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(54) HYDRAULIC PUMP ASSEMBLY

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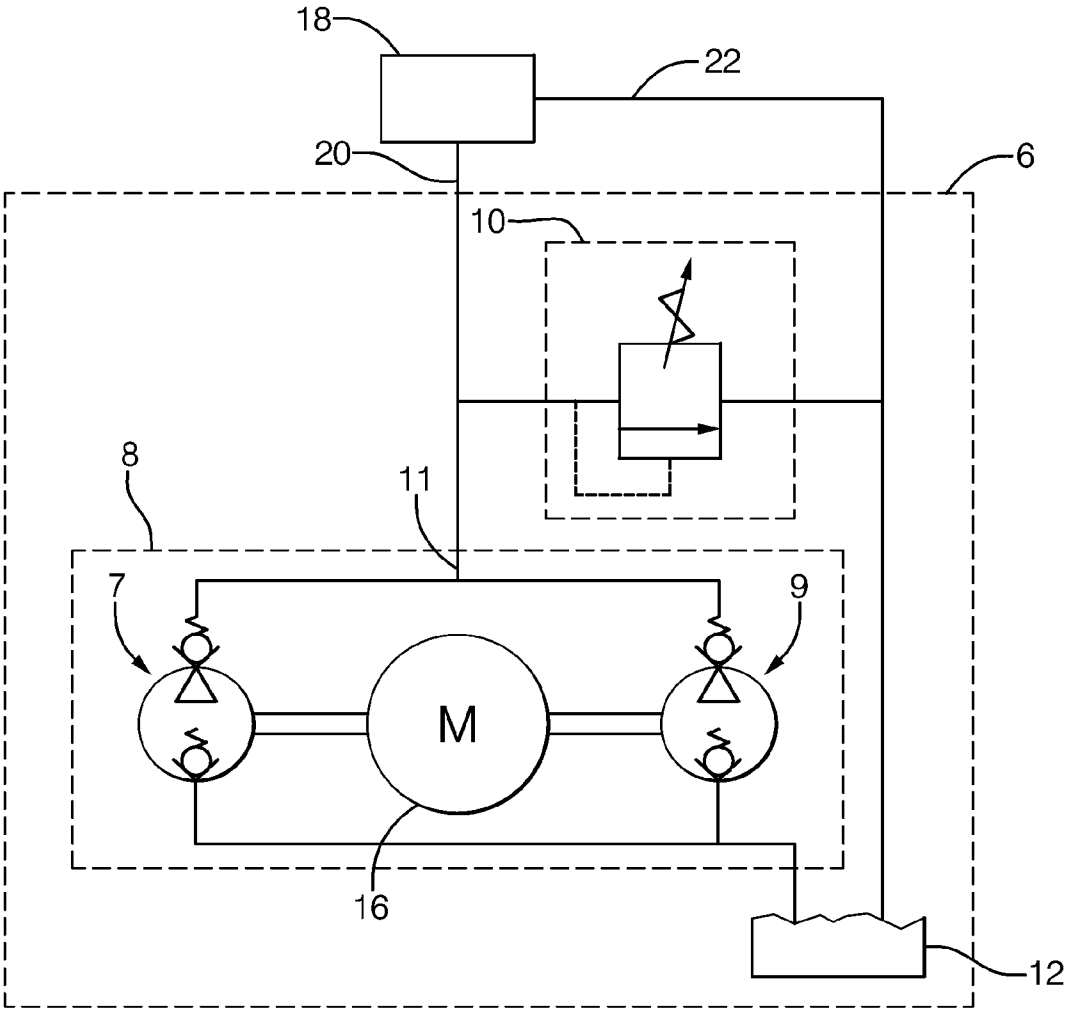
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(57) **ABSTRACT**

A hydraulic pump assembly including a fluid reservoir, a body defining a fluid inlet and a fluid outlet, the fluid inlet being in fluid communication with the fluid reservoir, and a radially opposed piston pump assembly at least partially housed within the body and including a first piston pump mechanism and a second piston pump mechanism, the first piston pump mechanism being in fluid communication with the fluid inlet and having a first pump outlet, the second piston pump mechanism being in fluid communication with the fluid inlet and having a second pump outlet, wherein the first pump outlet and the second pump outlet are both in fluid communication with the fluid outlet.



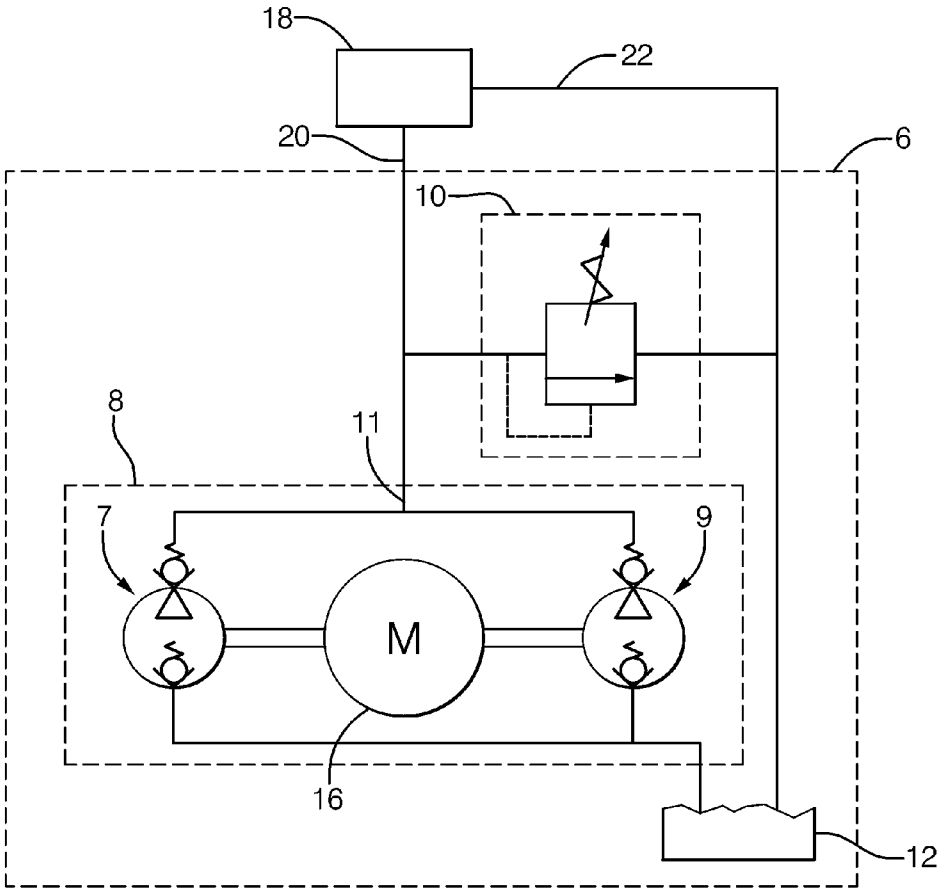


FIG. 1

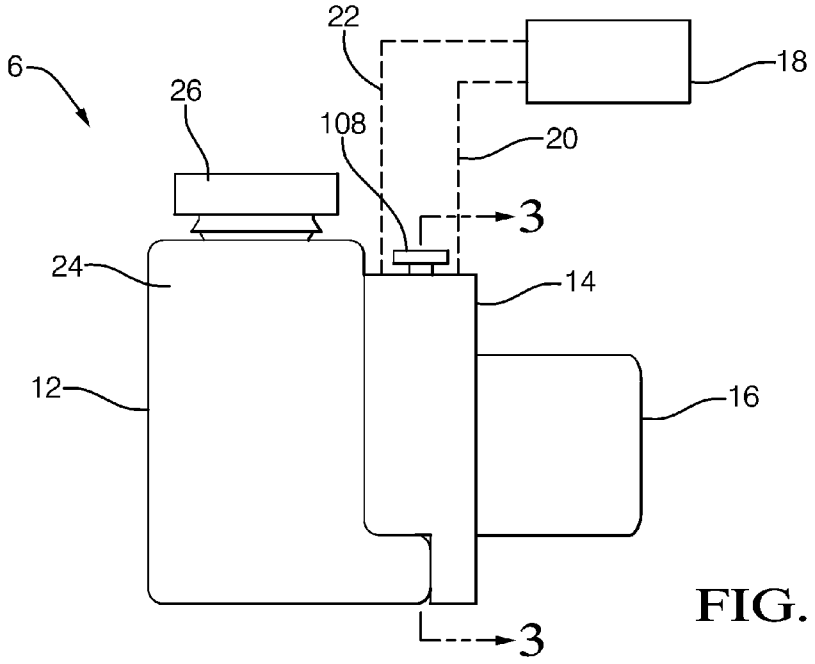


FIG. 2

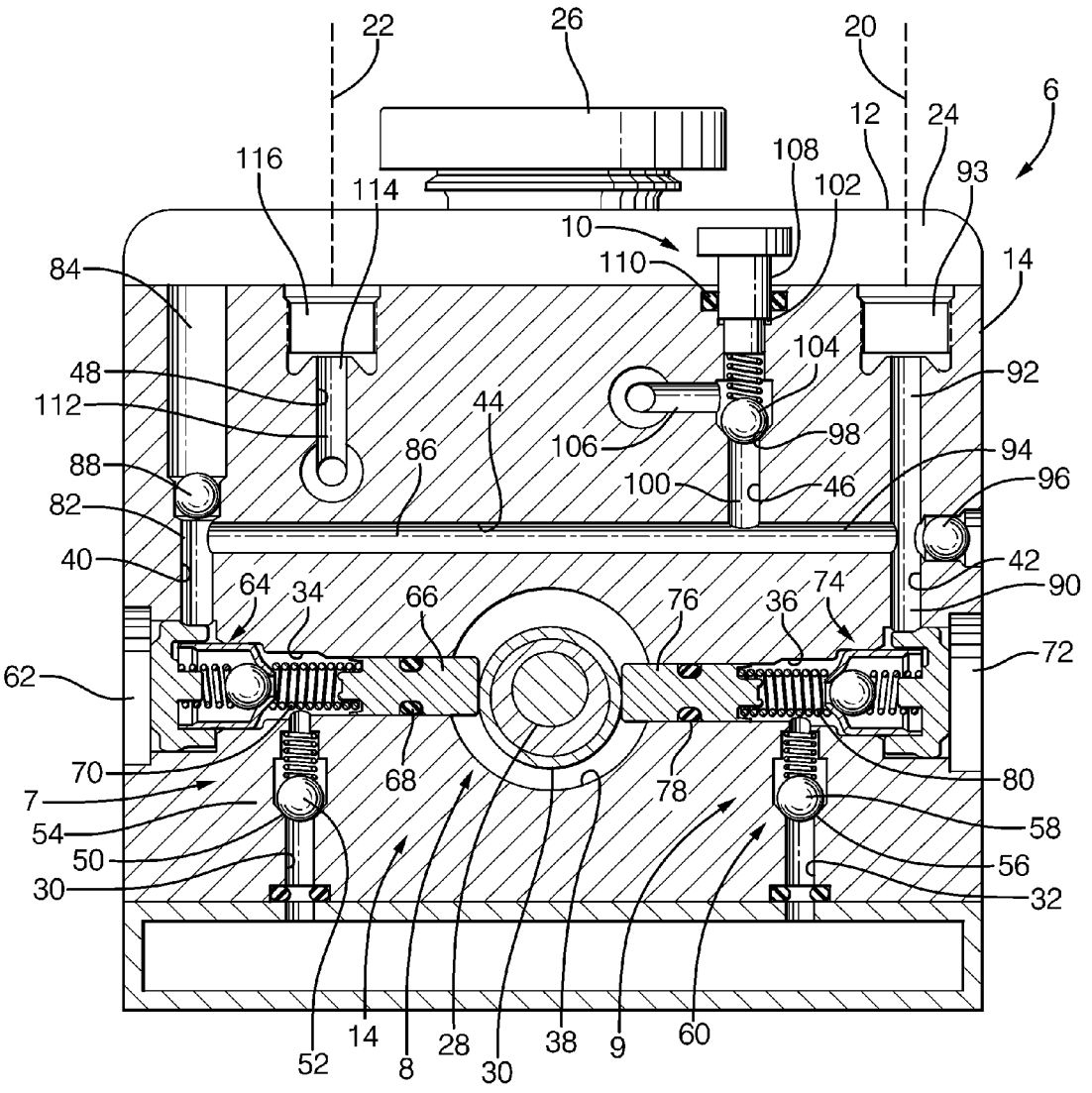

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FIG. 3

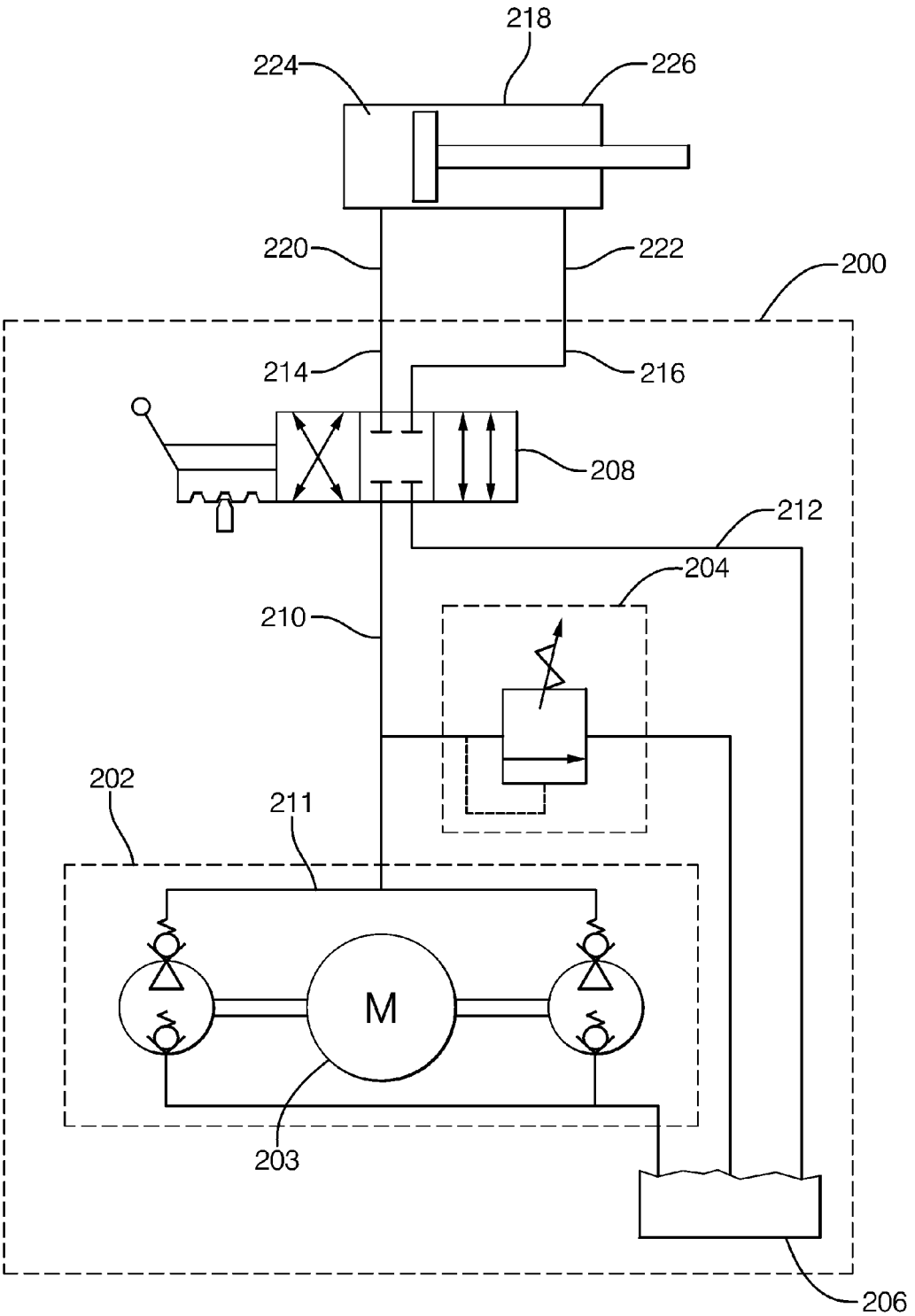


FIG. 4

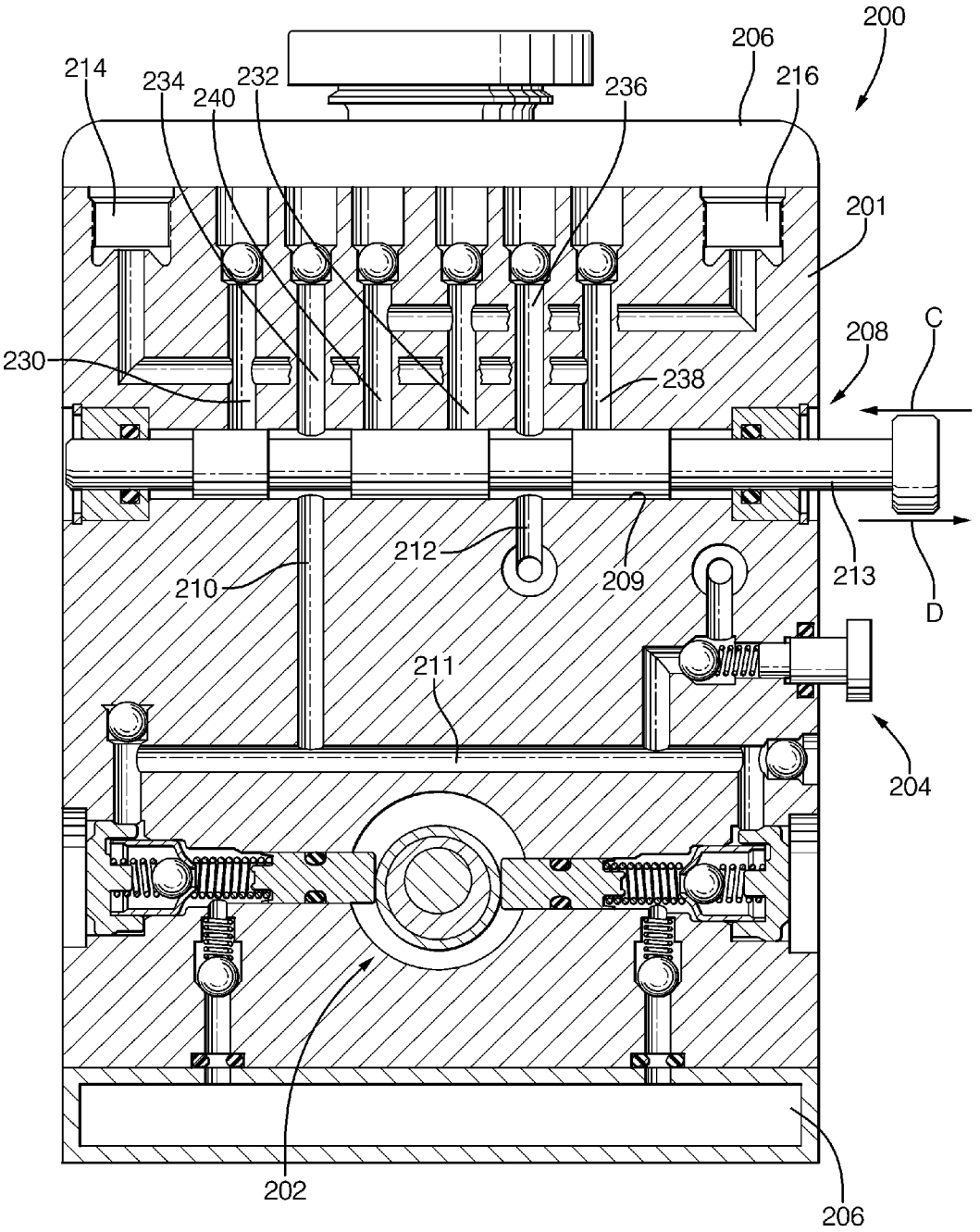

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FIG. 5

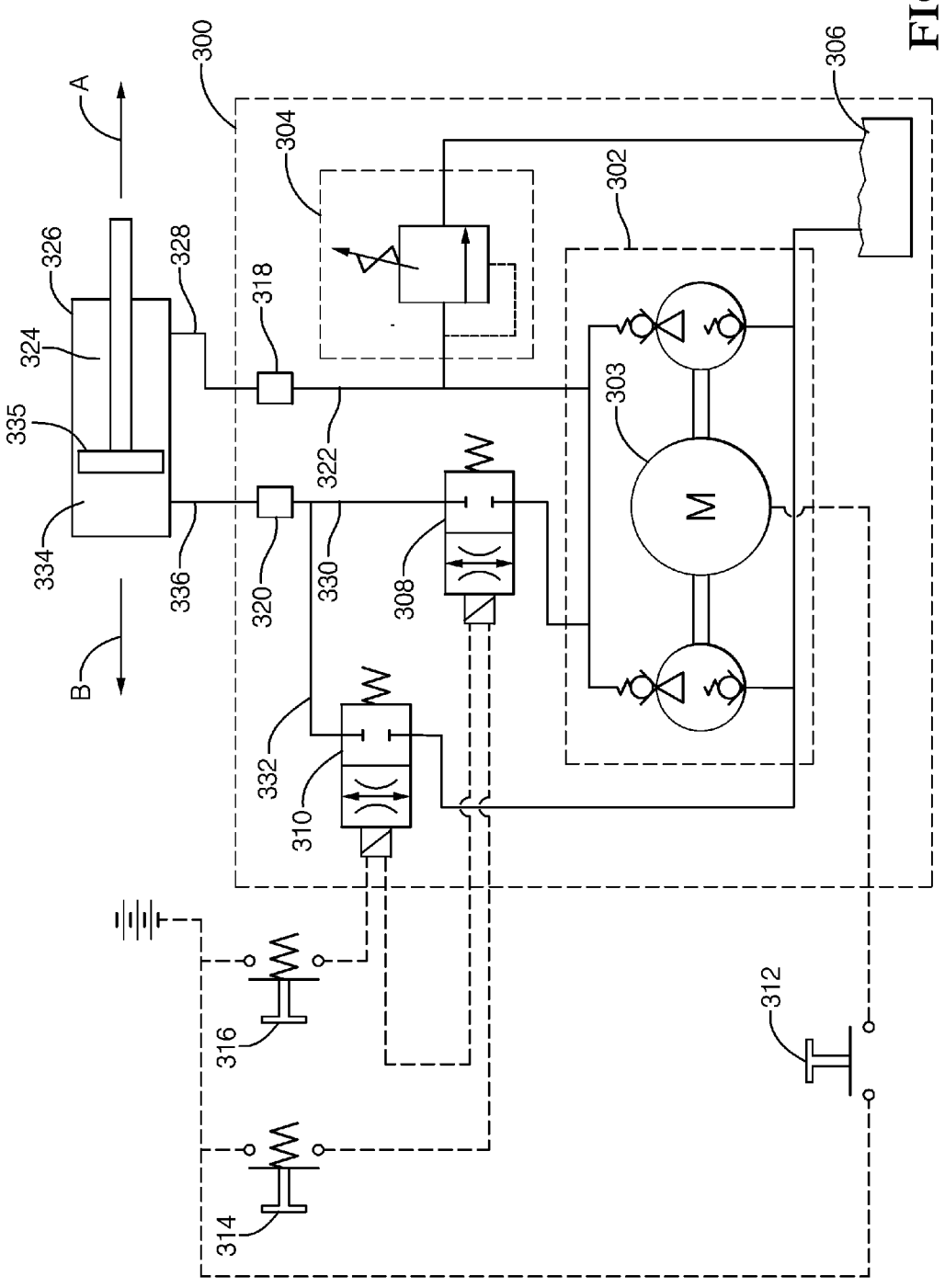

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FIG. 6

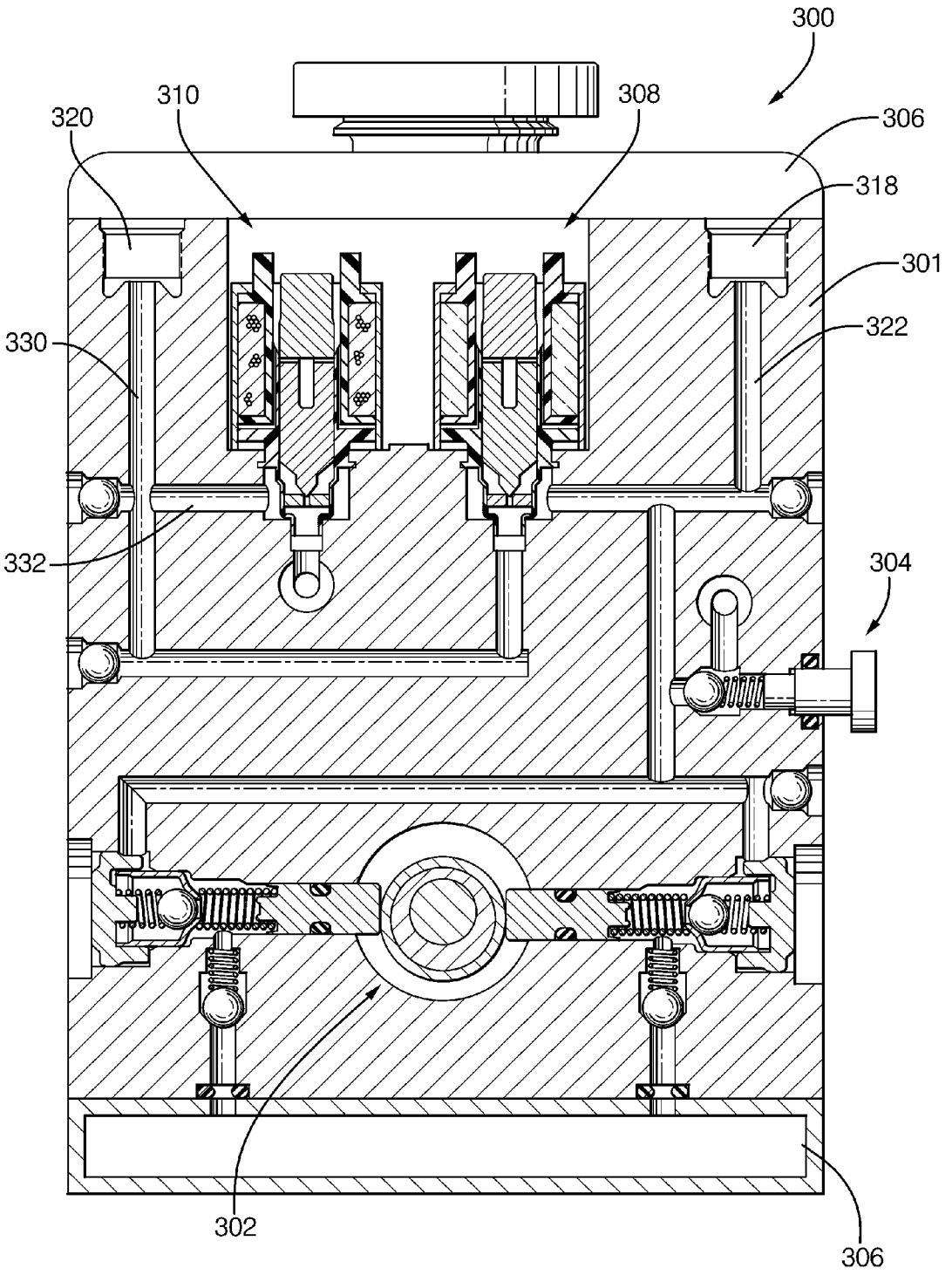


FIG. 7

HYDRAULIC PUMP ASSEMBLY

FIELD

[0001] The present patent application is directed to pump assemblies and, more particularly, to hydraulic pump assemblies configured to supply a pressurized fluid line to various auxiliary applications.

BACKGROUND

[0002] Anti-lock braking systems typically include wheel speed sensors, an electronic control unit and a hydraulic control unit. The electronic control unit is integrated with the hydraulic control unit to form a hydraulic modulator or electro-hydraulic control unit. The hydraulic control unit may include a motor for pumping hydraulic fluid through various channels, accumulators for storing accumulated hydraulic fluid and valves having internal components for directing hydraulic fluid to the brakes. The electronic control unit may include a processor for receiving signals from the speed sensors and solenoid coils corresponding to each valve stem for actuating the valves according to command signals generated by the processor. The electronic control unit may be integrated with the hydraulic control unit such that the coils contact the valve stems, thereby forming the electro-hydraulic control unit.

[0003] Advances in electro-hydraulic control unit technology and, in particular, advances in the manufacture of electro-hydraulic control units, including the machining of the associated hydraulic control units, have resulted in efficiencies and economies of scale that led to mass production of electro-hydraulic control unit. As a result, anti-lock braking systems have become standard features of modern automobiles.

[0004] Elsewhere in the art, hydraulic pumps such as gear pumps and vane pumps are used to supply hydraulic fluid to various auxiliary applications, such as positioning applications (e.g., hydraulic door operators, conveyor belt tensioners and medical chairs and beds), recreational vehicle applications (e.g., leveling, slideouts and tent trailers), clamping applications (e.g., tool fixtures and jigs, hydraulic brakes, crimping tools, arbor presses and truck restraints), cycling applications (e.g., garbage compactors, valve operators, press controls, packing equipment and indexing tables), and lifting applications (e.g., handicap lifts, scissor lift tables and pellet movers).

[0005] It has been discovered that electro-hydraulic control unit technology may be used to supply a highly pressurized fluid line to various auxiliary applications, thereby providing a low-cost alternative to traditional hydraulic pumps for auxiliary applications.

SUMMARY

[0006] In one aspect, the disclosed hydraulic pump assembly may include a fluid reservoir, a body defining a fluid inlet and a fluid outlet, the fluid inlet being in fluid communication with the fluid reservoir, and a radially opposed piston pump assembly at least partially housed within the body and including a first piston pump mechanism and a second piston pump mechanism, the first piston pump mechanism being in fluid communication with the fluid inlet and having a first pump outlet, the second piston pump mechanism being in fluid communication with the fluid inlet and having a second pump outlet, wherein the first pump outlet and the second pump outlet are both in fluid communication with the fluid outlet.

[0007] In another aspect, the disclosed hydraulic pump assembly may include a fluid reservoir, a body defining a fluid inlet and a fluid outlet, the fluid inlet being in fluid communication with the fluid reservoir, a radially opposed piston pump assembly at least partially housed within the body and including a first piston pump mechanism, a second piston pump mechanism and an electric motor, the electric motor including an eccentric that engages the first and second piston pump mechanisms, the first piston pump mechanism being in fluid communication with the fluid inlet and having a first pump outlet, the second piston pump mechanism being in fluid communication with the fluid inlet and having a second pump outlet, wherein the first pump outlet and the second pump outlet are both in fluid communication with the fluid outlet, a first pump inlet check valve positioned in a first inlet fluid path within the body between the fluid reservoir and the first piston pump mechanism, a second pump inlet check valve positioned in a second inlet fluid path within the body between the fluid reservoir and the second piston pump mechanism, a first pump outlet check valve positioned in a first outlet fluid path within the body between the first piston pump mechanism and the first pump outlet, a second pump outlet check valve positioned in a second outlet fluid path within the body between the second piston pump mechanism and the second pump outlet, and a pressure relief valve in fluid communication with the fluid outlet.

[0008] Other aspects of the disclosed hydraulic pump assembly will become apparent from the following description, the accompanying drawings and the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a schematic illustration of one aspect of the disclosed hydraulic pump assembly connected to an auxiliary application;

[0010] FIG. **2** is a side elevational view of the hydraulic pump assembly of FIG. **1**;

[0011] FIG. **3** is a front elevational view, shown in section, of the hydraulic pump assembly of FIG. **2**;

[0012] FIG. **4** is a schematic illustration of a second aspect of the disclosed hydraulic pump assembly;

[0013] FIG. **5** is a front elevational view, shown in section, of the hydraulic pump assembly of FIG. **4**;

[0014] FIG. **6** is a schematic illustration of a third aspect of the disclosed hydraulic pump assembly; and

[0015] FIG. **7** is a front elevational view, shown in section, of the hydraulic pump assembly of FIG. **6**.

DETAILED DESCRIPTION

[0016] Referring to FIG. **1**, one aspect of the disclosed hydraulic pump assembly, generally designated **6**, may include a radially opposed piston pump assembly **8**, a pressure relief valve **10**, and a fluid reservoir **12**. The radially opposed piston pump assembly **8** may include a first piston pump mechanism **7** and a second piston pump mechanism **9**, wherein the outputs of the first and second piston pump mechanisms **7**, **9** may be combined to provide a single hydraulic fluid outlet **11**. The fluid outlet **11** of the radially opposed piston pump assembly **8** may be in fluid communication with an auxiliary application **18** by way of a pressurized fluid line **20**. The pressurized fluid line **20** may supply high pressure hydraulic fluid to the auxiliary application **18**

and a return fluid line **22** may return hydraulic fluid from the auxiliary application **18** to the fluid reservoir **12** at atmospheric pressure.

[0017] In particular, as shown in FIG. **2**, the hydraulic pump assembly **6** may include the fluid reservoir **12**, a hydraulic control unit body **14**, and a pump motor **16**. The hydraulic control unit body **14** may house the radially opposed piston pump assembly **8** and the pressure relief valve **10**, and, in response to rotational power supplied by the pump motor **16**, may operate to draw hydraulic fluid from the fluid reservoir **12**, pressurize the hydraulic fluid, communicate the hydraulic fluid to the auxiliary application **18** by way of fluid line **20**, and then return the hydraulic fluid to the fluid reservoir **12** by way of fluid line **22**.

[0018] The fluid reservoir **12** may be any vessel capable of storing a hydraulic fluid. For example, as shown in FIGS. **2** and **3**, the fluid reservoir **12** may include a bottle **24** (e.g., a plastic bottle) and a cap **26** for securing hydraulic fluid within the bottle **24**. In one aspect, the fluid reservoir **12** may be connected to the body **14** to form an integral reservoir/body/motor assembly. In an alternative aspect, the fluid reservoir **12** may be physically separated from the body **14**, but in fluid communication with the body **14** by way of external fluid lines (not shown).

[0019] The pump motor **16** may be any appropriate motor having a motor shaft **28** (FIG. **3**) with an eccentric **30** (FIG. **3**) extending therefrom. In one example, the pump motor **16** may be a 12-volt electric motor with an eccentric **30** of about 0.85 mm to about 1.20 mm. In another example, the pump motor **16** may be a 24-volt motor. In another example, the pump motor **16** may be 10-volt motor. However, those skilled in the art will appreciate that the size of the pump motor **16**, the shaft **28** and the eccentric **30** will be dictated by design considerations.

[0020] As shown in FIG. **2**, the pump motor **16** may be connected to the body **14** such that, as shown in FIG. **3**, the motor shaft **28** and associated eccentric **30** extend into the shaft chamber **38** (discussed below) defined in the body **14** for engagement with the first and second pistons **66**, **76** (discussed below). Therefore, rotational power from the pump motor **16** may be translated into flow and pressurization of hydraulic fluid within the body **14**.

[0021] Referring to FIG. **3**, the body **14** may be a block of rigid material, such as aluminum, and may define a first fluid inlet bore **30**, a second fluid inlet bore **32**, a first piston bore **34**, a second piston bore **36**, a shaft chamber **38**, a first fluid outlet bore **40**, a second fluid outlet bore **42**, a connecting bore **44**, a pressure relief bore **46** and a fluid return bore **48**. The bores **30**, **32**, **34**, **36**, **40**, **42**, **44**, **46**, **48** and chamber **38** may be machined into the body **14** using any available technique (e.g., drilling). Plugs (discussed in greater detail below), such as ball plugs, may be inserted into the bores to seal the bores as appropriate.

[0022] The first fluid inlet bore **30** may be in fluid communication with the fluid reservoir **12** at a first end thereof and the first piston bore **34** at a second end thereof, and may define a valve seat **50** therein. A spring-loaded ball **52** may be received in the first fluid inlet bore **30** and may be biased into engagement with the valve seat **50**, thereby defining a first pump inlet check valve **54** between the first fluid inlet bore **30** and the first piston bore **34**. The first pump inlet check valve **54** may allow hydraulic fluid to flow from the fluid reservoir **12** to the first piston pump mechanism **7**, but not in the reverse direction.

[0023] The second fluid inlet bore **32** may be in fluid communication with the fluid reservoir **12** at a first end thereof and the second piston bore **36** at a second end thereof, and may define a valve seat **56** therein. A spring-loaded ball **58** may be received in the second fluid inlet bore **32** and may be biased into engagement with the valve seat **56**, thereby defining a second pump inlet check valve **60** between the second fluid inlet bore **32** and the second piston bore **36**. The second pump inlet check valve **60** may allow hydraulic fluid to flow from the fluid reservoir **12** to the second piston pump mechanism **9**, but not in the reverse direction.

[0024] The first piston bore **34** may include a plug **62** sealing a first end thereof and may connect with the shaft chamber **38** at a second end thereof. The first piston bore **34** may fluidly couple the first fluid inlet bore **30** with the first fluid outlet bore **40** (i.e., the outlet of the first piston pump mechanism **7**) and may include a first pump outlet check valve **64** positioned between the first fluid inlet bore **30** and the first fluid outlet bore **40**. The first pump outlet check valve **64** may allow hydraulic fluid to flow from the first piston bore **34** to the first fluid outlet bore **40**, but not in the reverse direction.

[0025] A first piston **66** may be closely and sideably received in the first piston bore **34**. A seal **68** may create a fluid-tight seal across the first piston **66** such that hydraulic fluid does not pass across the first piston **66** from the first piston bore **34** and into the shaft chamber **38**. A biasing element **70**, such as a coil spring, may bias the first piston **66** out of the first piston bore **34** and in the direction of the shaft chamber **38** for engagement with the eccentric **30** of the shaft **28** of the pump motor **16**.

[0026] The second piston bore **36** may include a plug **72** sealing a first end thereof and may connect with the shaft chamber **38** at a second end thereof. The second piston bore **36** may fluidly couple the second fluid inlet bore **32** with the second fluid outlet bore **42** (i.e., the outlet of the second piston pump mechanism **9**) and may include a second pump outlet check valve **74** positioned between the second fluid inlet bore **32** and the second fluid outlet bore **42**. The second pump outlet check valve **74** may allow hydraulic fluid to flow from the second piston bore **36** to the second fluid outlet bore **42**, but not in the reverse direction.

[0027] A second piston **76** may be closely and sideably received in the second piston bore **36**. A seal **78** may create a fluid-tight seal across the second piston **76** such that hydraulic fluid does not pass across the second piston **76** from the second piston bore **36** and into the shaft chamber **38**. A biasing element **80**, such as a coil spring, may bias the second piston **76** out of the second piston bore **36** and in the direction of the shaft chamber **38** for engagement with the eccentric **30** of the shaft **28** of the pump motor **16** (FIG. **2**).

[0028] As the pump motor **16** rotates the shaft **28** and associated eccentric **30**, the eccentric **30** alternately acts on the first and second pistons **66**, **76** such that the pistons **66**, **76** are urged into the associated first and second piston bores **34**, **36**. Then, when the eccentric **30** passes, the biasing elements **70**, **80** urge the associated pistons **66**, **76** out of the associated piston bores **66**, **76**.

[0029] Accordingly, due to the reciprocating action of the pistons **66**, **76** caused by the pump motor **16** and the biasing elements **70**, **80**, hydraulic fluid is drawn from the fluid reservoir **12**, through the first and second pump inlet check valves **54**, **60**, and into the first and second piston bores **34**, **36** when the pistons **66**, **76** are urged out of the associated piston bores **34**, **36** by the biasing elements **70**, **80**. Then, when the

pistons **66**, **76** are urged into the associated piston bores **34**, **36** by the eccentric **30**, the hydraulic fluid in the piston bores **34**, **36** is urged through the first and second pump outlet check valves **64**, **74** and into the first and second fluid outlet bores **40**, **42**, thereby operating as the radially opposed piston pump assembly **8**.

[0030] The first fluid outlet bore **40** may include a first end **82** and a second end **84**. The first end **82** of the first fluid outlet bore **40** may be connected to the first piston bore **34** and a first end **86** of the connecting bore **44**. The second end **84** of the first fluid outlet bore may include a plug **88**, such as a ball plug, received therein to form an external seal.

[0031] The second fluid outlet bore **42** may include a first end **90** and a second end **92**. The first end **90** of the second fluid outlet bore **42** may be connected to the second piston bore **36** and a second end **94** of the connecting bore **44**. (A plug **96**, such as a ball plug, may be used to seal the external portion of the second end **94** of the connecting bore **44**.) The second end **92** of the second fluid outlet bore **42** may be connected to an outlet port **93**, which may be connected to the pressurized fluid line **20** for directing hydraulic fluid to the auxiliary application **18** (FIG. **2**).

[0032] Thus, the connecting bore **44** may combine the first and second fluid outlet bores **40**, **42** (i.e., both outputs of the radially opposed piston pump assembly **8**) into a single fluid outlet port **93**.

[0033] Still referring to FIG. **3**, the pressure relief bore **46** may define a valve seat **98** therein and may include a first end **100** in fluid communication with the connecting bore **44** and a second end **102** having threads formed therein. A spring-loaded ball **104** or the like may be positioned in the pressure relief bore **46** to engage the valve seat **98** and form a pressure sensitive seal therebetween, thereby operating as the pressure relief valve **10**. A return bore **106** extending between the fluid reservoir **12** and the pressure relief bore **46** may fluidly couple the pressure relief bore **46** with the fluid reservoir **12**. The return bore **106** may be connected to the pressure relief bore **46** at a point between the valve seat **98** and the second end **102** of the pressure relief bore **46**.

[0034] A pressure relief control screw **108** may engage the threads at the second end **102** of the pressure relief bore **46** and a seal **110** may provide a fluid tight seal between the pressure relief bore **46** and the pressure relief control screw **108**. Rotation of the pressure relief control screw **108** about the threads may compress the spring-loaded ball **104**, thereby urging the spring-loaded ball **104** against the valve seat **98** with greater force, thereby increasing the amount of fluid pressure that may be resisted by the spring-loaded ball **104** before the spring-loaded ball **104** is displaced from the valve seat **98** to release hydraulic fluid to the fluid reservoir **12** through the return bore **106**.

[0035] The fluid return bore **48** may include a first end **112** and a second end **114**. The first end **112** of the fluid return bore **48** may be in fluid communication with the fluid reservoir **12**. The second end **114** of the fluid return bore **48** may be connected to a return port **116**. The return port **116** may be connected to the return fluid line **22** for directing return fluid to the fluid reservoir **12**.

[0036] At this point, those skilled in the art will appreciate that the body **14** of the hydraulic pump assembly **6** may be formed by machining a solid block of material (e.g., aluminum) to form a plurality of bores having the desired configuration and geometry, and inserting the necessary plugs and components (e.g., pistons, check valves and biasing elements) into the bores to form the radially opposed piston pump assembly **8** that delivers a single, high pressure fluid outlet and the pressure relief valve **10** that controls excess fluid pressure within the hydraulic pump assembly **6**.

[0037] Accordingly, those skilled in the art will appreciate that the disclosed hydraulic pump assembly **6** may provide a low-cost, high-volume radial two piston pump and motor assembly with an integral pressure relief valve, and, optionally, an integral plastic fluid reservoir.

[0038] Referring to FIGS. **4** and **5**, a second aspect of the disclosed hydraulic pump assembly, generally designated **200**, may include a hydraulic control unit body **201** (FIG. **5**), a pump motor **203** (FIG. **4**), a pressure relief valve **204**, a fluid reservoir **206** and a manual control valve **208**. The hydraulic control unit body **201** and the pump motor **203** may combine to form a radially opposed piston pump assembly **202**. The radially opposed piston pump assembly **202**, the pressure relief valve **204** and the fluid reservoir **206** may be configured in the manner described above in connection with the hydraulic pump assembly **6**. However, those skilled in the art will appreciate that the radially opposed piston pump assembly **202**, the pressure relief valve **204** and the fluid reservoir **206** may be configured in various ways.

[0039] The manual control valve **208** may be a three-position, two-way bi-direction spool valve having a moveable spool **213** received in a bore **209** defined in the body **201** of the assembly **200**. The manual control valve **208** may be in communication with the combined fluid output **211** of the radially opposed piston pump assembly **202** by way of a first fluid channel **210**, the fluid reservoir **206** by way of a second fluid channel **212**, a first bi-directional input/output port **214** and a second bi-directional input/output port **216**. Those skilled in the art will appreciate that the combined fluid output **211**, the first and second fluid channels **210**, **212** and the first and second input/output ports **214**, **216** may be formed as bores machined into the body **201** of the assembly **200**.

[0040] As shown in FIG. **4**, the first and second input/output ports **214**, **216** may be in fluid communication with an auxiliary application **218** by way of first and second fluid lines **220**, **222**. The auxiliary application **218** is shown in FIG. **4** as a hydraulic cylinder; however, those skilled in the art will appreciate that the auxiliary application **218** may be any auxiliary device that can be manipulated by the application of pressurized hydraulic fluid.

[0041] In the first (e.g., left) position (not shown), the spool **213** may be shifted in the direction of arrow C (FIG. **5**) such that the manual control valve **208** may connect the first input/output port **214** with the first fluid channel **210** (i.e., the pressurized fluid) by way of a first valve bore **230** and the second input/output port **216** with the second fluid channel **212** (i.e., the reservoir) by way of a second valve bore **232**. In the first position, the first input/output port **214** may be pressurized while the second input/output port **216** may be depressurized, thereby pressurizing the piston chamber **224** of the auxiliary application **218** and depressurizing the rod chamber **226** of the auxiliary application **218**.

[0042] In the second (e.g., middle) position (shown in FIG. **4**), the spool **213** may be centered in the bore **209** such that the first fluid channel **210** (i.e., the pressurized fluid) is in fluid communication with a third valve bore **234**, which is not in fluid communication with either the first input/output port **214** or the second input/output port **216**, and the second fluid channel **212** (i.e., the reservoir) is in fluid communication with a fourth valve bore **236**, which is not in fluid communi-

cation with either the first input/output port **214** or the second input/output port **216**. Therefore, in the second position, the manual control valve **208** locks hydraulic fluid in the first and second input/output ports **214**, **216**, thereby locking the auxiliary application **218** in a fixed position.

[0043] In the third (e.g., right) position (not shown), the spool **213** may be shifted in the direction of arrow D (FIG. **5**) such that the manual control valve **208** may connect the first input/output port **214** with the second fluid channel **212** (i.e., the reservoir) by way of a fifth valve bore **238** and the second input/output port **216** with the first fluid channel **210** (i.e., the pressurized fluid) by way of a sixth valve bore **240**. In the third position, the first input/output port **214** may be depressurized while the second input/output port **216** may be pressurized, thereby depressurizing the piston chamber **224** of the auxiliary application **218** and pressurizing the rod chamber **226** of the auxiliary application **218**.

[0044] Accordingly, those skilled in the art will appreciate that the disclosed hydraulic pump assembly **200** may provide a low-cost, high-volume radial two piston pump and motor assembly with an integral pressure relief valve, an integral plastic fluid reservoir, and an integral three-position, bi-directional spool valve for manual pressure control.

[0045] Referring to FIGS. **6** and **7**, a third aspect of the disclosed hydraulic pump assembly, generally designated **300**, may include a hydraulic control unit body **301**, a pump motor **303**, a pressure relief valve **304**, a fluid reservoir **306**, a first normally closed solenoid actuated poppet valve **308** (actuated by electric switch **314**), and a second normally closed solenoid actuated poppet valve **310** (actuated by electric switch **316**). The hydraulic control unit body **301** and the pump motor **303** may combine to form a radially opposed piston pump assembly **302** (actuated by electric switch **312**), The radially opposed piston pump assembly **302**, the pressure relief valve **304** and the fluid reservoir **306** may be configured in the manner described above in connection with the hydraulic pump assembly **6**. However, those skilled in the art will appreciate that the radially opposed piston pump assembly **302**, the pressure relief valve **304** and the fluid reservoir **306** may be configured in various ways.

[0046] Furthermore, the hydraulic pump assembly **300** may include a first, constant high pressure outlet port **318** and a second, variable pressure outlet port **320**. The first outlet port **318** may be in fluid communication with the radially opposed piston pump assembly **302** by way of a first bore **322** and a rod chamber **324** of a hydraulic cylinder **326** by way of a first fluid line **328** (FIG. **6**). The second outlet port **320** may be in fluid communication with the radially opposed piston pump assembly **302** by way of a second bore **330**, the fluid reservoir **306** by way of a third bore **332**, and a rod chamber **334** of the hydraulic cylinder **326** by way of a second fluid line **336** (FIG. **6**). The second bore **330** may be interrupted by the first normally closed solenoid actuated poppet valve **308** and the third bore **332** may be interrupted by the second normally closed solenoid actuated poppet valve **310**.

[0047] In a first configuration of the disclosed hydraulic pump assembly **300**, the radially opposed piston pump assembly **302** may be actuated by the switch **312**, but the first and second solenoid actuated poppet valves **308**, **310** may not actuated, thereby locking the hydraulic cylinder **326**. In a second configuration of the disclosed hydraulic pump assembly **300**, the radially opposed piston pump assembly **302** may be actuated by the switch **312**, the first solenoid actuated poppet valve **308** may be actuated by the switch **314**, and the second solenoid actuated poppet valve **310** may not be actuated, thereby pressurizing the piston chamber **334** and driving the piston **335** in the direction shown by arrow A. (Equal pressures in the piston and rod chambers **334**, **324**, but the rod chamber **324** has less surface area due to the rod.) In a third configuration of the disclosed hydraulic pump assembly **300**, the radially opposed piston pump assembly **302** may be actuated by the switch **312**, the second solenoid actuated poppet valve **310** may be actuated by the switch **316**, and the first solenoid actuated poppet valve **308** may not be actuated, thereby pressurizing the rod chamber **324** and driving the piston **335** in the direction shown by arrow B. In a fourth configuration of the disclosed hydraulic pump assembly **300**, the radially opposed piston pump assembly **302** may be actuated by the switch **312**, the first solenoid actuated poppet valve **308** may be actuated by the switch **314**, and the second solenoid actuated poppet valve **310** may be actuated by the switch **316**, thereby freeing the hydraulic cylinder **326** and removing the load from the radially opposed piston pump assembly **302**.

[0048] Accordingly, those skilled in the art will appreciate that the disclosed hydraulic pump assembly **300** may provide a low-cost, high-volume radial two piston pump and motor assembly with an integral pressure relief valve, an integral plastic fluid reservoir, and integral solenoid actuated poppet valves allowing for remote operation and full pressure control using electric switches.

[0049] Although various aspects of the disclosed hydraulic pump assembly have been shown and described, modifications may occur to those skilled in the art upon reading the specification. The present application includes such modifications and is limited only by the scope of the claims.

What is claimed is:

1. A hydraulic pump assembly comprising:

a fluid reservoir;

a body defining a fluid inlet and a fluid outlet, said fluid inlet being in fluid communication with said fluid reservoir; and

a radially opposed piston pump assembly at least partially housed within said body and including a first piston pump mechanism and a second piston pump mechanism, said first piston pump mechanism being in fluid communication with said fluid inlet and having a first pump outlet, said second piston pump mechanism being in fluid communication with said fluid inlet and having a second pump outlet, wherein said first pump outlet and said second pump outlet are both in fluid communication with said fluid outlet.

2. The hydraulic pump assembly of claim **1** further comprising a pressure relief valve in fluid communication with said fluid outlet.

3. The hydraulic pump assembly of claim **2** wherein said pressure relief valve includes a biasing element that urges a ball into engagement with a valve seat.

4. The hydraulic pump assembly of claim **3** wherein said pressure relief valve further includes a pressure relief control screw, said biasing element being positioned between said ball and said pressure relief control screw.

5. The hydraulic pump assembly of claim **1** wherein said fluid reservoir includes a bottle and a cap, said cap sealingly engaging said bottle.

6. The hydraulic pump assembly of claim **1** wherein said radially opposed piston pump assembly includes a motor connected to said body, said motor having a shaft with an eccentric.

7. The hydraulic pump assembly of claim **6** wherein said eccentric operatively engages said first and said second piston pump mechanisms.

8. The hydraulic pump assembly of claim **6** wherein said motor is an electric motor.

9. The hydraulic pump assembly of claim **6** wherein said first piston pump mechanism includes a first piston biased into engagement with said eccentric and said second piston pump mechanism includes a second piston biased into engagement with said eccentric.

10. The hydraulic pump assembly of claim **1** further comprising a first pump inlet check valve positioned in a first fluid path within said body between said fluid reservoir and said first piston pump mechanism and a second pump inlet check valve positioned in a second fluid path within said body between said fluid reservoir and said second piston pump mechanism.

11. The hydraulic pump assembly of claim **1** further comprising a first pump outlet check valve positioned in a first fluid path within said body between said first piston pump mechanism and said first pump outlet and a second pump outlet check valve positioned in a second fluid path within said body between said second piston pump mechanism and said second pump outlet.

12. The hydraulic pump assembly of claim **1** further comprising a spool valve received within said body, said spool valve being disposed in a fluid channel between said fluid outlet and said first and second pump outlets.

13. The hydraulic pump assembly of claim **12** wherein said spool valve includes a first input/output and a second input/output, and wherein said spool valve is configurable between a first position, wherein said first input/output is in fluid communication with said fluid output, a second position, wherein said fluid output is decoupled from said first input/output and said second input/output, and a third position, wherein said second input/output is in fluid communication with said fluid output.

14. The hydraulic pump assembly of claim **1** wherein said first pump outlet and said second pump outlet are combined to form a combined pump outlet, said combined pump outlet being in fluid communication with a constant pressure outlet port and a variable pressure outlet port, and wherein a first normally closed solenoid actuated poppet valve is disposed in a first fluid line between said variable pressure outlet port and said combined pump outlet, said first normally closed solenoid actuated poppet valve being received, at least partially, within said body.

15. The hydraulic pump assembly of claim **14** further comprising a second normally closed solenoid actuated poppet valve disposed in a second fluid line between said variable pressure outlet port and said fluid reservoir, said second normally closed solenoid actuated poppet valve being received, at least partially, within said body.

16. A hydraulic pump assembly comprising:

a fluid reservoir;

a body defining a fluid inlet and a fluid outlet, said fluid inlet being in fluid communication with said fluid reservoir;

a radially opposed piston pump assembly at least partially housed within said body and including a first piston pump mechanism, a second piston pump mechanism and an electric motor, said electric motor including an eccentric that engages said first and said second piston pump mechanisms, said first piston pump mechanism being in fluid communication with said fluid inlet and having a first pump outlet, said second piston pump mechanism being in fluid communication with said fluid inlet and having a second pump outlet, wherein said first pump outlet and said second pump outlet are both in fluid communication with said fluid outlet;

a first pump inlet check valve positioned in a first inlet fluid path within said body between said fluid reservoir and said first piston pump mechanism;

a second pump inlet check valve positioned in a second inlet fluid path within said body between said fluid reservoir and said second piston pump mechanism;

a first pump outlet check valve positioned in a first outlet fluid path within said body between said first piston pump mechanism and said first pump outlet;

a second pump outlet check valve positioned in a second outlet fluid path within said body between said second piston pump mechanism and said second pump outlet; and

a pressure relief valve in fluid communication with said fluid outlet.

17. The hydraulic pump assembly of claim **16** wherein said pressure relief valve includes a biasing element that urges a ball into engagement with a valve seat, and a pressure relief control screw, said biasing element being positioned between said ball and said pressure relief control screw.

18. The hydraulic pump assembly of claim **16** wherein said fluid reservoir includes a bottle and a cap sealing engaged with said bottle.

19. The hydraulic pump assembly of claim **16** further comprising a three-position, bi-directional spool valve at least partially received in said body, said spool valve being in fluid communication with said fluid outlet.

20. The hydraulic pump assembly of claim **16** further comprising a normally closed solenoid actuated poppet valve at least partially received in said body, said solenoid actuated poppet valve being in fluid communication with said fluid outlet.

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