

DEVICE AND METHOD FOR CONVEYING AND FLIPPING A COMPONENT

FIELD OF INVENTION

The present invention relates to a device and method for conveying and
5 flipping a component, and more particularly to a device and method for conveying
and flipping a semiconductor component for use in conjunction with a rotary turret
module in semiconductor industry.

BACKGROUND OF INVENTION

10 Semiconductor processing can be divided into two sequential sub-
processes generally referred to as front-end and back-end processes. Rotary
turret module is widely used in the back-end processes such as testing, inspection
and packaging of the semiconductor components due to its high throughput rates.

During processing of the semiconductor components, orientation of the
15 semiconductor components may need to be changed according to the various
conditions or requirements in the back-end processes. For example, some of the
semiconductor components are required to change from “live-bug” position to
“dead-bug” position or vice versa before testing or inspection can be carried out. It
should be noted that the desired orientation of the semiconductor components can
20 be changed by flipping or inverting the component 180 degrees. The existing
flipping module used in the industry involves complex procedures and thus could
affect the progress of the entire back-end processes as more time is spent in
changing or inverting the orientation of the semiconductor components to the
desired orientation.

Therefore, it is desirous to provide a device that is configured to flexibly use in conjunction with a rotary turret module and is capable of carrying out simple yet efficient process to change the orientation of the semiconductor components for further processing.

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SUMMARY OF THE INVENTION

The present invention relates to a device for conveying and flipping a component for use in conjunction with a rotary turret module. In the preferred embodiment, the device includes at least a pair of spaced apart flipping arms, a first flipping arm and a second flipping arm suitably mounted on a platform. It should be noted that the flipping arms are preferably positioned adjacent to one another.

Each of the flipping arms is provided with one nozzle, wherein a first nozzle is associated with the first flipping arm and a second nozzle is associated with the second flipping arm. Each of the first and second nozzles has one end configured to pick a component from a pick-up head of the rotary turret module and another end fixedly mounted on a shaft with a longitudinal axis of the nozzle substantially orthogonal to a longitudinal axis of the shaft. In accordance with the preferred embodiment of the present invention, the shaft is supported on the flipping arm and is operatively connected to a rotary actuating means. The rotary actuating means is adapted to be capable of affecting a rotational motion of the shaft about the longitudinal axis of the shaft, thereby rotating the nozzles by substantially 90 degrees. It should be noted the nozzles are rotated in a counter direction so as to position the ends of the nozzles to pick the component to face each other.

Preferably, the device is provided with a pneumatic means to control the pressure of the nozzle either to hold or to release the component.

Preferably, the device is provided with a linear actuating means suitably mounted on the platform. It should be noted that the linear actuating means is operatively connected to at least one of the flipping arms. The linear actuating means is adapted to be capable of moving the flipping arm or arms in a horizontal direction.

In one embodiment of the present invention, the linear actuating means is operatively connected to the first flipping arm. In this embodiment, the first flipping arm is moving horizontally towards or apart from the second flipping arm. In another embodiment, the linear actuating means is operatively connected to the second flipping arm. In this embodiment, the second flipping arm is moving horizontally towards or apart from the first flipping arm. In yet another embodiment of the present invention, the linear actuating means is operatively connected to the first and second flipping arms. In this embodiment, the flipping arms are capable of moving towards or apart from one another.

It should be noted that the linear actuating means of each of the three embodiments above is provided with a sensor and/or an encoder. The sensor and/or the encoder is adapted to control and determine the distance travelled by the moving flipping arm or arms so as to position the ends of the nozzles configured to pick the component proximate to each other, thereby allowing the transfer of the component from the first nozzle to the second nozzle. It will be appreciated that the component is flipped 180 degrees when the component is transferred from the first nozzle to the second nozzle.

The present invention consists of several novel features and a combination of parts hereinafter fully described and illustrated in the accompanying description and drawing, it being understood that various changes in the details may be made without departing from the scope of the invention or sacrificing any of the advantages of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be fully understood from the detailed description given herein below and the accompanying drawing which is given by way of illustration only, and thus is not limitative of the present invention, wherein:

FIG.1 illustrates the perspective view of a device for conveying and flipping a component for use in conjunction with a rotary turret module;

FIG. 2 shows the back view of the device with a first nozzle holds the component picked from a pick-up head of the rotary turret module;

FIG.3 shows the back view of the device with the nozzles of a first and second flipping arms rotated to substantially 90 degrees; and

FIG. 4 illustrates the back view of the device with the second nozzle holds the 180 degrees flipped component.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention relates to a device for conveying and flipping a component for use in conjunction with a rotary turret module. Hereinafter, this specification will describe the present invention according to preferred embodiments. However, it is to be understood that limiting the description to the

preferred embodiments of the invention is merely to facilitate discussion of the present invention and it is envisioned that those skilled in the art may devise various modifications and equivalents without departing from the scope of the appended claims.

5 The device for conveying and flipping a component for use in conjunction with a rotary turret module according to the preferred mode of carrying out the present invention will now be described in accordance to the accompanying drawings FIGS. 1 to 4, either individually or in any combination thereof.

 Referring to FIGS. 1 and 2, illustrated therein is a device **1** for conveying
10 and flipping a component **10** according to the preferred embodiment of the present invention. The device **1** includes at least a pair of spaced apart flipping arms, a first flipping arm **100** and a second flipping arm **300**. The flipping arms **100** and **300** are preferably positioned adjacent to one another and suitably mounted on a platform **500**. It should be noted that each of the flipping arms **100**, **300** is provided
15 with a nozzle, a first nozzle **110** and a second nozzle **310**, wherein the first nozzle **110** is associated with the first flipping arm **100** and the second nozzle **310** is associated with the second flipping arm **300**.

 In the preferred embodiment of the present invention, each of the nozzles **110**, **310** is having one end **111**, **311** configured to pick the component **10**
20 preferably from a pick-up head **31** of a rotary turret module **30** and another end **113**, **313** fixedly mounted on a shaft **130**, **330** with a longitudinal axis of the nozzle **110**, **310** substantially orthogonal to a longitudinal axis of the shaft **130**, **330**. It should be noted that the component **10** can include but not limited to semiconductor die or chip. In the preferred embodiment, each of the shafts **130**,

330 is supported on the flipping arm **100, 300** and is operatively connected to a rotary actuating means **150, 350**. By way of example but not limitation, the rotary actuating means **150, 350** is of the voice coil type or the like.

The rotary actuating means **150** and **350** in accordance with the preferred embodiment of the present invention is adapted to be capable of affecting a rotational motion of the shafts **130** and **330** about the longitudinal axis of the shaft **130, 330** so as to rotate the nozzles **110** and **310** by substantially 90 degrees. It should be noted that the first nozzle **110** and the second nozzle **310** are rotated in a counter direction so as to position the end **111** of the first nozzle **110** and the end **311** of the second nozzle **310** to face each other as illustrated in FIG.3. In accordance with the preferred embodiment of the present invention, the device **1** is provided with a pneumatic means (not shown) to control the pressure of the nozzles **110** and **310** so as to enable the nozzles **110** and **310** either to hold or to release the component **10**. It should be noted that the pneumatic means can include but not limited to pressure regulators or vacuum pump.

The device **1** is provided with a linear actuating means **400**. The linear actuating means **400** is suitably mounted on the platform **500** and operatively connected to at least one of the flipping arms **100, 300**. The linear actuating means **400** is adapted to be capable of moving the flipping arm **100, 300** or arms **100** and **300** in a horizontal direction so as to bring the nozzles **110, 310** towards or apart from one another. The linear actuating means **400** is provided with a sensor and/or an encoder (not shown). It should be noted that the sensor and/or encoder is adapted to control and determine the distance travelled by the moving flipping arm **100, 300** or arms **100** and **300**. The ends **111** and **311** of the nozzles **110** and **310** configured to pick-up the component **10** are brought into close

proximity with each other during transferring of the component **10** from the first nozzle **110** to the second nozzle **310**. Once the component **10** is transferred to the second nozzle **310**, the linear actuating means **400** is operable to return the flipping arm **100**, **300** or arms **100** and **300** to the respective original position. The rotary actuating means **150** and **350** then rotate the shafts **130** and **330** about the longitudinal axis of the shafts **130** and **330** to return the nozzles **110** and **310** to the respective original position. In this way, the component **10** held on the second nozzle **310** would have been flipped by 180 degrees while the first nozzle **110** is ready to receive another component to be flipped as illustrated in FIG. 4.

In one embodiment, the linear actuating means **400** is operatively connected to the first flipping arm **100**, thereby effecting the horizontal movement of the first flipping arm **100** towards or apart from the second flipping arm **300**. In another embodiment, the linear actuating means **400** is operatively connected to the second flipping arm **300**. In this embodiment, the second flipping arm **300** is moving horizontally towards or apart from the first flipping arm **100**. In yet another embodiment, the liner actuating means is operatively connected to the first and second flipping arms **100** and **300**, thereby effecting the horizontal movements of the first and second flipping arms **100** and **300** towards or apart from one another. By way of example but not limitation, the linear actuating means **400** is of the voice coil type or the like.

The present invention also relates to a method for conveying and flipping a component **10** for use in conjunction with a rotary turret module **30** according to the device **1** described above wherein the method includes steps of:

- a. connecting a first nozzle **110** associated with a first flipping arm **100** with a source of negative pressure;
- b. picking a component **10** preferably from a pick-up head **31** of a rotary turret module **30** with the first nozzle **110**;
- 5 c. rotating the first nozzle **110** and a second nozzle **310** associated with a second flipping arm **300** by substantially 90 degrees in a counter direction so as to position the nozzles **110** and **310** to face each other;
- d. moving at least one of the flipping arms **100**, **300** or **100** and **300** in a horizontal direction, thereby bringing the nozzles **110** and **310** to close
10 proximity to each other;
- e. connecting the negative pressure to the second nozzle **310**;
- f. neutralising the negative pressure at the first nozzle **110**, thereby transferring the component **10** from the first nozzle **110** to the second nozzle **310**;
- 15 g. moving the flipping arms **100** and **300** apart in the horizontal direction;
- h. moving the first and second nozzles **110** and **310** to a vertically upward position, thereby flipping the component **10** 180 degrees; and
- i. repeating steps a to h for picking and flipping a second component.

The method also includes step of providing a rotary actuating means **150**,
20 **350** operatively connected to a shaft **130**, **330** supported on the flipping arm **100**, **300**. It should be noted that one end **111**, **311** of the nozzles **110**, **310** of the flipping arms **100**, **300** is configured to pick the component **10** and another end **113**, **313** is fixedly mounted on the shaft **130**, **330** with a longitudinal axis of the nozzle **110**, **310** substantially orthogonal to a longitudinal axis of the shaft **130**,
25 **330**. The rotary actuating means **150**, **350** is adapted to be capable of effecting a

rotational motion of the shaft **130**, **330** about the longitudinal axis of the shaft **130**, **330** and hence the nozzles **110**, **310** in a counter direction.

In the preferred embodiment, the method further includes step of providing a pneumatic means to control the pressure of the nozzles **110**, **310** so as to enable the nozzles **110**, **310** to either hold or release the component **10**. It should be noted that the method in accordance with the preferred embodiment of the present invention also includes step of providing a linear actuating means **400** operatively connected to at least one of the flipping arms **100**, **300** or **100** and **300**. In the preferred embodiment, the linear actuating means **400** is suitably mounted on a platform **500**.

The linear actuating means **400** is configured to effect a horizontal motion of the flipping arm **100**, **300** or arms **100** and **300** so as to position the nozzles **110**, **310** sufficiently proximate to each other for transferring of the component **10** between the first and second nozzle **110** and **310**. In one embodiment, the first flipping arm **100** is adapted to move horizontally towards or apart from the second flipping arm **300**. In another embodiment, the second flipping arm **300** is adapted to move towards or apart from the first flipping arm **100**. In yet another embodiment, the first and second flipping arms **100** and **300** are adapted to move horizontally towards or apart from one another. The linear actuating means **400** is provided with a sensor and/or an encoder to determine and control the distance travelled by the flipping arm **100**, **300** or arms **100** and **300**.

Once the component **10** has been transferred to the second nozzle **310**, the flipping arms **100** and **300** moved apart and followed by rotations of the first and second nozzles **110** and **310** back to their respective original positions. The

component **10**, held in the second nozzle **310** would have been flipped 180 degrees and ready to be picked by a pick-up head **31** of the rotary turret module **30** for further processing while the first nozzle is ready to receive another component **10**.

5 The invention being thus described, it is obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the principle and scope of the invention, and all such modifications as would be obvious to one skilled in the art intended to be included within the scope of following claims.

CLAIMS

1. A device (1) for conveying and flipping a component (10) for use in conjunction with a rotary turret module (30), the device (1) includes

at least a pair of spaced apart flipping arms (100, 300), a first flipping arm
5 (100) and a second flipping arm (300), mounted on a platform (500);
wherein each of the flipping arms (100, 300) is provided with one nozzle, a
first nozzle (110) associated with the first flipping arm (100) and a second
nozzle (310) associated with the second flipping arm (300), each having
one end (111, 311) configured to pick the component (10) and another end
10 (113, 311) fixedly mounted on a shaft (130, 330) with a longitudinal axis of
the nozzle (110, 310) substantially orthogonal to a longitudinal axis of the
shaft (130, 330); the shaft (130, 330) being supported on the flipping arm
(100, 300) and operatively connected to a rotary actuating means (150,
350); wherein the rotary actuating means (150, 350) is adapted to be
15 capable of effecting a rotational motion of the shaft (130, 330) about the
longitudinal axis of the shaft (130, 330) and hence the nozzles (110, 310)
by substantially 90 degrees,

wherein the nozzles (110, 310) are caused to rotate in a counter direction
so as to position the ends (111, 311) of the nozzles (110, 310) configured
20 to pick the component (10) to face each other;

a pneumatic means (not shown) for controlling the pressure at the nozzles
(110, 310) to enable the nozzles (110, 310) either to hold or to release the
component (10); and

a linear actuating means (400) mounted on the platform (500) and
25 operatively connected to at least one of the flipping arms (100, 300 or 100

and 300), the linear actuating means (400) being adapted to be capable of moving at least one of the flipping arms (100, 300 or 100 and 300) in a horizontal direction to bring the nozzles (110, 310) towards or apart from one another.

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2. The device (1) for conveying and flipping a component (10) according to claim 1, wherein the two flipping arms (100 and 300) are preferably positioned adjacent to one another.

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3. The device (1) for conveying and flipping a component (10) according to claim 1, wherein the first flipping arm (100) is moving horizontally towards or apart from the second flipping arm (300).

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4. The device (1) for conveying and flipping a component (10) according to claim 1, wherein the second flipping arm (300) is moving horizontally towards or apart from the first flipping arm (100).

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5. The device (1) for conveying and flipping a component (10) according to claim 1, wherein the first and second flipping arms (100 and 300) are moving horizontally towards or apart from each other.

6. The device (1) for conveying and flipping a component (10) according to claim 1, wherein the linear actuating means (400) is provided with a sensor and/or an encoder (not shown).

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7. The device (1) for conveying and flipping a component (10) according to claim 6, wherein the sensor and/or the encoder (not shown) determines the distance travelled by the moving flipping arm (100, 300) or arms (100 and 300) so as to bring the ends (111, 311) of the nozzles (110, 310) configured to pick the component (10) to close proximity to each other to effect transfer of the component (10) from the first nozzle (110) to the second nozzle (310).
8. A method for conveying and flipping a component (10) for use in conjunction with a rotary turret module (30) according to the device (1) for conveying and flipping a component (10) comprising the steps of
- a. connecting a first nozzle (110) associated with a first flipping arm (100) with a source of negative pressure;
 - b. picking a component (100) with the first nozzle (110);
 - c. rotating the first nozzle (110) and a second nozzle (330) associated with a second flipping arm (300) by substantially 90 degrees in a counter direction so as to position the nozzles (110 and 310) to face each other;
 - d. moving at least one of the flipping arms (100, 300 or 100 and 300) in a horizontal direction, thereby bringing the nozzles (110 and 310) to close proximity to each other;
 - e. connecting the negative pressure to the second nozzle (310);
 - f. neutralising the negative pressure at the first nozzle (110), thereby transferring the component (10) from the first nozzle (110) to the second nozzle (310);

- g. moving the flipping arms (100 and 300) apart in the horizontal direction;
- h. moving the first and second nozzles (110 and 310) to a vertically upward position, thereby flipping the component (10) 180 degrees;
- 5 and
- i. repeating steps a to h for picking and flipping a second component.

9. The method for conveying and flipping a component (10) according to claim 8, wherein the first nozzle (110) is preferably picked the component (10) from a pick-up head (31) of the rotary turret module (30) in step b.

10. The method for conveying and flipping a component (10) according to claim 8, wherein the 180 degrees flipped component (10) in step h is preferably picked by the pick-up head (31) of the rotary turret module (30).

11. The method for conveying and flipping a component (10) according to claim 8, wherein the nozzle (110, 310) having one end (111, 311) configured to pick the component (10) and another end (113, 313) fixedly mounted on a shaft (130, 330) supported on the flipping arm (100, 300).

12. The method for conveying and flipping a component (10) according to claim 11, wherein the shaft (130, 330) is operatively connected to a rotary actuating means (150, 350).

13. The method for conveying and flipping a component (10) according to claim 12, wherein the rotary actuating means (150, 350) is adapted to be capable of effecting a rotational motion of the shaft (113, 313) and hence the nozzles (110, 310) in a counter direction so as to position the ends (111, 311) of the nozzles (110, 310) configured to pick the component (10) to face each other.
14. The method for conveying and flipping a component (10) according to claim 8, wherein the pressure of the nozzles (110, 310) in steps a, e and f is controlled by a pneumatic means (not shown).
15. The method for conveying and flipping a component (10) according to claim 8, wherein the horizontal motion of the flipping arms (100, 300) in steps d and g are effected by a linear actuating means (400) operatively connected to at least one of the flipping arms (100, 300 or 100 and 300).
16. The method for conveying and flipping a component (10) according to claim 8 or 15, wherein the first flipping arm (100) is moving horizontally towards or apart from the second flipping arm (300).
17. The method for conveying and flipping a component (10) according to claim 8 or 15, wherein the second flipping arm (300) is moving horizontally towards or apart from the first flipping arm (100).

18. The method for conveying and flipping a component (10) according to claim 8 or 15, wherein the first and second flipping arms (100 and 300) are moving horizontally towards or apart from each other.
- 5 19. The method for conveying and flipping a component (10) according to claim 8 or 15, wherein the distance travelled by the moving flipping arm (100, 300) or arms (100 and 300) is determined by a sensor and/or an encoder (not shown).