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(54) **Linear capper and capping method**

Linearer Verschliesser und Verschlussmethode

Capsuleur linéaire et procédé de fermeture

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Description

[0001] The present invention relates to a linear capper which automatically caps receptacles arranged on a conveyor, and to a capping method used by the capper.

[0002] Jpn. Pat. Appln. KOKOKU Publication No. 4-59233 discloses a capper described below.

[0003] The capper comprises: a cap shoot which causes caps supplied from a cap supply section to fall freely along an inclined plane; and capping chucks which chuck the caps. The capper also comprises a scratch piece unit which moves the caps from the cap shoot to the capping chucks. The scratch piece unit is movable between a position which is near the cap shoot and a position which is away from it.

[0004] When a scratch piece moves a rod out of a cylinder device, a movable plate comes to a position above the receptacles by means of a lever and a swingable arm. At the time, the arm of the scratch piece is held horizontal because of its own weight. After the rod is moved out of the cylinder device, an operation arm lowers an operation cam. A cam follower swings down, with a pin as a shaft. In addition, the arm of the scratch piece unit, namely the scratch pieces, swings in a predetermined direction.

[0005] In a state where the scratch piece is raised, the caps are carried to the terminating end of the cap shoot. After being sequentially caught, the caps are returned to their original positions.

[0006] When the movable cam and the cam follower separate from each other, the arm of the scratch piece unit, namely the scratch piece, swings with the pin as a shaft because of its own weight. Then, the scratch piece is returned into the horizontal state. The capping head moves down, then the cap on the scratch piece is chucked, and then the capping head moves up. After a rod is pulled from the cylinder device, the movable plate gets off above the receptacles by means of the lever and the swinging arm. Subsequently, the capping head moves down, and the receptacles are capped.

[0007] In the technology shown in Jpn. Pat. Appln. KOKOKU Publication No. 4-59233, the scratch piece moves (swings) up or down. Depending upon the weight of the scratch piece, the swinging motion may result in the cap position being shifted from the right position.

[0008] Additionally, European Patent Application EP 0745555 Al discloses an apparatus and a method according to the preamble of claim 1 and claim 4. In order to transfer the caps from the receiving position to the capping chucks, the scratch piece unit moves in a parallel direction to and above the conveyor track. In addition, a spindle which transmits a torque to the lower end of the capping chucks, moves down during which the receptacles are capped. After that capping the spindle moves back upward till the capping chucks reach the setting position.

[0009] In addition French Patent specification FR 2606006-A1 relates to a linear capper of an intermittent type comprising a scratch piece unit. A chain drive is arranged within the scratch piece unit for moving the caps from a terminating end of a cap transport passage to a setting position. The scratch piece unit including the chain drive moves in a vertical direction with respect to the conveying direction of the conveyor to a position above the conveyor where the caps are chucked.

[0010] Furthermore, many movable units, such as a vertically movable member and a motor, are arranged above the receptacles. With this structure, it may happen that some member will fall or the abraded particles of the units will attach to the surface of the receptacles or enter the interior of the receptacles.

[0011] the present invention has been conceived in an effort to solve the above problems, and the object of the invention is to provide a linear capper and a capping method which reliably arranges caps at the intended positions and which prevents the components from falling or reduces the amount of abraded particles.

[0012] To achieve the above object, a linear capper with the features of claim 1 and a method with the features of claim 4 are proposed.

[0013] The present invention comprises:

a conveyor which sequentially conveys a plurality of receptacles at a constant rate;

a cap transport passage along which caps for the receptacles are supplied;

a piece unit in which a plurality of scratch pieces for receiving the caps are arranged in the same plane in such a manner that one array or a number of parallel arrays are formed;

a piece unit transport mechanism which movably supports and transports a piece unit between a cap-receiving position and a setting position in a substantially horizontal plane, the caps are sequentially transferred from a terminating end of the cap transport passage to pieces of the piece unit, and the setting position being a position where the piece unit is set above the conveyor;

a plurality of capping chucks arranged in one or more arrays in a direction in which the receptacles are fed, the capping chucks chucking the caps mounted on the piece unit in a state where the piece unit is located at the setting position and above the conveyor;

a chuck driving means for vertically driving the chucks, the chuck driving means lowering the chucks form a standby position, which is above the piece unit, to a capping position where the receptacles are capped, when the piece unit separates from the conveyor, the chuck driving means capping the receptacles while moving in such a manner as to follow the conveyor;

the setting position being a position where the scratch pieces are set above the conveyor from a cap-receiving position aside the conveyor track; and

a first axially moving means and a second axially moving means, that the first and the second axially moving means being arranged an orthogonal direction to each other.

[0014] In a capping method

a conveyor sequentially conveys a plurality of receptacles at a constant rate, caps for the receptacles are first supplied along a cap transport passage and then sequentially transferred from a terminating end of the cap transport passage onto a piece unit wherein a plurality of scratch pieces are arranged in such a manner as to form one array or a number of arrays, the piece unit is movably supported by a piece unit transport mechanism and is moved to a setting position above the conveyor, and the caps mounted on pieces of the piece unit are chucked by capping chucks and attached to the receptacles, for capping,

a step of moving the piece unit to the setting position below the capping chucks in a substantially horizontal plane until the caps and the capping chucks are substantially aligned;

a step of lowering the capping chucks until the capping chucks chuck the caps;

a step of moving the capping chucks upward and thereafter moving the piece unit away from the setting position where the piece unit is below the capping chucks and the caps on the piece unit are aligned with the capping chucks;

a step of capping the receptacles while moving the capping chucks, down;

a step of opening the capping chucks, separating the capping chucks from the caps, and moving the capping chucks upward; and

a step of moving the piece unit to the setting position above the conveyor from a cap receiving position aside the conveyor track; and

a step of moving the piece unit by means of the transport mechanism in two directions which are orthogonal to each other, when moving between the cap receiving position and the setting position.

[0015] This summary of the invention does not necessarily describe all necessary features so that the invention may also be a sub-combination of these described features.

[0016] The invention can be more fully understood from the following detailed description when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a schematic front view of a linear capper according to one embodiment of the present invention.

FIG. 2A is schematic plan view of the linear capper depicted in FIG. 1.

FIG. 2B is a schematic diagram showing how the positional relationships of a scratch piece unit and scratch pieces are relative to a cap shoot.

FIG. 3A is a schematic plan view of a scratch piece transport mechanism which the embodiment uses for moving the scratch piece unit.

FIG. 3B is a schematic side view of what FIG. 3A shows.

FIG. 4 is a schematic front view of a gripper, which is employed in the linear capper shown in FIG. 1.

FIG. 5 is a schematic plan view of the gripper shown in FIG. 4.

FIG. 6 is a schematic side view of the gripper shown in FIGS. 4 and 5.

FIG. 7 is a diagram illustrating how the positional relationship of the scratch piece unit to a conveyor is in a horizontal plane.

FIG. 8A shows a schematic plan view illustrating how the scratch piece unit and capping chucks are in one state, and also shows a schematic side view of them.

FIG. 8B shows a schematic plan view illustrating how the scratch piece unit and the capping chucks are in another state, and also shows a schematic side view of them.

FIG. 9A shows a schematic plan view illustrating how the scratch piece unit and the capping chucks are in another state, and also shows a schematic side view of them.

FIG. 9B shows a schematic plan view illustrating how the scratch piece unit and the capping chucks are in another state, and also shows a schematic side view of them.

FIG. 9C shows a schematic plan view illustrating how the scratch piece unit and the capping chucks are in another state, and also shows a schematic side view of them.

[0017] An embodiment of the present invention will now be described with reference to the accompanying drawings.

[0018] As shown in FIG. 1, a capper 2 comprises a frame 4 that supports an operation unit 18 described later. As shown in FIG. 1 and 2A, a linear conveyor 6 is provided on the frame 4. Receptacles 8 are arranged on the conveyor 6 at predetermined intervals (pitches). In this state, the conveyor 6 is driven at a constant speed.

[0019] A rack 12 and a pair of parallel support rods 13 are provided on the frame 4 and extend in parallel to the conveying direction of the conveyor 6. The operation unit 18 is on the support rods 13 and is slidable along it. The operation unit 18 is provided with a first servo motor 16, and the driving shaft of this servo motor extends downward. As shown in FIG. 1, a pinion 14 is attached to the driving shaft. The pinion 14 is in engagement with the rack 12. In this manner, an operation unit-moving means 88 is formed.

[0020] The operation unit-moving means 88 operates as below. When the first servo motor 16 rotates in a predetermined direction, the torque generated thereby is transmitted to the pinion 14. By the rotation of this pinion

14, the operation unit 18 bearing the first servo motor 16 thereon linearly moves along the rack 12 and the support rods 13.

[0021] When the first servo motor 16 rotates in the reverse direction, the operation unit 18 moves substantially linearly in the direction opposite to the conveying direction of the conveyor 6. In other words, the operation unit 18 moves back and forth along the rack 12 and support rods 13 within a predetermined range of the frame 4.

[0022] The moving speed of the operation unit 18 is under the feedback control by the first servo motor 16. By this feedback control, the moving speed of the operation unit 18 can be controlled in accordance with the conveying speed of the conveyor 6. When the pinion 14 has reached a predetermined position at one end of the rack 12, the first servo motor 16 is stopped temporarily. The subsequent operation is optional--the first servo motor 16 may remain at rest or may be driven in the opposite direction. In other words, the operation unit 18 moves in two directions: one is the same as the conveying direction of the conveyor 6, and the other is opposite to that conveying direction. In either case, the moving speed of the operation unit 18 may be equal to, or greatly different from the driving speed of the conveyor 6. For example, the moving speed of the operation unit 18 can be arbitrarily controlled on the basis of the intervals at which the receptacles are arranged on the conveyor 6.

[0023] The operation unit 18 is also provided with a second servo motor 20 adjacent to the first servo motor 16. The driving shaft of this servo motor 20 is projected in the opposite direction to that of the first servo motor 16. That is, it extends upward in the operation unit 18. A timing pulley 22 is attached to the driving shaft of the second servo motor 20.

[0024] A ball screw 26 is located above the operation unit 18. The lower end of the ball screw 26 is substantially at the same level as the timing pulley 22 attached to the driving shaft of the second servo motor 20. A timing pulley 28 is attached to the lower end of the ball screw 26. A timing belt 24 is wound around both the timing pulley 28 and the timing pulley 22 of the second servo motor 20.

[0025] A bearing 30 is provided at the upper end of the ball screw 26. A base member 32 provided for the operation unit 18 is coupled to the ball screw 26 through the bearing 30. When the ball screw 26 rotates, this rotation causes the base member 32 to move linearly in a vertical direction.

[0026] The rear end portion of a capping head 34 is located above the base member 32. As shown in FIG. 2A, the front end portion of the capping head 34 is provided with three capping chucks 36. These capping chucks 36 are linearly arranged above the line of the conveyor 6 and extend downward. A timing pulley 38 is provided at the upper end of each capping chuck 36.

[0027] Three motors 42, preferably servo motors, are located between the front and rear ends of the capping head 34. These motors 42 are arranged linearly and have their driving shafts projected upward. A timing pulley 44 is attached to each driving shaft. A timing belt 46 is wound around each timing pulley 44 and the corresponding one of the timing pulleys 38 at the upper end of the capping chuck 36.

[0028] The lower end of the capping chuck 36 is a chuck portion 40 which is openable/closable and rotatable. A spindle 41 is provided between the upper and lower ends of the capping chuck 36. In this manner, a chuck driving means 90 is formed.

[0029] The chuck driving means 90 operates as follows. When the second servo motor 20 rotates, the torque is transmitted to the timing pulley 22, and then to the timing belt 24 which is in engagement with the timing pulley 22. This torque is transmitted to the ball screw 26 through the timing pulley 28. The rotation of the ball screw 26 causes the base member 32 to linearly move in the vertical direction. The capping head 34 attached to the base member 32 is raised or lowered in accordance with the vertical movement of the base member 32, so that the capping chuck 36 linearly moves in the vertical direction. When the capping chuck 36 moves, its moving distance is determined based on the feedback control of the second servo motor 20. The moving speed of the capping chuck 36 can be controlled in association with the operation of a scratch piece transport mechanism 52.

[0030] When the motor 42 adjacent to the capping head 34 is driven, the torque of the motor 42 is transmitted to the timing belt 46 through the timing pulley 44. The torque is then transmitted to the spindle 41 through the timing pulley 38, thereby rotating the spindle 41. As a result, the chuck portion 40 at the lower end of the capping chuck 36 is rotated. The torque applied by the chuck portion 40 is determined by controlling the motor 42. Therefore, when caps 48 are attached to receptacles 8, the tightened state of the caps 48 can be optimally controlled.

[0031] The stroke of the capping chuck 36, i.e., the distance for which the capping chuck 36 linearly moves in the vertical direction, can be freely determined. In addition, the rotation of the capping chuck 36 can be determined in such a manner that the caps 48 are secured to the receptacles 8 with an appropriate force.

[0032] As shown in FIGS. 2A and 2B, the frame 4 is provided with a cap transport passage 50 (a cap shoot) for successively supplying the caps 48. The cap transport passage 50 is disposed above the upper surface of the frame 4 in such a manner that its terminating end is along the conveying direction of the conveyor 6.

[0033] The caps 48 are sequentially supplied from a cap supply section (not shown) to the cap transport passage 50. In the state where the caps 48 are in mutual contact, the caps 48 slide down in a line along the cap transport passage 50 and come to the terminating end of the cap transport passage 50. A scratch piece unit 60, which is parallel to the upper surface of the frame 4,

is located in the neighborhood of the terminating end of the cap transport passage 50. The scratch piece unit 60 has three scratch pieces 58. At the terminating end of the cap transport passage 50, the caps 48 come into engagement with the scratch pieces 58 one by one.

[0034] The scratch piece unit 60 is provided with a scratch piece transport mechanism 52. The scratch piece unit 60 is movably supported by this transport mechanism 52. As shown in FIGS. 3A and 3B, the scratch piece transport mechanism 52 includes a first base 54 and a second base 56, both of which are rectangular. The first and second bases 54 and 56 cross at right angles and form a substantially "T"-shaped structure. A first axially moving means 84 extends in the longitudinal direction (X-axis direction) of the first base 54. Likewise, a second axially moving means 86 extends in the longitudinal direction (Y-axis direction) of the second base 56.

[0035] The first axially moving means 84 of the first base 54 includes a first linearly guiding device 62 (a first guide section) in the form of a rail. This rail extends in an X-axis direction. The X-axis direction is parallel to the conveying direction of the conveyor 6. A first ball screw 64 extends along the longitudinal center of the first linearly guiding device 62. A first slider 66 is provided for the first ball screw 64 and first linearly guiding device 62. The first slider 66 penetrates the first ball screw 64 and is in threadable engagement therewith. The first slider 66 is slidably coupled to the first linearly guiding device 62 (which is a rail).

[0036] A first servo motor 68 is coupled to one end of the first ball screw 64. When the first servo motor rotates in a predetermined direction, the torque produced thereby rotates the first ball screw 64. The rotation of the first ball screw 64 causes the first slider 66 to linearly slide along the first linearly guiding device 62 in the conveying direction of the conveyor 6. On the other hand, when the first servo motor 68 rotates in the direction opposite to the predetermined direction, the torque produced thereby rotates the first ball screw 64 in the opposite direction. This rotation of the first ball screw 64 causes the first slider 66 to linearly slide along the first linearly guiding device 62 in the direction opposite to the conveying direction of the conveyor 6.

[0037] The second axially moving means 86 of the second base 56 includes a second linearly guiding device 70 (a second guide section) in the form of a rail. This rail extends in a Y-axis direction. The Y-axis direction is orthogonal to the conveying direction of the conveyor 6. A second ball screw 72 extends along the longitudinal center of the second linearly guiding device 70. A second slider 74 is provided for the second ball screw 72 and second linearly guiding device 70. The second ball screw 72 penetrates the second slider 74 and is in threadable engagement therewith. The second slider 74 is slidably coupled to the second linearly guiding device 70 (which is a rail). A cam follower 78 (an engagement member) is attached to the second slider 74.

[0038] A second servo motor 76 is coupled to one end of the second ball screw 72. When the second servo motor rotates in a predetermined direction, the torque produced thereby rotates the second ball screw 74. The rotation of the second ball screw 74 causes the second slider 74 to linearly slide along the second linearly guiding device 70 in a direction approaching the first base 54. On the other hand, when the second servo motor 76 rotates in the direction opposite to the predetermined direction, the torque produced thereby rotates the second ball screw 72 in the opposite direction. This rotation of the second ball screw 72 causes the second slider 74 to linearly slide along the second linearly guiding device 70 in the direction away from the first base 54.

[0039] As shown in FIG. 3B, the scratch piece unit 60 and the first slider 66 are connected together. A pair of parallel rods 80, extending in parallel in the X-axis direction, are disposed on the lower surface of the scratch piece unit 60, as can be seen from FIGS. 3A and 3B. The cam follower 78 described above is sandwiched between the parallel rods 80 and in engagement with the scratch piece unit 60.

[0040] The cam follower 78 moves in such a manner as to follow the second slider 74. Therefore, when the second slider 74 moves in the Y-axis direction, the scratch piece unit 60 also moves in the same direction. When the scratch piece unit 60 moves in the X-axis direction, it moves along the parallel rods 80 in such a manner as to follow the first slider 66.

[0041] When the scratch piece transport mechanism 52 moves in the conveying direction of the conveyor 6, it approaches the terminating end of the cap transport passage 50. During this movement, the scratch piece transport mechanism 52 comes to a reception position where the scratch pieces 58 come into engagement with the caps 48. When the scratch piece transport mechanism 52 moves in the Y-axis direction, it comes to a setting position which is under the capping chucks 36 and coaxial therewith, in the state where the caps 48 are mounted on the scratch pieces 58. The setting position is a position where the caps 48 are chucked and transferred to the chuck portions 40 of the capping chucks 36.

[0042] As can be seen from the above, the scratch piece transport mechanism 52 is movable in two directions within a predetermined horizontal range, one direction being the X-axis direction which is along the conveying direction of the conveyor 6, and the other direction being the Y-axis direction orthogonal to the conveying direction of the conveyor 6.

[0043] In the above embodiment, the cam follower 78 was described as an engagement member disposed between the scratch piece unit 60 and the second slider 74. However, the cam follower 78 may be replaced with a bearing or another member formed of resin or brass as long as the alternative member allows the scratch piece unit 60 to move in a predetermined direction.

[0044] When the capper 2 caps the receptacles 8 arranged on the conveyor 6, grippers 10 shown in FIG. 2A

hold the receptacles 8 one by one. As shown in FIG. 2A, the grippers 10 arranged on the conveyor 6 are three in number, like the capping chucks 36 and the scratch pieces 38.

[0045] As shown in FIGS. 4 through 6, each gripper 10 is provided with a guide section 92 which is formed as a rail. As shown in FIGS. 5 and 6, a pair of sliders 94, which are away from each other by a predetermined distance, are slidable along the guide section 92. A cylinder 96 is located between the sliders 94 and extends along the guide section 92. A joint 98 is attached to that one end of the cylinder 96. A pair of first links 100 are provided for the tip end of the joint 98. The first ends of these first links 100 are pivotally coupled to the joint 98 by means of a first pivotal coupling section 102. At the second ends, the first links 100 are connected to second links 106, respectively. The second ends of the first links 100 and the first ends of the second links 106 are pivotally coupled by means of second pivotal coupling sections 104. Third pivotal coupling sections 108 are provided at appropriate positions on the second links 106. The third pivotal coupling sections 108 are coupled to a base 113 shown in FIGS. 4 and 6. A pair of gripper bases 110 are connected to appropriate positions of the second links 106. Preferably, the gripper bases 110 are each shaped as "C" and face each other.

[0046] The cylinder 96 moves the joint 98 relative to the sliders 94 in the conveying direction of the conveyor 6, i.e., rightward as viewed in FIG. 5. This movement opens the first links 100. To be more specific, the angle formed by the first links 100 changes from acute to obtuse. In accordance with the opening movement of the first links 100, the second links 106 move, with the third pivotal coupling sections 108 as fulcrums. As a result, the second pivotal coupling sections 104 move away from each other, and the gripper bases 110 move in the closing direction. In this manner, a receptacle 8 is held.

[0047] The cylinder 96 moves the joint 98 relative to the sliders 94 in the direction opposite to the conveying direction of the conveyor 6, i.e., leftward as viewed in FIG. 5. This movement closes the first links 100. To be more specific, the angle formed by the first links 100 becomes more acute. In accordance with the closing movement of the first links 100, the second links 106 move, with the third pivotal coupling sections 108 as fulcrums, in such a manner that the second pivotal coupling sections 104 move closer to each other. Accordingly, the gripper bases 110 move in the opening direction. In this manner, the receptacle 8 is released.

[0048] As can be seen from the above, the gripper bases 110 move to the receptacle 8 in such a manner that the movements of them are simultaneous and symmetric. As compared to the case where a single gripper base is provided, the movements of the gripper bases can be controlled with high accuracy. Since the receptacle 8 can be handled gently, the liquid in the receptacle 8 is prevented from gushing.

[0049] Each gripper 10 has a pair of brackets 112. These brackets 112 are attached to the operation unit 18, as shown in FIGS. 4 through 6. Therefore, when the operation unit 18 moves in the conveying direction of the conveyor 6, the gripper 10 moves in the same direction, following the operation unit 18. Conversely, when the operation unit 18 moves in the direction opposite to the conveying direction of the conveyor 6, the gripper 10 moves in the same direction (i.e., the direction opposite to the conveying direction of the conveyor 6), following the operation unit 18.

[0050] A description will be given as to how the capper 2 caps the receptacles 8, referring to FIGS. 7 through 9.

[0051] In FIG. 7, (a) illustrates how the caps 48 are sequentially transferred from the cap transport passage to the scratch piece unit 60, (b) illustrates how the scratch piece unit 60 is moved in the conveying direction of the conveyor 6, (c) illustrates how the scratch pieces 58 of the scratch piece unit 60 are arranged on the conveyance passage of the conveyor 6, and (d) illustrates how the scratch piece unit 60 is moved in the direction opposite to the conveying direction of the conveyor 6.

[0052] In FIG. 8A, (a) is a plan view illustrating how the scratch piece unit 60, which holds the caps 48 at the scratch pieces 58, is moved to the region below the capping chucks 36, and (b) is a side view of what is shown in (a). In FIG. 8B, (a) is a plan view illustrating how the scratch piece unit 60, which holds the capping chucks 36 at the scratch pieces 58, is located in the region below the capping chucks 36, and (b) is a side view of what is shown in (a).

[0053] In FIG. 9A, (a) is a plan view illustrating how the capping chucks 36 chuck the caps 48 mounted on the scratch pieces 58, and (b) is a side view of what is shown in (a). In FIG. 9B, (a) is a plan view illustrating how the caps 48 chucked by the capping chucks 36 are moved upward from the scratch piece 58, and (b) is a side view of what is shown in (a). In FIG. 9C, (a) is a plan view illustrating how the scratch piece unit 60 is moved in the Y-axis direction from the position below the capping chucks 36, and (b) is a side view of what is shown in (a).

[0054] In the initial state of the capper 2 of the embodiment, the operation unit 18 is located at a position which is upstream with respect to the conveying direction of the conveyor 6 (i.e., the positive direction of the X axis). The caps 48 are at the terminating end of the cap transport passage 50 attached to the frame 4. The scratch piece unit 60 on the scratch piece transport mechanism 52 is at the upstream position and extends along the terminating end of the cap transport passage 50. The capping chucks 36 are in front of, and above the scratch piece unit 60. The chuck portions of the capping chucks 36 are in the open state and stationary (not rotating). The grippers 10 with which to grip the receptacles 8 are in the open state.

[0055] First of all, the receptacles 8 arranged at the predetermined intervals are fed downstream (in the positive direction of the X-axis) at a constant speed. Simul-

taneous with the conveyance by the conveyor 6, the first servo motor 16 is rotated. The operation unit 18 is moved downstream (in the positive direction of the X-axis) substantially at the same feeding speed as the conveyor 6. At the time, the scratch piece transport mechanism 52 is driven to move the scratch piece unit 60 to a position in the neighborhood of the terminating end of the cap transport passage 50. The scratch piece unit 60 moves to the downstream position of the conveyor 6 faster than the operation unit 18.

[0056] As shown in (a) of FIG. 7, the caps 48 are sequentially scratched with the scratch pieces 58 of the scratch piece unit 60. This scratching operation is executed beginning with the terminating end of the cap transport passage 50. As a result, the caps are transferred onto the scratch pieces 58.

[0057] As shown in (b) of FIG. 7 and (a) and (b) of FIG. 8A, the scratch piece unit 60 is moved in the conveying direction of the conveyor 6 (in the positive direction of the X-axis). Subsequently, the array of the capping chucks 36 and the array of the caps 48 of the scratch pieces 58 of the scratch piece unit 60 are made parallel to each other.

[0058] Then, as shown in (c) of FIG. 7 and (a) and (b) of FIG. 8B, the scratch piece unit 60 is moved in the negative direction of the Y-axis, until the caps 48 on the scratch pieces 58 are just under the respective capping chucks 36. In this manner, the scratch piece unit 60 is moved to the setting position where the caps 48 are aligned with the capping chucks 36. Furthermore, the scratch piece unit 60 is moved in such a manner that its speed relative to the operation unit 18 becomes zero. In other words, the scratch piece unit 60 and the operation unit 18 are moved in the positive direction of the X-axis at the same speed.

[0059] As shown in (d) of FIG. 7 and (a) and (b) of FIG. 9A, the second servo motor 20 is rotated, and the capping chucks 36 are moved downward (in the negative direction of the Z-axis in (b) of FIG. 9A). Thereafter, the chuck portions 40 chuck the caps 48 on the scratch pieces 58.

[0060] As shown in (a) and (b) of FIG. 9B, the capping chucks 36 are moved upward (in the positive direction of the Z-axis in (b) of FIG. 9A). In other words, the caps 48 are separated from the scratch pieces 58.

[0061] As shown in (d) of FIG. 7 and (a) and (b) of FIG. 9C, the scratch piece unit 60 is moved from under the capping chucks 36 in the negative direction of the X-axis and the positive direction of the Y-axis. That is, the scratch piece unit 60 is returned to the original position shown in (a) of FIG. 7. At the time, the receptacles 8 are being linearly conveyed on the conveyor 6 in the region just under the capping chucks 36.

[0062] The motor 42 rotates the chuck portions 40 in the predetermined direction when the capping chucks 36 are being moved downward (in the negative direction of the Z-axis). The caps 48 are provided on the respective receptacles 48, with their tightness for the receptacles 8 being controlled in an optimal manner.

[0063] The cap portions 40 are opened, and the caps 48 are separated from the capping chucks 36. The capping chucks 36 are moved upward (in the positive direction of the Z-axis). The first servo motor 16 is stopped to temporarily stop the operation unit 18. Thereafter, the first servo motor 16 is rotated in the reverse direction to move the operation unit 18 toward a predetermined upstream position on the conveyor 6 (in the negative direction of the X-axis).

[0064] When the operation unit 18 has come to the predetermined upstream position on the conveyor 6, the first servo motor 16 is stopped to temporarily stop the operation unit 18. At the time, the scratch piece unit 60 is disposed upstream of the terminating end of the cap transport passage. Then, the operation unit 18 is moved again in the conveying direction of the conveyor 6 (in the positive direction of the X-axis). The caps 48 are sequentially mounted on the scratch pieces 58, as shown in (a) of FIG. 7.

[0065] The above process is repeated to sequentially provide the caps 48 on the receptacles 8.

[0066] In the initial state of the above process, the moving speed of the scratch piece unit 60 as measured in the positive direction of the X-axis is set higher than that of the operation unit 18 as measured in the same direction, and the caps 48 are sequentially mounted from the cap transport passage 50 by scratching. The present invention should not be limited to this. For example, the scratch piece transport mechanism 52 may be moved in such a manner as to follow the operation unit 18.

[0067] The steps of the above process need not be executed one by one. In other words, a given step can be executed without waiting for its preceding step to end. For example, the capping chucks 36 may cap a receptacle 8 when the scratch piece unit 60 is scratching another caps 48. If this is performed, the cappers 2 can be moved with high efficiency.

[0068] The caps 48 are transferred from the scratch piece unit 60 to the capping chucks 36. Then, the scratch piece transport mechanism 52 is actuated to move the scratch piece unit 60 from under the capping chucks 36. At the time, the caps 48 may be sensed to see if they are on the scratch pieces 58. If this sensing operation shows that the caps 48 remains on the scratch piece 58 (i.e., if a chucking error occurs), the entire capper 2 is brought to a halt.

[0069] The capping chucks 36 move upward after they receive the caps 48 from the scratch pieces 58 of the scratch piece unit 60. At the time, the caps 48 may be sensed to see if they are held on the scratch pieces 58. If they are not, a chucking error is determined, and the capper is brought to a halt. In this case, the chuck portions 40 may be associated with the cap transport passage 50 and scratch piece unit 60 so as to sense whether or not the caps 48 are arranged on the scratch pieces 58 of the scratch piece unit 60.

[0070] In the embodiment described above, the scratch unit 60 has three scratch pieces 58, but this number does not restrict the present invention. The scratch piece unit 60 may have only one scratch piece, two scratch pieces, four or more scratch pieces. Where four or more scratch pieces arranged on the scratch piece unit 60 are provided in an array, the moving distance of the operation unit 18 is set to be long. In addition, the scratch pieces 58 need not be arranged in a single array. They may be arranged in a number of arrays, such as two or three arrays. Likewise, the capping chucks 36 may be arranged in a number of arrays so as to cap a large number of receptacles 8 at a time. In this case, three conveyors 6 may be provided. Alternatively, a wide conveyor 6 in which three arrays of receptacles 8 are arranged may be provided.

[0071] In the embodiment described above, the ball screw 26 is used for vertically moving the capping chucks 36. The ball screw 26 may be replaced with a cylinder device, if so desired. Likewise, the first and second axially moving means 84 and 86 may employ cylinder devices in place of the ball screws 64 and 72. Conversely, each gripper 10 may employ a ball screw in place of the cylinder device 96.

[0072] In the capper 2 of the above embodiment, the receptacles 8 must be arranged on the conveyor 6 at regular intervals and moved. This, however, does not restrict the present invention. For example, the grippers 10 of the above embodiment may be designed to operate independently of one another and to sense the receptacles 8 before these receptacles 8 reach them. To be more specific, the operation unit 18 is moved in the conveying direction of the conveyor 6 in accordance with the arrangement of the receptacles 8, and the grippers 10 are individually opened or closed. With this structure, the receptacles 8 are held reliably even if they are shifted from their right positions, and reliable capping of the receptacles 8 is thus ensured. Since the receptacles 8 need not be accurately arranged, a means for doing so, such as an attachment chain, is not required.

[0073] In the embodiment of the present invention, the caps 48 are provided for the receptacles 8 by rotating the capping chucks 36 until the caps 48 are tightened on the receptacles 8. The capping method is not limited to such rotation and may be pushing in, for example. In this alternative capping method, the capping chucks 36 are not rotated but vertically moved by means of the second servo motor 20. By utilization of this vertical movement, the caps 48 are pushed in the receptacles 8.

[0074] To summarize the above, the following advantages can be pointed out with respect to the linear capper 2 of the embodiment.

[0075] When the receptacles 8 on the conveyor 6 are carried, a unit that includes movable parts is not located above them. With this structure, the receptacles 8 are not adversely affected by a dropping component, and the abraded particles from the operation unit 18 do not attach to, or enter the receptacles 8.

[0076] The scratch piece unit 60 is movable in a horizontal plane only. Since this structure leads to a simple mechanism, the capper 2 can be made of a small number of parts and manufactured at low cost.

[0077] Since the operation unit 18 and the scratch piece unit 60 are small, especially in light of the dimension measured in the conveying direction of the conveyor 6, an efficient operation is ensured. In addition, the capper 2 can be compact in size.

[0078] Furthermore, the weight of the scratch pieces 58 does not have adverse effects on the positions of the caps 48. The caps 48 can be reliably arranged at their intended positions.

[0079] The capping chucks 36 are vertically moved by means of the second servo motor 20. With this structure, the stroke of the chuck portions 40 can be controlled arbitrarily, and the scratch piece unit 60 need not be moved vertically. In addition, the cap supply section and the cap transport passage may be simple in mechanism and can be manufactured at low cost.

Claims

1. A linear capper (2) comprising:

a conveyor (6) which sequentially conveys a plurality of receptacles (8) at a constant rate;
a cap transport passage (50) along which caps (48) for the receptacles are supplied;
a scratch piece unit (60) in which a plurality of scratch pieces (58) for receiving the caps (48) are arranged in a single plane such that one array or a number of parallel arrays are formed;
a scratch piece unit transport mechanism (52) which movably supports and transports the scratch piece unit (60) between a cap-receiving position and a setting position in a substantially horizontal plane, the cap-receiving position being a position where the caps (48) are sequentially transferred from a terminating end of the cap transport passage (50) to the scratch pieces (58) of the scratch piece unit (60);
a plurality of capping chucks (36) arranged in one or more arrays in a direction in which the receptacles (8) are fed, the capping chucks (36) chucking the caps (48) mounted on the scratch pieces (58) in a state where the scratch piece unit (60) is located at the setting position above the conveyor (6); and
chuck driving means (90) for vertically driving the capping chucks (36), the chuck driving means (90) lowering the capping chucks (36) from a standby position, which is above the scratch piece unit (60), to a capping position where the receptacles (8) are capped, when the scratch piece unit (60) separates from the set-

ting position, the chuck driving means (90) capping the receptacles (8) while moving in such a manner as to follow the conveyor (6),

characterized by:

the setting position being a position where the scratch pieces unit(60) is set above the conveyor (6) from a cap-receiving position aside the conveyor track;
said scratch piece unit transport mechanism (52) having:

first axially moving means (84) and second axially moving means (86), said first and said second axially moving means (84, 86) being arranged in an orthogonal direction to each other.

2. A linear capper according to claim 1, **characterized in that**:

said first axially moving means (84) comprising:

a first guide section (62) shaped as a rail;
a first slider (66) attached to the scratch piece unit (60) and being slidable along the first guide section (62); and a first driving member (68) being slidable on the first guide section (62) and transmitting power to the first slider (66); and
said second axially moving means(86) comprising:

a second guide section (70) shaped as a rail; a second slider (74) being slidable along the second guide section (70); an engagement member (78) attached to the second slider (74) and in engagement with a lower portion of the scratch piece unit (60); and a second driving member (76) which transmits power to the second slider (74) and thereby causes the second slider (74) to slide on the second guide section (70),
at least one of the first and second driving members (68, 76) being operated to slide at least one of the first and second sliders (66, 74) along the first and second guide sections (62, 70),
said engagement member (78) and said first slider (66) permitting the scratch piece unit (60) to move in a predetermined horizontal plane.

3. A linear capper according to claim 1,
characterized in that said chuck driving means (90) includes:

a rotating member (20);
a driving force-converting member (26) which converts rotation of the rotating member (20) into linear movement; and
a capping head (34) provided for the driving force-converting member (26) and comprising the capping chucks (36),
said chuck driving means (90) vertically moving the capping chucks (36).

4. A capping method wherein a conveyor (6) sequentially conveys a plurality of receptacles (8) at a constant rate, caps (48) for the receptacles are first supplied along a cap transport passage (50) and then sequentially transferred from a terminating end of the cap transport passage (50) onto a scratch piece unit (60) in which a plurality of scratch pieces (58) are arranged in such a manner as to form one array or a number of arrays, the scratch piece unit (60) is movably supported by a scratch piece unit transport mechanism (52) and is moved to a setting position below the capping chucks (36) in a substantially horizontal plane until the caps (48) and the capping chucks (36) are substantially aligned, and the capping chucks (36) are lowered until the capping chucks (36) chuck the caps (48) which are mounted on the scratch pieces (58) of the scratch piece unit (60), the capping chucks (36) are moved upward and thereafter the scratch piece unit (60) is moved away from the setting position where the scratch piece unit (60) is below the capping chucks (36) and the caps (48) on the scratch piece unit (60) are aligned with the capping chucks (36), the caps are attached to the receptacles (8), for capping, while moving the capping chucks (36) down, and the capping chucks (36) are opened and separated from the caps (48), and the capping chucks (36) are moved upward,

said capping method **characterized by** comprising:

said scratch piece unit (60) is moved to the setting position above the conveyor (6) from a cap-receiving position aside the conveyor track; and the scratch piece unit (60) is moved by means of the scratch piece unit transport mechanism (52) in two directions which are orthogonal to each other, when moving between the cap receiving position and the setting position.

Patentansprüche

1. Lineare Verschlussvorrichtung (2), welche umfasst:

ein Förderband (6), welches sequentiell eine

Vielzahl von Behältern (8) mit einer konstanten Rate fördert;
eine Passage (50) für den Verschlusskappentransport, entlang welcher die Verschlusskappen (48) für die Behälter geliefert werden;
eine Transporteinheit (60), an welcher eine Vielzahl von Transportelementen (58) zur Aufnahme von Verschlusskappen (48) in einer einzigen Ebene angeordnet ist, derart, dass eine reihenförmige Anordnung oder eine Anzahl von parallelen reihenförmigen Anordnungen gebildet wird;
ein Transportmechanismus (52) für eine Transporteinheit, welcher die Transporteinheit (60) beweglich unterstützt und zwischen einer Position, bei welcher die Verschlusskappen aufgenommen werden, und
einer Einstellposition transportiert, in einer im Wesentlichen horizontalen Ebene, wobei die Position, bei welcher die Verschlusskappen aufgenommen werden, eine Position ist, bei welcher die Verschlusskappen (48) sequentiell von einem Ausgangsende der Passage (50) für den Verschlusskappentransport aus zu den Transportelementen (58) der Transporteinheit (60) transferiert werden;
eine Vielzahl von Verschlussköpfen (36), welche in einer reihenförmigen Anordnung oder in mehreren reihenförmigen Anordnungen in einer Richtung angeordnet sind, in welcher die Behälter (8) zugeführt werden, wobei die Verschlussköpfe (36) die Verschlusskappen (48) aufnehmen, welche sich auf den Transportelementen (58) befinden, in einem Zustand, bei welchem sich die Transporteinheit (60) an der Einstellposition über dem Förderband (6) befindet; und
ein Hilfsmittel (90) für den Antrieb der Verschlussköpfe, um die Verschlussköpfe (36) vertikal zu bewegen, wobei das Hilfsmittel (90) für den Antrieb der Verschlussköpfe die Verschlussköpfe (36) von einer Stand-by Position aus, welche sich über der Transporteinheit (60) befindet, zu einer Verschlussposition absenkt, bei welcher die Behälter (8) verschlossen werden, wenn sich die Transporteinheit (60) von der Einstellposition trennt,

wobei das Hilfsmittel (90) für den Antrieb der Verschlussköpfe die Behälter (8) verschliesst, während es sich derart bewegt, dass es dem Förderband (6) folgt,
dadurch gekennzeichnet, dass:

die Einstellposition eine Position ist, in welcher die Transporteinheit (60) über dem Förderband (6)
eingestellt wird, von einer Position aus, bei welcher Verschlusskappen aufgenommen werden, abseits der Bahn des Förderbandes;
der genannte Transportmechanismus (52) für die Transporteinheit aufweist:

ein erstes sich axial bewegendes Hilfsmittel (84) und
ein zweites sich axial bewegendes Hilfsmittel (86), wobei das genannte erste und das genannte zweite sich axial bewegende Hilfsmittel (84, 86) in einem rechten Winkel zueinander angeordnet sind.

2. Lineare Verschlussvorrichtung gemäss Anspruch 1,
dadurch gekennzeichnet, dass:

das genannte erste sich axial bewegene Hilfsmittel (84) umfasst:

einen ersten Führungsbereich (62), welcher die Form einer Schiene aufweist; einen ersten Schlitten (66), welcher an der Transporteinheit (60) befestigt ist, und welcher entlang des ersten Führungsbereiches (62) gleiten kann; und ein erstes Antriebselement (68), welches auf dem ersten Führungsbereich (62) gleiten kann, und welches Antriebskraft auf den ersten Schlitten (66) überträgt; und
das genannte zweite sich axial bewegene Hilfsmittel (86) umfasst:

einen zweiten Führungsbereich (70), welcher die Form einer Schiene aufweist; einen zweiten Schlitten (74), welcher entlang dem zweiten Führungsbereich (70) gleiten kann; ein Eingreifelement (78), welches am zweiten Schlitten (74) befestigt ist, und welches in Verbindung mit dem unteren Abschnitt der Transporteinheit (60) steht; und ein zweites Antriebselement (76), welches Antriebskraft auf den zweiten Schlitten (74) überträgt, und welches **dadurch** bewirkt, dass der zweite Schlitten (74) auf dem zweiten Führungsbereich (70) gleitet,

wobei mindestens eines von dem ersten und dem zweiten Antriebselement (68, 76) betrieben wird, um mindestens einen von dem ersten und dem zweiten Schlitten (66, 74) entlang dem ersten und dem zweiten Führungsbereich (62, 70) gleitend zu bewegen,
wobei das genannte Eingreifelement (78) und der genannte erste Schlitten (66) der Transporteinheit (60) ermöglichen, sich in einer vorherbestimmten

horizontalen Ebene zu bewegen.

3. Lineare Verschlussvorrichtung gemäss Anspruch 1, **dadurch gekennzeichnet, dass** das genannte Hilfsmittel (90) für den Antrieb des Verschlusskopfes umfasst:

ein sich drehendes Element (20);
ein Element (26) für die Umwandlung der Antriebskraft, welches die Drehung des sich drehenden Elementes (20) in eine lineare Bewegung umwandelt; und
einen Verschlussmaschinenoberteil (34), welcher für das Element (26) für die Umwandlung der Antriebskraft vorgesehen ist, und welcher die Verschlussköpfe (36) umfasst,

wobei das genannte Hilfsmittel (90) für den Antrieb der Verschlussköpfe die Verschlussköpfe (36) vertikal bewegt.

4. Verschlussverfahren, wobei ein Förderband (6) im Wesentlichen eine Vielzahl von Behältern (8) mit einer konstanten Rate transportiert, wobei Verschlusskappen (48) für die Behälter zuerst entlang einer Passage (50) für den Verschlusskappentransport geliefert werden und dann sequentiell von einem Ausgangsende von der Passage (50) für den Verschlusskappentransport aus auf die Transporteinheit (60) transferiert werden, auf welcher eine Vielzahl von Transportelementen (58) derart angeordnet sind, dass eine reihenförmige Anordnung oder eine Anzahl von reihenförmigen Anordnungen gebildet wird, wobei die Transporteinheit (60) beweglich unterstützt wird durch einen Transportmechanismus (52) für eine Transporteinheit und zu einer Einstellposition unter den Verschlussköpfen (36) transportiert wird, in einer im Wesentlichen horizontalen Ebene, bis die Verschlusskappen (48) und die Verschlussköpfe (36) im Wesentlichen ausgerichtet sind, und die Verschlussköpfe (36) abgesenkt werden bis die Verschlussköpfe (36) die Verschlusskappen (48) aufnehmen, welche auf den Transportelementen (58) der Transporteinheit (60) aufgebracht sind, wobei die Verschlussköpfe (36) nach oben bewegt werden, und danach die Transporteinheit (60) von der Einstellposition weg bewegt wird, bei welcher die Transporteinheit (60) sich unter den Verschlussköpfen 36 befindet, und die Verschlusskappen (48) auf der Transporteinheit (60) mit den Verschlussköpfen (36) ausgerichtet sind, wobei die Verschlusskappen an den Behältern (8) zum Verschliessen befestigt werden, während sich die Verschlussköpfe (36) nach unten bewegen, und wobei die Verschlussköpfe (36) geöffnet und von den Verschlusskappen (48) getrennt werden, und wobei die Verschlussköpfe (36) nach oben bewegt werden, wobei das genannte Verschlussverfahren **dadurch gekennzeichnet ist, dass** es umfasst:

das Bewegen einer genannten Transporteinheit (60) zu der Einstellposition über dem Förderband (6) von einer Position aus, bei welcher die Verschlusskappen aufgenommen werden, abseits der Bahn des Förderbandes; und
das Bewegen einer Transporteinheit (60) mit Hilfe von einem Transportmechanismus (52) für eine Transporteinheit in zwei Richtungen, welche im rechten Winkel zueinander stehen, während sie sich zwischen der Position, bei welcher Verschlusskappen aufgenommen werden, und der Einstellposition bewegt.

Revendications

1. Capsulateur linéaire (2) comprenant :

un convoyeur (6) qui transporte séquentiellement une pluralité de réceptacles (8) à une vitesse constante ;
un passage de transport de capsule (50) le long duquel sont fournies des capsules (48) pour les réceptacles ;
une unité de pièces d'accroc (60) dans laquelle une pluralité de pièces d'accroc (58) pour recevoir les capsules (48) sont agencées dans un plan unique de sorte qu'un rang ou un nombre de rangs parallèles sont formés ;
un mécanisme de transport d'unité de pièces d'accroc (52) qui supporte de façon mobile et transporte l'unité de pièces d'accroc (60) entre une position de réception de capsule et une position de positionnement dans un plan sensiblement horizontal, la position de réception de capsule étant une position où les capsules (48) sont séquentiellement transférées à partir d'une extrémité de terminaison du passage de transport de capsule (50) jusqu'aux pièces d'accroc (58) de l'unité de pièces d'accroc (60) ;
une pluralité de mandrins de capsulage (36) agencés dans un ou plusieurs rangs dans une direction dans laquelle les réceptacles (8) sont alimentés, les mandrins de capsulage (36) serrant les capsules (48) montées sur les pièces d'accroc (58) dans un état où l'unité de pièces d'accroc (60) est située au niveau de la position de positionnement au-dessus du convoyeur (6) ; et
des moyens d'entraînement de mandrin (90) pour entraîner verticalement les mandrins de capsulage (36), les moyens d'entraînement de mandrin (90) baissant les mandrins de capsulage (36) à partir d'une position d'attente, qui est au-dessus de l'unité de pièces d'accroc (60), jusqu'à une position de capsulage où les

réceptacles (8) sont capsulés, lorsque l'unité de pièce d'accroc (60) se sépare de la position de positionnement, les moyens d'entraînement de mandrin (90) capsulant les réceptacles (8) tout en se déplaçant de manière telle à suivre le convoyeur (6),

caractérisé par :

la position de positionnement étant une position où l'unité de pièces d'accroc (60) est positionnée au-dessus du convoyeur (6) à partir d'une position de réception de capsule à côté de la piste de convoyeur ;
ledit mécanisme de transport d'unité de pièces d'accroc (52) ayant :

des premiers moyens se déplaçant de façon axiale (84) et des seconds moyens se déplaçant de façon axiale (86), lesdits premiers et lesdits seconds moyens se déplaçant de façon axiale (84, 86) étant agencés dans une direction orthogonale les uns par rapport aux autres.

2. Capsulateur linéaire selon la revendication 1, **caractérisé en ce que** :

lesdits premiers moyens se déplaçant de façon axiale (84) comprenant :

une première section de guidage (62) en forme de rail ; un premier coulisseau (66) attaché à l'unité de pièces d'accroc (60) et pouvant coulisser le long de la première section de guidage (62) ; et un premier élément d'entraînement (68) pouvant coulisser sur la première section de guidage (62) et transmettant une puissance au premier coulisseau (66) ; et
lesdits seconds moyens se déplaçant de façon axiale (86) comprenant :

une seconde section de guidage (70) en forme de rail ; un second coulisseau (74) pouvant coulisser le long de la seconde section de guidage (70) ; un élément de prise (78) attaché au second coulisseau (74) et en prise avec une partie inférieure de l'unité de pièces d'accroc (60) ; et un second élément d'entraînement (76) qui transmet une puissance au second coulisseau (74) et ainsi force le second coulisseau (74) à coulisser sur la seconde section de guidage (70),
au moins un parmi les premier et second éléments d'entraînement (68, 76) étant actionné pour faire coulisser au moins un parmi les premier et second coulisseaux (66, 74) le long des première et seconde sections de guidage (62, 70),
ledit élément de prise (78) et ledit premier coulisseau (66) permettant à l'unité de pièces d'accroc (60) de se déplacer dans un plan horizontal prédéterminé.

3. Capsulateur linéaire selon la revendication 1, **caractérisé en ce que** lesdits moyens d'entraînement de mandrin (90) comprennent :

un élément rotatif (20) ;
un élément de conversion de force d'entraînement (26) qui convertit la rotation de l'élément rotatif (20) en mouvement linéaire ; et
une tête de capsulage (34) fournie pour l'élément de conversion de force d'entraînement (26) et comprenant les mandrins de capsulage (36),
lesdits moyens d'entraînement de mandrin (90) déplaçant verticalement les mandrins de capsulage (36).

4. Procédé de capsulage, dans lequel un convoyeur (6) transporte séquentiellement une pluralité de réceptacles (8) à une vitesse constante, des capsules (48) pour les réceptacles sont d'abord fournis le long d'un passage de transport de capsule (50) et ensuite transférées séquentiellement à partir d'une extrémité de terminaison du passage de transport de capsule (50) jusqu'à une unité de pièces d'accroc (60) dans laquelle une pluralité de pièces d'accroc (58) sont agencées de manière telle à former un rang ou un nombre de rangs, l'unité de pièces d'accroc (60) est supportée de façon mobile par un mécanisme de transport d'unité de pièces d'accroc (52) et est déplacée jusqu'à une position de positionnement en dessous des mandrins de capsulage (36) dans un plan sensiblement horizontal jusqu'à ce que les capsules (48) et les mandrins de capsulage (36) soient sensiblement alignés, et les mandrins de capsulage (36) sont baissés jusqu'à ce que les mandrins de capsulage (36) serrent les capsules (48) qui sont montées sur les pièces d'accroc (58) de l'unité de pièces d'accroc (60), les mandrins de capsulage (36) sont déplacés vers le haut et après cela l'unité de pièces d'accroc (60) est déplacée pour s'éloigner de la position de positionnement où l'unité de pièces d'accroc (60) est en dessous des mandrins de capsulage (36) et les capsules (48) sur l'unité de pièces d'accroc (60) sont alignées avec les mandrins de capsulage (36), les capsules sont attachées aux réceptacles (8), pour le capsulage, tout en déplaçant les mandrins de capsulage

(36) vers le bas, et les mandrins de capsulage (36) sont ouverts et séparés des capsules (48), et les mandrins de capsulage (36) sont déplacés vers le haut,

ledit procédé de capsulage **caractérisé en ce que** :

ladite unité de pièces d'accroc (60) est déplacée jusqu'à la position de positionnement au-dessus du convoyeur (6) à partir d'une position de réception de capsule à côté de la piste de convoyeur ; et

l'unité de pièces d'accroc (60) est déplacée au moyen du mécanisme de transport d'unité de pièces d'accroc (52) dans deux directions qui sont orthogonales l'une par rapport à l'autre, lorsqu'elle se déplace entre la position de réception de capsule et la position de positionnement.

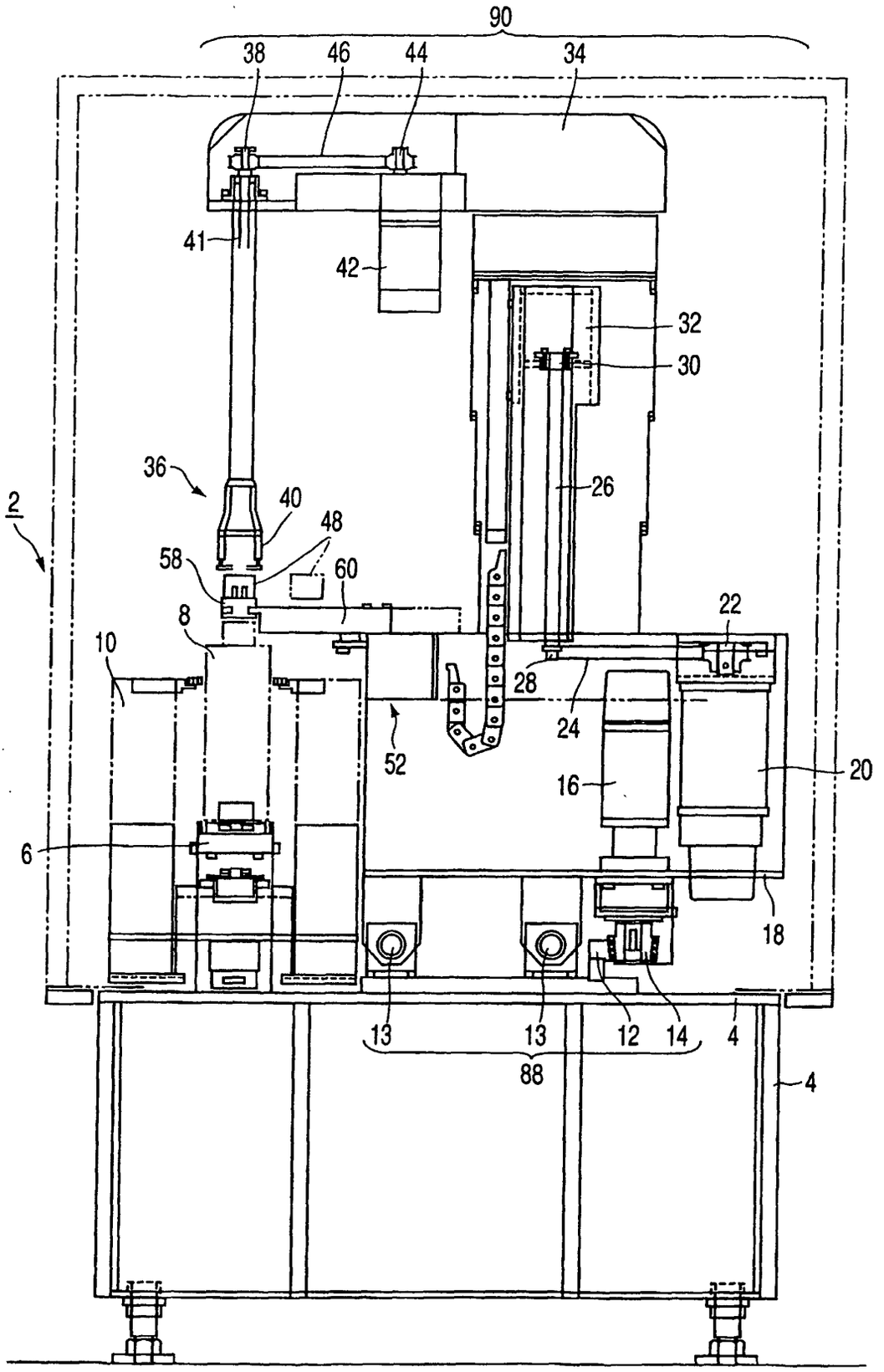

90
38
46
44
34
41
42
32
30
36
26
2
40
48
58
60
22
8
10
28
24
52
20
16
6
18
13
13
12
14
4
88
4

FIG. 1

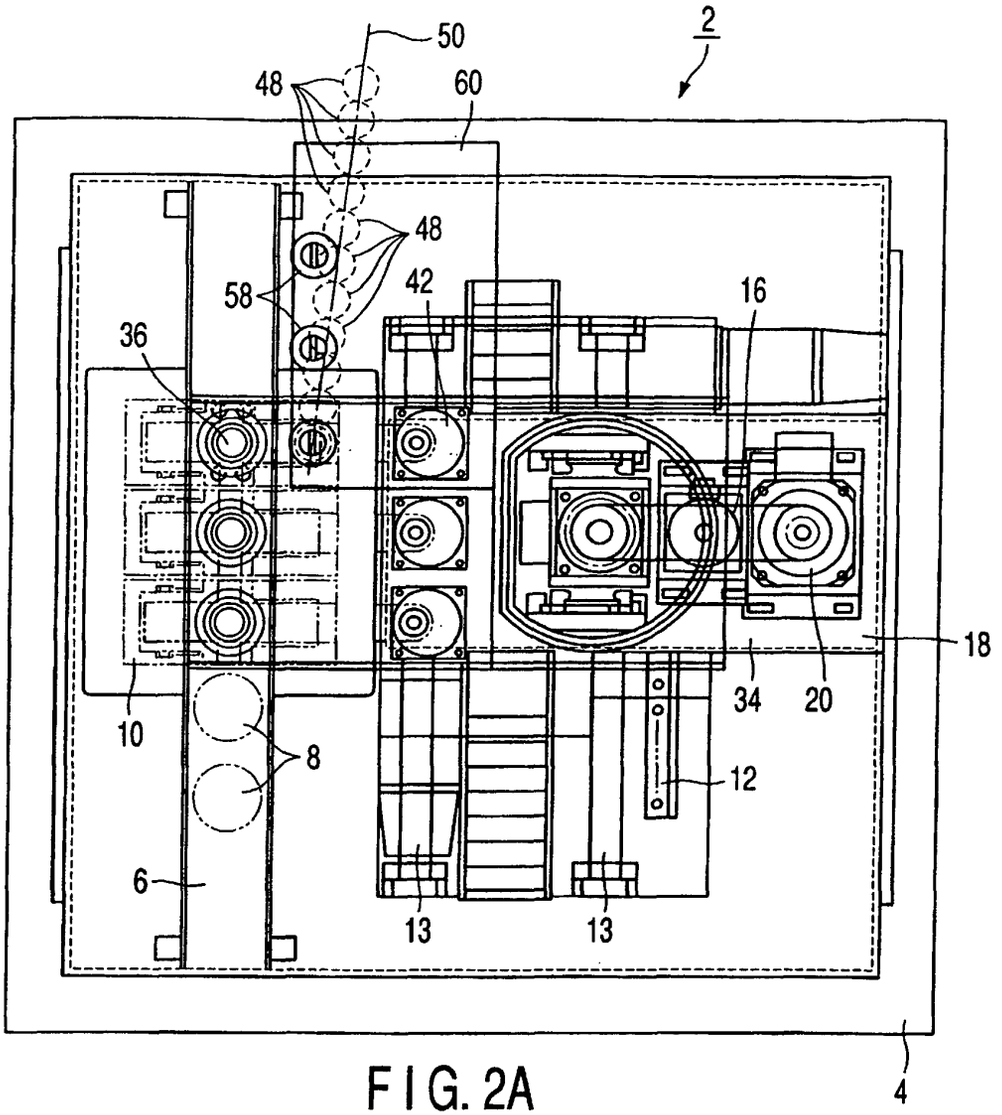
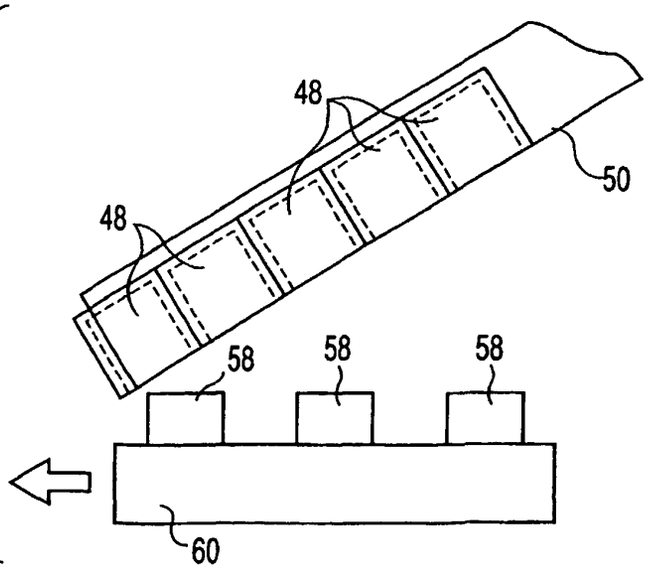


FIG. 2A

FIG. 2B



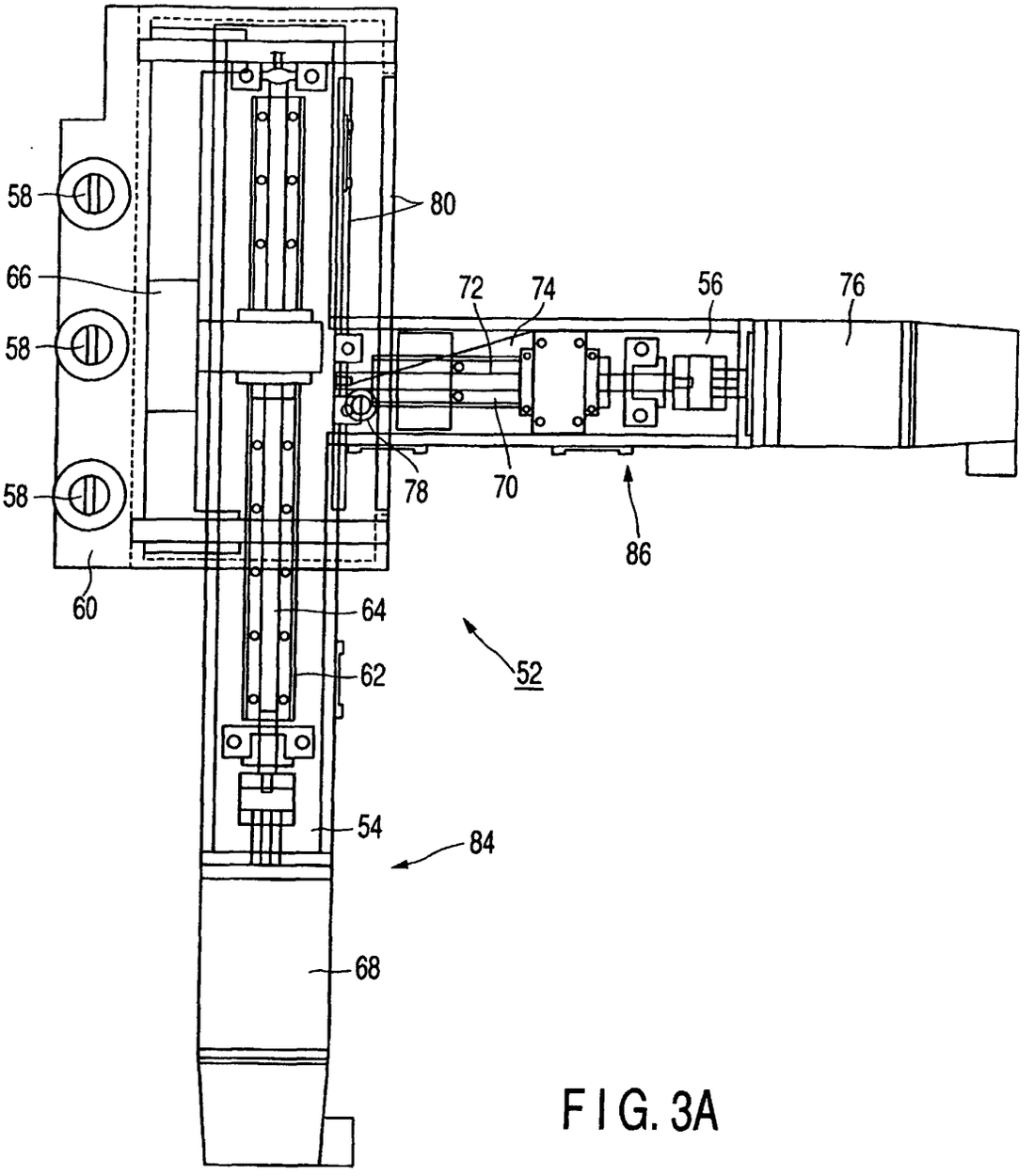

58
66
58
58
60
80
72
74
56
76
78
70
86
64
62
52
54
84
68

FIG. 3A

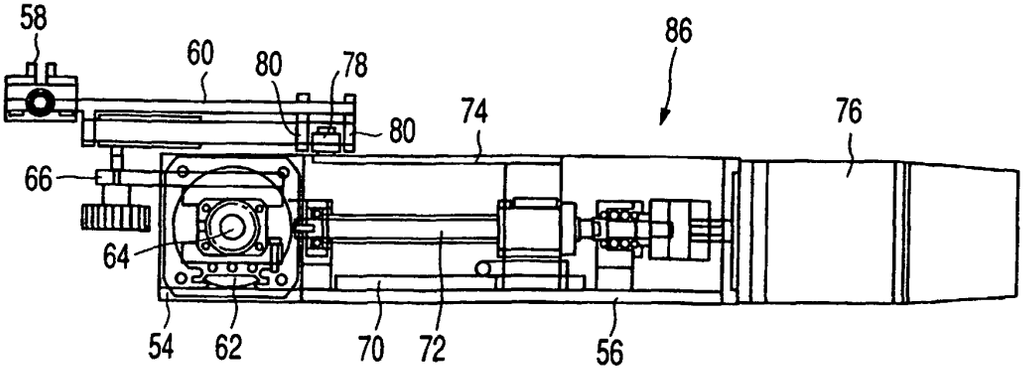

58
60
80
78
86
74
76
66
64
54
62
70
72
56

FIG. 3B

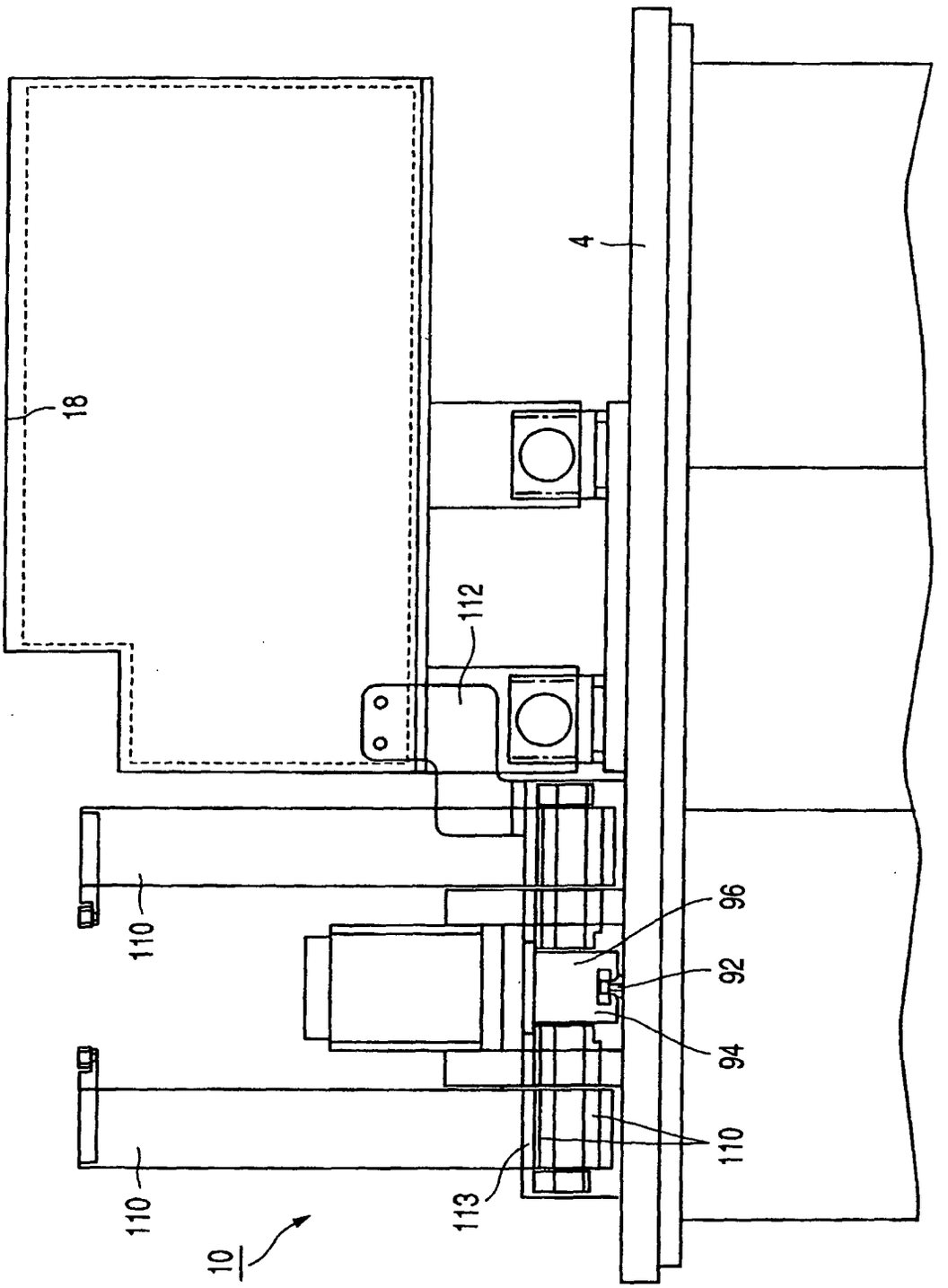


FIG. 4

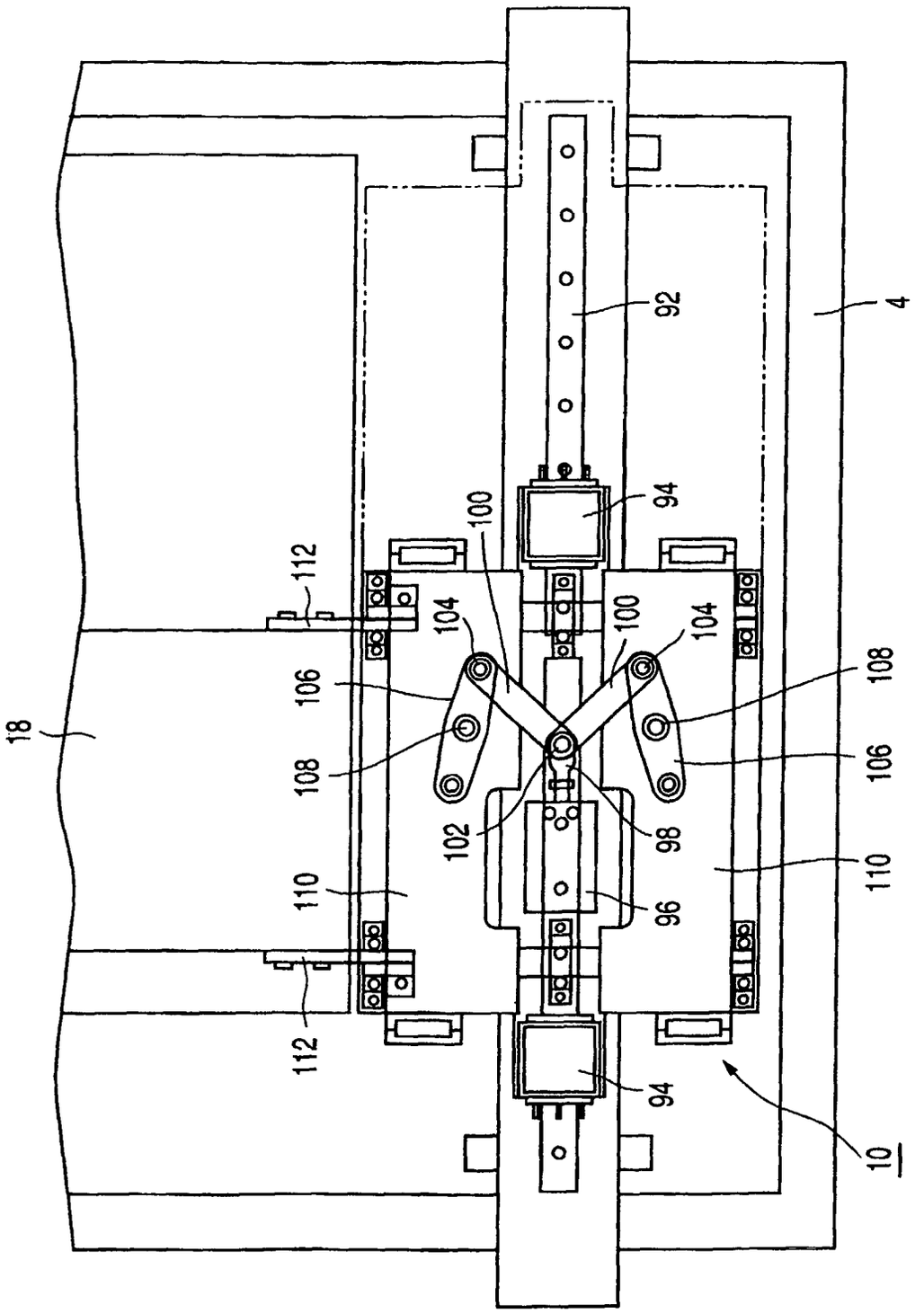

92
4
94
100
112
104
100
104
108
106
18
108
106
102
98
110
110
96
112
94
10

FIG. 5

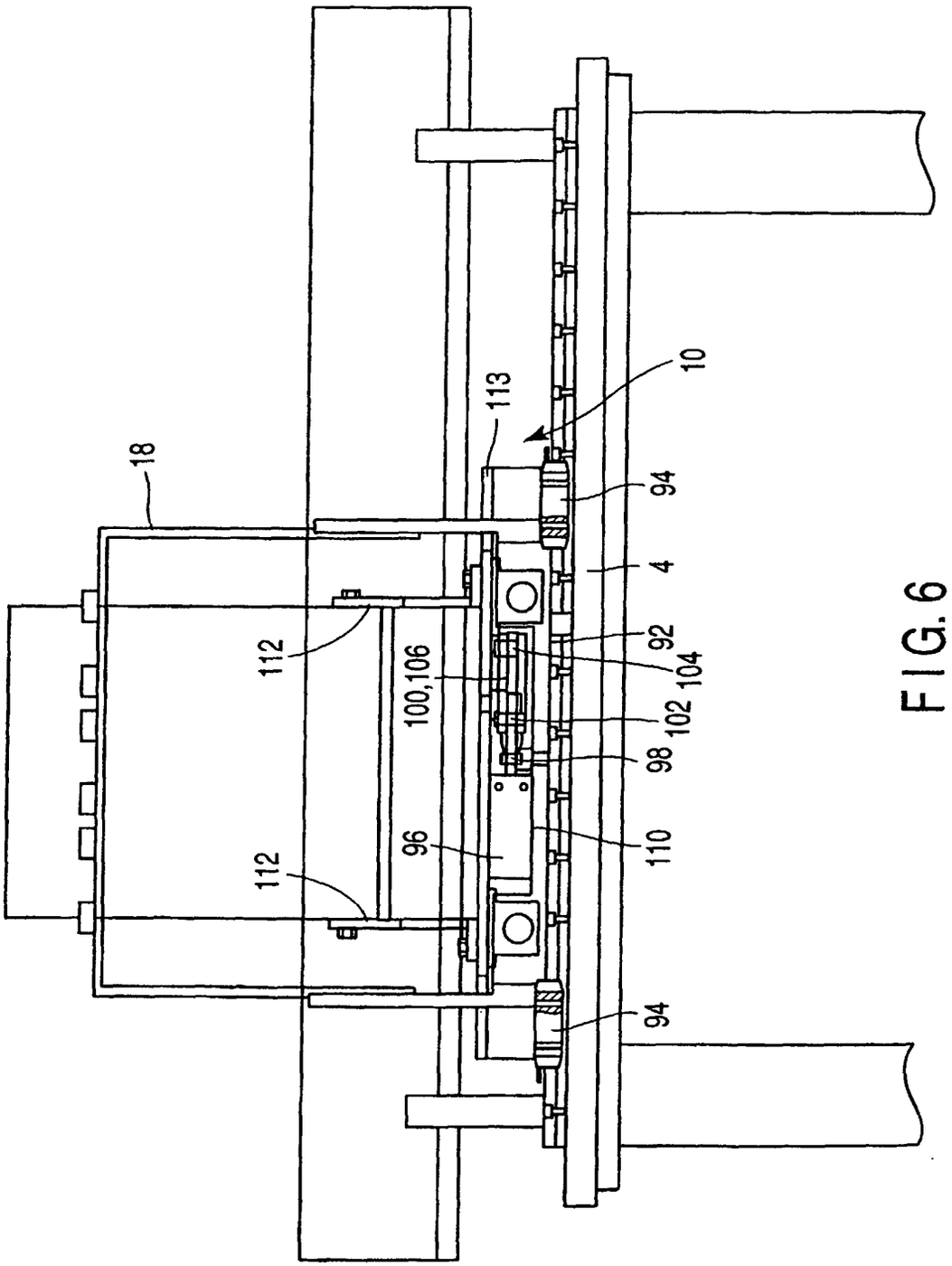


FIG. 6

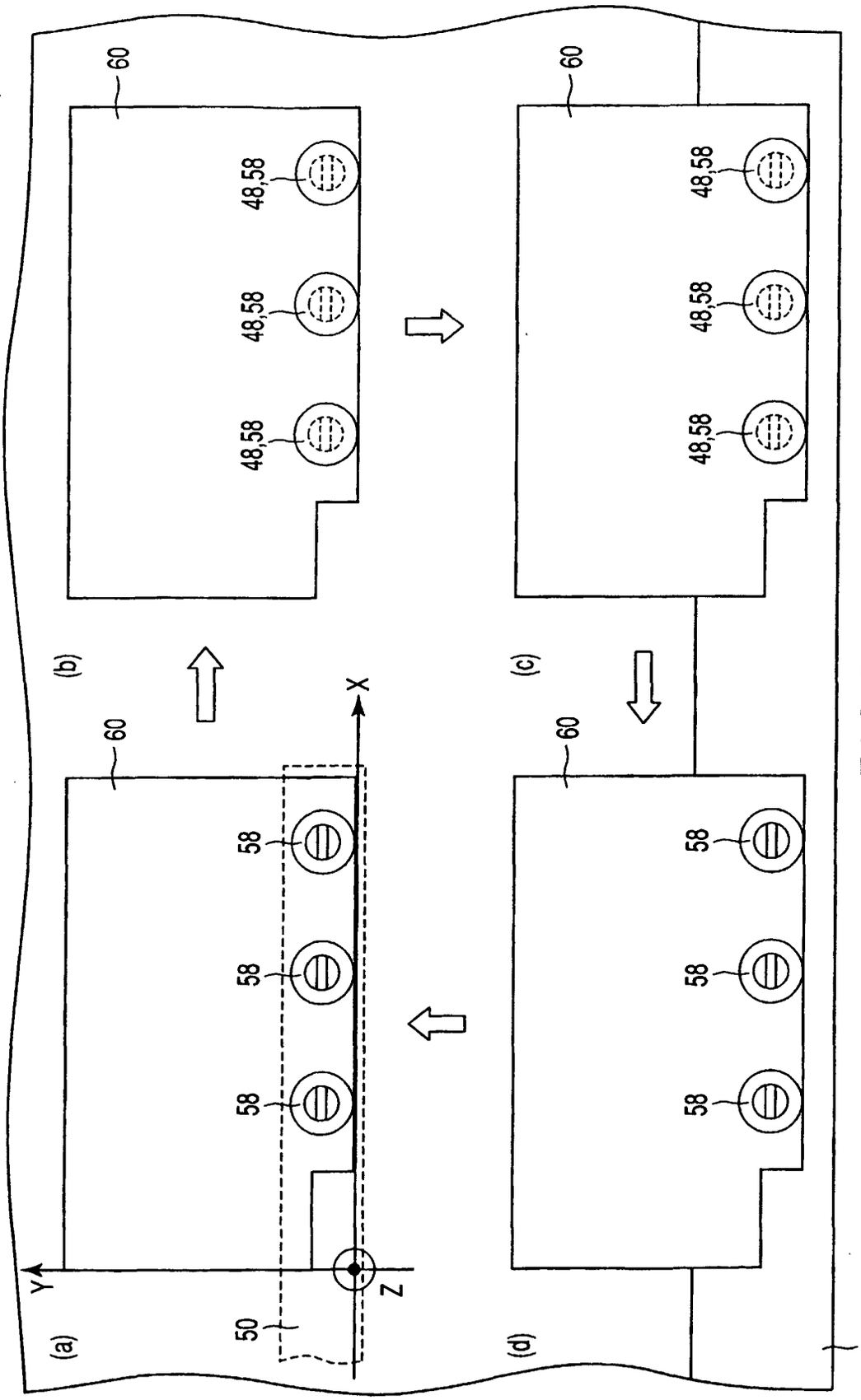


FIG. 7

FIG. 8A

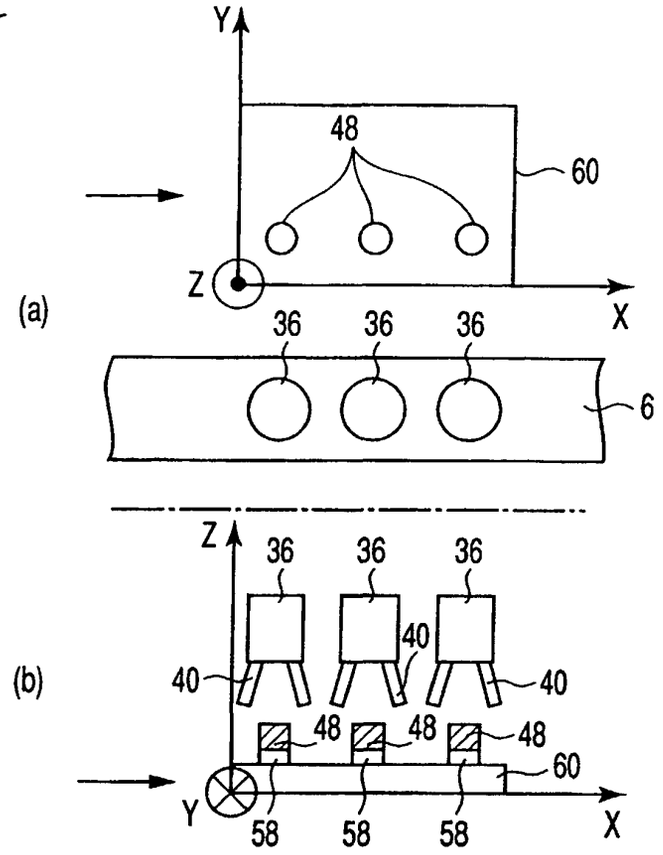

(a)
Y
48
60
Z
X
36
36
36
6
(b)
Z
36
36
36
40
40
40
48
48
48
60
Y
X
58
58
58

FIG. 8B

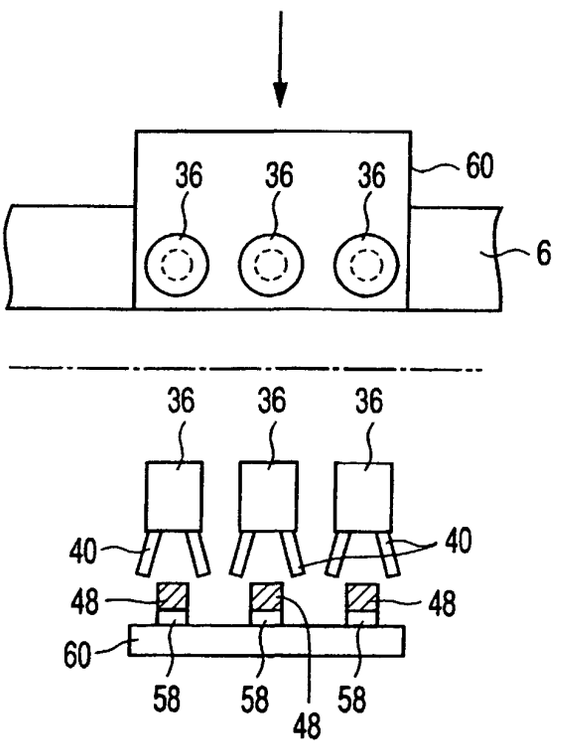

(a)
36
36
36
60
6
(b)
36
36
36
40
40
48
48
60
58
58
48
58

FIG. 9A

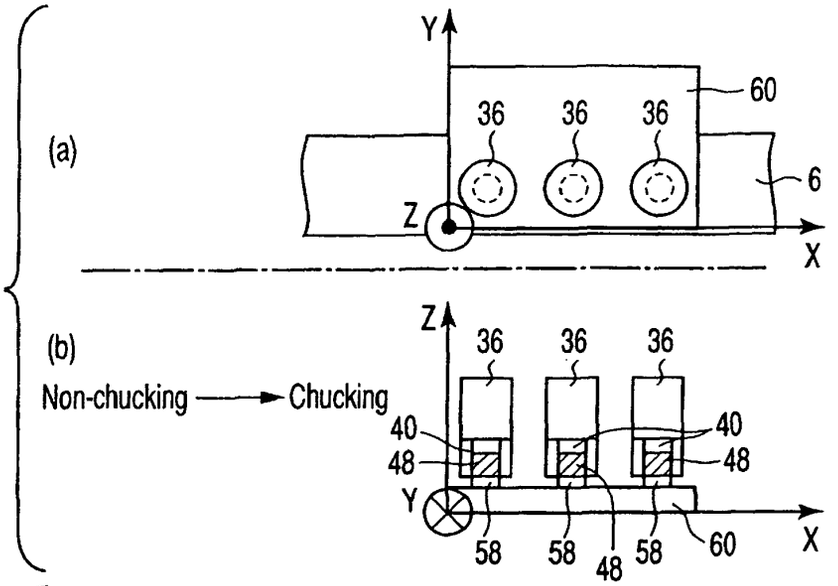


FIG. 9B

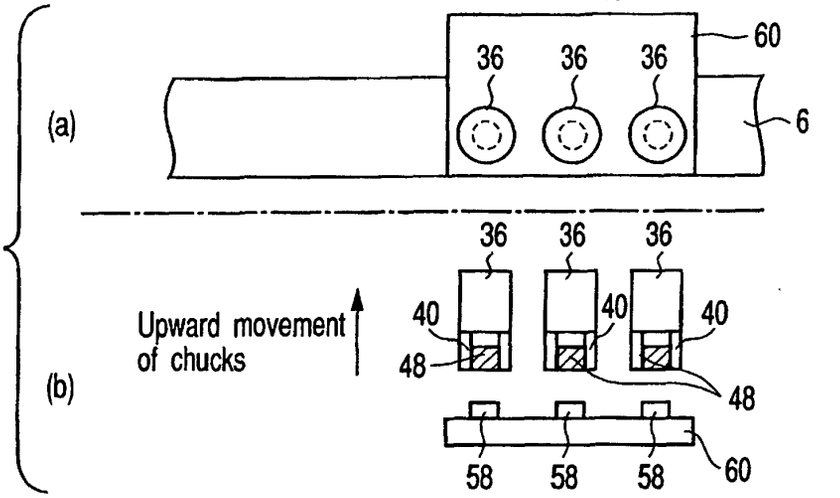


FIG. 9C