; and

FIG. 36 is an illustration of the operation of a packaging and weighing system according to a third embodiment of the present invention;

DESCRIPTION OF EMBODIMENTS

Embodiment 1

[0026] FIG 1 is an overhead view of the configuration of a packaging and weighing system according to a first embodiment of the present invention. FIG 2 is a side view of the packaging and weighing system according to the first embodiment of the present invention as seen from arrow A in FIG 1. For purposes of explanatory convenience, a transport robot 6 illustrated in FIG 2 is omitted from FIG 1, and a packaging machine 1 illustrated in FIG 1 is omitted from FIG 2. The axes X and Y shown in FIGS.

1 and 2 indicate horizontal directions.

[0027] As shown in FIGS. 1 and 2, the packaging and weighing system according to the first embodiment has a packaging machine 1, a rest 2, a weighing machine 3, a conveyor 4, a processing device 5, a transport robot 6, and a frame 7.

[0028] The packaging machine 1 is, for example, a deep drawing packaging machine that casts a plurality of trays at a time using a deep drawing die and charges a product 100 into the each of cast trays. The packaging machine 1 then seals the trays charged with the product 100 using a film or the like. In this way, a packaged product 100 is produced.

[0029] In the packaging machine 1 according to the first embodiment, it is possible to simultaneously produce a plurality of trays arranged in a row using a deep drawing die. Specifically, it is possible to simultaneously produce a total of twelve trays arranged in three rows in the X axial direction and four rows in the Y axial direction. A total of twelve packages of products 100 arranged in three rows in the X axial direction and four rows in the Y axial direction is considered one unit within the packaging machine 1, which discharges a plurality of packaged units of products 100 per unit. As a result, as shown in FIG. 1, a plurality of packaged units of products 100 arranged in a plurality of rows (four rows in the case of the first embodiment) are discharged in parallel in the X axial direction from the packaging machine 1. The plurality of rows of products 100 discharged in parallel from the packaging machine 1 come to rest upon the rest 2.

[0030] The packaging machine 1 is also provided with four conveyor belts 10 arranged in a row in the Y axial direction that convey the packaged products 100 in the X axial direction to the rest 2. The four rows of packaged products 100 extending in the X axial direction are each conveyed to the rest 2 by the four conveyor belts 10. Hereafter, unless otherwise noted, "products 100" will be understood to refer to "packaged products 100." The twelve products 100 arranged in three rows in the X axial direction and four rows in the Y axial direction, which constitute one unit of products 100 discharged by the packaging machine 1, will be referred to as a "product unit group" below.

[0031] The rest 2 is disposed in line with the packaging machine 1 in the X axial direction. The rest 2 is provided with four conveyor belts 20 arranged in a row in the Y axial direction that convey the products 100 resting thereupon in the X axial direction. The four rows of products 100 discharged in parallel from the packaging machine 1 each come to rest upon the four conveyor belts 20.

[0032] The twelve products 100 that constitute the product unit group produced by the packaging machine 1 are conveyed to the rest 2 contacting each other in the X axial direction and the Y axial direction.

[0033] The conveyance speed of the products 100 on the conveyor belts 20 of the rest 2 is set higher than the conveyance speed of the products 100 on the conveyor belts 10 of the packaging machine 1.

[0034] Because the conveyance speed of the conveyor belts 20 is thus set faster than the conveyance speed of the conveyor belts 10 in the first embodiment, when four products 100 forming a row in the Y axial direction discharged first simultaneously from the packaging machine 1 come to rest upon the four conveyor belts 20, they are carried away without coming into contact with four products 100 forming a row in the Y axial direction being discharged next from the packaging machine 1 at the same time thanks to the difference in conveyance speeds. The rest 2 functions as a separator that separates two products 100 adjacent in the X axial direction within the four rows of products 100 discharged in parallel from the packaging machine 1. When all of the twelve products 100 that constitute one product unit group come to rest on the rest 2, the four conveyor belts 20 of the rest 2 stop conveying the products 100. Each conveyor belt 20 is controlled by a controller not shown in the drawings.

[0035] The weighing machine 3 has three weighing sections 30 corresponding to the number of products 100 forming each row in the X axial direction in a product unit group (i.e., three). Each weighing section 30 has a rest surface 30a upon which the products 100 rests, and calculates the weight of the products 100 resting upon the rest surface 30a. In other words, the weighing machine 3 is capable of individually weighing the three products 100 on each of the three rest surfaces 30a making up a rest surface 3a.

[0036] Each weighing section 30 is disposed in line with the rest 2 in the Y axial direction. In other words, the rest surface 3a of the weighing machine 3 is disposed in line with the rest 2 in the Y axial direction. The three weighing sections 30 are arranged in a row in the X axial direction. The distance between the weighing sections 30 is the same as the distance between the rows of products 100 in the X axial direction of the product unit group on the rest 2. The products 100 on the rest 2 is placed upon each weighing section 30 by the transport robot 6.

[0037] In the product unit group, there are formed four rows of three products 100 lined up in the X axial direction; of these, the row closest to the weighing section 30 will be referred to as the first row, and the other rows as the second row, third row, and fourth row in order of increasing distance from the weighing section 30.

[0038] The conveyor 4 conveys the products 100 resting thereupon in the X axial direction to the subsequent processing device 5. The conveyor 4 is disposed in line with the rest surface 3a of the weighing machine 3 in the Y axial direction on the side thereof opposite to the rest 2. In other words, the rest 2, rest surface 3a of the weighing machine 3, and conveyor 4 are lined up in the stated order in the Y axial direction. The product 100 on the rest surface 3a of the weighing machine 3 is transported to the conveyor 4 by the transport robot 6 after being weighed. The conveyor 4 and plurality of weighing sections 30 are supported by the frame 7.

[0039] The processing device 5 is, for example, a labeling machine, and is disposed in line with the conveyor

4 in the X axial direction. The processing device 5 attaches a label printing product information such as product name and price to the products 100 being conveyed by the conveyor 4. The processing device 5 calculates the price of the products 100 based on the weighing results obtained by the weighing machine 3.

[0040] The processing device 5 may also be another processing device that performs a specific process upon the products 100. For instance, if the weighing machine 3 is a weight detecting device that determines whether the products 100 is satisfactory or not based upon the results of weighing the products 100, the processing device 5 can be a separating device that separates satisfactory products 100 from unsatisfactory products 100 based upon the weighing results obtained by the weighing machine 3.

[0041] The transport robot 6 has a first gripper 61 that grips the products 100 and a second gripper 62 that also grips the products 100, and uses the first gripper 61 and second gripper 62 to transport products 100 on the rest 2 to the rest surface 3a of the weighing machine 3, and products 100 on the rest surface 3a to the conveyor 4.

[0042] The first gripper 61 has three suction parts 61a forming a row along the X axial direction, and attachment members 61b to which the three suction parts 61a are attached. The first gripper 61 grips one product 100 with suction using one suction part 61a. The distance amongst the plurality of suction parts 61a is the same as that amongst the plurality of weighing sections 30. Likewise, the second gripper 62 has three suction parts 62a forming a row along the X axial direction, and attachment members 62b to which the three suction parts 62a are attached. The second gripper 62 holds one product 100 in place with suction using one suction part 62a. Each of the suction parts 61a and 62a applies suction to the products 100 by means of, for instance, a vacuum suction method.

[0043] The attachment members 61b of the first gripper 61 and the attachment members 62b of the second gripper 62 are linked by a linking part 60. Thus, the first gripper 61 and the second gripper 62 move as one. One end each of two arms 63 and 64 are connected to the linking part 60, and the another end of each of the arms 63 and 64 are connected to a driver not shown in the drawings. Because of the action of the driver, the first gripper 61 and second gripper 62 of the transport robot 6 are capable of moving as one in the Y axial direction, and of moving as one in a direction perpendicular to the X axial direction and the Y axial direction, i.e., the vertical direction.

[0044] As shown in FIG 2, the distance D1 between the weighing sections 30 (rest surfaces 30a) and the conveyor 4 is identical to the distance D2 between the first gripper 61 and the second gripper 62. Because of this, when the first gripper 61 is positioned directly over the weighing sections 30 (rest surfaces 30a), the second gripper 62 is positioned directly over the conveyor 4. The distance D1 between the weighing sections 30 and the

conveyor 4 is also identical to the distance D3 between the first row of products 100 in the product unit group on the rest 2 and the weighing sections 30. Because of this, when the first gripper 61 is positioned directly over the first row of products 100 of the product unit group on the rest 2, the second gripper 62 is positioned directly over the weighing sections 30.

[0045] The first gripper 61 of the transport robot 6 according to the first embodiment grips and transports the products 100 from the first row of products 100 in order through the fourth row of the product unit group on the rest 2 one row at a time, i.e., three products at a time, to the rest surface 3a of the weighing machine 3. The second gripper 62 then grips and transports the row (three products) of products 100 on the rest surface 3a to the conveyor 4. As described above, the distance of the weighing sections 30 is identical to the distance between the products 100 forming a row in the X axial direction in the product unit group on the rest 2, and the distance of the suction parts 61a is identical to the distance of the weighing sections 30. Thus, the first gripper 61 is capable both of simultaneously gripping three products 100 lined up in the X axial direction on the rest 2 using the three suction parts 61a and of simultaneously placing three products 100 being gripped onto the three weighing sections 30, respectively. Because the distance of the suction parts 62a is identical to the distance of the weighing sections 30, the second gripper 62 is capable of simultaneously gripping three products 100 on the three weighing sections 30 using the three suction parts 62a, and simultaneously placing the three products 100 being gripped upon the conveyor 4.

[0046] In this way, the product unit group on the rest 2 is conveyed one row at a time by the first gripper 61 to the rest surface 3a of the weighing machine 3, and the second gripper 62 conveys the rows of products 100 being conveyed in sequence to the rest surface 3a by the first gripper 61 from the rest surface 3a to the conveyor 4, so that the plurality of products 100 discharged in parallel from the packaging machine 1 are conveyed serially on the subsequent conveyor 4. Thus, it is possible for the processing device 5 following the conveyor 4 to process the products 100 one by one.

[0047] Next, a series of operations of the packaging and weighing system according to the first embodiment wherein the products 100 discharged from the packaging machine 1 is conveyed past the rest 2, weighing machine 3, and conveyor 4 to the processing device 5 will be described. FIGS. 3 through 19 illustrate these operations in sequence. In each of FIGS. 3 through 19, the lower half of the drawing depicts a side view of the packaging and weighing system according to the present embodiment, and the upper half depicts a top view of the packaging and weighing system according to the present embodiment.

[0048] As shown in FIG 3, when the product unit group is placed upon the rest 2, the transport robot 6 moves the first gripper 61 and second gripper 62 along the Y

axial direction so that the first gripper 61 is positioned directly above the first row of products 100 of the product unit group, lowers the first gripper 61 and second gripper 62, and simultaneously grips the first row of three products 100 using the three suction parts 61a of the first gripper 61.

[0049] Next, as shown in FIG. 4, the transport robot 6 raises the first gripper 61 and second gripper 62 with the first gripper 61 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the weighing section 30. Then, as shown in FIG. 5, the transport robot 6 lowers the first gripper 61 and second gripper 62 and places each of the three products 100 being gripped by the first gripper 61 onto the three weighing sections 30. Thus, the plurality of products 100 in the first row of the product unit group on the rest 2 are placed simultaneously on the rest surface 3a of the weighing machine 3. When the products 100 has been placed thereupon, each weighing section 30 begins calculating the weight of the products 100.

[0050] Next, as shown in FIG. 6, the transport robot 6 raises the first gripper 61 and second gripper 62 with no product 100 being gripped by both of the first gripper 61 and the second gripper 62, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the second row of products 100 on the rest 2. Then, as shown in FIG. 7, the transport robot 6 lowers the first gripper 61 and second gripper 62, and simultaneously grips the second row of three products 100 using the three suction parts 61a of the first gripper 61.

[0051] Next, as shown in FIG. 8, the transport robot 6 raises the first gripper 61 and second gripper 62 with the first gripper 61 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the second gripper 62 is positioned directly over the weighing sections 30. Then, as shown in FIG 9, the transport robot 6 lowers the first gripper 61 and second gripper 62 and grips the first row of three products 100 on the three weighing sections 30 with the three suction parts 62a of the second gripper 62, respectively. At this point, because the weighing of the products 100 on the weighing sections 30 has been completed, there is no problem presented by the second gripper 62 gripping the products 100 on the weighing sections 30.

[0052] Next, as shown in FIG. 10, the transport robot 6 raises the first gripper 61 and second gripper 62 with both the first gripper 61 and second gripper 62 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the weighing sections 30. At this point, because the distance D2 between the first gripper 61 and the second gripper 62 is identical with the distance D1 between the weighing sections 30 and the conveyor 4, when the first gripper 61 is positioned directly over the weighing sections 30, the second gripper 62 is positioned directly over the conveyor 4. Then, as

shown in FIG 11, the transport robot 6 lowers the first gripper 61 and second gripper 62, places each of the three products 100 being gripped by the first gripper 61 onto the three weighing sections 30, and places the three products 100 being gripped by the second gripper 62 onto the conveyor 4. In this way, the second row of three products 100 on the rest 2 is placed upon the rest surface 3 a of the weighing machine 3, and the first row of three products 100 on the rest surface 3a is placed onto the conveyor 4. When the three products 100 are placed thereupon, the conveyor 4 conveys the three products 100 in a serial manner in the X axial direction.

[0053] Next, as shown in FIG. 12, the transport robot 6 raises the first gripper 61 and second gripper 62 gripping no product 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the third row of products 100 on the rest 2. The transport robot 6 then lowers the first gripper 61 and second gripper 62, and simultaneously grips the third row of three products 100 using the three suction parts 61a of the first gripper 61.

[0054] Next, as shown in FIG. 13, the transport robot 6 raises the first gripper 61 and second gripper 62 with the first gripper 61 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the second gripper 62 is positioned directly over the weighing sections 30. The transport robot 6 then lowers the first gripper 61 and second gripper 62 and grips the three products 100 on the three weighing sections 30 using the three suction parts 62a of the second gripper 62, respectively. At this point, the weighing of the products 100 on each of the weighing sections 30 has been completed.

[0055] Next, as shown in FIG. 14, the transport robot 6 raises the first gripper 61 and second gripper 62 with both the first gripper 61 and second gripper 62 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the weighing sections 30 and the second gripper 62 is positioned directly over the conveyor 4. The transport robot 6 then lowers the first gripper 61 and second gripper 62, places each of the three products 100 being gripped by the first gripper 61 onto the three weighing sections 30, and places the three products 100 being gripped by the second gripper 62 onto the conveyor 4. In this way, the third row of three products 100 on the rest 2 is placed upon the rest surface 3 a of the weighing machine 3, and the second row of three products 100 on the rest surface 3a is placed onto the conveyor 4. At this point, because the first row of three products 100 that had been placed upon the conveyor 4 have all been conveyed to a conveyor belt 50 of the subsequent processing device 5, the second row of three products 100 can be placed upon the conveyor 4 without issue.

[0056] Next, as shown in FIG. 15, the transport robot 6 raises the first gripper 61 and second gripper 62 gripping no product 100, and moves the first gripper 61 and

second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the fourth row of products 100 on the rest 2. The transport robot 6 then lowers the first gripper 61 and second gripper 62, and simultaneously grips the fourth row of three products 100 using the three suction parts 61a of the first gripper 61.

[0057] Next, as shown in FIG. 16, the transport robot 6 raises the first gripper 61 and second gripper 62 with the first gripper 61 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the second gripper 62 is positioned directly over the weighing sections 30. The transport robot 6 then lowers the first gripper 61 and second gripper 62 and grips the third row of three products 100 on the three weighing sections 30 with the three suction parts 62a of the second gripper 62. At this point, the weighing of the products 100 on the weighing sections 30 has been completed.

[0058] Next, as shown in FIG. 17, the transport robot 6 raises the first gripper 61 and second gripper 62 with both the first gripper 61 and second gripper 62 gripping the products 100, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the weighing sections 30 and the second gripper 62 is positioned directly over the conveyor 4. At this point, the next product unit group is discharged from the packaging machine 1 onto the rest 2. Then, as shown in FIG 18, the transport robot 6 lowers the first gripper 61 and second gripper 62, places each of the three products 100 being gripped by the first gripper 61 onto the three weighing sections 30, and places the three products 100 being gripped by the second gripper 62 onto the conveyor 4. In this way, the fourth row of three products 100 on the rest 2 is placed upon the rest surface 3a of the weighing machine 3, and the third row of three products 100 on the rest surface 3a is placed onto the conveyor 4. At this point, the second row of three products 100 that had been placed upon the conveyor 4 have all been conveyed to a conveyor belt 50 of the subsequent processing device 5.

[0059] Next, as shown in FIG. 19, the transport robot 6 raises the first gripper 61 and second gripper 62 with no product 100 being gripped, and moves the first gripper 61 and second gripper 62 along the Y axial direction so that the first gripper 61 is positioned directly over the first row of products 100 of the new product unit group on the rest 2. The transport robot 6 then lowers the first gripper 61 and second gripper 62, and simultaneously grips the first row of three products 100 of the new product unit group using the three suction parts 61a of the first gripper 61. Because the distance D1 of the first gripper 61 and the second gripper 62 is identical to the distance D3 of the first row of products 100 of the product unit group on the rest 2 and the weighing sections 30, the transport robot 6 is capable of simultaneously gripping the first row of three products 100 of the new product unit group using the first gripper 61 and gripping the three products 100 on the three weighing sections 30 using the second gripper

per 62. Subsequently, in the packaging and weighing system according to the first embodiment, a similar process is performed, and the weighed plurality of products 100 is discharged in a serial manner from the conveyor 4 to the subsequent processing device 5.

[0060] As described above, the rest surface 3a of the weighing machine 3 in the packaging and weighing system according to the first embodiment is disposed in line in the Y axial direction with respect to the rest 2 upon which the product 100 discharged from the packaging machine 1 in the X axial direction rests, as illustrated in FIG. 1. The plurality of rows of products 100 on the rest 2 are then conveyed row by row in sequence to the rest surface 3a of the weighing machine 3 by the transport robot 6, and the rows of products 100 weighed by the weighing machine 3 are conveyed to the conveyor 4. Thus, it is possible to convey the plurality of products 100 discharged in parallel from the packaging machine 1 in a serial manner on the conveyor 4 while keeping down the length of the packaging and weighing system in the X axial direction.

[0061] In contrast hereto, when a plurality of rows of products 100 (product unit group) discharged in parallel from the packaging machine 1 to the rest 2 are conveyed serially on a subsequent conveyor 52 in a configuration such as that illustrated in FIG 20, the length of the packaging and weighing system in the X axial direction inevitably lengthens, creating limitations upon the degree of freedom in the layout of the packaging and weighing system. In the packaging and weighing system shown in FIG. 20, the product unit group on the rest 2 is conveyed in order by rows to a converger 51 through the operation in sequence of a plurality of conveyor belts 20 on the rest 2. In the example shown in FIG 20, three products 100 are conveyed one row at a time to the converger 51, starting with the fourth row and followed by the third row, second row, and first row in order. The converger 51 conveys the plurality of products 100 conveyed from the rest 2 in the X axial direction to the subsequent conveyor 52. The plurality of products 100 conveyed serially by the conveyor 52 are weighed in order by a subsequent weighing section not shown in the drawings.

[0062] As described above, because it is possible in the packaging and weighing system according to the first embodiment to convey the plurality of products 100 discharged in parallel from the packaging machine 1 in a serial manner on the conveyor 4 while keeping down the length of the packaging and weighing system in the X axial direction, the degree of freedom in the layout of the packaging and weighing system is improved.

[0063] In the first embodiment, two products 100 contiguous in the X axial direction within the product unit group discharged from the packaging machine 1 are separated before being weighed on the weighing machine 3 through the operation of the conveyor belts 20 of the rest 2. Because it is not possible to accurately weigh each product 100 when simultaneously weighing a plurality of products 100 if adjacent products 100 are in contact, sep-

arating two products 100 contiguous in the X axial direction prior to weighing, as is done in the first embodiment, enables each product 100 to be weighed to a high degree of precision.

[0064] Because the rest 2, rest surface 3a of the weighing machine 3, and conveyor 4 are disposed in the stated order with respect to the Y axial direction in the first embodiment, as shown in FIG. 1, it is possible to convey the plurality of products 100 discharged in parallel from the packaging machine 1 in a serial manner to the conveyor 4 while further keeping down the length of the packaging and weighing system in the X axial direction.

[0065] In the first embodiment, the transport robot 6, which functions as a transporter for transporting the products 100, grips the products 100 on the rest 2 using the first gripper 61, grips the products 100 on the rest surface 3a of the weighing machine 3 using the second gripper 62, and conveys the products 100 gripped by the first gripper 61 and second gripper 62 to the rest surface 3a and the conveyor 4, respectively. It is thus possible to move products 100 from the rest 2 to the rest surface 3a of the weighing machine 3 and from the rest surface 3a to the conveyor 4 in tandem. Processing efficiency is thus improved.

[0066] Because the first gripper 61 and the second gripper 62 are aligned in the Y axial direction so that the distance D2 therebetween is identical to the distance D1 between the rest surface 3a of the weighing machine 3 and the conveyor 4, it is possible to simultaneously convey the products 100 being gripped by the first gripper 61 and second gripper 62 to the rest surface 3a of the weighing machine 3 and the conveyor 4 by causing the first gripper 61 and second gripper 62 to move in unison as in the case of the first embodiment. It is thus possible to simultaneously convey the products 100 being gripped by the first gripper 61 and second gripper 62 to the rest surface 3a and the conveyor 4 by a simpler position control of the first gripper 61 and second gripper 62 as compared to when the positions of the first gripper 61 and second gripper 62 are controlled independently.

[0067] In the above example, four rows of products 100 were discharged in parallel from the packaging machine 1, but any number of rows of the products 100 is acceptable provided that at least two rows are discharged in parallel from the packaging machine 1. Any number of products 100 forming the rows of products 100 being discharged in parallel from the packaging machine 1 is acceptable provided that it is at least one. In other words, the number of constituent elements for each row of the "plurality of rows" referred to in the invention of the present application need only be at least one. For instance, the product unit group discharged from the packaging machine 1 in the X axial direction may be constituted of only one row of plurality of products 100 aligned in the Y axial direction.

Embodiment 2

[0068] In the case of the packaging and weighing system according to the first embodiment described above, because one product 100 is weighed by one weighing section 30, it is necessary to alter the number of weighing sections 30 provided on the weighing machine 3 when the number of products 100 in the X axial direction of the product unit group changes. Likewise, in the case of the packaging and weighing system according to the first embodiment, when there is a change in the distance between a plurality of products 100 forming a row in the X axial direction of the product unit group, a corresponding change in the distance of the plurality of weighing sections 30 aligned in the X axial direction of the weighing machine 3 must be made. Furthermore, in the case of the packaging and weighing system according to the first embodiment, when there is a change in the size of the product 100, a corresponding change in the size of the rest surfaces 30a of the weighing sections 30 must be made.

[0069] As can be seen, then, any changes in the arrangement of the products 100 in the product unit group and/or the size of the products 100 within the packaging and weighing system according to the first embodiment, i.e., any change in the deep drawing die used in the packaging machine 1 to form the trays, necessitates a corresponding change in the physical configuration of the weighing machine 3.

[0070] Thus, a second embodiment of the present invention provides a packaging and weighing system wherein it is possible to weigh the products 100 without making any change to the physical configuration of the weighing machine 3 even when changes are made to the arrangement of the products 100 in the product unit group and/or the size of the product 100.

[0071] FIG 21 is an overhead view of the configuration of a packaging and weighing system according to a second embodiment of the present invention. The packaging and weighing system according to the second embodiment will be described below, with focus laid upon points of difference with the packaging and weighing system according to the first embodiment.

[0072] As shown in FIG 21, the weighing machine 3 is provided with a number of weighing sections 30 that is greater than the number of products 100 in the X axial direction of the product unit group, and one product 100 is disposed so as to straddle a plurality of weighing sections 30. In the second embodiment, the weighing machine 3 is provided with, for example, nine weighing sections 30 forming a row in the X axial direction with a specific distance therebetween. The weighing machine 3 is provided with a controller (not shown in the drawings) made up of a central processing unit and the like that totals the partial weights of the products 100 obtained by the plurality of weighing sections 30 upon which the product 100 rests to obtain a total weight for the products 100. In the example of FIG 21, one product 100 is placed upon

the rest surfaces 30a of two weighing sections 30, and each of the two weighing sections 30 determines the weight of the part of the products 100 resting on that rest surface 30a. The controller of the weighing machine 3 totals the weights obtained by the two weighing sections 30 to find the weight of the products 100 resting upon the two weighing sections 30.

[0073] The first gripper 61 of the transport robot 6 according to the second embodiment is provided with a number of suction parts 61a that is greater than the number of products 100 forming a row in the X axial direction of the product unit group, and one product 100 is gripped by at least one suction part 61a. Likewise, the second gripper 62 is provided with a number of suction parts 62a that is greater than the number of products 100 forming a row in the X axial direction of the product unit group, and one product 100 is gripped by at least one suction part 62a. In the second embodiment, for example, the first gripper 61 is provided with eight suction parts 61a spaced at a specific interval in a row in the X axial direction, and the second gripper 62 is provided with eight suction parts 62a spaced at a specific interval in a row in the X axial direction. The distance amongst the plurality of suction parts 61a is identical to the distance amongst the plurality of suction parts 62a and the distance amongst the plurality of weighing sections 30.

[0074] FIG 22 is a side view of the relative positions of the plurality of suction parts 62a of the second gripper 62 and the plurality of weighing sections 30 when the second gripper 62 are positioned directly over the plurality of weighing sections 30. The relative positions of the plurality of suction parts 61a of the first gripper 61 and the plurality of weighing sections 30 when the first gripper 61 is positioned directly over the plurality of weighing sections 30 are also as shown in FIG 22.

[0075] As shown in FIG 22, the plurality of suction parts 62a are attached to the attachment members 62b so that the suction parts 62a are positioned directly over every gap 30b formed by two adjacent weighing sections 30 of the weighing machine 3 when the second gripper 62 is positioned directly over the plurality of weighing sections 30. Because the suction parts 62a are necessarily positioned directly over the gaps 30b between two adjacent weighing sections 30 in this way, it is possible to grip a product 100 resting upon at least two weighing sections 30 with at least one suction part 62a even when changes are made to the arrangement of the products 100 in the product unit group or to the size of the product 100.

[0076] When, for example, one product 100 rests upon two weighing sections 30 as shown in FIG. 21, it is possible to grip each of three products 100 resting on the plurality of weighing sections 30 with one suction part 62a.

[0077] Even when the number of products 100 in the X axial direction of the product unit group is changed from three to four as shown in FIG. 23, it is possible to grip each of the four products 100 on the plurality of weighing sections 30 with one suction part 62a.

[0078] Likewise, even when, as shown in FIG. 24, the number of products 100 in the X axial direction of the product unit group is changed from three to two, and one product 100 rests upon four weighing sections 30, it is possible to grip each of the two products 100 on the plu-

[0079] Likewise, even when, as shown in FIG. 25, the number of products 100 in the X axial direction of the product unit group is changed from three to one, and one product 100 rests upon seven weighing sections 30, it is possible to grip each one product 100 on the plurality of weighing sections 30 with six suction parts 62a.

[0080] In the second embodiment, the first gripper 61, like the second gripper 62, is configured so that the suction parts 61a are always positioned directly over the gaps 30b between two adjacent weighing sections 30 when the first gripper 61 is positioned directly over the plurality of weighing sections 30. In this way, it is possible to grip each product 100 with at least one suction part 61a when the first gripper 61 grips one row of the product unit group on the rest 2, even when changes are made to the arrangement of the products 100 in the product unit group and/or the size of the product 100.

[0081] If the weighing machine 3 is provided with at least three weighing sections 30, it is possible to use a plurality of types of deep drawing die without the need to modify the physical configuration of the weighing machine 3. When, for instance, the weighing machine 3 is provided with three weighing sections 30, a deep drawing die such that the product 100 is of a size such that one unit rests upon two weighing sections 30, as shown in FIGS. 21 and 23, can be used, and a deep drawing die such that the product 100 is of a size such that one unit rests upon three weighing sections 30 can be used.

[0082] Because the weighing machine 3 of the second embodiment calculates the weight of the product 100 by totaling the partial weights obtained by the plurality of weighing sections 30 upon which the product 100 rests as described above, it is possible to weigh the product 100 without the need to change the physical configuration of the weighing machine 3, even when changes are made to the arrangement of the products 100 in the product unit group discharged from the packaging machine 1 or to the size of the product 100.

[0083] Also, because the suction parts 62a are positioned directly over all the gaps 30b between two adjacent weighing sections 30 of the weighing machine 3 when the second gripper 62 is positioned directly over the plurality of weighing sections 30 in the second embodiment, it is possible to grip each product 100 on the rest surface 3a of the weighing machine 3 with the second gripper 62 without the need to change the configuration of the second gripper 62, even when changes are made to the arrangement of the products 100 in the product unit group or to the size of the product 100.

[0084] Also, because the suction parts 61a are positioned directly over all the gaps 30b between two adjacent weighing sections 30 of the weighing machine 3 when

the first gripper 61 is positioned directly over the plurality of weighing sections 30 in the second embodiment, it is possible to grip one row of the product unit group on the rest 2 with the first gripper 61 without the need to change the configuration of the first gripper 61, even when changes are made to the arrangement of the products 100 in the product unit group or to the size of the product 100.

[0085] When the deep drawing die of the packaging machine 1 is changed so that the arrangement of the products 100 in the product unit group and/or the size of the product 100 changes, a user inputs data identifying the weighing sections 30 upon which the product 100 rests when a plurality of products 100 forming a row in the X axial direction of the product unit group are placed upon the rest surface 3a of the weighing machine 3 into the controller of the weighing machine 3 mentioned above. Based on this data, the controller of the weighing machine 3 identifies the plurality of weighing sections 30 upon which the product 100 rests, and totals the partial weights obtained by the plurality of weighing sections 30 to calculate the total weight of the products 100.

Embodiment 3

[0086] FIG 26 is a side view of the configuration of a packaging and weighing system according to a third embodiment of the present invention. The first gripper 61 of the transport robot 6 of the packaging and weighing system according to the third embodiment conveys the products 100 on the rest 2 to the weighing sections 30, and a pusher 65 newly provided upon the transport robot 6 conveys the products 100 on the weighing sections 30 to the conveyor 4. The packaging and weighing system according to the third embodiment will be described below, with focus laid upon points of difference with the packaging and weighing system according to the first embodiment.

[0087] As shown in FIG. 26, the transport robot 6 of the third embodiment is provided with a pusher 65 instead of the second gripper 62 and arm 63. The pusher 65 is a plate-like member parallel to the vertical direction (direction perpendicular to the X axial direction and the Y axial direction) and extending in the X axial direction, and is linked to the attachment members 61b of the first gripper 61 by a linking part 60. One end of the arm 64 is connected to the linking part 60, and the other end of the arm 64 is connected to a driver not shown in the drawings. Because of the action of the driver, the first gripper 61 and the pusher 65 of the transport robot 6 are capable of moving as one in the Y axial direction, as well as moving as one in the vertical direction.

[0088] As in the case of the first embodiment, the first gripper 61 of the transport robot 6 according to the third embodiment grips and transports the products 100 from the first row of products 100 in order through the fourth row of the product unit group on the rest 2 one row at a time to the rest surface 3a of the weighing machine 3, and the pusher 65 pushes the row of products 100 on

the rest surface 3a to the conveyor 4. In this way, the plurality of products 100 discharged in parallel from the packaging machine 1 are conveyed serially to the subsequent conveyor 4. Thus, it is possible for the processing device 5 following the conveyor 4 to process the products 100 one unit at a time.

[0089] Next, a series of operations of the packaging and weighing system according to the third embodiment wherein the products 100 discharged from the packaging machine 1 is conveyed past the rest 2, weighing machine 3, and conveyor 4 to the processing device 5 will be described. FIGS. 27 through 36 illustrate these operations in sequence. In each of FIGS. 27 through 36, the lower half of the drawing depicts a side view of the packaging and weighing system, and the upper half depicts a top view of the packaging and weighing system.

[0090] As shown in FIG 27, when a product unit group is placed upon the rest 2, the transport robot 6 simultaneously grips the first row of three products 100 with the first gripper 61, and places each of the three products 100 upon the three weighing sections 30. When the product 100 has been placed thereupon, each weighing section 30 begins calculating the weight of the products 100.

[0091] Next, as shown in FIG. 28, the transport robot 6 moves the first gripper 61 gripping no product 100 and the pusher 65 towards the rest 2, and simultaneously grips the second row of three products 100 on the rest 2 using the first gripper 61.

[0092] Next, as shown in FIG 29, the transport robot 6 moves the first gripper 61 and the pusher 65, with the first gripper 61 gripping the second row of products 100, towards the weighing section 30, and places the second row of three products 100 being gripped by the first gripper 61 upon each of the three weighing sections 30, as shown in FIG 30. At this point, the transport robot 6 simultaneously pushes the first row of three products 100 on the three weighing sections 30 to the conveyor 4 with the pusher 65 while conveying the second row of products 100 being gripped by the first gripper 61 to the rest surface 3a of the weighing machine 3. At the point when the pusher 65 pushes the product 100 on the rest surface 3a of the weighing machine 3, the weighing of the product 100 on each weighing section 30 has been completed.

[0093] Next, as shown in FIG. 31, the transport robot 6 moves the first gripper 61 gripping no product 100 and the pusher 65 towards the rest 2, and simultaneously grips the third row of three products 100 on the rest 2 with the first gripper 61.

[0094] Next, as shown in FIG. 32, the transport robot 6 moves the first gripper 61 gripping the third row of products 100 and the pusher 65 towards the weighing sections 30, and places the third row of three products 100 being gripped by the first gripper 61 upon each of the three weighing sections 30, as shown in FIG. 33. At this point, the transport robot 6 simultaneously pushes the second row of three products 100 on the three weighing sections 30 to the conveyor 4 with the pusher 65 while conveying the third row of products 100 being gripped

by the first gripper 61 to the rest surface 3 a of the weighing machine 3.

[0095] Next, as shown in FIG. 34, the transport robot 6 moves the first gripper 61 gripping no product 100 and the pusher 65 towards the rest 2, and simultaneously grips the fourth row of three products 100 on the rest 2 with the first gripper 61.

[0096] Next, as shown in FIG 35, the transport robot 6 moves the first gripper 61 and the pusher 65, with the first gripper 61 gripping the fourth row of products 100, towards the weighing sections 30, and places the fourth row of three products 100 being gripped by the first gripper 61 upon each of the three weighing sections 30, as shown in FIG 36. At this point, the transport robot 6 simultaneously pushes the third row of three products 100 on the three weighing sections 30 to the conveyor 4 with the pusher 65 while conveying the fourth row of products 100 being gripped by the first gripper 61 to the rest surface 3a of the weighing machine 3.

[0097] Next, the transport robot 6 grips the first row of products 100 of a new product unit group on the rest 2 with the first gripper 61, and, in that state, moves the first gripper 61 and the pusher 65 towards the weighing section 30. At this point, the transport robot 6 simultaneously pushes the fourth row of three products 100 on the three weighing sections 30 to the conveyor 4 with the pusher 65 while conveying the first row of products 100 of the new product unit group being gripped by the first gripper 61 to the rest surface 3a of the weighing machine 3. A similar process is then performed.

[0098] Because the transport robot 6 of the third embodiment pushes the products 100 on the rest surface 3a of the weighing machine 3 to the conveyor 4 with the pusher 65 while conveying the products 100 gripped by the first gripper 61 to the rest surface 3a of the weighing machine 3 as described above, it is possible to simultaneously move the products 100 on the rest 2 to the rest surface 3a of the weighing machine 3 and move the products 100 on the rest surface 3a to the conveyor 4. Processing efficiency is thus improved.

[0099] Moreover, because a pusher 65 formed from a plate-like member is used as means for moving the products 100 on the rest surface 3a of the weighing machine 3 to the conveyor 4, the transport robot 6 can have a simpler configuration as compared to the transport robot 6 of the first embodiment.

[0100] In the packaging and weighing system according to the third embodiment, as with the packaging and weighing system according to the second embodiment, the weighing machine 3 may also be configured so that one product 100 rests upon a plurality of weighing sections 30, with the total weight of the products 100 being calculated by totaling the partial weights obtained by the plurality of weighing sections 30 upon which the product 100 rests. In this case, it is preferable that the first gripper 61, like the first gripper 61 according to the second embodiment, be configured so that the suction parts 61a are always present directly over the gaps 30b between two

adjacent weighing sections 30 when the first gripper 61 is positioned directly over the plurality of weighing sections 30. It is thus possible to grip a row of the product unit group on the rest 2 using the first gripper 61 without the need to make any changes to the configuration of the first gripper 61, even when changes are made to the arrangement of the products 100 in the product unit group and/or the size of the product 100.

REFERENCE SIGNS LIST

[0101]

1	PACKAGING MACHINE
2	REST
3	WEIGHING MACHINE
3a	REST SURFACE
4	CONVEYOR
6	TRANSPORT ROBOT
30	WEIGHING SECTIONS
61	FIRST GRIPPER
62	SECOND GRIPPER
65	PUSHER
61a, 62a	SUCTION PART
100	PRODUCT

Claims

1. A packaging and weighing system, comprising:

a packaging machine for packaging an object, and discharging a plurality of packaged objects arranged in a plurality of rows in parallel in a first direction;
 a rest configured such that upon which the plurality of rows of objects discharged in parallel from the packaging machine are placed thereon;
 a weighing machine having a rest surface arranged in line with the rest in a second direction perpendicular to the first direction, the weighing machine weighing each of the plurality of objects resting on the rest surface;
 a conveyor for conveying the resting objects in the first direction; and
 a transporter for transporting the plurality of rows of objects resting on the rest one row at a time

in sequence to the rest surface, and transporting the rows of objects weighed on the weighing machine from the rest surface to the conveyor.

2. The packaging and weighing system according to claim 1, wherein:

the rest is configured to function as a separator for separating two adjacent objects touching each other in the first direction within the plurality of rows of objects discharged in parallel from the packaging machine.

3. The packaging and weighing system according to claim 1 or 2, wherein:

the rest, rest surface, and conveyor are disposed in the stated order in the second direction.

4. The packaging and weighing system according to any one of claims 1 to 3, wherein:

the transporter has a first gripper for gripping the objects on the rest in rows and a second gripper for gripping the objects in rows on the rest surface of the weighing machine; and
 the transporter is configured to repeatedly perform the processes of :

- (a) gripping objects on the rest using the first gripper;
- (b) gripping objects on the weighing machine using the second gripper while objects are gripped by the first gripper; and
- (c) conveying the objects being gripped by the first and second grippers to the weighing machine and the conveyor, respectively.

5. The packaging and weighing system according to claim 3, wherein:

the transporter has a first gripper for gripping the objects on the rest in rows and a second gripper for gripping the objects in rows on the rest surface of the weighing machine;
 the first and second grippers are aligned in the second direction so that the distance therebetween is equal to the distance between the rest surface and the conveyor; and
 the transporter is configured to repeatedly perform the processes of :

- (a) gripping objects on the rest using the first gripper;
- (b) gripping objects on the rest surface using the second gripper, the first gripper being in a state of gripping objects; and
- (c) conveying the objects being gripped by

the first and second grippers to the rest surface and the conveyor, respectively.

6. The packaging and weighing system according to any one of claims 1 to 5, wherein:

the weighing machine has a number $N (\geq 3)$ of weighing sections having the rest surface, and determines the weight of objects to be weighed by finding the sum of the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections.

7. The packaging and weighing system according to claim 4 or 5, wherein:

the weighing machine has a number $N (\geq 3)$ of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects to be weighed by totaling the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections;

the first gripper has a plurality of suction parts for applying suction to the objects on the rest, the suction parts being arranged in a row in the first direction; and

the first gripper and the suction parts are configured in such a manner that, when the first gripper is positioned directly over the number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

8. The packaging and weighing system according to claim 4 or 5, wherein:

the weighing machine has a number $N (\geq 3)$ of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects to be weighed by totaling the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections;

the second gripper has a plurality of suction parts for applying suction to the objects on the rest surfaces of the weighing machine, the suction parts being arranged in a row in the first direction; and

the second gripper and the suction parts are configured in such a manner that, when the second gripper is positioned directly over the number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

9. The packaging and weighing system according to any one of claims 1 to 3, wherein:

the transporter has a gripper for gripping the objects on the rest in rows and a pusher for pushing the rows of objects upon the rest surfaces of the weighing machine onto the conveyor; and the transporter is configured to repeatedly perform the processes of:

(a) gripping objects on the rest using the gripper, and

(b) conveying objects being gripped by the gripper onto the rest surfaces while pushing the objects on the rest surfaces onto the conveyor using the pusher.

10. The packaging and weighing system according to claim 9, wherein:

the weighing machine has a number $N (\geq 3)$ of weighing sections having rest surfaces arranged in a row along the first direction, and calculates the weight of objects to be weighed by totaling the partial weights of the objects resting on a number M (wherein $2 \leq M \leq N$) of weighing sections;

the gripper has a plurality of suction parts for applying suction to the objects on the rest, the suction parts being arranged in a row in the first direction; and

the gripper and the suction parts are configured such that, when the gripper is positioned directly over the number N of weighing sections, the suction parts are positioned directly over all gaps between two adjacent weighing sections on the weighing machine.

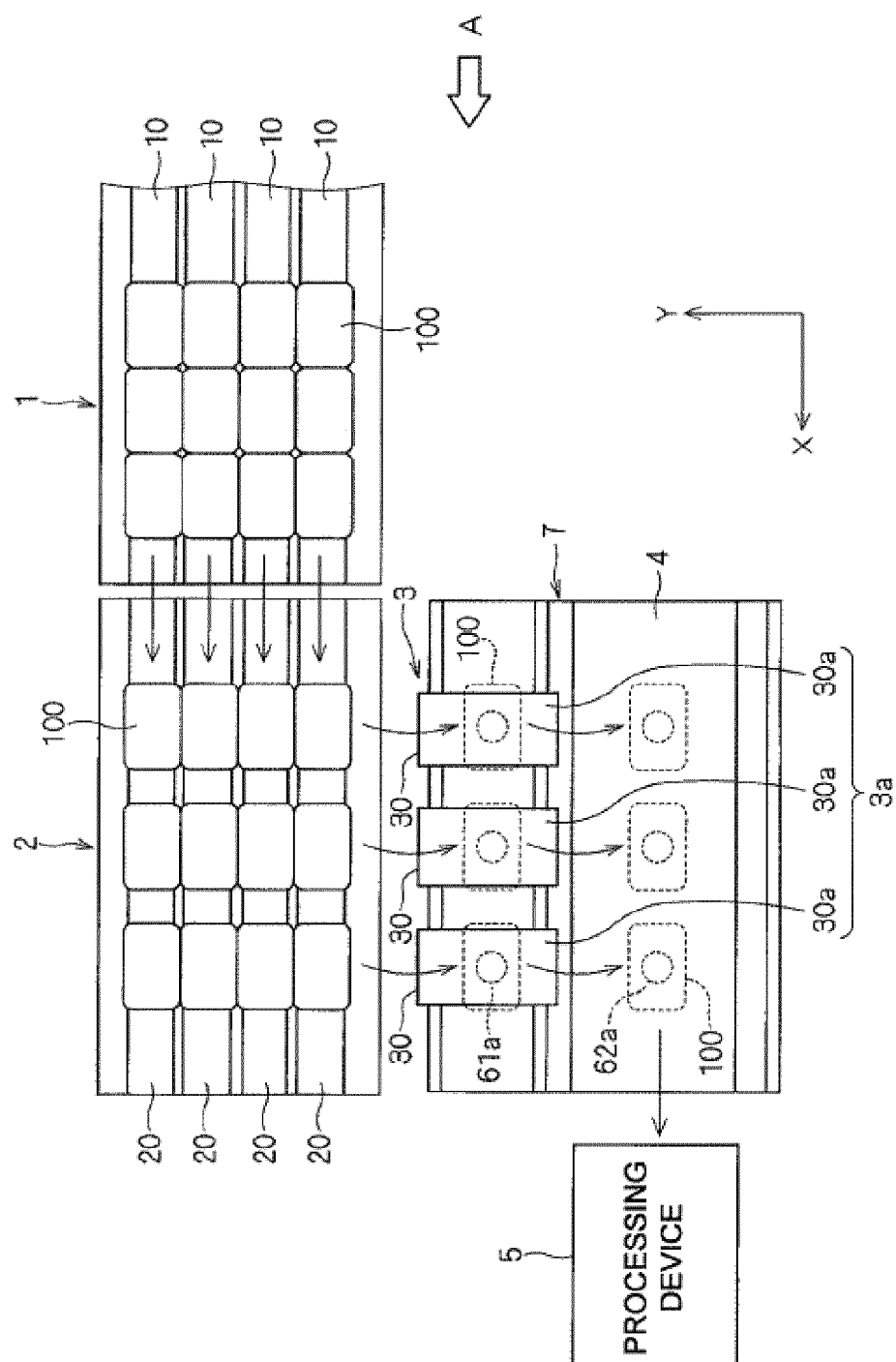


FIG. 1

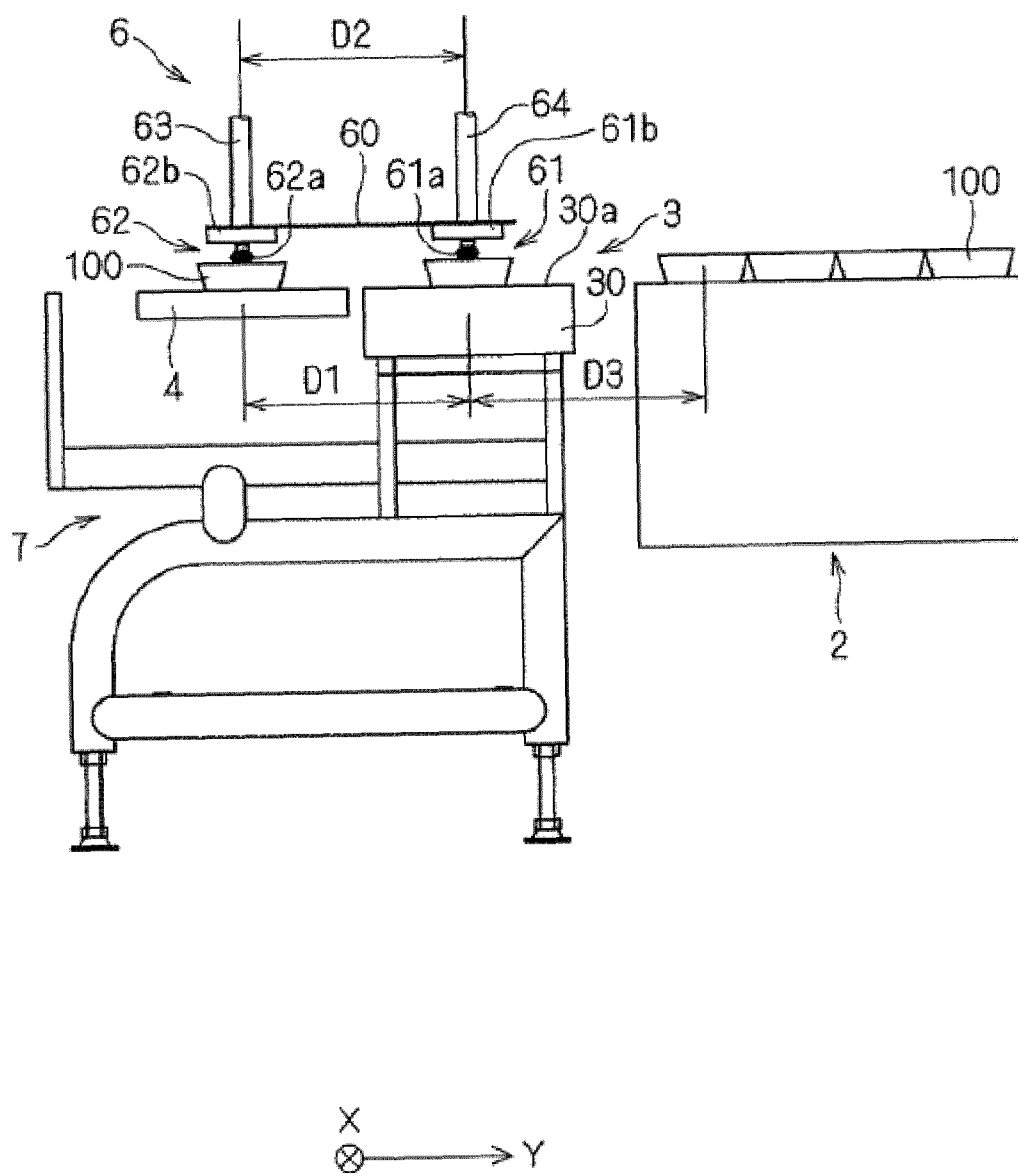


FIG. 2

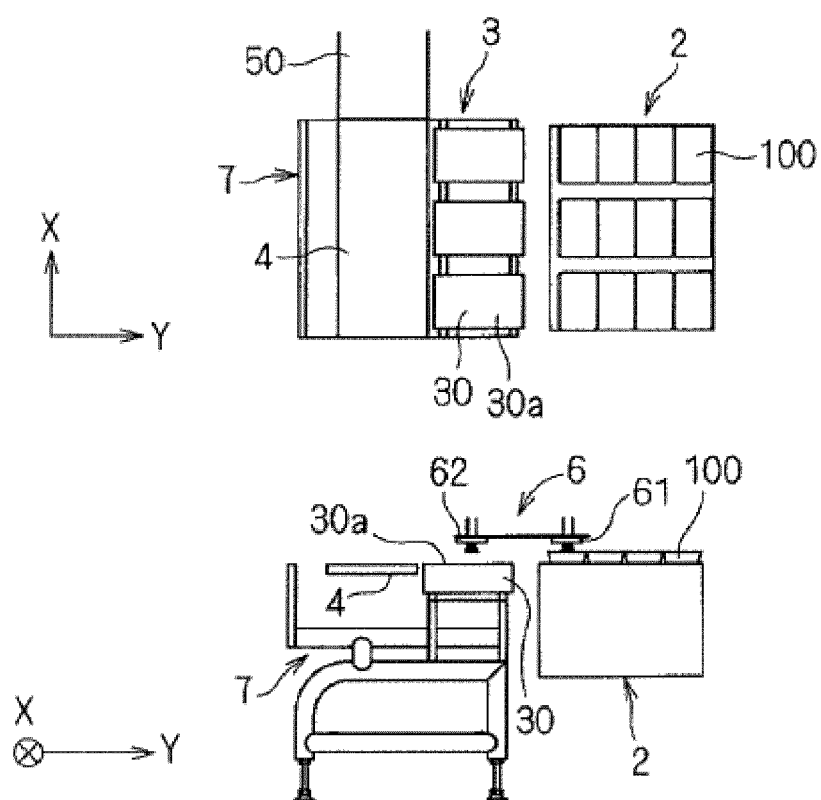


FIG. 3

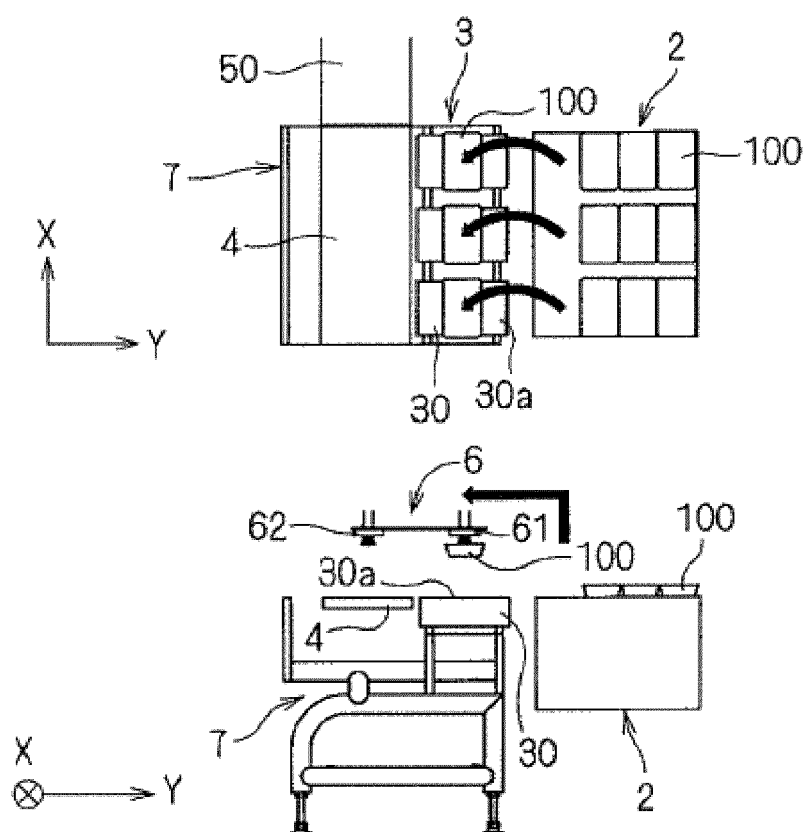


FIG. 4

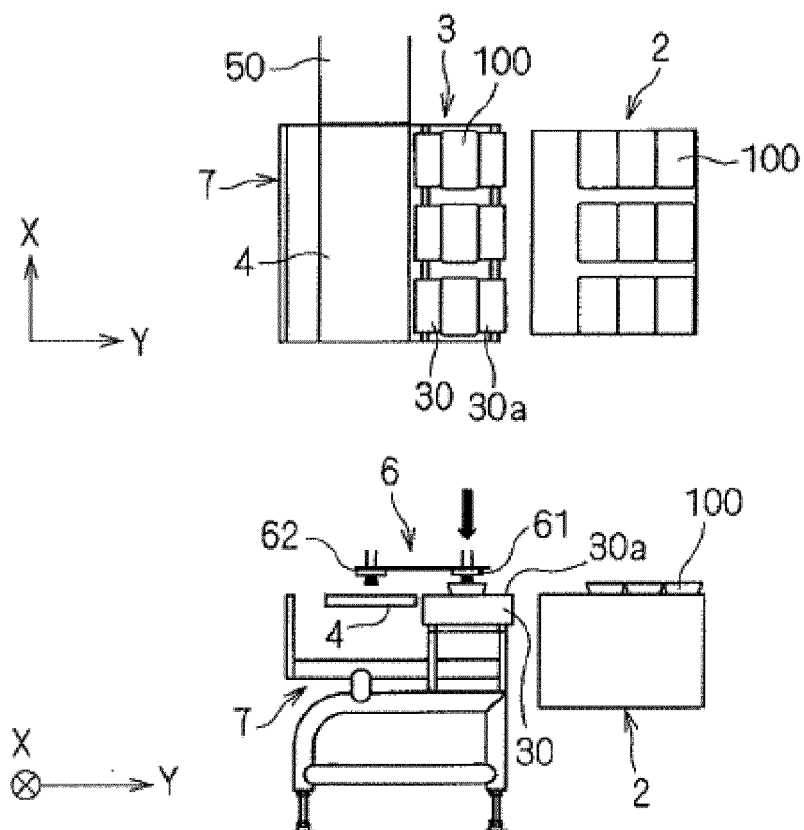


FIG. 5

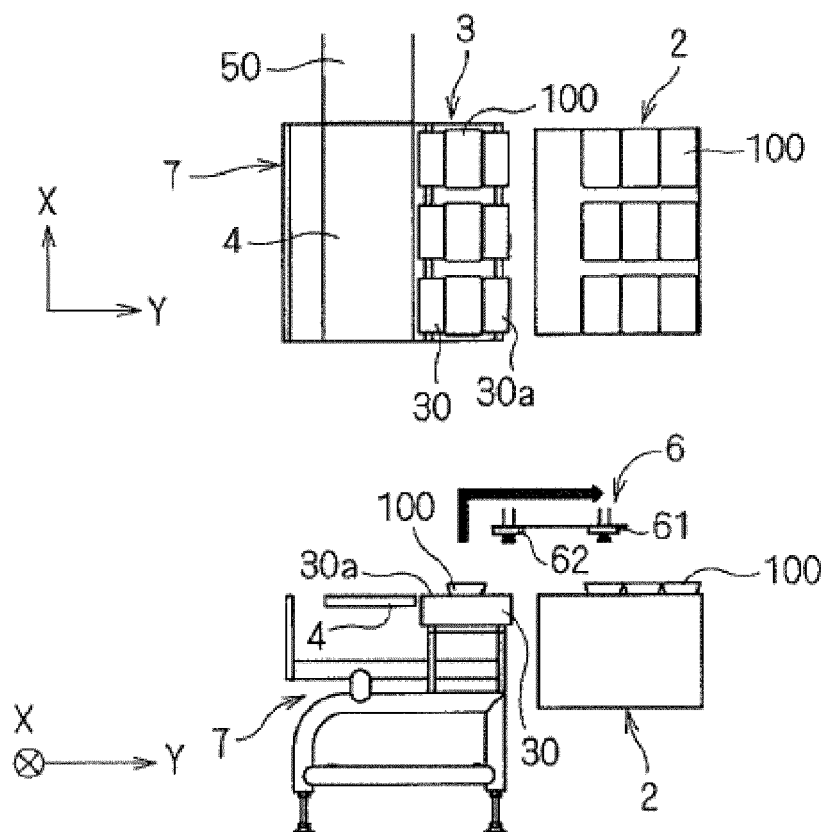


FIG. 6

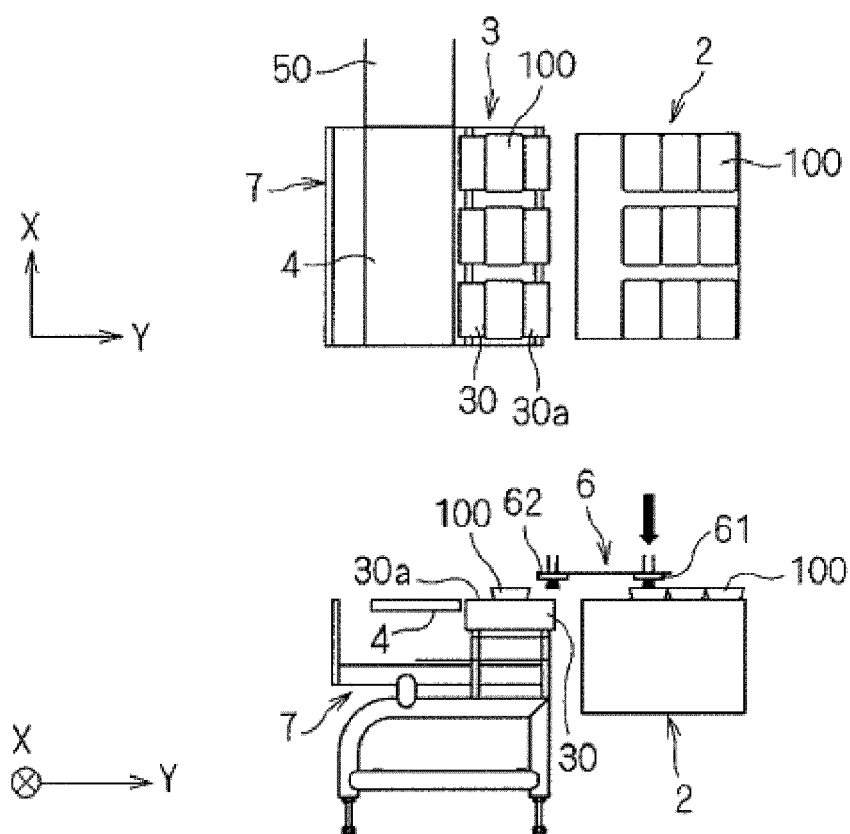


FIG. 7

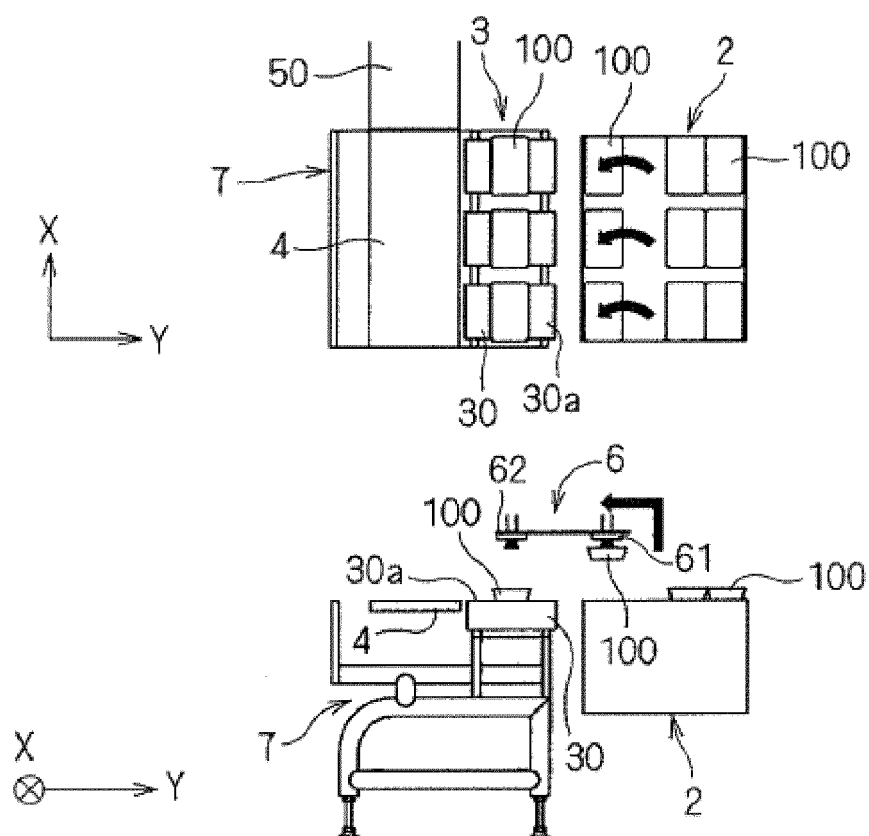


FIG. 8

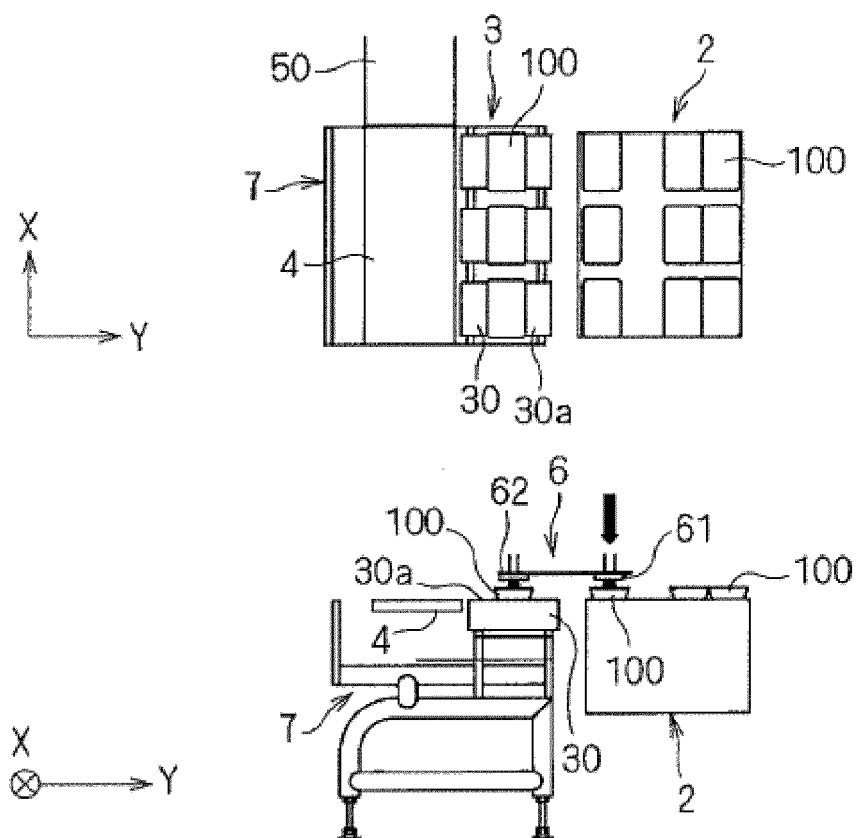


FIG. 9

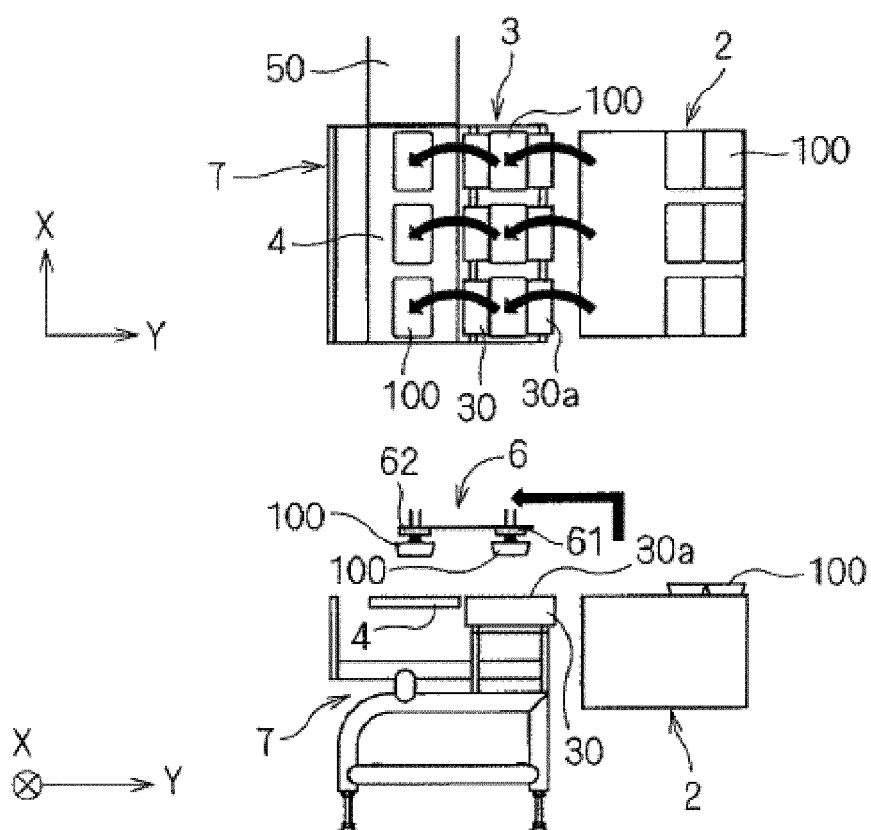


FIG. 10

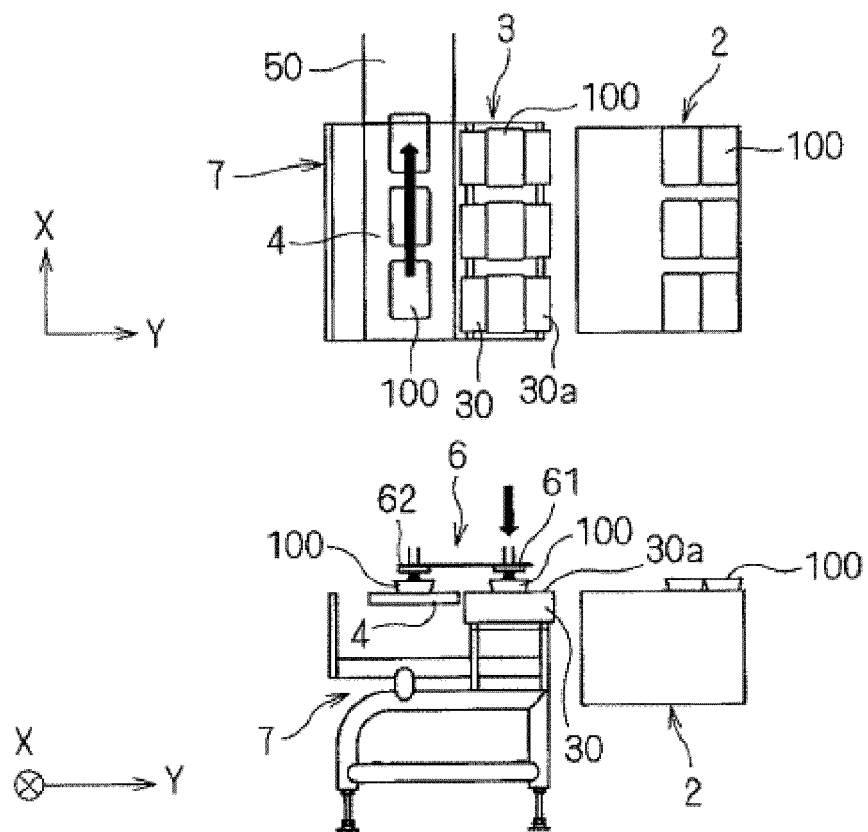


FIG. 11

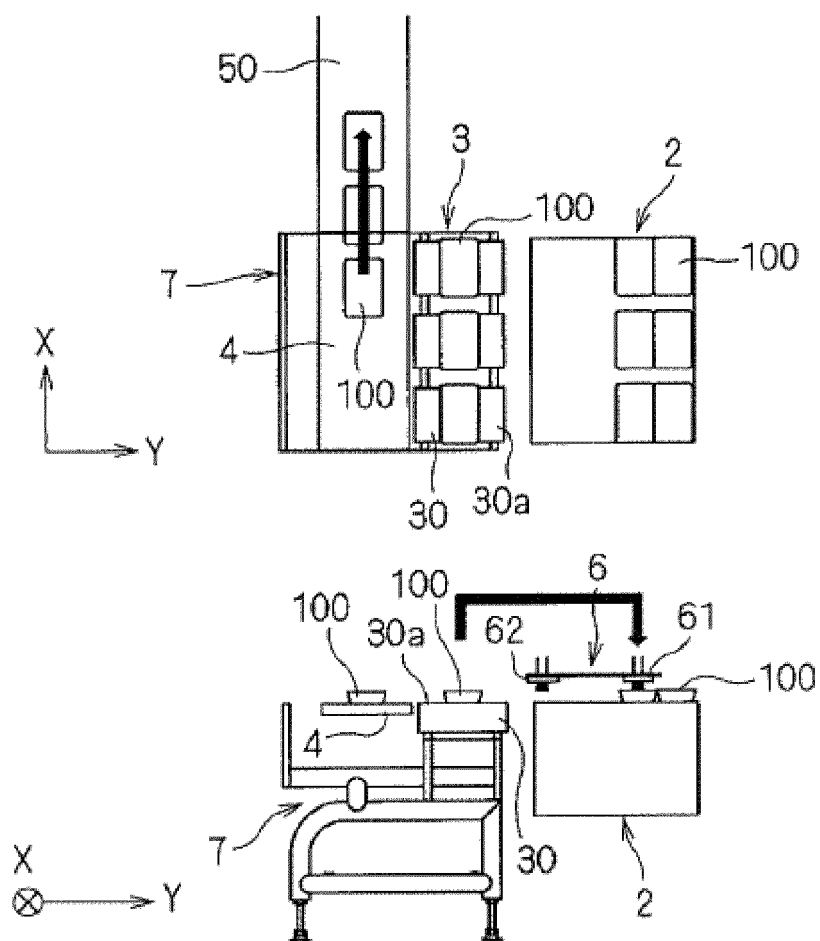


FIG. 12

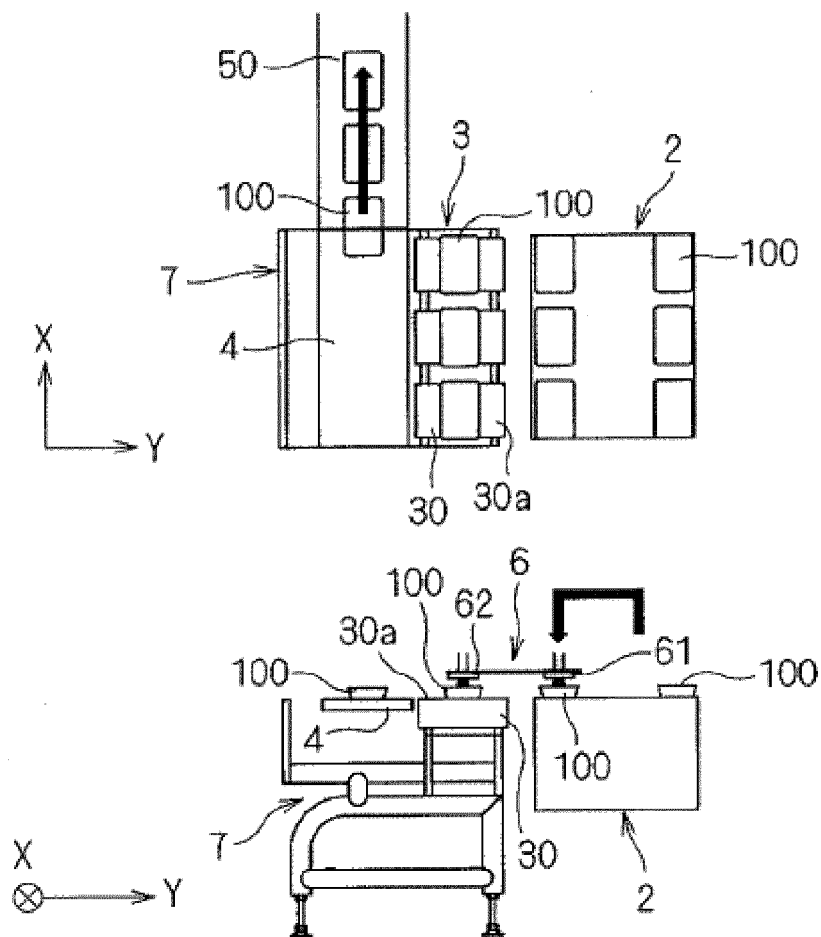


FIG. 13

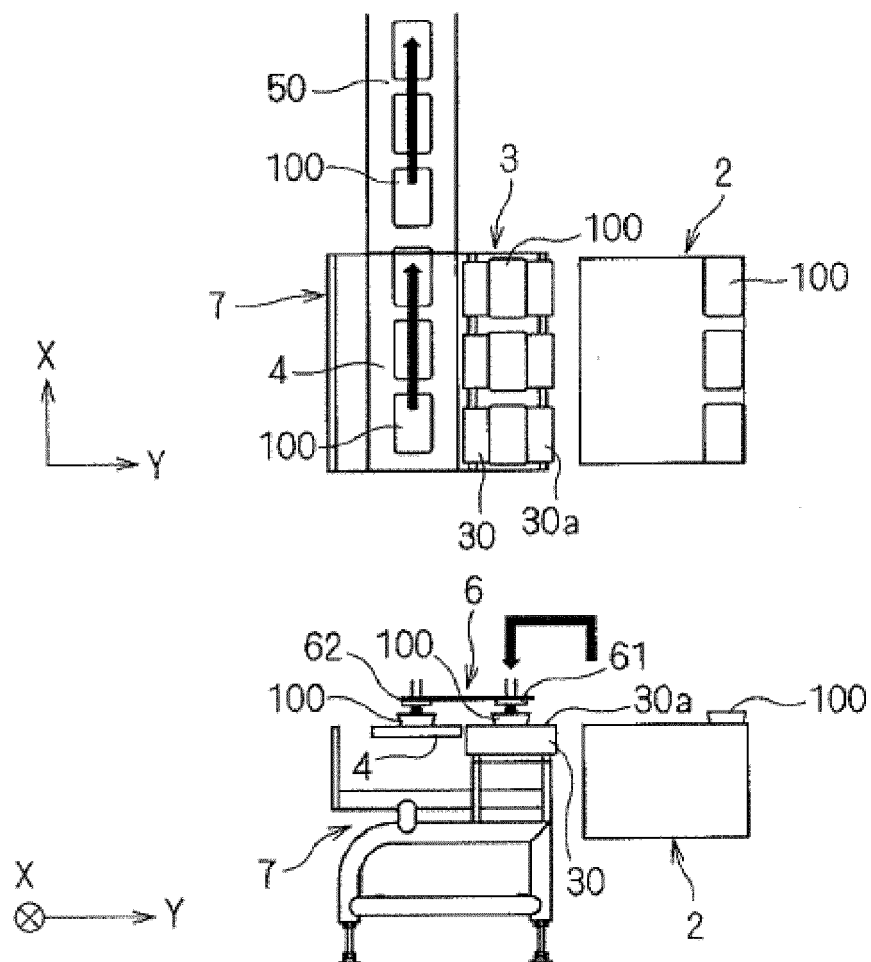


FIG. 14

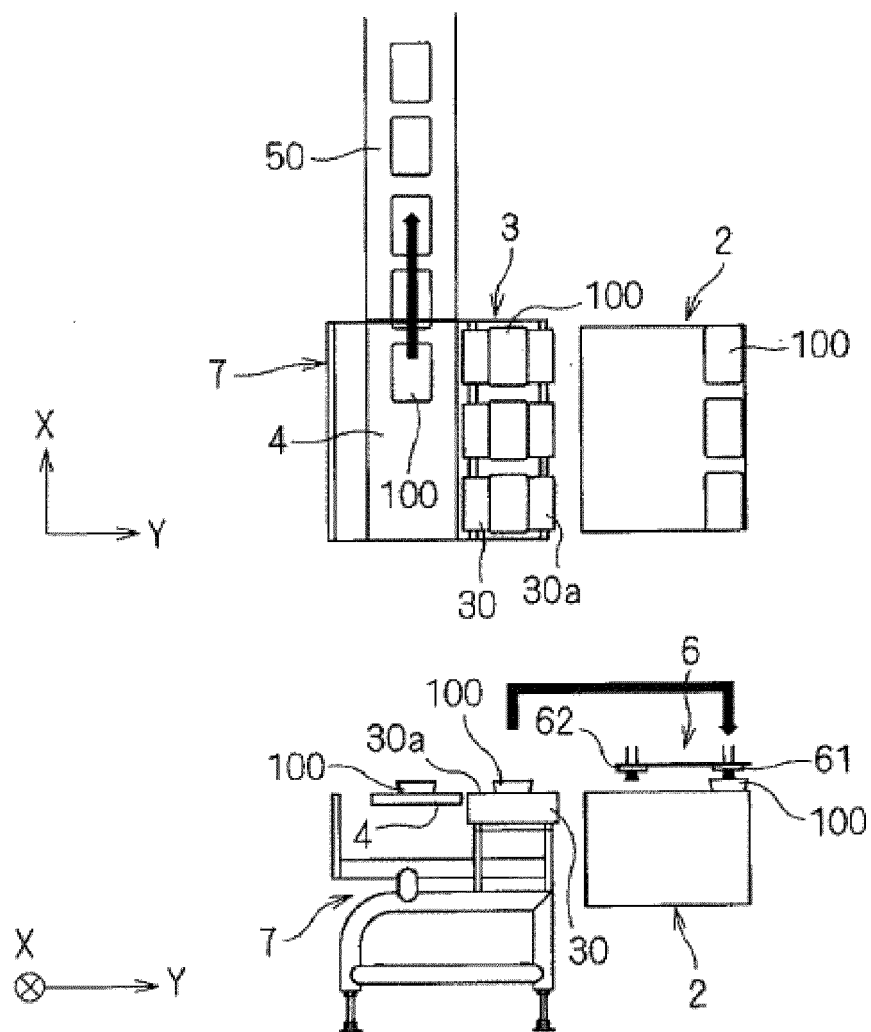


FIG. 15

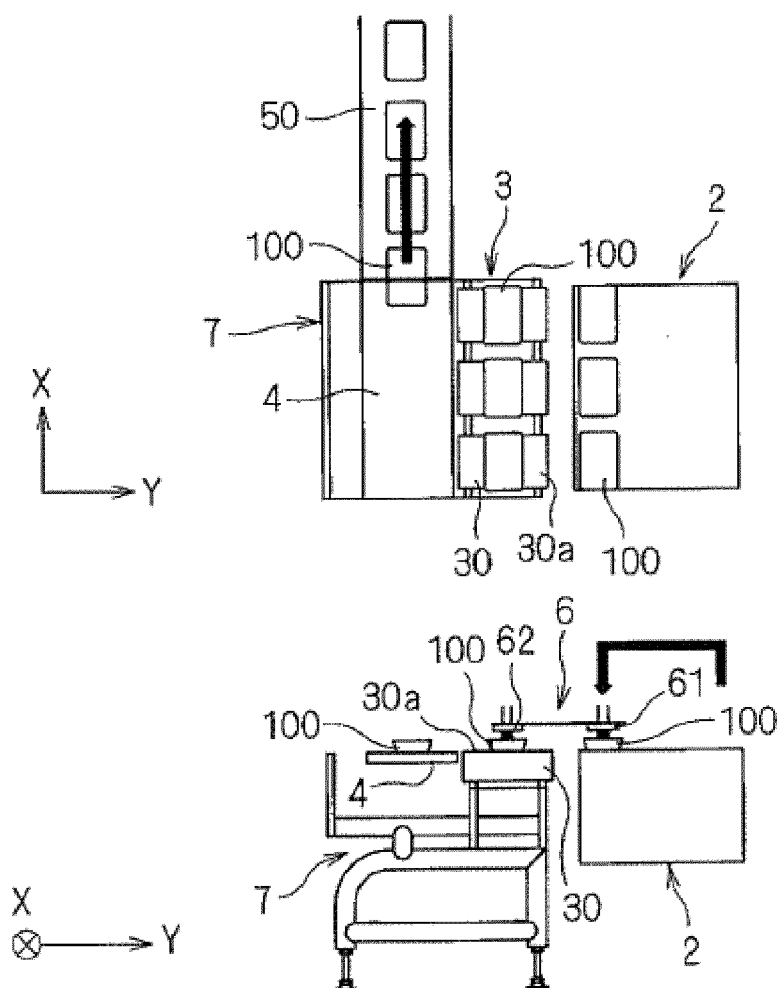


FIG. 16

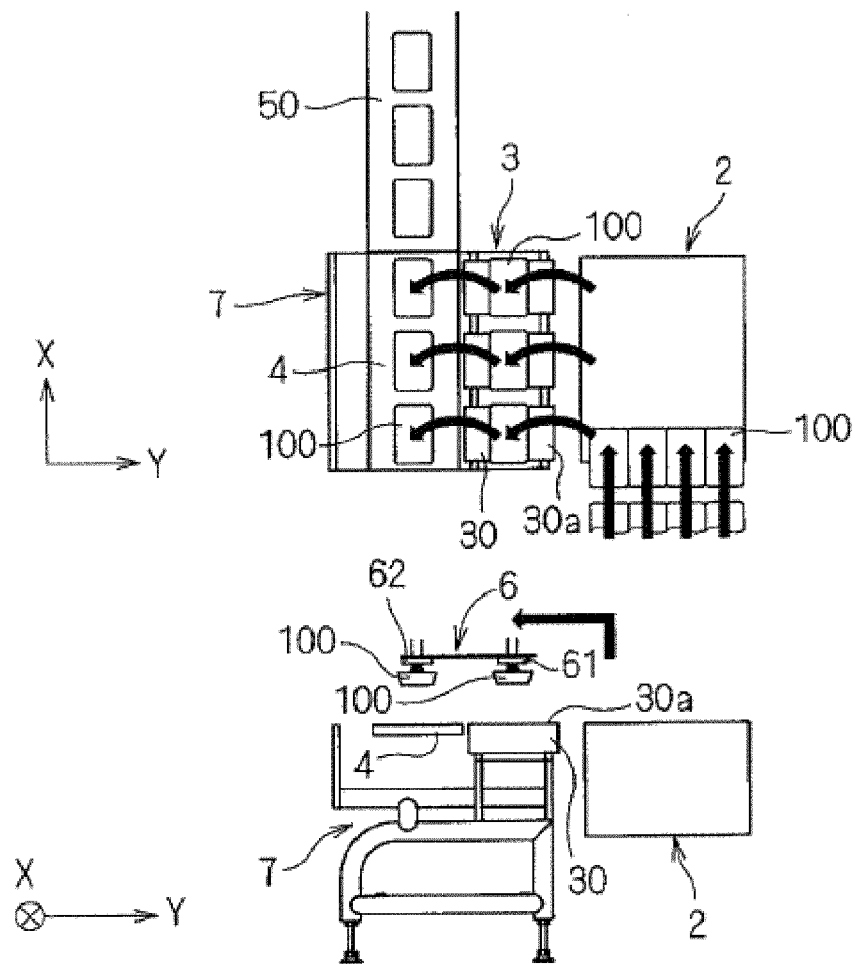


FIG. 17

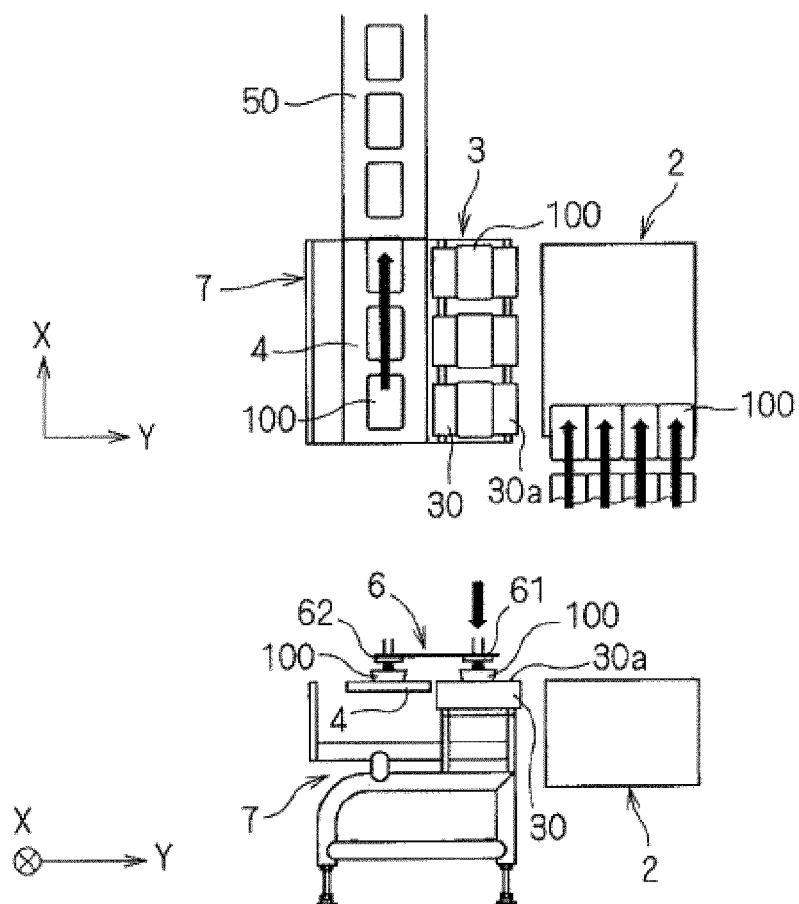


FIG. 18

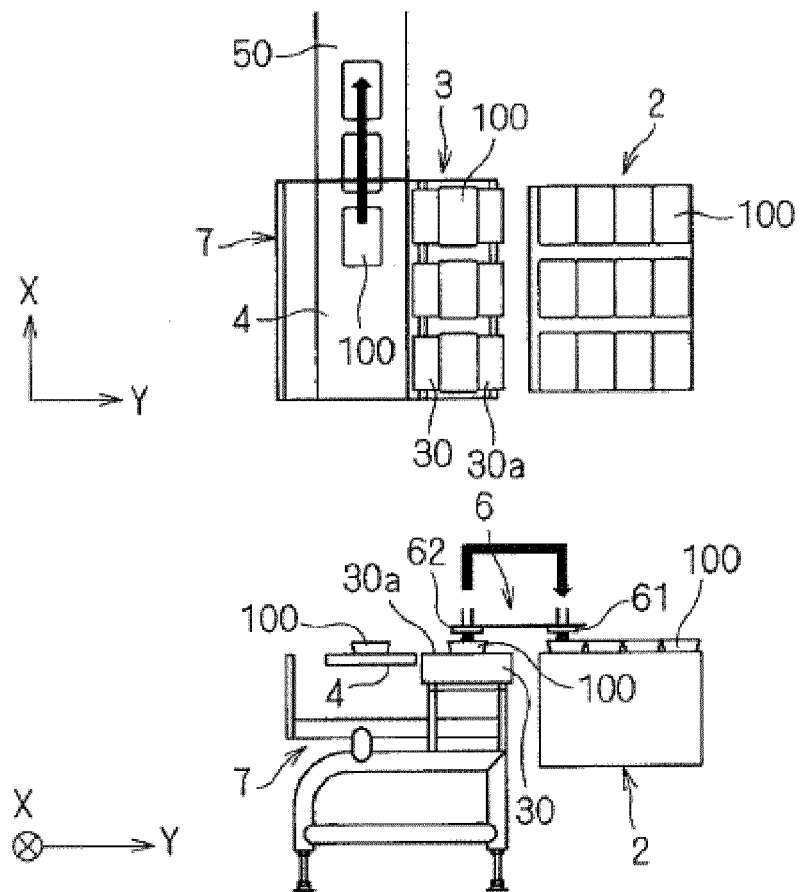


FIG. 19

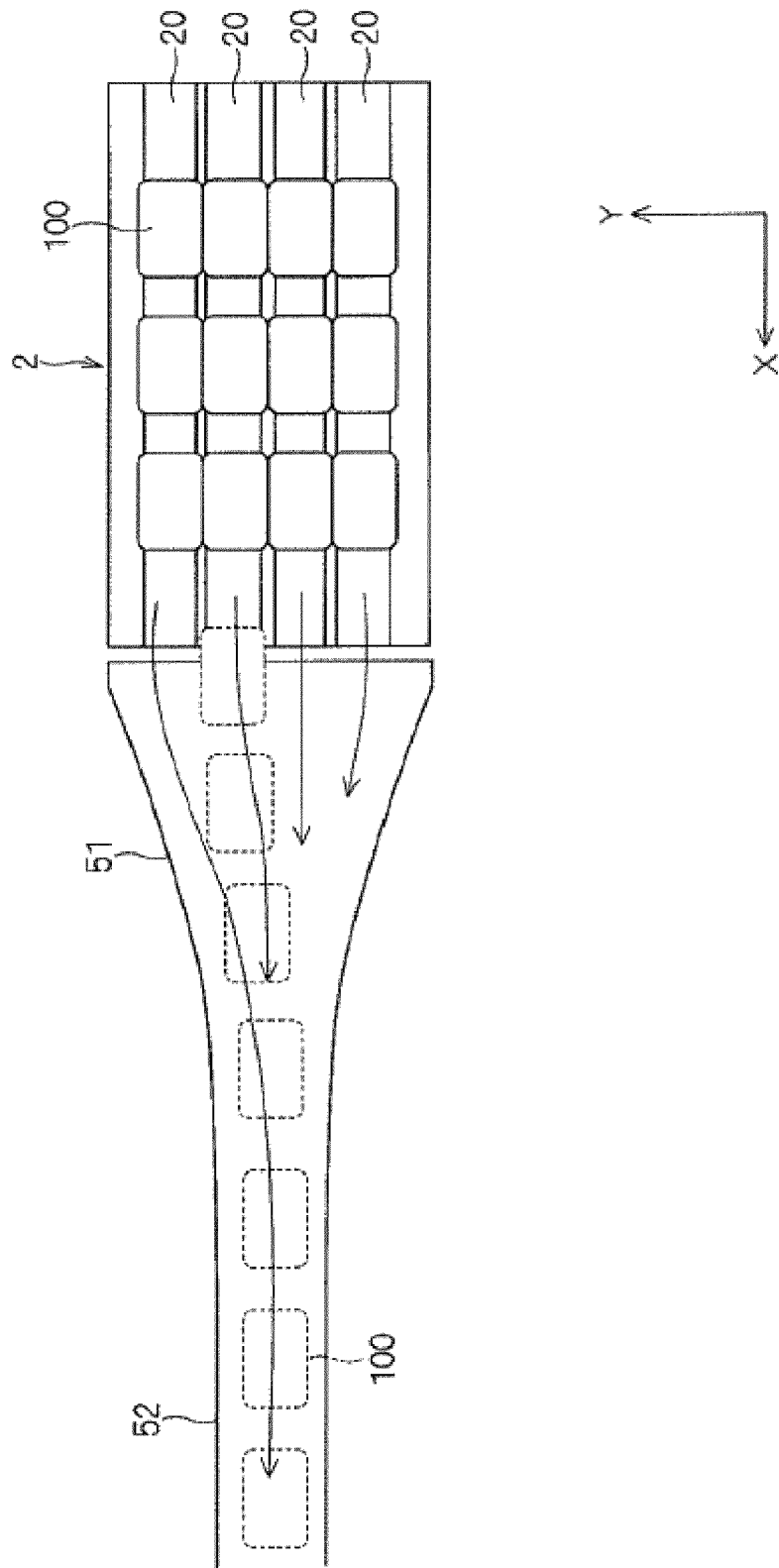


FIG. 20

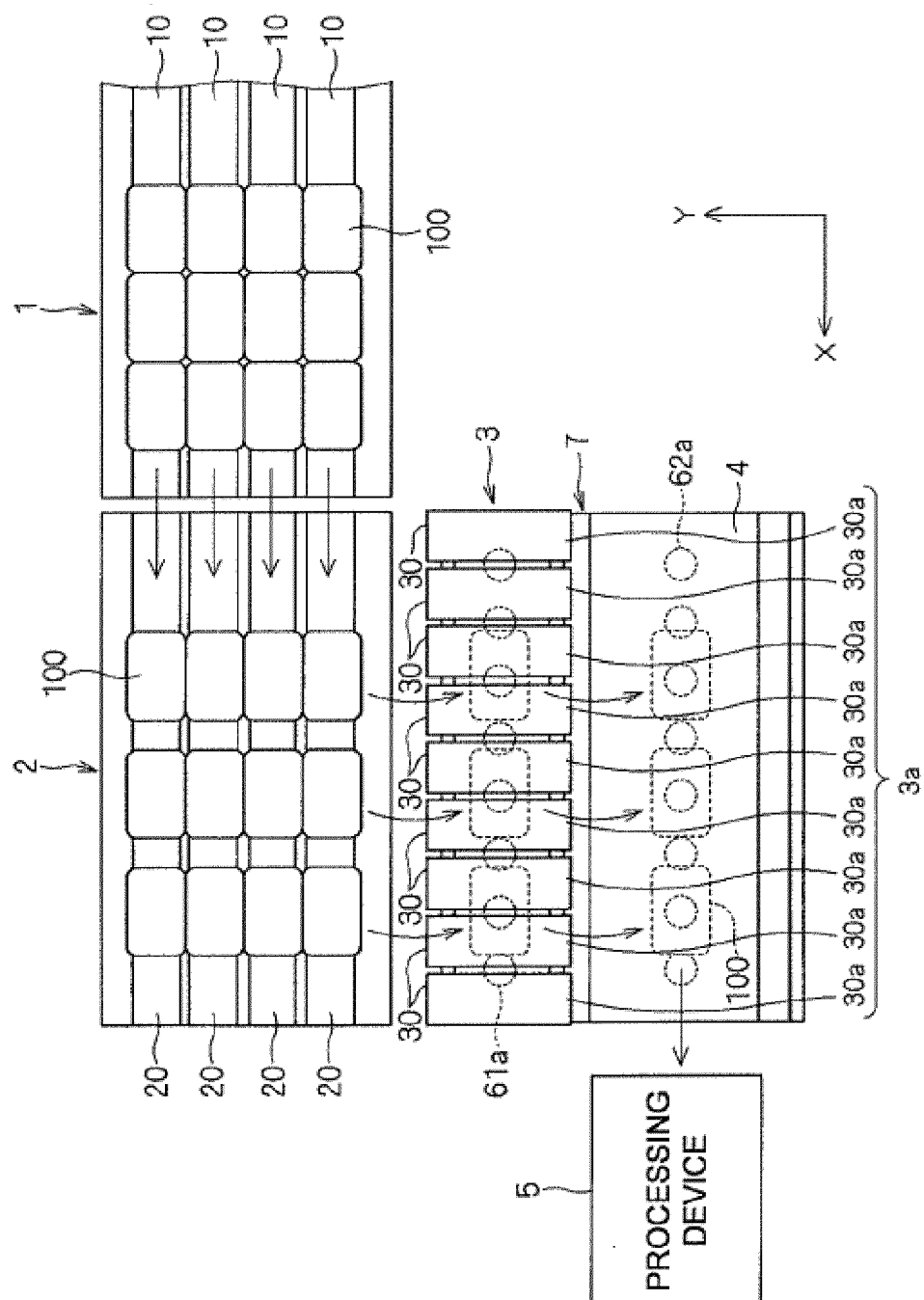


FIG. 21

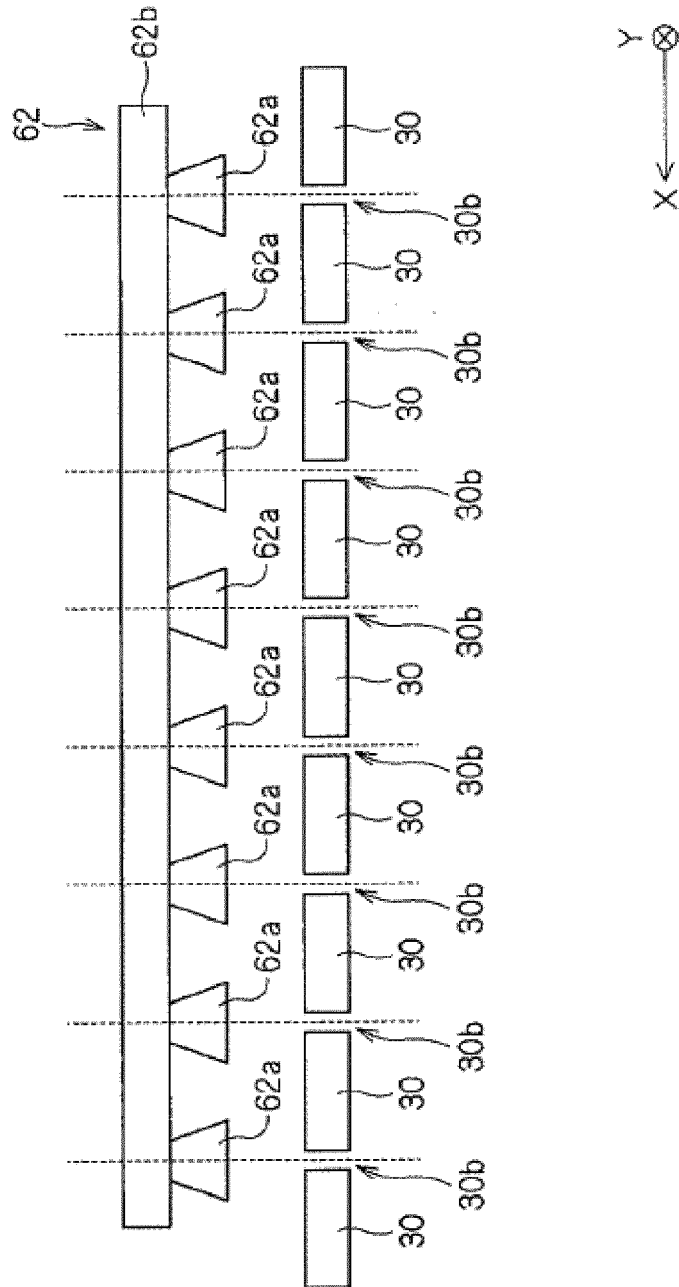


FIG. 22

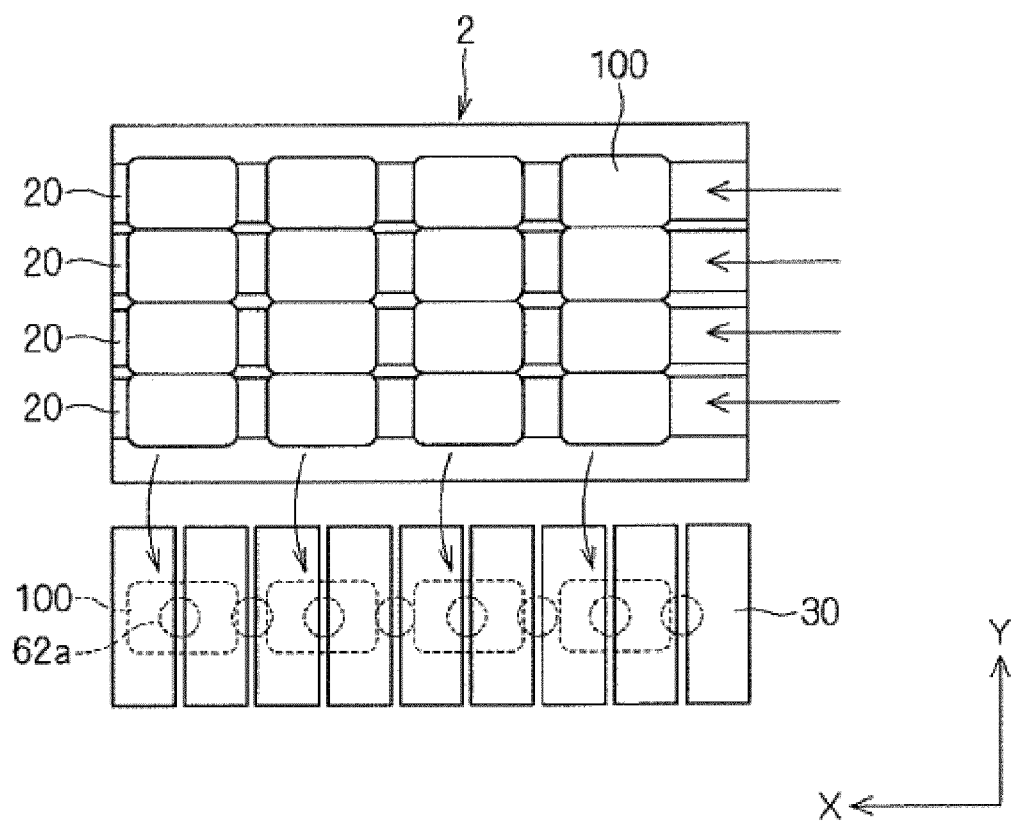


FIG. 23

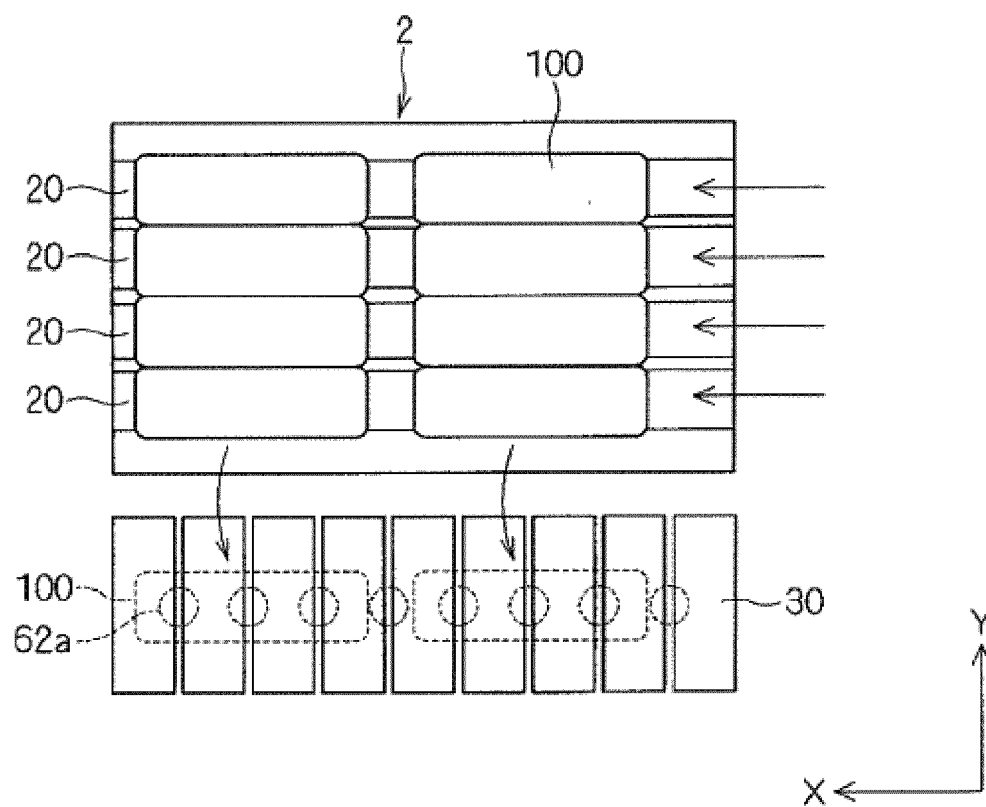


FIG. 24

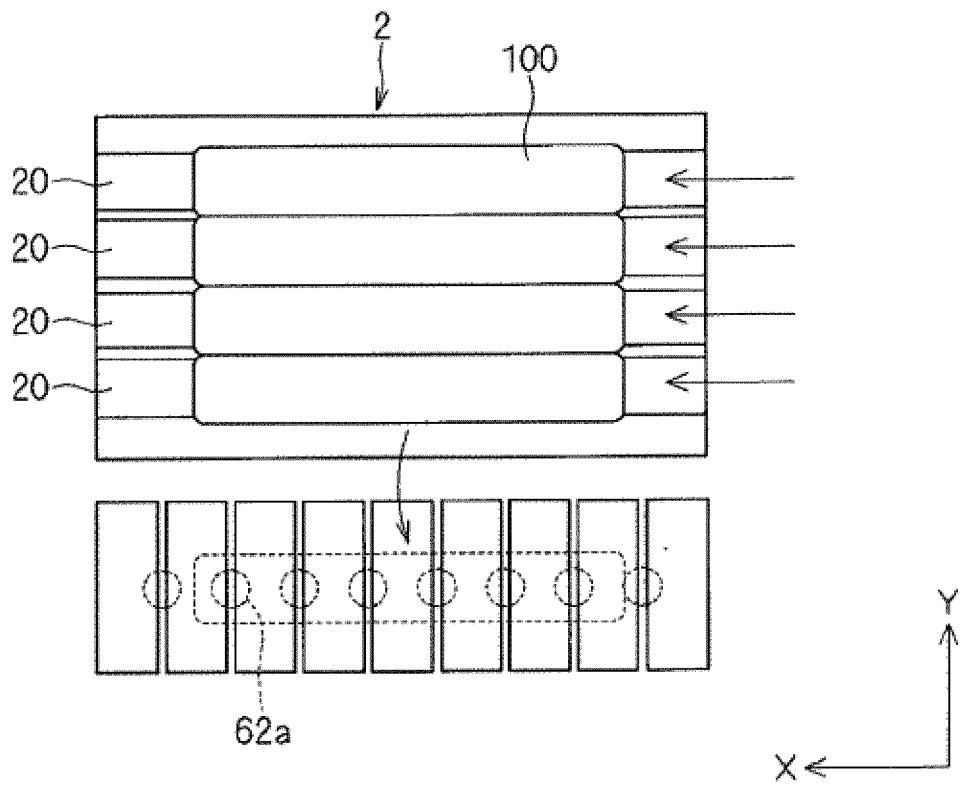


FIG. 25

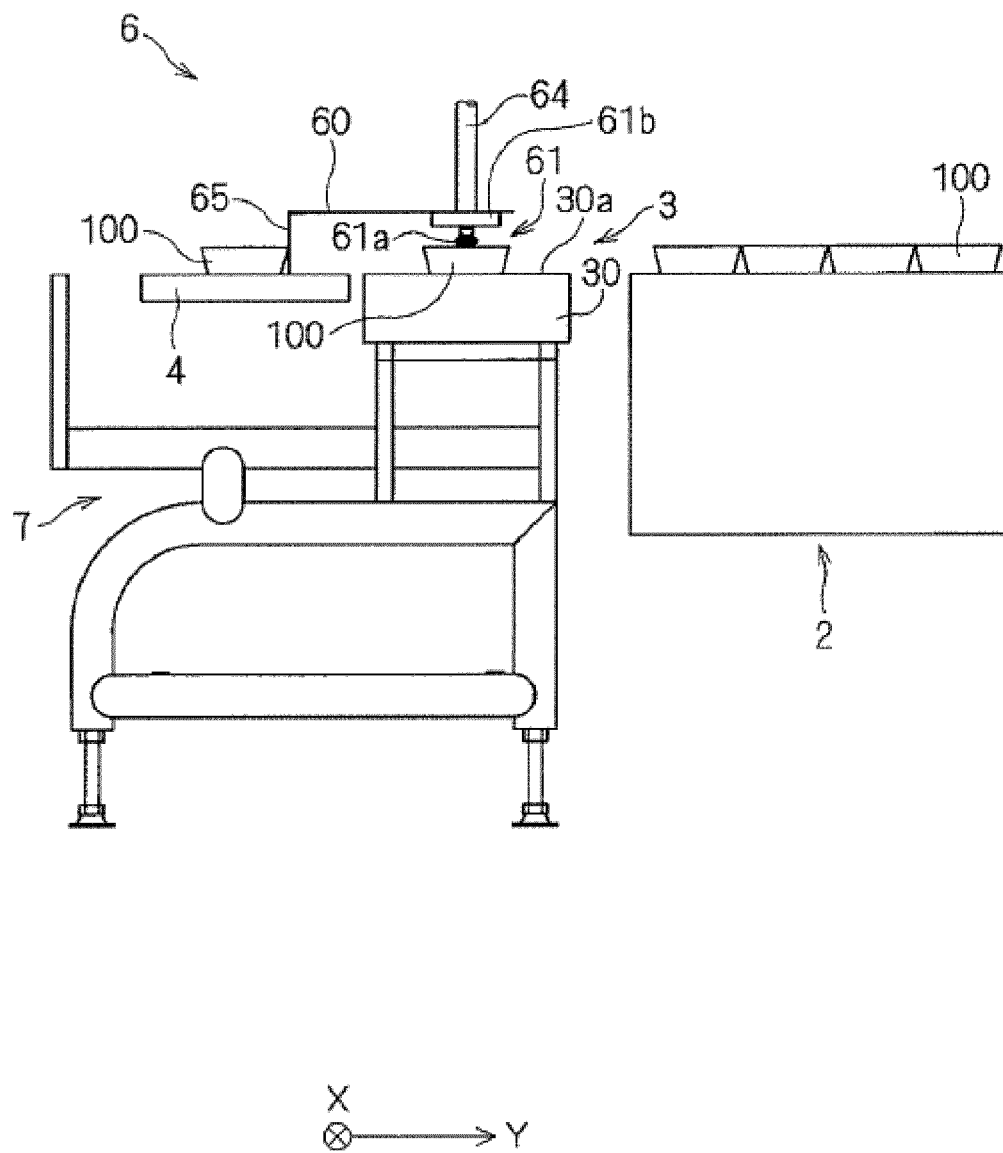


FIG. 26

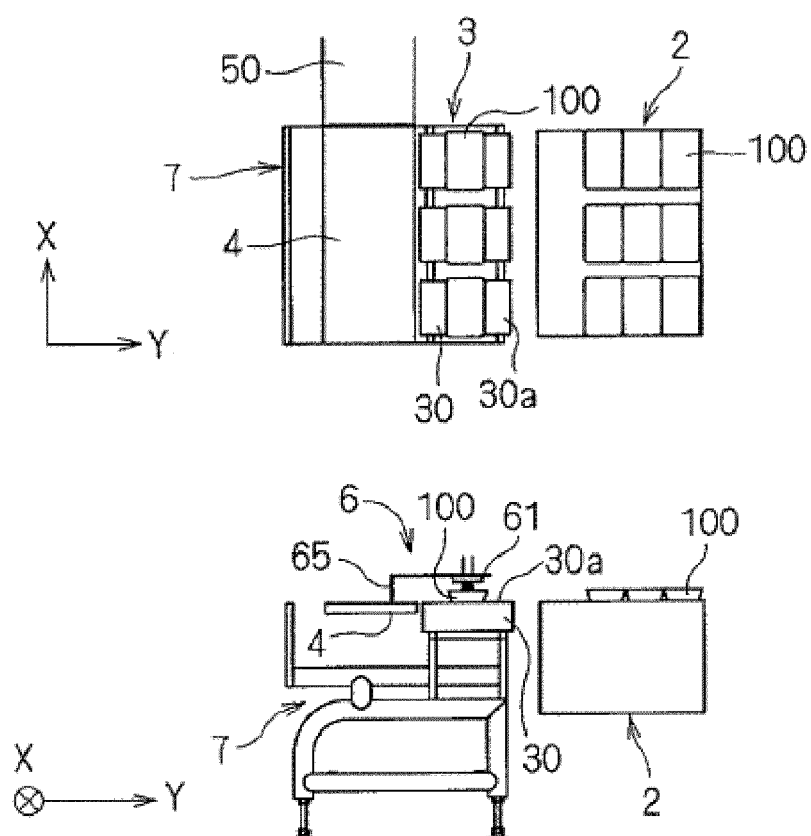


FIG. 27

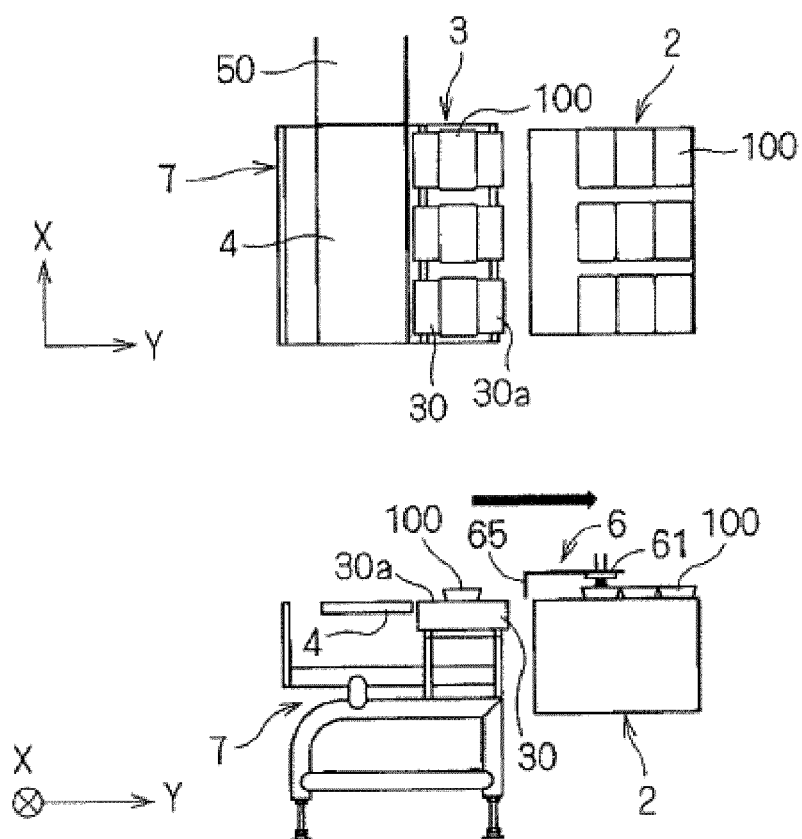


FIG. 28

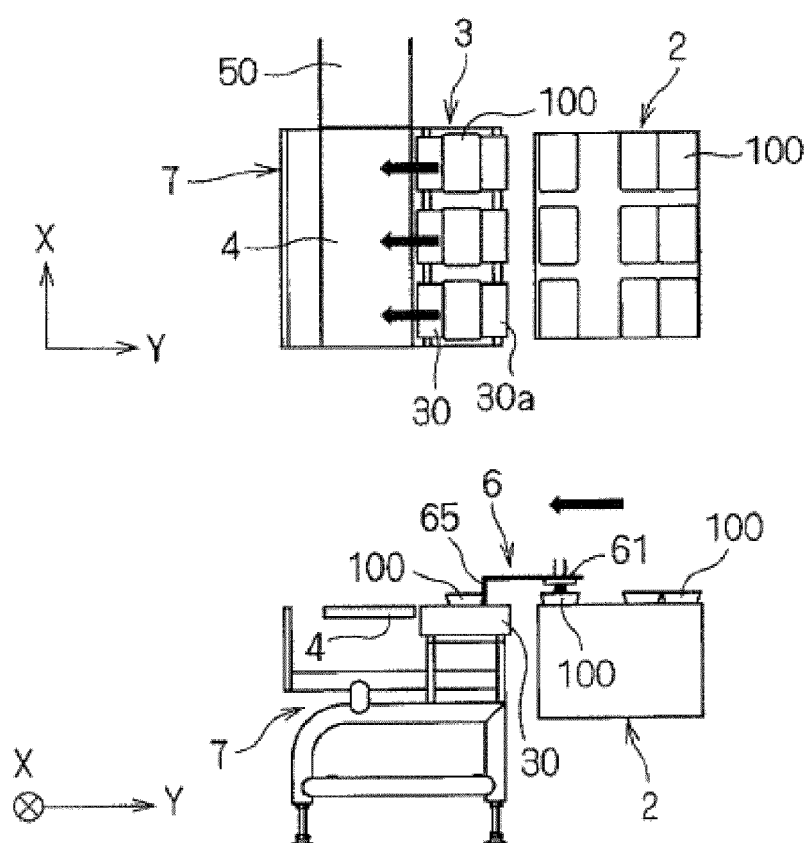


FIG. 29

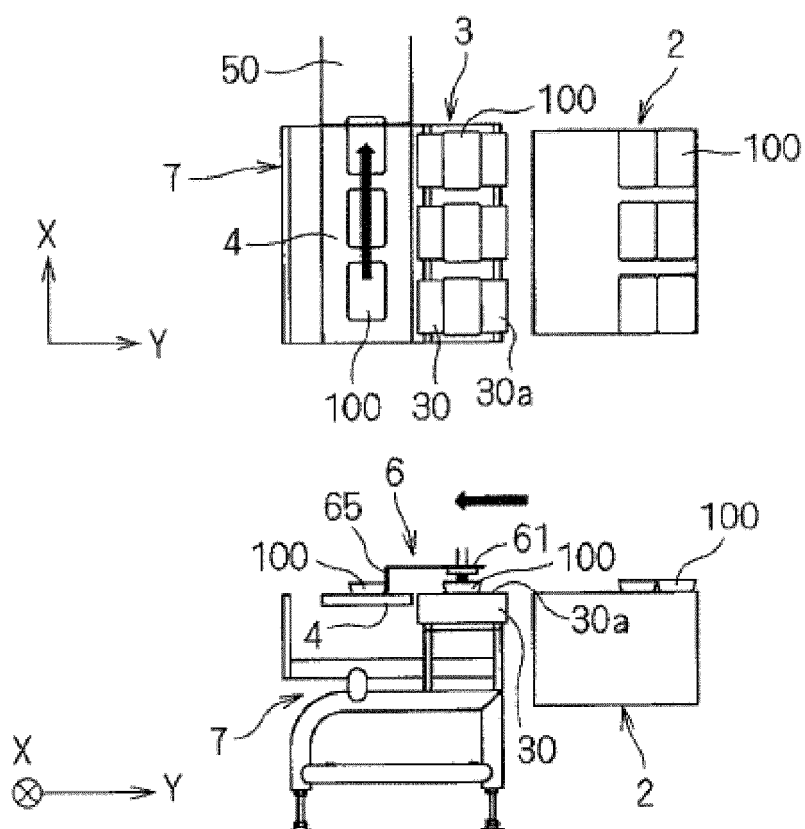


FIG. 30

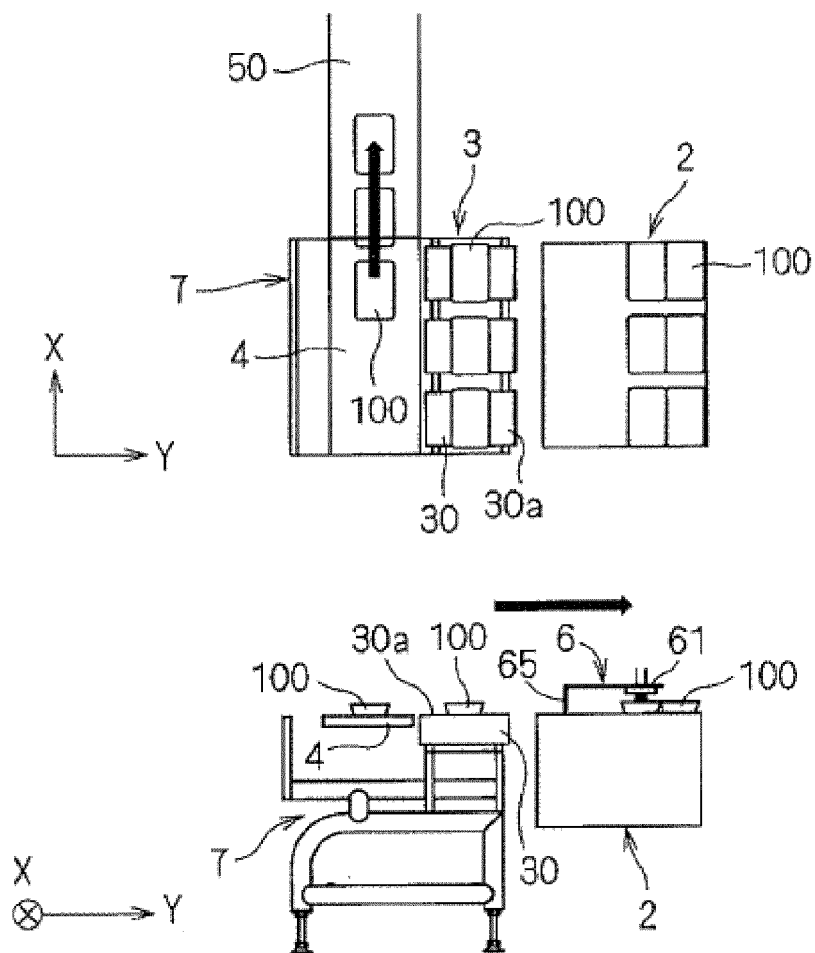


FIG. 3 1

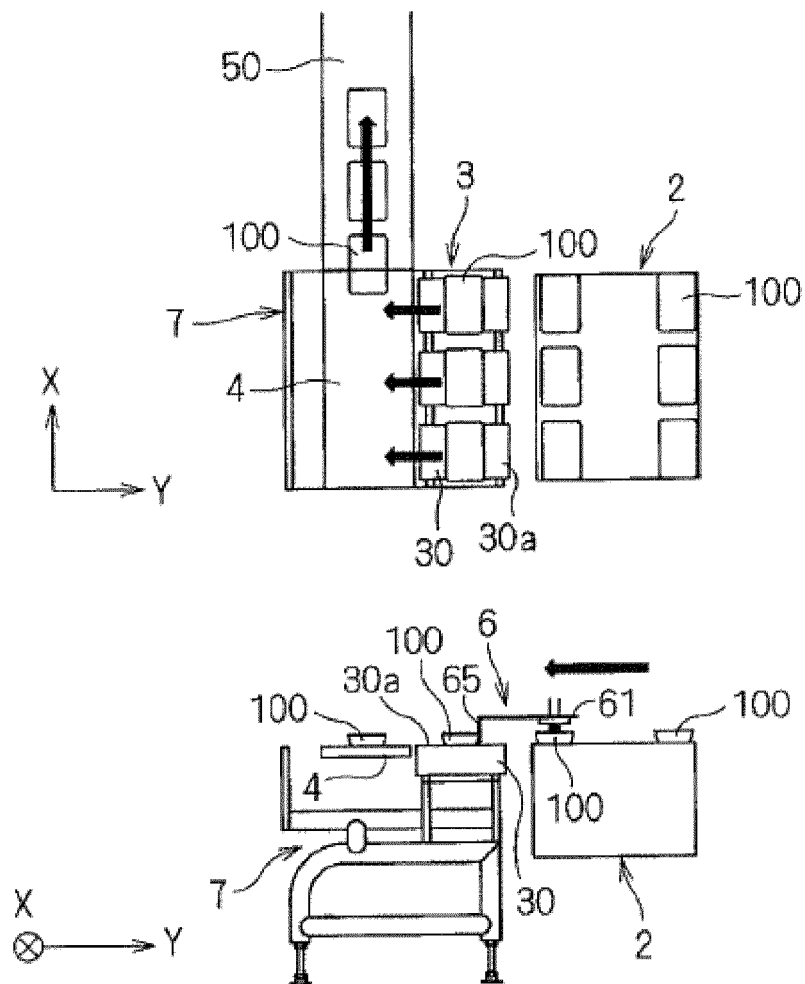


FIG. 3 2

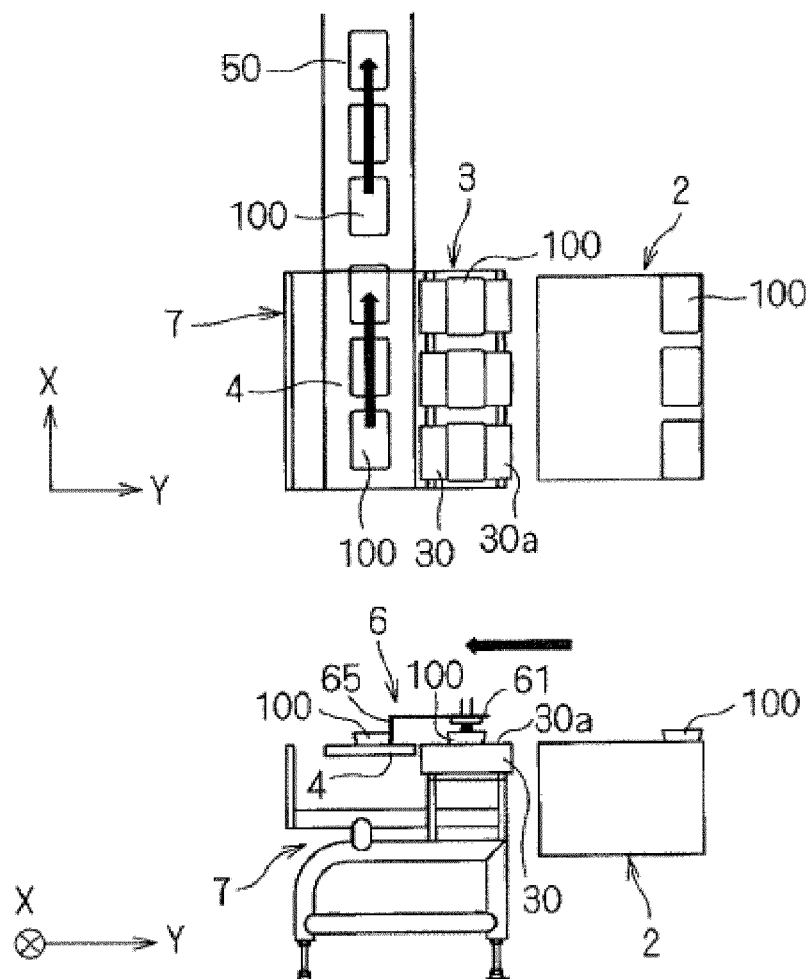


FIG. 33

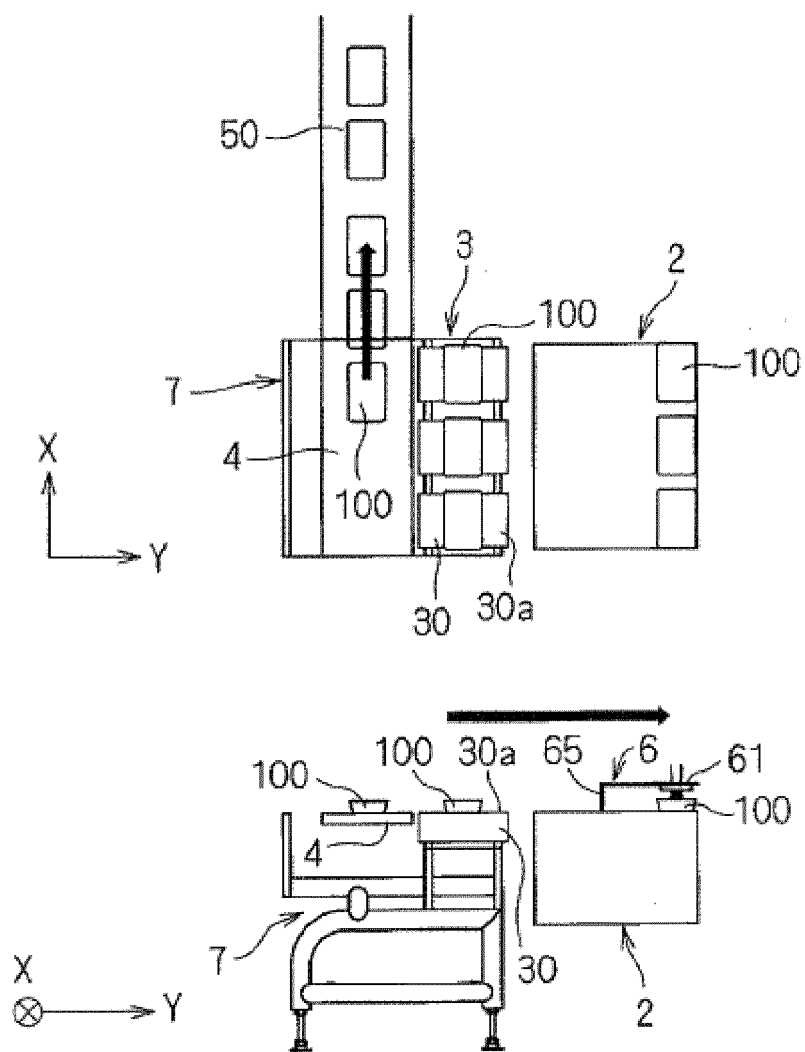


FIG. 34

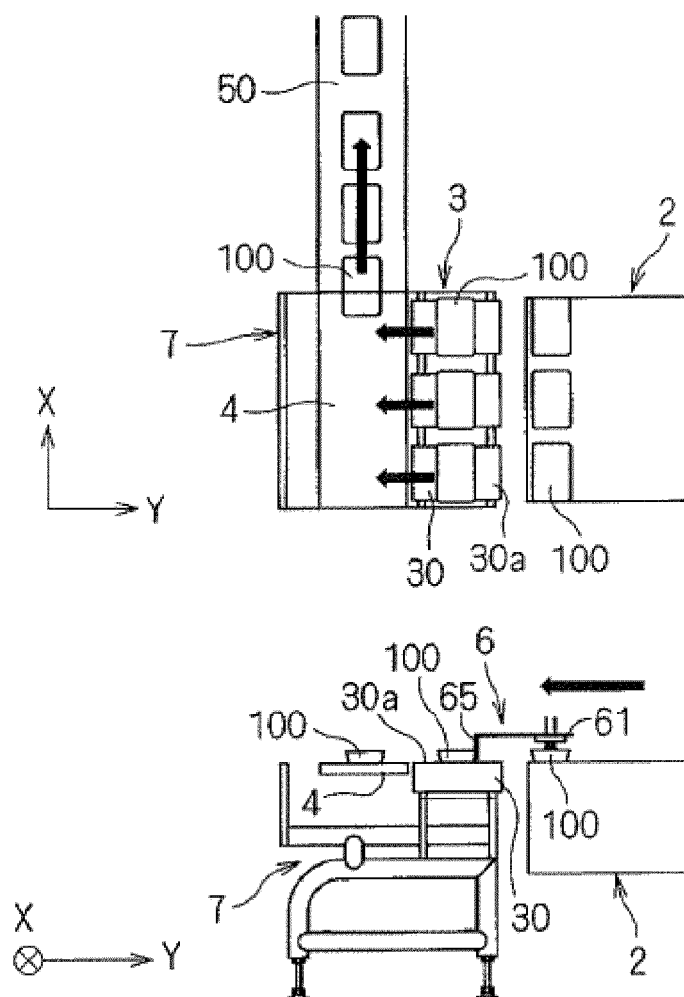


FIG. 35

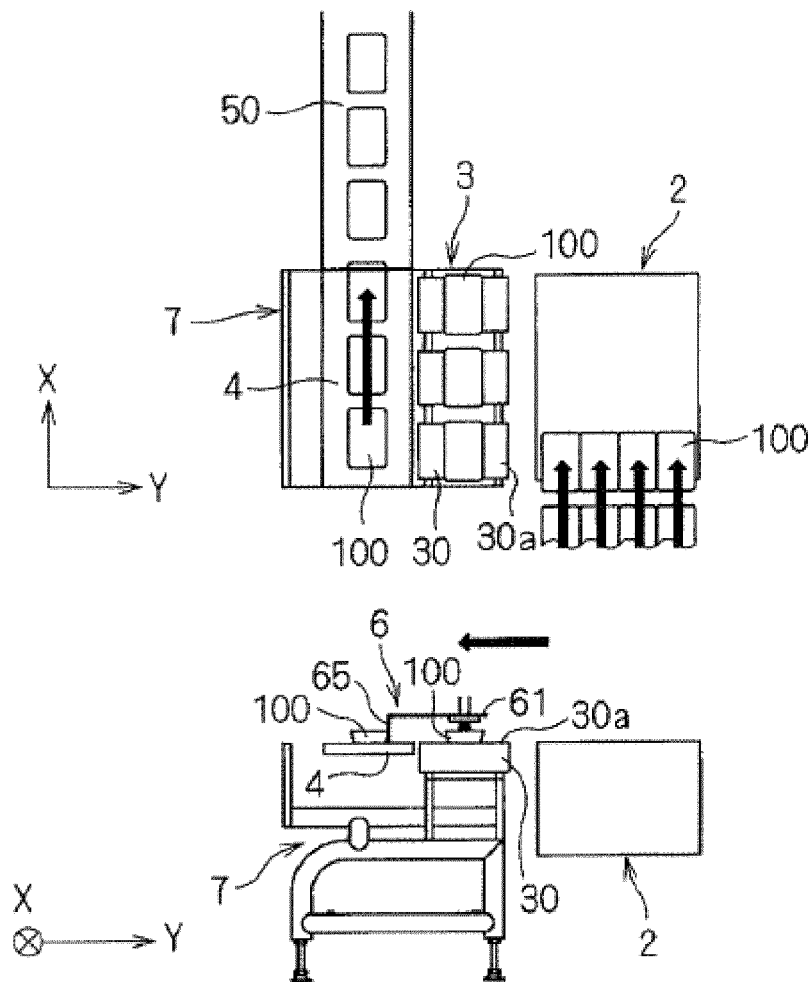


FIG. 36



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 9615

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y,D	JP 2008 536768 A (EHLMANN) 11 September 2008 (2008-09-11) * the whole document *	1	INV. B65B1/46 B65B35/38
Y	DE 10 2009 022820 A1 (IWK VERPACKUNGSTECHNIK GMBH [DE]) 2 December 2010 (2010-12-02) * the whole document *	1	
A	US 3 225 891 A (HICKIN ROBERT J ET AL) 28 December 1965 (1965-12-28) * the whole document *	1-10	
			TECHNICAL FIELDS SEARCHED (IPC)
			B65B G01G B65G B65H
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 26 June 2012	Examiner Lawder, M
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ON EUROPEAN PATENT APPLICATION NO.**

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26-06-2012

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
JP 2008536768 A	11-09-2008	AT 513742 T	15-07-2011
		AU 2006236987 A1	26-10-2006
		DE 102005018251 A1	26-10-2006
		EP 1871668 A1	02-01-2008
		ES 2364618 T3	08-09-2011
		JP 2008536768 A	11-09-2008
		US 2009071099 A1	19-03-2009
		WO 2006111141 A1	26-10-2006

DE 102009022820 A1	02-12-2010	BR PI1001490 A2	28-06-2011
		DE 102009022820 A1	02-12-2010

US 3225891 A	28-12-1965	NONE	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2008536768 A [0002]