

CLAIMS:

1. A substrate processing system comprising:

a transfer region housing defining a 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;

a plurality of alignment hubs disposed within the transfer region, wherein:

a respective one of the plurality of alignment hubs is positioned between each adjacent pair of the plurality of substrate supports; and

each of the plurality of alignment hubs comprises a substrate receiving surface; and

a transfer apparatus comprising:

a central hub including a first shaft and a second shaft extending about and concentric with the first shaft, the central hub having a housing positioned within the transfer region and coupled with the second shaft, wherein the housing defines an internal housing volume,

a plurality of arms equal to a number of substrate supports of the plurality of substrate supports, each arm of the plurality of arms coupled about an exterior of the housing, and

a plurality of arm hubs disposed within the internal housing volume, each arm hub of the plurality of arm hubs coupled with an arm of the plurality of arms through the housing, wherein the arm hubs are coupled with the first shaft of the central hub.

2. The substrate processing system of claim 1, wherein the arm hubs are distributed about a central axis of the central hub proximate a radial edge of the internal housing volume, and wherein the arm hubs are independently rotatable from the housing with which the plurality of arms are coupled.

3. The substrate processing system of claim 2, wherein the first shaft extends within the internal housing volume, wherein one or more linkages couples each arm hub of the plurality of arm hubs with the first shaft within the internal housing volume.

4. The substrate processing system of claim 3, wherein rotation of the first shaft is configured to rotate each arm hub of the plurality of arm hubs simultaneously, wherein each arm hub is characterized by a central axis radially offset from the central axis of the central hub, and wherein rotation of each arm hub of the plurality of arm hubs is configured to rotate a corresponding arm of the plurality of arms about the central axis of an associated arm hub.

5. The substrate processing system of claim 3, wherein the one or more linkages comprises one or more belts extending about each arm hub of the plurality of arm hubs and the first shaft.

6. The substrate processing system of claim 3, wherein the one or more linkages comprises a plurality of gears coupled between the first shaft and the plurality of arm hubs, and wherein each gear of the plurality of gears is disposed between and in contact with both the first shaft and an arm hub of the plurality of arm hubs.

7. The substrate processing system of claim 1, wherein each substrate support of the plurality of substrate supports comprises a set of lift pins accessible through the substrate support, and wherein each set of lift pins is characterized by a different vertical length than each other set of lift pins.

8. The substrate processing system of claim 1, wherein the transfer apparatus further comprises a third shaft and a plurality of aligners, each aligner positioned proximate a distal end of an associated arm of the plurality of arms, wherein each aligner is independently rotatable from the plurality of arms and from the housing.

9. 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, the substrate processing system including a transfer apparatus comprising:

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

a plurality of arms, each arm of the plurality of arms coupled about an exterior of the housing, and

a plurality of arm hubs, each arm hub of the plurality of arm hubs coupled with an arm of the plurality of arms, wherein the arm hubs are coupled with the first shaft of the central hub;

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

rotating the first shaft in a first direction about a central axis of the central hub to move the arm of the plurality of arms to recess the substrate towards the housing of the central hub;

rotating the second shaft in a second direction about the central axis of the central hub to rotate the housing of the central hub towards a second substrate support of the substrate processing system;

co-rotating the first shaft and the second shaft in the second direction about the central axis to rotate the housing of the central hub, the arm of the plurality of arms, and the substrate towards the second substrate support of the substrate processing system to reposition the substrate; and

delivering the substrate to the second substrate support of the substrate processing system.

10. The method of transferring a substrate of claim 9, further comprising transitioning the transfer apparatus by further rotating the second shaft in the second direction about the central axis and rotating the first shaft in the first direction about the central axis.

11. The method of transferring a substrate of claim 10, further comprising rotating the first shaft in the second direction about the central axis and rotating the second shaft in the first direction about the central axis.

12. The method of transferring a substrate of claim 9, further comprising, subsequent engaging the substrate, lifting the substrate from the first substrate support by translating the transfer apparatus vertically within the transfer region.

13. The method of transferring a substrate of claim 9, further comprising, subsequent engaging the substrate, recessing the first substrate support from the substrate.

14. The method of transferring a substrate of claim 9, wherein each arm of the plurality of arms further comprises an aligner independently rotatable from the arm, and wherein the substrate is seated on the aligner when the substrate is engaged by the arm of the plurality of arms.

15. The method of transferring a substrate of claim 9, 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.