

CLAIM LISTING FOR U.S. PATENT NO. 10,655,435

Claim Number	Claim Element
1[p]:	A hydraulic fracturing system, comprising:
1[a]	a plurality of pumps positioned at a wellsite and configured to pressurize a fracturing fluid;
1[b]	a distribution system fluidly coupled to receive and consolidate fracturing fluid from the plurality of pumps for injection into a wellhead; and
1[c]	a control system comprising:
1[d]	a plurality of sensing devices configured to measure one or more parameters of the plurality of pumps and the distribution system;
1[e][i]	one or more processing devices configured to receive a first parameter from a first device of the plurality of pumps, the distribution system, or the wellhead, and transmit the first parameter to a second device of the plurality of the plurality [sic] of pumps, the distribution system, or the wellhead, and
1[e][ii]	detect that the first parameter is outside of an acceptable threshold; and
1[e][iii]	generate automated control instructions at the second device based at least in part on the first parameter; and;
1[f]	one or more control devices configured to receive the automated control instructions and automatically adjust one or more aspects of the second device based on the control instructions.
2	The system of claim 1, wherein the plurality of sensing devices are installed on the plurality of pumps and the distribution system, and

	selected from a group including flow sensors, accelerometers, pressure transducer, and tachometers.
3	The system of claim 1, wherein the plurality of pumps or the distribution system includes at least one device selected from a group include a gate, valve, actuator, motor, suction pipe, discharge pipe, engine, transmission, and temperature regulation device, controllable via the one or more control devices.
4[a]	The system of claim 1, further comprising: a suction line through which fracturing fluid is supplied; and
4[b]	a discharge line through which fracturing fluid is discharged, wherein the plurality of sensing devices includes one or more flow sensors configured to measure flow through the suction line and the discharge line.
5[a]	The system of claim 1, further comprising: one or more blenders configured to mix together one or more materials to form the fracturing fluid, wherein the fracturing fluid is provided from the blender to the plurality of pumps via a manifold,
5[b]	wherein the plurality of sensing devices includes one or more pressure or flow sensors for measuring flow conditions at the one or more blenders, the manifold, the plurality of pumps, or the distribution system.
6	The system of claim 5, wherein the one or more control device is configured to control the one or more blenders, the manifold, the

	plurality of pumps and the distribution system based on the flow and/or pressure conditions,
7[p]	A hydraulic fracturing method, comprising,
7[a]	providing a fracturing fluid to a plurality of pumps;
7[b]	pumping the fracturing fluid into a distribution system;
7[c]	injecting the fracturing fluid into a wellhead;
7[d]	measuring one or more parameters of the plurality of pumps, the distribution system, or the wellhead via a plurality of sensing devices instrumented thereon;
7[e]	detecting that a first parameter of the one or more parameters is outside of an acceptable threshold;
7[f]	generating automated instructions for one or more control devices based at least in part on the one or more parameters;
7[g]	automatically adjusting one or more functions of the plurality of pumps, the distribution system, or the wellhead based at least in part on the automated instructions;
7[h]	transmitting the first parameter from a first device of the plurality of pumps, the distribution system, or the wellhead to a second device of the plurality of the plurality of pumps, the distribution system, or the wellhead
7[i]	generating the automated instructions at the second device based at least in part on the first parameter; and

7[j]	automatically adjusting one or more functions of the second device based on the automated instructions.
8[a]	The method of claim 7, further comprising: detecting that a first pump of the plurality of pumps is underperforming; and
8[b]	adjusting one or more of the pumps in the plurality of pumps to compensate for the first pump.
9	The method of claim 8, further comprising: selecting the one or more of the other pumps to adjust based at least in part on the conditions of the other pumps as indicated by one or more of the one or more parameters.
10[a]	The method of claim 7, further comprising: determining that the one or more parameters are indicative of a potential failure condition; and
10[b]	determining a source of the potential failure condition.
11	The method of claim 10, further comprising: generating an alert or notification indicative of the potential failure condition and the source.
12[a]	The method of claim 7, further comprising: logging operation data including a number of strokes and pumping hours performed by a pump of the plurality of pumps; and

12[b]	determining a maintenance schedule based at least in part on the operation data.
13[p]	A hydraulic fracturing method, comprising:
13[a]	performing one or more hydraulic fracturing operations at a hydraulic fracturing system, the hydraulic fracturing system comprising a plurality of pumps, a distribution system, and a wellhead;
13[b]	measuring one or more operational parameters of the plurality of pumps, the distribution system, or the wellhead;
13[c]	transmitting a first parameter of the one or more operational parameters from a first device of the plurality of pumps, the distribution system, or the wellhead to a second device of the plurality of the plurality of pumps, the distribution system, or the wellhead;
13[d]	detecting that the first parameter is outside of an acceptable threshold;
13[e]	generating automated instructions at the second device based at least in part on the first parameter; and
13[f]	automatically adjusting one or more functions of the second device based on the automated instructions.
14	The method of claim 13, wherein the distribution system receives and consolidates the fracturing fluid from the plurality of pumps for injection into a wellhead.

15	The method of claim 14, further comprising: controlling one or more functions of the distribution system based on the automated instructions.
16	The method of claim 13, wherein the first parameter includes measurements of one or more of the plurality of pumps.
17	The method of claim 16, further comprising: controlling one or more of the plurality of pumps individually based on the automated instructions.
18[a]	The method of claim 17, further comprising: detecting that a measurement associated with a first pump of the plurality of pumps is outside of an acceptable threshold; and
18[b]	automatically taking the first pump offline in response to the detection.
19	The method of claim 18, further comprising: adjusting one or more of the other pumps in the plurality of pumps to compensate for taking the first pump offline.