

HAYNES BOONE

***INTELLIGENT WELLHEAD SYSTEMS, INC
V. DOWNING WELLHEAD EQUIPMENT,
LLC***

IPR2024-00300 (11,560,770)

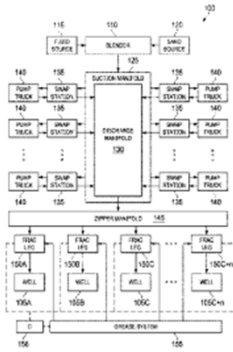
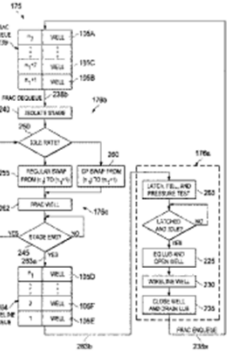
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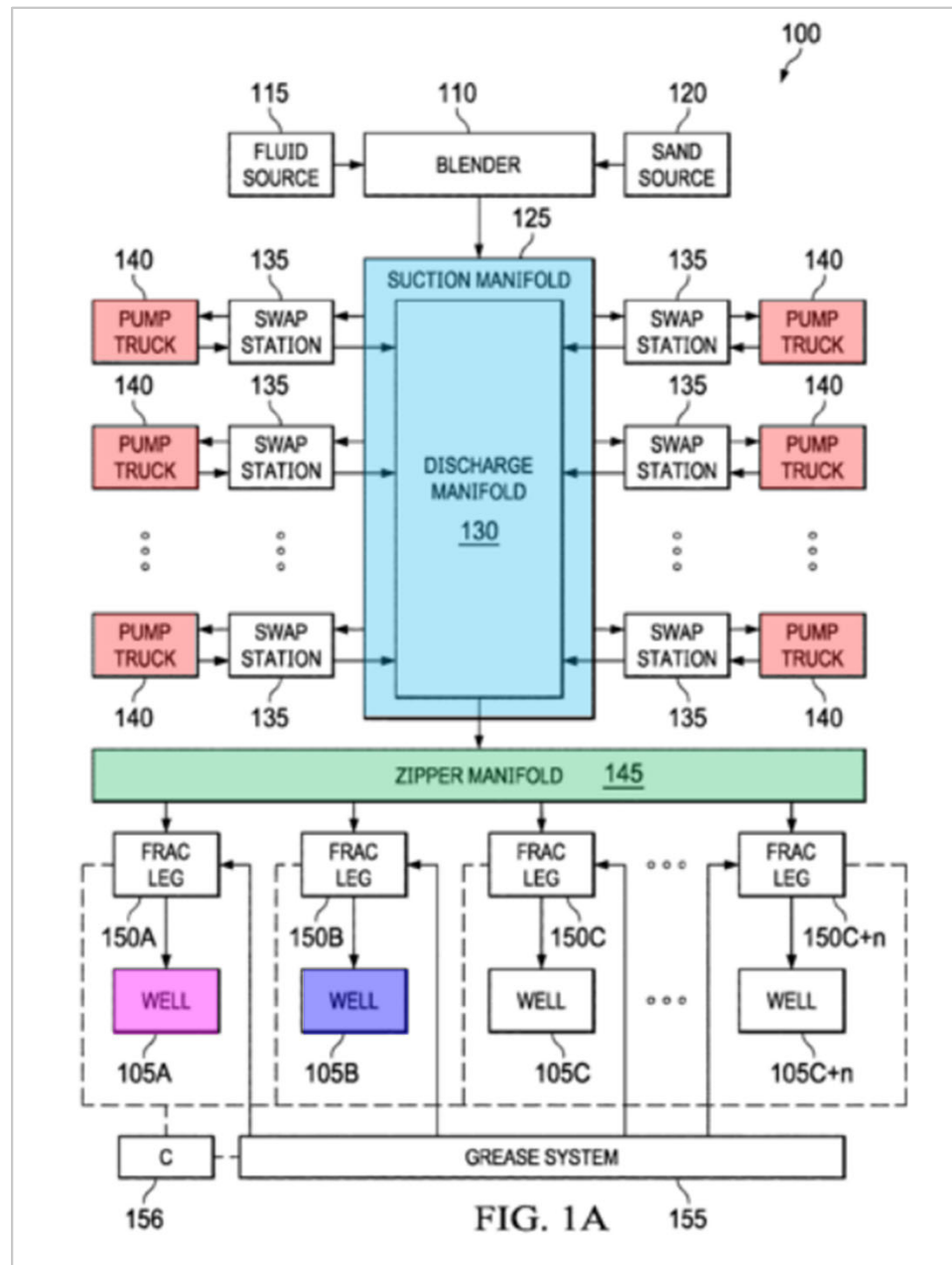
DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

The '770 Patent

(12) United States Patent Kuehn et al.	(10) Patent No.: US 11,560,770 B2 (45) Date of Patent: *Jan. 24, 2023
(54) HYDRAULIC FRACTURING PLAN AND EXECUTION OF SAME (71) Applicant: Downing Wellhead Equipment, LLC, Oklahoma City, OK (US) (72) Inventors: Jordan Kuehn, Forest Park, IL (US); Austin Johnson, Edmond, OK (US); Ronnie B. Beason, Lexington, OK (US); Nicholas J. Cannon, Washington, OK (US) (73) Assignee: DOWNING WELLHEAD EQUIPMENT, LLC, Oklahoma City, OK (US) (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days. This patent is subject to a terminal disclaimer. (21) Appl. No.: 17/878,493 (22) Filed: Aug. 1, 2022 (65) Prior Publication Data US 2022/0364435 A1 Nov. 17, 2022 Related U.S. Application Data (63) Continuation of application No. 17/388,716, filed on Jul. 29, 2021, now Pat. No. 11,401,779, which is a (Continued) (51) Int. Cl. <i>E21B 43/26</i> (2006.01) <i>E21B 33/068</i> (2006.01) <i>E21B 34/02</i> (2006.01) <i>E21B 41/00</i> (2006.01) <i>E21B 43/11</i> (2006.01) (Continued)	(52) U.S. CL. CPC <i>E21B 34/02</i> (2013.01); <i>E21B 17/006</i> (2013.01); <i>E21B 33/068</i> (2013.01); <i>E21B 41/00</i> (2013.01); <i>E21B 43/11</i> (2013.01); <i>E21B 43/26</i> (2013.01); <i>E21B 43/2607</i> (2020.05); <i>F16K 3/36</i> (2013.01); (Continued) (58) Field of Classification Search CPC <i>E21B 33/068</i>; <i>E21B 34/02</i>; <i>E21B 41/00</i>; <i>E21B 43/11</i>; <i>E21B 43/26</i>; <i>E21B 43/2607</i>; <i>F16K 3/36</i>; <i>F16N 11/00</i>; <i>F16N 2210/00</i>; <i>F16N 2210/02</i>; <i>F16N 29/02</i>; <i>F16N 39/00</i>; <i>F16N 7/38</i>; <i>F16N 7/40</i> See application file for complete search history. (56) References Cited U.S. PATENT DOCUMENTS 10,174,584 B2 * 1/2019 Kalaria F16K 17/16 10,563,778 B2 * 2/2020 Painter E21B 34/00 (Continued) <i>Primary Examiner</i> — Daniel P Stephenson (74) <i>Attorney, Agent, or Firm</i> — Haynes and Boone, LLP (57) ABSTRACT A hydraulic fracturing plan executable by a hydraulic fracturing system to hydraulically fracture a plurality of oil and gas wells. In one or more embodiments, the execution of the hydraulic fracturing plan implements the following steps: communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and, in response to determining that the fluid communicated via the manifold has satisfied one or more conditions: opening a second valve; communicating fluid to a second well via the second valve; and closing the first valve after opening the second valve. 38 Claims, 50 Drawing Sheets

The '770 Patent



'770 Patent, Fig. 1A (annotated);
PO Response, 5

The '770 Patent

CP Swap

As shown in FIGS. 16D and 16E, executing the CP swap from hydraulically fracturing (at the step 262) the n_1 well (e.g., well 105D) to hydraulically fracturing (at the step 262) the n_1+1 well (e.g., well 105B) transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is less than 20 seconds (as fast as 19 seconds in some instances).

'770 Patent, 14:43-51

The '770 Patent

1. A method, comprising:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
opening a second valve;
communicating fluid to a second well via the second valve; and
closing the first valve after opening the second valve.

Overview

- The Carr grounds fail to anticipate or render obvious
- The Tolman grounds are legally deficient
- The unrebutted evidence establishes nexus between industry praise and the claims

Carr grounds fail to anticipate or render obvious
independent claims 1, 14, and 27

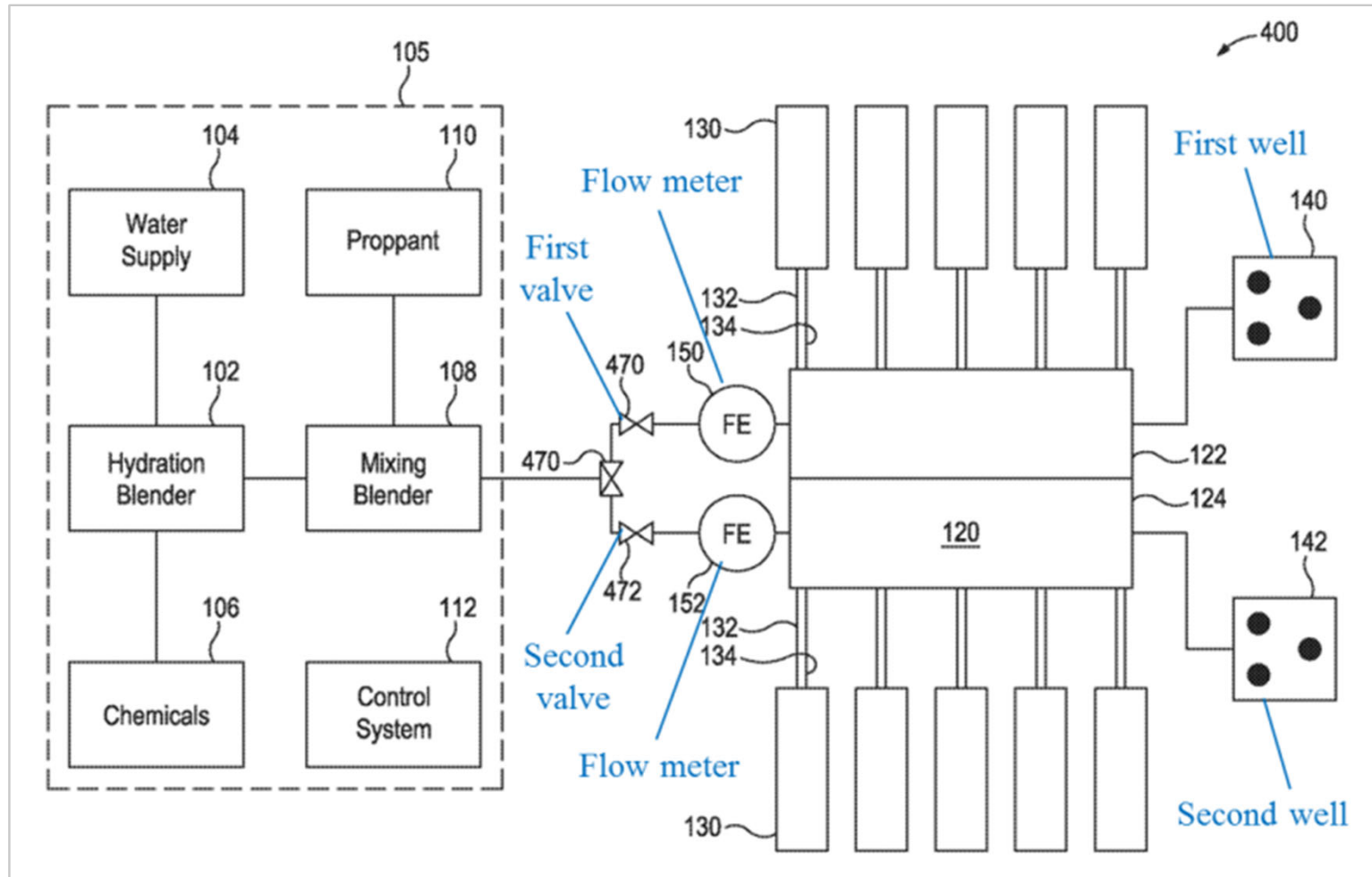
The '770 Patent

1. A method, comprising:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
opening a second valve;
communicating fluid to a second well via the second valve; and
closing the first valve after opening the second valve.

Claimed requirement: performing operations on a **second** well in response to fluid communicated to a **first** well

PO Response, 18

Petition does not allege claimed requirement



Ex.1004, Fig. 5 (annotated); Petition, 48; PO Response, 21

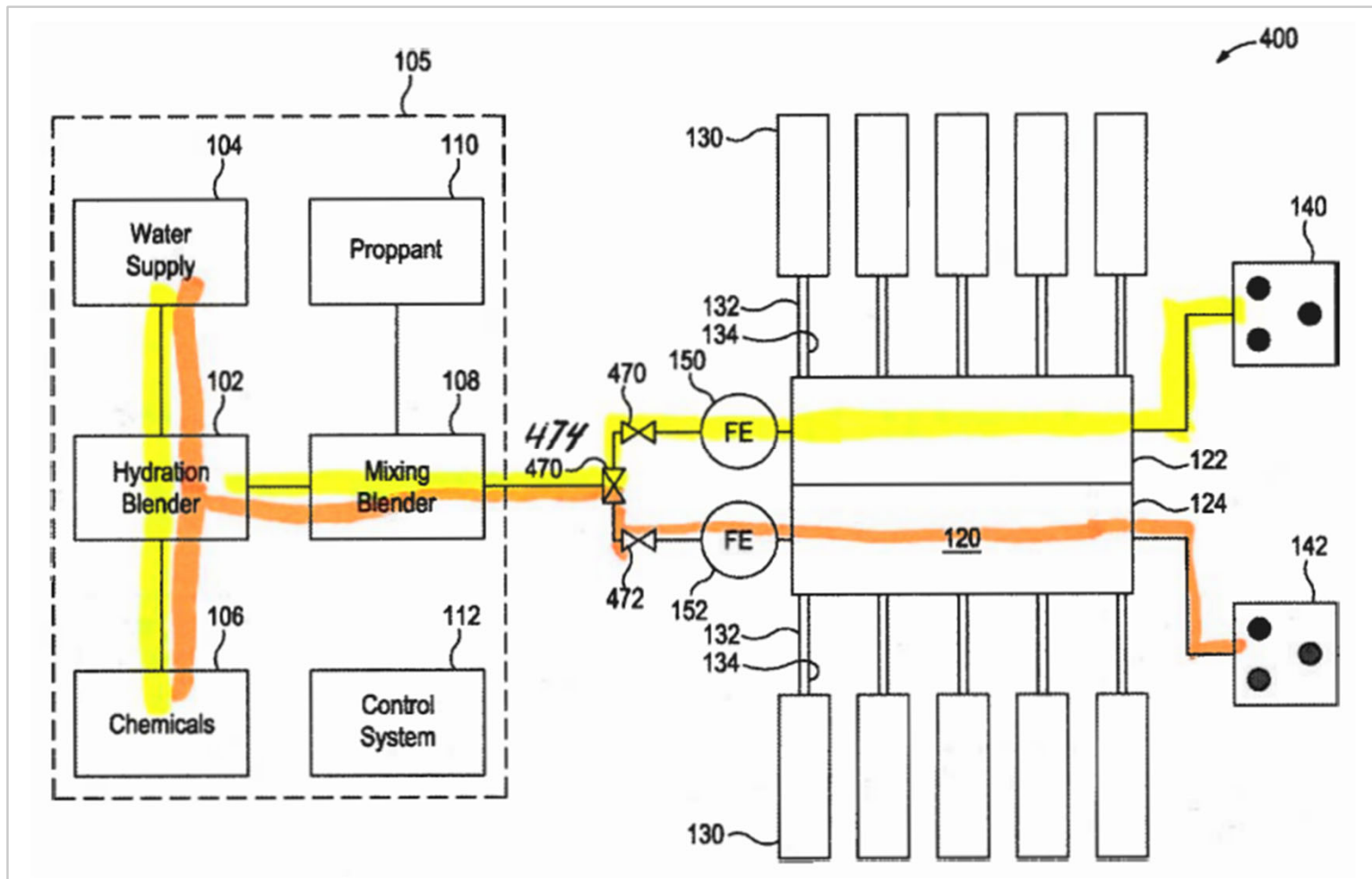
Petition does not allege claimed requirement

<u>[1.2]/[14.3]</u>-"in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:" [27.6]-"in response to: determining that the fluid communicated via the manifold has satisfied one or more conditions."	"Flow measurements for the first well 140 and the second well 142 can" be collected via associated flow meters and transmitted to a control system. [0023]-[0024]. Information from the flow meters "can be utilized to control the production of fluid and the output of fluid to the first well 140 and the second well 142." [0025]. For example, operations of the manifold and/or pumps "are controlled, coordinated, and monitored by a central control system" using the collected sensor data. [0025]. This "allow[s] for enhanced control of treatment or fracturing" of the wells from a centralized well treatment facility. [0023]. Further, the control system can control fluid to the wells by controlling the position of the valves to the wells "utilizing flow data from the first flow meter 150 and the second flow meter 152 in light of fluid flow targets for the first well 140 and/or the second well 142." [0035].
<u>[1.3]/[14.4]</u>-"opening a second valve; communicating fluid to a second well via the second valve; and" [27.4]-"open the second valve to thereby	<i>Carr</i> discloses using a first valve and a second valve to control fluid flow to an associated well. [0033]. "The first valve 470 and the second valve 472 can allow for the first well 140 and the second well 142 to each be stimulated individually by opening the respective first valve 470 or the second valve 472 and closing the other valve." [0033]. As "fluid flows from a centralized location 105 to...the second well second 142 via the manifold 120...a second flow meter 152 in fluid communication with the second isolated manifold path 124 can provide an operator and/or a control system 112 with flow rate and total flow information." [0023].

Petition, 51;
PO Response, 21

Carr does not disclose the claimed interdependency

“isolated” manifold paths with independent conditions



Ex.2011; PO Response, 13

Carr: valves 470/472 controlled based on respective flow rate

- “The *first valve 470* can be utilized to control the flow from the mixing blender 108 *to the first well 140* and the *second valve 472* can be utilized to control the flow from the mixing blender 108 *to the second well 142*.”

Ex.1004, [0033]; PO Sur-reply, 3-4

- “adjusting the *first valve* in response to the *first flow rate*”

Ex.1004, [0058]; PO Response, 20

- “adjusting the *second valve* in response to the *second flow rate*”

Ex.1004, [0060]; PO Response, 20

Petitioner's reliance on Carr's “and/or” sentence is misguided

Carr, as a whole, discloses or teaches that the valves are operated “in light of fluid flow targets for the first well 140 *and/or* the second well 142” to stimulate the wells individually or simultaneously. Ex. 1002, ¶¶ 109-110, 320, 326, 331-332;

Reply, 5 (quoting Ex.1004, [0035])

Petitioner's reliance on Carr's “and/or” sentence is misguided

[0035] In some embodiments, the control system **112** can be utilized to control the position of the first valve **470**, second valve **472**, and/or the proportioning valve **474** by utilizing flow data from the first flow meter **150** and the second flow meter **152** in light of fluid flow targets for the first well **140** and/or the second well **142**.

Ex.1004, [0035]; Reply, 5

Carr's simultaneous and individual stimulation are different “embodiments”

124. The first valve 470 can be utilized to control the flow from the mixing blender 108 to the first well 140 and the second valve 472 can be utilized to control the flow from the mixing blender 108 to the second well 142. The first valve 470 and the second valve 472 can be disposed outside of the manifold 120 or disposed within the manifold 120. The first valve 470 and the second valve 472 can allow for the first well 140 and the second well 142 to each be stimulated individually by opening the respective first valve 470 or the second valve 472 and closing the other valve. Further, in some embodiments, the first valve 470 and the second valve 472 can be used to control the flow rate to the first well 140, the second well 142, or to both the first well 140 and the second well 142 simultaneously.

Ex.1004, [0033]; PO Sur-Reply, 4

Carr's simultaneous and individual stimulation are "different operations"

Durham Deposition

Q. And so when you're -- you're stimulating individually and you're stimulating simultaneously, there's different operations occurring within the system of Carr; is that correct?

A. No, it's just -- well, yes, there's different operations because in one case you're fracking one well at a time in Carr and second cases you're fracking two wells at a time in Carr. That's a difference in operations. I can agree with that.

Ex.2033, 40:16-24; Sur-Reply, 4

Petition indiscriminately maps Carr's different embodiments to the *single* claimed valve sequence

<u>[1.4]/[14.5]-</u> “closing the first valve after opening the second valve.” [27.5]-“close the first valve after opening the second valve,”	<i>Carr</i> discloses pumping fluid alternatingly and/or simultaneously to a first and second well via associated first and second valves. “The first valve 470 and the second valve 472 can allow for the first well 140 and the second well 142 to each be stimulated <u>individually</u> by opening the respective first valve 470 or the second valve 472 and closing the other valve. Further, ...the first valve 470 and the second valve 472 can be used to control the flow rate to the first well 140, the second well 142, or to both the first well 140 and the second well 142 <u>simultaneously</u>.” [0033]. A POSITA would understand that operating the first and second valves to direct fluid into the associated first and second wells “individually” and/or “simultaneously,” as taught by <i>Carr</i>, includes closing the valve to one well (e.g., to the first well) after opening the valve to the other well (e.g., to the second well). Ex. 1002, ¶¶ 331-332.
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Petition, 52-53

Fed Cir: merely being “capable of” is not sufficient

“Here, Qualcomm failed to put forth any argument or evidence in its petitions as to whether Nozawa's device, ***even if capable of doing so***, actually would output a periodic signal with a plurality of integer-multiple harmonics, or why a person of ordinary skill in the art ***would have been motivated*** to use the particular inputs....”

ParkerVision, Inc. v. Qualcomm Inc., 903 F.3d 1354, 1363 (Fed. Cir. 2018);
PO Response, 13

Petition's single obviousness sentence is not sufficient

[0035]. A POSITA would find it necessary and at least obvious to close a first valve to a first well after opening a second valve to a second well based on the fluid flow targets to stimulate the first and second wells “individually” and “simultaneously.”

Ex. 1002, ¶¶ 331-332.

Petition, 52-53

Carr grounds fail to anticipate or render obvious
dependent claims 11, 24, and 36

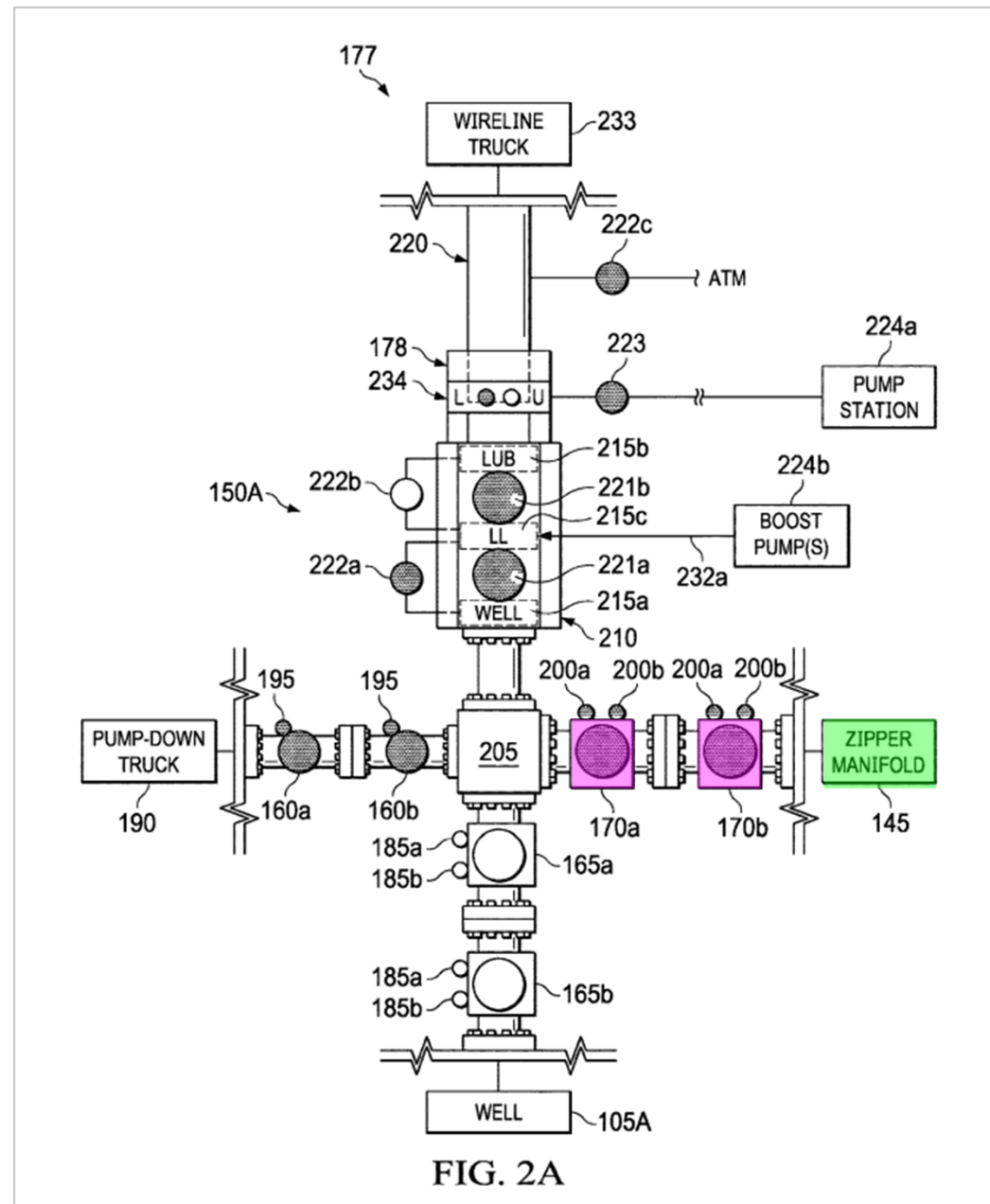
Petitioner misunderstands “zipper valves”

10. CLAIMS 11, 24, 36

Claims 11, 24, and 36 merely label the first/second valves differently without imparting any distinguishable functionality or structure over what the independent claims recite. Additionally, “zipper valves” are not distinguished from any other valve capable of allowing fluid flow into a well (e.g., a gate valve) by ’770’s specification (*see* Section X.A.10).

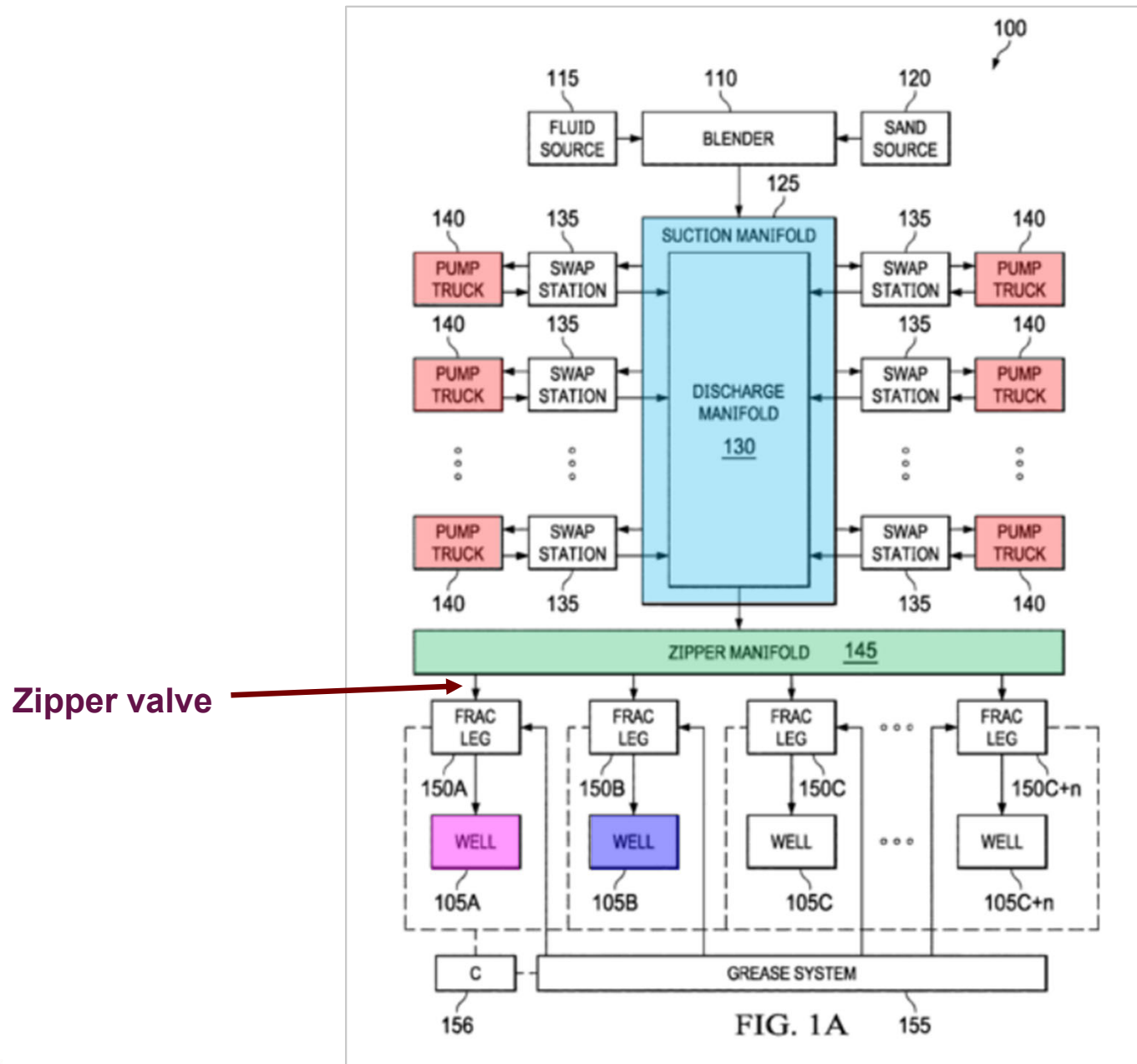
Petition, 59

A “zipper valve” has specific meaning and function



'770 Patent, Fig. 2A

A “zipper valve” has a specific meaning and function



'770 Patent, Fig. 1A (annotated);
PO Response, 5

Petitioner's expert disagrees with Petitioner

Original Durham Declaration

378. A POSITA would have understood a “zipper valve” to simply be a valve used in a zipper fracturing operation, typically between a discharge 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 IX.D. The '770 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.²⁴⁴ The figures of the '770 Patent show a “zipper valve” consistent with the general knowledge of a POSITA.

Ex.1002, ¶ 378; PO Response, 32

Petitioner's expert disagrees with Petitioner

Durham Deposition Testimony

Q. Are you familiar with a term called a zipper valve?

A. Yes.

Q. Why is a valve called a zipper valve?

A. It would be a valve used in the zipper fracturing operation as part of that sequential or simultaneous flow.

Q. Is it your position that any valve on a zipper fracturing operation, no matter its position or function, is a zipper valve?

A. No matter it's location, I would agree with. Function is used to direct fluid flow between the wells. So it would have to have that function to be a zipper valve.

Ex.2013, 81:7-23;
PO Response, 32

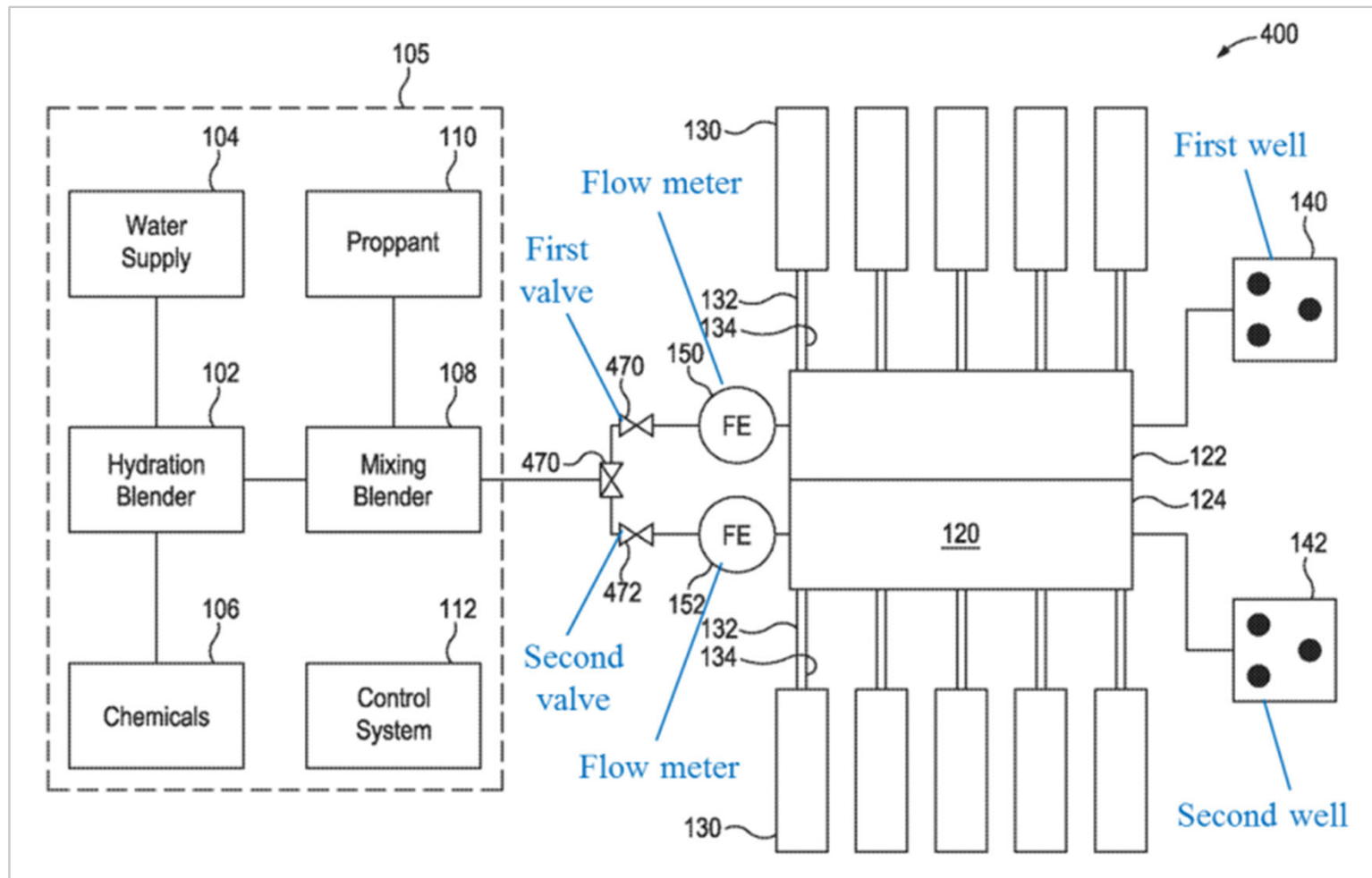
Petitioner's expert disagrees with Petitioner

Durham Reply Declaration

manifold.”¹⁴ What I actually testified was that a “zipper valve,” “[n]o matter its location ... is used to direct fluid flow between the wells,”¹⁵ and that a valve between the zipper manifold and the frac tree is “one example” of a zipper valve.¹⁶

Ex.1044, ¶ 15; PO Sur-reply, 9

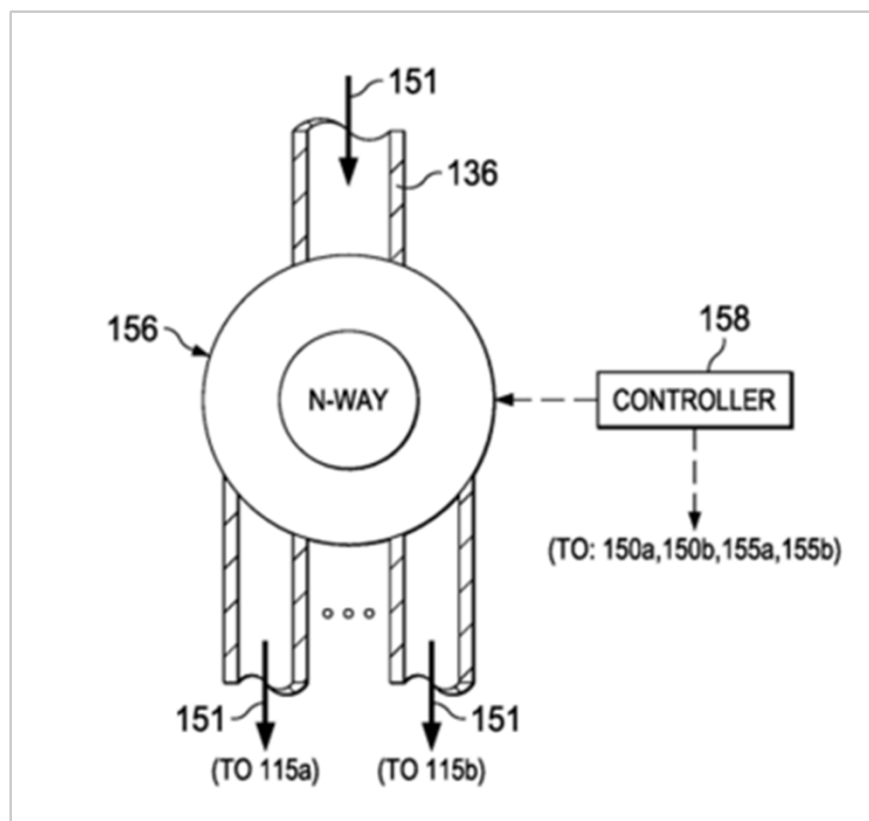
Carr's valves 470/472 are not “zipper valves”



Ex.1004, Fig. 5 (annotated); Petition, 48

Carr + Beuterbaugh fail to render obvious the Challenged Claims

Beuterbaugh's valve sequence *purpose*: high pressure pulses



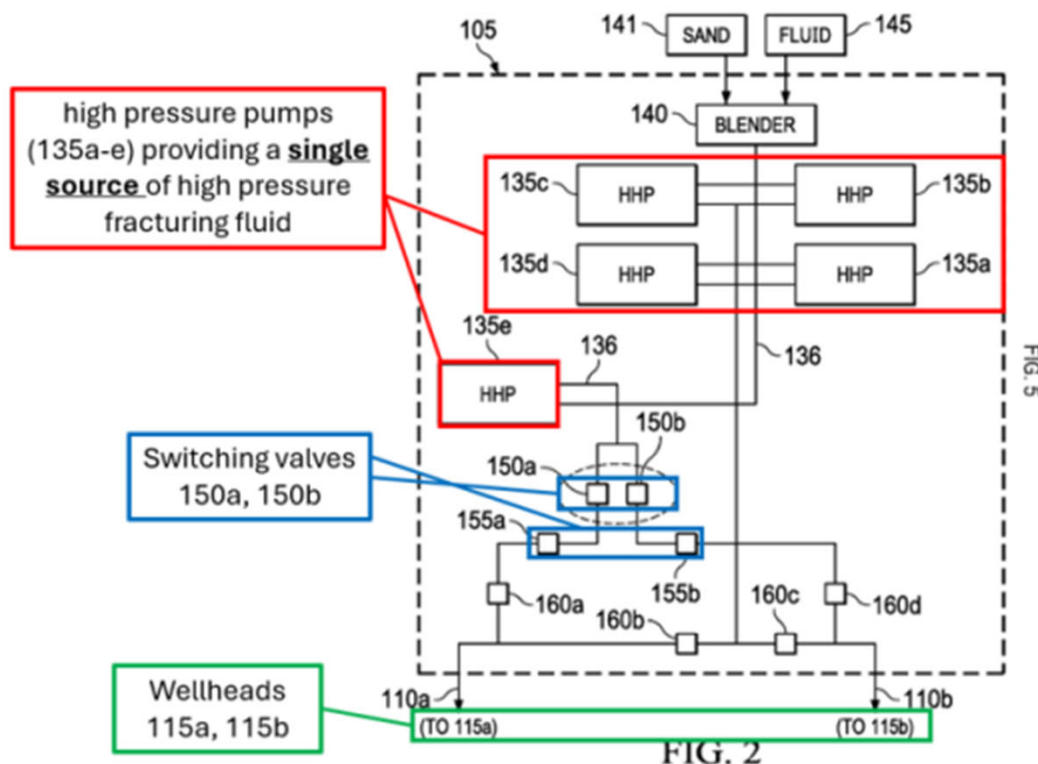
Ex.1005, Fig. 4; Petition, 62

Valve sequence purpose:
“two or more wells to be **pulsed** simultaneously by a single source of **high pressure** fracturing fluid”

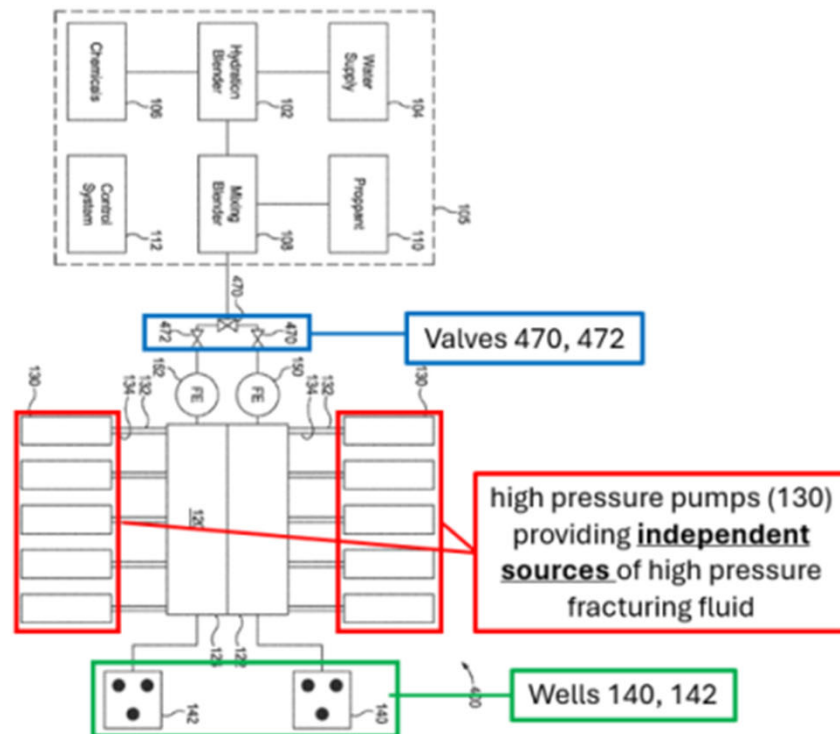
Ex.1005, [0015]; PO Response, 34

No reason to perform Beuterbaugh's valve sequence in Carr

Beuterbaugh



Carr



PO Response, 35

Petition's alleged motivations lack “rational underpinning”

Petition

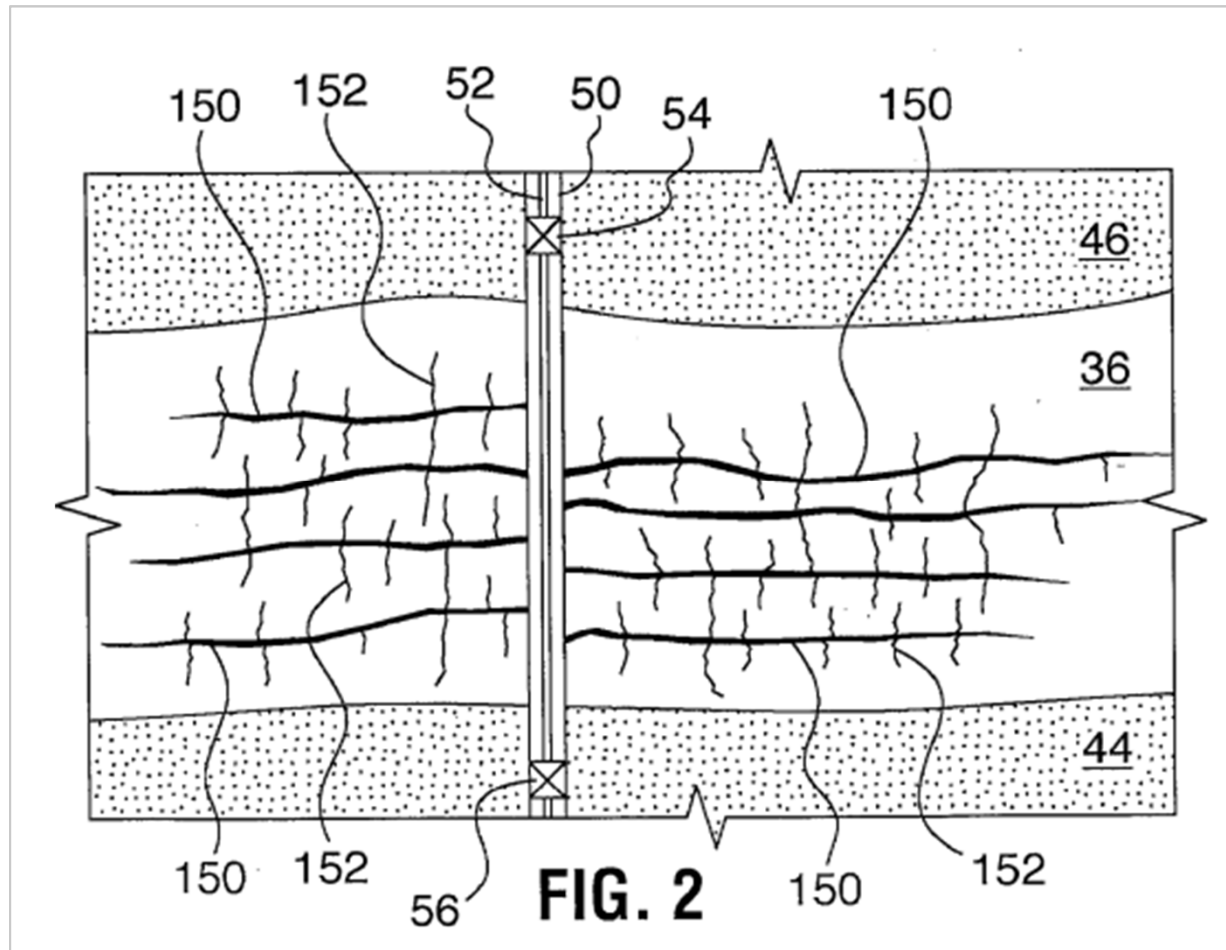
Beuterbaugh's valve sequencing allows the “overlap of fluid flows to each well [to] be controlled to optimize the downhole pressure waves and minimize the surface impacts.” *Beuterbaugh*, [0024]. Further, *Beuterbaugh*'s valve sequencing between alternating switching valves and associated plug valves allows “absolute shut off of fracturing fluid” by the plug valves upon switching wells “in case there is some leakage from the associated switching valve[s].” *Id.*, [0019]. A POSITA would

Petition, 66

Carr + Beuterbaugh + Jackson fails to render obvious
claims 5, 6, 9, 18, 19, 22, 31, 32

No teaching of swapping between two wells based on flow rate

Jackson's traditional, single-well operation



Ex.1007, Fig. 2; PO Response, 41

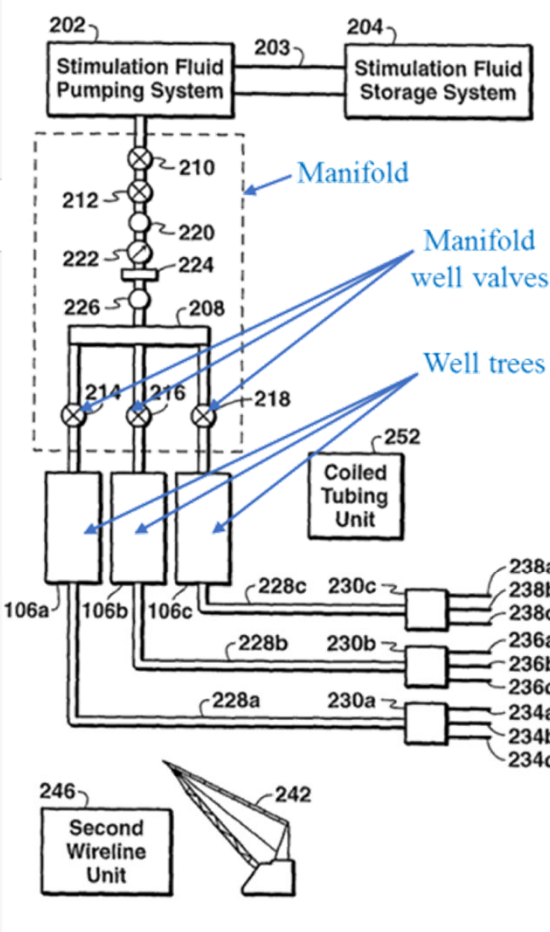
Tolman fails to anticipate or render obvious
the Challenged Claims

Fed Cir: Petitions require “particularity”

"It is of the utmost importance that petitioners in the IPR proceedings adhere to the requirement that the initial petition identify 'with particularity' the 'evidence that supports the grounds for the challenge to each claim.'"

Intelligent Bio-Sys., Inc. v. Illumina Cambridge Ltd., 821 F.3d 1359, 1369 (Fed. Cir. 2016)

Petition lacks particularity for the claimed “first valve”

Claim	Tolman ¹⁰
	 The diagram illustrates a well stimulation system. At the top, a 'Stimulation Fluid Pumping System' (202) is connected to a 'Stimulation Fluid Storage System' (204) via a line (203). The pumping system feeds into a manifold assembly (210) which includes valves (212, 220, 222, 224, 226) and a wellhead (208). This manifold connects to three well trees (106a, 106b, 106c). Each well tree has its own set of valves (214, 216, 218) and is connected to a 'Coiled Tubing Unit' (252). The well trees are further connected to a series of control units (238a, 238b, 238c, 236a, 236b, 236c, 234a, 234b, 234c) via lines (228a, 228b, 228c, 230a, 230b, 230c). A 'Second Wireline Unit' (246) is shown at the bottom left, connected to a wellhead (242) via a wireline (240). The diagram is annotated with blue arrows pointing to the manifold, manifold well valves, and well trees. FIG. 2 (annotated) . 6:50-65. A first manifold well valve 214 and a tree valve (not shown) installed on the first well's tree 106a may be opened to inject fluid into the first well. 6:19-33.

Petition, 72

Petition lacks particularity for the claimed “first valve”

[27.4]-“open the second valve to thereby communicate	<i>Tolman</i> discloses well tree valves are closed during isolation and open during stimulation. 7:27-33. A POSITA would understand that a well tree valve would also need to be open
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Claim	Tolman ¹⁰
fluid to the second well via the second valve; and”	while fluid is being flowed back to allow fluid into/out of the well. Ex. 1002, ¶¶ 554, 631, 669. Thus, during flowback from the first well, while a first well tree valve is open, a second well valve is opened to allow stimulation fluid to be pumped into the second well. 11:15-30. <i>Tolman</i> discloses when a main manifold valve 210 and a second manifold well valve 214 are open “to create a second well flow path,” “stimulation fluid [may be] pumped down the [second] well” to fracture the second well:

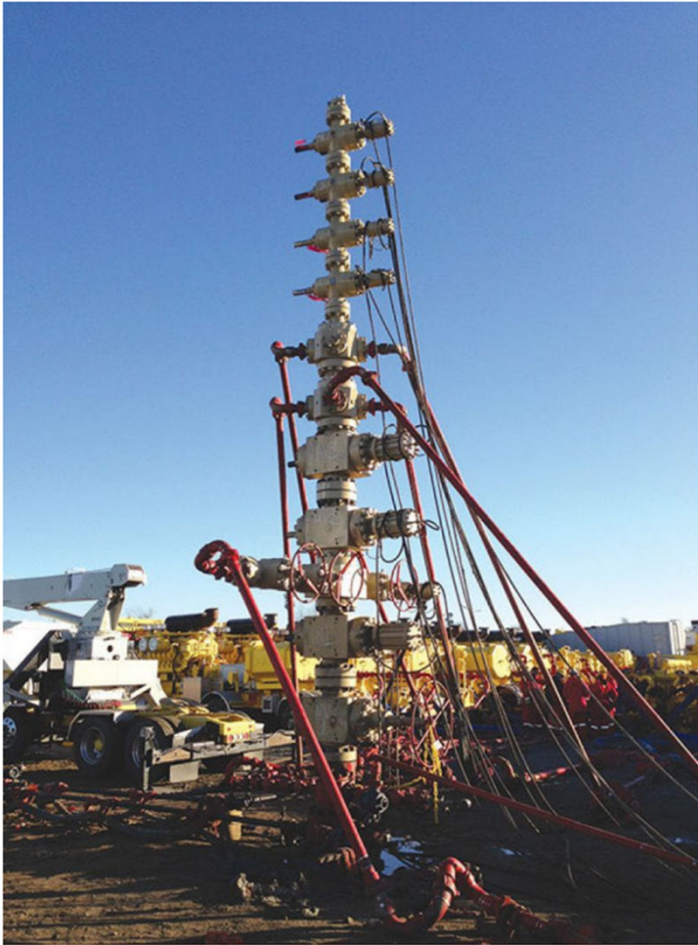
Petition, 75-76

Petition lacks particularity for the claimed “first valve”

<u>[1.4]/[14.5]-</u> “closing the first valve after opening the second valve.” [27.5]-“close the first valve after opening the second valve,”	When fracturing operations are completed in the second well and fluids are flowed back through the second well, the first well is shut-in. 11:63-67, 46-49. A POSITA would understand that “shutting in” the first well necessarily includes closing first well’s valves. Ex. 1002, ¶¶ 559, 631, 669.
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Petition, 77

A well tree has many valves and many configurations



Ex.2006, ¶97; see also Ex.1044; PO Sur-reply, 16
Ex. 2033, 22:24-24:13

Durham Depo

So the configuration of the cross would typically depend upon the specific frack job; is that correct?

A. Yes, sir. The particular frack job and the particular contractor, how they like to do things.

Q. So depending on the frack job, a frack tree may have different number of valves in different instances; is that correct?

A. Sure. One thing that always has is a valve or

Ex.2033, 23:14-22; PO Sur-reply, 16

Tolman: an unspecified tree valve is closed during isolation

fluid pumping system **202**. To enhance reliability, it may be preferred that two valves, such as a manifold well valve **214-218** and a valve (not shown) on the tree **106a-106c**, are closed during any given isolation from the other wells. Addi-

Ex.1006, 7:27-30; PO Response, 46

Original declaration is inconsistent

well valve **218** may be placed in the closed position”.³¹⁸ As discussed above, a POSITA would have understood that it would be necessary for the “tree valve” associated with first well 104a to be open in order to allow “the stimulation treatment to flow into the first well **104a**”.

Ex.1002, ¶548; PO Response, 46

stimulation operations.”³¹⁴ A POSITA would have known that a “tree” is a structure located above a wellbore that contains valves used for allowing or preventing flow into and/or out of the well.³¹⁵ Accordingly, a POSITA would immediately recognize

Ex.1002, ¶544; PO Response, 47

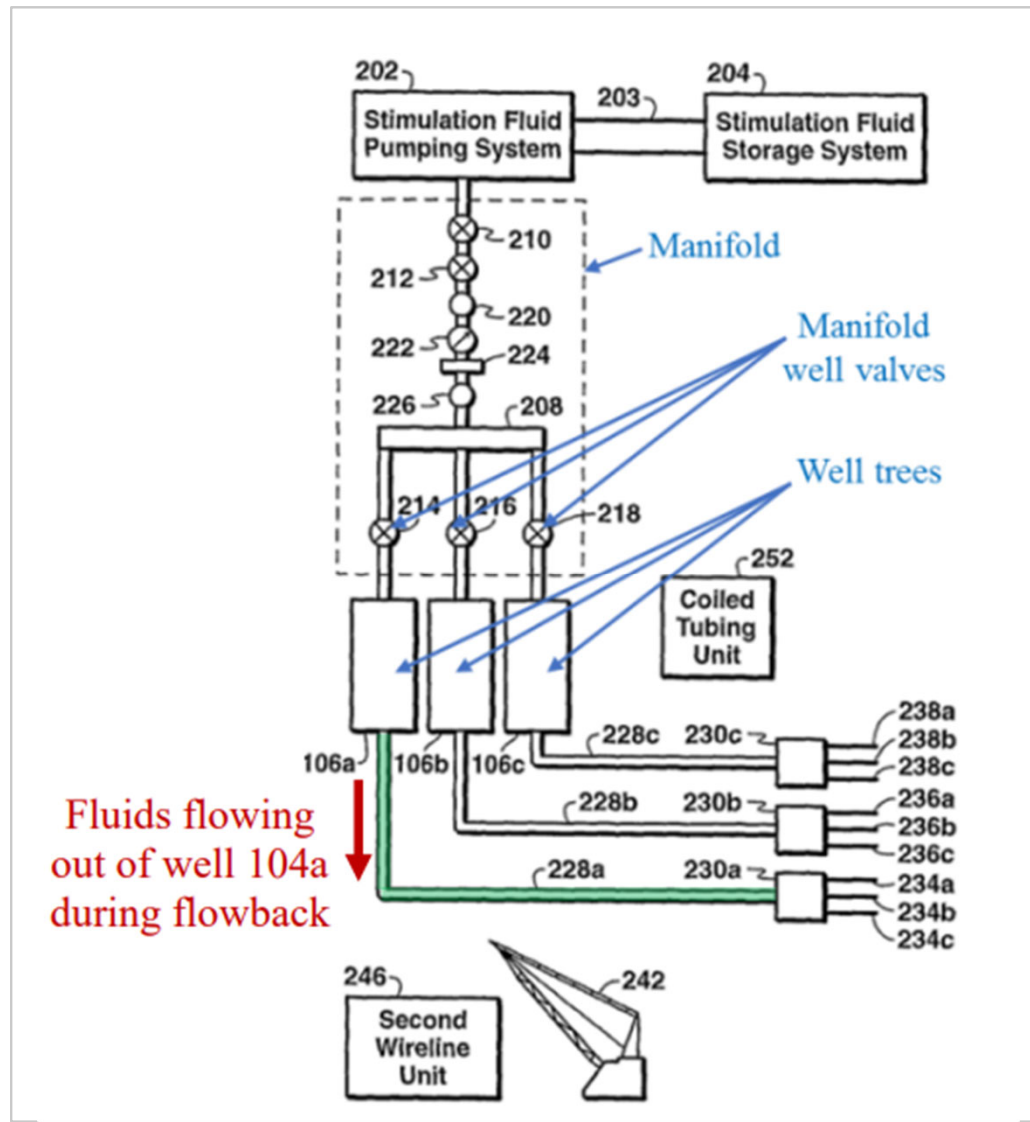
PO Response attempted to address Petition's reference to "flowback"

- (i) **Tolman's alleged "tree valve(s)" associated with flowback do not communicate fluid *to* the first well.**

To meet the claimed "*first valve*," Tolman's alleged flowback tree valve must, among other things, "communicat[e] fluid *to a first well* via a manifold." *See* claim elements 1.1, 14.2, 27.1. But Tolman's tree valve(s) associated with flowback communicate fluid *out of a well*—not *to* a well. Ex.1006, 10:65-11:3

PO Response, 51

PO Response attempted to address Petition's reference to flowback



Ex.1006, Fig. 2
(annotated);
PO Response, 52

Petitioner Reply identified “the master valve” for the first time

Petitioner Reply

At least one of *Tolman*’s “tree valves,” the master valve, is thus the claimed “first valve,” as explained in the Petition. Pet., 75-76; Ex. 1002, ¶¶ 544, 556-557; Ex.

Reply, 19

Petitioner's new “master valve” identification is precluded by law

Federal Circuit

“Shifting arguments in this fashion is foreclosed by statute, our precedent, and Board guidelines.”

Wasica Fin. GmbH v. Cont'l Auto. Sys., Inc., 853 F.3d 1272, 1286–87 (Fed. Cir. 2017)

“The Petitions and declarations, however, **do no more than point to a generic statement** in Dhallan that any sequencing method can be used; they make no mention of how the choice of sequencing method influences the use of a restriction-enzyme digestible primer, which occurs in the amplification step. '277 patent, col. 36, lines 6-19. **Not until Dr. Morton's Reply declaration did Ariosa identify specific embodiments** of Dhallan that do not use restriction-enzyme digestible primers.

Ariosa Diagnostics v. Verinata Health, Inc., 805 F.3d 1359, 1367–68 (Fed. Cir. 2015)

Belated mapping still lacks particularity

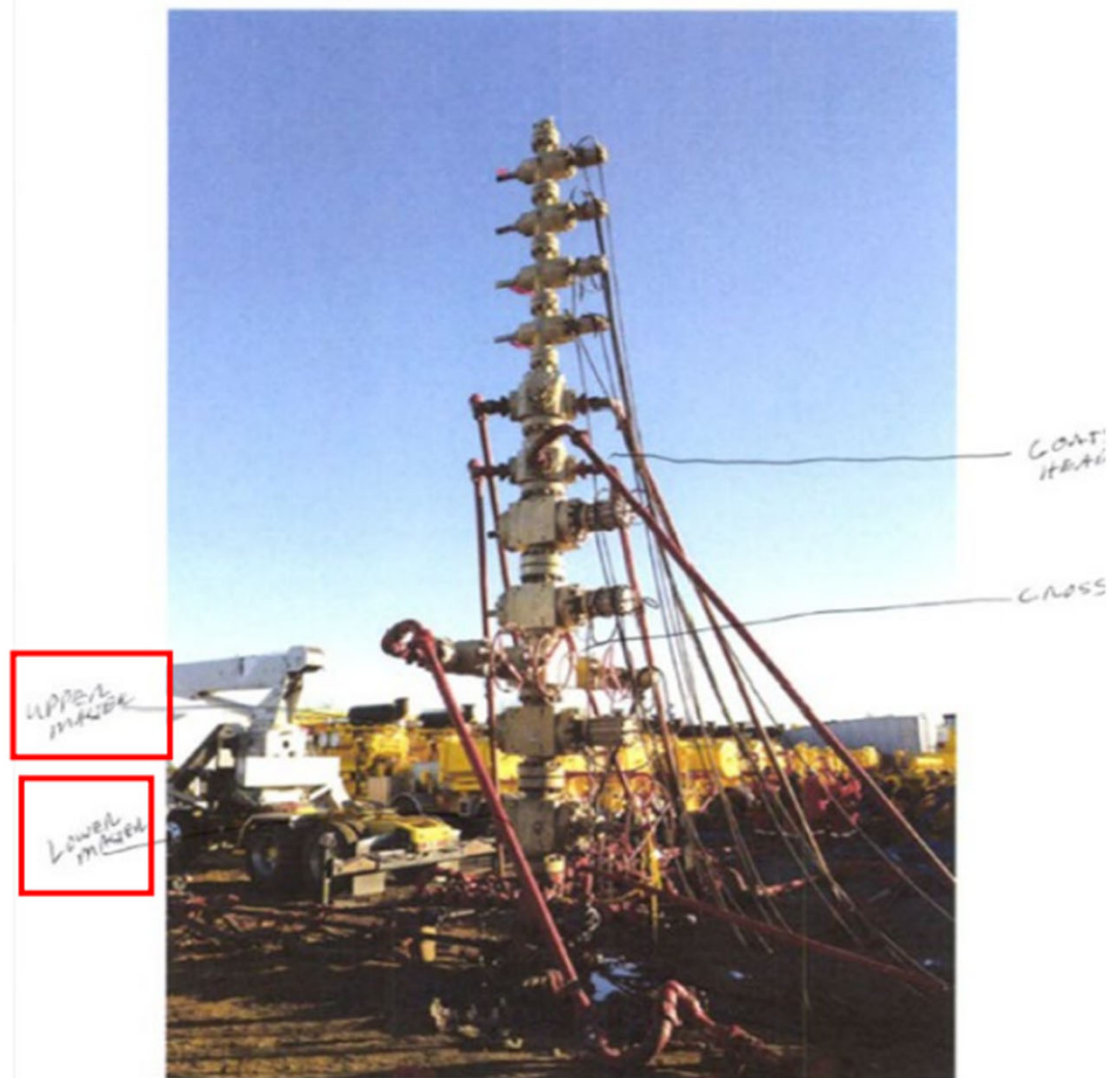


Figure 15 A "frac stack" atop BP's D-1 well in Oklahoma's Woodford shale while the well was being refractured in early 2013. BP doubled production from horizontal shale gas wells last year in a program meant to determine if refracturing

Ex.1044, ¶33;
PO Sur-reply, 18

Petitioner's belated mapping doesn't help element [1.4]

Petition

<u>[1.4]/[14.5]-</u> “closing the first valve after opening the second valve.”	When fracturing operations are completed in the second well and fluids are flowed back through the second well, the first well is shut-in. 11:63-67, 46-49.
[27.5]-“close the first valve after opening the second valve,”	A POSITA would understand that “shutting in” the first well necessarily includes closing first well’s valves. Ex. 1002, ¶¶ 559, 631, 669.

Petition, 77

Durham Deposition Testimony

Q. Are there any valves on Tolman's frack tree that would be open during shut-in?

A. There may be.

Ex.1033, 27:1-3; PO Sur-reply, 19

Evidence establishes nexus between industry praise and
the claims

Nexus does not require a limitation-by-limitation analysis

A patent owner can “prove nexus by showing that the evidence of secondary considerations is the ‘**direct result of the unique characteristics of the claimed invention.**’ ”

“It is instead important to consider ‘the invention as a whole,’ rather than on a ‘limitation-by-limitation’ basis.”

Volvo Penta of the Americas, LLC v. Brunswick Corp., 81 F.4th 1202, 1210 (Fed. Cir. 2023) (quoting *Fox Factory, Inc. v. SRAM, LLC*, 944 F.3d 1366, 1373–74 (Fed. Cir. 2019)).

Nexus exists when claim enables industry praise

“The Board erred when it found that Rambus’s objective evidence of nonobviousness lacked a nexus because it related to unclaimed features. Rambus presented ***uncontested evidence of long-felt need and industry praise due to the claimed dual-edge data transfer functionality*** claimed in the ’097 patent.”

“Rambus’s evidence shows beyond dispute that ***the claimed dual-edge data transfer functionality is what enabled the praised high-speed transfer of data.***”

Rambus Inc. v. Rea, 731 F.3d 1248, 1256-57 (Fed. Cir. 2013) (emphasis added).

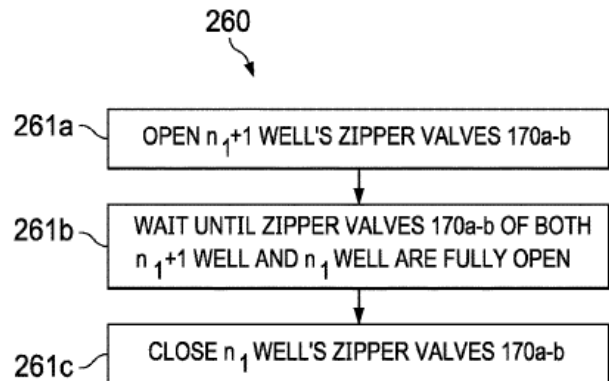
The '770 patent claims and describes a unique continuous pumping (CP) swap feature

1. A method, comprising:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
opening a second valve;
communicating fluid to a second well via the second valve; and
closing the first valve after opening the second valve.

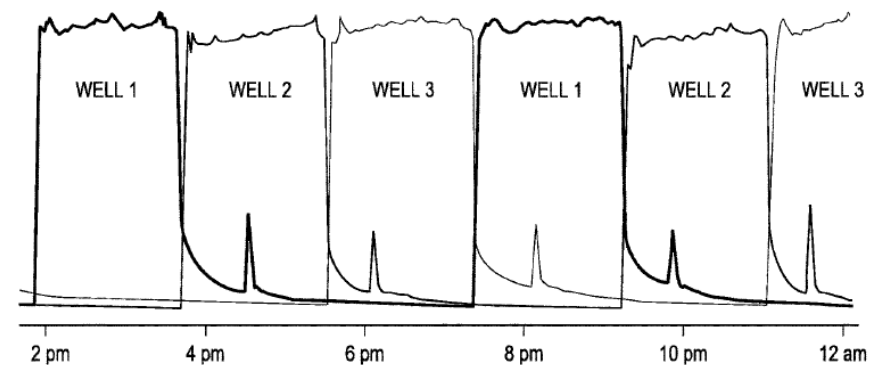
'770 patent, claim 1.

As shown in FIGS. 16D and 16E, executing the CP swap from hydraulically fracturing (at the step 262) the n_1 well (e.g., well 105D) to hydraulically fracturing (at the step 262) the n_1+1 well (e.g., well 105B) transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is less than 20 seconds (as fast as 19 seconds in some instances).

'770 patent, 14:43-51.

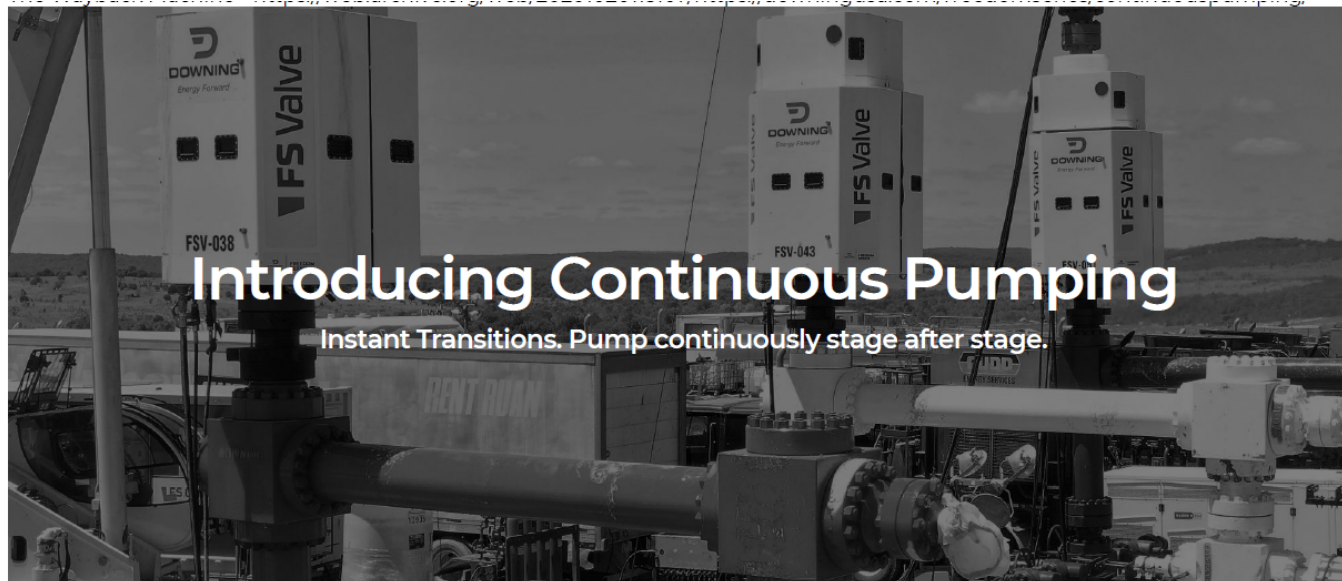


'770 patent, Fig. 15.



'770 patent, Fig. 16.

The Freedom Series implements the CP swap feature claimed in the '770 patent



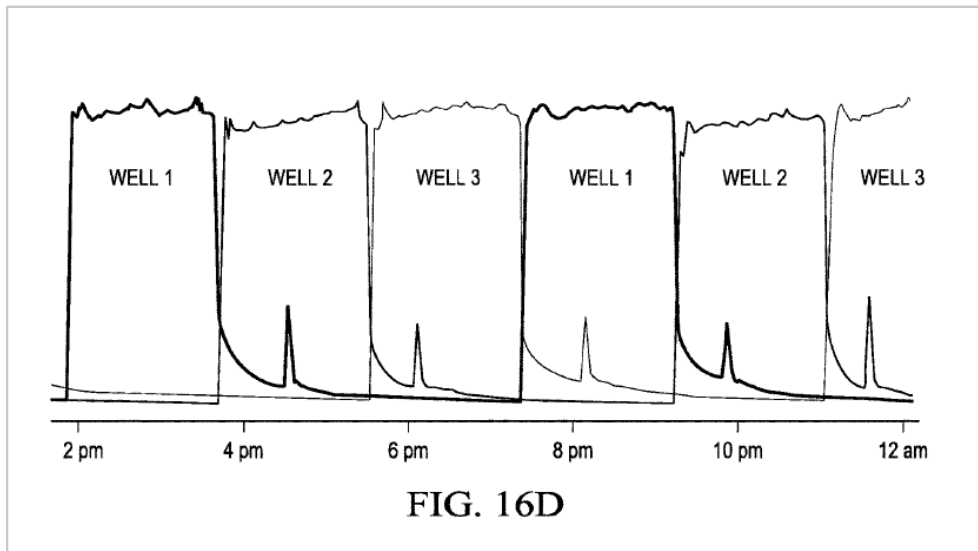
Freedom Series iControl

The [Freedom Series Completion System](#) with FS iControl enables instant transitions between stages, allowing your pumps to run continuously, dramatically increasing completion rates and reducing cost per well. By automating the hydraulic gate valves and integrating automatic greasing, along with Downing's proprietary algorithms, FS iControl delivers unrivaled efficiency to your completion operation.

Ex.2001, 1; PO Response, 61

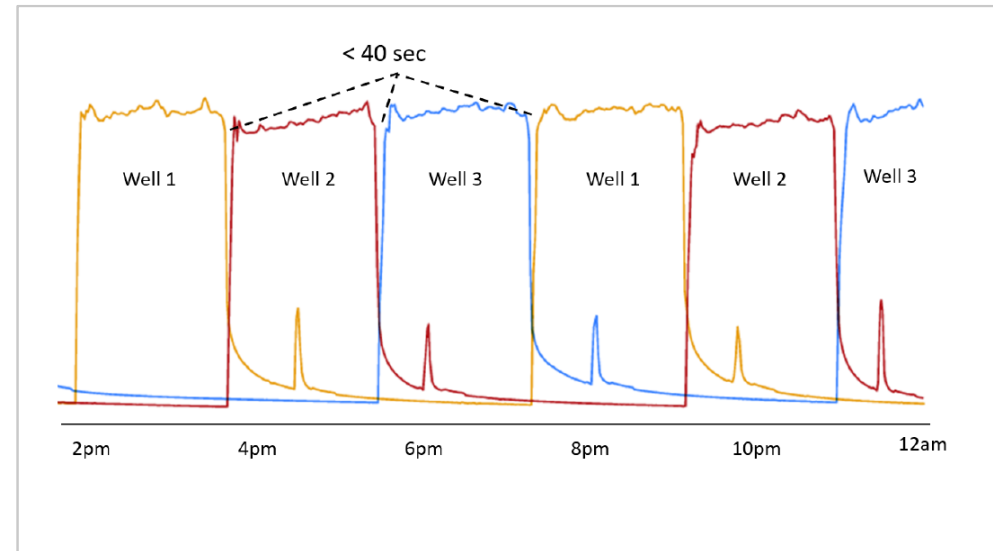
The Freedom Series implements the CP swap feature claimed in the '770 patent

'770 Patent



'770 patent, Fig. 16; PO Response 62-63;
PO Sur-Reply 24-25.

Downing's Website



Ex.2001, 2; PO Response 62-63;
PO Sur-Reply 24-25.

The Freedom Series implements the CP swap feature claimed in the '770 patent

1. A method, comprising:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
opening a second valve;
communicating fluid to a second well via the second valve; and
closing the first valve after opening the second valve.

'770 patent, claim 1.

As shown in FIGS. 16D and 16E, executing the CP swap from hydraulically fracturing (at the step 262) the n_1 well (e.g., well 105D) to hydraulically fracturing (at the step 262) the $n_1 + 1$ well (e.g., well 105B) transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is less than 20 seconds (as fast as 19 seconds in some instances).

'770 patent, 14:43-51; PO Response 61-65;
PO Sur-Reply 21-25.

Goodbye Transition Time

FS iControl's proprietary algorithms integrated with the Freedom Series Completion System transition the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is as fast as 40 seconds.

Ex.2001, 1; PO Response 61-65; PO Sur-Reply 21-25;
see also Ex.2014, p.1.

The Freedom Series implements the CP swap feature claimed in the '770 patent

8. This continuous pumping swap feature of the Freedom Series described on the webpage is the subject of the '770 Patent. I was involved with the commercialization of the continuous pumping swap feature, and I know that the '770 Patent was filed to protect that feature of the Freedom Series.

Ex.2032 (Marvel Decl.), ¶ 8; PO Response 61; PO Sur-Reply 25.

The CP swap feature claimed in the '770 patent enables continuous pumping operations

As shown in FIGS. 16D and 16E, executing the CP swap from hydraulically fracturing (at the step 262) the n_1 well (e.g., well 105D) to hydraulically fracturing (at the step 262) the n_1+1 well (e.g., well 105B) transitions the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is less than 20 seconds (as fast as 19 seconds in some instances).

'770 patent, 14:43-51; PO Response 61-65;
Sur-Reply 21-25.

Goodbye Transition Time

FS iControl's proprietary algorithms integrated with the Freedom Series Completion System transition the zipper valves from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping. The transition is instantaneous and the total time between stages measured at treatment pressure is as fast as 40 seconds.

Ex.2001, 1; PO Response 61-65; Sur-Reply 21-25;
see also Ex.2014, p.1.

The CP swap feature claimed in the '770 patent enables continuous pumping operations

B. The claimed CP swap feature enables continuous pumping in the Freedom Series and provides significant benefits.

240. In my opinion, it is also the claimed CP swap feature that enables continuous pumping in the Freedom Series. The process of having the first valve open, then opening the second valve and closing the first valve in response to satisfying a fluid condition in the manifold, allows the pumps to keep running when transitioning between wells. As I previously discussed, performing the traditional method of transitioning between wells by opening and then closing a first valve, and then opening and closing a second valve, requires shutting down the pumps for safety and equipment preservation reasons.¹²⁶ The Freedom Series' continuous pumping capability cannot occur without performing the claimed CP swap.

Ex.2012 (Hughett Decl.), ¶ 240; PO Response 63-64;
Sur-Reply 26.

The CP swap feature reduces NPT, improves efficiency, and allows faster completion times

241. Indeed, as recognized by Downing's webpages, it is the CP swap feature that enables "instantaneous" transitions when switching wells, effectively eliminating NPT.¹²⁷ If a typical zipper fracturing operation has 5 wells, with an average of 60 stages per well, implementing the CP swap feature can save as much as 15 hours per well and 75 hours of NPT per project, resulting in more efficient operations and faster completions.

Ex.2012 (Hughett Decl.), ¶ 241; PO Response 64-65;
Sur-Reply 26.

The industry praise results from the claimed method

LIBERTY ANNOUNCES MILESTONE ACHIEVEMENT OF 24 HOURS OF CONTINUOUS PUMPING TIME

September 27, 2021

DENVER—(BUSINESS WIRE)— Liberty Oilfield Services Inc. (NYSE: LBRT; “Liberty”) announced today that its team has collectively achieved the milestone of 24-hours of continuous plug and perf pumping time for Kaiser-Francis Oil Company in the Permian Basin. By delivering a full 1,440 minutes of pumping time with zero non-productive time, Liberty crews were able to attain the premier goal of Liberty’s Operation 1440.

* * *

Liberty teams utilized Downing’s Freedom Series iControl, a completion system that instantaneously transitions from one well to the other, opening the second well and subsequently shutting-in the first well, all while pumping, eliminating the time between stages.

Ex.2020, 1-2; PO Response 64-65.

The industry praise results from the claimed method

"From the beginning, Liberty has focused on safety and technology to become more agile and efficient. Efficiency is a win-win-win, resulting in reduced cost for our customers, lower environmental impact and increased profitability for Liberty," said CEO, Chris Wright. "Today's announcement marks the beginning of what is possible with Operation 1440. Liberty frac and wireline crews worked in concert with Downing to safely achieve the momentous goal of eliminating downtime and continuously pumping all 1,440 minutes in the day. I am proud of the Liberty team for reaching new heights during an unconventional time in the oil and gas cycle."

Ex.2020, 1-2; PO Response 66.



FS COMPLETION SYSTEM

DOWNING FREEDOM SERIES

"Using FS, we targeted 18 days with decreased well swap time and ensuring safe operations. Freedom Series with iControl enabled us to safely achieve our most efficient pad in the basin, shaving an additional 1.3 days off our FS target."

Addison Kowal, Crescent Point

Crescent Point's Fastest Pad in the Bakken

330 Stages, 16.7 Days

Ex.2027, 1; PO Response 66-67.

The Freedom Series received an industry award due to the CP swap feature

2023 Gulf Energy Information Excellence Award winners honored at live Houston gala

World Oil Staff October 11, 2023

October 11, 2023, HOUSTON — The 2023 Gulf Energy Information Excellence Awards were held on Wednesday evening at the Post Oak Hotel in Houston, Texas (U.S.). The black-tie gala recognized the energy industry's leading innovations and thought leaders. "We received more than 400 submissions this year, the most we have ever received! From these, more than 180 finalists were selected. With such a diverse and innovative field of technologies and thought leaders, just being nominated was a huge achievement," said Lee Nichols, Vice President, Content for Gulf Energy Information. Honorees received awards in 43 categories, encompassing the full breadth of the energy industry. Today's innovations, many of which would have seemed far-fetched a generation ago, are enabling operators to find and produce hydrocarbons more safely, economically and efficiently. A complete list of the categories and winners is as follows:

- **Best Advancement in Maintenance Technology – Midstream:** ReCAP Emissions Reduction System™ – WeldFit
- **Best Catalyst Technology:** The ECAD™ Platform for Dual Catalyst Systems – ART Hydroprocessing
- **Best Completions Technology:** Freedom Series Completion System – Downing Wellhead Equipment
- **CCS/CCUS/Carbon Removal Project of the Year:** Glacier Carbon Capture Facility – Entropy, Inc.
- **Best Coating/Corrosion Advancement Technology:** Honeywell Corrosion Predict® Crude – Honeywell
- **Best Controls, Instrumentation, Automation Technology – Upstream:** Intelligent Power Management – SLB
- **Best Controls, Instrumentation, Automation Technology – Downstream:** Experion® PKS Highly Integrated Virtual Environment (HIVE) – Honeywell Process Solutions

Ex.2015, 1; PO Response 65.

The Freedom Series received an industry award due to the CP swap feature



Ex.2032, ¶11; PO Response 65.

The Freedom Series received an industry award due to the CP swap feature

Describe the nominee and/or give a description of the technology or project being entered. [2000 character limit - including space and punctuation marks]:*

Downing, a leading technology provider, has developed an automated completion system that methodically eliminates time between plug and perf stages with the goal of fracturing the reservoir 24 hours a day, 7 days a week (please note the difference between being on a frac site 24/7, which occurs today, and fracturing the reservoir 24/7). Downing identified the primary barriers to fracturing the reservoir 24/7 as 1) the time between stages (this includes transition time and pressure tests), 2) downtime associated with gate valve maintenance and failures, 3) pump maintenance and 4) sand and water logistics. Taking these problems into account, Downing developed an automated completion system that has methodically eliminated the above issues. The system eliminates the time between stages with near instantaneous transitions from one stage to the next enabling operators to continuously pump for the duration of the completion. Through automation and interlocks with wireline and frac systems, the system eliminates NPT associated with gate valves. The latest addition to the system, FS Hot Swap, enables the exchange of pumps during frac operations without stopping the frac. Although the system does not directly solve logistic issues (i.e. sand and water shortages), the demonstrated consistency achieved using the system enables better planning of resources. The system has broken multiple pumping records across US basins including hours pumped continuously and stages completed. In addition, the system has over a dozen industry "firsts" that have changed completion operations. With the addition of FS Hot Swap, the automated completion system enables operators to frac 24/7. The base system was introduced more than 12 months ago. However, the latest addition to the system, FS Hot Swap, commercially introduced this year, enables the 24/7 pumping and therefore submitted the system in its entirety.

Ex.2019, 1; Ex.2032 (Marvel Decl.), ¶¶ 12-13; PO Response 68-69.

The unrebutted industry praise of the claimed CP swap is the most probative evidence in the record

“[E]vidence of secondary considerations may often be the most probative and cogent evidence in the record. It may often establish that an invention appearing to have been obvious in light of the prior art was not.”

Stratoflex, Inc. v. Aersoquip Corp., 713 F.2d 1530, 1538 (Fed. Cir. 1983)).

HAYNES BOONE

***INTELLIGENT WELLHEAD SYSTEMS, INC
V. DOWNING WELLHEAD EQUIPMENT,
LLC***

IPR2024-00300 (11,560,770)

Scott T. Jarratt, Laura Vu
Counsel for Patent Owner



DEMONSTRATIVE EXHIBIT – NOT EVIDENCE

Additional Slides

The '770 Patent

14. An apparatus, comprising:
a non-transitory computer readable medium; and
a plurality of instructions stored on the non-transitory computer readable medium and executable by one or more processors, wherein, when the instructions are executed by the one or more processors, the following steps are executed:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
opening a second valve;
communicating fluid to a second well via the second valve; and
closing the first valve after opening the second valve.

The '770 Patent

27. A system, comprising:
a first valve via which fluid is communicated from a manifold to a first well;
a second valve via which fluid is adapted to be communicated to a second well; and
one or more controllers,
configured to:
 open the second valve to thereby communicate fluid to the second well via the second valve; and
 close the first valve after opening the second valve,
in response to:
 determining that the fluid communicated via the manifold has satisfied one or more conditions.

Dr. Durham's testimony

A. Carr teaches a different flow meter associated with each path so that you can measure fluid flow separately and independently, as opposed to having a single meter upstream of valve 474, for example.

Q. (By Ms. Cooke) Why would that be important?

A. So that you can measure flow independently.

Q. Because the fluid conditions can be different, right?

A. Sure. So that you have more information.

Ex.2013, 153:5-17; PO Response, 20

Petition does not establish Krupa as prior art

A. *KRUPA*

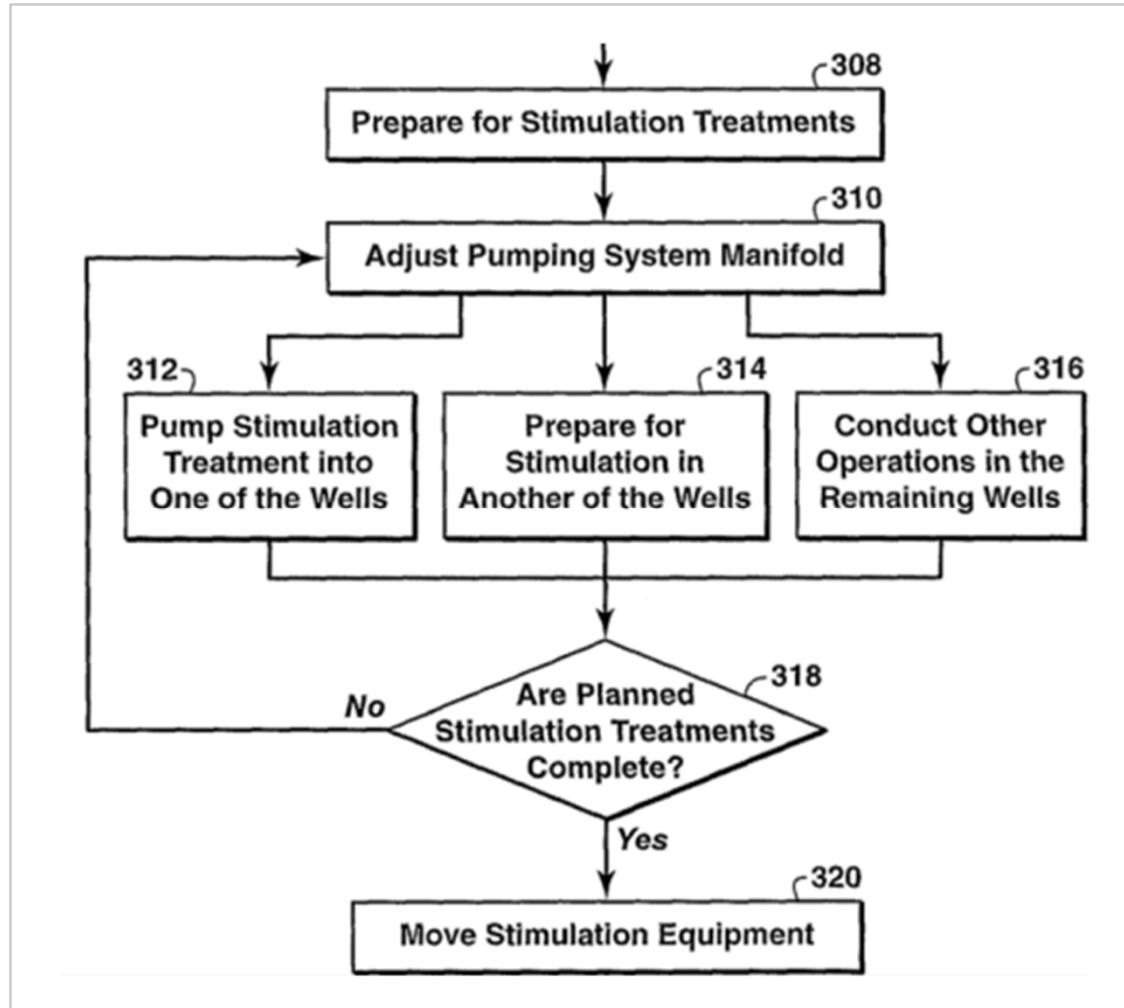
U.S. Patent Pub. No. 2022/0268141 (“*Krupa*,” Ex. 1003) was filed on February 18, 2022, published on August 25, 2022, and claims priority to U.S. Provisional App. No. 63/153,607, filed February 25, 2021. Because *Krupa*’s effective filing date is February 25, 2021—before ’770’s priority date (May 17, 2021)—*Krupa* is 35 U.S.C. § 102(a)(2)-prior art.

Petition, 4

“in response to”

1. A method, comprising:
communicating fluid to a first well via a manifold and a first valve, the first valve being associated with both the manifold and the first well; and
in response to determining that the fluid communicated via the manifold has satisfied one or more conditions:
 - ① opening a second valve;
 - ② communicating fluid to a second well via the second valve; and
 - ③ closing the first valve after opening the second valve.

Tolman



Ex.1006, Fig. 3; Petition, 74