

UNITED STATES PATENT AND TRADEMARK OFFICE

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BEFORE THE PATENT TRIAL AND APPEAL BOARD

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GD ENERGY PRODUCTS, LLC  
Petitioner,

v.

KERR MACHINE COMPANY  
Patent Owner.

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**PETITION**

**To Institute an *Inter Partes* Review for U.S. Patent No. 12,152,582  
under 37 C.F.R. § 42.200 *et seq.***

***PGR2025-00031***

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**EXHIBIT LIST**

| <b>Exhibit No.</b> | <b>Title</b>                                                              |
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| Ex. 1001           | U.S. Patent No. 12,152,582 (“Foster”)                                     |
| Ex. 1002           | File History for U.S. Patent No. 12,152,582                               |
| Ex. 1003           | Expert Declaration of William D. Marscher, P.E.                           |
| Ex. 1004           | Kerr KP-3300HP Plunger Pump Service Manual (“Kerr”)                       |
| Ex. 1005           | Dupagro Apex SC65 Manual (“Apex”)                                         |
| Ex. 1006           | U.S. Patent No. 7,186,097 to Blume (“Blume”)                              |
| Ex. 1007           | U.S. Pre-Grant Publication No. 2005/0200081 to Stanton et al. (“Stanton”) |
| Ex. 1008           | U.S. Patent No. 7,773,833 to Wilkinson et al. (“Wilkinson”)               |
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| Ex. 1013           | Kerr Website PT-3300HP Offer For Sale from December 28, 2014              |
| Ex. 1014           | Kerr Website Classic Pump Products from January 18, 2016                  |
| Ex. 1015           | Buckhorn Pumps Website Kerr Plunger Pump Manuals from March 17, 2016      |
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| Ex. 1018           | Declaration of Mark DeBoy                                                 |

## **I. RELIEF REQUESTED**

Petitioner GD Energy Products LLC (hereinafter "Petitioner") respectfully requests institution of post grant review ("IPR") under 35 U.S.C. §§ 321–329 and 37 C.F.R. § 42.200 et seq., and cancellation of claims 1-15 of U.S. Patent No. 12,152,582 to Foster et al. ("Foster") (EX1001), assigned to Kerr Machine Co. (hereinafter "PO"), as being invalid under 35 U.S.C. § 103 and 35 U.S.C. § 112 in light of the grounds presented herein.

## **II. BACKGROUND**

Foster is directed to a reciprocating pump. EX1003, ¶33. Reciprocating pumps are a class of positive displacement pumps widely used in various industries for transferring fluids by utilizing a back-and-forth (reciprocating) motion. EX1003, ¶33. The reciprocating motion of a piston or plunger within a cylinder creates alternating low and high-pressure zones, facilitating fluid intake and discharge. EX1003, ¶33. This action results in a steady, pulsating flow of fluid. Plunger pumps employ plungers that move within a sleeve or barrel and are often used for higher pressure applications. EX1003, ¶33.

A reciprocating pump primarily comprises two main sections: the fluid end and the power end. EX1003, ¶34. The power end is responsible for converting mechanical energy into the reciprocating motion that drives the fluid end. EX1003, ¶34. The power end comprises components that generate and transfer the necessary

force to move the piston or plunger, including a motor or engine that drives the pump. EX1003, ¶34. The motor/engine connects to a crankshaft that converts rotational motion into the reciprocating motion of the piston/plunger. EX1003, ¶35. Connecting rods link the crankshaft to the piston/plunger. EX1003, ¶35.

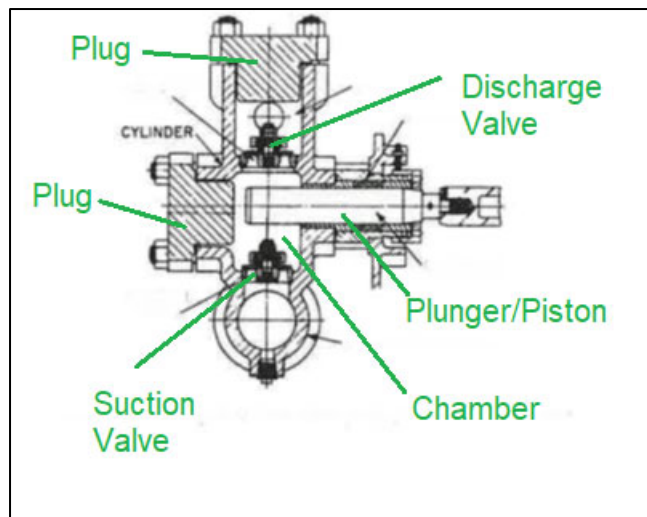
The fluid end defines or houses the pumping structures and mechanisms responsible for pressurizing and directing the fluid. EX1003, ¶36. They are typically high-strength structures made from materials like forged steel, stainless steel, or other corrosion- and wear-resistant alloys. EX1003, ¶36.

Fluid ends contain an internal chamber into which fluid enters and exits in response to reciprocation of the plunger/piston. EX1003, ¶37. Suction valves arranged within the fluid end allow fluid to enter the chamber during the intake stroke and prevent backflow during the discharge stroke. EX1003, ¶37. Discharge valves arranged within the fluid end permit fluid to exit the chamber during the discharge stroke and seal off the chamber during the intake stroke. EX1003, ¶37.

The reciprocating motion of plungers or pistons inside the fluid end creates the pumping action. EX1003, ¶38. Packing seals or stuffing boxes surround the plunger or piston to prevent fluid leakage and to maintain pressure. EX1003, ¶38.

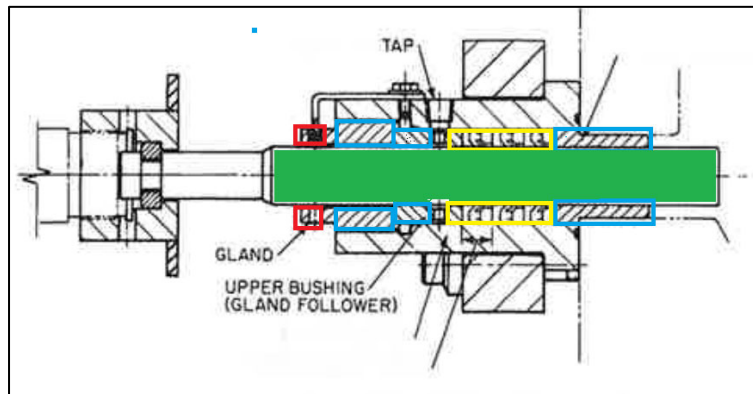
The figure below illustrates a typical reciprocating horizontal power pump fluid end cross-section, taken from Chapter 3 of the Pump Handbook edited by Igor Karassik (EX1010) and annotated for clarity. EX1003, ¶39. The conventional fluid

end includes an internal chamber, a piston or plunger driven by the power end, suction and discharge valves, and plugs covering the bores that provide access to the valves and internal chamber. EX1003, ¶39. When the plunger/piston is retracted by the power end (*i.e.*, the intake stroke), fluid is drawn into the chamber via the suction valve, and when the plunger/piston is extended (*i.e.*, the discharge stroke), the fluid is driven out of the chamber via the discharge valve. EX1003, ¶39.



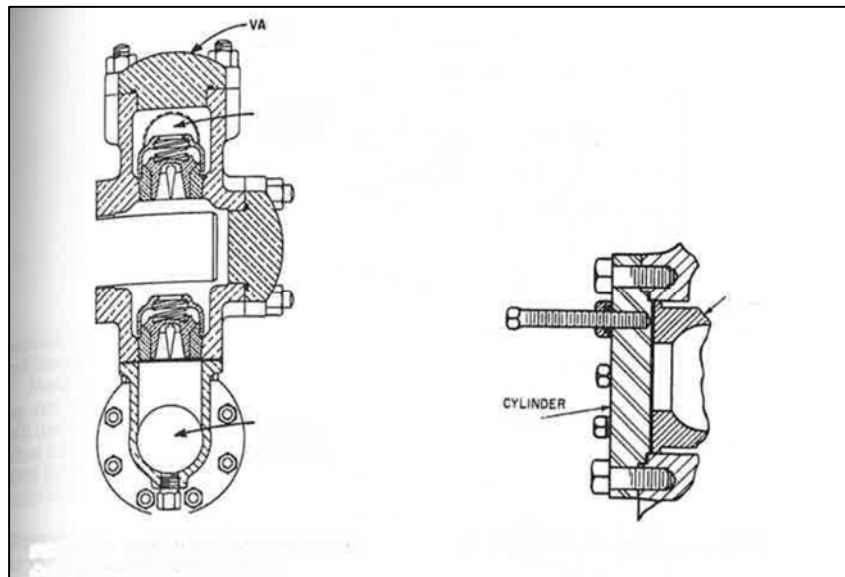
**Karassik Chapter 3, Fig. 1 (EX1010, 22) (annotated)**

As illustrated below (also from Karassik) the conventional fluid end includes a stuffing box (blue) that houses packing (*e.g.*, seals) (yellow) configured to engage with the plunger/piston to provide a fluid tight barrier around the reciprocating plunger/piston (green). EX1003, ¶40. This fluid barrier prevents fluid from traveling around the piston/plunger during a discharge stroke. EX1003, ¶40. The packing (*e.g.*, the seals) is maintained within the stuffing box via a nut or gland (red) arranged at the power-end side of the stuffing box. EX1003, ¶40.



**EX1010, p, 26, Fig. 7 (annotated)**

As further illustrated below (also from Karassik), the conventional fluid end includes covers for the bores formed in the fluid end. EX1003, ¶41. These covers may take the form of plates. EX1003, ¶41. The plate closure may include a bolted component that may have a segment that closely fits within the bore, while a flange of the component is bolted to the pump frame (body) by screws or by studs and nuts. EX1003, ¶40. Other types of plates, however, are bolted flush to external surfaces of the fluid end without a segment or portion of the plate extending into the bore. EX1003, ¶40.



### **EX1010, 29 (annotated)**

Reciprocating pumps can be single cylinder, meaning they have a single reciprocating plunger or piston. EX1003, ¶42. Reciprocating pumps can also be constructed as multiplex pumps. EX1003, ¶42. Multiplex pumps, such as duplex (two plungers/pistons) or triplex (three plungers/pistons) configurations, use multiple plungers/pistons operating in staggered sequences. EX1003, ¶42. Multiplex pumps handle higher pressures and flow rates more efficiently. EX1003, ¶42.

### **III. SUMMARY OF FOSTER AND THE CITED ART**

#### **a) Foster**

Foster is entitled “Fluid End Assembly” and issued on November 26, 2024. EX1001, 1. PO filed the application that issued as Foster on May 22, 2023, as a track one (*i.e.*, prioritized examination). *Id.* Foster is a continuation of Application No. 17/882,267, filed on August 5, 2022, now U.S. Patent No. 11,655,812, which is

a continuation of Application No. 16/876,414, filed on May 18, 2020, now U.S. Patent. No. 11,408,419, which is a continuation of Application No. 16/035,126, filed on July 13, 2018, now U.S. Pat. No. 10,670,013. EX1001, 1-2. Foster further claims priority to Provisional Application No. 62/562,588, filed on September 25, 2017, Provisional Application No. 62/536,297, filed on July 24, 2017, and Provisional Application No. 62/532,574, filed on July 14, 2017. *Id.* Accordingly, the earliest potential priority date for Foster is July 14, 2017.

Claims 1-15 of Foster, however, all recite a “plate” which was not introduced until Provisional Application No. 62/536,297, filed on July 24, 2017. Nevertheless, all of the art cited in this Petition is prior art to Foster based on either priority date.

As suggested by its title, Foster is directed to a “fluid end assembly” and more specifically, according to its Abstract:

A fluid end **having its fluid flow bores sealed without threading a retaining nut into the walls of each bore.** The fluid ends may be assembled using a plurality of different kits that each comprise a fluid end body, a component, a retainer element, and a fastening system. The retainer element holds the component within each of the bores formed in the fluid end body and the fastening system secures the retainer element to the body. The fastening system comprises a plurality of externally threaded studs, washers and nuts in some embodiments. In other embodiments, the fastening system comprises a plurality of screws.

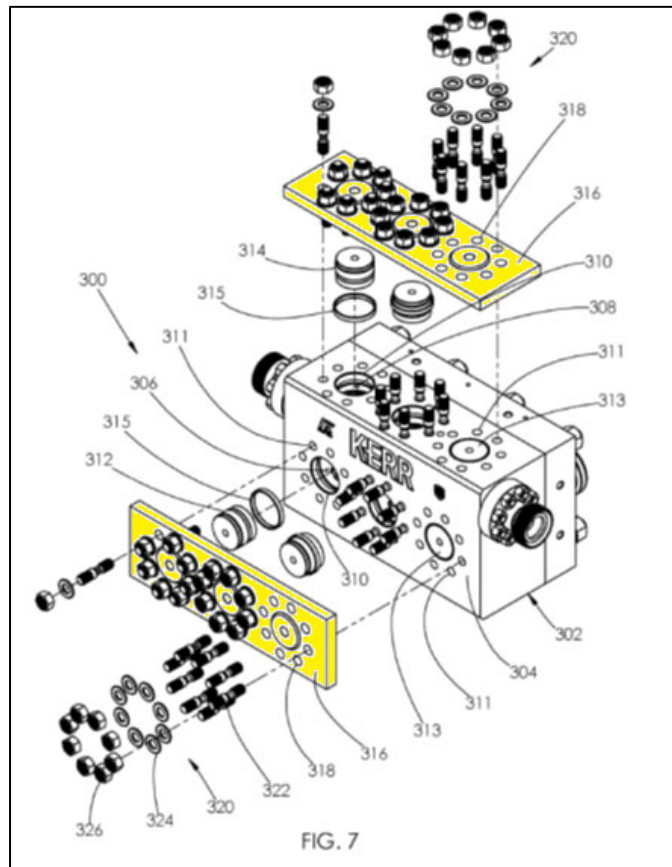
EX1001, Abstract (emphasis added).

Accordingly, the purported novelty of Foster is in the removal of retaining nuts that thread into the threaded bores of the fluid end. *See* EX1003, ¶45. Therefore, of particular note for the claims of Foster is the following discussion of the retainer elements 316, which replace the threaded retaining nuts and take the form of a plate sized to cover a plurality of adjacent bore openings:

Once installed within the body 302, a top surface 313 of each of the components 312, 314 may sit flush with the external surface 304 of the body 302. Each of the components 312, 314 is secured within each respective bore 306, 308 by a retainer element 316. **Each of the retainer elements 316 shown in FIG. 7 is a large rectangular plate having a footprint sized to cover a plurality of adjacent bore openings 310 at one time.** A plurality of openings 318 are formed in each retainer element 316 that are alienable with a corresponding one of the openings 311 in a one-to-one relationship.

EX1001, 8:41-51; *see also* EX1003, ¶45.

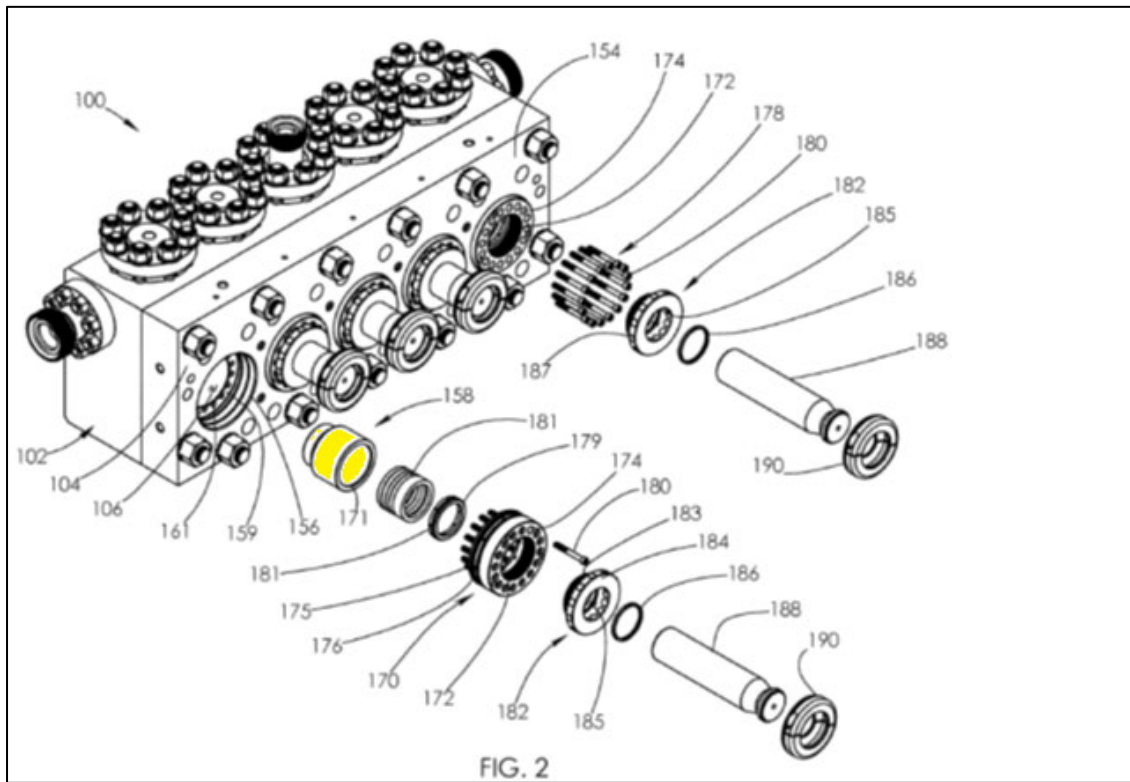
These rectangular plate retainer elements 316 are illustrated in FIG. 7 from Foster, reproduced below. *See* EX1003, ¶46. Foster draws no distinction between the cover plate 316 for the vertical bore and the cover plate 316 for the horizontal bore, giving them the same reference numeral and describing them as an identical part. EX1001, 8:41-60; *see also* EX1003, ¶46.

**EX1001, FIG. 7 (annotated)**

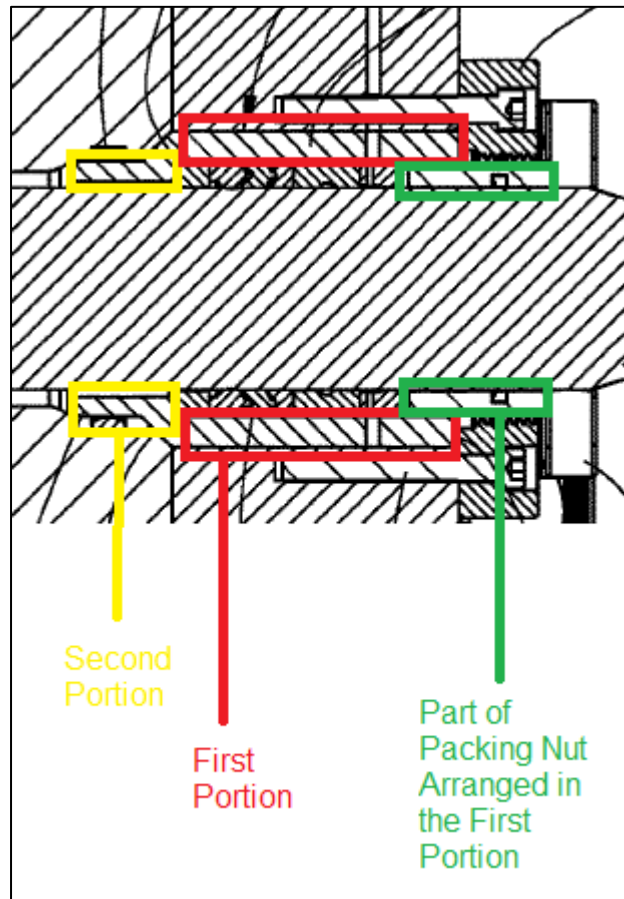
Also of note for the claims of Foster is the “component” installed in the horizontal bore of the fluid end, which is described and illustrated as follows:

A component 158 is positioned within each first bore 106 through each of the openings 156. Each of the components 158 is tubular and sized to be closely received within each bore 106. In one embodiment, the components 158 are stuffing box sleeves.

EX1001, 4:12-16; *see also* EX1003, ¶47.

**EX1001, FIG. 2 (annotated)**

The sleeve of Foster is described in more detail with reference to FIG. 6 (illustrated and annotated in detail below) as having a first section with a larger diameter than a second section, and with the packing nut 266 being at least partially arranged within the sleeve to form a backwall within the sleeve. EX1001, 7:1-12, FIG. 2. These specific features, however, are not claimed in Foster. *See* EX1003, ¶48.



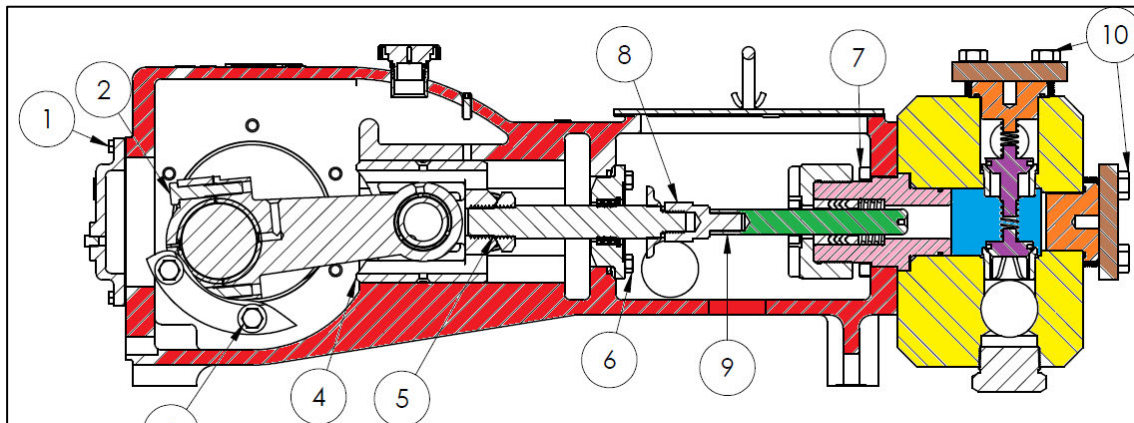
**EX1001, Detail of FIG. 6 (annotated)**

The remainder of the Foster specification relevant to the claims is a fairly conventional multiplex reciprocating pump fluid end. EX1003, ¶49.

**b) Kerr**

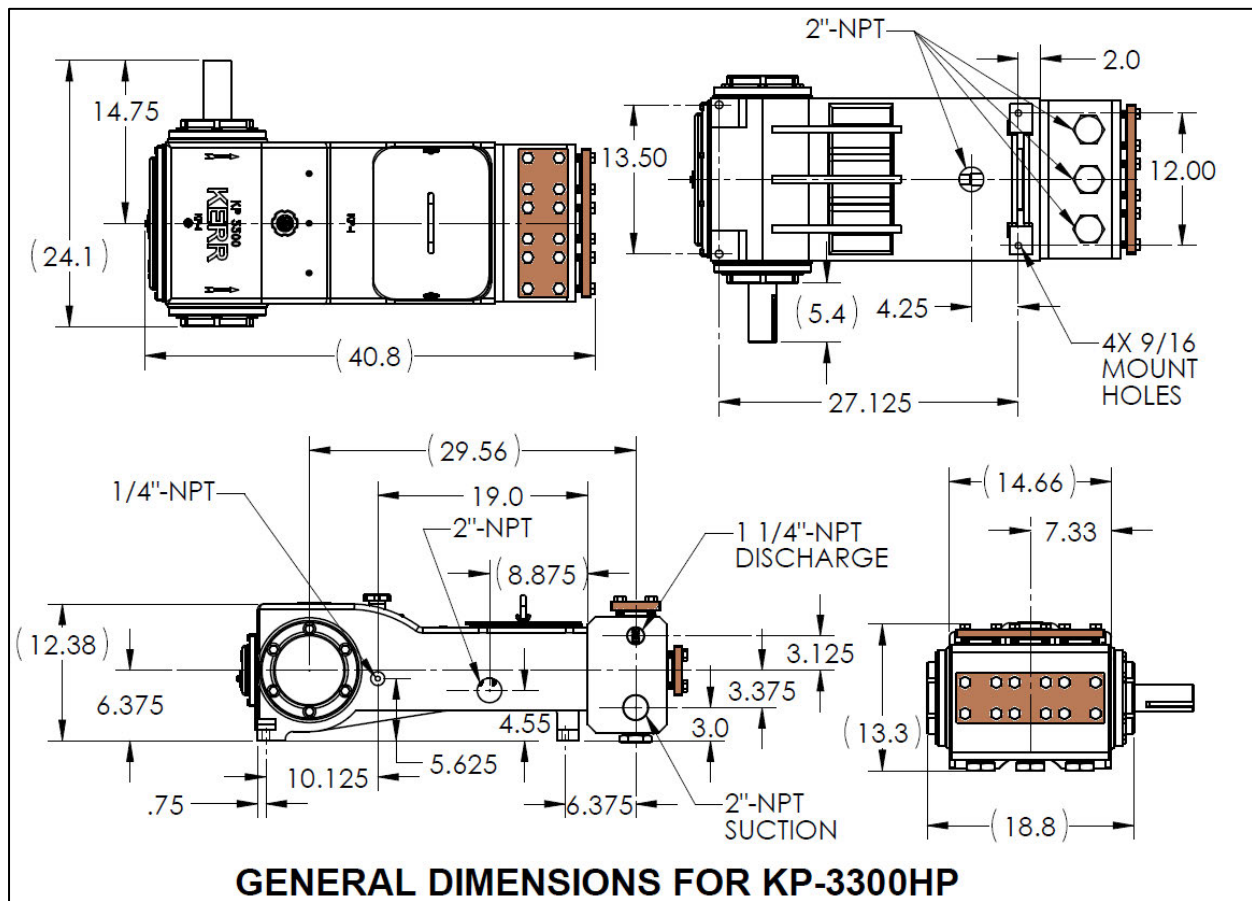
The Kerr KP-3300HP Plunger Pump (“Kerr Pump”) is shown and described in a service manual (“Kerr”), which is Ex. 1004 to the Petition. Kerr is a prior art printed publication that was publicly available prior to the earliest priority date for Foster. *See* section IV.g, *infra*.

Kerr is a triplex plunger pump. EX1003, ¶65. As illustrated in the annotated figure below, Kerr is a fairly conventional triplex pump with a fluid end that includes a fluid end housing (yellow) and a power end that includes a power end housing (red). Each bore pair of the fluid end includes a plunger (green), a packing sleeve (pink), an internal chamber (blue), suction and discharge valves (purple), bore plugs (orange), and cover plates (brown) covering both the horizontal and vertical bores. EX1003, ¶65. More details of Kerr will be described below when it is applied to the Foster claims.

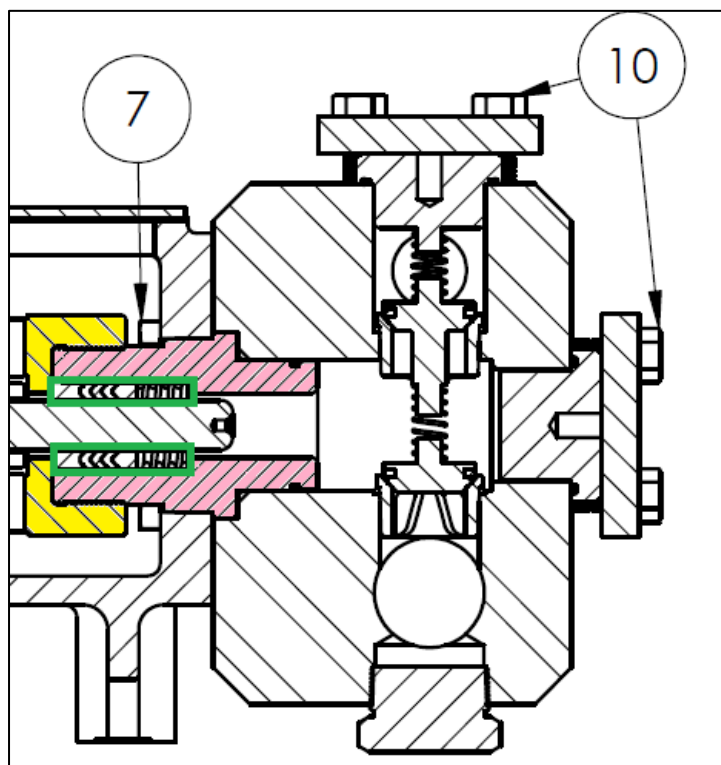


**EX1004, 26 (annotated)**

Of particular note in Kerr, a single cover plate covers the three horizontal bores of the triplex pump, and a single cover plate covers the three vertical bores of the triplex pump, as illustrated in the annotated figures below. EX1003, ¶66.

**EX1004, 25 (annotated)**

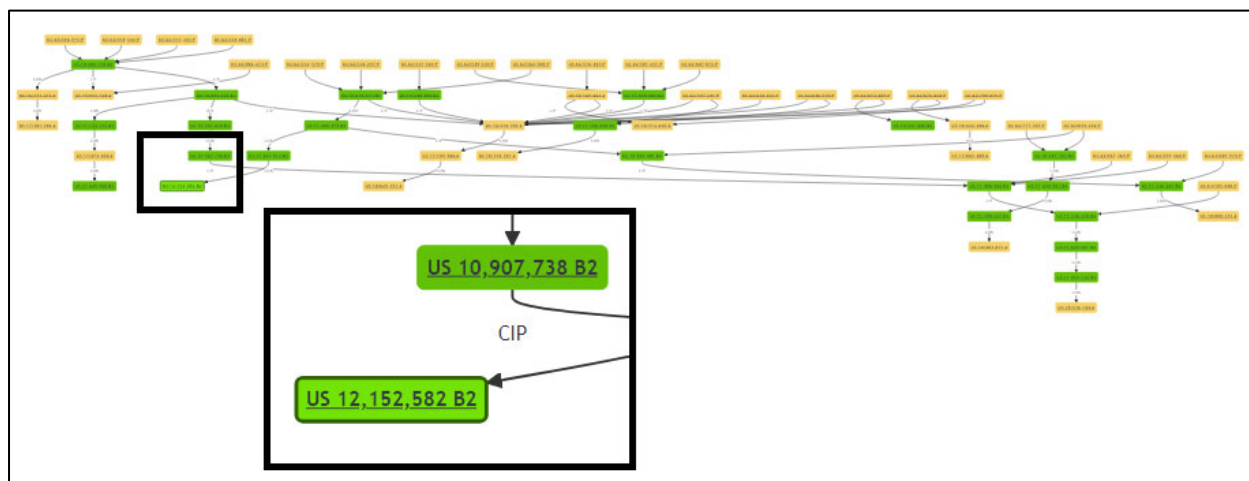
Also of note in Kerr is that its packing sleeve (annotated below in pink) is partially arranged within the fluid end and includes packing (green) retained therein via a packing nut or gland (yellow). EX1003, ¶67. As illustrated in this figure, the packing nut serves as a rear wall or barrier for the packing and/or the packing sleeve. EX1003, ¶67.



**EX1004, 26 (annotated)**

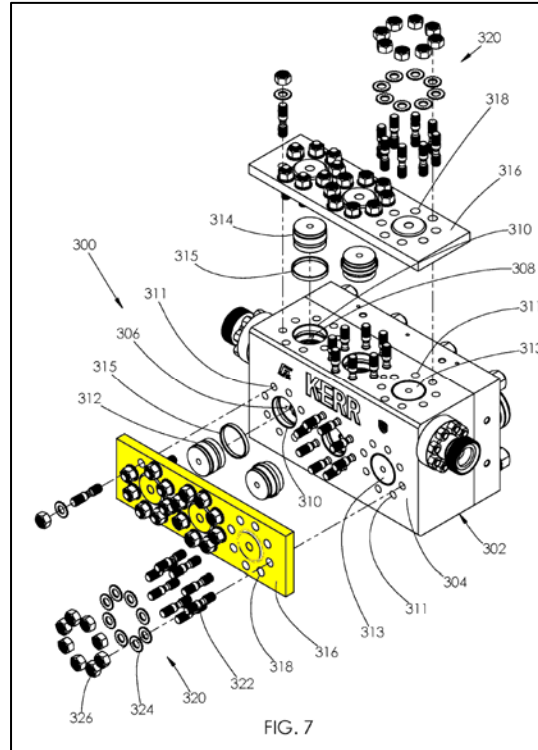
#### IV. INTRODUCTION

Foster is one patent in a large and convoluted family that includes over 50 applications and patents in the U.S. alone. Foster was filed more than 7 years after the earliest provisional applications to which it claims priority.



### Foster's U.S. Only Family Tree (Created by Patent Bots)

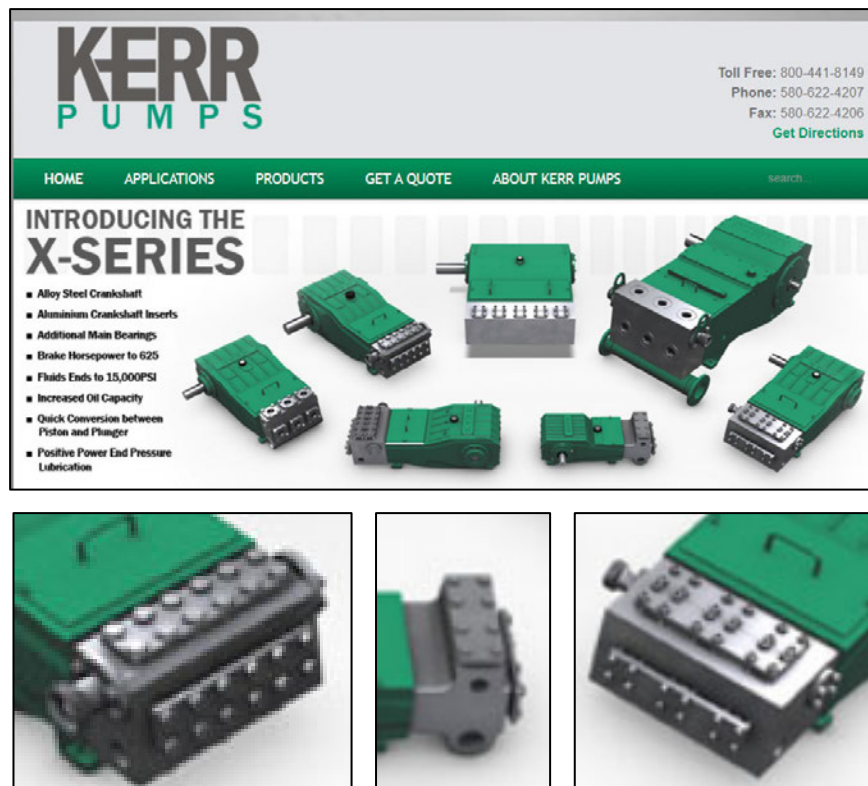
While the earlier filed and issued family members themselves have dubious validity (*see, e.g., Cizion, LLC v. Kerr Machine Co.*, Post Grant Review PGR2020-00065 of U.S. Patent No. 10,591,070), Foster boldly attempts to claim subject matter that PO and the rest of the power pump industry had been using for *years* prior to Foster's earliest possible priority date of July 14, 2017. Specifically, the purported novelty of the Foster claims is attributed to "a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores." EX1002, 6 ("Allowable Subject Matter"). An example of such a plate is annotated in yellow in FIG. 7 from Foster below.



**Foster FIG. 7 (annotated)**

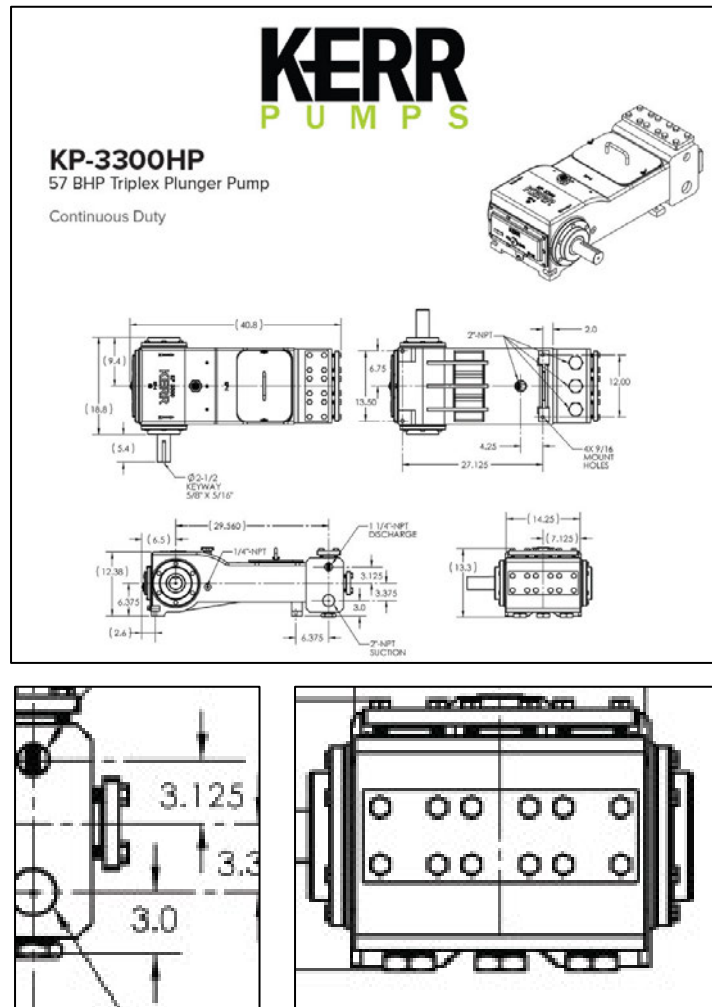
Simply put, Foster's claims recite a conventional arrangement of conventional features and are invalid over any number of prior art references, sales and public disclosures, only a few of which are presented herein.

For example, PO has disclosed such plates on its website going back to *at least* 2012:



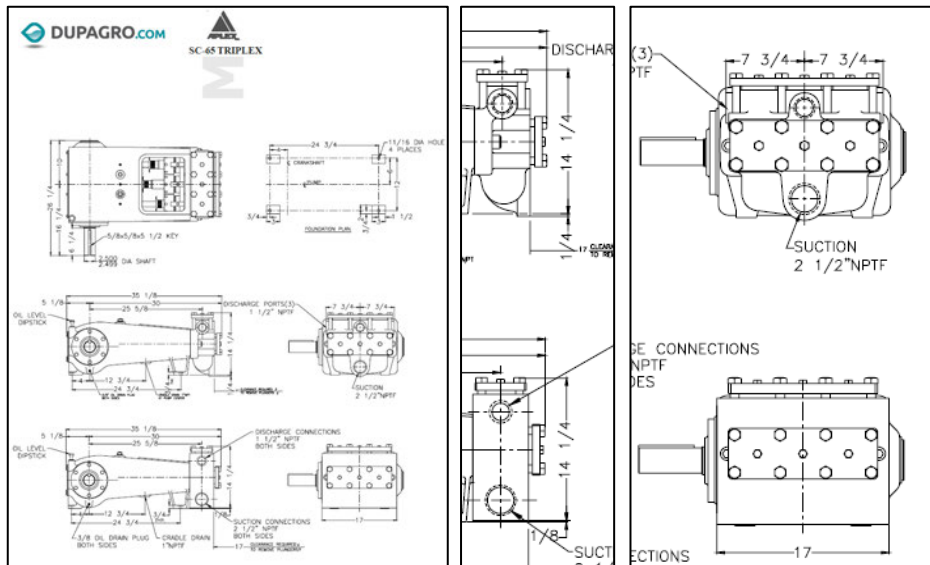
**PO Website from 2012 and Accompanying Details (EX1009, 23)**

PO has also included such plates in its pumps going back to *at least* 2013:



**PO's Kerr KP-3300HP Specification publicly available in 2014 and Accompanying Details (EX1011; see also EX1009, 25-26, 76)**

Still further, PO's competitors have been using such plates since *at least* 2016:



**Pentair Apex SC65 Parts Manual from 2016 and Accompanying Details  
(EX1005, see also EX1009, 27)**

Similar plates have been present in patent art since *at least* 1988:

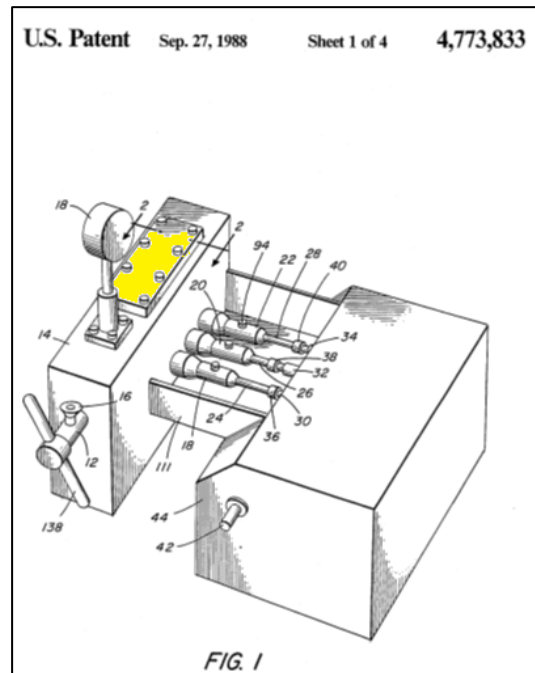
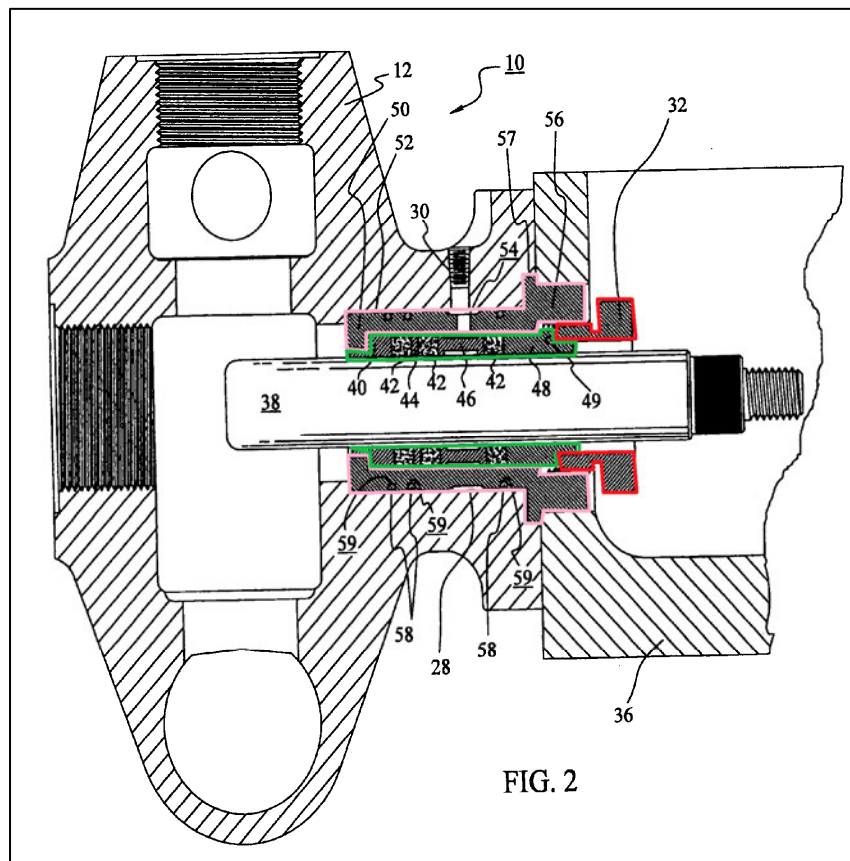


**FIG. 1 from U.S. 4,773,833 (“Wilkinson,” annotated) (EX1008)**

**a) Stanton**

U.S. Pre-Grant Publication No. US2005/0200081A1 (“Stanton”) was published on September 15, 2005, and is Ex. 1007 to the Petition. This is more than a year prior to the filing of the earliest provisional application to which Foster claims priority, and therefore, Stanton is prior art to Foster.

Stanton exhibits a wide variety of plunger-sealing stuffing box arrangements, including the stuffing box arrangement of FIG. 2, which is reproduced and annotated below. EX1003, ¶75. As illustrated, the packing arrangement is partially arranged within the fluid end and includes a packing sleeve (pink) with packing (green) that is retained within the packing sleeve via a packing nut or gland (red). EX1003, ¶75. As illustrated, the packing nut serves as a rear wall or barrier for the packing sleeve and/or the packing. EX1003, ¶75.



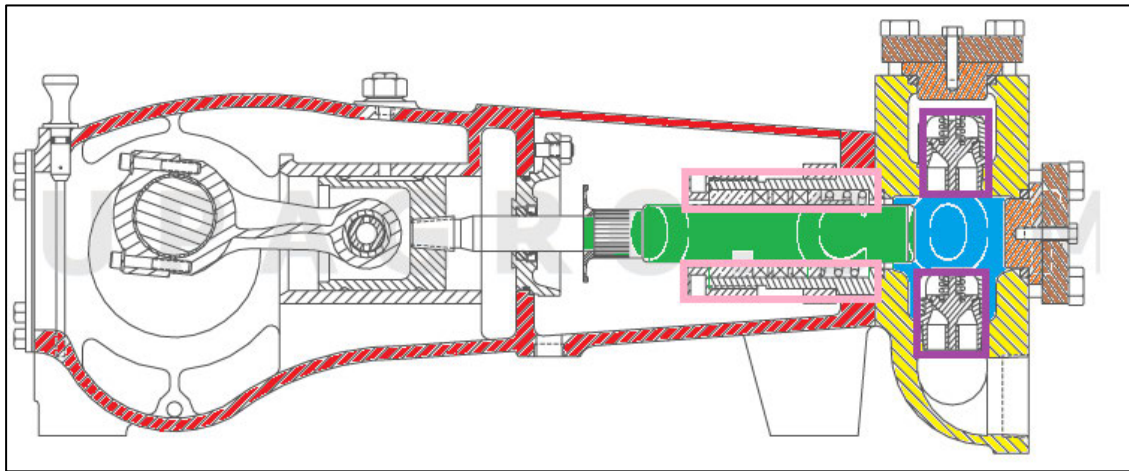
**EX1007, FIG. 2 (annotated)**

**b) Apex**

The Pentair Apex SC-65 Pump (“Apex Pump”) is shown and described in a service manual (“Apex”), which is Ex. 1005 to the Petition. As discussed in detail below, Apex is a prior art printed publication that was publicly available prior to the earliest priority date for Foster. *See* section IV.g, *infra*.

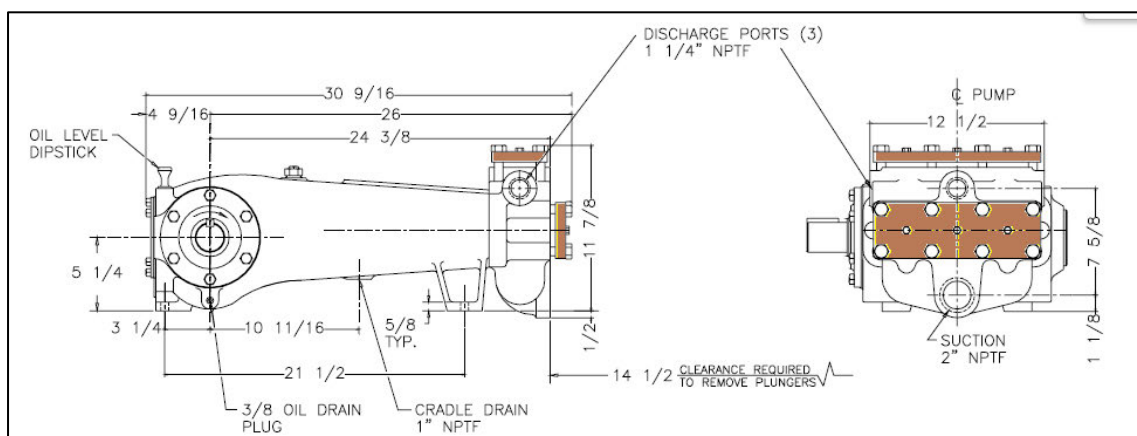
Apex describes, as illustrated in the annotated figure below, a fairly conventional triplex pump with a fluid end including a fluid end housing (yellow), a power end including a power end housing (red). Each bore pair of the fluid end includes, a plunger (green), a packing sleeve (pink), an internal chamber (blue),

suction and discharge valves (purple), bore plugs (orange), and cover plates (brown) covering both the horizontal and vertical bores. EX1003, ¶70. More details of Apex will be described below when the reference is applied to the claims of Foster.



### EX1005, 7 (annotated)

Like Kerr, Apex uses a single plate to cover the three horizontal bores of the triplex pump, and a single plate to cover the three vertical bores of the triplex pump, as illustrated in the annotated figures below. EX1003, ¶71.

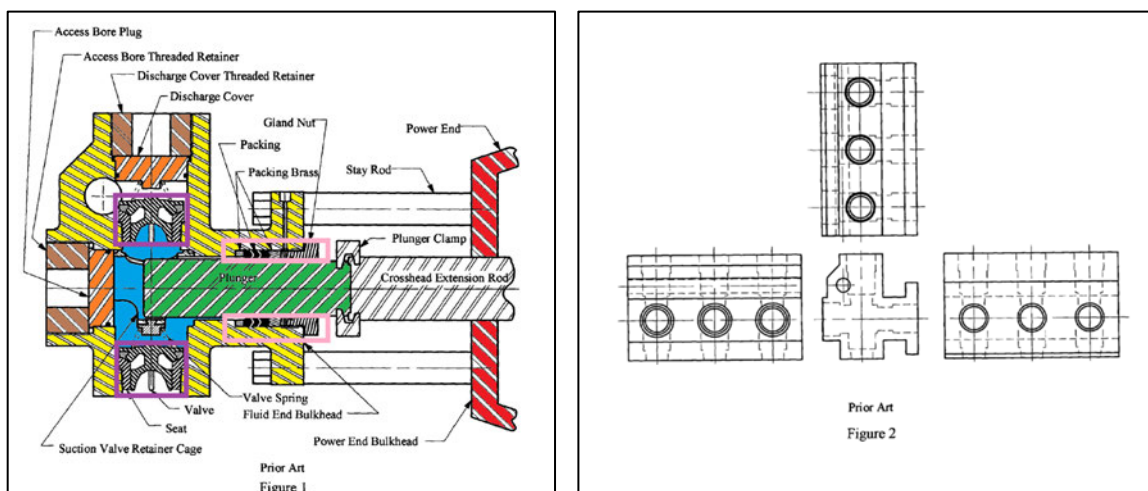


### EX1005, 8 (annotated)

**c) Blume**

U.S. Patent No. 7,186,097 (“Blume”), which issued on March 6, 2007, is Ex. 1006 to the Petition. Ex1006, 1. This is more than a year prior to the filing of the earliest provisional application to which Foster claims priority, and therefore, Blume is prior art to Foster.

In Blume, FIGs. 1 and 2 (reproduced below) illustrate a fairly conventional fluid end of a triplex pump that was “prior art” even at the time of filing of Blume. This fluid end includes a fluid end housing (yellow) and a power end that includes a power end housing (red). Each bore pair of the fluid end includes a plunger (green), a packing sleeve (pink), an internal chamber (blue), suction and discharge valves (purple), bore plugs (orange), and bore covers (brown) covering both the horizontal and vertical bores. EX1003, ¶73.

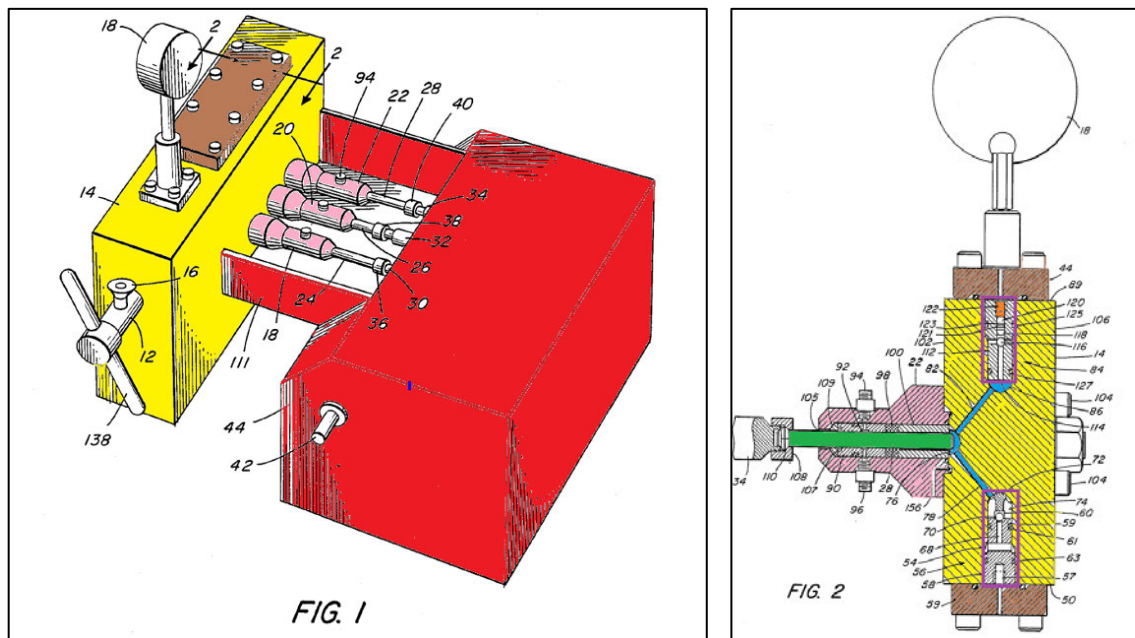


**EX1006, FIGs. 1 and 2 (annotated)**

**d) Wilkinson**

U.S. Patent No. 4,773,833 (“Wilkinson”) issued on September 27, 1988, and is Ex. 1008 to the Petition. This is more than a year prior to the filing of the earliest provisional application to which Foster claims priority, and therefore, Wilkinson is prior art to Foster.

Wilkinson illustrates a fairly conventional triplex pump. As illustrated in FIGs. 1 and 2 (reproduced below), the triplex pump includes a fluid end with a fluid end housing (yellow) and a power end with a power end housing (red). Each bore pair of the fluid end includes a plunger (green), a packing box (pink), an internal chamber (blue), suction and discharge valves (purple), a bore plug (orange), and bore covers (brown). EX1003, ¶77.



**EX1008, FIGs. 1 and 2 (annotated)**

Notably, the bore covers of Wilkinson are plates. EX1003, ¶78. As explained in column 3, line 25 of Wilkinson: “A set of three suction valves are accessed through the bottom of the block 14, and a set of three discharge valves are accessed through the top of the block **by removal of a plate 44.**” EX1008, 3:25 (emphasis added); EX1003, ¶78.

**e) Kerr and Aplex are Prior Art Printed Publications**

“[A]t the institution stage, the petition must identify, with particularity, evidence sufficient to establish a reasonable likelihood that the reference was publicly accessible before the critical date of the challenged patent and therefore that there is a reasonable likelihood that it qualifies as a printed publication.” *Hulu, LLC v. Sound View Innovations, LLC*, IPR2018-01039, Paper 29, 13 (PTAB Dec. 20,

2019) (precedential). Such sufficient evidence may be established by affidavits provided by Internet Archive records request processors indicating the availability of a reference prior to the relevant priority date. *Samsung Electronics Co., Ltd. v. Maxell, Ltd.*, IPR2024-00907, Paper 11, 25 (PTAB Dec. 11, 2024); *see also Valve Corp. v. Ironburg Inventions Ltd.*, 8 F.4th 1364, 1374 (Fed. Cir. 2021) (finding that Internet Archive affidavits and evidence are from a source “whose accuracy cannot reasonably be questioned”).

Though not necessary, such affidavits may be bolstered by other reliable indicia of public availability. *Hulu*, Paper 29 at 20. Furthermore, where, as here, “a publication’s purpose is dialogue with the intended audience, that purpose indicates public accessibility.” *Weber, Inc. v. Provisur Techs., Inc.*, 92 F.4th 1059, 1067–68 (Fed. Cir. 2024); *Valve Corp.*, 8 F.4th at 1374; *SRI Int’l, Inc. v. Internet Sec. Sys., Inc.*, 511 F.3d 1186 (Fed. Cir. 2008) (recognizing that “intent to publicize” is a factor “involved in the public accessibility determination”). Under this framework, Kerr and Apex are easily shown to be prior art publications that were publicly available prior to the priority date of Foster.

As indicated in the Affidavit of Tanya Zeif, a Records Request Processor at the Internet Archive, Ex. 1009 to the Petition, links to Kerr were available on the Buckhorn Pumps Website no later than March 17, 2016:

<https://web.archive.org/web/20160317104619/http://www.buckhornpumps.com/kerr-plunger-pump-manuals/>

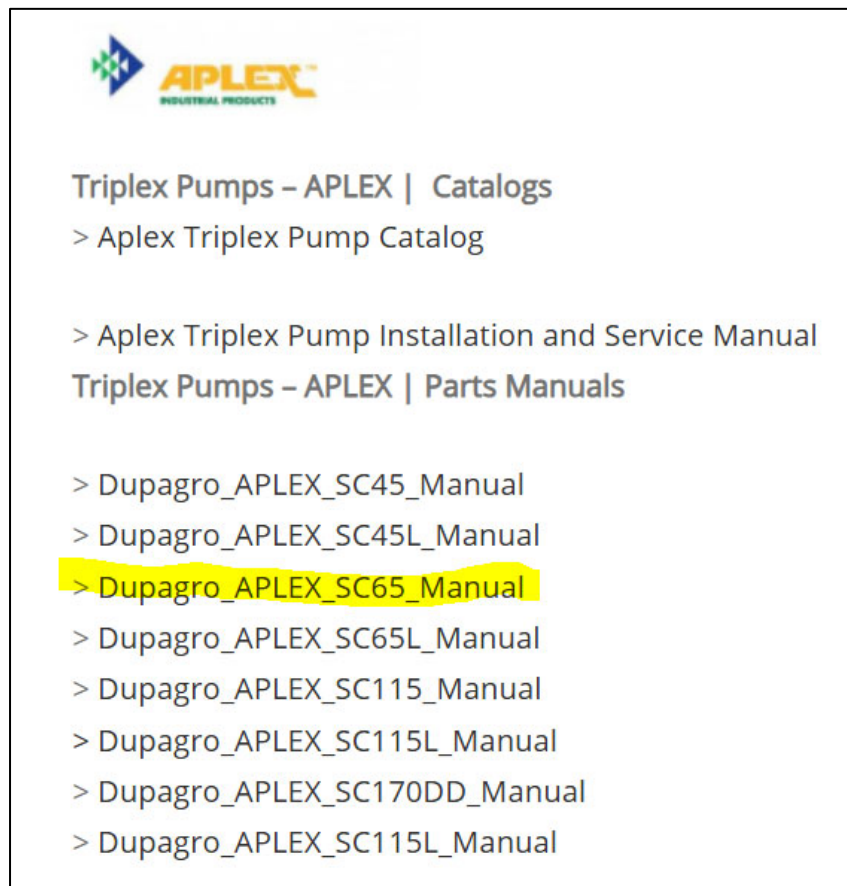


## KP-3300HP PARTS AND SERVICE MANUAL

### **EX1009, 4, 6 (annotated)**

Links to Apex were available no later than May 12, 2016, on the Dupagro website:

<https://web.archive.org/web/20160512190758/http://www.dupagro.com/support/manuals-and-part-lists/>

**EX1009, 77, 78 (annotated)**

Specifically, the highlighted numbers in the above-noted Internet Archive web addresses indicate that links making Kerr available to the public were archived on March 17, 2016 and links making Apex available to the public were archived on May 12, 2016. As these dates predate the priority date for Foster, “based on this preliminary record ... Petitioner has sufficiently shown the public accessibility of [Kerr] and [Apex] for purpose of institution.” *Samsung*, Paper 11 at 11.

Further, as described by Petitioner’s expert, Mr. Marscher, the Buckhorn Pumps and Dupagro Pumps websites, which hosted Kerr and Apex, respectively, were websites known and used by the relevant audience interested in power pumps

to research and evaluate power pumps for specific needs prior to the Foster priority date:

A person in industry looking to purchase or otherwise research pumps in the 2017 timeframe, would perform a web search for potential pumps, which would lead them to distributor sites, like Buckhorn Pumps, or the manufacturer site itself. These distributors and manufactures would host documents like the manual relied upon here. These sites would also host specification or “spec” sheets. Accordingly, these documents would be readily known and used by those skilled in the art in the 2017 timeframe. Kerr was created for dissemination to the interested public to provide instructions about how to assemble, use, clean, and maintain the Kerr Pump. Catalogs would also be readily available to the skilled artisan through internet searches and websites, like the Buckhorn Pump and Kerr websites.

EX1003, 64; see also EX1003, ¶69 (describing Dupagro site in the same way).

This additional information, while not required under the framework laid out in *Samsung*, further illustrates that both Kerr and Apex were publicly available prior to the priority date of Foster.

Both Kerr and Apex also include additional indicia that further illustrates that they were publicly available prior to the priority date for Foster. As indicated in the details from Kerr and Apex provided below, both references include information indicating that the documents were intended to be made available to the public. Kerr

includes information that allows members of the public to contact the Kerr Pump Corporation, and in fact, instructs the members of the public to do so.



|                             |                                                                                                                                                                                                                                                                                |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Packing failure (Excessive) | <p>it becomes erratic.</p> <ul style="list-style-type: none"> <li>• Improper installation.</li> <li>• Improper type of lubrication.</li> <li>• Incorrect type of packing for particular installation.</li> <li>• (Contact Kerr Pump Corporation if you are unsure.)</li> </ul> |
|-----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**EX1004, 1, 4 (annotated)**

Aplex includes information that allows members of the public to contact Dupagro and Myers/Aplex:



|                                                                                                          |                                                                                                                                             |                                                                                                 |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| <b>Dupagro B.V.</b><br>Ooststeeg 102<br>6708 AX Wageningen<br>The Netherlands<br><b>REVISED 02/21/06</b> | Phone +31 (0) 317 840 197<br><a href="mailto:info@dupagro.com">info@dupagro.com</a><br><a href="http://www.dupagro.com">www.dupagro.com</a> | <br><b>1</b> |
|----------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|

|                                                                   |
|-------------------------------------------------------------------|
| <b>MYERS/APEX INDUSTRIES, INC.</b><br><b>Ashland, Ohio U.S.A.</b> |
|-------------------------------------------------------------------|

**EX1005, 1, 4**

Accordingly, both Kerr and Apex are prior art printed publications that were publicly available prior to Foster's priority date.

**V. STANDING**

Petitioner certifies that Foster is available for PGR: (1) Petitioner is not an owner of Foster, see § 42.201; (2) before the date on which this Petition for review was filed, none of Petitioner or Petitioner's real parties-in-interest or privies filed a civil action challenging the validity of a claim of Foster, see § 42.201(a); and (3) Petitioner, Petitioner's real parties-in-interest or privies are not estopped from challenging the claims on the grounds identified in this Petition, see § 42.201(b).

**VI. MANDATORY NOTICES**

Pursuant to 37 C.F.R. § 42.8(b)(1), GD Energy Products, LLC is the real party-in-interest for this Petition.

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner identifies the following proceedings:

- None

Pursuant to 37 C.F.R. § 42.8(b)(3), Petitioner designates counsel as follows:

|               | <b>Lead Counsel</b>                                                                           | <b>Back-Up Counsel</b>            | <b>Back-Up Counsel</b>                                             |
|---------------|-----------------------------------------------------------------------------------------------|-----------------------------------|--------------------------------------------------------------------|
|               | Mark J. DeBoy<br>(Reg. # 66983)                                                               | Andrew Haberman<br>(Reg. # 69209) | Larry Shatzer<br>( <i>pro hac vice</i><br>application to be filed) |
| Email:        | mdeboy@esfip.com                                                                              | ahaberman@esfip.com               | lshatzer@esfip.com                                                 |
| Postal        | EDELL, SHAPIRO & FINNAN, LLC<br>9801 Washingtonian Blvd., Suite 750<br>Gaithersburg, MD 20878 |                                   |                                                                    |
| Hand<br>Del.: | Same as Postal                                                                                |                                   |                                                                    |
| Tel.:         | 301-424-3640                                                                                  |                                   |                                                                    |
| Fax:          | 301-762-4056                                                                                  |                                   |                                                                    |

Pursuant to 37 C.F.R. § 42.8(b)(4), papers concerning this matter should be served on either Mark DeBoy or Andrew Haberman as identified above. Petitioner consents to electronic service via the email addresses set forth above.

## **VII. IDENTIFICATION OF CHALLENGES**

### **a) Claims, Statutory Grounds and Prior Art**

Petitioner is requesting PGR and cancellation of claims 1-15 of Foster (the "Challenged Claims") under the following grounds:

| Ground No. | Claim Nos. | Proposed Statutory Rejections                                             |
|------------|------------|---------------------------------------------------------------------------|
| 1          | 1-14       | Invalid under 35 U.S.C. § 103 over Kerr                                   |
| 2          | 1-14       | Invalid under 35 U.S.C. § 103 over Apex in view of Stanton                |
| 3          | 1-14       | Invalid under 35 U.S.C. § 103 over Blume in view of Stanton and Wilkinson |
| 4          | 1-14       | Invalid under 35 U.S.C. § 103 due to the sale of the Kerr Pump            |
| 5          | 15         | Indefinite under 35 U.S.C. § 112                                          |

### **b) Claim Construction**

Claims in PGR are construed using the same claim construction standard as in a civil action. 37 C.F.R. § 42.200(b). For purposes of this Petition, Petitioner submits that all claim terms in the Challenged Claims should be given their ordinary and customary meaning as understood by the POSITA and no further construction is necessary at this time.

## **VIII. PERSON OF ORDINARY SKILL IN THE ART**

The person of ordinary skill in the art would have a minimum of a bachelor's degree in mechanical or petrochemical engineering, or a comparable engineering discipline, and a minimum of 3-5 years of work experience in the design and/or manufacturing of reciprocating pumps and valves, including fluid ends and/or comparable high pressure fluid components, for industrial applications, including for use in the oil and gas industry. *See, e.g.*, EX1003, ¶32.

## **IX. HOW THE CLAIMS ARE UNPATENTABLE**

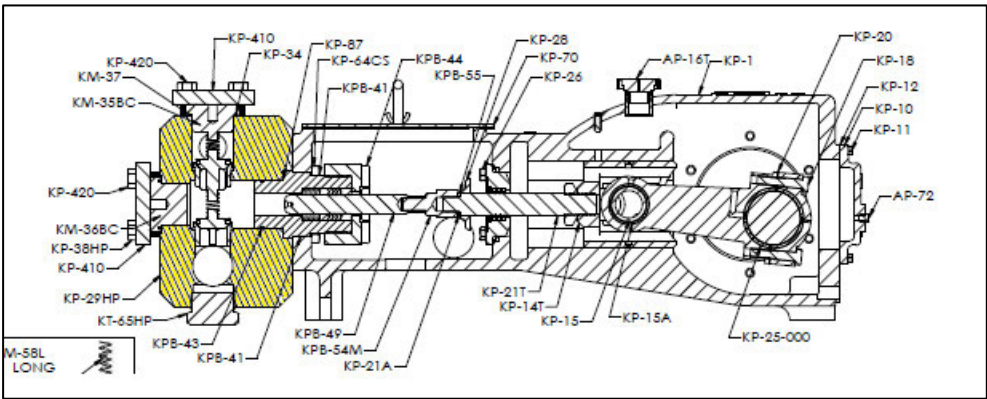
As explained in section IV.a, Foster is directed to a conventional fluid end whose purported novelty lies in a fluid bore sealing arrangement that does not require “threading a retaining nut into the walls of each bore.” EX1001, Abstract. The claimed structure for achieving such a fluid bore seal is “a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores.” EX1001, claim 1. As explained in detail below, this plate, as well as every other claimed feature in claims 1-14 of Foster is disclosed or would have been obvious at the time of filing based on a number of different invalidity grounds.

**a) Ground 1**

Claims 1-14 of Foster are invalid as obvious over Kerr. Kerr explicitly illustrates every element of claims 1-14 directed to a “first” plunger arrangement of the recited fluid end. EX1003, ¶¶79-171. The elements of the claims directed to a “second” plunger arrangement would have been obvious to the POSITA at Foster’s earliest priority date (“time of filing”) because Kerr is a triplex pump. *See* EX1003, ¶¶86-98. As Petitioner’s expert Mr. Marscher explains, the POSITA would understand that each plunger arrangement of a triplex pump has the same structure, and therefore, the “second” recitations of the Foster claims would have been obvious to the POSITA. *See, e.g.*, EX1003, ¶¶89, 94, 98. For ease of description, the recitations are being addressed using the labels provided by the Claims Listing Appendix.

i.       **Claim 1**  
1.       **Recitation 1.P**

The preamble of claim 1 recites “A fluid end assembly.” Kerr includes a fluid end assembly as illustrated in the annotated figures from Kerr reproduced below.



**EX1004, 27, fluid end housing annotated in yellow**

|           |                                         |
|-----------|-----------------------------------------|
| KP-28     | Pony Rod Splash Guard                   |
| KP-29HP   | Fluid End Vessel Only                   |
| KP-29HPSS | Fluid End Vessel Only (Stainless Steel) |
| KM-37     | Pony End Gland Capscrew SS              |

**EX1004, 29**

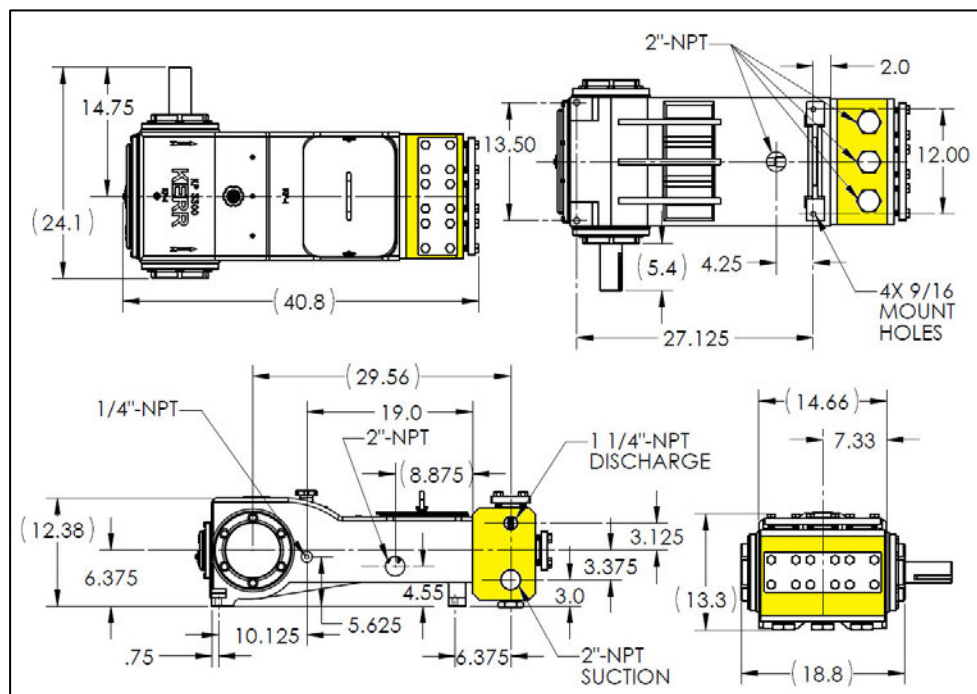
Furthermore, the text of Kerr explains that Kerr includes a fluid end:

Power End/Fluid End Connection: A common misconception is that there is some form of fluid seal between the power end and **the fluid end**. This is false. The fluid end is merely bolted to the power frame. ... On models KP-3300, KT-3350/KT-3400 and R335/R340 the bolted in stuffing box assemblies must be removed prior to removal **of the entire fluid end**. They are held in place by four studs each.

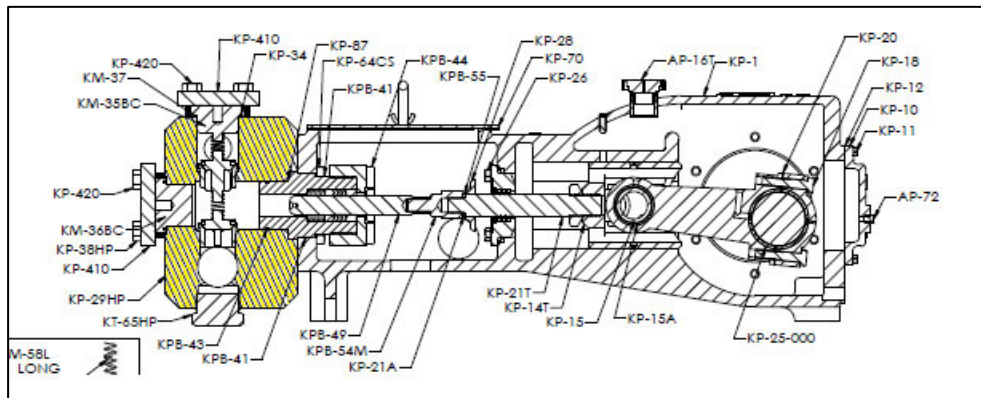
EX1004, 12 (emphasis added).

## 2. Recitation 1.a

The housing of the Kerr fluid end is “made of a single integrally formed piece,” and therefore, Kerr includes “a housing” as recited in Recitation 1.a. As illustrated in the figures from Kerr reproduced below, the Kerr fluid end housing is illustrated as a single piece with no breaks or seams. EX1003, ¶84. As Mr. Marscher explains, these illustrations would indicate to the POSITA that the Kerr fluid end housing is “made of a single integrally formed piece.” EX1003, ¶84. As also explained by Mr. Marscher, fluid ends are conventionally made of a single integrally formed piece: “because of the high pressure developed and contained therein; in order to not split the fluid end housing, the housings are machined as an integral piece or ‘monoblock.’” EX1003, ¶84.



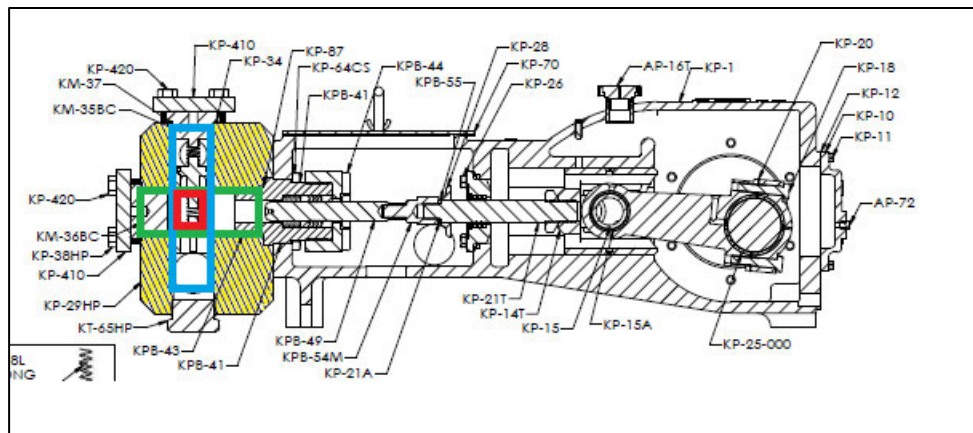
**EX1004, 25, fluid end housing annotated in yellow**



**EX1004, 27, fluid end housing annotated in yellow**

### 3. Recitation 1.b

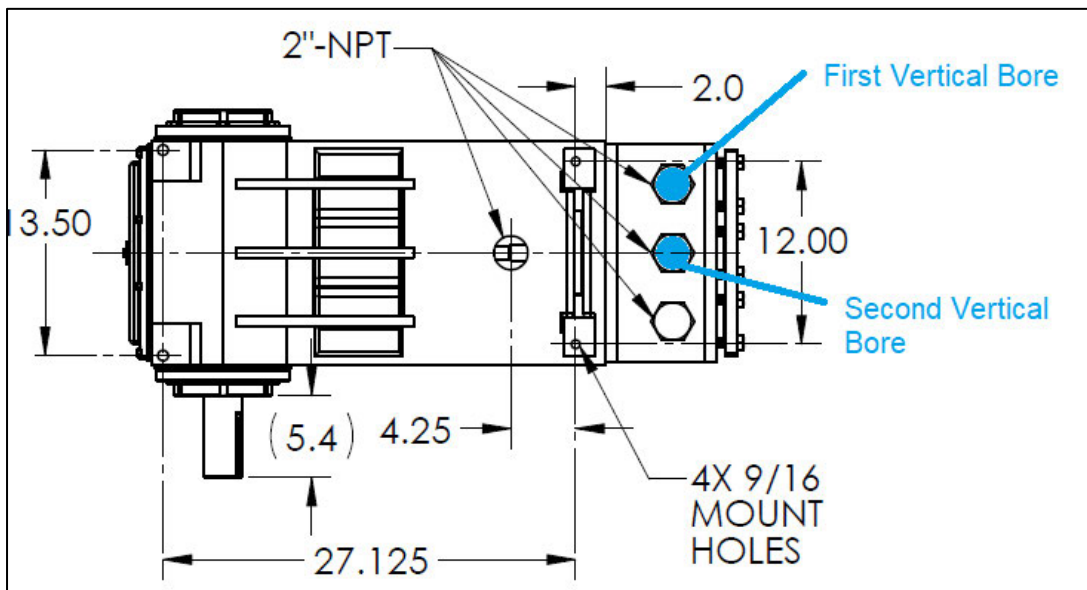
Kerr includes “a first horizontal bore and a first vertical bore formed within the housing, the first vertical bore intersecting the first horizontal bore to form a first internal chamber.” As illustrated in the annotated figures below, the Kerr fluid end includes an internal chamber (red) formed at the intersection of a vertical bore (blue) and horizontal bore (green). EX1003, ¶85. As also explained by Mr. Marscher, such an internal chamber formed from the intersection of a vertical bore and a horizontal bore “is a conventional part of a fluid end, as illustrated in” the prior art discussed in section IV.b-f. EX1003, ¶85.



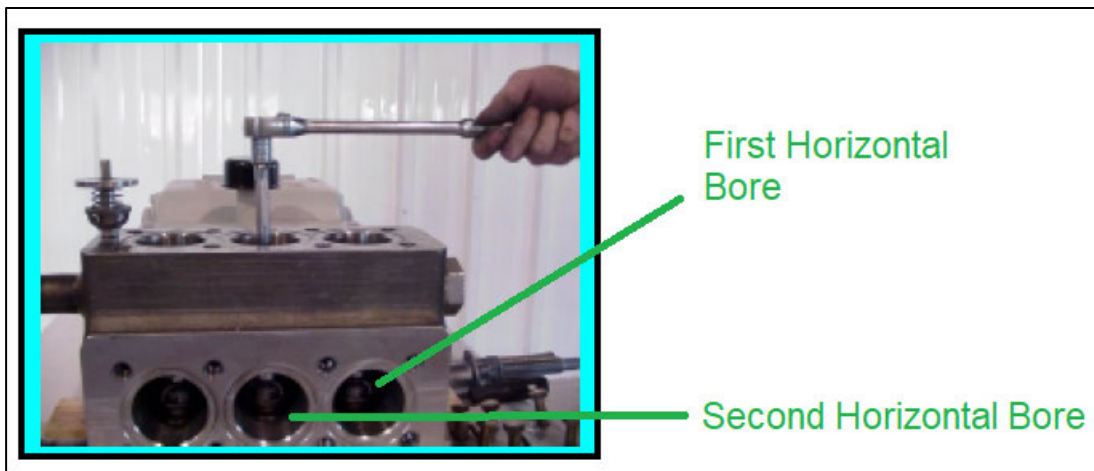
Provided below is a comparison of the internal structure of the Kerr fluid end (left) with the Foster fluid end (right), with the respective internal chambers annotated in red, the respective horizontal bores annotated in green and the respective vertical bores annotated in blue.



Recitation 1.c recites “a second horizontal bore and a second vertical bore formed within the housing, the second vertical bore intersecting the second horizontal bore to form a second internal chamber.” The “second vertical bore” is explicitly illustrated in the following figure from Kerr. EX1003, ¶¶86-87.

**EX1004, 25 (annotated)**

A “second horizontal bore” is illustrated in the following figure from Kerr.

**EX1004, 20 (annotated)**

The “second internal chamber” is not explicitly shown in Kerr. As Mr. Marscher explains, however, such an internal chamber would have been obvious to the POSITA:

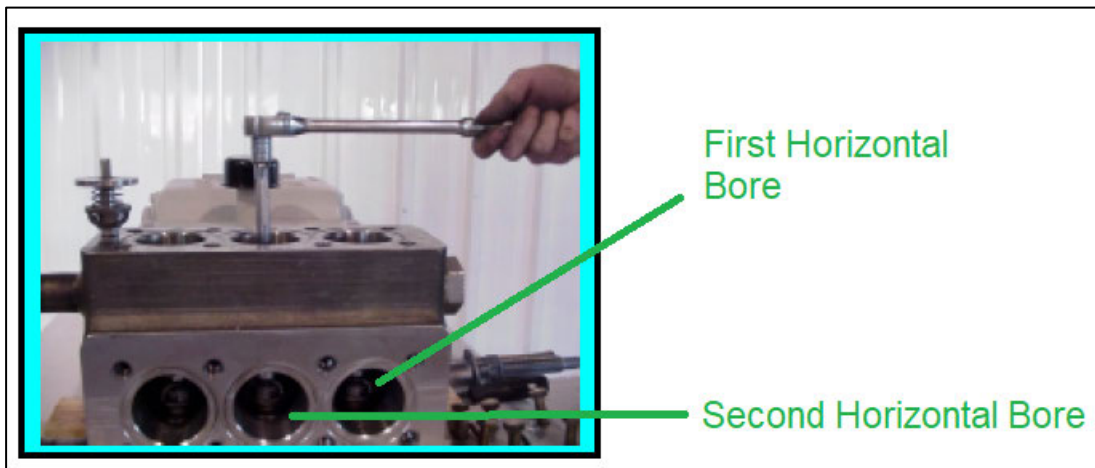
“Second” as used here refers to the bores associated with a second of the plungers of the example triplex pump. Only one such

plunger assembly is illustrated in the drawings (*e.g.*, the annotated above) because the POSITA would understand from this being a triplex pump that each plunger assembly is one of a homologous series (of three in this case, given the triplex pump being the example), each member of which has the same structure. It would, therefore, have been obvious to the person of ordinary skill in the art that the Kerr Pump has these features, as would be typical of any reciprocating power pump.

EX1003, ¶89 (citations omitted).

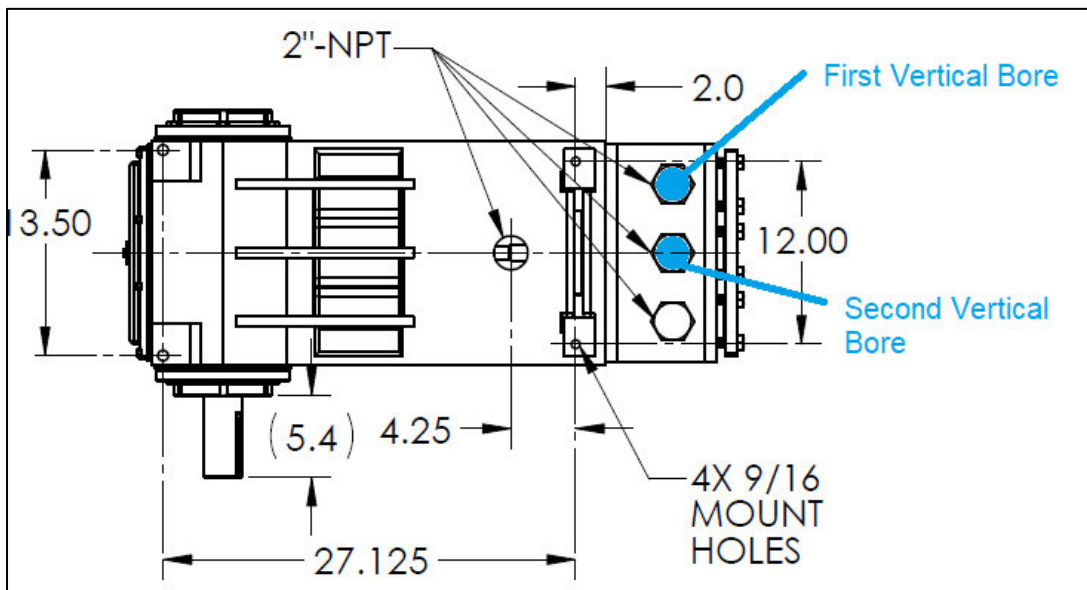
### 5. Recitation 1.d

Kerr illustrates the “second horizontal bore” in a “side-by-side relationship with the first horizontal bore,” as illustrated below.



### EX1004, 20 (annotated)

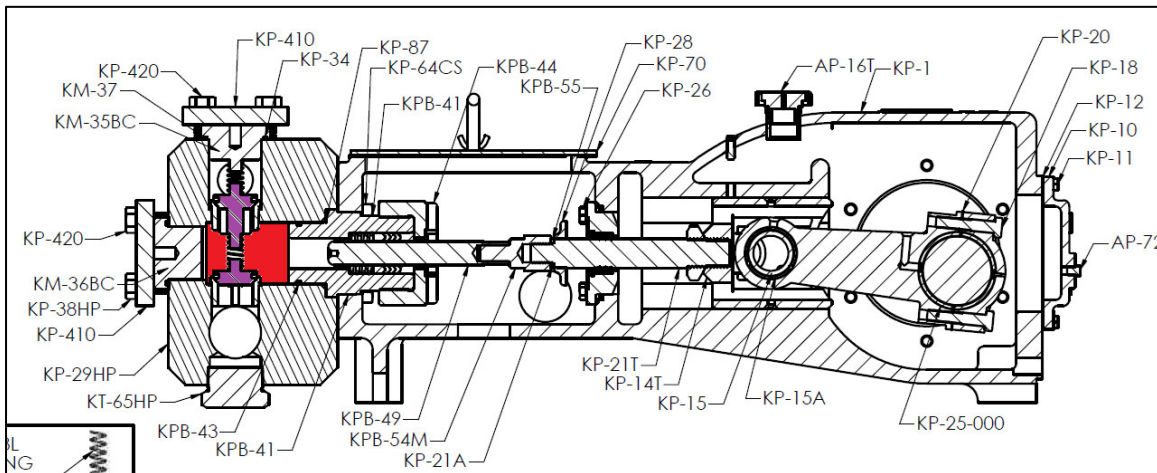
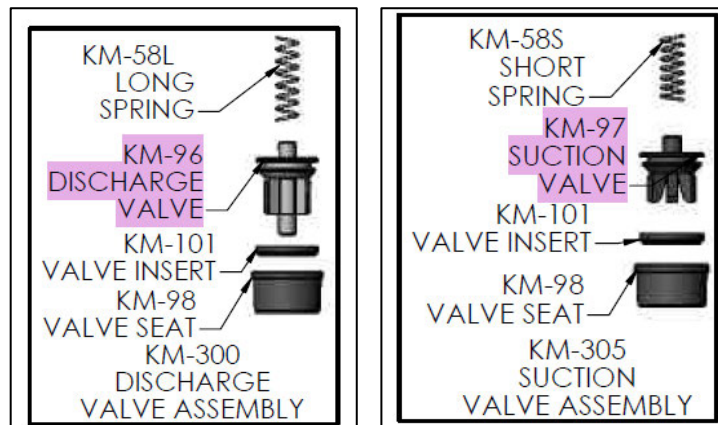
Kerr illustrates the “second vertical bore” in a “side-by-side relationship with ... the first vertical bore,” as illustrated below.

**EX1004, 25 (annotated)**

Kerr does not explicitly illustrate the “second internal chamber” in a “side-by-side relationship with ... the first internal chamber.” As Mr. Marscher explains, however, a side-by-side arrangement of first and second internal chambers would have been obvious to the POSITA. EX1003, ¶90. Accordingly, Kerr includes the features of recitation 1.d.

## **6. Recitation 1.e**

Kerr includes “a first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber.” EX1003, ¶¶91-92. As illustrated below in the annotated figures from Kerr, discharge valve KM-96 is arranged on the opposite side of the internal chamber (annotated in red) from the suction valve KM-97. EX1003, ¶¶91-92.

**EX1004, 27 (annotated)****EX1004, 27 (annotated)**

## 7. Recitation 1.f

Kerr does not explicitly illustrate “a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal chamber.” Nevertheless, as Mr. Marscher explains, such a “second pair of valves” would have been obvious to the POSITA:

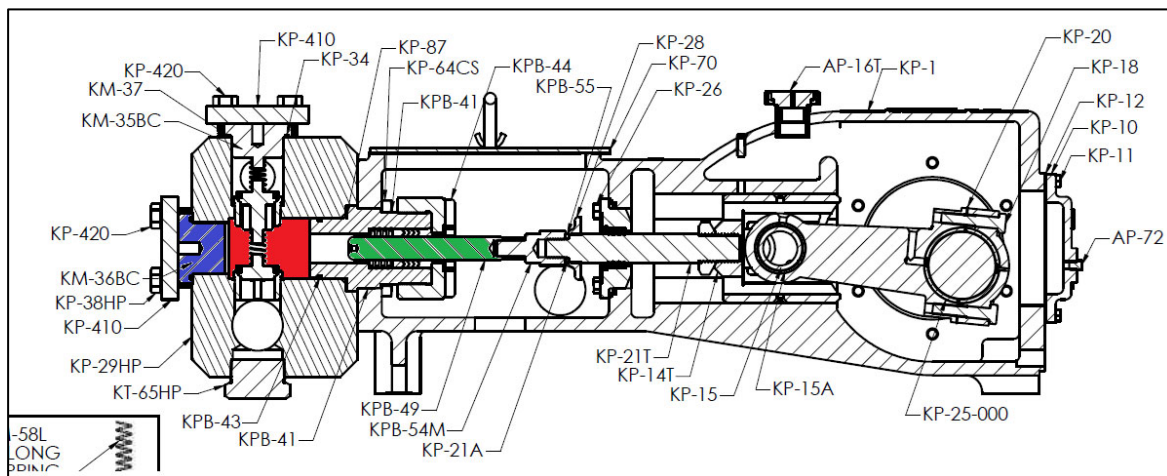
“Second” as used here refers to the pair of valves associated with a second of the plungers of the example triplex pump. Only one such plunger assembly is illustrated in the drawings (*e.g.* the annotated below [i.e., the same figures annotated above illustrating the “first pair

of valves]) because the POSITA would understand from this being a triplex pump that each plunger assembly is one of a homologous series ... it would have been obvious to the person of ordinary skill in the art that the Kerr Pump has these features, as would be typical of any reciprocating power pump.

EX1003, ¶94 (citations omitted).

### 8. Recitation 1.g

Kerr includes “a first plug and a first reciprocating plunger installed within the first horizontal bore and positioned on opposite sides of the first internal chamber,” as illustrated in the annotated figure from Kerr below. *See also* EX1003, ¶96. As illustrated, a plug (blue) is installed within the horizontal bore on the opposite side of the internal chamber (red) from the plunger (green).



**EX1004, 27 (annotated)**

### 9. Recitation 1.h

Kerr does not explicitly illustrate “a second plug and a second reciprocating plunger installed within the second horizontal bore and positioned on opposite sides

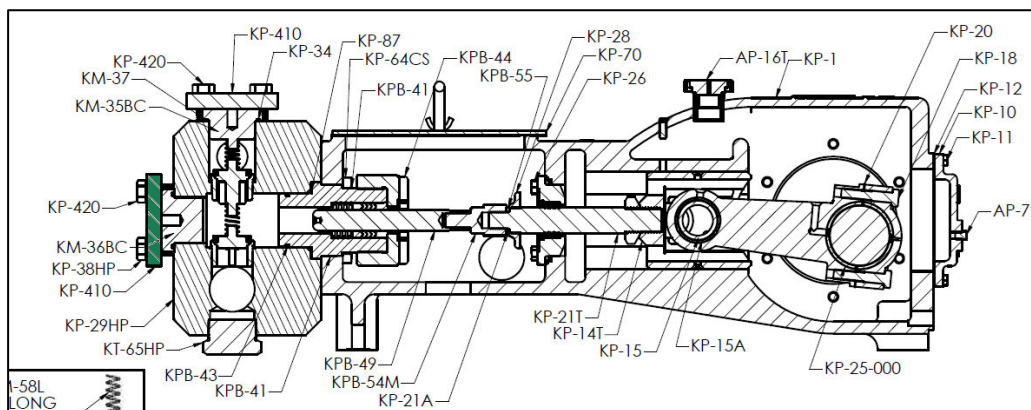
of the second internal chamber.” As Mr. Marscher explains, however, such a “second plug” and “second plunger” would have been obvious to the POSITA:

“Second” as used here refers to the plug and plunger associated with a second of the plunger assemblies of the example triplex pump. Only one such plunger assembly is illustrated in the drawings (*e.g.* the annotated below) because the POSITA would understand from this being a triplex pump that each plunger assembly is one of a homologous series ... it would have been obvious to the person of ordinary skill in the art that the Kerr Pump has these features, as would be typical of any reciprocating power pump.

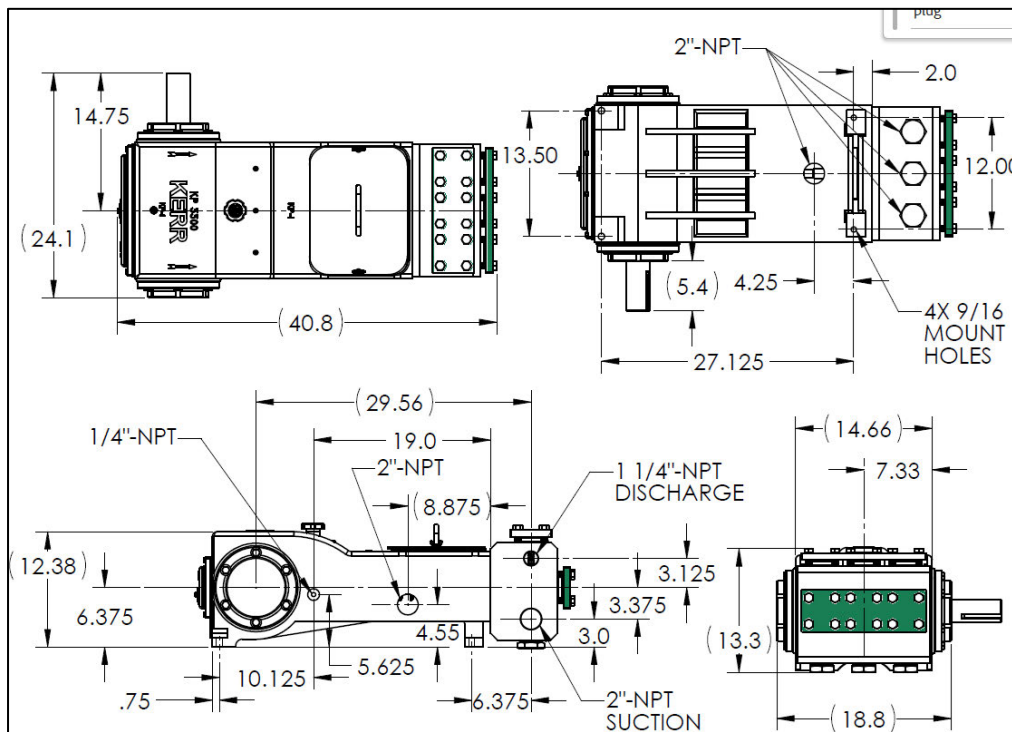
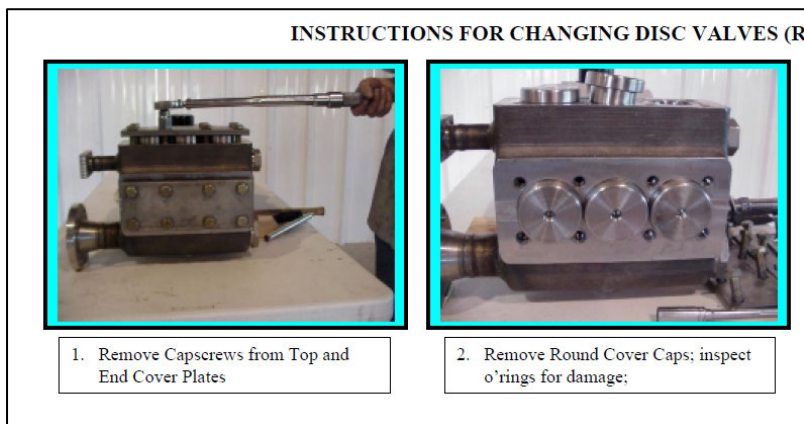
EX1003, ¶98 (citations omitted).

#### 10. Recitation 1.i

Kerr includes “a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores” as illustrated below in the annotated figure from Kerr. *See also* EX1003, ¶¶99-100.

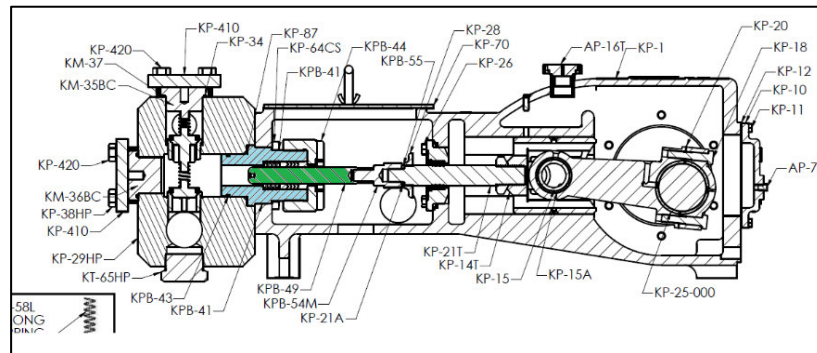


EX1004, 27 (annotated)

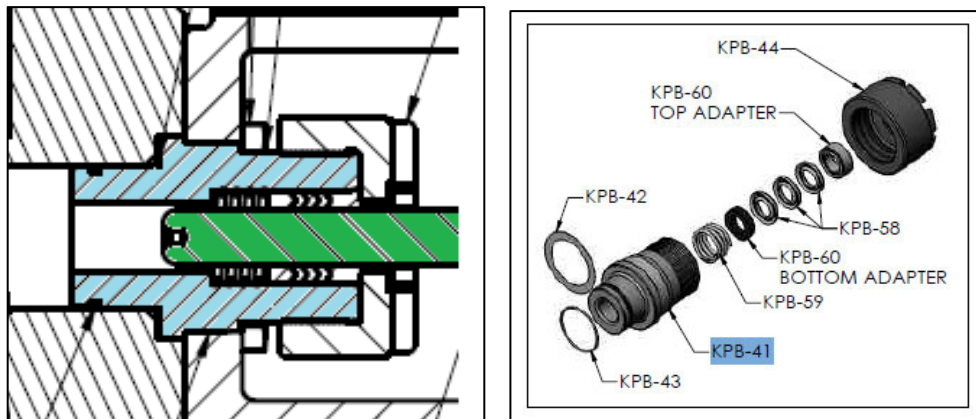
**EX1004, 25 (annotated)****EX1004, 20****11. Recitation 1.j**

Kerr includes “a first component having a central opening formed therein, at least a portion of the first component installed within the first horizontal bore and at least a portion of the first reciprocating plunger installed within the central opening of the first component.” EX1003, ¶101.

First, “component” is a broad term that could arguably refer to almost any structure arranged within the first horizontal bore other than the later recited “seals.” EX1003, ¶101. Foster, however, describes “stuffing box sleeves” as potential components. *See, e.g.*, EX1001 at 4:15-16, 6:66-67, 9:17-20, 11:2-4; *see also* EX1003, ¶101. Kerr includes a stuffing box sleeve (blue) with a central opening and the stuffing box sleeve is arranged within the first horizontal bore while a portion of a reciprocating plunger (green) is installed within the sleeve, as illustrated in the annotated figures below. *See also* EX1003, ¶101.



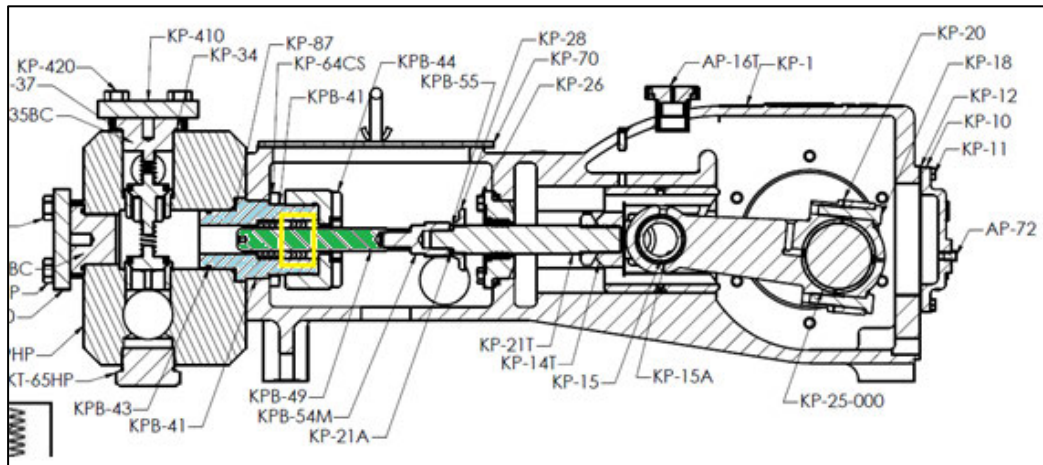
**EX1004, 27 (annotated)**



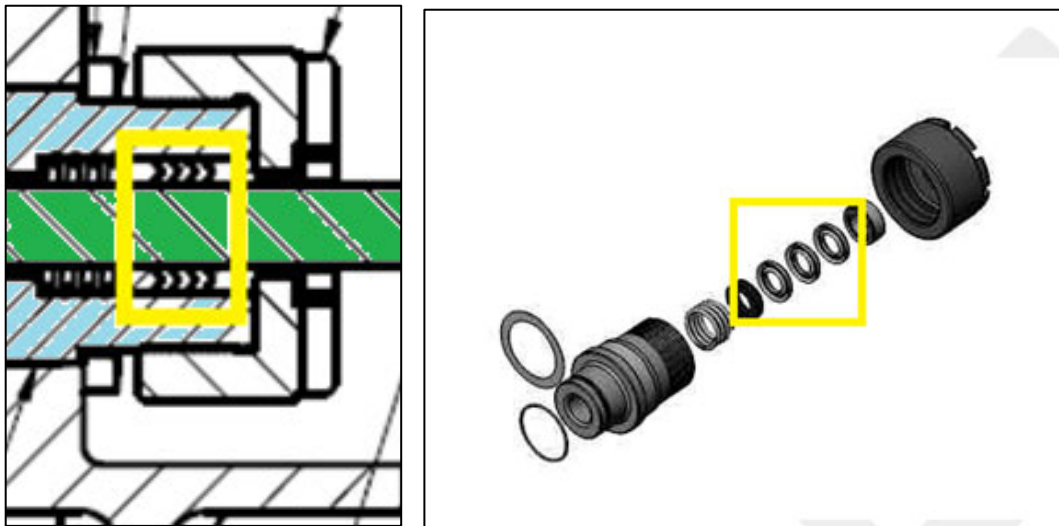
**EX1004, 27 (annotated)**

## 12. Recitation 1.k

Kerr includes “a first plurality of packing seals installed within the first component and engaging the first reciprocating plunger,” as illustrated in the annotated figures below from Kerr. EX1003, ¶102.



**EX1004, 27 (annotated)**

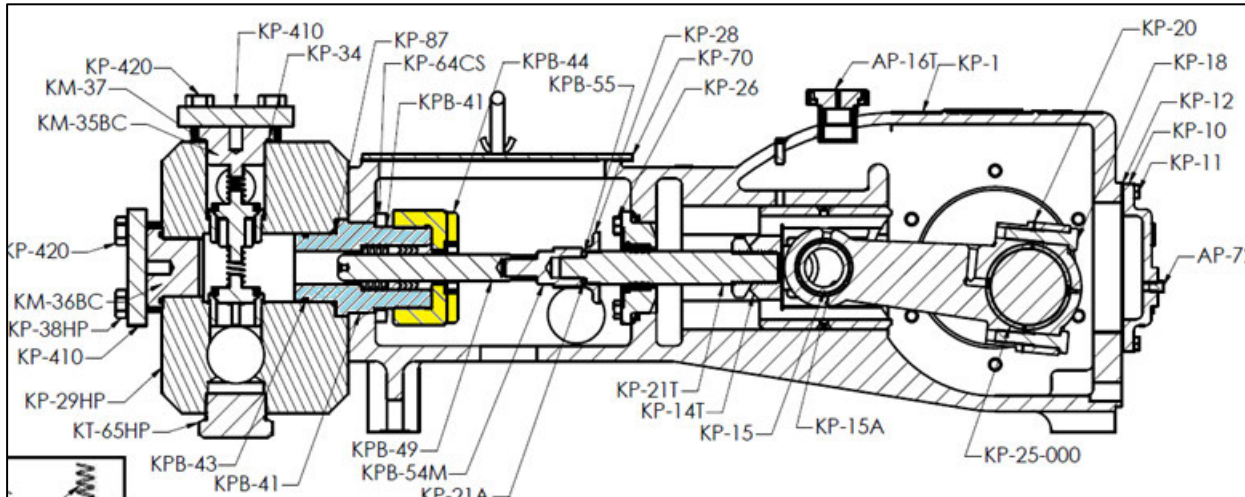


**EX1004, 27 (annotated)**

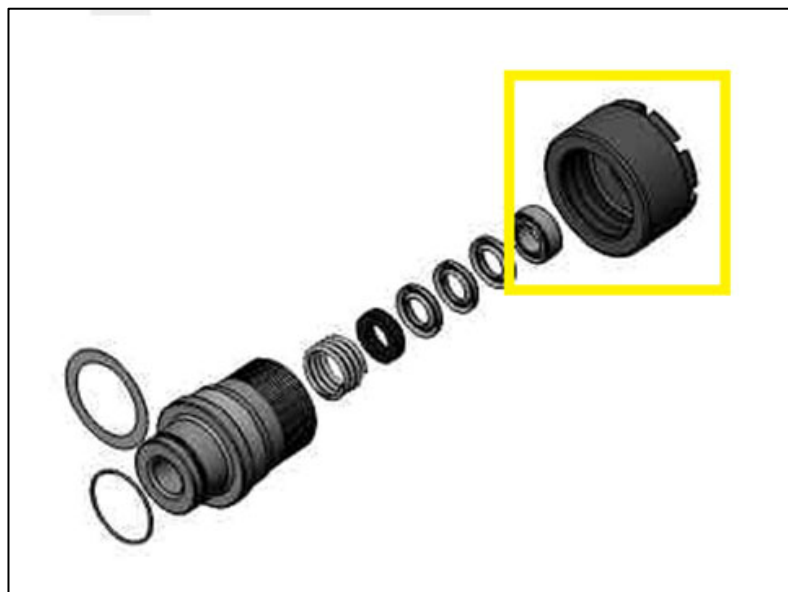
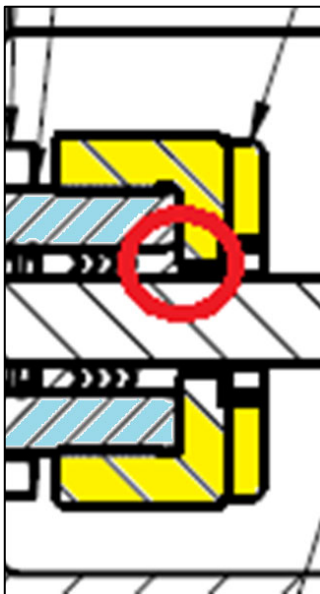
As indicated in the annotated figures above, the seals (yellow), which are arranged within the component/sleeve (blue) engage the reciprocating plunger (green). EX1003, ¶102.

### 13. Recitation 1.1

Kerr includes “a first packing nut attached to the first component and holding the first plurality of packing seals within the first component,” as illustrated in the annotated figures provided below. EX1003, ¶¶103-104.



EX1004, 27 (annotated)



EX1004, 27 (annotated)

The Kerr packing nut (yellow) is attached to the component/sleeve (blue) and holds the seals within the component/sleeve, as indicated via the red circle. As Mr. Marscher, explains:

[T]he packing nut (annotated in yellow) is attached to the sleeve with threading. This mimics how any packing nut “hold[s] the first plurality of packing seals within the first component” due to the compression of the packing. If there is no nut, then all the packing loses its fit and function, because the pressure ahead of the plunger would push it from the bore, and it could not seal around the plunger. This nut not only compresses the packing rings to squeeze out radial clearance around the plunger through which fluid could leak, but acts to hold the packing rings in the sleeve and as an additional fluid barrier at the rear of the packing box assembly, essentially acting as a detachable rear end of the packing sleeve, as circled in red ...

EX1003, ¶104 (citations omitted).

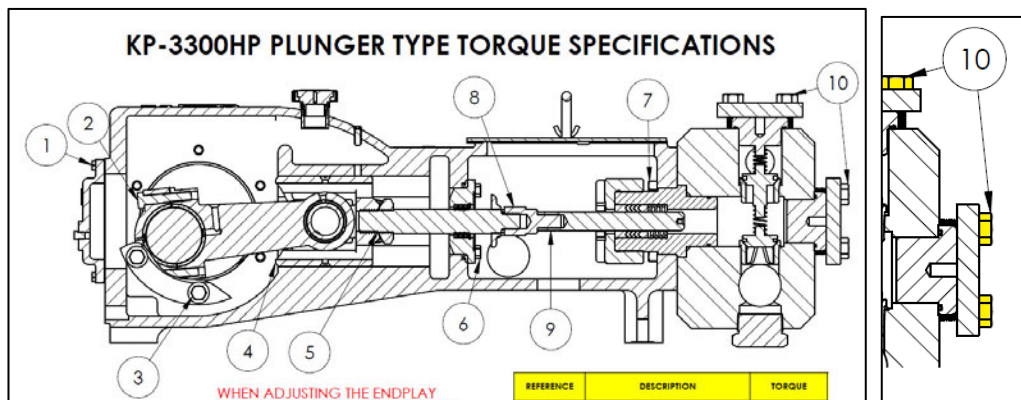
**ii. Claim 2**

**1. Recitation 2.a**

A plate that “comprises a plurality of fastener openings that align with a plurality of threaded openings formed in the housing in a one-to-one relationship” would have been obvious to the POSITA from Kerr. EX1003, ¶¶105-106.

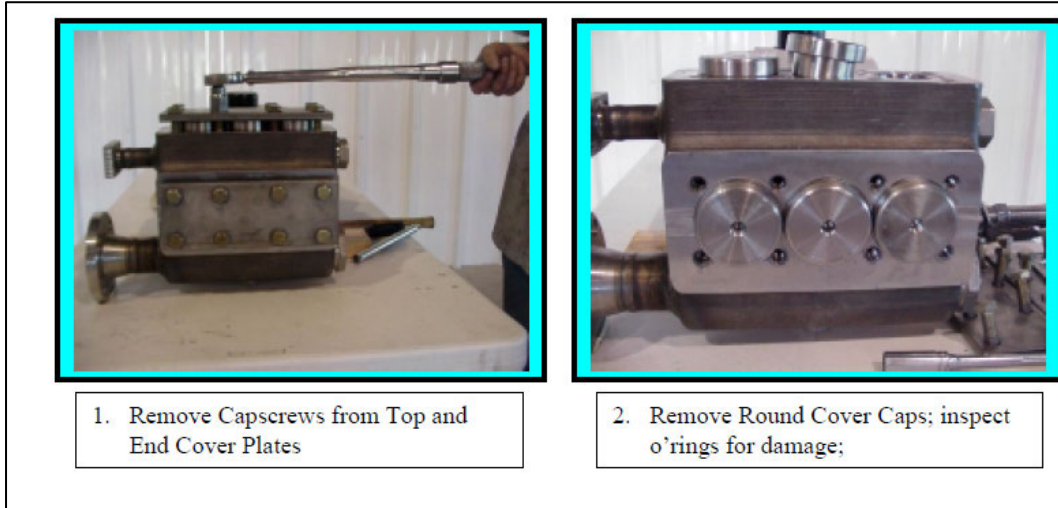
The figures from Kerr reproduced below illustrate that the cover plates of Kerr are secured to the housing using “capscrews” with hex heads. The POSITA would understand that these hex-headed capscrew fasteners pass through fastener openings

in the plate and engage with threaded openings formed in the housing in a one-to-one relationship to secure the plates to the fluid end housing. EX1003, ¶106. The threaded openings are not shown in sufficient detail to illustrate the actual threads. EX1003, ¶106. The presence of threads (in the fastener and its opposing hole or “opening”), however, would have been obvious to the POSITA given the fasteners are named “capscrew” fasteners, are illustrated with a hex head, and are illustrated being removed from the fluid end housing using a ratchet or torque wrench. EX1003, ¶106. The POSITA would understand that a screw, a type of threaded fastener, particularly one fastened and unfastened using a torque wrench, would need to engage with a threaded opening in order to secure the plate to the housing. EX1003, ¶106. Accordingly, it would have been obvious to the POSITA that the openings formed in the fluid end housing would be threaded and would engaged with the capscrew fasteners that pass through fastener openings in the plate in a one-to-one relationship.

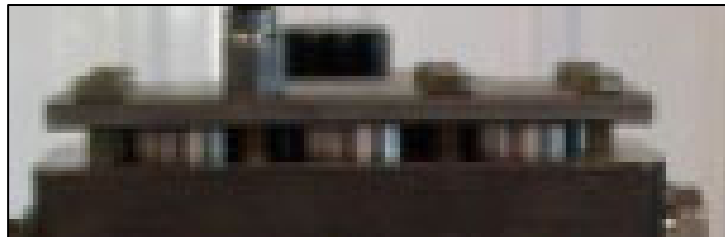


**EX1004, 26 (annotated)**

|    |                                |                    |
|----|--------------------------------|--------------------|
| 7  | PONT ROD CONNECTOR TO PONT ROD | 300 ft-lb [406 Nm] |
| 10 | FLUID END COVER PLATE CAPSCREW | 300 ft-lb [406 Nm] |

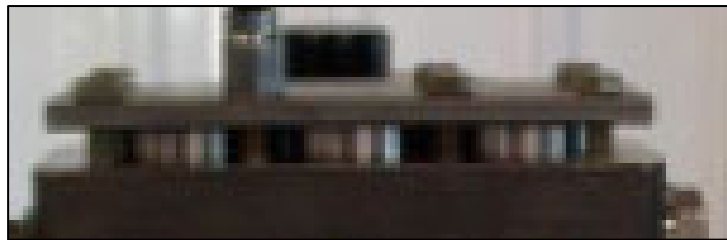
**EX1004, 26 (annotated)****EX1004, 20**

Furthermore, in the close-up detail provided below, the capscrew fasteners can be seen passing through the cover plate and into the fluid end housing, confirming the alignment and one-to-one relationship between the openings in the plate and threaded openings in the housing. EX1003, ¶107

**EX1004, 20****2. Recitation 2.b**

1. Similar to the discussion above for recitation 2.a, Kerr includes “a plurality of fasteners, each of the plurality of fasteners installed within a corresponding one of the aligned fastener openings and threaded openings.”

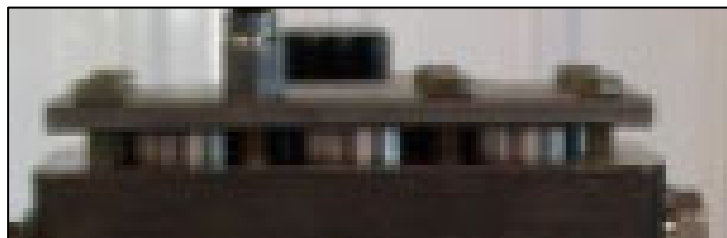
EX1003, ¶¶108-109. As discussed above, and as illustrated in the figures above, the POSITA would understand that the capscrew fasteners in Kerr are threaded fasteners that would be installed within the aligned fastener openings in the plate and the threaded openings in the housing. EX1003, ¶¶108-109. In fact, this arrangement of the capscrew fasteners is illustrated in the close-up detail from Kerr provided below. EX1003, ¶¶108-109.



**EX1004, 20**

**iii. Claim 3**

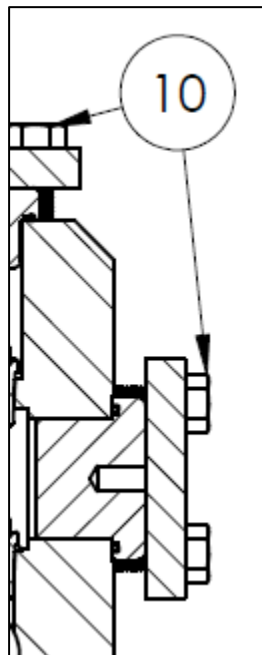
2. Similar to the discussion above directed to recitation 2.b, Kerr includes “a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing.” EX1003, ¶¶111-112. This arrangement of the Kerr capscrew fasteners is illustrated in the close-up detail from Kerr provided below. EX1003, ¶¶111-112.



**EX1004, 20**

**iv. Claim 4**

It would have been obvious to the POSITA that “each of the plurality of fasteners [in Kerr] is a threaded fastener.” EX1003, ¶¶113-114. The capscrew fasteners are not shown in sufficient detail to explicitly confirm that the fasteners are threaded. EX1003, ¶¶113-114. The threads, however, are suggested in the detail from Kerr provided below. EX1003, ¶¶113-114.

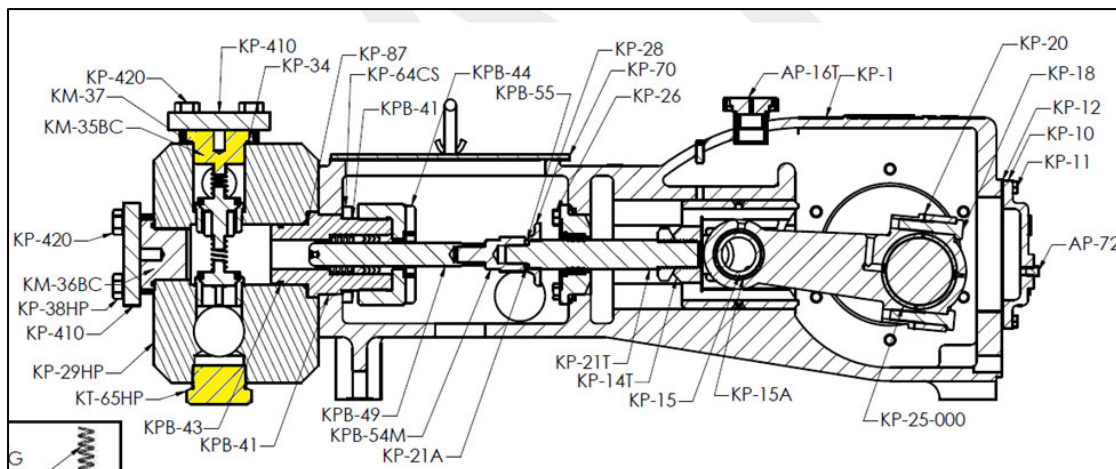
**EX1004, 26**

Furthermore, the use of a ratchet or torque wrench to fasten and unfasten the capscrews, as illustrated below, would strongly suggest, if not confirm, to the POSITA that the capscrews are threaded. EX1003, ¶115.

**EX1004, 20 (annotated)****v. Claim 5**

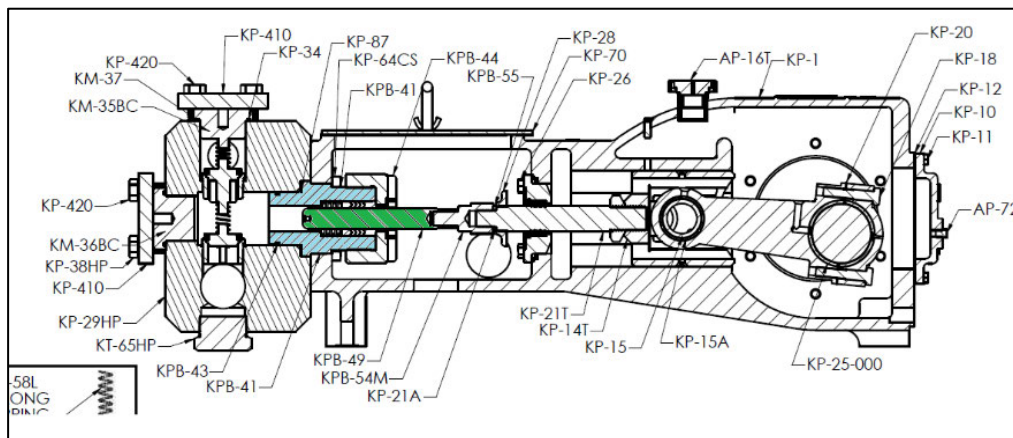
Kerr includes “a third plug installed within the first vertical bore and positioned between an external surface of the housing and one of the first pair of valves.” EX1003, ¶116.

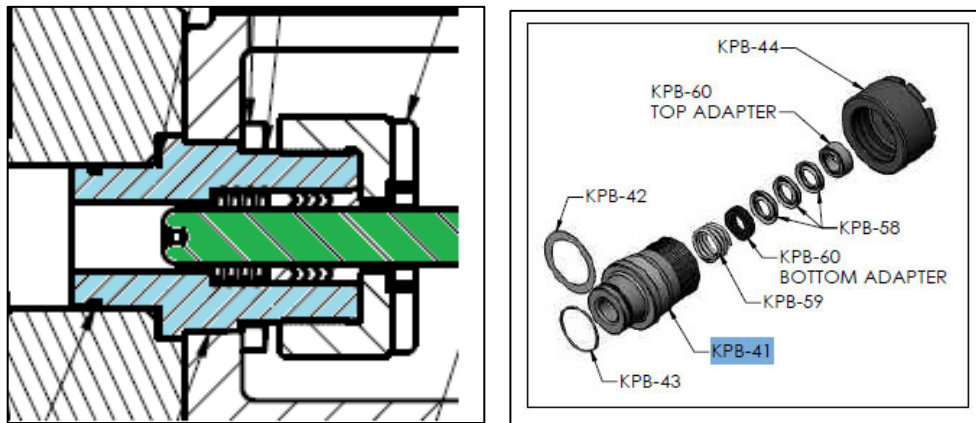
Claim 5 is recited broadly enough such that the “third plug” could arguably be arranged within the intake side of the vertical bore or the discharge side of the vertical bore. EX1003, ¶116. Kerr includes a plug in both sides of the vertical bore, as illustrated in the detail from Kerr provided below. EX1003, ¶116.



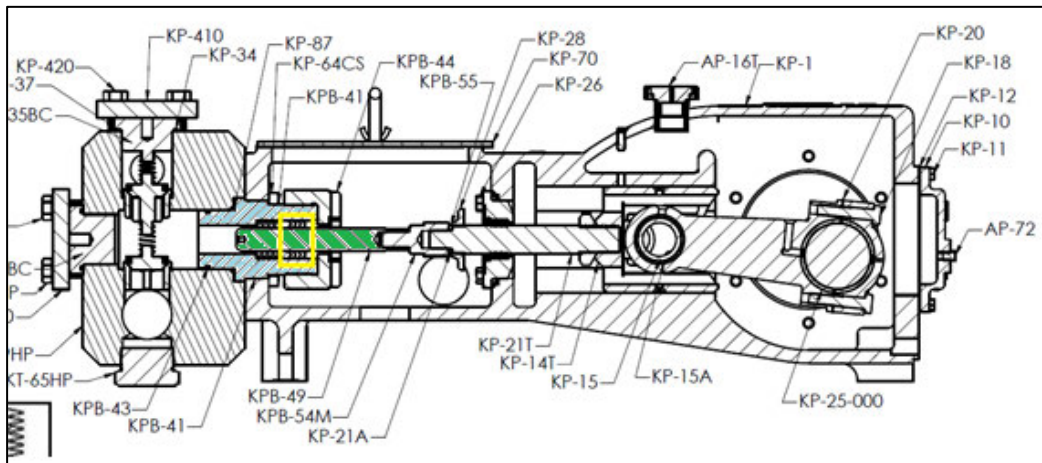
**EX1004, 27 (annotated)****vi. Claim 6****1. Recitation 6.a**

Kerr includes “a second component” as recited in recitation 6.a. EX1003, ¶¶117-118. As Mr. Marscher explains, “second” as used in this claim refers to “the corresponding ‘component’ for a second plunger assembly of a multiplex pump.” EX1003, ¶¶117-118. As also explained by Mr. Marscher, the POSITA would understand that each plunger assembly of a triplex pump (of which Kerr is an example) would have the same structure, including the same packing/stuffing box that surrounds and engages the plunger of the second plunger assembly. EX1003, ¶¶117-118. Accordingly, the annotated details from Kerr illustrate a “second component” as recited in recitation 6.a for reasons analogous to those presented with respect to recitation 1.j in section IX.a.i.11, *supra*.

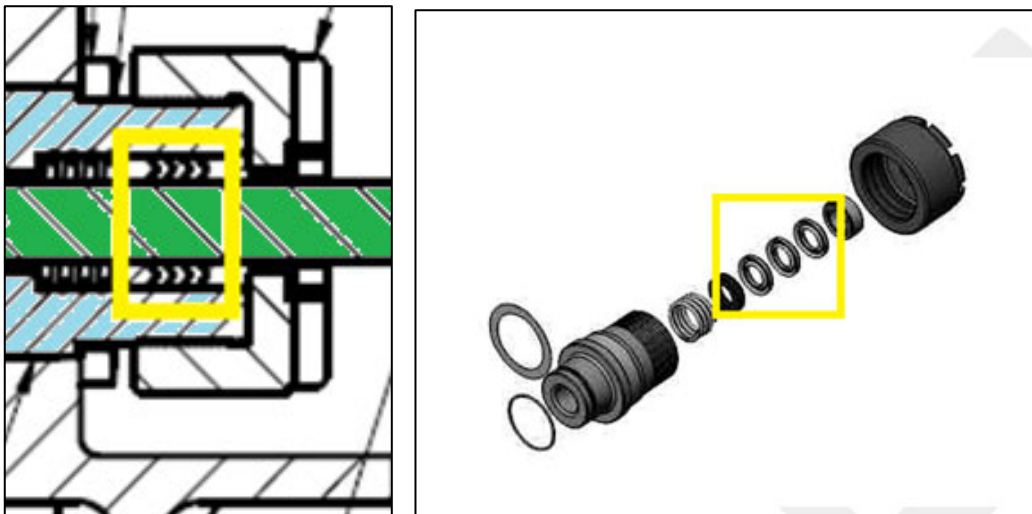
**EX1004, 27 (annotated)**

**EX1004, 27 (annotated)****2. Recitation 6.b**

Kerr includes “a second plurality of packing seals” as recited in recitation 6.b. EX1003, ¶¶119-120. As Mr. Marscher explains, “second” as used in this claim refers to “the corresponding ‘plurality of packing seals’ for a second plunger assembly of a multiplex pump.” EX1003, ¶¶119-120. As also explained by Mr. Marscher, the POSITA would understand that each plunger assembly of a triplex pump (of which Kerr is an example) would have the same structure, including the same packing seals that surround and engage the plunger of the second plunger assembly. EX1003, ¶¶119-120. Accordingly, the annotated details from Kerr illustrate a “second plurality of packing seals” as recited in recitation 6.b for reasons analogous to those presented with respect to recitation 1.k in section IX.a.i.12, *supra*.



EX1004, 27 (annotated)

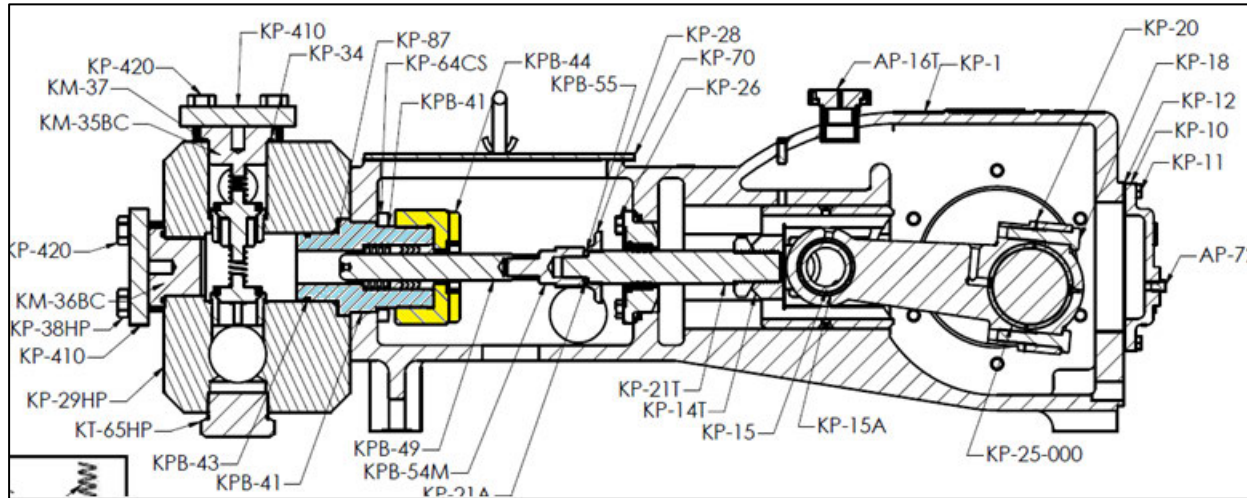


EX1004, 27 (annotated)

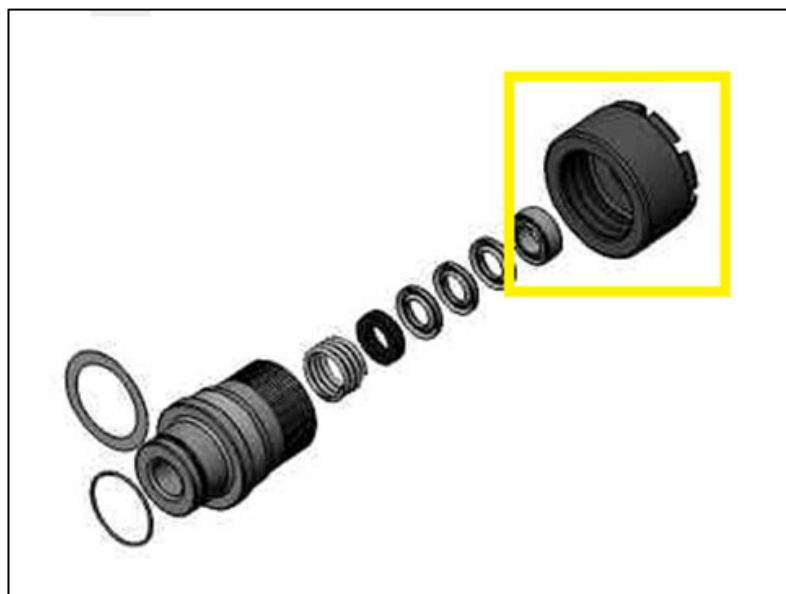
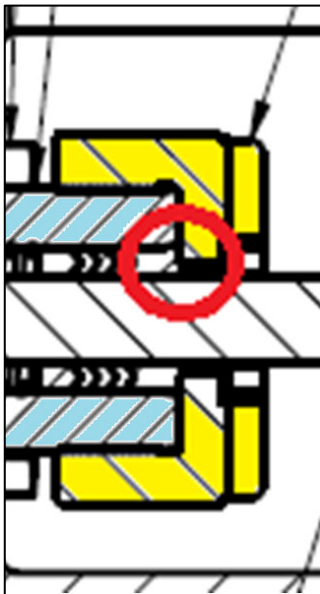
### 3. Recitation 6.c

Kerr includes “a second packing nut” as recited in recitation 6.c. EX1003, ¶¶121-122. As Mr. Marscher explains, “second” as used in this claim refers to “the corresponding ‘packing nut’ for a second plunger assembly of a multiplex pump.” EX1003, ¶¶121-122. As also explained by Mr. Marscher, the POSITA would understand that each plunger assembly of a triplex pump (of which Kerr is an example) would have the same structure, including the same packing nut that holds

the plurality of packing seals within the component of the second plunger assembly. EX1003, ¶¶121-122. Accordingly, the annotated details from Kerr illustrate a “second packing nut” as recited in recitation 6.c for reasons analogous to those presented with respect to recitation 1.1 in section IX.a.i.13, *supra*.



**EX1004, 27 (annotated)**



**EX1004, 27 (annotated)**

vii. Claim 7

**1. Recitation 7.P**

Recitation 7.P is analogous to recitation 1.P, and therefore, recitation 7.P is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.1, *infra*. See also EX1003, ¶¶123-126.

**2. Recitation 7.a**

Recitation 7.a is analogous to recitation 1.a, and therefore, recitation 7.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.2, *infra*. See also EX1003, ¶127.

**3. Recitation 7.b**

Recitation 7.b is analogous to recitation 1.b, and therefore, recitation 7.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.3, *infra*. See also EX1003, ¶128.

**4. Recitation 7.c**

Recitation 7.c is analogous to recitation 1.c, and therefore, recitation 7.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.4, *infra*. See also EX1003, ¶¶129-131.

**5. Recitation 7.d**

Recitation 7.d is analogous to recitation 1.d, and therefore, recitation 7.d is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.5, *infra*. See also EX1003, ¶132.

**6. Recitation 7.e**

Recitation 7.e is analogous to recitation 1.e, and therefore, recitation 7.e is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.6, *infra*. See also EX1003, ¶¶133-134.

**7. Recitation 7.f**

Recitation 7.f is analogous to recitation 1.f, and therefore, recitation 7.f is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.7, *infra*. See also EX1003, ¶¶135-136.

**8. Recitation 7.g**

Recitation 7.g is analogous to recitation 1.i, and therefore, recitation 7.g is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.10, *infra*. See also EX1003, ¶¶137-138.

**9. Recitation 7.h**

Recitation 7.h includes recitations analogous to recitation 1.j, and therefore, recitation 7.h is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.11, *infra*. See also EX1003, ¶139.

**10. Recitation 7.i**

Recitation 7.i is analogous to the “reciprocating plunger” features of recitation 1.g and 1.j, and therefore, recitation 7.i is disclosed or would have been obvious for reasons analogous to those directed to the “first reciprocating plunger” presented in section IX.a.i.8 and IX.a.i.11, *infra*. See also EX1003, ¶140.

**11. Recitation 7.j**

Recitation 7.j is analogous to recitation 1.k, and therefore, recitation 7.j is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.12, *infra*. See also EX1003, ¶141.

**12. Recitation 7.k**

Recitation 7.k is analogous to recitation 1.l, and therefore, recitation 7.k is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.13, *infra*. See also EX1003, ¶¶142-143.

**viii. Claim 8****1. Recitation 8.a**

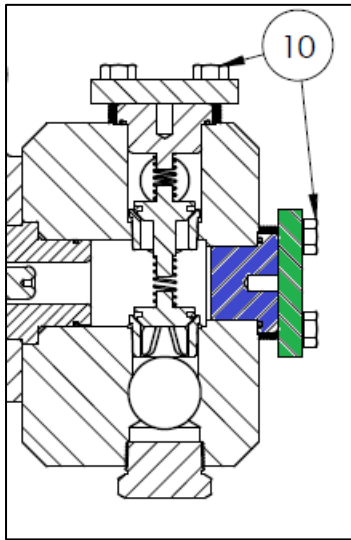
Recitation 8.a is analogous to recitation 1.g, and therefore, recitation 8.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.8, *infra*. See also EX1003, ¶¶144-145.

**2. Recitation 8.b**

Recitation 8.b is analogous to recitation 1.h, and therefore, recitation 8.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.i.9, *infra*. See also EX1003, ¶¶146-147.

**3. Recitation 8.c**

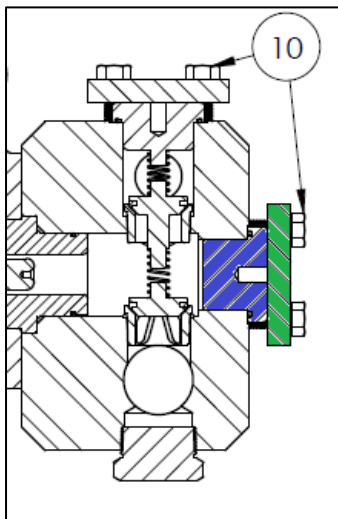
The “first plug” of Kerr is “positioned adjacent the plate,” as illustrated in the annotated figure provided below. Specifically, the first plug (blue) is adjacent to the plate (green), and also abuts the plate. EX1003, ¶¶148-149.



**EX1004, 26, annotated.**

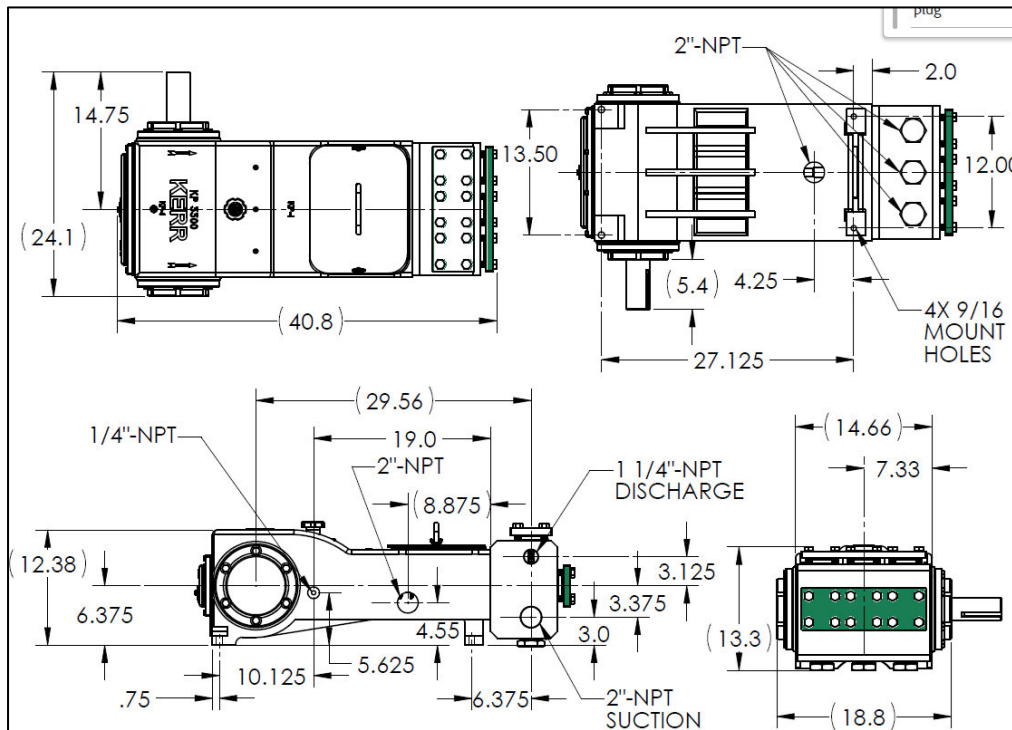
**4. Recitation 8.d**

The “second plug” of Kerr is positioned adjacent the plate.” As Mr. Marscher explains, the “second plug” would have the same structure as the “first plug.” Accordingly, the “second plug” of Kerr is “positioned adjacent the plate,” as illustrated in the annotated figure provided below. Specifically, the first plug (blue) is adjacent to the plate (green), and also abuts the plate. EX1003, ¶¶150-151.

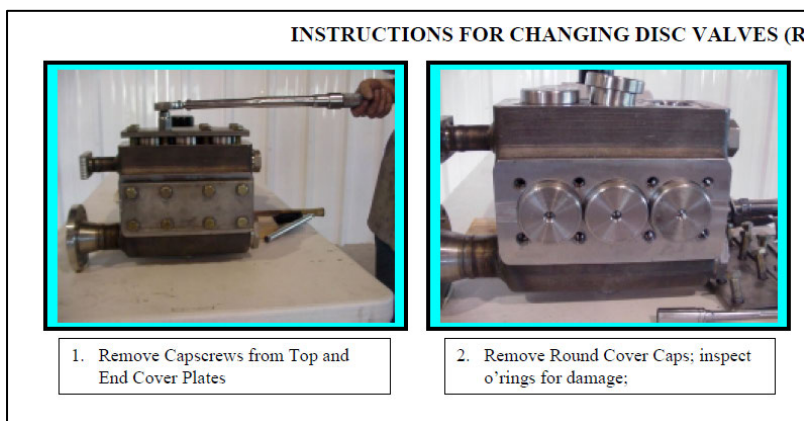


**EX1004, 26 (annotated)**

For completeness, it is noted that the plate of Kerr covers both horizontal bores of the fluid end, as illustrated below. EX1003, ¶149. This confirms that the plate is adjacent to and abuts both of the “first plug” and the “second plug.”



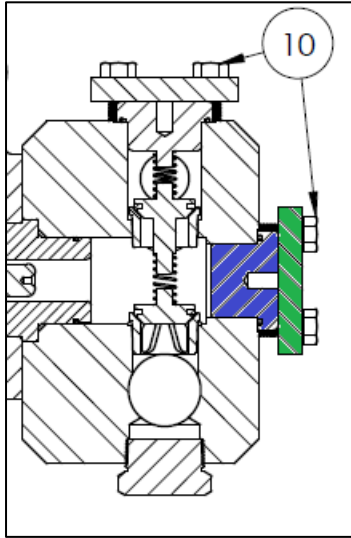
**EX1004, 25 (annotated)**



**EX1004, 20**

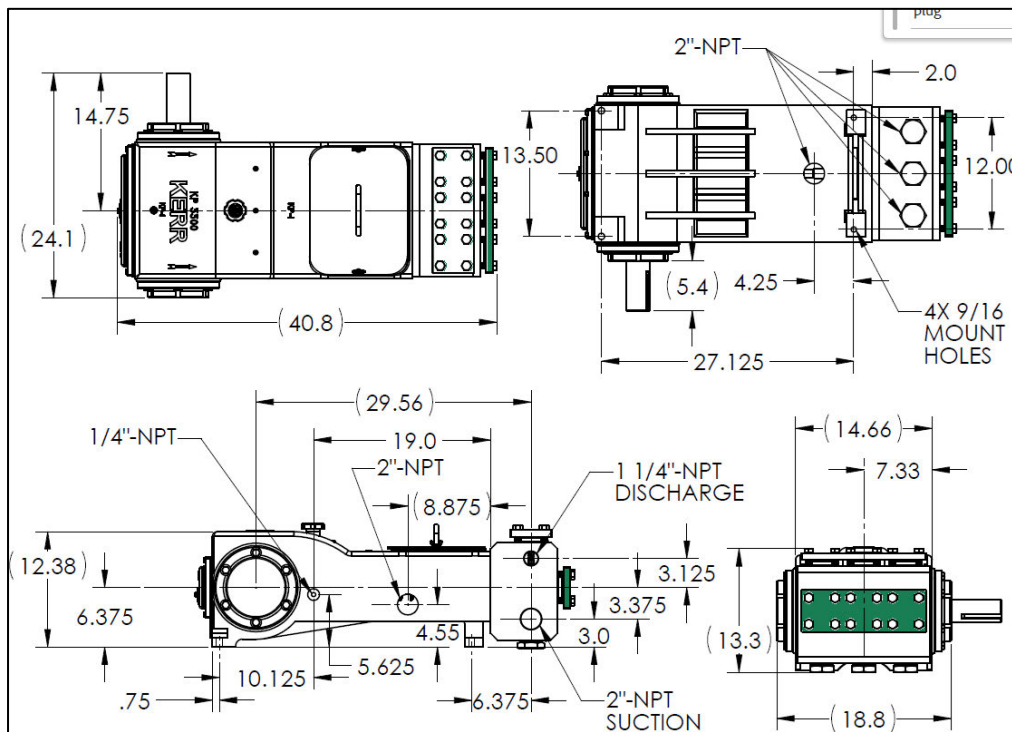
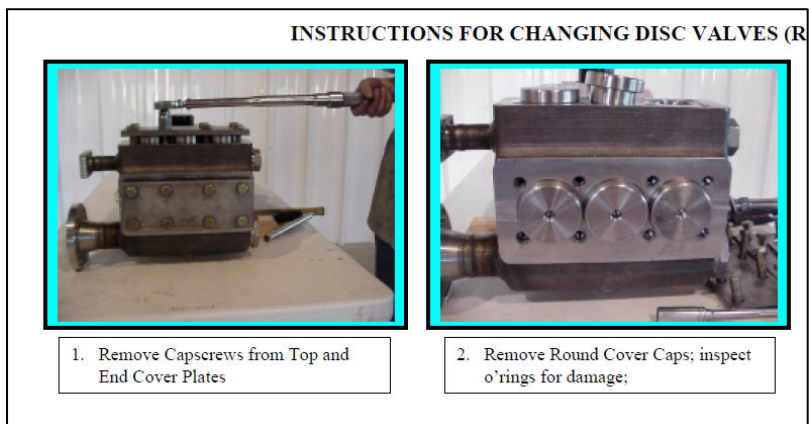
**i. Claim 9**

As explained above, the plate of Kerr is adjacent to and abuts the “first plug” and the “second plug.” As illustrated in the annotated figure provided below. Specifically, the plate (green) abuts the first plug (blue). EX1003, ¶152.



**EX1004, 26 (annotated)**

As Mr. Marscher explains, the “second plug” would have the same structure as the first plug. Accordingly, the plate (green) also abuts the second plug (blue). EX1003, ¶152. For completeness, it is noted that the plate of Kerr covers both horizontal bores of the fluid end, as illustrated below. EX1003, ¶149. This confirms that the plate abuts both of the “first plug” and the “second plug.”

**EX1004, 25 (annotated)****EX1004, 20****ii. Claim 10**

Claim 10 is analogous to recitation claim 5, and therefore, claim 10 is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.v, *infra*. See also EX1003, ¶153.

**iii. Claim 11****1. Recitation 11.a**

Recitation 11.a is analogous to recitation 2.a, and therefore, recitation 11.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.ii.1, *infra*. See also EX1003, ¶¶154-156.

**2. Recitation 11.b**

Recitation 11.b is analogous to recitation 2.b, and therefore, recitation 11.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.ii.2, *infra*. See also EX1003, ¶¶157-159.

**iv. Claim 12**

Claim 12 is analogous to claim 3, and therefore, claim 12 is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.iii, *infra*. See also EX1003, ¶¶160-161.

**v. Claim 13**

Claim 13 is analogous to claim 4, and therefore, claim 13 is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.iv, *infra*. See also EX1003, ¶¶162-163.

**vi. Claim 14****1. Recitation 14.a**

Recitation 14.a is analogous to recitation 6.a, and therefore, recitation 14.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.vi.1, *infra*. See also EX1003, ¶164.

**2. Recitation 14.b**

Recitation 14.b is a combination of the features of recitations 1.h and 6.a. Therefore, recitation 14.b is disclosed or would have been obvious for reasons analogous to those presented in sections IX.a.i.9 and IX.a.vi.1, *infra*. See also EX1003, ¶165.

**3. Recitation 14.c**

Recitation 14.c is analogous to recitation 6.b, and therefore, recitation 14.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.vi.2, *infra*. See also EX1003, ¶¶167-168.

**4. Recitation 14.d**

Recitation 14.c is analogous to recitation 6.c, and therefore, recitation 14.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.a.vi.3, *infra*. See also EX1003, ¶¶169-170.

**b) Ground 2**

Each of claims 1-14 of Foster is invalid as obvious over Apex as modified to use the stuffing/packing assembly of Stanton. As is detailed below, Apex explicitly

illustrates the elements of claims 1-14 directed to the fluid end housing. EX1003, ¶¶172-266. The elements of the claims directed to the “first component,” “second component,” “first plurality of seals,” “second plurality of seals,” “first packing nut” and “second packing nut” would have been an obvious modification to Apex based upon the teachings of Stanton. EX1003, ¶¶172-266.

As Petitioner’s expert Mr. Marscher explains, the POSITA would have understood that replacing the packing/stuffing arrangement of Apex with that of Stanton would be replacing one known method of providing packing to a plunger pump with another with predictable results. EX1003, ¶¶189, 236. Furthermore, the POSITA would be motivated to make such a modification because the POSITA would understand that providing the packing/stuffing arrangement at least partially within the fluid end housing, as is illustrated in Stanton, may provide improved pressure/fluid isolation compared with the packing bolted to the outside of the fluid end as constructed in Apex. EX1003, ¶¶189, 236.

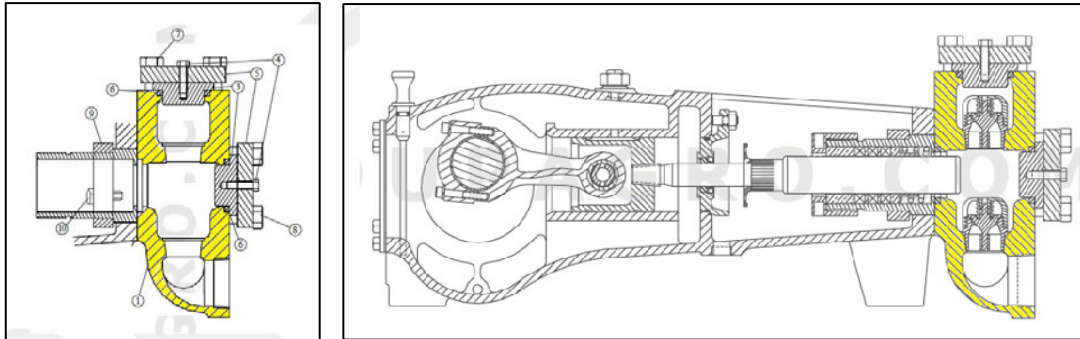
**i. Claim 1**

**1. Recitation 1.P**

The preamble of claim 1 recites “A fluid end assembly.” Apex includes a fluid end assembly as illustrated in the annotated figures from Kerr reproduced below. EX1003, ¶¶173-175.

|                                          |    |
|------------------------------------------|----|
| FLUID END ASSEMBLY<br>DUCTILE IRON ..... | 38 |
|------------------------------------------|----|

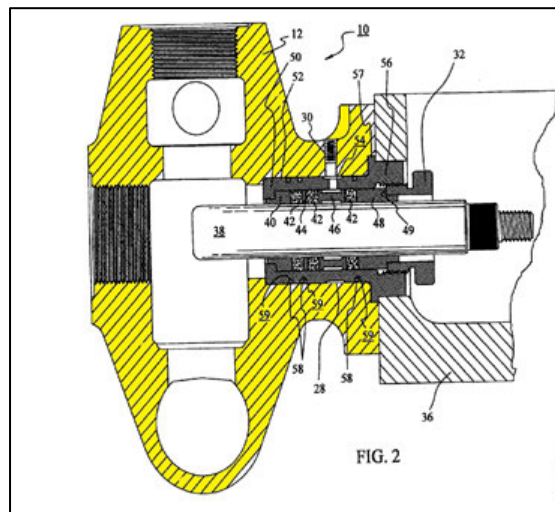
### EX1005, 3 (annotated)



### EX1005, 7, 38 (fluid end housing annotated in yellow)

For completeness, it is noted that Stanton also discloses a fluid end. EX1003,

¶175.

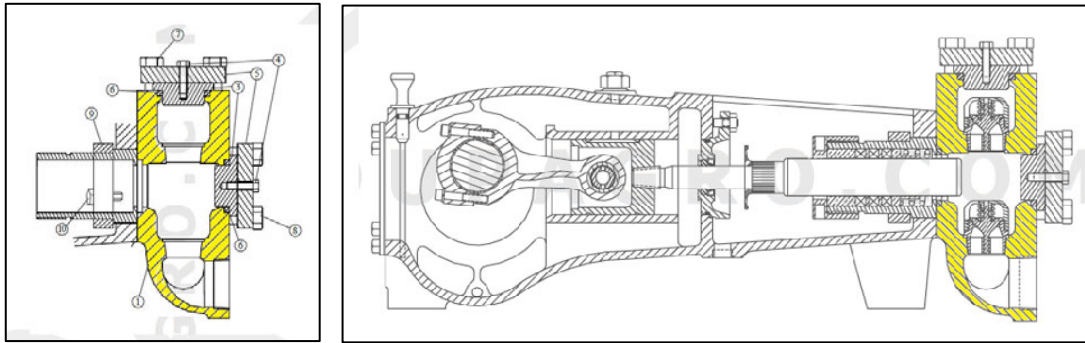


### EX1007, FIG. 2 (fluid end housing annotated in yellow)

#### 2. Recitation 1.a

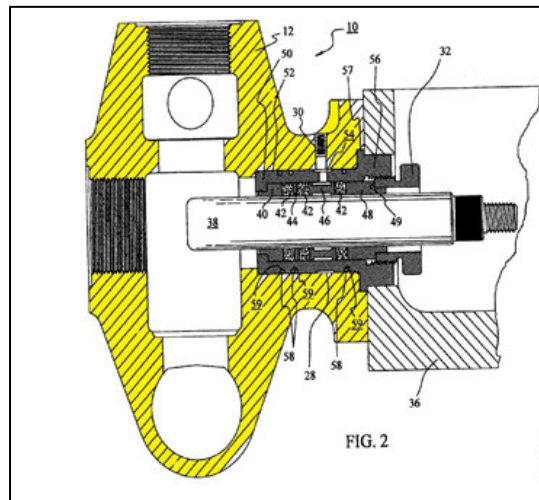
The housing of the Apex fluid end is “made of a single integrally formed piece,” and therefore, Apex includes “a housing” as recited in Recitation 1.a. As illustrated in the figures from Apex reproduced below, the Apex fluid end housing

is illustrated as a single piece with no breaks or seams. As Mr. Marscher explains, these illustrations would suggest to the POSITA that the Apex fluid end is “made of a single integrally formed piece.” EX1003, ¶¶176-177. As also explained by Mr. Marscher, fluid ends are conventionally made of a single integrally formed piece: “because of the high pressure developed and contained therein; in order to not split the fluid end housing, the housings are machined as an integral piece or ‘monoblock.’” EX1003, ¶¶176-177.



**EX1005, 7, 38 (annotated)**

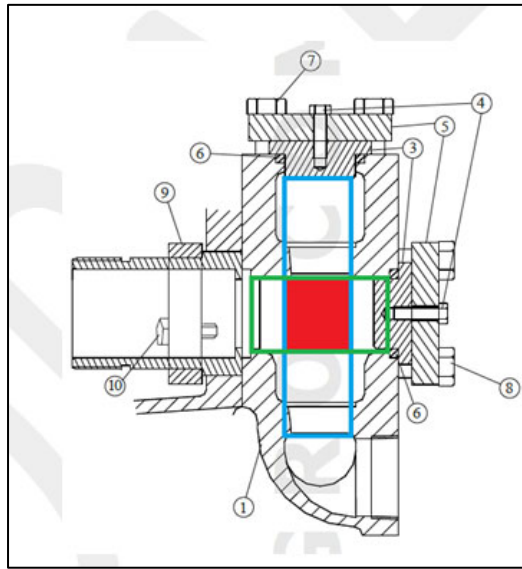
For completeness, it is noted that Stanton also discloses a fluid end housing with a monoblock construction, and therefore, also discloses a fluid end with the features of recitation 1.a. EX1003, ¶178.



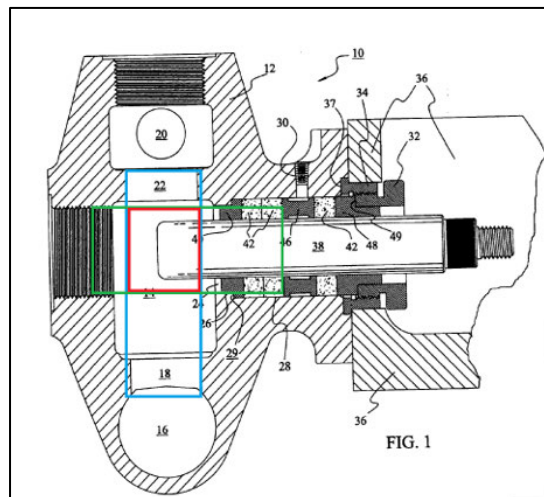
**EX1007, FIG. 2 (annotated)**

### 3. Recitation 1.b

Aplex includes “a first horizontal bore and a first vertical bore formed within the housing, the first vertical bore intersecting the first horizontal bore to form a first internal chamber.” As illustrated in the annotated figure below from Aplex, the Aplex fluid end includes an internal chamber (red) formed at the intersection of a vertical bore (blue) and a horizontal bore (green). EX1003, ¶¶179-180. As also explained by Mr. Marscher, such an internal chamber formed from the intersection of a vertical bore and a horizontal bore “is a conventional part of a fluid end, as illustrated in” the prior art discussed in section IV.b-f.

**EX1005, 38 (annotated)**

For completeness, it is noted that Stanton also discloses a fluid end with the features of recitation 1.b. EX1003, ¶181.

**EX1007, FIG. 1 (annotated)**

#### 4. Recitation 1.c

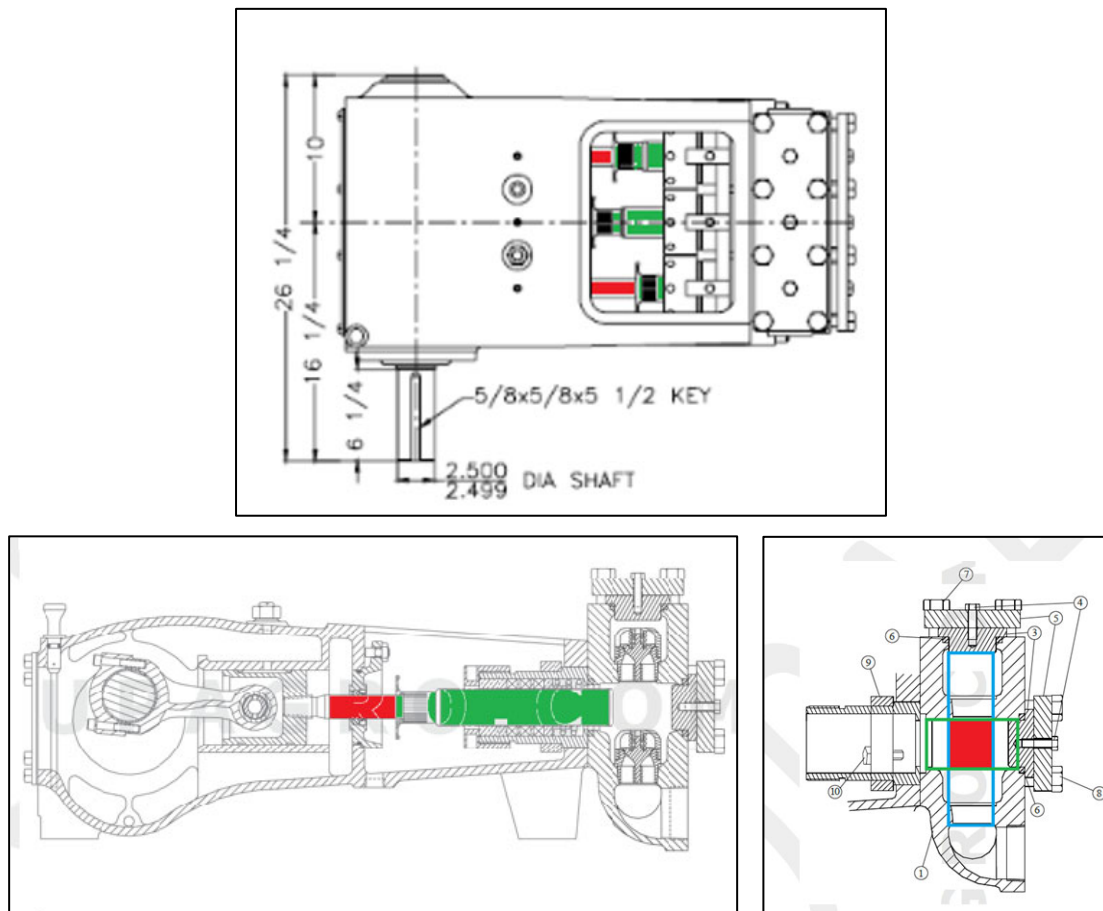
Recitation 1.c recites a second horizontal bore and a second vertical bore formed within the housing, the intersection of which forms a second internal chamber. EX1003, ¶182. The “second horizontal bore,” the “second vertical bore”

and the “second internal chamber” are not explicitly illustrated in Aplex. EX1003, ¶182. Aplex, however, is a triplex pump and its three plunger assemblies are illustrated in the figures of Aplex. EX1003, ¶182. As illustrated in the figures below from Aplex, the Aplex Pump includes three plunger assemblies. EX1003, ¶182. Specifically, the three connecting rods (annotated in red) of the power end connect to three plungers (annotated in green). As Mr. Marscher explains:

“Second” as used [in recitation 1.c] refers to the bores associated with a second of the plungers of the example triplex pump. ... the POSITA would understand from this being a triplex pump that each plunger assembly is one of a homologous series (of three in this case, given the triplex pump being the example), each member of which has the same structure.

EX1003, ¶182 (citations omitted).

Accordingly, Aplex would include the features of recitation 1.c as the Aplex triplex pump would have “a second horizontal bore and a second vertical bore formed within the housing, the second vertical bore intersecting the second horizontal bore to form a second internal chamber” with the same structure as the corresponding “first horizontal bore,” “first vertical bore,” and “first vertical chamber” as discussed in section IX.b.i.3, *supra*.

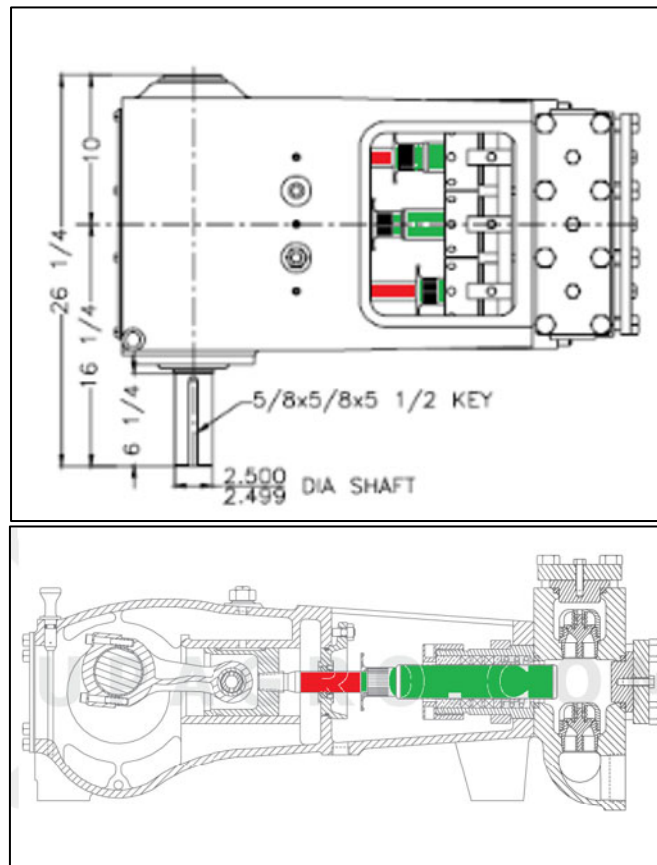


### EX1005, 7, 8, 38 (annotated)

#### 5. Recitation 1.d

As illustrated in the figures below from Aplex, the three plunger assemblies of the Aplex Pump are in a side-by-side arrangement. EX1003, ¶183. Specifically, the three connecting rods (annotated in red) of the power end connect to three plungers (annotated in green). EX1003, ¶183. Each of the three plungers is configured to reciprocate within a horizontal bore, pumping fluid in through the intake or suction valve of the vertical bore to the internal chamber, and out the outtake valve of the vertical bore. EX1003, ¶183. Accordingly, it would have been obvious to the POSITA that Aplex includes “the second horizontal bore, the second

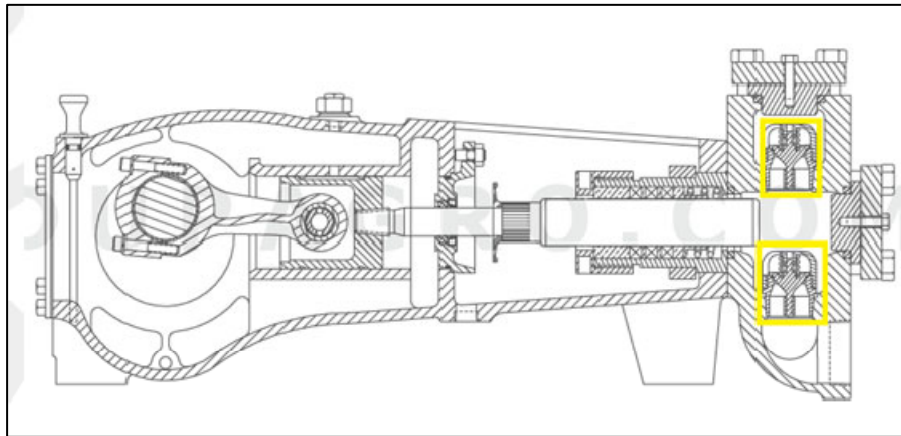
vertical bore, and the second internal chamber ... situated in a side-by-side relationship with the first horizontal bore, the first vertical bore, and the first internal chamber” as recited in recitation 1.c. EX1003, ¶183.



**EX1005, 7, 8, 38 (annotated)**

## 6. Recitation 1.e

Aplex includes “a first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber.” EX1003, ¶184. As illustrated below, the Aplex Pump includes a pair of valves (a suction valve and a discharge valve) arranged in the vertical bore and positioned on opposites side of the internal chamber. EX1003, ¶184.



**EX1005, 7 (annotated)**

### 7. Recitation 1.f

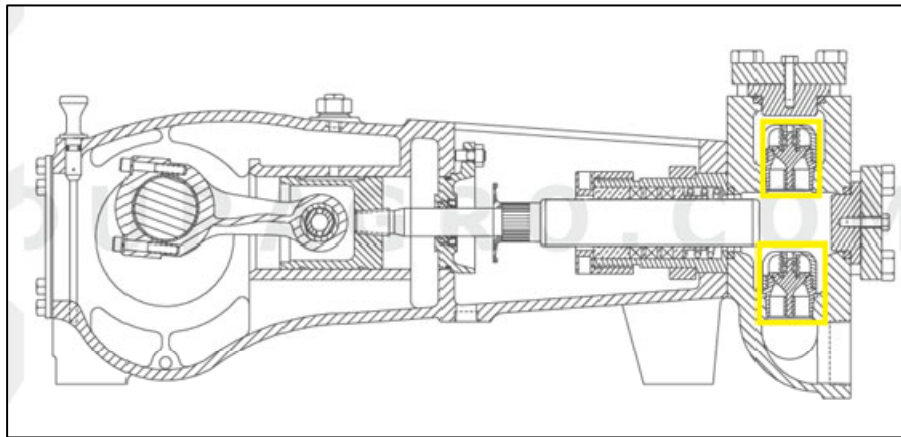
A “second pair of valves” with the features of those recited in recitation 1.f are not explicitly illustrated in Apex. EX1003, ¶¶185-187. Apex, however, is a triplex pump and its three plunger assemblies are illustrated in the figures of Apex. EX1003, ¶¶185-187; *see* section IX.b.i.5, *supra*. As Mr. Marscher explains:

Each of the three plungers is configured to reciprocate within the horizontal bore, pumping fluid in through the intake or suction valve of the vertical bore to the internal chamber, and out the outtake valve of the vertical bore. Accordingly, the Apex Pump includes “a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal chamber” as recited in claim 1.

EX1003, ¶187.

Accordingly, Apex would include the features of recitation 1.f as the Apex triplex pump would have “a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal

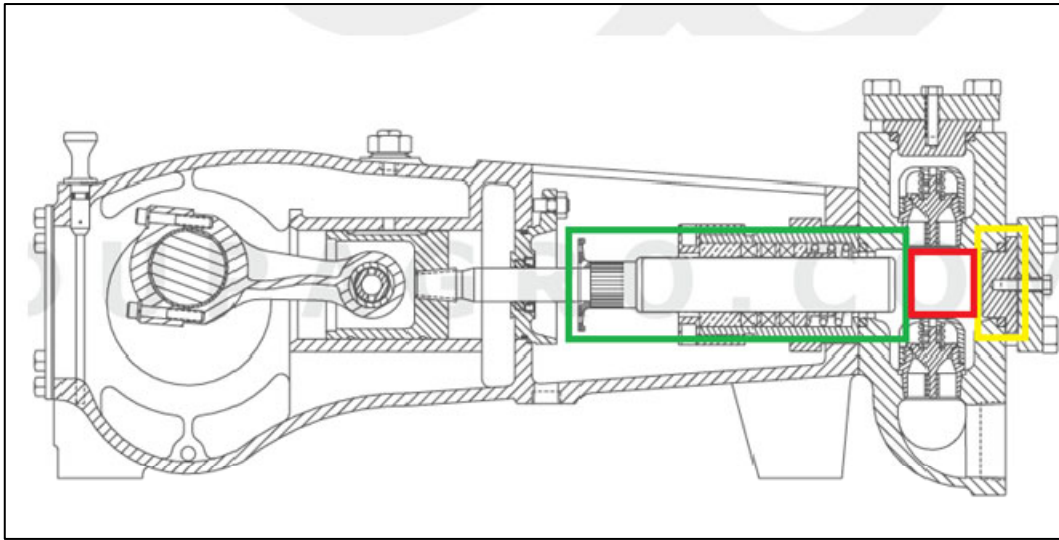
chamber” with the same structure as the corresponding “first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber” as discussed in section IX.b.i.6, *supra*.



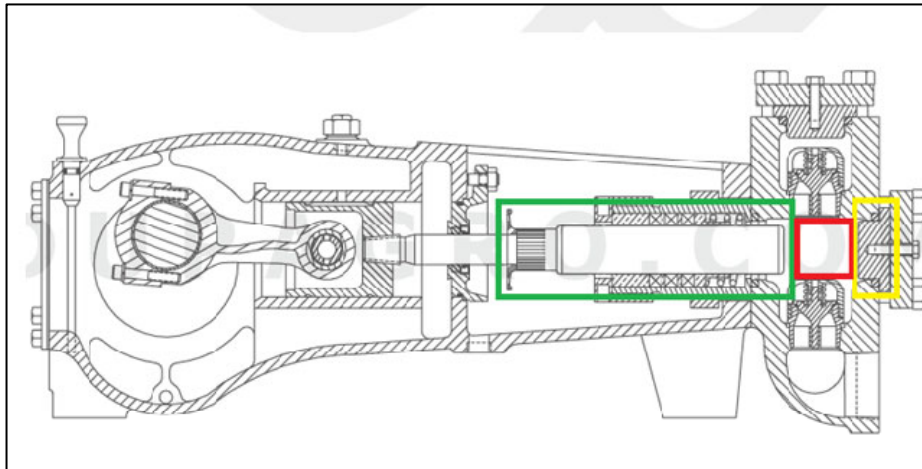
**EX1005, 7 (annotated)**

#### **8. Recitation 1.g**

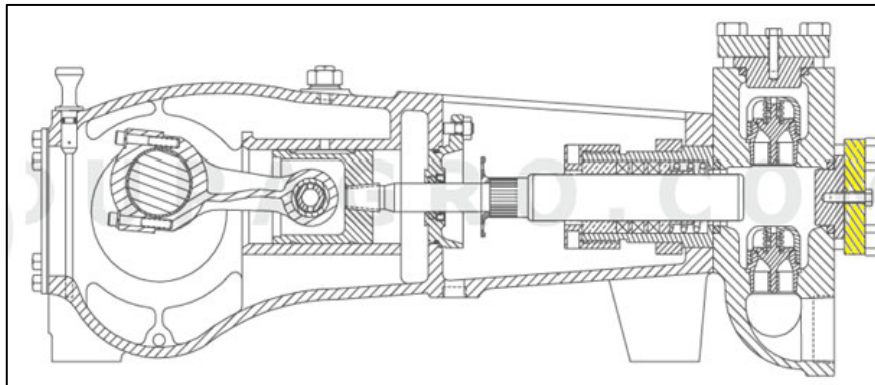
Aplex includes “a first plug and a first reciprocating plunger installed within the first horizontal bore and positioned on opposite sides of the first internal chamber,” as illustrated in the annotated figure from Aplex. *See also* EX1003, ¶¶188-189. As illustrated, a plug (yellow) is installed within the horizontal bore on the opposite side of the internal chamber (red) from the plunger (green).

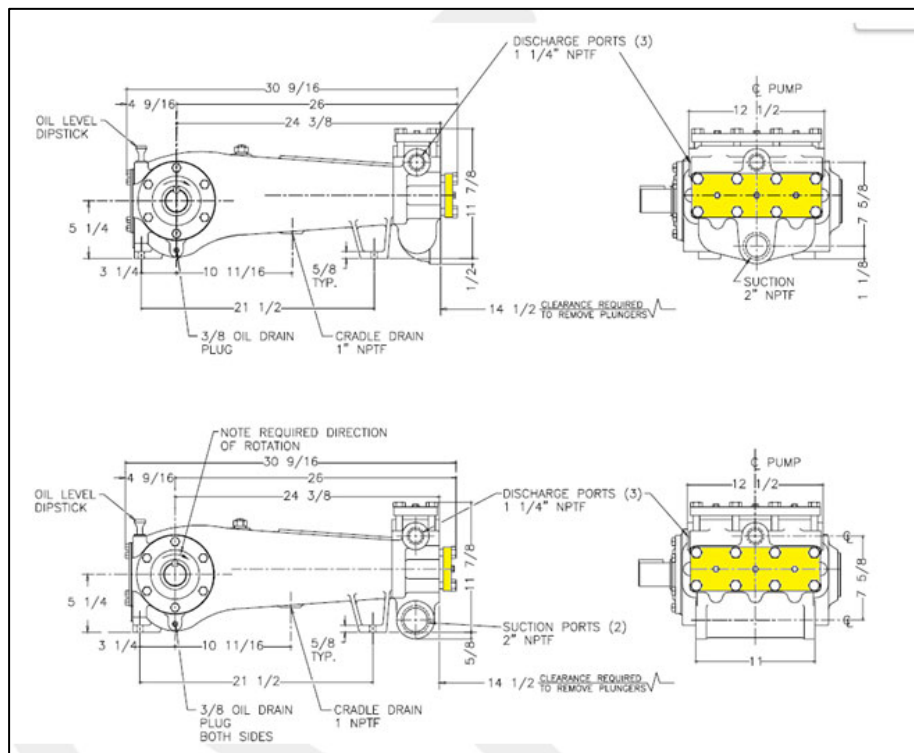
**EX1005, 7 (annotated)****9. Recitation 1.h**

Aplex does not explicitly illustrate “a second plug and a second reciprocating plunger installed within the second horizontal bore and positioned on opposite sides of the second internal chamber.” Nevertheless, as Mr. Marscher explains, such a “second plug” and “second plunger” would have been obvious to the POSITA because each plunger assembly would have the same structure as that illustrated in the figure below in which a plug (yellow) is installed within the horizontal bore on the opposite side of the internal chamber (red) from the plunger (green). EX1003, ¶¶190-191.

**EX1005, 7 (annotated)****10. Recitation 1.i**

Aplex includes “a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores” as annotated in the figures below from Aplex. *See also* EX1003, ¶¶192-193.

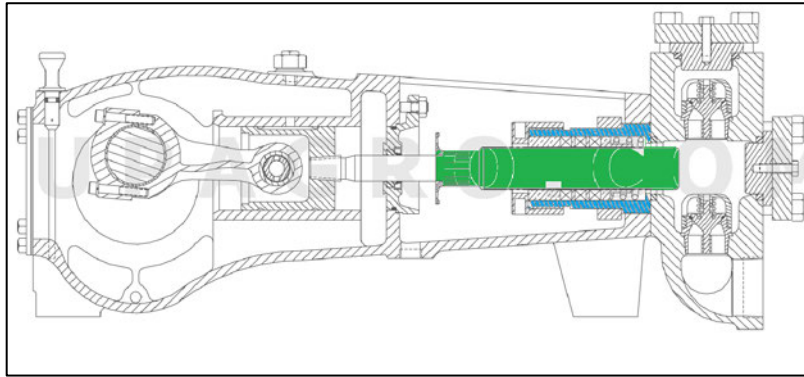


**EX1005, 7, 8 (annotated)****11. Recitation 1.j**

Aplex as modified by Stanton would have rendered obvious “a first component having a central opening formed therein, at least a portion of the first component installed within the first horizontal bore and at least a portion of the first reciprocating plunger installed within the central opening of the first component.” EX1003, ¶¶194-195.

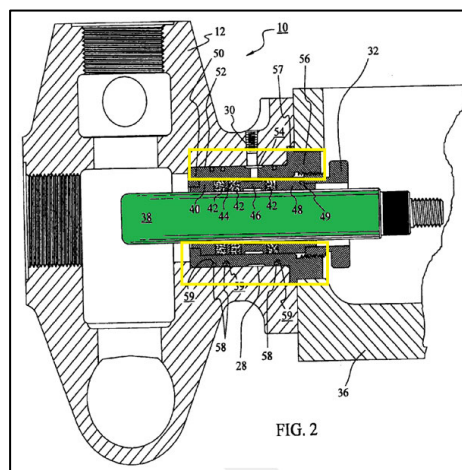
First, “component” is a broad term that could arguably refer to almost any structure arranged within the first horizontal bore other than the later recited “seals.” EX1003, ¶¶194-195. Foster, however, describes “stuffing box sleeves” as potential components. *See, e.g.,* EX1001 at 4:15-16, 6:66-67, 9:17-20, 11:2-4; *see also* EX1003, ¶¶194-195.

Aplex includes a stuffing box (blue) including a central opening with a portion of a reciprocating plunger (green) installed within the box, as illustrated in the annotated figures below. *See also* EX1003, ¶¶194-195.



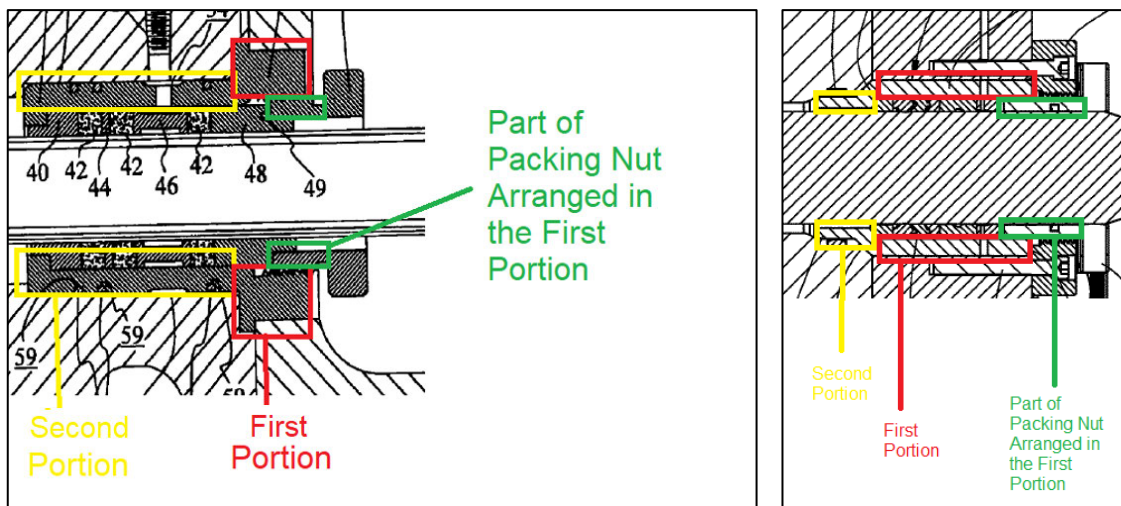
**EX1005, 7 (annotated)**

The Aplex stuffing box, however, arguably does not include “at least a portion ... installed within the first horizontal bore.” The packing assembly of Stanton, on the other hand, does include such a component in the form of a packing sleeve. As illustrated below, the Stanton packing sleeve (annotated in yellow) includes a portion that is installed in the horizontal bore. EX1003, ¶¶196-198. The plunger (annotated in green) is partially installed within this packing sleeve. EX1003, ¶¶196-198.



**EX1007, FIG. 2 (annotated)**

In fact, the stuffing box of Stanton includes the *unclaimed* features of the packing sleeve described in Foster – a first portion (red) with a larger diameter than a second portion (yellow) in which part of the packing nut (green) is arranged, as illustrated in the detail of FIG. 2 from Stanton provided below and compared with a detail of FIG. 6 of Foster. EX1003, ¶¶196-198



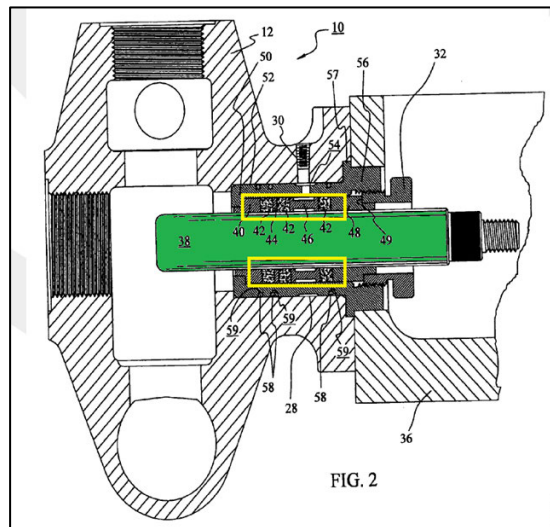
### Comparison of the Packing Sleeve of Stanton with the Component of Foster

As Petitioner's expert Mr. Marscher explains, the POSITA would have understood that replacing the packing/stuffing arrangement of Apex with that of Stanton would be replacing one known method of providing packing to a plunger pump and a connection to a power end with another known method with predictable results. EX1003, ¶¶196-198. Furthermore, the POSITA would have been motivated to make such a modification because the POSITA would understand that providing the packing/stuffing arrangement at least partially within the fluid end housing, as is illustrated in Stanton, may provide improved pressure/fluid isolation compared with

the packing bolted to the outside of the fluid end as constructed in Apex. EX1003, ¶¶196-198. Still further, such a modification has no bearing or relationship to the purported invention of Foster – utilizing a plate to allow threads to be removed from a fluid end housing.

## 12. Recitation 1.k

Apex as modified by Stanton would include “a first plurality of packing seals installed within the first component and engaging the first reciprocating plunger.” EX1003, ¶199. As illustrated below, in Stanton, a plurality of packing seals (yellow) are installed within the packing sleeve (*i.e.*, “the component”) and engage the reciprocating plunger (green). EX1003, ¶199. Apex also provides packing seals within a stuffing box.

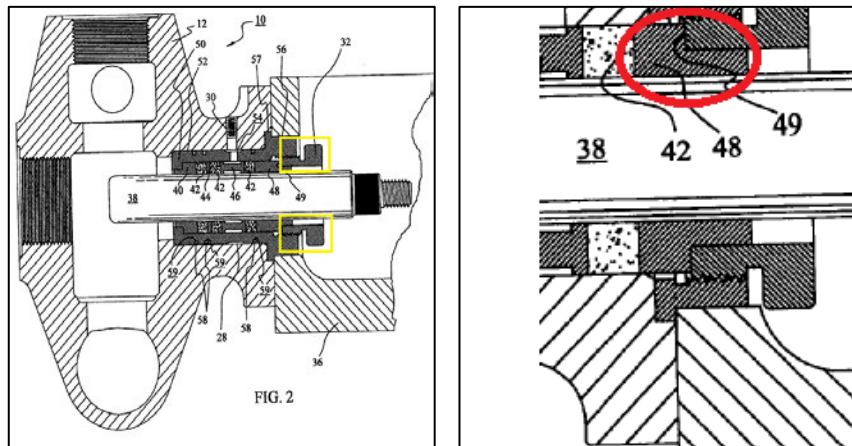


**EX1007, FIG. 2 (annotated)**

### 13. Recitation 1.1

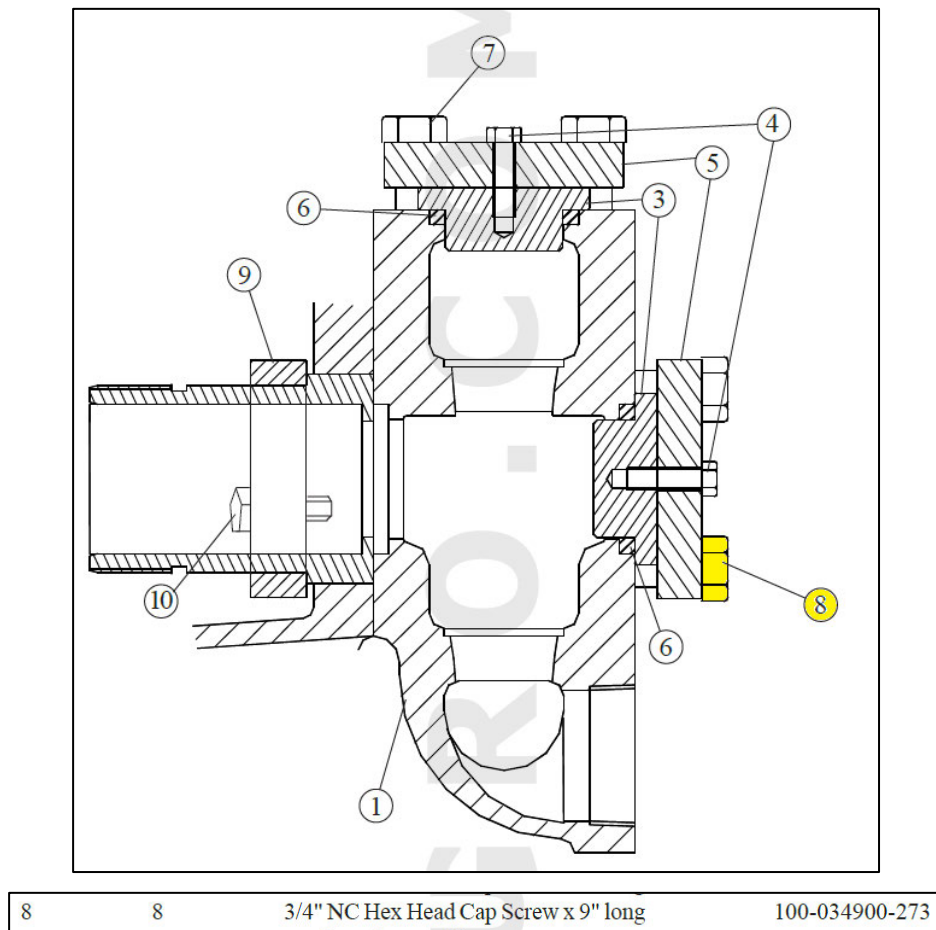
Aplex as modified to include the packing assembly/arrangement and power end connection of Stanton would include “a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.” EX1003, ¶¶200-201.

The Stanton packing nut (annotated in yellow) is attached to the sleeve with threading in the location highlighted by the red circle in the annotated figures below. EX1003, ¶¶200-201. This nut not only compresses the packing rings to squeeze out radial clearance around the plunger through which fluid could leak, but also acts to hold the packing rings in the sleeve, essentially acting as a detachable rear end of the packing sleeve. EX1003, ¶¶200-201. Accordingly, Aplex as modified to include the packing assembly of Stanton would include “a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.” In fact, Aplex utilizes a packing nut, indicating that such a packing nut would be desirable to include in Aplex as modified to include the packing assembly of Stanton. EX1003, ¶¶200-201

**EX1005, FIG. 2 (annotated)****ii. Claim 2****1. Recitation 2.a**

To the POSITA a plate that “comprises a plurality of fastener openings that align with a plurality of threaded openings formed in the housing in a one-to-one relationship” would have been obvious from Aplex. EX1003, ¶¶202-204.

The figures from Aplex reproduced below illustrate that the cover plates of Aplex are secured to the housing using fasteners with hex head cap screws.



### EX1005, 38 (annotated)

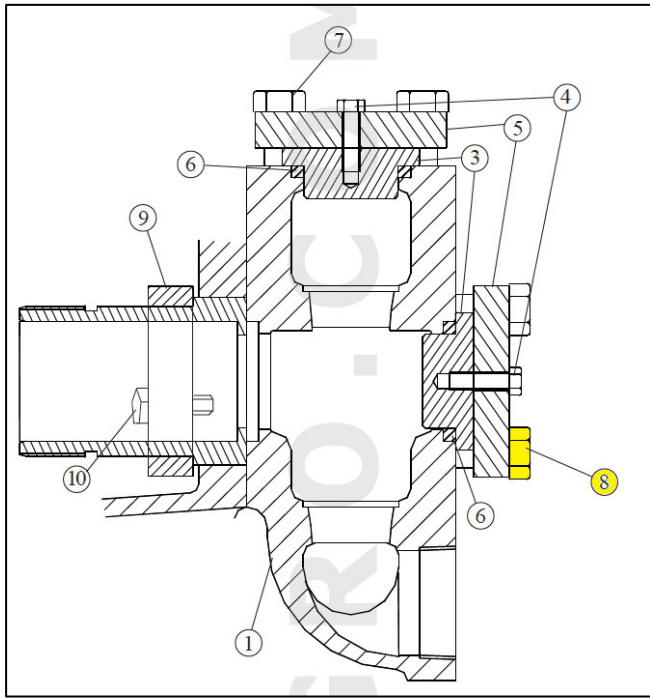
The POSITA would understand that these hex-headed cap screws pass through fastener openings in the plate and engage with threaded openings formed in the housing in a one-to-one relationship to secure the plates to the fluid end housing. EX1003, ¶¶202-204. The fastener openings and threaded openings are not illustrated in detail. EX1003, ¶¶202-204. The presence of threads (in its opposing hole or “opening”), however, would have been obvious to the POSITA given the

fasteners are illustrated with a hex head and described as cap screws. EX1003, ¶¶202-204.

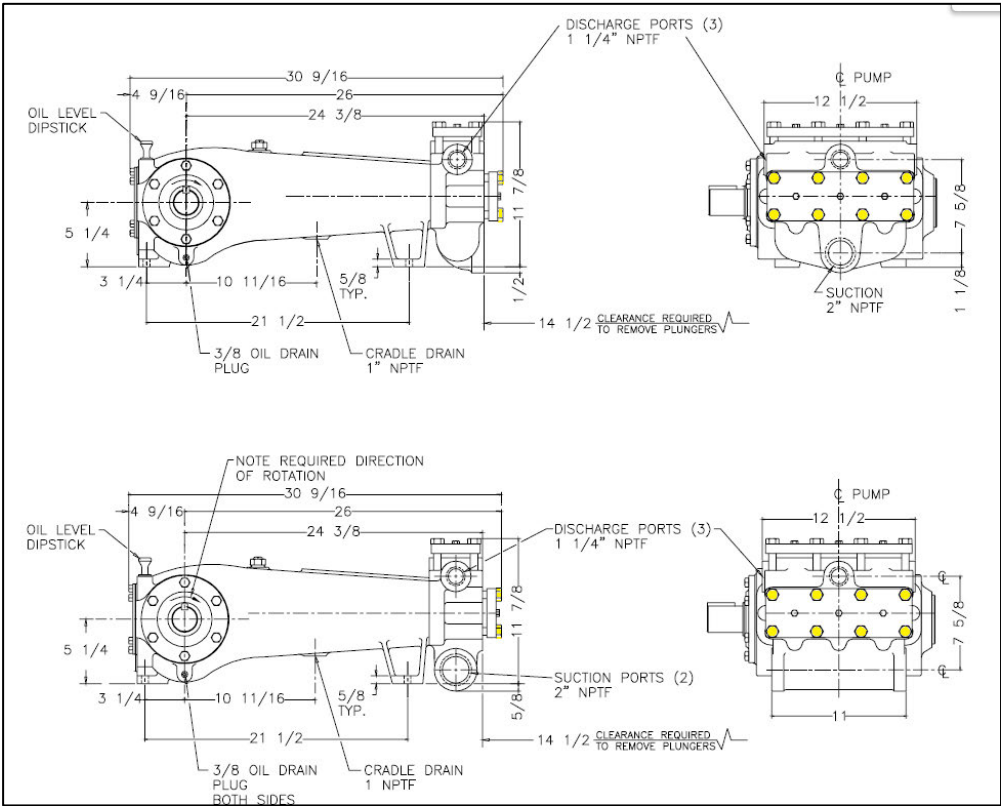
These hex heads screws would suggest to the POSITA that the fasteners are intended to be installed in and removed from the fluid end housing using a ratchet or wrench. EX1003, ¶¶202-204. The POSITA would understand that a hex-headed cap screw (a type of threaded fastener), fastened and unfastened using a ratchet or wrench, would need to engage with a threaded opening in order to secure the plate to the housing. EX1003, ¶¶202-204. Accordingly, it would have been obvious to the POSITA that the openings formed in the fluid end housing would be threaded and would engage with the fasteners in a one-to-one relationship via fastener openings in the plate that align with the threaded openings in the housing. EX1003, ¶¶202-204.

## **2. Recitation 2.b**

Aplex includes “a plurality of fasteners, each of the plurality of fasteners installed within a corresponding one of the aligned fastener openings and threaded openings.” EX1003, ¶¶205-206. Such fasteners are included in the Aplex Pump, the threaded cap screw fasteners discussed in section IX.b.ii.1, *supra*. The POSITA would understand that a hex-headed cap screw fastener would need to pass through a fastener opening in the plate and engage with an aligned threaded opening in the fluid end housing in order to secure the plate to the housing. EX1003, ¶¶205-206.



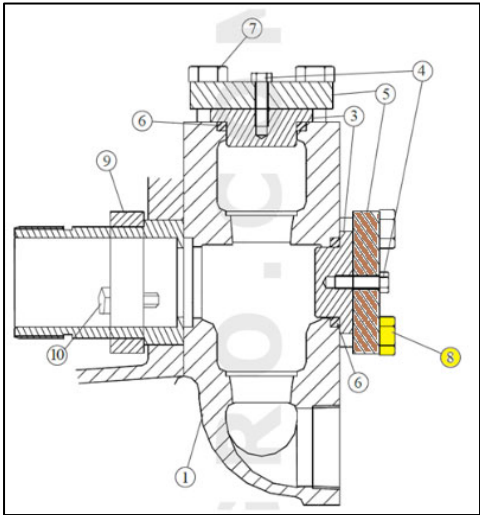
|   |   |                                      |                |
|---|---|--------------------------------------|----------------|
| 8 | 8 | 3/4" NC Hex Head Cap Screw x 9" long | 100-034900-273 |
|---|---|--------------------------------------|----------------|



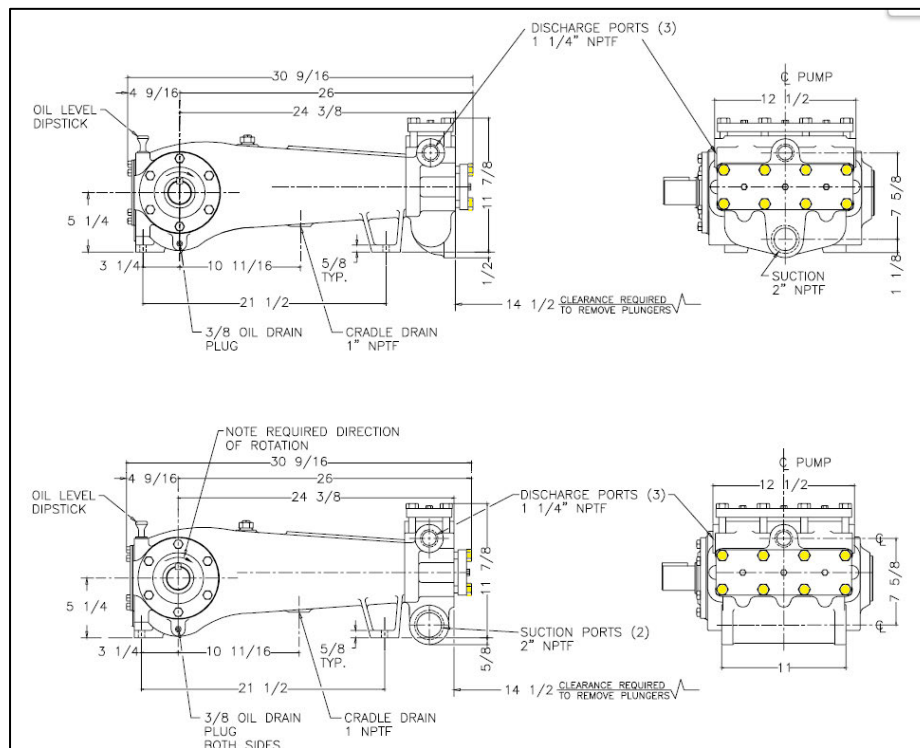
**EX1005, 8, 38 (annotated)**

iii. Claim 3

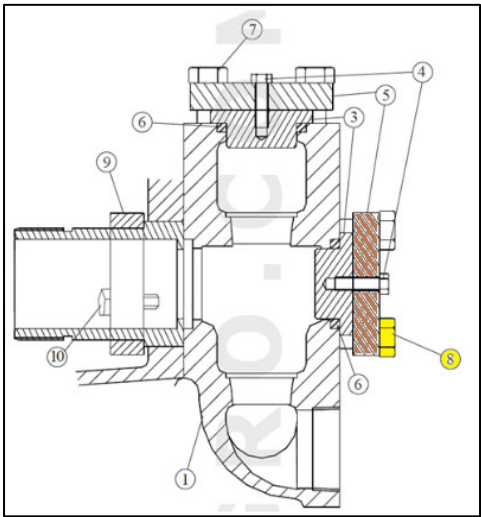
Aplex includes “a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing.” EX1003, ¶207. Such a plurality of fasteners are included in Aplex as illustrated in the annotated figures below, and these fasteners are described as “hex head cap screws,” the threaded cap screw fasteners discussed in section IX.b.ii.1, *supra*. The POSITA would understand that a hex-headed cap screw fastener (yellow) would need to pass through a fastener opening in the plate (brown) and engage with an aligned threaded opening in the fluid end housing to fasten the plate to the housing. EX1003, ¶207.



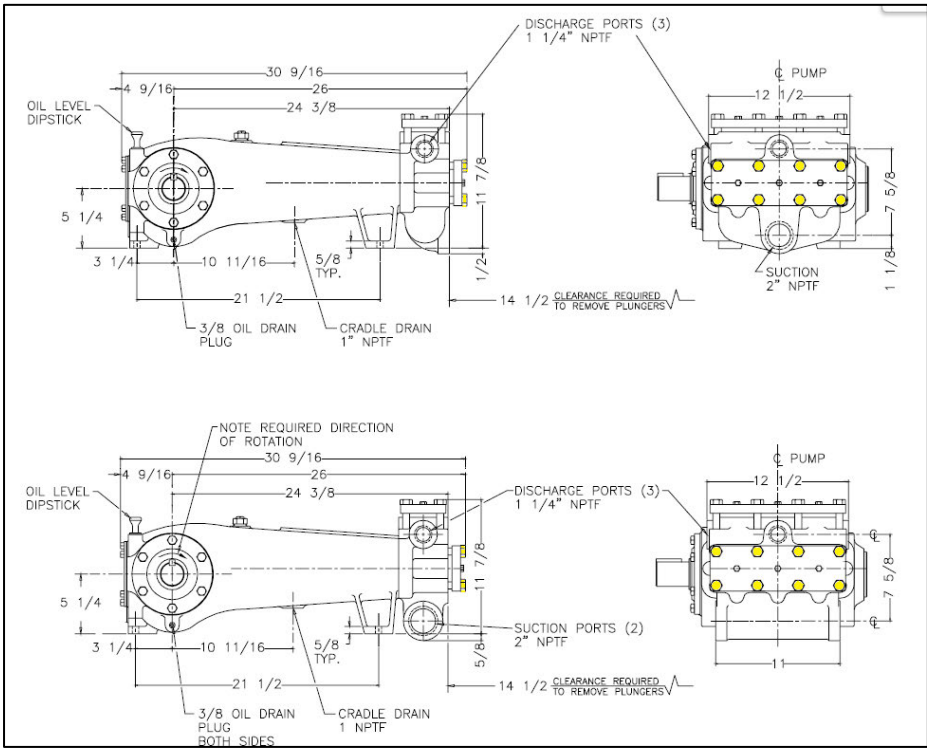
|   |   |                                             |                |
|---|---|---------------------------------------------|----------------|
| 5 | 2 | Retainer Plate, Valve Cover & Cylinder Head | 7203-0110-00B  |
| 6 | 6 | Fluid Seal, Nitrile Rubber                  | 7203-0118-00A  |
| 7 | 8 | 3/4" NC Hex Head Cap Screw x 3" long        | 100-034300-273 |
| 8 | 8 | 3/4" NC Hex Head Cap Screw x 9" long        | 100-034900-273 |

**EX1005, 8, 38 (annotated)****iv. Claim 4**

It would have been obvious to the POSITA that “each of the plurality of fasteners [in Aplex] is a threaded fastener.” EX1003, ¶¶208-209. The capscrew hex head fasteners of Aplex would have been understood by the POSITA to be a threaded fastener. EX1003, ¶¶208-209. A “cap screw” is a type of threaded fastener and the hex head would suggest to the POSITA that the cap screw fastener was intended to be secured to the housing via ratchet or wrench. EX1003, ¶¶208-209. Accordingly, it would have been obvious to the POSITA that each of the Aplex hex head cap screw fasteners is a threaded fastener.



|   |   |                                             |                |
|---|---|---------------------------------------------|----------------|
| 5 | 2 | Retainer Plate, Valve Cover & Cylinder Head | 7203-0110-00B  |
| 6 | 6 | Fluid Seal, Nitrile Rubber                  | 7203-0118-00A  |
| 7 | 8 | 3/4" NC Hex Head Cap Screw x 3" long        | 100-034300-273 |
| 8 | 8 | 3/4" NC Hex Head Cap Screw x 9" long        | 100-034900-273 |

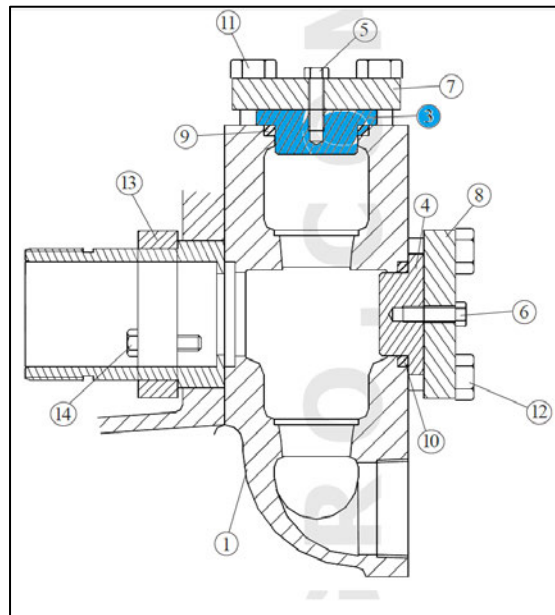


**EX1005, 8, 38 (annotated)**

v. **Claim 5**

Aplex includes “a third plug installed within the first vertical bore and positioned between an external surface of the housing and one of the first pair of valves.” EX1003, ¶210.

Claim 5 is recited broadly enough such that the “third plug” could arguably be arranged within the intake side of the vertical bore or the discharge side of the vertical bore. EX1003, ¶210. Aplex includes a plug (blue) in the discharge side of the vertical bore, as illustrated in the detail from Aplex provided below. EX1003, ¶210.



|   |   |                              |               |
|---|---|------------------------------|---------------|
| 3 | 6 | Valve Cover & Cyl. Head Plug | 7203-0119-00A |
|---|---|------------------------------|---------------|

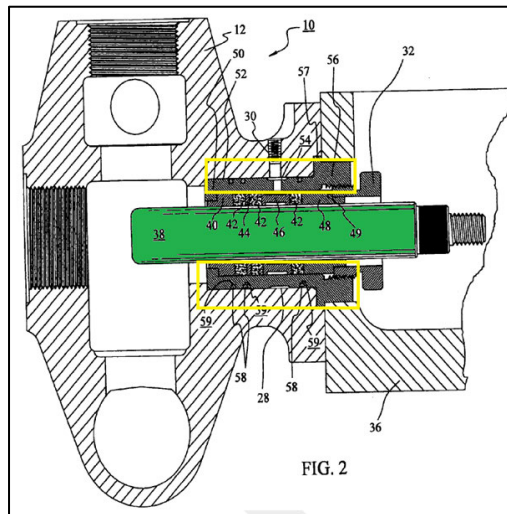
### EX1005, 38 (annotated)

#### vi. Claim 6

##### 1. Recitation 6.a

Aplex as modified by Stanton would include “a second component” as recited in recitation 6.a. EX1003, ¶¶211-212. As Mr. Marscher explains, “second” as used

in this claim refers to “the corresponding ‘component’ for a second plunger assembly of a multiplex pump.” EX1003, ¶¶211-212. As also explained by Mr. Marscher, the POSITA would understand that each plunger assembly of a triplex pump (of which Kerr is an example) would have the same structure, including the same packing/stuffing box that surrounds and engages the plunger of the second plunger assembly. EX1003, ¶¶211-212. Accordingly, the annotated details from Stanton illustrate a “second component” as recited in recitation 6.a for reasons analogous to those presented with respect to recitation 1.j in section IX.b.i.11, *supra*.



**EX1007, FIG. 2 (annotated)**

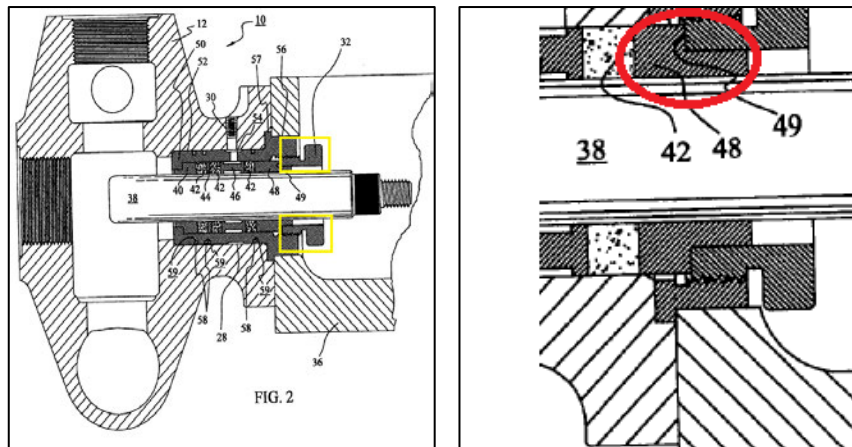
## **2. Recitation 6.b**

Aplex as modified by Stanton would include “a second plurality of packing” as recited in recitation 6.b. EX1003, ¶¶213-214. As Mr. Marscher explains, “second” as used in this claim refers to “the corresponding ‘plurality of packing seals’ for a second plunger assembly of a multiplex pump.” EX1003, ¶¶213-214. As also

### 3. Recitation 6.c

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pump (of which Apex and Stanton are examples) would have the same structure, including the same packing nut that holds the plurality of packing seals within the component of the second plunger assembly. EX1003, ¶¶215-216. Accordingly, the annotated details from Stanton illustrate a “second packing nut” as recited in recitation 6.c for reasons analogous to those presented with respect to recitation 1.1 in section IX.b.i.13, *supra*.



**EX1007, FIG. 2 (annotated)**

**i. Claim 7**

**1. Recitation 7.P**

Recitation 7.P is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.i.1, *infra*. See also EX1003, ¶¶217-218.

**2. Recitation 7.a**

Recitation 7.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.i.2, *infra*. See also EX1003, ¶¶219-221.

**3. Recitation 7.b**

Recitation 7.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.i.3, *infra*. See also EX1003, ¶¶222-224.

**4. Recitation 7.c**

Recitation 7.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.i.4, *infra*. See also EX1003, ¶225.

**5. Recitation 7.d**

Recitation 7.d is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.i.5, *infra*. See also EX1003, ¶226.

**6. Recitation 7.e**

Recitation 7.e is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.6, *infra*. See also EX1003, ¶227.

**7. Recitation 7.f**

Recitation 7.f is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.7, *infra*. See also EX1003, ¶¶228-230.

**8. Recitation 7.g**

Recitation 7.g is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.10, *infra*. See also EX1003, ¶¶221-232.

**9. Recitation 7.h**

Recitation 7.h is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.11, *infra*. See also EX1003, ¶¶233-236.

**10. Recitation 7.i**

Recitation 7.i is analogous to the “reciprocating plunger” features of recitation 1.g and 1.j, and therefore, recitation 7.i is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those directed to the “first reciprocating plunger” presented in section IX.b.i.8 and IX.b.i.11, *infra*. See also EX1003, ¶237.

**11. Recitation 7.j**

Recitation 7.j is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.12, *infra*. See also EX1003, ¶238.

**12. Recitation 7.k**

Recitation 7.k is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.13, *infra*. See also EX1003, ¶¶239-240.

**ii. Claim 8****1. Recitation 8.a**

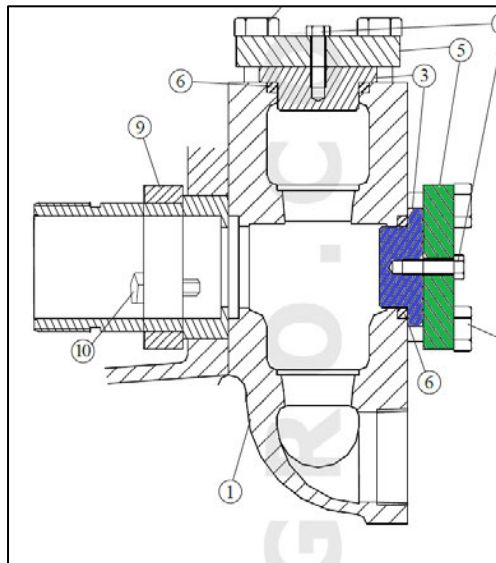
Recitation 8.a is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.8, *infra*. See also EX1003, ¶241.

**2. Recitation 8.b**

Recitation 8.b is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.i.9, *infra*. See also EX1003, ¶242.

**1. Recitation 8.c**

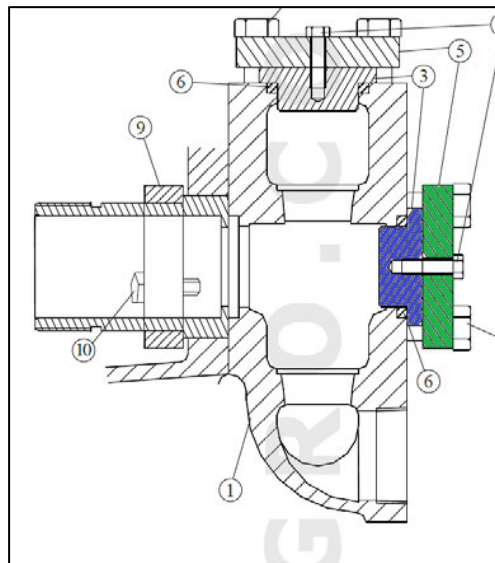
The “first plug” of Apex is “positioned adjacent the plate,” as illustrated in the annotated figure provided below. Specifically, the first plug (blue) is adjacent to the plate (green), and also abuts the plate. EX1003, ¶243.



**EX1005, 38 (annotated)**

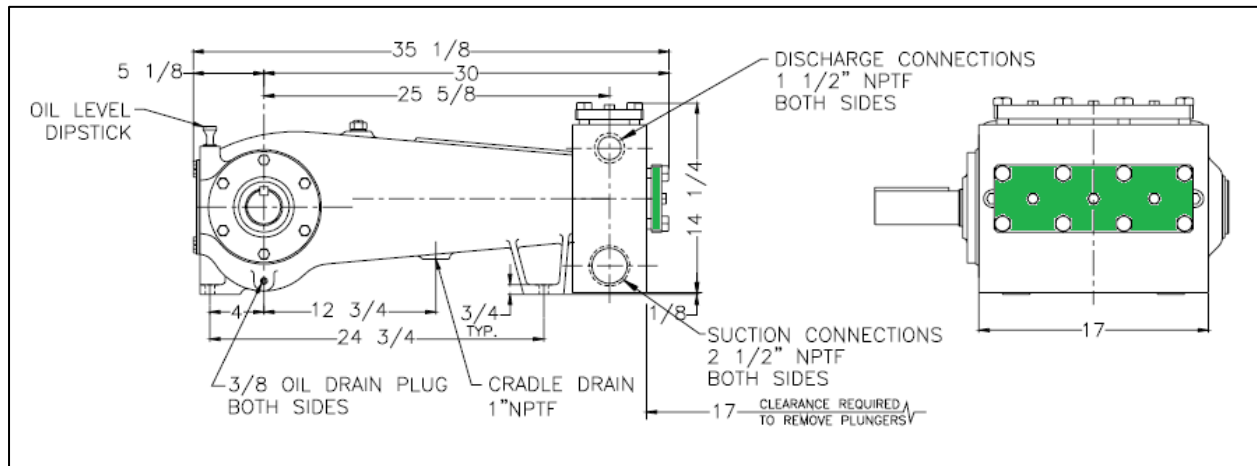
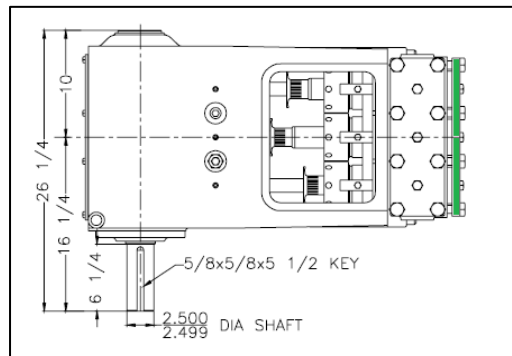
## 2. Recitation 8.d

The “second plug” of Apex is “positioned adjacent the plate.” As Mr. Marscher explains, the “second plug” would have the same structure as the “first plug.” Accordingly, the “second plug” of Apex is “positioned adjacent the plate,” as illustrated in the annotated figure provided below. Specifically, the first plug (blue) is adjacent to the plate (green), and also abuts the plate. EX1003, ¶¶244-245.



**EX1005, 38 (annotated)**

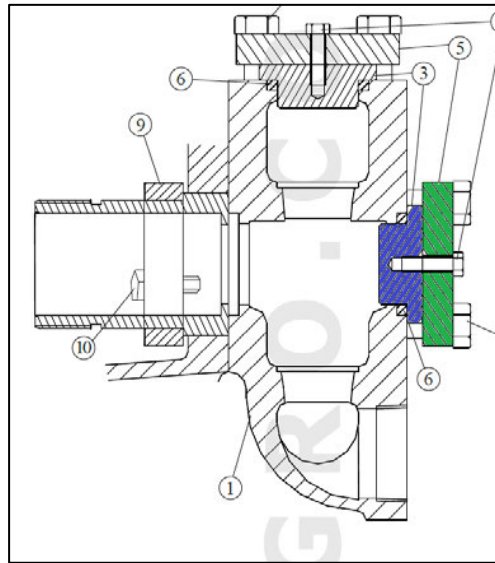
For completeness, it is noted that that the plate of Apex covers both horizontal bores of the fluid end, as illustrated below. EX1003, ¶¶244-245. This confirms that the plate is adjacent to and abuts both of the “first plug” and the “second plug.”



### EX1005, 8 (annotated)

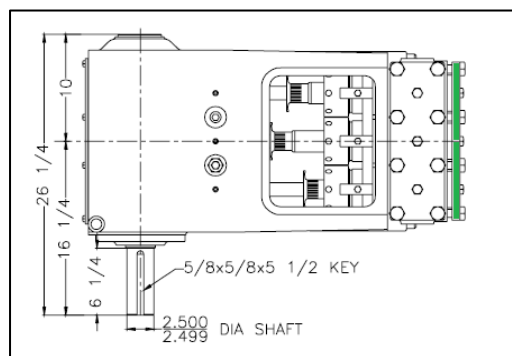
#### iii. Claim 9

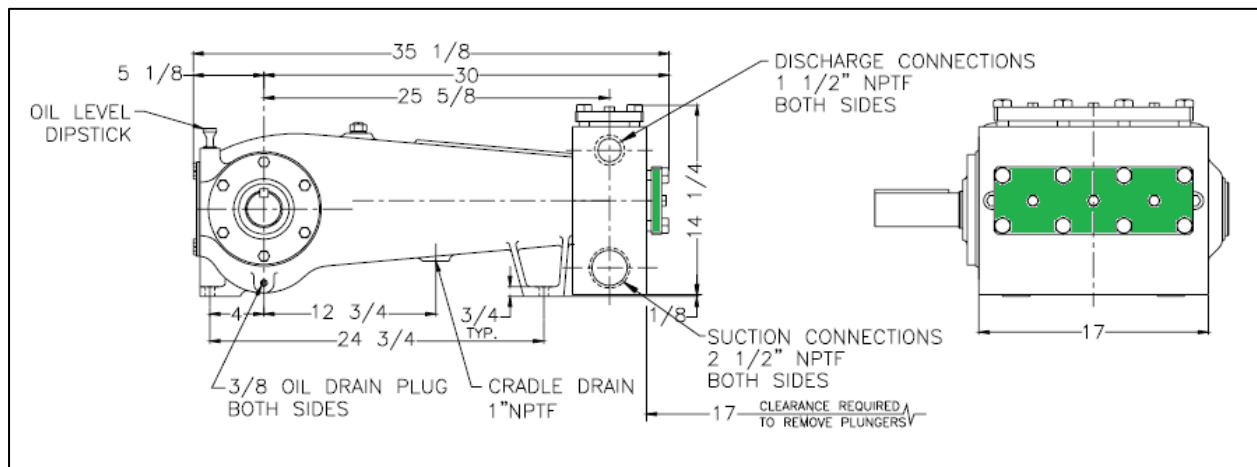
As explained above, the plate of Apex is adjacent to and abuts the “first plug” and the “second plug.” As illustrated in the annotated figure provided below, the plate (green) abuts the first plug (blue). EX1003, ¶¶246-247.



### EX1005, 38 (annotated)

As Mr. Marscher explains, the “second plug” would have the same structure as the first plug. Accordingly, the plate (green) also abuts the second plug (blue). EX1003, ¶247. For completeness, it is noted that that the plate of Apex covers both horizontal bores of the fluid end, as illustrated below. EX1003, ¶247. This confirms that the plate abuts both of the “first plug” and the “second plug.”



**EX1005, 8 (annotated)****iv. Claim 10**

Claim 10 is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.v, *infra*. See also EX1003, ¶248.

**v. Claim 11****1. Recitation 11.a**

Recitation 11.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.ii.1, *infra*. See also EX1003, ¶¶249-251.

**2. Recitation 11.b**

Recitation 11.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.ii.2, *infra*. See also EX1003, ¶¶252-253.

**vi. Claim 12**

Claim 12 is disclosed or would have been obvious over Aplex as modified by Stanton for reasons analogous to those presented in section IX.b.iii, *infra*. See also EX1003, ¶¶254.

**vii. Claim 13**

Claim 13 is disclosed or would have been obvious over Apex as modified by Stanton for reasons analogous to those presented in section IX.b.iv, *infra*. See also EX1003, ¶255.

**viii. Claim 14****1. Recitation 14.a**

Recitation 14.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.vi.1, *infra*. See also EX1003, ¶¶256-257.

**2. Recitation 14.b**

Recitation 14.b is a combination of the features of recitations 1.h and 6.a. Therefore, recitation 14.b is disclosed or would have been obvious for reasons analogous to those presented in sections IX.b.i.9 and IX.b.vi.1, *infra*. See also EX1003, ¶¶258-259.

**3. Recitation 14.c**

Recitation 14.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.vi.2, *infra*. See also EX1003, ¶¶260-262.

**4. Recitation 14.d**

Recitation 14.d is disclosed or would have been obvious for reasons analogous to those presented in section IX.b.vi.3, *infra*. See also EX1003, ¶¶263-265.

**c) Ground 3**

Each of claims 1-14 of Foster is invalid as obvious over Blume as modified to use the stuffing/packing arrangement of Stanton and the bore covers of Wilkinson. As described in detail below, Blume explicitly illustrates the elements of claims 1-14 directed to the fluid end housing. EX1003, ¶¶267-390. The elements of the claims directed to the “first component,” “second component,” “first plurality of seals,” “second plurality of seals,” “first packing nut” and “second packing” would have been an obvious modification to Blume based upon the teachings of Stanton. *E.g.*, EX1003, ¶¶306-307. As Petitioner’s expert Mr. Marscher explains, the POSITA would have understood that replacing the packing/stuffing arrangement of Blume with that of Stanton would be replacing one known method of providing packing to a plunger pump with another with predictable results. *E.g.*, EX1003, ¶¶306-307. Furthermore, the POSITA would have been motivated to make such a modification because the POSITA would understand that providing the packing/stuffing arrangement of Stanton, in which the packing nut engages the packing sleeve, provides benefits, such as easier repairs to the stuffing/packing and easier setting of the packing pressure. *E.g.*, EX1003, ¶¶306-307.

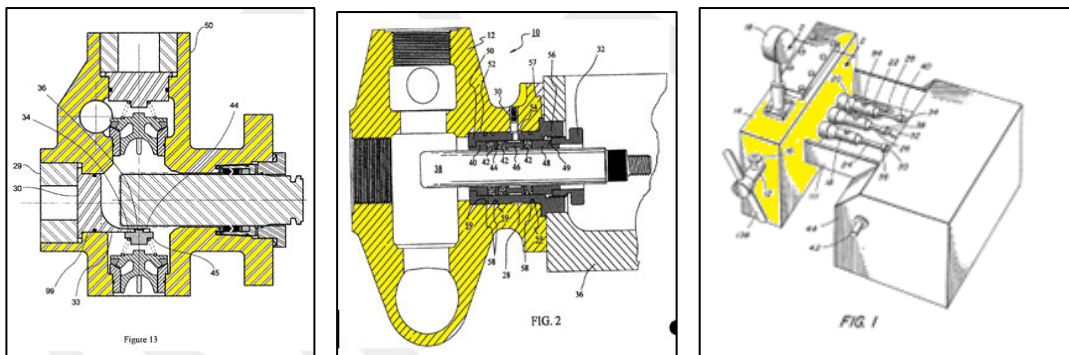
The POSITA would also find it obvious to replace the bore cover techniques of Blume with those of Wilkinson as it would be replacing one known method of

covering a fluid end bore with another with predictable results. *E.g.*, EX1003, ¶¶294-295.

**i. Claim 1**

**1. Recitation 1.P**

The preamble of claim 1 recites “A fluid end assembly.” Blume includes a fluid end assembly, as do Stanton and Wilkinson, as illustrated in the annotated figures from the references reproduced below. EX1003, ¶267.

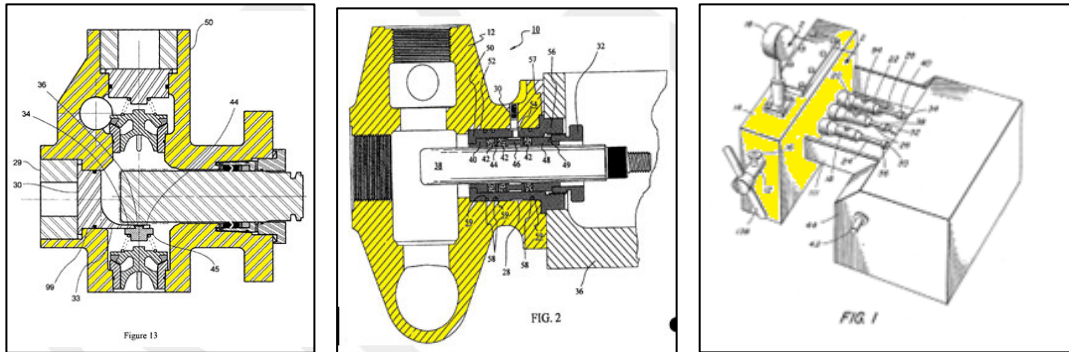


**EX1006, FIG. 13; EX1007, FIG. 2, EX1008, FIG. 1 (annotated)**

**2. Recitation 1.a**

The housing of the Blume fluid end is “made of a single integrally formed piece,” and therefore, Blume includes “a housing” as recited in Recitation 1.a. As illustrated in the figures reproduced below, the Blume fluid end is depicted as a single piece with no breaks or seams. As Mr. Marscher explains, these illustrations would suggest to the POSITA that the Blume fluid end “consists of a single piece, such that no breaks or seams are illustrated.” EX1003, ¶268. As also explained by Mr. Marscher, fluid ends are conventionally made of a single integrally formed

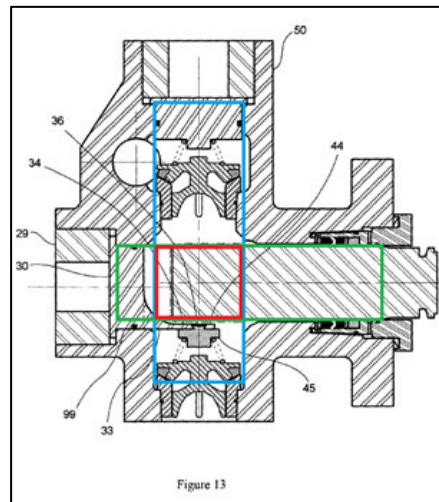
piece: “because of the high pressure developed and contained therein; in order to not split the fluid end housing, the housings are machined as an integral piece or ‘monoblock.’” EX1003, ¶268. For completeness, it is notated that Stanton and Wilkinson similarly illustrate monoblock fluid ends.



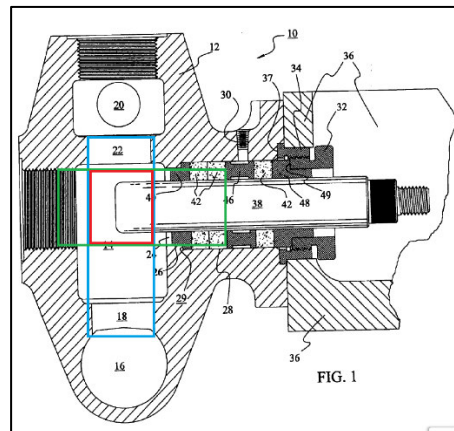
**EX1006, FIG. 13; EX1007, FIG. 2, EX1008, FIG. 1 (annotated)**

### 3. Recitation 1.b

Blume includes “a first horizontal bore and a first vertical bore formed within the housing, the first vertical bore intersecting the first horizontal bore to form a first internal chamber.” As illustrated in the annotated figures below, the Blume fluid end includes an internal chamber (red) formed at the intersection of a vertical bore (blue) and the horizontal bore (green). EX1003, ¶¶269-270. As also explained by Mr. Marscher, such an internal chamber formed from the intersection of a vertical bore and a horizontal bore “is a conventional part of a fluid end, as illustrated in” the prior art discussed in section IV.b-f. EX1003, ¶¶269-270.

**EX1006, FIG. 13 (annotated)**

For completeness, it is noted that Stanton also includes a fluid end with the features of recitation 1.b. EX1003, ¶271.

**EX1007, FIG. 1 (annotated)**

#### 4. Recitation 1.c

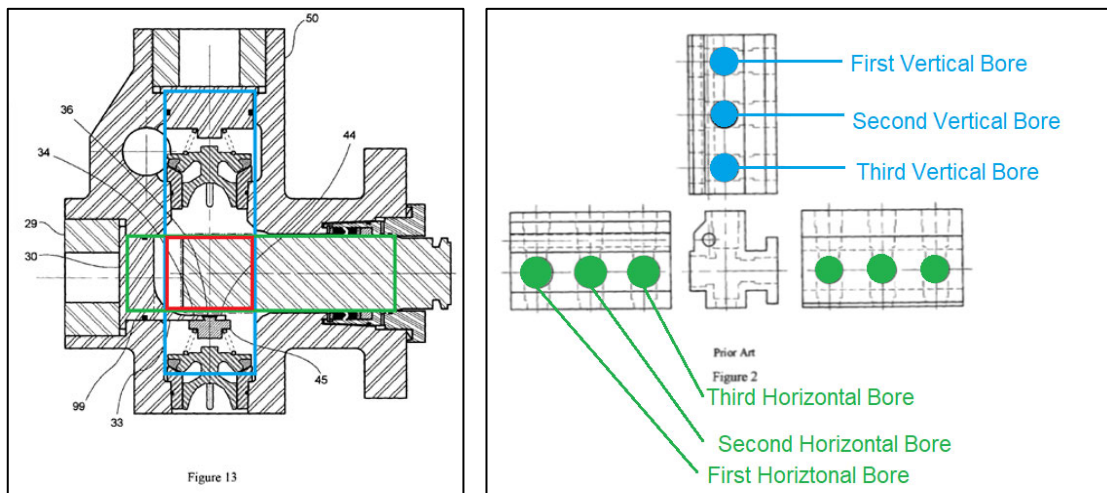
Recitation 1.c recites a second horizontal bore and a second vertical bore formed within the housing, the intersection of which forms a second internal chamber. EX1003, ¶272. A “second horizontal bore” and a “second vertical bore” are explicitly illustrated in Blume, but the “second internal chamber” is not.

EX1003, ¶272. Blume, however, is a triplex pump and its three plunger assemblies are illustrated in the figures of the Blume. EX1003, ¶272. As illustrated in the figures below from the Blume, the fluid pump includes three plunger assemblies. EX1003, ¶272. As Mr. Marscher explains:

“Second” as used [in recitation 1.c] refers to the bores associated with a second of the plungers of the example triplex pump. ... the POSITA would understand from this being a triplex pump that each plunger assembly is one of a homologous series (of three in this case, given the triplex pump being the example), each member of which has the same structure.

EX1003, ¶272.

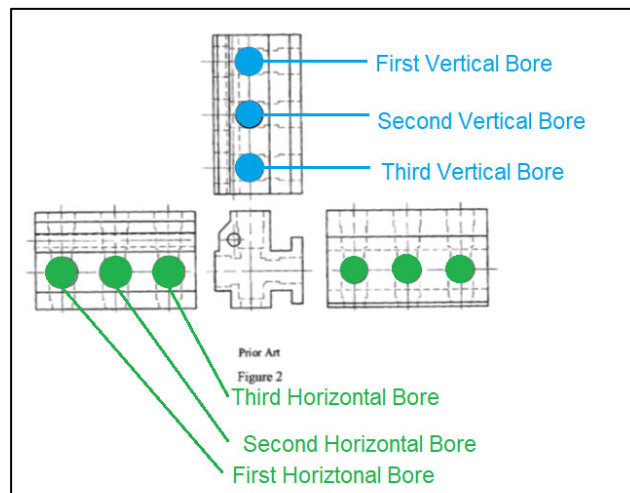
Accordingly, Blume would include the features of recitation 1.c as the Blume triplex pump would have “a second horizontal bore and a second vertical bore formed within the housing, the second vertical bore intersecting the second horizontal bore to form a second internal chamber” with the same structure as the corresponding “first horizontal bore,” “first vertical bore” and “first vertical chamber” as discussed in section IX.b.i.4, *supra*.



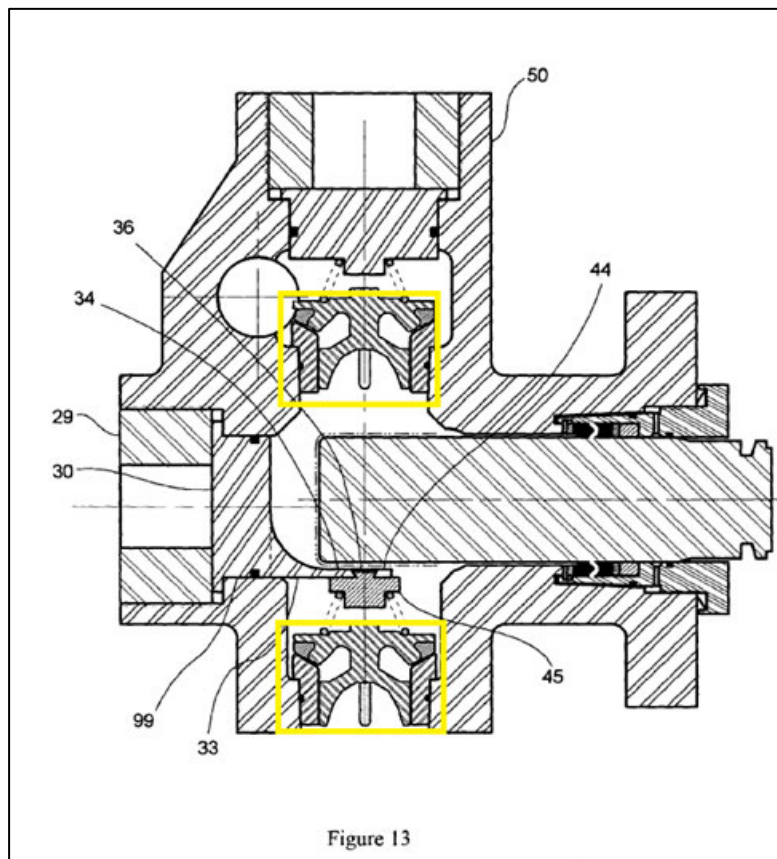
**EX1006, FIGs. 13 and 2 (annotated)**

### 5. Recitation 1.d

As illustrated in the figure below from Blume, the three horizontal and three vertical bores in Blume are in a side-by-side arrangement. EX1003, ¶274. Accordingly, it would have been obvious to the POSITA that Blume includes “the second horizontal bore, the second vertical bore, and the second internal chamber are situated in a side-by-side relationship with the first horizontal bore, the first vertical bore, and the first internal chamber” as recited in recitation 1.c. EX1003, ¶274.

**EX1006, FIG. 2 (annotated)****6. Recitation 1.e**

Blume includes “a first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber.” EX1003, ¶278. As illustrated below, the Blume fluid end includes a pair of valves (a suction valve and a discharge valve) arranged in the vertical bore and positioned on opposites side of the internal chamber. EX1003, ¶278.

**EX1006, FIG. 13 (annotated)****7. Recitation 1.f**

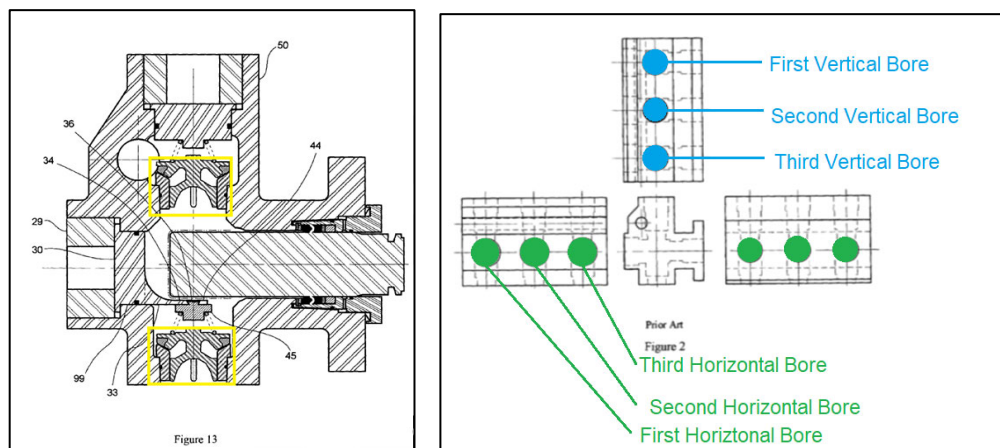
A “second pair of valves” with the features of those recited in recitation 1.f are not explicitly illustrated in Blume. EX1003, ¶282. Blume, however, describes a triplex pump and its three horizontal and three vertical bores are illustrated in its figures. EX1003, ¶282; *see* section IX.c.i.5, *supra*. As Mr. Marscher explains:

[E]ach of the plunger arrangements of the Blume fluid end would include substantially the same structure, including the valves illustrated above. Accordingly, “a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the

second internal chamber” would have been obvious at the time of filing to the skilled artisan from the teachings of the ‘097 Patent.

EX1003, ¶283.

Accordingly, Blume would include the features of recitation 1.f as the Blume triplex pump would have “a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal chamber” with the same structure as the corresponding “first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber” as discussed in section IX.c.i.6, *supra*.

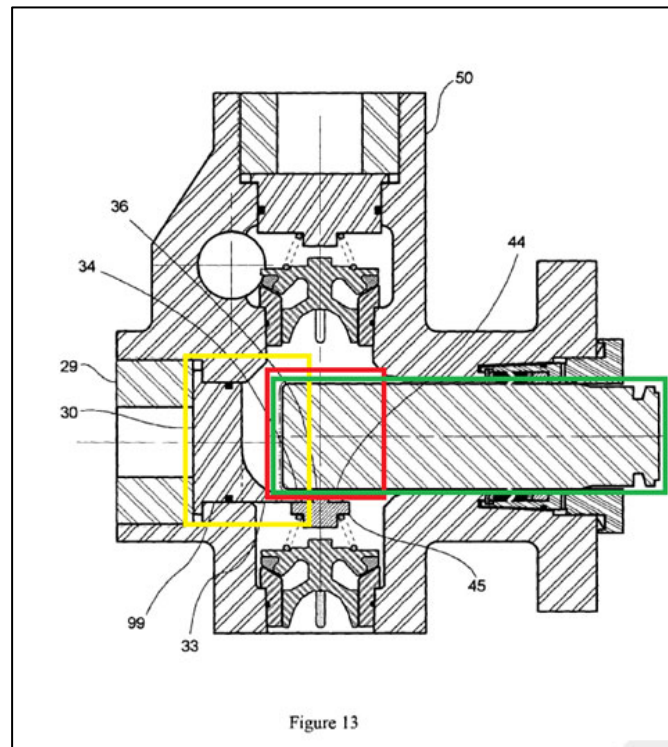


**EX1006, FIGs. 13 and 2 (annotated)**

## 8. Recitation 1.g

Blume includes “a first plug and a first reciprocating plunger installed within the first horizontal bore and positioned on opposite sides of the first internal chamber,” as illustrated in the annotated figure from Blume. *See also* EX1003, ¶¶285-286. As illustrated, a plug (yellow) is installed within the horizontal bore on

the opposite side of the internal chamber (red) from the plunger (green). To be clear, the plunger is shown below during a discharge stroke, but moves out of the internal chamber as reciprocating motion of the plunger continues. EX1003, ¶¶285-286.

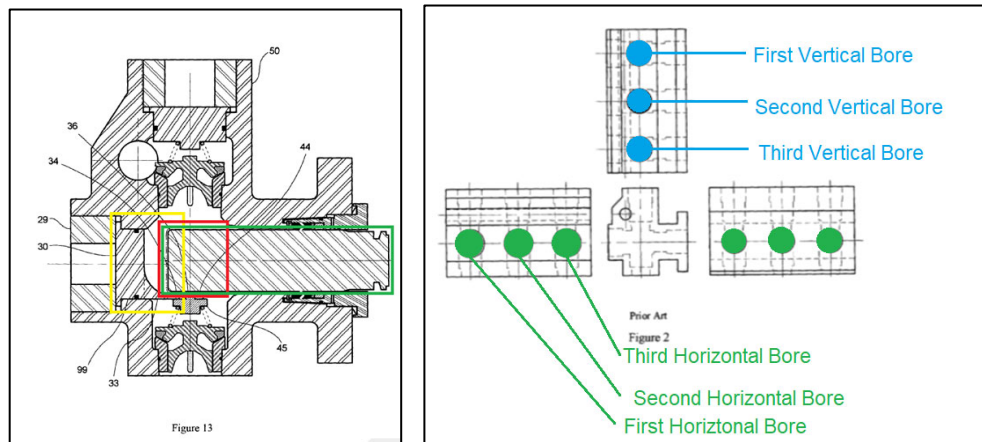


**EX1006, FIG. 2 (annotated)**

## 9. Recitation 1.h

Blume does not explicitly illustrate “a second plug and a second reciprocating plunger installed within the second horizontal bore and positioned on opposite sides of the second internal chamber.” As Mr. Marscher explains, however, such a “second plug” and “second plunger” would have been obvious to the POSITA because each plunger assembly of the Blume triplex pump would have the same structure as that illustrated in the figure below in which a plug (yellow) is installed

within the horizontal bore on the opposite side of the internal chamber (red) from the plunger (green). EX1003, ¶287.



**EX1006, FIGs. 13 and 2 (annotated)**

### 10. Recitation 1.i

Blume in view of Stanton and Wilkinson would have rendered obvious “a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores.” Such a plate would have been obvious to the POSITA based on the combined teachings of Blume and Wilkinson. EX1003, ¶¶288-301.

First, the nature of the recited plate is conventional, and had been used for many years prior to the priority date of Foster, including by Kerr themselves. EX1003, ¶¶285-286; EX1004, *passim*; EX1012; EX1005, *passim*. Such a plate also would have been obvious from the patent art prior to the priority date for Foster. EX1003, ¶¶289-293.

For example, as shown in figures from Wilkinson below, using a bolted-on plate to firmly secure a bore plug within a fluid end housing was well known.

EX1003, ¶¶289-293. As described in column 3 line 25 of the Wilkinson:

A set of three suction valves are accessed through the bottom of the block 14, and **a set of three discharge valves are accessed through the top of the block by removal of a plate 44.**

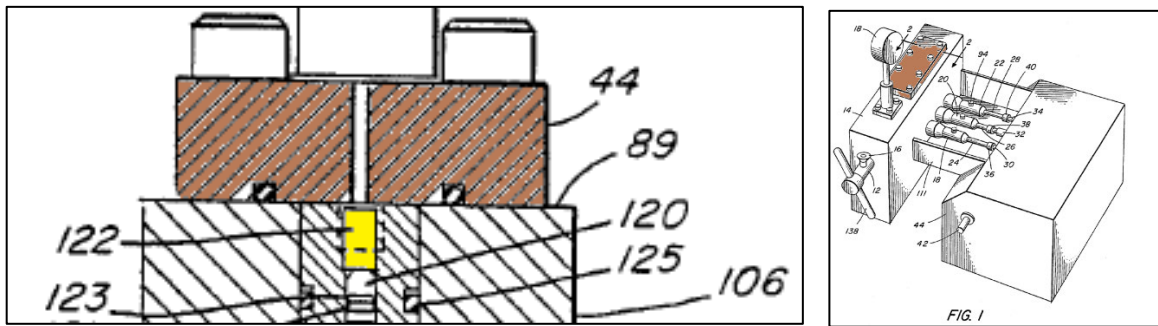
EX1008, 3:24 (emphasis added).

As further described in Wilkinson:

Each discharge valve assembly comprises a valve seat 112 having a center channel 114 in communication with the hemispherical termination of the valve bore. A ball 116 is guided within a bore 118 above the valve seat. A valve stop 120 is positioned in bore 118 of the valve seat **and is retained by a removable plug 122.**

EX1008, 4:55-60 (emphasis added).

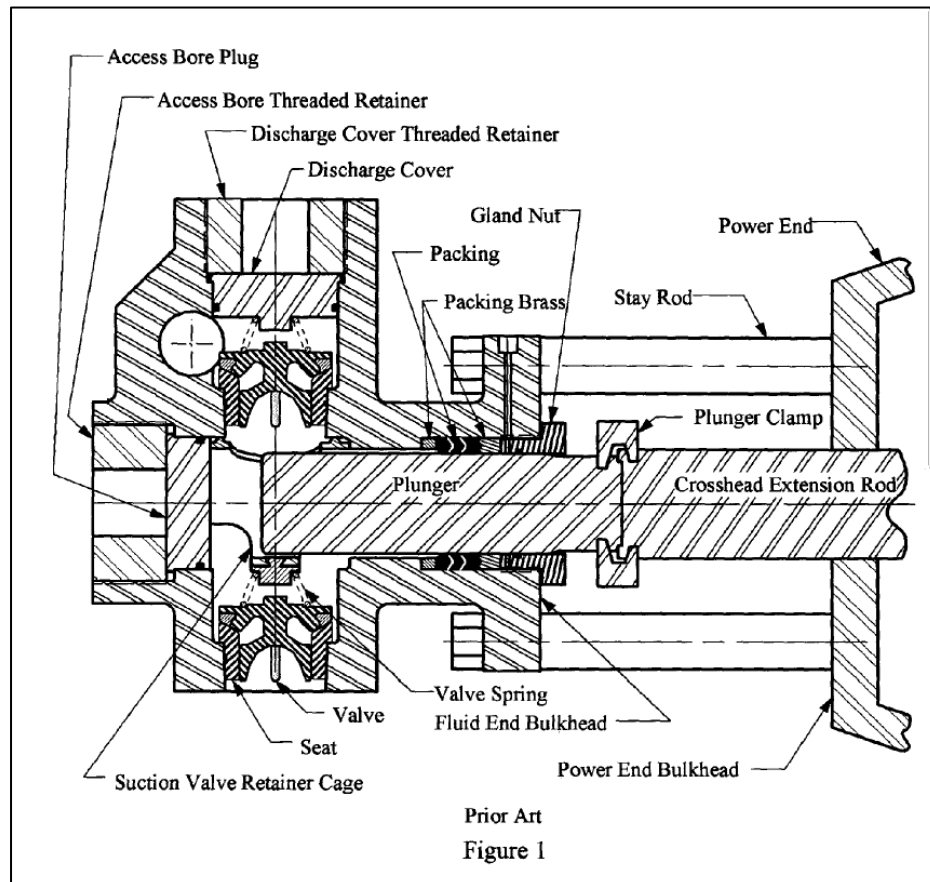
As indicated in the detail from FIG. 2 of Wilkinson provided below, plate 44 is fastened along the surface of the fluid end to retain the valve assembly and plug 122. EX1003, ¶292. Furthermore, the Wilkinson plate 44 covers the three bores associated with the three plunger assemblies of the Wilkinson fluid end. EX1003, ¶292.

**EX1006, FIGs. 2 and 1 (annotated)**

Claim 1 of Foster recites a plate that covers a horizontal bore, not a vertical bore. EX1003, ¶293. It would, nevertheless, have been obvious to the POSITA to use the plates from Wilkinson to cover the horizontal bore of the Blume fluid end. EX1003, ¶¶293-294. The POSITA would understand that there are numerous ways to secure a bore plug in a bore, such as the threaded plug of Blume or the cover plate of Wilkinson. EX1003, ¶¶293-294. The prior art also proves that a POSITA would understand that the same retention method may be used to cover both the vertical and horizontal bores of a fluid end.

More specifically, Blume shows that the same method of securing the plugs in the suction and discharge bores can be used to retain the plug in an access bore. EX1003, ¶¶293-295. That is, Blume uses the same retention technique (retainer covers) to secure plugs in both its horizontal and vertical bores. EX1003, ¶¶293-295. More specifically, as illustrated below, essentially identical threaded retainers are used to retain the discharge cover in the vertical bore and to retain the access bore plug in the horizontal bore. EX1003, ¶¶293-295. This suggests to the POSITA

that the same retention method, which ever one is selected, may be used to cover both the vertical and horizontal bores of a fluid end. EX1003, ¶¶293-295.



**EX1006, FIG. 1**

Accordingly, it would have been obvious to the POSITA to use a plate, such as plate 44 or 59 of Wilkinson, to secure the plug in the access bore of the Blume fluid end. Specifically, the POSITA would have understood that if a cover plate can be used to cover a vertical bore, then a structurally similar or identical plate could be used to cover a horizontal bore. EX1003, ¶¶293-296. Therefore, using a cover plate to cover the horizontal bore of Blume would be nothing more than replacing

one method of securing a bore plug with another known method with predictable results. EX1003, ¶¶293-296.

The POSITA would also understand that the structural and functional requirements for a vertical bore cover in Wilkinson are the same as those for the horizontal bore cover of Blume. EX1003, ¶¶293-296. The skilled artisan would also understand that the vertical bore pressure experienced by Wilkinson and Blume would be equivalent to the pressure experienced by the horizontal bore. EX1003, ¶¶293-296. Therefore, the POSITA would understand that using the vertical bore cover plate from Wilkinson would be an obvious and viable alternative to the horizontal bore plug retainer 29 of Blume.<sup>1</sup>

#### **11. Recitation 1.j**

Blume in view of Stanton and Wilkinson would have rendered obvious “a first component having a central opening formed therein, at least a portion of the first

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<sup>1</sup> Numerous other prior references, including those cited here (*e.g.*, Kerr (EX1004), Apex (EX1005), the Kerr website (EX1009, 23-24), the Kere Spec Sheet (EX1011), would have reinforced the obvious conclusion that the Wilkson vertical bore plate could be used to cover a horizontal bore of a fluid end like that in Blume. *See* EX1003, n1.

component installed within the first horizontal bore and at least a portion of the first reciprocating plunger installed within the central opening of the first component.”

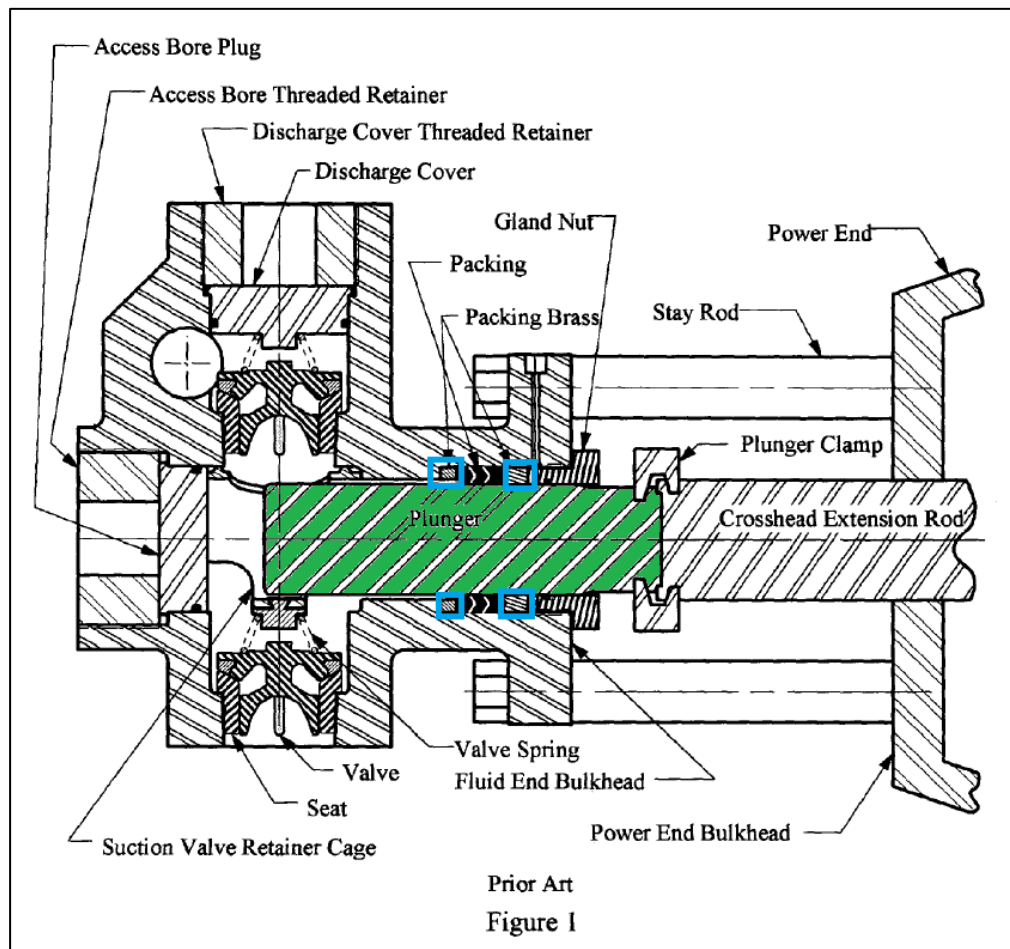
EX1003, ¶¶302-307.

First, “component” is a broad term that could arguably refer to almost any structure arranged within the first horizontal bore other than the later recited “seals.”

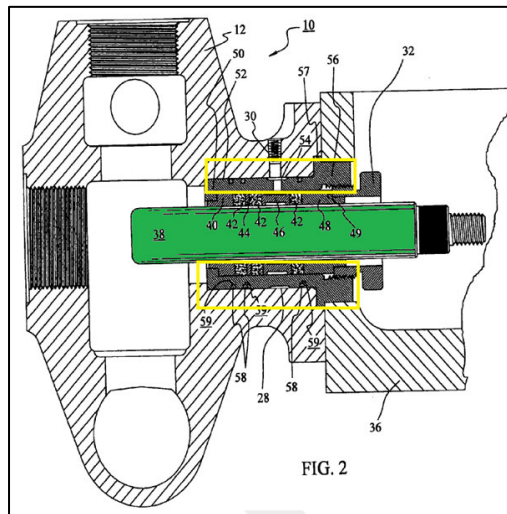
EX1003, ¶303. Foster, however, describes “stuffing box sleeves” as potential components. *See, e.g.*, EX1001 at 4:15-16, 6:66-67, 9:17-20, 11:2-4; *see also*

EX1003, ¶303.

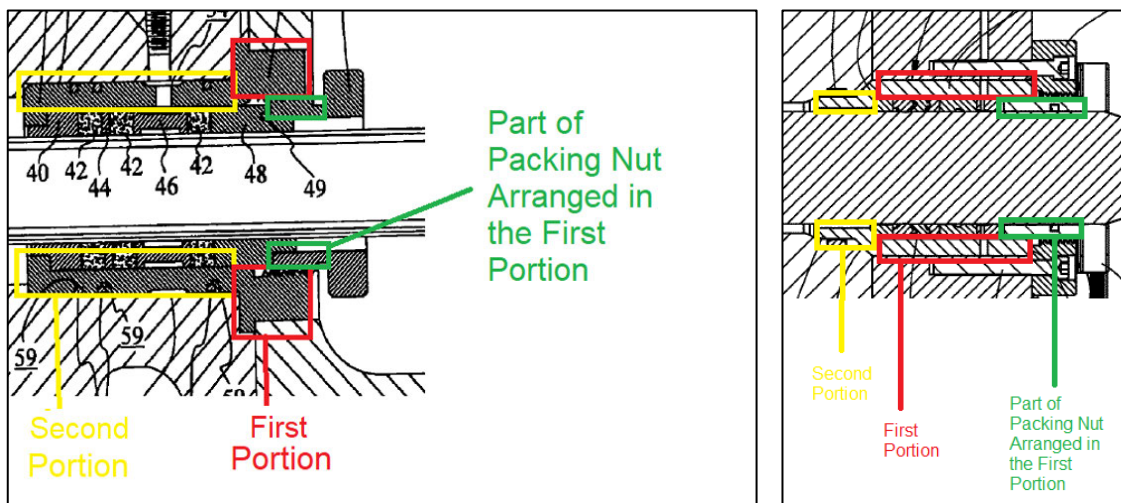
Blume includes a component (blue) with a central opening in which a portion of a reciprocating plunger (green) is installed, as illustrated in the annotated figures below. *See also* EX1003, ¶303.

**EX1006, FIG. 1 (annotated)**

The Blume component, however, is not explicitly illustrated as being a sleeve. EX1003, ¶304. While a sleeve is not necessarily needed to disclose the broad term “component,” the sleeve of Stanton is used in the present ground of rejection because a packing sleeve is an example of a “component” that is disclosed in Foster. As illustrated below, the Stanton packing sleeve (annotated in yellow) includes a portion that is installed in the horizontal bore and in which the plunger (annotated in green) is partially installed within the packing sleeve. EX1003, ¶304.

**EX1007, FIG. 2 (annotated)**

In fact, the stuffing box of Stanton includes the *unclaimed* features of the packing sleeve described in Foster – a first portion (red) with a larger diameter than a second portion (yellow) in which part of the packing nut (green) is arranged, as illustrated in the detail of FIG. 2 from Stanton provided below and compared with a detail of FIG. 6 of Foster. EX1003, ¶305.

**Comparison of the Packing Sleeve of Stanton with the Component of Foster**

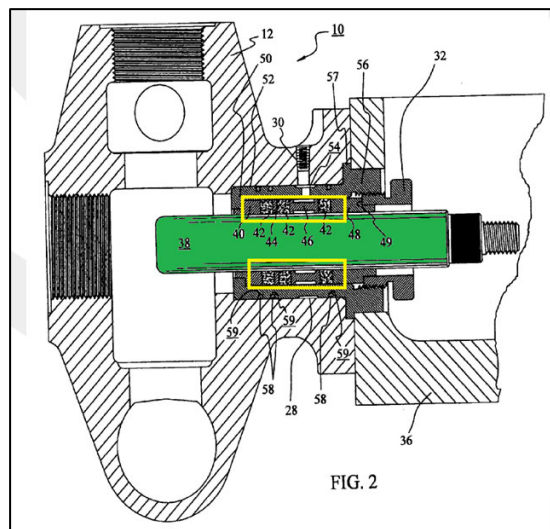
As Petitioner's expert Mr. Marscher explains, the POSITA would have understood that replacing the packing/stuffing arrangement of Blume with that of Stanton would be replacing one known method of providing packing to a plunger pump with another known method with predictable results. EX1003, ¶¶306-307. Furthermore, the POSITA would have been motivated to make such a modification because the POSITA would understand that providing a packing nut that screws into the stuffing box sleeve, as provided in Stanton, allows the compression of the packing arranged within the stuffing box sleeve to be set by torquing the packing nut 32 to a particular value. EX1003, ¶¶306-307. The arrangement of Blume requires a spring or other additional parts within the sleeve to set the pressure. EX1003, ¶¶306-307.

Having a packing nut that screws into a packing sleeve, as provided for in Stanton, also provides for easier repair in the event of damaged threads because the stuffing box sleeve may be replaced in the event of the damaged threads. EX1003, ¶¶306-307. In contrast, in the Blume design, the packing nut screws into the fluid end housing, making damaged threads much more difficult to replace or repair, requiring repair or replacement of the fluid end housing. EX1003, ¶¶306-307.

The above-described design choices would provide ample motivation for the POSITA to include a packing arrangement as provided for in Stanton in the place of the packing arrangement of Blume.

## 12. Recitation 1.k

Blume as modified by Wilkinson and Stanton would include “a first plurality of packing seals installed within the first component and engaging the first reciprocating plunger.” EX1003, ¶308. As illustrated below, installed within the packing sleeve (*i.e.*, “the component”) of Stanton are a plurality of packing seals (yellow) that engage the reciprocating plunger (green). EX1003, ¶308.



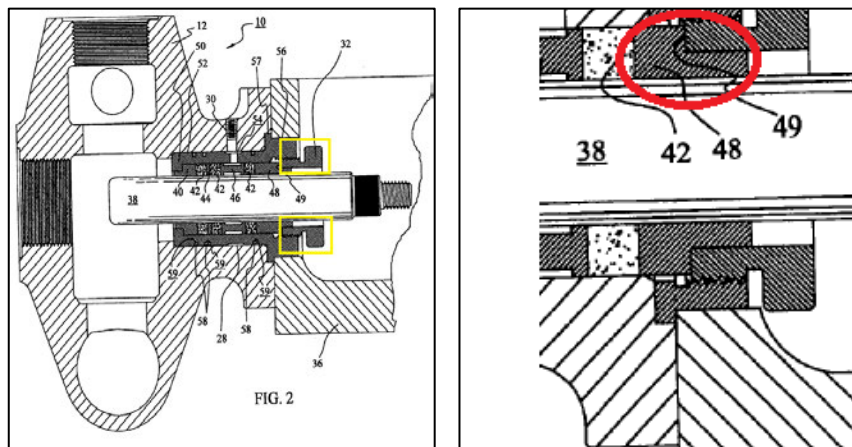
**EX1007, FIG. 2 (annotated)**

## 13. Recitation 1.l

Blume as modified by Wilkinson and Stanton to include the packing assembly/arrangement of Stanton would include “a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.” EX1003, ¶¶309-310.

The Stanton packing nut (annotated in yellow) is attached to its sleeve with threading in the location highlighted by the red circle in the annotated figures below.

EX1003, ¶¶309-310. This nut not only compresses the packing rings to squeeze out radial clearance around the plunger through which fluid could leak, but also acts to hold the packing rings in the sleeve, essentially acting as a detachable rear end of the packing sleeve. EX1003, ¶¶309-310. Accordingly, Blume as modified to include the packing assembly of Stanton would include “a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.” In fact, Blume utilizes a packing nut, indicating that such a packing nut would be desirable to include in Blume as modified to include the packing assembly of Stanton. EX1003, ¶¶309-310.



**EX1007, FIG. 2 (annotated)**

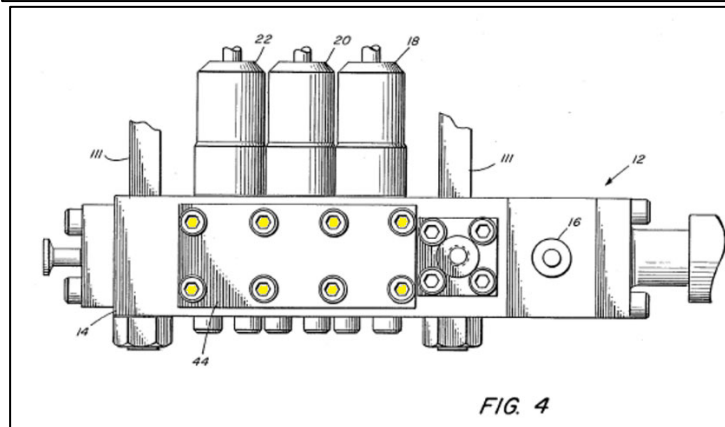
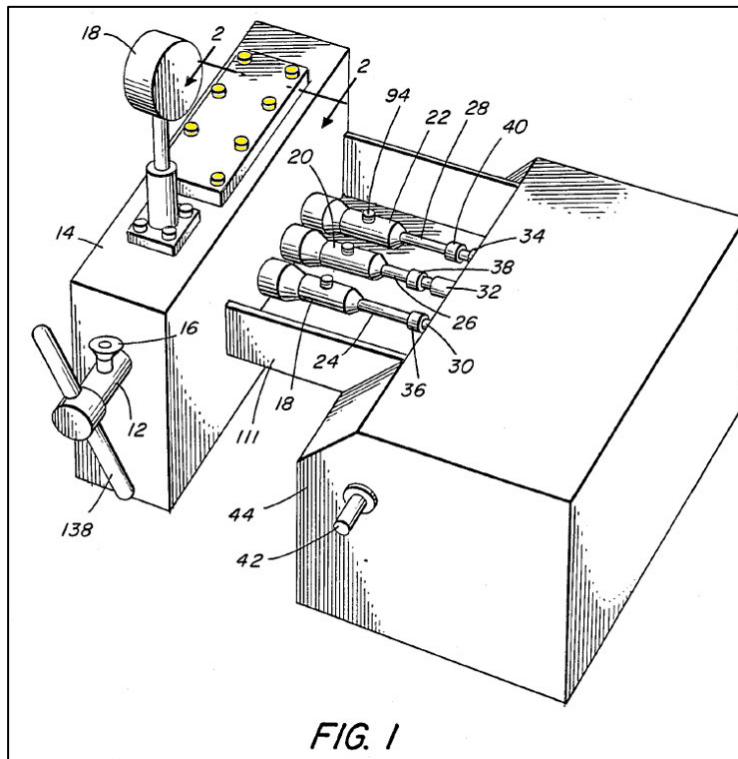
**ii. Claim 2**

**1. Recitation 2.a**

“[A] plurality of fastener openings that align with a plurality of threaded openings formed in the housing in a one-to-one relationship” would have been obvious from Blume in view of Stanton and Wilkinson.

FIGs. 1 and 4 from Wilkinson, reproduced below, illustrate hex-headed fasteners that secure the cover plates to the fluid end housing. EX1003, ¶¶311-312. As discussed in section IX.c.i.10, it would have been obvious to modify to the fluid end of Blume to cover the horizontal bore of Blume with a cover plate as disclosed in Wilkinson, which would include securing the cover plate to the fluid end housing using the hex-headed fasteners of Wilkinson. EX1003, ¶¶311-312. The POSITA would have understood that a hex head is used to torque a threaded fastener within a threaded opening in order to secure the fastener within the opening EX1003, ¶¶311-312.

The POSITA would also have understood that these hex-headed fasteners pass through fastener openings in the plate and engage with threaded openings formed in the housing in a one-to-one relationship in order to secure the plates to the fluid end housing. EX1003, ¶¶311-312. Specifically, the POSITA would have understood that a hex head is used to torque a threaded fastener within a threaded opening in order to secure the fastener within the opening. The threaded openings are not shown in sufficient detail to illustrate the actual threads. The presence of threads (in the fastener and its opposing hole or “opening”), however, would have been obvious to the POSITA given the fasteners that are illustrated with a hex head. Accordingly, it would have been obvious to the POSITA that the openings formed in the fluid end housing would be threaded.

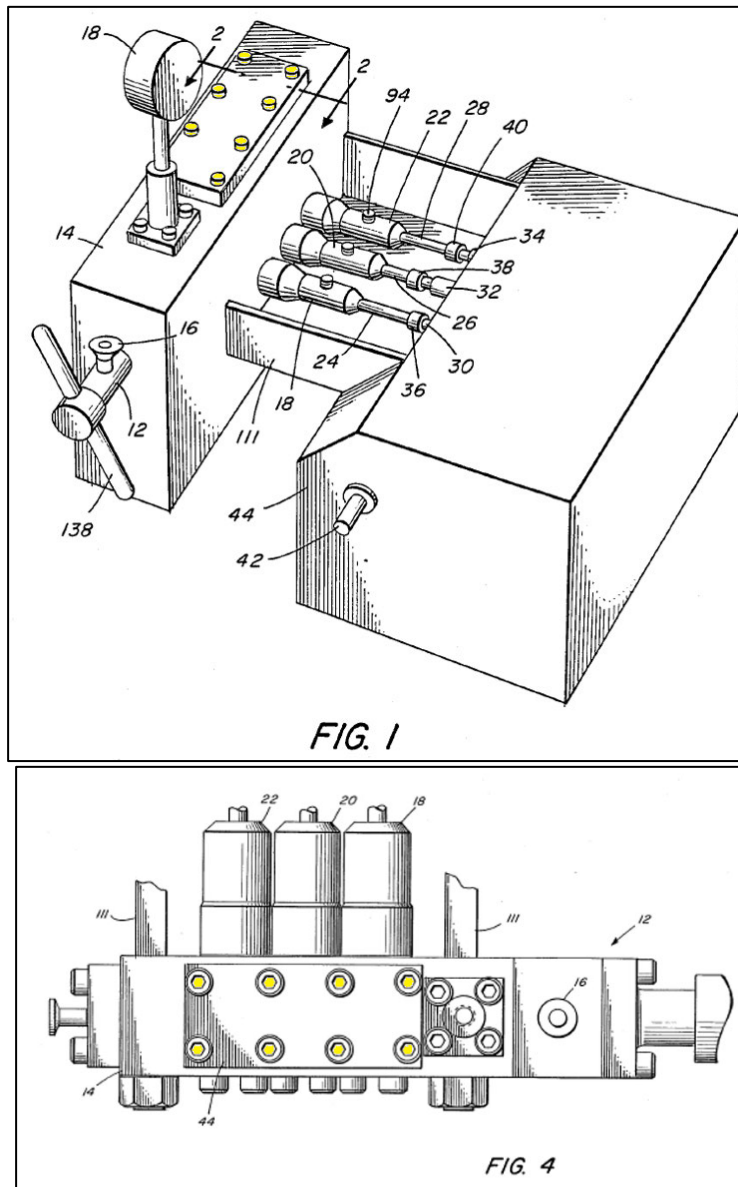


**EX1008, FIGs. 1 and 4 (annotated)**

**2. Recitation 2.b**

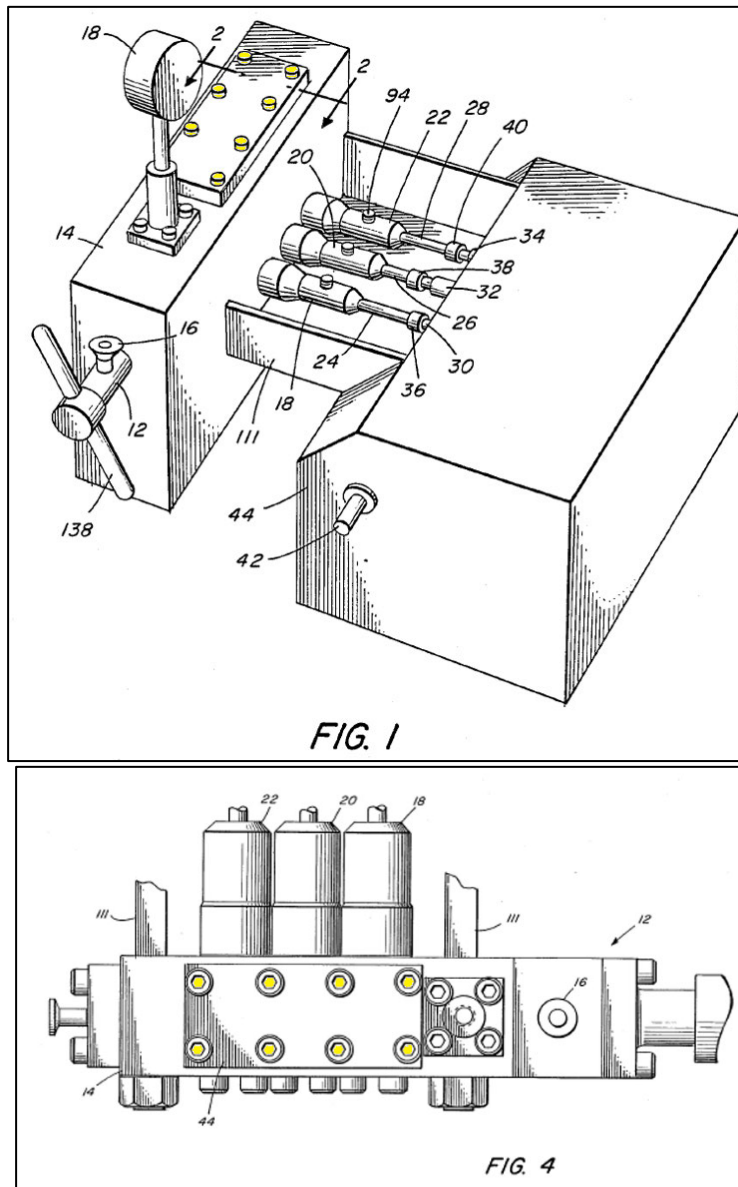
“[A] plurality of fasteners, each of the plurality of fasteners installed within a corresponding one of the aligned fastener openings and threaded openings” would have been obvious from Blume in view of Stanton and Wilkinson.

FIGs. 1 and 4 from Wilkinson, reproduced below, illustrate hex-headed fasteners that secure the cover plates to the fluid end housing. EX1003, ¶¶313-314. As discussed in section IX.c.i.10, it would have been obvious to modify to the fluid end of Blume to cover the horizontal bore of Blume with a cover plate as disclosed in Wilkinson, which would include securing the cover plate to the fluid end housing using the hex-headed fasteners of Wilkinson. EX1003, ¶¶313-314. The POSITA would have understood that a hex head threaded fastener used to secure the Wilkinson cover plate to the housing would pass through a fastener opening in the plate that is aligned with a threaded opening in the housing so that the threads of the hex-headed fastener would engage with the threads of the threaded openings to secure the plate to the housing. EX1003, ¶¶313-314.

**EX1008, FIGs. 1 and 4 (annotated)****iii. Claim 3**

Claim 3 of Foster recites “a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing.” The POSITA would have understood that a hex head threaded fastener used to secure the Wilkinson cover plate to the housing would pass through a

fastener opening in the plate that is aligned with a threaded opening in the housing so that the threads of the hex-headed fastener would engage with the threads of the threaded openings to secure the plate to the housing. EX1003, ¶¶315-316. Accordingly, “a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing” would have been obvious to the POSITA from Blume in view of Stanton and Wilkinson. EX1003, ¶¶315-316.

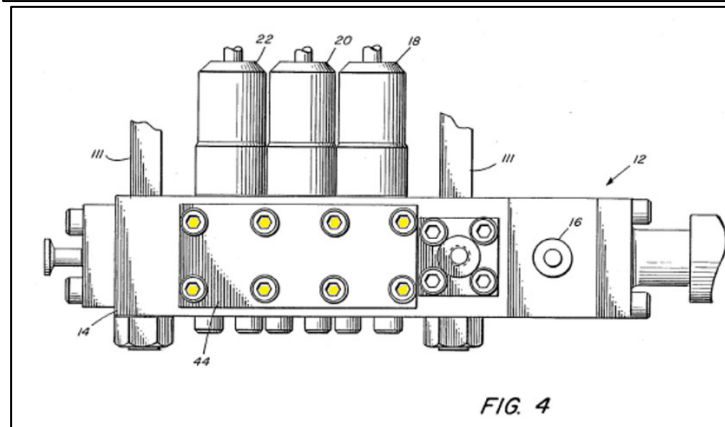
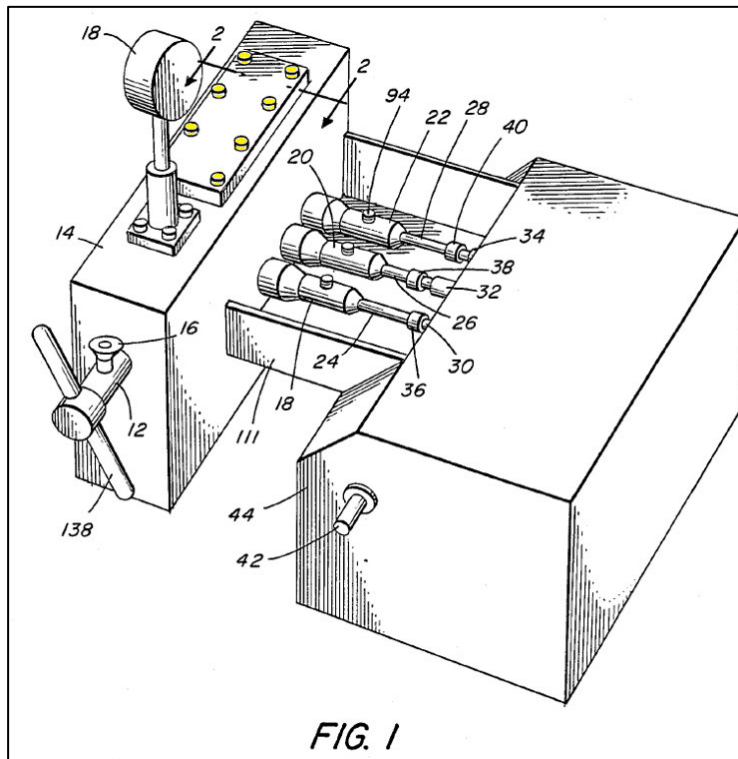


**EX1008, FIGs. 1 and 4 (annotated)**

#### iv. Claim 4

Claim 4 of Foster recites that “each of the plurality of fasteners is a threaded fastener.” The POSITA would have understood that a hex head is used to torque a threaded fastener within a threaded opening in order to secure the fastener within the opening EX1003, ¶¶317-318. The POSITA would also have understood that the

hex-headed fasteners of Wilkinson are threaded fasteners. EX1003, ¶¶317-318. Specifically, the POSITA would have understood that a hex head is used to torque a threaded fastener within a threaded opening in order to secure the fastener within the opening. EX1003, ¶¶317-318. The fasteners are not shown in sufficient detail to illustrate the actual threads. EX1003, ¶¶317-318. The presence of threads (in the fastener and its opposing hole or “opening”), however, would have been obvious to the POSITA given the fasteners that are illustrated with a hex head. EX1003, ¶¶317-318.

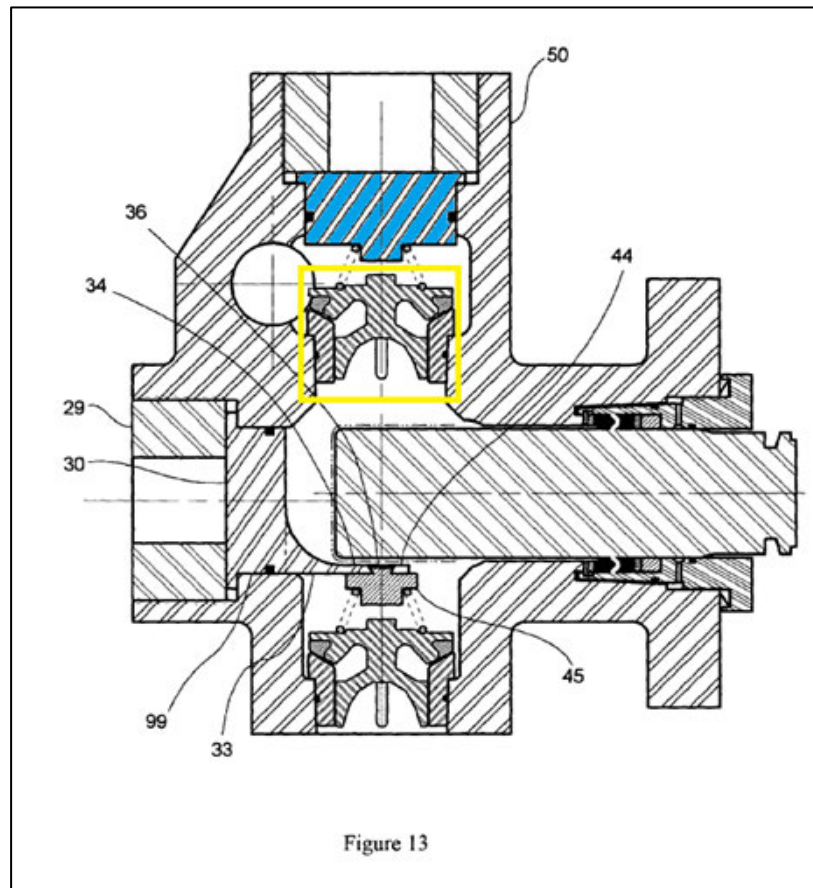


**EX1008, FIGs. 1 and 4 (annotated)**

**v. Claim 5**

Claim 5 recites “a third plug installed within the first vertical bore and positioned between an external surface of the housing and one of the first pair of valves.” This claim is arguably broad enough to cover a top vertical bore plug or a bottom vertical bore plug. EX1003, ¶319. A top vertical bore plug is shown in

Figure 13 below, from Blume, and is a conventional part of a plunger pump fluid end. These plugs provide a pressure retention seal, and in some fluid ends, retain valves in the fluid end.



**EX1006, FIG. 13 (annotated)**

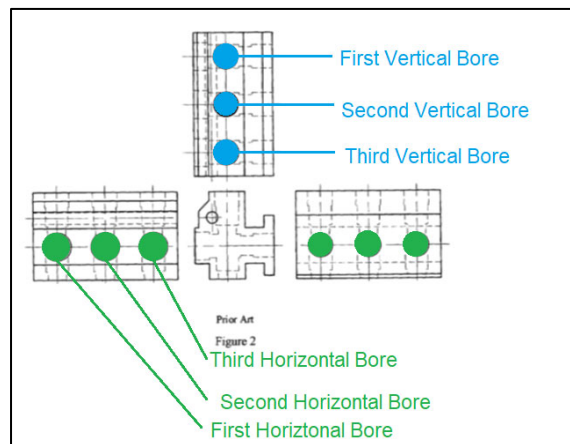
**vi. Claim 6**

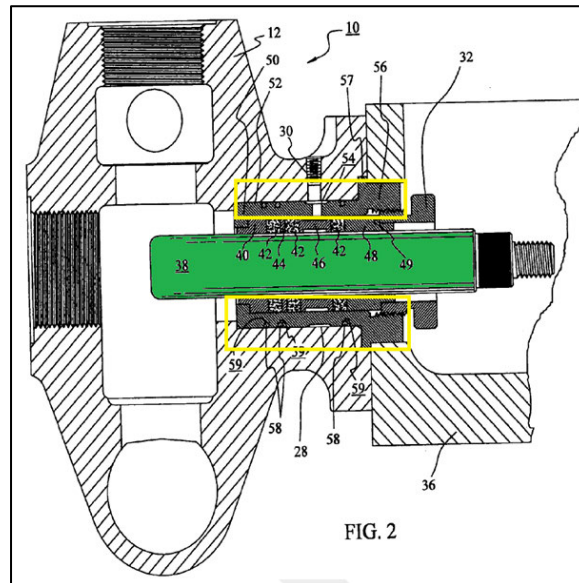
**1. Recitation 6.a**

Recitation 6.a of claim 6 recites “a second component having a central opening formed therein, at least a portion of the second component installed within the second horizontal bore and at least a portion of the second reciprocating plunger installed within the central opening of the second component.” Where recitation 1.j

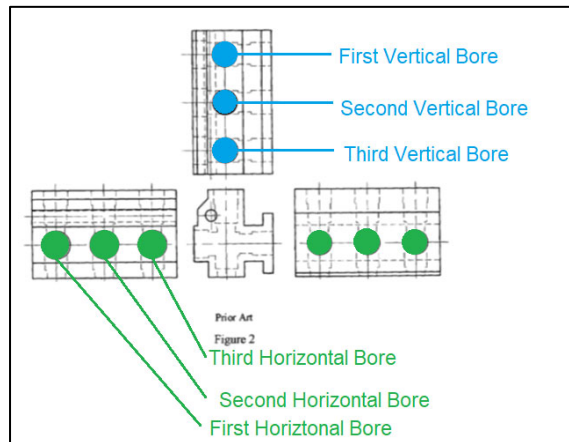
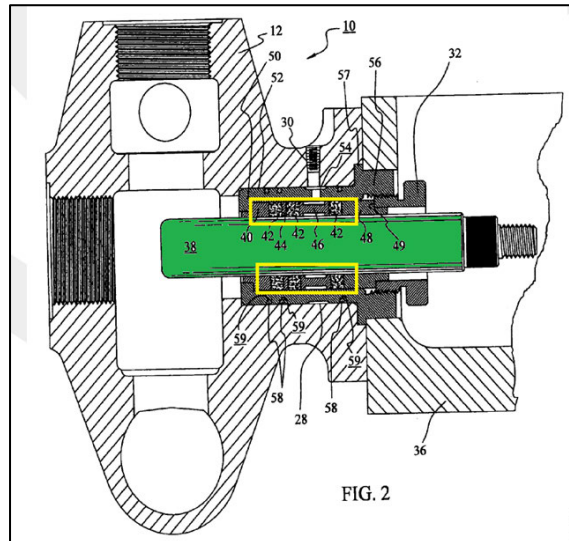
of claim 1 recites the “first component” for a first plunger assembly, this recitation recites the corresponding “component” for a second plunger assembly of a multiplex pump. EX1003, ¶¶320-321. Accordingly, Blume as modified by Wilkinson and Stanton provides a second component for the same reasons as the first component of recitation 1.j.

Blume describes a triplex pump and its three horizontal and three vertical bores are illustrated in its figures. EX1003, ¶¶320-321; *see* section IX.c.i.5, *supra*. Accordingly, a triplex pump as disclosed in Blume modified to include the packing arrangement of Stanton would include three such packing arrangements – one for each plunger assembly. EX1003, ¶¶320-321. Accordingly, a “second component” as recited in recitation 6.a would have been obvious from Blume in view of Stanton and Wilkinson – the “first component” corresponding to the Stanton packing sleeve of a first of the plunger arrangements and the “second component” corresponding to the Stanton packing sleeve of a second of the plunger arrangements.



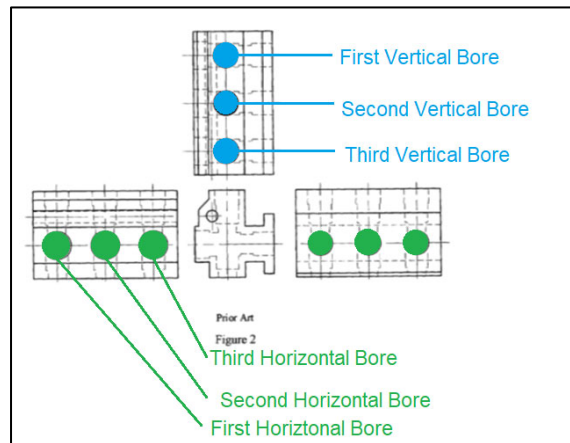
**EX1006, FIG. 2 (annotated)****EX1007, FIG. 2 (annotated)****2. Recitation 6.b**

Recitation 6.b of claim 6 recites “a second plurality of packing seals installed within the second component and engaging the second reciprocating plunger.” A triplex pump as disclosed in Blume modified to include the packing arrangement of Stanton would include such a “second plurality of packing seals.” EX1003, ¶¶322-323. Specifically, a “second plurality of packing seals” as recited in recitation 6.b would have been obvious from Blume in view of Stanton and Wilkinson – the “first plurality of packing seals” corresponding to the Stanton packing seals of a first of the plunger arrangements and the “second plurality of packing seals” corresponding to the Stanton packing seals of a second of the plunger arrangements.

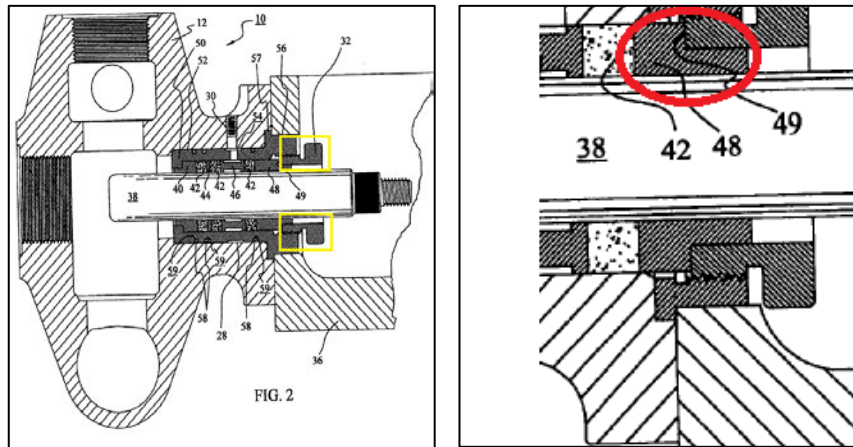
**EX1006, FIG. 2 (annotated)****EX1007, FIG. 2 (annotated)****3. Recitation 6.c**

Recitation 6.c of claim 6 recites “a second packing nut attached to the second component and holding the second plurality of packing seals within the second component.” A triplex pump as disclosed in Blume modified to include the packing arrangement of Stanton would include such a “second packing nut.” EX1003, ¶¶324-325. Specifically, a “second packing nut” as recited in recitation 6.c would have been obvious from Blume in view of Stanton and Wilkinson – the “first packing nut”

corresponding to the Stanton packing nut of a first of the plunger arrangements and the “second packing nut” corresponding to the Stanton packing nut of a second of the plunger arrangements.



**EX1006, FIG. 2 (annotated)**



**EX1007, FIG. 2 (annotated)**

**i. Claim 7**

**1. Recitation 7.P**

Recitation 7.P is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.1, *infra*. See also EX1003, ¶326.

**2. Recitation 7.a**

Recitation 7.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.2, *infra*. See also EX1003, ¶327.

**3. Recitation 7.b**

Recitation 7.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.3, *infra*. See also EX1003, ¶¶328-330.

**4. Recitation 7.c**

Recitation 7.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.4, *infra*. See also EX1003, ¶¶331-332.

**5. Recitation 7.d**

Recitation 7.d is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.5, *infra*. See also EX1003, ¶¶333-336.

**6. Recitation 7.e**

Recitation 7.e is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.6, *infra*. See also EX1003, ¶¶337-340.

**7. Recitation 7.f**

Recitation 7.f is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.7, *infra*. See also EX1003, ¶¶341-343.

**8. Recitation 7.g**

Recitation 7.g is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.10, *infra*. See also EX1003, ¶¶344-357.

**9. Recitation 7.h**

Recitation 7.h is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.11, *infra*. See also EX1003, ¶¶358-364.

**10. Recitation 7.i**

Recitation 7.i is analogous to the “reciprocating plunger” features of recitation 1.g and 1.j, and therefore, recitation 7.i is disclosed or would have been obvious for reasons analogous to those directed to the “first reciprocating plunger” presented in section IX.c.i.8 and IX.c.i.11, *infra*. See also EX1003, ¶¶365.

**11. Recitation 7.j**

Recitation 7.j is disclosed or would have been obvious over Blume-Wilkinson-Stanton for reasons analogous to those presented in section IX.c.i.12, *infra*. See also EX1003, ¶366.

**12. Recitation 7.k**

Recitation 7.k is disclosed or would have been obvious over Blume-Wilkinson-Stanton for reasons analogous to those presented in section IX.c.i.13, *infra*. See also EX1003, ¶¶367-368.

**ii. Claim 8****1. Recitation 8.a**

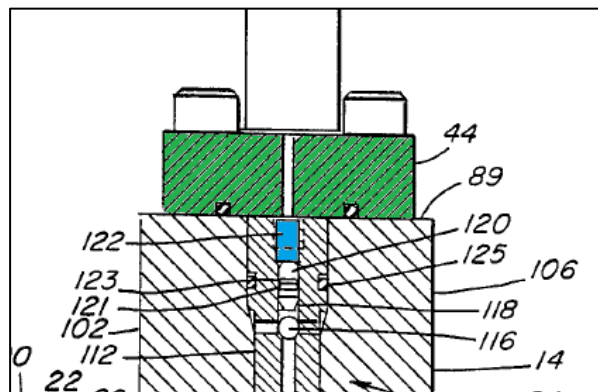
Recitation 8.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.8, *infra*. See also EX1003, ¶¶368-370.

## 2. Recitation 8.b

Recitation 8.b is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.i.9, *infra*. See also EX1003, ¶¶371.

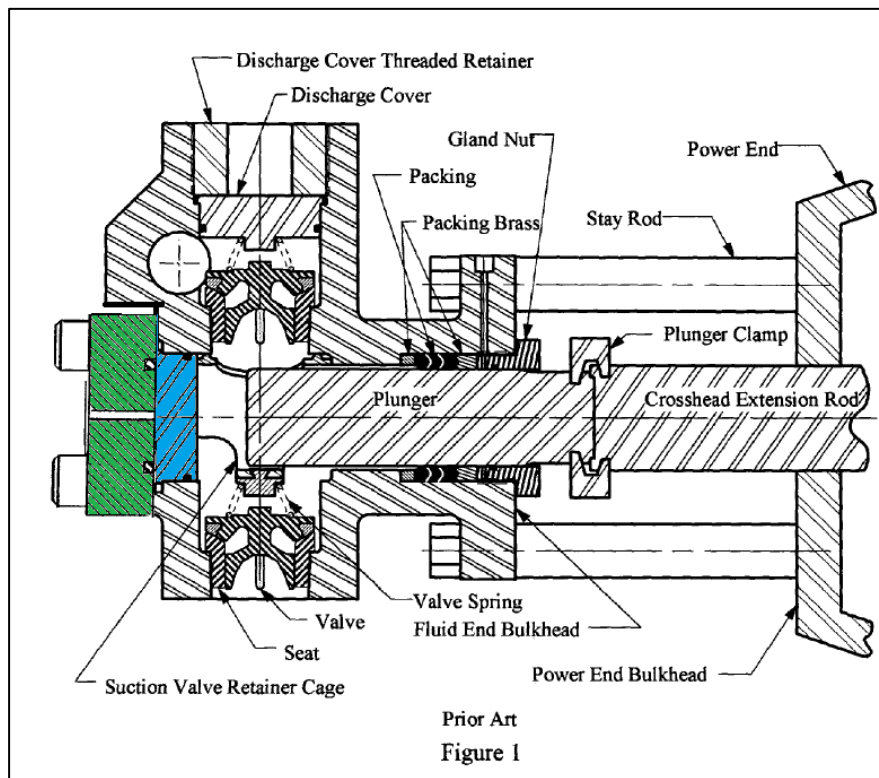
## 3. Recitation 8.c

Blume as modified by Stanton and Wilkinson would include a first plug “positioned adjacent the plate.” Specifically, the plate 44 of Wilkinson secures its valve in the bore via a plug 122. EX1008, 3:25-29, 4:59-60; EX1003, ¶¶372-373. The plate 44 (green) is positioned adjacent to plug 122 (blue) such that they are abutting, as illustrated in the annotated detail from FIG. 2 of Wilkinson. EX1003, ¶¶372-373.



**EX1008, FIG. 2 (annotated)**

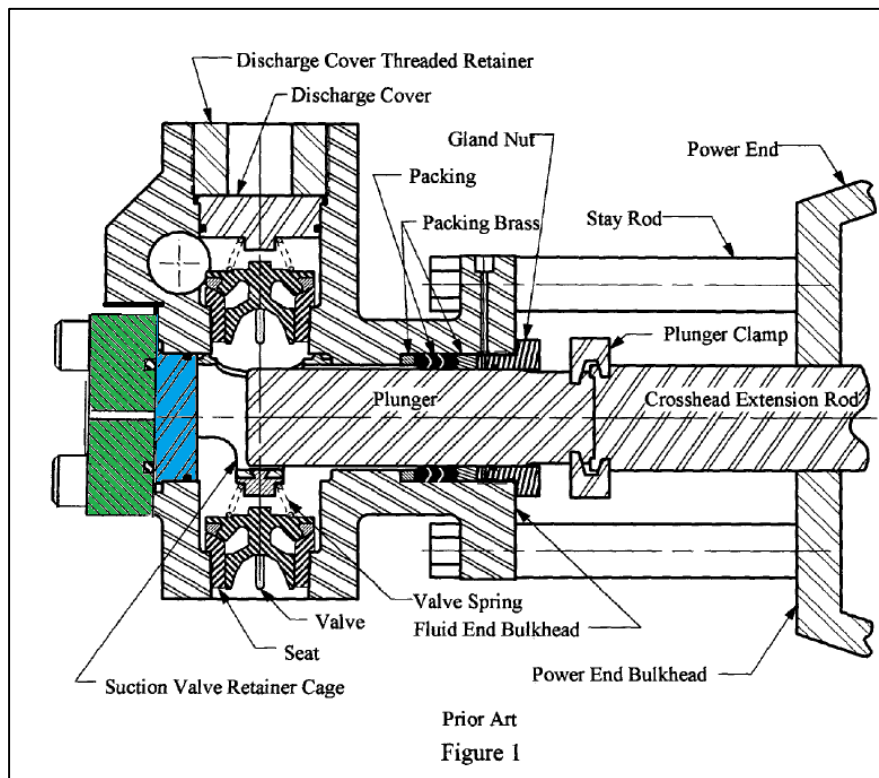
Accordingly, when the POSITA applies the plate of Wilkinson to cover the horizontal bore of Blume, the POSITA will position the plate adjacent to the “first plug” arranged within the horizontal bore, as illustrated in the combination of FIG. 1 of Blume with the plate of Wilkinson, as proposed by Mr. Marscher below.



**EX1006, FIG. 1 (annotated to include plate of Wilkinson (EX1008); see also EX1003, ¶¶372-373**

#### 4. Recitation 8.d

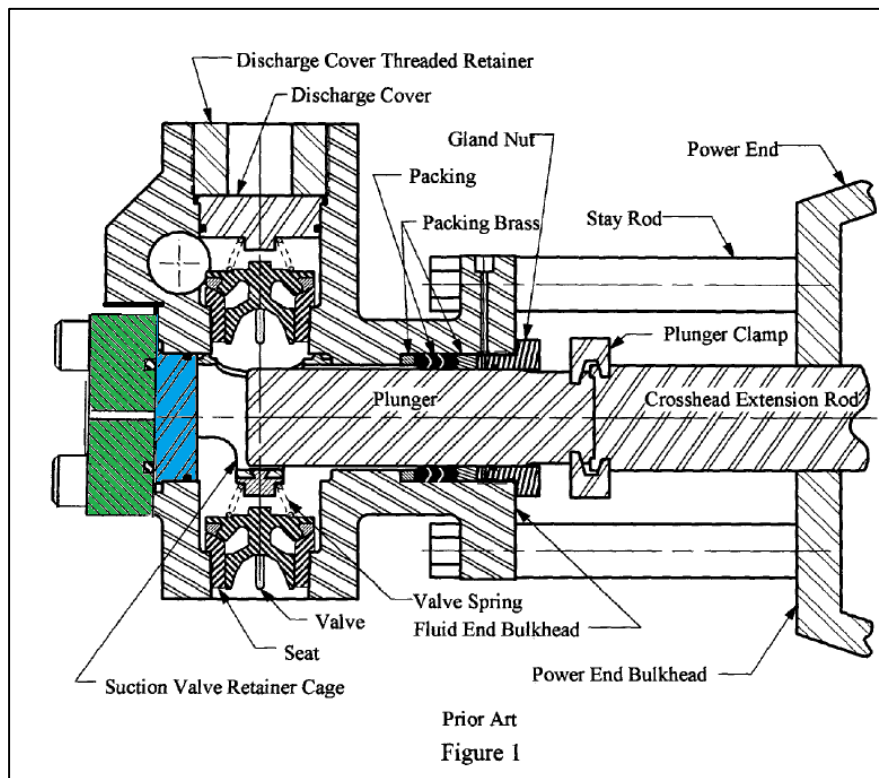
The “second plug” of Blume as modified by Stanton and Wilkinson would be “positioned adjacent the plate.” As Mr. Marscher explains, the “second plug” would have the same structure as the “first plug.” EX1003, ¶¶374-375. Furthermore, Wilkinson discloses that its plate 44 is configured to cover multiple bores. EX1008, 3:35:25-29. Accordingly, the “second plug” of Blume as modified by Stanton and Wilkinson would be “positioned adjacent the plate,” as illustrated in the annotated figure provided below. Specifically, the second plug (blue) is adjacent to the plate (green), and also abuts the plate. EX1003, ¶¶374-375.



**EX1006, FIG. 1 (annotated to include plate of Wilkinson (EX1008); see also EX1003, ¶¶372-373**

**iii. Claim 9**

As explained above, modifying Blume to cover plugs arranged in the first and second bores with the Wilkinson plate would result in the “plate” abutting the “first plug” and the “second plug,” as illustrated in the annotated figure provided below. Specifically, the plate (green) abuts the first plug (blue). EX1003, ¶376. Similarly, the second plug would have the same relative arrangement to the plate. EX1003, ¶376. Therefore, the second plug would also abut the plate.



**EX1006, FIG. 1 (annotated to include plate of Wilkinson (EX1008); see also EX1003, ¶¶372-373**

**iv. Claim 10**

Claim 10 is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.v, *infra*; see also EX1003, ¶377.

**v. Claim 11**

**1. Recitation 11.a**

Recitation 11.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.ii.1, *infra*; see also EX1003, ¶¶378-379.

## **2. Recitation 11.b**

Recitation 11.b is disclosed or would have been obvious over Blume-Wilkinson-Stanton for reasons analogous to those presented in section IX.c.ii.2, *infra*; *see also* EX1003, ¶¶380-381.

### **vi. Claim 12**

Claim 12 is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.iii; *infra*; *see also* EX1003, ¶¶382-383.

### **vii. Claim 13**

Claim 13 is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.iv, *infra*; *see also* EX1003, ¶¶384-385.

### **viii. Claim 14**

#### **1. Recitation 14.a**

Recitation 14.a is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.vi.1, *infra*; *see also* EX1003, ¶386.

#### **2. Recitation 14.b**

Recitation 14.b is a combination of the features of recitations 1.h and 6.a. Therefore, recitation 14.b is disclosed or would have been obvious for reasons analogous to those presented in sections IX.c.i.9 and IX.c.vi.1, *infra*; *see also* EX1003, ¶387.

### 3. Recitation 14.c

Recitation 14.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.vi.2, *infra*; *see also* EX1003, ¶388.

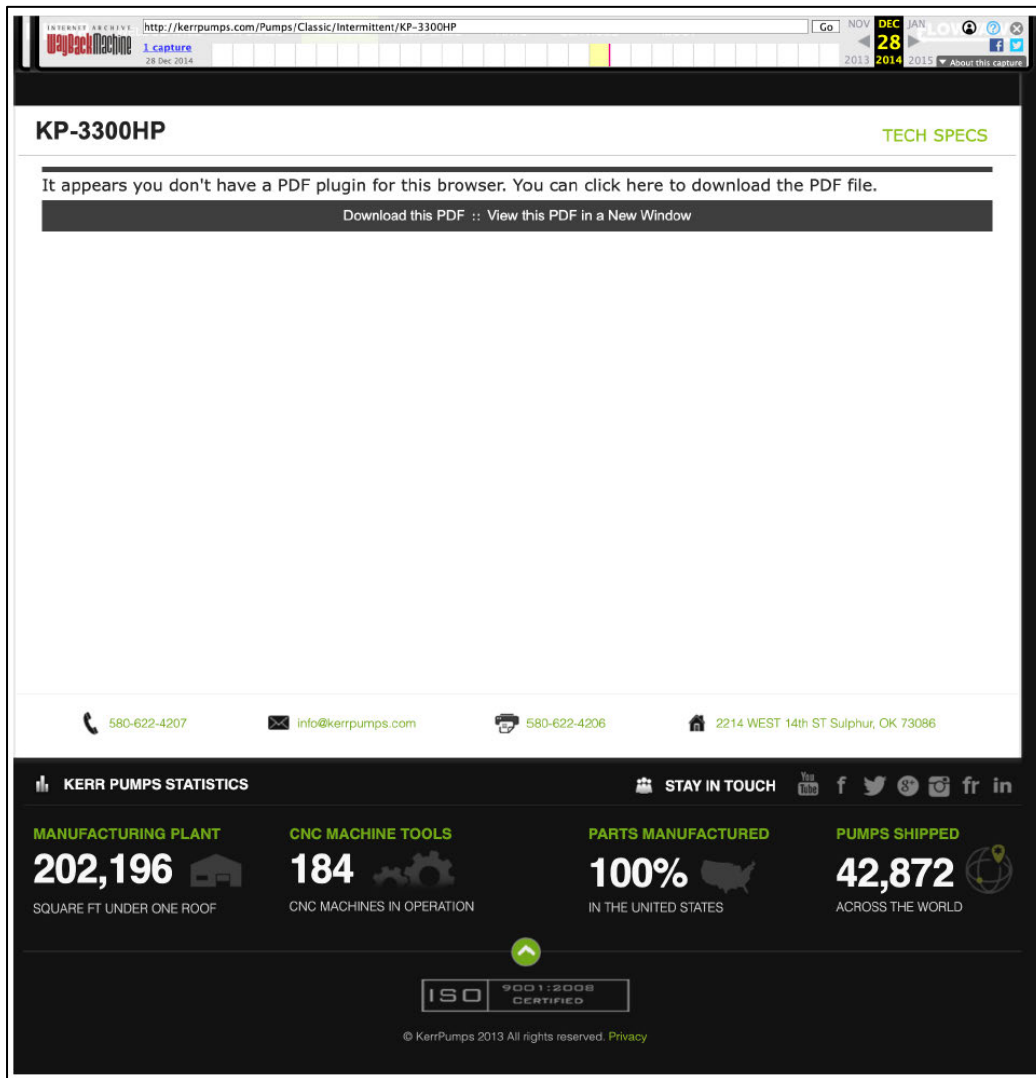
### 4. Recitation 14.d

Recitation 14.c is disclosed or would have been obvious for reasons analogous to those presented in section IX.c.vi.3, *infra*; *see also* EX1003, ¶389.

#### d) Ground 4

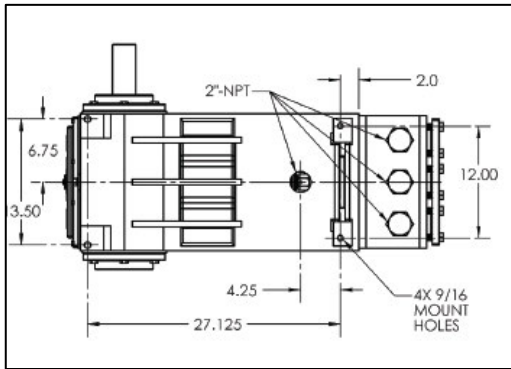
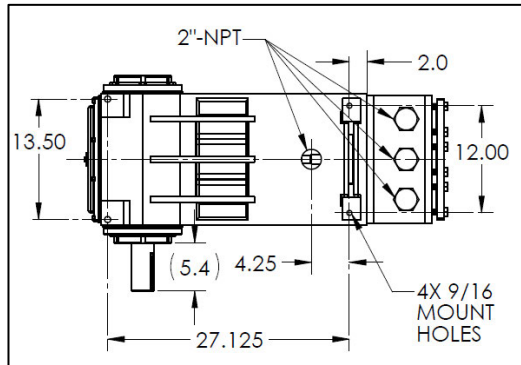
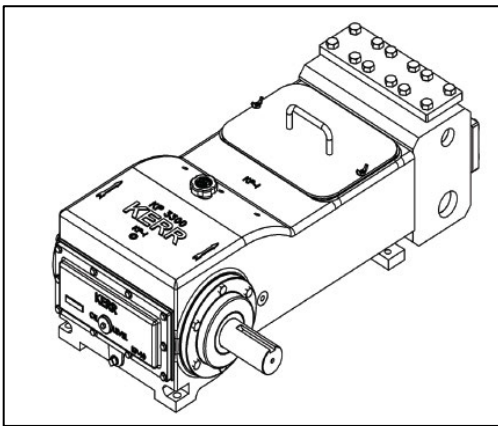
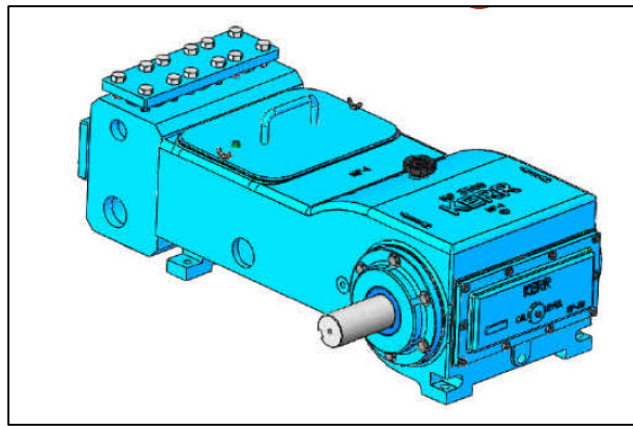
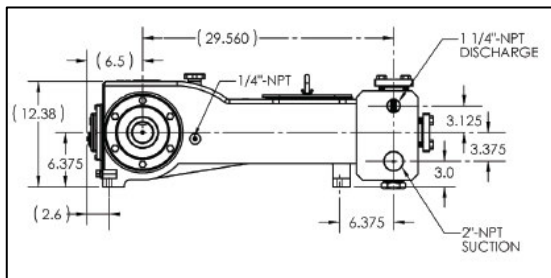
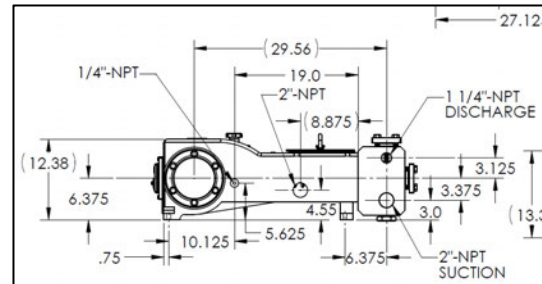
Claims 1-14 of Foster are invalid as obvious over the offer for sale of the Kerr Pump. The Kerr Pump was offered for sale by Kerr no later than December 28, 2014, as indicated by its inclusion as a product for sale on the Kerr website on or before December 28, 2014, as illustrated below:

|                                                                                                                                                                                                                         |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <a href="https://web.archive.org/web/20141228144522/http://kerrpumps.com/Pumps/Classic/Intermittent/KP-3300HP">https://web.archive.org/web/20141228144522/http://kerrpumps.com/Pumps/Classic/Intermittent/KP-3300HP</a> |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|



### EX1009, 25-26

As part of the offer for sale, Kerr provided a “spec sheet” for the KP-3300HP pump (“Kerr Spec Sheet,” EX1011), a link to which is illustrated in the image from EX1009 above. Furthermore, Kerr (i.e., EX1004, the Kerr Pump manual relied upon in Ground 1 above) is representative of the Kerr Pump that was offered for sale. Reproduced below are figures from the Kerr Spec Sheet (EX1011) provided by PO Kerr Pumps that are essentially identical to the figures included in Kerr (EX1004):

**EX1011****EX1004, 25****EX1011****EX1004, 24****EX1011****EX1004, 25**

Accordingly, the disclosures in Kerr (EX1004) are representative of the Kerr Pump as it was offered for sale on or before December 28, 2014. EX1003, ¶393. Therefore, claims 1-14 of Foster are invalid over the Kerr Pump for the same reasons as those presented in section IX.a based on Kerr. EX1003, ¶393.

e) **Ground 5**

Claim 15 is unpatentable under 35 U.S.C. § 112 as, for example, being indefinite for failing to particularly point out and distinctly claim the subject matter regarded as the invention. Claim 15 recites:

15. The fluid end assembly of claim 7, further comprising: **a retainer attached to the first component using the plurality of fasteners;**

in which at least a portion of the first packing nut is installed within the retainer.

(Emphasis added).

First, the “plurality of fasteners” lacks antecedent basis. Claim 7, from which claim 15 depends, does not recite “a plurality of fasteners,” nor does claim 15 introduce “a plurality of fasteners.” Therefore, claim 7 is indefinite for at least this reason. EX1003, ¶395.

Second, assuming *arguendo* that claim 15 was intended to depend from claim 12 which introduces “a plurality of fasteners,” the claim would still be indefinite because it is not clear to the POSITA how “a plurality of fasteners ... extending through the plate and into the housing to fasten the plate to the housing” could also attach a retainer to the first component arranged at least partially within the recited horizontal bore. EX1003, ¶396.

Third, even if it is assumed *arguendo* that the POSITA would understand how “a plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing” could also attach a retainer to the first component arranged at least partially within the recited horizontal bore, the claim would be unpatentable as failing the written description requirement of 35 U.S.C. § 112(a). Foster provides no disclosure of a plurality of fasteners that serve both of these functions. EX1003, ¶¶397-398; EX1001, *passim*.

## **X. THE PETITION SHOULD NOT BE PROCEDURALLY DENIED**

### **a) The Petition Should not be Denied Under 35 U.S.C. § 324**

As indicated in *Supercell OY v. Gree, Inc.*, PGR2020-00041, Paper 14 at 5 (PTAB, Sept, 14, 2020), the Board’s *Fintiv* Factors<sup>2</sup> apply to post grant review proceedings. In this case, however, none of the *Fintiv* Factors support discretionary denial. With regard to the first 5 *Fintiv* Factors,<sup>3</sup> there are no co-pending proceedings related to Foster. Therefore, none of the first 5 factors support discretionary denial. With regard to the 6<sup>th</sup> *Fintiv* Factor, “other circumstances that impact the Board’s exercise of discretion, including the merits,” the merits of this

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<sup>2</sup> See *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 (PTAB, Mar. 20, 2020).

<sup>3</sup> *Apple Inc. v. Fintiv, Inc.*, IPR2020-00019, Paper 11 at 6 (PTAB, Mar. 20, 2020).

Petition are strong, this is the first post-grant proceeding directed to Foster, and as explained below, there are no considerations implicating 35 U.S.C. § 325(d). Therefore, the 6<sup>th</sup> *Fintiv* Factor does not favor procedural denial. As *none* of the *Fintiv* Factors favor discretionary denial, Petitioner submits that the Petition should not be denied under 35 U.S.C. § 324.

**b) The Petition Should not be Denied under 35 U.S.C. § 325(d)**

The Board evaluates arguments to deny a petition under 35 U.S.C. § 325(d) with a two part framework:

(1) whether the same or substantially the same art previously was presented to the Office or whether the same or substantially the same arguments previously were presented to the Office; and

(2) if either condition of the first part of the framework is satisfied, whether the petitioner has demonstrated that the Office erred in a manner material to the patentability of the challenged claims.

*Advanced Bionics, LLC v. MED-EL Elektromedizinische Geräte GmbH*, Case IPR2019-01469, Paper 6 at 8 (Feb. 13, 2020).

The art relied upon in the Petition is not “substantially the same” as the art previously presented to the Office during prosecution, and even if it was, the arguments are different. Furthermore, even assuming *arguendo* that the art and arguments could be considered substantially the same, the Office clearly erred in a manner material to the patentability of the challenged claims – the allowance of the

claims was based on a misinterpretation of the scope of the claims, and therefore, the decision to allow the claims was in error.

With regards to Grounds 1 and 2, none of the art relied upon in these grounds was presented to or applied by the examiner during prosecution of Foster. *See* EX1001, 1-2. Furthermore, this art is not cumulative of the art cited during prosecution. Kerr and Aplex both include cover plates which cover fluid end horizontal bores. *See* Sections IX.a and IX.b, *supra*. No references with these types of plates were cited during the prosecution of Kerr, despite Kerr being owned by PO. *See* EX1002, *passim*. Therefore, the art and arguments presented in these grounds is not substantially the same as the art evaluated by the Office during prosecution.

With regard to Ground 3, neither Stanton nor Blume was presented to or applied by the examiner. *See* EX1001, 1-2. These references in combination with Wilkinson (which was cited and applied during prosecution (*see* EX1002, 58-70, 117-128)) present new and invalidating arguments not before the examiner during prosecution. Specifically, during prosecution, Wilkinson was cited in combination with U.S. Patent No. 7,290,560 (“Orr”) which illustrates a fluid end that PO characterized as “modular.” *See, e.g.,* EX1002, 48 (“Orr further teaches modular fluid end blocks 52. Each block has a single bore 56 formed therein.”). Accordingly, Wilkinson was not cited in conjunction with the monoblock triplex pump fluid ends of Stanton and Blume. PO used this modular aspect of Orr to argue why it would

not be obvious to combine Orr with Wilkinson. EX1002, 49-50. Therefore, the art and arguments presented in Ground 3 are not substantially the same as those evaluated by the Office during prosecution.

Finally, the Office erred in a manner material to the patentability of the challenged claims. When the claims were allowed, the examiner erroneously believed that the “plate” recited in the claims included one or more holes, holes not present in the Wilkinson plates:

While Wilkinson (US 4773833) teaches a single plate (44 or 59) and a single housing where the plate spans multiple fluid end bores, the plate does not have openings that open to the bores.

### **EX1002, 13 (annotated).**

The allowed claims have no such requirement as this subject matter was cancelled from the claims in the very amendment that led to allowance of the case<sup>4</sup>:

a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores; and having a first and a second opening formed therein, the first opening aligned with the first horizontal bore and the second opening aligned with the second horizontal bore, the first opening exposing the first plug and the second opening exposing the second plug;

a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores; and having a first and a second opening formed therein, the first opening aligned with the first horizontal bore and the second opening aligned with the second horizontal bore;

### **EX1002, 43-45 (annotated).**

---

<sup>4</sup> Foster also fails to provide any support for this now-canceled feature. EX1001, *passim*.

Accordingly, Foster seems to have been allowed, at least in part, due to features not recited in the claims. Therefore, the Petition should not be denied under 35 U.S.C. § 325(d).

## **XI. CONCLUSION**

In view of the foregoing, there is a reasonable likelihood that one of claims 1-15 is unpatentable and this Petition for post grant review should be granted.

February 6, 2025  
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**CLAIMS LISTING APPENDIX**

| Claim                                                                                                                                                                                                                               | Recitation Label |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 1. A fluid end assembly, comprising:                                                                                                                                                                                                | 1.P              |
| a housing made of a single, integrally-formed piece and comprising:                                                                                                                                                                 | 1.a              |
| a first horizontal bore and a first vertical bore formed within the housing, the first vertical bore intersecting the first horizontal bore to form a first internal chamber;                                                       | 1.b              |
| a second horizontal bore and a second vertical bore formed within the housing, the second vertical bore intersecting the second horizontal bore to form a second internal chamber;                                                  | 1.c              |
| in which the second horizontal bore, the second vertical bore, and the second internal chamber are situated in a side-by-side relationship with the first horizontal bore, the first vertical bore, and the first internal chamber; | 1.d              |
| a first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber;                                                                                         | 1.e              |
| a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal chamber;                                                                                      | 1.f              |
| a first plug and a first reciprocating plunger installed within the first horizontal bore and positioned on opposite sides of the first internal chamber;                                                                           | 1.g              |

| Claim                                                                                                                                                                                                                                                                  | Recitation Label |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| a second plug and a second reciprocating plunger installed within the second horizontal bore and positioned on opposite sides of the second internal chamber;                                                                                                          | 1.h              |
| a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores;                                                                                                                                                | 1.i              |
| a first component having a central opening formed therein, at least a portion of the first component installed within the first horizontal bore and at least a portion of the first reciprocating plunger installed within the central opening of the first component; | 1.j              |
| a first plurality of packing seals installed within the first component and engaging the first reciprocating plunger; and                                                                                                                                              | 1.k              |
| a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.                                                                                                                                       | 1.l              |
|                                                                                                                                                                                                                                                                        |                  |
| 2. The fluid end assembly of claim 1, in which the plate comprises a plurality of fastener openings that align with a plurality of threaded openings formed in the housing in a one-to-one relationship, the fluid end assembly further comprising:                    | 2.a              |
| a plurality of fasteners, each of the plurality of fasteners installed within a corresponding one of the aligned fastener openings and threaded openings.                                                                                                              | 2.b              |
|                                                                                                                                                                                                                                                                        |                  |

| Claim                                                                                                                                                                                                                                                                                                                                 | Recitation Label |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 3. The fluid end assembly of claim 1, further comprising: a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing.                                                                                                                           | 3                |
| 4. The fluid end assembly of claim 3, in which each of the plurality of fasteners is a threaded fastener.                                                                                                                                                                                                                             | 4                |
| 5. The fluid end assembly of claim 1, further comprising: a third plug installed within the first vertical bore and positioned between an external surface of the housing and one of the first pair of valves.                                                                                                                        | 5                |
| 6. The fluid end assembly of claim 1, further comprising: a second component having a central opening formed therein, at least a portion of the second component installed within the second horizontal bore and at least a portion of the second reciprocating plunger installed within the central opening of the second component; | 6.a              |
| a second plurality of packing seals installed within the second component and engaging the second reciprocating plunger; and                                                                                                                                                                                                          | 6.b              |
| a second packing nut attached to the second component and holding the second plurality of packing seals within the second component.                                                                                                                                                                                                  | 6.c              |

| Claim                                                                                                                                                                                                                               | Recitation Label |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
|                                                                                                                                                                                                                                     |                  |
| 7. A fluid end assembly, comprising:                                                                                                                                                                                                | 7.P              |
| a housing made of a single, integrally-formed piece and comprising:                                                                                                                                                                 | 7.a              |
| a first horizontal bore and a first vertical bore formed within the housing, the first vertical bore intersecting the first horizontal bore to form a first internal chamber;                                                       | 7.b              |
| a second horizontal bore and a second vertical bore formed within the housing, the second vertical bore intersecting the second horizontal bore to form a second internal chamber;                                                  | 7.c              |
| in which the second horizontal bore, the second vertical bore, and the second internal chamber are situated in a side-by-side relationship with the first horizontal bore, the first vertical bore, and the first internal chamber; | 7.d              |
| a first pair of valves, each valve installed within the first vertical bore and positioned on opposite sides of the first internal chamber;                                                                                         | 7.e              |
| a second pair of valves, each valve installed within the second vertical bore and positioned on opposite sides of the second internal chamber;                                                                                      | 7.f              |
| a plate fastened to the housing along an exterior surface containing openings to the first and second horizontal bores;                                                                                                             | 7.g              |

| Claim                                                                                                                                                                                                                 | Recitation Label |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| a first component having a central opening formed therein, at least a portion of the first component installed within the first horizontal bore;                                                                      | 7.h              |
| a first reciprocating plunger, at least a portion of the first reciprocating plunger installed within the central opening of the first component;                                                                     | 7.i              |
| a first plurality of packing seals installed within the first component and engaging the first reciprocating plunger; and                                                                                             | 7.j              |
| a first packing nut attached to the first component and holding the first plurality of packing seals within the first component.                                                                                      | 7.k              |
|                                                                                                                                                                                                                       |                  |
| 8. The fluid end assembly of claim 7, further comprising: a first plug and the first reciprocating plunger installed within the first horizontal bore and positioned on opposite sides of the first internal chamber; | 8.a              |
| a second plug and a second reciprocating plunger installed within the second horizontal bore and positioned on opposite sides of the second internal chamber;                                                         | 8.b              |
| in which the first plug is positioned adjacent the plate; and                                                                                                                                                         | 8.c              |
| in which the second plug is positioned adjacent the plate.                                                                                                                                                            | 8.d              |
|                                                                                                                                                                                                                       |                  |

| Claim                                                                                                                                                                                                                                                | Recitation Label |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 9. The fluid end assembly of claim 8, in which the plate abuts the first plug; and in which the plate abuts the second plug.                                                                                                                         | 9                |
|                                                                                                                                                                                                                                                      |                  |
| 10. The fluid end assembly of claim 8, further comprising: a third plug installed within the first vertical bore and positioned between an external surface of the housing and one of the first pair of valves.                                      | 10               |
|                                                                                                                                                                                                                                                      |                  |
| 11. The fluid end assembly of claim 7, in which the plate comprises a plurality of fastener openings that align with a plurality of threaded openings formed in the housing in a one-to-one relationship, the fluid end assembly further comprising: | 11.a             |
| a plurality of fasteners, each of the plurality of fasteners installed within a corresponding one of the aligned fastener openings and threaded openings.                                                                                            | 11.b             |
|                                                                                                                                                                                                                                                      |                  |
| 12. The fluid end assembly of claim 7, further comprising: a plurality of fasteners, each of the plurality of fasteners extending through the plate and into the housing to fasten the plate to the housing.                                         | 12               |
|                                                                                                                                                                                                                                                      |                  |
| 13. The fluid end assembly of claim 12, in which each of the plurality of fasteners is a threaded fastener.                                                                                                                                          | 13               |

| Claim                                                                                                                                                                                                          | Recitation Label |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| 14. The fluid end assembly of claim 7, further comprising: a second component having a central opening formed therein, at least a portion of the second component installed within the second horizontal bore; | 14.a             |
| a second reciprocating plunger, at least a portion of the second reciprocating plunger installed within the central opening of the second component;                                                           | 14.b             |
| a second plurality of packing seals installed within the second component and engaging the second reciprocating plunger; and                                                                                   | 14.c             |
| a second packing nut holding the second plurality of packing seals within the second component.                                                                                                                | 14.d             |
| 15. The fluid end assembly of claim 7, further comprising: a retainer attached to the first component using the plurality of fasteners;                                                                        | 15.a             |
| in which at least a portion of the first packing nut is installed within the retainer.                                                                                                                         | 15.b             |

**CERTIFICATION OF WORD COUNT**

I hereby certify that this petition conforms with the word count limits of 37 C.F.R. § 42.24(a)(II). This petition contains 18,650 words, excluding the parts of the petition exempted by 37 C.F.R. § 42.24(a), as calculated using Microsoft Word.

The undersigned further certifies that this petition complies with the requirements of 37 C.F.R. § 42.6. This brief has been prepared in a proportionally spaced typeface using Microsoft Word 2010 in Times New Roman 14 point font.

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**CERTIFICATE OF SERVICE**

I certify that the foregoing **Petition to Institute an *Inter Partes* Review for U.S. Patent No. 12,152,582 under 37 C.F.R. § 42.200 et seq.** and accompanying **EXHIBITS** were served February 6, 2025 by Federal Express to:

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