

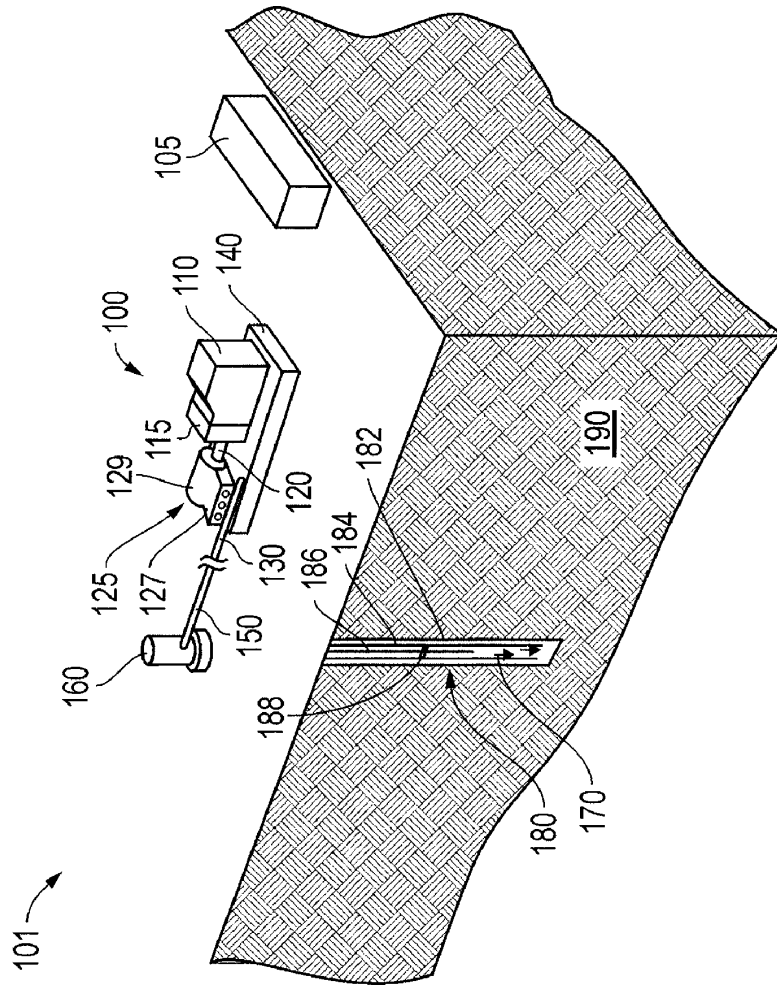


FIG. 1
(Prior Art)

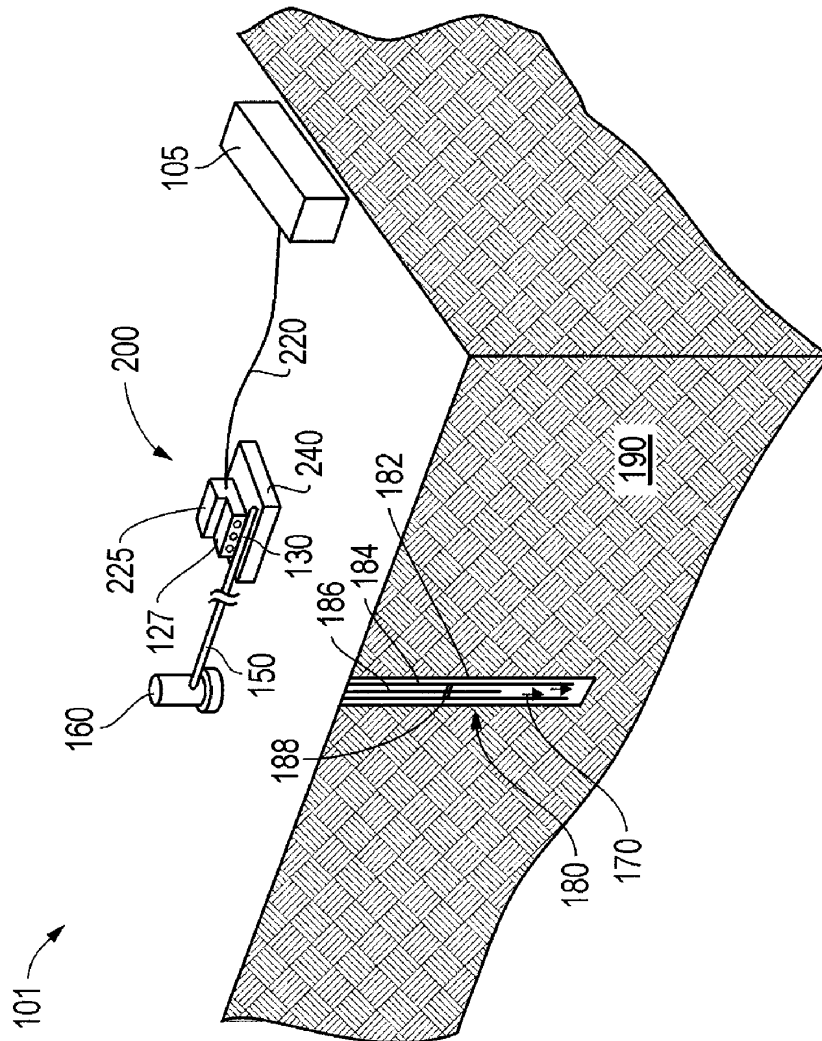


FIG. 2

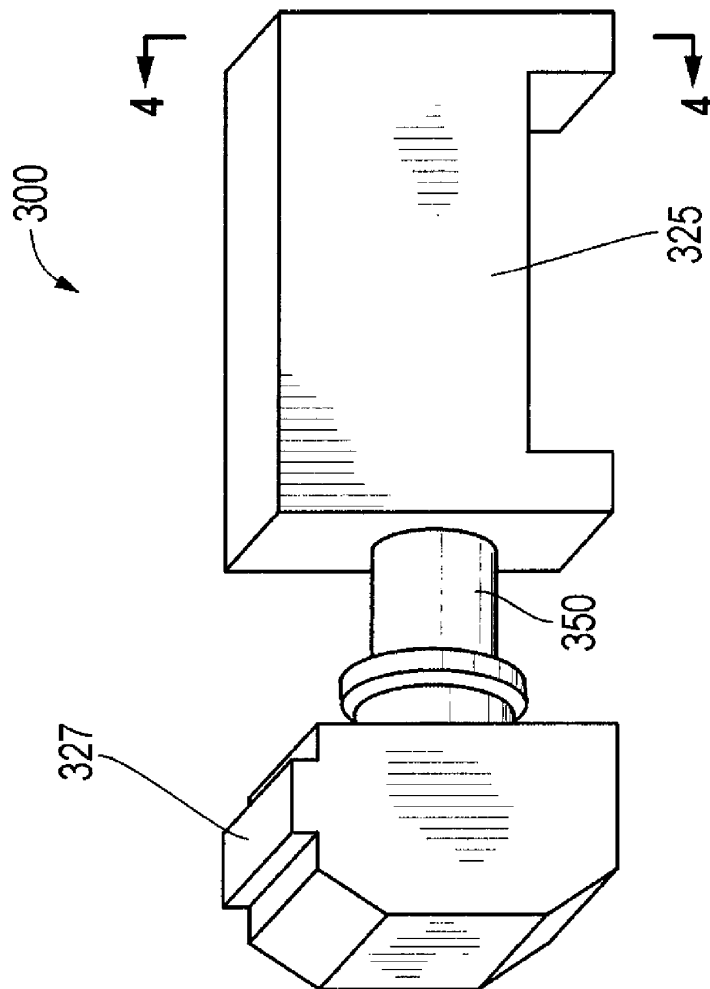


FIG. 3

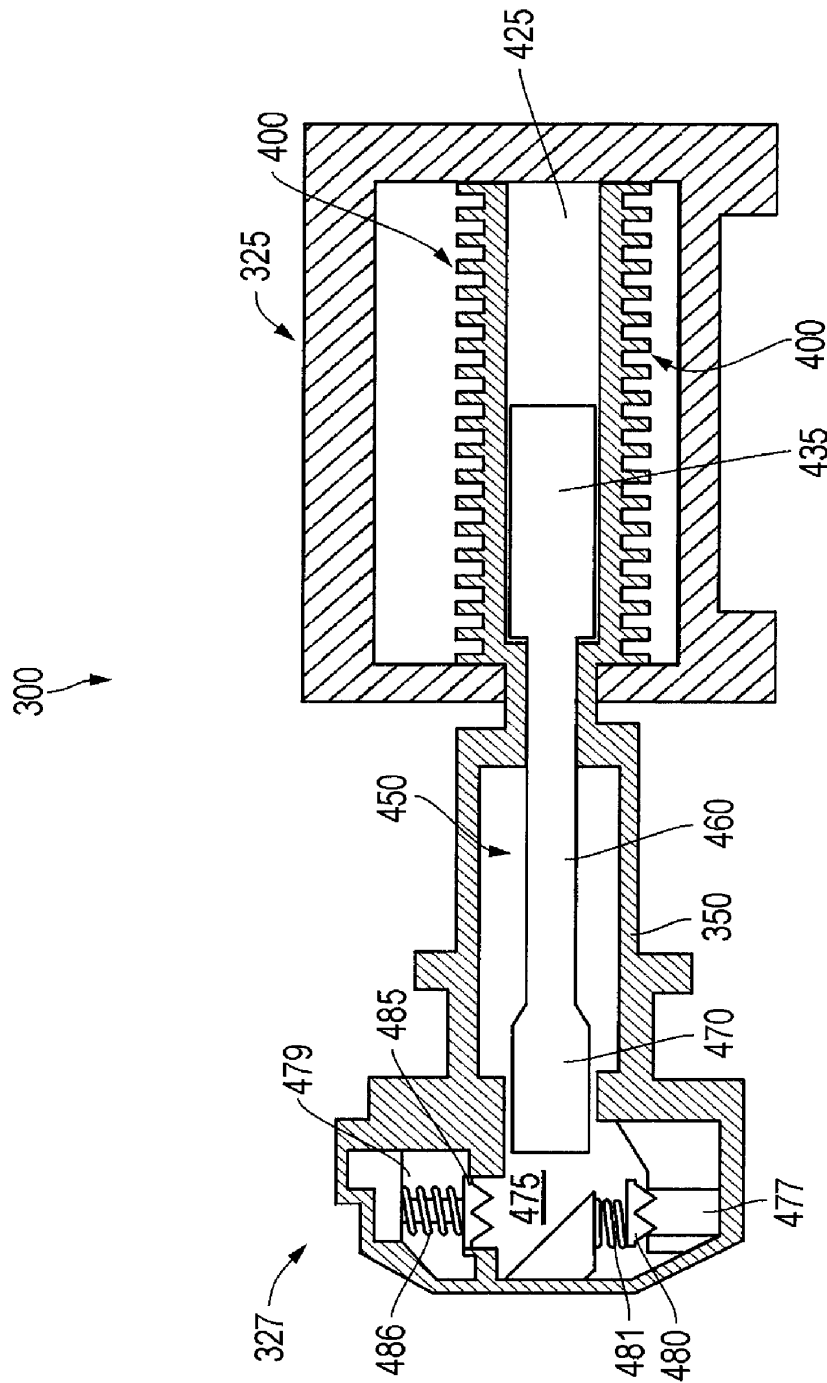


FIG. 4

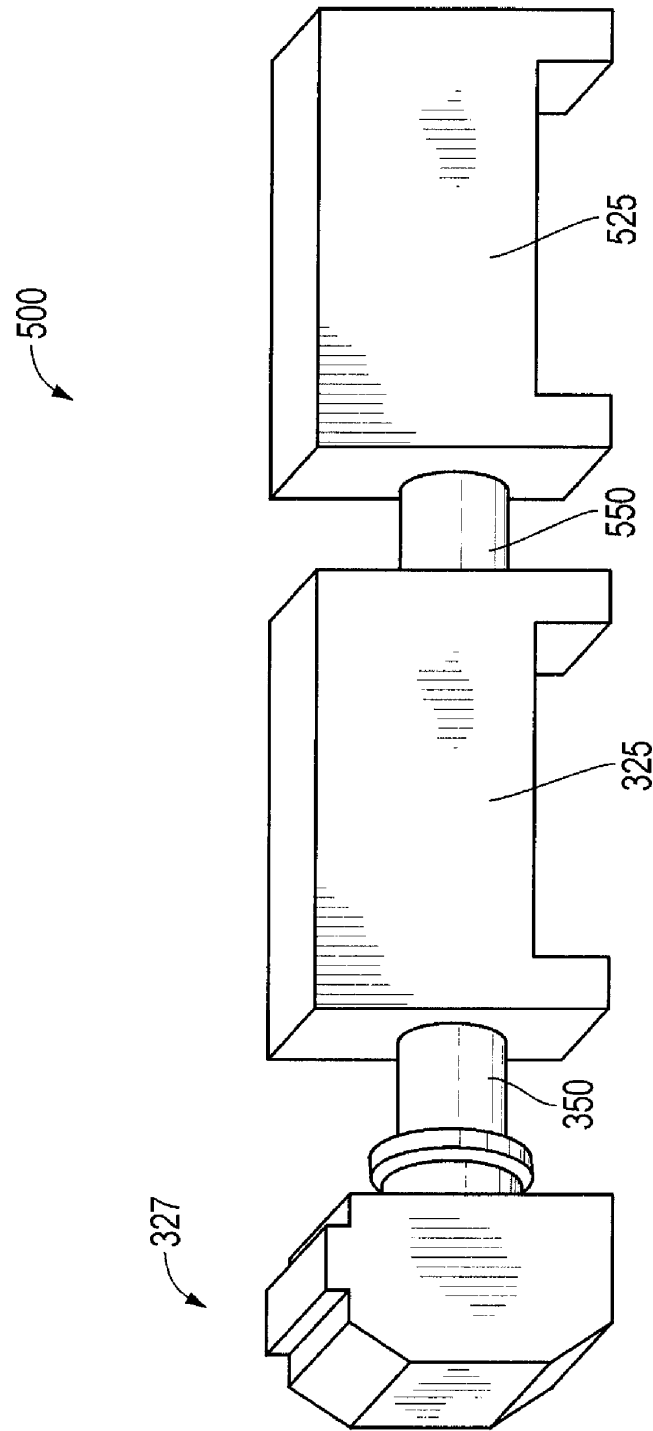


FIG. 5

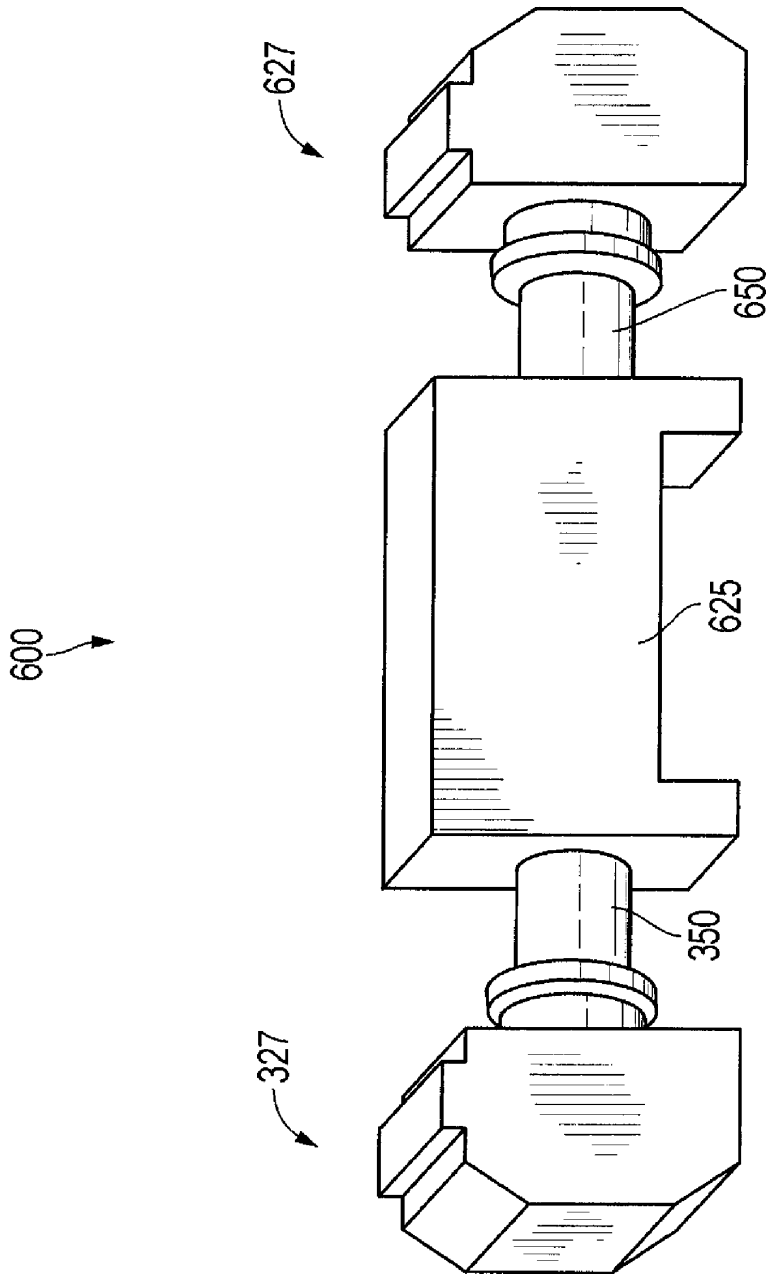


FIG. 6

LINEAR ELECTRIC MOTOR FOR AN OILFIELD PUMP

BACKGROUND

[0001] Embodiments described relate to oilfield pumps for delivering a variety of oilfield fluids to a well at an oilfield. In particular, embodiments of oilfield pumps employing a linear electric motor (LEM) are described. The presence of a LEM in place of crankshaft or hydraulic driving techniques may reduce the number of equipment parts and therefore maintenance expenses dedicated to a pump assembly at an oilfield. The presence of an LEM may also increase the precision and control over the fluid delivery provided by the pump assembly.

BACKGROUND OF THE RELATED ART

[0002] Drilling, completing, and operating hydrocarbon wells involves the employment of a variety of large scale equipment. Thus, well operations may be inherently expensive in terms of both capital equipment expenditures and equipment maintenance. Furthermore, in many circumstances, conventional large scale equipment tends to provide output in a fairly imprecise manner, no matter the amount of expenditures incurred.

[0003] As an example of large scale oilfield equipment, a host of crankshaft driven positive displacement pumps are often employed at an oilfield. A positive displacement pump may be a fairly massive piece of equipment with a plunger driven by a crankshaft toward and away from a chamber in order to dramatically effect a high or low pressure on the chamber. This makes it a good choice for high pressure applications. Indeed, where fluid pressure exceeding a few thousand pounds per square inch (PSI) is to be generated, a crankshaft driven positive displacement pump is generally employed. Crankshaft driven positive displacement pumps may be employed in large scale operations such as cementing, coiled tubing operations, water jet cutting, or hydraulic fracturing of underground rock to name a few. Hydraulic fracturing of underground rock, for example, often requires an abrasive containing fluid to be pumped at pressures of 10,000 to 15,000 PSI in order to create a "fracture" in the underground rock in order to facilitate the release of oil and gas from rock pores for extraction. Such pressures and large scale applications are readily satisfied by the noted crankshaft driven positive displacement pumps.

[0004] As alluded to above, a crankshaft driven positive displacement pump may include a variety of equipment parts that must be maintained to ensure the continued effectiveness of the oilfield operation involved. Such equipment parts may include an associated engine, transmission, crankshaft, driveline and other parts, operating at between about 1,500 Hp and about 4,000 Hp. Unfortunately, with such a large piece of equipment having numerous equipment parts playing a role in the mechanics of the pump, it may be difficult to attain a reliably precise output level from the pump. Techniques of compensating for such imprecision may be employed. For example, crankshaft driven pump operations may take place at higher output levels and for longer durations than necessary in order ensure that the minimum output levels are provided for a given operation. However, compensating for the imprecise output of such pumps in this manner results in wasted pump output and leads to premature wear of pump parts.

[0005] In order to address the inherent imprecision of crankshaft driven pump output, hydraulically driven pumps may be substituted for crankshaft driven pumps at the oilfield where the oilfield application allows. The hydraulic nature of such pumps may provide a degree of precision to pump output that is not available from the above noted crankshaft driven pumps. For example, rather than employing a large crankshaft to rotably actuate linear motion of a plunger, a hydraulically driven pump may include a plunger that is driven by more tightly controllable hydraulics that are directed at the plunger. Thus, the output of the hydraulically driven pump may be more precisely controlled.

[0006] Unfortunately, the employment of a hydraulically driven pump may dramatically increase the variety of equipment and parts employed in the pumping application. That is, in the case of a crankshaft driven pump a prime mover may be coupled to a transmission that directs the movement of the noted crankshaft. However, in the case of a hydraulically driven pump, the prime mover may be coupled to multiple hydraulic pumps that are employed to drive the hydraulically driven pump or intensifier. The additional pumps may be equipped with their own hydraulic lines therebetween. Furthermore, all of this equipment and parts such as the hydraulic lines and additional valving need to be maintained in order to realize the benefit of improved output precision that may be afforded by use of hydraulically driven pumps. That is, in order to attain the improved output precision, added expense in terms of capital equipment expenditures and equipment maintenance may be incurred.

SUMMARY

[0007] In one embodiment, the present invention is an oilfield pump assembly that is provided at an oilfield and includes a plunger for reciprocating relative to a chamber. The reciprocating may be employed for directing an oilfield fluid from the pump assembly and to a well at the oilfield. The plunger may be coupled to a linear electric motor in order to power the reciprocating.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 is a perspective sectional overview of a prior art employment of a cementing operation at an oilfield employing a crankshaft pump assembly.

[0009] FIG. 2 is a perspective sectional overview of the cementing operation at the oilfield of FIG. 1 employing a linear electric motor (LEM) pump assembly.

[0010] FIG. 3 is a side perspective view of an embodiment of an LEM pump assembly having a fluid end coupled to an LEM.

[0011] FIG. 4 is a side cross-sectional view of the LEM pump assembly of FIG. 3.

[0012] FIG. 5 is a side perspective view of an embodiment of a stacked LEM pump assembly employing the fluid end of FIG. 3.

[0013] FIG. 6 is a side perspective view of an embodiment of a multiple output LEM pump assembly employing the fluid end of FIG. 3.

DETAILED DESCRIPTION

[0014] Embodiments are described with reference to certain linear electric motor (LEM) pump assemblies, particularly for cementing operations at an oilfield. However, other operations may be addressed at the oilfield employing LEM

pump assembly embodiments described herein. For example, LEM pump assemblies described herein may be employed in fracturing, drilling, dosing, and other fluid delivery operations at an oilfield. Regardless, embodiments described herein include the use of an LEM to drive an oilfield pumping assembly, as opposed to crankshaft or hydraulic driving techniques, thereby potentially reducing equipment parts and maintenance expenses and increasing the precision and control over the fluid delivery as compared to conventional crankshaft or hydraulic driven pump assemblies.

[0015] Referring now to FIGS. 1 and 2, a prior art crankshaft pump assembly 100 employing a variety of equipment for operation may be viewed in light of a linear electric motor (LEM) pump assembly 200 that may be directly plugged into an electric power source 105 for operation. The availability of electrical powering of the LEM pump assembly 200 in particular allows for the minimization of equipment employed for powering of the LEM pump assembly 200. For example, an engine 110 that employs a transmission 115 directed at a driveline 120 for transferring power to a crankshaft 129 of a crankshaft pump assembly 100 is unnecessary for acquiring useful power from an LEM 225 of an LEM pump assembly 200. Similarly, the LEM pump assembly 200 does not require a variety of leak prone valving or hydraulic lines for transferring power within or between assemblies as in the case of conventional hydraulic pump assemblies (not shown).

[0016] In the embodiment shown, the pump assemblies 100, 200 are to be employed at an oilfield 101 for a cementing operation. While only a single pump assembly 100, 200 is shown in each of FIGS. 1 and 2, multiple pump assemblies 100, 200 may be in simultaneous operation for cementing of a well 180 through a formation 190 at the oilfield 101. For example, in one embodiment between about 4 and about 20 pump assemblies 100, 200 may be positioned about 10 to 20 feet apart and in simultaneous operation at the oilfield 101 for the cementing operation. In an alternate embodiment, between about 4 and about 20 such assemblies may also be coupled and directed at the well 180 in this manner for a fracturing operation.

[0017] Continuing with reference to FIGS. 1 and 2, cementing operations may proceed with a cementing pipe 186 advanced below a wellhead 160 toward the terminal end of a borehole casing section 184. A plug 188 may be pre-positioned at a terminal end of the borehole casing section 184 for sealing it off. The cementing pipe 186 may thus be directed to pierce the plug 188. Once the plug 188 is pierced a cement slurry 170 may be delivered downhole thereof by the cementing pipe 186 as powered by the pump assembly 100, 200. The cement slurry 170 is directed downhole in a pressurized manner such that it may be forced back uphole adjacently exterior the borehole casing 186 and against the side of the wall 182 of the well 180. Thus, the borehole casing 186 may be stabilized securely in place by the cement slurry 170.

[0018] Cementing as described above may be achieved with the pump assembly 100, 200 operating at between about 200 Hp and about 800 Hp, preferably at about 300 Hp. In this manner, between about 1,500 PSI and about 15,000 PSI may be generated for driving the cement slurry 170 under pressure as noted above. As also indicated, cementing of this nature may be achieved through employment of multiple pump assemblies 100, 200 coupled together through a common delivery manifold that is ultimately coupled to the wellhead

160 (e.g. through a transfer line 150). In this manner, the cement slurry 170 may be driven from the pump assembly 100, 200

[0019] Continuing now with particular reference to the prior art crankshaft pump assembly 100 of FIG. 1 in contrast to the LEM pump assembly 200 of FIG. 2, significant distinctions are apparent. For example, while both pump assemblies 100, 200 may be directed at a cementing or other oilfield application, the crankshaft pump assembly 100 may require a variety of equipment parts that are unnecessary to the operation of the LEM pump assembly 200. Furthermore, the crankshaft pump assembly 100 may fail to employ an electric power source 105 that is often available at the oilfield 101 irrespective of any operations employing a pump assembly 100, 200.

[0020] As shown in FIG. 1, the prior art embodiment of a crankshaft pump assembly 100 is equipped with a crankshaft driven pump 125 for pumping of a cement slurry 170 to an exit pipe 130 and ultimately to a well 180 as described above. The crankshaft driven pump 125 includes a large crankshaft 129 that is employed to drive a triplex fluid end 127 for the indicated pumping of the cement slurry 170. The crankshaft 129 is a quite large rotatable mechanism that is powered by an engine 110 that shares a crankshaft assembly skid 140 with the crankshaft driven pump 125. However, as with many conventional engines, the powering of the crankshaft 129 by the engine 110 requires the intervening mechanics of a transmission 115 and a driveline 120. Thus, as alluded to above, the crankshaft pump assembly 100 employs added equipment parts 115, 120 between the power source (i.e. the engine 110) and the crankshaft 129. These parts 115, 120 must be maintained in an operational condition. Furthermore, the intervening nature of such equipment parts 115, 120 inherently results in a degree of imprecision to the output from the fluid end 127. Additionally, as indicated, the crankshaft driven pump 125 fails to take advantage of a power source 105 that is already generally available at the oilfield 101.

[0021] Referring now to FIG. 2, with added reference to FIG. 1, an embodiment of an LEM pump assembly 200 is shown. The LEM pump assembly 200 includes a linear electric motor (LEM) 225 coupled to the same type of triplex fluid end 127 that is noted above with respect to the crankshaft pump assembly 100. However, as detailed further below, the LEM 225 is powered directly, in an electrical manner. That is, unlike the crankshaft 129 of the crankshaft pump assembly 100 which obtains power from an engine 110 as translated through a transmission 115 and a driveline 120, the LEM 225 may be coupled directly to an electric power source 105. As a result, power and control thereover are not lost in translation between the power source 105 and the LEM 225. That is, no intervening transmission 115, driveline 120, or other equipment part is present. Rather, a power cord 220 is merely provided to link the LEM 225 to the electric power source 105. Furthermore, the electronic nature of the LEM 225 allows for the possibility of synchronized responsiveness or feedback to information relative to the operation of the LEM pump assembly 200, for example from a transducer monitoring the acoustics of the operating LEM pump assembly 200.

[0022] Continuing with reference to FIG. 2, the electric power source 105 may be a conventional electrical supply such as is often found at an oilfield 101 (see FIG. 1 also). For an application as shown, the power source 105 may provide between about 150 KW and about 600 KW to the LEM 225 for the pumping of the cement slurry 170 as shown. By taking

advantage of such a readily available source of power, the modularity of the LEM pump assembly 200 may be enhanced due to a reduction in power equipment parts. In fact, the LEM assembly skid 240 that is dropped at the oilfield 101 may even be of a more limited size depending on the requirements of the operation. Regardless, the reduction in equipment parts, reduces the overall expense of equipment maintenance.

[0023] Referring now to FIG. 3 an embodiment of an LEM pump assembly 300 is shown. For ease of explanation and depiction, the LEM pump assembly 300 is of a single fluid end 327 configuration as opposed to one of a triplex variety as depicted in FIGS. 1 and 2 (see triplex fluid end 127). The LEM pump assembly 300 includes an LEM 325 as described above that is coupled to the fluid end 327 through a plunger housing 350. As described below with reference to FIG. 4, the LEM 325 is configured to drive a plunger 450 toward and away from a chamber 475 within the fluid end 327 to effect pressure changes thereat. In this manner, the intake and discharge of a fluid such as a cement slurry 170 with respect to the fluid end 327 may be directed (see FIGS. 1 and 2).

[0024] Continuing with reference to FIGS. 3 and 4, the mechanics of the LEM pump assembly 300 in operation are detailed. Namely, the above described plunger 450 is of a reciprocating nature, as indicated, in order to effectuate pumping of a fluid by the LEM pump assembly 300. As shown in FIG. 4, the plunger 450 includes a body 460 having a head 470 for interacting with the above noted chamber 475 and a rear 435 for gliding within an LEM cylinder 425. In particular, the rear 435 may be configured to interact with a stator 400 about the LEM cylinder 425 in order to achieve the noted reciprocation of the plunger 450.

[0025] As shown in FIG. 4, the rear 435 of the plunger 450 is positioned within the LEM cylinder 425 adjacent the stator 400 as indicated. The stator 400 may be responsive to electrical input from a power source in order to drive the movement of the rear 435. In the embodiment shown, the stator 400 includes an array of magnets and cooling fins. The magnets may be electromagnetic stator windings such as wire wound into coils. Regardless, when electrically activated, the stator 400 may drive the rear 435 of the plunger 450 by conventional electromotive means. For example, the rear 435 of the plunger 450 may include an iron core with alternating bands of copper and iron thereabout which are responsive to such an electromagnetic driving force. Similarly, in an alternate embodiment, the rear 435 may include an inner core of ferrous material and an outer layer of conductive material thereabout in order to provide responsiveness to the stator 400.

[0026] Regardless of the particular stator 400 and plunger rear 435 configurations employed, the stator 400 may be effectuated in a poly-phase manner (e.g. from magnet to magnet) in order to drive the linear movement of the plunger rear 435 in one direction and then back again. This reciprocating movement of the plunger 450 is achieved in a manner that includes substantially no friction between the plunger rear 435 and the wall of the cylinder 425. That is, the magnetic nature of the interface between the plunger rear 435 and the stator 400 may be self-centering such that the plunger rear 435 is kept out of contact with the wall of cylinder 425 during its reciprocation.

[0027] In addition to the self-centered friction free nature of the reciprocation, the stator 400 is able to drive the movement of the plunger 450 from its rear 435 in a fairly precise manner. That is, as alluded to above, the power supplied to the stator 400 is direct and does not require translation through other

equipment parts in order to effect the fluid end 327. Rather, the power is transferred directly through precisely controllable magnets of the stator 400 and to the plunger rear 435 as noted herein. This degree of control also allows for a greater range of achievable plunger reciprocation speeds. For example, the LEM pump assembly 300 may achieve much lower and higher controlled speeds than those available for a conventional crankshaft driven pump 125 with larger less precisely controllable power transfer equipment parts.

[0028] Continuing with reference to FIG. 4 the plunger 450 is configured to reciprocate toward and away from the chamber 475. In this manner, the plunger 450 effects high and low pressures on the chamber 475 as noted above. For example, as the plunger 450 is thrust toward the chamber 475, the pressure within the chamber 475 is increased. At some point, the pressure increase will be enough to effect an opening of a discharge valve 485 to allow the release of fluid and pressure within the chamber 475 and out a discharge channel 479. Thus, this movement of the plunger 450 is often referred to as its discharge stroke. The amount of pressure required to open the discharge valve 485 may be determined by a discharge mechanism 486 such as spring which keeps the discharge valve 485 in a closed position until the requisite pressure is achieved in the chamber 475. As indicated above, in an embodiment where the LEM pump assembly 300 is to be employed in a cementing operation pressures may be achieved in the manner described that are between about 1,500 PSI and about 15,000 PSI for pumping of a cement slurry 170 (see FIG. 2).

[0029] As described above, the plunger 450 also effects a low pressure on the chamber 475. That is, as the plunger 450 retreats away from an advanced discharge position near the chamber 475, the pressure therein will decrease. As the pressure within the chamber 475 decreases, the discharge valve 480 will close returning the chamber 475 to a sealed state. As the plunger 450 continues to move away from the chamber 475 the pressure therein will continue to drop, and eventually a low or negative pressure will be achieved within the chamber 475. Similar to the action of the discharge valve 485 described above, the pressure decrease will eventually be enough to effect an opening of an intake valve 480. Thus, this movement of the plunger 450 is often referred to as the intake stroke. The opening of the intake valve 155 allows the uptake of fluid into the chamber 475 from an intake channel 477 adjacent thereto. The amount of pressure required to open the intake valve 480 as described may be determined by an intake mechanism 481, such as spring, which keeps the intake valve 480 in a closed position until the requisite low pressure is achieved in the chamber 475.

[0030] The above described mechanics of the LEM pump assembly 300 may be employed for delivery of a variety of fluids under pressure at an oilfield 101 such as that of FIGS. 1 and 2. Furthermore, given the electromagnetic mechanics of the LEM pump assembly 300, synchronization of multiple such assemblies applied to the same well 180 at an oilfield may be readily available. For example, the LEM pump assembly 300 may be of a multi-plunger configuration, such as the triplex configuration as shown in FIG. 2 (see LEM pump assembly 200).

[0031] In such a configuration an LEM pump assembly according to the present invention includes multiple plungers similar to the plunger 450 of FIG. 4. In a multi-plunger pump it is often desirable to synchronize the plungers such that they are out of phase with respect to each other. For example, it is

typically desirable to synchronize the plungers of a triplex fluid end 180 degrees out of phase with respect to each other. This may be achieved in an LEM pump assembly according to the present invention by providing the LEM with a separate stator, such as the stator 400 of FIG. 4, for each plunger 450. Thus, each plunger 450 may be energized separately.

[0032] In addition, the mechanics of an LEM assembly according to the present invention, such as assemblies 200 and 300, avail themselves to stacking or multiple output configurations for increasing the power, pressure, or total output thereof.

[0033] Continuing now with reference to FIGS. 5 and 6, alternate embodiments of LEM assemblies 500, 600 are shown. These embodiments involve modifications to LEM assemblies 200, 300 such as those noted above, in order to address the output obtainable therefrom.

[0034] Referring to FIG. 5 in particular, a secondary LEM 525 is coupled to the primary LEM 325 that is shown in FIGS. 3 and 4. That is, an extra or secondary LEM 525 is directly coupled to the back of the primary LEM 325 through a coupling housing 550. In this manner the secondary LEM 525 with additional stator and powering capacity is employed to increase the amount of power that may be employed in reciprocating a plunger 450 such as that shown in FIG. 4. Thus, the pressurization capacity of the LEM pump assembly 500 may be increased.

[0035] Increasing the pressurization capacity, for example, by employment of the LEM pump assembly 500 of FIG. 5, may be beneficial to certain applications at an oilfield 101 (see FIGS. 1 and 2). For example, a cementing application is described above with respect to FIG. 2 wherein an LEM pump assembly 200 is employed to provide between about 1,500 PSI and about 15,000 PSI for driving a cement slurry 170 into a well 180. However, in the embodiment shown in FIG. 5, the LEM pump assembly 500 may be employed to provide more than about 15,000 PSI, for example to drive a fracturing fluid into a well for a fracturing operation. Therefore, while the single primary LEM 325 may need to be quite sizable in order to achieve such pressurization, the nature of the linear electric motors allows them to be coupled in a stacked or series configuration as shown. Thus, a standard modular linear electronic motor size may be established and taken advantage of. Indeed, synchronization of such stacked or series configurations may be readily attained, again due to the electrical drive nature of linear electric motors.

[0036] As shown in FIG. 6, the output of an LEM pump assembly 600 may also be addressed in terms of volume. That is, as shown in FIG. 6, a single LEM 625 is provided that is coupled to a secondary fluid end 627 through a secondary housing 650. That is, output in addition to that from the primary fluid end 327 and plunger housing 350 is obtained from the secondary fluid end 627. In this manner twice the volume or amount of fluid may be pumped by the LEM pump assembly 600 for each stroke of the plunger 450 as compared to the output obtainable from the LEM pump assembly 300 of FIGS. 3 and 4.

[0037] An increase in the amount of output per plunger stroke as noted above is an improvement in terms of efficiency. Additionally, increased output in this manner may be of particular benefit to certain applications at an oilfield 101 (see FIGS. 1 and 2). For example, a drilling application may proceed wherein no more than about 5,000 PSI of mud is to be directed to a well 180 such as that of FIGS. 1 and 2. However, unlike the above noted cementing and fracturing operations,

a larger volume of fluid (i.e. mud) may be employed during the drilling operation. Therefore, the addition of a secondary fluid end 627 to the LEM pump assembly 600 may be of particular benefit in carrying out a drilling operation.

[0038] The above described embodiments provide improved control and precision over a delivery profile of a fluid provided to an oilfield by way of an oilfield pump assembly. This is provided without reliance on a hydraulically driven pump. Therefore an increase in equipment parts such as hydraulic lines and additional valving may be avoided, thereby reducing maintenance expenses.

[0039] The preceding description has been presented with reference to presently preferred embodiments. Persons skilled in the art and technology to which these embodiments pertain will appreciate that alterations and changes in the described structures and methods of operation may be practiced without meaningfully departing from the principle, and scope of these embodiments. For example, embodiments described herein are directed primarily at cementing, fracturing, and drilling operations wherein a linear electric motor is driven with between about 150 KW and about 600 KW. However, other operations such as dosing may take advantage of oilfield pump assemblies described herein that are driven with between about 5 KW and about 10 KW. Furthermore, the foregoing description should not be read as pertaining only to the precise structures described and shown in the accompanying drawings, but rather should be read as consistent with and as support for the following claims, which are to have their fullest and fairest scope.

We claim:

1. An oilfield pump assembly comprising:
 - a plunger for reciprocating relative to a chamber to direct a fluid therefrom; and
 - a linear electrical motor coupled to said plunger for the reciprocating.
2. The oilfield pump assembly of claim 1 further comprising a fluid end to house the chamber, the chamber coupled to a cylinder of the linear electric motor to accommodate a rear of said plunger.
3. The oilfield pump assembly of claim 2 wherein said linear electric motor comprises a stator adjacent the cylinder to electromagnetically actuate linear movement of said rear.
4. The oilfield pump assembly of claim 3 wherein said stator comprises an array of magnets and cooling fins.
5. The oilfield pump assembly of claim 3 wherein said rear comprises:
 - a ferrous core; and
 - an outer layer of bands selected from a group consisting of copper and iron.
6. The oilfield pump assembly of claim 3 wherein said movement is substantially frictionless.
7. The oilfield pump assembly of claim 1 wherein the reciprocating is to direct the fluid to a well at an oilfield for a well services operation thereat.
8. The oilfield pump assembly of claim 7 wherein the well services operation is one of drilling, fracturing, cementing, and dosing.
9. The oilfield pump assembly of claim 7 wherein the oilfield pump assembly is a first oilfield pump assembly coupled to the well, the well coupled to a second oilfield pump assembly for obtaining fluid therefrom.
10. The oilfield pump assembly of claim 2 wherein said fluid end is one of a triplex configuration and a singular configuration.

11. An oilfield pump assembly comprising:
a plunger for reciprocating relative to a chamber to direct a fluid therefrom;
a primary linear electric motor coupled to said plunger for the reciprocating; and
a secondary linear electric motor coupled to said primary linear electric motor for increased power of the reciprocating.

12. The oilfield pump assembly of claim 11 wherein the increased power of the reciprocating is to direct the fluid under a pressure of more than about 15,000 PSI.

13. The oilfield pump assembly of claim 12 wherein the reciprocating is to direct the fluid to a well for a fracturing operation thereat.

14. An oilfield pump assembly comprising:
a primary pump fluid end;
a secondary pump fluid end;
a plunger for reciprocating between a chamber of said primary pump fluid end and a chamber of said secondary pump fluid end to direct fluid from the chambers; and
a linear electric motor disposed between said primary pump fluid end and said secondary pump fluid end and coupled to said plunger for the reciprocating.

15. The oilfield pump assembly of claim 14 wherein the reciprocating is to direct the fluid to a well for a drilling operation thereat.

16. A method of performing a well services operation in a well at an oilfield, the method comprising:

powering a linear electric motor with an electric power source at the oilfield, the linear electric motor coupled to a plunger; and
employing the linear electric motor to reciprocate the plunger relative to a chamber to direct a well services fluid therefrom and to the well.

17. The method of claim 16, wherein the well services operation is one of drilling, fracturing, cementing, and dosing.

18. The method of claim 16, wherein the well services operation comprises cementing a borehole casing, and wherein the well services fluid comprises a cement slurry.

19. The method of claim 18 further comprising:
driving the cement slurry into the borehole casing through a cementing pipe terminating within the borehole casing; and
forcing the cement slurry into a space between the borehole casing and a wall of the well for stabilization of the borehole casing.

20. The method of claim 19 wherein said driving and said forcing occur under pressurization of between about 1,500 PSI and about 15,000 PSI.

21. The method of claim 18 wherein said powering delivers between about 150 KW and about 600 KW to the linear electric motor.

22. The method of claim 18 wherein the linear electric motor operates at between about 200 Hp and about 800 Hp.

23. The method of claim 18 wherein the linear electric motor operates in an electromagnetic polyphase manner.

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