



(56)

References Cited

U.S. PATENT DOCUMENTS

D756,373 S \* 5/2016 Raskin ..... D14/485  
 D757,028 S \* 5/2016 Goldenberg ..... D14/485  
 D759,063 S \* 6/2016 Chen ..... D14/486  
 9,394,769 B2 7/2016 Nenniger  
 D763,277 S \* 8/2016 Ahmed ..... D14/485  
 D764,501 S \* 8/2016 Dias ..... D14/486  
 D767,624 S \* 9/2016 Lee ..... D14/488  
 D768,152 S \* 10/2016 Gutierrez ..... D14/485  
 D770,476 S \* 11/2016 Jitkoff ..... D14/485  
 D771,116 S \* 11/2016 Dellinger ..... D14/487  
 D776,683 S \* 1/2017 Gobinski ..... D14/485  
 D777,177 S \* 1/2017 Chen ..... D14/485  
 D779,514 S \* 2/2017 Baris ..... D14/486  
 D782,526 S \* 3/2017 Rind ..... D14/488  
 D785,022 S \* 4/2017 Vazquez ..... D14/486  
 D786,280 S \* 5/2017 Ma ..... D14/486  
 D786,896 S \* 5/2017 Kim ..... D14/485  
 D788,123 S \* 5/2017 Shan ..... D14/485  
 D788,128 S \* 5/2017 Wada ..... D14/485  
 D788,792 S \* 6/2017 Alessandri ..... D14/485  
 9,745,833 B2 8/2017 Carvajal et al.  
 D798,886 S \* 10/2017 Prophete ..... D14/485  
 D800,742 S \* 10/2017 Rhodes ..... D14/485  
 D800,744 S \* 10/2017 Jitkoff ..... D14/485  
 D803,235 S \* 11/2017 Markson ..... D14/485  
 D805,525 S \* 12/2017 Dascola ..... D14/485  
 D806,108 S \* 12/2017 Day ..... D14/486  
 D807,900 S \* 1/2018 Raji ..... D14/485  
 D808,981 S \* 1/2018 Hazam ..... D14/485  
 9,864,353 B2 1/2018 Tonkin et al.  
 D822,678 S \* 7/2018 Wu ..... D14/485  
 D823,326 S \* 7/2018 Pinzon Garcia ..... D14/486  
 D823,860 S \* 7/2018 Wiffen ..... D14/485  
 D830,382 S \* 10/2018 Marohn ..... D14/486  
 D833,459 S \* 11/2018 Blechschmidt ..... D14/485  
 D841,017 S \* 2/2019 Bathla ..... D14/485  
 D849,014 S \* 5/2019 Senders ..... D14/485  
 D853,412 S \* 7/2019 Hofner ..... D14/485  
 D854,030 S \* 7/2019 Dascola ..... D14/485  
 D888,739 S \* 6/2020 Christiana ..... D14/486  
 D905,734 S \* 12/2020 Christiana ..... D14/488  
 D906,358 S \* 12/2020 Christiana ..... D14/486  
 10,982,516 B2 4/2021 Arukhe et al.  
 11,188,209 B2 \* 11/2021 Kaufthal ..... G06F 9/451  
 D938,974 S \* 12/2021 Wang ..... D14/486  
 D941,849 S \* 1/2022 Knowles ..... G06F 9/451  
 D14/492  
 11,243,976 B2 \* 2/2022 Beckham ..... G06F 16/29  
 11,250,176 B2 \* 2/2022 Schwartz ..... G06K 7/1413  
 2005/0121190 A1 6/2005 Oberkircher et al.  
 2007/0168056 A1 7/2007 Shayegi et al.  
 2008/0236839 A1 10/2008 Oddie  
 2008/0262737 A1 10/2008 Thigpen et al.  
 2009/0308601 A1 12/2009 Poe et al.  
 2010/0005411 A1 \* 1/2010 Duncker ..... G06F 3/0482  
 715/769  
 2010/0217575 A1 8/2010 Briers et al.  
 2011/0042083 A1 2/2011 Sierra et al.  
 2011/0301851 A1 12/2011 Briers et al.  
 2012/0095603 A1 4/2012 Rashid et al.  
 2012/0194558 A1 \* 8/2012 Dykes ..... G06T 11/206  
 345/660  
 2014/0039793 A1 2/2014 Querales  
 2014/0358511 A1 12/2014 Waage et al.  
 2016/0054713 A1 2/2016 Foss et al.  
 2016/0061003 A1 3/2016 Gottumukkala et al.  
 2016/0273315 A1 9/2016 Carvajal et al.  
 2016/0312552 A1 10/2016 Early et al.  
 2016/0328497 A1 11/2016 Hamza et al.  
 2016/0369590 A1 12/2016 Tonkin et al.  
 2017/0081950 A1 3/2017 Filatyev et al.  
 2017/0177761 A1 6/2017 Early et al.  
 2018/0030816 A1 2/2018 Devalve et al.  
 2018/0066515 A1 3/2018 Balan et al.  
 2018/0119533 A1 5/2018 Alhuthali et al.

2018/0285515 A1 10/2018 Isichei  
 2018/0347326 A1 12/2018 Shammari et al.  
 2020/0242497 A1 7/2020 Shahkarami et al.  
 2020/0362670 A1 11/2020 Alanazi et al.  
 2020/0362674 A1 11/2020 Alanazi et al.  
 2020/0362697 A1 11/2020 Alanazi et al.  
 2021/0102446 A1 4/2021 Alghazali  
 2021/0148196 A1 5/2021 Bukhamseen et al.  
 2021/0277747 A1 9/2021 Al Naimi et al.

FOREIGN PATENT DOCUMENTS

WO 2016205158 12/2016  
 WO WO 2016195846 12/2016  
 WO WO 2020232218 11/2020

OTHER PUBLICATIONS

Ranjith et al., "Production Optimization Through Utilization of Smart Wells in Intelligent Fields," SPE 185709, presented at the SPE Western Regional Meeting, Bakersfield, CA, Apr. 23, 2017, 29 pages.  
 PCT International Search Report and Written Opinion in International Appln. No. PCT/US2020/032833, dated Aug. 11, 2020, 16 pages.  
 Abukhamsin et al., "Inflow profiling and production optimization in smart wells using distributed acoustic and temperature measurements," A dissertation submitted to the Department of Energy Resources Engineering the Committee on Graduate Studies of Stanford University, Jun. 2017, 190 pages.  
 Bukhamsin et al., "Optimization of multilateral well design and location in a real field using a continuous genetic algorithm," SPE 136944, presented at the SPE/DGS Annual Saudi Arabia Section Technical Symposium and Exhibition, Apr. 4-7, 2010, 16 pages.  
 Cetkovic et al., "A methodology for multilateral wells optimization—field case study," SPE 183004, presented at the Abu Dhabi International Petroleum Exhibition & Conference, Abu Dhabi, UAE, Nov. 7-10, 2016, 18 pages.  
 PCT International Search Report and Written Opinion in International Appln. No. PCT/US2020/032831, dated Aug. 11, 2020, 16 pages.  
 PCT International Search Report and Written Opinion in International Appln. No. PCT/US2020/032835, dated Aug. 11, 2020, 16 pages.  
 Al-Anazi et al., "Innovative Production Optimization Technique for Smart Well Completions Using Real-Time Nodal Analysis Applications," SPE-189198-MS, presented at the SPE Symposium: Production Enhancement and Cost Optimisation held in Kuala Lumpur, Malaysia, Nov. 7-8, 2017, 14 pages.  
 PCT International Search Report and Written Opinion in International Appln. No. PCT/US2020/060864, dated Mar. 3, 2021, 19 pages.  
 Brouwer et al., "Recovery Increase through Water Flooding with Smart Well Technology," SPE 68979 presented at the SPE European Formation Damage Conference, The Neatherlands, May 21-22, 2001, 10 pages.  
 Edabi and Davies, "Techniques for Optimum Placement of Interval Control Valve(s) in an Intelligent Well," SPE 100191 presented at the SPE Europe/EAGE Annual Conference and Exhibition, Austria, Jun. 12-15, 2006, 11 pages.  
 Elmsallati and Davies, "Automatic Optimization of Infinite Variable Control Valves," IPTC-10319, presented at the International Petroleum Technology Conference, Qatar, Nov. 21-23, 2005, 7 pages.  
 Farshi, "Improving Genetic Algorithms for Optimum Well Placement," Master's Report, Department of Energy Resources Engineering, Stanford University, California, Jun. 2008, 94 pages.  
 Ghosh and King, "Optimization of Smart Well Completion Design in the Presence of Uncertainty," SPE 166008, presented at the SPE Reservoir Characterization and simulation Conference and Exhibition held in Abu Dhabi, Sep. 16-18, 2013, 17 pages.  
 Glandt, "Reservoir Aspects of Smart Wells," SPE 81107 presented at the SPE Latin America and Caribbean Petroleum Engineering Conference, Trinidad, Apr. 27-30, 2003, 11 pages.

(56)

**References Cited**

## OTHER PUBLICATIONS

Haupt and Haupt, "Practical Genetic Algorithms," 2nd Edition, John Wiley & Sons, New York, 2004, 261 pages.

Holland, "Genetic algorithms," *Scientific American*, pp. 66-79, Jul. 1992, 14 pages.

Jalali et al., "Intelligent Completion System—The Reservoir Rationale," SPE 50587, presented at the SPE European Petroleum Conference, The Netherlands, Oct. 20-22, 1998, 6 pages.

Lorenz et al., "Uniform Inflow Completion System Extended Economic Field Life: A Field Case Study and Technology Overview," SPE 101895, presented at the SPE Annual Technical Conference and Exhibition, Texas, Sep. 24-27, 2006, 9 pages.

Mitchell, "An Introduction to Genetic Algorithms," Chapter 1-4, Chapter 6, Appendix A-B, MIT Press, 1996, 162 pages.

Naus et al., "Optimization of Commingled Production using Infinitely Variable Inflow Control Valves," SPE 90959, presented at the SPE Annual Technical Conference and Exhibition, Texas, Sep. 26-29, 2004, 12 pages.

Radcliff, "Formal Analysis and Random Respectful Recombination," proceedings of 4th International Conference and Genetic Algorithms, San Mateo, CA, 1991, 9 pages.

Rudolph, "Convergence Analysis of Canonic Genetic Algorithms," *IEEE Transactions on Neural Networks*, special issue on Evolutionary Computational vol. No. 1, Jan. 1994, 6 pages.

Sinha et al., "Flow Equilibration Toward Horizontal Well Using Downhole Valves," SPE 68635 presented at the SPE Asia Pacific Oil and Gas Conference and Exhibition, Indonesia, Apr. 17-19, 2001, 6 pages.

Yeten and Jalali, "Effectiveness of Intelligent Completions in a Multiwell Development," 2001 SPE Middle East Oil Show, Bahrain, Mar. 17-20, 2017 pages.

GCC Examination Report in GCC Appln. No. GC 2020-40905, dated Oct. 18, 2021, 4 pages.

GCC Examination Report in GCC Appln. No. GC 2020-39758, dated Nov. 4, 2021, 4 pages.

GCC Examination Report in GCC Appln. No. GC 2020-39751, dated Aug. 19, 2021, 4 pages.

GCC Examination Report in GCC Appln. No. GC 2020-39756, dated Aug. 23, 2021, 5 pages.

Sampaio et al., "Optimization of proactive control valves of producer and injector intelligent wells under economic uncertainty," presented at the SPE Europec/EAGE Annual Conference, Copenhagen, Denmark, Jun. 2012, 13 pages.

Alghareeb et al., "Proactive Optimization of Oil Recovery in Multilateral Wells Using Real Time Production Data," SPE 124999, presented at the SPE Annual Technical Conference and Exhibition, New Orleans, Louisiana, 16 pages.

Carvajal et al., "A Smart Flow for SmartWells: Reactive and Proactive Modes," presented at the SPE Intelligent Energy Conference & Exhibition, Utrecht, The Netherlands, Apr. 2014, 15 pages.

Das et al., "A Novel Workflow for Intelligent Well Inflow Control Valve Design by Integrating Reservoir Dynamics to Facilitate Proactive Reservoir Management in Minagish Field, West Kuwait," presented at the SPE Annual Technical Conference and Exhibition, Amsterdam, 2014, 15 pages.

\* cited by examiner

