

CLAIMS:

1. A substrate processing system comprising:

a transfer region housing defining a transfer region fluidly coupled with a plurality of processing regions disposed above the transfer region, wherein a sidewall of the transfer region housing defines a sealable access for providing and receiving substrates;

a plurality of substrate supports disposed within the transfer region; and

a transfer apparatus comprising:

a central hub including a first shaft and a second shaft extending about and concentric with the first shaft, wherein the second shaft is counter-rotatable with the first shaft, and wherein the central hub is characterized by a central axis, wherein each of the plurality of substrate supports is at a fixed horizontal position relative to the central hub,

an eccentric hub extending at least partially through the central hub, wherein the eccentric hub is radially offset from the central axis of the central hub, and wherein the eccentric hub is coupled with the first shaft of the central hub, and

an end effector coupled with the eccentric hub, the end effector comprising a body having a plurality of arms equal to a total number of substrate supports of the plurality of substrate supports.

2. The substrate processing system of claim 1, wherein one or more linkages couples the eccentric hub with the first shaft of the central hub, and wherein the one or more linkages comprises one or more belts extending about the first shaft or the eccentric hub or a plurality of gears coupled between the first shaft and the eccentric hub.

3. The substrate processing system of claim 1, wherein the end effector further comprises a plurality of end pieces configured to support a substrate.

4. The substrate processing system of claim 3, wherein each end piece extends vertically to a similar plane extending orthogonally to the central hub.

5. The substrate processing system of claim 3, wherein each arm includes a first end piece and a second end piece of the plurality of end pieces, the first end piece and the second end piece configured to support a substrate during movement of the end effector.

6. The substrate processing system of claim 3, wherein each first end piece and each second end piece define a recessed ledge and a shelf.

7. The substrate processing system of claim 1, wherein the central hub is vertically translatable along a central axis of the central hub.

10 8. A method of transferring a substrate, the method comprising:

receiving a substrate at a first substrate support within a transfer region of a substrate processing system, wherein the transfer region is fluidly coupled with a plurality of processing regions disposed above the transfer region, and wherein the substrate processing system includes a transfer apparatus positioned within the transfer region and comprising:

15 a central hub including a first shaft and a second shaft extending about and concentric with the first shaft,

an eccentric hub extending at least partially through the central hub, wherein the eccentric hub is radially offset from a central axis of the central hub, and wherein the eccentric hub is coupled with the first shaft of the central hub, and

20 an end effector coupled with the eccentric hub, the end effector comprising a plurality of arms;

engaging the substrate with an arm of the plurality of arms;

rotating the second shaft in a first direction about the central axis of the central hub;

rotating the first shaft in the first direction about the central axis of the central hub at a fixed ratio with the second shaft to radially reposition the substrate about the central axis within the transfer region; and

5 delivering the substrate to a second substrate support within the transfer region of the substrate processing system, wherein each of the first substrate support and the second substrate support is at a fixed horizontal position relative to the central hub.

9. The method of transferring a substrate of claim 8, further comprising transitioning the transfer apparatus by further rotating the first shaft in the first direction or a second direction opposite the first direction about the central axis at an increased rate from a rate of the fixed ratio to laterally reposition the substrate along a radius extending from the central axis within the transfer region.

10. The method of transferring a substrate of claim 8, further comprising, subsequent engaging the substrate, lifting the substrate from the first substrate support by translating the transfer apparatus vertically within the transfer region of the substrate processing system.

11. The method of transferring a substrate of claim 8, further comprising, subsequent engaging the substrate, recessing the first substrate support from the substrate, wherein the substrate is received in the transfer region from a robot of a transfer chamber of the substrate processing system.

20 12. The method of transferring a substrate of claim 8, wherein each arm of the end effector comprises a first end piece and a second end piece, wherein each first end piece and each second end piece define a recessed ledge and a shelf, and wherein engaging the substrate comprises rotating the arm across the substrate to position the substrate between the arm and the shelf of the first end piece and the shelf of the second end piece.

13. The method of transferring a substrate of claim 8, further comprising, prior to delivering the substrate to the second substrate support, delivering the substrate to an alignment hub positioned between the first substrate support and the second substrate support.

5 14. A substrate processing system comprising:

a transfer region housing defining a transfer region fluidly coupled with a plurality of processing regions above the transfer region, wherein a sidewall of the transfer region housing defines a sealable access for providing and receiving substrates;

a plurality of substrate supports disposed within the transfer region; and

10 a transfer apparatus positioned within the transfer region comprising:

a central hub including a first shaft and a second shaft extending about the first shaft, wherein the second shaft is counter-rotatable with the first shaft, and wherein the central hub is characterized by a central axis, wherein each of the plurality of substrate supports is at a fixed horizontal position relative to the central hub,

15 an eccentric hub extending at least partially through the central hub, wherein the eccentric hub is radially offset from the central axis of the central hub, and wherein the eccentric hub is coupled with the first shaft of the central hub with one or more linkages, and

20 an end effector coupled with the eccentric hub, the end effector comprising a plurality of arms having a number of arms equal to a number of substrate supports of the plurality of substrate supports.

25 15. The substrate processing system of claim 14, wherein the end effector further comprises a plurality of end pieces configured to support a substrate, wherein each end piece extends vertically to a similar plane extending orthogonally to the central hub, and wherein each arm includes a first end piece and a second end piece of the plurality of end

pieces, the first end piece and the second end piece configured to support a substrate during movement of the end effector.