CLAIMS

1. A riser tensioner, comprising:

a cylinder barrel adapted to be connected to a riser;

a rod reciprocally carried within the cylinder barrel and extending out an upper end of the cylinder barrel, the rod having an upper end adapted to be connected to a floating platform;

a flange on the upper end of the cylinder barrel, the flange having an opening through which the rod sealingly extends;

a piston on a lower end of the rod that slides and seals against an inner surface of the cylinder barrel;

a low pressure chamber in the cylinder barrel on a lower side of the piston and containing a low pressure fluid; and

a sealed annulus between the rod and the cylinder barrel, the annulus extending from an upper side of the piston to the flange and containing a high pressure fluid and a seal lubricant, both introduced into the sealed annulus via independent flow paths, both at a pressure higher than the low pressure fluid to urge the piston downward relative to the cylinder barrel, thereby retracting the riser tensioner and exerting an upward force on the riser.

2. The riser tensioner of claim 1, further comprising:

at least two piston high pressure seals extending around the piston in sealing engagement with the inner surface of the cylinder barrel to seal one end of the annulus;

a high pressure seal lubricant conduit extending within the rod to a point between the piston high pressure seals; and

a high pressure seal lubricant within the high pressure seal lubrication conduit at a pressure that is the same as the fluid pressure in the annulus.

3. The riser tensioner of claim 2, further comprising:

a piston low pressure seal extending around the piston below the piston high pressure seals;

a low pressure lubricant conduit extending within the rod to a point below the piston high pressure seals and above the piston low pressure seal; and

a low pressure lubricant within the low pressure lubricant conduit that is at a same pressure as the fluid pressure in the low pressure chamber.

4. The riser tensioner of claim 2, further comprising:

a high pressure annulus lubricant conduit extending within the rod to the annulus; and the seal lubricant within the high pressure annulus lubricant conduit at a pressure that is the same as the fluid pressure in the annulus.

5. The riser tensioner of claim 1, wherein the rod has a hollow interior that defines a rod chamber, the rod chamber containing a high pressure accumulator fluid in fluid communication with and at the same pressure as the high pressure fluid in the annulus.

6. The riser tensioner of claim 2, wherein:

the rod is solid; and

the high pressure seal lubricant conduit comprises a passage extending downward in the rod.

7. A riser tensioner, comprising:

a cylinder barrel;

a rod reciprocally carried within the cylinder barrel and having an external end sealingly extending out of a proximal end of the cylinder barrel;

a piston on an interior end of the rod that slides and seals against an inner surface of the cylinder barrel;

a selectively sealed low pressure chamber in the cylinder barrel between the piston and a distal end of the cylinder barrel and fillable with a low pressure fluid;

a first high pressure seal extending around the piston in sealing engagement with the inner surface of the cylinder barrel;

a low pressure seal extending around the piston in sealing engagement with the inner surface of the cylinder barrel, the low pressure seal closer to the low pressure chamber than the high pressure seal;

a low pressure seal lubricant conduit extending to a point between the high pressure seal and the low pressure seal and fillable with a low pressure lubricant at approximately the same pressure as the low pressure chamber; and

a selectively sealed annulus between the rod and the cylinder barrel, the annulus extending between the piston and the proximal end of the cylinder barrel and fillable with an annulus fluid at a pressure higher than the low pressure fluid, thereby urging the piston and rod towards the distal end of the cylinder barrel and the riser tensioner towards retraction.

8. The riser tensioner of claim 7, further comprising:

a second high pressure seal extending around the piston in sealing engagement with the inner surface of the cylinder barrel, the second high pressure seal located on a side of the first high pressure seal opposite the low pressure seal.

9. The riser tensioner of claim 8, further comprising:

a high pressure seal lubricant conduit extending to a point between the first high pressure seal and the second high pressure seal and fillable with a high pressure lubricant at the same pressure as the annulus fluid.

10. The riser tensioner of claim 7, further comprising a high pressure annulus lubricant conduit extending to the annulus and fillable with an annulus lubricant at the same pressure as the annulus fluid.

11. The riser tensioner of claim 7, further comprising a low pressure communication conduit extending to the low pressure chamber and in communication with the low pressure seal lubricant conduit, equalizing pressure between the low pressure chamber and the low pressure seal lubricant conduit.

12. The riser tensioner of claim 7, wherein the external end of the rod is couplable with a floating platform and the distal end of the cylinder barrel is couplable with a riser or riser tension ring.

13. The riser tensioner of claim 7, further comprising a high pressure chamber within the rod and fillable with a high pressure fluid at the same pressure as the annulus fluid.

14. The riser tensioner of claim 13, further comprising a communication port formed in the rod placing the high pressure chamber in fluid communication with the annulus.

15. The riser tensioner of claim 13, further comprising a high pressure lubricant conduit extending to the high pressure chamber through which a high pressure lubricant is deliverable.

16. A method of tensioning a riser, comprising

pressurizing a low pressure chamber of a riser tensioner, the low pressure chamber formed between a piston and a distal end of a cylinder barrel, wherein the piston is sealed against an inner surface of the cylinder barrel via a seal and coupled to a rod extending from the piston and beyond a proximal end of the cylinder barrel, and wherein the cylinder barrel is adapted to connect to a riser and the rod is adapted to connect to a floating platform;

pressurizing an annulus of the riser tensioner at a higher pressure than the low pressure chamber, the annulus of the riser tensioner formed between the rod and the cylinder barrel and extending between the piston and the proximal end of the cylinder barrel;

filling a low pressure seal lubricant conduit at least partially with a low pressure lubricant, the low pressure lubricant conduit extending to a point on a low pressure side of the seal; and

filling a high pressure seal lubricant conduit at least partially with a high pressure lubricant, the high pressure lubricant conduit extending to a point on a high pressure side of the seal.

17. The method of claim 16, further comprising sealing any or all of the low pressure chamber, the annulus, the low pressure seal lubricant conduit, and the high pressure seal lubricant conduit.

18. The method of claim 16, further comprising removing any external pressure or lubricant sources from the riser tensioner.

19. The method of claim 16, further comprising maintaining a pressure differential between the annulus and the low pressure chamber via an internal accumulator formed within the rod, the accumulator comprising a high pressure chamber at the same pressure as the annulus.

20. The method of claim 16, further comprising urging retraction of the riser tensioner via a pressure differential between the annulus and the low pressure chamber.