

DECLARATION PART 2

This section of my declaration addresses Grounds 6-7, as follows:

Declaration Part	Summary	Description
Part 2 (Ex. 1002-2)	Ground 6	<i>Christie</i> (§ 103 against All Claims)
	Ground 7	<i>Christie, Pitcher, and Al-Salmanni</i> (§ 103 against All Claims)

XV. PRIOR ART GROUNDS

A. GROUND 6: CHRISTIE ALONE RENDERS ALL CLAIMS OBVIOUS

154. It is my opinion that *Christie* alone renders all Challenged Claims obvious.

1. INDEPENDENT CLAIM 1

155. It is my opinion that *Christie* alone renders Claim 1 obvious and discloses, or at least suggests each and every limitation of Claim 1.

a. 1.1: “A method of hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the method comprising:”

156. To the extent the preamble is limiting, *Christie* discloses a method of hydraulically fracturing a plurality of wells, including a first and second well.¹⁰²

¹⁰² I understand that the preambles may not be limiting. However, I include analysis of the preamble for Claim 1 out of an abundance of caution.

Christie teaches well treatment systems and methods that “enable coordinated pumping operations,” including “a fracturing fluid system having a fracturing fluid mixing and pumping system for facilitating well fracturing operations including pumping a fracturing fluid into a wellbore extending into a subterranean formation from a surface of an oil and gas wellsite.”¹⁰³ *Christie* teaches, and a POSITA would have understood, that “fracturing” is a type of “stimulation” or “treatment” operation, and that “fracturing fluid” is a type of “treatment (e.g., stimulation) fluid.”¹⁰⁴

157. Further, *Christie* further explicitly discloses “a system that includes a fracturing fluid system having a fracturing fluid mixing and pumping system for facilitating well fracturing operations including pumping a fracturing fluid into a wellbore extending into a subterranean formation from a surface of an oil and gas wellsite.”¹⁰⁵ *Christie*’s Figure 1 shows an example “wellsite system 100” containing “multiple wellbores 102,” including a first and second well, “each extending from a terrain surface of a wellsite 104.”¹⁰⁶

¹⁰³ *Christie*, Abstract, [0009]; see also *Christie* [0036], [0039], Claim 2 ,13, 20; see, *Christie Provisional*, Abstract, [0005], [0101].

¹⁰⁴ *Christie*, [0034], [0039], [0095]; *Christie Provisional*, [0015], [0075].

¹⁰⁶ *Christie*, [0034]; see, *Christie Provisional*, [0022], [00101], Fig. 1.

158. The “wellsite system 100 may facilitate recovery of oil, gas, and/or other materials that are trapped in the subterranean formation 106” by injecting fluid “into one or more of the well bores 102 during fracturing and other stimulation operations.”¹⁰⁷ More specifically, *Christie* discloses that the treatment fluid system of the wellsite system is “operable to [] produce a fracturing fluid that may be pressurized and injected into a selected wellbore 102 during hydraulic fracturing operations.”¹⁰⁸

159. Accordingly, *Christie* discloses a method of hydraulically fracturing a plurality of wells, the plurality of wells comprising a first and second well.

b. 1.2: “communicating fluid from one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps; and”

(1)communicating fluid from one or more pumps to the first well via a manifold and a first valve,

160. *Christie* discloses, as part of wellsite system 100, a “fleet of pump units 150 [annotated in red],” that each “include a pump 152 [annotated in blue], a prime

¹⁰⁷ *Christie*, [0034], [0036], [0039]-[0041], [0045], [0047]-[0048], and *Christie* generally; see *Christie Provisional*, [0016], [0017], [0029], [0049], [0065], and *Christie Provisional* generally.

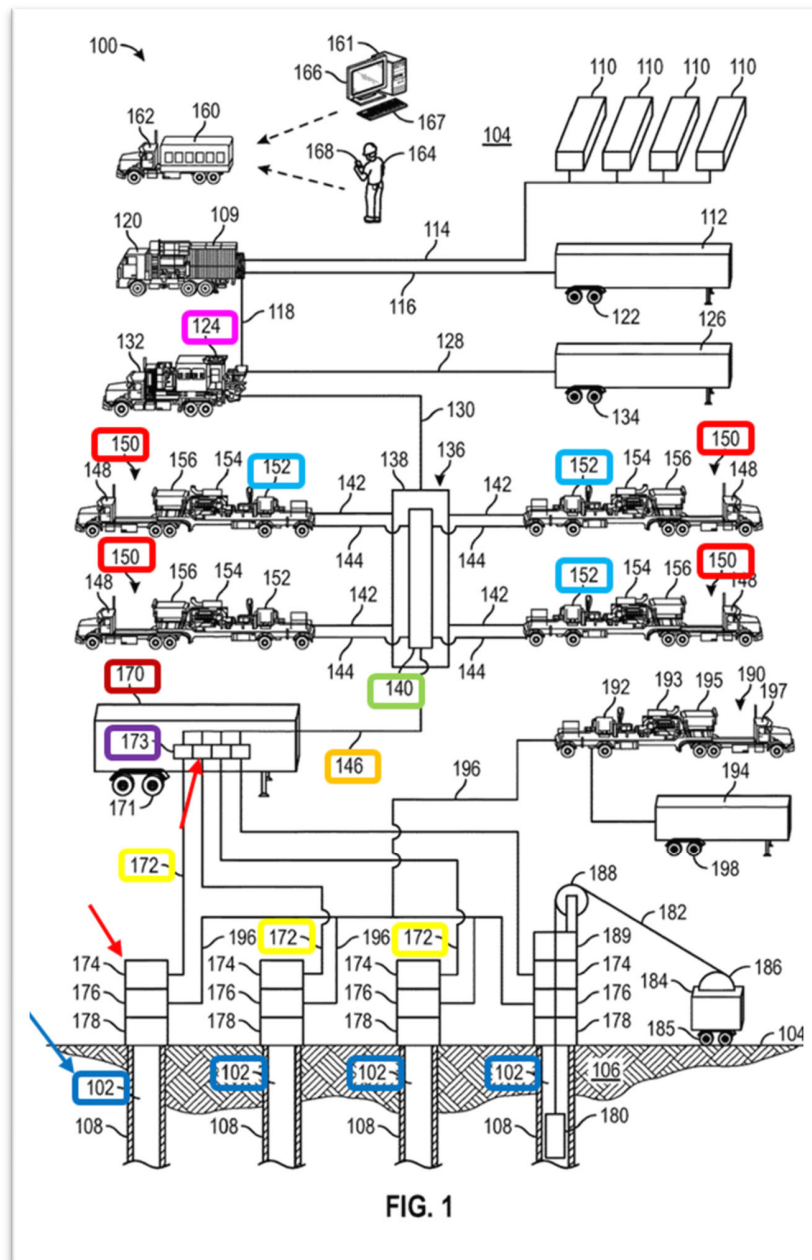
¹⁰⁸ *Christie*, [0039]; see *Christie Provisional*, [0022].

mover 154, and perhaps a heat exchanger 156.”¹⁰⁹ These pumps receive fracturing fluid from the mixer (blender) 124 (annotated in magenta) and discharge the fracturing fluid “under pressure into a corresponding inlet of the high-pressure collection and discharge manifold 140 [annotated in green].”¹¹⁰ The fracturing fluid is then discharged from “manifold 140 via one or more conduits 146 [annotated in orange]” to deliver the fracturing fluid to “fracturing manifold 170, [annotated in dark red].”¹¹¹ These components are shown in Fig. 1 (annotated below). Fig. 1 is also included as part of the *Christie Provisional*.

¹⁰⁹ *Christie*, [0037]-[0038]; see *Christie Provisional*, [0020]-[0021], Fig. 1.

¹¹⁰ *Christie*, [0038]; see *Christie Provisional*, [0021].

¹¹¹ *Christie*, [0038]; see *Christie Provisional*, [0021].



Christie, Fig.1 (annotated)¹¹²

¹¹² Christie, Fig. 1; see Christie Provisional, Fig. 1.

161. The fracturing manifold 170 “may selectively distribute the treatment fluid between the wellbores 102 [annotated in dark blue] via a plurality of corresponding fluid conduits 172 [annotated in yellow] extending between the fracturing manifold 170 and each wellbore 102.”¹¹³ The “fracturing manifold 170 may include a plurality of remotely operated fluid flow control valves 173 [annotated in purple] (e.g., frac valves, shut-off valves), each remotely operable to fluidly connect (and disconnect) the fluid conduit 146 to (and from) a selected one or more of the fluid conduits 172 and, thus, *facilitate injection of the treatment fluid into a selected one or more of the wellbores* 102. The fracturing manifold 170 may be known in the art as a “zipper manifold.”¹¹⁴ The “plurality of remotely operated fluid flow control valves 173” include a first and second valve.

162. Further, *Christie* discloses that “[e]ach wellbore 102 may be capped by a plurality (e.g., a stack) of fluid flow control devices 174, 176, which may include or form a Christmas tree (e.g., a frac tree) including fluid flow control valves.”¹¹⁵ “[T]he fluid flow control valves of the fluid flow control device 174, 176 may be configured to close selected tubulars or pipes [] to selectively facilitate fluid access to the wellbore 102.”¹¹⁶ The fluid flow control device/valve 174 of the first and

¹¹³ *Christie*, [0039]; see *Christie Provisional*, [0023].

¹¹⁴ *Christie*, [0040]; see *Christie Provisional*, [0023].

¹¹⁵ *Christie*, [0041]; see *Christie Provisional*, [0024].

¹¹⁶ *Christie*, [0041]; see *Christie Provisional*, [0024].

second wells would be a first valve and a second valve, respectively. Further, “each fluid flow control valve 173 of the fracturing manifold 170 may be fluidly connected to a corresponding fluid flow control device 174 via one or more fluid conduits 172, to facilitate selective fluid connection between the common manifold 136 and one or more of the wellbores 102.”¹¹⁷

163. The valves 173 of the fracturing manifold 170 and the valves 174, 176 “may collectively form a fluid flow control valve system configured to fluidly connect (and disconnect) one of the treatment fluid system and a pump-down system, as described herein, to (and from) a selected one or more of the wellbores 102.”¹¹⁸

164. Accordingly, *Christie* discloses communicating fluid from one or more pumps (152) to the first well (one of wellbores 102, identified with blue arrow in annotated Fig. 1 above) via a manifold (170) and a first valve (one of a plurality of valves 173 or valves 174, identified with red arrows in annotated Fig. 1 above).

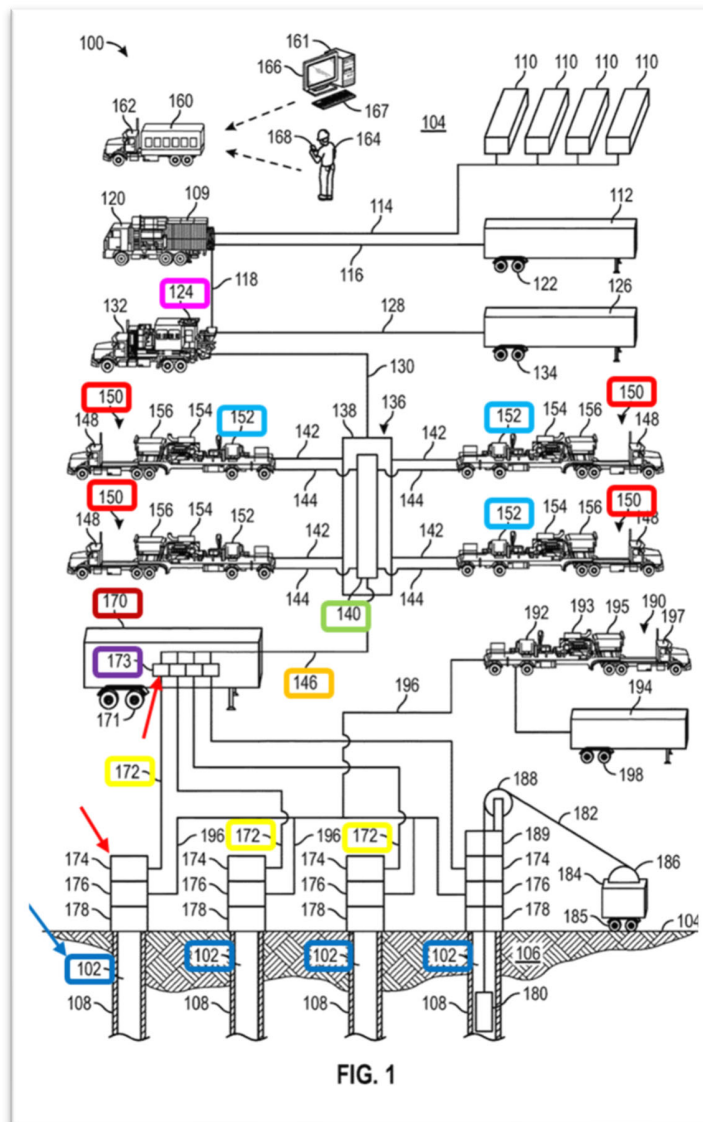
**(2) wherein the first valve is associated with both
the first well and the manifold**

165. As seen in the annotated *Christie* Figure 1 below, valves 173 (including a first valve, identified with red arrow) are part of zipper manifold 170 (annotated in

¹¹⁷ *Christie*, [0041]; *Christie Provisional*, [0024].

¹¹⁸ *Christie*, [0041]; *Christie Provisional*, [0024].

dark red), and thus are associated with the manifold. Further, the first valve communicates fluid to the first well via an isolated conduit 172 (annotated in yellow). Accordingly, the first valve is also associated with the first well.



Christie, Fig.1 (annotated)¹¹⁹

¹¹⁹ Christie, Fig. 1; see Christie Provisional, Fig. 1.

166. Further still, *Christie* teaches that “each fluid flow control valve 173 of the fracturing manifold 170 may be fluidly connected to a corresponding fluid flow control device 174 via one or more fluid conduits 172, to facilitate selective fluid connection between the common manifold 136 and one or more of the wellbores 102.”¹²⁰ Accordingly, valves 174 (including a first valve, identified with red arrow) is part of the wellhead tree associated with the first well and thus is associated with the first well. As the first valve 174 is fluidly directly connected between the manifold and the first well (via first valve 173), first valve 174 is also associated with the manifold.

167. Therefore, *Christie* teaches multiple examples of a first valve associated with both a first well and the manifold.

(3)so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps; and”

168. Because the first valve 173 is part of the fracturing manifold 170, and connects and disconnects the first well with/from the manifold to “facilitate injection of treatment fluid,”¹²¹ valves 173 (including a first valve) is in fluid communication with the manifold.

¹²⁰ *Christie*, [0041]; *see Christie Provisional*, [0024].

¹²¹ *Christie*, [0040]; *see Christie Provisional*, [0023].

169. Further, as described above and shown in annotated Figure 1 above, the first valve controls fluid delivered from the pumps (pump units 150 [annotated in red] with each pump unit having a pump 152 [annotated in blue]) and to the first well 102. This shows that the valve is fluidically positioned between the first well and the plurality of pumps.

170. Additionally, as *Christie* teaches that the valves 174 (including a first valve identified with red arrow) is connected between the manifold 170 and the first well (identified with blue arrow), the first valve is in fluid communication with the manifold, fluidically positioned between the manifold (and the pumps, which are upstream of the manifold) and the first well.¹²²

171. Accordingly, *Christie* discloses this limitation.

c. 1.3: “executing a continuous pumping (“CP”) swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

172. *Christie* discloses a continuous pumping (CP) swap as claimed. The specification of the '952 Patent does not provide a specific definition for “continuous pumping” or “continuous pumping swap,” but rather describes various steps that are part of the CP swap. Claim Limitation 1.3 provides that a CP swap is executed and

¹²² *Christie*, [0040], [0041]; see *Christie Provisional*, [0023], [0024].

the subsequent claim language is used to describe a “CP Swap” for purposes of Claim 1 and its dependent claims.

173. *Christie* uses a controller to “coordinate automation control commands to inform sub-services of the timing of each operation at the wellsite 104,” which “may automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves 444, pressure testing, bleeding off pressure, and providing safety interlocks.”¹²³ The controller 410 can “maintain a completion strategy (e.g., order) by determining which wellbore 102 is to be completed and orchestrating movement to the next intended wellbore 102 in the plan.”¹²⁴ Accordingly, *Christie* discloses a “swap” from fracturing a first well to fracturing a second well.

174. *Christie*’s controller monitors and coordinates control of “the stimulation operations performed by the stimulation system[] and the fluid flow control valve operations performed by the wellhead fluid flow control valve system [] to implement optimal (e.g., most efficient) wellsite equipment coordination across the well services [] with the goal of performing continuous pumping downhole.”¹²⁵

¹²³ *Christie*, [0101]; *Christie Provisional*, [0083].

¹²⁴ *Christie*, [0101]; *Christie Provisional*, [0083].

¹²⁵ *Christie*, [0098]; *Christie Provisional*, [0080].

The controller “may provide or facilitate continuous stimulation operations through the orchestration of such well services.”¹²⁶

175. Further, *Christie* teaches that “the fracturing manifold 170 may be configured to facilitate ‘zipper’ fracturing operations, which may provide improved (perhaps nearly continuous) utilization of the frac crew and equipment, resulting in substantial improvement to the effective use of the fracturing resources and, thus, to the overall economics of the well.”¹²⁷. The use of the term “nearly continuous” here explicitly refers to the “utilization of the frac crew and equipment.” For example, *Christie* recognizes the need for maintenance or repair activities and that such maintenance events may be planned in order to minimize downtime.¹²⁸ Thus, a POSITA would have understood that *Christie*’s disclosure accounts for such maintenance activities and “nearly continuous” does not teach away from continuous pumping, which is one of *Christie*’s goals of the coordinated pumping operations.¹²⁹ Instead, “nearly continuous” would refer to continuous pumping interrupted only by maintenance or other planned activities.¹³⁰

¹²⁶ *Christie*, [0093]; *Christie Provisional*, [0080].

¹²⁷ *Christie*, [0047]; *Christie Provisional*, [0030].

¹²⁸ *Christie*, [0047], [0049], [0101]; *Christie Provisional*, [0030], [0032], [0083].

¹²⁹ *Christie*, [0098]; *Christie Provisional*, [0080].

¹³⁰ See *Christie*, [0102] (disclosing interrupting continuous pumping operation to perform maintenance events); *Christie Provisional*, [0084].

176. *Christie* discloses a zipper fracturing system and method which provides for switching between wells between stages while continuously operating the fracturing pumps (continuous pumping). Implementing the teachings of *Christie* would teach the operator to fracture a stage in one well, then shift to fracture a stage in a next well while keeping the pumps running, and so forth, moving from well-to-well while keeping the pumps running. For example, after moving well-to-well to fracture a first stage in all wells at a multi-well site, with the pumps continuously running, a second stage of the first well may be fractured, followed by the second stage of the next well, etc. This is a conventional pattern of fracturing a four well pad.

177. As discussed in the subsections below, *Christie* also discloses, or at least renders obvious, the steps of a “continuous pumping swap” claimed.

d. 1.3.1: “opening a second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

(1) opening a second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold,

178. *Christie* teaches several specific examples of equipment coordination comprising a sequence of valve operations that allows for the pumps to continue to operate (pump fluid downhole) by overlapping pumping fluid, for example, into the first well and the second well. A controller may use an “orchestration level program [to] provide or facilitate continuous stimulation operations” to obtain “the goal of performing continuous pumping downhole.”¹³¹

179. *Christie* teaches that there is continuous pumping during a swap between hydraulically fracturing one well and hydraulically fracturing a second well. Initially, *Christie* discloses that “the controller 410 may coordinate automation control commands to inform sub-services of the timing of each operation at the wellsite 104. In certain embodiments, the controller 410 may automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves 444, pressure testing, bleeding off pressure, and providing safety interlocks. In certain embodiments, the controller 410 may be configured to maintain a completion strategy (e.g., order) by determining which wellbore 102 is to be completed and orchestrating movement to the next intended wellbore 102 in the plan.”¹³²

¹³¹ *Christie*, [0093], [0098]; *Christie Provisional*, [0075], [0080].

180. *Christie* teaches several specific example of equipment coordination comprising a sequence of valve operations that allows for the pumps to continue to operate (pump fluid downhole) by overlapping pumping, for example, into the first well and the second well, and a controller that may use an “orchestration level program [to] provide or facilitate continuous stimulation operations”¹³³ to obtain “the goal of performing continuous pumping downhole.”¹³⁴

181. For example, *Christie* discloses the steps of a continuous pumping swap as outlined further in the subsections below. *Christie* discloses first “pumping a treatment fluid into a first wellbore 102 or a second wellbore 102 extending into a subterranean formation 106 from a surface of an oil and gas wellsite 104.”¹³⁵ *Christie* further teaches that, after this pumping has begun, “the controller may be further configured to operate the fluid valve system to simultaneously:

fluidly disconnect the pump-down system from the second wellbore 102;

fluidly connect the treatment fluid system to the second wellbore 102 to permit pumping of the treatment fluid into the second wellbore 102;

¹³⁵ *Christie*, [0155], *see also* [0151] (“perform the well treatment operations by operating the treatment fluid system to pump the treatment fluid into the wellbore 102”); *See, Christie Provisional*, [0115], *see also* [0006], [00108], [00113-00114].

fluidly disconnect the treatment fluid system from the first wellbore 102; and
fluidly connect the pump-down system to the first wellbore 102 to permit pumping of the pump-down fluid into the first wellbore 102 to convey the perforating tool 234 within the first wellbore 102.”¹³⁶

182. First, a POSITA reading *Christie* would have understood that the pumps are run continuously throughout this valve swap process, as the pumps are already started at the beginning (*i.e.* “pumping a treatment fluid into a first wellbore 102”) and there is no mention of stopping the pumps during the valve process.

183. Second, *Christie* teaches that “fluidly connecting” and “fluidly disconnecting” a well from the treatment fluid pumping system is simply the operation of valves (e.g., zipper manifold valves 173 and frac tree valves 174).¹³⁷ A POSITA would have understood, based on the teachings of *Christie*, that “operat[ing] the fluid valve system” to “fluidly connecting” a second well to the treatment fluid pumping system would involve opening a second valve to the second well. Conversely, a POSITA would have understood that “fluidly disconnecting” a

¹³⁶ *Christie*, [0156], *see also* [0152]; *See, Christie Provisional*, [0115], *see also* [0006], [00108], [00113-00114].

¹³⁷ *Christie*, [0040]-[0041], [0073]; *Christie Provisional*, [0023]-[0024], [0055], [0069].

well would involve closing a valve (e.g., first valve). This is a well-known function of valves.¹³⁸ Thus, *Christie*'s described swap sequence includes opening a second valve associated with the second well to "fluidly connect the treatment fluid system [(i.e. pumps, etc.,)] to the second wellbore 102 to permit pumping of the treatment fluid into the second wellbore." A POSITA would have recognized that, with the pumps already running, fluidly connecting the pumps to the second wellbore would, in fact, permit pumping of the treatment fluid into the second wellbore.

184. Third, a POSITA reading *Christie* would have understood that the described "simultaneous" swap sequence would not be exactly "simultaneous." For example, a POSITA would have understood based on *Christie* and general fracturing knowledge that the second wellbore would not be fluidly disconnected from the pump-down system and fluidly connected to the fluid treatment system (pumped fracturing fluid) at exactly the same time. Rather, a POSITA would have understood *Christie*'s swap sequence to be performed generally in the same order as recited, e.g., fluidly disconnecting the pump-down system before fluidly connecting the fluid treatment system to a well. For example, *Christie* explains that the controller "operate[s] the fluid valve system to alternatingly connect and disconnect the treatment fluid system and the pump-down system to and from the respective

¹³⁸ *Christie*, Fig. 9, [0160]-[0162]; See, *Christie Provisional*, [00115]-[00116], [0006], [0069], [00108], [00113], [00114].

wellbore.”¹³⁹ This is further evidenced by *Christie*’s clarification from *Christie*’s *Provisional* that the term “simultaneous” means “performed at generally the same time (e.g., concurrently),” *i.e.*, “at least partially overlap in time.”¹⁴⁰

185. Accordingly, the description of the swap process in *Christie* discloses a continuous pumping swap, including opening a second valve to “fluidly connect” pumped fluid to a second wellbore while fluid is being pumped into a first well.

186. Further, *Christie* distinguishes this continuous pumping swap from a “conventional” swap where pumps are shut down before opening and closing valves associated with the manifold and wellbores 102 (fluidly connecting and disconnecting wellbores 102 from the treatment fluid system). For example, *Christie* teaches a separate sequence of valve operations that a POSITA would have recognized as a “conventional” (*i.e.* no continuous pumping) swap in a zipper frac operation. *Christie* teaches the steps of a conventional frac swap including the steps below:¹⁴¹

operate the pump-down system to pump the pump-down fluid;

stop operating the pump-down system to stop pumping the pump-down fluid;

¹³⁹ *Christie*, [0161]; *Christie Provisional*, [0069].

¹⁴⁰ *Christie*, [0033]; *Christie Provisional*, [0006].

¹⁴¹ *See, e.g., Christie*, [0157]; *See, Christie Provisional*) [00116].

fluidly disconnect the pump-down system from the first wellbore 102 and fluidly connect the treatment fluid system to the first wellbore 102 after the perforating tool 234 is retrieved from the first wellbore 102;

operate the treatment fluid system to pump the treatment fluid

stop operating the treatment fluid system to stop pumping the treatment fluid;

fluidly disconnect the treatment fluid system from the second wellbore 102 and fluidly connect the pump-down system to the second wellbore 102 after the perforating tool 234 is inserted into the second wellbore 102;

operate the pumpdown system to pump the pump-down fluid;

stop operating the pump-down system to stop pumping the pump-down fluid;

fluidly disconnect the pump-down system from the second wellbore 102 and fluidly connect the treatment fluid system to the second wellbore 102 after the perforating tool 234 is retrieved from the second wellbore 102;

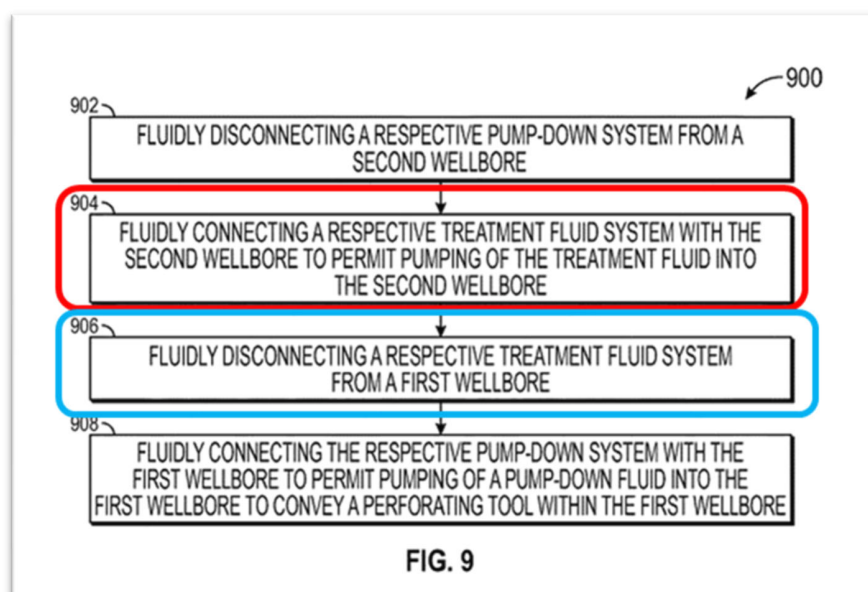
operate the treatment fluid system to pump the treatment fluid;

and stop operating the treatment fluid system to stop pumping the treatment fluid.

187. In this example of embodiments, it is clear that *Christie* is teaching stopping the pumps (*i.e.*, treatment fluid system) before operating valves (*i.e.*, fluidly connecting or disconnecting the treatment fluid system). Accordingly, when the step

of “stop operating the treatment fluid system” is left out, as it is in the continuous pumping swap description above, *Christie* is specifically teaching leaving the pumps running during the valve operations (*i.e.* CP swap).

188. As another example, Figure 9 shows this CP swap valve sequence. The sequence of Figure 9, while not provided in a figure in the *Christie Provisional* application, is described in the *Christie Provisional*.¹⁴² The figure is discussed below for ease of explanation and illustration.



Christie, Fig. 9 (annotated)

¹⁴² See, e.g., *Christie Provisional*, [00115], see also [0006], [00108], [00113], [00114], [00116].

189. As *Christie* teaches, “FIG. 9 is a block diagram of a method 900 for coordinat[ing] pumping operations of a plurality of wellbores 102.”¹⁴³ *Christie* explains that the method 900 includes “operating the fluid valve system to simultaneously” perform the steps 902, 904, 906, and 908.¹⁴⁴ As step 906 (annotated in blue) shows the step of “fluidly disconnecting respective treatment fluid system [*i.e.* fracturing system] from a first wellbore”, a POSITA would have understood that the treatment system would have been connected to the first wellbore before the method of 900 beginning. *Christie* also teaches the same valve sequence associated with the continuous pumping swap displayed in Fig. 9 in several locations, where the steps are performed after pumping has begun.¹⁴⁵

190. Further, as step 904 (annotated in red) discloses “fluidly connecting a respective treatment fluid system with the second wellbore *to permit pumping* of the treatment fluid into the second wellbore”, a POSITA would have understood that this meant opening a valve and pumping fluid into the second well.¹⁴⁶

¹⁴³ *Christie*, [0161], *see also* [0150], [0154]-[0156], [0162], Claim 11; *see, Christie Provisional*, [00115], *see also* [0006], [00108], [00113], [00114].

¹⁴⁴ *Christie*, [0162]; *see also* [0150], [0154]-[0156], [0161], Claim 11; *see, Christie Provisional*, [00115], *see also* [0006], [00108], [00113], [00114].

¹⁴⁵ *Christie*, [0155], *see also* [0151] (“perform the well treatment operations by operating the treatment fluid system to pump the treatment into the wellbore 102”); *see, Christie Provisional*, [00115], *see also* [0006], [00108], [00113], [00114].

¹⁴⁶ *Christie*, Fig.9, *see also* [0160]-[0162]; *Christie Provisional*, [00115]-[00116].

191. With regard to the fluid being communicated from the one or more pumps to the wellbore, *Christie* teaches that, while performing the well swap process (e.g., as demonstrated in method of Figure 9), the controller monitors the operational status of and controls operations of treatment fluid systems configured to pump a treatment fluid into each of a plurality of wellbores, where “the treatment fluid may be or include a fracturing fluid, and the treatment fluid systems may be or include a fracturing fluid mixing and pumping system for facilitating well fracturing operations.”¹⁴⁷ Therefore, before step 906, fluid would have been pumped into the first wellbore and, after step 904, fluid would have been pumped into the second wellbore. Thus, between steps 904 and 906, fluid would have been simultaneously pumped into the first and second wellbores. This would enable *Christie*’s “goal of performing continuous pumping downhole”¹⁴⁸ while swapping between hydraulically fracturing the first well and a second well.

192. Accordingly, *Christie*’s swap between hydraulic fracturing the first well and hydraulically fracturing the second well occurs using the steps of:

Pumping fluid into the first well;

¹⁴⁷ *Christie*, [0101], [0144], [0161]; see, *Christie Provisional*, [0083], [00110], [00115], see also [0006], [00108], [00113], [00114].

¹⁴⁸ *Christie*, [0098]; *Christie Provisional*, [0080].

Opening a second valve (fluidly connecting) to allow hydraulic fracturing fluid to be pumped into the second well while fluid is still pumped to the first well; and

Closing a first valve (fluidly disconnecting) to stop pumping hydraulic fracturing fluid into the first well after opening the second valve.

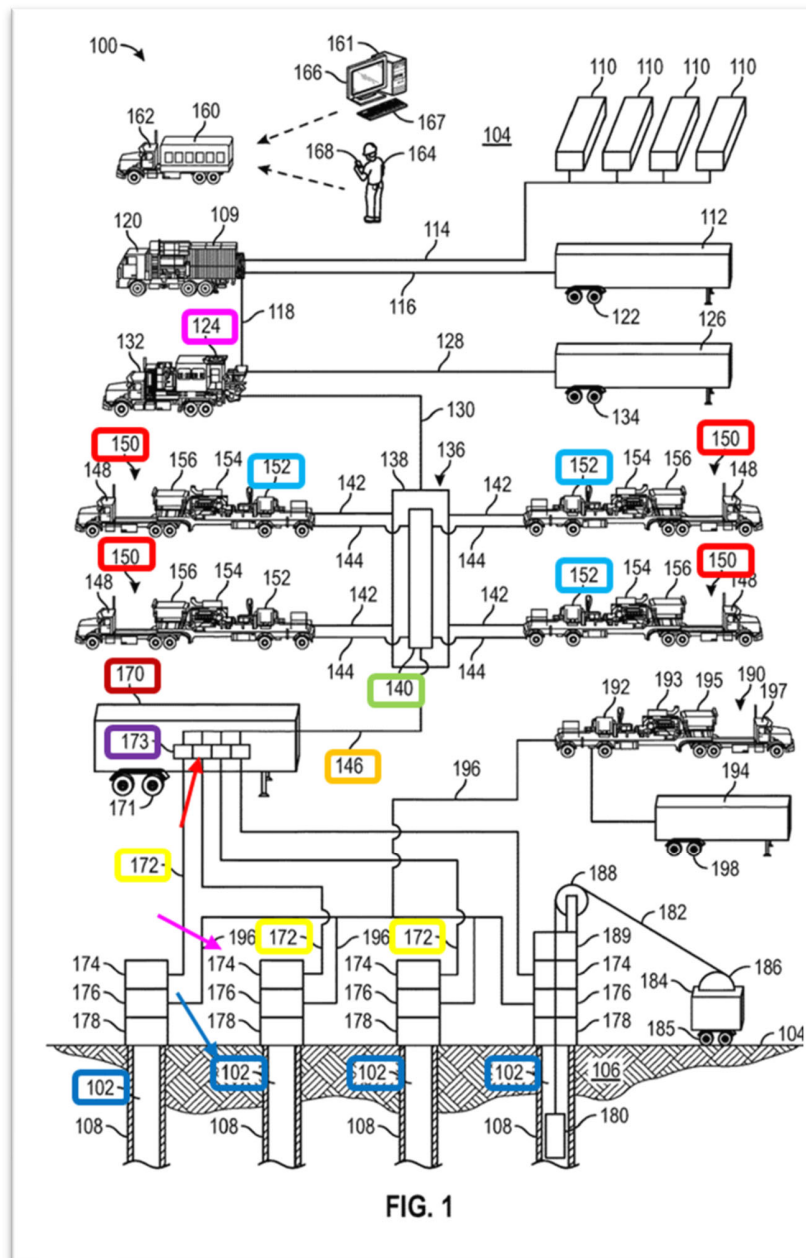
193. To the extent that *Christie* does not explicitly state that the well treatment system is pumping into the first well before step 906 and that the pump was operating continuously through the coordinated valve operations (i.e. fluidly connecting the second well and after that connection, fluidly disconnecting the first well), a POSITA would have found it obvious that fluid would have been pumped into the first well before “fluidly disconnecting” the pumping system from the first well. *Christie* teaches that Fig. 9 is a “block diagram of a method 900 for coordinate[d] pumping operations of a plurality of wellbores,”¹⁴⁹ which, at least suggests that the pumps are being operated during the entirety of Fig. 9, including while the first well is “fluidly connected” to the pumping system. Further, Fig. 9 discloses that the second well is “fluidly connected” to “permit pumping of the treatment fluid into the second wellbore” which shows or provides or allows for the pumps to operate continuously. Further, as discussed above, the goal of *Christie* is to have “continuous pumping” except during planned maintenance events.

¹⁴⁹ *Christie*, [0161]; see, *Christie Provisional*, [00115], see also [0006], [00108], [00113], [00114].

194. Thus, *Christie* discloses opening a second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold.

(2) wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and

195. As seen in the annotated Figure 1 below, valves 173 (including a second valve, identified with red arrow) are part of zipper manifold 170 (annotated in dark red), and thus are associated with the manifold. Further, the second valve communicates fluid from the zipper manifold to the second well 102 (identified with blue arrow) via an isolated conduit 172 (annotated in yellow). Accordingly, the second valve is also associated with the second well.



Christie, Fig.1 (annotated)

196. Further, a similar analysis pertains to second valve 174 (identified with magenta arrow). Second valve 174 (identified with magenta arrow) is part of the wellhead attached to the second well 102 (identified with blue arrow) and thus is

associated with the second well. Further, the second valve 174 communicates fluid from the zipper manifold 170 (annotated in dark red), and thus is associated with the manifold.

197. Accordingly, *Christie's* second valves (173 or 174) are associated with both the manifold and the second well.

(3) and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve,

198. *Christie* discloses that the valves 173 of the fracturing manifold 170 and the frac tree valves 174 may be remotely operable to fluidly connect (and disconnect) the treatment fluid system (including pumps) to (and from) a selected one or more wells “and, thus, facilitate injection of the treatment fluid into a selected one or more of the wellbores 102.”¹⁵⁰ As the second valve is part of the fracturing manifold, and controls (connects and disconnects) the second well from the manifold to “facilitate injection of treatment fluid”, valves 173 (including a second valve) is in fluid communication with the manifold.

199. Further, as described above and shown in annotated Figure 1 above, the second valve (173 or 174) controls fluid delivered from the pumps (pump units 150 [annotated in red] with each pump unit having a pump 152 [annotated in blue]) and

¹⁵⁰ *Christie*, [0040]-[0041]; see *Christie Provisional*, [0023]-[0024].

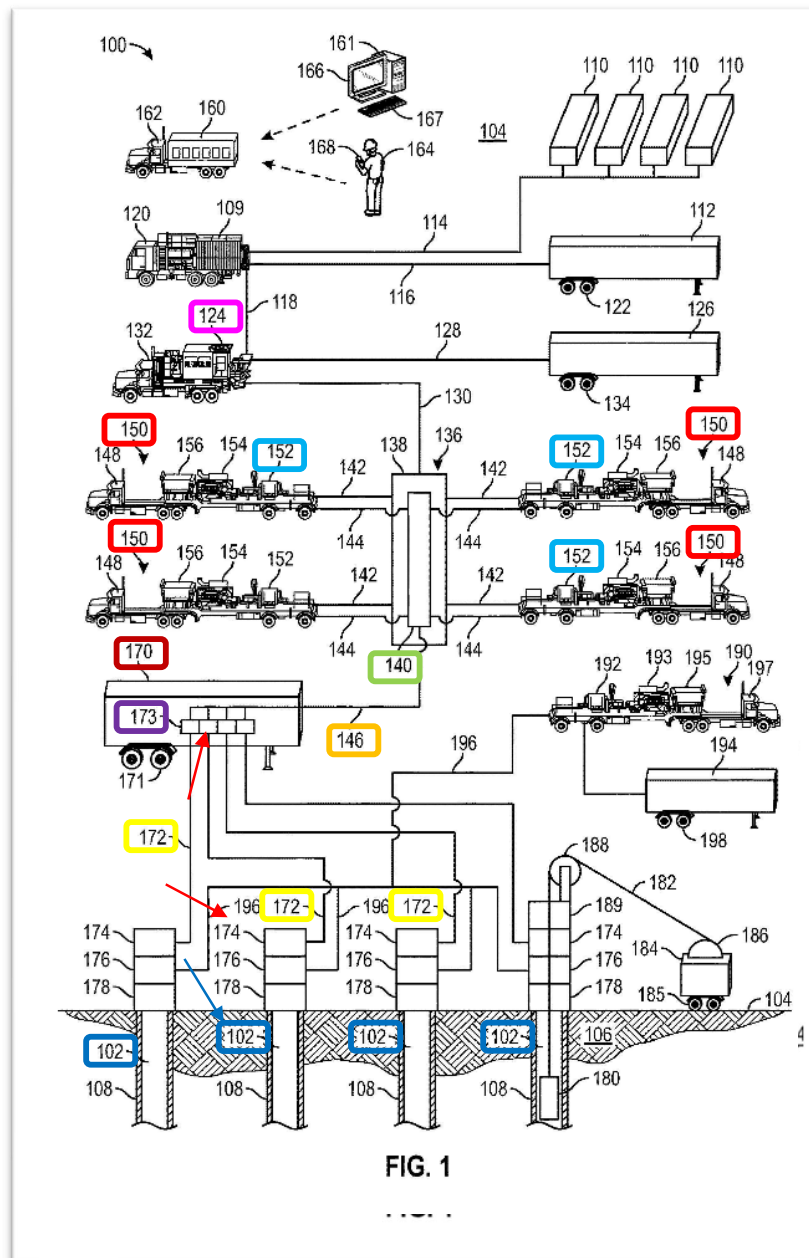
to the second well 102. This shows that the second valves are fluidically positioned between the second well and the plurality of pumps.

(4) wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve,

200. *Christie* discloses, as part of wellsite system 100, a “fleet of pump units 150 [annotated in red],” each including “a pump 152 [annotated in blue], a prime mover 154, and perhaps a heat exchanger 156.”¹⁵¹ These pumps receive fracturing fluid from the mixer (blender) 124 (annotated in magenta) and discharge the fracturing fluid under pressure into a discharge manifold 140 (annotated in green).¹⁵² The fracturing fluid is then delivered from the discharge manifold 140 via one or more conduits 146 (annotated in orange) to a fracturing manifold 170 (annotated in dark red), “which may selectively distribute the treatment fluid between the wellbores 102 [annotated in dark blue] via a plurality of corresponding fluid conduits 172 extending between the fracturing manifold 170 and each wellbore 102.”¹⁵³

¹⁵¹ *Christie*, [0037]-[0038]; see *Christie Provisional*, [0020]-[0021].

¹⁵³ *Christie*, [0038]; see *Christie Provisional*, [0021].



Christie, Fig.1 (annotated)

201. Christie further discloses that “fracturing manifold 170 may include a plurality of remotely operated fluid flow control valves 173 [annotated in purple] (e.g., frac valves, shut-off valves), each remotely operable to fluidly connect (and

disconnect) the fluid conduit 146 to (and from) a selected one or more of the fluid conduits 172 and, thus, *facilitate injection of the treatment fluid into a selected one or more of the wellbores 102*. The fracturing manifold 170 may be known in the art as a zipper manifold.”¹⁵⁴

202. As discussed above, the “plurality of remotely operated fluid flow control valves” includes a second valve, e.g., fracturing manifold valve 173 and frac tree valve 174 (identified with red arrows above), associated with and fluidly connected to a second well. When the second valve(s) is opened “*injection of the treatment fluid into a selected one or more of the wellbores 102,*” *i.e.* second well, occurs.

203. Accordingly, second valves 173 and 174 (identified with red arrows) work together to fluidly connect and disconnect the pumps (treatment fluid system) from the wells. When the second valves are opened, fluid flows (*i.e.*, is pumped) from the pumps to the wells.

204. Accordingly, *Christie* discloses opening the second valve (one of the plurality of valves 173, 174) to cause fluid to be communicated fluid from the one or more pumps (152) to the second well (one of wellbores 102, identified with blue

¹⁵⁴ *Christie*, [0040]-[0041]; *see Christie Provisional*, [0023]-[0024].

arrow) via the manifold (170) and the second valve (one of plurality of valves 173, red arrow or 174, magenta arrow).

- e. **1.3.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold; and”**

205. *Christie* discloses this limitation, or at least it would have been obvious based on the teachings of *Christie*. Limitation 1.3.2 does not provide any limitations on the “conditions” that control opening of the second valve, other than the “conditions include a flowrate and/or a pressure” of at least a portion of the fluid communicated via the manifold. As such any teaching that a flowrate or pressure of at least a portion of the fluid communicated via the manifold influences the opening of the second valve would teach the claimed limitation.

206. Controlling valves, including opening a valve in response to a flowrate or pressure condition was well known to a POSITA for decades prior to the ‘952 Patent. Whether using sensors, or just observing fluid flowing through a valve system, opening or closing valves to alter the flow direction and/or flow conditions, as desired, has been done since the beginning of using valves. In fact, the function of a valve is to control fluid conditions such as flowrate and/or pressure. Further, a review of the ‘952 Patent shows that the ‘952 Patent does not provide any specific flowrate or pressure or other “condition” criteria, how that “condition” is selected,

or any rationale as to how a condition or satisfaction of that condition is selected so as to know when to open the second valve associated with the second well.

207. *Christie* teaches that the operational status monitored by the controller is used to control “fluid flow control valve operations performed by the wellhead fluid flow control valve system 440.”¹⁵⁵ Control of these valves allows for “optimal (e.g., most efficient) well-site equipment coordination across the well services []with the goal of performing continuous pumping downhole.”¹⁵⁶

208. Further, *Christie* discloses that the “controller 410 may automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves 444,” which include the zipper manifold valves 173 and frac tree valves 174.¹⁵⁷ In certain embodiments, the controller 410 may be configured to maintain a completion strategy (e.g., order) by determining which wellbore 102 is to be completed and orchestrating movement to the next intended wellbore 102 in the plan.”¹⁵⁸ A POSITA would have understood these disclosures of *Christie* to teach that the controller would execute an automatic well swap process, including a

¹⁵⁵ *Christie*, [0098]; *Christie Provisional*, [0080].

¹⁵⁶ *Christie*, [0098]; *Christie Provisional*, [0080].

¹⁵⁷ *Christie*, [0101], [0097], [0067]; see *Christie Provisional*, [0083], [0079], [0049].

¹⁵⁸ *Christie*, [0101]; see *Christie Provisional*, [0083].

continuous pumping swap as described above regarding limitations 1.3 and incorporated herein by reference, and related disclosures in the *Christie* provisional.

209. *Christie*'s controller can "monitor the operational status of the treatment fluid system [] and control operations of the treatment fluid system [] and the fluid valve system based at least in part on the operational status of the treatment fluid system."¹⁵⁹ The controller uses operational parameters such as flow rates and pressures to automate the operation of the fracturing system 100. For example, *Christie* teaches that "the pump rates of the pump units 150, 190 at the surface of the wellsite 104 may be monitored by one or more sensors 448, and these pump rates may be used by the orchestration level program 412 of the coordinated controller 410 to control other parameters of the other systems of the wellsite system 100."¹⁶⁰ In addition, "pressures, temperatures, and/or flow rates of the fluids exiting the pump units 150, 190 may be monitored by one or more sensors 448 of the pump units 150, 190 at the surface of the well site 104, and these pressures, temperatures, and/or flow rates may be used by the orchestration level program 412 of the coordinated

¹⁵⁹ *Christie*, Abstract; *Christie Provisional*, Abstract.

¹⁶⁰ *Christie*, [0108]; *Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

controller 410 to control other parameters of the other systems of the wellsite system 100.”¹⁶¹

210. The “fluids exiting the pump units 150” include the fluid communicated via the manifold (or at least a portion thereof), as the pumps are the source of the fluid communicated via the manifold. *Christie* uses the sensor data (including flowrate and pressure of the fluid communicated via the manifold) to implement optimal (e.g., most efficient) wellsite equipment coordination across the well services 420, 430, 440, with the goal of performing continuous pumping downhole.¹⁶² Specifically, *Christie* explains that the “controller 410 may control any and all operations of any and all of the equipment described herein *based at least in part on feedback from sensors relating to any and all of the operational parameters* described herein such that all of the well services described herein may be performed in a coordinated manner.”¹⁶³ Accordingly, *Christie* teaches that “any and all operations of any and all of the equipment”, including the automated continuous pumping swap” may be based on, “feedback relating to any and all of

¹⁶¹ *Christie*, [0108]; *Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

¹⁶² *Christie*, [0094], [0098], [0108]; *see Christie Provisional*, [0076]-[0083].

¹⁶³ *Christie*, [0094] (emphasis added), [0108]; *see Christie Provisional*, [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

the operational parameters” described by *Christie*, including flow rate and pressure, as discussed above.

211. The controller 410 executing the orchestration level program 412 may be further configured to minimize time between pumping stages and to increase personnel safety, such as by forbidding wellsite personnel to enter high-pressure areas of the wellsite systems 100, 200, 300.”¹⁶⁴ *Christie* provides an example of this coordination by disclosing that “*after stimulation is completed* on one wellbore 102, the controller 410 executing the orchestration level program 412 will know the well service status of the next wellbore 102. If the next wellbore 102 is ready for stimulation operations, the controller 410 executing the orchestration level program 412 may operate (i.e., open) the corresponding fluid access valve 204 and cause the stimulation system 420 and the fluid flow control valve system 440 to operate to inject the treatment fluid (e.g., fracturing fluid) into the next wellbore 102.”¹⁶⁵ A POSITA would have understood that “after stimulation is completed” means that the pumping rate, and the corresponding pressure, has been reduced to the point that the fractures have stopped being created in the formation. This does not mean that the pumps have been stopped, rather that the flowrate has been reduced.

¹⁶⁴ *Christie*, [0098],[0108]; *see Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

¹⁶⁵ *Christie*, [0099] (emphasis added); *see Christie Provisional*, [0081].

212. *Christie* teaches that “[a] stimulation job for a horizontal wellbore may include dividing the wellbore into numerous individual operations or stages.”¹⁶⁶ The process includes operating valves associated with each well to perform “individual pumping and wireline operations (e.g., pump-down and perforating operations) between each stimulation stage (e.g., hydraulic fracturing) to isolate the wellbore and perforate a casing.”¹⁶⁷ Further, *Christie* teaches that “the controller may be configured to operate the fluid valve system to alternately connect and disconnect the treatment fluid system and the pump-down system to and from the wellbore 102.”¹⁶⁸ In other words, fracturing is completed in one stage in one well, then a stage is pumped in additional wells, then the next stage in the first well is pumped.

213. Accordingly, based on the teachings of *Christie* above, a POSITA would have understood that *Christie* uses operational parameters (e.g. flow rate and/or pressure of at least a portion of the fluid communicated via the manifold) to determine, for example, when stimulation is completed on one wellbore 102 (e.g., first well) and operate (i.e., open) the appropriate valves (i.e., second valve) and cause the stimulation system to inject the treatment fluid (e.g. fracturing fluid) into the next wellbore 102.

¹⁶⁶ *Christie*, [0004]; *Christie Provisional*, [0001].

¹⁶⁷ *Christie*, [0004]; *Christie Provisional*, [0001].

¹⁶⁸ *Christie*, [0159]; *Christie Provisional*, [0006], [0083], [00108], [00113], [00114], [00115], [00116].

214. As discussed above in Section XI.E, a POSITA would have recognized that there is a reduction in flow and/or pressure at the end of the fracturing stage, and that one way to determine when stimulation is completed on one wellbore, would be to monitor the flowrate and/or pressure, as taught by *Christie*, to recognize this reduction in flow and/or pressure indicating the end of the fracturing stage and then to swap which well is being fractured by manipulating valves, including opening the second valve, to accomplish *Christie*'s stated goals of monitoring and operating the system with the controller, injecting treatment fluid into a next wellbore when the system is ready, continuous pumping downhole, and optimal (e.g., most efficient) wellsite equipment coordination across well services.

215. Accordingly, *Christie* discloses that the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions (e.g., reduced flow and/or pressure indicating the end of a fracturing stage), which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold.

216. A POSITA would have found that determination of the end of a fracturing stage as an obvious time to operate valves and swap between fracturing a first well and a second well. *Christie* explicitly teaches performing a well swap "after stimulation is completed on one wellbore 102" (a first well). A POSITA would have immediately recognized that a fluid condition such as a reduced flowrate and/or

pressure are indicators of completion of a fracturing stage, as described above in Section XI.E. In other words, once a sufficient volume of fracturing fluid has been pumped into the well, according to the pumping plan, the flowrate and pressure of fluid being pumped into the well is reduced. In a continuous pumping swap, as described in *Christie*, the fluid flowrate and pressure are reduced to a level safe for valve operation, but maintained at a level sufficient to allow continuous pumping.¹⁶⁹ Accordingly, it would have been obvious, based on the teachings of *Christie* and the general knowledge of basic hydraulic fracturing, to use the operational parameters, including flowrate and pressure of at least a portion of the fluid communicated via the manifold, to determine when fracturing is complete in the first well and to move on to hydraulically fracturing the second well by opening the second valve.

217. To the extent that *Christie* teaches measuring pump rates and pressures of the pump units 150 (annotated in red) and that this does not explicitly teach measuring the operational parameters of a “portion of the fluid communicated via the manifold”, it would have been obvious to a POSITA to measure the portion of the fluid communicated via the manifold. For example, the sum of the flowrates of the pump units 150 is *all* of the fluid communicated via manifold 170 (annotated in dark red). Moreover, the '952 Patent only discloses determining flow rates regarding

¹⁶⁹ See *supra* section XI.E.

the pump rates – (e.g., idle rate, frac rate, slurry rate)¹⁷⁰-- and nowhere does the '952 Patent disclose the flow rate is determined after the fluid has flowed through the manifold.

218. The '952 Patent is silent with respect to determining a pressure with respect to the fluid communicated via the manifold for purposes of determining a CP swap.

219. Nevertheless, *Christie* discloses and/or renders obvious swapping to a second well's fracturing stage (by opening a second valve) based at least on pressure conditions of the fluid being pumped via the manifold being satisfied. For example, *Christie* monitors "pressures, temperatures, and/or flow rates of the fluids exiting the pump units 150, 190 [by one or more sensors] and these pressures, temperatures, and/or flow rates may be used by the orchestration level program 412 of the coordinated controller 410 to control other parameters of the other systems of the wellsite system 100."¹⁷¹ Further, the pressure at manifold 170, or any of the wellbores which are fluidly connected to the pumps, is a direct function of the pressure at the discharge of the pump units. The pressure at 170 is a small margin lower than the discharge pressure of the pump units due to the friction in fluid

¹⁷⁰ '952 Patent, 13:35-54, Figs. 12, 16E; Ex. 1006, [0009], [0027], Figs. 8, 11F.

¹⁷¹ *Christie*, [0108]; see *Christie Provisional*, [0071], [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

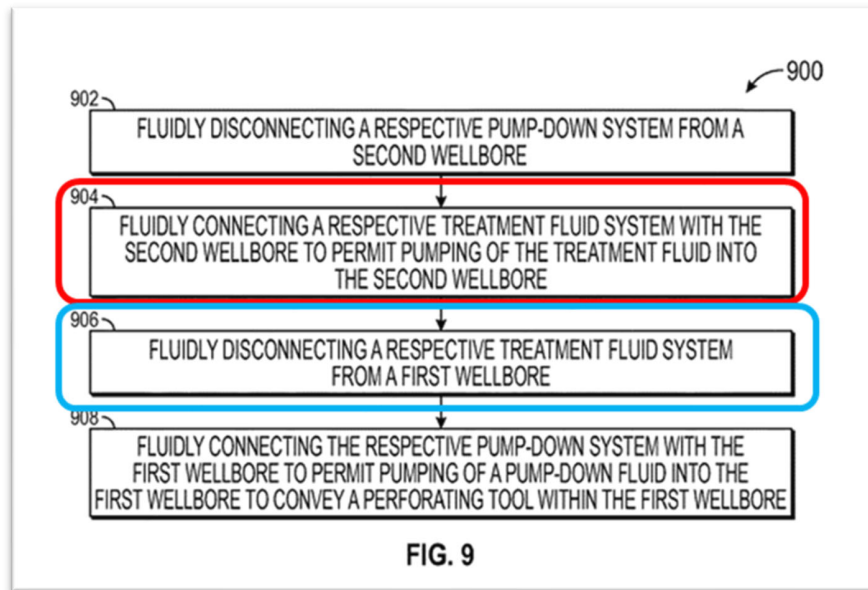
conduit 146, manifold 140 and conduits 144, but they are directly related. A POSITA would have recognized the teaching of monitoring flowrate and/or pressure of the pump units to be an example, and that *Christie* teaches using operational parameters in general, and not limited to the single location in the example. Accordingly, a POSITA would have found it obvious, based on the teachings of *Christie* of using operational parameters to control the fracturing system 100 and using sensors to obtain sensor data and provide sensor signals to equipment for facilitating automated/semi-automated operations, to place pressure and/or flowrate sensors at any location in the system, such as at the wellhead or at manifold 170, as needed to gather information for control, such as pump rates (or a sum of pump rates). A POSITA would have understood that information from a variety of locations throughout the system would have been used to determine the end of a stage and to signal a swap, as taught by *Christie*.

220. Therefore, *Christie* discloses wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate and/or a pressure, of the at least a portion of fluid communicated via the manifold, or at least such a limitation would have been obvious to a POSITA based on the teachings of *Christie*.

221. Accordingly, *Christie* each disclose the limitations of 1.3.2, or at least they would have been obvious to a POSITA.

- f. 1.3.3: “closing the first valve: after the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold, and”**

222. *Christie* discloses this limitation, or at least it would have been obvious to a POSITA based on the teachings of *Christie*. As discussed above regarding limitation 1.3.2, *Christie* discloses, or at least it would have been obvious to a POSITA, that the second valve is opened after a portion of fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold. As one example, disclosed in, or at least obvious to a POSITA from, Fig. 9 of *Christie*, and the accompanying description in the specification, the first valve is closed (step 906) after the second valve is opened (step 904).



Christie, Fig. 9 (annotated)

223. As a further example, *Christie* discloses a swap process using a controller “to operate the fluid valve system to simultaneously: fluidly disconnect the pump-down system from the second wellbore 102; fluidly connect the treatment fluid system to the second wellbore 102 to permit pumping of the treatment fluid into the second wellbore 102; fluidly disconnect the treatment fluid system from the first wellbore 102; and fluidly connect the pump-down system to the first wellbore 102 to permit pumping of the pump-down fluid into the first wellbore 102 to convey the perforating tool 234 within the first wellbore 102.”¹⁷² It would have been obvious to POSITA reading *Christie*’s swap disclosure that the “fluidly connect”

¹⁷² *Christie*, [0156], *see also* [0152]; *see, Christie Provisional*, [0115], *see also* [0006], [0083], [00108], [00113]-[00114].

and “disconnect” steps (i.e. opening and closing valves) would not have been performed exactly simultaneously in time—starting and ending at the exact same time. Rather, a POSITA would have found it obvious that *Christie*’s swap steps are performed generally at the same time, *i.e.*, concurrently, and in the order recited, as the pump-down system would be disconnected from a well before connecting the treatment/fracturing fluid system (opening a valve) to the well to fracture the well and vice versa.¹⁷³ Thus, a POSITA would have understood *Christie*’s swap process to include “fluidly disconnect[ing] the treatment fluid system from the first wellbore” (i.e., closing the first valve) after “fluidly connect[ing] the treatment fluid system to the second wellbore” (i.e., opening the second valve).¹⁷⁴

224. Thus, the first valve is closed after the second valve is opened. Further, because the second valve is opened after the fluid condition is met, as described above regarding limitation 1.3.2 and incorporated herein by reference, the first valve is also closed after the fluid condition is met as required by Limitation 1.3.3.

225. Accordingly, *Christie* teaches closing the first valve: after the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure,

¹⁷³ *Christie*, [0033], [0161]; *Christie Provisional*, [0006], [0069], [00108], [00113], [00114], [00115], [00116].

¹⁷⁴ *Christie*, [0156]; *Christie Provisional*, [0082].

of the at least a portion of fluid communicated via the manifold, or at least such a limitation would have been obvious to a POSITA based on the teachings of *Christie*.

g. 1.3.4: “while fluid is communicated from the one or more pumps to the second well via the second valve and the manifold”

226. *Christie* discloses closing the first valve while fluid is communicated from the one or more pumps to the second well via the second valve and the manifold as claimed. As discussed above regarding limitations 1.3 – 1.3.3, and incorporated herein by reference, *Christie* discloses a continuous pumping swap between fracturing the first well and fracturing the second well, for example as shown in Fig. 9 of *Christie*, that includes operating the fluid valve system (after pumping has begun) to “fluidly connect the treatment fluid system to the second wellbore 102 to permit pumping of the treatment fluid into the second wellbore” and “fluidly disconnect the treatment fluid system from the first wellbore.”¹⁷⁵

227. As discussed above regarding limitation 1.2, and incorporated herein by reference, the fracturing system of *Christie* contains pumps, conduits and fracturing manifold 170 which contains valves 173, including a second valve to

¹⁷⁵ *Christie*, [0155]-[0156], *see also* [0151] (“perform the well treatment operations by operating the treatment fluid system to pump the treatment into the wellbore 102”) and [0152]; *see Christie Provisional*, [00115], *see also* [00109], [0006], [00108], [00113]-[00114].

control fluid flow to the second well 102 via conduit 172. When *Christie's* first valve is closed (fluidly disconnecting a first well) while the second valve is open to “permit hydraulic fracturing of the second well”, the source of the fracturing fluid to the second well is the pumps 152 via the manifold 170 and valves 173, including a second valve. Accordingly, when *Christie's* first valve is closed (fluidly disconnecting a first well) while the second valve is open to “permit hydraulic fracturing of the second well”, the pumped fluid is being pumped from the pumps to the second well via the second valve and manifold.

h. 1.4: “wherein, during the CP swap, fluid is continuously communicated from the one or more pumps via the manifold.”

228. A POSITA would have understood *Christie's* instructions for “fluidly connecting”/“disconnecting” by operating the valves (rather than by turning on/off the pumps) “to permit pumping of the treatment fluid into the second wellbore” during *Christie's* continuous swap process, to mean that the pumps would be continuously pumping fluid via the manifold as the valves were opened/closed to “fluidly connect”/“disconnect.”¹⁷⁶ Accordingly, a POSITA reading *Christie* would have understood that the pumps are run continuously throughout the valve swap

¹⁷⁶ *Christie*, [0155]-[0156], *see also* [0151] (“perform the well treatment operations by operating the treatment fluid system to pump the treatment into the wellbore 102”) and [0152]; *see, Christie Provisional*, [0115], *see also* [00109], [0006], [00108], [00113]-[00114].

process, as the pumps are started at the beginning (i.e. “pumping a treatment fluid into a first wellbore 102”) and there is no mention of stopping the pumps during the valve process. For example, the second valve is opened to fluidly connect the treatment fluid system, i.e. pumps, etc., to the second wellbore 102 *to permit pumping of the treatment fluid into the second wellbore*. A POSITA would have recognized that, with the pumps already running, fluidly connecting the pumps to the second wellbore would, in fact, permit pumping of the treatment fluid into the second wellbore. This would enable *Christie’s* “goal of performing continuous pumping downhole”¹⁷⁷ while swapping between hydraulically fracturing the first well and a second well. Accordingly, the description of the swap process in *Christie* discloses a continuous pumping swap.

229. *Christie* also distinguishes this continuous pumping swap from a “conventional” swap where pumps are shut down before opening and closing valves associated with the manifold and wellbores 102 (fluidly connecting and disconnecting wellbores 102 from the treatment fluid system), as discussed with Limitation 1.3.1. A POSITA would have understood *Christie’s* distinctions between the “conventional” swap having a step to “stop operating the treatment fluid system” and *Christie’s* continuous pumping swap not including a stop-pumping step as

¹⁷⁷ *Christie*, [0098]; *Christie Provisional*, [0080].

further teaching that Christie's continuous pumping swaps leave the pumps running during the valve operations (i.e. swap).¹⁷⁸

230. Thus, the pumps are running continuously, and the second valve is opened "to permit pumping of the treatment fluid into the second wellbore" without teaching the pumps are stopped before disconnecting the treatment fluid system from the first wellbore.

231. Accordingly, *Christie* discloses, or at least it would have been obvious based on the teachings of *Christie* to close the first valve while fluid is communicated from the one or more pumps to the second well via the second valve and the manifold.

232. Thus, Claim 1 is disclosed by Christie, or at least it would have been obvious to a POSITA based on the teachings of *Christie*, and the general knowledge of a POSITA.

**2. DEPENDENT CLAIM 2: "THE METHOD OF CLAIM 1, WHEREIN:
THE FIRST VALVE IS A FIRST ZIPPER VALVE; AND/OR THE
SECOND VALVE IS A SECOND ZIPPER VALVE."**

233. Dependent Claim 2 depends from Claim 1. In addition to the discussion above regarding Claim 1, *Christie* discloses the additional limitations of Claim 2, or at least they would have been obvious to a POSITA. A POSITA would have

¹⁷⁸ See, e.g., *Christie*, [0157]; see *Christie Provisional*, [0116].

understood a “zipper valve” to simply be a valve used in a zipper fracturing operation, often between a manifold (e.g., a zipper manifold) and the wellhead. These valves would be used to swap fracturing operations from one wellhead to another as described above in Section XV.A.1. Zipper fracturing was well known prior to the ’952 Patent. The ’952 Patent contains little written description of the structure of a “zipper valve” other than indicating zipper valves may be, for example, gate valves, and communicate fluid between the zipper manifold and a well.¹⁷⁹

234. *Christie* discloses, as part of wellsite system 100, shown in Fig. 1, pumps that pump fracturing fluid to “fracturing manifold 170, which may selectively distribute the treatment fluid between the wellbores 102 via a plurality of corresponding fluid conduits 172 extending between the fracturing manifold 170 and each wellbore 102.”¹⁸⁰ *Christie* further discloses that “fracturing manifold 170 may include a plurality of remotely operated fluid flow control valves 173 [annotated in purple] (e.g., frac valves, shut-off valves), each remotely operable to fluidly connect (and disconnect) the fluid conduit 146 to (and from) a selected one or more of the fluid conduits 172 and, thus, *facilitate injection of the treatment fluid into a selected one or more of the wellbores* 102. The fracturing manifold 170 may be known in

¹⁷⁹ ’952 Patent, 7:60-63, 14:9-11, 23-26, 30-34, and 43-48.

¹⁸⁰ *Christie*, [0037]-[0038], [0040], Fig. 1; *Christie Provisional*, [0020]-[0021], [0023], Fig. 1.

the art as a *zipper manifold*.”¹⁸¹ The “plurality of remotely operated fluid flow control valves” include a first and second valve.

235. Accordingly, *Christie* teaches that valves 173, including a first and second valve, perform the function of a zipper valve (i.e. control fluid flow during a zipper fracturing operation) and are accordingly a “zipper valve”. Further, *Christie* describes that valves 173, including a first and second valve, are part of the “zipper manifold,” and thus would be recognized by a POSITA as zipper valves.

236. Accordingly, *Christie* discloses that the first valve and the second valve are “zipper valves,” and *Christie* renders Claim 2 obvious.

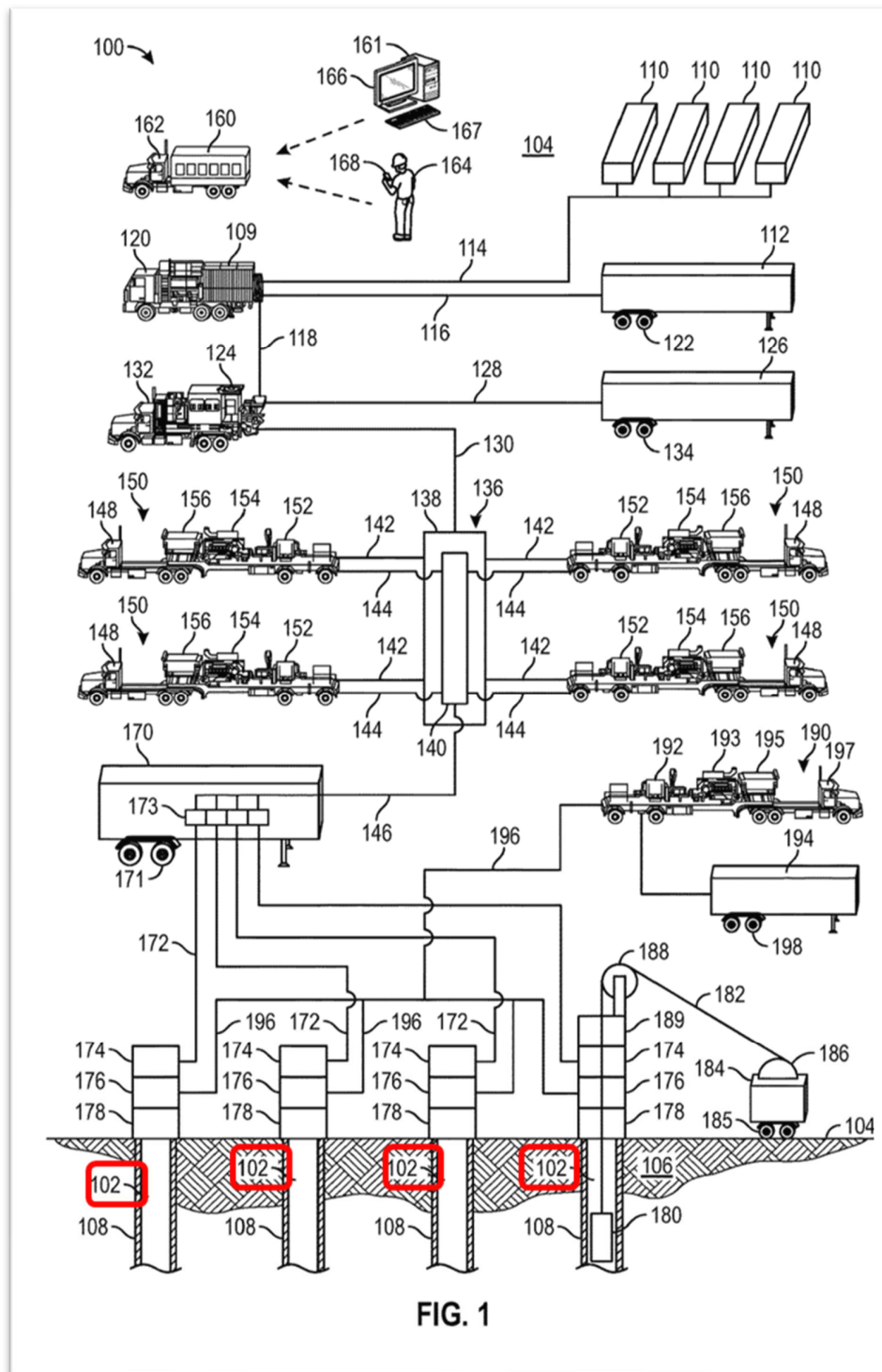
3. DEPENDENT CLAIM 3

237. Dependent Claim 3 depends from Claim 1. In addition to the discussion above regarding Claim 1, incorporated herein by reference, *Christie* discloses the additional limitations of Claim 3, or at least they would have been obvious to a POSITA as discussed in the subsections below.

¹⁸¹ *Christie*, [0040]; *Christie Provisional*, [0023].

- a. 3.1: “The method of claim 1, wherein the plurality of wells further comprises third and fourth wells, and the method further comprises:”**

238. *Christie* discloses third and fourth wells. For example, Fig 1 of *Christie* shows four wellbores 102 (annotated in red), each with very similar connections to the rest of well treatment system 100.



Christie, Fig. 1

239. Accordingly, *Christie* discloses a third and fourth well.

b. 3.2: “communicating fluid to the third well via the manifold and a third valve, wherein the third valve is associated with both the third well and the manifold;”

240. *Christie* discloses a third well to which fluid is communicated via the manifold and a third valve, and the valve is associated with both the third well and the manifold. As discussed above regarding Claim 1, *Christie* discloses, as part of wellsite system 100, pumps that pump fracturing fluid to a fracturing manifold 170 (annotated in dark red], “which may selectively distribute the treatment fluid between the wellbores 102 [annotated in dark blue] via a plurality of corresponding fluid conduits 172 extending between the fracturing manifold 170 and each wellbore 102.”¹⁸²

¹⁸² *Christie*, [0040]; *Christie Provisional*, [0023].

disconnect) the fluid conduit 146 to (and from) a selected one or more of the fluid conduits 172 and, thus, *facilitate injection of the treatment fluid into a selected one or more of the wellbores 102*. The fracturing manifold 170 may be known in the art as a zipper manifold.”¹⁸³ The “plurality of remotely operated fluid flow control valves” include a third valve.

242. As seen in the annotated *Christie* Figure 1 above, valves 173 (including a third valve, identified with red arrow) are part of zipper manifold 170 (annotated in dark red), and thus are associated with the manifold. Further, the third valve communicates fluid to the third well via an isolated conduit 172 (annotated in yellow). Accordingly, the third valve is also associated with the third well.

243. Further still, *Christie* teaches that “each fluid flow control valve 173 of the fracturing manifold 170 may be fluidly connected to a corresponding fluid flow control device 174 via one or more fluid conduits 172, to facilitate selective fluid connection between the common manifold 136 and one or more of the wellbores 102. Thus, the fluid flow control valves 173 of the fracturing manifold 170 and the fluid flow control valves of the fluid flow control devices 174, 176 may collectively form a fluid flow control valve system configured to fluidly connect (and disconnect) one of the treatment fluid system and a pump-down system, as described herein, to

¹⁸³ *Christie*, [0040]; *Christie Provisional*, [0023].

(and from) a selected one or more of the wellbores 102.”¹⁸⁴ Accordingly, valves 174 (including a third valve, identified with red arrow) is part of the wellhead tree associated with the third well and thus is associated with the third well. As the third valve 174 is fluidly directly connected between the manifold and the third well (via first valve 173), third valve 174 is also associated with the manifold.

244. Therefore, *Christie* teaches multiple examples of a third valve associated with both a third well and the manifold.

¹⁸⁴ *Christie*, [0041]; *Christie Provisional*, [0024].

c. **3.3: “wherein executing the CP swap further transitions from hydraulically fracturing the third well to hydraulically fracturing the fourth well, the CP swap further comprising:”**

3.3.1: “opening a fourth valve while fluid is communicated to the third well via the third valve and the manifold, wherein the fourth valve is associated with both the fourth well and the manifold, wherein opening the fourth valve causes fluid to be communicated to the fourth well via the manifold and the fourth valve, and ”

3.3.2: “wherein the fourth valve is opened in response to the at least a portion of the fluid communicated via the manifold satisfying the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of the fluid communicated via the manifold; and”

3.3.3: “closing the third valve: after the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold, and”

3.3.4: “while fluid is communicated to the fourth well via the fourth valve and the manifold.”

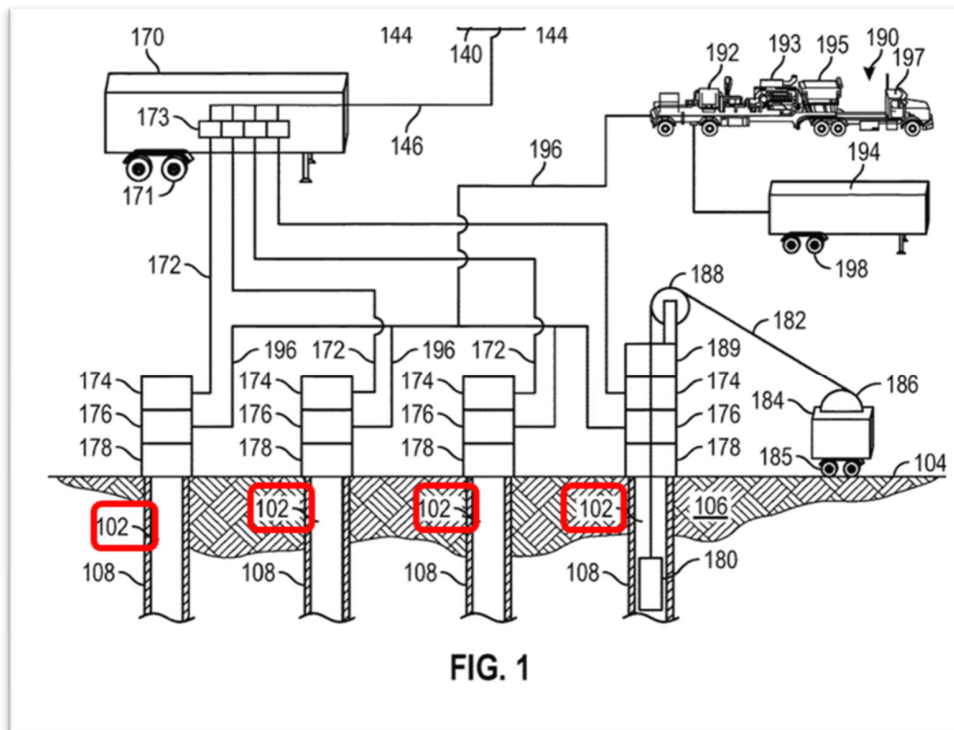
245. In my opinion, a POSITA would have found it obvious to apply the CP swap taught by *Christie* (swap between hydraulically fracturing a first and second well, as discussed above regarding Claim 1) to swap between hydraulically fracturing a third and fourth well. The limitations of the CP swap claimed in Claim 3 are substantially similar to those claimed in Claim 1, except for being applied to a “third” and “fourth” well instead of a “first” and “second” well.

246. *Christie* discloses using “coordinated pumping operations” to perform CP swap methods to swap between fracturing “a plurality of wellbores,” e.g., between the four wells shown in Fig. 1.¹⁸⁵ As discussed above regarding Limitation 3.3, Fig. 1 of *Christie* discloses at least third and fourth wellbores. Further, *Christie* teaches using a controller to “monitor operational status of a plurality of treatment fluid systems [] configured to pump a treatment fluid *into each of a plurality of wellbores 102*.”¹⁸⁶ The controller also “control[s] operations of the treatment fluid systems, the pump-down systems, and the fluid valve systems with respect to the wellbores 102” and “operate[s] the fluid valve system to alternately connect and disconnect the treatment fluid system and the pump-down system to and from the respective wellbore 102.”¹⁸⁷ As *Christie* teaches the method applies to “each of a plurality of wellbores 102”, a POSITA would have understood that *Christie* was teaching applying its CP swap methods to at least the four wellbores 102 shown in Fig. 1.

¹⁸⁵ *Christie*, [0002], [0101], Fig. 1, Abstract; *Christie Provisional*, [0023], [0083], [00107], Fig. 1, Abstract.

¹⁸⁶ Ex. 1014 (*Christie*) [0161] (emphasis added); *Christie Provisional*, [0006], [0069], [00108], [00113], [00114], [00115], [00116].

¹⁸⁷ *Christie*, [0159], [0161]; *Christie Provisional*, [0006], [0069], [00108], [00113], [00114], [00115], [00116].



Christie, Fig. 1 (annotated and excerpted)

247. Further a POSITA would have recognized that Christie’s example CP swap method shown in Fig. 9, referring to a first and second wellbore, was merely an example of the application of the method to “each of a plurality of wellbores 102”, and that the method would apply to all of the wellbores, including the third and fourth wellbore and in any order deemed necessary by the controller or orchestration level program.¹⁸⁸

¹⁸⁸ See, e.g., *Christie*, [0161]-[0162] (describing Fig. 9 as an example of the method); *Christie Provisional* [0006], [0069], [00108], [00113], [00114], [00115], [00116].

248. To the extent the Board finds that *Christie* does not expressly disclose applying *Christie*'s CP swap methodology (and related disclosure in *Christie* Provisional) to "third and fourth wells," it would have been obvious to a POSITA to apply the teachings of a "first and second well" from *Christie* to a "third and fourth well" to take advantage of the increased hydrocarbon production, operating efficiencies and reduced time between stages taught by *Christie* at multiple well locations, including the third and fourth wells disclosed by *Christie*.

249. *Christie* discloses communicating fluid to a well in a multi-well environment. As was well known to a POSITA, and disclosed by *Christie*, a well pad may include one, two, three, four, (or more) wells. Thus, although Fig. 9 of *Christie* discusses a first well and a second well in detail, it would have been obvious to a POSITA to perform the same method or sequence of the first and second wells on a third well, a fourth well, and any additional wells based on *Christie*'s teaching of performing the method on "each of a plurality of wellbores 102", which include third and fourth wellbores. Moreover, mere repetition of elements has no patentable significance unless a new and unexpected result is produced. Here, performing the method of Claim 1 on additional wells in the same environment (*i.e.*, third well and fourth well) following the same methodology would be performed in the same way and produce the same expected results as using the method on the first and second wells and, therefore, would have been obvious to a POSITA.

250. *Christie*, therefore, discloses each and every limitation of Claim 3, or at least they would have been obvious to a POSITA.

4. DEPENDENT CLAIM 4: “THE METHOD OF CLAIM 1, FURTHER COMPRISING: DETERMINING THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

251. Dependent Claim 4 depends from Claim 1. In my opinion, Claim 4 adds no additional limitations to Claim 1. Claim 1, Limitation 1.3.2 claims “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions”. Before the method claimed in claim 1 can open the valve “in response to” at least a portion of fluid communicated via the manifold satisfying one or more conditions, the method must first “determine” that the fluid has met the one or more conditions.

252. To the extent that the Board finds that Claim 4 does add additional limitations, the limitations of Claim 4 would have been obvious to a POSITA based on the teachings of *Christie*. As discussed above regarding Limitation 1.3.2, Claim 4 does not provide any additional limitations on the “conditions” that control opening of the second valve, other than the “conditions include a flowrate and/or a pressure” of at least a portion of the fluid communicated via the manifold. As such any teaching that a flowrate or pressure influences the opening of the second valve would teach the claimed limitation.

253. As discussed above regarding Limitation 1.3.2, and incorporated herein by reference, *Christie* teaches or at least suggests, determining when a stage is complete in a first well, and then transitioning (via a CP swap) to fracturing a second well.¹⁸⁹ *Christie* also discloses sensors that monitor (which would include determining) the pump rates of the pump units, as well as pressures, temperatures, and/or flow rates of fluids exiting the pump units.¹⁹⁰ Further, a POSITA would have understood that *Christie* uses operational parameters (e.g., flow rate and/ or pressure of at a least a portion of the fluid communicated via the manifold) to determine when stimulation is completed on one wellbore 102 (e.g. first well) and operate (i.e. open) the appropriate valves (i.e. second valve) and cause the stimulation system to inject the treatment fluid (e.g. fracturing fluid) into the next wellbore 102. Further, *Christie* teaches that “controller 410 executing the orchestration level program 412 may be configured to determine future events (e.g., look-ahead forecasting) *based at least in part on monitored current operational status* and a planned (i.e., future) job schedule.”¹⁹¹

254. As discussed above regarding Claim 1, and incorporated herein by reference, *Christie* teaches, when discussing the automation provided by controller

¹⁸⁹ *Christie*, [0099], [0101]; *Christie Provisional*, [0081], [0083].

¹⁹⁰ *Christie*, [0108]; *see Christie Provisional*, [0045], [0047], [0080], [0070], [0076]-[0083], [0091], [0097], [0099].

¹⁹¹ *Christie*, [0100] (emphasis added); *Christie Provisional*, [0082].

410 via orchestration level program 412, that “after stimulation is completed on one wellbore 102, the controller 410 executing the orchestration level program 412 will know the well service status of the next wellbore 102. If the next wellbore 102 is ready for stimulation operations, the controller 410 executing the orchestration level program 412 may operate (i.e., open) the corresponding fluid access valve 204 and cause the stimulation system 420 and the fluid flow control valve system 440 to operate to inject the treatment fluid (e.g., fracturing fluid) into the next wellbore 102.”¹⁹² A POSITA would have understood *Christie* to be teaching that the controller would at least be determining when stimulation is complete, which would include a “flow rate and/or pressure” condition of at least a portion of the fluid communicated via the manifold.

255. As discussed above in Section XI.E, a POSITA would have known that there is a reduction in flow and/or pressure at the end of the fracturing stage, and that one way to determine when stimulation is completed on one wellbore, would be to monitor the flowrate and/or pressure, as taught by *Christie*, to recognize this reduction in flow and/or pressure indicating the end of the fracturing stage and then to swap which well is being fractured by manipulating valves, including opening the second valve.

¹⁹² *Christie*, [0098]; *Christie Provisional*, [0080].

256. Accordingly, *Christie* discloses that the second valve is opened in response to determining that at least a portion of fluid communicated via the manifold has satisfied one or more conditions (e.g. reduced flow and/or pressure indicating the end of a fracturing stage), which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold.

257. To the extent that the Board finds that *Christie* does not explicitly state that the second valve is opened “in response to” the fluid conditions indicating the end of a fracturing stage (determining the condition is satisfied), a POSITA would have found that determination of the end of a fracturing stage an obvious time to operate valves and swap between fracturing a first well and a second well. *Christie* explicitly teaches performing a well swap “after stimulation is completed on one wellbore” (e.g., a first well).¹⁹³ A POSITA would have immediately recognized that a fluid condition such as a reduced flowrate and/or pressure are indicators of completion of a fracturing stage, as described above in Section XI.E. In other words, once a sufficient volume of fracturing fluid has been pumped into the well (i.e., the stimulation is completed for that stage), according to the pumping plan, flow is reduced. In a continuous pumping swap, as described in *Christie*, the flowrate and

¹⁹³ *Christie*, [0099]; *Christie Provisional*, [0081].

pressure of fluid being pumped via the manifold to the well(s) would have been reduced to a level safe for valve operation, but maintained at a level sufficient to allow continuous pumping.¹⁹⁴ Accordingly, it would have been obvious, based on the teachings of *Christie* and the general knowledge of basic hydraulic fracturing, to determine that the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions (*e.g.*, *Christie*'s operation parameters including flow rate and pressure), using *Christie*'s sensors, to determine when fracturing is complete in the first well and to move on to hydraulically fracturing the second well by opening the second valve.

5. DEPENDENT CLAIM 5: “THE METHOD OF CLAIM 1, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE FLOW RATE OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

258. Dependent Claim 5 depends from Claim 1. My analysis above with respect to Claim 1 already discusses how *Christie* discloses the satisfied one or more conditions include the flow rate of the at least a portion of fluid communicated via the manifold, as claimed in Claim 5.

259. As described above regarding limitations 1.3.2, 1.3.3, 3.3.2 and 3.3.3, and Claim 4, each incorporated herein by reference, valve operations, such as opening or closing, are performed in response to determining that the fluid

¹⁹⁴ See *supra* section XI.C – XI.D.

communicated via the manifold has satisfied one or more conditions such as reduced flowrate or injection established (flowrate condition) and pressure has stabilized (pressure condition). Further, *Christie* discloses that pressures, temperatures, and/or flow rates of the fluids exiting the pump units 150, 190 may be monitored by one or more sensors 448.¹⁹⁵ The “fluids exiting the pump units 150” include the fluid communicated via the manifold (or at least a portion thereof), as the pumps are the source of the fluid communicated via the manifold. Accordingly, *Christie* discloses the one or more satisfied conditions include the flow rate of the at least a portion of the fluid communicated via the manifold.

6. DEPENDENT CLAIMS 6-8: FLOW RATE THRESHOLDS

260. Claims 6-8 recite that the “condition(s)” are satisfied with the flowrate is below an upper threshold and/or above a lower threshold. The ’952 Patent does not provide any guidance as to what these “upper” and “lower” thresholds could be, other than a single example where a seemingly arbitrarily selected 10 bbl is used as an upper threshold rate and 0 bbl is used as a lower threshold rate.¹⁹⁶ Further, the ’952 Patent does not provide any guidance as to how these upper and lower thresholds would be selected, leaving it up to the reader to take their best guess.

¹⁹⁵ *Christie*, [0108]; *Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

¹⁹⁶ ’952 Patent, 13:45-48.

261. A POSITA having general knowledge of typical zipper fracturing operations would be aware that zipper fracturing operations typically switch to a next fracturing stage at the end of a current fracturing stage. Further, a POSITA having general knowledge of typical zipper fracturing operations would be well aware that the system's valves should only be operated safely, e.g., when the flow through the valves have low enough flowrate and pressure to be operated. Thus, because the '952 Patent gives no guidance/instruction as to which upper/lower thresholds to select, a POSITA would have found it obvious to select thresholds indicating the end of a current fracturing stage and indicating that it is safe to operate the valves. Accordingly, a POSITA would have likely selected flowrate "upper thresholds" that are low enough to indicate the end of a fracturing stage and that it is safe to operate a valve. Further, in continuous pumping operations as taught by *Christie*, where the pumps continuously pump fluid to the zipper manifold and selected well(s), a POSITA would have understood that there would at least be some fluid flow – a flowrate above a lower threshold of zero. This is commensurate with the '952 Patent's lone example of a lower flowrate threshold of 0 bbl.

262. In a continuous pumping swap, as described in *Christie*, flowrate is reduced to a level indicating that stimulation in the first well is complete, and it is safe for valve operation, below an upper threshold, but maintained at a level

sufficient to allow continuous pumping downhole, above a lower threshold of zero.¹⁹⁷

263. *Christie* uses a controller to “automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves” “to maintain a completion strategy (e.g., order) by determining which wellbore 102 is to be completed and orchestrating movement to the next intended wellbore 102 in the plan.”¹⁹⁸ *Christie*’s controller uses operational parameters, such as flowrates and pressures to automate the operation of the fracturing system. For example, *Christie* teaches that “pressures, temperatures, and/or flow rates of the fluids exiting the pump units 150, 190 may be monitored by one or more sensors 448 of the pump units 150, 190 at the surface of the well site 104, and these pressures, temperatures, and/or flow rates may be used by the orchestration level program 412 of the coordinated controller 410 to control other parameters of the other systems of the wellsite system 100.”¹⁹⁹

264. The “fluids exiting the pump units 150” include the fluid communicated via the manifold (or at least a portion thereof), as the pumps are the source of the fluid communicated via the manifold. *Christie* uses these sensor data (including

¹⁹⁷ See, e.g., *Christie*, [0093], [0098]-[0099]; *Christie Provisional*, [0075]-[0083].

¹⁹⁸ *Christie*, [0101]; *Christie Provisional*, [0083].

¹⁹⁹ *Christie*, [0108]; *Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

flowrate and pressure of the fluid communicated via the manifold) “to implement optimal (e.g., most efficient) wellsite equipment coordination across the well services 420, 430, 440, with the goal of performing continuous pumping downhole” and “to minimize time between pumping stages.”²⁰⁰ *Christie* provides an example of this coordination by disclosing that “after stimulation is completed on one wellbore 102, the controller 410 executing the orchestration level program 412 will know the well service status of the next wellbore,” and if the next wellbore is ready for stimulation operations, the controller may operate (i.e., open) the corresponding fluid access valve (e.g., fracturing manifold valves 173) to inject the treatment/fracturing fluid into the next wellbore.²⁰¹

265. Accordingly, based on the teachings of *Christie*, a POSITA would have understood that *Christie* uses operational parameters (e.g. flow rate and/or pressure of at least a portion of the fluid communicated via the manifold) to determine when stimulation is completed on one wellbore (e.g. first well) and operate (i.e. open) the appropriate valves (i.e. second valve) and to direct the continuously pumped treatment/fracturing fluid into the next wellbore.

²⁰⁰ *Christie*, [0098]; *Christie Provisional*, [0080].

²⁰¹ *Christie*, [0097], [0099], [0101], Figs. 1 and 4; *Christie Provisional*, [0079], [0081], [0083], Figs. 1 and 4.

266. To the extent that the Board finds that *Christie* does not explicitly state that the second valve is opened “in response to” the fluid condition threshold indicating the end of a fracturing stage, a POSITA would have found that determination of the end of a fracturing stage an obvious time to operate valves and swap between fracturing a first well and a second well. *Christie* explicitly teaches performing a well swap “after stimulation is completed on one wellbore” e.g., a first well.²⁰² A POSITA would have immediately recognized that a fluid condition such as a reduced flowrate and/or pressure are indicators of completion of a fracturing stage, as described above in Section XI.E. In other words, once a sufficient volume of fracturing fluid has been pumped into the well, according to the pumping plan, flowrate is reduced. In a continuous pumping swap, as described in *Christie*, flowrate is reduced to a level indicating that fracturing in the first well is complete, and it is safe for valve operation, below an upper threshold, but maintained at a level sufficient to allow continuous pumping downhole, above a lower threshold. Accordingly, it would have been obvious, based on the teachings of *Christie* and the general knowledge of basic hydraulic fracturing, to use a flowrate below an upper threshold and/or above a lower threshold, to determine when fracturing is complete

²⁰² *Christie*, [0099]; *Christie Provisional*, [0081].

in the first well and to move on to hydraulically fracturing the second well by opening the second valve while continuously pumping.

267. Further, using upper and/or lower thresholds to make automation decisions is not new. For example, *Christie* teaches that its controller may include a processor and program code instructions “to receive and process sensor data (e.g., sensor measurements), and output control commands to the wellsite equipment based at least in part on programming, predetermined set-points, and the received sensor data.”²⁰³ A POSITA would have understood these “predetermined set-points” to be thresholds, or points at which a command will occur, such as operating a valve.

268. *Christie*’s systems/methods also “enable various levels of automation [] of the operational parameters of the equipment of the wellsite system” using “data relating to the operational parameters of the wellsite system” (e.g., the measured fluid flowrate and/or pressure) “to determine whether a particular operational parameter is within an acceptable operating range.”²⁰⁴ It is well understood that “ranges” have upper and lower endpoints, or thresholds, above and below which (respectively) would be outside of the range. It would have been obvious to a POSITA that *Christie*’s controller would include upper and/or lower thresholds of

²⁰³ *Christie*, [0125]-[0126]; *Christie Provisional*, [0090]-[0091].

²⁰⁴ *Christie*, [0110]; *Christie Provisional*, [0076]-[0083].

the monitored and controlled operational parameters so the controller can “automatically coordinate” (without separate instruction) “a well swap process, such as by automatically opening and closing flow control wellhead valves” based on whether the measured fluid parameters (e.g., flowrate and/or pressure) are above or below thresholds (e.g., within an acceptable operating range) indicating the end of a fracturing stage and when to initiate the next well’s fracturing stage “with the goal of performing continuous pumping.”²⁰⁵

a. Dependent claim 6: “The method of claim 5, wherein the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions when the flow rate is below an upper threshold.”

269. Dependent Claim 6 depends from Claim 5, which further depends from Claim 1. In addition to the discussion above regarding Claims 1 and 5, the additional limitations of Claim 6 would have been obvious to a POSITA. Claim 6 only claims that the flowrate is “below an upper threshold.”

270. As discussed above, a POSITA would have recognized that there is a reduction in flowrate and/or pressure at the end of the fracturing stage, and that one way to determine when stimulation is completed on one wellbore would be to monitor the flowrate and/or pressure, as taught by *Christie*, to recognize this reduction in flowrate and/or pressure below an upper threshold indicating the end of

²⁰⁵ *Christie*, [0098], [0101]; *Christie Provisional*, [0080], [0083].

the fracturing stage (and that it is safe to operate valves), and then to swap which well is being fractured by manipulating valves, including opening the second valve.²⁰⁶

271. Accordingly, Claim 6 would have been obvious to a POSITA based on the teachings of *Christie*.

b. Dependent Claim 7: “The method of claim 5, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the flow rate is above a lower threshold.”

272. Dependent Claim 7 depends from Claim 5, which further depends from Claim 1. In addition to the discussion above regarding Claims 1 and 5, the additional limitations of Claim 7 would have been obvious to a POSITA.

273. As described above regarding Claim 6 and in Section XV.A.6, and incorporated herein by reference, *Christie* teaches or at least renders obvious swapping to hydraulically fracturing a “second” wellbore “after stimulation is completed on one wellbore.”²⁰⁷ Further, as discussed above regarding Claim 1 and Claim 4, *Christie* teaches a continuous pumping swap to transition between hydraulically fracturing wellbores, e.g., first and second wellbores.²⁰⁸

²⁰⁶ See also Section XI.C – XI.E of Part 1.

²⁰⁷ *Christie*, [0099]; *Christie Provisional*, [0081].

²⁰⁸ *Christie*, [0101], [0156], Fig. 9; *Christie Provisional*, [0081], [0083], [0006], [0083], [00108], [00113], [00114], [00115].

274. Thus, in *Christie*'s continuous pumping swap, it would have been obvious to a POSITA that flow is reduced to a level indicating that stimulation in the first well is complete, and it is safe for valve operation, but maintained at a level sufficient to allow continuous pumping, *i.e.*, above a lower threshold. To the extent that *Christie* does not specifically recite a "lower threshold," a POSITA would have readily understood that in order to accomplish continuous pumping downhole (*Christie*'s explicitly stated goal), the flowrate would need to be above zero (a lower threshold). The pumps used in fracturing operations (plunger pumps) do not allow for pumps to operate while there is zero flow.²⁰⁹ Further, a lower threshold would be required as the basis for the controller's and orchestration level program's decision making in its automated coordination across well services, including across multiple wellbores, to "automatically" coordinate the operations based on whether the sensor-measured fluid parameters (e.g., flowrate) met the programmed threshold requirements. A POSITA would have understood that, if the pumps were running, there would be flow from the pumps. At the very least, it would have been obvious to a POSITA that a flowrate above zero (*i.e.*, a lower threshold) flow would be the basis for a continuous pumping swap, as described in *Christie*, as fluid is pumped into the first well prior to the second valve being opened.

²⁰⁹ See Section XI.B.

275. Accordingly, Claim 7 is obvious based on the teachings of *Christie*, and the general knowledge of a POSITA.

c. Dependent Claim 8: “The method of claim 5, wherein the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions when the flow rate is both below an upper threshold and above a lower threshold.”

276. Dependent Claim 8 depends from Claim 5, which further depends from Claim 1. In addition to the discussion above regarding Claims 1 and 5, the additional limitations of Claim 8 would have been obvious to a POSITA.

277. As discussed above regarding Claims 6 and 7, and in Section XV.A.6, it would have been obvious to a POSITA that the fluid condition is satisfied when flowrate is both below an upper threshold (e.g., indicating an end of the fracturing stage and/or that it is safe to operate the valve) and above a lower threshold (e.g., above zero flow).

278. It would have also been obvious to a POSITA to have these upper and/or lower thresholds used with *Christie*’s controller in order to “automatically” (without separate instruction) “coordinate a well swap process” while continuously pumping based on the monitored fluid parameters (e.g., flowrate), as thresholds are commonly used for automation.²¹⁰

²¹⁰ *Christie*, [0101]; *Christie Provisional*, [0083].

279. Accordingly, *Christie* renders obvious, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the flowrate is both below an upper threshold and above a lower threshold. Thus, Claim 8 would have been obvious to a POSITA based on the teachings of *Christie* and the general knowledge of a POSITA.

7. DEPENDENT CLAIM 9: “THE METHOD OF CLAIM 1, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE PRESSURE OF THE AT LEAST A PORTION OF THE FLUID COMMUNICATED VIA THE MANIFOLD.”

280. As discussed above regarding Limitation 1.3.2, and incorporated herein by reference, *Christie* teaches or at least suggests, determining when a stage is complete in a first well, and then transitioning (via a CP swap) to fracturing a second well. Further, a POSITA would have understood that *Christie* uses operational parameters (e.g. flowrate and/or pressure of at a least a portion of the fluid communicated via the manifold) to determine when stimulation is completed on one wellbore 102 (e.g. first well) and operate (i.e. open) the appropriate valves (i.e. second valve) and cause the stimulation/fracturing system to inject the treatment fluid (e.g. fracturing fluid) into the next wellbore 102.²¹¹

²¹¹ See, e.g., *Christie*, [0048], [0108]; *Christie Provisional*, [0031], [0080], [0045] [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

281. As discussed above regarding Claim 1, and incorporated herein by reference, *Christie* teaches, when discussing the automation provided by the controller via orchestration level program, that “after stimulation is completed on one wellbore 102, the controller 410 executing the orchestration level program 412 will know the well service status of the next wellbore 102. If the next wellbore 102 is ready for stimulation operations, the controller 410 executing the orchestration level program 412 may operate (i.e., open) the corresponding fluid access valve 204 and cause the stimulation system 420 and the fluid flow control valve system 440 to operate to inject the treatment fluid (e.g., fracturing fluid) into the next wellbore 102.”²¹² A POSITA would have understood *Christie* to be teaching that the controller would at least be determining when stimulation is complete, which would include a “flowrate and/or pressure” condition of at least a portion of the fluid communicated via the manifold.

282. As discussed above in Section XI.E, a POSITA would have known that there is a reduction in flowrate and pressure at the end of the fracturing stage, and that one way to determine when stimulation is completed on one wellbore, would be to monitor the flowrate and/or pressure, as taught by *Christie*, to recognize this reduction in flow and/or pressure indicating the end of the fracturing stage and then

²¹² *Christie*, [0098]; *Christie Provisional*, [0080].

to swap which well is being fractured by manipulating valves, including opening the second valve.

283. Accordingly, *Christie* discloses that the second valve is opened in response to determining that at least a portion of fluid communicated via the manifold satisfying one or more conditions (e.g. reduced flowrate and/or pressure indicating the end of a fracturing stage), which one or more conditions include a flowrate, and/or a pressure, of the at least a portion of fluid communicated via the manifold.

284. A POSITA would have found that determination of the end of a fracturing stage an obvious time to operate valves and swap between fracturing a first well and a second well. *Christie* explicitly teaches performing a well swap after stimulation is completed on a wellbore. A POSITA would have immediately recognized that a fluid condition such as a reduced flowrate and/or pressure are indicators of completion of a fracturing stage, as described above in Section XI.E. In *Christie*'s continuous pumping swap, fluid flowrate and pressure would have been reduced to a level indicative of a "completed" stimulation operation in the first well, and safe for valve operation, but maintained at a level sufficient to allow continuous pumping.

285. Accordingly, it would have been obvious, based on the teachings of *Christie* and the general knowledge of basic hydraulic fracturing, to use the

operational parameters, including pressure of at least a portion of the fluid communicated via the manifold, to determine when fracturing is complete in the first well and to move on to hydraulically fracturing the second well by opening the second valve.

286. Accordingly, Claim 9 would have been obvious to a POSITA based on the teachings of *Christie* and the general knowledge of a POSITA.

8. DEPENDENT CLAIMS 10-12: PRESSURE THRESHOLDS

287. Claims 10-12 recite that the “condition(s)” are satisfied with the pressure is below an upper threshold and/or above a lower threshold. The ’952 Patent is completely silent as to using pressure conditions for indicating when to operate a valve in a CP swap. Accordingly, the ’952 Patent is also completely silent as to what “upper” and “lower” pressure thresholds could be or how to select upper and lower pressure thresholds.

288. As discussed above with Claims 6-8, a POSITA having general knowledge of typical zipper fracturing operations would be aware that zipper fracturing operations typically switch to a next fracturing stage at the end of a current fracturing stage and valve operation for such switching only occurs when it is safe to do so, e.g., when the flow through the valves have low enough flowrate and pressure to be operated. Thus, because the ’952 Patent gives no guidance/instruction for operating valves in a CP swap in response to the fluid pressure conditions, a

POSITA would have relied on their general engineering knowledge and found it obvious to select pressure thresholds indicating the end of a current fracturing stage and indicating that it is safe to operate the valves. Accordingly, a POSITA would have likely selected flowrate “upper thresholds” that are low enough to indicate the end of a fracturing stage and that it is safe to operate a valve. Further, in continuous pumping operations, where the pumps continuously pump fluid to the zipper manifold and selected well(s), a POSITA would have understood that there would at least be enough fluid flow for the continuous pumping operations, e.g., a pressure above a lower threshold of zero.

289. In a continuous pumping swap, as described in *Christie*, fluid flow is reduced to a level indicating that stimulation in the first well is complete, and it is safe for valve operation, where the fluid’s pressure would be below an upper threshold but maintained at a level sufficient to allow continuous pumping downhole, where the fluid’s pressure would be above a lower threshold of zero.²¹³

290. Based on the teachings of *Christie*, a POSITA would have understood that *Christie* uses operational parameters (e.g., flow rate and/or pressure of at least a portion of the fluid communicated via the manifold) to determine when stimulation is completed on one wellbore (e.g., first well) and operate (i.e., open) the appropriate

²¹³ See, e.g., *Christie*, [0093], [0098]-[0099]; *Christie Provisional*, [0075], [0080], [0081].

valves (*i.e.*, second valve) and to direct the continuously pumped treatment/fracturing fluid into the next wellbore.

291. To the extent that the Board finds that *Christie* does not explicitly state that the second valve is opened “in response to” fluid pressure threshold(s) indicating the end of a fracturing stage, a POSITA would have found that determination of the end of a fracturing stage an obvious time to operate valves and swap between fracturing a first well and a second well. *Christie* explicitly teaches performing a well swap “after stimulation is completed on one wellbore” e.g., a first well.²¹⁴ A POSITA would have immediately recognized that a fluid condition such as a reduced flowrate and/or pressure are indicators of completion of a fracturing stage, as described above in Section XI.E. In a continuous pumping swap, as described in *Christie*, pressure is reduced to a level indicating that fracturing in the first well is complete, and it is safe for valve operation, below an upper pressure threshold, but maintained at a level sufficient to allow continuous pumping downhole, above a lower pressure threshold. Accordingly, it would have been obvious, based on the teachings of *Christie* and the general knowledge of basic hydraulic fracturing, to use a fluid pressure below an upper threshold and/or above a lower threshold, to determine when fracturing is complete in the first well and to move on to

²¹⁴ *Christie*, [0099]; *Christie Provisional*, [0081].

hydraulically fracturing the second well by opening the second valve while continuously pumping.

292. Further, a POSITA would have found it obvious to use such fluid pressure thresholds as “predetermined set-points” with *Christie*’s controller to “enable various levels of automation...of the operational parameters of the equipment of the wellsite system” using “data relating to the operational parameters of the wellsite system” (e.g., the measured fluid flowrate and/or pressure) and “to determine whether a particular operational parameter is within an acceptable operating range.”²¹⁵ By doing so, *Christie*’s controller could “automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves” based on whether the measured fluid pressure is above and/or below pressure thresholds (e.g., within an acceptable operating range) indicating the end of a fracturing stage and when to initiate the next well’s fracturing stage “which the goal of performing continuous pumping.”²¹⁶

²¹⁵ *Christie*, [0110], [0125]-[0126]; *Christie Provisional*, [0076]-[0083], [0090]-[0091].

²¹⁶ *Christie*, [0098], [0101]; *Christie Provisional*, [0080], [0083].

- a. Dependent Claim 10: “The method of claim 9, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the pressure is below an upper threshold.”**

293. Claim 10 depends from Claim 9, which further depends from Claim 1. In addition to the discussion above regarding Claims 1 and 9, each incorporated herein by reference, the additional limitations of Claim 10 would have been obvious to a POSITA.

294. As discussed above regarding Claim 5, and incorporated herein by reference, it would have been obvious to a POSITA that flowrate and pressure drops at the end of the fracturing stage, and that this drop in flowrate and pressure below a threshold indicative of a completed stimulation treatment in a first well would be an obvious time to execute a continuous pumping swap between a first well and a second well. Accordingly, it would have been obvious to a POSITA that a drop in pressure below an upper threshold would also be an obvious time to swap between hydraulically fracturing a first well and a second well, including a CP swap as discussed above regarding Limitation 1.3.

295. Accordingly, Claim 10 would have been obvious to a POSITA based on the teachings of *Christie* and the general knowledge of a POSITA.

b. Dependent Claim 11: “The method of claim 9, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the pressure is above a lower threshold.”

296. Dependent Claim 11 depends from Claim 9, which further depends from Claim 1. In addition to the discussing above regarding Claims 1 and 9, each incorporated herein by reference, the additional limitations of Claim 11 would have been obvious to a POSITA.

297. As discussed above regarding Claim 9 and in Section XV.A.8, and incorporated herein by reference, it would have been obvious to a POSITA that there would be at least some flow during a CP swap as taught by *Christie*, as valves are open allowing fracturing fluid to be pumped into at least one well throughout the whole process, including fluid being pumped into the first well prior to opening the second valve and allow fluid to be pumped into the second well. Further, a POSITA would have understood, based on the general knowledge of hydraulic fracturing and the characteristics of the formation, that flow into the formation would develop some additional pressure above the natural pressure of the formation.²¹⁷ A POSITA would have understood that, if the pumps were running, there would be flow from the pumps and a corresponding increase in pressure in the manifold and pumps. Accordingly, it would have been obvious to a POSITA that a pressure above a lower

²¹⁷ See section XI.C – XI.E.

threshold (i.e. natural formation pressure) would also be an obvious time to swap between hydraulically fracturing a first well and a second well, including a CP swap as discussed above regarding Limitation 1.3.

298. Thus, Claim 11 would have been obvious to a POSITA based on the teachings of *Christie* and the general knowledge of a POSITA.

c. Dependent Claim 12: “The method of claim 9, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the pressure is both below an upper threshold and above a lower threshold.”

299. Dependent Claim 12 depends from Claim 9, which further depends from Claim 1. In addition to the discussing above regarding Claims 1 and 9, the additional limitations of Claim 12 would have been obvious to a POSITA.

300. As discussed above regarding Claims 10-11 (referring to the discussion of Claim 9) and Claim 1, it would have been obvious to a POSITA that the fluid condition is satisfied when pressure is both below an upper threshold (i.e., end of the stage) and above a lower threshold (e.g., natural formation pressure). Accordingly, *Christie* renders obvious, wherein the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions when the pressure is both below an upper threshold and above a lower threshold. Thus, Claim 12 would have been obvious to a POSITA based on the teachings of *Christie*, and the general knowledge of a POSITA

9. DEPENDENT CLAIM 13

301. Dependent Claim 13 depends from Claim 1. In addition to the discussing above regarding Claim 1, *Christie* discloses, or at least renders obvious, the additional limitations of Claim 13, or at least they would have been obvious to a POSITA.

302. The limitations of Claim 13 are substantially similar to the limitations of Claim 3 except that the CP swap discussed swaps from hydraulically fracturing the third well to hydraulically fracturing the first well, as opposed to the swap to hydraulically fracturing the fourth well, as discussed in Claim 3. Further, it would have been obvious to a POSITA, based on the teachings of *Christie* swapping between hydraulically fracturing the third well and the first well.

303. For the same reasons provided with Claim 3 outlining *Christie*'s application of its CP swap methods to "each of a plurality of wellbores 102", including first through fourth wells shown in Fig. 1, *Christie*'s CP swap method would apply to all of the wellbores, including swapping fracturing from fracturing the third wellbore to fracturing the first wellbore.²¹⁸

304. To the extent the Board finds that *Christie* does not expressly disclose applying the CP swap methodology to "first and third wells," it would have been

²¹⁸ See, e.g., *Christie*, [0161]-[0162] (describing Fig. 9 as an example of the method).

obvious to a POSITA to apply the teachings of a “first and second well” from *Christie* to a “third and first well” to take advantage of the increased hydrocarbon production, operating efficiencies and reduced time between stages taught by *Christie* at multiple well locations, including the third and first wells disclosed by *Christie*.

305. Moreover, mere repetition of elements has no patentable significance unless a new and unexpected result is produced. Here, performing the method of Claim 1 on additional wells in the same environment (*i.e.*, third well and first well) would be performed in the same way and produce the same expected results as using the method on the first and second wells and, therefore, would have been obvious to a POSITA.

306. *Christie*, therefore, discloses each and every limitation of Claim 13, or at least they would have been obvious to a POSITA, Claim 13 would have been obvious to a POSITA based on the teachings of *Christie*.

**10. DEPENDENT CLAIM 14 THE METHOD OF CLAIM 1, FURTHER
COMPRISING: HYDRAULICALLY FRACTURING THE FIRST WELL;
AND HYDRAULICALLY FRACTURING THE SECOND WELL;
WHEREIN THE FLUID, WHICH IS CONTINUOUSLY
COMMUNICATED VIA THE MANIFOLD DURING THE CP SWAP, IS
HYDRAULIC FRACTURING FLUID.**

307. Dependent Claim 14 depends from Claim 1. In addition to the discussing above regarding Claim 1, incorporated herein by reference, *Christie*

discloses the additional limitations of Claim 14, or at least they would have been obvious to a POSITA.

308. As discussed above regarding Claim 1, *Christie*'s continuous pumping swap operations use a treatment fluid that "may be or include a fracturing fluid, and the treatment fluid systems may be or include a fracturing fluid mixing and pumping system for facilitating well fracturing operations."²¹⁹

309. Accordingly, *Christie* discloses, or at least renders obvious, wherein the fluid of Claim 1 is a fracturing fluid, as recited in Claim 14.

11. DEPENDENT CLAIM 15: "THE METHOD OF CLAIM 14, WHEREIN THE HYDRAULIC FRACTURING FLUID COMPRISES SAND."

310. Dependent Claim 15 depends from Claim 14, which further depends from Claim 1. In addition to the discussing above regarding Claims 1 and 14, *Christie* discloses the additional limitations of Claim 15, or at least they would have been obvious to a POSITA.

311. As discussed above regarding Claim 14, *Christie* teaches a method of continuous pumping swap using wellsite system 100 and hydraulic fracturing fluid. Further, *Christie* teaches the wellsite system 100 may further include a container containing a second material that "may be or include a proppant material, such as

²¹⁹ *Christie*, [0161]; *Christie Provisional*, [0006], [0069], [00108], [00113], [00114], [00115], [00116].

quartz, sand, sand-like particles, silica, and/or propping agents, among other examples.”²²⁰ A mixer mixes or otherwise combines a base fluid and the second material “to form a mixed fluid, which may be or include what is known in the art as a fracturing fluid.”²²¹ Further, using sand as a proppant in a fracturing fluid was well known to a POSITA for decades prior to the ’952 Patent.²²²

312. Accordingly, *Christie* discloses or at least renders obvious wherein the hydraulic fracturing fluid comprises sand as recited in Claim 15.

12. DEPENDENT CLAIM 16

313. Dependent Claim 16 depends from Claim 1. In addition to the discussing above regarding Claim 1, *Christie* discloses or renders the additional limitations of Claim 16 obvious. *Christie* discloses or at least suggests each and every limitation of Claim 16, as discussed in the subsections below. Accordingly, *Christie* renders Claim 16 obvious.

a. 16.1: “The method of claim 1, further comprising: displaying a dashboard, which dashboard comprises:”

314. *Christie* discloses the use of a “dashboard”. *Christie* discloses that “controller(s) 161 may be communicatively connected to one or more human-machine interface (HMI) devices, which may be utilized by the wellsite operator(s)

²²⁰ *Christie*, [0036]; *Christie Provisional*, [0019].

²²¹ *Christie*, [0036]; *Christie Provisional*, [0019].

²²² *See, e.g.*, Section XI.B.

164 for entering or otherwise communicating the control commands to the controller(s) 161, and for displaying or otherwise communicating information from the controller(s) 161 to the wellsite operator(s) 164.”²²³ The HMI includes “one or more output devices,” “e.g., a video monitor.”²²⁴ *Christie* discloses the use of HMIs throughout its figures, e.g., HMIs 166, 168 in Fig. 1.

315. Although *Christie* does not use the term “dashboard”, a POSITA would have understood *Christie*’s disclosure of an HMI “for displaying or otherwise communicating information from the controller(s) 161 to the wellsite operator(s)” to be a “dashboard” as the term is used in the ’952 Patent.

316. Further, the use of HMI dashboards would have been obvious based on the general knowledge of a POSITA at the time of the ’952 Patent (January 2023). A POSITA would have recognized that computer screens used as HMIs were ubiquitous in many industries, including oil & gas completion and fracturing. Computerized control for fracturing operations, including using displays as HMIs has been known since at least the late 1980s.²²⁵ I first used a computer display as a

²²³ *Christie*, [0050], [0057], [0066], [0069], [0082], [0110], [0132]; *Christie Provisional*, [0033], [0040], [0048], [0051], [0064], [0076]-[0083], [0097].

²²⁴ *Christie*, [0050], [0066]; *Christie Provisional*, [0033], [0048].

²²⁵ See, e.g., H. Tomlinson, A. Byrd, and C. VanBerg, “Fracturing process control and automation,” in *Permian Basin Oil and Gas Recovery Conference*, 1988: OnePetro.

“dashboard”, including visual representations of the positions of valves, when designing control systems around 1990 and have used them, and seen them used, continuously since. Accordingly, a POSITA would have found it obvious to use a “dashboard” (i.e., HMI) based on the teachings of *Christie* and the general knowledge of a POSITA.

b. 16.2: “a visual reference of the first valve; and a visual reference of the second valve;”

317. As discussed above, *Christie* teaches using a dashboard (HMI) to communicate information from the controller to the wellsite operators. *Christie* further teaches that the HMI “may permit visualization or other sensory perception of various data, such as sensor data, status data, and/or other example data.”²²⁶ *Christie* further teaches that the “status data” being monitored by the controller and displayed by the HMI includes “operational status (i.e., position) of the fluid flow control valves (e.g., the fluid flow control valves 204, 206, the access valve 208, the fluid flow control valves 173) for controlling fluid flow through one or more of the wellheads 178 into the corresponding one or more of the wellbores 102.”²²⁷ Accordingly, *Christie* discloses displaying the position of the fluid flow control valves, including valves 173 identified above regarding Claim 1 as the “first and

²²⁶ *Christie*, [0132]; *Christie Provisional*, [0097].

²²⁷ *Christie*, [0093]; *Christie Provisional*, [0075].

second valves”. It would have been obvious to a POSITA to use a “visual reference” of a first and second valve to communicate the position of the valves. *Christie* teaches “visualization” of data including “operational status (i.e., position)” of the valves, which would at least have made it obvious to a POSITA to include a “visual reference” of the valves. Visual references of equipment, including valves, have been used for decades on HMIs, including with fracturing systems.

c. 16.3”: “wherein the display of the dashboard visually communicates respective states of the first and second valves.”

318. As discussed above, *Christie*’s HMI (dashboard) permits visualization of “status data” including the “operational status (i.e., position)” of valves 173 (identified “first” and “second” valves). The “position” of the valves would comprise the respective states of the valves. Accordingly, *Christie* discloses, or at least it would have been obvious, to visually communicate respective states of the first and second valves for the same reasons as those described above.

13. DEPENDENT CLAIM 17: “THE METHOD OF CLAIM 16, WHEREIN THE DASHBOARD FURTHER COMPRISES: A FIRST VISUAL INDICATOR ASSOCIATED WITH THE VISUAL REFERENCE OF THE FIRST VALVE, THE FIRST VISUAL INDICATOR INDICATING THAT THE STATE OF THE FIRST VALVE IS OPEN TO PERMIT COMMUNICATING FLUID TO THE FIRST WELL VIA THE MANIFOLD AND THE FIRST VALVE.”

319. Dependent Claim 17 depends from Claim 16. In addition to the discussing above regarding Claim 16, *Christie* discloses or renders the additional limitations of Claim 17 obvious.

320. As discussed above regarding Claim 16 and incorporated herein by reference, *Christie* teaches, or it would have been obvious to a POSITA, that its HMI (dashboard) visually displays the “operational status (i.e., position)” of the first and second valve (e.g., valve 173). The “position” of the valve would include an “open” position of the valve. Accordingly, it would have at least been obvious to a POSITA to use a visual indicator (e.g., display percent open textually, shading, color, etc.) to visually present the “operational status (i.e., position)” of the valve, including when the valve is open to permit communicating fluid to the first well via the manifold and the first valve. Using a visual representation on an HMI to display when the valve is opened has been known for decades.

14. DEPENDENT CLAIM 18: “THE METHOD OF CLAIM 17, WHEREIN THE DASHBOARD FURTHER COMPRISES: A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

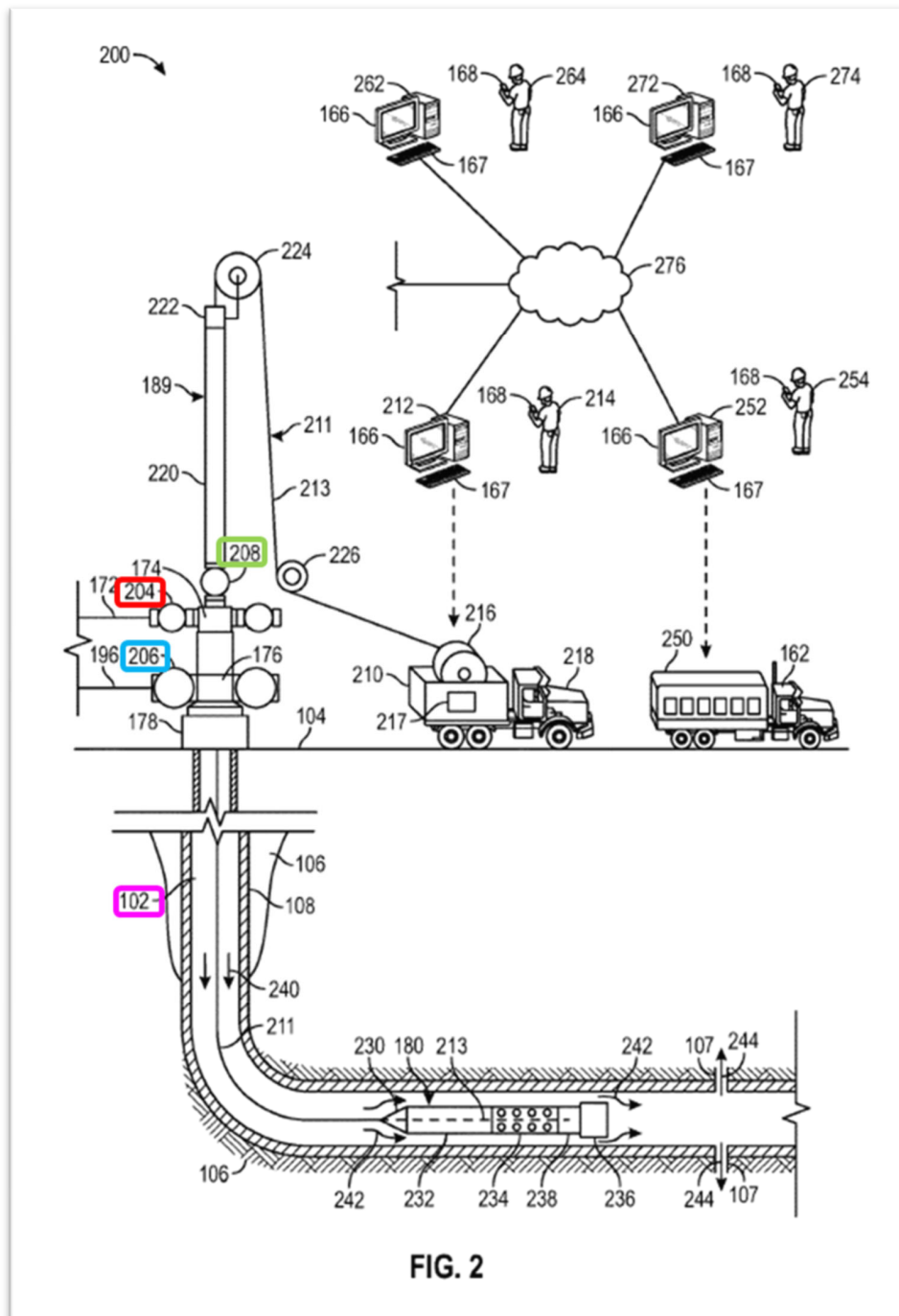
321. Dependent Claim 18 depends from Claim 17. In addition to the discussing above regarding Claim 17, *Christie* renders the additional limitations of Claim 18 obvious.

322. As discussed above regarding Claim 16 and incorporated herein by reference, *Christie* discloses using a dashboard to display the “status data” including “operational status (i.e., position) of the fluid flow control valves (e.g., the fluid flow control valves 204, 206, the access valve 208, the fluid flow control valves 173) for controlling fluid flow through one or more of the wellheads 178 into the

corresponding one or more of the wellbores 102.”²²⁸ *Christie* shows that valves 204, 206 and 208 (annotated in red, blue, green respectively) comprise a wellhead, as shown in Fig. 2 of *Christie*. Further, Fig. 2 shows that the wellhead is in communication with “first well” 102 (annotated in magenta). This is the same as the “plurality of wellbores 102” discussed above regarding Claim 1 and used for fracturing the formation. *Christie* teaches that “[e]ach wellbore 102 may be capped by a plurality (e.g., a stack) of fluid flow control devices 174, 176, which may include or form a Christmas tree (e.g., a frac tree).”²²⁹ It was common, even necessary, for wellbores being hydraulically fractured to have a wellhead (frac tree) to allow the well to be opened for injection of fracturing fluid, and closed to isolate the well from the treatment fluid.

²²⁸ *Christie*, [0093]; *Christie Provisional*, [0075].

²²⁹ *Christie*, [0041]; *Christie Provisional*, [0024].



Christie Provisional, Fig. 2 (annotated)²³⁰

²³⁰ See *Christie Provisional, Fig. 2*.

323. A POSITA would have found it obvious to include a visual reference of a wellhead, such as the visual representation of a wellhead in Fig. 2, in order to show the operational status of valves, such as valves 204 and 206 and “provide visibility to operational status of multiple operations across multiple wells.”²³¹ Such a reference would enable the operator to more easily distinguish the position of the various valves 204, 206 associated with different wells and to see which wells were opened for treatment and which wells were isolated from the treatment fluid (fracturing fluid) being pumped continuously in the system of *Christie*. Accordingly, *Christie* renders Claim 18 obvious.

15. DEPENDENT CLAIM 19: “THE METHOD OF CLAIM 17, WHEREIN THE DASHBOARD FURTHER COMPRISES: A SECOND VISUAL INDICATOR ASSOCIATED WITH THE VISUAL REFERENCE OF THE SECOND VALVE, THE SECOND VISUAL INDICATOR BEING DIFFERENT FROM THE FIRST VISUAL INDICATOR TO INDICATE THAT THE STATE OF THE SECOND VALVE IS CLOSED.”

324. Dependent Claim 19 depends from Claim 17. In addition to the discussing above regarding Claim 17, *Christie* renders the additional limitations of Claim 19 obvious. As discussed above regarding Claim 18 and incorporated herein by reference, *Christie* teaches, or at least it would have been obvious to a POSITA to use a visual indicator to show the “operational status (i.e., position)” of the valves (first valve) including when the valve is opened. For the same reasons, it would

²³¹ *Christie*, [0050], [0089]; *Christie Provisional*, [0033], [0071].

have been obvious to a POSITA to use a different indicator (e.g., display percent open (0%) textually, different shading, different color, etc.) to visually present the “operational status (i.e. position)” of the valve when it is closed. Using a different visual representation on an HMI to display when the valve is closed has been known for decades.

16. INDEPENDENT CLAIM 20

325. It is my opinion that *Christie* alone renders Claim 20 obvious and discloses, or at least suggests each and every limitation of Claim 20.

- a. 20.1: “A non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the operations comprising:”**

326. With the exception of a reference to a “non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations”, which a POSITA would have recognized as a generic computer system, this claim limitation is substantially similar to Limitation 1.1 and is disclosed by *Christie* for the same reasons as those described in Section XV.A.1.a.

327. Further, *Christie* also discloses the claimed generic computer system. *Christie* teaches its “controller includes a processor and a memory storing computer

program code.”²³² Further still, *Christie* teaches the use of “one or more control centers 160, each having a controller 161 (e.g., a processing device, a computer, a programmable logic controller (PLC), etc.), which may be configured to monitor and provide control to one or more portions of the wellsite system 100,” and that “controller(s) 161 may store control commands, operational parameters and set-points, coded instructions, executable programs, and other data or information, including for implementing one or more aspects of the operations described herein.”²³³ The description in *Christie* matches the claimed “non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations for hydraulically fracturing a plurality of wells” of Limitation 20.1.

328. A POSITA would have immediately equated the “control commands, operational parameters and set-points, coded instructions, executable programs” of *Christie* to the claimed “plurality of instructions.” A POSITA would have also immediately recognized the disclosure of *Christie* to be a disclosure of the instructions “executable by one or more processors,” as claimed. Additionally, a POSITA would have immediately equated *Christie*’s disclosure of the “commands,

²³² *Christie*, [0031]; see *Christie Provisional*, [0004].

²³³ *Christie*, [0048]; see *Christie Provisional*, [0031].

instructions and programs” to the claimed “instructions [] executed by the one or more processors,” to execute the claimed steps.

329. Accordingly, *Christie* discloses the limitations of 20.1, or at least they would have been obvious to a POSITA based on the disclosure of *Christie*.

b. 20.2: “communicating fluid from one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”

330. This claim limitation is identical to Limitation 1.2 and is disclosed by *Christie* for the same reasons as those described in Section XV.A.1.b.

c. 20.3: “executing a continuous pumping ("CP") swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

331. This claim limitation is identical to Limitation 1.3 and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.c.

- d. 20.3.1: “opening a second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”**

332. This claim limitation is identical to Limitation 1.3.1 and is disclosed by *Christie* for the same reasons as those described in Section XV.A.1.d.

- e. 20.3.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold; and”**

333. This claim limitation is identical to Limitation 1.3.2 and is and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.e.

- f. 20.3.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of the fluid communicated via the manifold, and”**

334. This claim limitation is identical to Limitation 1.3.3 is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.f.

g. 20.3.4: “while fluid is communicated from the one or more pumps to the second well via the second valve and the manifold;”

335. This claim limitation is identical to Limitation 1.3.4 is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.g.

h. 20.4: “wherein, during the CP swap, fluid is continuously communicated from the one or more pumps via the manifold.”

336. This claim limitation is identical to Limitation 1.4 is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.h.

337. Claim 20, therefore, would have been obvious to a POSITA in view of the teachings of *Christie*.

17. DEPENDENT CLAIM 21

338. Except for depending from Claim 20, the limitations of Claim 21 are identical to those of Claim 2, and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.2.

18. DEPENDENT CLAIM 22

339. Except for depending from Claim 20, the limitations of Claim 22 are the same as those of Claim 3, and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.3.

19. DEPENDENT CLAIM 23: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 20, WHEREIN THE OPERATIONS FURTHER COMPRISE: DETERMINING THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

340. Except for depending from Claim 20, Claim 23 recites the same limitations as in Claim 4. In my opinion, Claim 23 adds no additional limitations to Claim 20. Claim 20, Limitation 20.3.2 claims “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions...” (identical to Limitation 1.3.2). Before the method claimed in claim 20 can open the valve “in response to” at least a portion of fluid communicated via the manifold satisfying one or more conditions, the method must first “determine” that the fluid has met the one or more conditions.

341. To the extent that the Board finds that Claim 23 does add additional limitations, *Christie*, discloses or renders the additional limitations of Claim 23 obvious for the same reasons as those described with Limitation 1.3.2 and Claim 4 in Sections XV.A.1.e and XV.A.4.

20. DEPENDENT CLAIM 24: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 20, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE FLOW RATE OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

342. Dependent Claim 24 depends from Claim 20 and recites the “condition” includes flowrate, which was analyzed in the discussion of Claims 1 and 5.

343. *Christie* discloses or renders Claim 24 obvious for the same reasons as those described in Sections XV.A.1.e and XV.A.5.

21. CLAIMS 25 – 27

344. Except for depending from Claim 24, the limitations of Claims 25-27 are identical to those of Claims 6-8, respectively, and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.6.

22. DEPENDENT CLAIM 28

345. Except for depending from claim 20, the limitations of Claim 28 are substantially similar to those of Claim 9 and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.7.

23. CLAIMS 29 – 31

346. Except for depending from claim 28, the limitations of Claims 29-31 are substantially similar to those of Claim 10-12, respectively, and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.8.

24. DEPENDENT CLAIMS 32 – 38

347. Except for depending from Claim 20, the limitations of Claim 32 - 38, are substantially similar to those of Claims 13- 19, respectively, and are disclosed or obvious over *Christie* for the same reasons as those described in Section XV.A.9-15.

25. INDEPENDENT CLAIM 39

348. It is my opinion that *Christie* alone renders Claim 39 obvious and discloses, or at least suggests each and every limitation of Claim 39.

a. 39.1: “A system for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the system comprising:”

349. Except for being rewritten as a system claim, the limitations of 39.1 are identical to those of Limitation 1.1 and are disclosed by *Christie* for the same reasons as those discussed above in Section XV.A.1.a.

b. 39.2: “a manifold via which fluid is adapted to be communicated from one or more pumps;”

350. *Christie* discloses a manifold via which fluid is adapted to be communicated from one or more pumps. *Christie* discloses, as part of wellsite system 100, pump units 150 (annotated in red) that each include a pump 152 (annotated in blue).²³⁴ These pumps pump fracturing fluid to a fracturing manifold 170 (annotated in dark red), which may selectively distribute the fracturing fluid between the wellbores 102 (annotated in dark blue) via a plurality of corresponding fluid conduits 172 (annotated in yellow) extending between the fracturing manifold 170 and each wellbore 102.”²³⁵

²³⁴ *Christie*, [0037]-[0038]; see *Christie Provisional*, [0020]-[0021], Fig. 1.

²³⁵ *Christie*, [0038], [0040]; see *Christie Provisional*, [0021], [0023].

351. Accordingly, *Christie* discloses a manifold (170) via which fluid is adapted to be communicated from one or more pumps (152) as claimed in Limitation 39.2.

c. **39.3: “a first valve via which fluid is adapted to be communicated from the one or more pumps to the first well, the first valve being associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

(1) a first valve via which fluid is adapted to be communicated from the one or more pumps to the first well

352. *Christie* further discloses that the fracturing/zipper manifold 170 includes fluid flow control valves 173 (annotated in purple) that are each remotely operable to fluidly connect (and disconnect) the pumping system to (and from) a selected one or more of the fluid conduits 172 and, thus, “*facilitate injection of the treatment fluid into a selected one or more of the wellbores 102.*”²³⁷ The “plurality of remotely operated fluid flow control valves 173” include a first and second valve.

353. Further, *Christie* discloses that “[e]ach wellbore 102 may be capped by a plurality (e.g., a stack) of fluid flow control devices 174, 176, which may include or form a Christmas tree (e.g., a frac tree) including fluid flow control valves.”²³⁸ The frac tree valves 174 “may be configured to close selected tubulars or pipes [] to

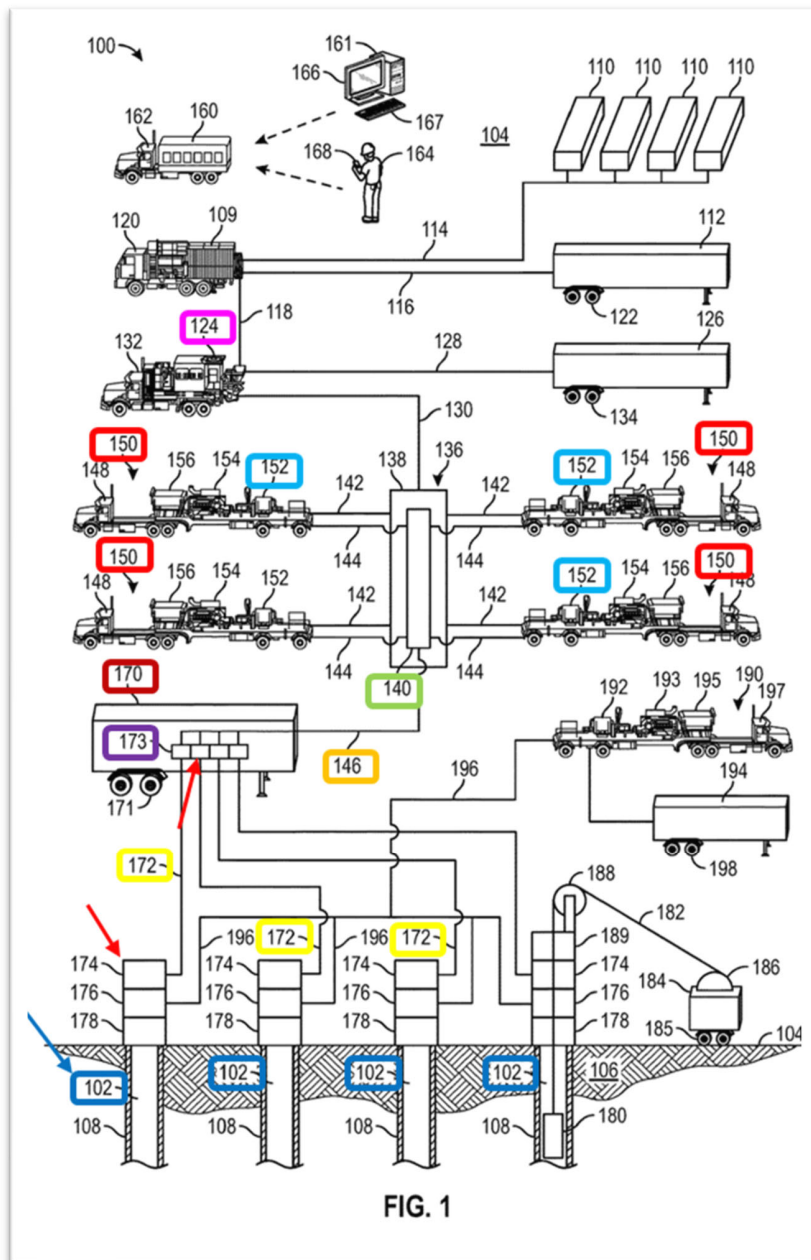
²³⁷ *Christie*, [0040]; see *Christie Provisional*, [0023].

²³⁸ *Christie*, [0041]; see *Christie Provisional*, [0024].

selectively facilitate fluid access to the wellbore 102.”²³⁹ Further, *Christie* discloses that each fracturing/zipper manifold valve 173 may be fluidly connected to a corresponding frac tree valve 174 via one or more fluid conduits 172, to facilitate selective fluid connection between the pumping system and one or more of the wellbores 102, thereby forming “a fluid flow control valve system configured to fluidly connect (and disconnect) [] the treatment fluid system [] to (and from) a selected one or more of the wellbores 102.”²⁴⁰ Accordingly, valves 174 also include a first valve (identified with red arrow, associated with the first well identified with blue arrow) and a second valve.

²³⁹ *Christie*, [0041]; *Christie Provisional*, [0024].

²⁴⁰ *Christie*, [0041]; see *Christie Provisional*, [0024].



Christie, Fig.1 (annotated)²⁴¹

²⁴¹ See *Christie Provisional*, Fig. 1.

354. Accordingly, *Christie* discloses a first valve (173, 174 identified with red arrow) via which fluid is adapted to be communicated from the one or more pumps (152, annotated in blue) to the first well (102, identified with blue arrow) as claimed.

(2) the first valve being associated with both the first well and the manifold

355. As seen in the annotated *Christie* Figure 1 above, valves 173 (including a first valve, identified with red arrow) are part of zipper manifold 170 (annotated in dark red), and thus are associated with the manifold. Further, the first valve communicates fluid to the first well via an isolated conduit 172 (annotated in yellow). Accordingly, the first valve is also associated with the first well.

356. Further still, *Christie* teaches that each fracturing/zipper manifold valve 173 and fluidly connected frac tree valve 174 fluidly connect the pumping system and wellbores, forming a fluid flow control valve system configured to fluidly connect (and disconnect) the treatment fluid (pumping) system to (and from) a selected one or more of the wellbores.²⁴² Accordingly, valves 174 (including a first valve, identified with red arrow) is part of the wellhead tree associated with the first well and thus is associated with the first well. As the first valve 174 is fluidly directly

²⁴² *Christie*, [0041]; *Christie Provisional*, [0024].

connected between the manifold and the first well (via first valve 173), first valve 174 is also associated with the manifold.

357. Therefore, *Christie* teaches multiple examples of a first valve associated with both a first well and the manifold.

(3)so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”

358. Because *Christie*’s valves 173 (including a first valve 173) are part of the fracturing manifold 170 and connect and disconnect the first well with/from the manifold to “facilitate injection of treatment fluid”, valves 173 (including a first valve) is in fluid communication with the manifold.²⁴³

359. Further, as described above and shown in annotated Figure 1 above, the first valve controls fluid delivered from the pumps (pump units 150 [annotated in red] with each pump unit having a pump 152 [annotated in blue]) and to the first well 102. This shows that the valve is fluidically positioned between the first well and the plurality of pumps.

360. A similar analysis pertains to first valve 174. As *Christie* teaches that the valves 174 (including a first valve identified with red arrow) is connected between the manifold 170 and the first well (identified with blue arrow), the first

²⁴³ *Christie*, [0040]; *Christie Provisional*, [0023].

valve 174 is in fluid communication with the manifold, fluidically positioned between the manifold (and the pumps, which are upstream of the manifold) and the first well.²⁴⁴ Accordingly, *Christie* discloses the limitations of 39.3.

d. 39.4: “a second valve via which fluid is adapted to be communicated from the one or more pumps to the second well, the second valve being associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is adapted to be communicated to the first well via the manifold and the first valve; and”

(1) a second valve via which fluid is adapted to be communicated from the one or more pumps to the second well,

361. *Christie* discloses, as part of wellsite system 100, pumps 152 that receive fracturing fluid from the mixer (blender) 124 (annotated in magenta) and discharge pressurized fracturing fluid to a zipper manifold 170 (annotated in dark red) via a discharge manifold 140 (annotated in green) and conduits 146 (annotated in orange).²⁴⁵

²⁴⁴ See *Christie*, [0040], *Christie Provisional*, [0023].

²⁴⁵ *Christie*, [0038]; *Christie Provisional*, [0021].

conduits 172 extending between the fracturing manifold 170 and each wellbore 102.²⁴⁶ The zipper manifold valves 173 (annotated in purple) are “remotely operable to fluidly connect (and disconnect) the fluid conduit 146 to (and from) a selected one or more of the fluid conduits 172 and, thus, *facilitate injection of the treatment fluid into a selected one or more of the wellbores 102.*”²⁴⁷ The “plurality of remotely operated fluid flow control valves” includes a second valve 173 (identified with red arrow above). When the valve is opened “*injection of the treatment fluid into a selected one or more of the wellbores 102 [i.e. second well]*” occurs.

363. Further, each fracturing/zipper manifold valve 173 is fluidly connected to a corresponding fluid flow control device 174 via one or more fluid conduits 172, to facilitate selective fluid connection between the pumping system and one or more of the wellbores 102. Thus, the fracturing/zipper manifold valves 173 and the fluid flow control valves 174 may fluidly connect (and disconnect) the treatment fluid system to (and from) a selected one or more of the wellbores 102.²⁴⁸ Accordingly, second valves 173 and 174 (identified with red arrows) work together to fluidly connect and disconnect the pumps (treatment fluid system) from the wells. When the second valves are opened, fluid flows from the pumps to the wells.

²⁴⁶ *Christie*, [0040]; *see Christie Provisional*, [0023].

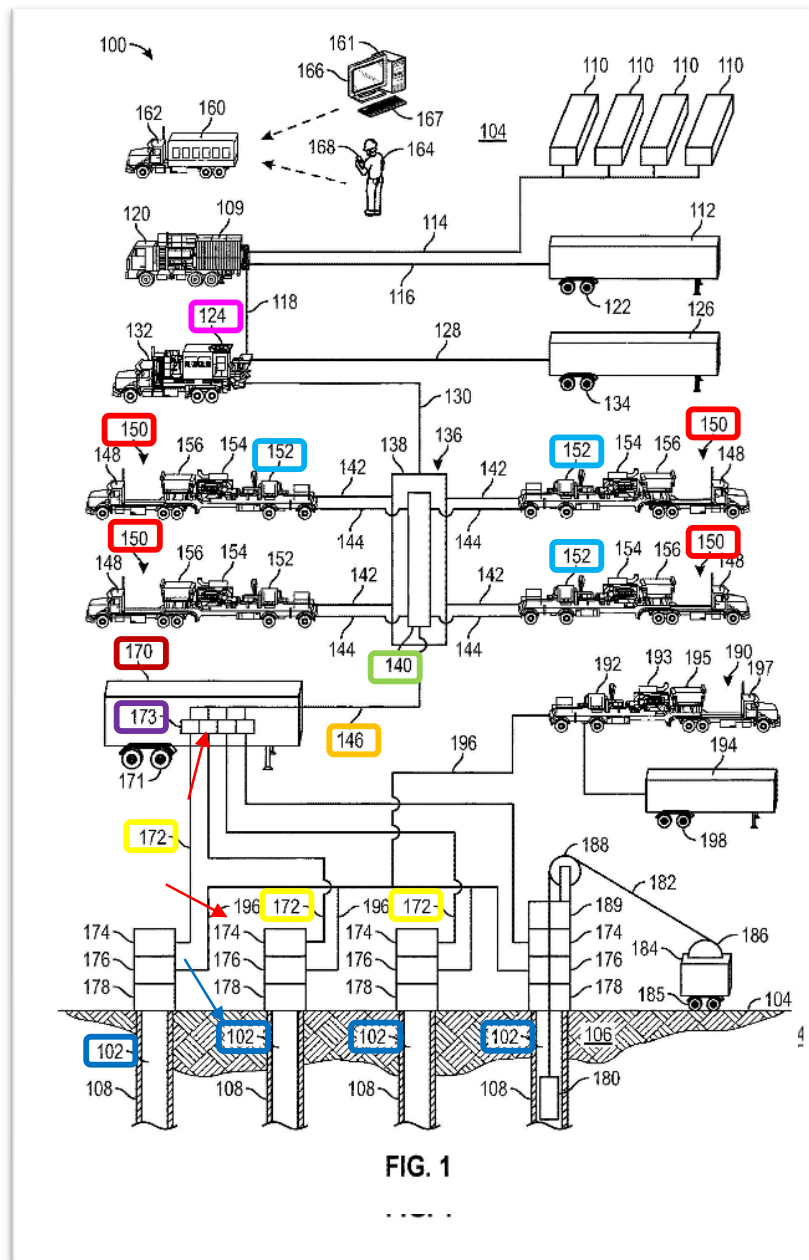
²⁴⁷ *Christie*, [0040]; *see Christie Provisional*, [0023].

²⁴⁸ *Christie*, [0041]; *see Christie Provisional*, [0024].

364. Accordingly, *Christie* discloses a second valve (one of the plurality of valves 173, 174) via which fluid is adapted to be communicated from the one or more pumps (152 annotated in red) to the second well (one of wellbores 102, identified with blue arrow).

(2) the second valve being associated with both the second well and the manifold

365. As seen in the annotated Figure 1 below, valves 173 (including a second valve, identified with red arrow) are part of zipper manifold 170 (annotated in dark red), and thus are associated with the manifold. Further, the second valve communicates fluid to the second well 102 (identified with blue arrow) via an isolated conduit 172 (annotated in yellow). Accordingly, the second valve is also associated with the second well.



Christie, Fig.1 (annotated)

366. Further, a similar analysis pertains to second valve 174 (identified with red arrow). Second valve 174 (identified with red arrow) is part of the wellhead attached to the second well 102 (identified with blue arrow) and thus is associated

with the second well. Further, the second valve 174 communicates fluid from the zipper manifold 170 (annotated in dark red), and thus is associated with the manifold.

367. Accordingly, *Christie's* second valves (173 or 174) are associated with both the manifold and the second well.

(3) the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is adapted to be communicated to the first well via the manifold and the first valve;

368. Because the fracturing/zipper manifold valves 173 (including a second valve 173) are part of the fracturing manifold, and controls (connects and disconnects) the second well from the manifold to “facilitate injection of treatment fluid”, valves 173 (including a second valve) is in fluid communication with the manifold.²⁴⁹ Further, the second valve 174 communicates fluid from the zipper manifold 170 into the well and is thus also in fluid communication with the manifold.

369. Further, as described above and shown in annotated Figure 1 above, the second valve (173 or 174) controls fluid delivered from the pumps 152 and to the second well 102. This shows that the second valves are fluidically positioned between the second well and the plurality of pumps.

²⁴⁹ *Christie*, [0040]; see *Christie Provisional*, [0023].

370. Accordingly, as described in the sections above, *Christie* discloses the limitations of 1.3.1(c).

- e. **39.5: “one or more controllers configured to execute a continuous pumping (“CP”) swap, during which CP swap fluid is continuously communicated via the manifold, to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, by:”**

371. *Christie* discloses a continuous pumping (CP) swap as claimed. The specification of the '952 Patent does not provide a specific definition for “continuous pumping” or “continuous pumping swap,” but rather describes various steps that may be a part of the CP swap. Claim Limitation 39.5 provides that a CP swap is executed and the subsequent claim language is used to describe a “CP Swap” for purposes of Claim 39 and its dependent claims.

372. *Christie* discloses that “the controller 410 may coordinate automation control commands to inform sub-services of the timing of each operation at the wellsite” and “may automatically coordinate a well swap process, such as by automatically opening and closing flow control wellhead valves.”²⁵⁰ The controller maintains “a completion strategy (e.g., order) by determining which wellbore 102 is to be completed and orchestrating movement to the next intended wellbore 102 in the plan.”²⁵¹ Accordingly, *Christie* discloses a “swap” from fracturing a first well to

²⁵⁰ *Christie*, [0101]; *Christie Provisional*, [0083].

²⁵¹ *Christie*, [0101]; *Christie Provisional*, [0083].

fracturing a second well. As discussed in the subsections below, *Christie* also discloses, or at least it would have been obvious to a POSITA, the steps of a “continuous pumping swap” claimed.

(1)39.5.1: “opening the second valve: while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, to cause fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

373. Except for being rewritten as a system claim, the limitations of 39.5.1 are substantially similar to those of Limitation 1.3.1 and are disclosed by *Christie* for the same reasons as those discussed above in Section XV.A.1.d.

(2)39.5.2: “in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold; and

374. Except for being rewritten as a system claim, the limitations of 39.5.2 are substantially similar to those of Limitation 1.3.2 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed above in Section XV.A.1.e.

(3)39.5.3: “closing the first valve: after the at least a portion of fluid communicated via the manifold has satisfied one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold, and”

375. Except for being rewritten as a system claim, the limitations of 39.5.3 are substantially similar to those of Limitation 1.3.3 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed above in Section XV.A.1.f.

(4)39.5.4: “while fluid is communicated to the second well via the second valve and the manifold.”

376. The limitations of 39.5.4 are identical to those of Limitation 1.3.4 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed above in Section XV.A.1.g.

26. DEPENDENT CLAIM 40

377. Except for depending from Claim 39, the limitations of Claim 40 are identical to those of Claim 2 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed above in Section XVA.2.

27. DEPENDENT CLAIM 41

378. Dependent Claim 41 depends from Claim 39. In addition to the discussing above regarding Claim 39, *Christie* renders the additional limitations of Claim 41 obvious, as discussed in the subsections below.

- a. **41.1: “ The system of claim 39, wherein: the plurality of wells further comprises third and fourth wells; the system further comprises:**

379. *Christie* discloses third and fourth wells for the same reasons described with substantially identical Limitation 3.1 of Claim 3, as those described in Section XV.A.3.a.

- b. **41.2:” a third valve via which fluid is adapted to be communicated from the manifold to the third well, the third valve being associated with both the third well and the manifold; and**

380. *Christie* discloses this limitation for the same reasons provided with Limitation 3.2 of Claim 3, as described in Section XV.A.3.b.

- c. **41.3: “a fourth valve via which fluid is adapted to be communicated from the manifold to the fourth well, the fourth valve being associated with both the fourth well and the manifold; and”**

381. *Christie* discloses this limitation for the same reasons provided with Limitation 3.3.1 of Claim 3, as described in Section XV.A.3.c.

- d. **41.4: “the one or more controllers are further configured to execute the CP swap, during which CP swap fluid is continuously communicated via the manifold, to transition from hydraulically fracturing the third well to hydraulically fracturing the fourth well, by:”**

382. Except for the reference to controllers executing the CP swap, which would have been obvious to a POSITA based on the disclosures of *Christie* as described above in Section XV.A.25.e, and being rewritten as a system claim, the

limitations of 41.4. are substantially similar to those of 3.3 and are obvious for the same reasons as those discussed above in Section XV.A.3.c.

- e. **41.4.1: “opening the fourth valve: while fluid is communicated to the third well via the third valve and the manifold, to cause fluid to be communicated to the fourth well via the manifold and the fourth valve, and”**
- f. **41.4.2: “in response to the at least a portion of fluid communicated via the manifold satisfying the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold; and”**
- g. **41.4.3: “closing the third valve: after the at least a portion of fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold, and”**
- h. **41.4.4: “while fluid is communicated to the fourth well via the fourth valve and the manifold.”**

383. Except for being rewritten as a system claim, the limitations of 41.4.1 – 41.4.4 are substantially similar to those of Limitations 3.3.1 – 3.3.4 and are disclosed for the same reasons as those discussed above in Section XV.A.3.c.

- 28. DEPENDENT CLAIM 42: “THE SYSTEM OF CLAIM 39, WHEREIN THE ONE OR MORE CONTROLLERS ARE FURTHER CONFIGURED TO: DETERMINE THAT THE AT LEAST A PORTION OF THE COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”**

384. Except for the reference to controllers executing the CP swap, which are disclosed by *Christie* as described above in Section XV.A.25.e, Claim 42 is

substantially similar to Claims 4 and 23 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed in Section XV.A.4.

**29. DEPENDENT CLAIMS 43 : “THE SYSTEM OF CLAIM 39,
WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE FLOW
RATE OF THE AT LEAST A PORTION OF THE FLUID
COMMUNICATED VIA THE MANIFOLD.”**

385. Except for depending from Claim 39 and referencing the controllers, which are disclosed by *Christie* as described above in Section XV.A.25.e, and being rewritten as a system claim, Claim 43 is substantially similar to Claim 5 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed in Sections XV.A.1.e and XV.A.5.

30. DEPENDENT CLAIMS 44 – 46

386. Except for depending from Claim 43, Claims 44 – 46 are substantially similar to Claims 6 – 8, respectively, and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed in Section XV.A.6.

**31. DEPENDENT CLAIM 47: “THE SYSTEM OF CLAIM 39, WHEREIN
THE ONE OR MORE CONDITIONS INCLUDE THE PRESSURE OF
THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE
MANIFOLD.”**

387. Except for depending from Claim 39, the limitations of Claim 47 are substantially similar to those of Claim 9 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those described in Section XV.A.1.e and XV.A.7.

32. DEPENDENT CLAIMS 48 - 50

388. Except for depending from Claim 47, the limitations of Claims 48-50 are substantially similar to those of Claims 10-12, respectively, and are disclosed or at least rendered obvious by *Christie* for the same reasons as those described in Section XV.A.8.

33. DEPENDENT CLAIM 51

389. Dependent Claim 51 depends from Claim 39. In addition to the discussion of Claim 39 above, and incorporated herein by reference, the limitations of Claim 51 are disclosed or at least rendered obvious by *Christie*. Except for depending from Claim 39 and referencing the controllers, which are disclosed by *Christie* as described above in Section XV.A.25.e, and being rewritten as a system claim, Claim 51 is substantially similar to Claims 13 and 32 and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed in Section XV.A.9.

34. DEPENDENT CLAIMS 52 – 57

390. Except for depending from Claim 39, the limitations of Claims 52-57 are identical to those of Claims 14-19, respectively, and are disclosed or at least rendered obvious by *Christie* for the same reasons as those discussed above in Sections XV.A.10-XV.A.15.

35. INDEPENDENT CLAIM 58

391. Christie renders Claim 58 obvious.

- a. 58.1: “A method of hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the method comprising:”**

392. Limitation 58.1 is identical to Limitation 1.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.a above.

- b. 58.2: “communicating fluid from the one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

393. Limitation 58.2 is identical to Limitation 1.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.b above.

- c. 58.3: “displaying a dashboard, which dashboard comprises:”**

394. Limitation 58.3 recites the same limitations as Limitation 16.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.a above.

- (1)58.3.1: “a visual reference of the first valve;”**

395. Limitation 58.3.1 recites the same limitations as Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.b above.

(2) 58.3.2: “a first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”

396. Limitation 58.3.2 recites the same limitations as Claim 17 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.13 above.

(3) 58.3.3: “a visual reference of a second valve,

(4) 58.3.4: wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve; and”

397. Limitations 58.3.3 and 58.3.4 recite the same limitations as in Limitation 16.2 and Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.12.b and XV.A.1.d above.

(5) 58.3.5: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator being different from the first visual indicator to indicate that a state of the second valve is closed; and”

398. Limitation 58.3.5 recites the same limitations as in Claim 19 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.15 above.

d. 58.4: “executing a continuous pumping ("CP") swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

399. Limitation 58.4 is identical to Limitation 1.3 and would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those discussed in Section XV.A.1.c above.

(1) 58.4.1: “opening the second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

400. Limitation 58.4.1 is identical to Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.d above.

(2) 58.4.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions; and”

401. Limitation 58.4.2 is substantially similar to, though less limiting than, Limitation 1.3.2, as Limitation 58.4.2 does not limit the claimed “conditions” at all. According to the plain language of the claim, the “conditions” of Limitation 58.4.2

could be the fluid's flowrate and/or pressure, as recited in Limitation 1.3.2, or could be any other condition of the fluid.

402. Despite the broad language of the claim, the '952 Patent does not describe any other condition of the fluid that should be met for opening the second valve other than flowrate (although, even the '952 Patent's disclosure of a flowrate condition leaves much to the imagination of the reader, as discussed in Section XIV.A). Thus, according to the language of Claim 58, the mere act of fluid being communicated via the manifold could satisfy a "condition," and the second valve could be opened in response. On the other hand, the '952 Patent only gives an example of operating the second valve in response to non-descript flowrate "conditions."

403. Nevertheless, whether the term "condition" is interpreted broadly or narrowly, *Christie* discloses or at least renders obvious opening a second valve in response to fluid communicated via a manifold satisfying flowrate and/or pressure conditions, as discussed with Limitation 1.3.2 in Section XV.A.1.e above. Thus, Limitation 58.4.2 is disclosed by and would have been obvious to a POSITA based on the disclosures of *Christie* for at least the same reasons as those discussed in Section XV.A.1.e above.

(3) 58.4.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions, and”

404. Limitation 58.4.3 is substantially similar to, though less limiting than, Limitation 1.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.f above.

e. 58.5: “wherein the display of the dashboard visually communicates the respective states of the first and second valves; and”

405. Limitation 58.5 recites the same limitations as Limitation 16.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.c above.

f. 58.6: “wherein fluid is continuously communicated via the manifold during the CP swap.”

406. Limitation 58.6 is substantially similar to Limitation 1.4 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.h above.

36. DEPENDENT CLAIM 59: “THE METHOD OF CLAIM 58, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

407. Except for depending from Claim 58, the limitations of Claim 59 are substantially similar to those of Claim 18 and would have been obvious to a POSITA

based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.14 above.

37. DEPENDENT CLAIMS 60 – 61

408. Except for depending from Claim 58, the limitations of Claims 60-61 are substantially similar to those of Claims 4-5, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.e, XV.A.4 and XV.A.5 above.

38. DEPENDENT CLAIM 62: “THE METHOD OF CLAIM 58, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A PRESSURE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

409. Except for depending from Claim 58, the limitations of Claim 62 are substantially similar to those of Claim 9 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.e and XV.A.7 above.

39. DEPENDENT CLAIMS 63 – 64

410. Except for depending from Claim 58, the limitations of Claims 63-64 are identical to those of Claims 14-15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.10 and XV.A.11 above.

40. INDEPENDENT CLAIM 65

411. *Christie* renders Claim 65 obvious, as discussed in the subsections below.

- a. 65.1: “A non-transitory computer readable medium of hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the method comprising:”**

412. The limitations of 65.1 are substantially similar to those of Limitation 20.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.a and XV.A.16.a above.

- b. 65.2: “communicating fluid from one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

413. The limitations of 65.2 are identical to those of Limitation 20.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.b above.

- c. 65.3: “displaying a dashboard, which dashboard comprises:”**

414. Limitation 65.3 recites the same limitations as Limitation 16.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.a above.

- (1) 65.3.1: “a visual reference of the first valve;”**

415. Limitation 65.3.1 recites the same limitations as Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.b above.

(2) 65.3.2: “first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”

416. Limitation 65.3.2 recites the same limitations as in Claim 17 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.13 above.

(3) 65.3.3: “a visual reference of a second valve,”

(4) 65.3.4: “wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve; and”

417. Limitations 65.3.3 and 65.3.4 recite the same limitations as in Limitation 16.2 and Limitations 1.3.1/20.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.12.b and XV.A.1.d above.

(5) 65.3.5: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator being different from the first visual indicator to indicate that a state of the second valve is closed; and”

418. Limitation 65.3.5 recites the same limitations as in Claim 19 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.15 above.

d. 65.4: “executing a continuous pumping (“CP”) swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

419. The limitations of 65.4 are identical to those of Limitation 1.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.c above.

(1) 65.4.1: “opening the second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

420. Limitation 65.4.1 recites the same limitations as in Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.d above.

(2) 65.4.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions; and”

421. Limitation of 65.4.2 is identical to Limitations 58.4.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.35.d.(2) above.

(3) 65.4.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions; and”

422. Limitation 65.4.3 is identical to Limitation 58.4.3 and similar to, though less limiting than, Limitation 1.3.3, and Limitation 65.4.3 would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.f and XV.A.35.d.(3) above.

e. 65.5: “wherein the display of the dashboard visually communicates the respective states of the first and second valves; and”

423. Limitation 65.5 is identical to Limitation 16.3. Accordingly, *Christie* renders the limitations of 65.5 obvious for the same reasons as those discussed in Section XV.A.12.c above.

f. 65.6: “wherein fluid is continuously communicated via the manifold during the CP swap.”

424. Limitation 65.6 is substantially similar to, Limitation 1.4 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.h above.

41. DEPENDENT CLAIM 66: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 65, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

425. Except for depending from Claim 65, the limitations of Claim 66 are substantially similar to those of Claim 18 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.14 above.

42. DEPENDENT CLAIM 67: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 65, FURTHER COMPRISING: DETERMINING THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

426. Except for depending from Claim 65, the limitations of Claim 67 are substantially similar to those of Claim 4 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.4 above.

43. DEPENDENT CLAIMS 68 – 69

427. Except for depending from Claim 65, the limitations of Claims 68 and 69 are substantially similar to those of Claims 5 and 9, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.e, XV.A.4, and XV.A.7 above.

44. DEPENDENT CLAIMS 70 – 71

428. Except for depending from Claim 65, the limitations of Claims 70 - 71 are substantially similar to those of Claims 14 – 15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.10 and XV.A.11 above.

45. INDEPENDENT CLAIM 72

429. The limitations of Claim 72 would have been obvious to a POSITA based on the teachings of *Christie* as discussed in the subsections below.

a. 72.1: “A system for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the system comprising:”

430. The limitations of 72.1 are substantially similar to those of Limitations 1.1 and 39.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.a and XV.A.25.a above.

b. 72.2: “a manifold via which fluid is adapted to be communicated from one or more pumps;”

431. The limitations of 72.2 are substantially similar to those of Limitation 39.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.25.b above.

- c. **72.3: “a first valve via which fluid is adapted to be communicated from the one or more pumps to the first well, the first valve being associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

432. The limitations of 72.3 are substantially similar to those of Limitation 39.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.25.c above.

- d. **72.4: “a second valve via which fluid is adapted to be communicated from the one or more pumps to the second well, the second valve being associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is adapted to be communicated to the first well via the manifold and the first valve;”**

433. The limitations of 72.4 are substantially similar to those of Limitation 39.4 and would have been obvious to a POSITA based on the disclosures of *Christie* or the same reasons as those discussed in Section XV.A.25.d above.

- e. **72.5: “a dashboard adapted to be displayed, which dashboard comprises:”**

434. The limitations of 72.5 recite the same limitations as in Limitations 16.1 and 58.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.a above.

- (1) **72.5.1: “a visual reference of the first valve;”**

435. The limitations of 72.5.1 recite the same limitations as in Limitations 16.2 and 58.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.b above.

(2) 72.5.2: “a first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”

436. The limitations of 72.5.2 recite the same limitations as in Claim 17 and Limitation 58.3.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.13 above.

(3) 72.5.3: “a visual reference of the second valve; and”

437. Limitation 72.5.3 recites the same limitations as in Limitations 16.2 and 58.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.b above.

(4) 72.5.4: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator being different from the first visual indicator to indicate that a state of the second valve is closed;”

438. The limitations of 72.5.4 recite the same limitations as in Claim 19 and Limitation 58.3.4 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.15 above.

- f. **72.6: “one or more controllers configured to execute a continuous pumping (“CP”) swap, during which CP swap fluid is continuously communicated via the manifold, to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, by:”**

439. The limitations of 72.6 are identical to those of Limitation 39.5 and would have been obvious to a POSITA based on the disclosures of *Christie* or the same reasons as those discussed in Section XV.A.25.e above.

- (1)72.6.1: “opening the second valve: while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold,”**

440. The limitations of 72.6.1 recite the same limitations as in Limitations 1.3.1 and 58.4.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.d above.

- (2)72.6.2: “in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, and”**

441. The limitations of 72.6.2 are substantially similar to those of Limitation 58.4.2 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.35.d.(2) above.

- (3)72.6.3: “to cause fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve; and”**

442. The limitations of 72.6.3 recites the same limitations as in Limitations 1.3.1 and 58.4.1 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.1.d above.

(4) 72.6.4: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions,”

443. Limitation 72.6.4 is identical to Limitation 58.4.3 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed above in Sections XV.A.1.f and XV.A.35.d.(3).

g. 72.7: “wherein the display of the dashboard visually communicates the respective states of the first and second valves.”

444. Limitation 72.7 recites the same limitations as in Limitations 16.3 and 58.5 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.12.c.

46. DEPENDENT CLAIM 73: “THE SYSTEM OF CLAIM 72, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

445. Except for depending from Claim 72, the limitations of claim 73 are identical to those of Claim 18 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.14 above.

47. DEPENDENT CLAIM 74: “THE SYSTEM OF CLAIM 72, WHEREIN THE ONE OR MORE CONTROLLERS ARE FURTHER CONFIGURED TO: DETERMINE THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

446. Except for depending from Claim 72 and referencing the controllers disclosed by *Christie*, as discussed above regarding Limitation 39.5 in Section XV.A.25.e, Claim 74 is substantially similar to Claim 4 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Section XV.A.4.

48. DEPENDENT CLAIM 75: “THE SYSTEM OF CLAIM 72, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A FLOW RATE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

447. Except for depending from Claim 72, Claim 75 is substantially similar to Claim 5 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.e and XV.A.5.

49. DEPENDENT CLAIM 76: “THE SYSTEM OF CLAIM 72, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A PRESSURE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

448. Except for depending from Claim 72, Claim 76 is substantially similar to Claim 9 and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.1.e and XV.A.7.

50. **DEPENDENT CLAIM 77: “THE SYSTEM OF CLAIM 72, WHEREIN THE FLUID, WHICH IS CONTINUOUSLY COMMUNICATED VIA THE MANIFOLD DURING THE CP SWAP, IS HYDRAULIC FRACTURING FLUID.”**

51. **DEPENDENT CLAIM 78: “THE SYSTEM OF CLAIM 77, WHEREIN THE HYDRAULIC FRACTURING FLUID COMPRISES SAND.”**

449. Except for depending from Claim 72, the limitations of Claims 77 - 78 are substantially similar to those of Claims 14 – 15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie* for the same reasons as those discussed in Sections XV.A.10 and XV.A.11 above.

B. GROUND 7: CHRISTIE IN VIEW OF PITCHER, FURTHER IN VIEW OF AL-SAMANI RENDERS ALL CLAIMS OBVIOUS

450. It is my opinion that the combination of *Christie*, *Pitcher* and *Al-Samani* renders each claim of the '952 Patent obvious. Further, a POSITA would have been motivated to combine the teachings of *Christie*, *Pitcher*, and *Al-Samani* with a reasonable expectation of success, as discussed below.

451. Initially, all three references are directed to valve control in multi-well hydraulic fracturing. An example system according to the disclosures of *Christie* would be “a treatment fluid system configured to pump a treatment fluid into a wellbore” and “a fluid valve system configured to selectively fluidly connect and disconnect the treatment fluid system [] to and from the wellbore.”²⁵² *Christie*

²⁵² *Christie*, Abstract; see *Christie Provisional*, Abstract.

teaches using a controller “to monitor the operational states of the treatment fluid system[] and the fluid valve system, and control operations of the treatment fluid system, [] and the fluid valve system based at least in part on the operational status of the treatment fluid system.”²⁵³ Further, *Christie* describes that, “the treatment fluid may be or include a fracturing fluid, and the treatment fluid systems may be or include a fracturing fluid mixing and pumping system for facilitating well fracturing operations.”²⁵⁴ Further still, *Christie* teaches “the wellbore 102 may be one of a plurality of wellbores 102.”²⁵⁵

452. *Al-Samani* teaches that its system and methods “are directed toward, among other things, improving efficiency of fracturing operations,”²⁵⁶ and includes fracturing trees arranged at a well site during a fracturing operation.²⁵⁷ The fracturing tree include remotely actuatable valves “that regulate flow of fluid into and out of the wellbore.”²⁵⁸ *Al-Samani* teaches sensors including “a valve position sensor arranged at a valve of the fracturing tree.”²⁵⁹ A “control unit” collects information

²⁵³ *Christie*, Abstract; see *Christie Provisional*, Abstract.

²⁵⁴ *Christie*, [0161], see *Christie Provisional*, [0019], [0022], [0006], [0069], [00101], [00108], [00113], [00114], [00115], [00116].

²⁵⁵ *Christie*, [0149], see *Christie Provisional*, [00107], [0075], [0015], [0023], [0077], [0004], [00100].

²⁵⁶ *Al-Samani*, [0022].

²⁵⁷ *Al-Samani*, [0034].

²⁵⁸ *Al-Samani*, [0006], [0035].

²⁵⁹ *Al-Samani*, [0006].

from the sensors at the wellhead and is “operable to drive movement of the valve via the actuator unit.”²⁶⁰ The control unit also contains a “display, which may relay information to the user regarding pressures, valve states and the like”.²⁶¹ The display provides “real or near-real time (e.g., without significant delay) information regarding operations at the fracturing site.”²⁶² Part of the information displayed includes “indicators of valve operations (e.g., color coded for different positions).”²⁶³ *Al-Samani* teaches that the control unit, including the display “may be arranged at a location remote from (e.g., at least a specified distance away from) the frac tree 100,” e.g., “outside of a pressure zone.”²⁶⁴ This allows operators to “continue to remotely operate the valves while keeping personnel away from the frac tree.”²⁶⁵

453. Implementing *Al-Samani*’s teachings of a control unit and display would help further *Christie*’s goal of “increase[ing] personnel safety, such as by forbidding wellsite personnel to enter high-pressure areas of the wellsite systems,”²⁶⁶ as use of a remote display would allow valve operations without personnel entering

²⁶⁰ *Al-Samani*, [0006].

²⁶¹ *Al-Samani*, [0046].

²⁶² *Al-Samani*, [0046].

²⁶³ *Al-Samani*, [0063].

²⁶⁴ *Al-Samani*, [0046].

²⁶⁵ *Al-Samani*, [0023].

²⁶⁶ *Christie*, [0098]; *Christie Provisional*, [0080].

the high-pressure area to manipulate valves. *Al-Samani's* teachings also reduce “non-productive time (NPT)” by allowing valve operations during pumping operations, including the continuous pumping fracturing swap taught by *Christie*, while still allowing personnel to monitor the status of the valves and other conditions at the wellsite.²⁶⁷ Finally, *Al-Samani* teaches the use of its system and methods at a well site with four wellheads, each wellhead including a fracturing tree.²⁶⁸ Accordingly, like *Christie* above, *Al-Samani* is applicable to multi-well fracturing operations.

454. Like *Christie* and *Al-Samani*, *Pitcher* is also directed to multi-well hydraulic fracturing.²⁶⁹ Further, like is taught in *Al-Samani*, *Pitcher* teaches that “the controller can remotely operate the output valves” to control the flow of fracturing fluid entering each of the wells. *Pitcher* teaches using operational parameters to determine when stimulation is completed on a wellbore. For example, *Pitcher* discloses controlling the flow to a well using a manifold valve and monitoring the flow using a sensor.²⁷⁰ Once the desired amount of fracturing fluid has been injected into the well, the next fracturing stages are isolated for stimulation.”²⁷¹ Like *Christie*,

²⁶⁷ *Christie*, [0026]; *Christie Provisional*, [0072], [0001], [0002].

²⁶⁸ *Al-Samani*, [0050].

²⁶⁹ *Pitcher*, Title.

²⁷⁰ *Pitcher*, [0030].

²⁷¹ *Pitcher*, [0037].

Pitcher teaches that this is not a one-shot, all-encompassing end of fracturing, but simply a move to the next stage, as *Pitcher* further teaches that “[e]ach fracturing stage of corresponding pairs of stages (e.g., zones 106 and 116, zones 108 and 118, and zones 110 and 120) can be fractured at the same rate and for the same duration if desired, although the rates and durations could also be varied (e.g., if it is intended that the zones are to receive different volumes of fracturing fluid).”²⁷²

455. A POSITA would have been motivated to incorporate the teachings of *Pitcher* involving using sensor data to determine the end of a fracturing stage (i.e., fracturing is complete on one wellbore” so that the controller of *Christie* can “automatically coordinate a well swap process,”²⁷³ which is a goal of *Christie*. Further, a POSITA would have a reasonable expectation of success in the implementation because *Christie* already teaches using sensors to measure the flowrate of fluid going into the well, and *Pitcher* simply teaches using that measured flowrate to determine when the fracturing stage is complete. This is merely using a known technique (determining fracture stage is complete of *Pitcher*) to improve similar methods (fracturing system of *Christie*) in the same way.

456. A POSITA would have been motivated to combine the teachings of *Christie* with *Al-Samani* and *Pitcher* at least because of their similarities. A POSITA

²⁷² *Pitcher*, [0037].

²⁷³ *Christie*, [0101]; *Christie Provisional*, [0083].

would have been further motivated to use sensors, remote operations and display described in *Al-Samani* in the system of *Christie* in order to gain the benefits taught by *Al-Samani* including “improved operational efficiency”, “optimized operation[s]”, “enhance[d] operational safety” and “minimize[d] operational uncertainty.” A POSITA would have a reasonable expectation of success in the combination as it merely involves use of known techniques (*Al-Samani*’s teachings of sensors, remote control and display) to improve similar systems and methods (fracturing operations including valve control) of *Christie* and *Pitcher* in the same way. *Al-Samani*’s sensors, remote control and display are intended to be used with fracturing valves in a multi-well fracturing operation and applying those teachings to the system of *Christie*, as modified by *Pitcher*, would require no more than regular design techniques, such as those taught by *Pitcher*.²⁷⁴

457. *Christie* further teaches that the operational status monitored by the controller is used to control “fluid flow control valve operations performed by the wellhead fluid flow control valve system.”²⁷⁵ Control of these valves allows for “optimal (e.g., most efficient) well-site equipment coordination across the well services [] with the goal of performing continuous pumping downhole.”²⁷⁶ *Christie*

²⁷⁴ *Pitcher* [0014].

²⁷⁵ *Christie*, [0096], [0098]; see *Christie Provisional*, [0078], [0080].

²⁷⁶ *Christie*, [0098]; see *Christie Provisional*, [0080].

teaches, or at least suggest that there is continuous pumping during a swap between hydraulically fracturing one well and hydraulically fracturing a second well.²⁷⁷ *Christie* teaches a specific example of equipment coordination comprising a sequence of valve operations that allow the pumps to continue operating (pump fluid downhole) by overlapping pumping, for example, into the first and second well.

458. *Christie*'s operations include pumping fracturing fluid simultaneously to multiple wells. For example, *Christie* explains that the treatment fluid system is operable to pump the treatment fluid into a first wellbore and a second wellbore, where the controller is operable to operate the fluid valve system (*e.g.*, open and close valves) "to simultaneously: ... *fluidly connect the treatment fluid system to the second wellbore 102 to permit pumping of the treatment fluid into the second wellbore 102; fluidly disconnect the treatment fluid system from the first wellbore 102; and fluidly connect the pump-down system to the first wellbore 102 to permit pumping of the pump-down fluid into the first wellbore 102.*"²⁷⁸ As described throughout *Christie*, steps that are performed simultaneously occur at generally the

²⁷⁷ *Christie*, [0156]; *Christie Provisional*, [0115].

²⁷⁸ *Christie*, [0156]; *Christie Provisional*, [0115], [0006], [0083], [00108], [00113], [00114].

same time such that the operations at least partially overlap in time.²⁷⁹ This would enable *Christie*'s "goal of performing continuous pumping downhole."²⁸⁰

459. In my opinion as a POSITA, the teachings of *Christie* regarding "in certain embodiments" or "the embodiments", or similar language throughout *Christie* contain teachings that are compatible across all teachings. For example, when discussing method 900 shown, for example, in Fig. 9, *Christie* makes specific reference to embodiments and equipment shown and described in Figs. 1 – 5. Similarly, when discussing method 700 and method 800 contained in Figs. 7 and 8, *Christie* again refers to equipment and embodiments shown in Figs. 1 – 5. As all embodiments reference the same equipment, and the same equipment is used across each of the figures 7-9, a POSITA would have been motivated, with a reasonable expectation of success, to combine teachings of the embodiments throughout *Christie*. *Christie* teaches a specific set of equipment and operating methods (for example, when discussing equipment shown in Figs. 1 – 5), and then further explains methods using this equipment (for example, in Figs. 7 – 9). A POSITA would have understood that methods using the same equipment would reasonably be combined and used successfully.

²⁷⁹ *Christie*, [0033]; *Christie Provisional*, [0006].

²⁸⁰ *Christie*, [0098]; *Christie Provisional*, [0080].

1. INDEPENDENT CLAIM 1

a. 1.1 – 1.3.1

460. As discussed above in Ground 6, Section XV.A.1, *Christie* discloses Limitations 1.1 – 1.3.1, or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

b. 1.3.2

461. As discussed above in Ground 6, it is my opinion that *Christie* discloses, or at the least renders Limitation 1.3.2 obvious.

462. To the extent that the Board finds that *Christie* does not explicitly teach that flowrate and pressure drops are indicative of a “fluid condition” that shows the end of the stage and for moving to the next fracturing stage, as taught by *Christie*,²⁸¹ *Pitcher* discloses using, for example, flowrate to indicate the end of a fracturing stage, which would have triggered the controller of *Christie* to perform valve operations to inject the fracturing fluid into the next wellbore, including with the continuous pumping swap disclosed by *Christie*.

²⁸¹ See, e.g., *Christie*, [0099] (“after stimulation is complete on wellbore 102” and then “operate (i.e., open) the corresponding fluid access valve 204 and cause the stimulation system 420 and the fluid flow control valve system 440 to operate to inject the treatment fluid (e.g., fracturing fluid) into the next wellbore 102”); see *Christie Provisional*, [0081].

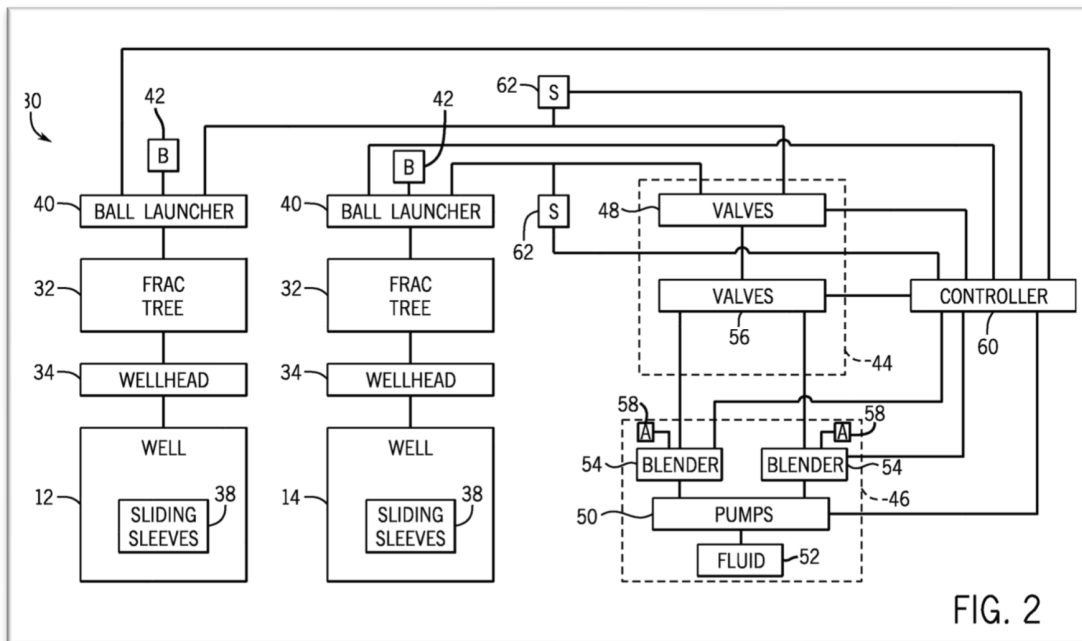
463. *Pitcher*, like *Christie* is concerned with operating valves “after stimulation is complete”.²⁸² For example, *Pitcher* teaches using fracturing manifold valves (48), as shown in *Pitcher*’s Figure 2 (reproduced below), to “independently control flow of fracturing fluid from the manifold to each of multiple wells.”²⁸³ *Pitcher* further teaches that a controller (60) monitors parameters of the system and that “[e]xamples of the monitored fluid parameters include flow rate, flow volume, density, and pressure, and these parameters can be measured via any suitable devices (e.g., sensors 62) downstream from the output valves 48.”²⁸⁴ *Pitcher*’s fracturing methods include operating valves of the fracturing manifold 44 “to control the fracturing fluid entering each of the wells connected to the manifold (block 96) based on fluid parameters monitored for each well.”²⁸⁵

²⁸² *Christie*, [0099]; *Christie Provisional*, [0081].

²⁸³ *Pitcher*, Abstract.

²⁸⁴ *Pitcher*, [0030].

²⁸⁵ *Pitcher*, [0030].



Pitcher Fig. 2

464. Further, *Pitcher* teaches balancing volumes of fluid flowing into the wells and that “the volume of fracturing fluid pumped into each well is equal to the product of the volumetric flow rate and the amount of time the fluid flows at that rate. Thus, the volume of fracturing fluid pumped into each well can be controlled

by adjusting either the flow rate or the amount of time that the fluid is pumped.”²⁸⁶

Further, *Pitcher* teaches that

full flow (e.g., twenty-five barrels per minute) can be provided to the well 14 and a desired fracturing time for a given zone can be calculated based on:

$$V_{frac} = Qt + V_p$$

where V_{frac} the volume of fracturing fluid to pump into the fracturing zone, Q is the volumetric flow rate at which fluid is pumped into the well 14 from the fracturing manifold 44, t is the desired fracturing time for the zone, and V_p is the volume of the passageway (i.e., fluid conduit) from the ball launcher 40 (of the well 14) to the far end of the zone being fractured.²⁸⁷

465. Once the volumetric flow rate and desired fracturing time are calculated, *Pitcher* discloses using the volumetric flow rate and desired time as thresholds to trigger subsequent fracturing stages.²⁸⁸ In particular, *Pitcher* discloses triggering the next stage of fracturing when the controller determines (using readings from a flowrate sensor) that the flow rate has been at the volumetric flowrate for a

²⁸⁶ *Pitcher*, [0036].

²⁸⁷ *Pitcher*, [0036].

²⁸⁸ *Pitcher*, [0037].

specific period of time. For example, *Pitcher* teaches the following: “[t]he manifold valve 48 that controls flow to the well 12 can then be adjusted to set the flow rate (which can be measured by a sensor 62) to the calculated amount. Once the desired fracturing time has elapsed, the ball launchers 40 may be activated to drop balls 42 into the wells 12 and 14 to isolate the next fracturing stages for stimulation.”²⁸⁹ *Pitcher* teaches that this is not a one-shot, all-encompassing end of fracturing, but simply a move to the next stage, as *Pitcher* further teaches that “[e]ach fracturing stage of corresponding pairs of stages (e.g., zones 106 and 116, zones 108 and 118, and zones 110 and 120) can be fractured at the same rate and for the same duration if desired, although the rates and durations could also be varied (e.g., if it is intended that the zones are to receive different volumes of fracturing fluid).”²⁹⁰

466. A POSITA would have understood *Pitcher* to be an example of generally applicable engineering knowledge in fluid systems – that fluid conditions through one valve in a fluid system may affect, and thus trigger, operation of another valve in the fluid system. *Pitcher* specifically monitors fluid conditions of fracturing fluid being injected into multiple wells from a common fracturing manifold and uses those conditions to indicate the status of a fracturing stage (e.g., the end of a fracturing stage) and when to move to a next step in the fracturing operation. A

²⁸⁹ *Pitcher*, [0037].

²⁹⁰ *Pitcher*, [0037].

POSITA would have found it obvious to apply this concept (that fluid conditions indicating the end of a fracturing stage can trigger the next step in the fracturing operation) in the same manner with other multi-well fracturing methods/systems, e.g., *Christie's* systems/methods, with the expectation that application of this concept would successfully improve efficiency.

467. Accordingly, a POSITA would have found it obvious to use *Pitcher's* teachings that fracturing fluid conditions (e.g., flowrate and/or pressure) trigger a next step in the fracturing operation with *Christie's* fracturing operations, including using fluid conditions to trigger the CP swap described by *Christie*. A POSITA would have recognized this combination as obvious, and would have been motivated to include *Pitcher's* teaching of flowrate and time thresholds, using sensors, into the teachings of *Christie* as a reliable way of knowing that stimulation was complete in the first well, and that it was time to move on to fracturing the second well. Further, a POSITA would have understood from the teachings of *Pitcher* that the end of the fracturing stage is indicated by at least a portion of fluid communicated via the manifold (fluid being pumped into the first well) satisfying one or more conditions, which one or more conditions include a flow rate (i.e., volumetric flow rate for a specified period of time), of the at least a portion of fluid communicated via the manifold.

468. *Al-Salmani* provides another example of application of this concept with hydraulic fracturing systems/methods and would have also been equally obvious to apply with *Christie's* CP swap systems/methods. *Al-Salmani* uses sensors, including flowrate and pressure sensors, in its multi-well fracturing systems/methods "to evaluate...ongoing wellbore operations," such as using monitored pressure conditions for indicating stages of a fracturing operation.²⁹¹ *Al-Salmani* teaches that using such monitored fluid data to evaluate "a particular mode or stage within the fracturing operation [] may drive additional operations."²⁹² "For example, if data indicates the end of the fracturing job is approached, the operator may plan to have subsequent operations prepared and ready at the well site to reduce NPT" (nonproductive time).²⁹³ A POSITA would have found it obvious to use *Al-Salmani's* known techniques of using fluid conditions to determine an end of a fracturing stage for moving to the next well with *Christie's* known CP swap systems/methods to efficiently determine when to swap to the next well's fracturing stage in the CP swap.

²⁹¹ *Al-Salmani*, [0029], [0038], [0065].

²⁹² *Al-Salmani*, [0024].

²⁹³ *Al-Salmani*, [0057].

469. Accordingly, *Christie*, *Pitcher*, and *Al-Salmani* each disclose the limitations of 1.3.2, or at least the combination of *Christie*, *Pitcher*, and *Al-Salmani* renders the limitations of 1.3.2 obvious.

c. 1.3.3 – 1.4

470. As discussed above in Ground 6, Sections XV.A.1.f-h, *Christie* discloses Limitations 1.3.3-1.4, or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

471. Therefore, *Christie* discloses, or at least renders obvious, all limitations of Claim 1. *Pitcher* and *Al-Salmani* also demonstrate that it was known to use fluid conditions (e.g., pressure and/or flowrate) of fluid being pumped into a well to determine the end of a fracturing stage and when to move to the next step in a multi-well fracturing operation. This concept would have been obviously and predictably applied with *Christie*'s CP swap systems/methods to efficiently determine when to swap to the next well's fracturing stage (by opening the next well's valve in *Christie*'s CP swap).

2. DEPENDENT CLAIMS 2 - 3

472. Dependent Claims 2 and 3 depend from Claim 1. As discussed above in Ground 6, Sections XV.A.2-3, *Christie* discloses the limitations of Claims 2 and 3 or at least they would have been obvious to a POSITA based on the teachings of *Christie*. Claims 2 and 3 are obvious over *Christie*, *Pitcher*, and *Al-Salmani*.

3. DEPENDENT CLAIM 4: “THE METHOD OF CLAIM 1, FURTHER COMPRISING: DETERMINING THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

473. As discussed above regarding Ground 6, Section XV.A.4, *Christie* discloses the additional limitations of Claim 4, or at least renders them obvious.

474. Further, to the extent that the Board finds that *Christie*’s disclosure, and the knowledge of a POSITA, are insufficient, *Pitcher* explicitly teaches determining that at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions.²⁹⁴ For example, *Pitcher* teaches that a controller monitors fluid parameters of the system e.g., flowrate and pressure, and operates valves of a fracturing manifold to control the fracturing fluid entering each of the wells connected to the manifold “based on fluid parameters monitored for each well.”²⁹⁵ Further, *Pitcher* teaches moving from one stage of fracturing to the next based on fluid conditions. *Pitcher* teaches the following:

full flow (e.g., twenty-five barrels per minute) can be provided to the well 14 and a desired fracturing time for a given zone can be calculated based on:

$$V_{frac} = Qt + V_p$$

²⁹⁴ *Pitcher*, [0037], [0039].

²⁹⁵ *Pitcher*, [0030], [0040].

where V_{frac} the volume of fracturing fluid to pump into the fracturing zone, Q is the volumetric flow rate at which fluid is pumped into the well 14 from the fracturing manifold 44, t is the desired fracturing time for the zone, and V_P is the volume of the passageway (i.e., fluid conduit) from the ball launcher 40 (of the well 14) to the far end of the zone being fractured.²⁹⁶

475. Once the volumetric flow rate and desired fracturing time are calculated, *Pitcher* discloses using the volumetric flow rate and desired time as thresholds to trigger subsequent fracturing stages.²⁹⁷ In particular, *Pitcher* discloses triggering the next stage of fracturing when the controller determines (using readings from a flowrate sensor) that the flow rate has been at the volumetric flowrate for a specific period of time. For example, *Pitcher* teaches the following: “[t]he manifold valve 48 that controls flow to the well 12 can then be adjusted to set the flow rate (which can be measured by a sensor 62) to the calculated amount. Once the desired fracturing time has elapsed, the ball launchers 40 may be activated to drop balls 42 into the wells 12 and 14 to isolate the next fracturing stages for stimulation.”²⁹⁸ *Pitcher* teaches that this is not a one-shot, all-encompassing end of fracturing, but

²⁹⁶ *Pitcher*, [0036].

²⁹⁷ *Pitcher*, [0037].

²⁹⁸ *Pitcher*, [0037].

simply a move to the next stage, as *Pitcher* further teaches that “[e]ach fracturing stage of corresponding pairs of stages (e.g., zones 106 and 116, zones 108 and 118, and zones 110 and 120) can be fractured at the same rate and for the same duration if desired, although the rates and durations could also be varied (e.g., if it is intended that the zones are to receive different volumes of fracturing fluid).”²⁹⁹

476. Accordingly, Claim 4 would have been obvious to a POSITA based on the teachings of *Christie*, *Pitcher*, and *Al-Samani*.

4. DEPENDENT CLAIMS 5 – 12 (CONDITIONS AND THRESHOLDS)

477. Dependent Claim 5 depends from Claim 1 and recites the “one or more conditions” of Claim 1 include “flow rate,” and Claim 9 recites the condition(s) include pressure. My analysis above with respect to Claim 1 already discusses how *Christie* discloses one or more conditions include the flow rate and/or pressure of the at least a portion of fluid communicated via the manifold from the pumps, as in Claims 5 and 9. See Sections XV.A.5 and XV.A.7.

478. Claims 6-8 and 10-12 recite that the flowrate and/or pressure conditions are satisfied when above and/or below thresholds. There is no disclosure in the ’952 Patent as to what these unquantified “thresholds” are or how or why they should be selected. Nevertheless, “thresholds” were generally and commonly used in

²⁹⁹ *Pitcher*, [0037].

fracturing operations and in automated operations, as evidenced by *Christie, Al-Salmani*, and *Pitcher*.

479. As described above regarding Limitations 1.3.2, 1.3.3, 3.3.2 and 3.3.3, and Claim 4 in Ground 6 (Sections XV.A.1 e-f, XV.A.3, and XV.A.4), each incorporated herein by reference, valve operations, such as opening or closing, are performed in response to determining that the fluid communicated via the manifold has satisfied one or more conditions such as reduced flowrate or injection established (flowrate condition) and pressure has stabilized (pressure condition). Further, *Christie* discloses that pressures, temperatures, and/or flow rates of the fluids exiting the pump units 150, 190 may be monitored by one or more sensors.³⁰⁰ The “fluids exiting the pump units 150” include the fluid communicated via the manifold (or at least a portion thereof), as the pumps are the source of the fluid communicated via the manifold. Accordingly, *Christie* discloses the one or more conditions include the flow rate of the at least a portion of the fluid communicated via the manifold.

480. As discussed above in Ground 6, *Christie* teaches the overall parameters of when to conduct a continuous pumping swap and in what state the fracturing system would be before, during and after the CP Swap. For example, *Christie* teaches that a well swap occurs “*after stimulation is completed* on one

³⁰⁰ *Christie*, [0108]; *Christie Provisional*, [0080], [0045], [0047], [0070], [0076]-[0083], [0091], [0097], [0099].

wellbore,” where the controller “may operate (i.e., open) the corresponding fluid access valve 204 and cause the stimulation system 420 and the fluid flow control valve system 440 to operate to inject the treatment fluid (e.g., fracturing fluid) into the next wellbore 102.”³⁰¹ Accordingly a POSITA would have known to conduct a well swap, including a CP swap, “*after stimulation is complete* on one wellbore [e.g., first wellbore].” Further, as discussed at length in Ground 6 regarding Claim 1 and incorporated herein by reference, *Christie* teaches “continuous pumping” during the well swap process from, for example, the first wellbore to the second wellbore. Accordingly, a POSITA would have known that the pumps would be running before, during and after the swap is made. Further, as discussed above in Section XI.B, a POSITA would have known that the pumps used in hydraulic fracturing were positive displacement (plunger) pumps, and that these pumps would have flow anytime the pumps were running.³⁰² Based on the teachings of *Al-Salmani*, a POSITA would have understood to use pressure thresholds to determine the state of the fracturing system to indicate when “stimulation is complete” in the first wellbore and when the pumps are still running.

³⁰¹ *Christie*, [0099] emphasis added; see *Christie Provisional*, [0081]. See also discussion in Section XV.A.1.e regarding limitation 1.3.2.

³⁰² As discussed above, a PD pump moves the same amount of fluid each stroke. If there is not a flow path, pressures would rise until something in the system failed.

481. *Al-Salmani* teaches use of a “pressure sensor arranged at a fracturing tree” that is “coupled to a control unit”.³⁰³ Further, *Al-Salmani* discloses “a method for monitoring operations at a well sit includes receiving, from a pressure sensor, pressure information for a fracturing tree, the pressure information indicative of an operational stage.”³⁰⁴ Further, *Al-Salmani* discloses “determining, based at least in part on the pressure information and the valve position information, a current status of a wellhead.”³⁰⁵ *Al-Salmani* teaches that the control system “utilize[s] analytics to categorize different operations of the well site, determine a phase of the operation, and/or monitor ongoing activities, which may improve well site operations,”³⁰⁶ based on the sensor data, including pressure and flowrate sensors.³⁰⁷ For example, “differences in the information received from the one or more sensors ... may be utilized in order to determine various operations at the well site.”³⁰⁸

482. *Al-Salmani* also teaches using flowrate from flow sensors to determine the state of the fracturing operation. *Al-Salmani* teaches that “[i]t should be appreciated that various other sensors and monitors may also be included within the frac tree 100, and that the illustrated pressure and position sensors are for illustrative

³⁰³ *Al-Salmani*, [0006].

³⁰⁴ *Al-Salmani*, [0007].

³⁰⁵ *Al-Salmani*, [0007].

³⁰⁶ *Al-Salmani*, [0040].

³⁰⁷ *Al-Salmani*, [0040].

³⁰⁸ *Al-Salmani*, [0065].

purposes only. In embodiments, flow sensors may also be incorporated into the system, thereby enabling monitoring of fracturing fluid flow into and/or out of the wellbore.”³⁰⁹ Accordingly, *Al-Salmani* teaches that flow sensors (flowrate) can be used in the same manner as pressure sensors (pressure).

483. In addition to the general teaching of *Al-Salmani* regarding using pressure (and flow) to determine the state of the fracturing operation, *Al-Salmani* specifically teaches comparing sensor data to upper and lower thresholds to determine the state of the fracturing operation. For example, *Al-Salmani* teaches that “information may further be transmitted to the control unit, which may be utilized to evaluate a change in the operating condition. For example, the pressure may increase and/or decrease more than a threshold amount,” which “may be correlated to a different action at the wellsite, such as a closed in well in cases where the valve is closed and/or the pressure is below a threshold amount.”³¹⁰

484. Accordingly, *Al-Salmani* discloses that pressure thresholds (e.g., pressure below a threshold amount) indicate a state of the fracturing operation. A POSITA would have understood, based on the teachings of *Al-Salmani* disclosing flowrate indicative of the state of a fracturing operations that it would have been

³⁰⁹ *Al-Salmani*, [0040].

³¹⁰ *Al-Salmani*, [0066].

obvious to use flowrate thresholds to equally indicate a state of the fracturing operation.

485. It would have been obvious and predictably implemented to use fluid condition thresholds for determining a phase of a fracturing operation as taught by *Al-Salmami*, e.g., to determine an end of a fracturing stage, to trigger the swap to the next well's fracturing stage (opening the next well's valve) in *Christie's* CP swap. Applying *Al-Salmami's* known fluid monitoring techniques with *Christie's* CP swap systems/methods would have obviously been used with *Christie's* controller-implemented coordinated pumping operations with the predictable results of improved efficiency.

486. A POSITA would have applied *Al-Salmami's* teaching of the use of thresholds to the disclosure of *Christie* that a well swap (CP swap) occurs after stimulation is complete in well bore and would have used an upper threshold (such as when pressure is below a threshold amount taught by *Al-Salmami*) to determine when the fracturing stage was complete, as the end of a stage was known to a POSITA to be accompanied by a reduction in pressure and flowrate. Similarly, a POSITA would have used a lower threshold (such as zero flow) to determine when the pumps were running, as taught by *Christie*, would be necessary for a CP swap. Accordingly, it would have been obvious to a POSITA, based on the combined teachings of *Christie* and *Al-Salmami* that a CP swap occurs when flow or pressure

is below an upper threshold (indicating that stimulation is complete in the first stage), when flow or pressure is above an upper threshold (indicating that the pumps are still running), and when flow or pressure is both below an upper and above a lower threshold. An operator or fracturing plan designer would have selected specific upper/lower thresholds based on the wellsite to optimize efficiency and safety.

487. Further, as discussed above regarding Limitation 1.3.2 and Claim 4, incorporated herein by reference, *Pitcher* discloses using flowrate of the at least a portion of fluid communicated via the manifold as a fluid condition to trigger moving fracturing operations to the next stage, which combined with the system of *Christie* is in the second well.³¹¹ For example, *Pitcher* discloses triggering the next stage of fracturing when the controller determines (using readings from a flowrate sensor) that the flow rate has been at the volumetric flowrate for a specific period of time.³¹² *Pitcher* teaches that this is not a one-shot, all-encompassing end of fracturing, but simply a move to the next stage, as *Pitcher* further teaches that “[e]ach fracturing stage of corresponding pairs of stages (e.g., zones 106 and 116, zones 108 and 118, and zones 110 and 120) can be fractured at the same rate and for the same duration if desired, although the rates and durations could also be varied (e.g., if it is

³¹¹ *Pitcher*, [0037].

³¹² *Pitcher*, [0037].

intended that the zones are to receive different volumes of fracturing fluid).”³¹³ *Pitcher*’s teachings of monitoring flowrate for indicating a current operational status of a fracturing stage and when to operate a valve to move to the next step is an example of how valves are typically used in fracturing operations.

488. Accordingly, Claims 5 – 12 would have been obvious to a POSITA based on the teachings of *Christie*, *Pitcher*, *Al-Samani*, and the general knowledge of a POSITA.

5. DEPENDENT CLAIM 13

489. Dependent Claim 13 depends from Claim 1. In addition to the limitations above regarding Claim 1, *Christie* discloses, or at least renders obvious, the additional limitations of Claim 13, or at least they would have been obvious to a POSITA for the same reasons as discussed with Ground 6.

6. CLAIMS 14 – 15 (FRACTURING FLUID AND FRACTURING FLUID CONTAINING SAND)

490. Dependent Claim 14 depends from Claim 1. In addition to the discussion above regarding Claim 1, incorporated herein by reference, *Christie* discloses the additional limitations of Claim 14, or at least they would have been obvious to a POSITA. As discussed above in Ground 6, *Christie* discloses the

³¹³ *Pitcher*, [0037].

limitations of Claim 14 or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

491. Further, both *Pitcher* and *Al-Salmani* disclose using fracturing fluid in the fracturing operation, including fracturing fluid containing sand. *Pitcher* discloses “fracturing processes typically include injecting a fracturing fluid-often a mixture or slurry including sand and water-into the well to increase the well's pressure and form the man-made fractures.”³¹⁴ Similarly, *Al-Salmani* discloses that “a sand supplier, provides sand to form the slurry that is injected during a fracturing operation.”³¹⁵

492. When combined with the system of *Christie*, a POSITA would have recognized that the slurry (including sand) would have been used to hydraulically fracture the first well and hydraulically fracture the second well, and that the hydraulic fracturing fluid is continuously communicated via the manifold during the CP swap.

493. Accordingly, the combination of *Christie*, *Pitcher*, and *Al-Samani* renders Claims 14-15 obvious.

³¹⁴ *Pitcher*, [0003]; *see also* [0023]–[0024].

³¹⁵ *Al-Salmani*, [0025].

7. DEPENDENT CLAIM 16

494. Dependent Claim 16 depends from Claim 1. As discussed above regarding Ground 6, *Christie* discloses the limitations of Claim 16 or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

495. In addition to the discussion above regarding Claim 1, *Al-Samani* discloses the additional limitations of Claim 16. *Al-Samani* discloses each and every limitation of Claim 16, as discussed in the subsections below. Accordingly, the combination of *Christie*, *Pitcher* and *Al-Samani* renders Claim 16 obvious.

a. 16.1: “The method of claim 1, further comprising: displaying a dashboard, which dashboard comprises:”

496. As discussed above regarding Ground 6, it is my opinion that the use of a dashboard as claimed in Claim 16 would have been obvious to a POSITA based on the teachings of *Christie* and the general knowledge of a POSITA. To the extent the Board finds the teachings of *Christie* insufficient, *Al-Samani* discloses a dashboard.

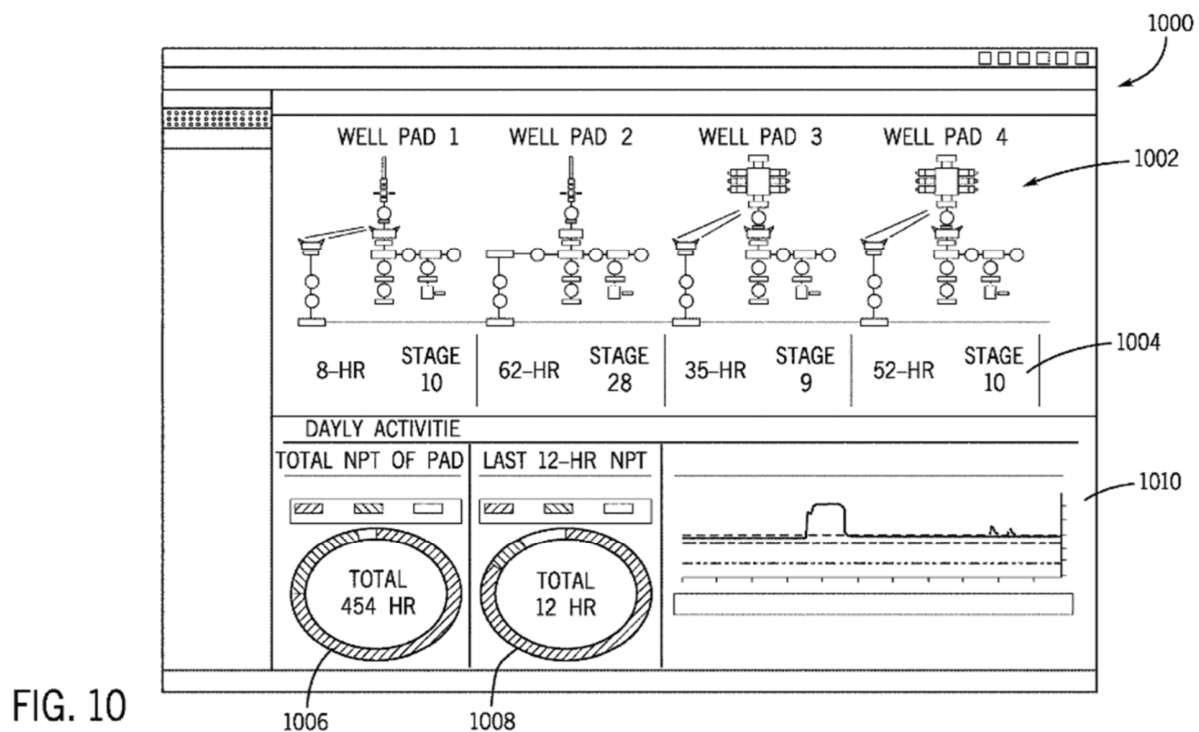
497. *Al-Samani* teaches “a user interface and display module for presenting information, for example at the control panel, for operators to track and monitor well site operations.”³¹⁶ *Al-Samani*’s display “may relay information to the user

³¹⁶ *Al-Samani*, [0026].

regarding pressures, valve state, and the like.”³¹⁷ *Al-Salmari*’s Fig. 10 “illustrates the user interface that includes graphical representations of frac trees illustrative of well configurations (e.g., number of wells, ball drop systems, etc.). In various embodiments, real or near-real time monitoring is provided, and may also include indicators of valve operations (e.g., color coded for different positions). For example, open valves may be presented in green, closed valves may be presented in red, and transitioning valves may be presented in yellow.”³¹⁸

³¹⁷ *Al-Salmari*, [0046]

³¹⁸ *Al-Salmari*, [0063], Fig. 10.



Al-Salmani, Fig. 10

498. Accordingly, *Al-Salmani* discloses a dashboard on its user interface. To the extent the board determines *Al-Salmani* do not explicitly use the term dashboard, it would have been obvious to a POSITA that *Al-Salmani*'s "display" is a "dashboard", as it encompasses all limitations of Claim 16 describing the "dashboard".

b. 16.2: "a visual reference of the first valve; and a visual reference of the second valve;"

499. As discussed above regarding limitation 16.1, *Al-Salmani*'s display includes "indicators of valve operations (e.g., color coded for different positions).

For example, open valves may be presented in green, closed valves may be presented in red, and transitioning valves may be presented in yellow.”³¹⁹ Thus, *Al-Salmani*’s display contains a visual reference of the first valve (associated with Well Pad 1) and a visual reference of the second valve (associated with Well Pad 2). Accordingly, *Al-Salmani* each disclose this limitation.

c. 16.3”: “wherein the display of the dashboard visually communicates respective states of the first and second valves.”

500. As discussed above regarding limitation 16.2, *Al-Salmani*’s display communicates the respective states of the first and second valves (*e.g.*, green for open and red for closed).

501. Accordingly, *Al-Salmani* discloses or renders obvious each and every limitation of Claim 16. It would have been obvious to a POSITA to use *Al-Salmani*’s dashboards, including valve visual references and indicators, with *Christie*’s dashboards, as a simple substitution to better monitor and visualize the operations, as taught in *Al-Salmani*.³²⁰ As a result, Claim 16 would have been obvious to a POSITA based on the combined teachings of *Christie*, *Pitcher* and *Al-Salmani*.

³¹⁹ *Al-Salmani*, [0063], Fig. 10.

³²⁰ *Al-Salmani*, [0026].

8. DEPENDENT CLAIM 17: “THE METHOD OF CLAIM 16, WHEREIN THE DASHBOARD FURTHER COMPRISES: A FIRST VISUAL INDICATOR ASSOCIATED WITH THE VISUAL REFERENCE OF THE FIRST VALVE, THE FIRST VISUAL INDICATOR INDICATING THAT THE STATE OF THE FIRST VALVE IS OPEN TO PERMIT COMMUNICATING FLUID TO THE FIRST WELL VIA THE MANIFOLD AND THE FIRST VALVE.”

502. Claim 17 depends from Claim 16. As discussed above regarding Ground 6, *Christie* discloses the limitations of Claim 16 or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

503. To the extent the Board finds the teachings of *Christie* insufficient, *Al-Samani* further discloses the additional limitations of Claim 17 and would have rendered Claim 17 obvious. As discussed above regarding Claim 16, *Al-Samani* teaches that “for example, open valves may be presented in green, closed valves may be presented in red, and transitioning valves may be presented in yellow.”³²¹ A POSITA would have understood that “open” wellhead valves permit communicating fluid to wellheads. The valves associated with the first wellhead (i.e., first valve) are shown in the diagram of “Well Pad 1.” The “red” color coding indicating closed is different from the “green” color coding indicating open. It would have been obvious to use Al-Samani’s dashboards, including valve visual indicators, with

³²¹ *Al-Samani*, [0063], Fig. 10.

Christie's dashboard to enable better visualization and monitoring of the fracturing operation.

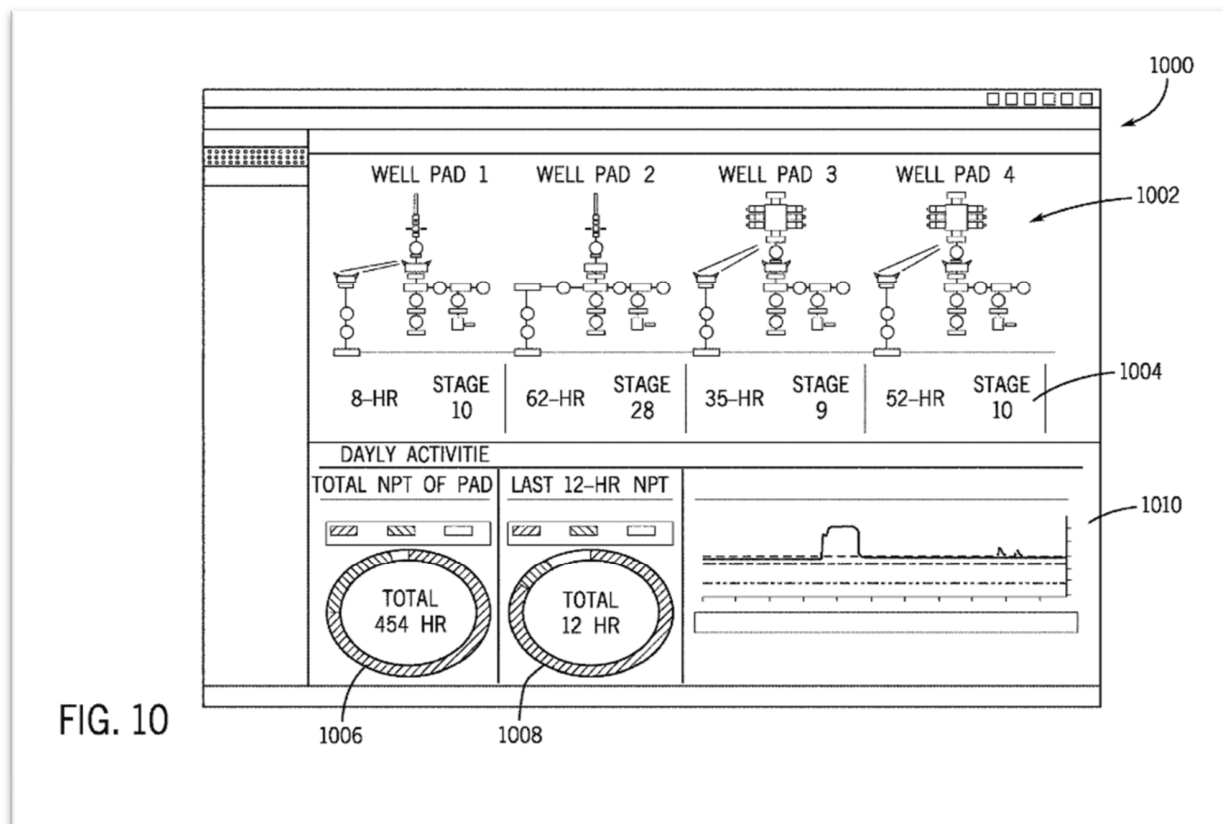
504. Accordingly, Claim 17 would have been obvious to a POSITA based on the combined teachings of *Christie*, *Pitcher* and *Al-Salmani*.

9. DEPENDENT CLAIM 18: "THE METHOD OF CLAIM 17, WHEREIN THE DASHBOARD FURTHER COMPRISES: A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL."

505. Claim 18 depends from Claim 17. As discussed above regarding Ground 6, *Christie* discloses the limitations of Claim 17 or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

506. To the extent the Board finds the teachings of *Christie* insufficient, *Al-Salmani's* Fig. 10 "illustrates the user interface that includes graphical representations of frac trees [i.e., wellheads] illustrative of well configurations (e.g., number of wells, ball drop systems, etc.). In various embodiments, real or near-real time monitoring is provided, and may also include *indicators* of valve operations (e.g., color coded for different positions). For example, open valves may be presented in green, closed valves may be presented in red, and transitioning valves may be presented in yellow."³²²

³²² *Al-Salmani*, [0063], Fig. 10.



Al-Salmani, Fig. 10

507. A POSITA would have understood the “frac trees” to at least include the wellheads, as shown in Figure 10, and the each frac tree is associated with a well. It would have been obvious to use *Al-Salmani*’s visual references of the wellheads in communication with the wells with *Christie*’s dashboards to better visualize the fracturing site and operations.

508. Accordingly *Al-Salmani* each discloses the limitations of Claim 18, and the combination of *Christie*, Pitcher and *Al-Samani* renders Claim 18 obvious.

10. DEPENDENT CLAIM 19: “THE METHOD OF CLAIM 17, WHEREIN THE DASHBOARD FURTHER COMPRISES: A SECOND VISUAL INDICATOR ASSOCIATED WITH THE VISUAL REFERENCE OF THE SECOND VALVE, THE SECOND VISUAL INDICATOR BEING DIFFERENT FROM THE FIRST VISUAL INDICATOR TO INDICATE THAT THE STATE OF THE SECOND VALVE IS CLOSED.”

509. Claim 19 depends from Claim 17. As discussed above in Ground 6, *Christie* discloses the limitations of Claim 17 or at least they would have been obvious to a POSITA based on the teachings of *Christie*.

510. To the extent the board finds the teachings of *Christie* insufficient, *Al-Salmani's* Fig. 10 “illustrates the user interface that includes graphical representations of frac trees illustrative of well configurations (e.g., number of wells, ball drop systems, etc.). In various embodiments, real or near-real time monitoring is provided, and may also include indicators of valve operations (e.g., color coded for different positions). For example, open valves may be presented in green, closed valves may be presented in red, and transitioning valves may be presented in yellow.”³²³ The valves associated with the second wellhead (i.e., second valve) are shown in the diagram of “well pad 2”. The “red” color coding indicating closed is different from the “green” color coding indicating open. It would have been obvious to use *Al-Salmani's* dashboards, including valve visual indicators, with *Christie's* dashboard to enable better visualization and monitoring of the fracturing operation.

³²³ *Al-Salmani*, [0063], Fig. 10.

511. Thus, *Al-Salmani* discloses the limitations of Claim 19 and Claim 19 would have been obvious to a *POSITA* based on the combined teachings of *Christie*, *Pitcher* and *Al-Salmani*.

11. INDEPENDENT CLAIM 20:

- a. “20.1: “A non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the operations comprising:”**

512. With the exception of a reference to a “non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations,” which a *POSITA* would have recognized as a generic computer system, this claim limitation is substantially similar to Limitation 1.1 and is disclosed by *Christie* for the same reasons as those described in Section XV.A.1.a.

513. Further, *Christie* also discloses the claimed generic computer system. *Christie* teaches its “controller includes a processor and a memory storing computer program code.”³²⁴ Further still, *Christie* teaches the use of “one or more control centers 160, each having a controller 161 (e.g., a processing device, a computer, a programmable logic controller (PLC), etc.), which may be configured to monitor

³²⁴ *Christie*, [0031]; see *Christie Provisional*, [0004].

and provide control to one or more portions of the wellsite system 100,” and that “controller(s) 161 may store control commands, operational parameters and set-points, coded instructions, executable programs, and other data or information, including for implementing one or more aspects of the operations described herein.”³²⁵ The description in *Christie* matches the claimed “non-transitory computer readable medium having stored thereon computer-readable instructions executable by one or more processors to perform operations for hydraulically fracturing a plurality of wells” of Limitation 20.1.

514. A POSITA would have immediately equated the “control commands, operational parameters and set-points, coded instructions, executable programs” of *Christie* to the claimed “plurality of instructions.” A POSITA would have also immediately recognized the disclosure of *Christie* to be a disclosure of the instructions “executable by one or more processors,” as claimed. Additionally, a POSITA would have immediately equated *Christie*’s disclosure of the “commands, instructions and programs” to the claimed “instructions ... executed by the one or more processors,” to execute the claimed steps.

515. Additionally, *Pitcher* discloses the claimed generic computer system as well. *Pitcher* discloses that the controller “includes a processor 132 connected by a

³²⁵ *Christie*, [0048]; see *Christie Provisional*, [0031].

bus 134 to a memory device 136. It will be appreciated that the system 130 could also include multiple processors or memory devices, and that such memory devices can include volatile memory (e.g., random-access memory) or non-volatile memory (e.g., flash memory and a read-only memory).”³²⁶ The one or more memory devices 136 are encoded with application instructions 138, e.g., software executable by the processor 132 to perform the control and analysis functionality.³²⁷

516. Accordingly, *Christie* and *Pitcher* disclose the limitations of 20.1, or at least they would have been obvious to a POSITA based on the disclosures of *Christie* and *Pitcher*.

- b. 20.2: “communicating fluid from one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

517. This claim limitation is identical to Limitation 1.2 and is disclosed by *Christie* for the same reasons as those described in Section XV.A.1.b.

³²⁶ *Pitcher*, [0039].

³²⁷ *Pitcher*, [0039].

- c. **20.3: “executing a continuous pumping ("CP") swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”**

518. This claim limitation is identical to Limitation 1.3 and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.c.

- (1)20.3.1: “opening a second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”**

519. This claim limitation is identical to Limitation 1.3.1 and is disclosed or render obvious by *Christie* for the same reasons as those described in Section XV.A.1.d.

- (2)20.3.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold; and”**

520. This claim limitation is identical to Limitation 1.3.2 and is disclosed by or at least rendered obvious based on the disclosures of *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those described in Section XV.B.1.b.

(3)20.3.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions, which one or more conditions include the flow rate, and/or the pressure, of the at least a portion of the fluid communicated via the manifold, and”

521. This claim limitation is identical to Limitation 1.3.3 and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.f.

(4)20.3.4: “while fluid is communicated from the one or more pumps to the second well via the second valve and the manifold;”

522. This claim limitation is identical to Limitation 1.3.4 and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.g.

d. 20.4: “wherein, during the CP swap, fluid is continuously communicated from the one or more pumps via the manifold.”

523. This claim limitation is identical to Limitation 1.4 and is disclosed by *Christie* or would have been obvious to a POSITA based on the disclosure of *Christie* for the same reasons as those described in Section XV.A.1.h.

524. Claim 20, therefore, would have been obvious to a POSITA in view of the teachings of *Christie*, *Pitcher*, and *Al-Salmani*.

12. DEPENDENT CLAIMS 21 - 22

525. Except for depending from Claim 20, the limitations of Claims 21 - 22 are identical to those of Claims 2 - 3, respectively, and are obvious over *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those described in Section XV.B.2.

13. DEPENDENT CLAIM 23: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 20, WHEREIN THE OPERATIONS FURTHER COMPRISE: DETERMINING THAT THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

526. Dependent Claim 23 depends from Claim 20. In my opinion, Claim 23 adds no additional limitations to Claim 20. Limitation 20.3.2 recites “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions”. Before the method claimed in Claim 20 can open the valve “in response to” at least a portion of fluid communicated via the manifold satisfying one or more conditions, the method must first “determine” that the fluid has met the one or more conditions.

527. To the extent that the Board finds that Claim 23 does add additional limitations, the combination of *Christie*, *Pitcher* and *Al-Salmani* renders the additional limitations of Claim 23 obvious for the same reasons as those described in Section XV.B.11.

14. DEPENDENT CLAIM 24: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 20, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE FLOW RATE OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

528. Dependent Claim 24 depends from Claim 20. My analysis above with respect to Claim 1 already discusses how *Christie*, *Pitcher*, and *Al-Salmani* discloses and/or renders obvious that the satisfied one or more conditions include the flow rate of the at least a portion of fluid communicated via the manifold.

529. The combination of *Christie*, *Pitcher* and *Al-Salmani* renders the additional limitations of Claim 24 obvious for the same reasons as those described in Section XV.B.1.b.

15. CLAIMS 25 – 27

530. Except for depending from Claim 24, the limitations of Claims 25 – 27 are identical to those of Claims 6 - 8, respectively, and are obvious over *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those described in Section XV.B.4.

16. DEPENDENT CLAIM 28

531. Except for depending from claim 20, the limitations of Claim 28 are substantially similar to those of Claim 9 and are obvious over *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those described in Section XV.B.4.

17. CLAIMS 29 – 31

532. Except for depending from claim 28, the limitations of Claims 29-31 are substantially similar to those of Claim 10-12, respectively, and are obvious over

Christie, Pitcher and *Al-Salmani* for the same reasons as those described in Section XV.B.4.

18. DEPENDENT CLAIMS 32 – 38

533. Except for depending from Claim 20, the limitations of Claim 32 - 38, are substantially similar to those of Claims 13-19, respectively, and are obvious over *Christie, Pitcher* and *Al-Salmani* for the same reasons as those described in Sections XV.B.5-XV.B.10.

19. INDEPENDENT CLAIM 39

534. It is my opinion that *Christie, Pitcher*, and *Al-Salmani* renders Claim 39 obvious and discloses, or at least suggests each and every limitation of Claim 39.

a. 39.1: “A system for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the system comprising:”

535. Except for being rewritten as a system claim, the limitations of 39.1 are identical to those of Limitation 1.1 and are disclosed by *Christie* for the same reasons as those discussed above in Section XV.A.1.a.

b. 39.2: “a manifold via which fluid is adapted to be communicated from one or more pumps;”

536. *Christie* discloses and renders obvious this limitation for the same reasons discussed with Limitation 1.2 above in Section XV.A.1.b.

- c. **39.3: “a first valve via which fluid is adapted to be communicated from the one or more pumps to the first well, the first valve being associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

537. *Christie* discloses this limitation for the same reasons discussed with Limitation 1.2 above in Section XV.A.1.b.

- d. **39.4: “a second valve via which fluid is adapted to be communicated from the one or more pumps to the second well, the second valve being associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is adapted to be communicated to the first well via the manifold and the first valve; and”**

538. *Christie* discloses this limitation for the same reasons discussed with Limitation 1.3.1 above in Section XV.A.1.d.

- e. **39.5: “one or more controllers configured to execute a continuous pumping (“CP”) swap, during which CP swap fluid is continuously communicated via the manifold, to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, by:”**

539. *Christie* discloses this limitation for the same reasons discussed with Limitation 39.5 in Ground 6, in Section XV.A.25.e. *Pitcher* also discloses a controller using software executable by its processor to perform the control and

analysis functionality of fracturing operations.³²⁸ *Al-Salmani* also discloses a control unit that may receive system sensor data and control equipment of the fracturing system such as valves.³²⁹

(1)39.5.1: “opening the second valve: while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, to cause fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

540. Except for being rewritten as a system claim, the limitations of 39.5.1 are substantially similar to those of Limitation 1.3.1 and are disclosed by *Christie* for the same reasons as discussed with Ground 6 in Section XV.A.1.d.

(2)39.5.2: “in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, which one or more conditions include a flow rate, and/or a pressure, of the at least a portion of fluid communicated via the manifold; and

541. Except for being rewritten as a system claim, the limitations of 39.5.2 are substantially similar to those of Limitation 1.3.2 and are disclosed and/or rendered obvious by *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.1.b.

(3)39.5.3: “closing the first valve: after the at least a portion of fluid communicated via the manifold has satisfied one or more conditions, which one or more conditions include the

³²⁸ *Pitcher*, [0039].

³²⁹ *Al-Salmani*, [0045], [0065].

flow rate, and/or the pressure, of the at least a portion of fluid communicated via the manifold, and”

542. Except for being rewritten as a system claim, the limitations of 39.5.3 are substantially similar to those of Limitation 1.3.3 and are disclosed or at least rendered obvious by *Christie* in view of *Pitcher* and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.1.c.

(4)39.5.4: “while fluid is communicated to the second well via the second valve and the manifold.”

543. The limitations of 39.5.4 are identical to those of 1.3.4 and are disclosed or at least rendered obvious by *Christie* in view of *Pitcher* and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.1.c.

20. DEPENDENT CLAIM 40

544. Except for depending from Claim 39, the limitations of Claim 40 are identical to those of Claim 2 and are disclosed or at least rendered obvious by *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed above in Sections XV.A.2 and XV.B.2.

21. DEPENDENT CLAIM 41

545. Except for depending from Claim 39, the limitations of Claim 41 are substantially the same as those of Claim 3 and are disclosed or at least rendered obvious by *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.2. The limitations of Claim 41 are also disclosed or at least

rendered obvious by *Christie* for the same reasons discussed with Ground 6 in Section XV.A.3.

22. DEPENDENT CLAIM 42: “THE SYSTEM OF CLAIM 39, WHEREIN THE ONE OR MORE CONTROLLERS ARE FURTHER CONFIGURED TO: DETERMINE THAT THE AT LEAST A PORTION OF THE COMMUNICATED VIA THE MANIFOLD HAS SATISFIED THE ONE OR MORE CONDITIONS.”

546. Except for the reference to controllers executing the CP swap, which are disclosed by *Christie* as described above in Sections XV.A.25.e and XV.B.19.e, Claim 42 is substantially similar to Claim 4 and 23 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.4.

23. DEPENDENT CLAIMS 43 : “THE SYSTEM OF CLAIM 39, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE FLOW RATE OF THE AT LEAST A PORTION OF THE FLUID COMMUNICATED VIA THE MANIFOLD.”

547. Except for depending from Claim 39 and referencing the controllers, which are disclosed by *Christie* as described above in Sections XV.A.25.e and XV.B.19.e, and being rewritten as a system claim, Claim 43 is substantially similar to Claim 5 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.1.b and XV.B.4.

24. DEPENDENT CLAIMS 44 - 46

548. Except for depending from Claim 43, Claims 44-46 are substantially similar to Claims 6-8, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.4.

25. DEPENDENT CLAIM 47: “THE SYSTEM OF CLAIM 39, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE THE PRESSURE OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

549. Except for depending from Claim 39, the limitations of Claim 47 are substantially similar to those of Claim 9 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those described in Section XV.B.4.

26. DEPENDENT CLAIMS 48 - 50

550. Except for depending from Claim 47, the limitations of Claims 48-50 are substantially similar to those of Claims 10-12, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those described in Section XV.B.4.

27. DEPENDENT CLAIM 51

551. Dependent Claim 51 depends from Claim 39. In addition to the discussion of Claim 39 above, and incorporated herein by reference, the limitations of Claim 51 would have been obvious to a POSITA based on the disclosures of

Christie, Pitcher and *Al-Salmani* for the same reasons provided above with the discussion of substantially identical Claim 13 in Sections XV.A.9 and XV.B.5.

28. DEPENDENT CLAIMS 52 – 57

552. Except for depending from Claim 39, the limitations of Claims 52 - 57 are identical to those of Claims 14–18, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.6-9.

29. INDEPENDENT CLAIM 58

553. The combination of *Christie, Pitcher* and *Al-Salmani* renders Claim 58 obvious.

a. 58.1: “A method of hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the method comprising:”

554. Limitation 58.1 is identical to Limitation 1.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

- b. 58.2: “communicating fluid from the one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

555. Limitation 58.2 is identical to Limitation 1.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

- c. 58.3: “displaying a dashboard, which dashboard comprises:”**

556. Limitation 58.3 recites the same limitations as Limitation 16.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.a above.

- (1) 58.3.1: “a visual reference of the first valve;”**

557. Limitation 58.3.1 recites the same limitations as Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.b above.

- (2) 58.3.2: “a first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”**

558. Limitation 58.3.2 recites the same limitations as Claim 17 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.8 above.

(3) 58.3.3: “a visual reference of a second valve,

(4) 58.3.4: “wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve; and”

559. Limitations 58.3.3 and 58.3.4 recite the same limitations as in Limitations 16.2 and Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.7.b and XV.B.1.a above.

(5) 58.3.5: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator being different from the first visual indicator to indicate that a state of the second valve is closed; and”

560. Limitation 58.3.5 recites the same limitations as Claim 19 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.10 above.

d. 58.4: “executing a continuous pumping ("CP") swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

561. Limitation 58.4 is identical to Limitation 1.3 and is would have been obvious to a POSITA based on the disclosure of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(1) 58.4.1: “opening the second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

562. Limitation 58.4.1 is identical to Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(2) 58.4.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions; and”

563. Limitation 58.4.2 is substantially similar to, though less limiting than, Limitation 1.3.2, as Limitation 58.4.2 does not limit the claimed “conditions” at all. Even though the ’952 Patent does not describe any other condition for opening the second valve other than flowrate, Claim 58 does not limit the “conditions” in any way – using just the plain language of Limitation 58.4.2, the “condition” could be the fluid’s flowrate and/or pressure, as recited in Limitation 1.3.2, or could be any other condition of the fluid.

564. Nevertheless, whether the term “condition” is interpreted broadly or narrowly, *Christie, Pitcher*, and *Al-Salmani* disclose or at least renders obvious opening a second valve in response to fluid communicated via a manifold satisfying many types of conditions, including flowrate and/or pressure conditions, as discussed with Limitation 1.3.2 in XV.B.1.b above. Thus, Limitation 58.4.2 is

disclosed by and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(3) 58.4.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions, and”

565. Limitation 58.4.3 is substantially similar to, though less limiting than, Limitation 1.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.c above.

e. 58.5: “wherein the display of the dashboard visually communicates the respective states of the first and second valves; and”

566. Limitation 58.5 recites the same limitations as Limitation 16.3 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.c above.

f. 58.6: “wherein fluid is continuously communicated via the manifold during the CP swap.”

567. Limitation 58.6 is substantially similar to Limitation 1.4 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher*, and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.c above.

30. DEPENDENT CLAIM 59: “THE METHOD OF CLAIM 58, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

568. Except for depending from Claim 58, the limitations of Claim 59 are substantially similar to those of Claim 18 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.9 above.

31. DEPENDENT CLAIMS 60 – 61

569. Except for depending from Claim 58, the limitations of Claims 60-61 are substantially similar to those of Claims 4-5, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.3 and XV.B.4 above.

32. DEPENDENT CLAIM 62: “THE METHOD OF CLAIM 58, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A PRESSURE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

570. Except for depending from Claim 58, the limitations of Claim 62 are substantially similar to those of Claim 9 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.4 above.

33. DEPENDENT CLAIMS 63 – 64

571. Except for depending from Claim 58, the limitations of Claims 63 - 64 are identical to those of Claims 14 – 15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.6 above.

34. INDEPENDENT CLAIM 65

572. The combination of *Christie*, *Pitcher* and *Al-Salmani* renders Claim 65 obvious, as discussed in the subsections below.

- a. **65.1: “A non-transitory computer readable medium of hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the method comprising:”**

573. The limitations of 65.1 are substantially similar to those of limitations 20.1 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.11.a above.

- b. 65.2: “communicating fluid from one or more pumps to the first well via a manifold and a first valve, wherein the first valve is associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

574. The limitations of 65.2 are identical to those of Limitations 1.2/20.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.A.1.b above.

- c. 65.3: “displaying a dashboard, which dashboard comprises:”**

575. Limitation 65.3 recites the same limitations as Limitation 16.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.a above.

- (1) 65.3.1: “a visual reference of the first valve;”**

576. Limitation 65.3.1 recites the same limitations as in Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.b above.

- (2) 65.3.2: “first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”**

577. Limitation 65.3.2 recites the same limitations as in Claim 17 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.8 above.

(3) 65.3.3: “a visual reference of a second valve,

(4) 65.3.4: “wherein the second valve is associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is communicated to the first well via the manifold and the first valve; and”

578. Limitation 65.3.3 and 65.3.4 recite the same limitations as in Limitation 1.3.1 and Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.1.a and XV.B.7.b above.

(5) 65.3.5: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator being different from the first visual indicator to indicate that a state of the second valve is closed; and”

579. Limitation 65.3.5 recites the same limitations as in Claim 19 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.10 above.

d. 65.4: “executing a continuous pumping ("CP") swap to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, the CP swap comprising:”

580. The limitations of 65.4 are identical to those of limitations 1.3 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(1) 65.4.1: “opening the second valve while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold, wherein opening the second valve causes fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve, and”

581. The limitations of 65.4.1 are substantially similar to, though less limiting than, those of Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(2) 65.4.2: “wherein the second valve is opened in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions; and”

582. The limitations of 65.4.2 are identical to Limitation 58.4.2 and substantially similar to, though less limiting than, those of Limitation 1.3.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.1.b and XV.B.29.d.(2) above.

(3) 65.4.3: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions; and”

583. The limitations of 65.4.3 are substantially similar to, though less limiting than, those of Limitation 1.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.c above.

- e. **65.5: “wherein the display of the dashboard visually communicates the respective states of the first and second valves; and”**

584. Limitation 65.5 recites the same limitations as in Limitation 16.3. Accordingly, the combination of *Christie*, *Pitcher* and *Al-Salmani* obvious the limitations of 65.5 obvious for the same reasons as those discussed in Section XV.B.7.c above.

- f. **65.6: “wherein fluid is continuously communicated via the manifold during the CP swap.”**

585. The limitations of 65.6 are substantially similar to, though less limiting than, those of Limitation 1.4 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.c above.

35. DEPENDENT CLAIM 66: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 65, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

586. Except for depending from Claim 65, the limitations of Claim 66 are substantially similar to those of Claim 18 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.9 above.

36. DEPENDENTS CLAIM 67 – 68

587. Except for depending from Claim 65, the limitations of Claims 67 – 68 are substantially similar to those of Claims 4 – 5, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.3 and XV.B.4 above.

37. DEPENDENT CLAIM 69: “THE NON-TRANSITORY COMPUTER READABLE MEDIUM OF CLAIM 65, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A PRESSURE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

588. Except for depending from Claim 65, the limitations of Claim 69 are substantially similar to those of Claim 9 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.1.b and XV.B.4 above.

38. DEPENDENT CLAIMS 70 – 71

589. Except for depending from Claim 65, the limitations of Claims 70 - 71 are substantially similar to those of Claims 14 – 15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher*, and *Al-Salmani* for the same reasons as those discussed in Section XV.B.6 above.

39. INDEPENDENT CLAIM 72

590. The limitations of Claim 72 would have been obvious to a POSITA based on the teachings of *Christie*, *Pitcher* and *Al-Salmani* as discussed in the subsections below.

a. 72.1: “A system for hydraulically fracturing a plurality of wells, the plurality of wells comprising first and second wells, the system comprising:”

591. The limitations of 72.1 are substantially similar to those of Limitations 1.1/39.1 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

b. 72.2: “a manifold via which fluid is adapted to be communicated from one or more pumps;”

592. The limitations of 72.2 recites the same limitations as in Limitations 1.2/39.2 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

- c. **72.3: “a first valve via which fluid is adapted to be communicated from the one or more pumps to the first well, the first valve being associated with both the first well and the manifold so that the first valve is: in fluid communication with the manifold; and fluidically positioned between the first well and the one or more pumps;”**

593. Limitation 72.3 recites the same limitations as in Limitations 1.2/39.3 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

- d. **72.4: “a second valve via which fluid is adapted to be communicated from the one or more pumps to the second well, the second valve being associated with both the second well and the manifold so that the second valve is: in fluid communication with the manifold; and fluidically positioned between the second well and the one or more pumps from which fluid is adapted to be communicated to the first well via the manifold and the first valve;”**

594. Limitation 72.4 recite the same limitations as in Limitations 1.3.1 and 39.4 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* or the same reasons as those discussed in Section XV.B.1.a above.

- e. **72.5: “a dashboard adapted to be displayed, which dashboard comprises:”**

595. Limitation 72.5 is identical to Limitation 58.3 and recites the same limitations as in Limitation 16.1 and would have been obvious to a POSITA based

on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.a above.

(1) 72.5.1: “a visual reference of the first valve;”

596. Limitation 72.5.1 is identical to Limitation 58.3.1 recites the same limitations as in Limitation 16.2 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.b above.

(2) 72.5.2: “a first visual indicator associated with the visual reference of the first valve, the first visual indicator indicating that a state of the first valve is open to permit communicating fluid to the first well via the manifold and the first valve;”

597. Limitation 72.5.2 is identical Limitation 58.3.2 and recites the same limitations as in Claim 17 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.8 above.

(3) 72.5.3: “a visual reference of the second valve; and”

598. Limitation 72.5.3 recites the same limitations as in Limitations 16.2 and 58.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.b above.

(4) 72.5.4: “a second visual indicator associated with the visual reference of the second valve, the second visual indicator

being different from the first visual indicator to indicate that a state of the second valve is closed;”

599. Limitation 72.5.4 is identical to Limitation 58.3.4 and recites the same limitations as in Claim 19 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher*, and *Al-Salmani* for the same reasons as those discussed in Section XV.B.10 above.

f. 72.6: “one or more controllers configured to execute a continuous pumping (“CP”) swap, during which CP swap fluid is continuously communicated via the manifold, to transition from hydraulically fracturing the first well to hydraulically fracturing the second well, by:”

600. Limitation 72.6 is identical to Limitation 39.5. Limitation 72.6 would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(1)72.6.1: “opening the second valve: while fluid is communicated from the one or more pumps to the first well via the first valve and the manifold,”

601. The limitations of 72.6.1 are substantially similar to those of Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(2)72.6.2: “in response to at least a portion of fluid communicated via the manifold satisfying one or more conditions, and”

602. The limitations of 72.6.2 are substantially similar to those of Limitation 58.4.2 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed with Limitations 1.3.2 and 58.4.2 in Sections XV.B.1.b and XV.B.29.d.(2) above.

(3) 72.6.3: “to cause fluid to be communicated from the one or more pumps to the second well via the manifold and the second valve; and”

603. Limitation 72.6.3 recites some of the limitations from Limitation 1.3.1 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.1.a above.

(4) 72.6.4: “closing the first valve: after the at least a portion of the fluid communicated via the manifold has satisfied the one or more conditions,”

604. Limitation 72.6.4 is identical to Limitation 58.4.3 and similar to Limitation 1.3.3 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed above in Section XV.B.1.c.

g. 72.7: “wherein the display of the dashboard visually communicates the respective states of the first and second valves.”

605. The limitations of 72.7 are identical to those of Limitation 58.5 and recite the same limitations as in Limitation 16.3 and would have been obvious to a

POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Section XV.B.7.c.

40. DEPENDENT CLAIM 73: “THE SYSTEM OF CLAIM 72, WHEREIN THE DASHBOARD FURTHER COMPRISES A VISUAL REFERENCE OF A FIRST WELLHEAD IN COMMUNICATION WITH THE FIRST WELL.”

606. Except for depending from Claim 72, the limitations of Claim 73 are identical to those of Claim 18 and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Samani* for the same reasons as those discussed in Section XV.B.9 above.

41. DEPENDENT CLAIMS 74 - 75

607. Except for depending from Claim 72 and referencing the controllers disclosed by *Christie*, as discussed above regarding Claim 72, Claims 74-75 are substantially similar to Claims 4-5, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie*, *Pitcher* and *Al-Salmani* for the same reasons as those discussed in Sections XV.B.3 and XV.B.4.

42. DEPENDENT CLAIM 76: “THE SYSTEM OF CLAIM 72, WHEREIN THE ONE OR MORE CONDITIONS INCLUDE A PRESSURE CONDITION OF THE AT LEAST A PORTION OF FLUID COMMUNICATED VIA THE MANIFOLD.”

608. Except for depending from Claim 72, Claim 76 is substantially similar to Claim 9 and would have been obvious to a POSITA based on the disclosures of

Christie, Pitcher and *Al-Salmari* for the same reasons as those discussed in Sections XV.B.1.b and XV.B.4.

43. DEPENDENT CLAIMS 77 - 78

609. Except for depending from Claim 72, the limitations of Claims 77 - 78 are substantially similar to those of Claims 14 – 15, respectively, and would have been obvious to a POSITA based on the disclosures of *Christie, Pitcher*, and *Al-Salmari* for the same reasons as those discussed in Section XV.B.6 above.