CLAIMS:

1. A crystal pulling system for growing a monocrystalline ingot from a silicon melt, the system having a pull axis and comprising:

a housing defining a growth chamber;

a crucible assembly disposed within the growth chamber for containing the silicon melt;

a heat shield that defines a central passage through which an ingot passes during ingot growth; and

a cover member that is moveable within the heat shield along the pull axis, the cover member comprising:

a first plate having a first plate axis that is parallel to the pull axis, the first plate comprising a hub, the hub having a hub opening;

a second plate having a second plate axis that is parallel to the pull axis, the second plate being disposed above the first plate;

one or more insulation layers disposed between the first plate and the second plate and contacting the first plate and the second plate; and

a shaft having an elongated portion and a collar that extends radially outward from the elongated portion, the shaft extending through the hub opening, the first plate resting on the collar.

2. The crystal pulling system as set forth in claim 1 wherein the first and second plates are both made of graphite.

3. The crystal pulling system as set forth in claim 2 wherein the first and second plates are silicon carbide coated.

4. The crystal pulling system as set forth in any one of claims 1 to 3 wherein the insulation layer is made of felt.

5. The crystal pulling system as set forth in any one of claims 1 to 4 wherein the heat shield has a bottom, the central passage of the heat shield having a diameter at the bottom of the heat shield, the cover member having a diameter, wherein the diameter of the cover member is at least 0.75 times the diameter of the central passage at the bottom of the heat shield.

6. The crystal pulling system as set forth in any one of claims 1 to 5 wherein the crystal pulling system comprises a pulling mechanism comprising a chuck, the pulling mechanism capable of raising and lowering a chuck along the pull axis, the cover member being removably connectable to the chuck.

7. The crystal pulling system as set forth in claim 6 wherein the chuck is connectable to a seed crystal for initiating ingot growth.

8. The crystal pulling system as set forth in any one of claims 1 to 7 wherein the crucible assembly comprises a bottom, an outer sidewall, and an inner weir that extends upward from the bottom.

9. The crystal pulling system as set forth in claim 8 wherein the crucible assembly comprises a central weir disposed between the outer sidewall and inner weir.

10. The crystal pulling system as set forth in claim 9 wherein the crucible assembly comprises three nested crucibles.

11. The crystal pulling system as set forth in any one of claims 1 to 10 further comprising a fluid-cooled cylindrical jacket having a jacket chamber through which an ingot passes during ingot growth.

12. A method for preparing a silicon melt in a crucible assembly of a crystal pulling system, the crystal pulling system comprising a housing defining a growth chamber, a crucible assembly disposed within the growth chamber for containing the silicon melt and a heat shield that defines a central passage through which an ingot passes during ingot growth, the crucible assembly comprising a bottom, an outer sidewall, an inner weir that

extends upward from the bottom, and a central weir disposed between the outer sidewall and inner weir, a crucible melt zone being disposed between the outer sidewall and the central weir, an intermediate zone being disposed between the central weir and the inner weir, and a growth zone being disposed within the inner weir, the method comprising:

adding an initial charge of polycrystalline silicon to the crucible assembly;

lowering a cover member through the central passage defined by the heat shield to cover at least a portion of the initial charge;

heating the initial silicon charge to produce a silicon melt in the crucible assembly while the cover member covers at least a portion of the initial charge;

adding a secondary amount of polycrystalline silicon to the crucible melt zone after the initial silicon charge has melted;

melting the secondary amount of polycrystalline silicon to cause silicon melt to flow through a central weir opening to the intermediate zone disposed between the central weir and the inner weir, and to cause silicon melt to flow through an inner weir opening to the growth zone disposed within the inner weir, the cover member covering at least a portion of the silicon melt while adding the secondary amount of polycrystalline silicon to the crucible melt zone; and

raising the cover member after the secondary amount of polycrystalline silicon has melted.

13. The method as set forth in claim 12 wherein the heat shield has a bottom, the central passage of the heat shield having a diameter at the bottom of the heat shield, the cover member having a diameter, wherein the diameter of the cover member is at least 0.75 times, at least 0.8 times, at least 0.9 times, at least 0.95 times, or at least 0.99 times the diameter of the central passage at the bottom of the heat shield.

14. The method as set forth in claim 12 or 13 wherein the cover member is lowered to within less than 30 mm from a bottom of the heat shield, or less than 20 mm, less than 10 or less than 5 mm from a bottom of the heat shield.

15. The method as set forth in any one of claims 12 to 14 wherein the cover member is lowered to a bottom of the heat shield.

16. The method as set forth in any one of claims 12 to 15 where the cover member includes an insulation layer.

17. The method as set forth in any one of claims 12 to 16 where the cover member includes a silicon carbide coated graphite plate.

18. The method as set forth in claim 16 wherein the silicon carbide coated graphite plate is a first silicon carbide coated graphite plate, the cover member further comprising:

a second silicon carbide coated graphite plate disposed above the first silicon carbide coated graphite plate; and

an insulation layer disposed between the first silicon carbide coated graphite plate and the second silicon carbide coated graphite plate.

19. A method for forming a single crystal silicon ingot comprising:

preparing a melt of silicon in a crucible of a crystal pulling system by the method of any one of claims 12 to 18; and

lowering a seed crystal to contact the melt after the cover member has been raised.

20. The method as set forth in claim 19 wherein the cover member and seed crystal are raised and lowered by a pulling mechanism comprising a chuck, the method comprising:

disconnecting the cover member from the chuck after the cover member is raised; and

connecting the seed crystal to the chuck after the cover member is disconnected from the chuck.

21. A crystal pulling system for growing a monocrystalline ingot from a silicon melt, the system having a pull axis and comprising:

a housing defining a growth chamber;

a crucible assembly disposed within the growth chamber for containing the silicon melt;

a heat shield that defines a central passage through which an ingot passes during ingot growth; and

a cover member that is moveable within the heat shield along the pull axis, the cover member comprising:

a first plate having a first plate axis that is parallel to the pull axis, the first plate comprising a hub, the hub having a hub opening;

a second plate having a second plate axis that is parallel to the pull axis, the second plate being disposed above the first plate, the hub opening extending through the first plate and through the second plate; and

a shaft having a collar and an elongated portion that extends from the collar, the collar extending radially outward from the elongated portion, the shaft extending through the hub opening, the first plate resting on the collar.

22. The crystal pulling system as set forth in claim 21 wherein the crystal pulling system comprises a pulling mechanism comprising a chuck, the pulling mechanism capable of raising and lowering a chuck along the pull

axis, the cover member being removably connectable to the chuck.

23. The crystal pulling system as set forth in claim 22 wherein the chuck is connectable to a seed crystal for initiating ingot growth.

24. The crystal pulling system as set forth in claim 21 wherein the crucible assembly comprises a bottom, an outer sidewall, and an inner weir that extends upward from the bottom.

25. The crystal pulling system as set forth in claim 24 wherein the crucible assembly comprises a central weir disposed between the outer sidewall and inner weir.

26. The crystal pulling system as set forth in claim 25 wherein the crucible assembly comprises three nested crucibles.