Claims

1. A torque tool comprising a tool housing;
at least one torque drive head;
a drive mechanism operable to rotate the at least one torque drive head;
wherein the drive mechanism comprises a first motor having a first torque output and a second motor having a second torque output;
wherein the first and second motors are operable to drive a common drive shaft.

2. The torque tool according to claim 1 wherein the first and second motors are hydraulic motors.

3. The torque tool according to claim 1 or claim 2 wherein the first and second motors are gerotors.

4. The torque tool according to any preceding claim wherein the first torque output and the second torque output have different torque values.

5. The torque tool according to claim 4 wherein the first torque output is lower than the second torque output.

6. The torque tool according to any preceding claim wherein the motors are operable in a clockwise direction and/or an anticlockwise direction.

7. The torque tool according to any preceding claim wherein the drive mechanism is configured to operate the first and second motors in the same direction.

8. The torque tool according to any preceding claim wherein the drive mechanism is configured to operate the first and second motors in opposing directions.

9. The torque tool according to any preceding claim wherein the drive mechanism is configured to selectively operate only the first motor; only or the second motor; or operate both motors simultaneously.

10. The torque tool according to any preceding claim, wherein the drive mechanism is configured to operate in a low torque mode, in which only the first motor is operated to generate a low torque output.

11. The torque tool according to any preceding claim, wherein the drive mechanism is configured to operate in a medium torque mode, in which only the second motor is operated to generate a medium torque output.

12. The torque tool according to any preceding claim, wherein the drive mechanism is configured to operate in a high torque mode, in which the first and second motors are operated concurrently in the same direction to generate a high torque output.

13. The torque tool according to any preceding claim, wherein the drive mechanism is configured to operate in a super low torque mode, in which the first and second motors are operated concurrently at the same time in opposing directions to generate a super low torque output.

14. The torque tool according to any preceding claim wherein the drive mechanism comprises a hydraulic motor interface device.

15. The torque tool according to claim 14 wherein the hydraulic motor interface device comprises a first interface surface on one side of the device configured to couple a hydraulic fluid supply to the first motor, and a second interface surface on an opposing side of the device configured to couple a hydraulic fluid supply to the second motor.

16. The torque tool according to claim 15 wherein the first and/or second interface surface are substantially planar.

17. The torque tool according to claim 15 or claim 16 wherein the first and/or second interface surface comprises one or more grooves to fluidly couple with the first and/or second hydraulic motors.

18. The torque tool according to any of claims 14 to 17 wherein the hydraulic motor interface device comprises a plurality of radial ports fluidly connected with one or more grooves to fluidly couple with the first and/or second hydraulic motors.

19. The torque tool according to any of claims 14 to 18 wherein the common drive shaft extends through the hydraulic motor interface device.

20. The torque tool according to any preceding claim wherein the drive mechanism comprises at least one transfer plate configured to control the flow of hydraulic fluid into and out from the motors.

21. The torque tool according to any of claims 14 to 20 wherein the drive mechanism comprises a transfer plate located between the hydraulic motor interface device and each motor.

22. The torque tool according to claim 21 wherein the or each transfer plate comprises an inner arrangement of channels and/or an outer arrangement of channels.

23. The torque tool according to claim 22 wherein the transfer plate is configured such that the hydraulic fluid enters the motor via the inner arrangement of channels and exits the motor via the outer arrangement of channels.

24. The torque tool according to claim 22 or claim 23 wherein the transfer plate is configured such that the hydraulic fluid enters the motor via the outer arrangement of channels and exits the motor via the inner arrangement of channels.

25. The torque tool according to any of claims 20 to 24 wherein the common drive shaft extends through the or each transfer plate.

26. The torque tool according to any of claims 2 to 25 comprising a drainage path for at least one of the first or second hydraulic motors.

27. The torque tool according to claim 26 wherein the drainage path is configured to enable hydraulic fluid from a disengaged hydraulic motor to be drained when the other of the hydraulic motors is operable.

28. The torque tool according to any of claims 12 to 27 wherein the hydraulic motor interface device comprise a drain port.

29. The torque tool according to claim 28 wherein the first and/or second interface surfaces on the motor interface device comprise one or more drainage grooves or channels which may be in fluid communication with the drain port.

30. The torque tool according to any preceding claim wherein the torque tool comprises a pilot relief manifold block.

31. The torque tool according to claim 30 wherein the pilot relief block controls the drainage of the hydraulic fluid from a disengaged motor to a hydraulic return line.

32. The torque tool according to any of claims 12 to 31 wherein the hydraulic motor interface device has an axial dimension in the direction of the drive shaft of less than approximately 100mm.

33. The torque tool according to claim 32 wherein the hydraulic motor interface device has an axial dimension in the direction of the drive shaft of less than approximately 40mm.

34. A motor assembly for a torque tool, the motor assembly comprising:
a first motor having a first torque output and a second motor having a second torque output;
wherein the first and second motors are operable to drive a common drive shaft.

35. The motor assembly according to claim 34 wherein the first and second motors are hydraulic motors.

36. The motor assembly according to claim 34 or claim 35 wherein the first torque output and the second torque output are different torque values.

37. The motor assembly according to any of 34 to 36 wherein the motor assembly is configured to enable hydraulic fluid from a disengaged hydraulic motor to be drained when the other of the hydraulic motors is operable.

38. A method of operating a torque tool comprising:
providing a torque tool, the torque tool comprising at least one torque drive head and a drive mechanism operable to rotate the at least one torque drive head; and a first

motor having a first torque output and a second motor having a second torque output;
operating the first and/or second motors to drive a common drive shaft.

39. The method according to claim 38 comprising operating the first and/or second motor to rotate in a clockwise direction and/or an anticlockwise direction.

40. The method according to claim 38 or claim 39, comprising operating the first and second motors to rotate in the same direction.

41. The method according to any of claims 38 to 40, comprising operating the first and second motors to rotate in opposing directions.

42. The method according to any of claims 38 to 41, comprising operating the drive mechanism in a low torque mode, in which only the first motor is operated to generate a low torque output.

43. The method according to any of claims 38 to 42, comprising operating the drive mechanism in a medium torque mode, in which only the second motor is operated to generate a medium torque output.

44. The method according to any of claims 38 to 43, comprising operating the drive mechanism in a high torque mode, in which the first and second motors are operated concurrently in the same direction to generate a high torque output.

45. The method according to any of claims 38 to 44, comprising operating the drive mechanism in a super low torque mode, in which the first and second motors are operated concurrently at the same time in opposing directions to generate a super low torque output.

46. The method according to any of claims 38 to 45, wherein the first and second motors are hydraulic motors, and the method comprises draining the hydraulic fluid from at least one of the first or second hydraulic motors.

47. he method according to claim 46, comprising draining the hydraulic fluid from a de-activated hydraulic motor when the other hydraulic motor is activated.

48. A subsea vehicle system comprising the torque tool according to any of claims 1 to 33.

49. The subsea vehicle system of claim 48, wherein the subsea vehicle is a Remotely Operated Vehicle (ROV).

50. A torque tool substantially as described herein with reference to the appended drawings.

51. A motor assembly for a torque tool substantially as described herein with reference to the appended drawings.

52. A Remotely Operated Vehicle (ROV) system substantially as described herein with reference to the appended drawings.

Claims

1. A subsea torque tool (10) comprising a tool housing;
at least one torque drive head (13);
a drive mechanism (16) operable to rotate the at least one torque drive head (13);
wherein the drive mechanism (16) comprises a first motor (17) having a first torque output characterised in that said drive mechanism further comprises a second motor (18) having a second torque output, and is operable to rotate the first and second motors (17, 18) in the same direction; and
wherein the first and second motors (17, 18) are operable to drive a common drive shaft (15).

2. The subsea torque tool (10) according to claim 1 wherein the first and second (17, 18) motors are gerotors.

3. The subsea torque tool (10) according to claim 1 or claim 2 wherein the first torque output and the second torque output have different torque values.

4. The subsea torque tool (10) according to any preceding claim wherein the drive mechanism (16) is configured to operate the first and second motors (17, 18) in the same direction in one mode of operation, and configured to operate the first and second motors (17, 18) in opposing directions in a second mode of operation.

5. The subsea torque tool (10) according to any preceding claim wherein the drive mechanism (16) is configured to selectively operate only the first motor (17); only the second motor (18); or operate both motors (17, 18) simultaneously.

6. The subsea torque tool (10) according to any preceding claim, wherein the drive mechanism (16) is configured to operate in a high torque mode, in which the first and second motors (17, 18) are operated concurrently in the same direction to generate a high torque output.

7. The subsea torque tool (10) according to any preceding claim, wherein the drive mechanism (16) is configured to operate in a super low torque mode, in which the first and second motors (17, 18) are operated concurrently at the same time in opposing directions to generate a super low torque output.

8. The subsea torque tool (10) according to any preceding claim wherein the first and second motors (17, 18) are hydraulic motors and the drive mechanism (16) comprises a hydraulic motor interface device (20) comprising a first interface surface on one side of the device configured to couple a hydraulic fluid supply to the first motor (17), and a second interface surface on an opposing side of the device configured to couple a hydraulic fluid supply to the second motor (18), and wherein the first and/or second interface surface comprises one or more grooves (63, 64, 65, 66) to fluidly couple with the first and/or second motors (17, 18).

9. The subsea torque tool (10) according to claim 8 wherein the hydraulic motor interface device (20) comprises a plurality of radial ports (62, 81, 82, 83, 84) fluidly connected with the one or more grooves to fluidly couple with the first and/or second motors (17, 18).

10. The subsea torque tool (10) according to claim 8 or claim 9 wherein the drive mechanism (16) comprises a transfer plate (42, 52) located between the hydraulic motor interface device (20) and each motor (17, 18), configured to control the flow of hydraulic fluid into and out from the motors (17, 18).

11. The subsea torque tool (10) according to any of claims 8 to 10 wherein the common drive shaft (15) extends through the hydraulic motor interface device (20) and through the transfer plates (42, 52).

12. The subsea torque tool (10) according to any of claims 8 to 11 comprising a drainage path for at least one of the first or second hydraulic motors (17, 18), wherein the drainage path is configured to enable hydraulic fluid from a disengaged hydraulic motor to be drained when the other of the hydraulic motors is operable.

13. The subsea torque tool (10) according to any of claims 8 to 12 wherein the hydraulic motor interface device (20) comprises a drain port (85), and wherein the first and/or second interface surfaces on the hydraulic motor interface device (20) comprise one or more drainage grooves or channels (67, 68) which may be in fluid communication with the drain port (85).

14. The subsea torque tool (10) according to any of claims 8 to 13 wherein the torque tool (10) comprises a pilot relief manifold block (100) which controls the drainage of hydraulic fluid from a disengaged motor to a hydraulic return line.

15. The subsea torque tool (10) according to any of claims 8 to 14 wherein the hydraulic motor interface device (20) has an axial dimension in the direction of the drive shaft (15) of less than approximately 40mm.

16. A method of operating a subsea torque tool (10) comprising:
providing a subsea torque tool (10), the subsea torque tool (10) comprising at least one torque drive head (13) and a drive mechanism (16) operable to rotate the at least one torque drive head (13); and a first motor (17) having a first torque output and a second motor (18) having a second torque output, wherein the first and second motors (17, 18) are operable to be rotated in the same direction;
operating the first and/or second motors (17, 18) to drive a common drive shaft.

17. The method according to claim 16, comprising:
operating the drive mechanism (16) in a high torque mode, in which the first and second motors (17, 18) are operated concurrently in the same direction to generate a high torque output; or
operating the drive mechanism (16) in a super low torque mode, in which the first and second motors (17, 18) are operated concurrently at the same time in opposing directions to generate a super low torque output.

18. The method according to claim 16 or claim 17 , wherein the first and second motors (17, 18) are hydraulic motors, and the method comprises draining the hydraulic fluid from a de-activated hydraulic motor when the other hydraulic motor is activated.

19. A subsea vehicle system comprising the subsea torque tool (10) according to any of claims 1 to 15.