

## Challenged Claims – U.S. Pat. No. 10,598,258

| <u>Claim<br/>Limitation</u> | <u>Claim</u>                                                                                                                                                                                                                                                                                                                                       |
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| 1[p]                        | A hydraulic fracturing system for fracturing a subterranean formation comprising:                                                                                                                                                                                                                                                                  |
| 1[a]                        | a multi-plunger hydraulic fracturing pump fluidly connected to a well associated with the subterranean formation, the multi-plunger pump configured to pump fluid into a wellbore associated with the well at a high pressure so that the fluid passes from the wellbore into the subterranean formation and fractures the subterranean formation; |
| 1[b]                        | a plurality of motors positioned to simultaneously power the multi-plunger pump; and                                                                                                                                                                                                                                                               |
| 1[c]                        | a planetary gear train having a plurality of input pinion gears in rotational contact with each of the plurality of motors,                                                                                                                                                                                                                        |
| 1[d]                        | wherein a gear ratio of the planetary gear train and a speed at which the plurality of motors operates are selected so as to limit a maximum pump speed associated with the multi-plunger pump.                                                                                                                                                    |
| 2                           | The system of claim 1, the system further comprising a plurality of speed reduction gearboxes positioned between the plurality of input pinion gears and the plurality of motors so as to achieve a desired pump rate.                                                                                                                             |
| 3                           | The system of claim 1, wherein the plurality of motors comprises one of a plurality of electric motors or a plurality of hydraulic motors.                                                                                                                                                                                                         |
| 4                           | The system of claim 1, wherein the maximum pump speed correlates to a critical plunger speed associated with the multi-plunger hydraulic fracturing pump.                                                                                                                                                                                          |
| 5                           | The system of claim 1, wherein the maximum pump speed is 5% or less over a critical plunger speed associated with the multi-plunger hydraulic fracturing pump.                                                                                                                                                                                     |
| 6                           | The system of claim 1, wherein the multi-plunger hydraulic fracturing pump comprises an odd number of plungers greater than or equal to five plungers.                                                                                                                                                                                             |
| 7                           | The system of claim 6, wherein a stroke length of each of the plungers associated with the multi-plunger hydraulic fracturing pump is selected to inversely relate to a pump speed associated with the multi-plunger hydraulic fracturing pump so as to achieve a predetermined flow rate.                                                         |

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| 8     | The system of claim 1, further comprising: a variable frequency drive (VFD) connected to the plurality of motors to control the speed of the plurality of motors, wherein the VFD is positioned to accelerate or decelerate pump rotational speeds associated with the multi-plunger hydraulic fracturing pump.                                    |
| 9     | The system of claim 8, wherein the VFD comprises a plurality of VFDs and wherein the plurality of VFDs are configured to share a load required to power the multiplunger hydraulic fracturing pump.                                                                                                                                                |
| 10    | The system of claim 9, wherein the plurality of VFDs are configured to automatically shut off in the event of an overpressure event with respect to the multi-plunger hydraulic fracturing pump.                                                                                                                                                   |
| 11[p] | A hydraulic fracturing system for fracturing a subterranean formation comprising:                                                                                                                                                                                                                                                                  |
| 11[a] | a multi-plunger hydraulic fracturing pump fluidly connected to a well associated with the subterranean formation, the multi-plunger pump configured to pump fluid into a wellbore associated with the well at a high pressure so that the fluid passes from the wellbore into the subterranean formation and fractures the subterranean formation; |
| 11[b] | a plurality of motors positioned to simultaneously power the multi-plunger pump;                                                                                                                                                                                                                                                                   |
| 11[c] | a variable frequency drive connected to the plurality of motors to control the speeds of the plurality of motors; and                                                                                                                                                                                                                              |
| 11[d] | a planetary gear train having a plurality of input pinion gears in rotational contact with each of the plurality of motors,                                                                                                                                                                                                                        |
| 11[e] | wherein a gear ratio of the planetary gear train and a speed at which the plurality of motors operates are selected so as to limit a maximum pump speed associated with the multi-plunger pump.                                                                                                                                                    |
| 12    | The system of claim 11, the system further comprising a plurality of speed reduction gearboxes positioned between the plurality of input pinion gears and the plurality of motors so as to achieve a desired pump rate.                                                                                                                            |
| 13    | The system of claim 11, wherein the plurality of motors comprises one of a plurality of electric motors or a plurality of hydraulic motors.                                                                                                                                                                                                        |
| 14    | The system of claim 11, wherein the maximum pump speed correlates to a critical plunger speed associated with the multi-plunger hydraulic fracturing pump.                                                                                                                                                                                         |

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| 15[p] | A method for pumping fluid into a wellbore associated with a subterranean formation, the method comprising:                                                                                                                                                                                                             |
| 15[a] | fluidly connecting a multi-plunger hydraulic fracturing pump to a well associated with the subterranean formation such that the multi-plunger pump pumps fluid into the wellbore at a high pressure so that fluid passes from the wellbore into the subterranean formation and fractures the subterranean formation;    |
| 15[b] | simultaneously powering the multi-plunger pump with a plurality of motors;                                                                                                                                                                                                                                              |
| 15[c] | providing a planetary gear train having a plurality of input pinion gears in rotational contact with each of the plurality of motors so as to translate power from the plurality of motors into a desired pump rate of the multi-plunger pump.                                                                          |
| 16    | The method of claim 15, further comprising: positioning a plurality of speed reduction gearboxes between the plurality of input pinion gears and the plurality of motors so as to achieve the desired pump rate.                                                                                                        |
| 17    | The method of claim 15, wherein the plurality of motors comprises one of a plurality of electric motors or a plurality of hydraulic motors.                                                                                                                                                                             |
| 18    | The method of claim 15, wherein the maximum pump speed correlates to a critical plunger speed associated with the multi-plunger hydraulic fracturing pump.                                                                                                                                                              |
| 19    | The method of claim 15, further comprising: connecting a variable frequency drive (VFD) to the plurality of motors so as to control the speed of the plurality of motors, wherein the VFD is positioned to accelerate or decelerate pump rotational speeds associated with the multi-plunger hydraulic fracturing pump. |
| 20    | The method of claim 19, the method further comprising: detecting an overpressure event with respect to the multi-plunger hydraulic fracturing pump; and automatically shutting off the VFD.                                                                                                                             |