

CLAIMS

1. A system for blocking ingress of debris into a riser tensioner, the system comprising:

an outer barrel (12);

an inner barrel (18) arranged within the outer barrel (12), the inner barrel (18) being moveable in first and second directions (52, 54) along an axis (56) to reciprocate within the outer barrel (12);

a first sealing assembly (28) at an upper end (40) of the outer barrel (12), the first sealing assembly (28) circumferentially surrounding the inner barrel (18) and comprising:

a first wiper seal (64) at a first top portion (66), the first wiper seal (64) arranged within a recess (62) of a first plurality of recesses (62) extending into a first body (60) of the first sealing assembly (28), and bearing against the inner barrel (18);

a first wear ring (70) arranged within a recesses (62) of the first plurality of recesses (62), the first wear ring (70) extending from the recess (62) to contact the inner barrel (18); and

a first seal (74) arranged within a recesses (62) of the first plurality of recesses (62);

a second sealing assembly (90) positioned above the first top portion (66) of the first sealing assembly (28), the second sealing assembly (90) circumferentially surrounding the inner barrel (18) and comprising:

a second wiper seal (64) at a second top portion, the second wiper seal (64) arranged within a recess (62) of a second plurality of recesses (62) extending into a second body (94) of the second sealing assembly (90), and bearing against the inner barrel (18);

a second wear ring (70) arranged within a recesses (62) of the second plurality of recesses (62), the second wear ring (70) extending from the recess (62) to contact the inner barrel (18); and

a second seal (74) arranged within a recesses (62) of the second plurality of recesses (62); and

an upper end cap (22) arranged on the inner barrel (18), the upper end cap (22) having a cap diameter that is larger than a diameter of the inner barrel (18).

2. The system of claim 1, wherein the upper end cap (22) is removably coupled to the inner barrel (18) and the second sealing assembly (90) has a continuous cylindrical body (94) with an inner diameter that is larger than the diameter of the inner barrel (18).

3. The system of claim 1, wherein the second sealing assembly (90) includes a seam (132), the seam (132) separating the second sealing assembly (90) into a first portion (134) and a second portion (136).

4. The system of claim 3, wherein each of the first and second portions (134, 136) of the second sealing assembly (90) include holes (140) extending through an outer diameter (142) of

the secondary sealing assembly (90), in a direction substantially transverse to the axis (56), that align when the first and second portions (134, 136) are mated together.

5. The system of claim 3, wherein the first and second portions (134, 136) are coupled together via a fastener, a clamp, an adhesive, or a combination thereof.

6. The system of claim 1, wherein each of the first and second sealing assembly (28, 90) comprise apertures (92), the apertures (92) arranged to align when the second sealing assembly (90) is stacked on the first sealing assembly (28) such that fasteners (96) extend through respective apertures (92) to couple the second sealing assembly (90) to the first sealing assembly (28).

7. The system of claim 1, wherein a stroke length of the inner barrel (18) is reduced after the second sealing assembly (90) is coupled to the first sealing assembly (28).

8. A system for applying a force to a rig, the system comprising:

a riser tensioner (10) having a piston cylinder arrangement for applying the force to the rig, the piston cylinder arrangement comprising an inner barrel (18) positioned within an outer barrel (12), the inner barrel (18) being linearly moveable along an axis (56) of the riser tensioner (10);

a primary sealing assembly (28) at an upper end (40) of the outer barrel (12), the primary sealing assembly (28) including a plurality of seals (74) positioned to block debris from entering

an interior chamber (24) of the riser tensioner (10), the seals (74) bearing against the inner barrel (18) as the inner barrel (18) translates along the axis (56);

an end cap (22) coupled to the inner barrel (18), the end cap (22) having a cap diameter greater than an inner barrel outer diameter, wherein the end cap (22) is positioned a first length from the upper end (40) of the outer barrel (12) when the inner barrel (18) is in an extended position and a second length from the upper end (40) of the outer barrel (12) when the inner barrel (18) is in a retracted position; and

a secondary sealing assembly (90) arranged between the end cap (22) and the primary sealing assembly (28), the secondary sealing assembly (90) including a plurality of secondary seals (74) positioned to block debris from entering the interior chamber (24) of the riser tensioner (10), wherein the secondary sealing assembly (90) reduces a stroke length of the inner barrel (18) when installed above the primary sealing assembly (28).

9. The system of claim 8, wherein the end cap (22) is removably coupled to the inner barrel (18) and the secondary sealing assembly (90) comprises a cylindrical body (94) that wraps around the outer diameter of the inner barrel (18).

10. The system of claim 8, wherein the secondary sealing assembly (90) is installed after one or more of the plurality of seals (74) of the primary sealing assembly (28) has been damaged or degraded.

11. The system of claim 8, wherein the secondary sealing assembly (90) includes a seam (132) separating the secondary sealing assembly (90) into a first portion (134) and a second portion (136).
12. The system of claim 8, wherein the first and second portions (134, 136) of the secondary sealing assembly (90) are coupled together to circumferentially surround the inner barrel (18), the first and second portions (134, 136) each including one or more holes (140) extending through respective bodies of the respective portions in a direction substantially transverse to the axis (56).
13. The system of claim 12, wherein the first and section portions (134, 136) are coupled together via a fastener, a clamp, an adhesive, or a combination thereof.
14. The system of claim 8, wherein the secondary sealing assembly (90) includes a wiper seal (64) at a top portion, the wiper seal (64) having an arm (68) that bears against the inner barrel (18), and in operation blocks debris from entering the interior chamber (24) of the riser tensioner (10) as the inner barrel (18) transitions from the extended position to the retracted position.
15. The system of claim 8, wherein each of the primary and secondary sealing assemblies (28, 90) comprise apertures (92), the apertures (92) arranged to align when the secondary sealing assembly (90) is stacked on the primary sealing assembly (28) such that fasteners (96) extend through respective apertures (92) to couple the secondary sealing assembly (90) to the primary sealing assembly (28).