Attorney Docket No. **0486-10685-1**

S P E C I F I C A T I O N

TO ALL WHOM IT MAY CONCERN:

BE IT KNOWN that we, Chris Buckley, of Tomball, Texas; and Paul Thomas Lightfoot, of Stockton Brook, Staffordshire, UK; have invented a new and useful

ELECTRIC DRIVE PUMP FOR WELL STIMULATION

of which the following is a specification.

CERTIFICATE OF TRANSMISSION UNDER 37 C.F.R. § 1.8(a)(1)(i)(C)
Date of Transmission: 25 September 2017
I hereby certify that this correspondence is being transmitted to the U.S. Patent and Trademark Office (USPTO) via the USPTO electronic filing system (EFS-Web) on the date shown above. By: /JOWilliams#67374/ Jeffrey O. Williams

BACKGROUND

1. Field of the Invention

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.

2. Description of Related Art

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.

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.

Although great strides have been made with respect to the power end of a fracturing pump system, considerable shortcomings remain. An improved pump for hydraulic fracturing fluid that overcomes the problems associated with diesel pumps is needed.

DESCRIPTION OF THE DRAWINGS

The novel features believed characteristic of the application are set forth in the description. However, the application 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.

Figure 1 is a side view of a schematic of a power end in communication with a plurality of electric motors according to an embodiment of the present application.

Figure 2 is a perspective view of a representative example of the power end with electric motors in association with a fluid end.

Figures 3-6 are charts of the operative functioning of the electric motors in various different power demand conditions.

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.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

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.

The assembly 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 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 independently to vary the power supplied 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. These and other unique features of the device are discussed below and illustrated in the accompanying drawings.

Referring now to Figures 1 and 2 in the drawings, a side view of a schematic of a power end in communication with a plurality of electric motors and a representative perspective view is illustrated. The power end includes a pump that is used to operate one or more fluid ends. The fluid ends are used to pump fluid into a well. As stated previously, a diesel powered power end has a number of disadvantages. This system includes a series of electric motors of sufficient number needed to give the required output to operate the one or more fluid ends. The precise number is dependent upon design constraints and engineering parameters. It is understood that more than one may be used. In Figure 1, a total of 10 are shown or implied, with 5 being located on either side of the power end.

The electric motors may be coupled to the power end in various orientations. Ultimately any restriction on the chosen orientation is that it must be able to convey energy so as to operate the power end. For example, the electric motors may be mounted in parallel with an axis of the pump; or the electric motors may be mounted perpendicular to the axis of the pump. Any combination of parallel or perpendicular are permitted between the numbers of motors. Additionally, any orientation between or beyond parallel and perpendicular are possible.

Selected gearing may be used to assist in mating the electric motors to the power end. As seen from Figure 1, these can be mounted at both ends of the pump, which apply the drive by means of any of the following: a gear/gears, chain or belt drive, or a combination of some or all. A clutch or system of clutches could be used to couple/de-couple the motors from the drive of the pump. Also a transfer gear system can be used if required. This may depend on the orientation of the axis of the motor to the axis of the pump.

Each electric motor is configured to produce a set amount of power (power max). The sizing of the plurality of motors can be such that they output equal or different amounts of power individually. Collectively, to some degree, a sufficient amount of power needs to be output from some number of the plurality of electric motors as is necessary to achieve the pumps output.

It is understood that if each of the motors are independently operable, some motors may be on while other are off. Referring now also to Figures 3-6 in the drawings, charts of the operative functioning of the electric motors are illustrated. The motors 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 14 motors which may be associated with a left side and a right side (the number of motors is exemplary only). The motors may be on one side only or associated with both sides. Under each side a label of “on” and “off” is provided. In Figure 3, an example of the operation of the motors is provided wherein only a small amount of power is needed. In this condition, only motor #1 is turned on. The others remained off.

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