# Description

# TOOL FOR TRANSFERRING SEMICONDUCTOR DEVICE

## Technical Field

[1] The present invention relates to a transferring tool, and more particularly, to a tool for transferring a semiconductor device capable of picking up an object to be transferred such as a semiconductor device for transferring.

## Background Art

[2] Generally, semiconductor devices having undergone a package process have to undergo various tests such as an electric characteristic test and a burn-in test for testing reliability against external heat. According to a result of the tests, the semiconductor devices are sorted to be good or bad. For test or sorting process, the semiconductor devices are loaded on each tray and/or a board, and the trays are sequentially transferred.

[3] The semiconductor devices loaded on each tray and/or board are picked up to be transferred by a tool for transferring, to a socket, a tray, a board, etc. of a testing apparatus thus to be tested or sorted.

[4] The conventional tool for transferring includes a supporting bracket; and one or more pickers installed at the supporting bracket, and having a suction head at an end thereof, the suction head for sucking an upper surface of a semiconductor device by forming a vacuum pressure.

[5] The pickers are configured in two, four, eight, etc. in number in one line, thereby transferring a plurality of semiconductor devices at a single time.

[6] However, a testing or a sorting apparatus for a semiconductor device, the apparatus having the tool for transferring installed thereat, has a different testing or sorting speed according to the number of semiconductor devices to be transferred. Therefore, the tool for transferring has to be configured so as to transfer semiconductor devices as much as possible.

## Disclosure of Invention

## Technical Problem

[7] Therefore, it is an object of the present invention to provide a tool for transferring semiconductor devices capable of transferring a plurality of semiconductor devices at one time by providing pickers arranged in a plurality of rows.

[8] It is another object of the present invention to provide a tool for transferring semiconductor devices capable of controlling an interval between pickers arranged in a plurality of rows in at least one direction of a horizontal direction and a vertical direction.

## Technical Solution

[9] To achieve these objects, there is provided a tool for transferring semiconductor devices, comprising: a supporting bracket movably installed at a transfer tool guide; and pickers installed at the supporting bracket in a plurality of rows, for picking up semiconductor devices.

[10] The supporting bracket includes a first supporting bracket movably installed at the transfer tool guide; and a plurality of second supporting brackets coupled to the first supporting bracket, and having the pickers installed in one row with an interval therebetween.

[11] The second supporting brackets have the pickers installed in one row with an interval therebetween, and may be further provided with a horizontal interval controller for controlling an interval between the pickers.

[12] The horizontal interval controller may include a plurality of supporting members to which the pickers are coupled, respectively; and a link unit having a link structure for connecting the supporting members to each other so as to control an interval between the supporting members.

[13] The horizontal interval controller may include a plurality of supporting members to which the pickers are coupled, respectively; a plurality of coupling pins coupled to the supporting members, respectively; and a driving plate having a plurality of slots for inserting the plurality of coupling pins, for controlling an interval between the supporting members by being moved in upper and lower directions.

[14] A vertical interval controller may be further comprised so as to control an interval between the second supporting brackets so that a vertical interval between the pickers can be controlled.

[15] The second supporting brackets are configured in one pair in number. The vertical interval controller may include an interval control shaft screw-coupled to the second supporting brackets so that the second supporting brackets can be moved in different directions when rotating; and a driving unit installed at the first supporting bracket, for rotating the interval control shaft.

[16] The vertical interval controller may include guide members installed at the second supporting brackets, respectively; a cam member rotatably installed at the first supporting bracket, and having guide grooves for respectively inserting the guide members, for controlling an interval between the second supporting brackets by controlling an interval between the guide members; and a rotation driving unit for rotating the cam member.

[17] The vertical interval controller may include a pulling force member installed so that the second supporting brackets can be connected to each other by pulling force; a cam

member rotatably installed at the first supporting bracket, for controlling an interval between the second supporting brackets by being rotated; and a rotation driving unit for rotating the cam member.

[18] The vertical interval controller may include a pulling force member installed so that the second supporting brackets can be connected to each other by pulling force; and an insertion member inserted between the second supporting brackets, for controlling an interval between the second supporting brackets.

[19] The pickers may be installed at facing surfaces of the second supporting brackets adjacent to each other.

## Advantageous Effects

[20] In the tool for transferring semiconductor devices in accordance with the present invention, since pickers arranged in a plurality of rows are provided, semiconductor devices can be transferred as much as possible at a single time.

[21] In the tool for transferring semiconductor devices in accordance with the present invention, since the semiconductor devices are transferred in a plurality of rows, the entire length of the same number of semiconductor devices being transferred can be reduced.

[22] In the tool for transferring semiconductor devices in accordance with the present invention, since the semiconductor devices are transferred in a plurality of rows, can be increased the number of semiconductor devices that can be photographed by a vision tester for testing a plurality of semiconductor devices by photographing each appearance of the semiconductor devices.

[23] In the tool for transferring semiconductor devices in accordance with the present invention, since an interval between the pickers arranged in a plurality of rows can be controlled in at least one direction of a horizontal direction and a vertical direction, an interval between the semiconductor devices can be properly controlled.

## Brief Description of the Drawings

[24] FIG. 1 is a conceptual view of a semiconductor device tester to which a tool for transferring semiconductor devices according to the present invention is applied;

[25] FIG. 2 is a conceptual view of the tool for transferring semiconductor devices of the semiconductor device tester of FIG. 1;

[26] FIG. 3 is a perspective view showing one example of the tool for transferring semiconductor devices of FIG. 2;

[27] FIG. 4 is a plane view of the tool for transferring semiconductor devices of FIG. 3;

[28] FIGS. 5 and 6 are plane views showing one example of a vertical interval controller of the tool for transferring semiconductor devices of FIG. 3;

[29] FIG. 7 is a lateral view of the tool for transferring semiconductor devices of FIG. 3;

[30] FIGS. 8 and 9 are plane views showing another example of the vertical interval controller of the tool for transferring semiconductor devices of FIG. 3;

[31] FIGS. 10 and 11 are plane views showing still another example of the vertical interval controller of the tool for transferring semiconductor devices of FIG. 3;

[32] FIGS. 12 and 13 are plane views showing yet still another example of the vertical interval controller of the tool for transferring semiconductor devices of FIG. 3;

[33] FIGS. 14 and 15 are sectional views taken along line 'VII-VII' and 'VIII-VIII' in FIG. 4;

[34] FIGS. 16 and 17 are conceptual views showing one example of a horizontal interval controller of the tool for transferring semiconductor devices of FIG. 3; and

[35] FIG 18 is a conceptual view showing another example of the horizontal interval controller of the tool for transferring semiconductor devices of FIG. 3.

## Mode for the Invention

[36] Hereinafter, a tool for transferring semiconductor devices according to the present invention will be explained in more detail with reference to the attached drawings.

[37] A tool for transferring semiconductor devices 700 according to the present invention is an apparatus for transferring an object to be transferred such as a semiconductor device 1. The tool for transferring semiconductor devices 700 is installed at a sorter for sorting the semiconductor device 1 or a tester for testing the semiconductor device 1, etc., thereby transferring the semiconductor device 1.

[38] As shown in FIGS. 1 and 2 which shows a semiconductor device inspection apparatus to which the tool for transferring semiconductor devices 700 is applied, the semiconductor device inspection apparatus 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 result by the first and the second vision inspection units 400 and 500.

[39] The loading unit 100 may have various configurations. As shown in FIG. 1, the loading unit 100 may include a guide unit 110 for guiding motion of a tray 2 on which the plurality of semiconductor devices 1 are mounted; and a driving unit (not shown) for moving the tray 2 along the guide unit 110.

[40] The first vision inspection unit 400 is installed at a body 10, and serves to inspect appearance of the respective semiconductor devices 1 by analyzing image of lower appearance of the respective semiconductor devices 1. The first vision inspection unit 400 includes an image capturing device for capturing image, and an image analyzing

device for analyzing an image.

[41] The second vision inspection unit 500 may be configured in a similar manner as the first vision inspection unit 400, but is installed above the body 100 so as to capture upper image of the respective semiconductor devices 1.

[42] The second vision inspection unit 500 includes an image capturing device 530 installed above the tray 2 on which the semiconductor devices 1 are mounted, for capturing upper image of each of the semiconductor devices 1.

[43] As shown in FIG. 1, in order to enhance a inspection speed for the semiconductor devices 1, the image capturing device 530 is installed so as to be movable in horizontal and vertical directions (X and Y directions) above the loading unit 100, which is a transfer path of the tray 2. Guide units 510 and 540 for guiding the image capturing device 530 to move in X and Y directions are installed at the body 10.

[44] The first vision inspection unit 400 and the second vision inspection unit 500 inspects appearance state or marking state on the surface of the respective semiconductor devices, such as damage of a lead or a ball grid, crack, and scratch.

[45] The sorting unit 300 has a similar configuration as the loading unit 100. And, the sorting unit 300 may be configured in plurality in number so that semiconductor devices can be classified into Good G, Bad 1 or Abnormal 1 R1, Bad 2 or Abnormal 2 R2, etc.

[46] Each of the sorting units 300 may include guide units 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 units 310.

[47] The tray 2 can be transferred by a tray transfer device (not shown) between the loading unit 100 and the sorting units 300. An empty tray unit 200 for supplying an empty tray 2 having no semiconductor device 1 mounted thereon may be further provided at the sorting units 300.

[48] The empty tray unit 200 may include guide units 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 units 210.

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

[50] In order to enhance a inspection speed like the first vision inspection unit 400, the semiconductor devices 1 have to be transferred at one time as many as possible. Since the semiconductor devices 1 are transferred with a mounted state on the tray 2, the transfer tools 700 and 620 have to be configured with consideration of a structure of the tray 2.

[51] As shown in FIG. 2, the transfer tool 700 for transferring the semiconductor devices

1 between the first vision inspection unit 400 and the loading unit 100, includes a supporting bracket installed so as to be movable along the transfer tool guide 601; and pickers 730 installed at the supporting bracket in a plurality of rows, for picking up the semiconductor devices 1. Here, the transfer tool 700 may transfer the semiconductor devices 1 so as to pass through a Field of View (FOV) of a camera device of the first vision inspection unit 400 with a constant speed or a constant step.

[52] The pickers 730 serve to pickup the semiconductor devices 1 for transfer, and may have various configurations. Each of the pickers 730 may include a suction head 731 for sucking and picking up the semiconductor devices 1 by generating a vacuum pressure while moving in upper and lower directions. Each of the suction heads 731 may be installed so as to be independently moved in upper and lower directions.

[53] The supporting bracket may have various configurations so that the plurality of pickers 730 can be arranged in m×n ('m' and 'n' denote natural number no less than 2). As shown in FIG. 3, the supporting bracket may include a first supporting bracket 710 installed at the transfer tool guide 601 so as to be movable; and a plurality of second supporting brackets 720 coupled to the first supporting bracket 710, the second supporting brackets 720 having the pickers 730 installed thereon with a predetermined interval therebetween.

[54] The first supporting bracket 710 is installed so as to be movable along the transfer tool guide 601, and is transferred by an additional transfer device thereby to move the second supporting brackets 720.

[55] The second supporting brackets 720 are installed in plurality in number 'n' with an interval therebetween, and may have various configurations so that the pickers 730 arranged in number 'm' can be installed thereon with an interval therebetween.

[56] Here, the pickers 730 are installed on the second supporting brackets 720 in a horizontal direction, and the second supporting brackets 720 are arranged in a vertical direction.

[57] As shown in FIG. 4, the second supporting brackets 720 may be configured in one pair. Here, with consideration of the structure, the pickers 730 are preferably installed at facing surfaces of the second supporting brackets 720.

[58] When the second supporting brackets 720 are installed in one pair at facing surfaces of the second supporting brackets 720 adjacent to each other, an interval between the pickers 730 thereat may be minimized.

[59] The semiconductor devices 1 mounted on the tray 2 may have a different interval therebetween according to the kind of the semiconductor devices 1 to be inspected, and a manufacturing company. The interval between the semiconductor devices 1 needs to be decreased or increased for an inspection when the semiconductor devices 1 are transferred to an inspection module such as the first vision inspection unit 400.

[60] Accordingly, the pickers 730 may be configured so that an interval Ph, Pv therebetween can be controlled in one of a horizontal direction and a vertical direction, rather than configured to be fixed to the supporting bracket. At least one of a vertical interval controller for controlling a vertical interval Pv of the pickers 730, and a horizontal interval controller for controlling a horizontal interval Ph of the pickers 730 may be installed at the supporting bracket.

[61] The vertical interval controller may have various configurations so that a vertical interval Pv between the pickers 730 can be controlled.

[62] When the second supporting brackets 720 are implemented in one pair, as shown in FIGS. 4, 5 and 6, the vertical interval controller may include a driving motor 761 fixed to the first supporting bracket 710; and an interval control shaft 765 connected to a driving shaft of the driving motor 761, and screw-coupled to said one pair of second supporting brackets 720, for controlling an interval between the second supporting brackets 720.

[63] Each of the second supporting brackets 720 is provided with a coupling portion 723 coupled to the interval control shaft 765. Also, the second supporting brackets 720 are differently screw-coupled to the interval control shaft 765 so as to move in directions different from each other.

[64] More concretely, the interval control shaft 765 is provided with screw portions in different directions, i.e., a left screw portion 763 and a right screw portion 764. One of the second supporting brackets 720 is coupled to the left screw portion 763, and the other of the second supporting brackets 720 is coupled to the right screw portion 764.

[65] In order to be coupled to the left screw portion 763 and the right screw portion 764 of the interval control shaft 765, female screw portions may be directly formed at the second supporting brackets 720, or an additional member 724 having female screw portions may be connected to the second supporting brackets 720.

[66] As shown in FIGS. 4 and 7, in order to minutely control a vertical interval between the second supporting brackets 720, the vertical interval controller may be provided with a vertical motion guiding unit. The vertical motion guiding unit includes a first guide member 716 disposed at both ends of an upper side of the second supporting brackets 720, for guiding a vertical motion of the second supporting brackets 720; and a second guide member 726 coupled to the first guide member 716, for guiding a vertical motion of the second supporting brackets 720.

[67] The vertical interval controller may have various configurations rather than the configurations shown in FIGS. 4, 5 and 6, and their detailed explanation will be explained.

[68] As shown in FIGS. 8 and 9, the vertical interval controller may include guide members 729 having the second supporting brackets 720 respectively installed thereat; a cam member 811 rotatably installed at the first supporting bracket 710, and having

guide grooves 811a for respectively inserting the guide members 729, for controlling an interval between the second supporting brackets 720 by controlling an interval between the guide members 729 inserted into the guide grooves 811a; and a rotation driving unit (not shown) for rotating the cam member 811.

[69] The guide members 729 may be integrally installed at the second supporting brackets 720, or may be installed as an additional members such as pins. Here, the second supporting brackets 720 may be connected to an additional connection member (not shown) so that an interval between the guide members 729 can be decreased.

[70] The cam member 811 has guide grooves 811a for inserting the guide members 729. The guide grooves 811a are implemented as through holes or grooves, or discs rotatably connected to the first supporting bracket 710.

[71] The guide grooves 811a are formed so as to decrease their distances from a rotation center of the cam member 811, so that an interval between the guide members 729 can be controlled when the cam member 811 is rotated.

[72] Although not shown, the rotation driving unit may be installed at the first supporting bracket 710. As shown in FIGS. 8 and 9, in order to enhance a rotational force, a gear portion 811b may be formed on an outer circumferential surface of the cam member 811. Also, the rotation driving unit may be configured so that a rotation force can be transmitted by a driving gear 812 gear-coupled to the gear portion 811b of the cam member 811.

[73] As shown in FIGS. 10 and 11, the vertical interval controller may include a pulling force member 821 for providing a pulling force installed so that the second supporting brackets 720 can be connected to each other; a cam member 822 rotatably installed at the first supporting bracket 710, for controlling an interval between the second supporting brackets 720 by being rotated; and a rotation driving unit (not shown) for rotating the cam member 811.

[74] The pulling force member 821 is configured so as to provide a pulling force to the second supporting brackets 720. As the pulling force member 821, an elastic member such as a spring may be used.

[75] The cam member 811 is installed so that its cam surface can support the second supporting brackets 720. As the second supporting brackets 720 move according to each position of the cam surface, an interval between the second supporting brackets 720 is controlled.

[76] As shown in FIGS. 12 and 13, the vertical interval controller may include a pulling force member 831 installed so that the second supporting brackets 720 can be connected to each other, and providing a pulling force; and an insertion member 832 inserted between the second supporting brackets 720, for controlling an interval between the second supporting brackets 720.

[77] The pulling force member 831 is configured so as to allow the second supporting brackets 720 to be pulling to each other. As the pulling force member 831, an elastic member such as a spring may be used.

[78] The insertion member 831 may have a tapered shape so as to be easily inserted into an insertion surface manually or by a driving unit. The insertion member 831 may be provided with one or more protrusions 832 for preventing the insertion members 831 from being separated from the insertion surface.

[79] A connection member 833 extending towards the second supporting brackets 720 facing each other may be additionally installed at the second supporting brackets 720, so that the insertion member 832 can be easily inserted between the second supporting brackets 720.

[80] A contact member 834 is installed at the end of the connection member 833, and is provided with an insertion surface 834a for inserting the insertion member 832 as well as the adjacent contact member 834.

[81] Referring to FIG. 12, when the insertion member 832 is inserted into the contact member 834, an interval between the second supporting brackets 720 is increased. On the contrary, referring to FIG. 13, when the insertion member 832 is removed from the contact member 834, the contact member 834 moves up to a contact position therebetween by the pulling force member 831. Accordingly, the interval between the second supporting brackets 720 is decreased.

[82] The horizontal interval controller serves to control a horizontal interval between the pickers 730, and may have various configurations. As shown in FIGS. 14 to 17, the horizontal interval controller may include a link unit 751 having a link structure for connecting the supporting members 732 to each other, the supporting members having the pickers 730 installed thereat; and a driving unit for controlling an interval between the supporting members 732 by driving the link unit 751.

[83] The link unit 751 is composed of a plurality of link members 751a, and pins 751b for connecting the link members 751a to each other. Here, the link unit 751 is coupled to the supporting members 732 by coupling pins 752. Preferably, a guide unit 721 for guiding motion of the supporting member 732 may be installed at the second supporting brackets 720.

[84] The driving unit consecutively moves the supporting members 732 coupled to the link unit 751 by moving the link unit 751 or the supporting members 732, thereby controlling a horizontal interval Ph between the supporting members 732 as shown in FIG. 14A or 14B.

[85] The driving unit includes a driving motor 753 fixed to the second supporting brackets 720; a driving pulley 754 rotatably installed at the second supporting brackets 720, and rotated by being coupled to a driving shaft of the driving motor 753; a driven pulley

756 rotatably installed at the second supporting brackets 720, and connected to the driving pulley 754 by a belt 755; 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.

[86] Here, the moving members 757 are coupled to the supporting members 732 disposed at both ends thereof, respectively. Also, the moving members 757 are implemented in one pair so that the supporting members 732 can move inwardly or outwardly. The one pair of moving members 757 are coupled to the belt 755 so that their moving directions can be opposite to each other.

[87] The driving motor 753 can transmit a rotation force to the driving pulley 754 installed at the adjacent second supporting bracket 720 by a coupler 758. Here, in order to control an interval between the second supporting brackets 720 by the vertical interval controller, the coupler 758 couples rotation shafts coupled to the adjacent driving pulley 754 so that one of the rotation shafts can move along a shaft direction.

[88] The horizontal interval controller may have various configurations. As shown in FIG. 18, instead of the link unit 751, can be used a driving plate 759 having a plurality of slots 759a of a certain shape for inserting the coupling pins 752 coupled to the supporting members 732.

[89] As shown in FIG. 18, the slots 759a formed at the driving plate 759 horizontally moves the coupling pins 752 inserted into the slots 759a by vertically moving, thereby moving the supporting members 732 coupled to the coupling pins 752. Accordingly, a horizontal interval Ph between the pickers 730 can be controlled.

[90] Although not shown, a sensing unit for sensing an interval between the pickers 730 may be further provided at the horizontal interval controller and the vertical interval controller, respectively, thereby controlling a horizontal interval Ph and a vertical interval Pv.

[91] It will also 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 invention. Thus, it is intended that the present invention cover modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.

## CLAIMS

1. A tool for transferring semiconductor devices, comprising:

a supporting bracket movably installed at a transfer tool guide; and

pickers installed at the supporting bracket in a plurality of rows, for picking up semiconductor devices,

wherein the supporting bracket includes: a first supporting bracket movably installed at the transfer tool guide; and a plurality of second supporting brackets coupled to the first supporting bracket, the second supporting brackets having the pickers installed in one row with an interval therebetween, and

wherein the tool for transferring semiconductor devices further comprises a vertical interval controller for controlling an interval between the second supporting brackets so that a vertical interval between the pickers can be controlled.

2. The tool for transferring semiconductor devices of claim 1, wherein the second supporting brackets have the pickers installed with a certain interval therebetween, and are further provided with a horizontal interval controller for controlling an interval between the pickers.

3. The tool for transferring semiconductor devices of claim 2, wherein the horizontal interval controller includes: a plurality of supporting members to which the pickers are coupled, respectively; and a link unit having a link structure for connecting the supporting members to each other so as to control an interval between the supporting members.

4. The tool for transferring semiconductor devices of claim 2, wherein the horizontal interval controller includes: a plurality of supporting members to which the pickers are coupled, respectively; a plurality of coupling pins coupled to the supporting members, respectively; and a driving plate having a plurality of slots for inserting the plurality of coupling pins, and being configured to control an interval between the supporting members by being moved in upper and lower directions.

5. The tool for transferring semiconductor devices of any one of claims 1, 2-4, wherein the second supporting brackets are configured in one pair in number,

wherein the vertical interval controller includes: an interval control shaft screw-coupled to the second supporting brackets so that the second supporting brackets can be moved in different directions when rotating; and a driving unit installed at the first supporting bracket, for rotating the interval control shaft.

6. The tool for transferring semiconductor devices of any one of claims 1, 2-4, wherein the vertical interval controller includes: guide members installed at the second supporting brackets, respectively; a cam member rotatably installed at the first supporting bracket, the cam member having guide grooves for respectively inserting the guide members, for controlling an interval between the second supporting brackets by controlling an interval between the guide members; and a rotation driving unit for rotating the cam member.

7. The tool for transferring semiconductor devices of any one of claims 1,

2-4, wherein the vertical interval controller includes: a pulling force member for providing pulling force installed so that the second supporting brackets can be connected to each other; a cam member rotatably installed at the first supporting bracket, for controlling an interval between the second supporting brackets by being rotated; and a rotation driving unit for rotating the cam member.

8. The tool for transferring semiconductor devices of any one of claims 1, 2-4, wherein the vertical interval controller includes: a pulling force member for providing pulling force installed so that the second supporting brackets can be connected to each other; and an insertion member inserted between the second supporting brackets, for controlling an interval between the second supporting brackets.

9. The tool for transferring semiconductor devices of any one of claims 1, 2-4, wherein the pickers are installed at facing surfaces of the second supporting brackets adjacent to each other.