

Claims:

1. A hydraulic control system (100) for actuating a downhole tool, the hydraulic control system comprising:

a plurality of valve members (124) operable to selectively allow and prevent fluid communication between high and low pressure sources (54, 56) and first and second sides (58, 60) of an actuator (64) operably associated with the downhole tool;

wherein, a first pair of valve members is ported to the high pressure source;

wherein, a second pair of valve members is ported to the low pressure source;

wherein, a third pair of valve members is ported to the first side of the actuator; and

wherein, a fourth pair of valve members is ported to the second side of the actuator.

2. A hydraulic control system as claimed in claim 1, wherein each of the valve members further comprises a 2-way valve and/or a 2-position valve.

3. A hydraulic control system as claimed in claim 1 or 2, wherein each of the valve members further comprises a

needle valve (124), and preferably, wherein each of the valve members further comprises a stem (126) operable to form a metal-to-metal seal with a valve seat (112).

4. A hydraulic control system as claimed in any of the preceding claims, further comprising a plurality of motors (120), one associated with each valve member, such that each motor operates one of the valve members between open and closed positions.

5. A hydraulic control system as claimed in any of claims 1 to 3, further comprising a drive assembly operably associated with the valve members to operate the valve members between open and closed positions, preferably wherein the drive assembly is operable to sequentially operate the valve members one at a time and/or wherein the drive assembly further comprises a ring gear and at least one motor.

6. A hydraulic control system as claimed in any of the preceding claims further comprising at least one power and control assembly (118).

7. A hydraulic control system for actuating a downhole tool, the hydraulic control system comprising:

a plurality of valve members operable to selectively allow and prevent fluid communication between high and low pressure sources and first and second sides of an actuator operably associated with the downhole tool;

wherein, a first valve member is ported between the high pressure source and the first side of the actuator;

wherein, a second valve member is ported between the low pressure source and the first side of the actuator;

wherein, a third valve member is ported between the high pressure source and the second side of the actuator;
and

wherein, a fourth valve member is ported between the low pressure source and the second side of the actuator.

8. A hydraulic control system as claimed in claim 7, wherein each of the valve members further comprises a 2-way valve and/or a 2-position valve.

9. A hydraulic control system as claimed in claim 7 or 8, wherein each of the valve members further comprises a needle valve, and preferably wherein each of the valve members further comprises a stem operable to form a metal-to-metal seal with a valve seat.

10. A hydraulic control system as claimed in any of claims 7 to 9, further comprising a plurality of motors, one associated with each valve member, such that each motor operates one of the valve members between open and closed positions.

11. A hydraulic control system as claimed in claims 7 to 9, further comprising a drive assembly operably associated with the valve members to operate the valve members between open and closed positions, preferably wherein the drive assembly is operable to sequentially operate the valve members one at a time and/or wherein the drive assembly further comprises a ring gear and at least one motor.

12. A hydraulic control system as claimed in any of claims 7 to 11, further comprising at least one power and control assembly.

Claims:

1. A hydraulic control system for actuating a downhole tool, the hydraulic control system comprising:

a plurality of valve members operable to selectively allow and prevent fluid communication between high and low pressure sources and first and second sides of a piston disposed in an actuator operably associated with the downhole tool; and

a drive assembly including a ring gear and at least one motor operably associated with the valve members to operate the valve members between open and closed positions;

wherein, a first pair of valve members is ported to the high pressure source;

wherein, a second pair of valve members is ported to the low pressure source;

wherein, a third pair of valve members is ported to the first side of the piston;

wherein, a fourth pair of valve members is ported to the second side of the piston;

and

wherein, operation of the valve members by the drive assembly to a first configuration shifts the piston in a first direction and operation of the valve members by the drive assembly to a second configuration shifts the piston in a second direction.

2. The hydraulic control system as recited in claim 1 wherein each of the valve members further comprises a 2-way valve.

3. The hydraulic control system as recited in claim 1 wherein each of the valve members further comprises a 2-position valve.

4. The hydraulic control system as recited in claim 1 wherein each of the valve members further comprises a needle valve.

5. The hydraulic control system as recited in claim 1 wherein each of the valve members further comprises a stem operable to form a metal-to-metal seal with a valve seat.

6. The hydraulic control system as recited in claim 1 wherein the drive assembly is operable to sequentially operate the valve members one at a time.

7. The hydraulic control system as recited in claim 1 further comprising at least one power and control assembly.

8. A hydraulic control system for actuating a downhole tool, the hydraulic control system comprising:

a plurality of valve members operable to selectively allow and prevent fluid communication between high and low pressure sources and first and second sides of a piston disposed in an actuator operably associated with the downhole tool; and

a drive assembly including a ring gear and at least one motor operably associated with the valve members to operate the valve members between open and closed positions;

wherein, a first valve member is ported between the high pressure source and the first side of the piston;

wherein, a second valve member is ported between the low pressure source and the first side of the piston;

wherein, a third valve member is ported between the high pressure source and the second side of the piston; and

wherein, a fourth valve member is ported between the low pressure source and the second side of the piston;

wherein, operation of the first and fourth valve members to the open position and the second and third valve members to the closed position by drive assembly shifts the piston in a first direction and operation of the first and fourth valve members to the closed position and the second and third valve members to the open position by drive assembly shifts the piston in a second direction.

9. The hydraulic control system as recited in claim 8 wherein each of the valve members further comprises a 2-way valve.

10. The hydraulic control system as recited in claim 8 wherein each of the valve members further comprises a 2-position valve.

11. The hydraulic control system as recited in claim 8 wherein each of the valve members further comprises a needle valve.

12. The hydraulic control system as recited in claim 8 wherein each of the valve members further comprises a stem operable to form a metal-to-metal seal with a valve seat.

13. The hydraulic control system as recited in claim 8 wherein the drive assembly is operable to sequentially operate the valve members one at a time.

14. The hydraulic control system as recited in claim 8 further comprising at least one power and control assembly.