We Claim:

1. A cleaning apparatus for mounting in an electroplating device and for removing electroplated metal deposits from the lipseal and/or cup bottom of the electroplating device, the cleaning apparatus comprising:

a first nozzle;

a first cleaning fluid supply conduit in fluidic connection with the first nozzle; and

a nozzle arm to which the first nozzle is affixed.

~~1~~2. ~~A method of cleaning a lipseal and/or cup bottom of an electroplating device by removing metal deposits accumulated on the lipseal and/or cup bottom in prior electroplating operations, the method~~The cleaning apparatus of Claim 1, further comprising:

a controller having machine readable instructions for:

orienting ~~a~~ the first nozzle relative to the lipseal and/or cup bottom such that the first nozzle is pointed substantially at the inner circular edge of the lipseal and/or cup bottom;

rotating the lipseal and cup bottom in a first rotational direction; and

dispensing a stream of cleaning solution having a fluid velocity between about 5 and 40 meters/second from the first nozzle such that the stream of cleaning solution contacts the inner circular edge of the lipseal and/or cup bottom while they are rotating in the first rotational direction, removing metal deposits from the lipseal and/or cup bottom.

~~2~~3. The ~~method~~ cleaning apparatus of Claim ~~1~~ 2, wherein the instructions of the controller comprise instructions for dispensing the stream of cleaning solution from the first nozzle with a fluid velocity of ~~the stream of cleaning solution is~~ between about 10 and 25 meters/second.

34. The ~~method~~ cleaning apparatus of Claim ~~1~~ 2, wherein the instructions of the controller comprise instructions for maintaining a fluid pressure within the first nozzle ~~while dispensing the stream of cleaning solution is~~ between about 20 and 100 PSI while dispensing the stream of cleaning solution from the first nozzle.

45. The ~~method~~ cleaning apparatus of Claim ~~1~~ 2, ~~further comprising~~ wherein the instructions of the controller comprise instructions for raising and/or lowering the lipseal and cup bottom while dispensing the stream of cleaning solution so as to vary the cleaning solution's area of contact with the inner circular edge of the lipseal and/or cup bottom.

56. The ~~method~~ cleaning apparatus of Claim ~~1~~ 2, ~~further comprising~~ wherein the instructions of the controller comprise instructions for varying the orientation of the first nozzle while dispensing the stream of cleaning solution so as to vary the cleaning solution's angle of impact with the inner circular edge of the lipseal and/or cup bottom.

67. The ~~method~~ cleaning apparatus of any one of Claims 1-6, wherein the metal deposits comprise a tin/silver alloy.

~~7. The method of Claim 1, wherein the cleaning solution is substantially distilled and deionized water.~~

~~8. The method of Claim 1, wherein the cleaning solution comprises distilled and deionized water, a surface tension reducing agent selected from polyethylene glycol and polypropylene glycol, and is substantially free of acid.~~

8. The cleaning apparatus of any one of Claim 2-6, further comprising:

a second nozzle; and

a second cleaning fluid supply conduit in fluidic connection with the second nozzle.

9. The ~~method~~ cleaning apparatus of Claim ~~1~~ 8, ~~further comprising~~ wherein the instructions of the controller comprise instructions for:

orienting ~~a~~ the second nozzle relative to the lipseal and/or cup bottom such that the second nozzle is pointed substantially at the inner circular edge of the lipseal and/or cup bottom; and

dispensing a stream of cleaning solution having a fluid velocity between about 5 and 40 meters/second from the second nozzle such that the stream of cleaning solution contacts the inner circular edge of the lipseal and/or cup bottom while they are rotating, removing metal deposits from the lipseal and/or cup bottom.

10. The ~~method~~ cleaning apparatus of Claim 9, ~~further comprising~~ wherein the instructions of the controller comprise instructions for rotating the lipseal and cup bottom in a second rotational direction opposite the first rotational direction, ~~wherein~~ such that the stream of cleaning solution dispensed from the first nozzle has a velocity component against the first rotational direction and the stream of cleaning solution dispensed from the second nozzle has a velocity component against the second rotational direction.

11. The ~~method~~ cleaning apparatus of any one of Claim 1-6, wherein the first nozzle is oriented such that the stream of cleaning solution dispensed from the first nozzle has a velocity component against the first rotational direction.

12. The ~~method~~ cleaning apparatus of Claim 11, wherein the first nozzle is oriented relative to the inner circular edge of the lipseal and/or cup bottom at a normal angle between about -45 and +45 degrees.

13. The ~~method~~ cleaning apparatus of Claim 12, wherein the first nozzle is oriented relative to the horizontal plane of the lipseal and/or cup bottom at a horizontal angle between about -30 and +10 degrees.

14. The ~~method~~ cleaning apparatus of Claim 13, wherein the first nozzle tip is oriented at a distance of between about 2 and 50 mm from nearest point of the inner circular edge of the lipseal and cup bottom.

15. The ~~method~~ cleaning apparatus of Claim 14, wherein the first nozzle tip is oriented at a distance of between about 2 and 10 mm from nearest point of the inner circular edge of the lipseal and cup bottom.

16. The ~~method~~ cleaning apparatus of Claim 13, wherein the ~~flow rate of~~ instructions of the controller comprise instructions for dispensing the stream of cleaning solution ~~dispensed~~ from the first nozzle ~~is~~ at a flow rate of between about 250 and 750 ml/min.

17. The ~~method~~ cleaning apparatus of any one of Claim 1-6, ~~further comprising~~ wherein the instructions of the controller comprise instructions for generating megasonic waves in the cleaning solution within the first nozzle as the cleaning solution is dispensed from the first nozzle.

~~18. A method of electroplating a metal onto a plurality of semiconductor substrates using an electroplating apparatus having a lipseal and cup bottom, the method comprising:~~

~~electroplating the metal onto a first set of one or more substrates;~~

~~determining whether to perform a cleaning operation which removes metal deposits accumulated on the lipseal and/or cup bottom while electroplating the first set of substrates, wherein the determining comprises an assessment of whether there is sufficient build-up of metal deposits on the lipseal and/or cup bottom to warrant cleaning;~~

~~if it is determined that the cleaning operation is warranted, performing the cleaning operation which removes the metal deposits according to the cleaning method of Claim 1; and~~

~~after determining whether a cleaning operation is warranted and if the cleaning operation is warranted after performing the cleaning operation, electroplating the metal onto a second set of one or more substrates.~~

~~19. The electroplating method of Claim 18, wherein the metal is a tin-silver alloy.~~

~~20. The electroplating method of Claim 19, wherein it is determined that a cleaning operation is warranted if more than a predetermined number of substrates have been electroplated since the last cleaning operation.~~

~~21. The electroplating method of Claim 20, wherein the predetermined number of substrates is selected dependent upon the ratio of patterned to unpatterned surface area of the substrates electroplated since the last cleaning operation.~~

~~22. The electroplating method of Claim 20, wherein the predetermined number of substrates is a number selected from the range of 1 to 200.~~

~~23. The electroplating method of Claim 18, wherein it is determined that a cleaning operation is warranted if more than a predetermined quantity of electric charge has been transferred to the substrate via electroplating since the last cleaning operation.~~

~~24. The electroplating method of Claim 23, wherein the predetermined quantity of electric charge is selected dependent upon the radial distribution of patterned surface area and/or the radial distribution of unpatterned surface area of the substrates electroplated since the last cleaning operation.~~

~~25. The electroplating method of Claim 23, wherein the predetermined quantity of electric charge is a charge quantity selected from the range of about 5 to 500 Coulombs.~~

~~26. A cleaning apparatus for mounting in an electroplating device and for removing electroplated metal deposits from the lipseal and/or cup bottom of the electroplating device, the cleaning apparatus comprising:~~

~~a first nozzle;~~

~~a first cleaning fluid supply conduit in fluidic connection with the first nozzle; and~~

~~a nozzle arm to which the first nozzle is affixed.~~

2718. The cleaning apparatus of any one of Claims 26 1-6, further comprising a nozzle arm actuator mechanically coupled to the nozzle arm and configured to move the first nozzle and nozzle arm between, when the cleaning apparatus is mounted in an electroplating device, a retracted position and a cleaning position such that:

in the retracted position, the first nozzle and nozzle arm are positioned such that a semiconductor substrate may be placed on the lipseal and lowered into the volume of the electroplating device configured to hold an electroplating bath without physically contacting the first nozzle or nozzle arm; and

in the cleaning position, the first nozzle is positioned such that it is substantially pointed at the inner circular edge of the lipseal and/or cup bottom of the electroplating device.

2819. The cleaning apparatus of Claim 27 18, wherein the nozzle arm actuator is configured to rotate the nozzle arm about an axis of rotation moving the nozzle arm between the retracted position and the cleaning position.

2920. The cleaning apparatus of Claim 26 18, wherein the metal deposits comprise a tin/silver alloy.

3021. The cleaning apparatus of Claim 26 18, wherein the first nozzle is a jet nozzle.

3122. The cleaning apparatus of Claim 30 21, wherein the first nozzle has an orifice diameter between about 0.02 and 0.04 inches.

3223. The cleaning apparatus of Claim 31 22, wherein the interior cross-section of the first nozzle tapers from base to tip with either a substantially constant camber angle between about 0 and 20 degrees, or a camber angle varying from base to tip but within a range between about 0 and 20 degrees.

3324. The cleaning apparatus of Claim 32 23, wherein the length from base to tip of the first nozzle is between about 0.5 and 2 cm.

3425. The cleaning apparatus of Claim ~~26~~ 18, further comprising a power generator for generating megasonic waves in the cleaning solution within the first nozzle as the cleaning solution is dispensed from the first nozzle.

3526. The cleaning apparatus of Claim ~~34~~ 25, wherein the power generator generates electrical power having a frequency between about 0.7 and 4 MHz to create the megasonic waves.

~~36. The cleaning apparatus of Claim 26, further comprising:~~

~~a second nozzle; and~~

~~a second cleaning fluid supply conduit in fluidic connection with the second nozzle.~~

3727. An electroplating apparatus for electroplating metal onto a patterned semiconductor substrate, the electroplating apparatus comprising:

a substrate holder comprising:

a cup having a cup bottom;

a lipseal mounted in the cup;

a plurality of electrical contact fingers; and

a cone movable relative to the cup and lipseal and configured to secure a substrate in the substrate holder by pressing the substrate into the lipseal;

an electroplating cell having a volume for holding an electroplating bath fluid;

a power supply configured to supply electrical charge to the electrical contact fingers; and

the cleaning apparatus of Claim ~~26~~ 1.

~~38~~28. The electroplating apparatus of Claim ~~37~~ 27, wherein the substrate holder is movable between a plurality of vertical positions within the electroplating apparatus, the positions comprising:

a loading position for opening the substrate holder, loading the substrate, and closing the substrate holder;

an electroplating position wherein a substrate loaded in the substrate holder is positioned such that the surface of the substrate to be electroplated upon is positioned within the volume of the electroplating cell which holds the electroplating bath fluid; and

a cleaning position wherein, without a substrate loaded in the substrate holder, the lipseal and/or cup bottom are positioned relative to the cleaning apparatus such that electroplated metal deposits on the lipseal and/or cup bottom may be removed by the cleaning apparatus.

~~39~~29. The electroplating apparatus of Claim ~~38~~ 28, further comprising a controller~~, the controller~~ having machine readable instructions ~~which it is configured to execute, the instructions comprising~~ for:

~~instructions for~~ moving the substrate holder to the loading position, receiving a substrate, and closing the substrate holder;

~~instructions for~~ moving the substrate holder to the electroplating position and electroplating the substrate;

~~instructions for~~ returning the substrate holder to the loading position, opening the substrate holder, and removing the substrate;

~~instructions for~~ moving the substrate holder to the cleaning position; and

~~instructions for~~ dispensing cleaning solution from the nozzle of the cleaning apparatus while rotating the substrate holder.

~~40~~30. The electroplating apparatus of Claim ~~39~~ 29, wherein:

the cleaning apparatus ~~of Claim 26,~~ further comprising a nozzle arm actuator mechanically coupled to the nozzle arm and configured to move the first nozzle and nozzle arm between, when the cleaning apparatus is mounted in an electroplating device, a retracted position and a cleaning position such that:

in the retracted position, the first nozzle and nozzle arm are positioned such that a semiconductor substrate may be placed on the lipseal and lowered into the volume of the electroplating device configured to hold an electroplating bath without physically contacting the first nozzle or nozzle arm; and

in the cleaning position, the first nozzle is positioned such that it is substantially pointed at the inner circular edge of the lipseal and/or cup bottom of the electroplating device; and

the ~~machine readable~~ instructions of the controller ~~further~~ comprise instructions for:

~~instructions for~~ moving the nozzle arm actuator of the cleaning apparatus to its cleaning position prior to moving the substrate holder to the cleaning position; and

~~instructions for~~ returning the nozzle arm actuator to its retracted position after moving the substrate holder out of the cleaning position.

~~41~~31. The electroplating apparatus of Claim ~~39~~ 29, further comprising:

a reclaim shield; and

a rinse shield;

wherein the plurality of vertical positions within the electroplating apparatus further comprise:

a reclaim position wherein the substrate is positioned above the volume of the electroplating cell which holds the electroplating bath fluid but below a reclaim shield such that rotating the substrate at this position between about 150 and 750 RPM causes at least a portion of any electroplating bath fluid adhered to the substrate to be

flung against the reclaim shield and returned to the volume of the electroplating cell which holds the electroplating bath; and

a rinse position for rinsing the substrate with a rinse solution wherein the substrate is positioned above the reclaim shield but below the rinse shield such that rotating the substrate at this position between about 150 and 750 RPM causes at least a portion of any rinse solution and/or electroplating bath fluid adhered to the substrate to be flung against the rinse shield and not returned to the volume of the electroplating cell which holds the electroplating bath; and

wherein the ~~machine readable~~ instructions of the controller ~~further~~ comprise instructions for:

~~instructions for~~ moving the substrate holder to the reclaim position and rotating the substrate holder and substrate; and

~~instructions for~~ moving the substrate holder to the rinse position and rinsing the substrate while rotating the substrate holder and substrate.

~~42~~32. The electroplating apparatus of Claim ~~38~~ 28, further comprising a retractable cleaning shield located above the volume of the electroplating cell which holds the electroplating bath and below the first nozzle and substrate when the substrate holder is positioned in the cleaning position, the cleaning shield having an expanded configuration and a retracted configuration, wherein:

in the retracted configuration, the substrate holder may be moved from the cleaning or loading positions to the electroplating position without being physically impeded by the cleaning shield; and

in the expanded configuration, the cleaning shield prevents cleaning fluid dispensed from the first nozzle from falling into the volume of the electroplating cell which holds the electroplating bath fluid.

~~43~~33. The electroplating apparatus of Claim ~~42~~ 32, wherein the diameter of the opening formed by the cleaning shield in the expanded configuration is less than about 75% of the diameter of the inner circular edge of the lipseal and cup bottom.

4434. The electroplating apparatus of Claim ~~42~~ 32, wherein the cleaning shield comprises a plurality of movable blades configured to slide over one another upon retraction and expansion of the retractable shield such that the blades create a substantially circular opening of variable size.

35. The electroplating apparatus of Claim 27, further comprising a controller having machine readable instructions for:

electroplating the metal onto a first set of one or more substrates;

determining whether to perform a cleaning operation which removes metal deposits accumulated on the lipseal and/or cup bottom while electroplating the first set of substrates, wherein the determining comprises an assessment of whether there is sufficient build-up of metal deposits on the lipseal and/or cup bottom to warrant cleaning;

if it is determined that the cleaning operation is warranted, performing the cleaning operation which removes the metal deposits by:

orienting a first nozzle relative to the lipseal and/or cup bottom such that the first nozzle is pointed substantially at the inner circular edge of the lipseal and/or cup bottom;

rotating the lipseal and cup bottom in a first rotational direction; and

dispensing a stream of cleaning solution having a fluid velocity between about 5 and 40 meters/second from the first nozzle such that the stream of cleaning solution contacts the inner circular edge of the lipseal and/or cup bottom while they are rotating in the first rotational direction, removing metal deposits from the lipseal and/or cup bottom; and

after determining whether a cleaning operation is warranted and if the cleaning operation is warranted after performing the cleaning operation, electroplating the metal onto a second set of one or more substrates.

36. The electroplating apparatus of Claim 35, wherein it is determined that a cleaning operation is warranted if more than a predetermined number of substrates have been electroplated since the last cleaning operation.

37. The electroplating apparatus of Claim 36, wherein the predetermined number of substrates is selected dependent upon the ratio of patterned to unpatterned surface area of the substrates electroplated since the last cleaning operation.

38. The electroplating apparatus of Claim 36, wherein the predetermined number of substrates is a number selected from the range of 1 to 200.

39. The electroplating apparatus of Claim 35, wherein it is determined that a cleaning operation is warranted if more than a predetermined quantity of electric charge has been transferred to the substrate via electroplating since the last cleaning operation.

40. The electroplating apparatus of Claim 39, wherein the predetermined quantity of electric charge is selected dependent upon the radial distribution of patterned surface area and/or the radial distribution of unpatterned surface area of the substrates electroplated since the last cleaning operation.

41. The electroplating apparatus of Claim 39, wherein the predetermined quantity of electric charge is a charge quantity selected from the range of about 5 to 500 Coulombs.