

Gripper for transporting a vertically standing semiconductor wafer and method for cleaning the semiconductor wafer

- 5 The invention relates to a gripper for transporting a vertically standing semiconductor wafer, comprising a flat body having a head section and a foot section, which form a planar front side;
arms, which extend from the head section to spaced-apart ends in the foot section;
at end portions of the arms, a supporting surface, which is arranged so as to be set
10 back from the plane of the front side; and
holding pins, which are arranged on the end sections and are intended for establishing a clamping connection between the semiconductor wafer and the body.

Prior art/problems

- 15 Grippers of this type are used, in particular, in cleaning lines in which semiconductor wafers, following chemical mechanical polishing (CMP), are individually transported into a cleaning module and cleaned. A cleaning line (running beam device) of this type is described, for example, US2020 0 203 152 A1. Such a gripper is also referred to as a blade.
20 CN213 845 245 U discloses such a gripper. The disadvantage here is that this gripper does not sufficiently protect a semiconductor wafer, following cleaning, against liquid cleaning agent passing onto the semiconductor wafer from the gripper and particles contained in the cleaning agent thus being able to contaminate the clean
25 semiconductor wafer anew and/or cleaning agent which subsequently passes on to the semiconductor wafer altering the roughness of the surface of the semiconductor wafer.

- The object of the invention is to reduce this risk of the cleaned semiconductor wafer becoming recontaminated.
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The object of the invention is achieved by a gripper for transporting a vertically standing semiconductor wafer, comprising a flat body having a head section and a foot section, which form a planar front side;

arms, which extend from the head section to spaced-apart ends in the foot section;
at end sections of the arms, a supporting surface, which is arranged so as to be set
back from the plane of the front side; and

holding pins, which are arranged on the end sections and are intended for

- 5 establishing a clamping connection between the semiconductor wafer and the body,
characterized by a channel which follows an inner side of the arms, is made in the
arms and terminates at edges, wherein the edges are separated from the ends of the
arms.

- 10 The proposed channel directs liquid predominantly past the semiconductor wafer to
the (end) edges of the channel, from which the liquid can drip off without passing to
the surface of the semiconductor wafer beforehand. The channel preferably extends
in the forward direction, that is to say it projects some way towards out of the plane of
the front side. It is preferably the case that the inner sides of the arms are curved
15 towards one another in a semi-circular manner. It is also possible for the arms to be
shaped in a manner other than this, for example for the arms to be spaced apart from
one another at a constant distance in the foot section.

- It is also preferred if the arms, at the ends, are each tapered to a point, the latter
20 having no contact with a semiconductor wafer transported by the gripper. The point is
preferably rounded. It is also the case with this configuration that liquid can drip off at
the points.

- The body of the gripper is thicker than the semiconductor wafer which is to be
25 transported, and it preferably consists of a polymer.

Apertures are preferably present in the head section, and these reduce the weight of
the gripper and the flow resistance thereof.

- 30 The semiconductor wafer preferably consists of a single-crystal silicon and has a
diameter of preferably 300 mm or greater.

- It is preferably the case that the semiconductor wafer transported by the gripper is at a
distance from the supporting surface. The distance is ensured by the configuration of
35 the holding pins. The distance is preferably at least equal to the thickness of the

semiconductor wafer. The holding pins preferably each have a resting surface for the semiconductor wafer, this surface being flanked by boundaries. The boundaries are in the form of truncated cones, which are located opposite one another, the base surfaces of the truncated cones being located on the outside.

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The invention also relates to a method for cleaning a semiconductor wafer in a cleaning line, wherein the semiconductor wafer is transported in a vertically standing state out of a cleaning module of the cleaning line, characterized in that, during this time, the semiconductor wafer is transported by a gripper according to the invention.

10 The method is preferably used following CMP.

The invention will be described in more detail hereinbelow with reference to drawings.

15 **Brief description of the figures**

Fig. 1 shows the front side of an embodiment according to the invention of the gripper and of the semiconductor wafer transported thereby.

20 **Fig. 2** shows an enlarged detail from Fig. 1.

Fig. 3 shows a view of parts of Fig. 1, which has been rotated by virtually 90° about a vertical axis in the anticlockwise direction.

25 **Fig. 4** shows a further possible configuration of the ends of the arms.

Fig. 5 shows a possible configuration of the holding pins.

List of reference signs

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- 1** gripper
- 2** body
- 3** head section
- 4** apertures
- 5** foot section

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- 6** arms
- 7** ends
- 8** inner side
- 9** supporting surface
- 5 **10** semiconductor wafer
- 11** holding pins
- 12** channel
- 13** end edge
- 14** point
- 10 **15** truncated cone

Detailed description of an exemplary embodiment according to the invention

The gripper 1 illustrated in Fig. 1 comprises a flat body 2 having a head section 3 with apertures 4 and a foot section 5, which is formed by arms 6, which extends from the head section 3 to ends 7 in the foot section 5. The arms 6 of this embodiment are curved along an inner side 8 and come together in the head section 3. The head section 3 and the foot ~~portion~~ section 5 form a planar front side of the body.

A supporting surface 9 is present at the end sections of the arms 6, the supporting surface being arranged so as to be set back from the plane of the front side. Also arranged on the end sections are holding pins 11, with the aid of which a clamping connection is established between the semiconductor wafer 10 and the body 2.

The gripper 1 also has a channel 12, which follows the curvature of the arms 6 and terminates at end edges 13. The channel 12 is made in the body 2 and follows the curvature of the inner side 8 of the arms at a certain distance therefrom.

Fig. 2 clearly shows that the end edges 13 and the ends 7 of the arms 6 are separated from one another. The ends of the channel 12 are oriented rather more away from one another in the outward direction, whereas the ends 7 of the arms 6 are oriented rather more towards one another in the inward direction.

Fig. 3 shows a perspective view in which the channel 12 can be seen to good effect. As far as the edges 13, the channel 12 largely follows the curvature of the inner side 8

of the arms 6. According to the embodiment shown, the channel 12 projects some way towards out of the plane of the front side.

5 The path for liquid once the gripper 1 has been transported out of the cleaning module leads from the head section 3 of the body 2 predominantly along the channel 12 to the end edges 13. From there, the liquid drips back, for example, into the cleaning module. Residues of liquid on the semiconductor wafer 10 are significantly reduced.

10 In the illustration according to Fig. 4, the arms 6, at the ends 7, are each tapered to a point 14, the latter having no contact with a semiconductor wafer 10 transported by the gripper. In the example shown, the point 14 is rounded. The point 14 may further be bevelled, that is, have a decreasing thickness, the thickness decreasing with distance from the holding pins 11. Preferably, the upper surface of the point 14 shown in Fig. 4 is bevelled.

15 Fig. 5 shows a preferred configuration of the holding pins 11, which holds a transported semiconductor wafer 10 at a distance from the supporting surface 9. The holding pins 11 each have a contact surface for the semiconductor wafer 10, the contact surface being flanked by boundaries. The boundaries are in the form of
20 truncated cones 15, which are located opposite one another, the base surfaces of the truncated cones 15 being located on the outside.

Patent claims

1. Gripper for transporting a vertically standing semiconductor wafer, comprising a flat body having a head section and a foot section, which form a planar front side;
5 arms, which extend from the head section to spaced-apart ends in the foot section;
at end sections of the arms, a supporting surface, which is arranged so as to be set back from the plane of the front side; and
holding pins, which are arranged on the end sections and are intended for establishing a clamping connection between the semiconductor wafer and the body,
10 characterized by a channel which follows an inner side of the arms, is made in the arms and terminates at end edges, wherein the edges are separated from the ends of the arms.
2. Gripper according to Claim 1, characterized by apertures in the head section.
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3. Gripper according to Claim 1 or Claim 2, characterized by the channel projecting out of the plane of the front side.
4. Gripper according to one of Claims 1 to 3, characterized in that the inner side of the
20 arms is curved.
5. Gripper according to one of Claims 1 to 4, characterized in that the arms, at the ends, are each tapered to a point, the latter having no contact with a semiconductor wafer transported by the gripper.
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6. Gripper according to one of Claims 1 to 5, characterized in that the holding pins hold the semiconductor wafer at a distance from the supporting surface.
7. Method for cleaning a semiconductor wafer in a cleaning line, wherein the
30 semiconductor wafer is transported in a vertically standing state out of a cleaning module of the cleaning line, characterized in that, during this time, the semiconductor wafer is transported by a gripper according to one of the preceding patent claims.