INTEGRATED MIXING PUMP

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ABSTRACT

A mixing pump includes a power cylinder and a second cylinder wherein one of the power cylinder and the second cylinder is interchangeable between single and double acting and wherein a working fluid is supplied to the power cylinder under pressure.
**FIG. 3**

<table>
<thead>
<tr>
<th>CHAMBERS WITH WORKING FLUID</th>
<th>CHAMBERS WITH ADDITIVE FLUID</th>
<th>RATIO OF WORKING FLUID TO ADDITIVE FLUID</th>
</tr>
</thead>
<tbody>
<tr>
<td>A,B,E,F</td>
<td>D</td>
<td>30:1</td>
</tr>
<tr>
<td>A,B,F</td>
<td>D</td>
<td>26:1</td>
</tr>
<tr>
<td>A,B,E</td>
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</tr>
<tr>
<td>A,B</td>
<td>C,D,E,F</td>
<td>1.54:1</td>
</tr>
</tbody>
</table>

**FIG. 4**
INTEGRATED MIXING PUMP

BACKGROUND OF INVENTION

[0001] 1. Field of the Invention

The present invention generally relates to a mixing system. More particularly, the invention relates to a mixing system for pumping two or more liquids from storage tanks to a supply tank.

[0002] 2. Background Art

There are numerous situations in which it is necessary to pump a mixture of fluids created from multiple sources. In the chemical industry and the fuel industry, it is desirable to control proportions within a mixture. For example, offshore oil drilling rigs often use water based fluids for hydraulic power for subsea control systems. Hydraulic fluids are typically low viscosity fluids used for the transmission of useful power by the flow of the fluid under pressure from a power source to a load. A liquid hydraulic fluid generally transmits power by virtue of its displacement under a state of stress with low compressibility.

[0003] Hydraulics are often used to actuate subsea tools. One example of a subsea control system. The hydraulic power is a blowout preventer ("BOP"). A BOP forms a seal around drill string to seal off well-head pressure. When an area of high pressure, such as a high pressure gas pocket, has been contacted during drilling. A BOP may use hydraulic fluid to actuate numerous components of the BOP. For example, hydraulic actuators may be used to move BOP rams axially within a bonnet assembly in a direction generally perpendicular to a wellbore axis.

[0004] At present, many conventional hydraulic fluids are not suitable for subsea applications due to their low tolerances, sea water contamination, or contamination by hydrocarbons. For example, conventional hydraulic fluids tend to readily form emulsions with small amounts of hydrocarbons. Furthermore, in marine environments, problems may arise due to bacterial infestations in the hydraulic fluid, especially from anaerobic bacteria, such as sulfate reducing bacteria prevalent in sea water. Additionally, though some conventional hydraulic fluids are substantially non-corrosion-resistant, many, in fact, cause corrosion with metals in contact with the fluid. Other conventional hydraulic fluids are reactive with paints, metal coatings, and elastomeric substances. Further, depending on the location of the control systems in which hydraulic fluids are used, the freezing point of the hydraulic fluid may need to be lowered.

[0005] Accordingly, in order to create a hydraulic fluid that may be used in a particular system, multiple additives may be combined with a base fluid. The majority of base fluids are potable water. In some instances, a hydraulic or BOP control fluid concentrate may be added to potable water. Control fluid concentrates are additive fluids that may be used, for example, to provide lubricity for moving parts in the control system, prevent corrosion of ferrous metal alloys, provide anti-wear properties, and provide a biocide. A biocide, also known as a bactericide, is an additive that prevents growth of micro-organisms. Commercially available examples of control fluid concentrates include Erifon HD 603HP, provided by MacDermid (Pasadena, Tex.), and Stack Magic, provided by Houghton Offshore (Houston, Tex.). At standard dilution ratios, control fluid concentrates and working fluids may be used at temperatures down to 32°F. (0°C.). In instances having operational temperatures below 32°F. (0°C.), a glycol additive may be used to lower the freezing point of the hydraulic fluid.

[0006] These fluids (working and additive fluids) are commonly mixed on a rig and stored in a supply tank. The ratio of the components of the mixture must be accurate enough to provide the right amount of biocide, lubricity, wear, and anti-freeze protection. Incorrect ratios of the components of the mixture may cause premature wear or failure of control system components. Alternatively, excess additive amounts are costly.

[0007] Generally, once the ratios of components of a control system fluid are determined for a particular application, the ratio does not change. However, if the ratio is changed, it is usually based on a change in operational temperature to accommodate fluctuations for the need of glycol.

[0008] Currently, there are generally two types of mixing systems used to mix multiple fluids into a hydraulic fluid for use in subsea control systems. The first mixing system includes an individual pump and motor for each fluid component. In this system, each component fluid may be stored in a separate storage tank and separate motor driven pumps supply each component fluid to a supply tank. Accordingly, variations in the calibrations of the pumps or variations in the water supply pressure may result in an inaccurate mixture. Additionally, failure of a single motor may result in an inaccurate mixture. Further, as space is limited on ocean rigs, it is often difficult to provide sufficient space for three storage tanks, three pumps, and three motors, in addition to a supply tank.

[0009] A second, less common, mixing system includes a single motor with multiple drive belts coupled to multiple pumps. In this system, each component fluid may be stored in a separate storage tank and separate pumps driven by a single common motor with multiple belt drives supply each component to a supply tank. Variations in water supply pressure, however, may result in inaccurate mixture ratios. Additionally, maintenance of the belt drives and pulleys for the belt drives may cause variations in the mixture ratio. Further, as pump calibration is critical to maintaining a desired ratio, variations in the calibrations of the pumps may result in inaccurate mixtures.

[0010] Accordingly, there exists a need for a mixing system that provides accurate ratios of each component of a mixture. Additionally, there exists a need for accurate ratios of each component of a mixture when fluid inlet pressures may vary. Further, there exists a need for a mixing system that requires a small amount of space on an ocean rig.

SUMMARY OF INVENTION

[0011] In one aspect, the present invention relates to a mixing pump having a power cylinder and a second cylinder, wherein one of the power cylinder and the second cylinder is interchangeable between single and double acting and wherein a working fluid is supplied to the power cylinder under pressure.

[0012] In another aspect, the present invention relates to a mixing pump including a power cylinder, a second cylinder, and a third cylinder, wherein a working fluid is supplied to the power cylinder under pressure.

[0013] In another aspect, the present invention relates to a mixing pump including a first cylinder, a second cylinder, and a piston assembly. Preferably, the first piston of the piston assembly divides the first cylinder into a first chamber and
a second chamber and a second piston of the piston assembly divides the second cylinder into a third chamber and a fourth chamber. Preferably, a pressurized working fluid is connected to a switching mechanism wherein the switching mechanism is configured to alternately communicate the pressurized working fluid between the first and second chambers of the first cylinder to displace the first piston. Preferably, a first additive fluid is connected to an inlet of one of the third and fourth chambers of the second cylinder, wherein the pressurized working fluid and the additive fluid are outputted to a supply tank as the piston assemblies reciprocate within the first and second cylinders.

[0016] Other aspects and advantages of the invention will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0017] FIG. 1 is a flow diagram of a mixing system in accordance with an embodiment of the present invention.
[0018] FIG. 2 is a flow diagram of a mixing system in accordance with an embodiment of the present invention.
[0019] FIG. 3 is a cross-sectional view of a mixing system in accordance with an embodiment of the present invention.
[0020] FIG. 4 is a chart of volume ratios of the embodiment shown in FIG. 3 in an embodiment of the present invention.

DETAILED DESCRIPTION

[0021] In one aspect, embodiments of the present invention relate to mixing systems that supply a pre-determined ratio of at least two fluids to a supply tank. In another aspect, embodiments of the present invention relate to mixing systems that provide three fluids to a mixing pump that pumps a pre-determined ratio of the three fluids to a supply tank. In another aspect, embodiments of the present invention relate to mixing systems that control a ratio of components of a mixture being pumped into a supply tank.

[0022] Referring initially to FIG. 1, a flow diagram of a mixing system 100 and a cross-sectional view of a mixing pump 102 in accordance with embodiments of the present invention is shown. Mixing system 100 includes mixing pump 102 and a drive pump 104. Drive pump 104 may be any device known in the art that supplies a base working fluid. In this disclosure, the term “base” is used to describe the fluids from which the final hydraulic fluid is based. Furthermore, the term “working” is used to describe base fluids that are used as the working medium to drive mixing pumps (e.g., drive pump 102) in accordance with embodiments of the present invention. Therefore, a single fluid may be used as a base fluid and as a working fluid in accordance with embodiments of the present invention. As such, in one embodiment, drive pump 104 may be a motor-drive pump. Alternatively, in another embodiment, drive pump 104 may be a tower that supplies pressurized working fluid by gravity. Mixing system 100 is configured to receive at least two fluids from individual storage tanks or fluid pipelines. As shown in FIG. 1, mixing system 100 is configured to receive a base working fluid and at least one additive fluid (e.g., glycol and/or control fluid concentrate). While potable water is described as the working fluid throughout this disclosure, it should be understood by those having ordinary skill in the art that any fluid may be used as a base fluid without departing from the scope of the present invention.

[0023] As shown in cross-sectional view of mixing pump 102 in FIG. 1, mixing pump 102 includes a power cylinder 114 coupled to a second cylinder 116. Cylinders 114, 116 may be coupled by any method known in the art, for example, by welding or bolting. A first piston 120 is disposed inside power cylinder 114 and a second piston 122 is disposed inside second cylinder 116. A piston rod 126 couples first piston 120 and second piston 122 together. In one embodiment, piston rod 126 may be integrally formed with first piston 120 and second piston 122. Alternatively, in another embodiment, piston rod 126 may be bolted or welded to first piston 120 and second piston 122. Piston rod 126 extends laterally from power cylinder 114 into second cylinder 116 through an opening in a first end 128 of power cylinder 114. A seal (not shown) may be disposed in the opening of first end 128 of power cylinder 114 around piston rod 126 to prevent fluid flow between cylinders 114, 116. Those having ordinary skill in the art will appreciate that the seals may be formed from any material known in the art, for example, an elastomer.

[0024] As discussed above, a base fluid and at least one additive fluid may be combined with mixing system 100. The base fluid and at least one additive fluid may be any fluids known in the art. For example, in the embodiment shown in FIG. 1, the base fluid may be potable water 112. In another embodiment, additive fluids that may be combined with base fluid include, but are not limited to, glycol 106 and a control system concentrate 108. In another embodiment, drive pump 104 may be configured to receive potable water 112 and discharge pressurized water 113 into power cylinder 114. In another embodiment, drive pump 104 may be a high volume, low pressure water pump. In another embodiment, glycol 106 may be stored in a tank and supplied to second cylinder 116 by gravity. Additionally, in another embodiment, control system concentrate 108 may be stored in a tank and supplied to second cylinder 116 by gravity. A selector valve 138 may selectively supply additive fluids, such as control system concentrate 108 or glycol 106, depending on the preferred additive fluid to second cylinder 116.

[0025] Referring still to FIG. 1, power cylinder 114 includes an inlet 160 and an outlet 162 in a first chamber 140 and an inlet 161 and an outlet 163 in a second chamber 142. Similarly, second cylinder 116 has an inlet 150 and an outlet 152 in a first chamber 144 and an inlet 151 and an outlet 153 in a second chamber 146. Thus, with two chambers, each cylinder 114, 116 may be single or double acting. For the purpose of this disclosure, a single-acting cylinder is one where a single chamber outputs fluid to a holding tank and a double-acting cylinder is one where both chambers output fluid to the holding tank. As such, both chambers of a single-acting cylinder may fill with fluid from an inlet, but only one of the two chambers will direct fluid to the holding tank when the piston is reciprocated. The fluid (if present) in the other, not active, chamber may be vented out back to the supply tank or any other location. In the embodiment shown in FIG. 1, cylinders 114, 116 are double acting, thus allowing fluids to fill each chamber 140, 142, 144, and 146 and exit to a holding tank through outlets 152, 153, 162, and 163. Therefore, those having ordinary skill in the art will appreciate that the present invention is not limited to the action (single or double acting) of each cylinder.

[0026] In the embodiment shown in FIG. 1, a base working fluid (e.g., potable water 112) may be supplied to drive
pump 104. As such, potable water 112 enters drive pump 104 to become pressurized water 113, which is pumped into power cylinder 114. A switch valve 132 directs pressurized water 113 into first chamber 140 or second chamber 142. Switch valve 132 may be controlled by a valve controller 159. Glycol 106 or control system concentrate 108 may be fed by gravity into chambers 144, 146 of second cylinder 116.

[0027] In the embodiment shown in FIG. 1, as first chamber 140 of power cylinder 114 fills with pressurized water 113, first piston 120 moves to the right. As first piston 120 moves to the right, pressurized water 113 that may be in second chamber 142 of power cylinder 114 is forced through outlet 163 to a supply tank (not shown). Simultaneously, piston rod 126 moves second piston 122 of second cylinder 116 to the right. As second piston 122 moves to the right, glycol 106 enters through inlet 150 and fills first chamber 144 and glycol 106 in second chamber 146 of second cylinder 116 is forced out through outlet 152 to the supply tank (not shown). Switch valve 132 then switches pressurized water 113 flow from inlet 160 to 161, thereby filling second chamber 142 of power cylinder 114. Accordingly, first piston 120 moves to the left.

[0028] As first piston 120 moves to the left, pressurized water 113 in first chamber 140 of power cylinder 114 is forced through outlet 162 to the supply tank (not shown). Simultaneously, piston rod 126 moves second piston 122 of second cylinder 116 to the left. As second piston 122 moves to the left, glycol 106 in first chamber 144 is forced through outlet 152 of second cylinder 116 to the supply tank (not shown) and glycol 106 enters through inlet 151 and fills second chamber 146. Check valves 188 may be disposed on the additive fluid lines entering and exiting second cylinder 116 to prevent reverse flow of additive fluids 106, 108 therethrough. Therefore, switch valve 138 may be used to alternately fill first chamber 140 and second chamber 142 of power cylinder 114 such that pistons 120 and 122 reciprocate to pump and mix base working fluid 112 and glycol 106 together.

[0029] In another embodiment, if glycol 106 is no longer preferred in the mixture, selector valve 138 may change additive fluid supply to second cylinder 116 from glycol 106 to control system concentrate 108, for example. Additionally, in another embodiment, selector valve 138 may change additive fluid supply to each chamber 144 and 146 of second cylinder 116, for example, allowing glycol 106 to enter into first chamber 144 and control system concentrate 108 to enter into second chamber 146. Accordingly, the mixing pump 102 performs in the same manner described above. Those having ordinary skill in the art will appreciate that selector valve 138 may be actuated by any method known in the art, for example, manually, or electrically.

[0030] Further, in another embodiment, power cylinder 114 may instead be single acting. In this embodiment, power cylinder 114 may include a biasing mechanism to push against first piston 120. For example, with a spring disposed within second chamber 142 of power cylinder 114, pressurized working fluid may fill first chamber 140, move piston 120 to the right, and compress the spring disposed within chamber 142. When compressed, the spring may be used to then push first piston 120 to the left, rather than needing pressurized working fluid to switch from flowing across inlets 160, 161. Those having ordinary skill in the art will appreciate other biasing mechanisms, such as elastomer, may be used without departing from the scope of the present invention. Furthermore, in such circumstances, second chamber 142 of single acting power cylinder 114 may be vented to prevent accumulation of pressure within second chamber 142 as first piston 120 moves. As such, those having ordinary skill in the art will appreciate that any of the chambers may be vented when used within a single acting cylinder of the present invention.

[0031] Referring now to FIG. 2, a flow diagram of a mixing system 200 and a cross-sectional view of a mixing pump 202 in accordance with embodiments of the present invention is shown. Mixing pump 202 of mixing system 200 in FIG. 2 further includes a third cylinder 118, in addition to power cylinder 114 and second cylinder 116. A third piston 124 is disposed inside third cylinder 118. Piston rod 126 then couples first piston 120, second piston 122, and third piston 124 together. Piston rod 126 extends laterally from power cylinder 114 to third cylinder 118 through an opening in a second end 130 of power cylinder 114. A seal may be disposed in the opening of second end 130 of power cylinder 114 around piston rod 126 to prevent fluid flow between cylinders 114, 118.

[0032] As shown in FIG. 2, glycol 106 may be stored in a tank and supplied to either (or both) chamber 144, 146 of second cylinder 116. Additionally, potable water 112 may also be supplied to either (or both) chamber 144, 146 of second cylinder 116. Selector valve 138 may be used to selectively supply potable water 112 or glycol 106 to second cylinder 116, depending on an operational temperature. Further, control system concentrate 108 may be stored in a tank and supplied to third cylinder 118 by gravity. However, those having ordinary skill in the art will appreciate that the present invention is not limited to any particular fluid supplied to the cylinder in that a base fluid and/or an additive fluid may be supplied to any of the chambers and cylinders within the mixing pump of the present invention.

[0033] Referring still to FIG. 2, third cylinder 118 has an inlet 170 and an outlet 171 in a chamber 148. Accordingly, power cylinder 114 and second cylinder 116 are double acting, and third cylinder 118 is single acting. Thus, for third cylinder 118, fluid may only enter chamber 148. However, as discussed above, those having ordinary skill in the art will appreciate that the present invention is not limited to the action of each cylinder. As such, while third cylinder 118 is shown as a single-acting cylinder having only one active chamber 148, it should be understood that a dual-acting cylinder having a second chamber may be used. Furthermore, as described above in reference to second cylinder 116, potable water 112 may also be supplied to chamber 148 to accommodate a variety of mixing ratios. Further still, a switching mechanism may be used to alternate between additively exercising potable water 112 to any chamber of any cylinder on selected (e.g., one of every two, one of every three, etc.) strokes of piston 120 to accommodate wide range of mixing ratios.

[0034] As shown in FIG. 2, as first chamber 140 of power cylinder 114 fills with pressurized water 113, third piston 124 will move simultaneously to the right with first piston 120 and second piston 122. As piston 124 moves to the right, control system concentrate 108, filled in chamber 148 of third cylinder 118, is forced through outlet 171 and into the supply tank (not shown). When switch valve 132 switches pressure water 113 flow from inlet 160 to 161, thereby filling second chamber 142 of power cylinder 114, third piston 124
will simultaneously move to the left with first piston 120 and second piston 122. As piston 124 moves to the left, control system concentrate 108 enters chamber 148 of third cylinder 118 through inlet 170.

[0035] In the embodiment shown in FIG. 2, if the operational temperature changes and glycol 106 is no longer needed in the mixture, selector valve 138 may change fluid supply to second cylinder 116 from glycol 106 to potable water 112. Accordingly, the mixing pump 102 performs in the same manner described above and the ratio of control system concentrate 108 remains unchange.

[0036] Referring now to FIG. 3, a cross-sectional view of a mixing system 300 in accordance with embodiments of the present invention is shown. Mixing pump 102 includes a power cylinder 114, a second cylinder 116, and a third cylinder 118 such that each of cylinders 114, 116, and 118 is double acting and has two chambers that may receive fluid. Power cylinder 114 includes chambers A and B, second cylinder 116 includes chambers C and D, and third cylinder includes chambers E and F. During operation, as chamber A of power cylinder 114 fills with fluid, chamber C of second cylinder 116 and chamber E of third cylinder 118 may fill with fluid and remaining chambers B, D, and F may expel fluids. Correspondingly, as chamber B of power cylinder 114 fills with fluid, chamber D of second cylinder 116 and chamber F of third cylinder 118 may fill with fluid and remaining chambers A, C, and E may expel fluids. In one embodiment, the full volume ratio of chamber A to chamber B to chamber C to chamber D to chamber E to chamber F (i.e., A:B:C:D:E:F) is 5:5:1:0:5:2:3. Therefore, chamber C would be five times larger in volume than chamber A, and chamber E would be two times larger in volume than chamber A.

[0037] Referring now to FIG. 4, a chart of volume ratios of base fluid to additive fluid when combined from chambers A, B, C, D, E, F of a mixing pump 102 (e.g. FIG. 3) in accordance with embodiments of the present invention is shown. Particularly, in the embodiment shown in FIG. 3, one base fluid and one additive fluid may be added to mixing pump 102 to provide a mixture for the supply tank (not shown). In FIG. 4, the first column provides the chambers of mixing pump 102 from FIG. 3 that may be filled with a working fluid and the second column provides the chambers of mixing pump 102 that may be filled with an additive fluid. Column 3 then provides a ratio of the working fluid to the additive fluid in a mixture after one full stroke of the mixing system 300. One full stroke refers to the pistons of the cylinders moving completely right and then moving completely left, allowing each chamber A, B, C, D, E, and F to fill completely with working fluid or additive fluid once. As shown in column 3 of FIG. 4, mixing system 300 of FIG. 3 allows for a broad range of ratios between the working fluid and the additive fluid (e.g. from 30:1 to 1.54:1).

[0038] Those having ordinary skill in the art will appreciate that the size of the cylinders, the size of the pistons, and the size of the piston rod may vary without departing from the scope of the present invention. Specifically, the sizes and volumes of the cylinders, pistons, and piston rod may be used to vary the ratio of individual components required for the mixture. For example, in one embodiment, by increasing the size of chambers E, F in FIG. 3 such that chamber E is four times larger in volume than chamber A and chamber F is five times larger in volume than chamber A (i.e., a mixing pump full volume ratio of 5:5:1:0:5:4:5), the maximum possible ratio of working fluid to additive fluid may increase to 38:1. In another embodiment, the size of a portion of piston rod 126 coupling first piston 120 to second piston 122 may be changed with respect to portions coupling first piston 120 to third piston 124. In this embodiment, the changed volume of the portion of piston rod 126 coupling first piston 120 to second piston 122 may increase or decrease the displacement volume of chambers A, D such that the mixing pump full volume ratio may be varied. Thus, changing the full volume ratio of the chambers with respect to one another allows for the ratio of the resulting mixture to change.

[0039] As shown and described with reference to FIGS. 1-3, the present invention provides a mixing system and a mixing pump that is powered by pressurized working fluid. The pressurized working fluid supplied to the power cylinder is used to regulate the amount of additive fluid that may enter and exit the mixing pump. Therefore, by regulating the configuration and geometry of the cylinders of the mixing pump, the ratio of the multiple additive fluids in the working fluid may be maintained without relying on multiple pumps and/or a constant water pressure.

[0040] Those having ordinary skill in the art will appreciate that the present invention is not limited to the use of pistons. For example, in another embodiment, instead of a piston, a flexible diaphragm may be used. As pressurized working fluid enters the chambers of a cylinder, the flexible diaphragm may transfer pressure from one chamber to another chamber, allowing fluid to enter and exit the respective chambers. Additionally, in another embodiment, a plunger pump may be used instead of piston. Thus, the present invention is not limited by specific means to translate pressure from one chamber of a cylinder to another.

[0041] Those having ordinary skill in the art will appreciate that the present invention may provide with a feedback mechanism. A feedback mechanism may be used to provide a relative position of a piston within its corresponding cylinder, thereby providing the current volumes of the chambers with the cylinder. Common examples that may be used for a feedback mechanism may be a linear variable displacement transducer ("LVDT"), a microswitch, or a magnet.

[0042] While embodiments described above refer to a mixing system and mixing pump with three cylinders (i.e., one power, two additive cylinders), those having ordinary skill in the art will appreciate that additional fluids may be combined at differing ratios by providing additional cylinders and pistons. These additional pistons may be coupled to the piston rod and powered by a fluid pressure acting within a power cylinder. For example, in another embodiment, a fourth cylinder having a fourth piston disposed therein may be added to the mixing pump. As such, the fourth cylinder may be attached to the third cylinder with the fourth piston may be coupled to the third piston through the piston rod. As the piston rod, and therefore the third piston, moves from the fluid pressure within the power cylinder, the fourth piston would correspondingly move within the fourth cylinder, pumping the fluids supplied to the fourth cylinder to a supply tank.

[0043] Advantageously, the present invention provides a mixing system with accurate and reliable ratios of components in a mixture. The present invention provides a mixing system that requires less space for operation. Further, the
present invention provides a mixing system with fewer pumps and motors, allowing a mixing pump to be most cost effective.

While the invention has been described with respect to a limited number of embodiments, those skilled in the art, having benefit of this disclosure, will appreciate that other embodiments can be devised which do not depart from the scope of the invention as disclosed herein. Accordingly, the scope of the invention should be limited only by the attached claims.

What is claimed:
1. A mixing pump comprising:
a power cylinder; and
a second cylinder;
wherein one of the power cylinder and the second cylinder is interchangeable between single and double acting;
wherein a working fluid is supplied to the power cylinder under pressure.
2. The mixing pump of claim 1, wherein the power cylinder includes a biasing mechanism.
3. The mixing pump of claim 1, further comprising a third cylinder.
4. The mixing pump of claim 1, wherein one of the working fluid and an additive fluid is supplied to the second cylinder.
5. The mixing pump of claim 4, wherein the additive fluid is at least one of glycol and control system concentrate.
6. The mixing pump of claim 1, further comprising a fluid selector valve coupled to the second cylinder.
7. The mixing pump of claim 1, further comprising a switch valve to alternately direct the working fluid between a first chamber and a second chamber of the power cylinder.
8. A mixing pump comprising:
a power cylinder;
a second cylinder; and
a third cylinder;
wherein a working fluid is supplied to the power cylinder under pressure.
9. The mixing pump of claim 8, wherein at least one of the power cylinder, the second cylinder, and the third cylinder is interchangeable between single and double acting.
10. The mixing pump of claim 8, wherein at least one of the working fluid and an additive fluid is supplied to at least one of the second cylinder and the third cylinder.
11. The mixing pump of claim 10, wherein the additive fluid is at least one of glycol and control system concentrate.
12. The mixing pump of claim 8, wherein the working fluid is potable water.
13. The mixing pump of claim 8, further comprising a switch valve to alternately direct the working fluid between a first chamber and a second chamber of the power cylinder.
14. A mixing pump comprising:
a first cylinder, a second cylinder, and a piston assembly;
a first piston of the piston assembly dividing the first cylinder into a first chamber and a second chamber;
a second piston of the piston assembly dividing the second cylinder into a third chamber and a fourth chamber, wherein the second piston is displaced by the first piston;
a pressurized working fluid connected to a switching mechanism, wherein the switching mechanism is configured to alternately communicate the pressurized working fluid between the first and second chambers of the first cylinder to displace the first piston; and
a first additive fluid connected to an inlet of one of the third and the fourth chambers of the second cylinder, wherein the pressurized working fluid and the additive fluid are outputted to a supply tank as the piston assembly reciprocates within the first and second cylinders.
15. The mixing pump of claim 14, wherein the first and second cylinders are sized to output a specified ratio of the pressurized working fluid and the first additive fluid.
16. The mixing pump of claim 14, wherein a second additive fluid is connected to an inlet of the other of the third and fourth chambers of the second cylinder.
17. The mixing pump of claim 16, wherein the first and second cylinders are sized to output a specified ratio of the pressurized working fluid, the first additive fluid, and the second additive fluid.
18. The mixing pump of claim 14, wherein the first additive fluid is connected to an inlet of the other of the third and fourth chambers of the second cylinder.
19. The mixing pump of claim 14, further comprising:
a third cylinder;
a third piston of the piston assembly dividing the third cylinder into a fifth chamber and a sixth chamber, wherein the third piston is displaced by the first piston; and
a second additive fluid connected to an inlet of at least one of the fifth and sixth chambers of the third cylinder.
20. The mixing pump of claim 19, wherein the first, second, and third cylinders are sized to output a specified ratio of the pressurized working fluid, the first additive fluid, and the second additive fluid.
21. The mixing pump of claim 14, wherein the pressurized working fluid is switchably connected to an inlet of at least one of the third and fourth chambers of the second cylinder.

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