Claims

What is claimed is:

1. A turret system for use in a floating production storage and offloading (FPSO) vessel, the FPSO vessel having a hull and a moon pool opening in a bow section of the hull, the turret system comprising:

a turret body fixedly positionable in the moon pool opening and rotatable about a center axis defined by the moon pool opening, the turret body having:

a top surface;

a bottom surface opposite to the top surface;

a first mooring line storage section, the first mooring line storage section including a first opening in the turret body top surface and a first cavity formed between the turret body top surface and turret body bottom surface, wherein the first opening is operable to receive a first mooring line, and wherein the first cavity is operable to house at least a majority length of the first mooring line;

a first mooring line channel section formed through the turret body between the turret body top surface and turret body bottom surface, the first mooring line channel section being an elongated passageway for the first mooring line to pass between an exterior of the FPSO vessel and the first mooring line storage section;

a second mooring line storage section, the second mooring line storage section including a second opening in the turret body top surface and a second cavity formed between the turret body top surface and turret body bottom surface, wherein the second opening is operable to receive a second mooring line, and wherein the second cavity is operable to house at least a majority length of the second mooring line; and

a second mooring line channel section formed through the turret body between the turret body top surface and turret body bottom surface, the second mooring line channel section being an elongated passageway for the second mooring line to pass between an exterior of the FPSO vessel and the second mooring line storage section;

a transportable windlass subsystem having a rotatable member configurable to rotate in a first direction and a second direction opposite to the first direction, the transportable windlass system configured to be securable to and transportable between a plurality of locations on the turret body top surface, including a first location and a second location; and

a hoisting assembly, the hoisting assembly configurable in such a way that:

when the hoisting assembly is positioned at a location above the first

location, the hoisting assembly is operable to control at least a position of a portion of the first mooring line spanning between the first mooring line storage section and the first mooring line channel section; and

when the hoisting assembly is positioned at a location above the second location, the hoisting assembly is operable to control at least a position of a portion of the second mooring line spanning between the second mooring line storage section and the second mooring line channel section;

wherein the first location is a location on the turret body top surface between the first mooring line channel section and the first opening of the first mooring line storage section;

wherein the second location is a location on the turret body top surface between the second mooring line channel section and the second opening of the second mooring line storage section; and

wherein, when the transportable windlass assembly is configured to be secured to the turret body top surface at the first location, the transportable windlass assembly is configurable to receive and control a movement of a portion of the first mooring line between the first opening of the first mooring line storage section and the first mooring line channel section.

2. The turret system of claim 1,

wherein the rotary member is configurable in such a way that, when the transportable windlass assembly is secured to the turret body top surface at the first location and when the transportable windlass assembly receives the first mooring line, the rotary member is operable to:

direct at least a portion of the first mooring line into the first mooring line storage section by rotating in the first direction; and

direct at least a portion of the first mooring line out of the first mooring line storage section by rotating in the second direction.

3. The turret system of claim 1, further comprising:

a first fairlead assembly secured to the turret body at a location between the first mooring line channel section and the first location, the first fairlead assembly operable to guide the first mooring line between the first mooring line channel section and the first mooring line storage section; and

a second fairlead assembly secured to the turret body at a location between the second mooring line channel section and the second location, the second fairlead assembly operable to guide the second mooring line between the second mooring line channel section and the second mooring line storage section.

4. The turret system of claim 3,

wherein the first fairlead assembly is configurable in such a way that, when the transportable windlass assembly is configured to be secured to the turret body top surface at the first location and when the transportable windlass assembly receives the first mooring line, the first fairlead assembly is operable to guide the first mooring line between the first mooring line channel section and the transportable windlass assembly; and

wherein the second fairlead assembly is configurable in such a way that, when the transportable windlass assembly is configured to be secured to the turret body top surface at the second location and when the transportable windlass assembly receives the second mooring line, the second fairlead assembly is operable to guide the second mooring line between the second mooring line channel section and the transportable windlass assembly.

5. The turret system of claim 1, further comprising:

a first mooring line stopper assembly operable to receive the first mooring line, the first mooring line stopper assembly actuatable between a first stop position and a first release position; and

a second mooring line stopper assembly operable to receive the second mooring line, the second mooring line stopper assembly actuatable between a second stop position and a second release position;

wherein, when the first mooring line stopper assembly receives the first mooring line and when the first mooring line stopper assembly is actuated to the first stop position, the first mooring line stopper assembly is operable to restrict a movement of the first mooring line through the first mooring line channel section;

wherein, when the first mooring line stopper assembly is actuated to the first release position, the first mooring line stopper assembly is operable to allow a movement of the first mooring line through the first mooring line channel section;

wherein, when the second mooring line stopper assembly receives the second mooring line and when the second mooring line stopper is actuated to the second stop position, the second mooring line stopper assembly is operable to restrict a movement of the second mooring line through the second mooring line channel section; and

wherein, when the second mooring line stopper assembly is actuated to the second release position, the second mooring line stopper assembly is operable to allow a movement of the second mooring line through the second mooring line channel section.

6. The turret system of claim 1, further comprising a windlass rail assembly;

wherein the windlass rail assembly is a rail extending between at least the first location and the second location; and

wherein the windlass rail assembly is operable to receive the transportable windlass assembly and enable the transportable windlass assembly to be transported between at least the first location and the second location.

7. The turret system of claim 6, further comprising:

a plurality of other mooring line storage sections, including a third mooring line storage section, each of the plurality of other mooring line storage sections having an opening and a cavity formed between the turret body top surface and turret body bottom surface; and

a plurality of other mooring line channel sections, including a third mooring line channel section, each of the plurality of other mooring line channel sections being an elongated passageway for one of a plurality of other mooring lines to pass between an exterior of the FPSO vessel and the one of the plurality of mooring line storage sections, each of the plurality of other mooring line channel sections formed through the turret body between the turret body top surface and turret body bottom surface;

wherein the windlass rail assembly further extends to a plurality of other locations, including at least a third location being a location between the third mooring line storage section and the third mooring line channel section; and

wherein the windlass rail assembly is operable to enable the transportable windlass assembly to be transported between at least the first location, the second location, and the third location.

8. The turret system of claim 1,

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the first location, the hoisting assembly is operable to move a portion of the first mooring line spanning between the first mooring line storage section and the first mooring line channel section away from the turret body top surface; and

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the second location, the hoisting assembly is operable to move a portion of the second mooring line spanning between the second mooring line storage section and the second mooring line channel section away from the turret body top surface.

9. The turret system of claim 8,

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the first location and when the portion of the first

mooring line spanning between the first mooring line storage section and the first mooring line channel section is moved by the hoisting assembly to be away from the turret body top surface, the hoisting assembly is operable to control the position of the first mooring line so as to be received by the transportable windlass subsystem when the transportable windlass subsystem is transported to the first position; and

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the second location and when the portion of the second mooring line spanning between the second mooring line storage section and the second mooring line channel section is moved by the hoisting assembly to be away from the turret body top surface, the hoisting assembly is operable to control the position of the second mooring line so as to be received by the transportable windlass subsystem when the transportable windlass subsystem is transported to the second position.

10. The turret system of claim 9,

wherein the hoisting assembly is configurable in such a way that, when the transportable windlass subsystem is positioned at the first position and when the first mooring line is received by the transportable windlass subsystem, the hoisting assembly is operable to control the position of the first mooring line so as to be removed from the transportable windlass subsystem; and

wherein the hoisting assembly is configurable in such a way that, when the transportable windlass subsystem is positioned at the second position and when the second mooring line is received by the transportable windlass subsystem, the hoisting assembly is operable to control the position of the second mooring line so as to be removed from the transportable windlass subsystem.

11. The turret system of claim 1, further comprising a hoisting rail assembly, the hoisting rail assembly being a rail extending between at least the location above the first location and the location above the second location, the hoisting rail assembly operable to receive the hoisting assembly and enable the hoisting assembly to be transported between at least the location above the first location and the location above the second location.

12. The turret system of claim 1, further comprising a second transportable windlass assembly;

wherein the second transportable windlass assembly is configured to be securable to and transportable between a plurality of locations on the top surface of the turret body, including the first location and the second location;

wherein the second transportable windlass assembly comprises a second rotary member configurable to rotate in the first direction and the second direction;

wherein the second rotary member is configurable in such a way that, when the second transportable windlass assembly is secured to the top surface of the turret body at the first location and when the second transportable windlass assembly receives the first mooring line, the second rotary member is operable to:

direct at least a portion of the first mooring line into the first mooring line storage section by rotating in the first direction; and

direct at least a portion of the first mooring line out of the first mooring line storage section by rotating in the second direction.

13. The turret system of claim 1, further comprising a controller in communication with the transportable windlass assembly, wherein the controller is operable to perform one or more of the following:

control the rotation of the rotary member;

configure the transportable windlass assembly to variably adjust a tension of the first mooring line when the transportable windlass assembly is configured to be secured to the turret body at the first location and when a first end of the first mooring line is secured to a bottom of a body of water via an anchor; and

control the movement of the transportable windlass assembly between the first position and the second position;

wherein the controller configures the transportable windlass assembly to variably adjust the tension of the first mooring line based on a predetermined load/force calculation.

14. A windlass assembly for use in a turret system of a floating production storage and offloading (FPSO) vessel, the FPSO vessel having a hull and a moon pool opening in a bow section of the hull, the turret system having a turret body positioned in the moon pool opening and rotatable about a center axis defined by the moon pool opening, the turret body having a top surface, a bottom surface opposite to the top surface, a mooring line storage section, and a mooring line channel section, the mooring line storage section including a first opening in the turret body top surface and a first cavity formed between the turret body top surface and turret body bottom surface, the first opening operable to receive a mooring line, the mooring line channel section formed through the turret body between the turret body top surface and turret body bottom surface, the mooring line channel section being an elongated passageway for the mooring line to pass between an exterior of the FPSO vessel and the mooring line storage section, the windlass assembly comprising:

a transportable windlass subsystem having a rotatable member configurable to rotate in a first direction and second direction opposite to the first direction, the transportable windlass

subsystem configured to be securable to and transportable between a plurality of locations on the turret body top surface, including a first location; and

a hoisting assembly, the hoisting assembly configurable in such a way that, when the hoisting assembly is positioned at a location above the first location, the hoisting assembly is operable to control at least a position of a portion of the mooring line that is between the mooring line storage section and the mooring line channel section;

wherein, when the transportable windlass assembly is configured to be secured to the turret body top surface at the first location between the first opening and the mooring line channel section, the transportable windlass assembly is configurable to receive and control a movement of a portion of the mooring line between the first opening of the mooring line storage section and the mooring line channel section.

15. The turret system of claim 14,

wherein the rotary member is configurable in such a way that, when the transportable windlass assembly is secured to the turret body top surface at the first location and when the transportable windlass assembly receives the first mooring line, the rotary member is operable to:

direct at least a portion of the mooring line into the mooring line storage section by rotating in the first direction; and

direct at least a portion of the mooring line out of the mooring line storage section by rotating in the second direction.

16. The turret system of claim 14, further comprising a windlass rail assembly;

wherein the windlass rail assembly is a rail extending between at least the first location and a second location different from the first location; and

wherein the windlass rail assembly is operable to receive the transportable windlass assembly and enable the transportable windlass assembly to be transported between at least the first location and the second location.

17. The turret system of claim 14,

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the first location, the hoisting assembly is operable to move the portion of the mooring line that is between the mooring line storage section and the mooring line channel section away from the turret body top surface.

18. The turret system of claim 17,

wherein the hoisting assembly is configurable in such a way that, when the hoisting assembly is positioned at the location above the first location and when the portion of the

mooring line between the mooring line storage section and the mooring line channel section is moved by the hoisting assembly to be away from the turret body top surface, the hoisting assembly is operable to control the position of the mooring line so as to be received by the transportable windlass subsystem when the transportable windlass subsystem is transported to the first position.

19. The turret system of claim 18,

wherein the hoisting assembly is configurable in such a way that, when the transportable windlass subsystem is positioned at the first position and when the mooring line is received by the transportable windlass subsystem, the hoisting assembly is operable to control the position of the mooring line so as to be removed from the transportable windlass subsystem.

20. The turret system of claim 14, further comprising a hoisting rail assembly, the hoisting rail assembly being a rail extending between at least the location above the first location and a location above a second location different from the first location, the hoisting rail assembly operable to receive the hoisting assembly and enable the hoisting assembly to be transported between at least the location above the first location and the location above the second location.

21. The turret system of claim 14, further comprising a second transportable windlass assembly;

wherein the second transportable windlass assembly is configured to be securable to and transportable between a plurality of locations on the top surface of the turret body;

wherein the second transportable windlass assembly comprises a second rotary member configurable to rotate in the first direction and the second direction;

wherein the second rotary member is configurable in such a way that, when the second transportable windlass assembly is secured to the top surface of the turret body at the first location and when the second transportable windlass assembly receives the mooring line, the second rotary member is operable to:

direct at least a portion of the mooring line into the mooring line storage section by rotating in the first direction; and

direct at least a portion of the mooring line out of the mooring line storage section by rotating in the second direction.

22. The turret system of claim 14, further comprising a controller in communication with the transportable windlass assembly, wherein the controller is operable to perform one or more of the following:

control the rotation of the rotary member;

configure the transportable windlass assembly to variably adjust a tension of the mooring line when the transportable windlass assembly is configured to be secured to the turret body at the first location and when a first end of the mooring line is secured to a bottom of a body of water via an anchor; and

control the movement of the transportable windlass assembly between the first position and a second position different from the first position;

wherein the controller configures the transportable windlass assembly to variably adjust the tension of the mooring line based on a predetermined load/force calculation.