TRANSFERRING TOOL

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a transferring tool, and particularly, to a transferring tool capable of picking up an object to be transferred such as a semiconductor device so as to transfer the object to another position.

2. Background of the Invention

Generally, semiconductor devices having completely undergone packaging processes undergo a plurality of tests such as a burn-in test for the reliability by external thermal factor, electric test for a direct current (DC) characteristic. According to the test results, the semiconductor devices are classified into good or bad ones.

In the test and sorting process, the semiconductor devices are loaded on a tray and/or a board, and the trays are sequentially transferred.

The semiconductor devices loaded on a tray and/or a board are picked-up to be transferred to sockets, a tray, a board, etc. of an inspection apparatus by a transferring tool.

The conventional transferring tool comprises supporting brackets; and one

or more pickers installed at the supporting brackets, and having suction heads at the respective ends thereof for sucking the upper surface of the respective semiconductor devices by forming vacuum pressure. And, the

pickers may be configured to be serially arranged in two, four, eight, etc., in number so as to transfer a plurality of semiconductor devices at one time.

However, the semiconductor device inspection apparatus or the sorting apparatus having a transferring tool may have different inspection or sorting speed according to the number of semiconductor devices to be transferred by the transferring tool. Therefore, the transferring tool needs to be configured to transfer larger number of semiconductor devices.

In order to solve the above problems, there has been proposed a transferring tool having pickers arranged in two rows. The conventional transferring tool having pickers arranged in two rows are configured to control a gap (horizontal gap) between the pickers, and a gap (vertical gap) between one pair of fixing brackets where the pickers are installed, with consideration of a loaded gap between the semiconductor devices to be transferred.

However, in the conventional transferring tool having pickers arranged in two rows, a gap controller for controlling a horizontal gap or a vertical gap is installed at the fixing brackets for supporting the pickers. This may cause the positions of the pickers not to be easily controlled due to an inertia of the gap controller when the transferring tool moves.

Furthermore, in the conventional transferring tool having pickers arranged in two rows, the gap controller for controlling a horizontal gap or a vertical gap is coupled to one of the pair of fixing brackets. This may cause precise control for the pickers to be impossible due to asymmetry between centers of gravity of the pair of fixing brackets.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a transferring tool capable of preventing position control for pickers from being influenced by an inertia of a gap controller, by separating one pair of supporting brackets where pickers in a row are installed from the gap controller for controlling a gap between the pickers.

Another object of the present invention is to provide a transferring tool capable of precisely controlling motion of pickers by making centers of gravity of one pair of supporting brackets and the pickers symmetric to each other, by separating said one pair of supporting brackets where of pickers in a row are installed from a gap controller for controlling a gap between the pickers.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a transferring tool, comprising: a first supporting bracket installed so as to be movable along a transferring tool guide of a semiconductor device handler; one pair of second supporting brackets coupled to the first supporting bracket with a gap therebetween, and having a plurality of pickers for picking-up semiconductor devices with a gap therebetween; and a vertical gap controller for controlling a gap of the pair of the second supporting brackets by moving the pair of second supporting brackets, wherein the vertical gap controller comprises: a vertical driving unit installed at the first supporting bracket for generating a

vertical driving force; and a linear-motion unit installed at the first supporting bracket, and connected to the second supporting brackets, for controlling a gap between the second supporting brackets by being linearly-moved by the vertical driving unit.

The vertical driving unit comprises a rotation driving unit installed at the first supporting bracket; and one pair of pulleys installed at the first supporting bracket, and rotated by the rotation driving unit, and the linear-motion unit comprises a control belt coupled to said one pair of pulleys, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved.

The vertical driving unit may comprise a rotation driving unit installed at the first supporting bracket; and one pair of gears installed at the first supporting bracket, and rotated by the rotation driving unit. And, the linear-motion unit may comprise a control chain coupled to said one pair of gears, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved.

The first supporting bracket is formed with apertures over the pickers so that pneumatic pipes for controlling the pickers can be connected to the pickers.

The vertical gap controller may be installed at a position corresponding to the center of the second supporting brackets, or at a position corresponding to one end of the second supporting brackets.

The transferring tool may further comprise a supplementary vertical gap controller, comprising: one pair of pulleys installed at positions corresponding to another ends of the second supporting brackets; a

control belt coupled to said one pair of pulleys, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved; and a connection shaft coupled to pulleys of the vertical gap controller, and coupled to one of said one pair of pulleys, for transmitting a rotational force of the pulleys of the vertical gap controller to one of said one pair of pulleys.

The rotation driving unit may comprise a driving motor installed at the first supporting bracket, a driving pulley coupled to the driving motor, and a driving belt for connecting the driving pulley to a driven pulley connected to one of the pulleys of the vertical gap controller. Preferably, the driving pulley may be configured to have a diameter smaller than that of the driven pulley for deceleration of the driving motor.

The horizontal gap controller may comprise: link units having a link structure and installed at one of the second supporting brackets, for connecting supporting members where the respective pickers are installed; a driving unit installed at one of the second supporting brackets, for controlling a gap between the supporting members by driving the link units; and a driving force generating unit for driving the driving unit.

The driving unit may comprise: one pair of pulleys rotatably installed at the second supporting brackets, and rotated by receiving a rotational force from the driving force generating unit; a belt rotated by connecting said one pair of pulleys; and one or more moving members having one end coupled to the belt, and another end coupled to one of the supporting members.

In order to inwardly or outwardly move the supporting members

disposed at both ends of the second supporting brackets, the moving members are formed in one pair. One pair of the moving members may be coupled to the belts so that moving directions thereof can be opposite to each other.

The driving force generating unit may comprise: a driving motor for generating a rotational force; a driving pulley coupled to the driving motor; a driven pulley connected to one rotation shaft of one of the pulleys of the driving unit respectively installed at the second supporting brackets; and a driving belt for connecting the driving pulley and the driven pulley.

The driving pulley may be configured to have a diameter smaller than that of the driven pulley. And the driving motor may be directly connected to the driving unit of the second supporting brackets, respectively.

At least one rotation shaft of the pulleys of the driving unit of the second supporting brackets may be connected to a coupler having a controllable coupling length of the rotation shaft. And, the driven pulley may be connected to the rotation shaft of one pulley of one driving unit of the second supporting brackets, or may be installed at the coupler.

The coupler may be provided with an insertion hole for movably inserting the rotation shafts of the pulleys of the driving unit of the second supporting brackets.

According to another aspect of the present invention, there is provided a transferring tool, comprising: a first supporting bracket installed so as to be movable along a transferring tool guide of a semiconductor device handler; one pair of second supporting brackets coupled to the first

supporting bracket with a gap therebetween, and having a plurality of pickers for picking-up semiconductor devices with a gap therebetween; and a horizontal gap controller for controlling a gap of the pickers installed at the second supporting brackets, wherein the horizontal gap controller comprises: link units having a link structure and installed at one of the second supporting brackets, for connecting supporting members where the respective pickers are installed; a driving unit installed at one of the second supporting brackets, for controlling a gap between the supporting members by driving the link units; and a driving force generating unit for driving the driving unit, and the driving force generating unit comprises: a driving motor for generating a rotational force; a driving pulley coupled to the driving motor; a driven pulley connected to a rotation shaft of one of pulleys of the driving unit respectively installed at the second supporting brackets; and a driving belt for connecting the driving pulley and the driven pulley.

Preferably, the driving pulley may be configured to have a diameter smaller than that of the driven pulley for deceleration of the driving motor. Preferably, the pulleys and the belts of the transferring tool are implemented as timing pulleys and timing belts for precise control.

The transferring tool for semiconductor devices according to the present invention has the following advantages.

Firstly, positions of the pickers can be prevented from being influenced by an inertia of a gap controller, by separating one pair of supporting brackets (second supporting bracket) where pickers in a row are installed from a first supporting bracket where a gap controller for

controlling a gap between the pickers is installed.

Secondly, motion of the pickers can be precisely controlled by making centers of gravity of one pair of supporting brackets and the pickers symmetric to each other, by separating said one pair of supporting brackets where a series of the pickers are installed from a gap controller for controlling a gap between the pickers.

Thirdly, motion of the pickers can be more precisely controlled by using timing belts and timing pulleys as belts and pulleys for driving said one pair of supporting brackets where the pickers in a row are installed, and the gap controller for controlling the gap between the pickers.

Fourthly, in the conventional transferring tool for semiconductor devices, a gap between one pair of supporting brackets is controlled by combination between right and left screws, or by using a cam. This causes the pair of supporting brackets to be imprecisely moved, and thus first and second gaps has to be preset. The first gap corresponds to a gap between semiconductor devices on a tray, and the second gap corresponds to a gap between semiconductor devices on a socket, etc. Under these configurations, a gap between the semiconductor devices is passively controlled, i.e., the gap is adjusted only to the first and the second gaps.

But, in the transferring tool for semiconductor devices of the present invention, a gap between one pair of supporting brackets is movably controlled in combination manners between pulleys and belts, and between gears and chains. This may enable the gap between said one pair of supporting brackets to be real-time controlled without any

limitations, thereby implementing an active handling.

Fifthly, in the transferring tool for semiconductor devices of the present invention, a diameter ratio between a plurality of pulleys is set to be different so as to drive said one pair of supporting brackets where the pickers in a row are installed, and the gap controller for controlling a gap between the pickers. This may enable a rotational force of the driving motor to decrease without using an additional decelerator.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

FIG. 1 is a conceptual view of a semiconductor device inspection apparatus provided with a transferring tool for a semiconductor device of the present invention;

FIG. 2 is a conceptual view showing a configuration of the transferring tool of the semiconductor device inspection apparatus of FIG.

1;

FIG. 3 is a perspective view of one example of the transferring tool of FIG. 2;

FIG. 4 is a plane view of the transferring tool of FIG. 3;

FIGS. 5 and 6 are side views of the transferring tool of FIG. 3;

FIGS. 7 and 8 are conceptual views respectively showing a vertical gap controller for controlling a vertical gap between the transferring tool of FIG. 3; and

FIGS. 9 and 10 are conceptual views respectively showing a horizontal gap controller for controlling a horizontal gap between the transferring tool of FIG. 3.

DETAILED DESCRIPTION OF THE INVENTION

Description will now be given in detail of the present invention, with reference to the accompanying drawings.

Hereinafter, a transferring tool according to the present invention will be explained in more detail with reference to the attached drawings.

The transferring tool 700 of the present invention serves to transfer an object to be transferred such as semiconductor devices 1, and is installed at a semiconductor device handling apparatus such as a semiconductor device sorting apparatus and a semiconductor device inspection apparatus.

Referring to FIGS. 1 and 2, the semiconductor device inspection apparatus, one example of the semiconductor device handling apparatus

installed with the transferring tool 700 of the present invention, comprises a loading unit 100, a first vision inspection unit 400 installed at one side of the loading unit 100 for inspecting lower appearance of the semiconductor devices 1, a second vision inspection unit 500 installed at one side of the loading unit 100 for inspecting upper appearance of the semiconductor devices 1, and a sorting unit 300 for sorting the semiconductor devices 1 according to inspection results by the first and the second vision inspection units 400, 500.

The loading unit 100 may have various configurations. As shown in FIG. 1, the loading unit 100 may include a guide portion 110 for guiding movement of a tray 2 wherein the plurality of semiconductor devices 1 have been loaded, and a driving unit (not shown) for moving the tray 2 along the guide portion 110.

The first vision inspection unit 400 is installed at a body 10, and serves to inspect the appearance of each semiconductor device 1 by analyzing an image of the lower appearance of the semiconductor device 1. The first vision inspection unit 400 includes an image obtaining device for obtaining an image, and an image analyzing device for analyzing the image obtained by the image obtaining device.

The second vision inspection unit 500 may be similarly configured to the first vision inspection unit 400. However, the second vision inspection unit 500 may be installed at an upper side of the body 10 so as to obtain an image of the upper appearance of the semiconductor device 1.

The second vision inspection unit 500 includes an image obtaining device 530 installed above the tray 2 where the semiconductor devices 1

have been loaded, for obtaining an image of the upper appearance of each semiconductor device 1.

As shown in FIG. 1, the image obtaining device 530 may be installed above the loading unit 100 so as to be moveable in horizontal and vertical directions (X and Y directions) along a moving path of the tray 2 in order to enhance inspection speed for the semiconductor device 1. And, guide portions 510, 540 for guiding movement of the image obtaining device 530 in X and Y directions are installed at the body 10.

The first and the second vision inspection units 400, 500 inspect whether ball grid or lead has been damaged, appearance states such as crack or scratch, and whether mark on the semiconductor devices 1 are good or not, etc.

The sorting unit 300 has a similar configuration as the loading unit 100, and may be configured in plurality in number so as to be classified into 'G'(good products), 'R1'(having first inferior products), 'R2'(having second inferior products) according to the results of the semiconductor devices 1.

Each of the sorting units 300 may include a guide portion 310 installed at one side of the loading unit 100 in parallel, and a driving unit (not shown) for moving the tray 2 along the guide portion 310.

The tray 2 can be transferred by a tray transferring apparatus (not shown) between the loading unit 100 and the sorting units 300. And, the tray 2 may further include an empty tray unit 200 for transferring the empty tray 2 on which the semiconductor devices 1 have not been loaded, to the sorting units 300.

The empty tray unit 200 may include a guide portion 210 installed at one side of the loading unit 100 in parallel, and a driving unit (not shown) for moving the tray 2 along the guide portion 210.

The semiconductor devices 1 are transferred between the first vision inspection unit 400 and the loading unit 100, and between the trays 2 by one or more transferring tools 700, 620 along a transferring tool guide 601 installed at the body 10.

In order to enhance inspection speed by the first vision inspection unit 400, larger number of semiconductor devices 1 need to be transferred at one time. Since the semiconductor devices 1 are generally transferred by being loaded in the tray 2, the transferring tools 700, 620 are required to be configured with consideration of a structure of the tray 2 such as a gap between the semiconductor devices 1 accommodated in the tray 2 and a size of the semiconductor devices 1.

The size of the semiconductor devices 1 to be inspected or sorted, or a gap between sockets for inserting the semiconductor devices 1 therein, or a gap between accommodation grooves of the tray 2 for accommodating the semiconductor devices 1 therein may be varied. Accordingly, required are configurations to transfer larger number of semiconductor devices 1, and to more actively cope with change of the size of the semiconductor devices 1 or change of the gap between the semiconductor devices 1.

Therefore, one of the transferring tools 700, 620 may include a plurality of pickers 730 installed in two rows so as to be movable along the transferring tool guide 601 when necessary, for picking-up the

semiconductor devices 1.

The pickers 730 for transferring the semiconductor devices 1 by picking up the semiconductor device 1 may have various configurations, and may include a suction head 731. The suction head 731 serves to pick-up the semiconductor device 1 in a suction manner by generating a vacuum pressure together with up-down movement. Each suction head 731 may be installed so as to be up-down moveable independently.

A supporting bracket may be implemented as the plurality of pickers 730 are installed in two rows in a various manner. As shown in FIGS. 3 to 6, the supporting bracket includes a first supporting bracket 710 moveably installed at the semiconductor device inspection apparatus, etc., and one pair of second supporting brackets 720 being coupled to the first supporting bracket 710 and having the pickers 730 installed thereat with a gap therebetween.

The first supporting bracket 710 is installed so as to be movable along the transfer tool guide 601, and is transferred by an additional transferring apparatus. Accordingly, the second supporting bracket 720 is moved to move the pickers 730.

The transferring tool guide 601 serves to guide movement of the transferring tool 700 in various directions such as X, Y, and X-Y directions.

As shown in FIGS. 3 and 4, a coupling portion 711 for coupling the first supporting bracket 710 with the transferring tool guide 601 may be formed at or coupled to the first supporting bracket 710.

The first supporting bracket 710 is provided with apertures 712 opened toward an upper direction of the pickers 730, i.e. over the pickers

730. Through the apertures 712, pneumatic pipes (not shown) for controlling the pickers 730 may be connected to the pickers 730.

The first supporting bracket 710 may further include an external pneumatic pipe connection member 713 firstly connected to a pneumatic generator (not shown) for generating a pneumatic pressure by external pneumatic pipe (not shown) and secondly connected to the pneumatic pipes for connecting the respective pickers 730 so as to prevent movement of the pickers 730 from being influenced by the pneumatic pipes.

The one pair of second supporting brackets 720 are installed with a gap therebetween, and each of the second supporting brackets 720 may have various configurations to install the pickers 730 thereat. The plurality of pickers 730 are installed at each second supporting bracket 720 with a gap therebetween.

Here, the pickers 730 are installed at each of the second supporting brackets 720 in a horizontal direction, wherein the pair of second supporting brackets are disposed in a vertical direction. With consideration of the structure of the pickers 730, the pickers 730 are preferably installed on the facing surfaces of the second supporting brackets 720.

In the case that the pickers 730 are installed on the facing surfaces of the adjacent second supporting brackets 720, a gap between the pickers 730 installed at the adjacent second supporting brackets 720 may be minimized.

The pair of second supporting brackets 720 may be linear-movably

coupled to the first supporting bracket 710 so as to have a gap therebetween controlled by a vertical gap controller that will be later explained. Here, the second supporting brackets 720 may be coupled to the first supporting bracket 710 by a linear motion guide unit 740 for guiding linear motion of the second supporting brackets 720.

The linear motion guide unit 740 may have any configuration for linear-movably coupling the second supporting brackets 720 to the first supporting bracket 710. As shown in FIGS. 3 and 5, the linear motion guide unit 740 may include a guide member 741 coupled to the first supporting bracket 710; and a guide block 742 coupled to the guide member 741 so as to be movable along the guide member 741, and coupled to the second supporting brackets 720.

The transferring tool 700 may be installed so as to have a gap (Ph or Pv) controlled by at least one of horizontal and vertical directions. And, the transferring tool 700 may be provided with a vertical gap controller for controlling a vertical gap (Pv) of the pair of second supporting brackets 720, and a horizontal gap controller for controlling a horizontal gap (Ph) of the pickers 730.

The vertical gap controller serves to control a vertical gap (Pv) of the pair of second supporting brackets 720 where the pickers 730 are installed. And, the vertical gap controller includes a vertical driving unit installed at the first supporting bracket 710 for generating a vertical driving force; and a linear-motion unit installed at the first supporting bracket 710 and connected to the second supporting brackets, for controlling a gap between the second supporting brackets by being linearly-moved by the

vertical driving unit.

The vertical gap controller may have various configurations such as combination between belts and pulleys, combination between gears and chains, and a screw method.

As shown in FIGS. 3 to 6, the vertical gap controller, as one example, may include a rotation driving unit 761 installed at the first supporting bracket 710, and one pair of pulleys 762 installed at the first supporting bracket 710 so as to be rotated by the rotation driving unit 761. And, the linear-motion unit may include control belts 763 coupled to the pair of pulleys 762 and connected to the second supporting brackets 720 so as to control a gap between the second supporting brackets 720 by being moved.

The rotation driving unit 761 serving to rotate the pulleys 762 of the vertical gap controller may have various configurations. And, the rotation driving unit 761 may include a driving motor 761a installed at the first supporting bracket 710, a driving pulley 761b coupled to the driving motor 761a, and a driving belt 761c for connecting the driving pulley 761b to one of the pulleys 762 of the vertical gap controller 720. The driving motor 761a is preferably inwardly installed. With consideration of this structure, the first supporting bracket 710 may be provided with a slot 716 for passing the driving belt 761c therethrough.

Here, the pulleys and belts of the rotation driving unit 761 may be implemented as timing pulleys and timing belts with consideration of the accuracy. Without an additional decelerator, the vertical gap controller 720 can be more accurately controlled by controlling a diameter ratio between

the driving pulley 761b and the pulley 762 of the vertical gap controller 720. Here, the driving pulley 761b may be configured to have a diameter smaller than that of the pulley 762 of the vertical gap controller 720.

The rotation driving unit 761 may further include a driven pulley 761d in the combinational configuration between the pulleys and belts. Also, the rotation driving unit 761 may rotate the pulleys 762 of the vertical gap controller 720 by various methods such as gear coupling.

The driving motor 761a is installed at the first supporting bracket 710 so that a driving shaft thereof cannot influence on movement of the second supporting bracket 720. And, the driving motor 761a is installed in parallel to rotation shafts of the pulleys 762 of the vertical gap controller 720.

The pair of pulleys 762 are installed at the first supporting bracket 710 so that a control belt 763 can be installed to cross the second supporting brackets 720. And, the pulleys 762 may be installed so as to be rotatable by being supported by a supplementary bracket 762a.

The control belt 763 is installed so as to be coupled to the pair of pulleys 762, and so as to be rotated by rotation of the pulleys 762. One or more slots 729 may be formed at the second supporting brackets 720 for smooth installation of the control belt 763.

Once the control belt 763 coupled with driving members 721 fixedly-coupled to the second supporting brackets 720, is rotated by rotation of the pulleys 762, the driving members 721 are together moved, thereby moving the second supporting brackets 720 fixedly-coupled to the driving members 721.

Preferably, the pulleys 762 and the control belts 763 are implemented as timing pulleys and timing belts with consideration of the accuracy.

The vertical gap controller may be installed at various positions according to designs, and may be installed at a position corresponding to the center of the second supporting brackets 720, or at a position corresponding to one end of the second supporting brackets 720.

In the case that the vertical gap controller is installed at a position corresponding to one end of the second supporting brackets 720, a vertical gap has to be controlled so as to be symmetrical to each other. For this, may be further installed a supplementary vertical gap controller, including one pair of pulleys 862 installed at positions corresponding to the other ends of the second supporting brackets 720; a control belt 863 coupled to the pair of pulleys 862, and connected to the second supporting brackets 720 so as to control a gap between the second supporting brackets 720 by being moved; and a connection shaft 865 coupled to the pulleys 762 of the vertical gap controller, and coupled to one of the pair of pulleys 862, for transmitting a rotational force of the pulleys 862 of the vertical gap controller to one of the pair of pulleys 862.

Preferably, the vertical gap controller may further include a sensor for sensing a gap between the second supporting brackets 720.

The vertical gap controller can be more precisely moved by combination between belts and pulleys and combination between gears and chains, thereby more actively control a gap between the semiconductor devices according to the size of the semiconductor devices

and the structure of the tray or socket, etc.

With reference to FIGS. 7 and 8, will be explained a process for controlling the vertical gap (Pv) of the pickers 730 arranged in two rows by the vertical gap controller. Here, it was explained that the vertical gap has decreased. However, the vertical gap may increase, and the vertical gap between the pickers 730 may be variously set by using timing belts and timing pulleys.

As shown in FIG. 7, the pickers 730 arranged in two rows are disposed at predetermined positions, and have a predetermined vertical gap (Pv).

When the vertical gap needs to be narrowed while picking-up or transferring the semiconductor devices 1, a controller (not shown) drives the vertical gap controller.

Firstly, the rotation motor 761a of the rotation driving unit 761 is rotated by a driving signal under control of the controller. As the rotation motor 761a is rotated, the control belt 763 is rotated via the driving pulley 761b, the driving belt 761c coupled to the driving pulley 761b, the driven pulley 761d coupled to the driving belt 761c, and the pulleys 762 connected to the driven pulley 761d.

Once the control belt 763 is rotated, the driving members 721 coupled to the control belt 763 are together moved. As the result, the second supporting brackets 720 coupled to the driving members 721 are moved as shown in FIG. 8. Here, the second supporting brackets 720 can be more smoothly moved by the supplementary vertical gap controller connected with the pulleys 762 via the connection shaft 865.

Here, the pickers 730 coupled to the second supporting brackets720 in rows form a vertical gap (Pv) therebetween as the second supporting brackets 720 are moved.

When the vertical gap (Pv) of the pickers 730 disposed in two rows is to be controlled, the vertical gap controller is used.

The vertical gap (Pv) of the pickers 730 can be more precisely controlled by using timing belts and timing pulleys as the vertical gap controller.

The supplementary vertical gap controller has a similar structure as the vertical gap controller except for the connection shaft 865, and thus its detailed explanations will be omitted for convenience.

The horizontal gap controller serves to control a horizontal gap (Ph) of the pickers 730, and may have various configurations. As shown in FIGS. 9 and 10, the horizontal gap controller may include link units 751 installed at the second supporting brackets 720, for connecting supporting members 732 where the pickers 730 are installed to each other; a driving unit installed at the second supporting brackets 720, for controlling a gap between the supporting members 732 by driving the link units 751; and a driving force generating unit for driving the driving unit.

The link units 751 serve to control a horizontal gap between the pickers 730, and may have various configurations according to designs. And, the link units 751 may include a plurality of link members 751a, and pins 751b for connecting the link members 751a to each other. Here, the link units 751 are coupled to the supporting members 732 by coupling pins 752. Preferably, guide portions 721 for guiding movement of the supporting

members 732 may be installed at the second supporting brackets 720.

The driving unit consecutively move the link units 751 or the supporting members 732, thereby controlling the horizontal gap (Ph) of the supporting members 732 as shown in FIGS. 9 and 10.

The driving unit may include one pair of pulleys 754 rotatably installed at the second supporting brackets 720, and rotated by receiving a rotational force from the driving force generating unit 753; a belt 755 rotated by connecting the pair of pulleys 754; and one or more moving members 757 having one end coupled to the belt 755, and another end coupled to one of the supporting members 732.

Preferably, the respective moving members 757 is coupled to the respective supporting members 732 positioned at both ends thereof. In order to inwardly or outwardly move the supporting members 732, the moving members 757 are formed in one pair. The pair of moving members 757 may be coupled to the belt 755 so that moving directions thereof can be opposite to each other. In the case of installing the moving members 757 and the supporting members 732 on opposite surfaces of the second supporting brackets 720, slots 727 may be formed with consideration of connection and motion thereof.

The driving force generating unit for operating the link units 751 by driving the driving unit may have various configurations.

As shown in FIGS. 3 and 6, the driving force generating unit may include a driving motor 753 for generating a rotational force; and a driving belt 753c for connecting a driving pulley 753a coupled to the driving motor 753, for transmitting a rotational force and the driven pulley 753b a driven

pulley 753b connected to one rotation shaft 759 of the pulleys 754 respectively installed at the second supporting brackets 720. For deceleration of the driving motor 753, the driving pulley 753a is preferably formed to have a diameter smaller than that of the driven pulley 753b.

With considering that the second supporting brackets 720 are vertically moved, the driving motor 753 is preferably installed at the first supporting bracket 710 rather than at the second supporting brackets 720. The first supporting bracket 710 may be provided with a slot 717 so as to smoothly install the driving belt 753c.

The driving motor 753 may be configured to be directly connected to driving unit of the second supporting brackets 720. Also, at least one rotation shaft 759 of the pulleys 754 may be connected with a coupler 758, and the driven pulley 753b is connected one of the pulley 754 of the driving unit of the second brackets 720 or installed at the coupler 758.

The pair of second supporting brackets 720 may have a different gap therebetween. Therefore, the driving force generating unit is required to smoothly transmit a driving force to the driving unit without being influenced by the change of the gap.

The coupler 758 is configured to have a variable coupling length so that a gap between the second supporting brackets 720 can be controlled by the vertical gap controller. For instance, as shown in FIGS. 3 and 6, the coupler 758 is installed so as to be rotatable by a fixing bracket 758a disposed at the first supporting bracket 710, and includes at one through hole or two insertion holes 758b for movably inserting the rotation shafts 759 of the pulleys 754 of the driving unit of the second supporting

brackets 720.

The rotation shafts 759 of the pulleys 754 of the driving unit of the second supporting brackets 720, and the through hole or two insertion holes 758b have polygonal sectional surfaces. And, the rotation shafts 759 are coupled to the through hole or two insertion holes 758b so as to be movable in the shaft direction and so as to be rotated together.

Preferably, the horizontal gap controller may be further provided with a sensor 820 for sensing a gap between the pickers 730 installed at the second supporting brackets 720.

With reference to FIGS. 9 and 10, will be explained a process for controlling a horizontal gap (Ph) of the pickers 730 arranged in two rows. Here, it was explained that the horizontal gap has decreased. However, the horizontal gap may increase, and the horizontal gap between the pickers 730 may be variously set by using timing belts and timing pulleys.

As shown in FIG. 9, the pickers 730 arranged in two rows are disposed at predetermined positions, and have a predetermined horizontal gap (Ph).

When the horizontal gap needs to be narrowed while picking-up or transferring the semiconductor devices 1, a controller (not shown) drives the horizontal gap controller.

Firstly, the driving motor 753 of the driving force generating unit is rotated by a driving signal under control of the controller. As the driving motor 753 is rotated, rotated are the driving pulley 753a, the driving belt 753c coupled to the driving pulley 753a, the driven pulley 753b coupled to the driving belt 753c, and the coupler 758 connected to the driven pulley

753b.

Once the coupler 758 is rotated, the rotation shaft 759 coupled to the coupler 758 is rotated, and the belt 755 is rotated via the pulley 754 coupled to the rotation shaft 759.

Once the belt 755 is rotated, the moving members 757 coupled to the belt 755 are together moved. As the moving members 757 are moved, the second supporting brackets 720 coupled to the moving members 757 are moved as shown in FIG. 9. Here, the rotation shaft 759 is coupled to the coupler 758 so as to be movable in the shaft direction and so as to be rotated together, thereby smoothly controlling a gap between the second supporting brackets 720.

As the second supporting brackets 720 are moved, the pickers 730 installed at the second supporting brackets 720 in two rows can have the controllable horizontal gap (Ph).

When the horizontal gap (Ph) of the pickers 730 arranged in two rows needs to be controlled, the horizontal gap controller can be used.

Especially, the horizontal gap between the pickers 730 can be more precisely controlled by applying timing belts and timing pulleys as the horizontal gap controller.

The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present disclosure. The present teachings can be readily applied to other types of apparatuses. This description is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art. The features, structures,

methods, and other characteristics of the exemplary embodiments described herein may be combined in various ways to obtain additional and/or alternative exemplary embodiments.

As the present features may be embodied in several forms without departing from the characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalents of such metes and bounds are therefore intended to be embraced by the appended claims.

What is claimed is:

1. A transferring tool, comprising:

a first supporting bracket installed so as to be movable along a transferring tool guide of a semiconductor device handler;

one pair of second supporting brackets coupled to the first supporting bracket with a gap therebetween, and having a plurality of pickers for picking-up semiconductor devices with a gap therebetween; and

a vertical gap controller for controlling a gap of the pair of the second supporting brackets by moving the pair of second supporting brackets,

wherein the vertical gap controller comprises:

a vertical driving unit installed at the first supporting bracket for generating a vertical driving force; and

a linear-motion unit installed at the first supporting bracket, and connected to the second supporting brackets, for controlling a gap between the second supporting brackets by being linearly-moved by the vertical driving unit.

2. The transferring tool of claim 1, wherein the vertical driving unit comprises a rotation driving unit installed at the first supporting bracket; and one pair of pulleys installed at the first supporting bracket, and rotated by the rotation driving unit, and

the linear-motion unit comprises a control belt coupled to said one

pair of pulleys, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved.

3. The transferring tool of claim 1, wherein the vertical driving unit comprises a rotation driving unit installed at the first supporting bracket; and one pair of gears installed at the first supporting bracket, and rotated by the rotation driving unit, and

wherein the linear-motion unit comprises a control chain coupled to said one pair of gears, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved.

4. The transferring tool of claim 1, wherein the first supporting bracket is formed with apertures over the pickers so that pneumatic pipes for controlling the pickers can be connected to the pickers.

5. The transferring tool of claim 1, wherein the vertical gap controller is installed at a position corresponding to the center of the second supporting brackets, or at a position corresponding to one end of the second supporting brackets.

6. The transferring tool of any one of claims 1 to 5, further comprising a supplementary vertical gap controller, comprising:

one pair of pulleys installed at positions corresponding to another

ends of the second supporting brackets;

a control belt coupled to said one pair of pulleys, and connected to the second supporting brackets so as to control a gap between the second supporting brackets by being moved; and

a connection shaft coupled to pulleys of the vertical gap controller, and coupled to one of said one pair of pulleys, for transmitting a rotational force of the pulleys of the vertical gap controller to one of said one pair of pulleys.

7. The transferring tool of one of claims 1 to 5, wherein the rotation driving unit comprises:

a driving motor installed at the first supporting bracket;

a driving pulley coupled to the driving motor; and

a driving belt for connecting the driving pulley to a driven pulley connected to one of the pulleys of the vertical gap controller.

8. The transferring tool of one of claims 1 to 5, wherein the horizontal gap controller comprises:

link units having a link structure and installed at one of the second supporting brackets, for connecting supporting members where the respective pickers are installed;

a driving unit installed at one of the second supporting brackets, for controlling a gap between the supporting members by driving the link units; and

a driving force generating unit for driving the driving unit.

9. The transferring tool of claim 8, wherein the driving unit comprises:

one pair of pulleys rotatably installed at the second supporting brackets, and rotated by receiving a rotational force from the driving force generating unit;

a belt rotated by connecting said one pair of pulleys; and

one or more moving members having one end coupled to the belt, and another end coupled to one of the supporting members.

10. The transferring tool of claim 9, wherein the moving members are formed in one pair so as to inwardly or outwardly move the supporting members disposed at both ends of the second supporting brackets, and

wherein said one pair of moving members are coupled to the belts so that moving directions thereof can be opposite to each other.

11. The transferring tool of claim 9, wherein the driving force generating unit comprises:

a driving motor for generating a rotational force;

a driving pulley coupled to the driving motor;

a driven pulley connected to a rotation shaft of one of pulleys of the driving unit respectively installed at the second supporting brackets; and

a driving belt for connecting the driving pulley and the driven pulley.

12. The transferring tool of claim 9, wherein the driving pulley is configured to have a diameter smaller than that of the driven pulley.

13. The transferring tool of claim 11, wherein the driving motor is directly connected to the driving unit of the second supporting brackets, respectively.

14. The transferring tool of claim 11, wherein at least one rotation shaft of the pulleys of the driving unit of the second supporting brackets is connected to a coupler having a controllable coupling length of the rotation shaft, and

wherein the driven pulley is connected to the rotation shaft of one pulley of one driving unit of the second supporting brackets, or is installed at the coupler.

15. The transferring tool of claim 14, wherein the coupler is provided with an insertion hole for movably inserting the rotation shafts of the pulleys of the driving unit of the second supporting brackets.

16. The transferring tool of one of claims 1 to 5, wherein the pulleys and the belts are implemented as timing pulleys and timing belts.

17. A transferring tool, comprising:

a first supporting bracket installed so as to be movable along a

transferring tool guide of a semiconductor device handler;

one pair of second supporting brackets coupled to the first supporting bracket with a gap therebetween, and having a plurality of pickers for picking-up semiconductor devices with a gap therebetween; and

a horizontal gap controller for controlling a gap of the pickers installed at the second supporting brackets,

wherein the horizontal gap controller comprises:

link units having a link structure and installed at one of the second supporting brackets, for connecting supporting members where the respective pickers are installed;

a driving unit installed at one of the second supporting brackets, for controlling a gap between the supporting members by driving the link units; and

a driving force generating unit for driving the driving unit, and

the driving force generating unit comprises:

a driving motor for generating a rotational force;

a driving pulley coupled to the driving motor;

a driven pulley connected to a rotation shaft of one of pulleys of the driving unit respectively installed at the second supporting brackets; and

a driving belt for connecting the driving pulley and the driven pulley.

18. The transferring tool of claim 17, wherein the driving motor is directly connected to the driving unit of the second supporting brackets,

respectively.

19. The transferring tool of claim 17, wherein at least one rotation shaft of the pulleys of the driving unit of the second supporting brackets is connected to a coupler having a controllable coupling length of the rotation shaft, and

wherein the driven pulley is connected to the rotation shaft of one pulley of one driving unit of the second supporting brackets, or is installed at the coupler.

20. The transferring tool of claim 19, wherein the coupler is provided with an insertion hole for movably inserting the rotation shafts of the pulleys of the driving unit of the second supporting brackets.

21. The transferring tool of claim 17, wherein the driving pulley is configured to have a diameter smaller than that of the driven pulley.

22. The transferring tool of one of claims 17 to 21, wherein the pulleys and the belts are implemented as timing pulleys and timing belts.