

CLAIMS

1. A wafer boat for supporting a plurality of semiconductor wafers in a furnace comprising:

a vertical rod;

a set of fingers that extend radially inward from the vertical rod along a finger axis, each finger of the set comprising:

an elongated segment that extends from the vertical rod, the elongated segment having a portion having a constant width; and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, the contact protuberance having a longitudinal contact protuberance axis, the longitudinal contact protuberance axis and the finger axis being angled relative to each other at an angle from 5° to 75° when viewed from above, the contact protuberance including a rounded surface for supporting and contacting a semiconductor wafer, the contact protuberance being disposed on the portion of the elongated segment having a constant width.

2. The wafer boat as set forth in claim 1 wherein the contact protuberance has a width of 10 mm to 25 mm, a length of 20 mm to 40 mm, and the distance from the contact protuberance to a longitudinal central axis of the wafer boat is from 75 mm to 125 mm.

3. The wafer boat as set forth in claim 1 wherein the contact protuberance has a width of 16 mm and a length of 30 mm.

4. The wafer boat as set forth in any one of claims 1 to 3 wherein the angle between the longitudinal contact protuberance axis and the finger axis is at least 10° when viewed from above.

5. The wafer boat as set forth in claim 1 wherein the angle between the longitudinal contact protuberance axis and the finger axis is at least 20° when viewed from above.

6. The wafer boat as set forth in any one of claims 1 to 5 wherein the longitudinal contact protuberance axis is tangent to a circle centered about a longitudinal central axis of the wafer boat, at a location where the contact protuberance intersects the circle.

7. The wafer boat as set forth in any one of claims 1 to 5 wherein the contact protuberance is a first contact protuberance and the longitudinal contact protuberance axis is a longitudinal first contact protuberance axis, the finger comprising a second contact protuberance toward a distal end of the finger for contacting and supporting the semiconductor wafer, at least a portion of the second contact protuberance being raised with respect to the elongated segment, the second contact protuberance having a longitudinal second contact protuberance axis, the longitudinal second contact protuberance axis and the finger axis being angled relative to each other when viewed from above.

8. The wafer boat as set forth in claim 7 wherein the longitudinal second contact protuberance axis is parallel to the longitudinal first contact protuberance axis.

9. The wafer boat as set forth in claim 7 or claim 8 wherein the first and second contact protuberances are supported by a platform, the platform is mounted to a pin pivotable about a gimbal mounted to the distal end of the elongated segment.

10. The wafer boat as set forth in any one of claims 1 to 9 wherein the finger axis extends over a chord of a circle centered about a longitudinal central axis of the wafer boat, the chord not intersecting the longitudinal central axis of the wafer boat.

11. The wafer boat as set forth in claim 10 wherein the vertical rod is a first rod, the set of fingers is a first set of fingers, and the chord is a first chord, the wafer boat comprising:

a second vertical rod;

a second set of fingers that extend radially inward from the second vertical rod along a second finger axis, the second finger axis extending over a second chord of the circle, the second chord not intersecting the longitudinal central axis of the wafer boat, each finger of the second set comprising:

an elongated segment that extends from the second vertical rod;

and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, the contact protuberance having a longitudinal contact protuberance axis, the longitudinal contact protuberance axis and the second finger axis being angled relative to each other when viewed from above.

12. The wafer boat as set forth in claim 11 further comprising:

a third rod;

a third set of fingers that extend radially inward from the third vertical rod along a third finger axis, the third finger axis extending over a third chord of the circle, the third chord intersecting the longitudinal central axis of the wafer boat, each finger of the third set comprising:

an elongated segment that extends from the third vertical rod; and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, the contact protuberance having a longitudinal contact protuberance axis, the protuberance axis and the third finger axis being perpendicular.

13. The wafer boat as set forth in claim 12 wherein the distal end of each finger is spaced 120° about the wafer boat.

14. The wafer boat as set forth in claim 12 wherein the contact protuberances of the first set, second set, and third set are spaced 120° about the wafer boat.

15. The wafer boat as set forth in any one of claims 12 to 14 wherein the contact protuberances of the first set, second set, and the third set are arranged such that contact protuberances of the first set, second set, and the third set are in a rotationally symmetric pattern.

16. A wafer boat for supporting a plurality of semiconductor wafers in a furnace comprising:

a vertical rod;

a set of fingers that extend radially inward from the vertical rod along a finger axis, each finger of the set comprising:

an elongated segment that extends from the vertical rod, the elongated segment having a portion having a constant width; and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, the contact protuberance having a longitudinal contact protuberance axis, the longitudinal contact protuberance axis and the finger axis being angled relative to each other at an angle from 5° to 75° when viewed from above, wherein the longitudinal contact protuberance axis is tangent to a circle centered about a longitudinal central axis of the wafer boat, at a location where the contact protuberance intersects the circle, the contact protuberance being disposed on the portion of the elongated segment having a constant width.

17. The wafer boat as set forth in claim 16 wherein the contact protuberance includes a rounded surface for supporting and contacting a semiconductor wafer.

18. The wafer boat as set forth in claim 16 wherein the contact protuberance includes a flat surface for supporting and contacting a semiconductor wafer.

19. The wafer boat as set forth in claim 16 wherein the vertical rod is a first vertical rod, the set of fingers is a first set of fingers, and the finger axis being a first finger axis, wherein the first finger axis extends over a chord of a circle centered about a longitudinal central axis of the wafer boat, the chord not intersecting the longitudinal central axis of the wafer boat, the wafer boat further comprising:

a second vertical rod;

a second set of fingers that extend radially inward from the second vertical rod along a second finger axis, the second finger axis extending over a chord of the circle, the chord not intersecting the longitudinal central axis of the wafer boat, each finger of the second set comprising:

an elongated segment that extends from the second vertical rod; and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment;

a third vertical rod;

a third set of fingers that extend radially inward from the third vertical rod along a third finger axis, the third finger axis extending over a chord of the circle, the chord intersecting the longitudinal central axis of the wafer boat, each finger of the third set comprising:

an elongated segment that extends from the third vertical rod; and

a contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, wherein the contact protuberances or the first, second, and third set of fingers are spaced 120° about the wafer boat.

20. A wafer boat for supporting a plurality of semiconductor wafers in a furnace comprising:

a vertical rod;

a set of fingers that extend radially inward from the vertical rod along a finger axis, each finger of the set comprising:

an elongated segment that extends from the vertical rod; and

a single contact protuberance disposed on the elongated segment toward a distal end of the finger for contacting and supporting a semiconductor wafer, at least a portion of the contact protuberance being raised with respect to the elongated segment, the contact protuberance having a longitudinal contact protuberance axis, the longitudinal contact protuberance axis and the finger axis being angled relative to each other when viewed from above, the contact protuberance including a rounded surface for supporting and contacting a semiconductor wafer.