CLAIMS

What is claimed is:

1. A gas shielding device for use with a laser processing head, the gas shielding device comprising:

a neck defining a central aperture extending from a first end to a second end of the neck, wherein the central aperture is configured to receive a laser beam passing from the first end through the second end to a workpiece; and

a shielding plate coupled to the neck proximate the second end such that the neck extends from a first side of the shielding plate and the shielding plate extends circumferentially around the central aperture,

the shielding plate including a plurality of gas outlets on a second side of the shielding plate opposite the first side,

wherein the plurality of gas outlets are fluidly coupled to at least one gas inlet and are configured to direct a flow of gas in a direction toward a surface of the workpiece at a plurality of locations,

wherein the at least one gas inlet is located on the first side of the shielding plate, and

wherein the shielding plate defines a gas diffusion region that fluidly couples the at least one gas inlet to the plurality of gas outlets.

2. The gas shielding device of claim 1, further including

at least one gas distribution tube coupled to the at least one gas inlet for distributing shielding gas to the plurality of gas outlets on the second side.

3. The gas shielding device of claim 1,

wherein the neck includes at least one cooling passageway and at least one cooling inlet/outlet coupled to the cooling passageway to allow a cooling liquid to flow through the cooling passageway.

4. The gas shielding device of claim 1,

wherein the shielding plate is circular shaped.

5. The gas shielding device of claim 4,

wherein the shielding plate has a diameter in a range of 100 mm to 150 mm.

6. The gas shielding device of claim 1,

wherein the shielding plate is coaxial with the neck and the central aperture.

7. The gas shielding device of claim 1,

wherein the neck includes a processing head coupling mechanism at the first end of the neck for coupling to a laser processing head.

8. The gas shielding device of claim 1,

wherein the plurality of gas outlets are formed in lines extending outward from a central portion of the shielding plate to an outer portion of the shielding plate.

9. The gas shielding device of claim 1,

wherein the plurality of gas outlets are arranged to deliver a laminar flow of gas surrounding the laser beam passing through the shielding plate to the workpiece.

10. The gas shielding device of claim 1,

wherein the central aperture has a diameter in a range of 10-60 mm.

11. The gas shielding device of claim 1,

wherein the shielding plate includes a porous material between the at least one gas inlet and the plurality of gas outlets.

12. A shielded laser welding head comprising:

a scanning laser welding head device configured to be coupled to an output fiber of a fiber laser and configured to move a laser beam within only a limited field of view; and

a gas shielding device coupled to the scanning laser welding head device, the gas shielding device comprising:

a neck defining a central aperture extending from a first end to a second end of the neck, wherein the central aperture is configured to receive the moving laser beam passing from the first end through the second end to a workpiece; and

a shielding plate coupled to the neck such that the neck extends from a first side of the shielding plate and the shielding plate extends circumferentially around the central aperture,

the shielding plate including a plurality of gas outlets on a second side of the shielding plate opposite the first side,

wherein the plurality of gas outlets are fluidly coupled to at least one gas inlet and are configured to direct a flow of gas in a direction toward a surface of the workpiece at a plurality of locations,

wherein the at least one gas inlet is located on the first side of the shielding plate, and

wherein the shielding plate defines a gas diffusion region that fluidly couples the at least one gas inlet to the plurality of gas outlets.

13. The laser welding head of claim 12,

wherein the limited field of view is defined by a scan angle of 1-2º.

14. The laser welding head of claim 12, wherein the scanning laser welding head device comprises:

a collimator;

at least first and second movable mirrors configured to receive a collimated laser beam from the collimator and to move the beam in the first and second axes within the limited field of view; and

a focus lens configured to focus the laser beam relative to the workpiece while the beam is moved.

15. The laser welding head of claim 14,

wherein the movable mirrors are galvanometer mirrors.

16. The laser welding head of claim 14,

wherein the movable mirrors are configured to move the collimated laser beam within only a limited field of view having a dimension less than 30 x 30 mm.

17. A laser welding system comprising:

a fiber laser including an output fiber;

a scanning laser welding head coupled to the output fiber of the fiber laser and comprising movable mirrors configured to move a laser beam within only a limited field of view;

a gas shielding device coupled to the scanning laser welding head, the gas shielding device comprising;

a neck defining a central aperture extending from a first end to a second end of the neck, wherein the central aperture is configured to receive the moving laser beam passing from the first end through the second end to a workpiece; and

a shielding plate coupled to the neck such that the neck extends from a first side of the shielding plate and the shielding plate extends circumferentially around the central aperture,

the shielding plate including a plurality of gas outlets on a second side of the shielding plate opposite the first side,

wherein the plurality of gas outlets are fluidly coupled to at least one gas inlet and are configured to direct a flow of gas in a direction toward a surface of the workpiece at a plurality of locations,

wherein the at least one gas inlet is located on the first side of the shielding plate, and

wherein the shielding plate defines a gas diffusion region that fluidly couples the at least one gas inlet to the plurality of gas outlets; and

a control system for controlling at least the fiber laser and positions of the movable mirrors.

18. The laser welding system of claim 17,

wherein the fiber laser includes an Ytterbium fiber laser.

19. The laser welding system of claim 17,

wherein the fiber laser includes multiple output fibers for delivering multiple laser beams.

20. The laser welding system of claim 17,

wherein the control system is configured to control movement of the moving laser beam within the limited field of view to provide a wobble pattern.