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SEMICONDUCTOR PACKAGE PROCESSING APPARATUS AND CONTROL METHOD THEREOF

[0001] This application claims the benefit of Korean Patent Application No. 10-2006-0085551, filed on September 6, 2006, which is hereby incorporated by reference as if fully set forth herein.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to a semiconductor package processing apparatus and a control method thereof, and more particularly, to a semiconductor package processing apparatus and a control method thereof that can efficiently transfer a semiconductor package.

Discussion of the Related Art

[0003] Generally, a semiconductor package is manufactured through processes of attaching a semiconductor chip formed with a large scale integrated circuit having a transistor, a capacitor, etc., onto a semiconductor substrate made of silicon, molding a resin to an upper surface of the semiconductor chip to protect the semiconductor chip, and bonding a lead frame onto the substrate so as to be electrically connected with the semiconductor chip.

[0004] The semiconductor package manufactured through the above processes is seated and aligned on a table, and then is subjected to a singulation process in which the semiconductor

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package is transferred to a sawing device and cut to be individually separated. Thereafter, the semiconductor package undergoes a process of inspecting a processed state of the semiconductor package. Such a series of processes are performed by a semiconductor package processing apparatus.

[0005] Specifically, the semiconductor package processing apparatus performs a process of transferring the semiconductor package to a proper position to process or inspect the semiconductor package.

[0006] A semiconductor package suction device provided in a conventional semiconductor package processing apparatus includes eight pickers in one set. Accordingly, when a pitch of the pickers and a pitch of the table are different from each other, in order to suck the semiconductor packages, the suction device itself should move eight times in the X-axis direction, and the respective pickers should move vertically in the Y-axis direction at a time interval.

[0007] Thus, if using the pickers provided in the suction device moving in a unitary body, the suction device should repeatedly move. As a result, productivity is decreased.

[0008] Especially, also when a pitch of the semiconductor packages received in the table and a pitch of the semiconductor packages received in the tray are different from each other, the suction device should be driven eight

times in the X-axis direction, and the eight pickers should be independently driven in the Y-axis direction.

SUMMARY OF THE INVENTION

[0009] Accordingly, the present invention is directed to a semiconductor package processing apparatus and a control method thereof that substantially obviates one or more problems due to limitations and disadvantages of the related art.

[0010] An object of the present invention is to provide a semiconductor package processing apparatus and a control method thereof that can efficiently transfer semiconductor packages even when a pitch of pickers for transferring the semiconductor packages is different from a pitch of a table in which the semiconductor packages are received.

[0011] Another object of the present invention is to provide a semiconductor package processing apparatus and a control method thereof that can increase a unit per hour of the semiconductor packages and decrease a manufacturing cost.

[0012] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention may be

realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0013] To achieve these objects and other advantages and in accordance with the purpose of the invention, as embodied and broadly described herein, a semiconductor package processing apparatus comprises: first package receiving portions to receive a plurality of semiconductor packages therein; second package receiving portions to receive the semiconductor packages, transferred from the first package receiving portions, therein; plural picker units to suck the semiconductor packages received in the first package receiving portions and transfer the semiconductor packages to the second package receiving portions; and a conveying device to transfer the plural picker units individually in a transferring direction of the semiconductor packages.

[0014] The conveying device may transfer the picker units so that pickers provided in the picker units can suck or release the semiconductor packages at positions corresponding to a pitch of the first package receiving portions and a pitch of the second package receiving portions.

[0015] The semiconductor packages received in the first package receiving portions may be transferred in plural groups by the plural picker units.

[0016] The pickers may be configured to suck or release the plural semiconductor packages at the same time.

[0017] Each of the picker units may include a main body which forms an external shape, at least one pair of pickers including two pickers, and a picker moving device to move the pickers vertically.

[0018] The picker moving device may be configured to vertically move the two pickers of the pair of pickers interlockingly with each other.

[0019] The semiconductor package processing apparatus may further comprise at least one inspection device to inspect a processed state of the semiconductor packages.

[0020] The picker units may include a first picker unit and a second picker unit. While a part of the semiconductor packages are inspected at an area above the inspection device after being sucked by the first picker unit, the other part of the semiconductor packages may be sucked by the second picker unit.

[0021] The picker units may individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and the conveying device may transfer the picker units having sucked the semiconductor packages to an area above the inspection device in sequence.

[0022] The picker units may individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and the conveying device may transfer the picker units having sucked the semiconductor packages to areas above plural inspection devices at the same time.

[0023] While a picker provided in one of the picker units sucks the semiconductor package received in the first package receiving portions, a picker provided in the other picker unit may move closely to an area above the other semiconductor package received in the first package receiving portions.

[0024] The first package receiving portions may be provided on a table, the second package receiving portions may be provided on a tray, and the inspection device may be mounted between the table and at least one tray.

[0025] The conveying device may include a driving motor, and a power transmission member to convert a rotational force of the driving motor into rectilinear movement of the respective picker units.

[0026] In another aspect of the present invention, a control method of a semiconductor package processing apparatus, comprises: sucking plural semiconductor packages using plural picker units; transferring the picker units individually in a transferring direction of the semiconductor

packages to transfer the semiconductor packages from first package receiving portions, in which the semiconductor packages are received, to second package receiving portions corresponding to the first package receiving portions; and seating the semiconductor packages transferred by the picker units in the second package receiving portions.

[0027] The control method may further comprise inspecting the semiconductor packages sucked by the picker units using an inspection device to inspect a processed state of the semiconductor packages.

[0028] While the sucking step of sucking the semiconductor packages received in the first package receiving portions is performed by a part of the picker units, the inspecting step may be performed to inspect the semiconductor packages sucked by the other part of the picker units.

[0029] In the sucking step, the picker units may individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and in the transferring step, the picker units may be transferred to an area above the inspection device in sequence to inspect the sucked semiconductor packages.

[0030] In the sucking step, the picker units may individually and simultaneously suck the semiconductor packages received in the first package receiving portions one

by one at once, and in the transferring step, the picker units having sucked the semiconductor packages may be transferred to areas above plural inspection devices at the same time.

[0031] In the sucking step, while a picker provided in one of the picker units sucks the semiconductor package received in the first package receiving portions, a picker provided in the other picker unit may move closely to an area above the other semiconductor package received in the first package receiving portions.

[0032] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0034] FIG. 1 is a block diagram illustrating a constitution of a semiconductor package processing apparatus in accordance with the present invention;

[0035] FIG. 2 is a sectional view illustrating a first embodiment of a picker unit provided in the semiconductor package processing apparatus in accordance with the present invention;

[0036] FIGs. 3A and 3B are operational views illustrating a first embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 2;

[0037] FIGs. 4A and 4B are operational views illustrating a second embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 2;

[0038] FIGs. 5A and 5B are operational views illustrating a third embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 2;

[0039] FIGs. 6A and 6B are operational views illustrating a fourth embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 2;

[0040] FIGs. 7A to 7C are operational views illustrating a fifth embodiment of an operation of processing the

semiconductor package using the picker unit depicted in FIG. 2;

[0041] FIG. 8 is a sectional view illustrating a second embodiment of a picker unit provided in the semiconductor package processing apparatus in accordance with the present invention;

[0042] FIG. 9 is an operational view illustrating a first embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 8;

[0043] FIGs. 10A to 10D are operational views illustrating a second embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 8;

[0044] FIG. 11 is an operational view illustrating a third embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 8;

[0045] FIGs. 12A and 12B are operational views illustrating a fourth embodiment of an operation of processing the semiconductor package using the picker unit depicted in FIG. 8; and

[0046] FIG. 13 is a sectional view illustrating a third embodiment of a picker unit provided in the semiconductor package processing apparatus in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0047] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

[0048] An overall constitution of a semiconductor package processing apparatus according to the present invention will be briefly described with reference to FIG. 1.

[0049] The semiconductor package processing apparatus includes an on-loader A to load a strip of a plurality of semiconductor packages thereon, a cutting part B to cut the strip into the respective semiconductor packages, and an inspection part G to inspect a processed state of the respective semiconductor packages.

[0050] The semiconductor package processing apparatus further includes a first conveying part C to transfer the semiconductor package between the on-loader A and the cutting part B, and a first loading part D to load the semiconductor package, which has been cut and transferred, thereon.

[0051] The semiconductor package processing apparatus further includes a second conveying part E to transfer the semiconductor package loaded on the first loading part D to the inspection part G to inspect the semiconductor package, and a second loading part F to load the semiconductor package, which has been inspected by the inspection part G, thereon.

[0052] A first embodiment of a picker unit provided in the semiconductor package processing apparatus according to the present invention and a first embodiment of an operation of processing the semiconductor package using the picker unit will now be described with reference to FIGs. 2, 3A and 3B.

[0053] The semiconductor package processing apparatus according to the present invention includes plural picker units 100 and 200 to move a semiconductor package 1 by sucking the same, a conveying device 50 to move the picker units 100 and 200, and an inspection device 40 to inspect the semiconductor package.

[0054] The semiconductor package processing apparatus further includes a table 20 to receive a plurality of semiconductor packages before they are inspected by the inspection device 40, and a tray 30 to receive the semiconductor packages which have been inspected by the inspection device 40.

[0055] The table 20 is provided with first package receiving portions 21 to receive the semiconductor packages. The table 20 includes a turn table which can move left and right or can be turned. A pitch of the first package receiving portions may have a value different from a pitch of the pickers.

[0056] The tray 30 may be provided with second package receiving portions 31 to receive the semiconductor packages

while having a pitch different from the first package receiving portions 21.

[0057] The conveying device functions to convey the plural picker units individually in a transferring direction of the semiconductor packages. Also, the conveying device conveys the picker units so that the pickers provided in the picker units can suck and release the semiconductor packages at positions corresponding to the pitch of the first package receiving portions and the pitch of the second package receiving portions.

[0058] The conveying device 50 includes a driving motor 52 to move the picker units, a screw 51 which is axially coupled to the driving motor 52, and a moving block 53 which moves rectilinearly by the rotation of the screw 51.

[0059] If a control device (not shown) controlling the semiconductor package processing apparatus drives the driving motor 52, the screw 51 rotates in a rotating direction of the motor, and the moving block 53 moves rectilinearly on the screw. The picker unit coupled to the moving block 53 moves in the X-axis direction.

[0060] The inspection device 40 is mounted between the table 20 and the tray 30. One or more inspection device may be provided on the substantially same plane as the table 20 and the tray 30. The inspection device may be mounted in a position opposite to the moving direction of the picker unit

shown in FIGs. 3A and 3B, i.e., in a left side from the table in the drawings.

[0061] The inspection device 40 may include an image recognition device (not shown) to measure a shape of the semiconductor package, and a control part (not shown) to process information recognized by the image recognition device. The image recognition device takes a photograph of the shape of the semiconductor package, and the control part determines the processed state of the semiconductor package based on data of the photographed shape of the semiconductor package.

[0062] The information of the processed state of the inspected semiconductor package is stored in the control part, and is used in the process of separating the inferior semiconductor packages.

[0063] The plural picker units of this embodiment are composed of two picker units, i.e., the first picker unit 100 and the second picker unit 200. Accordingly, the semiconductor packages received in the first package receiving portions in one row can be transferred in two groups by the first picker unit and the second picker unit. If the picker units are provided in more than two, the number of groups of the transferred semiconductor packages become more than two.

[0064] The first picker unit 100 includes a main body 150 which forms an external shape, pickers 110, 120, 130 and 140 which are mounted such that a portion of each picker protrudes downward from the main body 150, and a picker moving device 160 which is mounted in the main body 150 to move the pickers vertically.

[0065] Particularly, the picker unit is composed of two pairs of pickers, i.e., a first pair of pickers 110 and 120 and a second pair of pickers 130 and 140. The first pair of pickers and the second pair of pickers are respectively composed of two pickers.

[0066] The first pair of pickers 110 and 120 have a first picker 110 and a second picker 120, and the second pair of pickers 130 and 140 have a third picker 130 and a fourth picker 140. The first picker 110 and the second picker 120 move interlockingly with each other in the Y-axis direction, and the third picker 130 and the fourth picker 140 move interlockingly with each other in the Y-axis direction. The interlocking movement of the two pickers by the picker moving device will be described later.

[0067] The second picker unit 200 is composed of two pairs of pickers, i.e., a third pair of pickers 210 and 220 and a fourth pair of pickers 230 and 240. The third pair of pickers have a fifth picker 210 and a sixth picker 220, and the fourth pair of pickers have a seventh picker 230 and an

eighth picker 240. Since the movement of the second picker unit 200 is performed identically to the movement of the first picker unit 100, the detailed explanation thereof will be omitted.

[0068] The first picker unit 100 and the second picker unit 200 are connected to the conveying device 50, and the whole picker units move in the X-axis direction by the conveying device 50. In other words, the individual pickers do not separately move in the X-axis direction, but the whole pickers composing one picker unit move together in the X-axis direction.

[0069] The picker moving device will be explained based on the picker moving device provided at the first pair of pickers. The picker moving device 160 includes a first rack gear 163a provided at the first picker 110, a second rack gear 163b provided at the second picker 120, a pinion gear 161 provided between the first rack gear 163a and the second rack gear 163b, and a picker motor 165 to drive the pinion gear 161.

[0070] When sucking the semiconductor packages, the pickers are kept in a stationary state in the X-axis direction, and move vertically in the Y-axis direction to vacuum suck the semiconductor packages. The control part (not shown) drives the picker motor 165 so as to lift up the semiconductor packages by vacuum sucking the same.

[0071] If the picker motor 165 is driven, the pinion gear 161 rotates. If the pinion gear 161 rotates in the clockwise direction, the first rack gear 163a engaged with the pinion gear 161 moves downward, and thus the first picker 110 moves downward from its original position. On the other hand, the pinion gear 161 moves the second rack gear 163b provided at the second picker upward, and thus the second picker moves upward from its original position.

[0072] The present invention is not restricted to the above embodiment. The respective pinion gears and rack gears may be provided corresponding to the respective picker motors. By such a configuration, the plural picker units may move separately in the X-axis direction, and the pickers provided in the respective picker units may move separately in the Y-axis direction.

[0073] Hereinafter, a process of inspecting the processed state of the semiconductor package in the first embodiment of the semiconductor package processing apparatus according to the present invention will be described.

[0074] The first to fourth pickers respectively suck the semiconductor packages in sequence one by one. The first picker unit 100 itself, having the first to fourth pickers, moves to an area above the inspection device 40. When the first picker unit 100 moves to the area above the inspection device 40 after sucking the semiconductor packages, the

second picker unit 200 moves to an area above the table 20 to suck the semiconductor packages.

[0075] The inspection device 40 inspects the processed state of the semiconductor packages sucked by the first picker unit 100. While the inspection device 40 inspects the semiconductor package, the fifth to eighth pickers composing the second picker unit 200 respectively suck the semiconductor packages in sequence one by one.

[0076] The semiconductor packages of the first picker unit 100, which have been inspected by the inspection device 40, are transferred to the area above the tray 30. While the semiconductor packages of the first picker unit 100 are transferred to the area above the tray 30, the semiconductor packages sucked by the second picker unit 200 are transferred to the area above the inspection device 40.

[0077] The inspected semiconductor packages, i.e., the semiconductor packages sucked by the first picker unit 100 are received in the second package receiving portions 31 of the tray 30. While the semiconductor packages are received in the second package receiving portions 31, the inspection device 40 inspects the processed state of the semiconductor packages sucked by the second picker unit.

[0078] Resultantly, while a part of the semiconductor packages are inspected by the inspection device 40, the other part of the semiconductor packages are sucked by the pickers

or seated on the package receiving portions, thereby increasing a unit per hour (UPH). In other words, the operations of differently processing the plural picker units in the different positions at the same time are performed successively and repeatedly.

[0079] It is not necessary to always simultaneously move the first picker unit and the second picker unit. In other words, a time taken to inspect the semiconductor packages using the inspection device may be set differently from a time taken to suck the semiconductor packages using the picker unit.

[0080] Hereinafter, a second embodiment of the operation of inspecting the processed state of the semiconductor packages using the first embodiment of the picker unit according to the present invention will be described with reference to FIGs. 4A and 4B.

[0081] The first picker unit 100 and the second picker unit 200 suck the semiconductor packages from the first package receiving portions of the table one by one at the same time. Particularly, the first picker 110 and the fifth picker 210 respectively suck one semiconductor package at the same time in the set positions in consideration of the pitch by which the semiconductor packages are received.

[0082] The first picker unit 100 and the second picker unit 200 are transferred simultaneously in the X-axis

direction, correspondingly to the pitch of the semiconductor packages received in the first package receiving portions 21.

[0083] Next, the second picker 120 of the first picker unit and the sixth picker 220 of the second picker unit respectively suck another semiconductor package at the same time. Similarly, the first picker unit and the second picker unit are transferred in the X-axis direction by the conveying device. Also at this time, the picker units are transferred correspondingly to the pitch of the semiconductor packages received in the first package receiving portions.

[0084] Through the above operations, the first picker unit 100 and the second picker unit 200 suck eight semiconductor packages over four operations, and accordingly a plurality of semiconductor packages are divided into two groups.

[0085] Thereafter, the first picker unit 100 is transferred to the area above the inspection device, and the inspection device inspects the semiconductor packages sucked by the first picker unit 100. At this time, the semiconductor packages sucked by the second picker unit 200 are in a stand-by state before the processed state of the semiconductor packages is inspected.

[0086] The inspection device may include a first inspection device and a second inspection device corresponding to the first picker unit and the second picker unit. Particularly, both the first inspection device and the

second inspection device may be provided between the table and the tray. While the semiconductor packages sucked by the first picker unit are inspected by the first inspection device, the semiconductor packages sucked by the second picker unit may be inspected by the second inspection device. Resultantly, the two picker units simultaneously suck the semiconductor packages one by one, and the two inspection devices simultaneously inspect the processed state of the semiconductor packages.

[0087] If the inspection by the inspection device is terminated, the first picker unit and the second picker unit are transferred to the area above the tray provided with the second package receiving portions. The semiconductor packages sucked by the first picker unit and the second picker unit are received in the second package receiving portions.

[0088] At this time, a pitch between the semiconductor packages sucked by the first picker unit and the second picker unit may be different from the pitch of the second package receiving portions. In this case, the semiconductor packages should be received in the second package receiving portions while moving the first picker unit and the second picker unit in the X-axis direction.

[0089] For instance, the first picker 110 and the fifth picker 210 put down the respectively sucked semiconductor

packages at the same time in the second package receiving portions in the set positions in consideration of the pitch of the second package receiving portions.

[0090] Thereafter, the first picker unit 100 and the second picker unit 200 are simultaneously transferred in the X-axis direction, correspondingly to the pitch of the second package receiving portions 31.

[0091] Next, the second picker 120 of the first picker unit and the sixth picker 220 of the second picker unit put down the respectively sucked semiconductor packages at the same time in the second package receiving portions. By repeatedly performing the above operations, the semiconductor packages sucked by the first picker unit and the second picker unit are received corresponding to the pitch of the second package receiving portions.

[0092] Hereinafter, a third embodiment of the operation of inspecting the processed state of the semiconductor packages using the first embodiment of the picker unit according to the present invention will be described with reference to FIGs. 5A and 5B.

[0093] Also in this embodiment, the two picker units suck the semiconductor packages one by one at once. However, in this embodiment, while one picker in the same picker unit sucks the semiconductor package, another picker is in a stand-by state for sucking the semiconductor package.

[0094] Particularly, the first picker 110 of the first picker unit and the fifth picker 210 of the second picker unit suck the semiconductor packages at the same time. At this time, the third picker 130 of the first picker unit and the seventh picker 230 of the second picker unit move downward, and are ready to suck the semiconductor packages. After the first picker 110 and the fifth picker 210 suck the semiconductor packages and lift up the semiconductor packages in the Y-axis direction to a predetermined height, the first picker unit 100 and the second picker unit 200 are simultaneously transferred in the X-axis direction, correspondingly to the pitch of the semiconductor packages.

[0095] If the first picker unit 100 and the second picker unit 200 are transferred in the X-axis direction, the third picker 130 and the seventh picker 230, which have already moved down and have been ready to suck the semiconductor packages, i.e., in a stand-by state for suction, suck the semiconductor packages at the same time. Through the above operations, the second picker 120 and the sixth picker 220 suck the semiconductor packages at the same time, and then the fourth picker 140 and the eighth picker 240, which have already moved down and have been in a stand-by state, suck the semiconductor packages at the same time.

[0096] Resultantly, when a part of the pickers suck a part of the semiconductor packages, the remaining pickers have

already moved down and have been in a stand-by state to suck the remaining semiconductor packages, thereby shortening a time taken to suck the semiconductor packages.

[0097] The semiconductor packages sucked by the above manner are transferred to the area above the inspection device 40, and the inspection device 40 inspects the processed state of the semiconductor packages. In this embodiment, while the semiconductor packages sucked by the first picker unit 100 are inspected, the semiconductor packages sucked by the second picker unit 200 are in a stand-by state to be inspected.

[0098] Two inspection devices may be mounted between the table and the tray, and the semiconductor packages sucked by the two picker units may be simultaneously inspected by the two inspection devices.

[0099] Since the operation in which the semiconductor packages are received in the second package receiving portions of the tray is the same as the operation in which the semiconductor packages are sucked from the first package receiving portions of the table, the explanation thereof will be omitted.

[00100] Hereinafter, a fourth embodiment of the operation of inspecting the processed state of the semiconductor packages using the first embodiment of the picker unit

according to the present invention will be described with reference to FIGs. 6A and 6B.

[00101] Since the semiconductor package processing apparatus according to this embodiment is substantially the same as the semiconductor package processing apparatus shown in FIGs. 4A and 4B, the same elements are denoted by the same reference numerals, and the detailed explanation thereof will be omitted.

[00102] However, the semiconductor package processing apparatus of this embodiment is provided with plural inspection devices 41 and 42, and the inspection devices are not disposed between the table and the tray, but are disposed on the left side and the right side of the table.

[00103] The operation of inspecting the processed state of the semiconductor packages in the semiconductor package processing apparatus according to this embodiment will now be described.

[00104] The first picker unit 100 and the second picker unit 200 simultaneously suck the semiconductor packages one by one. Such an operation is substantially same as that of the semiconductor package processing apparatus shown in FIGs. 4A and 4B. The first picker unit 100 and the second picker unit 200 which have sucked the semiconductor packages are transferred in the directions opposite to each other.

[00105] Particularly, the first picker unit 100 is transferred to the area above the first inspection device 41, and the second picker unit 200 is transferred to the area above the second inspection device 42. The picker units are respectively provided with driving motors (not shown) to move the corresponding picker units. The driving motors rotate in the directions opposite to each other, and the rotational force of the driving motors is transmitted to the screw 51 by a power transmission means (not shown).

[00106] Accordingly, the respective picker units are transferred to the areas above the respective inspection devices along the screw 51, and the semiconductor packages sucked by the picker units are simultaneously inspected by the inspection devices. Thereafter, the inspected semiconductor packages are respectively received in the second package receiving portions 31 of the tray.

[00107] Hereinafter, a fifth embodiment of the operation of inspecting the processed state of the semiconductor packages using the first embodiment of the picker unit according to the present invention will be described with reference to FIGs. 7A to 7C.

[00108] Differently from the semiconductor package processing apparatus shown in FIGs. 6A and 6B, the semiconductor package processing apparatus according to this embodiment is provided with plural inspection devices 41 and

42 and plural trays 30 and 800, which are disposed on the left side and the right side of the table 20.

[00109] Particularly, in the semiconductor package processing apparatus according to this embodiment, the first inspection device 41 is disposed on the right side (in the drawings) of the table 20, and the second inspection device 42 is disposed on the left side of the table 20. The first tray 30 is disposed on the right side of the first inspection device 41, and the second tray 800 is disposed on the left side of the second inspection device 42.

[00110] The operation of inspecting the processed state of the semiconductor packages in the semiconductor package processing apparatus according to this embodiment is substantially similar to the fourth embodiment. However, the semiconductor packages sucked by the first picker unit 100 are inspected by the first inspection device 41, and then are received in the first tray 30, and the semiconductor packages sucked by the second picker unit 200 are inspected by the second inspection device 42, and then are received in the second tray 800.

[00111] Hereinafter, a first embodiment of the operation of processing the semiconductor packages using the second embodiment of the picker unit according to the present invention and the aforesaid picker units will be described with reference to FIGs. 8 and 9.

[00112] The semiconductor package processing apparatus according to this embodiment includes plural picker units 300, 400, 500 and 600 to suck the semiconductor packages and transfer the same, a first conveying device 710 and a second conveying device 720 to transfer the picker units, and an inspection device 40 to inspect the semiconductor packages.

[00113] The semiconductor package processing apparatus further includes a table 20 having first package receiving portions 21 to receive a plurality of semiconductor packages before being inspected by the inspection device 40, and a tray 30 having second package receiving portions 31 to receive the semiconductor packages after being inspected by the inspection device 40. Since such a configuration is substantially the same as the above embodiment, the detailed explanation thereof will be omitted.

[00114] Differently from the above embodiment, each picker unit according to this embodiment is composed of a pair of pickers. Accordingly, the semiconductor package processing apparatus according to this embodiment has four picker units to suck eight semiconductor packages and transfer the same.

[00115] Particularly, the first picker unit 300 has a first picker 310 and a second picker 320, and the second picker unit 400 has a third picker 410 and a fourth picker 420. The third picker unit 500 has a fifth picker 510 and a sixth

picker 520, and the fourth picker unit 600 has a seventh picker 610 and an eighth picker 620.

[00116] Similarly to the above first embodiment of the picker unit, the first picker 310 and the second picker 320 of the first picker unit 300 move interlockingly with each other in the Y-axis direction by a picker moving device. Such a configuration is identically adapted to the second picker unit 400, the third picker unit 500, and the fourth picker unit 600. Hereinafter, the structures of the first picker unit and the second picker unit will be described in detail.

[00117] A first conveying device 710 is mounted above the first picker unit 300 to transfer the first picker unit 300, and a second conveying device 720 is mounted above the second picker unit 400 to transfer the second picker unit 400.

[00118] The first conveying device 710 includes a first driving motor 711 to move the first picker unit 300, a first screw 713 axially-coupled to the first driving motor 711, and a first moving block 715 moving rectilinearly by the rotation of the first screw 713.

[00119] If the first driving motor 711 is driven, the first screw 713 rotates in the rotating direction of the motor, and the first moving block 715 moves rectilinearly along the first screw 713. Accordingly, the first picker unit 300

coupled to the first moving block 715 moves in the X-axis direction.

[00120] The second conveying device 720 includes a second driving motor 721 to move the second picker unit 400, a second screw 723 axially-coupled to the second driving motor 721, and a second moving block 725 moving rectilinearly by the rotation of the second screw 723. The present invention is not restricted to the aforesaid embodiment. Instead of the screw, a gear, an LM guide, or the like may be used.

[00121] The second conveying device 720 is mounted between the first picker unit 300 and the second picker unit 400 to move the second picker unit 400 left or right below the first picker unit 300. The above structural relation between the first picker unit and the second picker unit is identically adapted to the structural relation between the third picker unit and the fourth picker unit.

[00122] The first picker unit 300 includes a first main body 350 which forms an external shape, a first picker 310 and a second picker 320 which are mounted in the first main body, and a first picker moving device 360 to move the first picker and the second picker interlockingly with each other in the Y-axis direction.

[00123] The first picker moving device 360 includes a first rack gear 363a provided at an upper portion of the first picker 310, a second rack gear 363b provided at an upper

portion of the second picker 320, a first pinion gear 361 provided between the first rack gear 363a and the second rack gear 363b, and a first picker motor 365 to drive the first pinion gear 361.

[00124] The first main body 350 has an upper body and a lower body which are unitarily formed in an L shape. The lower body is crooked downward from the upper body.

[00125] The second picker unit 400 is mounted below the upper body, and moves in the X-axis direction by the second conveying device 720. The second picker unit 400 includes a second main body 450 which forms an external shape, a third picker 410 and a fourth picker 420 which are mounted in the second main body, and a second picker moving device 460 to move the third picker and the fourth picker interlockingly with each other in the Y-axis direction. Since the second picker moving device is substantially the same as the first picker moving device, the detailed explanation thereof will be omitted.

[00126] The operation of inspecting the semiconductor packages in the semiconductor package processing apparatus having the above picker units will now be described.

[00127] First, the second picker unit 400 and the fourth picker unit 600 suck the semiconductor packages at the same time. Particularly, the fourth picker 420 mounted in the second picker unit and the eighth picker 620 mounted in the

fourth picker unit respectively suck one semiconductor package at the same time.

[00128] Next, the third picker 410 mounted in the second picker unit and the seventh picker 610 mounted in the fourth picker unit respectively suck one semiconductor package at the same time.

[00129] Thereafter, the first picker unit 300 and the third picker unit 500 suck the semiconductor packages by the same method as described above.

[00130] Resultantly, since the two pickers simultaneously suck the semiconductor packages, a time taken to suck the semiconductor packages is reduced to a half. The sucking operation may be modified such that after the second picker unit and the fourth picker unit suck the semiconductor packages one by one, the first picker unit and the third picker unit suck the semiconductor packages one by one.

[00131] Hereinafter, a second embodiment of the operation of inspecting the processed state of the semiconductor packages using the second embodiment of the picker unit according to the present invention will be described with reference to FIGs. 10A to 10D.

[00132] In this embodiment, the four picker units simultaneously suck the semiconductor packages one by one. Particularly, the second picker 320 of the first picker unit, the fourth picker 420 of the second picker unit, the sixth

picker 520 of the third picker unit, and the eighth picker 620 of the fourth picker unit respectively suck one semiconductor package at the same time (refer to FIG. 10A).

[00133] At this time, the first picker unit, the second picker unit, the third picker unit, and the fourth picker unit simultaneously suck the semiconductor packages in the set positions in consideration of the pitch of the first package receiving portions, in which the semiconductor packages are received, i.e., in the initial positions of the respective picker units.

[00134] Next, the first picker unit 300, the second picker unit 400, the third picker unit 500, and the fourth picker unit 600 are transferred in the X-axis direction at the same time, correspondingly to the pitch of the semiconductor packages received in the first package receiving portions 21.

[00135] The first picker 310 of the first picker unit, the third picker 410 of the second picker unit, the fifth picker 510 of the third picker unit, and the seventh picker 610 of the fourth picker unit respectively suck one semiconductor package at the same time (refer to FIG. 10B).

[00136] Thereafter, the semiconductor packages are transferred to the area above the inspection device 40, and the inspection device 40 inspects the processed state of the semiconductor packages (refer to FIG. 10C). The operation of inspecting the semiconductor packages is substantially the

same as the above embodiments, the explanation thereof will be omitted.

[00137] The inspected semiconductor packages are received in the second package receiving portions 31 of the tray (refer to FIG. 10D). Also at this time, when a gap between the sucked semiconductor packages is different from the pitch of the second package receiving portions, the semiconductor packages should be received in consideration of the pitch of the second package receiving portions.

[00138] For instance, the first picker 310 of the first picker unit, the third picker 410 of the second picker unit, the sixth picker 520 of the third picker unit, and the eighth picker 620 of the fourth picker unit put down the respectively sucked semiconductor packages at the same time in the second package receiving portions in the set positions in consideration of the pitch of the second package receiving portions.

[00139] Thereafter, the first picker unit 300, the second picker unit 400, the third picker unit 500, and the fourth picker unit 600 are transferred in the X-axis direction, correspondingly to the pitch of the second package receiving portions 31.

[00140] The second picker 320 of the first picker unit, the fourth picker 420 of the second picker unit, the fifth picker 510 of the third picker unit, and the seventh picker 610 of

the fourth picker unit put down the respectively sucked semiconductor packages at the same time in the second package receiving portions.

[00141] An order in which the semiconductor package sucked by which picker in each picker unit is first put down in the second package receiving portions may be stored in the control part in advance.

[00142] Resultantly, the operation of sucking the semiconductor packages using the picker unit according to this embodiment shortens a necessary time to a quarter, when compared to a case in which a unitarily formed picker unit sucks the semiconductor packages in sequence one by one.

[00143] Hereinafter, a third embodiment of the operation of inspecting the processed state of the semiconductor packages using the second embodiment of the picker unit according to the present invention will be described with reference to FIG. 11.

[00144] The semiconductor package processing apparatus according to this embodiment is configured such that four picker units suck the semiconductor packages in sequence. Particularly, while the first picker 310 of the first picker unit sucks the semiconductor package, the third picker 410 of the second picker unit has already moved down and has been in a stand-by state to suck another semiconductor package. In other words, as the second picker unit 400 is transferred in

the X-axis direction, the third picker 410 is transferred in the X-axis direction, and at the same time the third picker 410 moves in the Y-axis direction and is positioned above the semiconductor package to be sucked.

[00145] Also, as the third picker unit 500 is transferred in the X-axis direction, the fifth picker 510 is transferred in the X-axis direction, and at the same time the fifth picker 510 moves in the Y-axis direction and is positioned above the semiconductor package to be sucked. At this time, a height of the fifth picker 510 may be set to be higher than a height of the third picker 410.

[00146] Also, as the fourth picker unit 600 is transferred in the X-axis direction, the seventh picker 610 is transferred in the X-axis direction, and at the same time the seventh picker 610 moves in the Y-axis direction and is positioned above the semiconductor package to be sucked. At this time, a height of the seventh picker 610 may be set to be higher than a height of the fifth picker 510. Resultantly, while the first picker 310 sucks the semiconductor package, the third picker 410, the fifth picker 510 and the seventh picker 610 have already moved down to sequential heights and have been in a stand-by state to suck the respectively corresponding semiconductor packages.

[00147] The second picker 320 of the first picker unit, the fourth picker 420 of the second picker unit, the sixth picker

520 of the third picker unit, and the eighth picker 620 of the fourth picker unit also suck the semiconductor packages through the aforesaid sucking operation. As a result, a time taken for the picker units to suck the semiconductor packages is shortened.

[00148] Hereinafter, a fourth embodiment of the operation of inspecting the processed state of the semiconductor packages using the second embodiment of the picker unit according to the present invention will be described with reference to FIGs. 12A and 12B.

[00149] The semiconductor package processing apparatus according to this embodiment is provided with four picker units 300, 400, 500 and 600, and plural inspection devices 41 and 42 and plural trays 30 and 800, which are disposed on the left side and the right side of the table 20.

[00150] Particularly, in the semiconductor package processing apparatus according to this embodiment, the first inspection device 41 is disposed on the right side (in the drawings) of the table 20, and the second inspection device 42 is disposed on the left side of the table 20. The first tray 30 is disposed on the right side of the first inspection device 41, and the second tray 800 is disposed on the left side of the second inspection device 42.

[00151] The operation of inspecting the processed state of the semiconductor packages in the semiconductor package

processing apparatus according to this embodiment will now be described.

[00152] First, the four picker units simultaneously suck the semiconductor packages one by one. Such an operation is substantially the same as the operation of the semiconductor package processing apparatus shown in FIGs. 10A to 10D. After sucking the semiconductor packages, the first picker unit 300 and the second picker unit 400 are transferred right in the drawings, and the third picker unit 500 and the fourth picker unit 600 are transferred left in the drawings.

[00153] Particularly, the first picker unit 300 and the second picker unit 400 are transferred to the area above the first inspection device 41, the third picker unit 500 and the fourth picker unit 600 are transferred to the area above the second inspection device 42.

[00154] The semiconductor packages sucked by the first picker unit 300 and the second picker unit 400 are inspected by the first inspection device 41, and then are received in the first tray 30. The semiconductor packages sucked by the third picker unit 500 and the fourth picker unit 600 are inspected by the second inspection device 42, and then are received in the second tray 800.

[00155] The inspection devices may be provided in the same number as the picker units, so that the inspection devices

can respectively inspect the semiconductor packages sucked by the corresponding picker units.

[00156] The present invention is not restricted to the above embodiments. When the pitch of the semiconductor packages received in the first package receiving portions of the table is different from the pitch of the semiconductor packages received in the second package receiving portions of the tray, the pickers which have sucked the semiconductor packages may be individually transferred correspondingly to the pitch. In this case, the semiconductor package processing apparatus may include separate driving motors to respectively transfer the corresponding pickers in the X-axis direction, and a control part to automatically adjust the positions of the pickers.

[00157] Hereinafter, a third embodiment of the picker unit provided in the semiconductor package processing apparatus according to the present invention will be described with reference to FIG. 13.

[00158] A picker unit according to this embodiment is substantially similar to the picker unit shown in FIG. 8. However, differently from the picker unit of FIG. 8, a main body 3500 of a first picker unit 3000 and a main body 4500 of a second picker unit 4000 are arranged in series with respect to the transferring direction of the picker units. The main body 3500 of the first picker unit and the main body 4500 of

the second picker unit may be connected to each other in series by a second screw 7230.

[00159] Similarly to the picker unit shown in FIG. 8, the first picker unit 3000 and the second picker unit 4000 according to this embodiment may be simultaneously transferred left and right by a first conveying device 7100. Also, the second picker unit 4000 may be transferred relative to the first picker unit 3000 by a second conveying device 7200. In other words, the second conveying device 7200 can adjust a distance between the second picker unit 4000 and the first picker unit 3000.

[00160] Since the first conveying device and the second conveying device of this embodiment are substantially the same as the embodiment shown in FIG. 8, the detailed explanation thereof will be omitted.

[00161] As apparent from the above description, the semiconductor package processing apparatus according to the present invention can improve productivity and increase a unit per hour by minimizing the transfer of the picker units even when the pitch of the semiconductor packages before being sucked by the picker units is different from the pitch of the semiconductor packages which are received after the processed state is inspected.

[00162] Further, even when the pitch of the received semiconductor packages is different from the pitch of the

pickers, the received semiconductor packages can be efficiently transferred.

[00163] It will be apparent to those skilled in the art that various modifications and variations can be made in the present invention without departing from the spirit or scope of the inventions. Thus, it is intended that the present invention covers the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

WHAT IS CLAIMED IS:

1. A semiconductor package processing apparatus comprising:

first package receiving portions to receive a plurality of semiconductor packages therein;

second package receiving portions to receive the semiconductor packages, transferred from the first package receiving portions, therein;

plural picker units to suck the semiconductor packages received in the first package receiving portions and transfer the semiconductor packages to the second package receiving portions; and

a conveying device to transfer the plural picker units individually in a transferring direction of the semiconductor packages.

2. The semiconductor package processing apparatus according to claim 1, wherein the conveying device transfers the picker units so that pickers provided in the picker units can suck or release the semiconductor packages at positions corresponding to a pitch of the first package receiving portions and a pitch of the second package receiving portions.

3. The semiconductor package processing apparatus according to claim 1, wherein the semiconductor packages received in the first package receiving portions are transferred in plural groups by the plural picker units.

4. The semiconductor package processing apparatus according to claim 2, wherein the plural picker units can suck or release the plural semiconductor packages at the same time.

5. The semiconductor package processing apparatus according to any one of claims 1 to 4, wherein each of the picker units includes a main body which forms an external shape, at least one pair of pickers including two pickers, and a picker moving device to move the pickers vertically.

6. The semiconductor package processing apparatus according to claim 5, wherein the picker moving device is configured to vertically move the two pickers of the pair of pickers interlockingly with each other.

7. The semiconductor package processing apparatus according to any one of claims 1 to 4, further comprising:

at least one inspection device to inspect a processed state of the semiconductor packages.

8. The semiconductor package processing apparatus according to claim 7, wherein the picker units include a first picker unit and a second picker unit,

whereby while some semiconductor packages are being inspected at an area above the inspection device after being sucked by the first picker unit, other semiconductor packages are being sucked by the second picker unit.

9. The semiconductor package processing apparatus according to claim 7, wherein the picker units individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and

the conveying device transfers the picker units having sucked the semiconductor packages to an area above the inspection device in sequence.

10. The semiconductor package processing apparatus according to claim 7, wherein the picker units individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and

the conveying device transfers the picker units having sucked the semiconductor packages to areas above plural inspection devices at the same time.

11. The semiconductor package processing apparatus according to any one of claims 1 to 4, wherein while a picker provided in one of the picker units sucks the semiconductor package received in the first package receiving portions, a picker provided in the other picker unit moves closely to an area above the other semiconductor package received in the first package receiving portions.

12. The semiconductor package processing apparatus according to claim 7, wherein the first package receiving portions are provided on a table, the second package receiving portions are provided on a tray, and the inspection device is mounted between the table and at least one tray.

13. The semiconductor package processing apparatus according to any one of claims 1 to 4, wherein the conveying device includes a driving motor, and a power transmission member to convert a rotational force of the driving motor into rectilinear movement of the respective picker units.

14. A control method of a semiconductor package processing apparatus, comprising:

sucking plural semiconductor packages using plural picker units;

transferring the picker units individually in a transferring direction of the semiconductor packages to transfer the semiconductor packages from first package receiving portions, in which the semiconductor packages are received, to second package receiving portions corresponding to the first package receiving portions; and

seating the semiconductor packages transferred by the picker units in the second package receiving portions.

15. The control method according to claim 14, further comprising:

inspecting the semiconductor packages sucked by the picker units using an inspection device to inspect a processed state of the semiconductor packages.

16. The control method according to claim 15, wherein while the sucking step of sucking the semiconductor packages received in the first package receiving portions is performed by at least one picker unit, the inspecting step is performed to inspect the semiconductor packages sucked by other picker units.

17. The control method according to claim 15, wherein in the sucking step, the picker units individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and

in the transferring step, the picker units are transferred to an area above the inspection device in sequence to inspect the sucked semiconductor packages.

18. The control method according to claim 15, wherein in the sucking step, the picker units individually and simultaneously suck the semiconductor packages received in the first package receiving portions one by one at once, and

in the transferring step, the picker units having sucked the semiconductor packages are transferred to areas above plural inspection devices at the same time.

19. The control method according to claim 15, wherein in the sucking step, while a picker provided in one of the picker units sucks the semiconductor package received in the first package receiving portions, a picker provided in the other picker unit moves closely to an area above the other semiconductor package received in the first package receiving portions.