an input parameter value in block 412 and the control loop in blocks 406, 408 is indicated by a dotted line in Figure 7.

The process proceeds to block 414 where the operator stops the controller 102. This action in block 414 will affect the control loop in blocks 406, 408 as indicated by a dashed line in Figure 7. Specifically, stopping the controller 102 in block 414 causes the control loop in blocks 406, 408 to be exited. The process proceeds to block 416 where the physical plant 10 may be disconnected from the supply lines 28, 30 for water and dry cement, respectively, and the discharge line 32 may be disconnected from the pipes coupling the physical plant 10 to the well bore. The other equipment may be disassembled, the well bore may be closed in for a period to allow the cement to set, and the equipment of the physical plant 10 may be flushed and/or cleaned. The process exits at block 418.

In an embodiment, the indication of the height h_1 of the first mixture 13 in the first tank 12, and the indication of the height h_2 of the second mixture 15 in the second tank 16 are provided by two height observer components, which estimate rather than directly sense h_1 and h_2. In another embodiment, a single height observer may be employed to provide an indication of the height h_2 of the second mixture 15 in the second tank 16. In yet another embodiment, a single height observer may be employed to provide an indication of the height h_1 of the first mixture 13 in the first tank 12, for example in a physical plant 10 having only one tank.

Under field conditions, the height indications h_1, h_2 provided by the h_1 sensor 110 and the h_2 sensor 112 may be subject to various errors, for example height oscillations due to movement of the physical plant 10 onboard a floating platform or ship. Additionally, the stirring action of the first stirrer 24 and second stirrer 26 may significantly agitate the level surface of the first mixture 13 in the first tank 12 and of the second mixture 15 in the second tank 16, introducing variations in the height indications h_1 and h_2. The introduction of the first and second materials into the first tank 12, for example dry cement and/or water, may introduce further variations in the height indication h_1 provided by the h_1 sensor 110. All of these surface height variations may be analyzed as noise in the height signals. It may be desirable to employ estimated height indications of h_1 and h_2 rather than propagate the noise or

oscillation that may be present in the indications of direct sensors, for example the h_1 sensor 110 and the h_2 sensor 112, into the controller 102.

Generally, a height observer is implemented as a dynamic control system to obtain an estimated height of the mixture in the tank in real time. First, this estimate of the mixture height is compared to the measured mixture height to obtain a height error. Then this mixture height error is used to drive the estimated mixture height to an actual mixture height through the use of a proportional-integral type controller, also referred to as a PI controller. By setting the gains of the PI controller, the noise and oscillations of the mixture in the tank can be substantially removed from the mixture height estimate while tracking the actual value of the mixture height. The height observer according to the present disclosure reduces the negative effects of noise and poor sensor performance due to environmental effects such as cement dust in the air or tank oscillations from the height readings. This height observer reflects the state of the actual mixture height with substantially no time lag.

Turning now to Figure 8A, a block diagram depicts a general height observer 270. The height observer 270 includes a height PI controller component 272 and a height tank model component 274. An estimated height negative feedback term 273 is negatively summed by a fifth summation component 269 with a sensed height input 271 to determine a third error term $e_3(t)$. As shown in Figure 8A, the estimated height negative feedback term 273 is the same signal as the final output produced by the general height observer 270, an estimated height 277, as described herein. While the value of the estimated height negative feedback term 273 and the estimated height 277 are the same, different labels are used herein to distinguish the different functions to which the signals are applied. The estimated height negative feedback term 273 is fed back into the height observer 270 as an input, thereby creating an estimating control loop, which yields a more accurate estimated height 277 each time through. The third error term $e_3(t)$ is processed by the height PI controller component 272 having a gain K_{p3} for a third proportional component 275 and an integral gain K_{i3} for a third integral component 276 associated with a third integration factor 278. The proportional and integral operations on the third error term $e_3(t)$ are then positively summed by a sixth summation component 280. The temporal response of the height

PI controller component 272 to the third error term $e_3(t)$ input, represented by the function $u_3(t)$, may be expressed mathematically as:

$$u_3(t) = K_{p3}e_3(t) + K_{I3}\int e_3(t)dt \quad (8)$$

The output of the height PI controller component 272 may be employed as an estimate of system errors, for example the difference between the desired and actual volumetric flow rates as well as other parameter estimations, for example the cross sectional area A_1 of the first tank 12. These errors may be collected and referred to as a disturbance, where the disturbance accounts for the discrepancies between what is demanded from the first control system 100 and what the first control system 100 actually produces, unmeasured quantities such as air flows into or out of the subject tank, and inaccuracies of estimates of system parameters. When the physical plant 10 mixes dry cement, there may be differences between the desired cement rate and the actual cement rate, because the cement delivery may be inconsistent. Differences between the desired cement rate and the actual cement rate may be accommodated by the disturbance. The output of the height PI controller component 272 may be referred to as a first disturbance estimate 281. The first disturbance estimate 281 may be fed back into the controller 102 to provide disturbance decoupling. Disturbance decoupling is described in more detail hereinafter.

The output of the height PI controller component 272 (*i.e.*, the output from the sixth summation component 280) is positively summed by a seventh summation component 282 with one or more height feed forward inputs 283, for example volumetric flow rates such as the difference between the commanded volumetric flow rate dv_{in}/dt into the first tank 12 and the volumetric flow rate dv_{12}/dt of cement slurry out of the first tank 12 over the weir 14 into the second tank 16. The performance of the height observer 270 is expected to be improved by using height feed forward inputs 283 as compared to the performance of more traditional controllers, which only employ feedback terms with no feed forward inputs. Because the height of a mixture in a tank, for example the height h_1 of the first mixture 13 in the first tank 12, will increase or decrease due to a net positive or negative volumetric flow rate into the tank, the estimate of the height of the mixture in the tank depends upon the net positive or negative volumetric flow rate into the tank: the height feed forward inputs

283. The height feed forward inputs 283 may be summed either negatively or positively at the seventh summation component 282. The output of the seventh summation component 282 conforms to a volumetric flow rate that may be represented generally as dv/dt.

The height tank model component 274 multiplies the volumetric flow rate output of the seventh summation component 282 by a fourth integral component 284 associated with a fourth integration factor 286. The fourth integral component 284 corresponds to the inverse of the cross-sectional area of the tank, represented by "1/A" in the block for the fourth integral component 284. Multiplying a volumetric flow rate term (dv/dt) by the inverse of an area term, for example the inverse of a cross-sectional tank area expressed as 1/A, results in a velocity term (dx/dt), or more particularly in the case of a height controller, an estimated height rate of change dh/dt 285. The intermediate result of the estimated height rate of change dh/dt 285 may be used by other components in the controller 102, for example by the $flow_2$ state feedback controller with command feed forward 252.

Integrating the velocity term via the fourth integration factor 286 results in a displacement x, or in the present case a height h. Thus, the output of the height tank model component 274 is an estimated height 277 of the mixture in the tank. One skilled in the art will recognize that the results of the analysis of the height observer 270 above may be applied to digital signals as well as analog signals. For example, analog parameters such as the sensed height input 271 may be converted by an analog-to-digital converter (A/D converter) to a digital signal. Similarly, analog outputs may be produced by a digital-to-analog converter (D/A converter), optionally combined with an amplifier to provide sufficient power to drive an electromechanical device, converting a digital control signal to an analog control signal suitable for controlling the first actuator 18 and the second actuator 20. Height observers, such as the height observer 270, are further disclosed in related U.S. Patent Application Serial No. 11/029,072, entitled "Methods and Systems for Estimating a Nominal Height or Quantity of a Fluid in a Mixing Tank While Reducing Noise," filed January 4, 2005, which is incorporated herein by reference for all purposes.

Turning now to Figure 8B, a block diagram shows a portion of one embodiment of the first control system 100 depicted in Figure 2 and Figure 6, incorporating a first

height observer 270-a and a second height observer 270-b rather than directly using the h_1 sensor 110 and the h_2 sensor 112. In the embodiment depicted in Figure 8B, the h_1 sensor 110 provides an indication of the height h_1 of the first mixture 13 in the first tank 12 to the first height observer 270-a, which is negatively summed by a ninth summation component 269-a with a first estimated height negative feedback term 273-a of the first mixture 13 in the first tank 12 to obtain an error term $e_{3\text{-}a}(t)$ that is fed into a first height PI controller component 272-a. The output of the first height PI controller component 272-a is positively summed by a tenth summation component 282-a with a height feed forward input 283-a from an eleventh summation component 279, and the output of the tenth summation component 282-a is processed by a first height tank model component 274-a to produce an estimated height 277-a of the first mixture 13 in the first tank 12. The first proportional factor 284 (*i.e.*, 1/A) for the first height tank model component 274-a employs the cross-sectional area A_1 of the first tank 12. The estimated height 277-a of the first mixture 13 in the first tank 12, which may be referred to as an indication of the height of the first mixture in the first tank 12, is output to the first flow regulator 202 and also to the second height observer 270-b. Note that the estimated height 277-a and the first estimated height negative feedback term 273-a are the same signals but are identified by different labels to point out their different functions in the controller 102. The output from the first height PI controller component 272-a, as a first disturbance estimate signal 281-a, optionally may be negatively summed with the output of the first flow regulator 202 by the eleventh summation component 279 to provide disturbance decoupling to the determination of the commanded volumetric flow rate dv_{in}/dt of material into the first tank 12. In another embodiment, disturbance decoupling is provided by a second disturbance estimate signal 281-b that is negatively summed with the output of the first flow regulator 202 by the eleventh summation component 279. The second disturbance estimate signal 281-b is determined by the second height observer 270-b, as discussed in more detail below. The commanded volumetric flow rate dv_{in}/dt output by the eleventh summation component 279 is the commanded first volume flow rate dv_{in}/dt signal 151 to the flow modulator 150 or to the first and second flow modulators 152, 154 as described above with reference to Figure 3.

The h_2 sensor 112 provides an indication of the height h_2 of the second mixture 15 in the second tank 16 to the second height observer 270-b, which is negatively summed by a twelfth summation component 269-b with a second estimated height negative feedback term 273-b of the second mixture 15 in the second tank 16 to obtain an error term $e_{3\text{-}b}(t)$ that is fed into a second height PI controller component 272-b. The output of the second height PI controller component 272-b is positively summed by a thirteenth summation component 282-b with a second height feed forward input 283-b output by a first calculation component 268. The first calculation component 268 outputs the result of the function $F(h_1)$ based on the estimated height 277-a of the first mixture 13 in the first tank 12 . In an embodiment, the value of $F(h_1)$ is calculated by the first flow regulator 202 and provided to the thirteenth summation component 282-b as the second height feed forward input 283-b. In this embodiment, the first calculation component 268 is not employed. The output of the thirteenth summation component 282-b is then processed by a second height tank model component 274-b to produce a second estimated height 277-b of the second mixture 15 in the second tank 16. The first proportional factor 284 (*i.e.*, 1/A) for the second height tank model component 274-b employs the cross-sectional area A_2 of the second tank 16. Note that the second estimated height 277-b and the second estimated height negative feedback term 273-b are the same signals but are identified by different labels to point out their different functions in the controller 102.

Within the second height observer 270-b, the output from the second height PI controller component 272-b provides the second disturbance estimate signal 281-b that is negatively summed by the eleventh summation component 279, as previously discussed. In an embodiment, the second disturbance estimate signal 281-b may provide a more accurate estimate of the volumetric rate disturbance in the system 100 as compared to the first disturbance estimate signal 281-a because the height of the second mixture 15 in the second tank 16 varies more than the height of the first mixture 13 in the first tank 12. Additionally, in the two tank system of Figure 1, the surface of the first mixture 13 in the first tank 12 may not be level but may slope downwardly from the point where the actuators 18, 20 dispense the materials to the weir 14. The second estimated height 277-b of the second mixture 15 in the second tank 16, which may be referred to as an indication of the height h_2 of the second

mixture 15 in the second tank 16, is fed into the $flow_1$ state feedback controller with command feed forward 250 as an input, and the control process is repeated. The estimated height rate of change dh/dt 277 of the second height observer 270-b, dh_2/dt, is used for state feedback decoupling by the $flow_2$ state feedback controller with command feed forward 252.

The advantages of the height observer 270, such as, for example, attenuation of noise and improvement of poor sensor performance, estimation of a disturbance term, and estimation of a parameter rate of change, may be obtained in a density observer having a structure related to the height observer 270. In an embodiment, the indication of the density ρ_{12} of the first mixture 13 in the first tank 12 and the indication of the density ρ_s of the second mixture 15 in the second tank 16 are provided by two density observer components which estimate rather than directly sense the densities ρ_{12}, ρ_s of the mixtures 13, 15, respectively. In another embodiment, the density observer may be used to estimate the density of other mixtures or materials in systems other than the physical plant 10 depicted in Figure 1.

Turning now to Figure 9A, a general density observer 290 operable to determine an estimated density of a mixture in a tank is depicted. The density observer 290 includes a density PI controller component 292 and a density tank model component 294. An eighth summation component 299 negatively sums an estimated density negative feedback term 295 with a sensed density input 291 to determine a fourth error term $e_4(t)$. The fourth error term $e_4(t)$ is processed by the density PI controller component 292, which has a gain K_{p4} for a fourth proportional component 296 and an integral gain K_{i4} for a fifth integral component 298 associated with a fifth integration factor 300. In an embodiment, the fourth error term $e_4(t)$ may be processed by a filter instead of by the density PI controller component 292, such as an analog filter or a digital filter, to introduce desirable time lags or to attenuate and/or amplify certain frequency components of the fourth error term $e_4(t)$.

The output of the density PI controller component 292 may be employed as an estimate of system errors, for example the difference between the desired and actual mass flow rates as well as other parameter estimations. These errors may be collected and referred to as a disturbance, where the disturbance accounts for the discrepancies between what is demanded from the first control system 100 and what

the first control system 100 actually produces, unmeasured quantities such as air flows into or out of the subject tank, and inaccuracies of estimates of system parameters. The output of the density PI controller component 292 may be referred to as a second disturbance estimate 301. The second disturbance estimate 301 may be fed back into the controller 102 to provide disturbance decoupling. Disturbance decoupling is described in more detail hereinafter.

The output of the density PI controller component 292, which conforms to a mass flow rate, is summed with one or more density feed forward inputs 293, for example a mass flow rate, such as the difference between the commanded mass flow rate into the first tank 12 and the mass flow rate of cement slurry out of the first tank 12 over the weir 14 into the second tank 16, by a third summation component 302. The output of a twelfth multiplication component 435 and the output of a thirteenth multiplication component 440 are also negatively summed by the third summation component 302. Generally, the density feed forward inputs 293 are associated with mass flow into the associated tank and the outputs of the twelfth and thirteenth multiplication components 435, 440 are associated with mass flow out of the associated tank. The output of the third summation component 302 is processed by the density tank model component 294. The density tank model component 294 multiplies the output of the third summation component 302 by a sixth integral component 304 associated with a sixth integration factor 306. The sixth integral component 304 is inversely proportional to the height of the mixture times the cross-sectional area of the tank, as represented by "1/hA" in the block for the sixth integral component 304. Note that dividing a mass flow rate by hA is substantially equivalent to dividing through by the volume of the tank resulting in an estimated density rate of change 307 dρ/dt. The height may be provided by a height sensor, for example the h_1 sensor 110, or the height observer 270. Alternatively, the height may be a fixed constant determined by experimentation to provide a preferred response rate of the general density observer 290. Integrating this quotient with respect to time results in a density. The output of the density tank model component 294 is thus the estimated density 297 of the mixture in the tank. The estimated density negative feedback term 295 is the same signal as the estimated density 297, but the estimated density feedback term 295 is fed back into the eighth summation component 299 at the input

to the density observer 290 to be processed through the PI controller 292 and tank model component 294 to yield a more accurate estimated density 297 each time through. The estimated density negative feedback term 295 is multiplied by a factor A(dh/dt) by the twelfth multiplication component 435 to produce a ρA(dh/dt) term that is negatively fed back to the third summation component 302 as described above. The ρA(dh/dt) term corresponds to a mass rate of change based on changes in the height of the mixture in the tank. The dh/dt factor may be determined from a height sensor or a height observer. Alternatively, in an embodiment of the system 100 that provides no indication or estimate of height of the mixture, the twelfth multiplication 435 may be absent from the general density observer 290. The estimated density negative feedback term 295 is also multiplied by a factor dv/dt by the thirteenth multiplier component 440 to produce a ρ(dv/dt) term that is negatively fed back to the third summation component 302 as described above. The ρ(dv/dt) term corresponds to a mass rate of change due to flow of the mixture out of the tank. In an embodiment, the sensed density input 291 may be provided by a density sensor, for example the ρ_{12} sensor 114, installed in a recirculation line or an outflow line, such as the discharge line 32, associated with the tank. Thus, the density of the mixture as measured in the recirculation line may lag several seconds behind the density of the mixture in the tank. In this embodiment, a time delay of several seconds, such as three seconds, for example, may be introduced in the estimated density negative feedback term 295 before negatively summing with the sensed density 291 at the eighth summation component 299 to determine the fourth error term $e_4(t)$. This allows the sensed and estimated density to be in the same time reference frame before determining the fourth error term $e_4(t)$. The appropriate time delay may be readily determined from experimentation by one skilled in the art and depends upon the viscosity of the mixture and the speed of mixing.

Because the structures of the height observer 270 and the density observer 290 are related, one skilled in the art need only determine the gains appropriate to the height observer 270, determine the gains appropriate to the density observer 290, and configure the two observer structures 270, 290 accordingly. One skilled in the art will recognize that the results of the analysis of the density observer 290 above may be applied to digital signals as well as analog signals. For example, analog parameters

such as the indication of density ρ_s of the second mixture 15 in the second tank 16 from the ρ_s sensor 116 may be converted by an analog-to-digital converter (A/D converter) to a digital signal. Similarly, analog outputs may be produced by a digital-to-analog converter (D/A converter), optionally combined with an amplifier to provide sufficient power to drive an electromechanical device, converting a digital control signal to an analog control signal suitable for controlling the first actuator 18 and the second actuator 20.

Turning now to Figure 9B, a block diagram shows a portion of one embodiment of the first control system 100 incorporating a first density observer 290-a and a second density observer 290-b. The ρ_{12} sensor 114 provides an indication of the density ρ_{12} of the first mixture 13 in the first tank 12 to the first density observer 290-a, which is negatively summed by a fourteenth summation component 299-a with a first estimated density negative feedback term 295-a of the first mixture 13 in the first tank 12 to obtain an error term $e_{4\text{-}a}(t)$. As described above, in an embodiment where the ρ_{12} sensor 114 is located in a recirculation line, the estimated density negative feedback term 295-a may be delayed several seconds before it is input to the fourteenth summation component 299-a. The $e_{4\text{-}a}(t)$ error term is fed into a first density PI controller component 292-a. The output of the first density PI controller component 292-a is positively summed with a first density feed forward input 293-a from a seventeenth summation component 305 by a fifteenth summation component 302-a. The output of a fourteenth multiplication component 435-a and a fifteenth multiplication component 440-a, corresponding to a mass rate of change due to changes in height in the first tank 12 and the mass flow rate out of the first tank 12, respectively, are negatively summed by the fifteenth summation component 302-a The sum output by the fifteenth summation component 302-a is processed by a first density tank model component 294-a. Note that the sixth integral component 304 for the first density tank model component 294-a employs the cross sectional area A_1 of the first tank 12 and the height h_1 of the first mixture 13 in the first tank 12. Note that the first estimated density negative feedback term 295-a and a first estimated density 297-a are the same signals but are identified by different labels to point out their different functions in the controller 102.

The output from the first density PI controller component 292-a, as the second disturbance estimate 301, is negatively summed by the seventeenth summation component 305 with the output from the second flow regulator 204 plus the output generated by a fifth multiplier component 321 to determine the commanded mass flow rate dm_{12}/dt signal 203. The second disturbance estimate 301 provides disturbance decoupling to the determination of the commanded mass flow rate dm_{12}/dt signal 203, while the fifth multiplier component 321 provides state feedback decoupling. The fifth multiplier component 321 outputs the product formed by multiplying the first estimated density 297-a of the first mixture 13 in the first tank 12 by the height rate of change dh_1/dt of the first mixture 13 in the first tank 12 and by the area A_1 of the first tank 12, obtaining the height rate of change dh_1/dt, for example, from the estimated height rate of change 285 output of the first height observer 270a. In another embodiment, the second disturbance estimate 301 may be provided by the second density observer 290-b.

To estimate the density ρ_s of the second mixture 15, the ρ_s sensor 116 provides an indication of the density ρ_s of the second mixture 15 in the second tank 16 to the second density observer 290-b. This indication of ρ_s is summed by an eighteenth summation component 299-b with a second estimated density negative feedback 295-b of the second mixture 15 in the second tank 16 to obtain an error term $e_{4\text{-}b}(t)$. As described above, in an embodiment where the ρ_s sensor 116 is located in a recirculation line or in an outflow line, such as the discharge line 32, the estimated density negative feedback term 295-b may be delayed several seconds before it is input to the eighteenth summation component 299-b. The error term $e_{4\text{-}b}(t)$ is fed into a second density PI controller component 292-b. A second density feed forward input 293-b, output by a sixth multiplier component 322, is positively summed by a nineteenth summation component 302-b with the output of the second density PI controller component 292-b. The sixth multiplier component 322 outputs the product formed by multiplying the first estimated density 297-a of the first mixture 13 in the first tank 12 by the volumetric flow rate dv_{12}/dt of the first mixture 13 into the second tank 16. The output of a sixteenth multiplication component 435-b and a seventeenth multiplication component 440-b, corresponding to a mass rate of change due to changes in height in the second tank 16 and mass flow rate out of the second tank 16,

respectively, are negatively summed by the nineteenth summation component 302-b. The output of the nineteenth summation component 302-b is processed by a second density tank model component 294-b. Note that the sixth integral component 304 for the second density tank model component 294-b employs the cross sectional area A_2 of the second tank 16 and the height h_2 of the second mixture 15 in the second tank 16. The second estimated density 297-b of the second mixture 15 in the second tank 16 is provided as an input to the $flow_2$ state feedback controller with command feed forward 252 for use in generating the commanded mass flow rate dm_{12}/dt, which is the commanded mass flow rate dm_{12}/dt signal 203 provided as a commanded parameter value to the second flow regulator 204 as described above with reference to Figure 4. Note that the second estimated density negative feedback term 295-b and the second estimated density 297-b are the same signals but are identified by different labels to point out their different functions in the controller 102.

One skilled in the art will readily appreciate that the components of the first control system 100 disclosed above are susceptible to many alternate embodiments. While several alternate embodiments are disclosed hereinafter, other embodiments are contemplated by the present disclosure.

Turning now to Figure 10A, a portion of a second control system 364 is depicted. The second control system 364 controls a physical plant 10 having a single tank, such as the first tank 12 of Figure 1, and first and second actuators 18, 20. The second control system 364 uses a height observer 270, which is substantially similar to that described above with respect to Figure 8A, to estimate the height of the first mixture 13 in the first tank 12 and to determine the first disturbance estimate 281.

Several components are combined to provide a first height controller 366 that is substantially similar to the $flow_1$ state feedback controller with command feed forward 250 described above with reference to Figure 5B. Specifically, an eighteenth summation component 346 determines a fifth error term $e_5(t)$ by negatively summing the estimated height 277 produced by the height observer 270 with an h_1 input 340, provided for example by an operator. The fifth error term $e_5(t)$ is processed by a proportional gain term N_p in a seventh multiplication component 344. A thirtieth summation component 426 sums the output of the seventh multiplication component 344 positively with the dv_s/dt input 106 that provides command feed forward. A

twenty-eighth summation component 422 negatively sums the first disturbance estimate 281 with the output of the thirtieth summation component 426. The twenty-eighth summation component 422 provides the same function as the $flow_1$ regulator 202 as described above with reference to Figure 8B. The output of the twenty-eighth summation component 422 is the commanded first volume flow rate dv_{in}/dt signal 151 that is fed to the first and second flow modulators 152, 154 and into the seventh summation component 282 of the height observer 270 as the volume feed forward inputs 283. A first dv_s/dt term 445 is fed negatively into the seventh summation component 282, and the first dv_s/dt term 445 may be obtained either from a flow sensor or may be based on the dv_s/dt input 106. The first flow modulator 152 controls the first actuator 18 based on the commanded first volume flow rate dv_{in}/dt signal 151 and the commanded first mass flow rate dm_{in}/dt signal 153, which is generated as described below with reference to Figure 10B.

Turning now to Figure 10B, another portion of the second control system 364 is depicted. Several components are combined to provide a first density controller 368 that is substantially similar to the $flow_2$ state feedback controller with command feed forward 252 described above with reference to Figure 5C, with the exception that the $(dh_2/dt)A_2$ term associated with the first multiplication component 266 is omitted, because there is no second tank 16 in this embodiment.A twentieth summation component 350 determines a sixth error term $e_6(t)$ by negatively summing the density estimate 297 produced by the modified density observer 356 with the input ρ_s 108. The sixth error term $e_6(t)$ is processed by a proportional gain term K_m in a ninth multiplication component 352. A tenth multiplication component 360 multiplies the density estimate 297 by the dv_s/dt input 106. The second disturbance estimate 362 is negatively summed with the outputs of the ninth and tenth multiplication components 352, 360 by a twenty-ninth summation component 424. The output of the tenth multiplication component 360 may be considered to provide command feed forward to a density controller 368 that comprises the twentieth summation component 350, the ninth multiplication component 352, the tenth multiplication component 360, and the twenty-ninth summation component 424. The output of the twenty-ninth summation component 424 is the commanded first mass flow rate dm_{in}/dt signal 153 that is fed into the first and second flow modulators 152, 154 and into the density observer 290

as the density feed forward inputs 293. The second flow modulator 154 controls the second actuator 20 based on the commanded first volume flow rate dv_{in}/dt signal 151 and the commanded first mass flow rate dm_{in}/dt signal 153, which is generated as described above with reference to Figure 10A.

One of ordinary skill in the art will readily appreciate that no integral processing is employed in the first height controller 366 described above with reference to Figure 10A or in the density controller 368 because the effect of command feed forward and disturbance decoupling is to reduce steady-state error to substantially zero, thereby transforming the second control system 364 from a first order non-linear system (as in the first control system 100), to a first order linear system that may be controlled by proportional controllers. In general, if the disturbances are decoupled or removed using the observers, for example by the height observer 270 and/or the density observer 290, and the command feed forward terms, then a proportional (P) controller may be used with substantially zero steady state error, since the second control system 364 will behave in accordance with a linear first order differential equation. If the disturbances are not decoupled, it may be preferrable to use a PI controller, so that the integral term acts to ensure substantially zero steady state error.

Turning now to Figure 11, a third control system 376 is depicted. The third control system 376 controls a physical plant 10 having two actuators 18, 20; two tanks 12, 16; and only a single sensor, the ρ_{12} sensor 114, measuring the density ρ_{12} of the first mixture 13 in the first tank 12. In this embodiment, the commanded first volume flow rate dv_{in}/dt signal 151 to the first and second flow modulators 152, 154 is provided directly by the dv_s/dt input 106 without employing a flow regulator or other components as in the first control system 100. Also, this embodiment contains no height controller, so an operator may adjust the actual volumetric flow rate dv_s/dt out of the second tank 16 by controlling the outflow pump 22, and thereby maintain the desired height h_2 of the second mixture 15 in the second tank 16.

The density observer 290 determines the density estimate 297 of the density ρ_{12} of the first mixture 13 in the first tank 12 and the second disturbance estimate 362 based on the output of the ρ_{12} sensor 114 and density feed forward inputs 293. Because this embodiment provides no indication of height, the A(dh/dt) term in Figure 9A that is associated with the twelfth multiplier component 435 is omitted. As described above

with reference to Figure 9A, in the present embodiment the height component of the sixteenth integral component 304 is a constant value chosen to provide a desirable system response time. A twenty-second summation component 380 negatively sums the density estimate 297 with a ρ_{12} input parameter value 370 to determine a seventh error term $e_7(t)$, which is multiplied by a proportional gain K_m by an eleventh multiplication component 382. The ρ_{12} input 370, for example, may be provided by an operator through an interface. The twenty-second summation component 380 and the eleventh multiplication component 382 comprise a second density controller 372 that controls the density ρ_{12} of the first mixture 13 in the first tank 12. In steady state conditions, the density of the second mixture 15 in the second tank 16 will follow the controlled density ρ_{12} of the first mixture 13 in the first tank 12. When the ρ_{12} input 370 is changed, the density ρ_s of the second mixture 15 in the second tank 16 will substantially equal the density ρ_{12} of the first mixture 13 in the first tank 12 after a time lag.

A twelfth multiplication component 384 multiplies the density estimate 297 by the approximate actual volumetric flow dv_{12}/dt. Because h_1 is not measured, and the function $F(h_1)$ may not be used, the dv_s/dt input 106 is used to approximate the actual volumetric flow dv_{12}/dt over the weir 14. The output of the twelfth multiplication component 384 provides state feedback decoupling to the control system 376 to compensate for mass leaving the first tank 12.

The second disturbance estimate 362 is negatively summed with the output of the eleventh and twelfth multiplication components 382, 384 by a twenty-first summation component 374 to determine the commanded first mass flow rate dm_{in}/dt signal 153. The commanded first mass flow rate dm_{in}/dt signal 153 is provided to the first and second flow modulators 152, 154 to control the first and second actuators 18, 20 as described above. The output of the twenty-first summation component 374 also provides the density feed forward inputs 293 to the density observer 290.

Turning now to Figure 12, a fourth control system 378 is depicted. The fourth control system 378 is substantially similar to the third control system 376, with the exception that the fourth control system 378 includes the height observer 270 and a second height controller 428. The height observer 270 determines the estimated height 277 of the second mixture 15 in the second tank 16 based on input from the h_2

sensor 112 and the height feed forward inputs 283. A second dv_s/dt factor 450 is negatively summed with the height feed forward inputs 283 and the output of the height PI controller 272 by the seventh summation component 282. The estimated height 277 is negatively summed with the h_2 input 104 by a twenty-third summation component 386 to generate an eighth error term $e_8(t)$. The eighth error term e8(t) is processed by a third PI controller 390 to produce a commanded height signal 430, which is summed with the dv_s/dt input 106 by a twenty-fourth summation component 388 to produce the dv_{in}/dt signal 151 provided to the flow modulators 152, 154. Based on the dv_{in}/dt signal 151 and the dm_{in}/dt signal 153, the first and second flow modulators 152, 154 control the states of the first and second actuators 18, 20 as described above.

While the physical plant 10 controlled by the several embodiments of the control systems 100, 364, 376, and 378 described above included either one or two tanks, in other embodiments the control systems may control mixing parameters of more than two tanks connected in series. In other embodiments, one or more sensors may be employed selected from the ρ_{12} sensor 114, the ρ_s sensor 116, the h_1 sensor 110, the h_2 sensor 112, and a flow rate sensor. Embodiments may use a mixture of sensors with no height observer 270 or density observer 290. Other embodiments may use one or more sensors with one or more height observers 270 and/or density observers 290. While the height observer 270 and the density observer 290 are discussed above, the observer concept may be extended to other sensors to reduce noise output from these and other sensors and to obtain the benefits associated with decoupling or removing disturbances and estimating intermediate rate terms. One skilled in the art will readily appreciate that coupling among control components may be altered to simplify processing, as for example combining two summation components in series by directing all the inputs to the two summation components to a single summation component or by replacing two components that calculate the same value by one component and routing the output of the one component to two destinations. Alternately, in an embodiment, a summation component summing more than two inputs may be expanded into a series of two or more summation components that collectively sum the several inputs.

The controller 102 used in the various control systems 100, 364, 376, and 378 described above may be implemented on any general-purpose computer with sufficient processing power, memory resources, and network throughput capability to handle the necessary workload placed upon it. Figure 13 illustrates a typical, general-purpose computer system 580 suitable for implementing one or more embodiments of the several control system embodiments disclosed herein. The computer system 580 includes a processor 582 (which may be referred to as a central processor unit or CPU) in communication with memory devices including secondary storage 584, read only memory (ROM) 586, random access memory (RAM) 588, input/output (I/O) 590 devices, and network connectivity devices 592. The processor may be implemented as one or more CPU chips. The commands or signals output to the first actuator 18 and the second actuator 20 may be converted from a digital to an analog signal by a digital to analog converter (DAC), not shown, or otherwise conditioned to make the actuator signal conformable to a control input to the first actuator 18 and a control input to the second actuator 20.

The secondary storage 584 typically comprises one or more disk drives or tape drives and is used for non-volatile storage of data and as an over-flow data storage device if RAM 588 is not large enough to hold all working data. Secondary storage 584 may be used to store programs that are loaded into RAM 588 when such programs are selected for execution. The ROM 586 is used to store instructions and perhaps data that are read during program execution. ROM 586 is a non-volatile memory device which typically has a small memory capacity relative to the larger memory capacity of secondary storage 584. The RAM 588 is used to store volatile data and perhaps to store instructions. Access to both ROM 586 and RAM 588 is typically faster than to secondary storage 584.

I/O devices 590 may include printers, video monitors, liquid crystal displays (LCDs), touch screen displays, keyboards, keypads, switches, dials, mice, track balls, voice recognizers, card readers, paper tape readers, or other well-known input devices. The network connectivity devices 592 may take the form of modems, modem banks, ethernet cards, universal serial bus (USB) interface cards, serial interfaces, token ring cards, fiber distributed data interface (FDDI) cards, wireless local area network (WLAN) cards, radio transceiver cards such as Global System for Mobile

Communications (GSM) radio transceiver cards, and other well-known network devices. These network connectivity devices 592 may enable the CPU 582 to communicate with an Internet or one or more intranets. With such a network connection, it is contemplated that the CPU 582 might receive information from the network, or might output information to the network in the course of performing the above-described method steps. Such information, which is often represented as a sequence of instructions to be executed using processor 582, may be received from and outputted to the network, for example, in the form of a computer data signal embodied in a carrier wave.

Such information, which may include data or instructions to be executed using processor 582 for example, may be received from and outputted to the network, for example, in the form of a computer data baseband signal or signal embodied in a carrier wave. The baseband signal or signal embodied in the carrier wave generated by the network connectivity devices 592 may propagate in or on the surface of electrical conductors, in coaxial cables, in waveguides, in optical media, for example optical fiber, or in the air or free space. The information contained in the baseband signal or signal embedded in the carrier wave may be ordered according to different sequences, as may be desirable for either processing or generating the information or transmitting or receiving the information. The baseband signal or signal embedded in the carrier wave, or other types of signals currently used or hereafter developed, referred to herein as the transmission medium, may be generated according to several methods well known to one skilled in the art.

The processor 582 executes instructions, codes, computer programs, scripts which it accesses from hard disk, floppy disk, optical disk (these various disk based systems may all be considered secondary storage 584), ROM 586, RAM 588, or the network connectivity devices 592.

While several embodiments have been provided in the present disclosure, it should be understood that the disclosed systems and methods may be embodied in many other specific forms without departing from the spirit or scope of the present disclosure. The present examples are to be considered as illustrative and not restrictive, and the intention is not to be limited to the details given herein, but may be modified within the scope of the appended claims along with their full scope of

equivalents. For example, the various elements or components may be combined or integrated in another system or certain features may be omitted, or not implemented.

Also, techniques, systems, subsystems and methods described and illustrated in the various embodiments as discrete or separate may be combined or integrated with other systems, modules, techniques, or methods without departing from the scope of the present disclosure. Other items shown or discussed as directly coupled or communicating with each other may be coupled through some interface or device, such that the items may no longer be considered directly coupled to each other but may still be indirectly coupled and in communication, whether electrically, mechanically, or otherwise with one another. Other examples of changes, substitutions, and alterations are ascertainable by one skilled in the art and could be

thout departing from the spirit and scope disclosed herein.

What is claimed is:

1. A control system for mixing at least two materials in a physical system having two or more tanks, comprising:

at least two actuators, each actuator being operable to introduce a material into a first tank to form a first mixture, the first mixture flowing into a second tank to form a second mixture; and

a controller operable, based on a commanded input, to control the at least two actuators to obtain a density of either the first mixture or the second mixture and a volume flow rate of the second mixture out of the second tank;

wherein the density is controlled independently from the volume flow rate.

2. The control system of Claim 1, wherein the actuators are selected from the group consisting of valves, screw feeders, augurs, and elevators.

3. The control system of Claim 1, wherein the materials are selected from the group consisting of water, carrier fluid, dry cement material, sand, and proppants.

4. The control system of Claim 1 wherein the commanded input comprises:

a commanded combined volume flow rate of the materials passing through the actuators into the first tank [commanded dv_{in}/dt]; and

a commanded combined mass flow rate of the materials passing through the actuators into the first tank [commanded dm_{in}/dt].

5. The control system of Claim 4, wherein a first actuator is controlled by a first signal based on a function f_1 where:

f_1 = [commanded dm_{in}/dt – (commanded dv_{in}/dt) x ρ_{m2}] / (ρ_{m1}– ρ_{m2})

wherein: ρ_{m1} = density of a first material; and

ρ_{m2} = density of a second material.

6. The control system of Claim 4, wherein a second actuator is controlled by a second signal based on a function f_2 where:

f_2 = [(commanded dv_{in}/dt) x ρ_{m1} – commanded dm_{in}/dt] / (ρ_{m1}– ρ_{m2})

wherein: ρ_{m1} = density of a first material; and

ρ_{m2} = density of a second material.

7. The control system of Claim 4, wherein the commanded dv_{in}/dt is based, at least in part, on a volumetric flow rate command feed forward input [dv_s/dt input] and the

commanded dm_{in}/dt is based, at least in part, on a first indication of density of the first mixture and a first commanded density of the first mixture or the second mixture.

8. The control system of Claim 7, wherein the commanded dv_{in}/dt is further based, at least in part, on an indication of height of the second mixture in the second tank and an operator input height of the second mixture.

9. The control system of Claim 7, wherein the commanded dv_{in}/dt is further based, at least in part, on the quantity:

$$F(h)(1-K_v) + K_v(\text{commanded } dv_{12}/dt)$$

wherein: K_v = a first constant of proportionality;

$F(h)$ = a non-linear function of a height of the first mixture in the first tank;

and

commanded dv_{12}/dt = a commanded volume flow rate of the first mixture flowing from the first tank into the second tank.

10. The control system of Claim 10, wherein the commanded dv_{12}/dt is based on:

a first error term determined by subtracting an indication of a height of the second mixture in the second tank from an operator input desired height of the second mixture in the second tank [h_2 input]; and

an operator input desired volume flow rate of the second mixture out of the second tank [dv_s/dt input].

11. The control system of Claim 10, wherein the first error term is processed by either a first proportional integral controller component or a first proportional controller component.

12. The control system of Claim 7, wherein the commanded dv_{in}/dt is further based, at least in part, on a volumetric disturbance estimate.

13. The control system of Claim 7, wherein the commanded dm_{in}/dt is further based, at least in part, on the quantity:

$$F(h)(\rho_{12})(1-K_m) + K_m(\text{commanded } dm_{12}/dt);$$

wherein: K_m = a second constant of proportionality;

$F(h)$ = a non-linear function of a height of the first mixture in the first tank;

commanded dm_{12}/dt = a commanded mass flow rate of the first mixture flowing from the first tank into the second tank; and

ρ_{12} = an indication of the density of the first mixture in the first tank.

14. The control system of Claim 13, wherein the commanded dm_{12}/dt is based on a second error term determined by subtracting the first indication of density from the first commanded density.

15. The control system of Claim 13, wherein the commanded dm_{12}/dt is based on a second error term determined by subtracting a second indication of density of the second mixture from the first commanded density of the second mixture.

16. The control system of Claim 15, wherein the second error term is processed by either a second proportional integral controller component or a second proportional controller component.

17. The control system of Claim 15, wherein the commanded dm_{12}/dt is further based on a parameter selected from the group consisting of:

an operator input desired volume flow rate of the second mixture out of the second tank [dv_s/dt input]; and

an indication of a height rate of change of the second mixture in the second tank.

18. The control system of Claim 7, wherein the commanded dm_{in}/dt is further based, at least in part, on a mass disturbance estimate.

19. The control system of Claim 7, wherein the commanded dv_{in}/dt is further based, at least in part, on an indication of height of the first mixture in the first tank and a commanded height of the first mixture in the first tank.

20. The control system of Claim 19, further comprising:

a first height sensor operable to produce a first sensed height output of the first mixture in the first tank; and

a first height observer operable to provide the indication of height of the first mixture in the first tank based on the first sensed height output, the commanded height, and a commanded volumetric flow rate.

21. The control system of Claim 20, wherein the first height observer is further operable to provide a first disturbance estimate.

22. The control system of Claim 20, further comprising:

a second height sensor operable to produce a second sensed height output of the second mixture in the second tank; and

a second height observer operable to provide an indication of height of the second mixture in the second tank based on the second sensed height output and on the indication of height of the first mixture in the first tank.

23. The control system of Claim 22, wherein the second height observer is further operable to provide the first disturbance estimate.

24. The control system of Claim 7, further comprising:

a first density sensor operable to produce a first sensed density output of the first mixture in the first tank; and

a first density observer operable to provide the indication of density of the first mixture in the first tank based on the first sensed density output, the first commanded density of the first mixture, and a mass flow rate.

25. The control system of Claim 24, wherein the first density observer comprises:

a third proportional integral controller responsive to a third error term determined as the sensed density output minus the first indication of density of the first mixture in the first tank; and

a tank model having an integrating component and a gain component, the gain component inversely proportional to the area of the first tank and to the height of the first mixture in the first tank, the tank model responsive to the output of the third proportional integral controller.

26. The control system of Claim 25, wherein the first indication of density is delayed before determining the third error term.

27. The control system of Claim 24, wherein the first density observer is further operable to provide a second disturbance estimate.

28. The control system of Claim 24, further comprising:

a second density sensor operable to produce a second sensed density output of the second mixture in the second tank; and

a second density observer operable to provide an indication of the density of the second mixture in the second tank based on the second sensed density output and the indication of density of the first mixture in the first tank.

29. The control system of Claim 28, wherein the second density observer is further operable to provide the second disturbance estimate.

30. A control system for mixing at least two materials in a tank, comprising:

at least two actuators, each actuator being operable to introduce a material into the tank to form a mixture; and

a controller operable, based on a commanded input, to control the at least two actuators to obtain a density of the mixture and a volume flow rate of the mixture out of the tank;

wherein the density is controlled independently from the volume flow rate.

31. The control system of Claim 30, wherein the commanded input comprises:

a commanded combined volume flow rate of the materials passing through the actuators into the tank [commanded dv_{in}/dt]; and

a commanded combined mass flow rate of the materials passing through the actuators into the tank [commanded dm_{in}/dt].

32. The control system of Claim 31, wherein a first actuator is controlled by a first signal based on a function f_1, where:

f_1 = [commanded dm_{in}/dt – (commanded dv_{in}/dt) x ρ_{m2}] / (ρ_{m1} – ρ_{m2})

wherein: ρ_{m1} = density of a first material; and

ρ_{m2} = density of a second material.

and wherein a second actuator is controlled by a second signal based on a function f_2, where:

f_2 = [(commanded dv_{in}/dt) x ρ_{m1} – commanded dm_{in}/dt] / (ρ_{m1} – ρ_{m2}).

33. The control system of Claim 31, wherein the commanded dv_{in}/dt is based, at least in part, on a volumetric flow rate command feed forward input [dv_s/dt input] and the commanded dm_{in}/dt is based, at least in part, on an indication of density of the mixture and a first commanded density of the mixture.

34. The control system of Claim 33, wherein the indication of density is provided by a density observer and the commanded dm_{in}/dt is further based, at least in part, on a mass flow rate disturbance estimate output by the density observer.

35. The control system of Claim 33, wherein the commanded dv_{in}/dt is further based, at least in part, on an indication of height of the mixture in the tank and a commanded height of the mixture in the tank.

36. The control system of Claim 35, wherein the indication of height is provided by a height observer and the commanded dv_{in}/dt is further based, at least in part, on a volumetric disturbance estimate output by the height observer.

37. A control system for mixing at least two materials, comprising:

a controller operable to control a physical system comprising a plurality of actuators, each actuator being operable to introduce a material into a first tank to form a first mixture;

wherein the controller operates the actuators to control a desired characteristic of the first mixture.

38. The control system of Claim 37, wherein the actuators are selected from the group consisting of valves, screw feeders, augurs, and elevators.

39. The control system of Claim 37, wherein the materials are selected from the group consisting of water, carrier fluid, dry cement material, sand, and proppants.

40. The control system of Claim 37, wherein the controller further operates the actuators to control a desired operating parameter of the physical system.

41. The control system of Claim 37, wherein the controller further operates the actuators based on a combination of sensors, the sensors selected from the group consisting of: a density sensor measuring the density of the first mixture, a flow rate sensor, and a mixture height sensor measuring the height of the first mixture.

42. The control system of Claim 41, wherein the mixture height sensor comprises a height observer.

43. The control system of Claim 41, wherein the density sensor comprises a density observer.

44. The control system of Claim 41, wherein the first mixture overflows the first tank into a second tank to form a second mixture, and wherein the controller further operates the actuators to control a desired characteristic of the second mixture.

45. The control system of Claim 44, wherein the controller employs feed forward based on an input selected from the group consisting of: a combined inflow volume of the materials introduced by the actuators, a volume of the first mixture flowing into the second tank, a volume of the second mixture flowing out of the second tank, a density of the first mixture, and a density of the second mixture.

46. The control system of Claim 44, wherein the sensors are further selected from the group consisting of: a density sensor measuring the density of the second mixture and a mixture height sensor measuring the height of the second mixture.

47. The control system of Claim 46, wherein the mixture height sensor measuring the height of the second mixture comprises a height observer.

48. The control system of Claim 46, wherein the density sensor measuring the density of the second mixture comprises a density observer.

49. A method for mixing at least two materials, comprising:

introducing the at least two materials into a physical system;

combining the at least two materials to form a mixture thereof;

independently controlling a desired characteristic of the mixture of the at least two materials and a desired parameter of the physical system.

50. The method of Claim 49, wherein the controlling involves decoupling a volumetric flow rate disturbance parameter.

51. The method of Claim 49, wherein the controlling involves decoupling a mass flow rate disturbance parameter.

52. A method for mixing at least two materials, comprising:

determining a commanded combined mass flow rate of the at least two materials into a first tank [commanded dm_{in}/dt];

determining a commanded combined volume flow rate of the at least two materials into the first tank [commanded dv_{in}/dt]; and

independently controlling, based on the commanded dm_{in}/dt and the commanded dv_{in}/dt, a density of a mixture of the at least two materials in the first tank [ρ_{12}]and a volume flow rate of the mixture out of the first tank [dv_{12}/dt].

53. The method of Claim 52, wherein the controlling includes regulating at least two actuators, each actuator being operable to dispense one of the at least two materials, respectively, into the first tank.

54. The method of Claim 52, further including:

determining a commanded mass flow rate of the mixture from the first tank into a second tank [commanded dm_{12}/dt]; and wherein determining the commanded dm_{in}/dt is based on an indication of the density of the mixture in the first tank and the commanded dm_{12}/dt; and

determining a commanded volume flow rate of the mixture from the first tank into the second tank [commanded dv_{12}/dt]; and wherein determining the commanded dv_{in}/dt is based on an indication of a height of the mixture in the first tank and the commanded dv_{12}/dt.

55. The method of Claim 54, further comprising:

determining a desired height of the mixture in the second tank [input h_2];

determining a desired volume flow rate of the mixture out of the second tank [input dv_s/dt], wherein determining the commanded dv_{12}/dt is based on the input h_2, the input dv_s/dt, and an indication of a height of the mixture in the second tank; and

determining a desired density of the mixture in the second tank [input ρ_s], wherein determining the commanded dm_{12}/dt is based on the input ρ_s and an indication of a density of the mixture in the second tank.

56. The method of Claim 55, further comprising:

sensing the density of the mixture in the first tank [ρ_{12} sensor];

determining an estimated density of the mixture in the first tank [estimated ρ_{12}] based on the ρ_{12} sensor and on the commanded dm_{12}/dt;

providing the estimated ρ_{12} as the indication of the density of the mixture in the first tank;

sensing the density of the mixture in the second tank [ρ_s sensor];

determining an estimated density of the mixture in the second tank [estimated ρ_s] based on ρ_s sensor and on the indication of the density of the mixture in the first tank; and

providing the estimated ρ_s as the indication of the density of the mixture in the second tank.

57. The method of Claim 55, further comprising:

sensing the height of the mixture in the first tank [h_1 sensor];

determining an estimated height of the mixture in the first tank [h_1 estimated] based on h_1 sensor and on the commanded dv_{12}/dt;

providing the estimated h_1 as the indication of the height of the mixture in the first tank;

sensing the height of the mixture in the second tank [h_2 sensor];

determining an estimated height of the mixture in the second tank [h_2 estimated] based on h_2 sensor and on the indication of the height of the mixture in the first tank; and

providing the estimated h_2 as the indication of the height of the second mixture in the second tank.

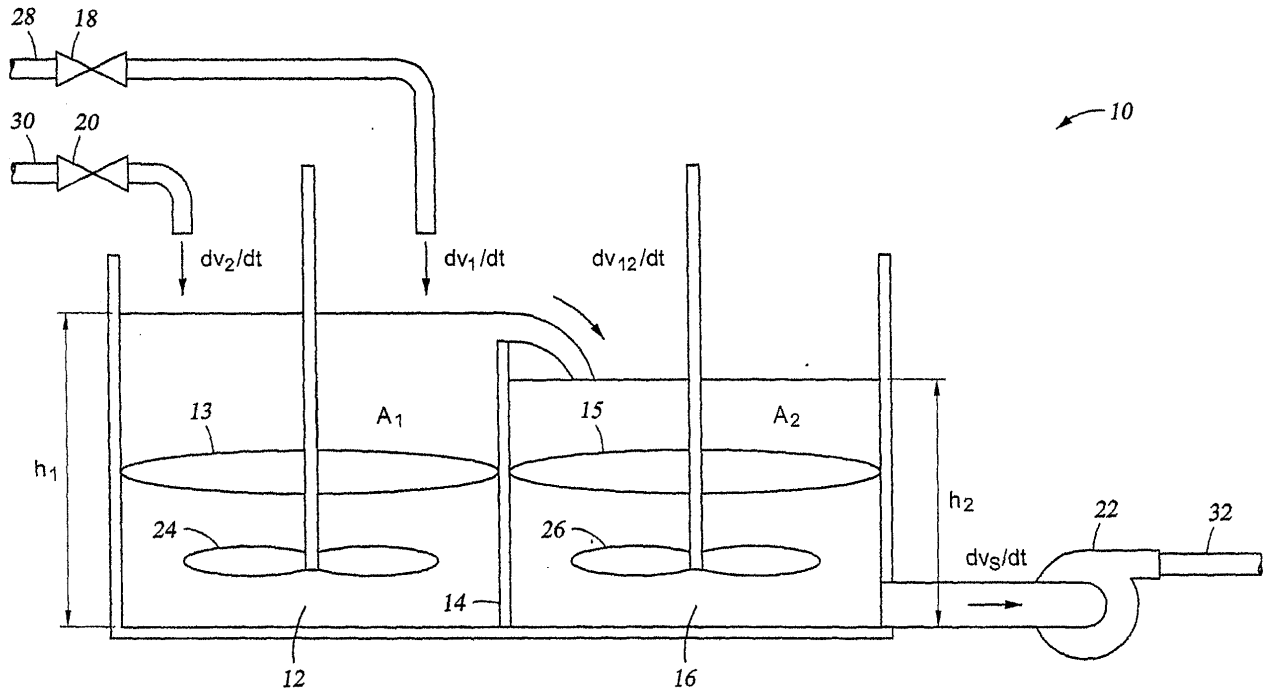

28
18
30
20
10
dv2/dt
dv1/dt
dv12/dt
13
A1
15
A2
h1
h2
24
26
22
32
dvS/dt
14
12
16

Fig. 1

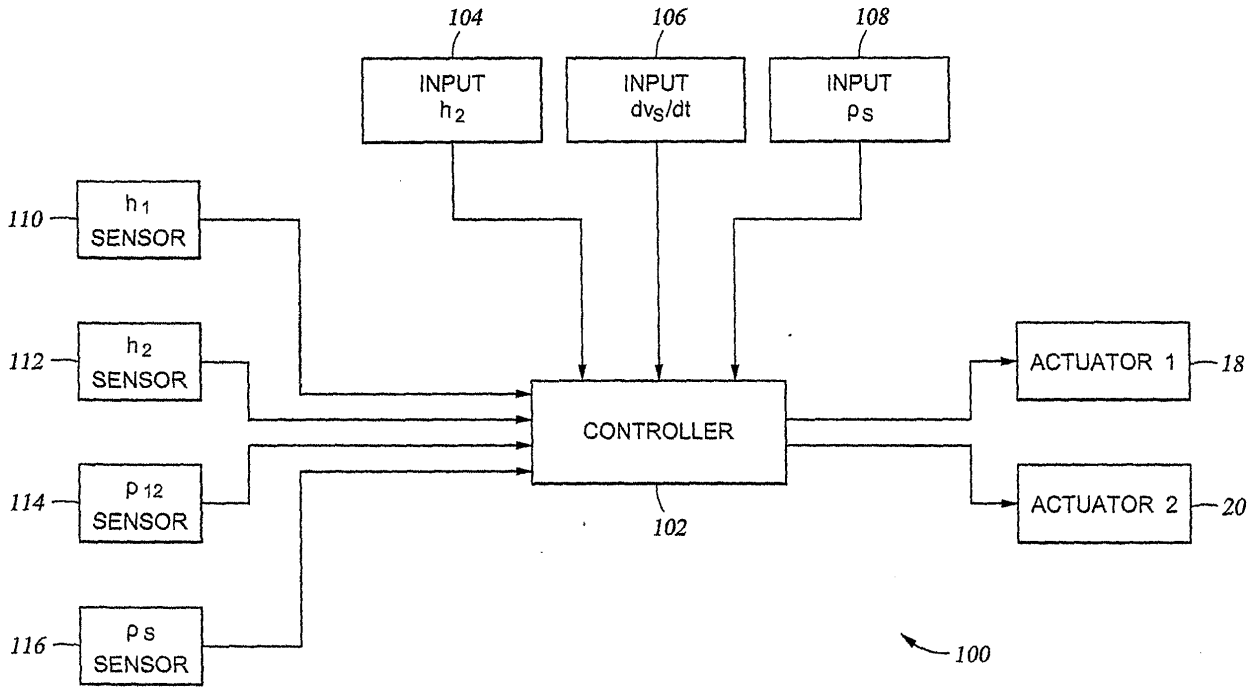

104
106
108
INPUT
h2
INPUT
dvS/dt
INPUT
pS
110
h1
SENSOR
112
h2
SENSOR
114
p12
SENSOR
116
pS
SENSOR
CONTROLLER
102
ACTUATOR 1
18
ACTUATOR 2
20
100

Fig. 2

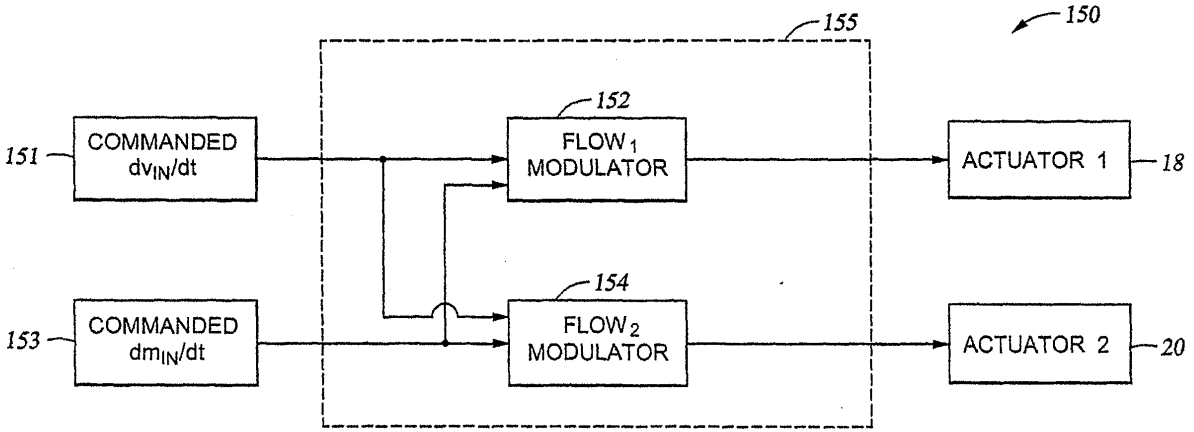

155
150
152
151
COMMANDED
dv_{IN}/dt
FLOW 1
MODULATOR
ACTUATOR 1
18
154
153
COMMANDED
dm_{IN}/dt
FLOW 2
MODULATOR
ACTUATOR 2
20

Fig. 3

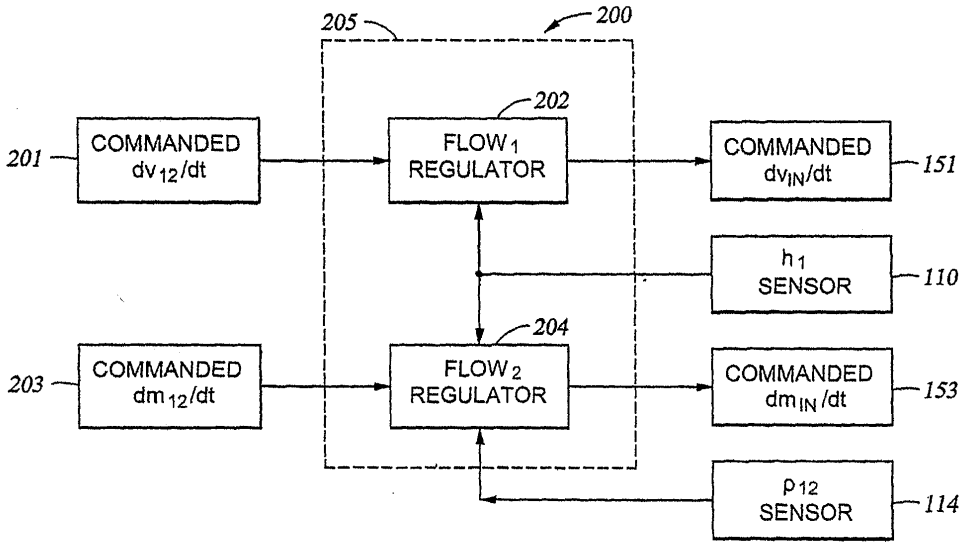

205
200
202
201
COMMANDED
dv12/dt
FLOW1
REGULATOR
COMMANDED
dvIN/dt
151
h1
SENSOR
110
204
203
COMMANDED
dm12/dt
FLOW2
REGULATOR
COMMANDED
dmIN/dt
153
p12
SENSOR
114

Fig. 4

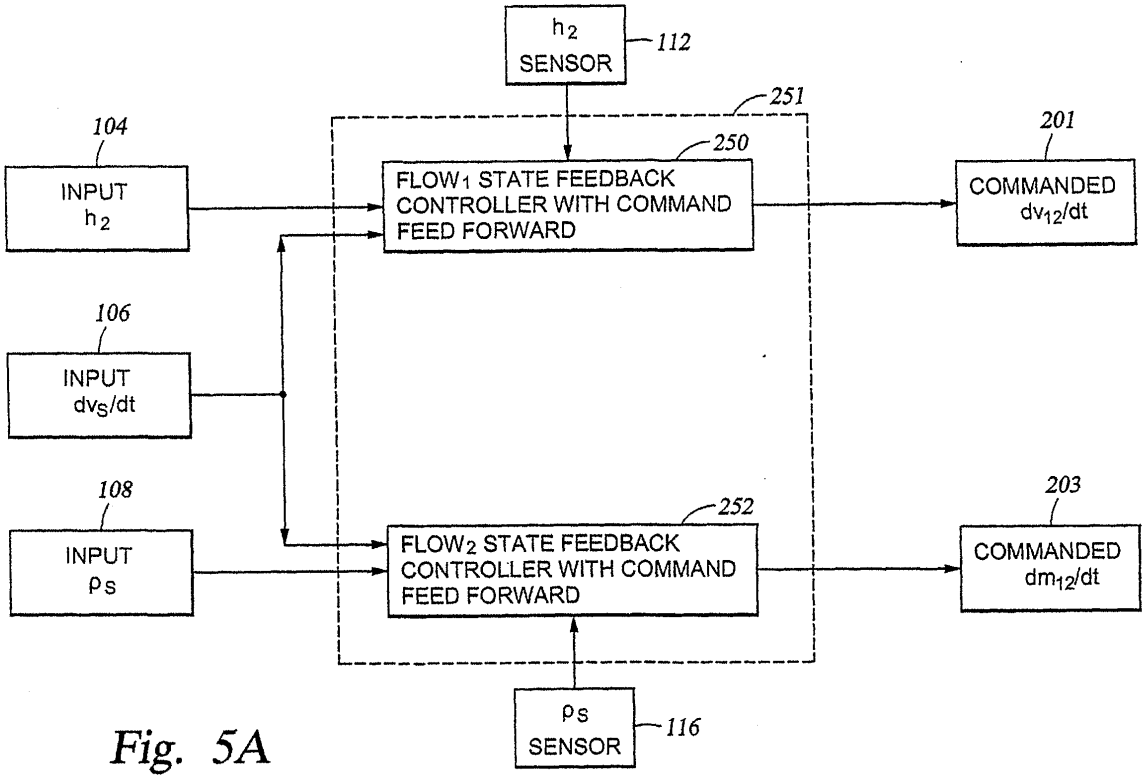

h2
SENSOR
112
251
104
INPUT
h2
250
FLOW1 STATE FEEDBACK
CONTROLLER WITH COMMAND
FEED FORWARD
201
COMMANDED
dv12/dt
106
INPUT
dvS/dt
108
INPUT
ρS
252
FLOW2 STATE FEEDBACK
CONTROLLER WITH COMMAND
FEED FORWARD
203
COMMANDED
dm12/dt
ρS
SENSOR
116

Fig. 5A

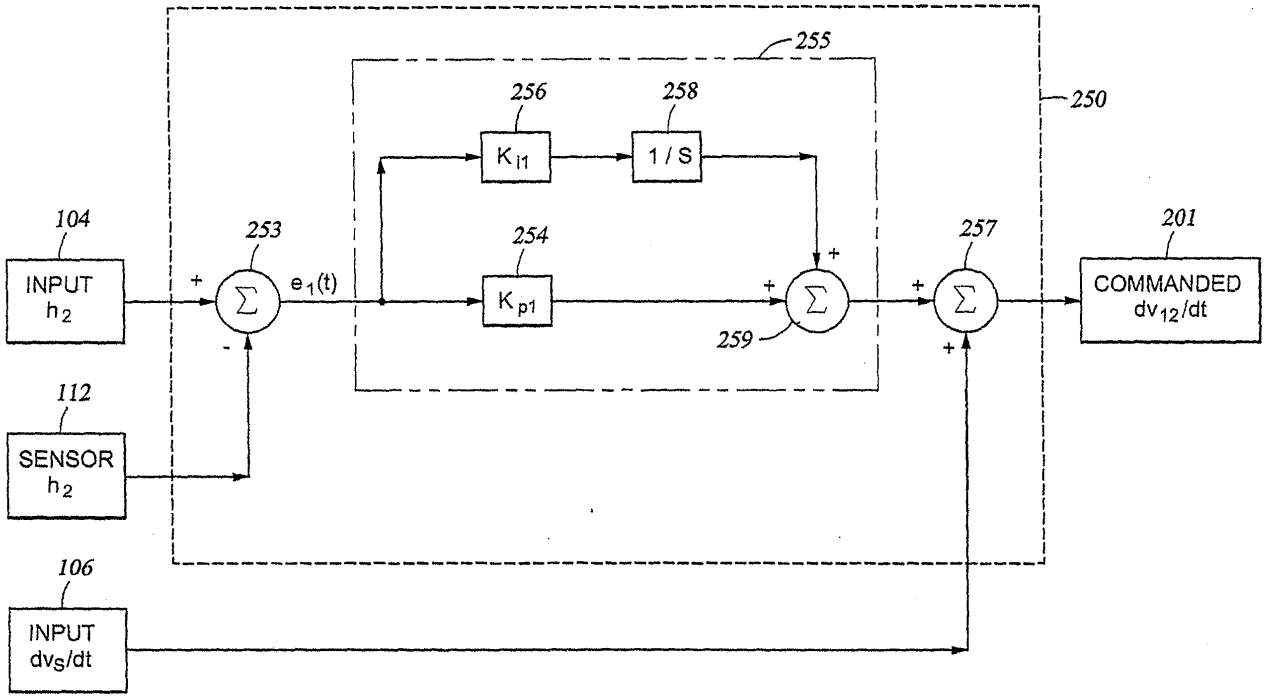

255
250
256
258
K_{I1}
1 / S
104
INPUT
h_2
253
$e_1(t)$
254
K_{P1}
257
201
COMMANDED
dv_{12}/dt
259
112
SENSOR
h_2
106
INPUT
dv_S/dt

Fig. 5B

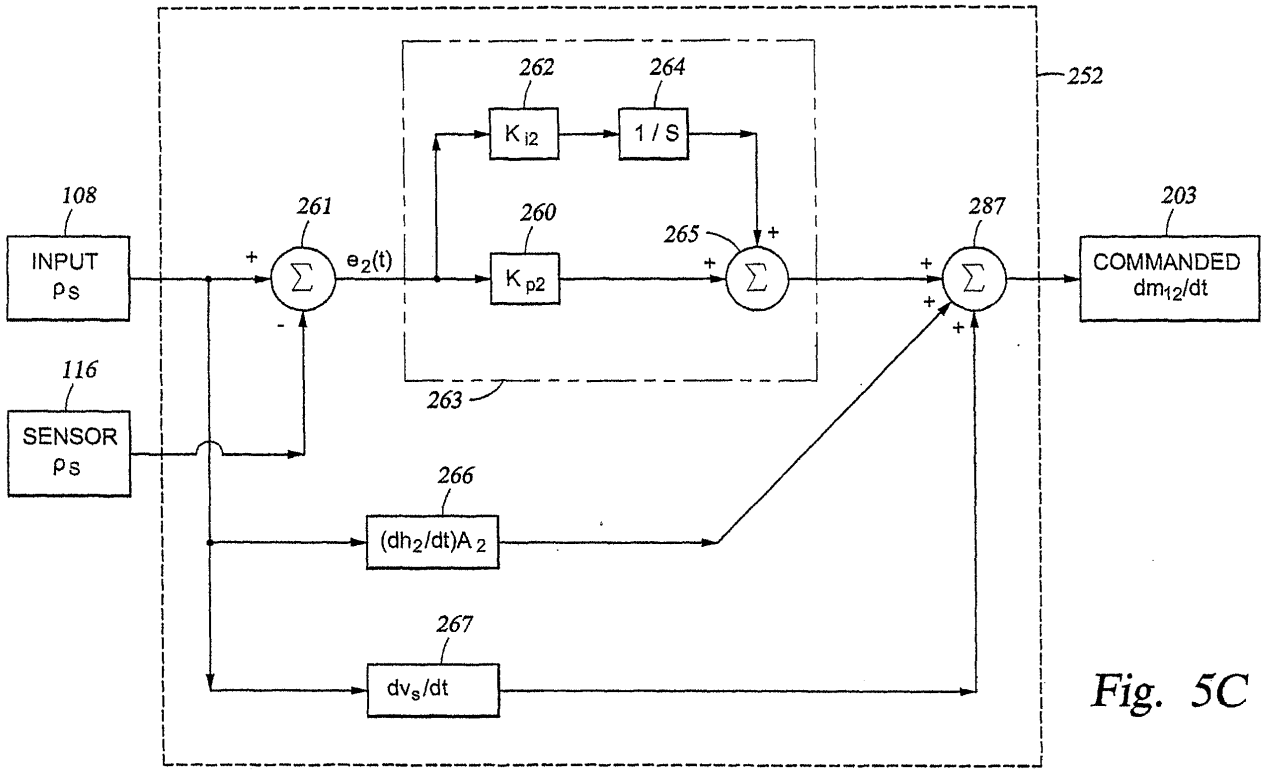

252
262
264
K_{i2}
1 / S
108
INPUT
ρ_S
261
$e_2(t)$
260
K_{p2}
265
287
203
COMMANDED
dm_{12}/dt
116
SENSOR
ρ_S
263
266
$(dh_2/dt)A_2$
267
dv_s/dt

Fig. 5C

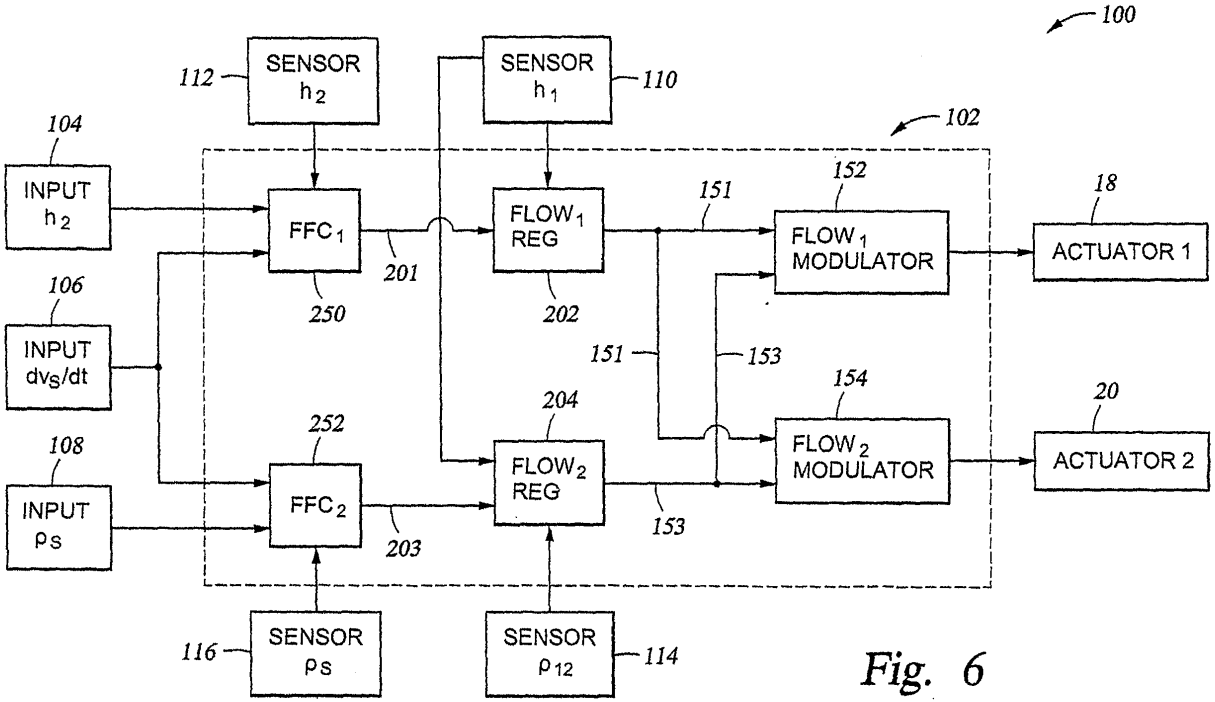

100
102
SENSOR h2
112
SENSOR h1
110
104
INPUT h2
FFC1
201
250
FLOW1 REG
202
151
152
FLOW1 MODULATOR
18
ACTUATOR 1
106
INPUT dvS/dt
151
153
154
204
252
FLOW2 REG
FFC2
203
153
FLOW2 MODULATOR
20
ACTUATOR 2
108
INPUT ρS
SENSOR ρS
116
SENSOR ρ12
114

Fig. 6

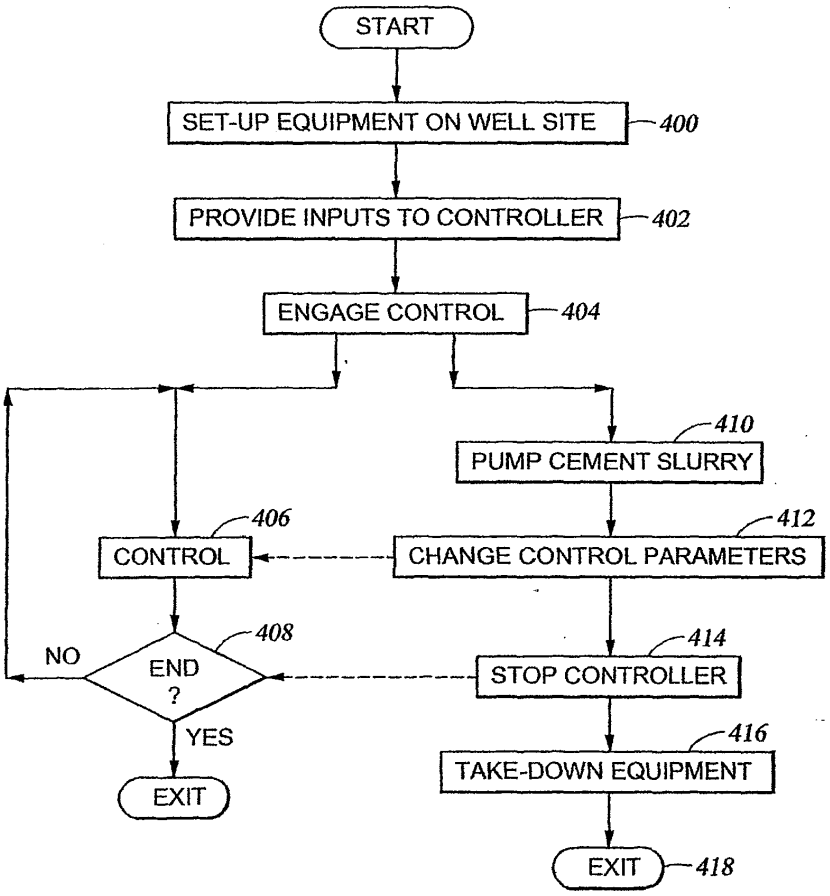

START
SET-UP EQUIPMENT ON WELL SITE
400
PROVIDE INPUTS TO CONTROLLER
402
ENGAGE CONTROL
404
410
PUMP CEMENT SLURRY
406
CONTROL
412
CHANGE CONTROL PARAMETERS
408
NO
END ?
414
STOP CONTROLLER
YES
416
TAKE-DOWN EQUIPMENT
EXIT
EXIT
418

Fig. 7

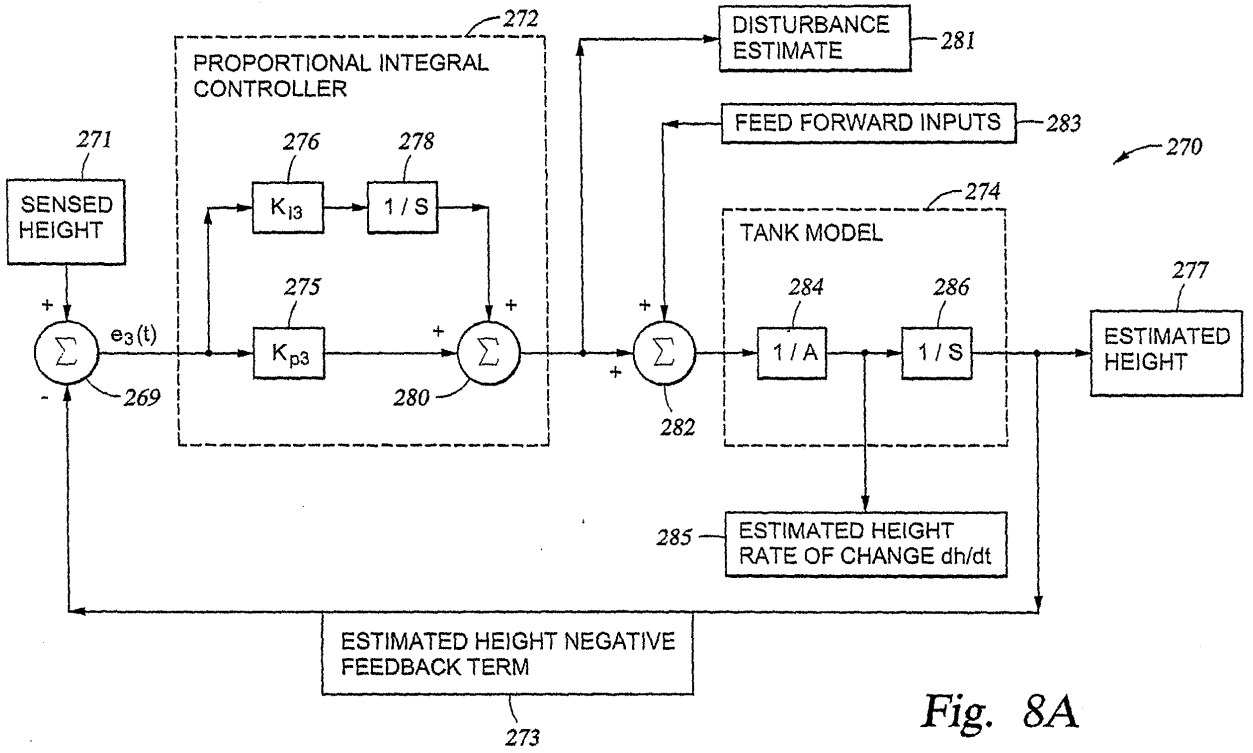

272
PROPORTIONAL INTEGRAL CONTROLLER
DISTURBANCE ESTIMATE
281
FEED FORWARD INPUTS
283
270
271
SENSED HEIGHT
276
278
K_{I3}
1 / S
274
TANK MODEL
275
284
286
277
$e_3(t)$
K_{p3}
1 / A
1 / S
ESTIMATED HEIGHT
269
280
282
285
ESTIMATED HEIGHT RATE OF CHANGE dh/dt
ESTIMATED HEIGHT NEGATIVE FEEDBACK TERM
273

Fig. 8A

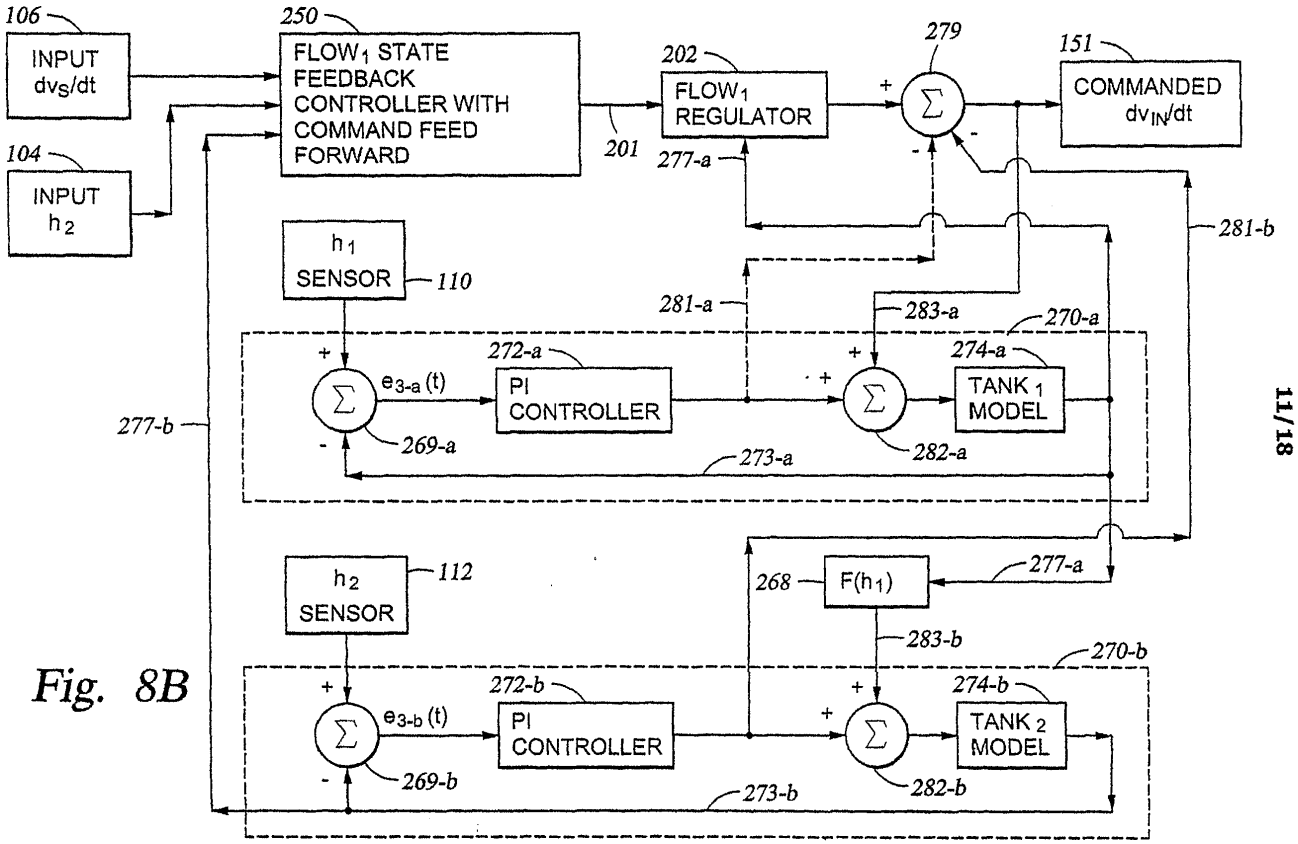

106
INPUT
dvS/dt
104
INPUT
h2
250
FLOW1 STATE
FEEDBACK
CONTROLLER WITH
COMMAND FEED
FORWARD
201
202
FLOW1
REGULATOR
279
151
COMMANDED
dvIN/dt
277-a
281-b
h1
SENSOR
110
281-a
283-a
270-a
272-a
274-a
e3-a (t)
PI
CONTROLLER
TANK 1
MODEL
277-b
269-a
273-a
282-a
h2
SENSOR
112
268
F(h1)
277-a
283-b
270-b
272-b
274-b
e3-b (t)
PI
CONTROLLER
TANK 2
MODEL
269-b
273-b
282-b

Fig. 8B

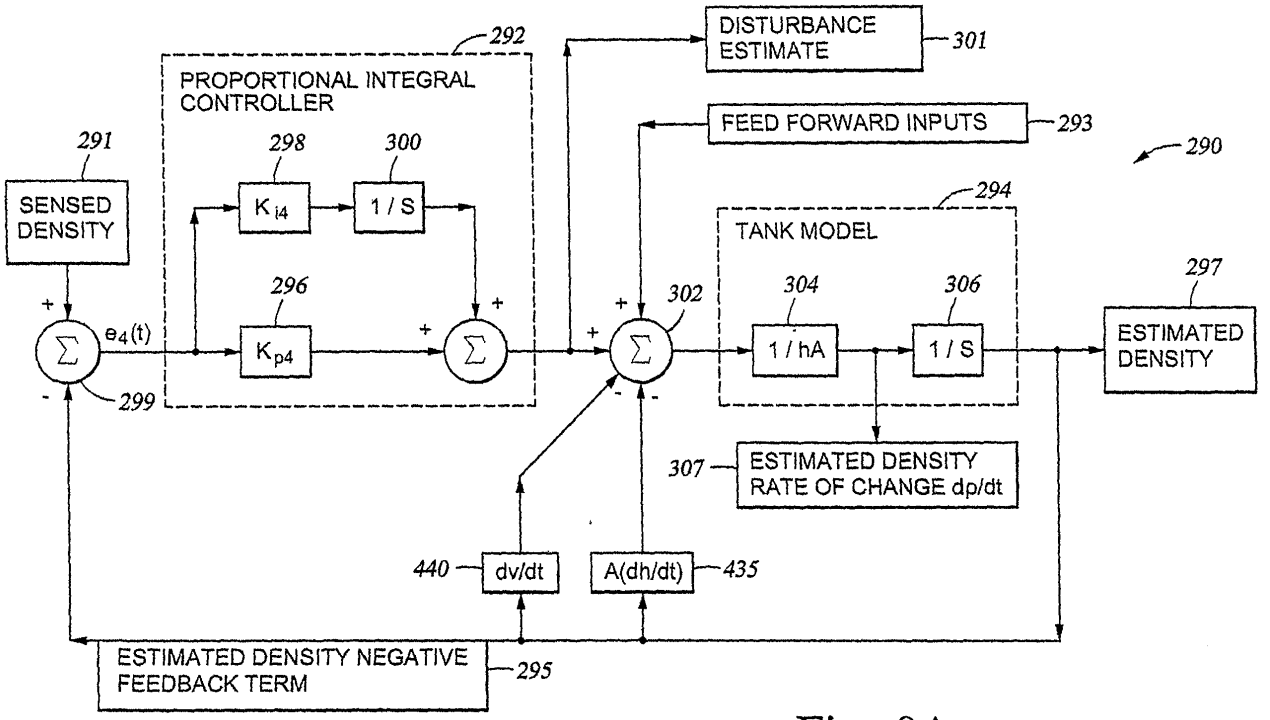

292
PROPORTIONAL INTEGRAL CONTROLLER
DISTURBANCE ESTIMATE
301
FEED FORWARD INPUTS
293
290
291
SENSED DENSITY
298
300
K i4
1 / S
294
TANK MODEL
297
296
304
306
302
e4(t)
K p4
1 / hA
1 / S
ESTIMATED DENSITY
299
307
ESTIMATED DENSITY RATE OF CHANGE dp/dt
440
dv/dt
A(dh/dt)
435
ESTIMATED DENSITY NEGATIVE FEEDBACK TERM
295

Fig. 9A

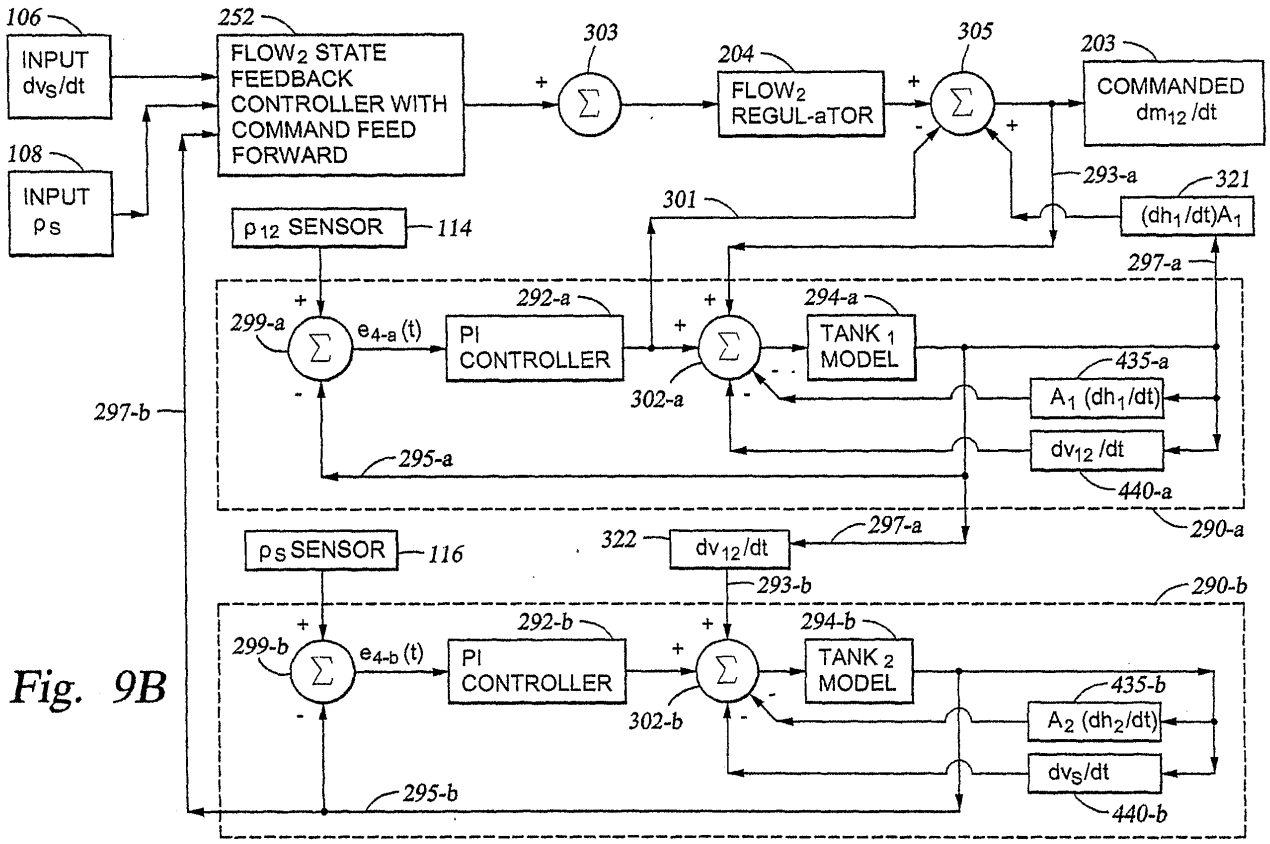

106
INPUT
dvS/dt
108
INPUT
ρS
252
FLOW2 STATE
FEEDBACK
CONTROLLER WITH
COMMAND FEED
FORWARD
303
204
FLOW2
REGUL-aTOR
305
203
COMMANDED
dm12/dt
293-a
321
(dh1/dt)A1
301
ρ12 SENSOR
114
297-a
299-a
e4-a (t)
292-a
PI
CONTROLLER
294-a
TANK 1
MODEL
435-a
A1 (dh1/dt)
dv12/dt
440-a
302-a
297-b
295-a
290-a
ρS SENSOR
116
322
dv12/dt
297-a
293-b
290-b
299-b
e4-b (t)
292-b
PI
CONTROLLER
294-b
TANK 2
MODEL
435-b
A2 (dh2/dt)
dvS/dt
440-b
302-b
295-b

Fig. 9B

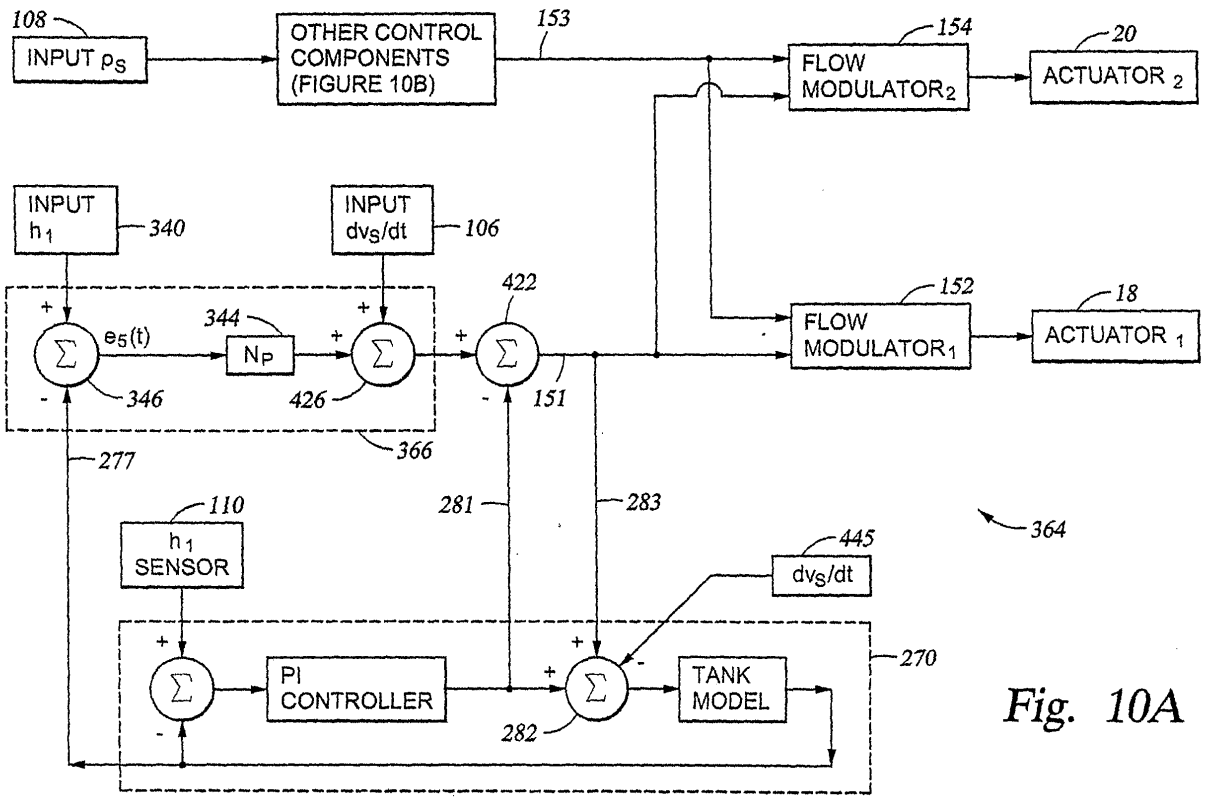

108
INPUT p_S
OTHER CONTROL COMPONENTS (FIGURE 10B)
153
154
FLOW MODULATOR$_2$
20
ACTUATOR $_2$
INPUT h_1
340
INPUT dv_S/dt
106
422
344
$e_5(t)$
N_P
346
426
151
152
FLOW MODULATOR$_1$
18
ACTUATOR $_1$
366
277
281
283
364
110
h_1 SENSOR
445
dv_S/dt
270
PI CONTROLLER
282
TANK MODEL

Fig. 10A

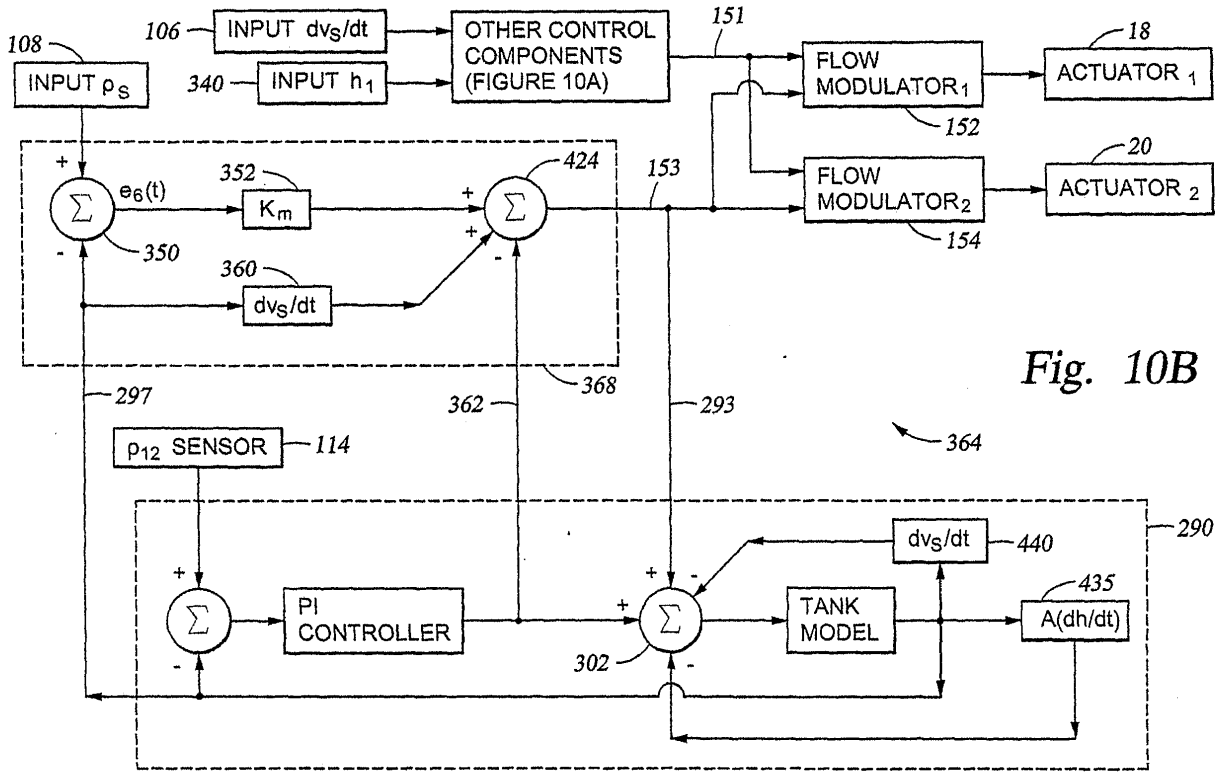

108
INPUT ρ_S
106
INPUT dv_S/dt
340
INPUT h_1
OTHER CONTROL COMPONENTS (FIGURE 10A)
151
FLOW MODULATOR$_1$
152
ACTUATOR $_1$
18
FLOW MODULATOR$_2$
154
ACTUATOR $_2$
20
153
352
K_m
$e_6(t)$
350
424
360
dv_S/dt
368
297
362
293
ρ_{12} SENSOR
114
364
290
PI CONTROLLER
302
TANK MODEL
dv_S/dt
440
435
A(dh/dt)

Fig. 10B

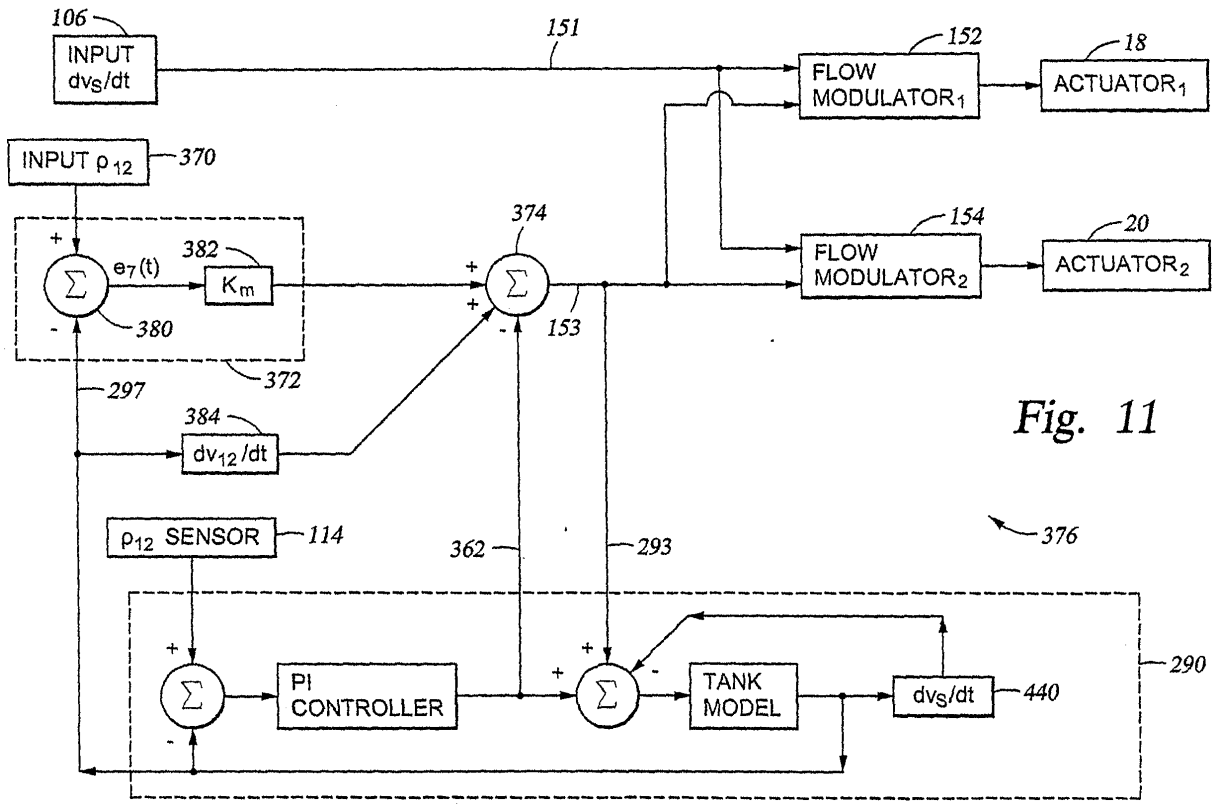

106
INPUT
dvS/dt
151
152
FLOW
MODULATOR1
18
ACTUATOR1
INPUT ρ12
370
374
382
e7(t)
Km
154
FLOW
MODULATOR2
20
ACTUATOR2
380
153
372
297
384
dv12/dt
ρ12 SENSOR
114
362
293
376
PI
CONTROLLER
TANK
MODEL
dvS/dt
440
290

Fig. 11

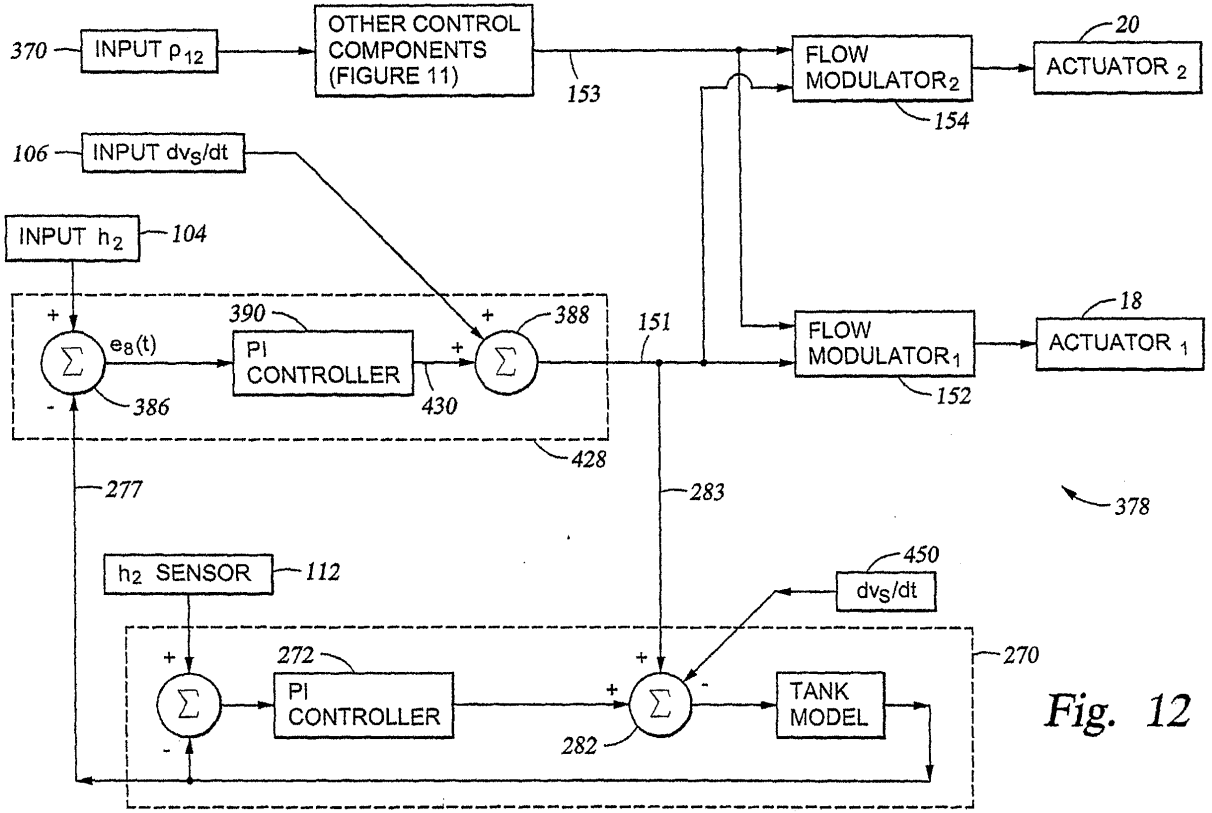

370
INPUT ρ_{12}
OTHER CONTROL COMPONENTS (FIGURE 11)
153
FLOW MODULATOR$_2$
ACTUATOR $_2$
20
154
106
INPUT dv_S/dt
INPUT h_2
104
390
388
151
$e_8(t)$
PI CONTROLLER
386
430
428
FLOW MODULATOR$_1$
ACTUATOR $_1$
18
152
277
283
378
h_2 SENSOR
112
450
dv_S/dt
272
270
PI CONTROLLER
282
TANK MODEL

Fig. 12

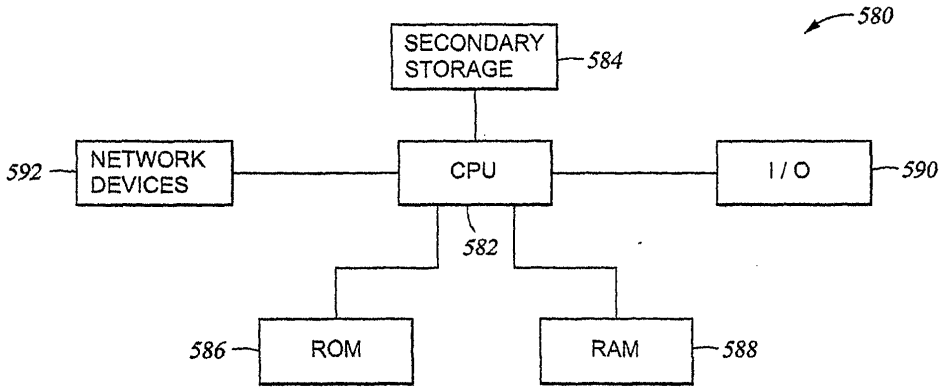

580
SECONDARY STORAGE
584
592
NETWORK DEVICES
CPU
I / O
590
582
586
ROM
RAM
588

Fig. 13

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001302

A. CLASSIFICATION OF SUBJECT MATTER
INV. G05D11/13 B01F15/04 E21B33/13

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
G05D B01F E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y A	US 5 289 877 A (NAEGELE ET AL) 1 March 1994 (1994-03-01) column 1, line 1 - column 5, line 20; figures 1A,1B,2	30, 37-43, 49-51 1-3, 44-48 4-29, 31-36, 52-57
Y A	US 5 103 908 A (ALLEN ET AL) 14 April 1992 (1992-04-14) the whole document	1-3, 44-48 4-43, 49-57
Y A	US 5 775 803 A (MONTGOMERY ET AL) 7 July 1998 (1998-07-07) column 1, line 27 - column 7, line 27; figure 1	1-3, 44-48 4-43, 49-57

-/--

[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

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"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
6 July 2006	17/07/2006

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Vaño Gea, J

Form PCT/ISA/210 (second sheet) (April 2005)

Profrac Holding Corporation
U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 493 of 988

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001302

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 4 397 561 A (STRONG ET AL) 9 August 1983 (1983-08-09)	30, 37-43, 49-51
Y	the whole document	1-3, 44-48
A		4-29, 31-36, 52-57

1

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2006/001302

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
US 5289877	A	01-03-1994	CA	2102649 A1	11-05-1994
US 5103908	A	14-04-1992	NONE		
US 5775803	A	07-07-1998	NONE		
US 4397561	A	09-08-1983	NONE		

Form PCT/ISA/210 (patent family annex) (April 2005)

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Paul N. Katz/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	4117015
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Paul N. Katz/Debbie Allen
Filer Authorized By:	Paul N. Katz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	15-OCT-2008
Filing Date:	01-DEC-2005
Time Stamp:	13:09:58
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	8293
Deposit Account	020383
Authorized User	
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Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930IDS.PDF	5621576 24f390a76be04e94c42c5942500d649f20aaf3d7	yes	119

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement Letter	1	2
	Information Disclosure Statement (IDS) Filed (SB/08)	3	3
	Foreign Reference	4	71
	NPL Documents	72	75
	NPL Documents	76	79
	NPL Documents	80	82
	NPL Documents	83	92
	NPL Documents	93	105
	NPL Documents	106	118
	NPL Documents	119	119

Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	30193 d7f8b7e72312a6daeb33c89faaf6b662a9021847	no	2
Warnings:					
Information:					
			Total Files Size (in bytes):	5651769	

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National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	Lloyd McNeel
Art Unit	3676
Examiner Name	Kerry W. Leonard
Attorney Docket Number	HES 2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5574218		1996-11-12	Withers	
	2	6575247		2003-06-10	Tolman, et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030050758	A1	2003-03-13	Soliman, Mohamed Y., et al.	
	2	20060289167	A1	2006-12-28	Surjaatmadja, Jim B., et al.	
	3	20080083538	A1	2008-04-10	Soliman, Mohamed Y.	
	4	20030141064	A1	2003-07-31	Roberson, James David, Jr.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Kerry W. Leonard
	Attorney Docket Number	HES 2005-IP-018647U1

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Office Action for U. S. Serial No. 11/753,314 dated November 19, 2008	☐
	2	Office Action for U.S. Serial NO. 11/396,918 dated October 15, 2008	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Kerry W. Leonard
	Attorney Docket Number	HES 2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	11-26-08
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.3

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Paul N. Katz/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	4364626
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Paul N. Katz/Debbie Allen
Filer Authorized By:	Paul N. Katz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	26-NOV-2008
Filing Date:	01-DEC-2005
Time Stamp:	17:12:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	4056
Deposit Account	020383
Authorized User	
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File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930IDS.PDF	1078692 28244c1a9516dfd50575387ec5c533fde1d9ab94	yes	29
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Information Disclosure Statement (IDS) Filed (SB/08)		1	3	
	NPL Documents		4	18	
	NPL Documents		19	29	
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	30193 57051472046995a6c1a1e95e951ff97b7fb81e42	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1108885		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

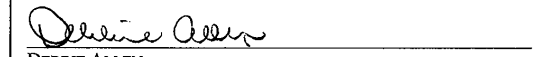
In re Application of:	§		
MCNEEL, *ET AL.*	§	Group Art Unit:	**3676**
	§		
Serial No.: **11/291,496**	§	Examiner:	**LEONARD, KERRY W.**
	§		
Filed: **DECEMBER 1, 2005**	§	Confirmation:	**7986**
	§		
Title: **"METHOD AND APPARATUS FOR CENTRALIZED WELL TREATMENT"**	§	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS
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DATE OF SUBMISSION: DECEMBER 17, 2008
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RESPONSE UNDER 37 C.F.R. § 1.111 TO
NON-FINAL OFFICE ACTION, MAILED AUGUST 21, 2008

Dear Honorable Commissioner:

In response to the Office Action mailed on August 21, 2008 (the "Office Action"), Applicants submit the following:

- **Amendments to the Claims**, which are reflected in the listing of claims that begins on page 2 of this paper; and
- **Remarks/Arguments**, which begin on page 10 of this paper.

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AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Withdrawn) A method of stimulating multiple wells from a central location, comprising the steps of:

stimulating a first well from the central location using a first stimulation fluid through a first fluid line; and

simultaneously stimulating a second well from the central location using a second stimulation fluid through a second fluid line.

2. (Withdrawn-Previously Presented) The method of claim 1 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

3. (Withdrawn-Previously Presented) The method of claim 1 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

4. (Withdrawn) The method of claim 1 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

5. (Withdrawn) A method of stimulating multiple wells comprising the steps of:

stimulating a first well location through a first stimulation fluid from a central manifold; and

simultaneously stimulating a second well location through a second stimulation fluid from the central manifold.

6. (Withdrawn-Previously Presented) The method of claim 5 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

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7. (Withdrawn-Previously Presented) The method of claim 5 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

8. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at the same pad.

9. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at different pads.

10. (Withdrawn) The method of claim 5 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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11. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid [[only]] to the first well location and not to the second well location; and

a second stimulation fluid [[only]] to the second well location and not to the first well location.

12. (Original) The system of claim 11 wherein the means for simultaneously flowing treatment fluid comprises a manifold.

13. (Original) The system of claim 12 wherein the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold.

14. (Original) The system of claim 13 wherein the well operations factory comprises a blending unit wherein the blending unit is operable to connect to the pumping grid.

15. (Previously Presented) The system of claim 14 wherein the well operations factory comprises a proppant storage system wherein the proppant storage system is operable to deliver proppant to the blending unit.

16. (Original) The system of claim 14 wherein the well operations factory comprises a chemical storage system wherein the chemical storage system is operable to connect to the blending unit.

17. (Original) The system of claim 15 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, the proppant storage system, the first well location, and the second well location.

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18. (Original) The system of claim 16 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, chemical storage system, the first well location, and the second well location.

19. (Original) The system of claim 17 wherein the well operations factory is enclosed in a structure selected from the group consisting of: a supported fabric structure, a collapsible structure, a prefabricated structure, a retractable structure, a composite structure, a temporary structure, a prefabricated wall and roof structure, a deployable structure, a modular structure, a preformed structure, a mobile accommodation structure, and combinations thereof.

20. (Original) The system of claim 12 wherein the first connection is operable to deliver a fluid from the first well location to the manifold.

21. (Original) The system of claim 12 wherein the second connection is operable to deliver a fluid from the second well location to the manifold.

22. (Original) The system of claim 20 wherein the fluid comprises a stimulation fluid.

23. (Original) The system of claim 21 wherein the fluid comprises a stimulation fluid.

24. (Original) The system of claim 12 wherein the manifold is connected to a second manifold.

25. (Original) The system of claim 24 wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location.

26. (Original) The system of claim 12 comprising a third connection between the manifold and the first well location.

27. (Original) The system of claim 26 wherein the third connection is operable to deliver a fluid from the first well location to the manifold.

28. (Original) The system of claim 27 comprising a fourth connection between the manifold and the second well location.

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29. (Original) The system of claim 28 wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold.

30. (Original) The system of claim 11 wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat.

31. (Previously Presented) The system of claim 11 wherein the first fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

32. (Previously Presented) The system of claim 11 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

33. (Original) The system of claim 11 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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34. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting pressurized stimulation fluid;

a first line connected to said first input, said first line comprising:

a first valve connected to a first pressure sensor, said first pressure sensor further connected to a second valve;

said first line connected to a first wellhead;

a second line connected to said first input, said second line comprising

a third valve connected to a second pressure sensor, said second pressure sensor further connected to a fourth valve;

said second line connected to a second wellhead.

35. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting a first pressurized stimulation fluid;

a second input for accepting a second pressurized stimulation fluid;

a first line connected to said first input, said first line comprising a first valve;

a second line connected to said second input, said second line comprising a second valve;

said first line and said second line connected together at a first junction, said first junction further connected to a first wellhead;

a third line connected to said first input, said third line comprising a third valve;

a fourth line connected to said second input, said fourth line comprising a fourth valve; and

said third line and said fourth line connected together at a second junction, said second junction further connected to a second wellhead.

36. (Withdrawn) The apparatus according to claim 35 wherein

said first line further comprises a fifth valve and a first pressure sensor, said first pressure sensor located between said first valve and said fifth valve.

37. (Withdrawn) The apparatus according to claim 36 wherein

said second line further comprises a sixth valve and a second pressure sensor, said second pressure sensor located between said second valve and said sixth valve.

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38. (Withdrawn) The apparatus according to claim 37 wherein

said third line further comprises a seventh valve and a third pressure sensor, said third pressure sensor located between said third valve and said seventh valve.

39. (Withdrawn) The apparatus according to claim 38 wherein

said fourth line further comprises an eighth valve and a fourth pressure sensor, said fourth pressure sensor located between said fourth valve and said eighth valve.

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40. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first pad and the well operations factory;

a second connection between a second pad and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first pad and not to the second pad; and

a second stimulation fluid to the second pad and not to the first pad.

41. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

42. (Previously Presented) The system of claim 11, wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.

43. (New) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location having a first plurality of wells and the well operations factory;

a second connection between a second well location having a second plurality of wells and the well operations factory; and

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means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

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REMARKS / ARGUMENTS

I. General Remarks

Applicants respectfully request that the above amendments be entered, and further request reconsideration of the application in light of the amendments and remarks contained herein. Applicants thank the Examiner for his careful consideration of this application.

II. Disposition of Claims

Claims 11-33 and 40-42 are pending in this application. Claims 11-33 and 40-42 currently stand rejected. New claim 43 has been added to recite aspects of the invention. The new claim is supported by the specification as filed and does not introduce new matter. Claims 11, 40, and 41 have been amended herein. Applicants respectfully submit that the amendments made herein add no new matter to the application and are supported by the specification as originally-filed. All the amendments are made in a good faith effort to advance the prosecution on the merits of this case. It should not be assumed that these amendments were made for reasons relating to patentability.

III. Rejections of Claims

A. Rejection of Claims Under 35 U.S.C. § 102 - Zakiewicz

Claims 11-13, 20-29, 31-33, and 40-42 are rejected under 35 U.S.C. § 102(b) as being anticipated by Zakiewicz, U.S. Patent Number 4,305,463 (hereinafter, "Zakiewicz").

With respect to these rejections, the Office Action states:

> With respect to claim 11, ZAKIEWICZ discloses a system for centralized well operations comprising a well treatment operations factory which manufactures and pumps a well stimulation fluid, a first connection between a first well location and the well operations factory, a second connection between a second well location and the well operations factory and means for simultaneously flowing a first stimulation fluid to the first well location and a second stimulation fluid to a second well location (column 4, lines 12-68 and Figure 1). With respect to the depending claims, the reference discloses that the means for simultaneously flowing treatment fluid comprises a manifold (Figure 1, items 9,10,11,12,13,14,21 wherein item 9 represents the first connection and location and item 10 represents the second

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> connection and location), that the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold, that the fist connection is operable to deliver a fluid from the first well location to the manifold, that the second connection is operable to deliver a fluid from the second well location to the manifold, that the fluid comprises a stimulation fluid, that the manifold is connected to a second manifold, that the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location, a third connection between the manifold and the first well location, that the third connection is operable to deliver a fluid from the first well location to the manifold, that there is a fourth connection between the manifold and the second well location, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold, that the first fluid comprises a compound selected from the group of claims 31 and 32, and that the first simulation fluid and the second stimulation fluid have the same composition. With respect to claims 40-42, the reference discloses a system for centralized well operations comprising a well treatment operations factory which manufactures and pumps a well stimulation fluid, connections between the first pad and second pad and the well operations factory, and means for simultaneously flowing a first stimulation fluid to the first pad and second stimulation fluid to the second pad.

Office Action at pages 2-3. Applicants respectfully disagree with these rejections.

To form a basis for a § 102(b) rejection, a prior art reference must disclose each and every element as set forth in the claim. *See* MANUAL OF PATENT EXAMINING PROCEDURE ("MPEP") § 2131 (2007). "The identical invention must be shown in as complete detail as it is contained in the claim." *Id.* "The elements must be arranged as required by the claim." *Id.*

With regard to amended independent claims 11, 40, and 41, Zakiewicz fails to disclose every element of the claims. In particular, Applicants respectfully reassert the position that Zakiewicz does not disclose both a first stimulation fluid and a second stimulation fluid. Rather, Zakiewicz simply disclose a single stream of fluid (*Zakiewicz* col. 4, lines 53-59; col. 7, lines 24-29; Fig. 1, elements 2 & 3) comprised of a brine (*Zakiewicz* col. 4, lines 29-35; col. 7, lines 24-29), a chemical reagent (*Zakiewicz* col. 8, lines 53-56), or both (*Zakiewicz* col. 8, lines 59-68).

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In characterizing Zakiewicz's brine as being a first "stimulation fluid" and Zakiewicz's chemical reagent as being a second "stimulation fluid," the Office Action dated October 16, 2007, provides an unreasonable interpretation of the claim term. The interpretation of the term "stimulation fluid" should be made according to the plain meaning of the term unless such meaning is inconsistent with the specification. MPEP § 2111.01. "Plain meaning" refers to the ordinary and customary meaning given to the term by those of ordinary skill in the art. *Id.* The ordinary and customary meaning of a term may be evidenced by the claims themselves, the specification, the prosecution history, and extrinsic evidence concerning the meaning of technical terms. *Id.* "If extrinsic reference sources, such as dictionaries, evidence more than one definition for the term, the intrinsic record must be consulted to identify which of the different possible definitions is most consistent with Applicants' use of the terms." *Id.* Therefore, the most reasonable interpretation of the plain meaning of the term "stimulation fluid" would be a definition provided by extrinsic evidence which is most consistent with Applicants' use of the term. Applicants respectfully submit that one of ordinary skill in the art would understand a "stimulation fluid" to be a fluid which is capable of increasing or improving the permeability of a formation, as evidenced by the attached computer print-outs from the New York State Department of Environmental Conservation and the Canadian Centre for Energy Information. Such interpretation is consistent with the disclosure of the instant application. It would be unreasonable to interpret use of a brine or a chemical reagent, either alone or in combination, as taught by Zakiewicz, to be a stimulation fluid. Moreover, it would be highly unreasonable to interpret co-mingled individual components of a fluid to be separately characterized as a first stimulation fluid and a second stimulation fluid, as done in the October 16, 2007, Office Action. Therefore, under the broadest *reasonable* interpretation of the term "stimulation fluid," Zakiewicz fails to disclose both a first stimulation fluid and a second stimulation fluid. As such, Zakiewicz does not disclose each and every limitation as set forth in amended independent claims 11, 40, and 41.

Moreover, Zakiewicz does not disclose a means for simultaneously flowing a first stimulation fluid to the first well location (or pad) and not to the second well location (or pad) and a second stimulation fluid to the second well location (or pad) and not to the first well

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location (or pad), as required by amended independent claims 11, 40, and 41. Rather, Zakiewicz simply discloses flowing a single stream to a plurality of well heads. *Zakiewicz* col. 4, lines 53-59 and col. 7, lines 24-29. Moreover, nowhere in Zakiewicz is there a disclosure of a stimulation fluid. Instead, even when referring to a "fracturing fluid," Zakiewicz actually connotes a fluid which "is expressly designed to solidify and render the fractured plane substantially fluid-impervious." *Zakiewicz* col. 6, lines 6-8. As such, Zakiewicz does not disclose each and every limitation as set forth in independent claims 11, 40, and 41.

Accordingly, Applicants submit that Zakiewicz cannot be used to anticipate Applicants' claims as set forth in independent claims 11, 40, and 41. The remaining claims rejected as anticipated by Zakiewicz under 35 U.S.C. § 102(b) depend either directly or indirectly from independent claim 11. All these dependent claims include all the limitations of their corresponding independent claim 11. Accordingly, Applicants respectfully request withdrawal of this rejection with respect to claims 11-13, 20-29, 31-33, and 40-42.

B. Rejection of Claims Under 35 U.S.C. § 102 - Luk

Claims 11-16, 20-25, 31-32, and 40-42 are rejected under 35 U.S.C. § 102(b) as being anticipated by Luk, U.S. Patent Number 5,515,920 (hereinafter, "Luk").

With respect to these rejections, the Office Action states:

> With respect to claim 11, LUK discloses a system for centralized well operations comprising a well treatment operations factory which manufactures and pumps a well stimulation fluid, a first connection between a first well location and the well operations factory, a second connection between a second well location and the well operations factory and means for simultaneously flowing a first stimulation fluid to the first well location and a second stimulation fluid to a second well location (abstract, Figure 6, column 6, lines 26-47). With respect to the depending claims, the reference discloses that the means for simultaneously flowing treatment fluid comprises a manifold (column 4, lines 51-59 and #5), that the factory comprises a pumping grid wherein the grid is operable to connect to the manifold, that the factory comprises a blending unit wherein the blending unit is operable to connect to the pumping grid (#20 and #30 and #70), wherein the factory comprises a proppant storage system wherein the storage system is operable to deliver proppant to the blending unit (column 6, lines 42-47 and #80 which is the proppant storage which delivers

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> proppant to the system), wherein the first connection is operable to deliver a fluid from the first well location to the manifold, wherein the second connection is operable to deliver a fluid from the second well location to the manifold, wherein the fluid comprises a stimulation fluid, wherein the manifold is connected to a second manifold (#40 and #5), wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location, and wherein the first fluid comprises a compound selected from the groups of claims 31 and 32 (column 7, lines 21-26). With respect to claims 40-42, the reference discloses a system for centralized well operations comprising a well treatment operations factory which manufactures and pumps a well stimulation fluid, connections between the first pad and second pad and the well operations factory, and means for simultaneously flowing a first stimulation fluid to the first pad and second stimulation fluid to the second pad.

Office Action at pages 3-4. Applicants respectfully disagree with these rejections.

With regard to amended independent claims 11, 40, and 41, Luk fails to disclose every element of the claims. In particular, Applicants respectfully reassert the position that Luk does not disclose both a first well location (or pad) and a second well location (or pad). Rather, Luk simply disclose a single well head (*Luk* col. 6, lines 32-41; Fig. 6, element 50).

In characterizing Luk's top of the well as being a first "well location" and Luk's formation as being a second "well location," the Office Action dated October 16, 2007, provides an unreasonable interpretation of the claim term. As discussed above, the interpretation of a claim term, such as "well location," should be made according to the plain meaning of the term unless such meaning is inconsistent with the specification. MPEP § 2111.01. Applicants respectfully assert that the interpretation proffered in the October 16, 2007, Office Action is inconsistent both with the plain meaning of the term and with the specification. As described in paragraph [0018] and illustrated in Figs. 2-4 and 7, a pad may contain one or more wellheads. Elements 101 and 102 in Figs. 3 and 7, and elements 401-404 in Fig. 4, represent "well locations," also referred to in the specification as "wells" or "wellheads." *See* paragraphs [0023], [0025], [0026]. Nowhere in the specification is there any indication of differentiation between the top of a well and the underlying formation. Therefore, under the broadest *reasonable* interpretation of the term "well location," Luk fails to disclose both a first well location (or pad)

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and a second well location (or pad). As such, Luk does not disclose each and every limitation as set forth in independent claims 11, 40, and 41.

Accordingly, Applicants submit that Luk cannot be used to anticipate Applicants' claims as set forth in amended independent claims 11, 40, and 41. The remaining claims rejected as anticipated by Luk under 35 U.S.C. § 102(b) depend either directly or indirectly from independent claims 11. All these dependent claims include all the limitations of their corresponding independent claims 11. Accordingly, Applicants respectfully request withdrawal of this rejection with respect to claims 11-16, 20-25, 31-32, and 40-42.

C. Rejection of Claims Under 35 U.S.C. § 103 – Luk alone

Claims 17-19 and 30 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Luk alone.

With respect to these rejections, the Office Action states:

> LUK discloses a system as described above. However the reference does not explicitly state that the well operations factory comprises a power unit or that the factory is enclosed. However, it would be obvious to one of ordinary skill in the art that the system of LUK would require some type of power unit in order to operate the system. In addition, the structures described in claim 19 are very well known in the art and it would be obvious to one of ordinary skill in the art to enclose some or all of the components in the well operations factory in order to protect them from the elements. It would also be considered obvious to provide the well operations factory on a vessel in order to produce hydrocarbons from undersea reservoirs.

Office Action at page 5. Applicants respectfully disagree with these rejections.

In order for a reference or combination of references to form the basis for a rejection under § 103(a), a *prima facie* case of obviousness must be established. MPEP § 2142. This requires a showing that the claimed invention "as a whole" would have been obvious to a person of ordinary skill in the art when the invention was unknown and just before it was made. *Id.* The showing must be made on the basis of the facts gleaned from the prior art without resorting to hindsight based upon applicant's disclosure. *Id.* Obviousness is determined by construing the scope of the prior art, identifying the differences between the claims and the prior art, determining the level of skill in the pertinent art at the time of the invention, and considering

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objective evidence present in the application indicating obviousness or nonobviousness. *Graham v. John Deere*, 383 U.S. 1, 17 (1966); *see also* MPEP § 2142(II). The Supreme Court in *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 127 S.Ct. 1727, 1731 (2007) noted that the analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit. The Federal Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). Applicants respectfully submit that due to the differences between the claims as currently amended and the cited references, the Office Action does not establish a *prima facie* case of obviousness, in that Luk alone fails to teach each and every recitation of the present claims.

In particular, as previously discussed, Luk fails to teach both a first well location and a second well location. Applicants respectfully assert that, after a thorough examination of the entire reference, Luk provides no teaching, suggestion, or indication of treating anything but a single well head. Luk, therefore, also fails to teach simultaneously flowing a first stimulation fluid to the first well location and a second stimulation fluid to the second well location, as required by amended independent claim 11. Moreover, only with impermissible hindsight could Luk be modified to provide such a teaching. For these reasons, at least, Luk alone cannot provide the basis for a *prima facie* case of obviousness against claim 11 or its dependent claims, specifically claims 17-19 and 30.

D. Rejection of Claims Under 35 U.S.C. § 103 – Zakiewicz alone

Claim 30 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Zakiewicz alone. With respect to these rejections, the Office Action states:

> ZAKIEWICZ discloses a system as described above. The reference does not explicitly state that the well operations factory is located on a boat, however, it would be considered obvious to one having ordinary skill in the art at the time the invention was made to provide the well operations factory on a vessel in order to produce hydrocarbons from undersea reservoirs.

Office Action at pages 5-6. Applicants respectfully disagree with these rejections.

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Applicants respectfully submit that due to the differences between the claims as currently amended and the cited references, the Office Action does not establish a *prima facie* case of obviousness, in that Zakiewicz alone does not teach each and every recitation of the present claims.

Specifically, as previously discussed, Zakiewicz fails to teach both a first stimulation fluid and a second stimulation fluid. Therefore, Zakiewicz necessarily fails to teach a means for simultaneously flowing a first stimulation fluid to the first well location and a second stimulation fluid to the second well location, as required by amended independent claim 11. As Zakiewicz lacks any teaching of a second stimulation fluid, it would be only with impermissible hindsight that Zakiewicz could be modified to teach simultaneously flowing multiple stimulation fluids. For these reasons, at least, Zakiewicz alone cannot provide the basis for a prima facie case of obviousness against claim 11 or its dependent claims, specifically claim 30.

IV. No Waiver

All of Applicants' arguments and amendments are without prejudice or disclaimer. Additionally, Applicants have merely discussed example distinctions from the cited references. Other distinctions may exist, and Applicants reserve the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the Examiner's additional statements. The amendments and example distinctions discussed by Applicants are sufficient to overcome the rejections of the claims.

All amendments are made in a good faith effort to advance the prosecution on the merits. It should not be assumed that the claims amended herein were amended for reasons relating to patentability. Applicants reserve the right to subsequently take up prosecution on the claims as originally filed in this or appropriate continuation, continuation-in-part and/or divisional applications.

Applicants respectfully request that the amendments submitted herein be entered and further requests reconsideration in light of the amendments and remarks contained herein.

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SUMMARY AND PETITION FOR A ONE-MONTH EXTENSION OF TIME TO FILE THIS RESPONSE

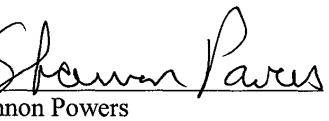
In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicants hereby petition for a one-month extension of time under 37 C.F.R. § 1.136 up to and including April 11, 2008. Applicants authorize the Commissioner to debit the Deposit Account of Baker Botts L.L.P., Deposit Account No. 02-0383, Order Number 063718.0930, in the amount of $130.00 for the fee associated with the extension of time.

The Commissioner is hereby authorized to debit Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0930, in the amount of $272.00 for the fee under 37 C.F.R. § 1.16(h) & (i) for the new independent claim.

Should the Commissioner deem that any additional fees are due, including any fees for extensions of time, the Commissioner is authorized to debit Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0930, for any underpayment of fees that may be due in association with this filing.

Respectfully submitted,

By: 

Shannon Powers
Registration No. 59,584
BAKER BOTTS L.L.P.
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ATTORNEY FOR APPLICANT

Date: December 17, 2008

Profrac Holding Corporation
U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 526 of 988

Solution Gas Drive: Type of primary reservoir energy where the major mechanism of energy is a result of gas coming out of solution with decreased reservoir pressure.

Source Bed: Rocks in which oil or gas are generated.

Spacing: Distance separating wells in a field to optimize recovery of oil and gas.

SPDES: State Pollutant Discharge Elimination System.

Spinner Survey: Generic name for logs that use spinner type velocimeters to monitor fluid velocities. Used to identify leaks in casing or tubing, analyze stimulation results, and establish injection or production profiles and flow rates.

Spring: A place where groundwater naturally flows from a rock or soil onto land or into a body of surface water.

Spudding: The initial stage of drilling a well.

Squeeze: Technique where cement is forced into the annular space between casing and the wellbore.

Step Out and Infill Drilling: To move the minimum spacing unit outside or inside an existing area.

Step-Rate Pressure Test: Pressure test where a succession of equal pressure steps (usually increasing) are sustained for a constant time duration.

Stimulation: Act of increasing a zone's permeability by increasing the porosity and permeability or inducing fractures.

Strand Plain: The shoreline, a beach.

Stratigraphic Trap: Accumulation of hydrocarbons entrapped as a result of variation in rock type, usually caused by a change in the environment of deposition.

Stratigraphic Test Well: A hole drilled to gather engineering, geologic or hydrological information including but not limited to lithology, structural, porosity, permeability and geophysical data.

Strippers: Stripper wells are oil wells producing less than 10 (BOPD) barrels of oil per day.

Stromatolite: Laminated calcareous rocks formed from fossil algae.

Structural Trap: Accumulation of hydrocarbons entrapped as a result of faulting or folding.

Surface Casing: Casing extending from the surface to below the deepest fresh water aquifer. It is inside the conductor pipe and also acts as an anchor for well control equipment.

Splitting
Fission

Spudding in
Beginning to drill a well.

Stakeholders
People with an interest in industry activities that affect them. They may include nearby landowners, Aboriginal communities, recreational land users, other industries, environmental groups, governments and regulators.

Steam injection
A technique in which steam is injected into a reservoir to reduce the viscosity of the crude oil.

Steam-assisted gravity drainage (SAGD)
A method of producing heavy oil which involves two horizontal wellbores, one above the other; steam is injected into the upper wellbore and softened bitumen is recovered from the lower wellbore.

Stimulating the formation
A technique for improving production from a reservoir; stimulation may involve acidizing, fracturing or simply cleaning out sand.

Stimulation
Fracturing or acidizing a formation to improve permeability and thus production

Storage tank water heaters
These heat and store water in a single tank. The energy source can be natural gas, electricity or fuel oil. They are the most common kind of water heater in Canada.

Straddle extraction plant
A gas processing plant located on or near a gas transmission line that removes natural gas liquids from the gas and returns it to the line.

Stranded Gas
Gas is considered stranded when it is not near its customer and a pipeline is not economically justified.

Stratification
Change in water quality that occurs when river flow slows due to a dam and colder, oxygen-depleted water sinks to the bottom. If water released to produce electricity is from the lower levels, the oxygen-depleted water can change downstream habitat.

Strip mining
A method of surface mining used where the coal seams are very shallow and laterally extensive

Sub-bituminous
The second rank of coal in terms of organic maturity

Sub-bituminous coal
Black coal softer than bituminous; this type of coal is used in Alberta to generate most of the province's electricity

Subsidence
A sinking of an area of the Earth's crust due to fluid withdrawal and pressure decline.

Substation
An electrical facility where the voltage of incoming and outgoing circuits is changed and controlled

Sulphur
A yellow mineral extracted from petroleum and used for making fertilizers, pharmaceuticals and other products.

Sulphur dioxide
Gas produced mostly from human activities (such as metal smelting, and fossil fuel combustion by factories, power plants and motor vehicles). Sulphur dioxide combines with water vapor to form sulphuric acid, a contributor to acid rain. Human exposure to sulphur dioxide emissions can also cause respiratory problems.

Sulphur dioxide (SOx)
A poisonous gas formed by burning hydrogen sulphide (or other sulphur compounds).

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Paul N. Katz/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Claims in excess of 20	1202	1	52	52
Independent claims in excess of 3	1201	1	220	220
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	130	130
Miscellaneous:				
		Total in USD ($)		**402**

Electronic Acknowledgement Receipt	
EFS ID:	4477037
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Paul N. Katz/Debbie Allen
Filer Authorized By:	Paul N. Katz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	17-DEC-2008
Filing Date:	01-DEC-2005
Time Stamp:	17:43:41
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$402
RAM confirmation Number	3583
Deposit Account	020383
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930ROA.PDF	953746 da431aaf305eeea01136a55b8581f3075756237c	yes	21
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Amendment/Req. Reconsideration-After Non-Final Reject		1	1	
	Claims		2	10	
	Applicant Arguments/Remarks Made in an Amendment		11	19	
	Examination support document		20	20	
	Examination support document		21	21	
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	33507 92f40e0d428bc1c73c00d64331f908c6e7020501	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	987253		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 11/291,496	Filing Date 12/01/2005	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	12/17/2008	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 43	Minus	** 42	= 1	X $ =		OR	X $52=	52
	Independent (37 CFR 1.16(h))	* 8	Minus	***7	= 1	X $ =		OR	X $220=	220
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	**272**

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/MARSHA R. RICHARDS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	McNeel, Lloyd
Art Unit	3676
Examiner Name	Ditrani, Angela
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2953460		1960-09-20	Baker, John C.	
	2	2980291		1961-04-18	Schuerger, Thomas R.	
	3	4410106		1983-10-18	Kierbow, et al.	
	4	4427133		1984-01-24	Kierbow, et al.	
	5	4701095		1987-10-20	Berryman, et al.	
	6	4850750		1989-07-25	Cogbill, et al.	
	7	5245548		1993-09-14	Kuan	
	8	6120175		2000-09-19	Tewell	

If you wish to add additional U.S. Patent citation information please click the Add button.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Office Action for U.S. Serial No. 11/363,559 mailed 1/23/09	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-02-02
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Acknowledgement Receipt	
EFS ID:	4713872
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Paul N. Katz/Debbie Allen
Filer Authorized By:	Paul N. Katz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	02-FEB-2009
Filing Date:	01-DEC-2005
Time Stamp:	08:03:10
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930IDS.PDF	546911 9366c5b40ad65832d571b535cf6c113308698372	yes	14

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	NPL Documents	4	14
Warnings:			
Information:			
	Total Files Size (in bytes):	546911	

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New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

	1	Office Action for U.S. Serial No. 11/545,749, mailed February 10, 2009	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

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OR

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☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-02-19
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.3

Electronic Acknowledgement Receipt	
EFS ID:	4820522
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Paul N. Katz/Debbie Allen
Filer Authorized By:	Paul N. Katz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	19-FEB-2009
Filing Date:	01-DEC-2005
Time Stamp:	13:09:56
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930IDS.PDF	320518 9fdcbd29cdad69e52e18442cdb6706af1d04840e	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	NPL Documents	4	8
Warnings:			
Information:			
	Total Files Size (in bytes):	320518	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/291,496	12/01/2005	William Lloyd McNeel	2005-IP-018647U1	7986

29920 7590 03/11/2009

JOHN W. WUSTENBERG
P.O. BOX 1431
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EXAMINER	
DITRANI, ANGELA M	

ART UNIT	PAPER NUMBER
3676	

NOTIFICATION DATE	DELIVERY MODE
03/11/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JOHN.WUSTENBERG@HALLIBURTON.COM
CHASIDY.SMITH@HALLIBURTON.COM

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/291,496	MCNEEL ET AL.	
	Examiner	Art Unit	
	Angela M. DiTrani	3676	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *17 December 2008*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) *1-10 and 34-39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-33 and 40-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *10/06/08, 10/15/08, 11/26/08, 02/02/09, 02/19/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 11-33 and 40-43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention.

Independent claim 11 has been amended to include the new limitation wherein "a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location." The added limitations of "and not to the second well location" and of "and not to the first well location" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported. Depending claims 12-33 and 42 are hereby rejected under 35 USC 112 first paragraph as well.

Independent claim 40 has been amended to include the new limitation wherein "a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad." The added limitations of "and not to the second pad" and of "and not to the first pad" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported.

Independent claim 41 has been amended to include the new limitation wherein "a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location." The added limitations of "and not to the second well location" and of "and not to the first well location" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported.

New independent claim 43 recites the limitation in lines 9-12 wherein "a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location." The added limitations of "and not to the second well location" and of "and not to the first well location" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported.

Claim Rejections - 35 USC § 102

3. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

4. Claims 11-13, 20-29, 31-33, and 40-43 are rejected under 35 U.S.C. 102(e) as being anticipated by Tolman et al. (WO 2007/024383).

With respect to independent claim 11, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see esp. [0012]; [0018]-[0041]; [0067]).

With respect to depending claim 12, the reference discloses wherein the means for simultaneously flowing treatment fluid comprises a manifold ([0067]).

With respect to depending claim 13, the reference discloses wherein the well operations factory comprises a pumping grid operable to connect to the manifold ([0020]; [0030]-[0031]).

With respect to depending claims 20-23, Tolman et al. discloses wherein the first connection is operable to deliver a fluid from the first well location to the manifold, wherein the second connection is operable to deliver a fluid from the second well location to the manifold, and wherein the fluid comprises a stimulation fluid ([0031]; [0035]-[0039]).

With respect to depending claims 24 and 25, Tolman et al. discloses wherein the manifold is connected to a second manifold, and, further, wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location ([0067]).

With respect to depending claims 26-29, Tolman et al. discloses a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold; a fourth connection between the manifold and the second well location, and, further, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold ([0027]-[0032]; [0067]).

With respect to depending claims 31-33, Tolman et al. discloses wherein the first fluid comprises at least one component selected from the group as claimed, wherein the second stimulation comprises at least one compound selected from the group as claimed, and wherein the first stimulation fluid and the second stimulation fluid have the same composition ([0012]; [0065]; [0067]).

With respect to depending claim 42, Tolman et al. discloses wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid ([0067]).

With respect to independent claim 40, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first pad and the well operations factory; a second connection between a second pad and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad (see esp. [0012]; [0018]-[0041]; [0067]).

With respect to independent claim 41, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see esp. [0012]; [0018]-[0041]; [0067]).

With respect to independent claim 43, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location having a first plurality of wells and the operations factory; a second connection between a second well location having a second plurality of wells and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and stimulation fluid to the second well location and not to the first (see esp. [0012]; [0018]-[0041]; [0067]).

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

6. Claims 14-19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tolman et al. as applied to claims 11-13 above, and further in view of Walker et al. (US 4,715,721).

With respect to depending claims 14 and 15, Tolman et al. discloses the system as stated above with respect to claims 11-13, wherein the system may be land-based or offshore-based ([0020]) and wherein a stimulation fluid storage system (**204**) and a stimulation fluid pumping system (**202**) are included within the system. The reference further discloses wherein the stimulation employing the disclosed system may involve a hydraulic fracturing procedure wherein the injected fluid comprises proppant material ([0065]). The reference, however, fails to teach a blending unit connected to the pumping grid of the disclosed system, and, further wherein the system comprises a proppant storage system operable to deliver proppant to the blending unit as claimed in depending claims 14 and 15. Walker et al. teaches a transportable integrated blending system employed within stimulation operations at offshore locations wherein the system comprises a pumping system for delivering a fracturing blend from a fixed assembly into an offshore well. The system comprises a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). The reference further teaches that it is well known in the oil

and gas industry that in creating an oil or gas well various fluids or flowable blends need to be prepared for different known purposes. In hydraulically fracturing a selected formation within a well, a fracturing fluid comprising a selectable combination of materials needs to be produced and pumped down hole; liquid gel concentrate can be mixed with several known additives to produce a mixture which is then blended with sand or other particulate material for the purpose of producing a fracturing blend comprising proppant; the blend can be prepared at the well site (col. 1, l. 5-28). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a blending unit as taught by Walker et al., wherein the system comprises a proppant storage system operable to deliver a proppant to the blending unit, within the system disclosed by Tolman et al. in order to provide a means for introducing the desired amount of proppant into the stimulation fluid, and, further, mixing the proppant with the stimulation fluid at an off-shore based location within a blending unit so as to provide a stimulation fluid blend most suitable to meet the needs of the actual formation.

With respect to depending claim 16, Tolman et al. discloses wherein the well operations factory comprises a chemical storage system (**204**). Although the reference fails to explicitly teach wherein the chemical storage system is operable to connect to the blending unit, as provided above within the rejection of claim 14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a blending unit as taught by Walker et al. within the system of Tolman et al. in

order to provide a stimulation fluid blend most suitable to meet the needs of the actual formation at the well site at the time the treatment fluid is used.

With respect to depending claims 17 and 18, Tolman et al. discloses wherein the system comprises a wireline unit, and, therefore, teaches a power unit operable to connect to the manifold, pumping grid, first well location, and second well location. Although the reference fails to disclose the inclusion of a proppant storage system and blending unit within the system, as provided above within the rejection of depending claims 14 and 15, Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a proppant storage unit and blending unit as taught by Walker et al. within the system of Tolman et al. in order to provide a stimulation fluid blend most suitable to meet the needs of the actual formation at the well site at the time the treatment fluid is used.

With respect to depending claim 19, Tolman et al. discloses wherein the system may be land-based or offshore-based and may be provided at a location such as a pad. The reference further teaches that various configurations and placement of components

may be used for additional functionality ([0030]). The reference, however, fails to explicitly disclose the system as enclosed in a structure selected from the group as claimed. Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). The system is enclosed within a transport means for the purpose of transporting the system to an offshore location (col. 3, l. 40 –col. 4, l. 2). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for the system of Tolman et al., in view of Walker et al. as stated above within the rejection of depending claims 14-18, wherein the system is enclosed in a structure selected from the group as claimed in order to provide a means for transporting the system to a desired offshore-based location.

With respect to depending claim 30, Tolman et al. discloses wherein the system may be land-based or offshore-based and may be provided at a location such as a pad. The reference, however, fails to explicitly disclose the system as located on a boat as claimed. Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials

can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). The system is provided on a transport means such as an ocean-going ship for the purpose of transporting the system to an offshore location (col. 3, l. 40 –col. 4, l. 2). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for the system of Tolman et wherein the system is provided on a boat in order to provide a means for transporting the system to a desired offshore-based location.

Response to Arguments

7. Applicant's arguments with respect to claims 11-33 and 40-43 have been considered but are moot in view of the new ground(s) of rejection in light of Applicant's amendments to the claims.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any

extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. DiTrani whose telephone number is (571)272-2182. The examiner can normally be reached on M-F, 6:30AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Gay can be reached on (571)272-7029. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AD
03/04/09

/Zakiya W. Bates/
Primary Examiner, Art Unit 3676

Notice of References Cited	Application/Control No. 11/291,496	Applicant(s)/Patent Under Reexamination MCNEEL ET AL.	
	Examiner Angela M. DiTrani	Art Unit 3676	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,715,721	12-1987	Walker et al.	366/132
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	WO 2007/024383	03-2007	WO	Tolman et al.	E21B 43/16
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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60/709,586 19 August 2005 (19.08.2005) US

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(72) Inventors; and
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(74) Agents: **KNIGHT, Brent, R.** et al.; ExxonMobil Upstream Research Company, P.O. Box 2189, Houston, TX 77252-2189 (US).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LV, LY, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declarations under Rule 4.17:
— *as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii))*
— *as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii))*

Published:
— *without international search report and to be republished upon receipt of that report*

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 2007/024383 A2

(54) Title: METHOD AND APPARATUS ASSOCIATED WITH STIMULATION TREATMENTS FOR WELLS

(57) Abstract: A method and apparatus associated with the production of hydrocarbons. In one embodiment, the method describes connecting multiple wells to a stimulation fluid pumping system via a pumping system manifold. The pumping system manifold is adjusted to provide a first well flow path from the stimulation fluid pumping system to a first well. Then, a first stimulation treatment is pumped into the first well. Concurrently with the pumping of the first stimulation treatment, a second well is prepared for a second stimulation treatment.

METHOD AND APPARATUS ASSOCIATED WITH STIMULATION TREATMENTS FOR WELLS

CROSS REFERENCE TO RELATED APPLICATIONS

[0001] This application claims the benefit of U.S. Provisional Application 60/709,586, filed 19 August, 2005.

BACKGROUND

[0002] This section is intended to introduce the reader to various aspects of art, which may be associated with exemplary embodiments of the present techniques, which are described and/or claimed below. This discussion is believed to be helpful in providing the reader with information to facilitate a better understanding of particular aspects of the present techniques. Accordingly, it should be understood that these statements are to be read in this light, and not necessarily as admissions of prior art.

[0003] The production of hydrocarbons, such as oil and gas, has been performed for numerous years. To produce these hydrocarbons, one or more wells in a field are typically drilled to subsurface locations, which are generally referred to as subterranean formations, reservoirs or basins. The process of producing hydrocarbons from the subsurface formations typically involves drilling one or more wells to access the subsurface formations. With the wells drilled, completion and stimulation activities or operations may be utilized to produce the hydrocarbons, such as oil and gas, from the subsurface formations.

[0004] Because a single well may be utilized to access various regions of subsurface formations, drilling multiple wells from a single location, such as a surface pad or offshore platform, may be beneficial for certain applications. For example, in an offshore application, wells are routinely drilled from a single offshore platform due to the substantial platform installation and operational costs. Also, drilling of multiple wells from a single surface pad on land may reduce surface disturbance and environmental impact associated with well construction activities. Further, well construction activities for multiple wells at a single location may be effectively managed in the presence of surface constraints, such as topography, proximity to other buildings, and existing surface easements and right-of-ways. As such, wells

located on a single surface pad may be utilized to reduce costs and enhance operations.

[0005] Despite the benefits from having multiple wells at a single location, certain combinations of operations may be complicated, restricted, or prevented by the presence of multiple wells. That is, when performing completion operations on one of the wells, the operations performed on other wells may be limited. For instance, when stimulating a well on a surface pad having multiple wells, stimulation operations are typically performed on only the single well. When the well is being stimulated, equipment and personnel have to wait because the stimulation operations are performed in a sequential manner and initiation of additional wellbore preparation operations may be deferred until completion of the stimulation operations. As a result, equipment and personnel are not efficiently utilized at the surface pad.

[0006] Accordingly, the need exists for a method, apparatus and system for enhancing operations involving multiple wells on a surface pad to reduce the time and cost associated with stimulation treatments. In particular, there is a need for new apparatus, method, and system to enable reliable and cost-effective execution of concurrent or simultaneous wellbore preparation and stimulation operations in multiple wellbores located at a single surface location.

[0007] For additional information please reference Ammer et al., "Unconventional Gas: Reserve Opportunities and Technology Needs", GasTIPS, Fall 2004, pp. 22-26; U.S. Patent No. 5,890,536; U.S. Patent No. 6,186,230; U.S. Patent No. 6,394,184, U.S. Patent No. 6,520,255, U.S. Patent No. 6,543,538, U.S. Patent No. 6,575,247; U.S. Patent No. 6,672,405; U.S. Patent Publication No. 2003/0075335; and/or U.K. Patent No. 1,243,062; and/or U.K. Patent No. 2,028,400.

SUMMARY OF INVENTION

[0008] In one embodiment, a method associated with the production of hydrocarbons is described. The method describes connecting multiple wells to a stimulation fluid pumping system via a pumping system manifold. The pumping system manifold is adjusted to provide a first well flow path from the stimulation fluid pumping system to a first well. Then, a first stimulation treatment is pumped into the first well. Concurrently with the pumping of the first stimulation treatment, a second well is prepared for a second stimulation treatment.

[0009] In an alternative embodiment, another method associated with the production of hydrocarbons is described. In this method, a plurality of wells is connected to a stimulation fluid pumping system via a pumping system manifold. Then, the pumping system manifold is adjusted to provide a stimulation treatment from the stimulation fluid pumping system to one of the plurality of wells, while isolating another of the plurality of wells from the stimulation treatment concurrently with the pumping of the stimulation treatment to prepare the another well for another stimulation treatment. These adjustments to provide the stimulation fluid and isolation of the other well are repeated until each of the plurality of wells have received stimulation treatments. Then, hydrocarbons are produced from the plurality of wells once the stimulation treatments have been performed.

[0010] In a second alternative embodiment, a well system is described. In this well system, a plurality of oil field trees is located on a surface pad, wherein each of the plurality of oil field trees is associated with one of a plurality of wells. A pumping system manifold connects a stimulation fluid pumping system to the plurality of oil field trees. The pumping system manifold is configured to provide a flow path from the stimulation fluid pumping system into at least one selected well of the plurality of wells and to isolate at least one non-selected well of the plurality of wells from the stimulation fluid pumping system. Further, the wells, stimulation fluid pumping system, and pumping system manifold may be located on a single surface pad.

[0011] In a third alternative embodiment, an apparatus is disclosed. The apparatus includes a main valve associated with a stimulation fluid pumping system, well valves and piping that couples the main valve to the well valves. In this apparatus, each of the well valves is associated with one of the wells and the piping is directly supported by the surface of the Earth. The apparatus may also include a densitometer, a manifold check valve, a pressure gauge, a flow meter, and a ball-seal injector, which are each coupled to the main valve and the well valves.

[0012] In a fourth alternative embodiment, a method associated with the production of hydrocarbons is described. The method comprises connecting a first well and a second well to a first stimulation fluid pumping system via a first pumping system manifold; connecting a third well and a fourth well to a second stimulation fluid pumping system via a second pumping manifold; adjusting the first pumping

system manifold to provide a first stimulation treatment to the first well and to isolate the second well for other operations; adjusting the second pumping system manifold to provide a second stimulation treatment to the third well and to isolate the fourth well; and pumping the first stimulation treatment into the first well and the second stimulation treatment into the third well concurrently with the pumping of the first stimulation treatment. Further, the method may also comprise preparing the second well for a third stimulation treatment concurrently with the pumping of the first stimulation treatment; and preparing the fourth well for a fourth stimulation treatment concurrently with the pumping of the second stimulation treatment.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] The foregoing and other advantages of the present technique may become apparent upon reading the following detailed description and upon reference to the drawings in which:

[0014] FIG. 1 is an exemplary production system having multiple wells located on a surface pad in accordance with certain aspects of the present techniques;

[0015] FIG. 2 is an exemplary surface pad configuration with equipment and wells for use with the production system of FIG. 1 in accordance with certain aspects of the present techniques;

[0016] FIG. 3 is an exemplary flow chart of operations performed on the wells located on the surface pad of FIG. 1 in accordance with aspects of the present techniques; and

[0017] FIGs. 4-6 are partial views of wells being utilized in concurrent operations associated with stimulation treatments according to the process of FIG. 3 in accordance with certain aspects of the present techniques.

DETAILED DESCRIPTION

[0018] In the following detailed description, the specific embodiments of the present invention will be described in connection with its preferred embodiments. However, to the extent that the following description is specific to a particular embodiment or a particular use of the present techniques, this is intended to be

illustrative only and merely provides a concise description of the exemplary embodiments. Accordingly, the invention is not limited to the specific embodiments described below, but rather, the invention includes all alternatives, modifications, and equivalents falling within the true scope of the appended claims.

[0019] The present technique is direct to drilling, treating, completing and producing hydrocarbons, such as oil and gas, from subterranean formations in a manner that reduces the overall costs to enable economic hydrocarbon production. In particular, the present techniques describe an apparatus and method for reducing and/or eliminating the non-productive time and resource utilization for drilling, stimulating, and completing multiple wells from a single surface pad or location. That is, the present techniques provide mechanisms to enhance production economics by enabling simultaneous or concurrent operations in the stimulation of multiple wells in a manner that reduces non-productive time for equipment, material, and/or personnel. As such, the present techniques may reduce the cost and time associated with performing operations for stimulation treatments of wells.

[0020] Accordingly, the present techniques may be applicable to land-based wells with two or more wells are located on a single surface pad and/or offshore-based wells where two or more wells are located on a single platform location. The present techniques utilize procedures and equipment that allow stimulation treatments to be performed more efficiently. In particular, the present techniques involve connecting two or more wells to a stimulation fluid pumping system via a well coupling system, such as a pumping system manifold. This pumping system manifold contains multiple valves to enable stimulation fluid to be pumped into any selected well, while the other remaining wells are hydraulically isolated from the pressure and energy created by the stimulation fluid pumping system. By isolating the other wells, other operations or activities, such as preparations for the next well to be stimulated or producing hydrocarbons, may be performed on the other wells. As a result, the present techniques enhance the stimulation process for multiple wells located at a single location, such as a surface pad.

[0021] Turning now to the drawings, and referring initially to FIG. 1, an exemplary production system **100** having multiple wells located at a single surface pad in accordance with certain aspects of the present techniques is illustrated. In the production system **100**, a surface pad **102** has two or more wells **104a-104n.** Each

of the wells **104a-104n** has an oil field tree **106a-106n** located over the wellbore **108a-108n** and are positioned in a specific configuration. These wellbores **108a-108n** follow specific trajectories that access one or more specific zones or regions **110a-110n** of a subsurface formation **112**. The wellbores **108a-108n** along with any casing or tubing strings utilized may provide flow paths from the respective regions **110a-110n** to one of the trees **106a-106n** for hydrocarbons, such as oil and gas. Within the wellbores **108a-108n**, casing strings or tubing (not shown) may be disposed to support the walls of the wellbore **108a-108n**. It should be understood that "n" may be any number of such units that can be utilized. Further, it should be noted that the production system **100** is illustrated for exemplary purposes and the present techniques may be useful in the production of fluids from any location, which may include offshore or onshore applications and other equipment, as well.

[0022] Because the wells **104a-104n** may be drilled in a variety of directions with different trajectories, drilling the wellbores **108a-108n** from a single location may provide access to various lateral and vertical locations, such as the regions **110a-110n** of the subsurface formation **112**. In fact, the wellbores **108a-108n** may penetrate the subsurface formation **112** at specific target locations or regions **110a-110n** that extend substantial lateral distances from the location of the surface pad **102**. The effective drainage area associated with regions **110a-110n** may vary because the resource recovery is influenced by a number of parameters, such as the number of wells drilled, spacing of wells, reservoir properties, and stimulation treatment design and effectiveness. For example, deviated wells may be drilled to depths greater than 20,000 ft with lateral throws greater than 5,000 ft. As such, a single surface pad **102** may include wells **104a-104n** that access and effectively drain hydrocarbon reservoirs, such as subsurface formation **112**, which may be an area greater than approximately 640 acres.

[0023] For certain types of subsurface formations **112**, such as low permeability ("tight") gas formations, different stimulation treatments may be utilized to access intervals or zones within the wellbore **108a-108n**. These stimulation techniques or treatments may include hydraulic proppant fracture stimulation and completion technologies to enable commercial development of this type of subsurface formations. For instance, new multi-zone stimulation and completion methods and equipment for the use of these methods are described in U.S. Patent No. 6,394,184,

U.S. Patent No. 6,520,255, U.S. Patent No. 6,543,538, U.S. Patent No. 6,575,247 and U.S. Patent No. 6,672,405, which are incorporated by reference, which describe techniques and tools for stimulating subsurface formations containing multiple hydrocarbon targets at reduced cost compared to conventional single-zone treatment approaches. As disclosed in the patents, the Just-in-Time Perforating ("JITP") and the Annular-Coiled Tubing Fracturing ("ACT-Frac") technologies, methods, and devices provide stimulation treatments to multiple subsurface formations targets within a single wellbore. In particular, the JITP and the ACT-Frac techniques: (1) enable stimulation of multiple target zones or regions via a single deployment of downhole equipment; (2) enable selective placement of each stimulation treatment for each individual zone to enhance well productivity; (3) provide diversion between zones to ensure each zone is treated per design and previously treated zones are not inadvertently damaged; and (4) allow for stimulation treatments to be pumped at high flow rates to facilitate efficient and effective stimulation. As a result, these multi-zone stimulation techniques have been developed to enhance hydrocarbon recovery from subsurface formations that contain multiple stacked subsurface intervals of hydrocarbons within regions of a well.

[0024] However, performing these stimulations may include a range of supporting operations that preclude pumping operations in the well at the time of the supporting operation is performed. For instance, non-pumping operations are usually performed when applying these multi-zone stimulation technologies to wells that are stimulated over one or more days. Accordingly, in performing these operations, it may be preferred to set bridge plugs or frac plugs between sets of intervals being treated by the stimulations. Setting these plugs may take substantial time, such as two or more hours depending on the well depth and operating speed of the wireline equipment. During the installation of the plug, it is not possible to perform stimulation treatment pumping operations in the well, which are an expensive portion of the stimulation operation. As a result, for wells containing many zones, the time associated with non-pumping operations may result in substantial incremental costs due to the cost structure associated with time-based equipment and crew fees.

[0025] As a specific example, nine wells may be drilled from a single surface location, such as the surface pad **102**, which is six-acre section of land. Each of the nine wells may be drilled with trees positioned in two rows on the surface pad **102**

and separated from each other by approximately fifteen feet. In this manner, the wells may be clustered in a relatively small portion of the surface pad **102** to provide additional space for other equipment that may be used in the stimulation treatments. Eight of the wells may be drilled with s-shape well trajectories, while one of the wells may have a vertical trajectory. Each of these wells may end at a bottomhole location that provides drainage for subsurface formation **112** for about a nominally 20 acre well spacing. Hence, the nine wells may drain about 180 acres from a single six acre surface location.

[0026] To enhance the stimulation, completion and production process from these wells on a surface pad, the operations performed on the individual wells may be coordinated and utilize mechanisms to perform these operations in an efficient manner. Accordingly, in FIG. 2, a surface pad configuration is shown with different equipment that may be utilized to perform the stimulation treatments in accordance with the present techniques. An exemplary flow chart is shown in FIG. 3 that describes possible concurrent operations that may be performed to enhance the operation of the wells of FIGs. 1 and 2. FIGs. 4-6 illustrate views of wells with different operations being performed on the wells in accordance with the process of FIG. 3. Accordingly, by utilizing the present techniques, simultaneous or concurrent operations involving stimulation of two or more wells located at a single surface pad may be performed in an efficient manner.

[0027] FIG. 2 is an exemplary surface pad configuration with equipment and wells for use with the production system **100** of FIG. 1 in accordance with certain aspects of the present techniques. In FIG. 2, the configuration of surface equipment involved with stimulation treatments by a JITP hydraulic proppant fracture stimulation of three wells **104a-104c** on the surface pad **102** is shown. In particular, to support the JITP hydraulic proppant fracture stimulation operations, the equipment on the surface pad **102** may include a stimulation fluid pumping system **202**, a stimulation storage system **204**, a well coupling system, such as a pumping system manifold **206,** and flowback manifolds **230a-230c**, for example. However, it should be understood that the JITP hydraulic proppant fracture stimulation system is only for exemplary purposes as other types of stimulation systems may also be utilized, including both multiple stage stimulation and single stage stimulation systems.

[0028] Generally, the wells **104a-104c** produce hydrocarbons through piping **228a-228c** that is coupled between the respective oil field trees **106a-106c** and the flowback manifolds **230a-230c**. The piping **228a-228c** may include high pressure steel lines utilized in oil field applications. The flowback manifolds **230a-230c** may also be coupled to one or more flowlines **234a-234c, 236a-236c** and **238a-238c**, respectively. These flowlines **234a-234c, 236a-236c** and **238a-238c** may be coupled to flowback pits, flow test units, sales lines, tankage, oil/gas/water separating and processing units and/or other similar devices. Thus, the hydrocarbons from the wells **104a-104c** typically flow through the flowback manifolds **230a-230c** for further processing or sales.

[0029] To provide a stimulation treatment, the JITP system may include the stimulation fluid pumping system **202** and stimulation fluid storage system **204**. The stimulation fluid pumping system **202** couples to the stimulation fluid storage system **204** via piping **203**, which may be high pressure steel lines or low pressure hoses depending on the specific application. The stimulation fluid storage system **204** is a vessel that holds a sufficient volume of fluid for the planned stimulation treatments. It is noted that the stimulation fluid storage system **204** may include tanks located on the surface pad **102**, a pit dug on the surface pad **102**, and/or a pond, lake, river or water storage facility located in close proximity to the surface pad **102**.

[0030] To couple the stimulation fluid pumping system **202** to the trees **106a-106c**, the pumping system manifold **206** is utilized. The pumping system manifold **206** may include various components utilized to manage access to the wells **104a-104c** from the stimulation fluid pumping system **202**. For instance, the pumping system manifold **206** may include a set of pipes **208** to interface each of the trees **106a-106c** with the stimulation fluid pumping system **202**. To manage the flow paths through the pipes **208**, a main manifold valve **210** and a manifold check valve **212** may be located near the stimulation fluid pumping system **202**, while a first manifold well valve **214**, second manifold well valve **216**, and a third manifold well valve **218** may be located near each of the trees **106a-106c**, respectively. Each of the trees **106a-106c** may be connected to the first manifold well valve **214**, second manifold well valve **216**, and a third manifold well valve **218**, respectively, or utilize other devices to couple to the trees **106a-106c**. Valves **210, 214, 216** and **218** may be any type of valve, including those routinely used in oil-field applications, such as gate

valves or ball valves, while the manifold check valve **212** may be configured to allow fluid flow from the stimulation fluid pumping system **202**, but to prevent reverse flow of fluids into the stimulation fluid pumping system **202**. These valves **210, 214, 216** and **218** may be actuated or positioned to a full-open or full-closed position to provide hydraulic isolation between individual wells **104a-104c** and the stimulation fluid pumping system **202**. While it may be beneficial for the valves **210, 212, 214, 216** and **218** to seal in a "leak-tight" position, in some applications, it may be acceptable to perform operations with leaky hydraulic seals. In addition, the pumping system manifold **206** may include a densitometer **220**, pressure gauge **222**, ball-sealer injector **224** and/or flowmeter **226**, which may be coupled along the piping **208** near the main manifold valve **210**. However, it should be understood that the specific configuration of components described in the pumping system manifold **206** is for exemplary purposes, and other configurations and placement of components may be utilized for additional functionality.

[0031] Through the coupling of the valves **210, 212, 214, 216** and **218**, flow paths may be provided through the pumping system manifold **206.** Because the first manifold well valve **214**, second manifold well valve **216**, and a third manifold well valve **218** may be set to an open or closed position, stimulation fluid may be injected into one or more of the wells **104a-104c**, while the other wells **104a-104c** may be isolated by at least one of the valves **214-218** from the stimulation fluid pumping system **202**. To enhance reliability, it may be preferred that two valves, such as a manifold well valve **214-218** and a valve (not shown) on the tree **106a-106c**, are closed during any given isolation from the other wells. Additionally, it may also be preferred that at least one or more valves be installed on trees **106a-106c** and that valves in the open position are marked during the stimulation operations.

[0032] Further, other equipment may also be utilized on the surface pad **102**. For instance, a first crane **240** and a second crane **242** may be utilized to suspend stimulation equipment, such as a JITP lubricator system. These cranes **240** and **242** may be located in a fixed position that may access any of the wells **104a-104c** or may be mobile to provide access to any of the wells **104a-104c**. Also, a first wireline unit **244** and a second wireline unit **246** may be used for deploying and activating JITP perforating tools **248**, such as perforating guns, and plug-setting tools **250**, which may include plugs, in the wells **104a-104c**. In addition, a coiled tubing unit

and/or workover rig **252** may be utilized to remove plugs and install production tubing within the wells. The use of the stimulation equipment is further explained below in FIG. 3.

[0033] FIG. 3 is an exemplary flow chart of operations that may be performed on the wells **104a-104c** located on the surface pad **102** of FIG. 1 in accordance with aspects of the present techniques. This flow chart, which is referred to by reference numeral **300**, may be best understood by concurrently viewing FIGs. 1 and 2. In this flow chart **300**, various operations may be performed on wells **104a-104n** in a concurrent or substantially simultaneous manner to reduce costs and time associated with stimulating wells. For exemplary purposes, these operations may be specific to JITP hydraulic proppant fracture stimulation operations, which may include the equipment described in FIG. 2. However, it should again be noted that other stimulation techniques or other operations may be performed under the present techniques.

[0034] The flow chart begins at block **302**. At block **304**, the wells **104a-104c** are drilled on the surface pad **102**. The drilling operations may include installing the production casing and cementing the production casing into the wellbore **108a-108c**. The drilling operations may also include setting the trees **106a-106c**. Then, the target zones to be stimulated within the completion interval may be identified, as shown by block **306**. The identification of the target zones may be performed by using open-hole and/or cased-hole logs to identify zones that include hydrocarbons.

[0035] Once the target zones are identified, the stimulation operations may be performed, as shown in blocks **308-318**. To begin, it should be noted that these stimulation operations may include various activities, such as pumping operations, wireline operations, flowback operations, and other logistical coordination operations. The pumping operations may include high pressure pumping; JITP ball arrival and pressure events; screen-out mitigation and sand flowback; and manipulating pumping manifold valves, wellhead tree valves and/or flowback manifold valves. The wireline operations may include wireless radio and hard wired radios communications; arming perforating guns and plug setting tools; picking-up and laying down perforating guns and plug setting tools; moving wireline in and out of the wellbores; pulling on the wireline to free stuck tools; installing or retrieving perforating guns; and/or raising or lowering man-lifts for personnel access to equipment located

off the surface pad **102**. The flowback operations may include flowing back the well, manipulating choke manifold valves; producing gas to the sales line; and/or venting and flaring gas to the atmosphere. Logistical coordination operations may include water recycling pumping and filtering; proppant delivery; chemical delivery; water hauling; and/or communicating with crews via cellular phones or radios.

[0036] In addition, other drilling-related operations, completion-related and production-related operations may be performed on another or a second well. For instance, other operations may include drilling another well; installing tubing into another well; installing a plug within another well; removing debris from another well; removing the plug from another well; installing production tubing in another well; removing production tubing from another well; moving equipment on the surface pad; delivering material on the surface pad; injecting fluid in another well; manipulating valves; performing coiled tubing operations in another well; performing logging operations in another well; producing hydrocarbons from another well; delivering equipment or materials on the surface pad and/or removing equipment or materials from the surface pad.

[0037] Accordingly, the surface pad **102** is prepared for the stimulation operations, as shown in block **308**. The preparations may include coupling the piping **228a-228c**, manifold valves **230a-230c** and flowlines **234a-234c, 236a-236c** and **238a-238c** together and coupling the pumping system manifold **206** to the trees **106a-106c** and the stimulation fluid pumping system **202**. The pumping system manifold **206** may be coupled to any number of wells with the appropriate valves, flow measurements devices, flow control devices. With the equipment in place, the pumping system manifold **206** may be adjusted to prepare a specific well to receive the stimulation treatment, while the other wells are isolated from the stimulation treatment, as shown in block **310**. As an example, for the stimulation treatment to flow into the first well **104a**, the main manifold valve **210** and first manifold well valve **214** may be placed in the open position, while the second manifold well valve **216** and third manifold well valve **218** may be placed in the closed position to isolate the second and third wells **104b** and **104c**.

[0038] Once the pumping system manifold **206** is configured, a stimulation treatment may be pumped into the one of the wells, as shown in block **312**. Concurrently, with the stimulation treatment of one of the wells, another well may be

prepared for stimulation treatments, as shown in block **314**, while other operations may be conducted in the remaining wells, as shown in block **316**. The preparations may include using the crane **240** and wireline unit **244** to install and run the JITP perforating tools **248** and plug-setting tools **250** into the another well, performing flow-back operations, performing other wireline operations, injecting fluids or materials, and performing plug removal operations and/or other operations, as discussed further below. By preparing another well concurrently with the stimulation of a first well, the other well may be ready for the stimulation treatment when the stimulation treatment is completed in the first well. In this manner, the execution of simultaneous operations performed on the other wells may reduce "non-pumping" time between the first stimulation treatment of the first well and a second stimulation treatment of another well, and reduce the time and cost of the stimulation operation.

[0039] After the first stimulation treatment is completed, a determination is made whether the planned stimulation treatments for the wells are completed, as shown in block **318**. If the planned stimulation treatments for the wells are not complete, then the pumping system manifold **206** may be adjusted to prepare for the next well. That is, the valves in the pumping system manifold **206** are positioned in the appropriate open or closed positions to enable stimulation fluid injection into another of the wells, which is to receive the second stimulation treatment. Again, concurrent or simultaneous operations, such as conveyance of JITP perforating tools **248** and plug-setting tools **250** downhole on wireline and/or flow-back operations may be performed if a third stimulation treatment is to be performed. These simultaneous operations are conducted to prepare other wells for the stimulation treatments with reduced non-pumping time between each of the stimulation treatments. The above process of sequentially manipulating the valves of the pumping system manifold, as shown in block **310**, and pumping stimulation treatments in the wells, while simultaneously performing operations to prepare other wells for further stimulation treatments may be repeated until each of the planned stimulation treatments is completed.

[0040] If the planned stimulation treatments for the wells are complete, then the equipment associated with the stimulation treatments may be rigged-down and moved off the surface pad **102**, as shown in block **320**. Then, a workover rig or coiled tubing unit **252** may be located at the surface pad **102** to drill-out the plugs and

run production tubing in each of the wells, as shown in block **322**. With the production tubing installed, the wells may be utilized to produce hydrocarbons, as shown in block **324**. Accordingly, the process ends at block **326**.

[0041] Beneficially, the present technique reduces the time associated with stimulating multiple wells on a surface pad by performing concurrent operations on two or more of the wells. Also, by saving time, the present technique reduces the cost of performing stimulations on these wells. Further, the use of the pumping system manifold reduces or eliminates the potential safety hazards and additional time delays associated with rig up and/or rig down of high pressure lines from the stimulation fluid pumping system to the individual wells, which may occur multiple times over the course of many days with the use of conventional methods. A specific example of the present techniques is process below and described in greater detail in FIGs. 4-6.

[0042] FIGs. 4-6 are partial views of wells **104a-104c** being utilized to perform concurrent stimulation operations according to the process of FIG. 3 in accordance with certain aspects of the present techniques. The partial views of FIG. 4-6, which are referred to by reference numerals **400, 500** and **600**, respectively, may be best understood by concurrently viewing FIGs. 1 and 2. In these partial views **400, 500** and **600**, three wells **104a-104c** from the surface pad **102** are shown with different operations being performed on each of the wells **104a-104c** in a concurrent or substantially simultaneous manner.

[0043] For exemplary purposes, the operations performed in FIGs. 4-6 may be specific to a five-stage JITP hydraulic proppant fracture treatment, which may be referred to as a stimulation treatment or JITP fracture treatment. Accordingly, each stage of the JITP fracture treatment includes different sub-stages. These sub-stages are as follows: (a) 5,000 gallons of 2% potassium chloride water solution; (b) 2,000 gallons of guar-based linear gel fracture fluid containing 1 pound-per-gallon of proppant; (c) 3,000 gallons of guar-based linear gel fracture fluid containing 2 pounds-per-gallon of proppant; (d) 10,000 gallons of guar-based linear gel fracture fluid containing 3 pounds-per-gallon of proppant; and (e) 3,000 gallons of guar-based linear gel fracture fluid containing 4 pound-per-gallon of proppant such that 50,000 pounds of proppant and 23,000 gallons (approximately 547 barrels of fluid) of stimulation fluid are used in each stage of the JITP fracture treatment. Then, the

pumping may be performed at an average rate of 20 barrels/minute. As a result, the pumping time for each stage may take approximately 27 minutes. Hence, the pumping time for a JITP fracture treatment may be approximately 2 hours and 15 minutes for each well. The following partial views **400, 500** and **600** are described in greater detail in each of the FIGs 4-6 below.

[0044] To begin, in FIG. 4, the first well **104a** may be stimulated using the JITP fracture treatment. It should be noted that for this stimulation treatment, the main manifold valve **210** and first manifold well valve **214** are in the open position, while the second manifold well valve **216** and third manifold well valve **218** are in the closed position to create a first well flow path. Also, a wireline-deployed JITP perforating gun **402**, which may be one of the JITP perforating tools **248**, is suspended via wireline **403** in the wellbore **108a** using the first crane **240**. This JITP perforating gun **402** is actuated and controlled from the first wireline unit **244**. In the first well **104a**, proppant fracture **404** has been placed into the region **110a** of the subsurface formation **112**. The stimulation fluid is pumped down the wellbore **108a** to create a proppant fracture **406**.

[0045] Concurrently, preparation operations may also be performed in the second well **104b**. In the second well **104b**, a wireline-deployed JITP perforating gun **408**, which is another of the JITP perforating tools **248**, and a frac plug setting system **410** having a composite frac plug **409**, which is one of the JITP plug-setting tools **250**, may be deployed via a wireline **411** down the second wellbore **108b** by the second crane **242** and second wireline unit **246**. The second well **104b** may have received a previous stimulation treatment, which has resulted in proppant fractures **412, 414, 416, 418** and **420** in the region **110b** of the subsurface formation **112**. Because these proppant fractures **412, 414, 416, 418** and **420** were previously placed in the subsurface formation **112**, the operations in the second well **104b** may be to place a composite frac plug **409** within the wellbore **108b** above the proppant fractures **412, 414, 416, 418** and **420.**

[0046] In addition to the concurrent operations being performed in the second well **104b**, other operations may also be performed in the third well **104c**. For example, in the third well **104c**, proppant fractures **422, 424, 426, 428** and **430** may have been previously formed in the region **110c** of the subsurface formation **112**. Because these proppant fractures **422, 424, 426, 428** and **430** were previously

formed, flowback operations may be performed to force close the proppant fractures **422, 424, 426, 428** and **430** and recover the stimulation fluid used to form the proppant fractures **422, 424, 426, 428** and **430**, and produce hydrocarbons to the sales lines.

[0047] Next, FIG. 5 illustrates the wells **104a-104c** after the operations performed in FIG. 4 are completed. As shown in the partial view **500**, the proppant fractures **404, 406, 502, 504** and **506** were created with the pumping of the five-stage JITP treatment in FIG. 4. However, in FIG. 5, the first well **104a** is being flowed back after the placement of proppant fractures **404, 406, 502, 504** and **506** in the region **110a** of the subsurface formation **112** to force close the proppant fractures **404, 406, 502, 504** and **506** and recover the stimulation fluid used to place the proppant fractures **404, 406, 502, 504** and **506**, and produce hydrocarbons to the sales lines.

[0048] Concurrently, the second well **104b** may be receiving the five-stage JITP hydraulic proppant fracture treatment. It should be noted that for this stimulation operation, the main manifold valve **210** and second manifold well valve **216** are in the open position, while the first manifold well valve **214** and third manifold well valve **218** are in the closed position to create a second well flow path. Again, as discussed in FIG. 4, the wireline-deployed JITP perforating gun **408** and frac plug setting system **410** are suspended via wireline **411** in the wellbore **108b** using the second crane **242**, which is also actuated and controlled from the second wireline unit **246**. However, in this view, the composite frac plug **409** is set above the proppant fracture **420**. With this composite frac plug **409** installed, the five-stage JITP proppant fracture treatment is underway with the stimulation fluid pumped down the wellbore **108b** to create proppant fracture **510**.

[0049] Another concurrent operation is also being performed in the third well **104c**. In this well, the flowback operation has been completed and the well **104c** is now shut-in. Accordingly, to prepare for the next stimulation treatment, a wireline-deployed JITP perforating gun **512,** which is another of the JITP perforating tools **248**, and a frac plug setting system **514** having a composite frac plug **516**, which is one of the JITP plug-setting tools **250,** are deployed down the wellbore **108c**. The JITP perforating gun **512** and a frac plug setting system **514** are suspended via wireline **403** in the wellbore **108c** using the first crane **240**, and are actuated and controlled from the first wireline unit **244**. The JITP perforating gun **512** and frac plug

setting system **514** may then be utilized to JITP stimulate and place additional proppant fractures above the proppant fractures **430**.

[0050] Finally, FIG. 6 illustrates the wells **104a-104c** after the operations performed in FIG. 5 are completed. As shown in the partial view **600**, the flowback operation has been completed and the first well **104a** has been shut-in. In this view, the wireline-deployed JITP perforating gun **601,** which is another of the JITP perforating tools **248**, and a frac plug setting system **602** having a composite frac plug **603**, which is one of the JITP plug-setting tools **250,** are deployed down the wellbore **108a**. The JITP perforating gun **601** and frac plug setting system **602** are suspended via wireline **411** in the wellbore **108a** using the second crane **242**, and are actuated and controlled from the second wireline unit **246**. The frac plug setting system **602** may be utilized to set the composite frac plug **603**, while the JITP perforating gun **601** may be utilized in the next five-stage JITP treatment to create proppant fractures above proppant fracture **506** during the next stimulation treatment.

[0051] Concurrently, in the second well **104b**, stimulation treatments are completed and the proppant fracture **510, 604, 606, 608** and **610** have been placed into the region **110b** of the subsurface formation **112**. Accordingly, the second well **104b** is flowed back after placement of proppant fractures **510, 604, 606, 608** and **610** to force close the fractures and recover the stimulation fluid used when placing the proppant fractures, and produce hydrocarbons to the sales lines.

[0052] Also, in another concurrent operation, the composite frac plug **516** has been set in the third well **104c** and the pumping of a five-stage JITP proppant fracture treatment has created proppant fractures **614** and **616.** It should be noted that for this stimulation treatment, the main manifold valve **210** and third manifold well valve **218** are in the open position, while the first manifold well valve **214** and second manifold well valve **216** are in the closed position to create a third well fluid flow path. Again, as discussed in FIG. 5, the wireline-deployed JITP perforating gun **512** and frac plug setting system **514** are suspended via wireline **403** in the wellbore **108c** using the first crane **240** and is actuated and controlled from the first wireline unit **244**. In this view, a composite frac plug **516** is set above the proppant fracture **430**. With this composite frac plug **516** installed, the JITP proppant fracture treatment is performed to form the proppant fractures **614** and **616** by having the stimulation fluid pumped down the wellbore **108c**.

[0053] Beneficially, in this example, the concurrent operations enhance the stimulation treatment process. For instance, if the wireline running speeds is approximately 150 ft/min (feet/minute) to 300 ft/min for the assumed approximate 12,000 ft well depth, then, the time to pump a total of fifteen proppant fracture treatments is approximately ten hours. Accordingly, each well receiving the stimulation treatment may be flowed back overnight for several hours of stimulation fluid recovery and for oil and gas sales. In this manner, the stimulation treatments for multiple wells may be performed in an efficient manner that reduces time and cost.

[0054] To further explain the benefits of the present techniques, another example is described. In this example, nine wells may be drilled on a single surface pad of approximately six acres. These wells may target gas-productive reservoir targets, such as sand bodies, within a subsurface formation, and are configured to drain an area of approximately 20 acres. For these wells, the well depths may range between approximately 12,000 ft to 15,000 ft with lateral throws of approximately 1,400 ft to 2,000 ft relative to the surface pad. The size and location of the surface pad may be determined by the geological and reservoir characteristics, governmental regulations, surface topography and terrain, and consideration of environmental or regulatory requirements that are identified during the pad selection/location process. The characteristic features of the subsurface formation may be gas resources contained in multiple (e.g., 20+ to 40+) low permeability ("tight") gas sands of limited areal extent distributed over a large vertical section of approximately 4,000 ft to 6,000 ft thick interval. Accordingly, each well includes up to forty or more reservoir targets or zones.

[0055] To access these target zones, the wells are stimulated with the JITP stimulation techniques with each five stage JITP fracture treatment separated by a plug. The wireline plug-setting operation, which may be approximately two to four hours depending on well depth, running speed, and rig-up/rig-down time, may be completed while the stimulation treatment pumping operations are performed on another well. The stimulation treatment pumping operations for the five zones may be completed in approximately 3 hours. Accordingly, fifteen to twenty zones may be pumped each work day, which results in approximately two or three work days to complete a forty zone stimulation operation. Thus, by performing the stimulation operations in a concurrent manner, a total of approximately one or two work days

associated with "non-pumping time" may be saved on each well during the stimulation treatments.

[0056] In addition, it should be noted that these stimulation operations may include various activities. For instance, as noted above, the stimulation operations may include pumping operations, wireline operations, flowback operations, and logistical coordination operations. Because these stimulation operations may be performed concurrently or simultaneously on different wells on a single surface pad, several risks associated with the different operations may be present. Accordingly, certain stimulation operations may be performed concurrently to reduce the risks and maintain the operational integrity of the simultaneous operations.

[0057] To begin, in performing the concurrent stimulation operations, different combinations of pumping operations, wireline operations, flowback operations, and logistical coordination operations may be performed on the different wells with certain monitoring procedures. The monitoring procedures may include using a spotter for certain operations, a light or audible warning, obtaining supervisor approval for certain operations, communicating between personnel, flagging or labeling valve positions, following lock-out tag-out procedures, and other similar processes. For instance, when the stimulation operations are being performed on the first well, operations, such as proppant delivery, chemical delivery, and/or water hauling, on the second well may be performed within designated areas and using a spotter, which is discussed below. As another example, supervisor approval may be obtained before venting gas when the operations on the other well involve high pressure pumping, manipulating pumping manifold/frac valves and gas to sales line operations. Further, when the operations on the first well involve high pressure pumping, operations on the second well, such as arming the perforating gun or setting tool and picking-up or laying down the perforating gun or setting tool, may utilize lights and audible notifications. Finally, it may be preferred to not perform certain operations concurrently. For instance, if the operations on the first well involve high pressure pumping or JITP ball sealing pressure events, the manipulating the manifold well valves and wellhead tree valves should not be concurrently performed. Also, if operations on the first well include wireless radio and cell phone communications, then the operations should not be performed concurrently with arming perforating guns and setting tools.

[0058] Another method of reducing risk may include assigning personnel to manage the operations. For instance, if a crane, such as cranes **240** and **242** of FIG. 2, are used as part of the stimulation operations, it may be preferred that the personnel operating the crane include a designated spotter to assist with crane operations. Further, the crane may be positioned to reduce potential collisions with other equipment on the surface pad. Also, based on the potential for hydraulically-energized lines associated with injection and flowback from the wells, it may be preferred that one of the personnel associated with the stimulation system manage the stimulation pumping valve positions and the flowback valve positions, while concurrent operations are being performed.

[0059] In another embodiment, it may be preferred to include monitoring equipment at the surface pad **102** of FIG. 2, which may detect gases, such as hydrocarbon gases. For example, the surface pad **102** and/or personnel may be equipped with portable Lower-Explosive Limit ("LEL") detectors. Accordingly, during flowback operations, the LEL detectors may continuously monitor the surface pad **102** for the presence of hazardous gas levels. If hazardous gas levels are detected, the flowback operations may be suspended and appropriate activities may be performed to solve any problems with equipment. Also, it may be preferred that windsocks are installed at various points and heights on the surface pad **102** to aid in determining wind direction, as well.

[0060] Further, in another alternative embodiment, it may be beneficial to have automated devices, such as processor based devices, which are utilized for the stimulation operations. For instance, the stimulation fluid pumping system **202** may be automated and controlled by a processor based device, such as a computer system. With the computer system, the stimulation treatment schedules for each individual stimulation treatment may be pre-programmed into the computer system. Also, the pumping system manifold **206** may include a processor based device, such as a computer system, as well. The computer system for the pumping system manifold **206** may include mechanisms to adjust the valves **210, 214, 216** and **218** between the open and closed positions, and communicate with the various gauges **220, 222** and **226** and ball-sealer injector **224**. In fact, the computer systems of the stimulation fluid pumping system **202** and the pumping system manifold **206** may be

configured to interact with each other to manage the pumping stimulation treatment process for the plurality of wells **104a-104c**.

[0061] In a third alternative embodiment, the designation of specific work areas for certain operations for handling associated tools and equipment may be performed between blocks **306** and **318** of FIG. 3. That is, the process may include designating different areas, such as high-pressure pumping area, wireline/crane areas, and flowback areas, on the surface pad **102** of FIG. 2 to prevent unauthorized personnel from entering restricted areas. The designation of work areas may include providing detailed drawings of piping, valves, and flow control/measurement devices for the operations for each of the work areas and wells. For instance, if cranes **240** and **242** and wireline units **244** and **246** of FIG. 2 are used, it may be preferred that a designated wireline/crane area be located surrounding and adjacent to each of the cranes **240** and **242**. Also, it may be preferred that stimulation equipment, such as the stimulation fluid pumping system **202**, stimulation fluid storage system **204** and pumping system manifold **206** of FIG. 2, are arranged on the surface pad **102** with pathways or routes around the outer perimeter of the high-pressure pumping area to provide access for reloading of stimulation materials and supplies. Further, it may be preferred that piping and valves be identified using different unique colored markings or other labels for each of the different wells to assist in visual observations and understanding of the flow paths and equipment tie-in points.

[0062] Also, in a fourth alternative embodiment, it may be preferable for a communication protocol to be established between blocks **306** and **318** of FIG. 3. For example, when executing simultaneous wireline operations, if select-fire perforating guns are used, it may be preferred that wireless communication devices, such as radios and other cellular devices, are turned off and/or stored in a central location when a gun is armed and placed in the wellbore or removed from the wellbore. Alternatively, it may be preferred that "hard-wired" radios and communication devices are used as the primary communication devices with wireless communication devices only utilized as back-up equipment. Further, strobe-warning lights and/or a loudspeaker system may be used to provide an indication of the status of the gun arming sequence and depth of gun during the operations.

[0063] It should be noted that the pumping system manifold **206** of FIG. 2 may not include each of the components described above. Indeed, in alternative

embodiments, additional measurement devices, flow control devices, fluid injection or withdrawal ports, and/or material injection or withdrawal ports may be included in the pumping system manifold **206** and/or upstream or downstream of the pumping system manifold **206**.

[0064] Furthermore, it should also be noted that the number of wells and geometry of the surface location may be influenced by a number of factors to conform to appropriate regulatory requirements and other factors. Accordingly, wells may possess vertical, deviated, S-shaped, and/or horizontal trajectories. For example, these trajectories may target multiple hydrocarbon bearing targets being drilled, stimulated, and completed on approximately 5/8 acre spacing in low-permeability oil fields; on approximately 10 to 40 acre well spacing in tight gas fields; and on approximately 40 acre, 80 acre and/or 160 acre spacing associated with in-fill drilling processes. Also, wells may be completed as cased-hole completions or open-hole completions. In addition, the present techniques may include a single unique surface area (i.e. pad) or two or more surface pads in sufficiently close proximity for performing the drilling, stimulation, completion, and production operations objectives. The possible use of wells from two or more surface pads may be determined based on local geographic conditions, material supply routes, and/or overall field infrastructure, specific operational requirements, and/or economic considerations.

[0065] As noted above, the present techniques may also be used for stimulation treatments involving hydraulic fracturing or acid stimulation in production or injection wells. Hydraulic fracturing may include injecting fluids into a formation at high pressures and rates that the reservoir rock fails and granular proppant material, such as sand, ceramic beads, or other materials, is injected to hold the fracture(s) open. Increased reservoir production capacity or injection capacity results from the flow path left between the grains of the proppant material within the fracture(s). In chemical stimulation treatments, such as matrix acidizing treatments or acid fracturing treatments, flow capacity is improved by dissolving materials in the formation or otherwise changing formation properties.

[0066] Moreover, the present techniques may be used for stimulation treatments involving multiple stage treatments or single-stage treatments. Multiple stage stimulation treatments may include the JITP or ACT-Frac treatment methods, which

are discussed above. In addition, the multiple stage stimulation treatments may include other multiple stage treatments, such as stimulation treatments disclosed in U.S. Patent 5,890,536 and U.S. Patent No. 6,186,230, which are herein incorporated by reference. Also, other methods utilized in oil and gas operations, such as "limited-entry" diverted multi-stage treatments, annular coiled-tubing, coiled-tubing, ball-sealer multi-stage treatments, modified limited entry multi-stage treatments, induced stress diverted treatments, or multiple single-stage treatments separated by plugs, or any combination of treatments, may also be utilized with the present techniques.

[0067] In addition, it should be appreciated that the surface pad, such as surface pad 102, may include two or more stimulation fluid pumping systems. For instance, a surface pad may include two stimulation fluid pumping system, which are stimulation fluid pumping system **202** of FIG. 2. This configuration for the surface pad may also include two stimulation storage systems **204**, two pumping system manifolds **206,** and other associated piping. Each of the stimulation storage systems, pumping system manifolds, and other associated piping may each be associated with two different groups or sets of wells. In this manner, two wells may be stimulated concurrently or simultaneously. That is, one well associated with each of the stimulation fluid pumping systems may receive stimulation treatments, while other wells from the well groups may be prepared for stimulation treatments.

[0068] While the present techniques of the invention may be susceptible to various modifications and alternative forms, the exemplary embodiments discussed above have been shown by way of example. However, it should again be understood that the invention is not intended to be limited to the particular embodiments disclosed herein. Indeed, the present techniques of the invention are to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the following appended claims.

CLAIMS

What is claimed is:

1. A method associated with the production of hydrocarbons comprising:

connecting a plurality of wells to a stimulation fluid pumping system via a pumping system manifold;

adjusting the pumping system manifold to provide a first well flow path from the stimulation fluid pumping system to a first well of the plurality of wells;

pumping a first stimulation treatment into the first well; and

preparing a second well of the plurality of wells for a second stimulation treatment concurrently with the pumping of the first stimulation treatment.

2. The method of claim 1 wherein adjusting the pumping system manifold comprises configuring at least one of a plurality of valves to provide the first well flow path and configuring at least one of the plurality of valves to isolate the first stimulation treatment from entering the second well.

3. The method of claim 1 further comprising adjusting the pumping system manifold to provide a second well flow path from the stimulation fluid pumping system to the second well.

4. The method of claim 3 further comprising pumping the second stimulation treatment in the second well.

5. The method of claim 1 wherein the first stimulation treatment comprises one of hydraulic proppant fracture treatment, acid fracture treatment, matrix acid treatment and any combination thereof.

6. The method of claim 1 wherein the first stimulation treatment comprises one of just-in-time perforating, annular coiled-tubing, coiled-tubing, limited-entry, ball-sealer, modified limited entry, induced stress diverted, or one or more single-stage stimulation treatments separated by plugs and any combination thereof.

7. The method of claim 1 wherein the first stimulation treatment comprises a multi-zone just-in-time perforating hydraulic proppant fracture stimulation treatment.

8. The method of claim 1 wherein preparing the second well comprises one of drilling the second well, installing tubing into the second well, installing a plug within the second well, flowing back the second well, removing debris from the second well, removing the plug from the second well, removing tubing from the second well, moving equipment on a surface pad, delivering material on the surface pad, communicating by radio or cellular phone on the surface pad, injecting fluid in the second well, manipulating valves, performing wireline operations in the second well, performing coiled tubing operations in the second well, installing or retrieving perforating guns in the second well, performing logging operations in the second well, producing hydrocarbons from the second well, venting gas on the surface pad, flaring gas on the surface pad, delivering equipment or materials on the surface pad, removing equipment or materials from the surface pad and performing logging operations.

9. The method of claim 1 further comprising producing hydrocarbons from the plurality of wells.

10. The method of claim 1 further comprising drilling the plurality of wells from a single surface pad.

11. The method of claim 1 wherein the plurality of wells are located on a single surface pad.

12. The method of claim 1 wherein the plurality of wells are in close proximity to each other on one or more surface pads or platforms.

13. The method of claim 1 further comprising installing production tubing into each of the plurality of wells.

14. A method associated with the production of hydrocarbons comprising the steps of:

a) connecting a plurality of wells to a stimulation fluid pumping system via a pumping system manifold;

b) adjusting the pumping system manifold to provide a stimulation treatment from the stimulation fluid pumping system to one of the plurality of wells;

c) isolating another of the plurality of wells from the stimulation treatment concurrently with the pumping of the stimulation treatment to prepare the another well for another stimulation treatment;

d) repeating steps b and c until each of the plurality of wells have received stimulation treatments; and

e) producing hydrocarbons from the plurality of wells once the stimulation treatments have been performed.

15. The method of claim 14 wherein the plurality of wells are located on a single surface pad.

16. A well system comprising:

a plurality of oil field trees located on a surface pad, wherein each of the plurality of oil field trees is associated with one of a plurality of wells;

a stimulation fluid pumping system; and

a pumping system manifold connecting the stimulation fluid pumping system to the plurality of oil field trees.

17. The well system of claim 16 wherein the pumping system manifold is configured to:

provide a flow path from the stimulation fluid pumping system into at least one selected well of the plurality of wells; and

isolate at least one non-selected well of the plurality of wells from the stimulation fluid pumping system.

18. The well system of claim 16 wherein the pumping system manifold comprises a plurality of valves.

19. The well system of claim 18 wherein the plurality of valves comprises at least one of a ball valve, gate valve and any combination thereof.

20. The well system of claim 16 wherein the plurality of wells are associated with a single surface pad.

21. The well system of claim 16 wherein the plurality of wells are in close proximity to each other on one or more surface pads.

22. The well system of claim 16 further comprising a stimulation fluid storage system coupled to the stimulation fluid pumping system.

23. The well system of claim 16 wherein at least two of the plurality of wells penetrate multiple hydrocarbon-bearing reservoirs.

24. The well system of claim 16 wherein the stimulation fluid pumping system and the pumping system manifold provide multi-zone stimulation treatments to the multiple hydrocarbon-bearing reservoirs penetrated by the at least two of the plurality of wells.

25. The well system of claim 16 wherein the stimulation fluid pumping system is a hydraulic proppant fracture stimulation system.

26. The well system of claim 16, wherein the stimulation fluid pumping system is one of a Just-in-Time Perforating system and a Annular-Coiled Tubing Fracturing system.

27. The well system of claim 16 further comprising:

a plurality of additional oil field trees located on the surface pad, wherein each of the plurality of additional oil field trees are associated with one of a plurality of additional wells;

an additional stimulation fluid pumping system; and

an additional pumping system manifold connecting the additional stimulation fluid pumping system to the plurality of additional oil field trees.

28. An apparatus for stimulating surface wells comprising:

a main valve associated with a stimulation fluid pumping system;

a plurality of well valves, wherein each of the plurality of well valves is associated with one of a plurality of wells; and

piping coupling the main valve to the plurality of well valves, wherein the piping is directly supported by the surface of the Earth.

29. The apparatus of claim 28 further comprising a densitometer coupled to the main valve and the plurality of well valves.

30. The apparatus of claim 28 wherein the plurality of well valves comprises at least one of a ball valve, gate valve and any combination thereof.

31. The apparatus of claim 28 further comprising at least one manifold check valve coupled to the main valve and the plurality of well valves.

32. The apparatus of claim 28 further comprising at least one pressure gauge coupled to the main valve and the plurality of well valves.

33. The apparatus of claim 28 further comprising at least one flow meter coupled to the main valve and the plurality of well valves.

34. The apparatus of claim 28 further comprising at least one ball-seal injector coupled to the main valve and the plurality of well valves.

35. A method associated with the production of hydrocarbons comprising:

connecting a first well and a second well to a first stimulation fluid pumping system via a first pumping system manifold;

connecting a third well and a fourth well to a second stimulation fluid pumping system via a second pumping manifold;

adjusting the first pumping system manifold to provide a first stimulation treatment to the first well and to isolate the second well for other operations;

adjusting the second pumping system manifold to provide a second stimulation treatment to the third well and to isolate the fourth well; and

pumping the first stimulation treatment into the first well and the second stimulation treatment into the third well concurrently with the pumping of the first stimulation treatment.

36. The method of claim 35 further comprising:

preparing the second well for a third stimulation treatment concurrently with the pumping of the first stimulation treatment; and

preparing the fourth well for a fourth stimulation treatment concurrently with the pumping of the second stimulation treatment.

37. The method of claim 36 wherein the preparing the second well for a third stimulation treatment comprises disposing a JITP perforating tool into the second well.

38. The method of claim 36 wherein the first stimulation treatment comprises one of hydraulic proppant fracture treatment, acid fracture treatment, matrix acid treatment and any combination thereof.

39. The method of claim 35 wherein the first stimulation treatment and the second stimulation treatment comprise one of just-in-time perforating, annular coiled-tubing, coiled-tubing, limited-entry, ball-sealer, modified limited entry, induced stress diverted, or one or more single-stage stimulation treatments separated by plugs and any combination thereof.

40. The method of claim 35 wherein the first stimulation treatment comprises a multi-zone just-in-time perforating hydraulic proppant fracture stimulation treatment.

41. The method of claim 36 wherein preparing the second well comprises one of drilling the second well, installing tubing into the second well, installing a plug within the second well, flowing back the second well, removing debris from the second well, removing the plug from the second well, removing tubing from the second well, moving equipment on a surface pad, delivering material on the surface pad, communicating by radio or cellular phone on the surface pad, injecting fluid in the second well, manipulating valves, performing wireline operations in the second well, performing coiled tubing operations in the second well, installing or retrieving perforating guns in the second well, performing logging operations in the second well, producing hydrocarbons from the second well, venting gas on the surface pad, flaring gas on the surface pad, delivering equipment or materials on the surface pad,

removing equipment or materials from the surface pad and performing logging operations.

42. The method of claim 35 comprising producing hydrocarbons from the first well once the stimulation treatment is completed.

43. The method of claim 35 further comprising drilling the first well, second well, third well and fourth well from a single surface pad.

44. The method of claim 35 wherein the first well, second well, third well and fourth well are located on a single surface pad.

45. The method of claim 35 wherein the first well, second well, third well and fourth well are in close proximity to each other on one or more surface pads or platforms.

46. The method of claim 35 comprising installing production tubing into each of the first well, second well, third well and fourth well.

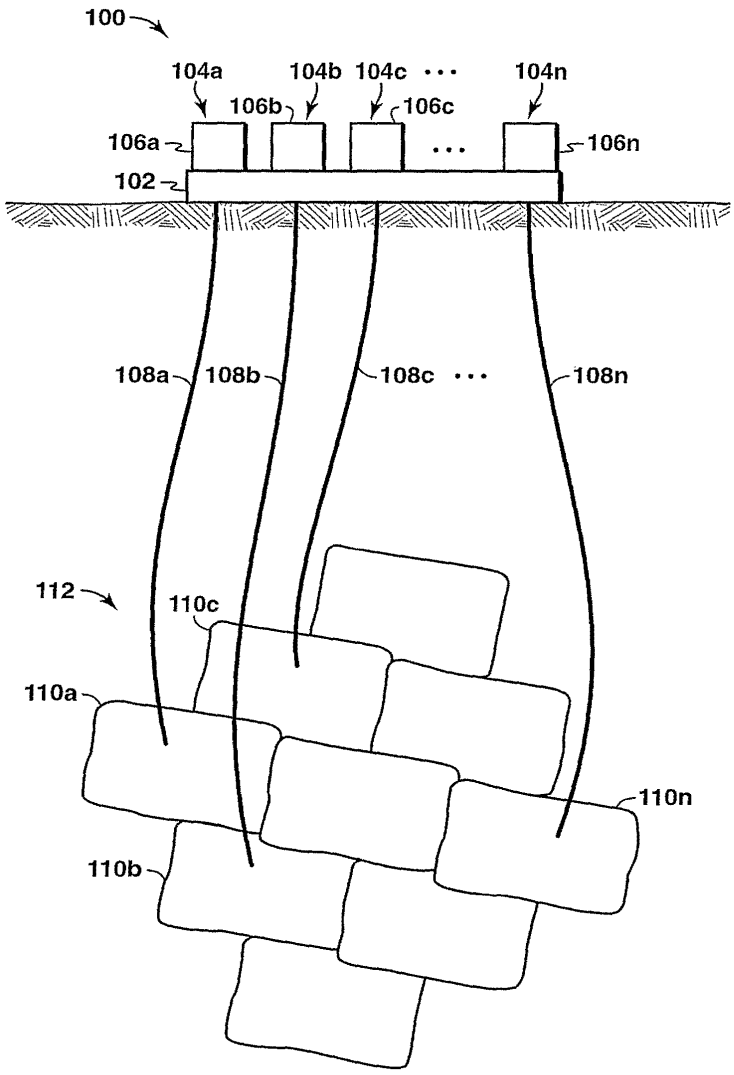

100
104a
104b
104c
104n
106b
106c
106a
106n
102
108a
108b
108c
108n
112
110c
110a
110n
110b

FIG. 1

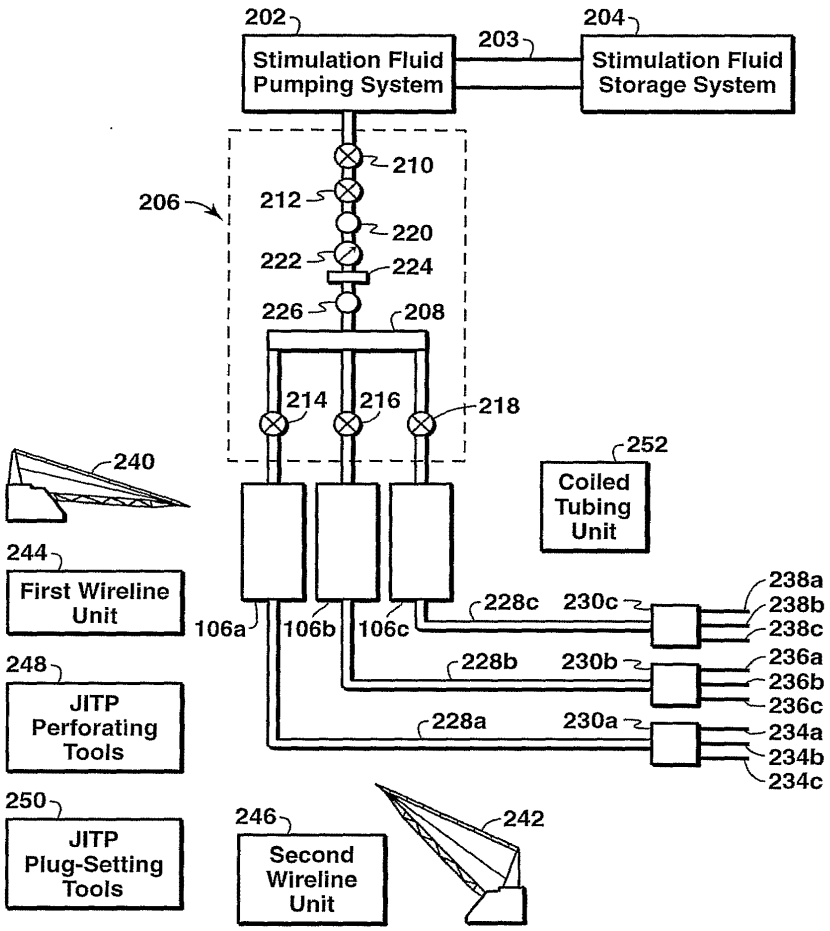

202
Stimulation Fluid Pumping System
203
204
Stimulation Fluid Storage System
206
210
212
220
222
224
226
208
214
216
218
240
252
Coiled Tubing Unit
244
First Wireline Unit
106a
106b
106c
228c
230c
238a
238b
238c
228b
230b
236a
236b
236c
248
JITP Perforating Tools
228a
230a
234a
234b
234c
250
JITP Plug-Setting Tools
246
Second Wireline Unit
242

FIG. 2

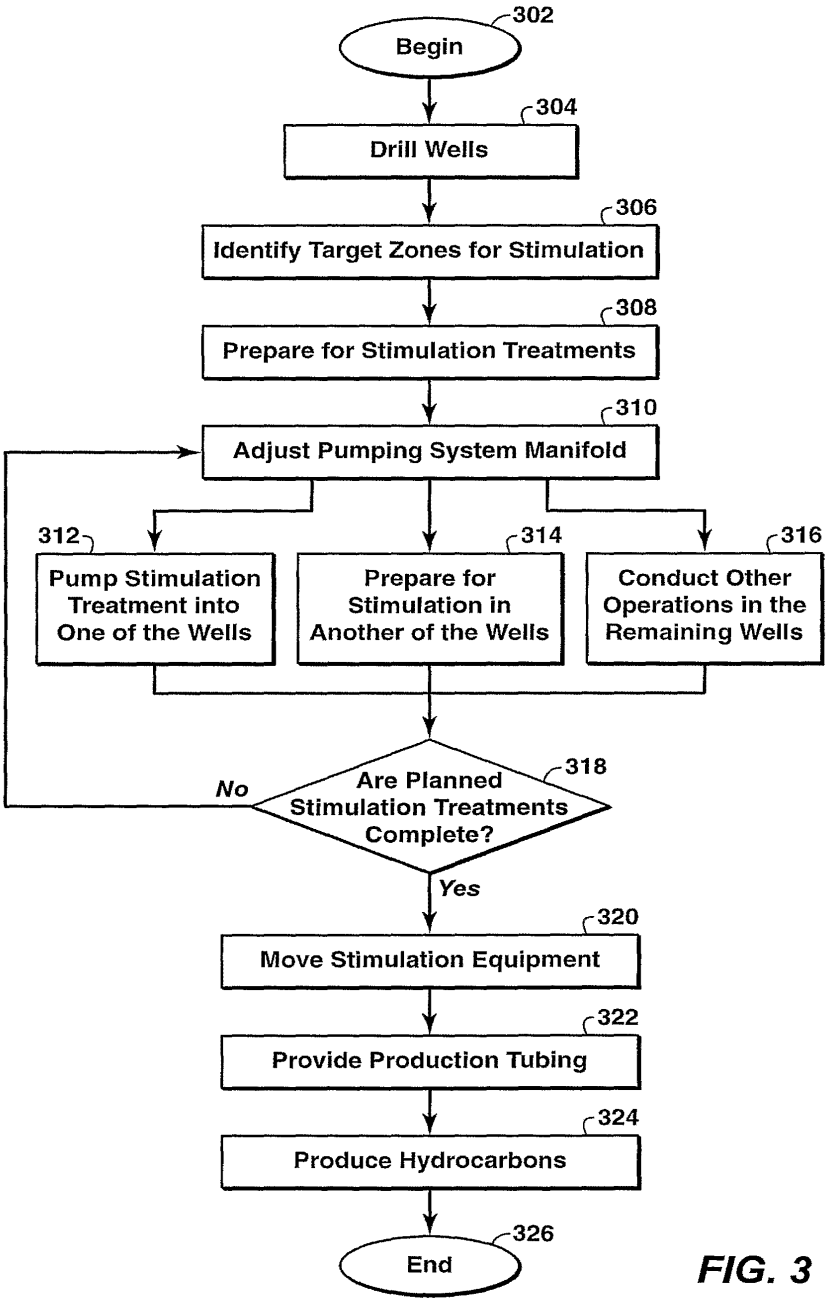

302
Begin
304
Drill Wells
306
Identify Target Zones for Stimulation
308
Prepare for Stimulation Treatments
310
Adjust Pumping System Manifold
312
Pump Stimulation Treatment into One of the Wells
314
Prepare for Stimulation in Another of the Wells
316
Conduct Other Operations in the Remaining Wells
318
Are Planned Stimulation Treatments Complete?
No
Yes
320
Move Stimulation Equipment
322
Provide Production Tubing
324
Produce Hydrocarbons
326
End

FIG. 3

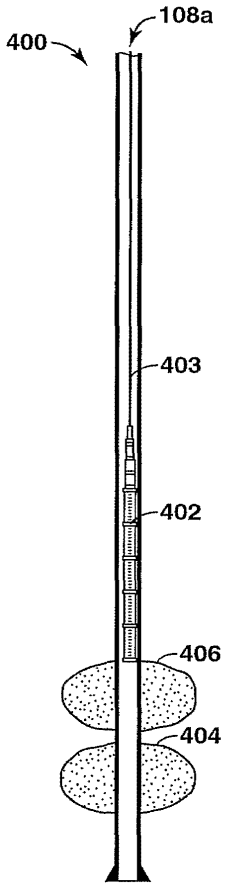


FIG. 4A

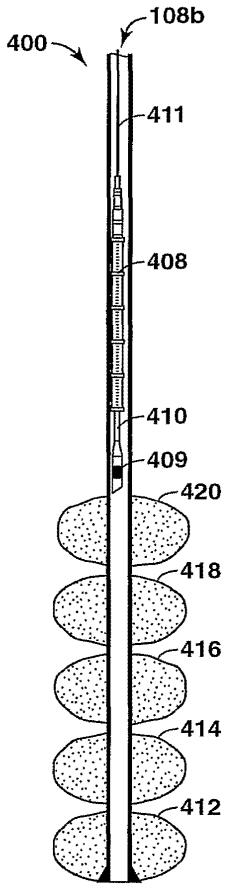


FIG. 4B

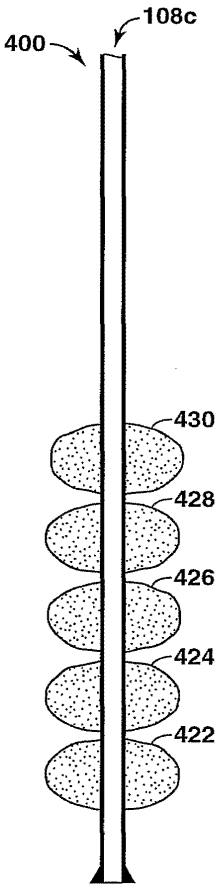


FIG. 4C

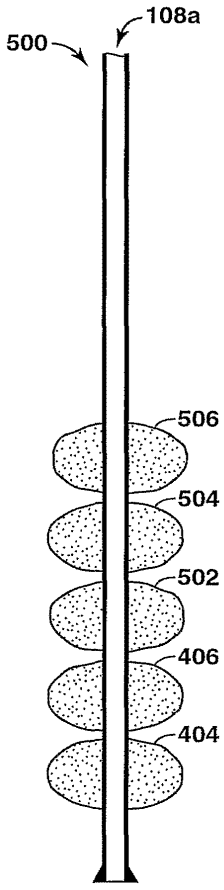


FIG. 5A

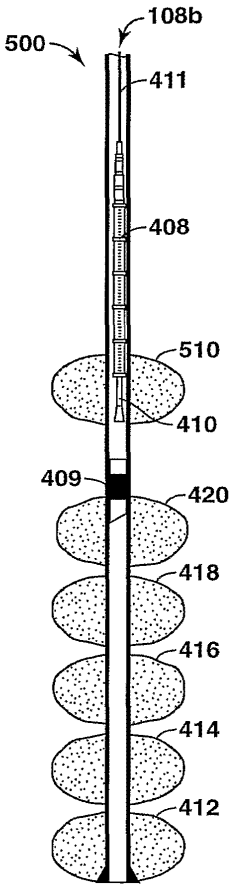


FIG. 5B

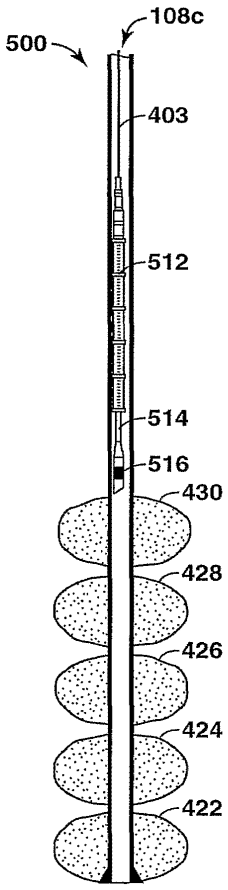


FIG. 5C

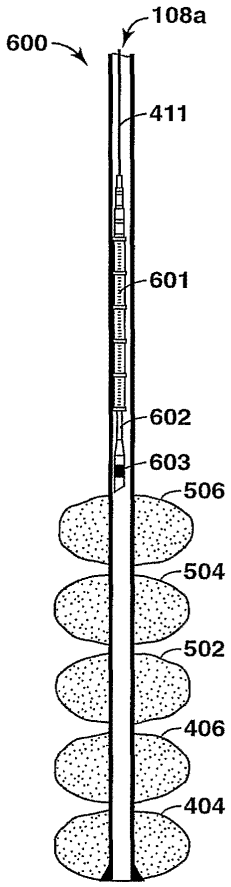


FIG. 6A

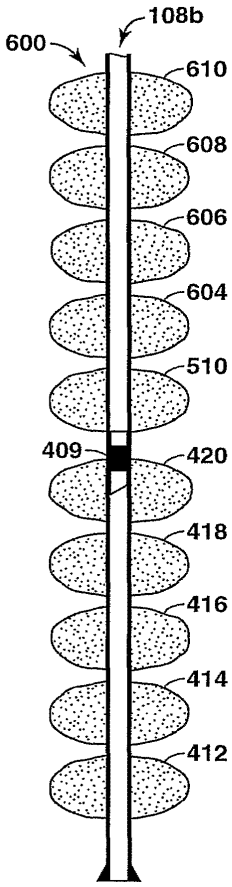


FIG. 6B

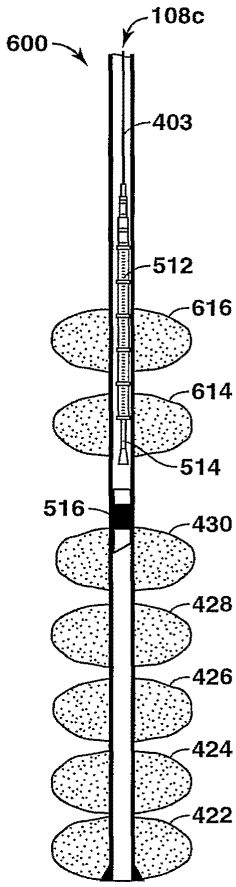


FIG. 6C

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11291496	MCNEEL ET AL.
	Examiner	Art Unit
	Angela M DiTrani	3676

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/27/2007	10/15/2007	08/18/2008	03/04/2009					
	1	N	N	N	N					
	2	N	N	N	N					
	3	N	N	N	N					
	4	N	N	N	N					
	5	N	N	N	N					
	6	N	N	N	N					
	7	N	N	N	N					
	8	N	N	N	N					
	9	N	N	N	N					
	10	N	N	N	N					
	11	✓	✓	✓	✓					
	12	✓	✓	✓	✓					
	13	✓	✓	✓	✓					
	14	✓	✓	✓	✓					
	15	✓	✓	✓	✓					
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	35	N	N	N	N					
	36	N	N	N	N					

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11291496	MCNEEL ET AL.
	Examiner	**Art Unit**
	Angela M DiTrani	3676

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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/27/2007	10/15/2007	08/18/2008	03/04/2009					
	37	N	N	N	N					
	38	N	N	N	N					
	39	N	N	N	N					
	40			✓	✓					
	41			✓	✓					
	42			✓	✓					
	43				✓					

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CONFIRMATION NO. 7986

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/291,496	12/01/2005 RULE	166	3676	2005-IP-018647U1

APPLICANTS

William Lloyd McNeel, Green River, WY;
Steve Harris, Palisade, CO;
Dave McLeod, Houston, TX;

**** CONTINUING DATA **************************

**** FOREIGN APPLICATIONS **************************

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01/06/2006

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/ANGELA M DITRANI/ Examiner's Signature	☐ Initials	WY	7	39	5

ADDRESS

JOHN W. WUSTENBERG
P.O. BOX 1431
DUNCAN, OK 73536
UNITED STATES

TITLE

Method and apparatus for centralized well treatment

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3372	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	392	manifold$1 and (subterranean welL $1bore$1 bore $1hole$1 down $1hole$1 oil$1well $1 oil$1field$1) and stimulat$3	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/03/02 10:13
S2	3	(("6745838") or ("6851444") or ("5555934")).PN.	USPAT; USOCR	OR	OFF	2009/03/02 10:38
S3	3	S2 and manifold$1	USPAT	OR	OFF	2009/03/02 10:38
S4	1	("6394184").PN.	USPAT; USOCR	OR	OFF	2009/03/02 12:27
S5	5	(("6394184") or ("6520255") or ("6543538") or ("6575247") or ("6672405")).PN.	USPAT; USOCR	OR	OFF	2009/03/02 12:47
S6	1	("4305463").PN.	USPAT; USOCR	OR	OFF	2009/03/02 12:54
S7	5	(("6394184") or ("6520255") or ("6543538") or ("6757247") or ("6672405")).PN.	USPAT; USOCR	OR	OFF	2009/03/04 09:55
S8	144	(prop$1ant$1 same blend$3 same ((fractur$3 stimulat $3) with fluid$1)) and (subterranean well$1bore$1 bore $1hole$1 down $1hole$1 oil$1well $1 oil$1field$1)	USPAT	OR	OFF	2009/03/04 09:56

3/4/2009 1:35:00 PM

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11291496	MCNEEL ET AL.
	Examiner	**Art Unit**
	Angela M DiTrani	3676

SEARCHED			
Class	**Subclass**	**Date**	**Examiner**

SEARCH NOTES		
Search Notes	**Date**	**Examiner**
Search in EAST and Google Patents (see search history)		KWL
Consulted primary examiners G Suchfield and H Dang and SPE J Gay		KWL
East text search (US-PGPUB, USOCR, USPAT, EPO, JPO, DERWENT, IBM_TDB)	03/02/09	AD

INTERFERENCE SEARCH			
Class	**Subclass**	**Date**	**Examiner**

/Angela M DiTrani/ Examiner.Art Unit 3676	

PTO/SB/08a (03-06)
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Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	McNeel, Lloyd
Art Unit	3676
Examiner Name	Ditrani, Angela
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2953460		1960-09-20	Baker, John C.	
	2	2980291		1961-04-18	Schuerger, Thomas R.	
	3	4410106		1983-10-18	Kierbow, et al.	
	4	4427133		1984-01-24	Kierbow, et al.	
	5	4701095		1987-10-20	Berryman, et al.	
	6	4850750		1989-07-25	Cogbill, et al.	
	7	5245548		1993-09-14	Kuan	
	8	6120175		2000-09-19	Tewell	

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Receipt date: 02/02/2009

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Application Number	11291496 11291496 - GAU: 3676
Filing Date	2005-12-01
First Named Inventor	McNeel, Lloyd
Art Unit	3676
Examiner Name	Ditrani, Angela
Attorney Docket Number	2005-IP-018647U1

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	1	Office Action for U.S. Serial No. 11/363,559 mailed 1/23/09	☐

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Doc description: Information Disclosure Statement (IDS) Filed

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	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

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Receipt date: 02/19/2009	Application Number	11291496	11291496 - GAU: 3676
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2005-12-01	
(Not for submission under 37 CFR 1.99)	First Named Inventor	McNeel, Lloyd	
	Art Unit	3676	
	Examiner Name	Ditrani, Angela	
	Attorney Docket Number	2005-IP-018647U1	

	1	Office Action for U.S. Serial No. 11/545,749, mailed February 10, 2009	☐

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Doc description: Information Disclosure Statement (IDS) Filed

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Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	Lloyd McNeel
Art Unit	3676
Examiner Name	Kerry W. Leonard
Attorney Docket Number	HES 2005-IP-018647U1

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Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20080236818	A1	2008-10-02	Dykstra	

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Receipt date: 10/06/2008	Application Number	11291496 11291496 - GAU: 3676
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
(Not for submission under 37 CFR 1.99)	Art Unit	3676
	Examiner Name	Kerry W. Leonard
	Attorney Docket Number	HES 2005-IP-018647U1

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PTO-1449 Information Disclosure Citation in an Application	Application No. 11/291,496	Applicant(s): MCNEEL ET AL.	
	Docket Number HES 2005-IP-018647U1	Group Art Unit 3676	Filing Date December 1, 2005

U.S. PATENT DOCUMENTS

		DOCUMENT NO.	ISSUE/ PUB. DATE	NAME	CLASS	SUBCLASS	FILING DATE
	1	US 5,281,023	01-25-94	CEDILLO ET AL.	366	17	08-02-89
	2	US 5,365,435	11-15-94	STEPHENSON	700	265	02-19-93
	3	US 4,305,463	12-15-81	ZAKIEWICZ	166	245	10-31-70
	4	US 5,515,920	05-14-96	LUK ET AL.	166	280.1	10-27-94
	5	2007/0125543	06-07-07	MCNEEL ET AL.	166	308.3	12-01-05
	6	2004/0020662	02-05-04	FREYER	166	387	06-29-01
	7	2008/0083532	04-10-08	SURJAATMADJA	166	250.1	05-24-07

FOREIGN PATENT DOCUMENTS

		DOCUMENT NO.	DATE	COUNTRY	CLASS	SUBCLASS	TRANSLATION YES	TRANSLATION NO
	1	WO 2006/109035 A	10-19-06		G05D	11/13		

NON-PATENT DOCUMENTS

		DOCUMENT (Including Author, Title, Source, and Pertinent Pages)	DATE
	1	Information Disclosure Statement for Application Serial No. 11/396,918	10-15-07
	2	Information Disclosure Statement for Application Serial No. 11/873,160	10-16-07
	3	Information Disclosure Statement for Application Serial No. 11/873,186	10-16-07
	4	Office Action for Application Serial No. 11,753,314	06-12-08
	5	International Search Report for International Application No. PCT/GB2008/001044	08-13-08
	6	Office Action for Application Serial No. 11,873,186	09-24-08
	7	Notice of Publication for Application Serial No. 11/691,623	10-02-08

EXAMINER	DATE CONSIDERED
/Angela DiTrani/	03/04/2009

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	Lloyd McNeel
Art Unit	3676
Examiner Name	Kerry W. Leonard
Attorney Docket Number	HES 2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	5574218		1996-11-12	Withers	
	2	6575247		2003-06-10	Tolman, et al.	

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20030050758	A1	2003-03-13	Soliman, Mohamed Y., et al.	
	2	20060289167	A1	2006-12-28	Surjaatmadja, Jim B., et al.	
	3	20080083538	A1	2008-04-10	Soliman, Mohamed Y.	
	4	20030141064	A1	2003-07-31	Roberson, James David, Jr.	

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Receipt date: 11/26/2008	Application Number	11291496 11291496 - GAU: 3676
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
(Not for submission under 37 CFR 1.99)	Art Unit	3676
	Examiner Name	Kerry W. Leonard
	Attorney Docket Number	HES 2005-IP-018647U1

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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	1	Office Action for U. S. Serial No. 11/753,314 dated November 19, 2008	☐
	2	Office Action for U.S. Serial NO. 11/396,918 dated October 15, 2008	☐

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EXAMINER SIGNATURE

Examiner Signature	/Angela DiTrani/	Date Considered	03/04/2009

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./

PTO/SB/08a (03-08)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	McNeel, Lloyd
Art Unit	3676
Examiner Name	Ditrani, Angela
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
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	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

	1	Office Action for U.S. Serial No. 11/873,186, dated March 23, 2009	☐

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[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-04-01
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Elizabeth L. Durham/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	5079384
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	01-APR-2009
Filing Date:	01-DEC-2005
Time Stamp:	17:00:59
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	2397
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File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930IDS.PDF	440134 0ca011fc0441202c08b93fd8e4b1cf668f8239c6	yes	11
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Information Disclosure Statement (IDS) Filed (SB/08)		1	3	
	NPL Documents		4	11	
Warnings:					
Information:					
2	Fee Worksheet (PTO-06)	fee-info.pdf	30148 c8457bfe0fd055716ffc807b7d726d6a8969dbf6	no	2
Warnings:					
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		Total Files Size (in bytes):	470282		

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If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§		
MCNEEL, *ET AL.*	§	Group Art Unit:	**3676**
	§		
Serial No.: **11/291,496**	§	Examiner:	**DITRANI, ANGELA M.**
	§		
Filed: **DECEMBER 1, 2005**	§	Confirmation:	**7986**
	§		
Title: **"METHOD AND APPARATUS FOR CENTRALIZED WELL TREATMENT"**	§	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

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RESPONSE UNDER 37 C.F.R. § 1.116 TO FINAL OFFICE ACTION, MAILED MARCH 11, 2009

Dear Honorable Commissioner:

In response to the final office action mailed on March 11, 2009 (the "Office Action"), Applicants submit this response and respectfully request reconsideration of the Examiner's rejections and re-issuance of the Office Action as a non-final office action.

In response to the Office Action, Applicants submit the following:

- **Listing of the Claims**, which begins on page 2 of this paper;
- **Remarks/Arguments**, which begin on page 10 of this paper; and
- **Exhibits**, which are attached at the end of this paper:
  Declaration of John Wustenberg Submitted Pursuant to 37 C.F.R. §1.131;
  Declaration of Paul Morico Submitted Pursuant to 37 C.F.R. §1.131.

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LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Withdrawn) A method of stimulating multiple wells from a central location, comprising the steps of:

stimulating a first well from the central location using a first stimulation fluid through a first fluid line; and

simultaneously stimulating a second well from the central location using a second stimulation fluid through a second fluid line.

2. (Withdrawn-Previously Presented) The method of claim 1 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

3. (Withdrawn-Previously Presented) The method of claim 1 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

4. (Withdrawn) The method of claim 1 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

5. (Withdrawn) A method of stimulating multiple wells comprising the steps of:

stimulating a first well location through a first stimulation fluid from a central manifold; and

simultaneously stimulating a second well location through a second stimulation fluid from the central manifold.

6. (Withdrawn-Previously Presented) The method of claim 5 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

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7. (Withdrawn-Previously Presented) The method of claim 5 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

8. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at the same pad.

9. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at different pads.

10. (Withdrawn) The method of claim 5 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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11. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

12. (Original) The system of claim 11 wherein the means for simultaneously flowing treatment fluid comprises a manifold.

13. (Original) The system of claim 12 wherein the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold.

14. (Original) The system of claim 13 wherein the well operations factory comprises a blending unit wherein the blending unit is operable to connect to the pumping grid.

15. (Previously Presented) The system of claim 14 wherein the well operations factory comprises a proppant storage system wherein the proppant storage system is operable to deliver proppant to the blending unit.

16. (Original) The system of claim 14 wherein the well operations factory comprises a chemical storage system wherein the chemical storage system is operable to connect to the blending unit.

17. (Original) The system of claim 15 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, the proppant storage system, the first well location, and the second well location.

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18. (Original) The system of claim 16 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, chemical storage system, the first well location, and the second well location.

19. (Original) The system of claim 17 wherein the well operations factory is enclosed in a structure selected from the group consisting of: a supported fabric structure, a collapsible structure, a prefabricated structure, a retractable structure, a composite structure, a temporary structure, a prefabricated wall and roof structure, a deployable structure, a modular structure, a preformed structure, a mobile accommodation structure, and combinations thereof.

20. (Original) The system of claim 12 wherein the first connection is operable to deliver a fluid from the first well location to the manifold.

21. (Original) The system of claim 12 wherein the second connection is operable to deliver a fluid from the second well location to the manifold.

22. (Original) The system of claim 20 wherein the fluid comprises a stimulation fluid.

23. (Original) The system of claim 21 wherein the fluid comprises a stimulation fluid.

24. (Original) The system of claim 12 wherein the manifold is connected to a second manifold.

25. (Original) The system of claim 24 wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location.

26. (Original) The system of claim 12 comprising a third connection between the manifold and the first well location.

27. (Original) The system of claim 26 wherein the third connection is operable to deliver a fluid from the first well location to the manifold.

28. (Original) The system of claim 27 comprising a fourth connection between the manifold and the second well location.

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29. (Original) The system of claim 28 wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold.

30. (Original) The system of claim 11 wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat.

31. (Previously Presented) The system of claim 11 wherein the first fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

32. (Previously Presented) The system of claim 11 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

33. (Original) The system of claim 11 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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34. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting pressurized stimulation fluid;

a first line connected to said first input, said first line comprising:

a first valve connected to a first pressure sensor, said first pressure sensor further connected to a second valve;

said first line connected to a first wellhead;

a second line connected to said first input, said second line comprising

a third valve connected to a second pressure sensor, said second pressure sensor further connected to a fourth valve;

said second line connected to a second wellhead.

35. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting a first pressurized stimulation fluid;

a second input for accepting a second pressurized stimulation fluid;

a first line connected to said first input, said first line comprising a first valve;

a second line connected to said second input, said second line comprising a second valve;

said first line and said second line connected together at a first junction, said first junction further connected to a first wellhead;

a third line connected to said first input, said third line comprising a third valve;

a fourth line connected to said second input, said fourth line comprising a fourth valve; and

said third line and said fourth line connected together at a second junction, said second junction further connected to a second wellhead.

36. (Withdrawn) The apparatus according to claim 35 wherein

said first line further comprises a fifth valve and a first pressure sensor, said first pressure sensor located between said first valve and said fifth valve.

37. (Withdrawn) The apparatus according to claim 36 wherein

said second line further comprises a sixth valve and a second pressure sensor, said second pressure sensor located between said second valve and said sixth valve.

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38. (Withdrawn) The apparatus according to claim 37 wherein

said third line further comprises a seventh valve and a third pressure sensor, said third pressure sensor located between said third valve and said seventh valve.

39. (Withdrawn) The apparatus according to claim 38 wherein

said fourth line further comprises an eighth valve and a fourth pressure sensor, said fourth pressure sensor located between said fourth valve and said eighth valve.

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40. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first pad and the well operations factory;

a second connection between a second pad and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first pad and not to the second pad; and

a second stimulation fluid to the second pad and not to the first pad.

41. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

42. (Previously Presented) The system of claim 11, wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.

43. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location having a first plurality of wells and the well operations factory;

a second connection between a second well location having a second plurality of wells and the well operations factory; and

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means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

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REMARKS / ARGUMENTS

I. General Remarks

Applicants respectfully request reconsideration of the application in light of the remarks contained herein. Applicants thank the Examiner for her careful consideration of this application.

II. Disposition of Claims

Claims 1-43 are pending in this application; of these, claims 1-10 and 34-39 are withdrawn. Claims 11-33 and 40-43 currently stand rejected.

III. Rejections of Claims Under 35 U.S.C. § 112, first paragraph

Claims 11-33 and 40-43 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. With respect to these rejections, the Office Action states:

> Independent claim 11 has been amended to include the new limitation wherein "a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location." The added limitations of "and not to the second well location" and of "and not to the first well location" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported. Depending claims 12-33 and 42 are hereby rejected under 35 USC 112 first paragraph as well.
>
> Independent claim 40 has been amended to include the new limitation wherein "a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad." The added limitations of "and not to the second pad" and of "and not to the first pad" are not explicitly disclosed by Applicant within the specification as originally filed, and, therefore, are not supported.
>
> New independent claim 43 recites the limitation in lines 9-12 wherein "a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location." The added limitations of "and not to the second well location" and of "and not to the first well location" are not explicitly disclosed by Applicant

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> within the specification as originally filed, and, therefore, are not supported.

Office Action at pages 2-3. Applicants respectfully disagree with these rejections.

A. The requirements of 35 U.S.C. § 112, first paragraph, are met.

The written description requirement of 35 U.S.C. 112, first paragraph, does not require claim limitations to be "explicitly disclosed...within the specification as originally filed," as stated in the Office Action. Rather, this provision only requires that the applicant show possession of the claimed invention "by describing the claimed invention with all of its limitations using such descriptive means as words, structures, figures, diagrams, and formulas that fully set forth the claimed invention." MPEP § 2163 I. "If a skilled artisan would have understood the inventor to be in possession of the claimed invention at the time of filing, even if every nuance of the claims is not explicitly described in the specification, then the adequate description requirement is met." MPEP § 2163 II(3)(a). (citing *Vas-Cath, Inc. v. Mahurkar*, 935 F.2d 1555, 1560, 19 USPQ2d 1111, 1114 (Fed. Cir. 1991); *Martin v. Johnson*, 454 F.2d 746, 751, 172 USPQ 391, 395 (CCPA 1972) (stating "the description need not be in *ipsis verbis* [*i.e.*, "in the same words"] to be sufficient")). Applicants respectfully submit that the application as filed describes the invention sufficiently for a skilled artisan to have understood that Applicants were in possession of the claimed invention.

In particular, the limitation of *means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location* is described in the original specification in numerous locations. For example:

> A method of communicating between a central location and multiple well locations is disclosed that includes the steps of stimulating a first well from the central location using a first stimulation fluid through a first fluid line; and simultaneously stimulating a second well from the central location using a second stimulation fluid through a second fluid line.

Abstract. As another example description of this limitation:

> In this example, multiple wells can be fractured simultaneously, or a treatment fluid can be flowed simultaneously to multiple wells. The treatment fluid flowed can be of the same composition or different.

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Paragraph [0023]. Another example description of this limitation can be found in:

> Fluid from input 601 can be delivered to well 101 and fluid from input 602 can be delivered to well 102 simultaneously by closing the valves on lines 610 and 612 and opening the valves on lines 611 and 609.

Paragraph [0026]. An illustration of this limitation can also be found in Figure 6. These examples taken together, and in light of the totality of the description provided in the application as filed, describe the invention sufficiently for a skilled artisan to have understood that Applicants were in possession of the claimed invention. This sufficiency -- rather than explicit disclosure, as asserted in the Office action -- is all that is required under Section 112, first paragraph. Accordingly, Applicants respectfully request withdrawal of this rejection.

B. The finality of the office action is improper.

The Office Action contends that "Applicant's [sic] amendment necessitated the new ground(s) of rejection presented in this Office Action." Office Action at 11. Applicants respectfully disagree. "A second or any subsequent action on the merits in any application or patent involved in reexamination proceedings should not be made final if it includes a rejection, on prior art not of record, of any claim amended to include limitations which should reasonably have been expected to be claimed." MPEP 706.07(a). The amendments made in response to the August 21, 2008, Office Action include limitations which should reasonably have been expected to be claimed.

Applicants note that the originally filed version of the claims differs from the current version of the claims by a mere two phrases: "and not to the second well location" and "and not to the first well location." Moreover, the implications of this claim limitation have been the subject of office actions on four separate occasions: May 3, 2007, pages 4-5; October 16, 2007, pages 2-3, August 21, 2008, pages 2-3, and March 11, 2009, pages 2-3. In all but the most recent of these, the office actions contend that U.S. Patent No. 4,305,463 to Zakiewicz anticipates Applicants' claim 11. In response, Applicants have made various arguments and amendments, each attempting to convey that Zakiewicz does not disclose simultaneously flowing a first fluid to a first location and a second fluid to a second location. *See* Response Under 37 C.F.R. § 1.111 To Non-Final Office Action, Mailed May 3, 2007, page 3; Request for Continued Examination Under 37 C.F.R. § 1.114, page 7; and Response Under 37 C.F.R. § 1.111 To Non-

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Final Office Action, Mailed August 21, 2008, page 12. The amendments made in the most recent response are no more than a restatement of this same concept: the first fluid flows to a first location; the second fluid flows to a second location; and the two fluids flow simultaneously. Even if the Examiner disagrees with Applicants' position regarding Zakiewicz, in view of Applicants' numerous and consistent remarks made in previous responses, along with the disclosure of the application as filed, the limitation included in these amendments should have reasonably been expected to be claimed. Accordingly, Applicants respectfully request re-issuance of the Office Action as a non-final office action.

IV. Rejection of Claims Under 35 U.S.C. § 102(e)

Claims 11-13, 20-29, 31-33, and 40-43 are rejected under 35 U.S.C. § 102(e) as being anticipated by Tolman et al. (WO 2007/024383). With respect to these rejections, the Office Action states:

> With respect to independent claim 11, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see esp. [0012]; [0018]-[0041]; [0067]).
>
> With respect to depending claim 12, the reference discloses wherein the means for simultaneously flowing treatment fluid comprises a manifold ([0067]).
>
> With respect to depending claim 13, the reference discloses wherein the well operations factory comprises a pumping grid operable to connect to the manifold ([0020]; [0030]-[0031]).
>
> With respect to depending claims 20-23, Tolman et al. discloses wherein the first connection is operable to deliver a fluid from the first well location to the manifold, wherein the second connection is operable to deliver a fluid from the second well location to the manifold, and wherein the fluid comprises a stimulation fluid ([0031]; [0035]-[0039]).
>
> With respect to depending claims 24 and 25, Tolman et al. discloses wherein the manifold is connected to a second manifold, and, further, wherein the second manifold is operable to

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simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location ([0067]).

With respect to depending claims 26-29, Tolman et al. discloses a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold; a fourth connection between the manifold and the second well location, and, further, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold ([0027]-[0032]; [0067]).

With respect to depending claims 31-33, Tolman et al. discloses wherein the first fluid comprises at least one component selected from the group as claimed, wherein the second stimulation comprises at least one compound selected from the group as claimed, and wherein the first stimulation fluid and the second stimulation fluid have the same composition ([0012]; [0065]; [0067]).

With respect to depending claim 42, Tolman et al. discloses wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid ([0067]).

With respect to independent claim 40, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first pad and the well operations factory; a second connection between a second pad and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad (see esp. [0012]; [0018]-[0041]; [0067]).

With respect to independent claim 41, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see esp. [0012]; [0018]-[0041]; [0067]).

With respect to independent claim 43, Tolman et al. discloses a system for centralized well operations comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location having a first plurality of wells and the operations factory; a

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> second connection between a second well location having a second plurality of wells and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and stimulation fluid to the second well location and not to the first (see esp. [0012]; [0018]-[0041]; [0067]).

Office Action at pages 4-6. Applicants respectfully disagree with these rejections.

A. Tolman is not prior art.

To form a basis for a § 102(e) rejection, a prior art reference must be (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language. 35 USC § 102(e). When any claim of an application is rejected, the inventor or the party qualified under §§ 1.42, 1.43, or 1.47, may submit an appropriate oath or declaration to establish invention of the subject matter of the rejected claim prior to the effective date of the reference. 37 CFR § 1.131. Such affidavits are seasonably presented after final but before appeal upon a showing of good and sufficient reason why the affidavit is necessary and was not earlier presented. MPEP § 715.09(C).

With regards to independent claims 11, 40, 41, and 43, Tolman is not prior art in that invention of the subject matter of these claims predates the effective date of Tolman, August 19, 2005. Applicants herein submit affidavits under 37 CFR § 1.131 as evidence that the invention predates Tolman. Moreover, Applicants respectfully submit that these affidavits are seasonably presented at this time due to the fact that Tolman was not cited as prior art until issuance of the Final Office Action.

Attached as Exhibits 1 and 2 are the declarations of John Wustenberg, Counsel for Halliburton Energy Services, Inc. ("Halliburton"), and Paul Morico, the Baker Botts L.L.P. ("Baker Botts") lawyer responsible for the preparation and prosecution of the present application. Dr. Wustenberg's declaration establishes that the invention disclosure was

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submitted to Halliburton on August 16, 2005 (Exhibit 1, Par. 2), and that Halliburton submitted the invention disclosure to outside counsel on the same day (Exhibit 1, Par. 3). Mr. Morico's declaration establishes that an invention was prepared on the basis of the invention disclosure and filed as the present application (Exhibit 2, Par. 3). Thus, invention of the subject matter of the rejected claims occurred before the effective date of Tolman. In addition, the short period of time between the submission of the invention disclosure to Baker Botts and the filing of the application demonstrates that all involved parties were diligent in filing the patent application with the U.S. Patent and Trademark Office on December 1, 2005. As such, because Tolman is not prior art to the present application, the rejections of the claims on the basis of Tolman should be withdrawn.

B. Tolman does not anticipate.

To form a basis for a § 102(e) rejection, a prior art reference must disclose each and every element as set forth in the claim. *See* MANUAL OF PATENT EXAMINING PROCEDURE ("MPEP") § 2131 (2007). "The identical invention must be shown in as complete detail as it is contained in the claim." *Id.* "The elements must be arranged as required by the claim." *Id.*

With regard to independent claims 11, 40, 41, and 43, Tolman fails to disclose every element of the claims. For example, Tolman does not disclose *a well treatment operations factory which manufactures and pumps a well stimulation fluid.* Tolman's disclosure is limited to a stimulation fluid pumping system. *See, e.g.,* Tolman's Abstract, Figs 2-3, and [0018]-[0041]. Applicants respectfully assert that, after a thorough examination of the entire reference, Tolman's disclosure is limited to usage of pre-manufactured stimulation fluids. Tolman fails to disclose any sort of stimulation fluid manufacturing process whatsoever. As such, Tolman does not disclose each and every limitation as set forth in independent claims 11, 40, 41, and 43.

Accordingly, Applicants submit that Tolman cannot be used to anticipate Applicants' claims as set forth in independent claims 11, 40, 41, and 43. The remaining claims rejected as anticipated by Tolman under 35 U.S.C. § 102(e) depend either directly or indirectly from independent claim 11. All these dependent claims include all the limitations of

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independent claim 11. Accordingly, Applicants respectfully request withdrawal of this rejection with respect to claims 11-13, 20-29, 31-33, and 40-43.

V. Rejection of Claims Under 35 U.S.C. § 103(a)

Claims 14-19 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tolman et al. as applied to claims 11-13 above, and further in view of Walker et al. (US 4,715,721). With respect to these rejections, the Office Action states:

> With respect to depending claims 14 and 15, Tolman et al. discloses the system as stated above with respect to claims 11-13, wherein the system may be land-based or offshore-based ([0020]) and wherein a stimulation fluid storage system (204) and a stimulation fluid pumping system (202) are included within the system. The reference further discloses wherein the stimulation employing the disclosed system may involve a hydraulic fracturing procedure wherein the injected fluid comprises proppant material ([0065]). The reference, however, fails to teach a blending unit connected to the pumping grid of the disclosed system, and, further wherein the system comprises a proppant storage system operable to deliver proppant to the blending unit as claimed in depending claims 14 and 15. Walker et al. teaches a transportable integrated blending system employed within stimulation operations at offshore locations wherein the system comprises a pumping system for delivering a fracturing blend from a fixed assembly into an offshore well. The system comprises a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, I. 55-col. 2, I. 54; col. 3, I. 40- col. 4, I. 19). The reference further teaches that it is well known in the oil and gas industry that in creating an oil or gas well various fluids or flowable blends need to be prepared for different known purposes. In hydraulically fracturing a selected formation within a well, a fracturing fluid comprising a selectable combination of materials needs to be produced and pumped down hole; liquid gel concentrate can be mixed with several known additives to produce a mixture which is then blended with sand or other particulate material for the purpose of producing a fracturing blend comprising proppant; the blend can be prepared at the well site (col. 1, I. 5-28). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made

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to include a blending unit as taught by Walker et al., wherein the system comprises a proppant storage system operable to deliver a proppant to the blending unit, within the system disclosed by Tolman et al. in order to provide a means for introducing the desired amount of proppant into the stimulation fluid, and, further, mixing the proppant with the stimulation fluid at an off-shore based location within a blending unit so as to provide a stimulation fluid blend most suitable to meet the needs of the actual formation.

With respect to depending claim 16, Tolman et al. discloses wherein the well operations factory comprises a chemical storage system (204). Although the reference fails to explicitly teach wherein the chemical storage system is operable to connect to the blending unit, as provided above within the rejection of claim 14, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a blending unit as taught by Walker et al. within the system of Tolman et al. in order to provide a stimulation fluid blend most suitable to meet the needs of the actual formation at the well site at the time the treatment fluid is used.

With respect to depending claims 17 and 18, Tolman et al. discloses wherein the system comprises a wireline unit, and, therefore, teaches a power unit operable to connect to the manifold, pumping grid, first well location, and second well location. Although the reference fails to disclose the inclusion of a proppant storage system and blending unit within the system, as provided above within the rejection of depending claims 14 and 15, Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, I. 55-col. 2, I. 54; col. 3, I. 40- col. 4, I. 19). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include a proppant storage unit and blending unit as taught by Walker et al. within the system of Tolman et al. in order to provide a stimulation fluid blend most suitable to meet the needs of the actual formation at the well site at the time the treatment fluid is used.

With respect to depending claim 19, Tolman et al. discloses wherein the system may be land-based or offshore-based and may be provided at a location such as a pad. The reference further teaches that various configurations and placement of components

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> may be used for additional functionality ([0030]). The reference, however, fails to explicitly disclose the system as enclosed in a structure selected from the group as claimed. Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). The system is enclosed within a transport means for the purpose of transporting the system to an offshore location (col. 3, l. 40 -col. 4, l. 2). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for the system of Tolman et al., in view of Walker et al. as stated above within the rejection of depending claims 14-18, wherein the system is enclosed in a structure selected from the group as claimed in order to provide a means for transporting the system to a desired offshore-based location.
>
> With respect to depending claim 30, Tolman et al. discloses wherein the system may be land-based or offshore-based and may be provided at a location such as a pad. The reference, however, fails to explicitly disclose the system as located on a boat as claimed. Walker et al. teaches a system comprising a storage means for the stimulation fluid and a storage means for the proppant, as well as a mixing means, a blending means, and a pumping means for pumping the blend from the blending means into the well for the purpose of providing an integrated system in which all necessary materials can be contained without the need to individually collect, assemble and disassemble separate pieces of equipment for each fluid producing and pumping job (col. 1, l. 55-col. 2, l. 54; col. 3, l. 40- col. 4, l. 19). The system is provided on a transport means such as an ocean-going ship for the purpose of transporting the system to an offshore location (col. 3, l. 40 -col. 4, l. 2). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for the system of Tolman et wherein the system is provided on a boat in order to provide a means for transporting the system to a desired offshore-based location.

Office Action at page 7-11. Applicants respectfully disagree with these rejections.

In order for a reference or combination of references to form the basis for a rejection under § 103(a), a *prima facie* case of obviousness must be established. MPEP § 2142.

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The showing must be made on the basis of the facts gleaned from the prior art without resorting to hindsight based upon applicant's disclosure. *Id.* The Supreme Court in *KSR International Co. v. Teleflex, Inc.*, 550 U.S. 398, 127 S.Ct. 1727, 1731 (2007) noted that the analysis supporting a rejection under 35 U.S.C. § 103 should be made explicit. The Federal Circuit has stated that "rejections on obviousness cannot be sustained with mere conclusory statements; instead, there must be some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *In re Kahn*, 441 F.3d 977, 988, 78 USPQ2d 1329, 1336 (Fed. Cir. 2006). To form a basis for a § 103 rejection, a prior art reference must be (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for the purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language. 35 USC §§ 102(e) and 103(a). Applicants respectfully submit that the Office Action does not establish a *prima facie* case of obviousness, in that the combination of Tolman in view of Walker cannot be used as prior art to teach each and every recitation of the present claims.

As previously discussed, Tolman is not prior art under 35 U.S.C. § 102(e). Hence, Tolman in view of Walker cannot provide the basis for a *prima facie* case of obviousness against claim 11 or its dependent claims, specifically claims 14-19 and 30.

VI. No Waiver

All of Applicants' arguments are without prejudice or disclaimer. Additionally, Applicants have merely discussed example distinctions from the cited references. Other distinctions may exist, and Applicants reserve the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the Examiner's additional statements. The example distinctions discussed by Applicants are sufficient to overcome the rejections of the claims. Applicants respectfully request reconsideration in light of the remarks contained herein.

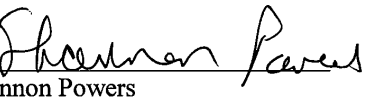
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SUMMARY

In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Alternatively, Applicants request re-issuance of the Office Action as a non-final office action. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicants believe that there are no fees due in association with the filing of this Response. However, should the Commissioner deem that any additional fees are due, including any fees for extensions of time, the Commissioner is authorized to debit Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0930, for any underpayment of fees that may be due in association with this filing.

Respectfully submitted,

By: 

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Registration No. 59,584
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Date: May 6, 2009

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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§		
McNeel, *et al.*	§	Group Art Unit:	**3676**
Serial No.: **11/291,496**	§	Examiner:	**Ditrani, Angela M.**
Filed: **December 1, 2005**	§	Confirmation:	**7986**
Title: **"Method and Apparatus for Centralized Well Treatment"**	§	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS
37 CFR 1.8

I HEREBY CERTIFY THAT I HAVE A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE IS BEING SUBMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA EFS (ELECTRONICALLY) ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

Debbie Allen
DEBBIE ALLEN

DATE OF SUBMISSION: MAY 6, 2009
ELECTRONIC FILING (EFS)

DECLARATION OF JOHN WUSTENBERG
SUBMITTED PURSUANT TO 37 C.F.R. § 1.131

I, John Wustenberg, hereby declare and state that:

1. I am a Patent Counsel at Halliburton Energy Services, Inc. ("Halliburton"). I am knowledgeable about the system that Halliburton has in place for receiving invention disclosures from Halliburton inventors, approving an invention disclosure for the preparation of a patent application, and the assignment of an approved invention disclosure to outside counsel for the preparation of a patent application.

2. A redacted copy of a Halliburton invention disclosure is attached to this Declaration as Exhibit A. This invention disclosure is titled "Fracturing Operations Factory" and

has been assigned Halliburton reference number 2005-IP-018647. As indicated by the date stamp in the upper-right corner of the first page of the disclosure, this invention disclosure was submitted to me on August 16, 2005.

3. On August 16, 2005, I provided the 2005-IP-018647 invention disclosure to the law firm Baker Botts L.L.P. for the preparation of a patent application corresponding to that invention disclosure.

4. I hereby declare that all statements made herein and of our knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 USC 1001 and such willful false statements may jeopardize the validity of the application or any patent issued thereon.

John Wustenberg
Registration No. 35415

Date: May 5, 2009

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EXHIBIT A

HALLIBURTON

Invention Disclosure

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Page: 1 of 8
Invention Disclosure Revision: 1
Docket Number: 2005-IP-018647 (Assigned by the Law Department)
Date: August 5, 2005
Title: Fracturing Operations Factory

Full Name of First Inventor

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Email				

Full Name of Fourth Inventor (Use additional sheets for more than 4 inventors)

First	Middle	Last		Employee Number
Residence: Street Address	City	County	State	Zip
Citizenship	Entity – PSL	Work Phone	Manager	Manager's Phone Number
Email				

Description of Invention: Give a thorough description of the invention as outlined below and, where possible, use sketches. Do not write on back of any sheets. If additional space is necessary, use additional disclosure sheets and number all sheets consecutively.

THE INVENTION

(1) Purpose of the Invention:

In the production of an oil and gas field, it is often required to stimulate and treat several well sites in close proximately. Stimulation and treatment processes are normally performed on land with mobile equipment that may be in place for a short period of time. Equipment is then moved by truck from pad to pad within short time periods.

The movement of equipment and personnel is difficult to manage such that chemicals, proppants, and equipment are available as needed. In addition, the supply of materials is often limited by truck capacity to supply a series of well production sites.

The servicing and stimulation of wells is a complex process that involves a series of coordinated operations that begin with the supply by truck of equipment, supplies, fuel, and chemicals to the well head. The equipment is then set-up and made ready with proppant and chemicals. After completion of the well services, equipment must then be broken down and made ready for transport to the next pad for service.

In some fields, the distance from pad to pad may be less than 500 feet. The movement of equipment and supplies to multiple pads in close proximity is inherently inefficient in the supply of chemical and the usage of equipment.

One purpose of the invention is to improve the efficiency of equipment usage and dramatically reduce supply limitations by the servicing of many wells from a centrally located operations site, herein known as the Fracturing Operations Factory. A centralized location for equipment, chemicals, and, supplies to service many wells provides efficiencies by the elimination or minimization of equipment set-up and break down time.

Another purpose of this invention is to minimize the environment impact resultant from the movement of many pieces of large equipment and large amounts of supplies. The Fracturing Operations Factory by use of a central power station reduces emissions. Oil and gas field conditions may involve extreme weather conditions with temperatures as low as -40 F. A centralized location may be outfitted with protective enclosures to offer protection from the elements and thus providing a more safe work environment. Furthermore, centralized operations increases safety by minimizing exposure to noise and reducing redundant equipment manipulations.

In off-shore operations as may be performed on or near off-shore drilling platforms, many wells may be serviced from a central location. However, land operations have not been carried out from a centralized location.

HALLIBURTON

Invention Disclosure

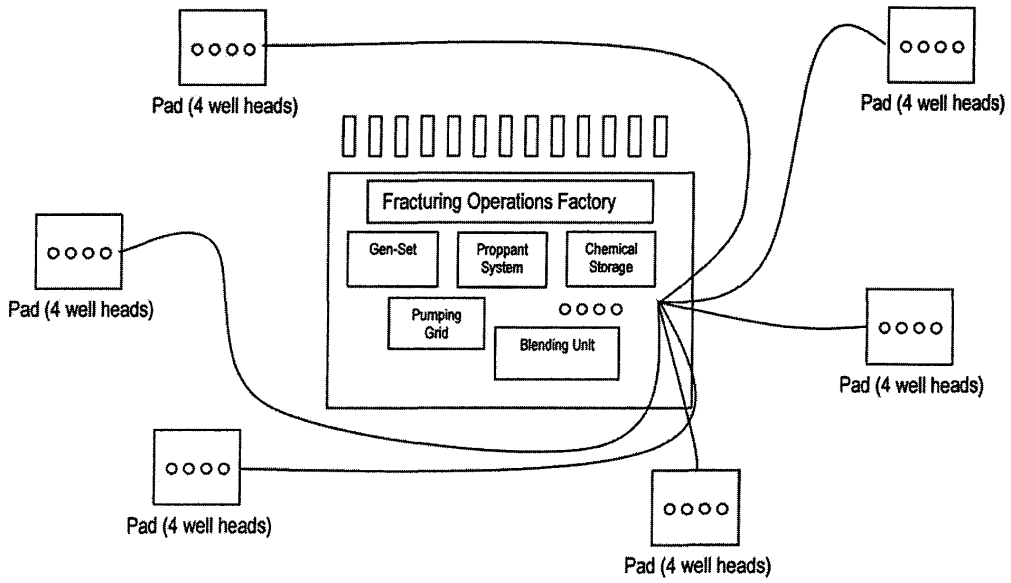
Attorney Client Privilege Communication

Invention Disclosure Revision: 1 Docket Number: _____

Date: August 5, 2005 *(Assigned by the Law Department)*

Title: Fracturing Operations Factory

(2) Description of the Invention:
(Attach sketches, flow-charts or diagrams as necessary)



The Fracturing Operations Factory is comprised of a centralized power unit (Gen-Set), a pumping grid, a proppant storage/metering system, a chemical storage/metering system, a blending unit, and a pumping horsepower grid. The Fracturing Operations Factory is set up on a pad from which many other well heads on nearby pads may be serviced. To protect from adverse weather conditions the Fracturing Operations Factory may be enclosed in a supported fabric structure.

To further speed and enhance service, more than one pipeline (not shown in drawing) may be run to the outlying well heads. For example, a second line would enable the Fracturing Operations Factory to be used for efficient CobraFrac services.

The Gen-Set or central power station provides electrical power with the option of the co-generation of steam or heated water. Power generation may be with gas or diesel. The Gen-Set is a single trailer with three units each with each unit to supply the energy equivalent of 5,000 horsepower for a total supply of15,000 horsepower. That is, with one unit out of service, at least 10,000 horsepower remains available.

The pumping grid is to have a total of 12,000 horsepower with a central manifold. Spare spaces are available for additional horsepower as needed. The pumping grid is pre-wired and has lube oil and cooling capabilities. The pumping grid also has a crane for manifold/pump/motor replacement. Pump motors are electric or diesel. The use of electric motors eliminates transmissions, which are historically a high maintenance issue in current diesel-powered units.

The blending unit to ultimately be a Growler-to-Growler configuration having a Growler for addition of a dry gel to water; followed by a hydration tank; and then addition of proppant (sand) to the hydrated gel by way of the second Growler mixer. In the intermediate term, the blending process to involve a liquid gel concentrate that is hydrated; proppant (sand) is then added by use a cam belt conveyer to a measuring hopper having a calibrated gate; the calibrated gate is used to meter proppant into the blending tank.

The proppant system addresses a major logistics issue in a Fracturing Operations Factory design; that is, the supply and efficient storage of proppant (sand). In an envisioned configuration, proppant storage is a set of at least p-tanks (or sand cans on wheels) with automatic valves. Each p-tank is monitored for level with a weigh scale. The p-tanks are arranged around a calibrated v-belt conveyer, for example, three p-tanks on each side of the conveyer belt. With a constant volume of proppant in each section of the conveyer, the proppant volume can be precisely calibrated for addition to the fracturing fluid. Extra p-tanks may be used to provide extra capacity for proppant storage as needed.

Optionally, a resin-coated proppant may be produced by addition of a mechanical blending system such as a Muller system. The long-term solution to resin-coated proppant production is a chemical coating process using a water-based resin system rather than a mechanical blending process.

The first step in efficient chemical storage and metering is the optimization of chemical and fluids utilization by minimization of the number of chemicals and fluids needed for the Fracturing Operations Factory. Chemical storage facilities to include tanks for breakers, gel additives, crosslinkers, and liquid gel concentrate. All chemical storage tanks to have level control systems as for example a wireless hydrostatic pressure system. All water-based chemical storage tanks are to be insulated and heated. Some tanks may be agitated and circulated.

The liquid adding pumps may be hydraulic or electric with the ability to change pumps on the fly. Pressurized chemical storage tanks may be used to provide positive pressure displacement to move chemicals.

On the whole, the Fracturing Operations Factory methodology allows for effectively producing an oil or gas field comprising the steps of:
a. 24/7 continuous or non-continuous stimulation, capable of operations in all weather conditions, from a central location to multiples of fields or wells
b. Utilizing electricity or gas or diesel or other fuel source powering fracturing equipment from a remote source
c. Simultaneous treatment of multiple wells from a single location
d. Use of more than one pipeline for servicing wells from a central location

Furthermore, the environmental and safely improvements are fundamentally of enormous potential. Again, taken as a whole, the Fracturing Operations Factory is a comprehensive process for producing an oil or gas field with minimal environmental impact by:
a. Use of produced formation water followed back frac fluid or other fluid source to be primary frac fluid
b. Elimination of Liquid Gel Concentrate by use of dry gel mixing
c. Use of centralized measuring proppant management system having accurate weight and volume measurement
d. Reduced emissions by a centralized frac facility and power unit

The basic attributes of the Fracturing Operations Factory may be operated with less personnel on location than conventional fracturing operations involving the same number of wells. In addition, there are large potential savings in transportation of chemicals, equipment, fuel, water, and supplies.

(3) Distinctive Features:
(How does the disclosed invention differ from earlier attempts to solve the same problem?)

[redacted]

(4) What are the commercial competitive advantages of the Invention?

[redacted]

(5) Background of the Invention:

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In order to comply with your duty of candor as an inventor, please identify:

(a) The most closely related products or processes existing before the invention of which you are aware.

[redacted]

(b) The potential prior publications (patents, published patent applications, advertisements, technical papers, etc.) that (i) describe any device, product or process that is closely related to the invention or (ii) disclose prior solutions to the same problems addressed by your invention, and discuss the advantages of your invention over the technology described in these documents:

INFORMATION ABOUT THE INVENTION:

(1) The invention was first thought of on or about [redacted]

(2) The Invention was first explained to [redacted] **on or about** [redacted]

(3) The first drawing, if any, of the Invention were made on or about [redacted] **and these drawings were first disclosed to** [redacted] **on or about** [redacted]

(4) The first written description (other than this one, if any) of the invention was made on or about [redacted] **and this written description was first disclosed to** [redacted] **on or about** [redacted]

(5) The Invention has been described or disclosed in Engineering or Laboratory Notebooks Nos. / Pages [redacted]**, Dated** [redacted] **and maintained by** [redacted] **or in the following documentation** xxx

(6) Describe any developmental work: [redacted]

(7) Was the Invention:

- **Sold or offered for sale?** [redacted] **If Yes, when?** [redacted]
- **Used in a public or commercial setting?** [redacted] **If Yes, when?** [redacted]
- **Disclosed in any printed publication?** [redacted] **If Yes, when?** [redacted]
- **Disclosed to a person/party outside of Halliburton (e.g. to a customer or vendor)?** [redacted] **If Yes, when?** [redacted]
- **When disclosed to a person/party outside of Halliburton, was a non-disclosure/ confidentiality agreement in place?** [redacted] **If Yes, when?** [redacted]

(8) Are there plans to produce the invention?[redacted] If Yes, when?[redacted]

(9) Does the subject matter of this disclosure relate to a government contract? [redacted] If Yes, the contract number is[redacted] and the classification is[redacted]

(10) Did you list a non-HES Inventor is Step 2? [redacted]

(10b) If Yes, is there an agreement in place with the Non-HES Inventor's entity?[redacted]

(11) Identify each HES Product Service Line (PSL) that might use the subject invention, each project that this invention relates to, and any existing/future products or services that may incorporate the invention.

[redacted]

(12) Provide any additional information that might persuade HES management to pay for patent protection for the subject Invention.

[redacted]

HALLIBURTON

Invention Disclosure

Attorney Client Privilege Communication

Invention Disclosure Revision: 1 Docket Number: _____

Date: August 5, 2005 (Assigned by the Law Department)

Title: Fracturing Operations Factory

Signatures (use additional sheets for more than 4 inventors):

1st Inventor _____

Signed Date

Witness:

The witness declares that (s)he has read, understood, and signed this Invention Disclosure, including attachments thereto, on the date following the signature.

Witness _____

Signed Date

2nd Inventor _____

Signed Date

Witness:

The witness declares that (s)he has read, understood, and signed this Invention Disclosure, including attachments thereto, on the date following the signature.

Witness _____

Signed Date

3rd Inventor _____

Signed Date

Witness:

The witness declares that (s)he has read, understood, and signed this Invention Disclosure, including attachments thereto, on the date following the signature.

Witness _____

Signed Date

4th Inventor _____

Signed Date

Witness:

The witness declares that (s)he has read, understood, and signed this Invention Disclosure, including attachments thereto, on the date following the signature.

Witness _____

Signed Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§		
McNeel, *et al.*	§	Group Art Unit:	**3676**
	§		
Serial No.: **11/291,496**	§	Examiner:	**Ditrani, Angela M.**
	§		
Filed: **December 1, 2005**	§	Confirmation:	**7986**
	§		
Title: **"Method and Apparatus for Centralized Well Treatment"**	§	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS
37 CFR 1.8

I HEREBY CERTIFY THAT I HAVE A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE IS BEING SUBMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA EFS (ELECTRONICALLY) ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

Debbie Allen
DEBBIE ALLEN

DATE OF SUBMISSION: MAY 6, 2009
ELECTRONIC FILING (EFS)

DECLARATION OF PAUL MORICO
SUBMITTED PURSUANT TO 37 CFR § 1.131

I, Paul Morico, hereby declare and state that:

1. I am a lawyer at the law firm Baker Botts L.L.P. ("Baker Botts"). Baker Botts is involved in the preparation and prosecution of patent applications for Halliburton Energy Services, Inc. ("Halliburton"). I am responsible for supervising the preparation and prosecution of patent applications for Halliburton in Baker Botts's Houston office.

2. A redacted copy of a Halliburton invention disclosure is attached to this Declaration as Exhibit A. This invention disclosure is titled "Fracturing Operations Factory" and

has been assigned Halliburton reference number 2005-IP-018647. This invention disclosure was received by Baker Botts on August 16, 2005 for the preparation of a patent application.

3. On December 1, 2005, Baker Botts filed a patent application corresponding to the 2005-IP-018647 invention disclosure with the U.S. Patent and Trademark Office. That patent application was titled "Method and Apparatus for Centralized Well Treatment" and was assigned serial number 11/291,496, which is the instant application.

4. I hereby declare that all statements made herein and of our knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Paul Morico
Registration No. 35960

Date: May 6, 2009

EXHIBIT A

HALLIBURTON

Invention Disclosure

Attorney Client Privilege Communication

RECEIVED
AUG 10 2005
JOHN W. WUSTENBERG

Page: 1 of 8

Invention Disclosure Revision: 1

Docket Number: 2005-IP-018647 (Assigned by the Law Department)

Date: August 5, 2005

Title: Fracturing Operations Factory

Full Name of First Inventor

Steven	D	Harris		
First	Middle	Last		Employee Number
Residence: Street Address	City	County	State	Zip
Citizenship	Entity – PSL	Work Phone	Manager	Manager's Phone Number
Email				

Full Name of Second Inventor

Lloyd	w	McNeel		
First	Middle	Last		Employee Number
Residence: Street Address	City	County	State	Zip
Citizenship	Entity – PSL	Work Phone	Manager	Manager's Phone Number
Email				

Full Name of Third Inventor

Dave		McLeod		
First	Middle	Last		Employee Number
Residence: Street Address	City	County	State	Zip
Citizenship	Entity – PSL	Work Phone	Manager	Manager's Phone Number
Email				

Full Name of Fourth Inventor (Use additional sheets for more than 4 inventors)

First	Middle	Last		Employee Number
Residence: Street Address	City	County	State	Zip
Citizenship	Entity – PSL	Work Phone	Manager	Manager's Phone Number
Email				

Description of Invention: Give a thorough description of the invention as outlined below and, where possible, use sketches. Do not write on back of any sheets. If additional space is necessary, use additional disclosure sheets and number all sheets consecutively.

THE INVENTION

(1) Purpose of the Invention:

In the production of an oil and gas field, it is often required to stimulate and treat several well sites in close proximately. Stimulation and treatment processes are normally performed on land with mobile equipment that may be in place for a short period of time. Equipment is then moved by truck from pad to pad within short time periods.

The movement of equipment and personnel is difficult to manage such that chemicals, proppants, and equipment are available as needed. In addition, the supply of materials is often limited by truck capacity to supply a series of well production sites.

The servicing and stimulation of wells is a complex process that involves a series of coordinated operations that begin with the supply by truck of equipment, supplies, fuel, and chemicals to the well head. The equipment is then set-up and made ready with proppant and chemicals. After completion of the well services, equipment must then be broken down and made ready for transport to the next pad for service.

In some fields, the distance from pad to pad may be less than 500 feet. The movement of equipment and supplies to multiple pads in close proximity is inherently inefficient in the supply of chemical and the usage of equipment.

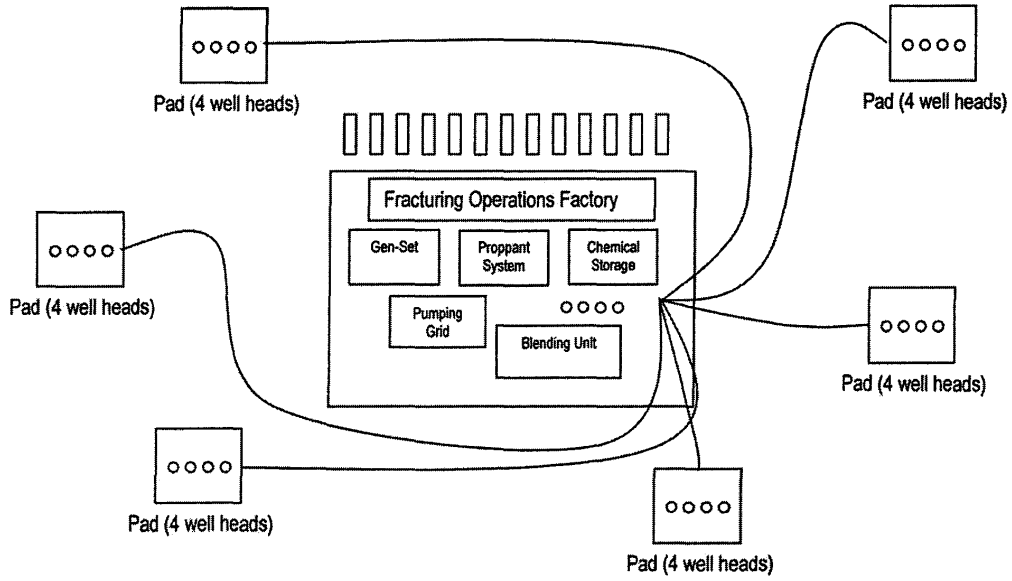
One purpose of the invention is to improve the efficiency of equipment usage and dramatically reduce supply limitations by the servicing of many wells from a centrally located operations site, herein known as the Fracturing Operations Factory. A centralized location for equipment, chemicals, and, supplies to service many wells provides efficiencies by the elimination or minimization of equipment set-up and break down time.

Another purpose of this invention is to minimize the environment impact resultant from the movement of many pieces of large equipment and large amounts of supplies. The Fracturing Operations Factory by use of a central power station reduces emissions. Oil and gas field conditions may involve extreme weather conditions with temperatures as low as -40 F. A centralized location may be outfitted with protective enclosures to offer protection from the elements and thus providing a more safe work environment. Furthermore, centralized operations increases safety by minimizing exposure to noise and reducing redundant equipment manipulations.

In off-shore operations as may be performed on or near off-shore drilling platforms, many wells may be serviced from a central location. However, land operations have not been carried out from a centralized location.

Invention Disclosure Revision: 1 Docket Number:
Date: August 5, 2005 (Assigned by the Law Department)
Title: Fracturing Operations Factory

(2) Description of the Invention:
(Attach sketches, flow-charts or diagrams as necessary)



The Fracturing Operations Factory is comprised of a centralized power unit (Gen-Set), a pumping grid, a proppant storage/metering system, a chemical storage/metering system, a blending unit, and a pumping horsepower grid. The Fracturing Operations Factory is set up on a pad from which many other well heads on nearby pads may be serviced. To protect from adverse weather conditions the Fracturing Operations Factory may be enclosed in a supported fabric structure.

To further speed and enhance service, more than one pipeline (not shown in drawing) may be run to the outlying well heads. For example, a second line would enable the Fracturing Operations Factory to be used for efficient CobraFrac services.

The Gen-Set or central power station provides electrical power with the option of the co-generation of steam or heated water. Power generation may be with gas or diesel. The Gen-Set is a single trailer with three units each with each unit to supply the energy equivalent of 5,000 horsepower for a total supply of15,000 horsepower. That is, with one unit out of service, at least 10,000 horsepower remains available.

The pumping grid is to have a total of 12,000 horsepower with a central manifold. Spare spaces are available for additional horsepower as needed. The pumping grid is pre-wired and has lube oil and cooling capabilities. The pumping grid also has a crane for manifold/pump/motor replacement. Pump motors are electric or diesel. The use of electric motors eliminates transmissions, which are historically a high maintenance issue in current diesel-powered units.

The blending unit to ultimately be a Growler-to-Growler configuration having a Growler for addition of a dry gel to water; followed by a hydration tank; and then addition of proppant (sand) to the hydrated gel by way of the second Growler mixer. In the intermediate term, the blending process to involve a liquid gel concentrate that is hydrated; proppant (sand) is then added by use a cam belt conveyer to a measuring hopper having a calibrated gate; the calibrated gate is used to meter proppant into the blending tank.

The proppant system addresses a major logistics issue in a Fracturing Operations Factory design; that is, the supply and efficient storage of proppant (sand). In an envisioned configuration, proppant storage is a set of at least p-tanks (or sand cans on wheels) with automatic valves. Each p-tank is monitored for level with a weigh scale. The p-tanks are arranged around a calibrated v-belt conveyer, for example, three p-tanks on each side of the conveyer belt. With a constant volume of proppant in each section of the conveyer, the proppant volume can be precisely calibrated for addition to the fracturing fluid. Extra p-tanks may be used to provide extra capacity for proppant storage as needed.

Optionally, a resin-coated proppant may be produced by addition of a mechanical blending system such as a Muller system. The long-term solution to resin-coated proppant production is a chemical coating process using a water-based resin system rather than a mechanical blending process.

The first step in efficient chemical storage and metering is the optimization of chemical and fluids utilization by minimization of the number of chemicals and fluids needed for the Fracturing Operations Factory. Chemical storage facilities to include tanks for breakers, gel additives, crosslinkers, and liquid gel concentrate. All chemical storage tanks to have level control systems as for example a wireless hydrostatic pressure system. All water-based chemical storage tanks are to be insulated and heated. Some tanks may be agitated and circulated.

The liquid adding pumps may be hydraulic or electric with the ability to change pumps on the fly. Pressurized chemical storage tanks may be used to provide positive pressure displacement to move chemicals.

On the whole, the Fracturing Operations Factory methodology allows for effectively producing an oil or gas field comprising the steps of:
a. 24/7 continuous or non-continuous stimulation, capable of operations in all weather conditions, from a central location to multiples of fields or wells
b. Utilizing electricity or gas or diesel or other fuel source powering fracturing equipment from a remote source
c. Simultaneous treatment of multiple wells from a single location
d. Use of more than one pipeline for servicing wells from a central location

Furthermore, the environmental and safely improvements are fundamentally of enormous potential. Again, taken as a whole, the Fracturing Operations Factory is a comprehensive process for producing an oil or gas field with minimal environmental impact by:
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The basic attributes of the Fracturing Operations Factory may be operated with less personnel on location than conventional fracturing operations involving the same number of wells. In addition, there are large potential savings in transportation of chemicals, equipment, fuel, water, and supplies.

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(How does the disclosed invention differ from earlier attempts to solve the same problem?)

[redacted]

(4) What are the commercial competitive advantages of the Invention?

[redacted]

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(6) Describe any developmental work: [redacted]

(7) Was the Invention:

- **Sold or offered for sale?** [redacted] **If Yes, when?** [redacted]
- **Used in a public or commercial setting?** [redacted] **If Yes, when?** [redacted]
- **Disclosed in any printed publication?** [redacted] **If Yes, when?** [redacted]
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(9) Does the subject matter of this disclosure relate to a government contract? [redacted] **If Yes, the contract number is** [redacted] **and the classification is** [redacted]

(10) Did you list a non-HES Inventor is Step 2? [redacted]

(10b) If Yes, is there an agreement in place with the Non-HES Inventor's entity? [redacted]

(11) Identify each HES Product Service Line (PSL) that might use the subject invention, each project that this invention relates to, and any existing/future products or services that may incorporate the invention.

[redacted]

(12) Provide any additional information that might persuade HES management to pay for patent protection for the subject Invention.

[redacted]

HALLIBURTON

Invention Disclosure

Attorney Client Privilege Communication

Invention Disclosure Revision: 1 Docket Number: _____

Date: August 5, 2005 (Assigned by the Law Department)

Title: Fracturing Operations Factory

Signatures (use additional sheets for more than 4 inventors):

1st Inventor _____
Signed Date

Witness:
The witness declares that (s)he has read, understood, and signed this Invention Disclosure, including attachments thereto, on the date following the signature.

Witness _____
Signed Date

2nd Inventor _____
Signed Date

Witness:
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Signed Date

3rd Inventor _____
Signed Date

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Signed Date

4th Inventor _____
Signed Date

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Witness _____
Signed Date

Electronic Acknowledgement Receipt	
EFS ID:	5285515
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	06-MAY-2009
Filing Date:	01-DEC-2005
Time Stamp:	13:40:43
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930RFOA.PDF	2215243 83fbf116963f794108988f8cad4e2cf2d3c0005d	yes	42

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment After Final	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	22
	Oath or Declaration filed	23	32
	Oath or Declaration filed	33	42
Warnings:			
Information:			
	Total Files Size (in bytes):	2215243	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
Approved for use through 1/31/2007. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 11/291,496	Filing Date 12/01/2005	☐ To be Mailed

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	05/06/2009	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 43	Minus	** 43	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/JACQUELINE LANFORD/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/291,496	12/01/2005	William Lloyd McNeel	2005-IP-018647U1	7986

29920 7590 05/19/2009

JOHN W. WUSTENBERG
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EXAMINER	
DITRANI, ANGELA M	

ART UNIT	PAPER NUMBER
3676	

NOTIFICATION DATE	DELIVERY MODE
05/19/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JOHN.WUSTENBERG@HALLIBURTON.COM
HOLLY.FINE@HALLIBURTON.COM

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/291,496	MCNEEL ET AL.	
	Examiner	Art Unit	
	Angela M. DiTrani	3676	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *06 May 2009*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-43* is/are pending in the application.

4a) Of the above claim(s) *1-10 and 34-39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-33 and 40-43* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *04/01/09*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. Applicant's request for reconsideration of the finality of the rejection of the last Office action is persuasive and, therefore, the finality of that action is withdrawn.

Claim Rejections - 35 USC § 102

2. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

3. Claims 11-33 and 40-43 are rejected under 35 U.S.C. 102(b) as being anticipated by Neal et al. (US 6,644,844).

With respect to independent claim 11, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (**100**) which manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see col. 5, l. 6-55).

With respect to depending claims 12-33, Neal et al. discloses the manifold (**154**); a pumping grid (**156a**, **156b**) operable to connect to the manifold; a blending unit (**114**); a proppant storage system (**112; 120**); a chemical storage system (**116**); a power unit (**106**); wherein the well operations factory is enclosed in a structure selected from the group as claimed (col. 2, l. 33-41); wherein the first and second connections are

operable to deliver a fluid from the first and second well locations to the manifold (**158**); wherein the fluid comprises a stimulation fluid (col. 1, l. 11-14; col. 2, l. 23-32); wherein the manifold is connected to a second manifold (**152**), and further, wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location; a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold, and a fourth connection between the manifold and the second well location, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold (**158**); wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat (col. 2, l. 33-41); wherein the first fluid and the second fluid each comprise at least one component selected from the group as claimed (col. 3, l. 3 - col. 4, l. 17); and wherein the first stimulation fluid and the second stimulation fluid have the same composition (col. 5, l. 33-45).

With respect to independent claim 40, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (**100**) which manufactures and pumps a well stimulation fluid; a first connection between a first pad and the well operations factory (**158**); a second connection between a second pad and the well operations factory (**158**); and means for simultaneously flowing: a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad (**154**).

With respect to independent claim 41, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (**100**) which dynamically manufactures and pumps a well stimulation fluid; a first connection (**158**) between a first well location and the well operations factory; a second connection (**158**) between a second well location and the well operations factory; and means for simultaneously flowing (**154**): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.

With respect to depending claim 42, the reference discloses wherein the locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.

With respect to independent claim 43, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (**100**) which manufactures and pumps a well stimulation fluid; a first connection (**158**) between a first well location having a first plurality of wells (**156a**) and the well operations factory; a second connection (**158**) between a second well location having a second plurality of wells (**156b**) and the well operations factory; and means for simultaneously flowing (**154**): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.

Double Patenting

4. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the “right to exclude” granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory

obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

5. Claims 1-33 and 40-43 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-31 of copending Application No. 11/873,186. Although the conflicting claims are not identical, they are not patentably distinct from each other because although the claims of the instant application are broader in scope than the claims of ‘186, the claims encompass the same subject matter claimed within the ‘186 application, and, therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the claims within the same application in order to provide for broadened patent protection.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. DiTrani whose telephone number is (571)272-2182. The examiner can normally be reached on M-F, 6:30AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Gay can be reached on (571)272-7029. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AD
05/14/09

/Zakiya W. Bates/
Primary Examiner, Art Unit 3676

Notice of References Cited	Application/Control No. 11/291,496	Applicant(s)/Patent Under Reexamination MCNEEL ET AL.	
	Examiner Angela M. DiTrani	Art Unit 3676	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-6,644,844	11-2003	Neal et al.	366/10
	B	US-			
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

Index of Claims	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11291496	MCNEEL ET AL.
	Examiner	**Art Unit**
	Angela M DiTrani	3676

✓	Rejected	-	Cancelled	N	Non-Elected	A	Appeal
=	Allowed	÷	Restricted	I	Interference	O	Objected

☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

CLAIM		DATE								
Final	Original	04/27/2007	10/15/2007	08/18/2008	03/04/2009	05/14/2009				
	1	N	N	N	N	N				
	2	N	N	N	N	N				
	3	N	N	N	N	N				
	4	N	N	N	N	N				
	5	N	N	N	N	N				
	6	N	N	N	N	N				
	7	N	N	N	N	N				
	8	N	N	N	N	N				
	9	N	N	N	N	N				
	10	N	N	N	N	N				
	11	✓	✓	✓	✓	✓				
	12	✓	✓	✓	✓	✓				
	13	✓	✓	✓	✓	✓				
	14	✓	✓	✓	✓	✓				
	15	✓	✓	✓	✓	✓				
	16	✓	✓	✓	✓	✓				
	17	✓	✓	✓	✓	✓				
	18	✓	✓	✓	✓	✓				
	19	O	O	✓	✓	✓				
	20	✓	✓	✓	✓	✓				
	21	✓	✓	✓	✓	✓				
	22	✓	✓	✓	✓	✓				
	23	✓	✓	✓	✓	✓				
	24	✓	✓	✓	✓	✓				
	25	✓	✓	✓	✓	✓				
	26	✓	✓	✓	✓	✓				
	27	✓	✓	✓	✓	✓				
	28	✓	✓	✓	✓	✓				
	29	✓	✓	✓	✓	✓				
	30	O	O	✓	✓	✓				
	31	✓	✓	✓	✓	✓				
	32	✓	✓	✓	✓	✓				
	33	✓	✓	✓	✓	✓				
	34	N	N	N	N	N				
	35	N	N	N	N	N				
	36	N	N	N	N	N				

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CLAIM		DATE								
Final	Original	04/27/2007	10/15/2007	08/18/2008	03/04/2009	05/14/2009				
	37	N	N	N	N	N				
	38	N	N	N	N	N				
	39	N	N	N	N	N				
	40			✓	✓	✓				
	41			✓	✓	✓				
	42			✓	✓	✓				
	43				✓	✓				

Search Notes	Application/Control No.	Applicant(s)/Patent Under Reexamination
	11291496	MCNEEL ET AL.
	Examiner	**Art Unit**
	Angela M DiTrani	3676

SEARCHED			
Class	**Subclass**	**Date**	**Examiner**

SEARCH NOTES		
Search Notes	**Date**	**Examiner**
Search in EAST and Google Patents (see search history)		KWL
Consulted primary examiners G Suchfield and H Dang and SPE J Gay		KWL
East text search (US-PGPUB, USOCR, USPAT, EPO, JPO, DERWENT, IBM_TDB)	03/02/09	AD
East text search (US-PGPUB, USOCR, USPAT, EPO, JPO, DERWENT, IBM_TDB)	05/13/09	AD

INTERFERENCE SEARCH			
Class	**Subclass**	**Date**	**Examiner**

/Angela M DiTrani/ Examiner.Art Unit 3676	

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BIB DATA SHEET

CONFIRMATION NO. 7986

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
11/291,496	12/01/2005 RULE	166	3676	2005-IP-018647U1

APPLICANTS

William Lloyd McNeel, Green River, WY;
Steve Harris, Palisade, CO;
Dave McLeod, Houston, TX;

**** CONTINUING DATA **************************

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
01/06/2006

Foreign Priority claimed	35 USC 119(a-d) conditions met	Verified and Acknowledged	Met after Allowance	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
☐ Yes ☑ No	☐ Yes ☑ No	/ANGELA M DITRANI/ Examiner's Signature	☐ Initials	WY	7	39	5

ADDRESS

JOHN W. WUSTENBERG
P.O. BOX 1431
DUNCAN, OK 73536
UNITED STATES

TITLE

Method and apparatus for centralized well treatment

FILING FEE RECEIVED		
3372	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S9	1	("6745838").PN.	USPAT; USOCR	OR	OFF	2009/05/12 07:43
S10	4	(("6745838") or ("5555934") or ("4339002") or ("6851444")).PN.	USPAT; USOCR	OR	OFF	2009/05/12 07:45
S11	4	(subterranean well$1bore $1 bore$1hole$1 down $1hole$1 oil$1well$1 oil $1field$1) and (factor$3 same manufactur$3 same (stimulat$3 with fluid$1))	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2009/05/12 08:11
S12	2	("2953460").PN.	USPAT; USOCR	OR	OFF	2009/05/12 08:13
S13	1	("20070116546").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2009/05/12 08:14

5/14/2009 11:51:15 AM
C:\Documents and Settings\aditrani\My Documents\EAST\Workspaces\11291496.wsp

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
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U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
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FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐
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NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./

Receipt date: 04/01/2009	Application Number	11291496 11291496 - GAU: 3676
INFORMATION DISCLOSURE STATEMENT BY APPLICANT	Filing Date	2005-12-01
(Not for submission under 37 CFR 1.99)	First Named Inventor	McNeel, Lloyd
	Art Unit	3676
	Examiner Name	Ditrani, Angela
	Attorney Docket Number	2005-IP-018647U1

	1	Office Action for U.S. Serial No. 11/873,186, dated March 23, 2009	☐

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EXAMINER SIGNATURE

Examiner Signature	/Angela DiTrani/	Date Considered	05/14/2009

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT
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Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	Lloyd McNeel, et al.
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Examiner Name	Angela Ditrani
Attorney Docket Number	2005-IP-018647

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	2758653		1956-08-14	Desbrow	
	2	3062286		1962-11-06	Wyllie	
	3	3537529		1970-11-03	Timmerman	
	4	3933205		1976-01-20	Kiel	
	5	4050529		1977-09-27	Tagirov, et al.	
	6	4733567		1988-03-29	Serata	
	7	4974675		1990-12-04	Austin, et al.	
	8	5111881		1992-05-12	Soliman, et al.	

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	9	5494103		1996-02-27	Surjaatmadja, et al.	
	10	5499678		1996-03-19	Surjaatmadja, et al.	
	11	6729394		2004-05-04	Hassan, et al.	
	12	7225869		2007-06-05	Willett, et al.	
	13	7431090		2008-10-07	Surjaatmadja, et al.	
	14	7445045		2008-11-04	East, Jr., et al.	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20050121196	A1	2005-06-09	East, Loyd E. Jr., et al.	
	2	20050211439	A1	2005-09-29	Willett, Ronald M., et al.	
	3	20060185848	A1	2006-08-24	Surjaatmadja, Jim B., et al.	

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
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	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647

	4	20070116546	A1	2007-05-24	Dearing, Mike	
	5	20090050311	A1	2009-02-26	Crawford, James B.	

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Office Action for U.S. Serial No. 11/396,918, dated April 29, 2009	☐
	2	Office Action for U.S. Serial No. 11/545,749, dated May 1, 2009	☐
	3	Office Action for U.S. Serial No. 11/753,314, dated May 5, 2009	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel, et al.
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-05-26
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.3

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Elizabeth L. Durham/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	5391420
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	26-MAY-2009
Filing Date:	01-DEC-2005
Time Stamp:	11:51:38
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	8141
Deposit Account	020383
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930IDS.PDF	1392766 57783d0c2b17e757428ab6610da3392ad196abc1	yes	38
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Information Disclosure Statement (IDS) Filed (SB/08)		1	5	
	NPL Documents		6	19	
	NPL Documents		20	32	
	NPL Documents		33	38	
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30148 d95fef1fa463b216f6157014ed7a183850ac395d	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1422914		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code :IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
If you wish to add additional U.S. Patent citation information please click the Add button.						

U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
If you wish to add additional U.S. Published Application citation information please click the Add button.						

FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐
If you wish to add additional Foreign Patent Document citation information please click the Add button								

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

	1	Office Action for U.S. Patent Application No. 11/691,623, dated July 9, 2009	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

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☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-07-16
Name/Print	Melody Wirz	Registration Number	53,783

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EFS Web 2.1.3

Electronic Acknowledgement Receipt	
EFS ID:	5715889
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	16-JUL-2009
Filing Date:	01-DEC-2005
Time Stamp:	15:17:47
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930IDS.pdf	283453 547ae70307cf44ac684103b8f01fba60982a2cfc	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	NPL Documents	4	8
Warnings:			
Information:			
	Total Files Size (in bytes):	283453	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
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National Stage of an International Application under 35 U.S.C. 371
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New International Application Filed with the USPTO as a Receiving Office
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UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/291,496	12/01/2005	William Lloyd McNeel	2005-IP-018647U1	7986

29920 7590 08/04/2009

JOHN W. WUSTENBERG
P.O. BOX 1431
DUNCAN, OK 73536

EXAMINER	
DITRANI, ANGELA M	

ART UNIT	PAPER NUMBER
3676	

NOTIFICATION DATE	DELIVERY MODE
08/04/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JOHN.WUSTENBERG@HALLIBURTON.COM
HOLLY.FINE@HALLIBURTON.COM

PTOL-90A (Rev. 04/07)

Interview Summary	Application No.	Applicant(s)	
	11/291,496	MCNEEL ET AL.	
	Examiner	Art Unit	
	Angela M. DiTrani	3676	

All participants (applicant, applicant's representative, PTO personnel):

(1) *Angela M. DiTrani*. (3)_____.

(2) *Shannon Powers*. (4)_____.

Date of Interview: *21 July 2009*.

Type: a)☒ Telephonic b)☐ Video Conference
c)☐ Personal [copy given to: 1)☐ applicant 2)☐ applicant's representative]

Exhibit shown or demonstration conducted: d)☐ Yes e)☒ No.
If Yes, brief description: _____.

Claim(s) discussed: *11 and 33*.

Identification of prior art discussed: *US 6,644,844*.

Agreement with respect to the claims f)☐ was reached. g)☐ was not reached. h)☒ N/A.

Substance of Interview including description of the general nature of what was agreed to if an agreement was reached, or any other comments: *Applicant requested clarification of Examiner's interpretation of the "means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location" cited in the previous action as described in '844 in col. 5, l. 6-55. The Examiner noted that the "means for simultaneously flowing," is depicted by reference character 154 (the manifold) in Figure 5, wherein the first stimulation fluid is that which is pumped through the manifold and to the "a" side while the second stimulation fluid is that which is pumped through the manifold and to the "b" side. The first and second fluids have the same composition, therefore, anticpating depending claim 33. Applicant noted that in claim 11, the first and second fluids can be the same or different, and further proposed amending claim 11 to include the limitation wherein the first and second fluids are fluids having different compositions. The Examiner noted that upon filing of the amendment further consideration will be given to the new limitation presented* .

(A fuller description, if necessary, and a copy of the amendments which the examiner agreed would render the claims allowable, if available, must be attached. Also, where no copy of the amendments that would render the claims allowable is available, a summary thereof must be attached.)

THE FORMAL WRITTEN REPLY TO THE LAST OFFICE ACTION MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a reply to the last Office action has already been filed, APPLICANT IS GIVEN A NON-EXTENDABLE PERIOD OF THE LONGER OF ONE MONTH OR THIRTY DAYS FROM THIS INTERVIEW DATE, OR THE MAILING DATE OF THIS INTERVIEW SUMMARY FORM, WHICHEVER IS LATER, TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW. See Summary of Record of Interview requirements on reverse side or on attached sheet.

/Zakiya W. Bates/ Primary Examiner, Art Unit 3676	

Summary of Record of Interview Requirements

Manual of Patent Examining Procedure (MPEP), Section 713.04, Substance of Interview Must be Made of Record
A complete written statement as to the substance of any face-to-face, video conference, or telephone interview with regard to an application must be made of record in the application whether or not an agreement with the examiner was reached at the interview.

Title 37 Code of Federal Regulations (CFR) § 1.133 Interviews
Paragraph (b)

In every instance where reconsideration is requested in view of an interview with an examiner, a complete written statement of the reasons presented at the interview as warranting favorable action must be filed by the applicant. An interview does not remove the necessity for reply to Office action as specified in §§ 1.111, 1.135. (35 U.S.C. 132)

37 CFR §1.2 Business to be transacted in writing.
All business with the Patent or Trademark Office should be transacted in writing. The personal attendance of applicants or their attorneys or agents at the Patent and Trademark Office is unnecessary. The action of the Patent and Trademark Office will be based exclusively on the written record in the Office. No attention will be paid to any alleged oral promise, stipulation, or understanding in relation to which there is disagreement or doubt.

———

The action of the Patent and Trademark Office cannot be based exclusively on the written record in the Office if that record is itself incomplete through the failure to record the substance of interviews.

It is the responsibility of the applicant or the attorney or agent to make the substance of an interview of record in the application file, unless the examiner indicates he or she will do so. It is the examiner's responsibility to see that such a record is made and to correct material inaccuracies which bear directly on the question of patentability.

Examiners must complete an Interview Summary Form for each interview held where a matter of substance has been discussed during the interview by checking the appropriate boxes and filling in the blanks. Discussions regarding only procedural matters, directed solely to restriction requirements for which interview recordation is otherwise provided for in Section 812.01 of the Manual of Patent Examining Procedure, or pointing out typographical errors or unreadable script in Office actions or the like, are excluded from the interview recordation procedures below. Where the substance of an interview is completely recorded in an Examiners Amendment, no separate Interview Summary Record is required.

The Interview Summary Form shall be given an appropriate Paper No., placed in the right hand portion of the file, and listed on the "Contents" section of the file wrapper. In a personal interview, a duplicate of the Form is given to the applicant (or attorney or agent) at the conclusion of the interview. In the case of a telephone or video-conference interview, the copy is mailed to the applicant's correspondence address either with or prior to the next official communication. If additional correspondence from the examiner is not likely before an allowance or if other circumstances dictate, the Form should be mailed promptly after the interview rather than with the next official communication.

The Form provides for recordation of the following information:
- Application Number (Series Code and Serial Number)
- Name of applicant
- Name of examiner
- Date of interview
- Type of interview (telephonic, video-conference, or personal)
- Name of participant(s) (applicant, attorney or agent, examiner, other PTO personnel, etc.)
- An indication whether or not an exhibit was shown or a demonstration conducted
- An identification of the specific prior art discussed
- An indication whether an agreement was reached and if so, a description of the general nature of the agreement (may be by attachment of a copy of amendments or claims agreed as being allowable). Note: Agreement as to allowability is tentative and does not restrict further action by the examiner to the contrary.
- The signature of the examiner who conducted the interview (if Form is not an attachment to a signed Office action)

It is desirable that the examiner orally remind the applicant of his or her obligation to record the substance of the interview of each case. It should be noted, however, that the Interview Summary Form will not normally be considered a complete and proper recordation of the interview unless it includes, or is supplemented by the applicant or the examiner to include, all of the applicable items required below concerning the substance of the interview.

A complete and proper recordation of the substance of any interview should include at least the following applicable items:
1) A brief description of the nature of any exhibit shown or any demonstration conducted,
2) an identification of the claims discussed,
3) an identification of the specific prior art discussed,
4) an identification of the principal proposed amendments of a substantive nature discussed, unless these are already described on the Interview Summary Form completed by the Examiner,
5) a brief identification of the general thrust of the principal arguments presented to the examiner,
   (The identification of arguments need not be lengthy or elaborate. A verbatim or highly detailed description of the arguments is not required. The identification of the arguments is sufficient if the general nature or thrust of the principal arguments made to the examiner can be understood in the context of the application file. Of course, the applicant may desire to emphasize and fully describe those arguments which he or she feels were or might be persuasive to the examiner.)
6) a general indication of any other pertinent matters discussed, and
7) if appropriate, the general results or outcome of the interview unless already described in the Interview Summary Form completed by the examiner.

Examiners are expected to carefully review the applicant's record of the substance of an interview. If the record is not complete and accurate, the examiner will give the applicant an extendable one month time period to correct the record.

Examiner to Check for Accuracy

If the claims are allowable for other reasons of record, the examiner should send a letter setting forth the examiner's version of the statement attributed to him or her. If the record is complete and accurate, the examiner should place the indication, "Interview Record OK" on the paper recording the substance of the interview along with the date and the examiner's initials.

.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:	§		
McNeel, *et al.*	§	Group Art Unit:	**3676**
	§		
Serial No.: **11/291,496**	§	Examiner:	**Ditrani, Angela M.**
	§		
Filed: **December 1, 2005**	§	Confirmation:	**7986**
	§		
Title: **"Method and Apparatus for Centralized Well Treatment"**	§	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS
37 CFR 1.8

I HEREBY CERTIFY THAT I HAVE A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE IS BEING SUBMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA EFS (ELECTRONICALLY) ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:

COMMISSIONER FOR PATENTS
P.O. BOX 1450
ALEXANDRIA, VA 22313-1450

Debbie Allen
DEBBIE ALLEN

DATE OF SUBMISSION: 8/12/2009
ELECTRONIC FILING (EFS)

RESPONSE UNDER 37 C.F.R. § 1.111 TO NON-FINAL OFFICE ACTION, MAILED MAY 19, 2009

Dear Honorable Commissioner:

In response to the Office Action mailed on May 19, 2009 (the "Office Action"), Applicants submit the following:

- **Amendments to the Claims**, which are reflected in the listing of claims that begins on page 2 of this paper; and
- **Remarks/Arguments**, which begin on page 11 of this paper.

Profrac Holding Corporation
U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 695 of 988

AMENDMENTS TO/LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Withdrawn) A method of stimulating multiple wells from a central location, comprising the steps of:

stimulating a first well from the central location using a first stimulation fluid through a first fluid line; and

simultaneously stimulating a second well from the central location using a second stimulation fluid through a second fluid line.

2. (Withdrawn-Previously Presented) The method of claim 1 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

3. (Withdrawn-Previously Presented) The method of claim 1 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

4. (Withdrawn) The method of claim 1 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

5. (Withdrawn) A method of stimulating multiple wells comprising the steps of:

stimulating a first well location through a first stimulation fluid from a central manifold; and

simultaneously stimulating a second well location through a second stimulation fluid from the central manifold.

6. (Withdrawn-Previously Presented) The method of claim 5 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

Profrac Holding Corporation
U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 696 of 988

7. (Withdrawn-Previously Presented) The method of claim 5 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

8. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at the same pad.

9. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at different pads.

10. (Withdrawn) The method of claim 5 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 697 of 988

11. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

12. (Original) The system of claim 11 wherein the means for simultaneously flowing treatment fluid comprises a manifold.

13. (Original) The system of claim 12 wherein the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold.

14. (Original) The system of claim 13 wherein the well operations factory comprises a blending unit wherein the blending unit is operable to connect to the pumping grid.

15. (Previously Presented) The system of claim 14 wherein the well operations factory comprises a proppant storage system wherein the proppant storage system is operable to deliver proppant to the blending unit.

16. (Original) The system of claim 14 wherein the well operations factory comprises a chemical storage system wherein the chemical storage system is operable to connect to the blending unit.

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17. (Original) The system of claim 15 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, the proppant storage system, the first well location, and the second well location.

18. (Original) The system of claim 16 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, chemical storage system, the first well location, and the second well location.

19. (Original) The system of claim 17 wherein the well operations factory is enclosed in a structure selected from the group consisting of: a supported fabric structure, a collapsible structure, a prefabricated structure, a retractable structure, a composite structure, a temporary structure, a prefabricated wall and roof structure, a deployable structure, a modular structure, a preformed structure, a mobile accommodation structure, and combinations thereof.

20. (Original) The system of claim 12 wherein the first connection is operable to deliver a fluid from the first well location to the manifold.

21. (Original) The system of claim 12 wherein the second connection is operable to deliver a fluid from the second well location to the manifold.

22. (Original) The system of claim 20 wherein the fluid comprises a stimulation fluid.

23. (Original) The system of claim 21 wherein the fluid comprises a stimulation fluid.

24. (Original) The system of claim 12 wherein the manifold is connected to a second manifold.

25. (Original) The system of claim 24 wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location.

26. (Original) The system of claim 12 comprising a third connection between the manifold and the first well location.

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27. (Original) The system of claim 26 wherein the third connection is operable to deliver a fluid from the first well location to the manifold.

28. (Original) The system of claim 27 comprising a fourth connection between the manifold and the second well location.

29. (Original) The system of claim 28 wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold.

30. (Original) The system of claim 11 wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat.

31. (Previously Presented) The system of claim 11 wherein the first fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

32. (Previously Presented) The system of claim 11 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

33. (Canceled)

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34. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting pressurized stimulation fluid;

a first line connected to said first input, said first line comprising:

a first valve connected to a first pressure sensor, said first pressure sensor further connected to a second valve;

said first line connected to a first wellhead;

a second line connected to said first input, said second line comprising

a third valve connected to a second pressure sensor, said second pressure sensor further connected to a fourth valve;

said second line connected to a second wellhead.

35. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting a first pressurized stimulation fluid;

a second input for accepting a second pressurized stimulation fluid;

a first line connected to said first input, said first line comprising a first valve;

a second line connected to said second input, said second line comprising a second valve;

said first line and said second line connected together at a first junction, said first junction further connected to a first wellhead;

a third line connected to said first input, said third line comprising a third valve;

a fourth line connected to said second input, said fourth line comprising a fourth valve; and

said third line and said fourth line connected together at a second junction, said second junction further connected to a second wellhead.

36. (Withdrawn) The apparatus according to claim 35 wherein

said first line further comprises a fifth valve and a first pressure sensor, said first pressure sensor located between said first valve and said fifth valve.

37. (Withdrawn) The apparatus according to claim 36 wherein

said second line further comprises a sixth valve and a second pressure sensor, said second pressure sensor located between said second valve and said sixth valve.

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38. (Withdrawn) The apparatus according to claim 37 wherein

said third line further comprises a seventh valve and a third pressure sensor, said third pressure sensor located between said third valve and said seventh valve.

39. (Withdrawn) The apparatus according to claim 38 wherein

said fourth line further comprises an eighth valve and a fourth pressure sensor, said fourth pressure sensor located between said fourth valve and said eighth valve.

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40. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first pad and the well operations factory;

a second connection between a second pad and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first pad and not to the second pad; and

a second stimulation fluid to the second pad and not to the first pad;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

41. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

42. (Previously Presented) The system of claim 11, wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.

43. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

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a first connection between a first well location having a first plurality of wells and the well operations factory;

a second connection between a second well location having a second plurality of wells and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

44. (New) A system for centralized well operations comprising:

a well treatment operations factory capable of manufacturing and simultaneously pumping a plurality of well stimulation fluids;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

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REMARKS / ARGUMENTS

I. General Remarks

Applicants respectfully request that the above amendments be entered, and further request reconsideration of the application in light of the amendments and remarks contained herein. Applicants thank the Examiner for her careful consideration of this application and the references that Applicants have submitted.

II. Disposition of Claims

Claims 1-43 are pending in this application; of these, claims 1-10 and 34-39 are withdrawn. Claims 11-33 and 40-43 currently stand rejected. Claims 11, 40, 41, and 43 have been amended herein. Applicants respectfully submit that the amendments made herein add no new matter to the application and are supported by the specification as originally-filed. All the amendments are made in a good faith effort to advance the prosecution on the merits of this case. It should not be assumed that these amendments were made for reasons relating to patentability. New claim 44 has been added to recite aspects of the invention. The new claims are supported by the specification as filed and do not introduce new matter. Claim 33 has been cancelled herein. Applicants reserve the right to subsequently take up prosecution on the claims as originally-filed in this or appropriate continuation, continuation-in-part and/or divisional applications.

III. Interview with the Examiner

On July 21, 2009, Examiner DiTriani conducted a telephonic interview with Applicants' attorney Shannon Powers. No exhibits were shown. Claims 11 and 33 were discussed. U.S. Patent Number 6,644,844 by Neal et al. (hereinafter, "*Neal*") was discussed. Agreement was reached that claim 11, as written, broadly covers both circumstances wherein the first stimulation fluid and the second stimulation fluid are of the same composition and circumstances wherein the fluids are of different compositions, while *Neal* discloses, at most, only situations wherein the first stimulation fluid and the second stimulation fluid are of the same composition. Other aspects of *Neal* were not discussed.

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IV. Rejections of Claims Under 35 U.S.C. § 102

Claims 11-33 and 40-43 are is rejected under 35 U.S.C. § 102(b) as being anticipated by *Neal*.

With respect to these rejections, the Office Action states:

> With respect to independent claim 11, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see col. 5, l. 6-55).
>
> With respect to depending claims 12-33, Neal et al. discloses the manifold (154); a pumping grid (156a, 156b) operable to connect to the manifold; a blending unit (114); a proppant storage system (112; 120); a chemical storage system (116); a power unit (106); wherein the well operations factory is enclosed in a structure selected from the group as claimed (col. 2, l. 33-41); wherein the first and second connections are operable to deliver a fluid from the first and second well locations to the manifold (158); wherein the fluid comprises a stimulation fluid (col. 1, l. 11-14; col. 2, l. 23-32); wherein the manifold is connected to a second manifold (152), and further, wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location; a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold, and a fourth connection between the manifold and the second well location, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold (158); wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat (col. 2, l. 33-41); wherein the first fluid and the second fluid each comprise at least one component selected from the group as claimed (col. 3, I. 3 - col. 4, I. 17); and wherein the first stimulation fluid and the second stimulation fluid have the same composition (col. 5, l. 33-45).
>
> With respect to independent claim 40, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well

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> stimulation fluid; a first connection between a first pad and the well operations factory (158); a second connection between a second pad and the well operations factory (158); and means for simultaneously flowing: a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad (154).
>
> With respect to independent claim 41, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which dynamically manufactures and pumps a well stimulation fluid; a first connection (158) between a first well location and the well operations factory; a second connection (158) between a second well location and the well operations factory; and means for simultaneously flowing (154): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.
>
> With respect to depending claim 42, the reference discloses wherein the locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.
>
> With respect to independent claim 43, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well stimulation fluid; a first connection (158) between a first well location having a first plurality of wells (156a) and the well operations factory; a second connection (158) between a second well location having a second plurality of wells (156b) and the well operations factory; and means for simultaneously flowing (154): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.

Office Action at 2-4. Applicants respectfully disagree with these rejections.

To form a basis for a § 102(b) rejection, a prior art reference must disclose each and every element as set forth in the claim. *See* MANUAL OF PATENT EXAMINING PROCEDURE ("MPEP") § 2131 (2007). "The identical invention must be shown in as complete detail as it is contained in the claim." *Id.* "The elements must be arranged as required by the claim." *Id.* With regard to amended independent claims 11, 40, 41, and 43, *Neal* fails to disclose every element of the claims.

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As to claims 11, 40, 41, and 43, *Neal* does not disclose, at least, a first stimulation fluid and a second stimulation fluid *wherein the first stimulation fluid and the second stimulation fluid have different compositions*. Rather, *Neal* simply discloses a manifold which distributes a single slurry to multiple discharge headers. *Neal* col. 5, lines 39-41; Fig. 5. Additionally, *Neal* fails to disclose *a first well location*, *a second well location*, *a first pad*, or *a second pad*. *Neal* merely refers generally to "hydraulic fracturing operations" (*Neal* col. 2, lines 28-29) and "downstream equipment" (*Neal* col. 5, lines 43-44). As such, *Neal* does not disclose each and every limitation as set forth in amended independent claims 11, 40, 41, and 43.

Accordingly, Applicants submit that *Neal* cannot be used to anticipate Applicants' claims as set forth in independent claims 11, 40, 41, and 43. The remaining claims rejected as anticipated by *Neal* under 35 U.S.C. § 102(b) depend either directly or indirectly from independent claims 11, 40, 41, and 43. All these dependent claims include all the limitations of their corresponding independent claims 11, 40, 41, and 43. Accordingly, Applicants respectfully request withdrawal of this rejection with respect to claims 11-33 and 40-43.

V. Rejection of Claims on Grounds of Nonstatutory Obviousness-Type Double Patenting

Claims 1-33 and 40-43 stand provisionally rejected on the grounds of nonstatutory obviousness-type double patenting over claims 1-31 of copending Application No. 11/873,186. With respect to this rejection, the Office Action states:

> Although the conflicting claims are not identical, they are not patentably distinct from each other because although the claims of the instant application are broader in scope than the claims of '186, the claims encompass the same subject matter claimed within the '186 application, and, therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the claims within the same application in order to provide for broadened patent protection.
>
> This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Office Action at 5.

As this rejection is provisional in nature, Applicants will hold in abeyance their response until allowable subject matter is indicated. However, should the double-patenting

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rejection be the only rejection remaining in the present application, Applicants respectfully request that the Examiner follow the procedure outlined in MPEP § 804.I.B.1 for nonstatutory double-patenting rejections between copending applications that were filed on different days. If, after following the appropriate procedure, the double-patenting rejection remains pending in the present application and is no longer provisional, Applicants will consider filing a terminal disclaimer at that time.

VI. No Waiver

All of Applicants' arguments and amendments are without prejudice or disclaimer. Additionally, Applicants have merely discussed example distinctions from the cited references. Other distinctions may exist, and Applicants reserve the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the Examiner's additional statements. The amendments and example distinctions discussed by Applicants are sufficient to overcome the rejections of the claims.

All amendments are made in a good faith effort to advance the prosecution on the merits. It should not be assumed that the claims amended herein were amended for reasons relating to patentability. Applicants reserve the right to subsequently take up prosecution on the claims as originally filed in this or appropriate continuation, continuation-in-part and/or divisional applications.

Applicants respectfully request that the amendments submitted herein be entered and further requests reconsideration in light of the amendments and remarks contained herein.

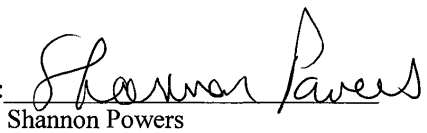
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SUMMARY

In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicants believe that there are no fees due in association with the filing of this Response. However, should the Commissioner deem that any additional fees are due, including any fees for extensions of time, Applicants respectfully request that the Commissioner accept this as a Petition therefor and direct that any additional fees be charged to Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0930, for any underpayment of fees that may be due in association with this filing.

Respectfully submitted,

By: 

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Date: August 12, 2009

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IPR2023-01319
Ex. 1002, p. 710 of 988

Electronic Acknowledgement Receipt	
EFS ID:	5873635
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	12-AUG-2009
Filing Date:	01-DEC-2005
Time Stamp:	13:35:03
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930ROA.PDF	653959 999329461fb3bd3e480adfe86db390e3cdbc145b	yes	16

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	16
Warnings:			
Information:			
	Total Files Size (in bytes):	653959	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (07-06)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number	Filing Date	☐ To be Mailed
11/291,496	12/01/2005	

APPLICATION AS FILED – PART I

	(Column 1)	(Column 2)	SMALL ENTITY ☐		OR	OTHER THAN SMALL ENTITY	
FOR	NUMBER FILED	NUMBER EXTRA	RATE ($)	FEE ($)		RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A			N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =		OR	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =			X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							
* If the difference in column 1 is less than zero, enter "0" in column 2.			TOTAL			TOTAL	

APPLICATION AS AMENDED – PART II

AMENDMENT	08/12/2009	(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)	OR	OTHER THAN SMALL ENTITY RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 43	Minus	** 43	= 0	X $ =		OR	X $52=	0
	Independent (37 CFR 1.16(h))	* 8	Minus	***8	= 0	X $ =		OR	X $220=	0
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	0

AMENDMENT		(Column 1) CLAIMS REMAINING AFTER AMENDMENT		(Column 2) HIGHEST NUMBER PREVIOUSLY PAID FOR	(Column 3) PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)		RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =		OR	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =		OR	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))									
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.

Legal Instrument Examiner:
/MONICA HARRIS/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**
If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	Lloyd McNeel
Art Unit	3676
Examiner Name	Angela Ditrani
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20090194273	A1	2009-08-06	Surjaatmadja	

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

	1		☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-08-24
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.3

Electronic Acknowledgement Receipt	
EFS ID:	5942142
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	24-AUG-2009
Filing Date:	01-DEC-2005
Time Stamp:	16:41:46
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Information Disclosure Statement (IDS) Filed (SB/08)	0637180930IDS.pdf	118458 cd51baeef9d57bc1409da8f943598fcd3042f9ee	no	3
Warnings:					
Information:					

This is not an USPTO supplied IDS fillable form	
Total Files Size (in bytes):	118458

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

Doc code :IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6991037		2006-01-31	Hockinig	
	2	7391675		2008-06-24	Drew	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Office Action for U.S. Patent Application No. 11/873,186, dated October 5, 2009	☐
	2	Office Action for U.S. Patent Application No. 11/873,160, dated October 1, 2009	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.3

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	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	Lloyd McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

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OR

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☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody Wirz	Date (YYYY-MM-DD)	2009-10-09
Name/Print	Melody Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.3

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Elizabeth L. Durham/Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	6233379
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	09-OCT-2009
Filing Date:	01-DEC-2005
Time Stamp:	11:01:21
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	6826
Deposit Account	020383
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees) Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)					
File Listing:					
Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0637180930IDS.pdf	2016749 eeb14b23acc83f23a2515644740d0cc9c9135310	yes	49
	Multipart Description/PDF files in .zip description				
	Document Description		**Start**	**End**	
	Information Disclosure Statement (IDS) Filed (SB/08)		1	3	
	NPL Documents		4	44	
	NPL Documents		45	49	
Warnings:					
Information:					
2	Fee Worksheet (PTO-875)	fee-info.pdf	30148 05e9c2a257e6d08d54563db82211b5ff0a6ea984	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	2046897		

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Doc code :IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (03-08)
Approved for use through 07/31/2008. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
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	Filing Date	2005-12-01
	First Named Inventor	McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
If you wish to add additional U.S. Patent citation information please click the Add button.						

U.S.PATENT APPLICATION PUBLICATIONS						
Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
If you wish to add additional U.S. Published Application citation information please click the Add button.						

FOREIGN PATENT DOCUMENTS								
Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐
If you wish to add additional Foreign Patent Document citation information please click the Add button								

NON-PATENT LITERATURE DOCUMENTS			
Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]

EFS Web 2.1.3

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

	1	International Preliminary Report on Patentability from PCT/GB2008/001044, dated October 8, 2009	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

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	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

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☐ See attached certification statement.

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☐ None

SIGNATURE

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Signature	Melody B. Wirz	Date (YYYY-MM-DD)	2009-11-30
Name/Print	Melody B. Wirz	Registration Number	53,783

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EFS Web 2.1.3

PATENT COOPERATION TREATY

RECEIVED
19 OCT 2009
PAC/N

PCT

From the INTERNATIONAL BUREAU

To:

RECEIVED
21 OCT 2009

CURTIS, Philip, Anthony
A.A. Thornton & Co.
235 High Holborn
London WC1V 7LE
ROYAUME-UNI

NOTIFICATION CONCERNING TRANSMITTAL OF COPY OF INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY (CHAPTER I OF THE PATENT COOPERATION TREATY)
(PCT Rule 44bis.1(c))

Date of mailing *(day/month/year)* 08 October 2009 (08.10.2009)	
Applicant's or agent's file reference PAC/26944WO	**IMPORTANT NOTICE**

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2008/001044	27 March 2008 (27.03.2008)	27 March 2007 (27.03.2007)

Applicant
HALLIBURTON ENERGY SERVICES, INC. et al

The International Bureau transmits herewith a copy of the international preliminary report on patentability (Chapter I of the Patent Cooperation Treaty)

RECORDS
NOTED

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Dorothée Mülhausen e-mail: pt01.pct@wipo.int

Form PCT/IB/326 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter I of the Patent Cooperation Treaty)

(PCT Rule 44*bis*)

Applicant's or agent's file reference PAC/26944WO	**FOR FURTHER ACTION**	See item 4 below
International application No. PCT/GB2008/001044	International filing date *(day/month/year)* 27 March 2008 (27.03.2008)	Priority date *(day/month/year)* 27 March 2007 (27.03.2007)
International Patent Classification (8th edition unless older edition indicated) See relevant information in Form PCT/ISA/237		
Applicant HALLIBURTON ENERGY SERVICES, INC.		

1. This international preliminary report on patentability (Chapter I) is issued by the International Bureau on behalf of the International Searching Authority under Rule 44 *bis*.1(a).

2. This REPORT consists of a total of 6 sheets, including this cover sheet.

   In the attached sheets, any reference to the written opinion of the International Searching Authority should be read as a reference to the international preliminary report on patentability (Chapter I) instead.

3. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

4. The International Bureau will communicate this report to designated Offices in accordance with Rules 44*bis*.3(c) and 93*bis*.1 but not, except where the applicant makes an express request under Article 23(2), before the expiration of 30 months from the priority date (Rule 44*bis* .2).

	Date of issuance of this report 29 September 2009 (29.09.2009)
The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Dorothée Mülhausen e-mail: pt01.pct@wipo.int

Form PCT/IB/373 (January 2004)

PATENT COOPERATION TREATY

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

see form PCT/ISA/220

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY
(PCT Rule 43*bis*.1)

Date of mailing
(day/month/year) see form PCT/ISA/210 (second sheet)

Applicant's or agent's file reference
see form PCT/ISA/220

FOR FURTHER ACTION
See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/GB2008/001044	27.03.2008	27.03.2007

International Patent Classification (IPC) or both national classification and IPC
INV. E21B21/06 E21B43/26

Applicant
HALLIBURTON ENERGY SERVICES, INC.

1. This opinion contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☒ Box No. VII Certain defects in the international application
- ☒ Box No. VIII Certain observations on the international application

2. **FURTHER ACTION**

If a demand for international preliminary examination is made, this opinion will usually be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notifed the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA:	Date of completion of this opinion	Authorized Officer
European Patent Office D-80298 Munich Tel. +49 89 2399 - 0 Tx: 523656 epmu d Fax: +49 89 2399 - 4465	see form PCT/ISA/210	Georgescu, Mihnea Telephone No. +49 89 2399-7502

Form (PCT/ISA/237) (Cover Sheet) (April 2005)

Box No. I. Basis of the opinion

1. With regard to the **language**, this opinion has been established on the basis of:

   ☒ the international application in the language in which it was filed

   ☐ a translation of the international application into , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1 (b)).

2. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43bis.1(a))

3. With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

   a. type of material:

   ☐ a sequence listing

   ☐ table(s) related to the sequence listing

   b. format of material:

   ☐ on paper

   ☐ in electronic form

   c. time of filing/furnishing:

   ☐ contained in the international application as filed.

   ☐ filed together with the international application in electronic form.

   ☐ furnished subsequently to this Authority for the purposes of search.

4. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

5. Additional comments:

Box No. V Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	1-14
	No: Claims	
Inventive step (IS)	Yes: Claims	
	No: Claims	1-14
Industrial applicability (IA)	Yes: Claims	1-14
	No: Claims	

2. Citations and explanations

see separate sheet

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

see separate sheet

Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

see separate sheet

Reference is made to the following documents:

D1: US 5 365 435
D2: WO 2006/109035
D3: US 5 281 023

V - Reasoned statement with regard to novelty, inventive step or industrial applicability

V-1 Claims 1 to 14

D1, which is considered as the closest prior art, describes a method for controlling the production of well treatment fluid (column 1, lines 7-11) comprising:
determining an output rate from a sand system (column 3, lines 22, as the input of sand to the blender tub is equal to the output of the sand system);
sensing an output rate for a water system (column 3, line 20);
sensing an output rate from a pumping system (column 4, lines 52-53);
sensing the height within a blender tub of a mixture of sand from the sand system and water from the water system (column 4, lines 51-52);
producing a drive signal to the pumping system using a desired rate of well treatment fluid to be delivered to a well, the output rate of the sand system, the output rate of the water system, and the output rate of the pumping system (column 5, lines 35-46).

The distinguishing feature of claim 1 with regard to D1 is the presence of a virtual rate control system.

The subject-matter of claim 1 is therefore new and the claim meets the novelty requirements of Art. 33(2)PCT.

The meaning of the distinguishing feature of claim 1 is unclear as the term "system" is considered describing a device which is supposed to comprise structural features, and the term "virtual" excludes a structural feature. Consequently, claim 1 does not meet the requirement of Art. 6 PCT since the scope of protection of the claim cannot be unambiguously determined. Thus, a problem-solution approach cannot be formulated and a solution to a technical

problem cannot be seen in the distinguishing feature of claim 1. Therefore, an inventive step could not be acknowledged and the claim does not meet the requirement for inventive step of Art. 33(3) PCT.

Similar arguments apply to the independent claim 8 and to the respective dependent claims 2 to 7 and 9 to 14 which inherit the clarity problem present in the independent claims.

Should the applicant amend the aforementioned claims in the direction of describing the virtual system as a software, his attention is drawn to the following:
1) D1 comprises also a software (column 5, line 43) which runs the mixing system and modifies its parameters in order to obtain a treatment fluid closer to a mathematical model
2) the amendment should not infringe Art 34(2)(b) PCT.

VII - Certain defects

VII-1 The independent claims are not properly cast in the two part form, with those features which in combination are part of the closest prior art (D1) being placed in the preamble, contrary to the requirements of Rule 6.3(b) PCT.

VII-2 The features of the claims are not provided with reference signs placed in parentheses (Rule 6.2(b) PCT).

VII-3 Contrary to the requirements of Rule 5.1(a)(ii)PCT, the relevant background art disclosed in document D1 is not mentioned in the description, nor is this document identified therein.

VIII - Certain observations (clarity)

VIII-1 See objection on point V-1.

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Electronic Acknowledgement Receipt	
EFS ID:	6534262
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Debbie Allen
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	30-NOV-2009
Filing Date:	01-DEC-2005
Time Stamp:	10:33:02
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0637180930ids.PDF	435231 5ddb55004ced61321a0c883480815abc62367816	yes	10

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	NPL Documents	4	10
Warnings:			
Information:			
	Total Files Size (in bytes):	435231	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/291,496	12/01/2005	William Lloyd McNeel	2005-IP-018647U1	7986

29920 7590 12/16/2009

JOHN W. WUSTENBERG
P.O. BOX 1431
DUNCAN, OK 73536

EXAMINER	
DITRANI, ANGELA M	

ART UNIT	PAPER NUMBER
3676	

NOTIFICATION DATE	DELIVERY MODE
12/16/2009	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JOHN.WUSTENBERG@HALLIBURTON.COM
HOLLY.FINE@HALLIBURTON.COM

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/291,496	MCNEEL ET AL.	
	Examiner	Art Unit	
	Angela M. DiTrani	3676	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *1* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *12 August 2009*.

2a)☐ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32 and 34-44* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☐ Claim(s) _____ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. The reply filed on 08/12/09 is not fully responsive to the prior Office Action because of the following omission(s) or matter(s): Applicant has added new claim 44. Although stating within the remarks under **Disposition of Claims** "New claim 44 has been added to recite aspects of the invention. The new claims are supported by the specification and do not introduce new matter," Applicant has not explicitly stated described where in the specification support is found or how new claim 44 defines over the prior art. See 37 CFR 1.111. Since the above-mentioned reply appears to be *bona fide*, applicant is given **ONE (1) MONTH or THIRTY (30) DAYS** from the mailing date of this notice, whichever is longer, within which to supply the omission or correction in order to avoid abandonment. EXTENSIONS OF THIS TIME PERIOD MAY BE GRANTED UNDER 37 CFR 1.136(a).

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. DiTrani whose telephone number is (571)272-2182. The examiner can normally be reached on M-F, 6:30AM-4:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jennifer Gay can be reached on (571)272-7029. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Jennifer H Gay/
Supervisory Patent Examiner, Art Unit 3676

AD
12/07/09

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

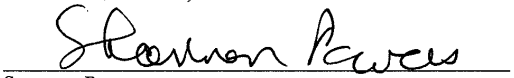
In re Application of:			
	MCNEEL, *ET AL.*	Group Art Unit:	**3676**
Serial No.:	**11/291,496**	Examiner:	**DITRANI, ANGELA M.**
Filed:	**DECEMBER 1, 2005**	Confirmation:	**7986**
Title:	**"METHOD AND APPARATUS FOR CENTRALIZED WELL TREATMENT"**	Atty. Docket No:	**HES 2005-IP-018647U1 (063718.0930)**

MAIL STOP AMENDMENT
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

CERTIFICATE OF FILING ELECTRONICALLY VIA EFS
37 CFR 1.8

I HEREBY CERTIFY THAT I HAVE A REASONABLE BASIS FOR BELIEF THAT THIS CORRESPONDENCE IS BEING SUBMITTED TO THE UNITED STATES PATENT AND TRADEMARK OFFICE VIA EFS (ELECTRONICALLY) ON THE DATE INDICATED BELOW, AND IS ADDRESSED TO:

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P.O. BOX 1450
ALEXANDRIA, VA 22313-1450



SHANNON POWERS

DATE OF SUBMISSION: **JANUARY 14, 2010**
ELECTRONIC FILING (EFS)

RESPONSE UNDER 37 C.F.R. § 1.111 TO NON-FINAL OFFICE ACTIONS, MAILED MAY 19 AND DECEMBER 16, 2009

Dear Honorable Commissioner:

In response to the Office Actions mailed on May 19 and December 16, 2009 (collectively, the "Office Action"), Applicants submit the following:

- **Amendments to the Claims**, which are reflected in the listing of claims that begins on page 2 of this paper; and
- **Remarks/Arguments**, which begin on page 11 of this paper.

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AMENDMENTS TO/LISTING OF THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

1. (Withdrawn) A method of stimulating multiple wells from a central location, comprising the steps of:

stimulating a first well from the central location using a first stimulation fluid through a first fluid line; and

simultaneously stimulating a second well from the central location using a second stimulation fluid through a second fluid line.

2. (Withdrawn-Previously Presented) The method of claim 1 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

3. (Withdrawn-Previously Presented) The method of claim 1 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

4. (Withdrawn) The method of claim 1 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

5. (Withdrawn) A method of stimulating multiple wells comprising the steps of:

stimulating a first well location through a first stimulation fluid from a central manifold; and

simultaneously stimulating a second well location through a second stimulation fluid from the central manifold.

6. (Withdrawn-Previously Presented) The method of claim 5 wherein the first stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

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7. (Withdrawn-Previously Presented) The method of claim 5 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

8. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at the same pad.

9. (Withdrawn) The method according to claim 5 wherein the first well location and the second well location are at different pads.

10. (Withdrawn) The method of claim 5 wherein the first stimulation fluid and the second stimulation fluid have the same composition.

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11. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

12. (Original) The system of claim 11 wherein the means for simultaneously flowing treatment fluid comprises a manifold.

13. (Original) The system of claim 12 wherein the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold.

14. (Original) The system of claim 13 wherein the well operations factory comprises a blending unit wherein the blending unit is operable to connect to the pumping grid.

15. (Previously Presented) The system of claim 14 wherein the well operations factory comprises a proppant storage system wherein the proppant storage system is operable to deliver proppant to the blending unit.

16. (Original) The system of claim 14 wherein the well operations factory comprises a chemical storage system wherein the chemical storage system is operable to connect to the blending unit.

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17. (Original) The system of claim 15 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, the proppant storage system, the first well location, and the second well location.

18. (Original) The system of claim 16 wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, chemical storage system, the first well location, and the second well location.

19. (Original) The system of claim 17 wherein the well operations factory is enclosed in a structure selected from the group consisting of: a supported fabric structure, a collapsible structure, a prefabricated structure, a retractable structure, a composite structure, a temporary structure, a prefabricated wall and roof structure, a deployable structure, a modular structure, a preformed structure, a mobile accommodation structure, and combinations thereof.

20. (Original) The system of claim 12 wherein the first connection is operable to deliver a fluid from the first well location to the manifold.

21. (Original) The system of claim 12 wherein the second connection is operable to deliver a fluid from the second well location to the manifold.

22. (Original) The system of claim 20 wherein the fluid comprises a stimulation fluid.

23. (Original) The system of claim 21 wherein the fluid comprises a stimulation fluid.

24. (Original) The system of claim 12 wherein the manifold is connected to a second manifold.

25. (Original) The system of claim 24 wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location.

26. (Original) The system of claim 12 comprising a third connection between the manifold and the first well location.

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27. (Original) The system of claim 26 wherein the third connection is operable to deliver a fluid from the first well location to the manifold.

28. (Original) The system of claim 27 comprising a fourth connection between the manifold and the second well location.

29. (Original) The system of claim 28 wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold.

30. (Original) The system of claim 11 wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat.

31. (Previously Presented) The system of claim 11 wherein the first fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

32. (Previously Presented) The system of claim 11 wherein the second stimulation fluid comprises at least one compound selected from the group consisting of: a proppant, a fracturing fluid, a gelling agent, a friction reducer, an acid, and a derivative thereof.

33. (Canceled)

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34. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting pressurized stimulation fluid;

a first line connected to said first input, said first line comprising:

a first valve connected to a first pressure sensor, said first pressure sensor further connected to a second valve;

said first line connected to a first wellhead;

a second line connected to said first input, said second line comprising

a third valve connected to a second pressure sensor, said second pressure sensor further connected to a fourth valve;

said second line connected to a second wellhead.

35. (Withdrawn) An apparatus for directing stimulation fluid comprising:

a first input for accepting a first pressurized stimulation fluid;

a second input for accepting a second pressurized stimulation fluid;

a first line connected to said first input, said first line comprising a first valve;

a second line connected to said second input, said second line comprising a second valve;

said first line and said second line connected together at a first junction, said first junction further connected to a first wellhead;

a third line connected to said first input, said third line comprising a third valve;

a fourth line connected to said second input, said fourth line comprising a fourth valve; and

said third line and said fourth line connected together at a second junction, said second junction further connected to a second wellhead.

36. (Withdrawn) The apparatus according to claim 35 wherein

said first line further comprises a fifth valve and a first pressure sensor, said first pressure sensor located between said first valve and said fifth valve.

37. (Withdrawn) The apparatus according to claim 36 wherein

said second line further comprises a sixth valve and a second pressure sensor, said second pressure sensor located between said second valve and said sixth valve.

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38. (Withdrawn) The apparatus according to claim 37 wherein

said third line further comprises a seventh valve and a third pressure sensor, said third pressure sensor located between said third valve and said seventh valve.

39. (Withdrawn) The apparatus according to claim 38 wherein

said fourth line further comprises an eighth valve and a fourth pressure sensor, said fourth pressure sensor located between said fourth valve and said eighth valve.

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40. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

a first connection between a first pad and the well operations factory;

a second connection between a second pad and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first pad and not to the second pad; and

a second stimulation fluid to the second pad and not to the first pad;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

41. (Currently Amended) A system for centralized well operations comprising:

a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

42. (Previously Presented) The system of claim 11, wherein the well locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.

43. (Previously Presented) A system for centralized well operations comprising:

a well treatment operations factory which manufactures and pumps a well stimulation fluid;

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a first connection between a first well location having a first plurality of wells and the well operations factory;

a second connection between a second well location having a second plurality of wells and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location;

wherein the first stimulation fluid and the second stimulation fluid have different compositions.

44. (New) A system for centralized well operations comprising:

a well treatment operations factory capable of manufacturing and simultaneously pumping a plurality of well stimulation fluids;

a first connection between a first well location and the well operations factory;

a second connection between a second well location and the well operations factory; and

means for simultaneously flowing:

a first stimulation fluid to the first well location and not to the second well location; and

a second stimulation fluid to the second well location and not to the first well location.

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REMARKS / ARGUMENTS

I. General Remarks

Applicants respectfully request that the above amendments be entered, and further request reconsideration of the application in light of the amendments and remarks contained herein. Applicants thank the Examiner for her careful consideration of this application and the references that Applicants have submitted.

II. Disposition of Claims

Claims 1-43 are pending in this application; of these, claims 1-10 and 34-39 are withdrawn. Claims 11-33 and 40-43 currently stand rejected. Claims 11, 40, 41, and 43 have been amended herein. Applicants respectfully submit that the amendments made herein add no new matter to the application and are supported by the specification as originally-filed. All the amendments are made in a good faith effort to advance the prosecution on the merits of this case. It should not be assumed that these amendments were made for reasons relating to patentability. New claim 44 has been added to recite aspects of the invention. The new claims are supported by the specification as filed and do not introduce new matter. Claim 33 has been cancelled herein. Applicants reserve the right to subsequently take up prosecution on the claims as originally-filed in this or appropriate continuation, continuation-in-part and/or divisional applications.

III. Interview with the Examiner

On July 21, 2009, Examiner DiTriani conducted a telephonic interview with Applicants' attorney Shannon Powers. No exhibits were shown. Claims 11 and 33 were discussed. U.S. Patent Number 6,644,844 by Neal et al. (hereinafter, "*Neal*") was discussed. Agreement was reached that claim 11, as written, broadly covers both circumstances wherein the first stimulation fluid and the second stimulation fluid are of the same composition and circumstances wherein the fluids are of different compositions, while *Neal* discloses, at most, only situations wherein the first stimulation fluid and the second stimulation fluid are of the same composition. Other aspects of *Neal* were not discussed.

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IV. Rejections of Claims Under 35 U.S.C. § 102

Claims 11-33 and 40-43 are is rejected under 35 U.S.C. § 102(b) as being anticipated by *Neal*.

With respect to these rejections, the Office Action states:

> With respect to independent claim 11, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well stimulation fluid; a first connection between a first well location and the well operations factory; a second connection between a second well location and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location (see col. 5, l. 6-55).
>
> With respect to depending claims 12-33, Neal et al. discloses the manifold (154); a pumping grid (156a, 156b) operable to connect to the manifold; a blending unit (114); a proppant storage system (112; 120); a chemical storage system (116); a power unit (106); wherein the well operations factory is enclosed in a structure selected from the group as claimed (col. 2, l. 33-41); wherein the first and second connections are operable to deliver a fluid from the first and second well locations to the manifold (158); wherein the fluid comprises a stimulation fluid (col. 1, l. 11-14; col. 2, l. 23-32); wherein the manifold is connected to a second manifold (152), and further, wherein the second manifold is operable to simultaneously flow a first stimulation fluid to a first well location and a second stimulation fluid to a second well location; a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold, and a fourth connection between the manifold and the second well location, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold (158); wherein the well operations factory and means for simultaneously flowing treatment fluid are located on a boat (col. 2, l. 33-41); wherein the first fluid and the second fluid each comprise at least one component selected from the group as claimed (col. 3, I. 3 - col. 4, I. 17); and wherein the first stimulation fluid and the second stimulation fluid have the same composition (col. 5, l. 33-45).
>
> With respect to independent claim 40, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well

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> stimulation fluid; a first connection between a first pad and the well operations factory (158); a second connection between a second pad and the well operations factory (158); and means for simultaneously flowing: a first stimulation fluid to the first pad and not to the second pad; and a second stimulation fluid to the second pad and not to the first pad (154).
>
> With respect to independent claim 41, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which dynamically manufactures and pumps a well stimulation fluid; a first connection (158) between a first well location and the well operations factory; a second connection (158) between a second well location and the well operations factory; and means for simultaneously flowing (154): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.
>
> With respect to depending claim 42, the reference discloses wherein the locations are pads and wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid.
>
> With respect to independent claim 43, Neal et al. discloses a system for centralized well operations comprising: a well treatment operations factory (100) which manufactures and pumps a well stimulation fluid; a first connection (158) between a first well location having a first plurality of wells (156a) and the well operations factory; a second connection (158) between a second well location having a second plurality of wells (156b) and the well operations factory; and means for simultaneously flowing (154): a first stimulation fluid to the first well location and not to the second location; and a second stimulation fluid to the second location and not to the first location.

Office Action at 2-4. Applicants respectfully disagree with these rejections.

To form a basis for a § 102(b) rejection, a prior art reference must disclose each and every element as set forth in the claim. *See* MANUAL OF PATENT EXAMINING PROCEDURE ("MPEP") § 2131 (2007). "The identical invention must be shown in as complete detail as it is contained in the claim." *Id.* "The elements must be arranged as required by the claim." *Id.* With regard to amended independent claims 11, 40, 41, and 43, *Neal* fails to disclose every element of the claims.

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As to claims 11, 40, 41, and 43, *Neal* does not disclose, at least, a first stimulation fluid and a second stimulation fluid *wherein the first stimulation fluid and the second stimulation fluid have different compositions*. Rather, *Neal* simply discloses a manifold which distributes a single slurry to multiple discharge headers. *Neal* col. 5, lines 39-41; Fig. 5. Additionally, *Neal* fails to disclose *a first well location*, *a second well location*, *a first pad*, or *a second pad*. *Neal* merely refers generally to "hydraulic fracturing operations" (*Neal* col. 2, lines 28-29) and "downstream equipment" (*Neal* col. 5, lines 43-44). As such, *Neal* does not disclose each and every limitation as set forth in amended independent claims 11, 40, 41, and 43.

Accordingly, Applicants submit that *Neal* cannot be used to anticipate Applicants' claims as set forth in independent claims 11, 40, 41, and 43. The remaining claims rejected as anticipated by *Neal* under 35 U.S.C. § 102(b) depend either directly or indirectly from independent claims 11, 40, 41, and 43. All these dependent claims include all the limitations of their corresponding independent claims 11, 40, 41, and 43. Accordingly, Applicants respectfully request withdrawal of this rejection with respect to claims 11-33 and 40-43.

V. Rejection of Claims on Grounds of Nonstatutory Obviousness-Type Double Patenting

Claims 1-33 and 40-43 stand provisionally rejected on the grounds of nonstatutory obviousness-type double patenting over claims 1-31 of copending Application No. 11/873,186. With respect to this rejection, the Office Action states:

> Although the conflicting claims are not identical, they are not patentably distinct from each other because although the claims of the instant application are broader in scope than the claims of '186, the claims encompass the same subject matter claimed within the '186 application, and, therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the claims within the same application in order to provide for broadened patent protection.
>
> This is a provisional obviousness-type double patenting rejection because the conflicting claims have not in fact been patented.

Office Action at 5.

As this rejection is provisional in nature, Applicants will hold in abeyance their response until allowable subject matter is indicated. However, should the double-patenting rejection be the only rejection remaining in the present application, Applicants respectfully

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request that the Examiner follow the procedure outlined in MPEP § 804.I.B.1 for nonstatutory double-patenting rejections between copending applications that were filed on different days. If, after following the appropriate procedure, the double-patenting rejection remains pending in the present application and is no longer provisional, Applicants will consider filing a terminal disclaimer at that time.

VI. Remarks Regarding New Claims

In this response, Applicants have added new claim 44. Applicants respectfully submit that this claim is allowable. Claim 44 requires that the well treatment operations factory be *capable of manufacturing and simultaneously pumping a plurality of well stimulation fluids*. This limitation is supported by the specification as filed (*e.g.*, paragraph [0026] and Figure 6). *Neal* fails to disclose this limitation. Rather, *Neal* simply discloses a manifold which distributes a single slurry to multiple discharge headers. *Neal* col. 5, lines 39-41; Fig. 5. Additionally, *Neal* fails to disclose *a first well location*, *a second well location*, *a first pad*, or *a second pad*. Therefore, Applicants respectfully submit that new claim 44 is allowable.

VII. No Waiver

All of Applicants' arguments and amendments are without prejudice or disclaimer. Additionally, Applicants have merely discussed example distinctions from the cited references. Other distinctions may exist, and Applicants reserve the right to discuss these additional distinctions in a later Response or on Appeal, if appropriate. By not responding to additional statements made by the Examiner, Applicants do not acquiesce to the Examiner's additional statements. The amendments and example distinctions discussed by Applicants are sufficient to overcome the rejections of the claims.

All amendments are made in a good faith effort to advance the prosecution on the merits. It should not be assumed that the claims amended herein were amended for reasons relating to patentability. Applicants reserve the right to subsequently take up prosecution on the claims as originally filed in this or appropriate continuation, continuation-in-part and/or divisional applications.

Applicants respectfully request that the amendments submitted herein be entered and further requests reconsideration in light of the amendments and remarks contained herein.

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SUMMARY

In light of the above remarks, Applicants respectfully request reconsideration and withdrawal of the outstanding rejections. Applicants further submit that the application is now in condition for allowance, and earnestly solicit timely notice of the same. Should the Examiner have any questions, comments or suggestions in furtherance of the prosecution of this application, the Examiner is invited to contact the attorney of record by telephone, facsimile, or electronic mail.

Applicants believe that there are no fees due in association with the filing of this Response. However, should the Commissioner deem that any additional fees are due, including any fees for extensions of time, Applicants respectfully request that the Commissioner accept this as a Petition therefor and direct that any additional fees be charged to Baker Botts L.L.P.'s Deposit Account No. 02-0383, Order Number 063718.0930, for any underpayment of fees that may be due in association with this filing.

Respectfully submitted,

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Date: January 14, 2010

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Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Elizabeth L. Durham/Crystle Garbade
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Independent claims in excess of 3	1201	1	220	220
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
		Total in USD ($)		**220**

Electronic Acknowledgement Receipt	
EFS ID:	6813679
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Crystle Garbade
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	14-JAN-2010
Filing Date:	01-DEC-2005
Time Stamp:	17:19:55
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
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RAM confirmation Number	3498
Deposit Account	020383
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		063718-0930-ROA.PDF	697593 1d4795c13f1720a9b38566420de1f4208136c829	yes	16

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	10
	Applicant Arguments/Remarks Made in an Amendment	11	16

Warnings:

Information:

2	Fee Worksheet (PTO-875)	fee-info.pdf	30245 fc85bda738306080624f3123f52815d48f95bf60	no	2

Warnings:

Information:

Total Files Size (in bytes):	727838

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

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New International Application Filed with the USPTO as a Receiving Office

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PTO/SB/08a (07-09)
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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	William L. McNeel
Art Unit	3676
Examiner Name	Angela Ditrani
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6236894	B1	2001-05-22	Stoisits et al.	
	2	7367411	B2	2008-05-06	Leuchtenberg	

If you wish to add additional U.S. Patent citation information please click the Add button.

U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020125011	A1	2002-09-12	Snider et al.	
	2	20060081412	A1	2006-04-20	Wright et al.	

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FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	WO2008/041010		A1	2008-04-10	Halliburton Energy Services, Inc.		☐

EFS Web 2.1.16

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
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	First Named Inventor	William L. McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

	2	WO2008/142406		A3	2008-11-27	Halliburton Energy Services, Inc.		☐
	3	1460647	GB	A	1977-01-06	Intercomp Resource Dev Eng Inc.		☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	SURJAATMADJA et al., "Consideration for Future Stimulation Options is Vital in Deciding Horizontal Well Drilling and Completion Schemes for Production Optimization," Society of Petroleum Engineers, 2006, SPE 103774	☐
	2	Office Action for U.S. Patent Application No. 11/545,749 dated January 27, 2010	☐
	3	Office Action for U.S. Patent Application No. 11/873,186 dated January 25, 2010	☐
	4	Notice of Allowance and Notice of Allowability for U.S. Patent Application No. 11/753,314 dated December 17, 2009	☐

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EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	William L. McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature		Date (YYYY-MM-DD)	2010-2-9
Name/Print	Carey C. Jordan	Registration Number	47,646

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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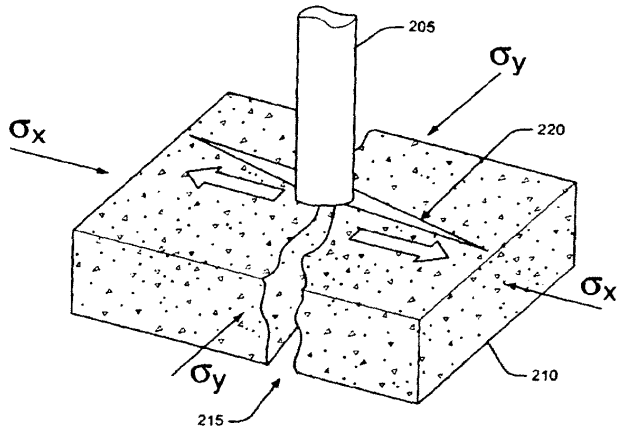
(74) Agents: **CURTIS, Philip, Anthony** et al.; A.A. Thornton & Co., 235 High Holborn, London WC1V 7LE (GB).

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(54) Title: METHODS AND SYSTEMS FOR WELL STIMULATION USING MULTIPLE ANGLED FRACTURING



(57) Abstract: Methods, systems, and apparatus for inducing fractures in a subterranean formation and more particularly methods and apparatus to place a first fracture with a first orientation in a formation followed by a second fracture with a second angular orientation in the formation are disclosed. The first and second fractures are initiated at about a fracturing location. The initiation of the first fracture is characterized by a first orientation line. The first fracture temporarily alters a stress field in the subterranean formation. The initiation of the second fracture is characterized by a second orientation line. The first orientation line and the second orientation line have an angular disposition to each other.

WO 2008/041010 A1

METHODS AND SYSTEMS FOR WELL STIMULATION USING MULTIPLE ANGLED FRACTURING

[0001] The present invention relates generally to methods, systems, and apparatus for inducing fractures in a subterranean formation and more particularly to methods and apparatus to place a first fracture with a first orientation in a formation followed by a second fracture with a second angular orientation in the formation.

[0002] Oil and gas wells often produce hydrocarbons from subterranean formations. Occasionally, it is desired to add additional fractures to an already-fractured subterranean formation. For example, additional fracturing may be desired for a previously producing well that has been damaged due factors such as fine migration. Although the existing fracture may still exist, it is no longer effective, or less effective. In such a situation, stress caused by the first fracture continues to exist, but it would not significantly contribute to production. In another example, multiple fractures may be desired to increase reservoir production. This scenario may be also used to improve sweep efficiency for enhanced recovery wells such water flooding steam injection, etc. In yet another example, additional fractures may be created to inject with drill cuttings.

[0003] Conventional methods for initiating additional fractures typically induce the additional factures with near-identical angular orientation to previous fractures. While such methods increase the number of locations for drainage into the wellbore, they may not introduce new directions for hydrocarbons to flow into the wellbore. Conventional method may also not account for, or even more so, utilize, stress alterations around existing fractures when inducing new fractures.

[0004] Thus, a need exists for an improved method for initiating multiple fractures in a wellbore, where the method accounts for tangential forces around a wellbore.

SUMMARY

[0005] The present invention relates generally to methods, systems, and apparatus for inducing fractures in a subterranean formation and more particularly to methods and apparatus to place a first fracture with a first orientation in a formation followed by a second fracture with a second angular orientation in the formation.

[0006] An example method of the present invention is for fracturing a subterranean formation. The subterranean formation includes a wellbore having an axis. A first fracture is induced in the subterranean formation. The first fracture is initiated at about a fracturing location. The initiation of the first fracture is characterized by a first orientation line. The first fracture temporarily alters a stress field in the subterranean formation. A second fracture is induced in the subterranean formation. The second fracture is initiated at about the fracturing location. The initiation of the second fracture is characterized by a second

orientation line. The first orientation line and the second orientation line have an angular disposition to each other.

[0007] An example fracturing tool according to present invention includes a tool body to receive a fluid, the tool body comprising a plurality of fracturing sections, wherein each fracturing section includes at least one opening to deliver the fluid into the subterranean formation at an angular orientation; and a sleeve disposed in the tool body to divert the fluid to at least one of the fracturing sections while blocking the fluid from exiting another at least one of the fracturing sections.

[0008] An example system for fracturing a subterranean formation according to the present invention includes a downhole conveyance selected from a group consisting of a drill string and coiled tubing, wherein the downhole conveyance is at least partially disposed in the wellbore; a drive mechanism configured to move the downhole conveyance in the wellbore; a pump coupled to the downhole conveyance to flow a fluid though the downhole conveyance; and a computer configured to control the operation of the drive mechanism and the pump.

[0009] The fracturing tool includes tool body to receive the fluid, the tool body comprising a plurality of fracturing sections, wherein each fracturing section includes at least one opening to deliver the fluid into the subterranean formation at an angular orientation and a sleeve disposed in the tool body to divert the fluid to at least one of the fracturing sections while blocking the fluid from exiting another at least one of the fracturing sections.

[0010] The features and advantages of the present invention will be apparent to those skilled in the art. While numerous changes may be made by those skilled in the art, such changes are within the spirit of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] These drawings illustrate certain aspects of some of the embodiments of the present invention, and should not be used to limit or define the invention.

[0012] Figure 1 is a schematic block diagram of a wellbore and a system for fracturing.

[0013] Figure 2A is a graphical representation of a wellbore in a subterranean formation and the principal stresses on the formation.

Figure 2B is a graphical representation of a wellbore in a subterranean formation that has been fractured and the principal stresses on the formation.

[0014] Figure 3 is a flow chart illustrating an example method for fracturing a formation according to the present invention.

[0015] Figure 4 is a graphical representation of a wellbore and multiple fractures at different angles and fracturing locations in the wellbore.

[0016] Figure 5 is a graphical representation of a formation with a high-permeability region with two fractures.

[0017] Figure 6 is a graphical representation of drainage into a horizontal wellbore fractured at different angular orientations.

[0018] Figures 7A, 7B, and 7C illustrate a cross-sectional view of a fracturing tool showing certain optional features in accordance with one example implementation.

[0019] Figure 8 is a graphical representation of the drainage of a vertical wellbore fractured at different angular orientations.

[0020] Figure 9 is a graphical representation of a fracturing tool rotating in a horizontal wellbore and fractures induced by the fracturing tool.

DETAILED DESCRIPTION

[0021] The present invention relates generally to methods, systems, and apparatus for inducing fractures in a subterranean formation and more particularly to methods and apparatus to place a first fracture with a first orientation in a formation followed by a second fracture with a second angular orientation in the formation. Furthermore, the present invention may be used on cased well bores or open holes.

[0022] The methods and apparatus of the present invention may allow for increased well productivity by the introduction of multiple fractures introduced at different angles relative to one another in the a wellbore.

[0023] Figure 1 depicts a schematic representation of a subterranean well bore 100 through which a fluid may be injected into a region of the subterranean formation surrounding well bore 100. The fluid may be of any composition suitable for the particular injection operation to be performed. For example, where the methods of the present invention are used in accordance with a fracture stimulation treatment, a fracturing fluid may be injected into a subterranean formation such that a fracture is created or extended in a region of the formation surrounding well bore 12 and generates pressure signals. The fluid may be injected by injection device 105 (e.g., a pump). At wellhead 115, a downhole conveyance device 120 is used to deliver and position a fracturing tool 125 to a location in the wellbore 100. In some example implementations, the downhole conveyance device 120 may include coiled tubing. In other example implementations, downhole conveyance device 120 may include a drill string that is capable of both moving the fracturing tool 125 along the wellbore 100 and rotating the fracturing tool 125. The downhole conveyance device 120 may be driven by a drive mechanism 130. One or more sensors may be affixed to the downhole conveyance device 120 and configured to send signals to a control unit 135. The control unit 135 is coupled to drive unit 130 to control the operation of the drive unit. The control unit

135 is coupled to the injection device 105 to control the injection of fluid into the wellbore 100. The control unit 135 includes one or more processors and associated data storage.

[0024] Figure 2 is an illustration of a wellbore 205 passing though a formation 210 and the stresses on the formation. In general, formation rock is subjected by the weight of anything above it, *i.e.* σ_z overburden stresses. By Poisson's rule, these stresses and formation pressure effects translate into horizontal stresses σ_x and σ_y. In general, however, Poisson's ratio is not consistent due to the randomness of the rock. Also, geological features, such as formation dipping and tectonic stresses may cause other stresses. Therefore, in most cases, σ_x and σ_y are different.

[0025] Figure 2B is an illustration the wellbore 205 passing though the formation 210 after a fracture 215 is induced in the formation 210. Assuming for this example that σ_x is smaller than σ_y, the fracture 215 will extend into the y direction. The orientation of the fracture is, however, in the x direction. As used herein, the orientation of a fracture is defined to be a vector perpendicular to the fracture plane.

[0026] As fracture 215 opens fracture faces to be pushed in the x direction. Because formation boundaries cannot move, the rock becomes more compressed, increasing both σ_x and σ_y however to different degrees. Over time, the fracture will tend to close as the rock moves back to its original shape due to the increased σ_x. The change in the two horizontal stresses will change the hoop stress (tangential stress around the wellbore) While the fracture is closing however, the stresses in the formation will cause a subsequent fracture to propagate in a new direction shown by projected fracture 220. The method, system, and apparatus according to the present invention are directed to initiating fractures, such as projected fracture 220, while the stress field in the formation 210 is temporarily altered by an earlier fracture, such as fracture 215.

[0027] If the existing fracture is prevented from taking any more fluid (by chemical or mechanical means) the new hoop stress will favor the initiation of a fracture at angle to the first fracture. The minimum tangential stress will be between 0 and 90 degrees. This value will depend on the magnitude of the minimum and maximum horizontal stresses, the fracture width, and net stress reached during creation of the first fracture. The tangential stress will not be 90 degrees even if the initial horizontal stresses are equal.

[0028] The foregoing is illustrated by the following example. The general equation for the distribution of the tangential (hoop) stress is given below:

$$\sigma_\theta = \frac{1}{2}(\sigma_y + \sigma_x)\left(1+\left(\frac{r}{r_w}\right)^2\right) - \frac{1}{2}(\sigma_y - \sigma_x)\left(1+3\left(\frac{r}{r_w}\right)^4\right)\cos(2\theta)$$

[0029] The tangential stress forms a profile around the wellbore. The minimum value occurs at angle, θ, of zero. The value of the tangential stress is at maximum at the wellbore surface. It declines quickly to a value equal to perpendicular principal stress within a few radii from the wellbore. The axial stress on the other hand is equal to zero at the wellbore.

[0030] The hoop stress before and after the creation of the first fracture given the reservoir data set forth in the Table I below is illustrated in Figure 10.

Table 1 – Input parameters for example

parameter	value	Parameter	value
σ_{min}, psi	6000	Pore pressure, psi	5000
σ_{max}, psi	6500	Net pressure, psi	500
σ_v, psi	7000	Wellbore radius, ft	0.25

From Figure 10, it is clear that the following has happened:

- The magnitude of the tangential stress all around the well bore has increased. The largest increase occurred right near where the first fracture was created.
- The location of the minimum tangential stress has moved from angle Theta of zero to angle Theta of $+38^0$ and -38^0.
- There are two preferred orientations for the second fracture. Presence of perforation / jetting will determine which orientation would be the actual orientation of the fracture.

[0031] Lithological heterogeneity may also play a part in the determining the fracture orientation It is highly desirable to orient the second fracture in the preferred orientation to minimize tortiousity. The technique used in creating the first fracture will apply when creating the second fracture.

[0032] After the creation of a second fracture, it would be expected that the tangential stress changes would be even more significant in the orientation of a third or subsequent fracture. In addition the symmetry of the system would be lost. Figure 11 illustrates the tangential stress profile in the first quadroon for the condition give in Figure 10 after creating two fractures. The minimum tangential stress would occur at about 52 degrees and at a value slightly more than 4700 psi.

[0033] The tangential stress after creating the first fracture was calculated first by calculating the increase in stress due to the presence of the fracture. Assuming that the width of the fracture is too small to affect the circular shape of the well, the tangential pressure may

be calculated using conventional methods. A more accurate method is to do this calculation using a numerical simulator. However the potential change in angle will most probably too small to be of significant effect under real operational conditions.

[0034] This invention may also be used to create multiple longitudinal fractures intersecting a horizontal well. If the horizontal well is drilled in the direction of maximum stress a longitudinal fracture is usually expected. This longitudinal fracture may be created in situations involving open hole fracturing, cased hole with perforations and slotted casing. The preferred way is to create the perforation or slot or other means of communication along the top and bottom of the well. One method to create the means of communication is by hydrojetting.

[0035] Figure 3 is a flow chart illustration of an example implementation of one method of the present invention, shown generally at 300. The method includes determining one or more geomechanical stresses at a fracturing location in step 305. In some implementations, step 305 may be omitted. In some implementations, this step includes determining a current minimum stress direction at the fracturing location. In one example implementation, information from tilt meters or micro-seismic tests performed on neighboring wells is used to determine geomechanical stresses at the fracturing location. In some implementations, geomechanical stresses at a plurality of possible fracturing locations are determined to find one or more locations for fracturing. Step 305 may be performed by the control unit 305 by computer with one or more processors and associated data storage.

[0036] The method 300 further includes initiating a first fracture at about the fracturing location in step 310. The first fracture's initiation is characterized by a first orientation line. In general, the orientation of a fracture is defined to be a vector normal to the fracture plane. In this case, the characteristic first orientation line is defined by the fracture's initiation rather than its propagation. In certain example implementations, the first fracture is substantially perpendicular to a direction of minimum stress at the fracturing location in the wellbore.

[0037] The initiation of the first fracture temporarily alters the stress field in the subterranean formation, as discussed above with respect to figures 2A and 2B. The duration of the alteration of the stress field may be based on factors such as the size of the first fracture, rock mechanics of the formation, the fracturing fluid, and subsequently injected proppants, if any. Due to the temporary nature of the alteration of the stress field in the

formation, there is a limited amount of time for the system to initiate a second fracture at about the fracturing location before the temporary stresses alteration has dissipated below a level that will result in a subsequent fracture at the fracturing being usefully reoriented. Therefore, in step 315 a second fracture is initiated at about the fracturing location before the temporary stresses from the first fracture have dissipated. In some implementations, the first and second fractures are imitated within 24 hours of each other. In other example implementations, the first and second fractures are initiated within four hours of each other. In still other implementations, the first and second fractures are initiated within an hour of each other.

[0038] The initiation of the second fracture is characterized by a second orientation line. The first orientation line and second orientation lines have an angular disposition to each other. The plane that the angular disposition is measured in may vary based on the fracturing tool and techniques. In some example implementations, the angular disposition is measured on a plane substantially normal to the wellbore axis at the fracturing location. In some example implementations, the angular disposition is measured on a plane substantially parallel to the wellbore axis at the fracturing location.

[0039] In some example implementations, step 315 is performed using a fracturing tool 125 that is capable of fracturing at different orientations without being turned by the drive unit 130. Such a tool may be used when the downhole conveyance 120 is coiled tubing. In other implementations, the angular disposition between the fracture initiations is cause by the drive unit 130 turning a drillstring or otherwise reorienting the fracturing tool 125. In general there may be an arbitrary angular disposition between the orientation lines. In some example implementations, the angular orientation is between 45° and 135°. More specifically, in some example implementations, the angular orientation is about 90°. In still other implementations, the angular orientation is oblique.

[0040] In step 320, the method includes initiating one or more additional fractures at about the fracturing location. Each of the additional fracture initiations are characterized by an orientation line that has an angular disposition to each of the existing orientation lines of fractures induced at about the fracturing location. In some example implementations, step 320 is omitted. Step 320 may be particularly useful when fracturing coal seams or diatomite formations.

[0041] The fracturing tool may be repositioned in the wellbore to initiate one or more other fractures at one or more other fracturing locations in step 325. For example, steps 310, 315, and optionally 320 may be performed for one or more additional fracturing locations in the wellbore. An example implementation is shown in Figure 4. Fractures 410 and 415 are initiated at about a first fracturing location in the wellbore 405. Fractures 420 and 425 are initiated at about a second fracturing location in the wellbore 405. In some implementations, such as that shown in figure 4, the fractures at two or more fracturing locations, such as fractures 410-425, and each have initiation orientations that angularly differ from each other. In other implementations, fractures at two or more fracturing locations have initiation orientations that are substantially angularly equal. In certain implementations, the angular orientation may be determined based on geomechanical stresses about the fracturing location.

[0042] Figure 5 is an illustration of a formation 505 that includes a region 510 with increased permeability, relative to the other portions of formation 505 shown in the figure. When fracturing to increase the production of hydrocarbons, it is generally desirable to fracture into a region of higher permeability, such as region 510. The region of high permeability 510, however, reduces stress in the direction toward the region 510 so that a fracture will tend to extend in parallel to the region 510. In the fracturing implementation shown in figure 5, a first fracture 515 is induced substantially perpendicular to the direction of minimum stress. The first fracture 515 alters the stress field in the formation 505 so that a second fracture 520 can be initiated in the direction of the region 510. Once the fracture 520 reaches the region 510 it may tend to follow the region 510 due to the stress field inside the region 510. In this implementation, the first fracture 515 may be referred to as a sacrificial fracture because its main purpose was simply to temporarily alter the stress field in the formation 505, allowing the second fracture 520 to propagate into the region 510.

[0043] Figure 6 illustrates fluid drainage from a formation into a horizontal wellbore 605 that has been fractured according to method 100. In this situation, the effective surface area for drainage into the wellbore 605 is increased, relative to fracturing with only one angular orientation. In the example shown in figure 6, fluid flow along planes 610 and 615 are able to enter the wellbore 605. In addition, flow in fracture 615 does not have to enter the wellbore radially, which causes a constriction to the fluid. Fig. 6 also shows flow entering the fracture 615 in a parallel manner; which then flows through the fracture 615 in a parallel

fashion into fracture 610. This scenario causes very effective flow channeling into the wellbore.

[0044] In general, additional fractures, regardless of their orientation, provide more drainage into a wellbore. Each fracture will drain a portion of the formation. Multiple fractures having different angular orientations, however, provide more coverage volume of the formation, as shown by the example drainage areas illustrated in figure 8. The increased volume of the formation drained by the multiple fractures with different orientations may cause the well to produce more fluid per unit of time.

[0045] A cut-away view of an example fracturing tool 125, shown generally at 700, that may be used with method 300 is shown in figures 7A-7C. The fracturing tool 700 includes at least two fracturing sections, such as fracturing sections 705 and 710. Each of sections 705 and 710 are configured to fracture at an angular orientation, based on the design of the section. In one example implementation, fluid flowing from section 710 may be oriented obliquely, such as between 45° to 90°, with respect to fluid flowing from section 705. In another implementation fluid flow from sections 705 and 710 are substantially perpendicular.

[0046] The fracturing tool includes a selection member 715, such as sleeve, to activate or arrest fluid flow from one or more of sections 705 and 710. In the illustrated implementation selection member 715 is a sliding sleeve, which is held in place by, for example, a detent. While the selection member 715 is in the position shown in Fig. 7A, fluid entering the tool body 700 exits though section 705.

[0047] A value, such as ball value 725 is at least partially disposed in the tool body 700. The ball value 725 includes an actuating arm allowing the ball valve 725 to slide along the interior of tool body 700, but not exit the tool body 700. In this way, the ball valve 725 prevents the fluid from exiting from the end of the fracturing tool 125. The end of the ball value 725 with actuating arm may be prevented from exiting the tool body 700 by, for example, a ball seat (not shown).

[0048] The fracturing tool further comprises a releasable member, such as dart 720, secured behind the sliding sleeve. In one example implementation, the dart is secured in place using, for example, a J-slot.

[0049] In one example implementation, once the fracture is induced by sections 705, the dart 720 is released. In one example implementations, the dart is released by quickly and

briefly flowing the well to release a j-hook attached to the dart 725 from a slot. In other example implementations, the release of the dart 720 may be controlled by the control unit 135 activating an actuator to release the dart 720. As shown in figure 7B, the dart 720 causes the selection member 715 to move forward causing fluid to exit though section 710.

[0050] As shown in Figure 7C, the ball value 725 with actuating arm may reset the tool by forcing the dart 720 back into a locked state in the tool body 700. The ball value 725 also may force the selection member 715 back to its original position, before fracturing was initiated. The ball value 725 may be force back into the tool body 700 by, for example, flowing the well.

[0051] Another example fracturing tool 125 is shown in figure 9. Tool body 910 receives fracturing fluid though a drill string 905. The tool body has an interior and an exterior. Fracturing passages pass from the interior to the exterior at an angle, causing fluid to exit from the tool body 910 at an angle, relative to the axis of the wellbore. Because of the angular orientation of the fracturing passages, multiple fractures with different angular orientations may be induced in the formation by reorienting the tool body 810. In one example implementation, the tool body is rotated to reorient the tool body to 810 to fracture at different orientations and create fractures 915 and 920. For example, the tool body may be rotate about 180°. In the example implementation shown in figure 9 where the fractures 915 and 920 are induced in a horizontal or deviated portion of a wellbore, the drill string 805 may be rotate more than the desired rotation of the tool body 910 to account for friction.

[0052] Therefore, the present invention is well adapted to attain the ends and advantages mentioned as well as those that are inherent therein. The particular embodiments disclosed above are illustrative only, as the present 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. Furthermore, no limitations are intended to the details of construction or design herein shown, other than as described in the claims below. It is therefore evident that the particular illustrative embodiments disclosed above may be altered or modified and all such variations are considered within the scope and spirit of the present invention. Also, the terms in the claims have their plain, ordinary meaning unless otherwise explicitly and clearly defined by the patentee.

What is claimed is:

1. A method for fracturing a subterranean formation, wherein the subterranean formation comprises a wellbore having an axis, the method comprising:

inducing a first fracture in the subterranean formation, wherein:

the first fracture is initiated at about a fracturing location,

the initiation of the first fracture is characterized by a first orientation line, and

the first fracture temporarily alters a stress field in the subterranean formation; and

inducing a second fracture in the subterranean formation, wherein:

the second fracture is initiated at about the fracturing location,

the initiation of the second fracture is characterized by a second orientation line, and

the first orientation line and the second orientation line have an angular disposition to each other.

2. The method of claim 1, wherein the second fracture is initiated before the temporary alteration of the set of geomechanical stresses at the fracturing location due to the first fracture has dissipated.
3. The method of claim 1, wherein the second fracture is initiated no later than twenty-four hours after the first fracture is initiated.
4. The method of claim 1, wherein the second fracture is initiated no later than four hours after the first fracture is initiated.
5. The method of claim 1, wherein the angular disposition is between 45°-135°.
6. The method of claim 1, wherein the angular disposition is about 90°.
7. The method of claim 1, further comprising:

determining a set of geomechanical stresses at the fracturing location in the wellbore and wherein the first orientation line and second orientation line are chosen based, at least in part, on the set of geomechanical stresses.

8. The method of claim 1, wherein the first fracture is substantially perpendicular to a direction of minimum stress at the fracturing location in the wellbore.
9. The method of claim 1, further comprising:

inducing a third fracture in the subterranean formation, wherein:

the third fracture is initiated at about a second fracturing location,

the initiation of the third fracture is characterized by a third orientation line, and

the third fracture temporarily alters a stress field in the subterranean formation; and

inducing a fourth fracture in the subterranean formation, wherein:

the fourth fracture is initiated at about the second fracturing location,

the initiation of the fourth fracture is characterized by a fourth orientation line, and

the third orientation line and the fourth orientation line have an angular disposition to each other.

10. The method of claim 1, further comprising:

inducing at least one additional fracture, wherein:

the at least one additional fracture is initiated at about the fracturing location;

the initiation of the at least one additional fracture is characterized by an additional orientation line, and

the additional orientation line differs from both the first orientation line and the second orientation line.

11. The method of claim 1, further comprising:

providing a fracturing tool that is configured to receiving a fluid and deliver a fluid into the subterranean formation, the fracturing tool comprising a plurality of sections, each comprising at least one opening to deliver the fluid into the formation at an orientation and a sleeve divert the fluid to at least one of the plurality of sections.

12. A system for fracturing a subterranean formation, wherein the subterranean formation comprises a wellbore, the system comprising:

a downhole conveyance selected from a group consisting of a drill string and coiled tubing, wherein the downhole conveyance is at least partially disposed in the wellbore;

a drive mechanism configured to move the downhole conveyance in the wellbore;

a pump coupled to the downhole conveyance to flow a fluid though the downhole conveyance;

a fracturing tool coupled to the downhole conveyance, the fracturing tool comprising:

a tool body to receive the fluid, the tool body comprising a plurality of fracturing sections, wherein each fracturing section includes at least one opening to deliver the fluid into the subterranean formation at an angular orientation; and

a computer configured to control the operation of the drive mechanism and the pump.

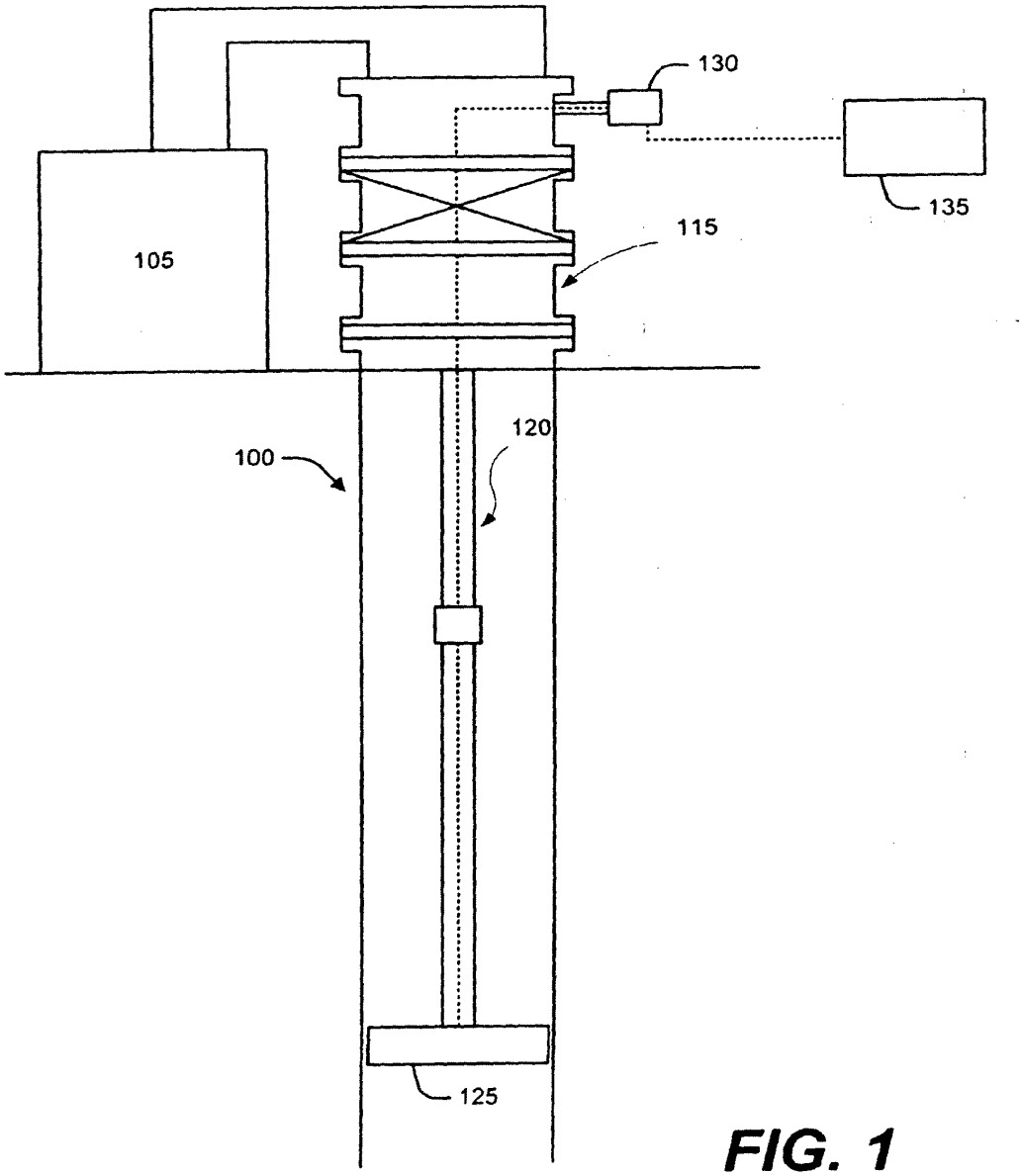


FIG. 1

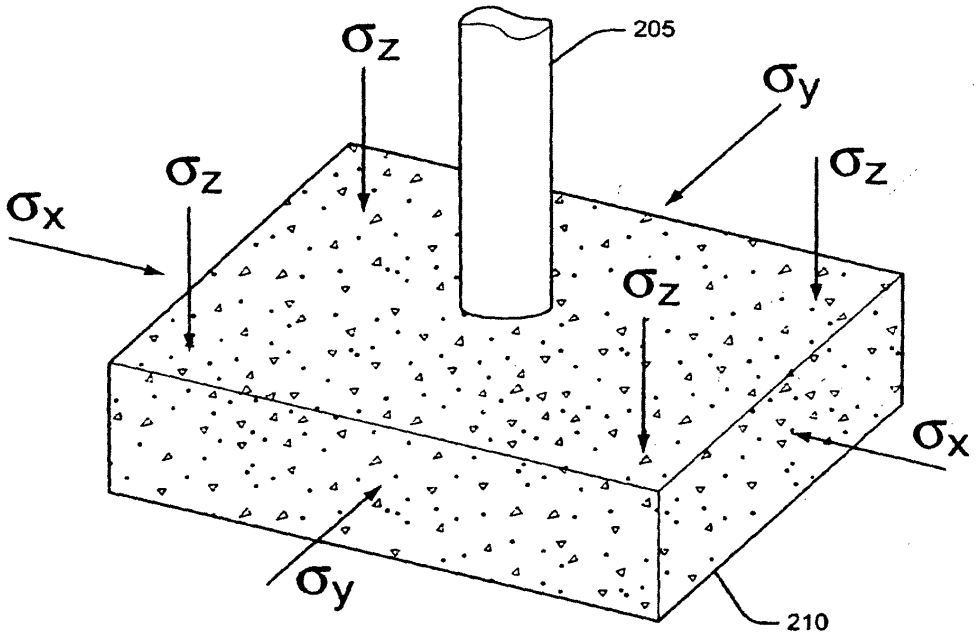


FIG. 2A

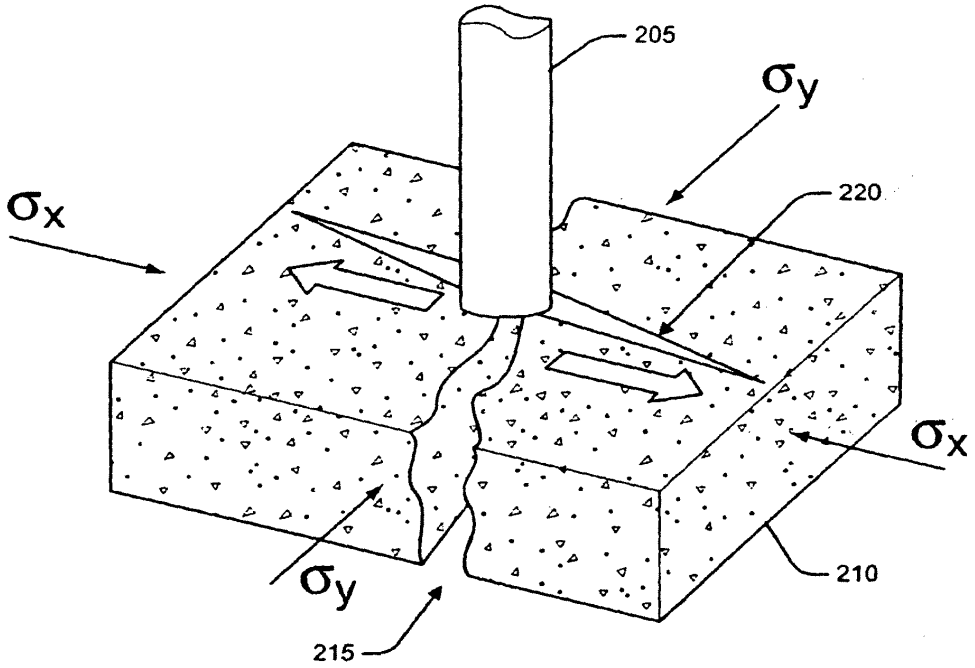
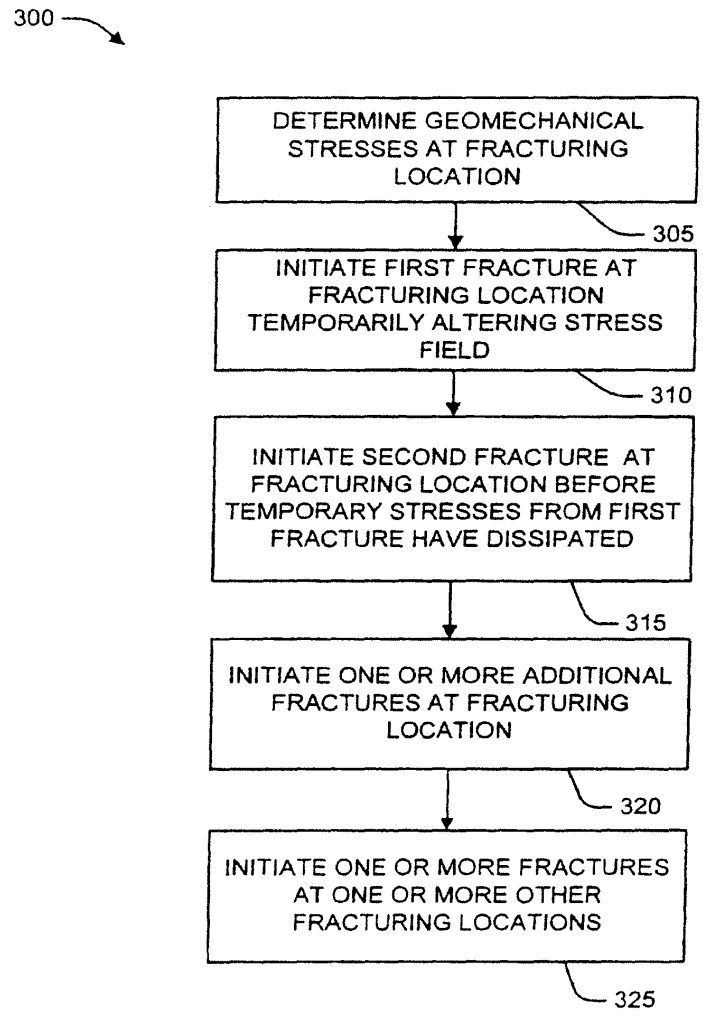


FIG. 2B

FIG. 3


300
DETERMINE GEOMECHANICAL STRESSES AT FRACTURING LOCATION
305
INITIATE FIRST FRACTURE AT FRACTURING LOCATION TEMPORARILY ALTERING STRESS FIELD
310
INITIATE SECOND FRACTURE AT FRACTURING LOCATION BEFORE TEMPORARY STRESSES FROM FIRST FRACTURE HAVE DISSIPATED
315
INITIATE ONE OR MORE ADDITIONAL FRACTURES AT FRACTURING LOCATION
320
INITIATE ONE OR MORE FRACTURES AT ONE OR MORE OTHER FRACTURING LOCATIONS
325

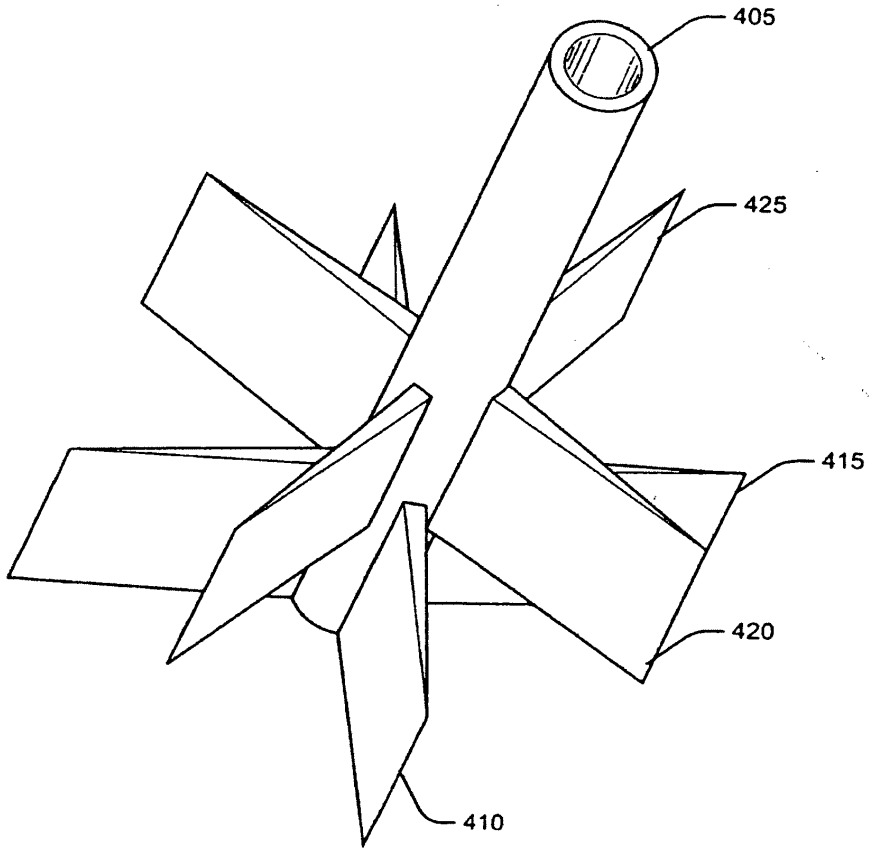


FIG. 4

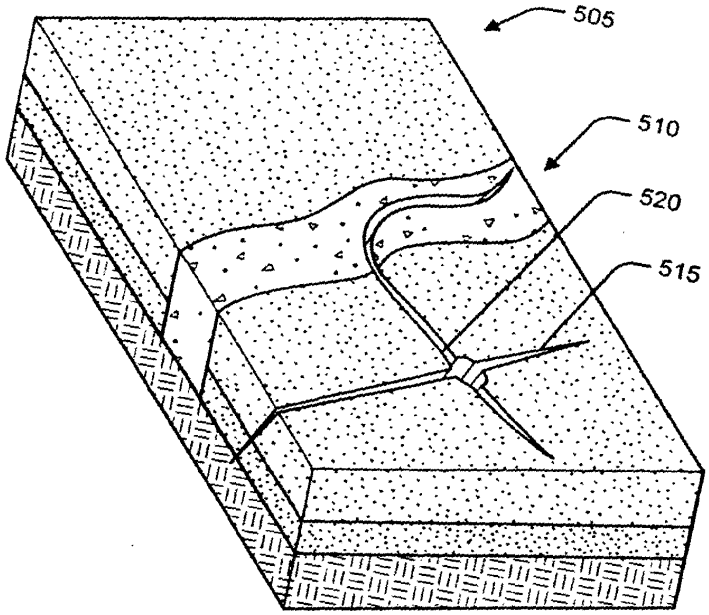


FIG. 5

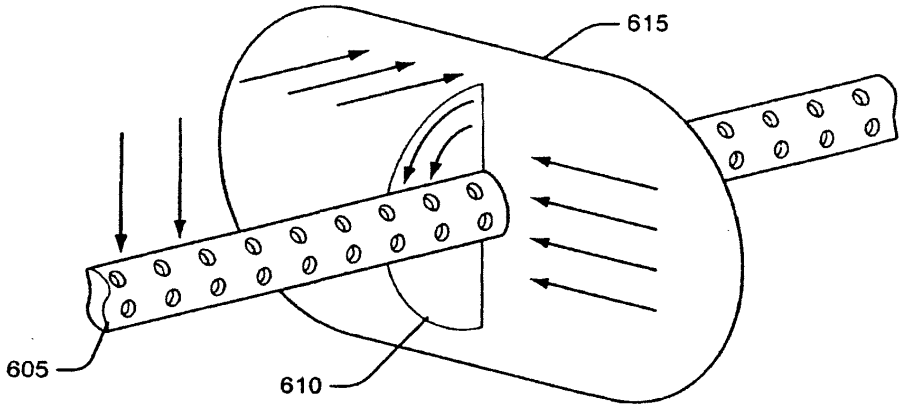


FIG. 6

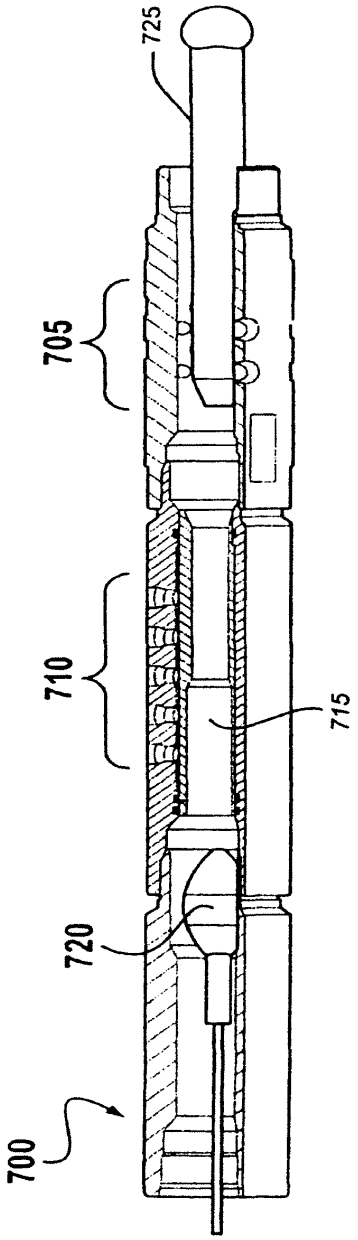


FIG. 7A

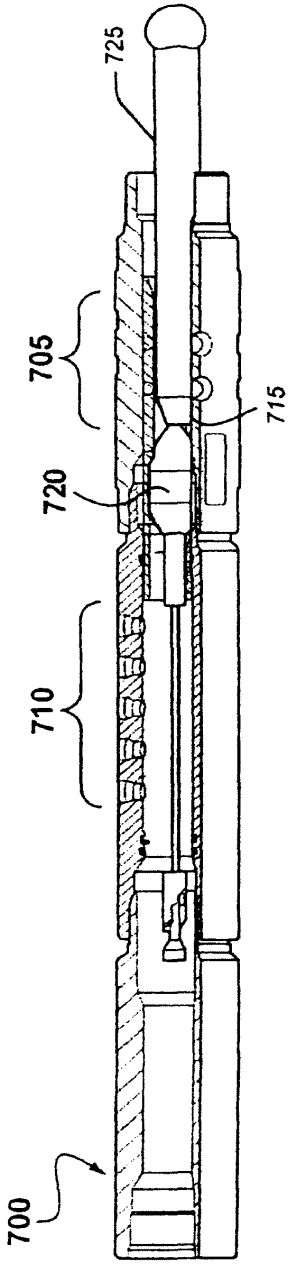


FIG. 7B

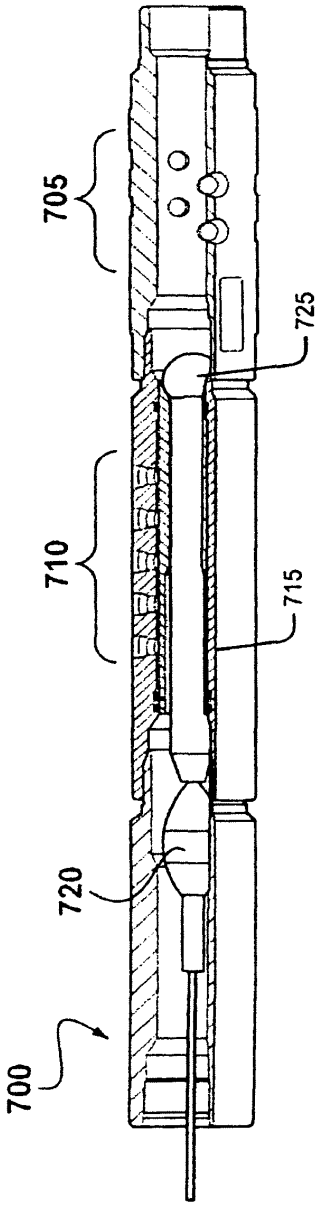


FIG. 7C

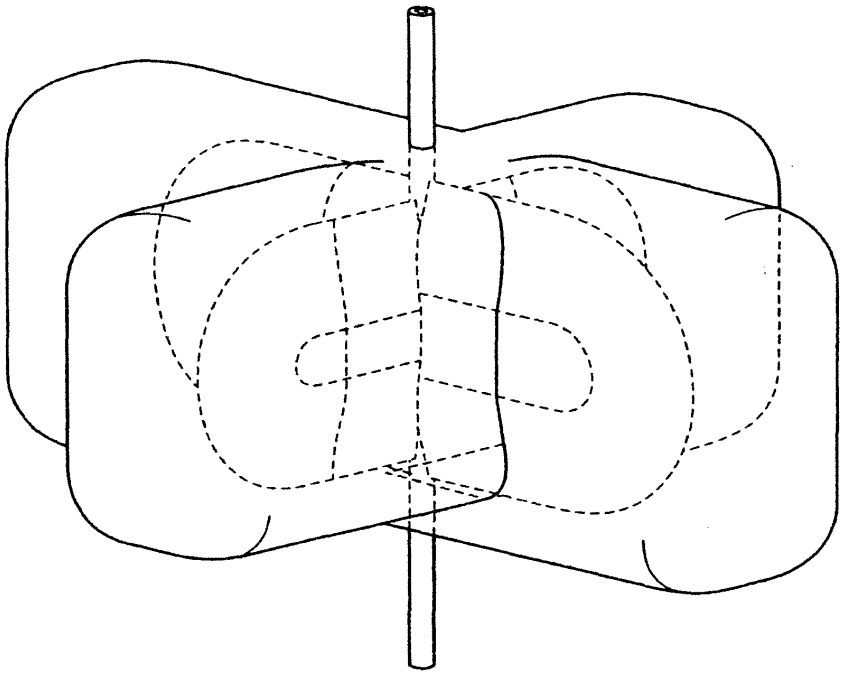


FIG. 8

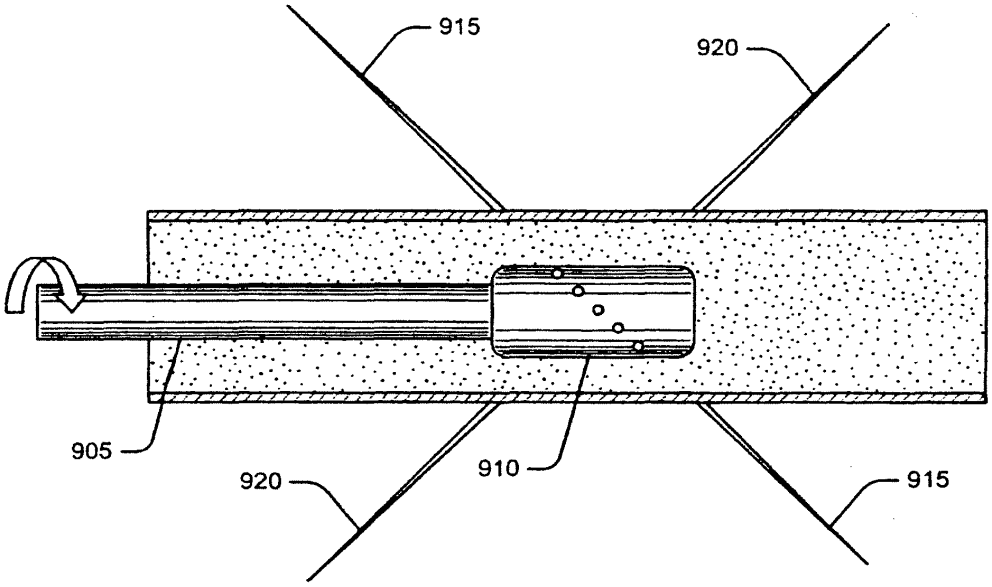


FIG. 9

Figure 10 – Stress profile around the wellbore for net pressure of 1000 psi

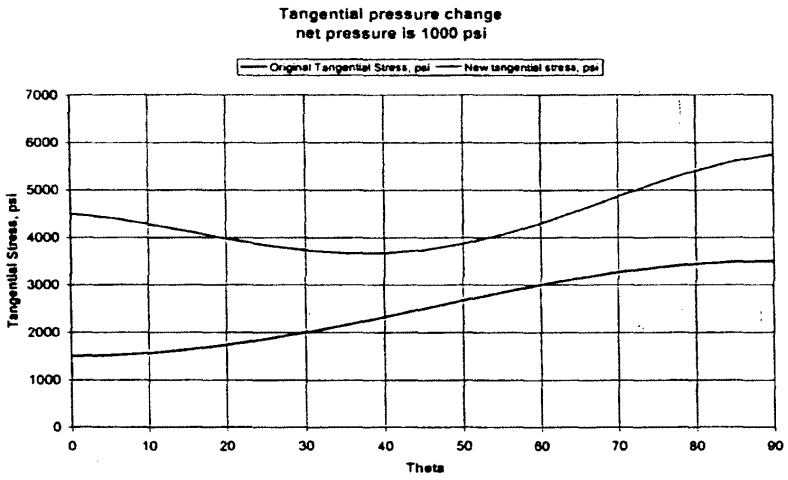
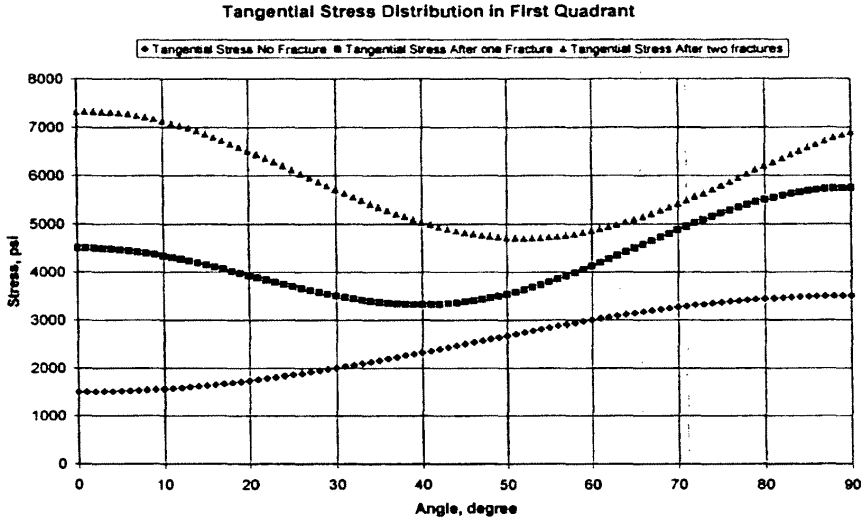


Figure 11 - Stress profile around the wellbore after creating two fractures



INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/003809

A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B43/26 E21B43/114 E21B49/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2005/145387 A1 (HOCKING GRANT [US]) 7 July 2005 (2005-07-07) paragraph [0012]; claim 1	1-11
X	US 3 835 928 A (STRUBHAR M ET AL) 17 September 1974 (1974-09-17) column 2, line 59 - column 3, line 23	1-11
X	GB 2 353 310 A (BAKER HUGHES INC [US]) 21 February 2001 (2001-02-21) page 12, line 24 - page 14, line 5 page 45, line 19 - page 45, line 22; figures 1,13,14	12
X	US 2005/133226 A1 (LEHMAN LYLE V [US]) 23 June 2005 (2005-06-23) paragraphs [0020] - [0030]; figures 1-2B	12

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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search	Date of mailing of the international search report
29 November 2007	11/12/2007

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INTERNATIONAL SEARCH REPORT

International application No
PCT/GB2007/003809

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	WO 00/29716 A (GOLDER SIERRA LLC [US]) 25 May 2000 (2000-05-25) page 11, line 11 - page 12, line 13	1-11
Y	US 4 432 078 A (SILVERMAN DANIEL [US]) 14 February 1984 (1984-02-14) column 3, line 53 - column 4, line 28; figures 1-9	1-11

Form PCT/ISA/210 (continuation of second sheet) (April 2005)

INTERNATIONAL SEARCH REPORT

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International application No
PCT/GB2007/003809

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	11753314	SURJAATMADJA, JIM B.
	Examiner	Art Unit
	MICHAEL P NGHIEM	2863

ORIGINAL		INTERNATIONAL CLASSIFICATION						
CLASS	SUBCLASS	CLAIMED					NON-CLAIMED	
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CROSS REFERENCE(S)					
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☐ Claims renumbered in the same order as presented by applicant ☐ CPA ☐ T.D. ☐ R.1.47

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
-	1	-	17												
-	2	-	18												
-	3	1	19												
-	4	2	20												
-	5	3	21												
-	6	4	22												
-	7	5	23												
-	8	6	24												
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-	10														
-	11														
-	12														
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-	15														
-	16														

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(74) Agents: **CURTIS, Philip, Anthony** et al.; A.A. Thornton & Co., 235 High Holborn, London WC1V 7LE (GB).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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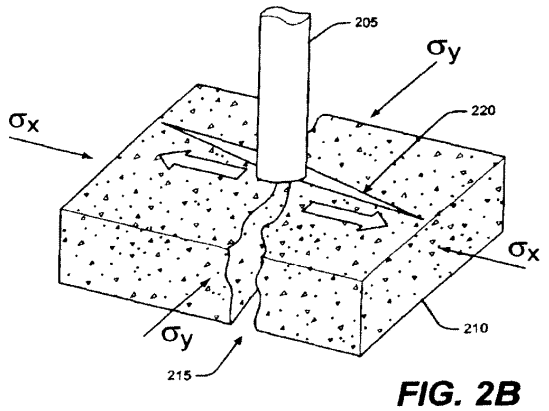


FIG. 2B

(57) Abstract: The present invention relates to methods, systems, and apparatus for inducing fractures in a subterranean formation and more particularly to methods and apparatus to place a first fracture (215) with a first orientation (x) in a formation (210) followed by a second fracture (220) with a second angular orientation (y) in the formation. The first and second fractures are initiated at about a fracturing location. The initiation of the first fracture is characterized by a first orientation line. The first fracture temporarily alters a stress field in the subterranean formation. The initiation of the second fracture is characterized by a second orientation line. The first orientation line and the second orientation line have an angular disposition to each other. There is a time delay between inducing the first fracture and inducing the second fracture.

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INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. E21B43/26

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
E21B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal

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Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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[X] Further documents are listed in the continuation of Box C. [X] See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
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Name and mailing address of the ISA/	Authorized officer
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Profrac Holding Corporation
U.S. Well Services, LLC
IPR2023-01319
Ex. 1002, p. 797 of 988

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1 460 647

PATENT SPECIFICATION

(11) 1 460 647

(21) Application No. 46458/74 (22) Filed 28 Oct. 1974
(44) Complete Specification published 6 Jan. 1977
(51) INT CL² E21B 43/26
(52) Index at acceptance E1F 44
(72) Inventor OTHAR MEADE KIEL

(19)

(54) HYDRAULIC FRACTURING PROCESS

(71) We, INTERCOMP RESOURCE DEVELOPMENT & ENGINEERING INC., a corporation organised under the laws of the State of Texas, United States of America, of 2000 West Loop South, Houston, State of Texas, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hydraulic fracturing of earth formations, and more particularly to the hydraulic fracturing of HC (hydrocarbon) bearing formations, e.g. oil and gas sands, for the purpose of increasing the producing rate and total amount of recovery of the hydrocarbons from a well completed in such a formation, and, in the case of storage wells for the purpose of increasing the injection rate and total capacity.

The hydraulic fracturing of HC formations is well known and is described for example in the following United States patents number:

3263751—Kiel et al.
3376930—Kiel et al.
3373815—Kiel et al.
3378074—Kiel
3399727—Graham & Kiel
3444889—Kiel et al.
3497008—Graham & Kiel
3552494—Kiel
3601198—Ahearn & Kiel

SPECIFICATION NO 1460647

By a direction given under Section 17 (1) of the Patents Act 1949 this application proceeded in the name of OTHAR MEADE KIEL, a citizen of the United States of America, of 5830 Cheena, Houston, State of Texas, United States of America.

Bas 33278/6

THE PATENT OFFICE [illegible] applied thereto.

The function of fracturing is to overcome the deficiency in permeability of the formation adjacent the well bore by creating a highly conductive path reaching out into the reservoir rock surrounding the well bore. According to the usual practice, a fluid such as water, oil, oil/water emulsion, gelled water, gelled oil, is pumped down a well bore with sufficient pressure to open a fracture in the HC formation. The fluid may carry a suitable propping agent, such as sand, into the fracture for the purpose of holding the fracture open after the fracturing fluid has been recovered, e.g. by allowing the well to flow. A normal fracture treatment consists of one continuous injection of fluid. In the case of tight, i.e. low permeability wells, i.e. below 1 md permeability, fracturing produces results that are of but a temperary nature as far as increasing rate of flow is concerned and little or no increase in total recovery is achieved. After perhaps a short period of accelerated flow, rate of production may drop off to near previous levels. Repeated stimulation with the same or similar procedure may again produce but a temporary gain.

The reason for the temporary increase in productivity is believed to be that the fracture communicates the well bore with a small portion of the joint system between

1 460 647

PATENT SPECIFICATION

(11) 1 460 647

(21) Application No. 46458/74 (22) Filed 28 Oct. 1974
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(52) Index at acceptance E1F 44
(72) Inventor OTHAR MEADE KIEL

(19)



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3497008—Graham & Kiel
3552494—Kiel
3601198—Ahearn & Kiel
3664420—Graham, Kiel & Terry
3695355—Wood & Kiel
3700032—Terry, Graham, Sinclair & Kiel
3722595—Kiel

and in the reference cited against the above listed patents and application.

Further description of the subject is to be found in an article entitled "Reservoirs in Fractured Rock" by Stearns and Friedman appearing at pages 82 et seq. of AAPG Memoir #16 Stratigraphic Oil & Gas Classification Methods and Case Histories—1972 and the bibliography appended thereto.

The function of fracturing is to overcome the deficiency in permeability of the formation adjacent the well bore by creating a highly conductive path reaching out into the reservoir rock surrounding the well bore. According to the usual practice, a fluid such as water, oil, oil/water emulsion, gelled water, gelled oil, is pumped down a well bore with sufficient pressure to open a fracture in the HC formation. The fluid may carry a suitable propping agent, such as sand, into the fracture for the purpose of holding the fracture open after the fracturing fluid has been recovered, e.g. by allowing the well to flow. A normal fracture treatment consists of one continuous injection of fluid. In the case of tight, i.e. low permeability wells, i.e. below 1 md permeability, fracturing produces results that are of but a temperary nature as far as increasing rate of flow is concerned and little or no increase in total recovery is achieved. After perhaps a short period of accelerated flow, rate of production may drop off to near previous levels. Repeated stimulation with the same or similar procedure may again produce but a temporary gain.

The reason for the temporary increase in productivity is believed to be that the fracture communicates the well bore with a small portion of the joint system between

the matrix elements of the formation. However, as soon as the low volume space has been drained, productivity drops off to that controlled by the low permeability reservoir matrix, and since the area exposed to such matrix by a short fracture is low, productivity is low.

Hydraulic fracturing procedure usually has best results in formations of moderate permeability, e.g. one to twenty millidarcies. In order to achieve satisfactory production from a formation of low permeability, e.g. below one millidarcy, it has been the belief of experts that a much longer fracture than that heretofore attainable would be necessary. Prior to the present invention, a conductive fracture extending radially one hundred fifty feet from the well bore is believed to be about maximum.

According to the invention there is provided a method of well treatment by hydraulic fracturing of the formation to be treated, said fracturing including at least one double cycle comprising injecting fluid capable of undergoing fluid loss to said formation once said formation is fractured into the formation at a pressure and for a period of time sufficient to allow hydraulic fracture to occur, discontinuing said fluid injection for a period of time at least long enough to allow a pressure drop in said fluid from fluid loss from said fracture to the formation, resuming injection of said fluid into said formation, and discontinuing said latter injection of fluid.

Otherwise stated, according to the invention there are scheduled periods of pump shut down or reduced rate to cause low fracture pressure to produce spalling, and there are plural periods of injection of fracturing fluid to move the spalls into propping position, to sandblast clear any fracture restrictions, and to sand out prior fractures to initiate secondary fractures transverse to the original.

In the case of an extremely thick section, e.g. in excess of fifty feet of uniform sand body, for the purpose of controlling loss of fracturing fluid to the formation, sand or other material of various sizes may be added to the fracturing material, and the vertical extent of the well bore treated thereby confined to the upper portion of the producing formation.

In general, in accordance with the present invention, well productivity is increased by multiple hydraulic fracturing cycles with high viscosity fluid, first creating a long primary fracturing and holding it open with formation spalls and sand blasting any great restrictions and then succesively creating two oppositely directed secondary long fractures transverse to the primary fractures, the loss of fracturing liquid to the formation being controlled with a selected size of sand to filter pack the natural joint system, and in some instances to filter pack the vertical downward extent of joints and fractures with the fracturing limited to the upper portion of the producing formation where upward leakage is inhibited by the overburden.

Further features of the invention will become apparent from the further description appearing hereinafter, by way of example.

In a preferred embodiment the injection pressure during each double cycle subsequent to the first double cycle is at least 10 per cent greater than during the first double cycle. Furthermore, the period of an even numbered injection is preferably 1/4 to 1/3 the period of an immediately preceding odd numbered injection, considering that the plurality of injections are numbered consecutively in chronological order.

The periods of the plurality of consecutive pairs of injection periods, considering the first and second injection periods as the first such pair are approximately proportional to the square root of the number of such pair, considering that the several pairs are numbered consecutively in chronological order.

The fracturing fluid is preferably of the formation pressure increasing type.

For a detailed description of preferred embodiments of the invention reference will be made to the following drawings wherein:

FIGURE 1 is a plan view of a well site showing graphically the time of travel of a pressure wave front versus radial distance from the well bore, the well being a tight well and having been completed by conventional perforation without further stimulation.

FIGURE 2 is a similar plan view showing the results of conventional fracturing and of an improved form of fracture in accordance with one form of the present invention.

FIGURES 3 and 4 are diagrams illustrating possible reasons for failure of conventional hydraulic fracturing producing very long fractures;

FIGURES 5, 6 and 7 are schematic plan views of dendritic fracture systems in accordance with the invention;

FIGURE 8 is a plan view similar to FIGURES 1 and 2 illustrating the wave front pattern utilizing the dendritic fracture system, esp. of FIGURES 6 and 7;

FIGURE 9 is a plan view similar to FIGURE 8 illustrating another aspect of the invention;

FIGURE 10 is a schematic plan view of a stage in the process of creating the dendritic fracture system of the invention,

FIGURE 11 is an isometric view of a thick sand provided in its upper portion with a dendritic fracture system in accordance with the invention,

FIGURE 12 is a chart comparing well productivities, and

FIGURE 13, 14 and 15 are charts of well productivity.

A. PRIOR ART—NO FRACTURE

According to reservoir engineering theory, the time for a pressure disturbance, e.g. a pressure drop initiated by producing a well, to be propagated radially through an earth formation from the well bore, may be determined the following equation:

$$t_D=(40)\ (\emptyset)(u)(c)(D)^2/k \qquad (1)$$

where t_D=diffusion time to radius D (days)

$\emptyset$=porosity (fractional)

u=viscosity in centipoise

c=fluid compressibility in (psi^{-1})

D=Distance to which the pressure disturbance has been propagated measured radially from the well bore in feet.

k=permeability in millidaries.

Reservoir engineering theory and practice further indicate that the time T to drain the volume within the radius D of the well bore is given approximately by the equation:

$$T=20\ t_D \qquad (2)$$

Twenty years is the drainage time conventionally allowed for a well. If T=20 years, $t_D=20/20=1$ year, so that at the end of one year the wave front will reach the distance D_{20} drained in twenty years. Therefore

$$D^2_{20}=9.125k/\emptyset uc \qquad (3)$$

From equation (3) one can calculate the radius D_{20} of volume drainable in a 20 year period, the conventional period of the production life of a well for any particular type of formation.

Assuming that

$\emptyset$=0.1

u=0.02 cps

c=1/1500

k=0.03 md

one finds that

D_{20}=450 feet

In other words, for the pressure wave front to reach just a 450 foot radius or 14.6 acre area, in such a tight formation takes a whole year, and it takes twenty years to drain such a small volume. Similar calculation show that the pressure wave will take 21.5 years to reach the perimeter of a 320 acre square centred on the well bore and that the volume extending horizontally over such an area would be drainable in 430 years. The wave would take 34 years in the case of a 640 acre tract (one square mile) which would be drainable in 680 years. The foregoing is shown graphically in FIGURE 1 wherein there is shown well bore 21 and 1, 21.5, and 34 year wave fronts 23, 25, 27 and the perimeters 29, 31 of 320 and 640 acre tracts.

It will be apparent from the foregoing that in order to produce a field of such low permeability within a twenty year period the well spacing would have to be 900 feet, i.e. a well density of 43 wells per square mile. This shows the impracticality of economically producing a well in such tight formation without special productive techniques.

B. CONVENTIONAL SHORT FRACTURES

Referring now to FIGURE 2 there is shown schematically the situation existing in the case of a producing formation that has been processed in accordance with hydraulic fracturing techniques to create a single highly conductive fracture along line 33 extending from the well bore 21 in opposite directions. In this situation we are no longer dealing with radial propagation of the pressure wave nor radial flow. Because of the highly conductive fracture, it may be assumed that pressure throughout the fracture plane is substantially equal to that at the well bore. The pressure disturbance produced by producing the well creates a pair of planar wave fronts parallel to the fracture plane that are propagated in opposite directions perpendicular to the fracture plane. The equation for t_D where D is now the distance measured perpendicularly from the fracture and t_D is the time for the wave front to reach distance D and the other parameters are as before is:

$$t_D=80(\emptyset)(u)(c)(D)^2/k \quad (4)$$

If, as before, one assumes that the time T to drain a volume within a distance D from the fracture (including both sides of the fracture) is given by the equation:

$$T=20t_D \quad (5)$$

then:

$$D^2_{20}=4.5625k/\emptyset uc \quad (6)$$

Using the same parameters as before

$$D_{20}=320 \text{ feet.}$$

Let (L) be the length of the hydraulic fracture and A be the area of a horizontal section of the volume drained in twenty years. Then

$$A=(2)(320)(L)/43560=0.0147(L) \text{ acres.} \quad (7)$$

In the case of a conventional fracture of say 150 feet in each direction from the well bore, indicated on FIGURE 2 by the line segment between points 34 and 35, the area drained would include the rectangular area computed as before.

$A=.0147(L)$
or $A=.0147(300)=4.41$ acres

plus the two semi-circular end areas indicated at 37, 39 whose total area is 14.8 acres, for a total of 19.2 acres, corresponding to a density of 33.3 wells per square mile for 100% draining. While this is better than the 43 wells per square mile for an unfractured well, it is greatly inferior to the results achieved with long fractures made in accordance with the present invention.

C. LONG FRACTURES

According to the present invention a long fracture is obtained by interrupting a conventional fracturing operation somewhere between the beginning and end of the injection period, preferably during the last 1/3—1/4 of the fluid injected. During the shut down period, that is, when the pumps are shut down and the flow rate of the injection fluid drops to zero, the pressure in the fracture is reduced to the sum of the hydrostatic head plus the surface instantaneous shut in pressure. The drop in pressure at the fracture face causes the formation to spall at the fracture face. The spalls remain in place until flow is resumed by starting the pumps again. When flow is resumed, the spalls are displaced by the fluid and carried along a greater or lesser distance according to the size of the spall and the width of the fracture. These spalls will maintain the fracture propped open to nearly its maximum width, and at the same time the advancing fluid will increase the fracture length.

If the fracture length is 3733 feet (the length of one side of a 320 acre tract), A=54.8 acres

and if the fracture length is 5280 feet (the length of one side of a square mile tract), A=77.6 acres.

These are to be compared with the 15 acres drained without a fracture and the 19.2 acres with a conventional or short fracture.

With a long fracture as shown in FIGURE 2 it would be practical to space wells with a density of 11.66 per square mile in the case of a fracture extending the length of a half square mile tract, and 5.7/square mile in the case of a one mile fracture. This of course would be much more economical than in the case of an unfractured well where the required density was 43 wells per square mile, or the case of wells with short fracture requiring 33.3 wells per square mile.

D. RECAP: SHORT & LONG FRACTURES

Recapitulating in order to obtain high productivity from an oil or gas well, it is necessary to produce a relatively long, highly conductive fracture. The lower the permeability of the formation, the longer the fracture must be. However, as the fracture length increases there is a greater and greater chance that the conductive path can be altered so that not all of the generated length will remain connected to the well bore after the fracture fluid is recovered. Some of the reasons that the full length would not be utilized are illustrated in FIGURES 3 and 4.

Referring to FIGURE 3 it is seen that a hydraulic fracture initially, that is, in the dynamic condition while the fracture is being formed, probably includes a plurality of relatively long straight fractures 41, 43, 45 joined by a plurality of short transverse fractures 47, 49 which interconnect the long fracture. In the static condition, the fracture consists of the same plurality of long fractures 41, 43, 45, held open by the frac sand to a limited degree, and the transverse fractures 47, 49 no longer interconnect the long fractures, the overlap of the long fracture at their ends disappearing as the fracture width diminishes, the transverse fractures shutting off the longitudinal fractures like valves.

Referring now to FIGURE 4, it is seen that initially, that is, during fracture fluid injection, the walls 51, 53 of the fracture are held apart and the space therebetween is filled with fluid or sand laden fluid which is free to move. However after the fracturing operation has been completed, the spalls and related fines will gradually fill the open spaces in the fracture. This will effectively shut off highly conductive channels when the well is put on production.

In order to insure that fluid flow is not shut off when the well is put on production either by the fracture closing at the intersection of joints or by the gradual blocking of the fracture by spalls and fines, the method of the invention, previously set forth briefly is employed, as follows:

During the fracture job; at calculated intervals, the pumps are shut down or at least the pressure is greatly reduced by reducing the injection rate for a period of time. This reduction of pressure causes the earth stress next to the fracture to form spalls at the fracture face. The pumps are then started up again to regular fracturing rate with a corresponding increase in pressure. Fluid flow and pressure forces the face of the fracture apart and allows—or forces—the spalls to move out of their original position and be driven into the generated width of the fracture where they will remain supporting the earth forces when pumping ceases.

There will be a concomitant generation of "fines" (small particles of formation) generated when the spalls move. These fines will have a tendency to sand blast any great restriction in the fracture to keep it at maximum conductivity.

It may or may not be necessary to use fracture sand in the fluid to obtain desired results. If such sand is used, its primary function will be that of a fluid loss prevention system.

E. HISTORICAL INVESTIGATION

Analysis of data from fracturing reports relative to well treatments that have been performed in the past five years on a series of wells in the same formation in the same geographical area shows that a recent two months production of wells that had inadvertently been shut down because of mechanical failure of equipment during the fracture job compared to wells that had not been shut down (i.e. had run according to fracture plan) show a marked difference in production.

Twenty-one wells that had had a shut down period during fracturing on the particular months chosen averaged about $2018 gross production each.

Thirty-six wells that had been run according to plan without the shut down averaged $783 gross production each.

F. TEST.

A group of wells was then selected that used the same fracturing schedule as a

previous group, but an intentional shut down period of one hour was put in the fracture plan.

First month's production was about double compared to when no shut down period was used.

When the shut down period was used, the wells would flow back treating fluid of about ½ the volume injected, approximately the same as with no shut down period.

G. DENDRITIC FRACTURE

Another well was selected. The same amount of fluid was used as before but three injection periods were used. At the start of the third injection period, even with higher pressure the injection rate was much lower. Then after a period of injection the pressure broke to a lower value and the rate of injection increased. No fracture sand was used in this well. After the job was completed the well flowed back about ½ the treating fluid in the same manner that the others had. However, gas appeared at the surface during swabbing operations much sooner than previous wells. The pressure break along with the early gas production indicated a change in direction of the fracture, as will now be explained.

When the pumps are started the third time, fluid flow in the fracture causes the debris formed by crushing of the spalls that moved during the second fluid injection period to move forward where they bridge against the chips or spalls that have just been formed. This causes a sand-out at the end of the primary fracture. Pressure now increases until a new fracture starts at a weak point of the fracture wall. Since the rock is now under stress perpendicular to the fracture direction, a new or secondary fracture will propagate in a direction approximately perpendicular to the primary fracture. The result is a system of fractures as shown in FIGURE 5, wherein 61 is the well bore, 63 is the initial or primary fracture, and 65 is the secondary or transverse fracture. To produce a long secondary fracture it will be necessary to proceed with the formation of this fracture wing in the same manner (i.e., two slugs of fluid with suitable shut down periods) as the primary fracture.

As noted in FIGURE 5, the secondary fracture, probably, almost surely, will consist of only one wing. However, after completion of the first wing, if the pumps are started once more, there will be a movement of the debris in the single wing transverse fracture causing a sandout thereof and further pumping with suitable shut down periods wil lextend a fracture wing in the opposite direction from the first secondary wing as shown in FIGURES 6 and 7. The FIGURES 6 and 7 systems are the same as that of FIGURE 5 except that in FIGURE 6 a second wing 69 on the opposite side of the well from wing 65 has been added, and in FIGURE 7 the second wing 69 is added on the same side of the well as the first wing 65. Such a system consisting of a primary fracture and one or more secondary transverse fractures may be called a dendritic fracture system. FIGURE 5, then, shows a single wing dendritic system, and FIGURES 6 and 7 show double wing dendritic systems.

The pumping sequence would be like the following to produce the double dentritic fracture system:

pump, wait, pump, wait (primary), pump, wait, pump, wait (first secondary), pump, wait, pump, shutdown end (second secondary).

The reason why the dendritic system, which is produced by the above described pumping cycle in accordance with the invention, causes a different, and as will appear, vastly improved well productivity, will next be considered.

Referring now to FIGURE 8, there is shown a well bore 21 from which extend a primary fracture 73 and a pair of transverse fractures 75, 77, the latter being shown as collinear in view of the scale of the drawing, it being assumed that they will both be close to the well bore. The pressure waves from the fracture will move out as indicated by the four chevron wave fronts 79, 81, 83, 85. Subsequent positions of these same wave fronts are shown at 79′, 81′, 83′, 85′.

The four chevron wave fronts shown in FIGURE 8 may be treated as eight linear wave fronts, the two linear wave fronts of each chevron front overlapping in their propagation. For each of the eight linear fronts, reservoir engineering theory shows that

$$t_D = \sqrt{40}\ \emptyset u c D^2/k \qquad (7)$$

and remembering from equation (2) that $T = 20 t_D$ so that for $T = 20$ year,s, $t_D = 1$ year, we find that the distance D drained by each of the eight waves in twenty years is

$$D^2_{20} = 57.71k/\emptyset uc \quad (8)$$

From equation (7) one finds that for the formation having the same constants as previously considered in the case of unfractured and conventionally fractured wells, the distance to which the formation is drained in twenty years by each of the eight linear fronts is 1140 feet.

Assuming as in the case of a long linear fracture previously described that the primary fracture is 3733 feet (the length of one side of a 320 acre or half square mile tract) and that the two wings of the transverse fracture total 3733 feet, the area drained by the dendritic fracture system is 272 acres. This is readily computed as the area of the square of 3733 feet on a side less the area of the four squares not drained by any of the eight linear wave fronts. The equation is

$$A = 320 - 4(1866 - D_{20})^2/43560 \quad (10)$$

where D_{20} as before is the distance drained in twenty years by each of the eight linear wave fronts. The foregoing 272 acres drained by the dendritic fracture system is to be compared with the 54.8 acres drained by a single long hydraulic fracture (3732 feet) in accordance with the invention and the 19 acres drained by a conventional 300 foot linear fracture and the 14.6 acres drainable in 20 years without any fracturing at all.

H. COMPARISON OF DRAINAGE

A comparison of the several fracture systems that gives a further insight into their differences is obtained with reference to the shape of the maximum equal pressure surfaces under steady state conditions of a field of several adjacent wells in which the well spacing is so related to the productivity that the wave fronts reach a maximum distance from the well and then cease to propagate further due to interference from waves from adjacent wells. In the case of unfractured wells, the cylindrical (circular horizontal section) waves from the several wells may ultimately meet and thereafter the maximum equal pressure surfaces may be considered to be overlapping cylindrical surfaces. In the case of linear hydraulic fracturing, parallel wave fronts from adjacent wells may meet and thereafter the maximum equal pressure surfaces are fixed planes (lines in horizontal sections) between the wells. But in the case of dendritic fracturing, the chevron wave fronts from adjacent wells overlap and meet at a single vertical line (point in a horizontal section).

I. NATURAL JOINT SYSTEMS

A very important advantage of the dendritic system over any linear fracture system results in the enhancement obtained from natural joint systems.

Consider a tight, well consolidated formation. In geologic time it will have developed a joint system that consists of cracks that are more or less cemented that trend in a general direction. The cement in the cracks is probably not as strong as the rock matrix. In addition, the cracks probably have more fluid transmissibility than the rock matrix. There will also be a secondary joint system more or less perpendicular to the major joint system. These are also planes of weakness.

Referring now to Figure 9, there is shown a chart similar to Figure 1, 2, and 8, showing a plan view of a well bore 21 relative to 320 and 640 acre squares. When a fracturing process as described herein is carried out, the primary fracture 86 probably follows one of the major joints 87. When the secondary fracture system is developed, it will intersect many joints of the major joint system. The addition of the transmissibility of all of the joints cut will further aid in rapid recovery of reservoir fluids. The relatively short arrival times for the pressure wave fronts at the 320 and 640 acre perimeters in the case of several assumed permeabilities of the natural joints in millidarcies is charted in the upper left hand quadrant of Figure 9 such times being calculated as before.

J. USE OF SAND: FLUID LOSS CONTROL

Depending on the strength of the reservoir rock and the configuration desired for the fracture system, it may or may not be necessary to use a propping agent. In the case of strong rock, self propping is achieved. However, fine sand may be useful for fluid loss control, the fine sand blocking fracture fluid from entering into the transected joints. This is illustrated in FIGURE 10 wherat is shown well bore 91,

primary fracture 93, secondary fracture 95, and joints 97, 99 the latter being blocked off with sand as shown in 101, 103.

There are several reasons to keep the amount of fracturing fluid to a minimum, especially in gas wells. Among these are the actual cost of the fluid and injecting the fluid along with the cost of propping agent. In addition, the well must produce back the fluid injected before it can reach its best potential.

In the dendritic fracturing techniques that have been described hereinabove stimulation is at least partially achieved by utilizing natural joint systems in the reservoir. In massive formations, these joint systems probably extend vertically as well as horizontally throughout the reservoir. (see page 87 of article entitled "Reservoirs in Fractured Rock", SUPRA.).

The fracture formed in the producing formation may be confined to the upper portion of the producing formation where lithology (overlying rock) will limit the upward growth of the fracture and sand properly scheduled will limit the downward growth of the fracture. When a dendritic fracture system is formed, the joints are intersected that will connect the reservoir both laterally as well as vertically to the fracture system and thus to the well bore. If the vertical extent of the fracture system is limited, as much as 80%—90% of the fluid that would be required normally could be saved.

The foregoing method of limiting the height of the fracture system is illustrated in FIGURE 11, wherein a portion of the producing formation is shown at 111. From the well bore 113 extends the primary fracture 115, extending parallel to or along a natural joint, and secondary fractures 117, 119 extending transverse thereto. Extending transverse to the natural joints such as 121 are natural transverse joints such as 123. It is these natural transverse joints which are blocked initially by the fracture sand to limit loss of fracture fluid during the second and third cycles of the fracturing method of the invention. As is apparent from FIGURE 10, the fracture sand not only blocks too extensive horizontal travel of fracture fluid along the natural transverse joints but also limits downward travel of the frac fluid along the primary fracture, the secondary fracture, and the natural primary and secondary joints.

K. FURTHER HISTORICAL COMPARISON

FIGURE 12 is a chart prepared from an examination of the fracture reports on a group of wells all in the same formation and all in the same general geographical area and all in what is believed to be a very tight formation. The wells were developed as near as the analyst could do so into two groups. In one group were wells wherein for some reason, e.g. mechanical break down of pumping equipment the fracturing procedure was interrupted; in the other group there was no substantial interruption. The productivity of all of the wells was checked from the monthly reports. It appeared that wells wherein the fracture process had been interrupted were in many cases of higher productivity than those wherein the fracture process was uninterrupted. Averages for the productivity of numbers of wells in the group treated by various types of fracture treatment are shown in FIGURE 12. This is not to imply that in every case the wells with interrupted fracturing produced better than wells similarly treated except for lack of interruption although this may be the case. Also, this is not to imply that such results will be found in the case of groups of wells or individual wells in other areas, although this also may be the case, at least in many instances. It is further to be observed that greater increase in productivity was obtained with interrupted fracturing in the case of visofrac (viscous oil fracturing), and F.W. (fresh water) emulsion and S.W. (salt water) emulsion than in the cases of gelled F.W. and S.W. fracturing; this being due it is believed to the higher viscosity of the oil and emulsion fracturing fluid compound to the gelled water, the higher viscosity resulting in higher fracturing pressures and widths, the greater fracture width allowing more opportunity for spalling when pumping ceases, thereby to obtain the advantages of the invention on resumed pumping as previously explained.

The invention has also been applied but without success to a single offset from three producing gas wells; the result was a substantial dry hole. This is believed to be due to the fact that the fracture did not contact any gas bearing reservoir.

L. APPARATUS

The methods of the invention can be carried out by any of the known apparatus used for previously known methods of hydraulic fracturing. A suitable apparatus is shown and described in my aforementioned United States patent number 3,722,595 issued March 27, 1973, the disclosure of which is incorporated herein by reference.

My United States patent number 3,378,074 issued April 16, 1968 also shows suitable apparatus and its disclosure is also incorporated herein by reference (the line 39, pump 40 and line 41 may be omitted). The fracturing fluid can be injected through the well tubing, casing, or other available or suitable pipe or conduit. The fluid can be injected through perforations in the tubing or casing extending through the pipe and surrounding outer pipe and/or bore hole annulus cement or directly into the formation, the injection being confined vertically by virtue of the location of the perforations, the pipe, the cement, and the formation above and below the perforation hole. Vertical extents of well pipe of one foot or less to one hundred feet or more are contemplated with respect to injection of fracturing fluid. The pumps used in carrying out the method will normally be positive displacement pumps, with diesel engines or gas turbine drive. Shutting down the engine or turbine will hold the pumps stationary and thereby holds back pressure in the well. In an example hereinafter set forth ISIP stands for Instantaneous Shut In Pressure and is the surface pressure existing at zero injection rate.

M. PARAMETERS

(i) Fracture Fluid

The fracture fluid preferably used in carrying out the method of the present invention desirably is such as to cause little pressure drop in the pipe, maximum pressure in the formation, minimum total fluid loss to the formation, minimum rate of fluid loss to the formation, high carrying capacity for sand or other propping agent with respect to both ratio of sand volume carried to volume of fracture fluid and also distance and time carried, and high and rapid retrieval of fracture fluid when the well is put on production. To a certain extent, some of these factors are related to viscosity, but high viscosity is effective to achieve some results but low viscosity is effective for other purposes. Fluids of time variant viscosity may therefore be used. The viscosity of the injection fluid may range from 30 centipoise or less up to 100 centipoise or more at reservoir temperatures. Other factors to be considered include the physical characteristics of the fluid; the fluid is a liquid or gel or emulsion, not usually pure gas. Preferably, fluids such as those known to the trade as Super Frac and Super Emulsifrac are used. These are described in U.S. patents number 3,710,865 —Kiel (emulsion) and number 3,378,074—Kiel (heavy oil) the disclosures of which are incorporated herein by reference. The Super Emulsifrac fluid is the better of these, especially for gas wells. It is to be observed that in fracturing with water, gelled water, light crude oil, gelled light crude oil, and the like, the pressure ordinarily decreases during the fracture job. With the preferred fluids for the present invention, pressure ordinarily increases during the job even when injection rate remains constant. It is to be noted, of course, that pressure drop occurs both in the pipe and the formation; every effort is made to reduce the drop in the pipe and to increase the formation pressure. Therefore fracturing fluids preferred in accordance with the invention may be characterized as formation pressure increasing fluids. It may be surmised that with such fluids, the formation matrix permeability may be temporarily decreased as fluid is injected, thereby causing the formation pressure to rise. The effect is to reduce fluid loss, thereby making it practical to have shut down periods in the course of a treatment. When sufficient fluid loss occurs, the remaining sand blocks the fracture at the well bore. In accordance with the invention, such well sandout are not to occur during the scheduled shut down periods.

(ii) Pressure

In carrying out the methods of the invention, pressures of 1,000 psi or less up to 15,000 psi or more may be employed, usually about 5,000 psi, the resultant formation pressure depending on the pump pressure and the well depth and the pressure drops in the pipe and through the formation.

(iii) Injection Time

The injection time depends on the volume of fracturing fluid to be injected, which is determined by how big a fracture is desired and is calculated in advance, and upon the flow rate, which depends on the pressure and flow resistance. The time typically may be one hour or less to eight hours or more for the entire treatment.

The total injection time will be the sum of the injection times of the several double cycles, that is, the times for the double cycles for each fracture configuration, primary, first transverse, and second transverse. The injection time for each double cycle will be the sum of an initial or first injection time and a following or second

injection time. There will be intra configuration shut down periods between the first and second injections of each double cycle, and there will be inter-configuration shut down periods between each double cycle.

(iv) Injection Volume

The division of injection volumes between the several double cycles may be varied. Absent consideration of any distinctions between the several fracture configurations and other factors, one might divide the volume equally between the several double cycles, e.g. 1/3 of the total volume to each double cycle in the case of three double cycles. To take into account fluid loss, one might assume that the total fluid lost is a linear function of the square root of time. On this assumption, it is presently the practice to divide injection volumes between three double cycles in the approximate proportions 10/14/18. However this may change in the light of future experience.

The division of injection volumes between the first injection and second injection of each double cycle may be such that the volume injected during the second injection is about 1/4 to 1/3 that injected during the first injection. This is arrived at by considering that it is desirable for the injection pressure during the second injection to rise the same amount above the initial injection pressure during the second cycle as the amount of rise above the initial injection pressure of the first injection that occurred during the first injection cycle.

The total volume of fluid injected may be from 3000 barrels or less up to 20000 barrels (42 gallon barrels) or more, preferably three thousand to five thousand barrels.

Since injection times are a function of injection volume, injection times for the several double cycles bay also be in the ratio of 10/14/18, and the second injection of each double cycle may take 1/4 to 1/3 the time of the first injection. On this basis the minimum injection times is 3.5 minutes.

(v) Shut Down Time

In determining shut down time, one may make reference to the time required for decrease in shut in pressure. Time for both the intra configuration and inter-configuration shut down periods has arbitrarily been selected to be such that surface pressure will not decrease more than 1/3 of the amount it increased during the pumping operation. Although shut down time has varied from five minutes or less to an hour or more, fifteen minutes seems to be long enough for spalling to take place.

In accordance with the invention, the well is not commercially produced between injections; this distinguishes the method from simple retreatment of a well and from a double cycle occurring accidentally due to mechanical breakdown in the course of a conventional treatment. Also, in accordance with the invention, the discontinuance of fluid injection in the course of the double cycle is intentional, which further distinguishes such a double cycle from that occurring accidentally due to mechanical breakdown. The period of injection interruption will, of course, normally be much less than in the period of commercial production of a well between repeated conventional treatments, which period would be a matter of months or years. The interruption of injection occurring during a double cycle according to the invention may therefore be characterized as scheduled and brief, thereby to distinguish it from accidental interruptions and from the case of retreatment after commercial production.

N. EXAMPLES:

EXAMPLE I.

The following is an example of a well stimulation treatment carried out in April of 1973 according to the invention. Permission to publish this information has been obtained.

Formation Thickness: 30'
Depth: 7896' to 7926'

Materials: Frac Fluid: Super Emulsifrac (which is an oil water emulsion consisting of 1 part of fresh water and 2 parts of lease condensate or other light hydrocarbon)
Propping Agent: Sand, 100 mesh, 150,000 lb.
20/40 mesh, 50,000 lb.
NE (normal emulsifying) agent type: SEM—5 which is quatenary compound, 486 gallons

Gelling Agent Type: WG—6,
which is Guar Gum, 3,000 gallons
pH buffer Type: CW—1,
which is mono sodium phosphate, 800 pounds

Casing: New, 4 1/2" O.D., from 0' to 8015', weight 10.5# per foot, maximum psi allowable 4,000.

Perforations: 1/2" diameter, from 7896' to 7926' one shot per foot

Displacement pressure:	2400 psi
Breakdown pressure:	2550 psi
Maximum pressure:	4100 psi

Final Shut In.

Instant Pressure:	1800
5 minutes	1850
15 minutes	1800

Hydraulic Horsepower:

Ordered:	3000
Available:	3000
Used:	2034

Average Rates in Barrels Per Minute:

Treating:	21
Displacement:	21
Overall:	21

Volumes:

PAD Gal	126,000
Treatment Gal	48,000
Displacement Gal	6,000
Total Volume Gal	180,000

Job Log: As follows:

Event No.	Time	Rate (rpm)	Volume (BBL) (GAL) (Incremental Volume)	Pumps C	Pressure (psi) (Casing)	Description of Operation and Materials
						Safety Meeting – Discuss Procedure With All Concerened.
1	1018	26	20,000	6	0	Start Pad – Load Hole
2	1025		P		5000	Test Lines
3	1031	4	A	1	2550	Breakdown
			D			
4	1048	24	4,000	4	3900	Start 4# No. 1 Sand
5	1053	24	2,000	4	3800	Start Pad
6	1054	24		4	3800	4# No. 1 On Formation
7	1055	24	4,000	4	3800	Start 4# No. 1 Sand
8	1058	24		4	4000	Pad On Formation
9	1059	21	2,000	4	4000	Start Pad
10	1101	24		4	3950	4# No. 1 On Formation
11	1101	24	4,000	4	3950	Start 4# No. 1 Sand
12	1105	18		4	3975	Pat Hit
13	1106	21	6,000	4	3975	Start Flush
14	1107	26		4	3950	4# No. 1 On Formation
**15	1113					ISIP 2200 – 5 Min. 2000 – 15 Min. 1800
17	1127	24	8,000	4	4000	Start Pad
18	1136	21	4,000	4	4000	Start 4# 20/40 Sand
19	1141	21	6,000	4	3700	Start Flush
20	1142	26		4	3400	4# 20/40 On Formation
21	1147	24		4	3900	Shut Down
**22	1147					ISIP 2250 – 5 Min. 2100 – 15 Min. 1900

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Event No.	Time	Rate (rpm)	Volume (BBL) (GAL) (Incremental Volume)	Pumps C	Pressure (psi) (Casing)	Description of Operation and Materials
23	1202	26	20,000	4	3800	Start Pad
24	1223	21	4,000	4	4000	Start 4# No. 1 Sand
25	1228	21	2,000	4	3900	Start Pad
26	1230	26		4	3700	4# No. 1 On Formation
27	1230+	21	4,000	4	3750	Start 4# No. 1 Sand
28	1234	17		4	4000	Pad On Formation
29	1235	24	2,000	4	4000	Start Pad
30	1237	24		4	4000	4# No. 1 On Formation
31	1239	18	4,000	4	4000	Start 4# No. 1 Sand
32	1241	18–1/2		4	4000	Pad On Formation
33	1243	24	6,000	4	4000	Start Flush
34	1244	27		4	4000	4# No. 1 On Formation
35	1249	22		4	4000	Shut Down
**36	1249					ISIP 2400 – 5 Min. 2200 – 15 Min. 2100
37	1306	25	8,000	4	4000	Start Pad
38	1313	20	4,000	4	4000	Start 4# 20/40 Sand
39	1319	23	6,000	4	3800	Start Flush
40	1320	26		4	3600	4# 20/40 On Formation
41	1325	23–1/2		4	4000	Shut Down
**42						ISIP 2450 – 5 Min. 2300 – 15 Min. 2200
43	1340	24	20,000	4	4000	Start Pad
44	1402	20	4,000	4	4000	Start 4# No. 1 Sand
45	1408	27	2,000	4	3800	Start Pad
46	1410	24		4	3800	4# No. 1 On Formation
47	1410	24	4,000	4	3800	Start 4# No. 1 Sand
48	1414	19		4	3900	Pad On Formation
49	1415	24	2,000	4	3800	Start Pad
50	1417	24		4	3800	4# No. 1 On Formation
51	1417–1/2	24	4,000	4	3800	Start 4# No. 1 Sand
52	1422	18		4	3900	Pad on Formation

Event No.	Time	Rate (rpm)	Volume (BBL) (GAL) (Incremental Volume	Pumps C	Pressure (psi)	Description of Operation and Materials
53	1423	24	6,000	4	3900	Start Flush
54	1424	21		4	3800	4# No. 1 On Formation
**55	1429	19–1/2		4	3900	Shut Down
56						ISIP 2800 – 5 Min. 2300 – 15 Min. 2300
57	1444	18	8,000	4	4000	Start Pad
58	1456	12	4,000	4	4000	Start 4# 20/40 Sand
59	1502	18	6,000	4	3600	Start Flush
60	1504	24		4	3400	4# 20/40 On Formation
61	1512	12		4	2500	Finish
						ISIP 1800 30 Min. 1700

In connection with the foregoing example, attention is directed to each of the instantaneous shut in pressures occurring during the treatment. At event #15 the ISIP is 2200 psi, which is normal for the particular area after a conventional treatment. At event #22 the ISIP is still only 2250 psi, reflecting greater width in the initial fracture, which has now a much larger connected length but still is only a single fracture. At event #36, the ISIP is 2400 psi, indicating a change in fracture direction as previously explained. At event #42, the ISIP is 2450 psi, indicating increased fracture width but no new fracture wing. At event #55 the ISIP is 2800 psi, indicative of a new fracture wing. The final ISIP of 1800 at the end of the treatment is with flush water in the hole instead of emulsion; the water being much denser than the emulsion, surface pressure is lower.

EXAMPLE II.

The following is another example of a well stimulation treatment carried out in February of 1973 in accordance with the invention the injection being through the tubing. The formation treated is known as the Muddy J Sand. Permission to publish the information has been obtained.

Allowable Pressure:
Tubing 4600 psi
Casing 1000 psi

Job Done Down Tubing.
Gas Well
New Well
4½" diameter casing.
2½" HD tubing.
Tubing Depth: 2230 feet
Baker packer.
Packer depth: 2230 feet
Casing Volume Below Packer: 100±barrels?
Tubing Volume: 15±barrels?

Perforated Intervals:
Depth 8083—8117 feet
Number of Holes 34

pH Information: Confidential?
Fluid: Superfrac K—1
Maximum Pressure: 4600 psi
Average Pressure: 4500 psi
Final pump in pressure: 3900
Adjusted Injection Rate (solids included) 18 barrels/min.

Total Fluid Pumped:
Oil 2365 barrels?
Water 1335 barrels?
(Note: 24 barrels equal 1000 gallons)

Props and Liquids Injected:
100 mesh sand, 144000 lb.
20/40 mesh sand, 48000 lb.

Time	INJECTION Rate	Bbls In	PRESSURE Csg.	Tbg.	Service Log
					Hook up – Mix chemicals.
					Hook up to well.
12:00					Suspend operations – Not enough time for job completion.
6:00	2–22–73				Resume operations – Complete hook up.
					Hold safety meeting & discuss procedures.
					Test connections – Repair leaks – Load & press. csg.
8:30			1000		Start K–1 Pad.
		86	1000	1500	Hole loaded–breakdown.
	11		1000	1800	Ftm. feeding – Improve rate & press.
	22		1000	4600	Adjust rates in observance of max. press.
	19	480	1000	4600	Start 100 mesh sand 4#/gal.
	22	592	1000	4200	Stop sand – start K–1 spacer.
	19	640	1000	4400	Resume sand @ 4#/gal.
	21	752	1000	4100	Stop sand – start K–1 spacer.
	19	800	1000	4300	Resume sand @ 4#/gal.
	16	912	1000	4500	Stop sand – start K–1 flush.
	18	1027	1000	4400	Flush comp. – S.D. – Observe press.
			1000	2200	ISIP
			1000	1950	14 Min. S.D. – Start K–1 pad – Stage II
	18		1000	4200	Rate & Press. Check.
	17	1219	1000	4500	Start 20–40 Sand 4#/gal.
	20		1000	3900	Rate & Press. Check.
	19	1329	1000	4300	Stop sand – Start K–1 Flush.
	16	1446	1000	4400	Flush Comp. – S.D. – Observe press.
			1000	2200	ISIP
			1000	1950	18 min. S.D. – Start K–1 Pad – Stage III.
	19		1000	4500	Rate & press. Check.

Time	INJECTION Rate	Bbls In	PRESSURE Csg.	Tbg.	Service Log
	19	1926	1000	4200	Start 100 mesh sand 4#/gal.
	15	2040	1000	4600	Stop sand – Start K–1 spacer.
	16	2088	1000	4400	Resume sand @ 4#/gal.
	16	2198	1000	4300	Stop sand – Start K–1 spacer.
	17	2246	1000	4500	Resume sand @ 4#/gal.
	19	2356	1000	4000	Stop sand – Start K–1 flush.
	18	2471	1000	4300	Flush comp. – S.D. – Observe press.
			1000		7 min. S.D. – Start K–1 pad – Stage IV.
	16		1000	4400	Rate & press. Check.
	18	2663	1000	4600	Start 20–40 sand 4#/gal.
	18	2773	1000	4600	Stop sand – Start K–1 flush.
	18	2888	1000	4500	Flush comp. – S.D. – Observe press.
			1000	2350	ISIP
			1000	2250	9 min. S.D. – Start K–1 pad – Stage V.
	18		1000	4600	Press. & rate check.
	18	3368	1000	4500	Start 100 mesh sand 4#/gal.
	20	3478	1000	4100	Stop sand – Start K–1 spacer.
	20	3526	1000	4320	Resume sand @ 4#/gal.
	18	3636	1000	4600	Stop sand – Start K–1 spacer.
	20	3684	1000	4100	Resume sand @ 4#/gal.
	16	3794	1000	4500	Stop sand – Start K–1 flush.
	19	3909	1000	4600	Flush comp. – S.D. – Observe press.
			1000	2500	ISIP
					12 min. S.D. – Start K–1 pad – Stage VI.
	18		1000	4200	Press. & rate check.
	20	4101	1000	4600	Start 20–40 sand 4#/gal.
	21	4211	1000	4100	Stop sand – Start K–1 flush.
	19	4281	1000	4200	Start H_2O flush.
2:05 pm	24	4336	1000	3900	Flush comp. S.D. – Job Completed.
			1000	2100	ISIP
			1000	1500	30 min. ISIP

Well tests performed on the well of Example II showed a fracture conductivity of 120,000 millidarcy inches. From experience with other wells not treated according to the invention, the applicant would expect that under the closure stress existing in the well, a fracture 1/4 inch wide fully packed with 100 mesh sand (the sand used in the example) would have a flow capacity of about 1500 millidarcy inches. See "Conductivity of Fracture Proppants in Multiple Layers" by C. E. Cooke, Jr., pp. 1101 et seq, Journal of Petroleum Technology, September 1973.

EXAMPLE III.

The following is a further example of a well stimulation treatment carried out in August of 1973. Permission to publish this information has been obtained.

Formation: J-Sand
Well Type: Gas, Workover
Casing: New, 4½ inch diameter, from 0 to 7890 feet, 10½ lb./foot, 4300 maximum allowable psi.
Perforations: 7788 to 7856 (15 holes)
7787 to 7793 (1 shot per foot)
7804 to 7856 (1 shot per foot)

Materials:
Treating Fluid: Super-Emulsifrac
Displacement Fluid: Super Emulsifrac
Prop: 100 mesh sand—75,000 lb.
and
20/40 mesh sand—75,000 lb.
Acid Type: HCL—500 gal., 15%
Surfactant: SEM—5 (300 gal.)
NE Agent: 11—N (3 gal.)

Gelling Agent: WG—6 3500 lb.
Breaker: CW—1 800 lb.
KCL 234 sacks
NF—1 60 quarts
(See example I for identification of the coded materials.
Also, ————————.)

Pressures (in PSI)

Displacement: 3600
Breakdown: 1400
Average: 4000
Shut In Instant: 2900

Hydraulic Horsepower

Ordered: 2500
Available: 3000
Used: 1765

Rates (In BPM)

Treating: 18
Displacement: 18
Overall: 19

Volumes

Preflush	10500 gal.
PAD	132000 gal.
Treatment	39000 gal.
Displacement	5400 gal.
Total Volume	186900 gal.

Event No.	Time	Rate (rpm)	Volume (BBL) (GAL) (Incremental Volume)	Pumps C	Pressure (psi) (Casing)	Description of Operation and Materials
	0945					Safety Meeting
		3	500	1	400	Pump Acid
	1010		10,000		400	Start Prepad Load Hole
						Test Lines
	1027	4			1400	Breakdown
1	1041	22–1/2	14,000	5	3700	Start Pad
2	1056	22	2,000	4	3950	Start 1–1/3# 20/40 & 2–1/2# 100 Mesh Sand
3	1058	22	3,000	4	3950	Start Spacer
4	1102	22	2,000	4	4000	Start 1–1/3# 2–1/2# as in event 2
5	1104	20–1/2	3,000	4	4000	Start Spacer
6	1107	21	3,000	4	4000	Start 1–1/3# & 2–1/2#
7	1110	21	3,000	4	3950	Start Spacer
8	1114	21	3,000	4	3900	Start 1–1/3# & 2–1/2#
9	1117	20	5,400	4	3950	Start Flush
*10	1124	19		4	4000	Shut Down ISIP 2700
11	1139	20	7,600	4	4000	Start Pad
12	1150	19	3,000	4	4000	Start 1–1/2# 20/40 Sand
13	1155	19	5,400	4	3700	Start Flush
14	1200	19		4	4000	Shut down ISIP 2700
15	1215	18	15,600	4	4000	Start Pad
16	1237	18	2,000	4	3950	Start 1–1/3# 20/40 & 2–1/2# 100 Mesh
17	1240	20	4,000	4	4000	Start Spacer
18	1244	20	2,000	4	4000	Start 1–1/3# & 2–1/2#
19	1247	19	4,000	4	4000	Start Spacer
20	1257	18	3,000	4	4000	Start 1–1/3# & 2–1/2#
21	1255	18	4,000	4	4000	Start Spacer
22	1300	17	3,000	4	4000	Start 1–1/3# & 2–1/2#
23	1305	20	5,400	4	4000	Start Flush
*24	1312	17		4	4000	Shut down ISIP 2950
25	1327	18	7,600	4	4000	Start Pad
26	1338	18	3,000	4	4000	Start 4# 20/40 Sand
27	1342	20–1/2	5,400	4	4000	Start Flush
28	1350	15–1/2		4	4000	Shut down ISIP 2900

18

1,460,647

18

Event No.	Time	Rate (rpm)	Volume (BBL) (GAL) (Incremental Volume)	Pumps C	Pressure (psi) (Casing)	Description of Operation and Materials
29	1405	18	22,600	4	4000	Start Pad
30	1441	12	2,000	3	4000	Start 1–1/3# & 2–1/2# (20/40 & 100 Mesh)
31	1444	16	4,000	4	4000	Start Spacer
32	1450	15	2,000	4	4000	Start 1–1/3# 20/40 & 2–1/2# 100 Mesh
33	1455	10	4,000	4	4000	Start Spacer
34	1501	11–1/2	3,000	4	4000	Start 1–1/3# & 2–1/2#
35	1507	16	4,000	4	4000	Start Spacer
36	1513	13	3,000	4	4000	Start 1–1/3# & 2–1/2#
37	1522	14–1/2	5,400	4	4000	Start Flush
*38	1557	5			4000	Shut down ISIP 3300
39	1611	16	5,600	4	3900	Start Pad
40	1616	16	3,000	4	3900	Start 4# 20/40 Sand
41	1620	18	5,400	4	3900	Finish Flush
42	1624	22		4	3900	Shut down ISIP 2550
						Finished

Again one can note the instantaneous shut in pressures, at events 10 (2700 psi), 24 (2950 psi) and 38 (3300 psi). The latter high ISIP indicates that a new fracture direction has been formed. In this regard it is to be observed, considering a hypothetical cube of formation material, that the stress in the direction perpendicular to one set of parallel vertical faces will usually be different from that in the direction parallel to the other set. Assume that the cube is oriented so that one set of vertical faces are in the direction of minimum formation stress. The initial fracture may be assumed to occur in a direction perpendicular to these faces since this is the direction requiring the least pressure to separate the sides of the fracture. After the fracture has occurred and the fracture has been propped open by dropping the pressure to allow spalling and resumption of high pressure to move the spalls to propping position and sand out the fracture terminii, the stress in the formation is changed. The next application of pressure (following the second shut down, during which the sand out occurs) causes a fracture in a different direction because the minimum rock stress is now in a different direction. The result is the dendritic fracture of this invention.

O. FURTHER COMPARISONS

FIGURE 13 is a chart plotting rate of well flow against time for four wells. Continuous line A plots productivity of the best well in this particular field, treated

by conventional fracturing methods. Long-short dashed line B plots the productivity of a well treated in accordance with the invention. Short dashed line C plots the productivity of a nearby well treated the same as the well of line B except the fracturing was continuous rather than interrupted. Long dashed line D plots the productivity of another nearby well treated in accordance with the invention and believed to be in a bad sand. The extra heavy continuous line E plots the average for a group of 74 wells, all treated by various conventional fracturing processes. It is seen that line B shows productivity better than the best other well in the group treated conventionally, line A, and far better than the average of convenionally treated wells, line E, and far better than a conventionally treated nearby well using a continuous but otherwise similar fracturing process, line C, and that even in a bad sand (apparently) the well treated according to the invention was of productivity, line D, of not too far from average.

FIGURE 14 is similar to FIGURE 13 except that it plots against cumulative production instead of time and omits the average line E. These are gas wells, but the invention is equally applicable to oil wells and to HC wells generally.

FIGURE 15 is another comparative chart similar to FIGURE 14, line W being a plot for a well treated according to the invention and lines X, Y and Z referring to wells treated by conventional fracturing methods.

WHAT WE CLAIM IS:—

1. A method of well treatment by hydraulic fracturing of the formation to be treated, said fracturing including at least one double cycle comprising injecting fluid capable of undergoing fluid loss to said formation once said formation is fractured into the formation at a pressure and for a period of time sufficient to allow hydraulic fracture to occur, discontinuing said fluid injection for a period of time at least long enough to allow a pressure drop in said fluid from fluid loss from said fracture to the formation, resuming injection of said fluid into said formation, and discontinuing said latter injection of fluid.

2. A method as claimed in claim 1, including a plurality of double cycles.

3. A method as claimed in claim 1 or 2 including two double cycles.

4. A method as claimed in claim 1 or 2 including three double cycles.

5. A method as claimed in any of claims 2, 3 or 4, wherein the injection pressure during each double cycle subsequent to the first double cycle is at least 10 per cent greater than during the first double cycle.

6. A method as claimed in any of claims 2 to 5, wherein the well is not produced between double cycles.

7. A method as claimed in any of claims 2 to 6, wherein the periods of discontinuance of injection, other than the last one, are such that the shut in pressure does not fall to less than 1/3 of the amount of the increase in pressure during the previous injection, thereby to avoid excess fluid loss.

8. A method as claimed in any of claims 2 to 7, wherein the period of an even numbered injection is 1/4 to 1/3 the period of an immediately preceding odd numbered injection, considering that the plurality of injections are numbered consecutively in chronological order.

9. A method as claimed in any of claims 2 to 8, wherein the periods of the plurality of consecutive pairs of injection periods, considering the first and second injection periods as the first such pair are approximately proportional to the square root of the number of such pair, considering that the plurality of pairs are numbered consecutively in chronological order.

10. A method as claimed in any of the preceding claims, wherein the fracturing fluid is of the formation pressure increasing type.

11. A method as claimed in any of the preceding claims, including injecting sand with the fracturing fluid to limit the vertical conductive extent of the fracturing.

12. A method as claimed in any of the preceding claims, including injecting sand for fluid loss control.

13. A method as claimed in any of the preceding claims wherein the period of fluid injection is at least 3.5 minutes.

14. A method as claimed in any of the preceding claims, whrein each period of said discontinuing injecting fracturing fluid, except the last such period, lasts for from 5 minutes to one hour.

15. A method as claimed in claim 1, wherein the pressure drop is at least 100 pounds per square inch.

16. A method as claimed in claim 1 substantially as hereinbefore described with reference to the accompanying drawings.

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Fig. 1

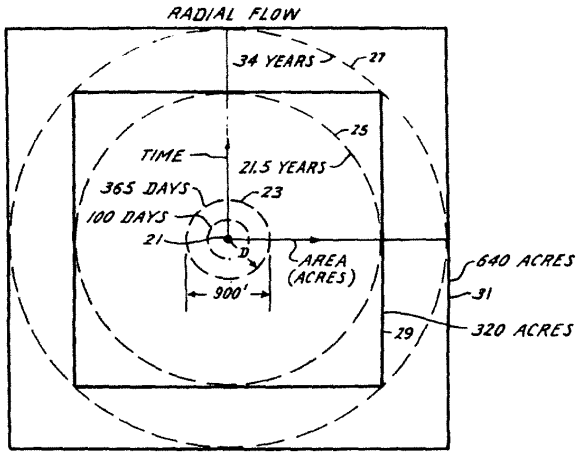

RADIAL FLOW
34 YEARS
27
25
TIME
21.5 YEARS
365 DAYS
23
100 DAYS
21
D
AREA (ACRES)
900'
640 ACRES
31
320 ACRES
29

Fig. 2

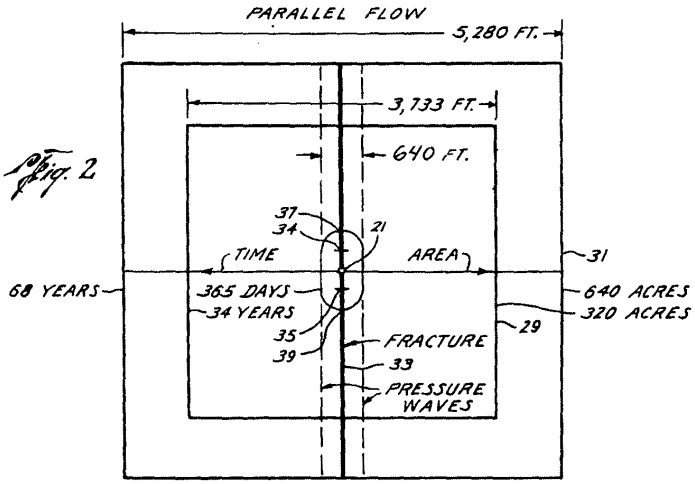
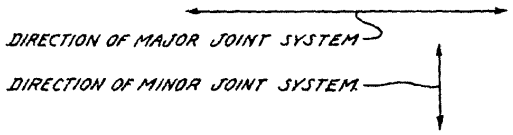
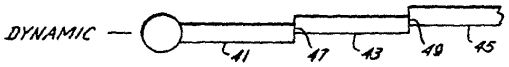

PARALLEL FLOW
5,280 FT.
3,733 FT.
640 FT.
37
34
21
TIME
AREA
31
68 YEARS
365 DAYS
34 YEARS
640 ACRES
320 ACRES
29
35
39
FRACTURE
33
PRESSURE WAVES

Fig. 3



LOOKING DOWN ON A VERTICAL FRACTURE AS IT IS BEING FORMED, THE FRACTURE MAY FORM AS :



AFTER FLUID PRESSURE IS GONE, THE FRACTURE WILL BE FRAC SAND FILLED, BUT SHUT OFF AT INTERSECTIONS OF MAJOR AND MINOR JOINT SYSTEMS.

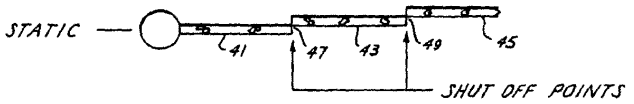
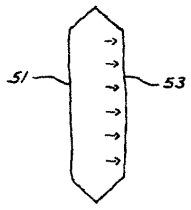


Fig. 4

LOOKING OUT HORIZONTALLY AT THE FACES OF A VERTICAL FRACTURE FROM THE WELL BORE :

UNDER DYNAMIC FLUID PRESSURE



AFTER PUMPS ARE SHUT DOWN OR NEARLY SHUT DOWN

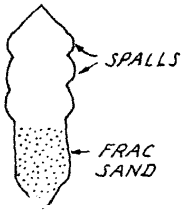


Fig. 5

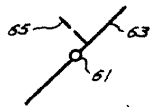


Fig. 6

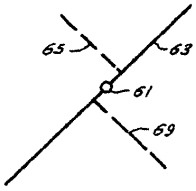


Fig. 7

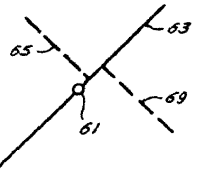


Fig. 8

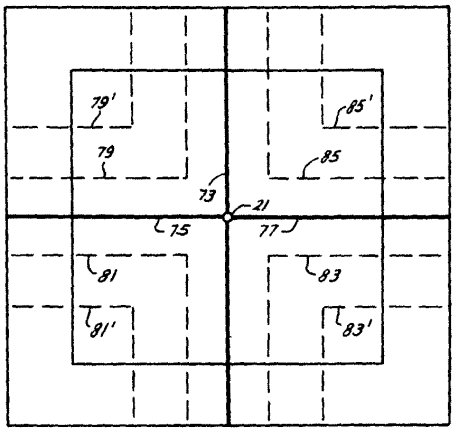


Fig. 9

PERMEABILITY	TIME — DAYS	
k_{NF} md	320 AC. TRACT	640 AC. TRACT
10	37	74
50	7	15
100	4	8

WAVE FRONT ARRIVALS

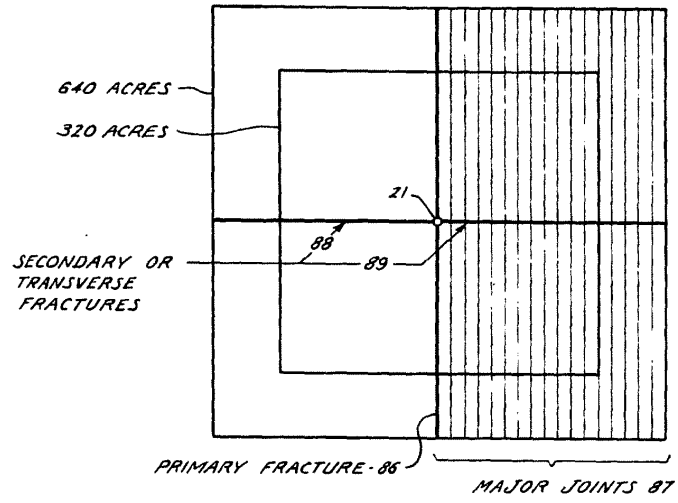


Fig. 10

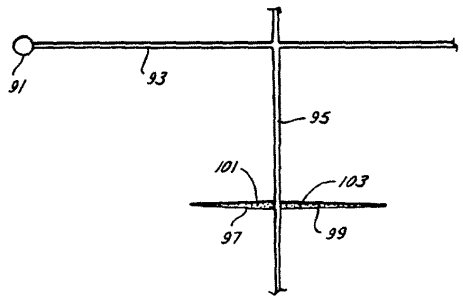


Fig. 11

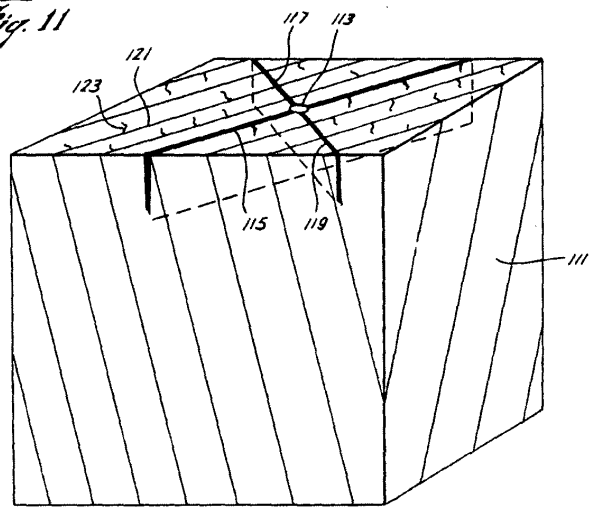


Fig. 12

COMPARISON OF FRACTURING TREATMENTS

	UNINTENTIONAL SHUT DOWN		CONVENTIONAL		
TYPE OF TREATMENT	NUMBER OF WELLS	BOPD	NUMBER OF WELLS	BOPD *	YEARS TESTED
VISOFRAC	5	19.80	4	7.60	2
SUPERFRAC			4	8.71	2
GELLED F.W.	4	13.46	5	11.20	2
GELLED S.W.	5	23.72	7	11.54	1
F.W. EMULSION	7	37.14	12	8.69	2
S.W. EMULSION	4	27.27	6	9.50	(3 MO.

* BOPD = BARRELS OIL PER DAY, AVERAGE

1460647 COMPLETE SPECIFICATION
9 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 6

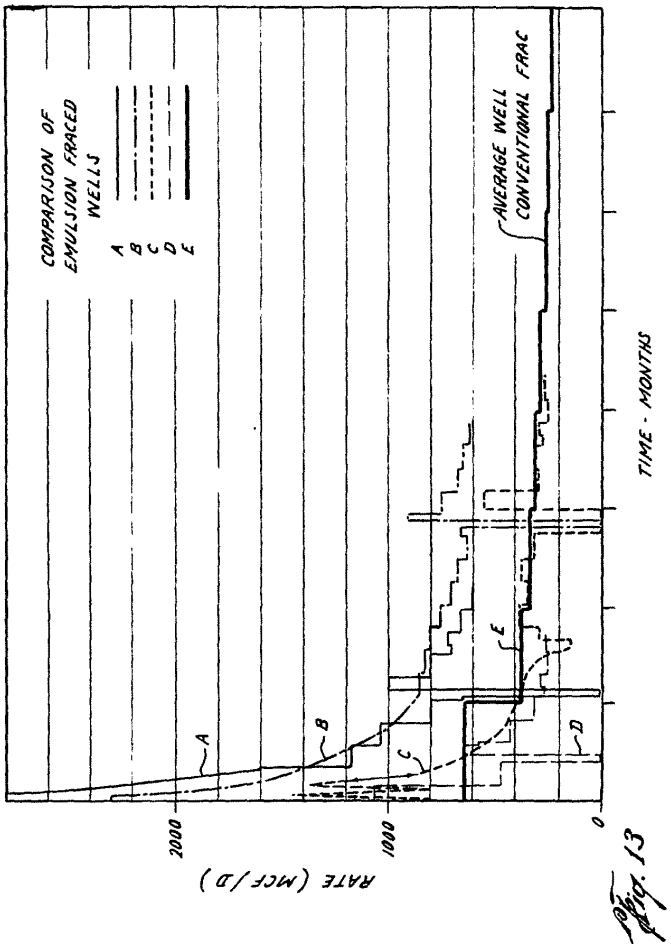

COMPARISON OF EMULSION FRACED WELLS
A
B
C
D
E
AVERAGE WELL CONVENTIONAL FRAC
TIME - MONTHS
RATE (MCF/D)
2000
1000
0

Fig. 13

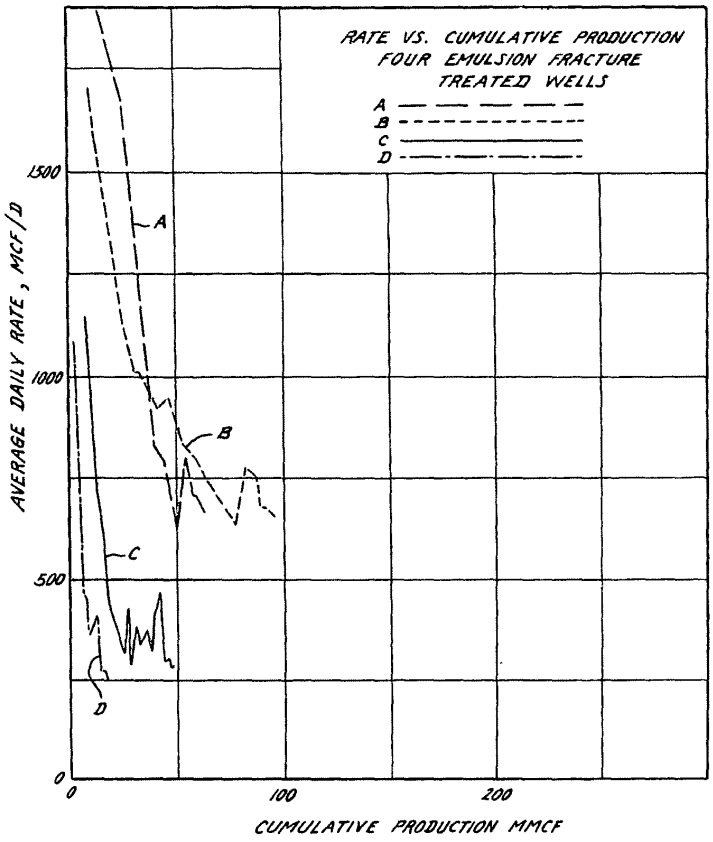

RATE VS. CUMULATIVE PRODUCTION
FOUR EMULSION FRACTURE
TREATED WELLS
A
B
C
D
AVERAGE DAILY RATE, MCF/D
1500
1000
500
0
0
100
200
CUMULATIVE PRODUCTION MMCF

Fig. 14

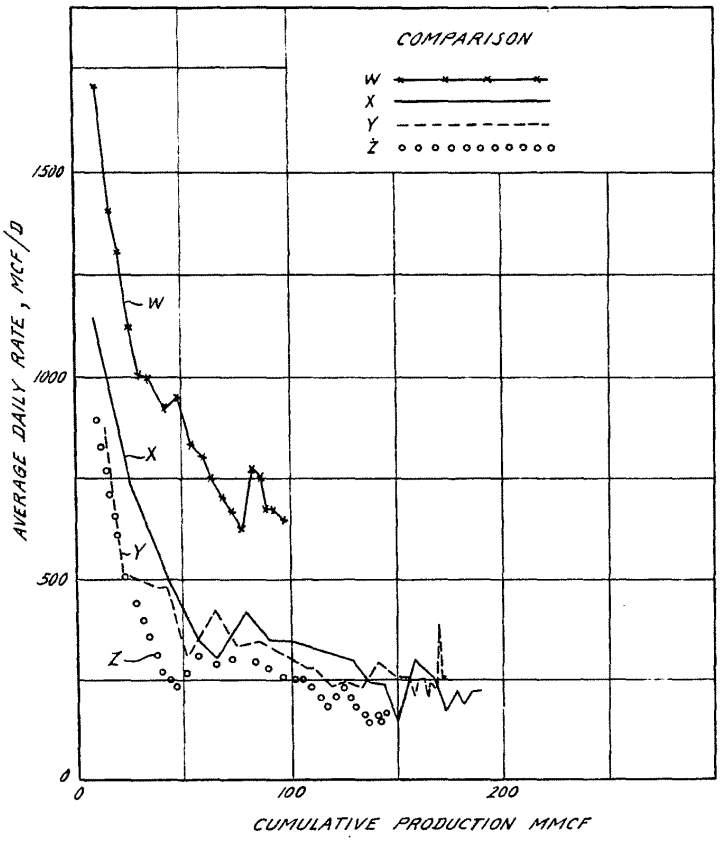

COMPARISON
W
X
Y
Z
AVERAGE DAILY RATE, MCF/D
1500
1000
500
0
0
100
200
CUMULATIVE PRODUCTION MMCF

Fig. 15

Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Carey Christine Jordan./Debbie Allen
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	6976231
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Carey Christine Jordan./Debbie Allen
Filer Authorized By:	Carey Christine Jordan.
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	09-FEB-2010
Filing Date:	01-DEC-2005
Time Stamp:	13:24:31
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	7868
Deposit Account	500417
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Document Number	**Document Description**	**File Name**	**File Size(Bytes)/ Message Digest**	**Multi Part /.zip**	**Pages (if appl.)**
1		0861080102IDS.pdf	3123426 9cb7be4a939f5ec1b6ea279d02b052825a7c6ecf	yes	106

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	Foreign Reference	4	34
	Foreign Reference	35	38
	Foreign Reference	39	69
	NPL Documents	70	80
	NPL Documents	81	89
	NPL Documents	90	96
	NPL Documents	97	106

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New International Application Filed with the USPTO as a Receiving Office

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Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99**)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	MCNEEL, ET AL.
	Art Unit	3676
	Examiner Name	DITRANI, ANGELA M.
	Attorney Docket Number	2005-IP-018647U1 (063718.0930)

U.S.PATENTS						
Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4845981		1989-07-11	Pearson	
	2	5417283		1995-05-23	Ejiogu et al.	
	3	7243726		2007-07-17	Ohmer	
	4	7367411		2008-05-06	Leuchtenberg	
	5	4715721		1987-12-29	Walker et al.	
	6	6644844		2003-11-11	Neal et al.	
	7	6236894		2001-05-22	Stoisits et al.	
If you wish to add additional U.S. Patent citation information please click the Add button.						
U.S.PATENT APPLICATION PUBLICATIONS						

EFS Web 2.1.17

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	MCNEEL, ET AL.
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	Attorney Docket Number	2005-IP-018647U1

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	20020125011		2002-09-12	Snider et al.	

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2]	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1							☐

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NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Notice of Allowance for U.S. Patent Application Serial No. 11/753,314, dated Dec 17, 2009.	☐
	2	Office Action for U.S. Patent Application Serial No. 11/396,918, dated Dec 1, 2009.	☐
	3	Office Action for U.S. Patent Application Serial No. 11/545,749, dated Jan 27, 2010.	☐
	4	Office Action for U.S. Patent Application Serial No. 11/873,186, dated Jan 25, 2010.	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	MCNEEL, ET AL.
	Art Unit	3676
	Examiner Name	DITRANI, ANGELA M.
	Attorney Docket Number	2005-IP-018647U1

EXAMINER SIGNATURE			
Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

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	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	MCNEEL, ET AL.
	Art Unit	3676
	Examiner Name	DITRANI, ANGELA M.
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

☐ That each item of information contained in the information disclosure statement was first cited in any communication from a foreign patent office in a counterpart foreign application not more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(1).

OR

☐ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☒ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Shannon Powers	Date (YYYY-MM-DD)	2010-02-12
Name/Print	Shannon Powers	Registration Number	59,584

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

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Electronic Patent Application Fee Transmittal	
Application Number:	11291496
Filing Date:	01-Dec-2005
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Filer:	Elizabeth L. Durham/Nicci Fowler
Attorney Docket Number:	2005-IP-018647U1
Filed as Large Entity	

Utility under 35 USC 111(a) Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Miscellaneous:				
Submission- Information Disclosure Stmt	1806	1	180	180
		Total in USD ($)		**180**

Electronic Acknowledgement Receipt	
EFS ID:	7059486
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Elizabeth L. Durham/Nicci Fowler
Filer Authorized By:	Elizabeth L. Durham
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	22-FEB-2010
Filing Date:	01-DEC-2005
Time Stamp:	16:12:39
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	yes
Payment Type	Deposit Account
Payment was successfully received in RAM	$180
RAM confirmation Number	2635
Deposit Account	020383
Authorized User	
The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows: Charge any Additional Fees required under 37 C.F.R. Section 1.16 (National application filing, search, and examination fees) Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)	

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)	
Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)	
Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)	

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Transmittal Letter	0637180-930-IDS.pdf	167568 135d855ae9fadd03ce97e512e3c709b61c8d611f	no	4
Warnings:					
Information:					
2	NPL Documents	063718-OA-dated-12-01-09.pdf	817998 580179e9792792063b058677f979e4bdc2934f50	no	21
Warnings:					
Information:					
3	NPL Documents	063718-OA-dated-1-27-10.pdf	799678 a152e7c88446e5cc724c51a851d47e876156373f	no	22
Warnings:					
Information:					
4	NPL Documents	063718-OA-dated-1-25-10.pdf	454801 641abbf192ec9e1c99502740f204cd8729d5e0c2	no	14
Warnings:					
Information:					
5	NPL Documents	063718-NOA-dated-12-17-09.pdf	4930753 10f18c7c32e74c25c3c200a9b610777e44f3d951	no	107
Warnings:					
Information:					
6	Fee Worksheet (PTO-875)	fee-info.pdf	30062 4738e4c4132468dcab8fe2c76821d9f88851a463	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	7200860		

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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/08a (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT

(Not for submission under 37 CFR 1.99)

Application Number	11291496
Filing Date	2005-12-01
First Named Inventor	William McNeel
Art Unit	3676
Examiner Name	Angela Ditrani
Attorney Docket Number	2005-IP-018647U1

U.S.PATENTS

Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					
	2					
	3					
	4					

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U.S.PATENT APPLICATION PUBLICATIONS

Examiner Initial*	Cite No	Publication Number	Kind Code[1]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1					

If you wish to add additional U.S. Published Application citation information please click the Add button.

FOREIGN PATENT DOCUMENTS

Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	William McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

	1							☐

If you wish to add additional Foreign Patent Document citation information please click the Add button

NON-PATENT LITERATURE DOCUMENTS

Examiner Initials*	Cite No	Include name of the author (in CAPITAL LETTERS), title of the article (when appropriate), title of the item (book, magazine, journal, serial, symposium, catalog, etc), date, pages(s), volume-issue number(s), publisher, city and/or country where published.	T[5]
	1	Notice of Allowance for U.S. Patent Application No. 11/691,623 dated February 18, 2010	☐
	2	Notice of Allowance for U.S. Patent Application No. 11/545,749 dated April 5, 2010	☐

If you wish to add additional non-patent literature document citation information please click the Add button

EXAMINER SIGNATURE

Examiner Signature		Date Considered	

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

EFS Web 2.1.16

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)		
	Application Number	11291496
	Filing Date	2005-12-01
	First Named Inventor	William McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

CERTIFICATION STATEMENT

Please see 37 CFR 1.97 and 1.98 to make the appropriate selection(s):

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OR

☒ That no item of information contained in the information disclosure statement was cited in a communication from a foreign patent office in a counterpart foreign application, and, to the knowledge of the person signing the certification after making reasonable inquiry, no item of information contained in the information disclosure statement was known to any individual designated in 37 CFR 1.56(c) more than three months prior to the filing of the information disclosure statement. See 37 CFR 1.97(e)(2).

☐ See attached certification statement.

☐ Fee set forth in 37 CFR 1.17 (p) has been submitted herewith.

☐ None

SIGNATURE

A signature of the applicant or representative is required in accordance with CFR 1.33, 10.18. Please see CFR 1.4(d) for the form of the signature.

Signature	Melody B. Wirz	Date (YYYY-MM-DD)	2010-4-20
Name/Print	Melody B. Wirz	Registration Number	53,783

This collection of information is required by 37 CFR 1.97 and 1.98. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 1 hour to complete, including gathering, preparing and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

EFS Web 2.1.16

Electronic Acknowledgement Receipt	
EFS ID:	7445941
Application Number:	11291496
International Application Number:	
Confirmation Number:	7986
Title of Invention:	Method and apparatus for centralized well treatment
First Named Inventor/Applicant Name:	William Lloyd McNeel
Customer Number:	29920
Filer:	Melody Bernice Wirz/Debbie Allen
Filer Authorized By:	Melody Bernice Wirz
Attorney Docket Number:	2005-IP-018647U1
Receipt Date:	20-APR-2010
Filing Date:	01-DEC-2005
Time Stamp:	09:32:20
Application Type:	Utility under 35 USC 111(a)

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		0861080102IDS.pdf	427346 2e70c2f0ffbbe55d6210b4a444fda110f6655b08	yes	13

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Information Disclosure Statement (IDS) Filed (SB/08)	1	3
	NPL Documents	4	7
	NPL Documents	8	13

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New Applications Under 35 U.S.C. 111
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New International Application Filed with the USPTO as a Receiving Office
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UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
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Alexandria, Virginia 22313-1450
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
11/291,496	12/01/2005	William Lloyd McNeel	2005-IP-018647U1	7986

29920 7590 05/13/2010

JOHN W. WUSTENBERG
P.O. BOX 1431
DUNCAN, OK 73536

EXAMINER	
DITRANI, ANGELA M	

ART UNIT	PAPER NUMBER
3676	

NOTIFICATION DATE	DELIVERY MODE
05/13/2010	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

JOHN.WUSTENBERG@HALLIBURTON.COM
HOLLY.FINE@HALLIBURTON.COM

PTOL-90A (Rev. 04/07)

Office Action Summary	Application No.	Applicant(s)	
	11/291,496	MCNEEL ET AL.	
	Examiner	Art Unit	
	Angela M. DiTrani	3676	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *14 January 2010*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-32 and 34-44* is/are pending in the application.

4a) Of the above claim(s) *1-10 and 34-39* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *11-32 and 40-44* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *05/26/09, 07/16/09, 08/24/09, 10/09/09, 11/30/09, 02/09/09, 02/23/09, 04/20/09*
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 11-23, 31, 32, 41, and 44 are rejected under 35 U.S.C. 102(e) as being anticipated by Albers et al. (US 2006/0243437).

With respect to independent claim 11, Albers et al. discloses a system for centralized well operations (see Figure 1) comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location (wellhead connection via **13**) and the well operations factory; a second connection between a second well location (wellhead connection via **13a**) and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location; wherein the first and second stimulation fluid have different compositions ([0028]-[0030]).

With respect to depending claim 12, Albers et al. discloses wherein the means for simultaneously flowing treatment fluid comprises a manifold ([0007]; [0028]-[0030]).

With respect to depending claim 13, Albers et al. discloses wherein the well operations factory comprises a pumping grid wherein the pumping grid is operable to connect to the manifold ([0022]).

With respect to depending claims 14-16, Albers et al. discloses wherein the well operations factory comprises a blending unit **1** wherein the blending unit is operable to connect to the pumping grid; wherein the well operations factory comprises a proppant storage system **4** wherein the proppant storage system is operable to deliver proppant to the blending unit; and wherein the well operations factory comprises a chemical storage system (i.e., the nitrogen/carbon dioxide storage tank) wherein the chemical storage system is operable to connect to the blending unit.

With respect to depending claims 17-19, Albers et al. discloses wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, the proppant storage system, the first well location, and the second well location ([0032]); wherein the well operations factory comprises a power unit operable to connect to the manifold, pumping grid, blending unit, chemical storage system, the first well location, and the second well location ([0032]); and wherein the well operations factory is enclosed in a structure selected from the group as claimed ([0022]-[0024]).

With respect to depending claims 20-23, Albers et al. discloses wherein the first connection is operable to deliver a fluid from the first well location to the manifold, and, further, wherein the fluid comprises a stimulation fluid, and wherein the second connection is operable to deliver a fluid from the second well location to the manifold, and, further, wherein the fluid comprises a stimulation fluid ([0022]; [0028]-[0030]).

With respect to depending claims 31 and 32, Albers et al. discloses wherein the first fluid comprises at least one compound selected from the group as claimed (i.e., proppant and a fracturing fluid); and wherein the second stimulation fluid comprises at least one compound selected from the group as claimed (i.e., a fracturing fluid).

With respect to independent claim 41, Albers et al. discloses a system for centralized well operations (see Figure 1) comprising: a well treatment operations factory which dynamically manufactures and pumps a well stimulation fluid; a first connection between a first well location (wellhead connection via **13**) and the well operations factory; a second connection between a second well location (wellhead connection via **13a**) and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location; wherein the first and second stimulation fluid have different compositions ([0028]-[0030])

With respect to new independent claim 44, Albers et al. discloses a system for centralized well operations (see Figure 1) comprising: a well treatment operations factory capable of manufacturing and simultaneously pumping a plurality of well stimulation fluids ([0028]-[0030]); a first connection between a first well location (wellhead connection via **13**) and the well operations factory; a second connection between a second well location (wellhead connection via **13a**) and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location ([0028]-[0030]).

Claim Rejections - 35 USC § 103

3. The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

4. Claims 24-30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Albers et al.

With respect to depending claim 24 and further depending claim 25, Albers et al. discloses the system as provided above with respect to independent claim 11. Although the reference teaches wherein the system is capable of simultaneous flow of a first stimulation fluid to a first well location and a second stimulation fluid to a second well location ([0028]-[0030]), the reference fails to explicitly teach wherein the first manifold is connected to a second manifold, and, further, wherein the second manifold is operable to provide for such simultaneous flow as claimed. Albers et al., however, teaches wherein additional equipment can be used so as to meet the specific requirements of a particular job, and, therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for a second manifold as claimed as based on the capacity of the treatment fluid being used and needs of the actual formation being stimulated in order to provide for an optimal stimulation treatment therein.

With respect to depending claims 26-29, Albers et al. fails to explicitly disclose wherein the system comprises a third connection between the manifold and the first well location, wherein the third connection is operable to deliver a fluid from the first well location to the manifold, and, further, wherein the system comprises a fourth connection

between the manifold and the second well location, wherein the fourth connection is operable to deliver a fluid from the second well location to the manifold. It would have been an obvious matter of choice or design to one having ordinary skill in the art to provide for the third and fourth connections as claimed in order to provide a means to flow back previously used stimulation fluid from each well location to the manifold or, alternatively, a means to produce fluid from the formation when producing fluids from the same well that which was stimulated.

With respect to depending claim 30, Albers et al. discloses wherein the well operations factory comprises various tanks and storage units which are brought to the location so as to provide for the factory thereon via trucks and/or trailers. Although the reference fails to explicitly disclose wherein the well operations factory and means for simultaneously flowing treatment fluid as disclosed are located on a boat, the Examiner hereby takes Official Notice in that it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide for a factory as disclosed by Albers et al. via a boat insofar as because it is well known in the art when providing for a factory comprising various tanks and storage units that are brought to a well site to employ a deployable unit, such as a truck, trailer, or boat.

5. Claim 42 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albers et al. as applied to independent claim 11 above, and further in view of Hassan et al. (US 6,729,394).

Albers et al. discloses the system as stated above, and, further, wherein the well treatment operations factory dynamically manufactures and pumps a well stimulation fluid. The reference also discloses wherein the well locations are different locations of a

well head. Albers et al., however, fails to teach wherein the well locations are well pads as claimed.

Hassan et al. teaches methods of preparing a well bore for injection by placement of pumps, production or injection tubing and other equipment into the well bore and the installation and connection of tanks, pumps, surface piping or other equipment at the surface on the well site and to the well bore, wherein wells are drilled from a pad for the purpose of reducing the environmental impact and economic cost of developing a subterranean hydrocarbon reservoir; by employing a well pad, the need to complete and equip each individual well bore is overcome (col. 2, l. 10-58). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ a well pad within the oil field fracturing unit of Albers et al. when conducting the stimulation operation at multiple locations within a given field in order to eliminate the need to complete multiple well bores therein.

6. Claim 40 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albers et al. in view of Hassan et al..

With respect to independent claim 40, Albers et al. discloses a system for centralized well operations (see Figure 1) comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location (wellhead connection via **13**) and the well operations factory; a second connection between a second well location (wellhead connection via **13a**) and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to

the second well location and not to the first well location; wherein the first and second stimulation fluid have different compositions ([0028]-[0030])

Albers et al. discloses wherein the well locations are a first location and a second location located at a well head. Albers et al., however, fails to teach wherein the well locations are first and second well pads as claimed.

Hassan et al. teaches methods of preparing a well bore for injection by placement of pumps, production or injection tubing and other equipment into the well bore and the installation and connection of tanks, pumps, surface piping or other equipment at the surface on the well site and to the well bore, wherein wells are drilled from a pad for the purpose of reducing the environmental impact and economic cost of developing a subterranean hydrocarbon reservoir; by employing a well pad, the need to complete and equip each individual well bore is overcome (col. 2, l. 10-58). Therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ the system of Albers et al. wherein the connection to the first well head location and second well head location is made instead to a first well pad and second well pad when conducting the stimulation operation at multiple locations within a given field in order to eliminate the need to complete multiple well bores therein.

7. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Albers et al..

With respect to independent claim 43, Albers et al. discloses a system for centralized well operations (see Figure 1) comprising: a well treatment operations factory which manufactures and pumps a well stimulation fluid; a first connection between a first well location (wellhead connection via **13**) and the well operations factory; a second

connection between a second well location (wellhead connection via **13a**) and the well operations factory; and means for simultaneously flowing: a first stimulation fluid to the first well location and not to the second well location; and a second stimulation fluid to the second well location and not to the first well location; wherein the first and second stimulation fluid have different compositions ([0028]-[0030]).

Although Albers et al. fails to explicitly disclose wherein the first well location has a plurality of wells and the second well location has a second plurality of wells, the reference teaches wherein the equipment referenced throughout the disclosure is conventional in nature and that the specific number of trucks/trailers/tanks used therein is not meant to be limiting. Therefore, in expanding the centralized system using more trucks/trailers/tanks, it would have been obvious to one having ordinary skill to further expand upon the system disclosed by Albers et al. so as to include a first plurality of wells and a second plurality of wells in order to provide a system capable of fracturing a given formation at multiple locations via each of the plurality of wells.

Double Patenting

1. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. A nonstatutory obviousness-type double patenting rejection is appropriate where the conflicting claims are not identical, but at least one examined application claim is not patentably distinct from the reference claim(s) because the examined application claim is either anticipated by, or would have been obvious over, the reference claim(s). See, e.g., *In re Berg*, 140 F.3d 1428, 46 USPQ2d 1226 (Fed. Cir. 1998); *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) or 1.321(d) may be used to overcome an actual or provisional rejection based on a

nonstatutory double patenting ground provided the conflicting application or patent either is shown to be commonly owned with this application, or claims an invention made as a result of activities undertaken within the scope of a joint research agreement.

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

2. Claims 1-33 and 40-43 are provisionally rejected on the ground of nonstatutory obviousness-type double patenting as being unpatentable over claims 1-31 of copending Application No. 11/873,186. Although the conflicting claims are not identical, they are not patentably distinct from each other because although the claims of the instant application are broader in scope than the claims of '186, the claims encompass the same subject matter claimed within the '186 application, and, therefore, it would have been obvious to one having ordinary skill in the art at the time the invention was made to include the claims within the same application in order to provide for broadened patent protection.

This is a provisional obviousness-type double patenting rejection because the conflicting claims have not yet been patented.

Response to Arguments

3. Applicant's arguments, with respect to the rejection(s) of the claim(s) as anticipated by Neal et al. have been fully considered and are persuasive in light of Applicant's amendments made to each of the independent claims. Therefore, the rejection has been withdrawn. However, upon further consideration of Applicant's newly recited limitations, a new ground(s) of rejection is made in view of Albers et al. as provided above.

Conclusion

4. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Angela M. DiTrani whose telephone number is (571)272-2182. The examiner can normally be reached on M-F, 7:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Bagnell can be reached on (571)272-6999. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

AD
05/08/10
/Zakiya W. Bates/
Primary Examiner, Art Unit 3676

Notice of References Cited	Application/Control No. 11/291,496	Applicant(s)/Patent Under Reexamination MCNEEL ET AL.	
	Examiner Angela M. DiTrani	Art Unit 3676	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-2006/0243437	11-2006	Albers et al.	166/250.01
*	B	US-6,729,394	05-2004	Hassan et al.	166/245
	C	US-			
	D	US-			
	E	US-			
	F	US-			
	G	US-			
	H	US-			
	I	US-			
	J	US-			
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N					
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
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	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

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11/291,496	12/01/2005	166	3676	2005-IP-018647U1

APPLICANTS

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Dave McLeod, Houston, TX;

**** CONTINUING DATA **************************

**** FOREIGN APPLICATIONS **************************

**** IF REQUIRED, FOREIGN FILING LICENSE GRANTED ****
01/06/2006

Foreign Priority claimed ☐ Yes ☑ No 35 USC 119(a-d) conditions met ☐ Yes ☑ No Verified and Acknowledged /ANGELA M DITRANI/ Examiner's Signature	☐ Met after Allowance Initials	STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
		WY	7	39	5

ADDRESS

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TITLE

Method and apparatus for centralized well treatment

FILING FEE RECEIVED		
3592	FEES: Authority has been given in Paper No._____ to charge/credit DEPOSIT ACCOUNT No._____ for following:	☐ All Fees ☐ 1.16 Fees (Filing) ☐ 1.17 Fees (Processing Ext. of time) ☐ 1.18 Fees (Issue) ☐ Other _____ ☐ Credit

BIB (Rev. 05/07).

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S28	1	("20040108853").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/21 11:15
S29	1	("4199680").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/21 11:16
S30	25	("2951535" | "2968721" | "3002091" | "3129331" | "4071756").PN. OR ("4199680").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/21 11:20
S31	1	("6644844").PN.	USPAT; USOCR	OR	OFF	2010/04/21 12:18
S32	18	("4003431" | "4089053" | "4239396" | "4915505" | "5026168" | "5103908" | "5114239" | "5289877" | "5355951" | "5538341" | "5571281" | "6193402" | "6286986").PN. OR ("6644844").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/21 12:18
S33	510	137/861.ccls.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 07:28
S34	2	S33 and (subterranean welL$1bore$1 bore $1hole$1 down$1hole$1 oil$1well$1 oil $1field$1)	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 07:29
S35	424	166/90.1.ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/04/23 07:30
S36	1	("20070201305").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 07:38
S37	2	("2953460").PN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 07:40
S38	76	S35 and manifold$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/04/23 08:57
S39	23	("2801218" | "2876839" | "3305016" | "3378074" | "3405062" | "3552494").PN. OR ("3722595").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 09:00
S40	28	S38 and fractur$3	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 09:00
S41	14	("3486560" | "3722595" | "3766986" | "3980136" | "4126181" | "4512405" | "4569394" | "4635727" | "4665982").PN. OR ("4716932").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 09:48
S42	1	("4716932").PN.	USPAT; USOCR	OR	OFF	2010/04/23 10:57

S43	14	("3486560" | "3722595" | "3766986" | "3980136" | "4126181" | "4512405" | "4569394" | "4635727" | "4665982").PN. OR ("4716932").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 10:57
S44	2917	(137/565.29,572,597,861,897).ccls.	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/04/23 11:06
S45	10	S44 and (subterranean welL$1bore$1 bore $1hole$1 down$1hole$1 oil$1well$1 oil $1field$1)	US-PGPUB; USPAT; USOCR	OR	OFF	2010/04/23 11:06
S46	10	S44 and (subterranean welL$1bore$1 bore $1hole$1 down$1hole$1 oil$1well$1 oil $1field$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/04/23 11:06
S47	1	("7234524").PN.	USPAT; USOCR	OR	OFF	2010/05/06 10:33
S48	29	("20020004014" | "20020011335" | "20040134662" | "20040253734" | "20040262008" | "20050137432" | "20050178556" | "3695047" | "3780750" | "4589434" | "4732215" | "4848475" | "5025865" | "6102124" | "6196314" | "6281489" | "6292756" | "6467340" | "6536528" | "6539778" | "6575248" | "6640900" | "6640901" | "6663361" | "6725924" | "6772840" | "6869251").PN. OR ("7234524").URPN.	US-PGPUB; USPAT; USOCR	OR	OFF	2010/05/06 10:33
S49	2760	(subterranean well$1bore$1 bore$1hole$1 oil$1well$1 oil$1field$1 well$1head$1 well $1pad$1 (well$1 with pad$1)) and stimulat $4 and prop$1ant$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/06 11:03
S50	155	S49 and manifold$1	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/06 11:03
S51	220	(subterranean well$1bore$1 bore$1hole$1 oil$1well$1 oil$1field$1 well$1head$1 well $1pad$1 (well$1 with pad$1)) and (stimulat $4 fractur$3) and prop$1ant$1 and (manifold$1 header$1)	US-PGPUB; USPAT; USOCR; FPRS; EPO; JPO; DERWENT; IBM_TDB	OR	OFF	2010/05/06 11:48
S52	0	("2009/0114392").URPN.	USPAT	OR	OFF	2010/05/06 11:54
S53	2	(("4126181") or ("4176064")).PN.	USPAT; USOCR	OR	OFF	2010/05/06 12:11
S54	1	("4239396").PN.	USPAT; USOCR	OR	OFF	2010/05/06 14:13

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**		
	Application Number	11291496
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	First Named Inventor	William L. McNeel
	Art Unit	3676
	Examiner Name	Angela Ditrani
	Attorney Docket Number	2005-IP-018647U1

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Examiner Initial*	Cite No	Patent Number	Kind Code[1]	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	6236894	B1	2001-05-22	Stoisits et al.	
	2	7367411	B2	2008-05-06	Leuchtenberg	

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	1	20020125011	A1	2002-09-12	Snider et al.	
	2	20060081412	A1	2006-04-20	Wright et al.	

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Examiner Initial*	Cite No	Foreign Document Number[3]	Country Code[2] i	Kind Code[4]	Publication Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear	T[5]
	1	WO2008/041010		A1	2008-04-10	Halliburton Energy Services, Inc.		☐

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ALL REFERENCES CONSIDERED EXCEPT WHERE LINED THROUGH. /A.D./