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(54) **ELECTRIC DRIVE PUMP FOR WELL STIMULATION**

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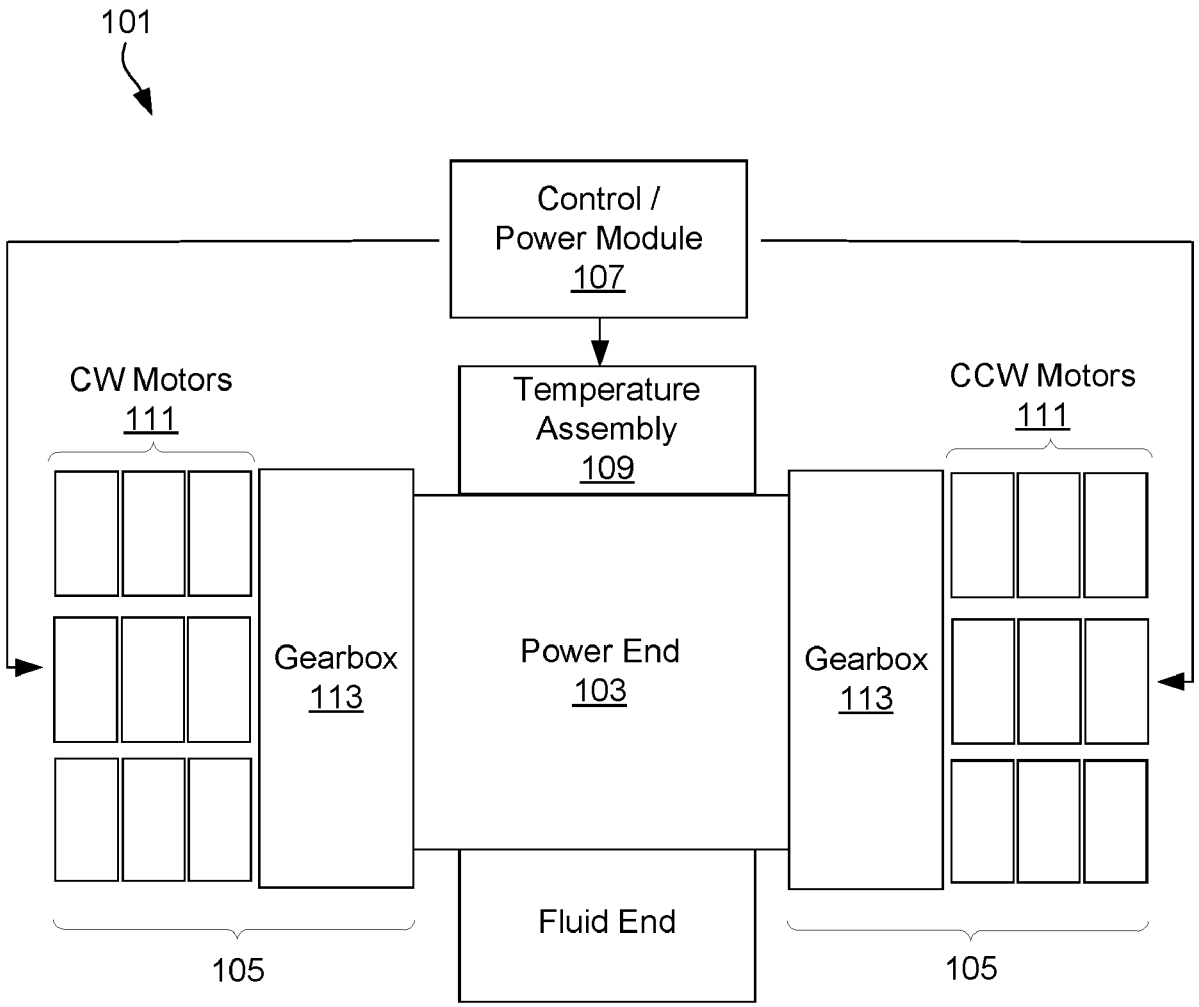
(57) **ABSTRACT**

An electric drive pump system includes a power end and a detachable transmission assembly. The transmission assembly is mounted to the power end and is configured to provide rotational power to the power end through a plurality of electric motors. The plurality of electric motors use a gearbox to drive an output spline that engages the power end. A control module is used to regulate the performance characteristics of the plurality of electric motors. A temperature regulation assembly is configured to regulate the temperature of the transmission assembly and the power end.



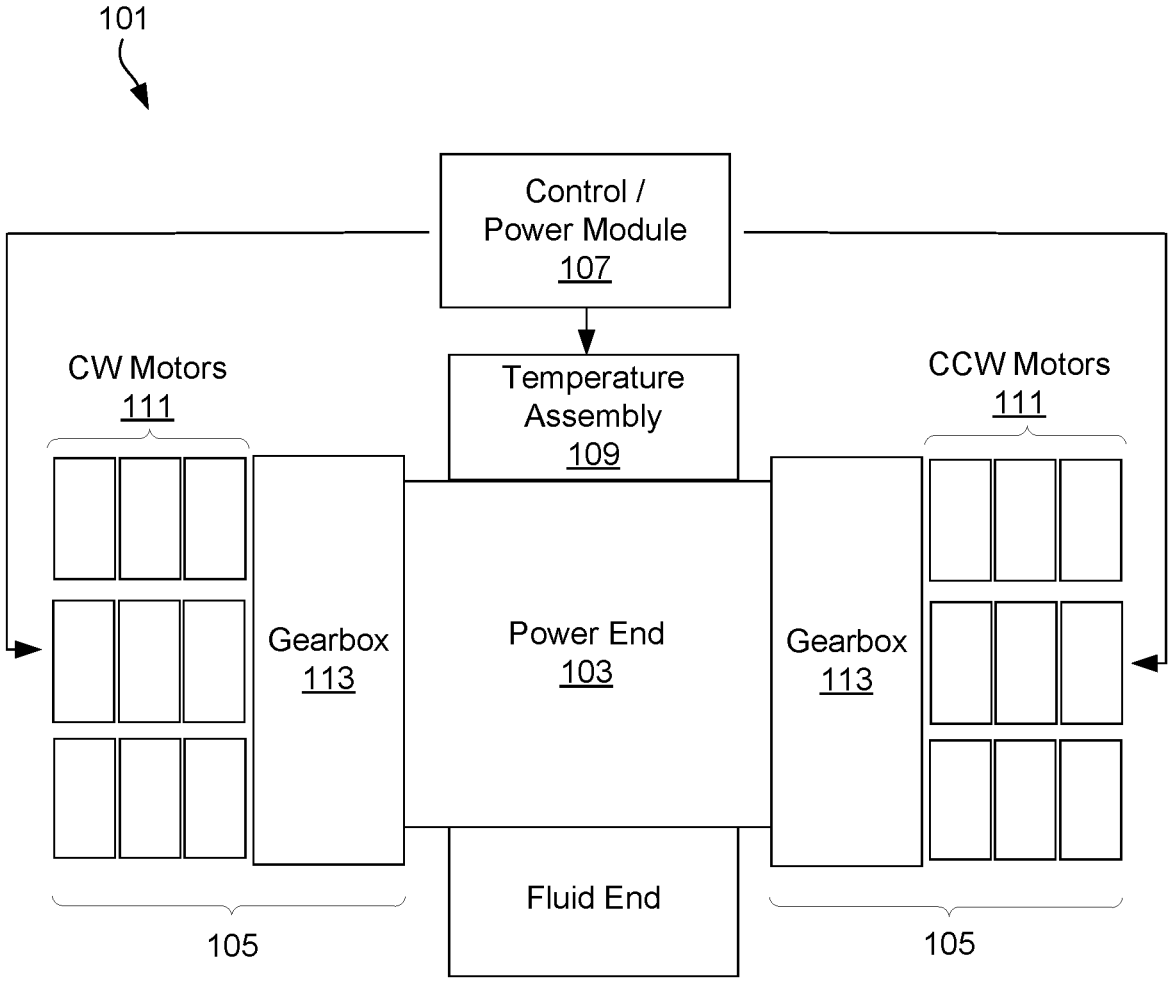

101
Control / Power Module 107
CW Motors 111
Temperature Assembly 109
CCW Motors 111
Gearbox 113
Power End 103
Gearbox 113
Fluid End
105
105

FIG. 1

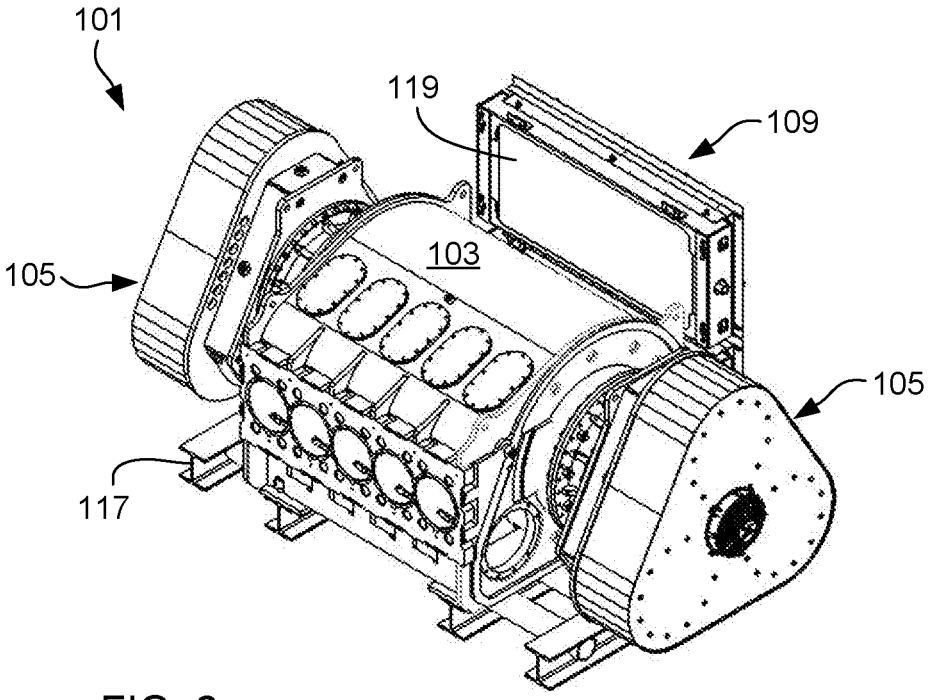


FIG. 2

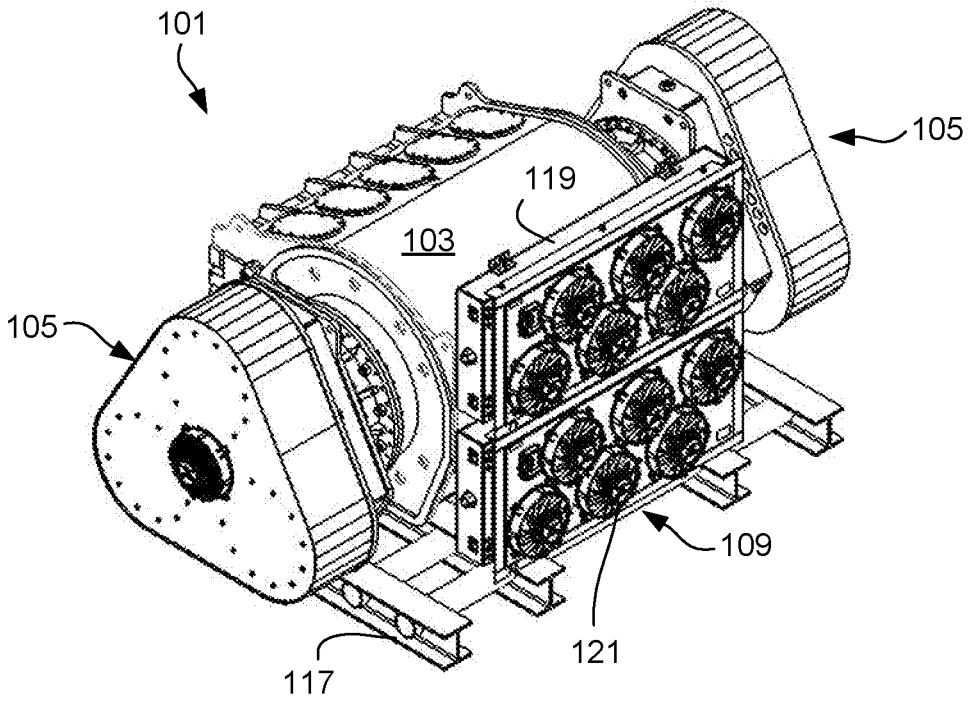


FIG. 3

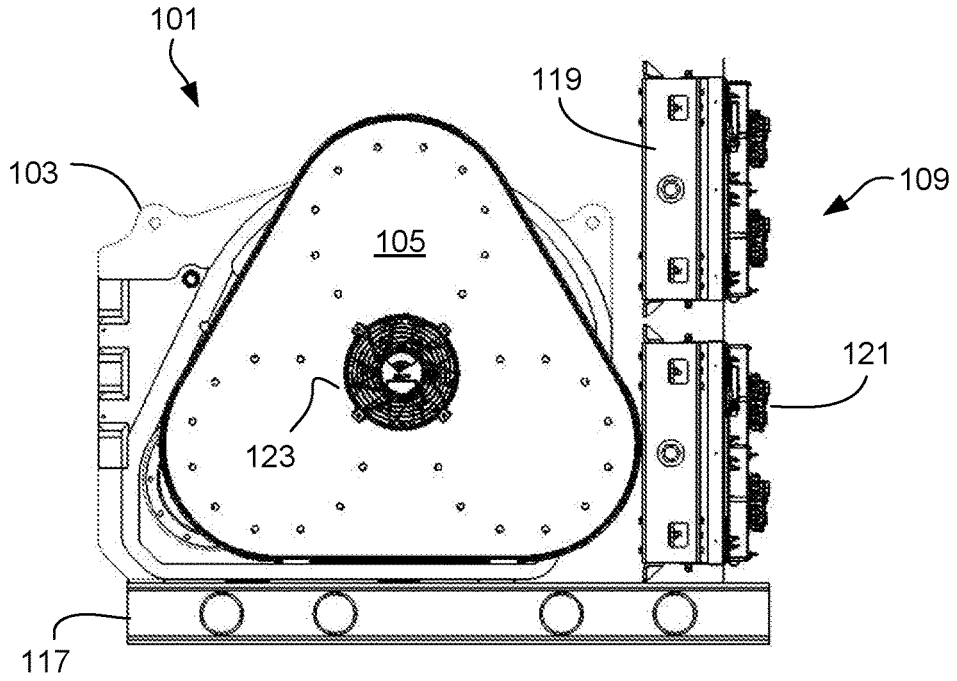

101
119
103
109
105
121
123
117

FIG. 4

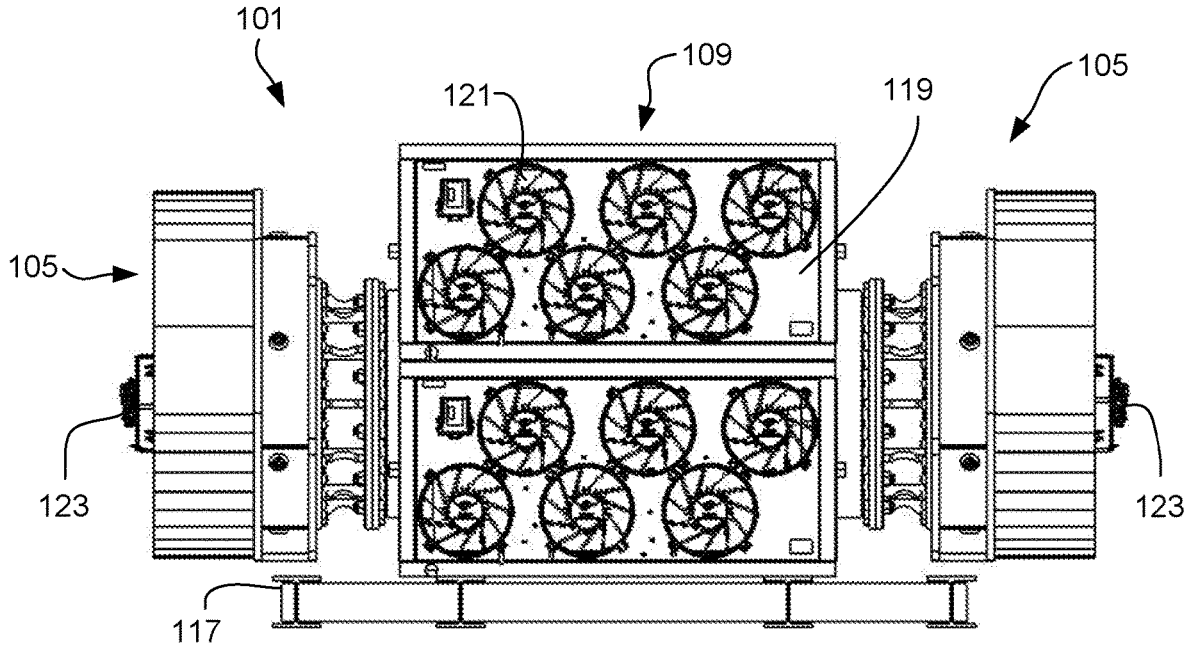

101
109
121
119
105
105
123
123
117

FIG. 5

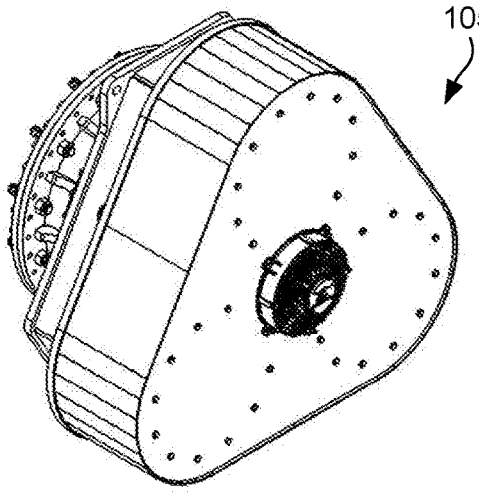


FIG. 6

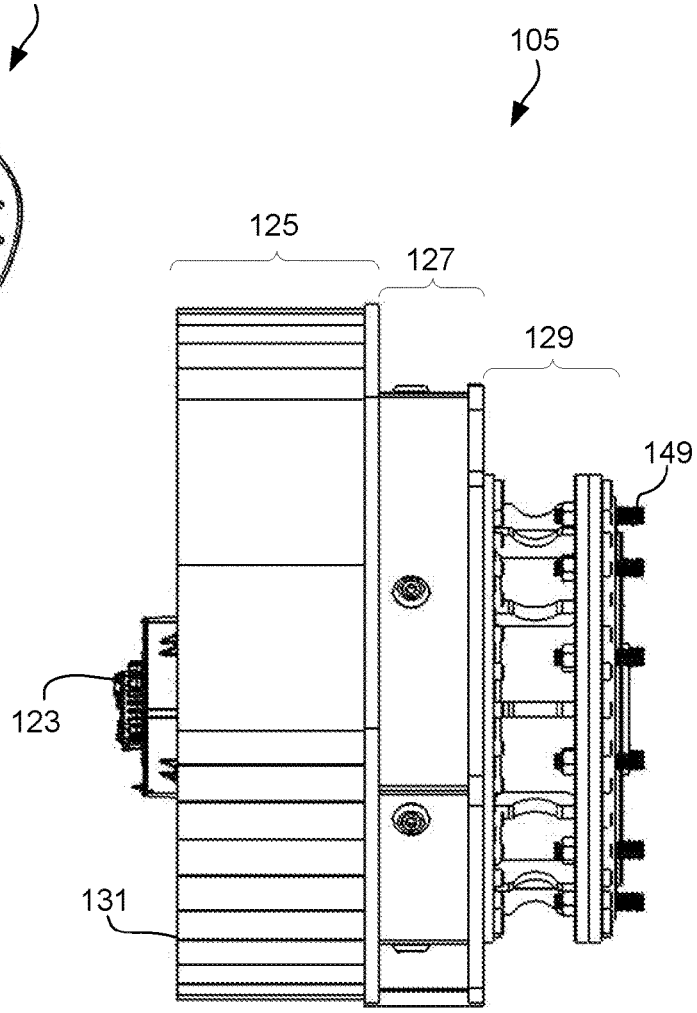


FIG. 7

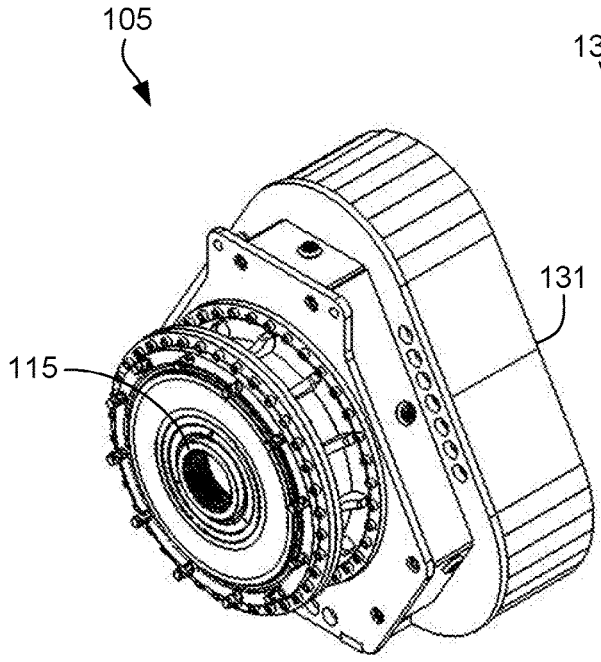


FIG. 8

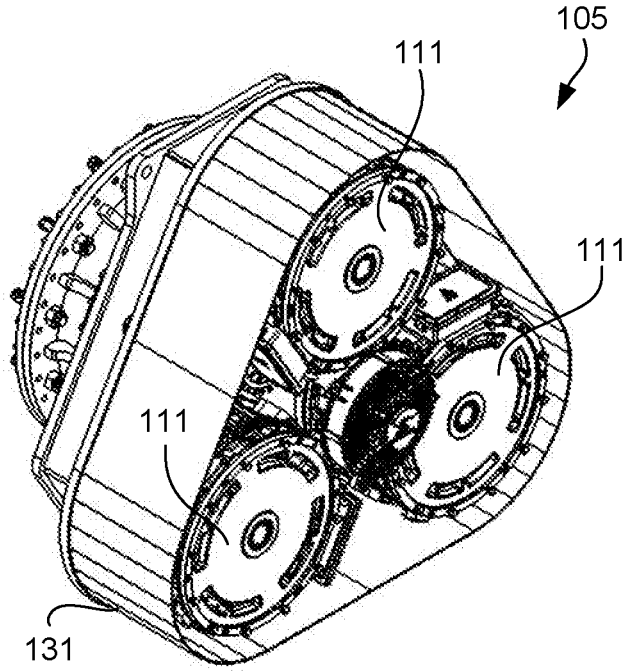


FIG. 9

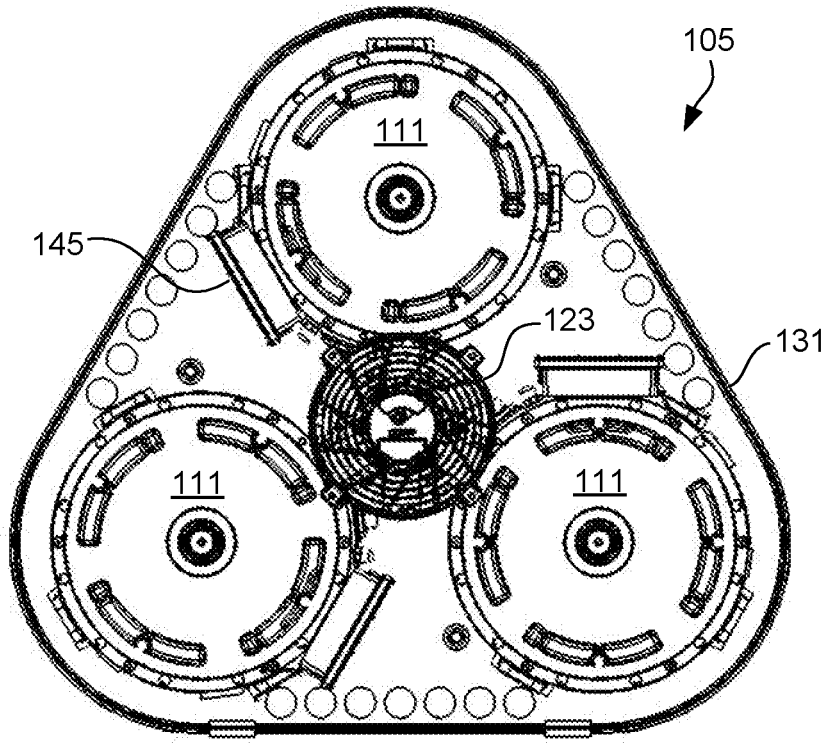


FIG. 10

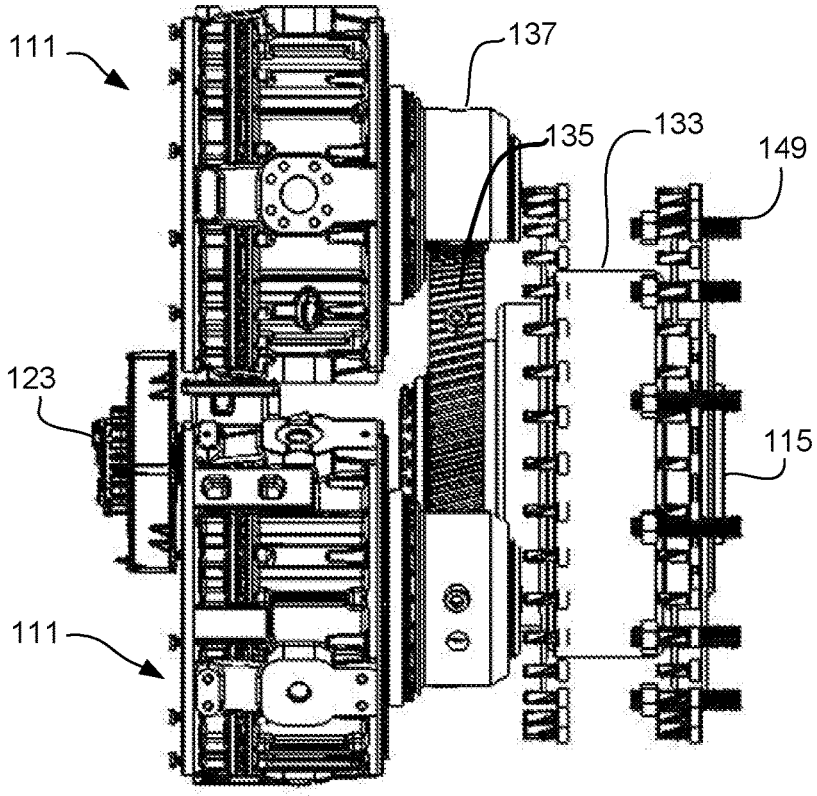


FIG. 11

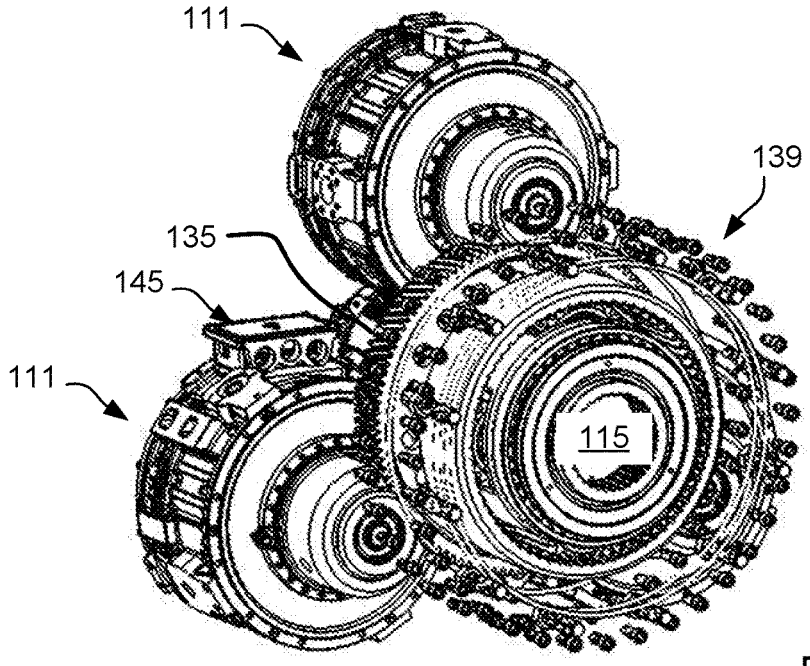


FIG. 12

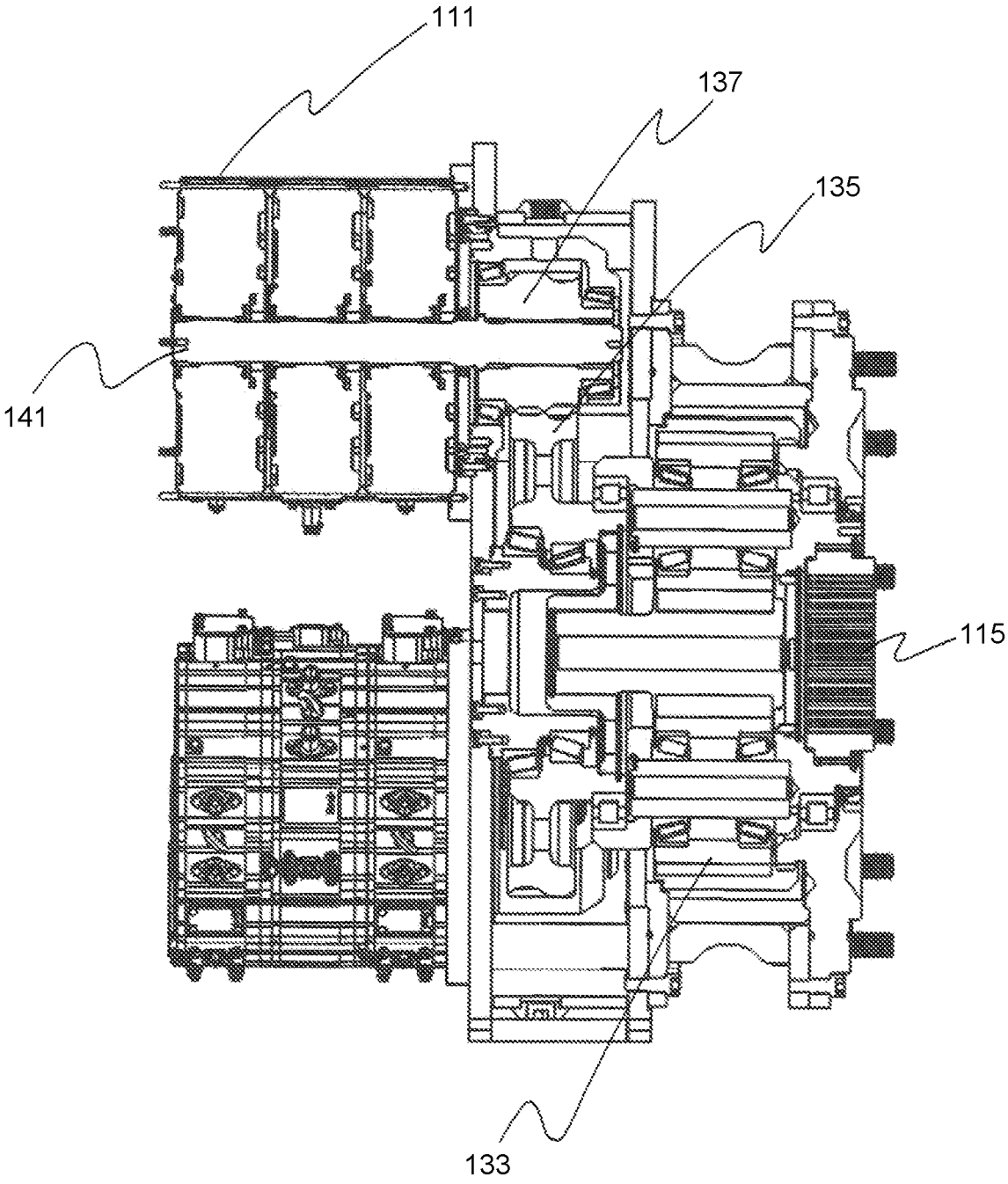


FIG. 13

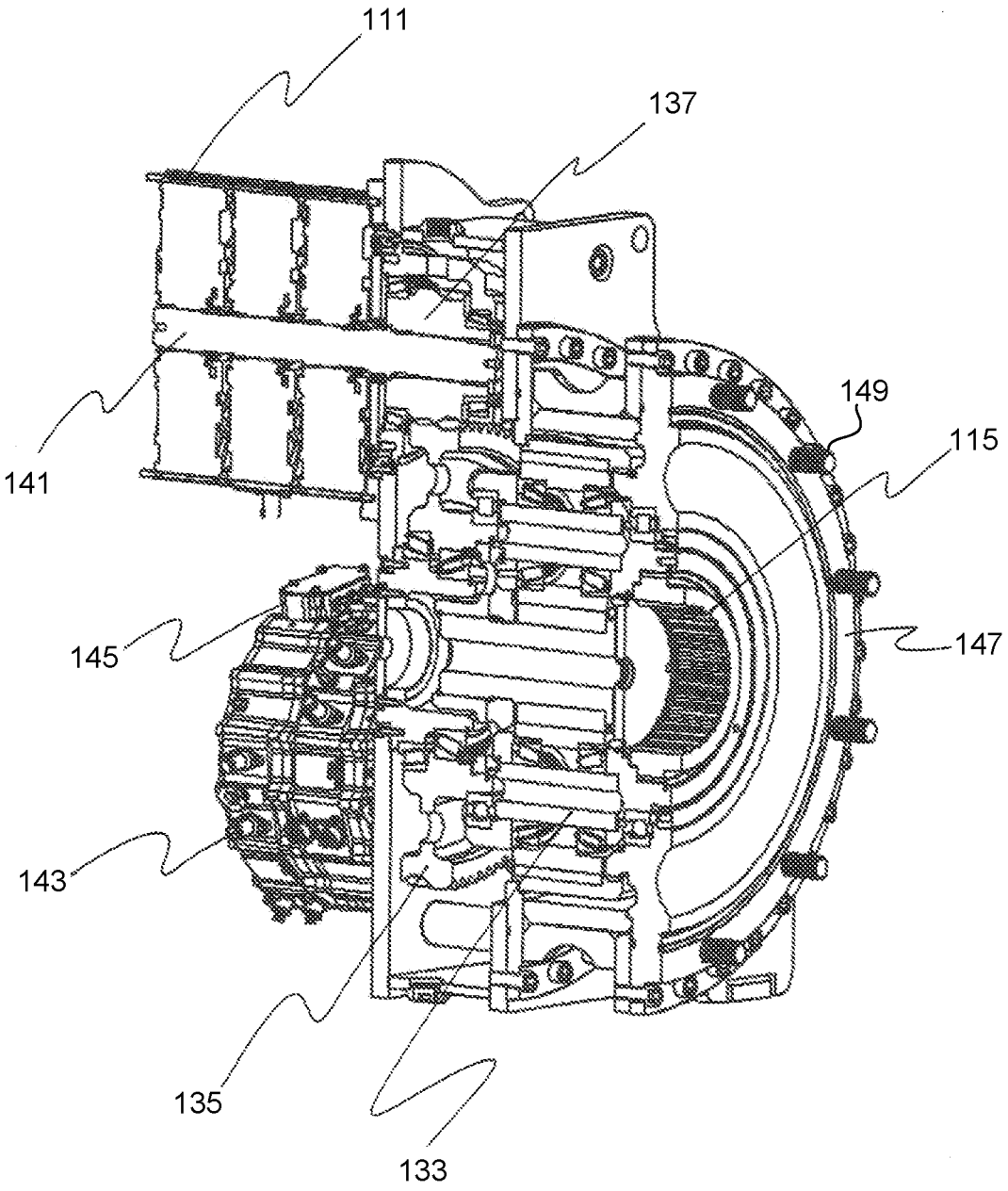


FIG. 14

Example: Tick Over

Motor #	Left Side	Right Side
1	On	On
2	Off	Off
3	Off	Off
4	Off	Off
5	Off	Off
6	Off	Off
7	Off	Off
8	Off	Off
9	Off	Off
10	Off	Off
11	Off	Off
12	Off	Off
13	Off	Off
14	Off	Off

FIG. 15

Example: 50% Required

Motor #	Left Side	Right Side
1	Off	Off
2	On	On
3	Off	Off
4	On	On
5	Off	Off
6	On	On
7	Off	Off
8	On	On
9	Off	Off
10	On	On
11	Off	Off
12	On	On
13	Off	Off
14	On	On

FIG. 16

Example: 100% Required

Motor #	Left Side	Right Side
1	On	On
2	On	On
3	On	On
4	On	On
5	On	On
6	On	On
7	On	On
8	On	On
9	On	On
10	On	On
11	On	On
12	On	On
13	On	On
14	On	On

FIG. 17

Example: 70% Required

Motor #	Left Side	Right Side
1	Off	Off
2	On	On
3	On	On
4	On	On
5	Off	Off
6	On	On
7	On	On
8	On	On
9	Off	Off
10	On	On
11	On	On
12	On	On
13	Off	Off
14	On	On

FIG. 18

ELECTRIC DRIVE PUMP FOR WELL STIMULATION

TECHNICAL FIELD

[0001] The present application relates generally to hydraulic fracturing in oil and gas wells, and in particular to an electric drive pump used to drive a fluid end for the pumping of a fracturing fluid into a well.

DESCRIPTION OF THE PRIOR ART

[0002] It is difficult to economically produce hydrocarbons from low permeability reservoir rocks. Oil and gas production rates are often boosted by hydraulic fracturing, a technique that increases rock permeability by opening channels through which hydrocarbons can flow to recovery wells. Hydraulic fracturing has been used for decades to stimulate production from conventional oil and gas wells. The practice consists of pumping fluid into a wellbore at high pressure (sometimes as high as 50,000 PSI). Inside the wellbore, large quantities of proppants are carried in suspension by the fracture fluid into the fractures. When the fluid enters the formation, it fractures, or creates fissures, in the formation. Water, as well as other fluids, and some solid proppants, are then pumped into the fissures to stimulate the release of oil and gas from the formation. When the pressure is released, the fractures partially close on the proppants, leaving channels for oil and gas to flow.

[0003] Fracturing rock in a formation requires that the fracture fluid be pumped into the well bore at very high pressure. This pumping is typically performed by large diesel-powered pumps in communication with one or more fluid ends. These specialized pumps are used to power the operation of the fluid end to deliver fracture fluids at sufficiently high rates and pressures to complete a hydraulic fracturing procedure or "frac job." Such pumps are able to pump fracturing fluid into a well bore at a high enough pressure to crack the formation, but they also have drawbacks. For example, the diesel pumps are very heavy, and thus must be moved on heavy duty trailers, making transport of the pumps between oilfield sites expensive and inefficient. In addition, the diesel engines required to drive the pumps require a relatively high level of expensive maintenance. Furthermore, the cost of diesel fuel is much higher than in the past, meaning that the cost of running the pumps has increased.

[0004] To avoid the disadvantages of diesel-powered pumps, some have moved to another option, such as electrically powered pumps. The electric frac pump configurations available now are largely comprised of existing mechanical units that are integrated into an electric system. This practice, however, can limit an operation's efficiency and performance.

[0005] Operators have at least two alternatives to choose from when in pursuit of a clean, electric power end pump. The first option offers a dual-motor configuration coupled with up to two triplex pumps. This large, industrial-sized, and air-cooled system can be capable of 3600-4500 hydraulic horsepower (HHP). The second option is a single-motor configuration. The centrally located motor is connected by two quintuplex pumps via a through-spindle design. This larger unit is also air-cooled, and is capable of 6000 HHP. Existing electric configurations experience inefficiencies in certain key areas. Contemporary offerings for electric frac configurations are composed of existing components from mechanical systems that are repurposed for electric applications. These components were not specifically built for electric systems. Consequently, effective horsepower is decreased due to design conflicts introducing hydraulic and mechanical resistance, as well as accelerated wear cycles as a result of violent harmonics and misalignments in provisional electric systems.

[0006] The inefficiencies do not end there: air-cooling solutions often leave something to be desired, as they are not capable of regulating the temperatures the motors generate, especially in environments where heat is a special concern. This leads to motors running hotter, and therefore, far less efficiently, which reduces the effective hydraulic horsepower of the entire operation. The inability to regulate running temperatures can also lead to premature failure.

[0007] There are other concerns regarding the integration of existing mechanical components and electrics, such as the optimization of the ratios used by power end reduction gears. Electric motors are often mistakenly considered to produce the same results at any RPM. Even though they have flatter and more consistent torque and power curves than internal combustion solutions, this is not entirely true. Electric motors do perform best within a certain RPM range, and contemporary offerings have not taken full advantage of the optimization that understanding provides. Reduction gear ratios that were not chosen for use in a specific electrical application, expose motors that drive them to possible premature failure, whether it be from spinning outside of the optimal range, or introducing harmonic imbalances and damaging the powertrain as a whole.

[0008] Although great strides have been made with respect to the power end of a fracturing pump system, there clearly is room left for improvement in electric drive pump fracing systems.

SUMMARY OF THE INVENTION

[0009] It is an object of the present application to provide an electric drive pump system for use in well stimulation. The electric drive pump system is configured to provide a plurality of individual motors in selective configurations that work together to provide power to a power end. The motors are arranged around a gearbox which is used to convert the rotary motion of the electric motors into linear motion for operation of the plungers in the fluid ends. The system includes a transmission assembly that is composed of the gearbox and the plurality of motors. The transmission assembly is detachable from any power end, and is operable with legacy power ends.

[0010] It is a further object of the present application to include a temperature regulation system that is configured to provide means of regulating the temperature of the components within the system. The temperature regulation system can be configured to provide both a heating effect and a cooling effect depending on configurations.

[0011] Another object is to provide a control module for the monitoring and regulation of the various components. The control module may use any number of sensors to monitor operations. The motors may be regulated in their performance as well as the temperature regulation system. Communication to and from the control module may occur through wireless and/or wired means. Any number of input/output interfaces may be included to input and receive parameters and instructions.

[0012] Ultimately the invention may take many embodiments beyond the exact depiction provided herein. This system overcomes the disadvantages inherent in the prior art.

[0013] The more important features of the system have thus been outlined in order that the more detailed description that follows may be better understood and to ensure that the present contribution to the art is appreciated. Additional features of the system will be described hereinafter and will form the subject matter of the claims that follow.

[0014] Many objects of the present system will appear from the following description and appended claims, reference being made to the accompanying drawings forming a part of this specification wherein like reference characters designate corresponding parts in the several views.

[0015] Before explaining at least one embodiment of the system in detail, it is to be understood that the system is not limited in its application to the details of construction and the arrangements of the components set forth in the following description or illustrated in the drawings. The system is capable of other embodiments and of being practiced and carried out in various ways. Also it is to be understood that the phraseology and terminology employed herein are for the purpose of description and should not be regarded as limiting.

[0016] As such, those skilled in the art will appreciate that the conception, upon which this disclosure is based, may readily be utilized as a basis for the designing of other structures, methods and systems for carrying out the various purposes of the present system. It is important, therefore, that the claims be regarded as including such equivalent constructions insofar as they do not depart from the spirit and scope of the present system.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017] The novel features believed characteristic of the invention are set forth in the appended claims. However, the invention itself, as well as a preferred mode of use, and further objectives and advantages thereof, will best be understood by reference to the following detailed description when read in conjunction with the accompanying drawings, wherein:

[0018] FIG. **1** is a schematic of an electric drive pump system according to an embodiment of the present application.

[0019] FIG. **2** is a front perspective view of an electric drive pump in the electric drive pump system of FIG. **1**.

[0020] FIG. **3** is a rear perspective view of the electric drive pump of FIG. **2**.

[0021] FIG. **4** is a side view of the electric drive pump of FIG. **2**.

[0022] FIG. **5** is a rear view of the electric drive pump of FIG. **2**.

[0023] FIG. **6** is a front perspective view of a transmission assembly in the electric drive pump of FIG. **2**.

[0024] FIG. **7** is a side view of the transmission assembly of FIG. **6**.

[0025] FIG. **8** is a rear perspective view of the transmission assembly of FIG. **6**.

[0026] FIG. **9** is an alternate front perspective view of the transmission assembly of FIG. **6**.

[0027] FIG. **10** is a front view of the transmission assembly of FIG. **9**.

[0028] FIG. **11** is an interior side view of the transmission assembly of FIG. **9**.

[0029] FIG. **12** is a rear perspective view of the transmission assembly of FIG. **11**.

[0030] FIG. **13** is a side section view of the transmission assembly of FIG. **12**.

[0031] FIG. **14** is a rear perspective view of the transmission assembly of FIG. **13**.

[0032] FIGS. **15-18** are charts of the operative functioning of the electric motors in various different power demand conditions.

[0033] While the application is susceptible to various modifications and alternative forms, specific embodiments thereof have been shown by way of example in the drawings and are herein described in detail. It should be understood, however, that the description herein of specific embodiments is not intended to limit the application to the particular forms disclosed, but on the contrary, the intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the application as described herein.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0034] Illustrative embodiments of the preferred embodiment are described below. In the interest of clarity, not all features of an actual implementation are described in this specification. It will of course be appreciated that in the development of any such actual embodiment, numerous implementation-specific decisions must be made to achieve the developer's specific goals, such as compliance with system-related and business-related constraints, which will vary from one implementation to another. Moreover, it will be appreciated that such a development effort might be complex and time-consuming but would nevertheless be a routine undertaking for those of ordinary skill in the art having the benefit of this disclosure.

[0035] In the specification, reference may be made to the spatial relationships between various components and to the spatial orientation of various aspects of components as the devices are depicted in the attached drawings. However, as will be recognized by those skilled in the art after a complete reading of the present application, the devices, members, apparatuses, etc. described herein may be positioned in any desired orientation. Thus, the use of terms to describe a spatial relationship between various components or to describe the spatial orientation of aspects of such components should be understood to describe a relative relationship between the components or a spatial orientation of aspects of such components, respectively, as the assembly described herein may be oriented in any desired direction.

[0036] The system in accordance with the present application overcomes one or more problems commonly associated with conventional pumps used to stimulate a well. The electric drive pump system of the present application is configured to incorporate a plurality of electric motors to the power end or pump portion of a pump system. The motors are configured to operate either collectively or independently to vary the power supplied to the power end. The electric motors may operate in any combined manner and may operate in any sequential order. By including smaller motors, the motors are more easily obtained in the market, precise power requirements may be met smoothly, and overall power consumption may be minimized. Additionally, the electric drive pump system of the present applica-

tion allows end-users to almost entirely eliminate hydrocarbon emissions by using clean-burning well gas turbines or local industrial power sources to fuel their operations. Noise pollution is also reduced by the removal of some of the loudest equipment on the pad, and electric configurations allow for cooling solutions that can be controlled to reduce or redirect most auditory nuisances. The electric drive pump system also has a smaller footprint on-pad than conventional pump systems. Maintenance is simplified to a considerable degree, since heavy, cumbersome mechanical power units are replaced with smaller, less complex electrical power units. These and other unique features of the device are discussed below and illustrated in the accompanying drawings.

[0037] The system will be understood, both as to its structure and operation, from the accompanying drawings, taken in conjunction with the accompanying description. Several embodiments of the assembly may be presented herein. It should be understood that various components, parts, and features of the different embodiments may be combined together and/or interchanged with one another, all of which are within the scope of the present application, even though not all variations and particular embodiments are shown in the drawings. It should also be understood that the mixing and matching of features, elements, and/or functions between various embodiments is expressly contemplated herein so that one of ordinary skill in the art would appreciate from this disclosure that the features, elements, and/or functions of one embodiment may be incorporated into another embodiment as appropriate, unless otherwise described.

[0038] The system of the present application is illustrated in the associated drawings. The assembly includes a portable base member that can roll along the ground. The base member defines an interior volume used for storage of various members and portions of the assembly. It also includes an elevating platform in communication with the base member. The elevating platform operates between a lowered position and an elevated position. The assembly is stabilized by one or more jacks and a hitch attachment assembly configured to secure the base member to the neighboring vehicle. Additional features and functions of the device are illustrated and discussed below.

[0039] Referring now to the Figures wherein like reference characters identify corresponding or similar elements in form and function throughout the several views. The following Figures describe the assembly of the present application and its associated features. With reference now to the Figures, an embodiment of the electric drive pump system is herein described. It should be noted that the articles "a", "an", and "the", as used in this specification, include plural referents unless the content clearly dictates otherwise.

[0040] Referring to FIG. **1** in the drawings, a schematic of an electric drive pump system for well stimulation through a power end is provided. The electric drive pump system **101** includes a power end **103**, a transmission assembly **105**, a control module **107** and a temperature regulation assembly **109**. Power end **103** is configured to convert the rotational/rotary motion generated through transmission assembly **105** into a linear motion for operation of plungers within one or more fluid ends. Power end **103** may have operate with any number of fluid ends and may be constructed from a casting or fabricated from one or more materials.

[0041] Transmission assembly **105** is releasably mounted to power end **103**, and includes a plurality of electric motors **111** and a gearbox **113** in communication with the plurality of electric motors. The gearbox **113** includes a plurality of gears for transferring rotational energy from the electric motors to the power end. Transmission assembly **105** also includes an output spline **115** in communication with gearbox **113**. Output spline **115** is configured to transfer rotational energy from gearbox **113** to power end **103**. In general, transmission assembly **105** is configured to hold the drive system (motors **111** and gearing) along with cooling components and sensors.

[0042] System **101** also includes control module **107** configured to regulate performance of the plurality of electric motors **111**. Electrical power is provided to motors **111** which in turn are used to induce a torque of selected power to rotate gears within gearbox **113**. Control module **107** is used to monitor each motor's performance and control selected functions, such as power output, speed, on/off, unit temperature, and so forth. It is understood that these are exemplary in nature and do not form an exhaustive listing of performance characteristics or functions that module **107** may regulate with respect to motors **111** or system **101**. Through control module **107**, operation of motors **111** can be done simultaneously as a group at a selected power level and/or independently wherein each motor **111** is independent of the operation of other motors **111** with respect to at least power output and runtime. Use of a plurality of motors **111** allows for simplification of maintenance as one or more motors **111** may be turned off for maintenance while others remain on to maintain operation of power end **103**.

[0043] It is understood that many different types of motors **111** exist and are possible. For example, motors **111** may be AC or DC, single or multiple wound, brushed or brushless, direct drive, servo or stepper motors. Another option is that motors **111** are rare earth magnet motors which have increased power density. Motors **111** may be powered via battery stacks or direct feed from a main power grid. Additionally, motors **111** may be powered off of waste gas from the sites. Ideally a DC power system is preferred.

[0044] As seen in FIG. **1**, a plurality of transmission assemblies may be coupled to drive power end **103**. Motors **111** can be configured to operate in a clock-wise (CW) direction or a counter clock-wise (CCW) direction so as to collectively rotate in the same direction relative to power end **103**. Also seen in FIG. **1**, motors may be arranged in any manner within transmission assembly **105**. One or more motor **111** may be in direct communication with gearing in gearbox **113**. Subsequent or additional motors **111** used may be stacked behind an adjacent motor **111**. In stacked configurations, the stacked motors **111** work together in a prescribed fashion according to control module **107** to apply power to gearbox **113** at a single location.

[0045] Temperature regulation assembly **109** is configured to regulate the temperature levels of various components and members of system **101**. For example, temperature regulation assembly **109** is configured to regulate the temperature of power end **103** and/or transmission assembly **105**. Module **107** is configured to operatively regulate performance of assembly **109**. One or more sensors are located throughout system **101** and communicate temperature readings back to module **107** and/or assembly **109**. Assembly **109** includes a radiator and a cooling fan and uses any type of working medium (i.e. fluid) to facilitate temperature regulation.

Assembly **109** may use an oil based fluid or a water based fluid as the working medium.

[0046] Additionally, assembly **109** is configured to provide both a cooling effect and a heating effect. For example, to optimize the performance of system **101**, assembly **109** can be used to heat critical components within system **101** to a stable operating temperature before actuation of the system as a whole. Assembly **109** then may switch to a cooling mode to cool various components while in operation so as to keep the working medium temperature optimized.

[0047] FIGS. **2-14** are provided to show an exemplary embodiment of system **101**. This embodiment is not limited to the physical characteristics so depicted but can extend to other embodiments that are considered within the same functional scope and spirit of the present system.

[0048] Referring now also to FIGS. **2-5** in the drawings, views of electric drive pump system **101** is illustrated. System **101** is shown in a front perspective view in FIG. **2** and a rear perspective view in FIG. **3**. Power end **103** is situated between two transmission assemblies **103**. Temperature regulation assembly **109** is shown adjacent power end **103**. Power end **103** and temperature regulation assembly **109** are resting on a platform **117**. Platform **117** is configured to elevate system **101** off the ground and provide for the overall stability of system **101**. Platform **117** is configured to enable mobility of system **101**. System **101** may be lifted by engaging platform **117** in one method. Other methods may involve pushing, pulling, or sliding for example. Platform **117** may be a skid, trailer, operate off of wheels, or consist of any mobile type of device. As seen in the Figures, a plurality of fasteners are used to couple transmission assembly **105** to power end **103**. Assembly **105** is detachable and interchangeable. During servicing, a single assembly **105** may be removed and replaced in a simple manner to avoid down time of the system.

[0049] Temperature regulation assembly **109** is shown in more detail from the side view of FIG. **4** and the rear view of FIG. **5**. Assembly **109** includes a radiator **119** and a fan **121**. Radiator **119** may include one or more cores with each core having the ability to cool a working medium to produce a cooling effect. This effect can be provided to motors **111**, transmission assembly **105**, and power end **103**. Any type of working medium may be used to pass within the core of radiator **119**. It is understood that multiple cores may be used. They may be stacked together in any manner. Each of the plurality of cores may be either independent from one another or in fluid communication with each other. Independent cores permit for the use of different working mediums. Use of different mediums may assist in providing both heating and cooling via the same radiator. Fan **121** is configured to pass air onto radiator **119** so as to create an exchange of heat.

[0050] It is worth noting as well that in FIGS. **4** and **5** the use of a circulation fan **123** is also seen in communication with transmission assembly **105**. Fan **123** is configured to selectively pass air over motors **111** by having outside air (outside of transmission assembly **105**) enter and mix within assembly **105**. Fan **123** may work independent of assembly **109** or in conjunction therewith. Module **107** may be used to regulate fan **123**.

[0051] Referring now also to FIGS. **6-8** in the drawings, assorted views of transmission assembly **105** are illustrated. AS noted previously, assembly **105** is detachable from power end **103**. Transmission assembly **105** is depicted herein separated therefrom as a whole unit. Transmission assembly **105** is composed of a plurality of various components and assemblies working together to provide the transfer of rotational energy to power end **103**. As seen in the side view of FIG. **7**, transmission assembly **105** includes a motor portion **125**, a gear reduction assembly **127**, and a planetary assembly **129**. These general assemblies **125** and **127** are defined in their relative location in FIG. **7** and constitute gearbox **113**. In the case of motor portion **125**, transmission housing **131** is a cover that surrounds motors **111**. In FIG. **8**, output spline **115** is shown. As motors **111** rotate gearing in gearbox **113**, output spline **115** rotates and drives power end **103**.

[0052] Referring now also to FIGS. **9** and **10** in the drawings, an alternate front perspective view and front view of transmission assembly **109** is illustrated. In these Figures, a portion of housing **131** is removed for clarity and to permit a view of motors **111**. Motors **111** are arranged in a radial manner about output spline **115**. Fan **123** has been maintained for visual purposes.

[0053] Referring now also to FIGS. **11-14** in the drawings, assorted views of the gearing in transmission assembly **105** is illustrated. FIG. **11** is an interior side view of transmission assembly **105** without housing **131** and covers associated with gearbox **113** so as to show the gearing being used. Planetary system **133** (i.e. gears) are illustrated adjacent output spline **115**. A bull gear **135** is shown as being located between planetary system **133** and a spur gear arrangement **137**. Power from motors **111** pass to the spur gear **137**, to the bull gear, and then to the planetary system before being output through the output spline **115**. A rear perspective view is shown in FIG. **12** and is provided for perspective. The gear reduction **139** is shown in more clarity.

[0054] In particular with FIG. **13** in the drawings, a side section view of transmission assembly **105**, from FIG. **11**, is provided. In this view, each of the prior gearing is shown from the side and serves to enhance clarity in the gearing options. Planetary system **133** is understood to be suitable for any number of configurations. Output spline **115** connects transmission assembly **105** to a crank shaft in power end **103**. It is understood that this could also be facilitated through a key drive or flexible coupling arrangement. Motors **111** are shown in section view as well. A drive shaft **141** is shown passing through the central part of motors **111**. Each motor engages shaft **141**. Shaft **141** engages and contacts the spur gear **137**. Also of note is the stacking capability of motors **111**. As shown, three motors are stacked to one shaft **141**.

[0055] In particular with FIG. **14** in the drawings, a rear perspective view of FIG. **13** is shown for clarity. In this view, a liquid port **143** is made more visible on motor **111**. Assembly **109** is able to engage motors **111** through this port to provide a cooling/heating effect. Module **107** may communicate with motors **111** through a cable entrance point **145**. Additionally, a power source may also use entrance point **145** to provide power to run motors **111**. A coupling flange **147** is shown as well. This is used to facilitate mating between transmission assembly **105** and power end **103**. Contact with power end **103** may occur along this flange. The fasteners **149** are used to secure assembly **105** in position.

[0056] Referring now also to FIGS. **15-18** in the drawings, charts of the operative functioning of the electric motors **111** are illustrated. As noted previously, motors **111** may operate

as a collective whole or independent of one another. Motors **111** can be used in a continuous duty cycle or as a sequenced duty cycle to meet the requirement of the pumps output. Each chart includes a table showing fourteen motors **111** which may be associated with a left side and a right side (the number of motors is exemplary only). Under each side a label of "on" and "off" is provided. In FIG. **15**, an example of the operation of the motors **111** is provided wherein only a small amount of power is needed. In this condition, only motor #1 is turned on. The others remained off.

[0057] In FIG. **16**, a 50% output is required. To produce this amount, the even numbered motors **111** are operative while the odd numbered motors **111** are deactivated or turned off. In this case, 50% power is provided by operating half the motors **111** at full capacity. In FIG. **17**, 100% power is required and therefore all motors **111** are turned on. In FIG. **18**, 70% power is required. In this example, motors **1**, **5**, **9**, and **13** are off while the others are on. As seen from the exemplary charts of FIGS. **15-18**, the power supplied can be adjusted by changing the number of motors **111** turned on and the respective power output through each motor.

[0058] As alluded to above, it would appear that each motor **111** is configured to operate in full output mode only. It is understood that the system of the present application may permit the motors **111** to be run at various speeds or power outputs. This could allow all the motors **111** to operate for a 50% required output, where each motor **111** is producing only ½ its max output. An advantage of varied output motors **111** would be that potentially maintenance may be provided to selected motors **111** during operation of the fluid end without the need to completely shut down operations as other motors **111** may be set to compensate for the needed load conditions. Naturally, the motors **111** may interact and operate in any number of different manners.

[0059] It is apparent that an invention with significant advantages has been described and illustrated. The particular embodiments disclosed above are illustrative only, as the invention may be modified and practiced in different but equivalent manners apparent to those skilled in the art having the benefit of the teachings herein. It is therefore evident that the particular embodiments disclosed above may be altered or modified, and all such variations are considered within the scope and spirit of the invention. Accordingly, the protection sought herein is as set forth in the description. Although the present invention is shown in a limited number of forms, it is not limited to just these forms, but is amenable to various changes and modifications without departing from the spirit thereof.

What is claimed is:

1. An electric drive hydraulic fracturing pump system, comprising:

a hydraulic fracturing pump having a power end;

a plurality of electric motors, each electric motor having a motor output shaft with a spur gear mounted thereon; and

a gearbox in communication with the plurality of electric motors, the gearbox including a bull gear engaged by each of the spur gears of the plurality of electric motors,

and a planetary gear system coupled to the bull gear, the gears for transferring rotational energy from the electric motors to the power end.

2. The system of claim **1**, further comprising:

a control module configured to regulate performance of the plurality of electric motors.

3. The system of claim **2**, wherein the control module is configured to individually regulate power output and runtime of each of the plurality of electric motors.

4. The system of claim **1**, wherein the plurality of electric motors are configured to operate simultaneously.

5. The system of claim **1**, wherein the plurality of electric motors are configured to operate independently from one another.

6. The system of claim **1**, wherein the plurality of electric motors can operate at different output power levels.

7. The system of claim **1**, further comprising:

a circulation fan to pass air over the plurality of electric motors.

8. An electric drive hydraulic fracturing pump system, comprising:

a hydraulic fracturing pump having a power end with a pump crankshaft extending along a crankshaft axis;

a transmission assembly coupled to the power end pump crankshaft, the transmission assembly having:

a plurality of electric motors radially spaced apart from one another about the crankshaft axis; and

a gearbox coupling the plurality of electric motors to the pump crankshaft, the gearbox including a plurality of gears for transferring rotational energy from the electric motors to the power end; and

a control module configured to regulate performance of the plurality of electric motors.

9. The system of claim **8**, further comprising:

a temperature regulation assembly in communication with the control module for monitoring and regulating the temperature of the power end.

10. The system of claim **9**, wherein the temperature regulation assembly is configured to heat at least one of the power end and the transmission assembly.

11. The system of claim **9**, wherein the temperature regulation assembly is configured to cool at least one of the power end and the transmission assembly.

12. The system of claim **9**, wherein the temperature regulation assembly includes a fan and a radiator, the fan used to pass air over the radiator.

13. The system of claim **8**, wherein the transmission assembly includes a circulation fan to pass air over the plurality of electric motors.

14. The system of claim **8**, wherein the power end has a first end and a second end, the system further comprising a plurality of electric motors disposed at each of the first and second ends of the power end.

15. The system of claim **8**, wherein the plurality of electric motors comprise at least three electric motors radially spaced apart from one another about the crankshaft axis.

16. The system of claim **8**, wherein the plurality of gears comprises a bull gear, a planetary gear system driven by the bull gear and a plurality of spur gears engaging the bull gear, wherein each spur gear is coupled to a separate electric motor.

17. The system of claim **8**, further comprising:

a platform coupled to the power end, the platform configured to elevate the power end above ground.

18. The system of claim **8**, wherein the power end is configured to convert rotary motion of an output spline driven by the transmission assembly into linear motion for use in a fluid end.

19. An electric drive hydraulic fracturing pump system, comprising:

a hydraulic fracturing pump having a power end with a pump crankshaft extending along a crankshaft axis;

at least three electric motors radially spaced apart from one another about the crankshaft axis, each electric motor having an electric motor output shaft coupled to the pump crankshaft; and

a reduction gear assembly coupling the output shafts of the electric motors to the pump crankshaft.

20. The system of claim **19**, wherein the power end has a first end and a second end; the system further comprising at least three electric motors disposed at each of the first and second ends of the power end and a gear reduction assembly disposed at each end of the first and second ends of the power end, wherein the at least three electric motors at each end of the power end are radially spaced about the crankshaft axis.

21. The system of claim **19**, further comprising a planetary assembly coupling the gear reduction assembly to the pump crankshaft.

22. The system of claim **20**, further comprising a planetary assembly disposed at each end of the power end and coupling a gear reduction assembly to the pump crankshaft.

23. The system of claim **19**; wherein one or more motors comprises at least two electric motors stacked adjacent one another to drive an electric motor output shaft.

24. The system of claim **19**, further comprising a temperature regulation assembly disposed to regulate the temperature of the at least three electric motors.

25. An electric drive hydraulic fracturing pump system, comprising:

a hydraulic fracturing pump;

a plurality of motors positioned to power the hydraulic fracturing pump; and

a planetary gear train having a plurality of input pinion gears in rotational contact with each of the plurality of motors.

26. The system of claim **25**, further comprising a control module configured to regulate performance of the plurality of motors by controlling one or more of power output and speed of each motor, either simultaneously as a group at a selected power level and/or independently wherein operation of each motor is independent of the operation of other motors with respect to at least power output and runtime.

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