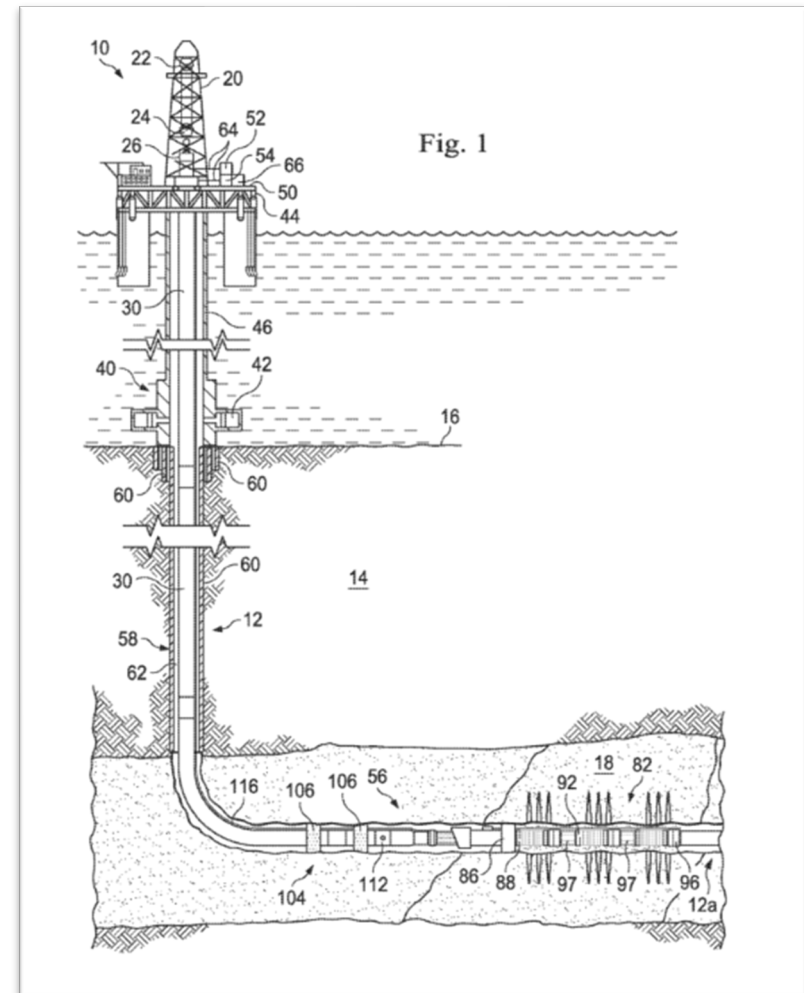


Patent Owner's Presentation
Weatherford US LP v. Halliburton Energy
Services, Inc.
October 22, 2025

IPR2024-00990 – U.S. Patent No. 11,333,007

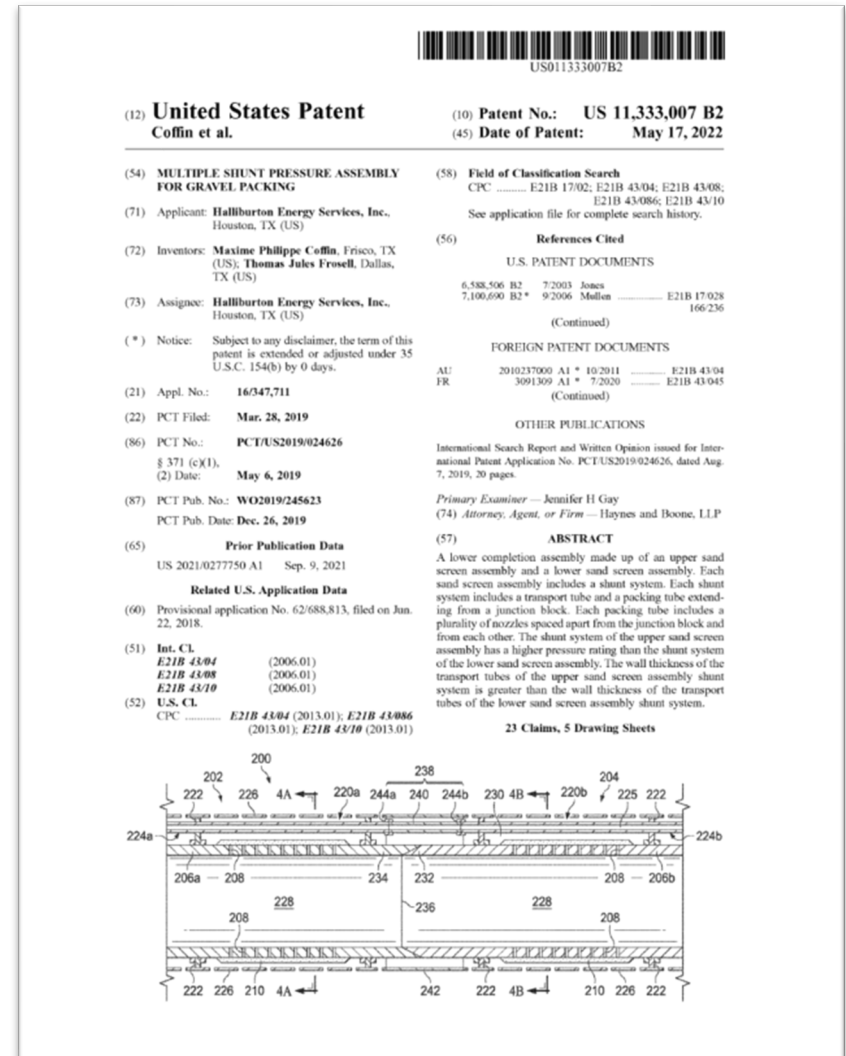
Overview Of The '007 Patent

- Figure 1 illustrates an example “wellbore production system 10” extending through “production zones 18 from which hydrocarbons are produced.”
- In production zones, “a perforated base pipe” is “surrounded by a sand screen to filter fines from the formation fluid.”
- The patent relates to “shunt tube systems utilized in the sand screen assemblies.”
- The shunt tube systems gravel pack “a relatively coarse sand (or gravel) which acts as a filter to reduce the amount of fine formation sand reaching the screen.”



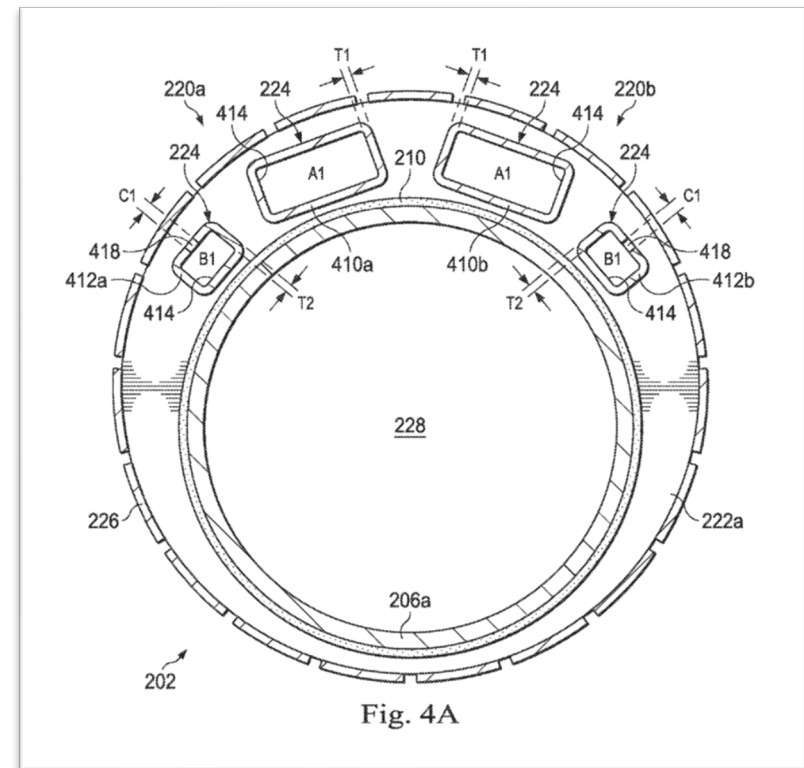
Overview Of The '007 Patent

- The inventors recognized ***"shunt tube assemblies ... are selected based on the highest operating pressure expected to be required across the entire length of the gravel packing interval"***
- "However, as the slurry flows ... to the downstream portion of the production zone, ***the pressure of the slurry drops off.***"
- The patent discloses systems in which the "shunt system of the upper sand screen assembly has a higher pressure rating than the shunt system of the lower sand screen assembly."



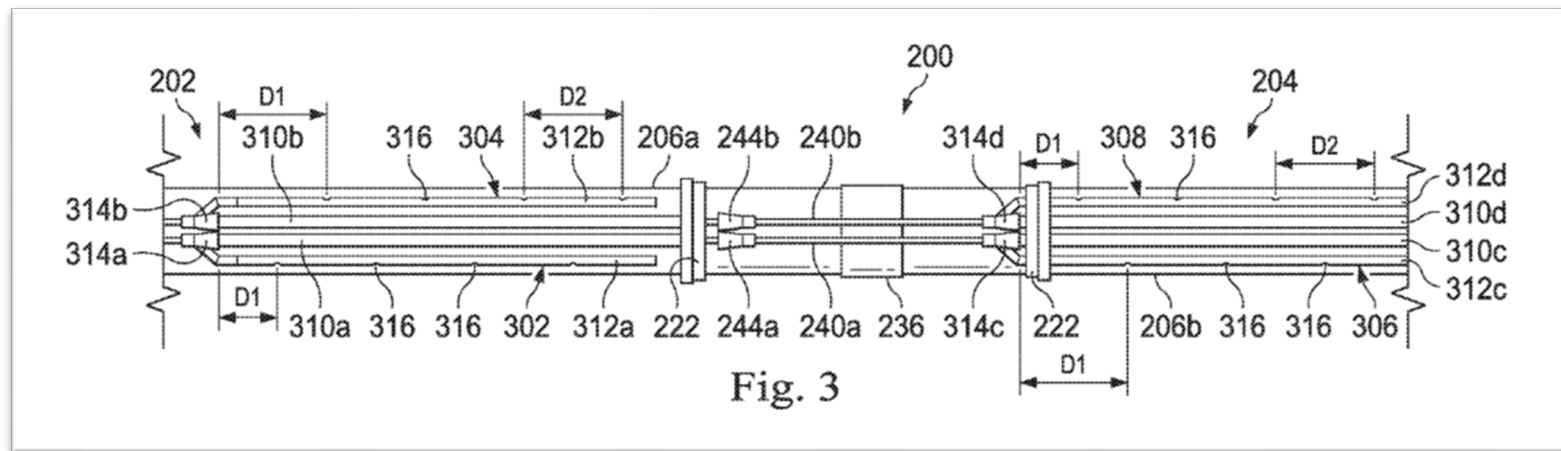
Overview Of The '007 Patent

- Figure 4A illustrates “a cross-sectional view of an embodiment of a shunt tube assembly.”
- Figure 4A illustrates an “eccentric alignment.”
- A shunt tube assembly includes “shunt tubes 224,” which are either “transport tube[s] 410” or “packing tube[s] 412.”
- “Packing tube[s] 412” pack gravel slurry in an annulus around “base pipe 228” and “transport tube[s] 410” transport gravel slurry to downstream assemblies



Overview Of The '007 Patent

- Figure 3 illustrates a “first sand screen assembly 202 interconnected with second sand screen assembly 204.”



- In claimed systems and methods, “geometries of the shunt tube assemblies ... of the first sand screen assembly 202 may be selected to have a higher operating pressure than the shunt tube assemblies ... of the second sandscreen assembly 204.”
- Shunt tube features—wall thickness, tube cross section, nozzle size/spacing—may also differ between upstream and downstream assemblies “to achieve the desired flow regime”

Instituted Grounds

Ground	'007 Patent Claims	Statutory Basis
1	1-12	Obvious under §103(a) over <i>Yeh</i> (EX1005), optionally in view of <i>Yeh2</i> (EX1006)
2	14-20	Obvious under §103(a) over <i>Yeh</i> (EX1005), <i>Yeh2</i> (EX1006), and optionally <i>Jones2</i> (EX1008)
3	21-22	Obvious under §103(a) over <i>Yeh</i> (EX1005) in view of <i>Jones</i> (EX1007)
4	23	Obvious under §103(a) over <i>Yeh</i> (EX1005), <i>Jones</i> (EX1007), and <i>Yeh2</i> (EX1006)

Claims 1, 11, 14, and 21 Are The Challenged Independent Claims

Limitation	Claim 1
1[p]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
1[a]	a first sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;
1[b]	a second sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;
1[c]	a source of pressurized working fluid fluidly coupled to an upstream end of the transport tube of the first sand screen assembly;
1[d]	wherein the first and second sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with one another such that the transport tube of the second sand screen assembly is fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first sand screen assembly; and
1[e]	wherein the transport tube of the first sand screen assembly has a first wall thickness and the transport tube of the second sand screen assembly has a second wall thickness, <i>the first wall thickness being greater than the second wall thickness.</i>

Claims 1, 11, 14, and 21 Are The Challenged Independent Claims

Limitation	Claim 11
11[p]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
11[a]	a source of pressurized working fluid;
11[b]	a first sand screen assembly attached to a second sand screen assembly
11[c]	wherein the first sand screen assembly comprises a shunt tube assembly with a first burst pressure and the second sand screen assembly comprises a shunt tube assembly with a burst pressure less than the first burst pressure,
11[d]	and wherein the shunt tube assembly with the first burst pressure is fluidly coupled between the source of pressurized working fluid and the shunt tube assembly with the burst pressure less than the first burst pressure.

Claims 1, 11, 14, and 21 Are The Challenged Independent Claims

Limitation	Claim 14
14[p]	A method of installing a completion assembly in a wellbore, the method comprising:
14[a]	identifying an elongated production zone having an upstream proximal end and a downstream distal end with respect to a source of pressurized working fluid;
14[b]	determining a shunt tube system operating pressure associated with the proximal end of the production zone and selecting a high pressure shunt tube system based on the proximal end determined pressure;
14[c]	determining a shunt tube system operating pressure associated with the distal end of the production zone and selecting a low pressure shunt tube system based on the distal end determined pressure;
14[d]	installing a first sand screen assembly in a wellbore adjacent the distal downstream end of the elongated production zone;
14[e]	attaching a second sand screen assembly to the first sand screen assembly at the proximal upstream end of the elongated production zone, wherein the first sand screen assembly has the low pressure shunt tube system and the second sand screen assembly has the high pressure shunt tube system, such that a downstream end of the high pressure shunt tube system is coupled to an upstream end of the low pressure shunt tube system; and
14[f]	coupling the source of pressurized working fluid to an upstream end of the high pressure shunt tube system.

Claims 1, 11, 14, and 21 Are The Challenged Independent Claims

Limitation	Claim 21
21[p]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
21[a]	a source of pressurized working fluid;
21[b]	a first sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area; and
21[c]	a second sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;
21[d]	wherein the first and second sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with one another and the source of pressurized working fluid, the transport tube of the second sand screen assembly fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first sand screen assembly; and
21[e]	wherein the transport tube of the first sand screen assembly is formed of a first material and the transport tube of the second sand screen assembly is formed of a second material, <i>the first material having a greater tensile strength than the second material.</i>

Ground 1

The Petition has not shown that Claims 1, 2, 4, or 5 are Obvious over Yeh (EX1005), optionally in view of Yeh2 (EX1006)

For claim 1, the Petition relies on concentric screens upstream of eccentric screens

- Claims 1 recites “the transport tube of the first sand screen assembly has a first wall thickness and the transport tube of the second sand screen assembly has a second wall thickness, ***the first wall thickness being greater than the second wall thickness.***”
- The Petition relies on *Yeh*’s embodiment containing a “**concentric screen** → crossover tool → **eccentric screen**” as teaching this limitation.
- In the Petition, the upstream **concentric screen** “would have to contain a higher differential pressure, such as **6,500 psi** near the heel in a **5,000-foot** horizontal wellbore.”
- **Only 6x3 concentric** screens were capable of handling **6,500 psi**.

Yeh's high-pressure concentric screen is a 6x3 screen

- The art used 2x2 screens (left) and 6x3 screens (right)

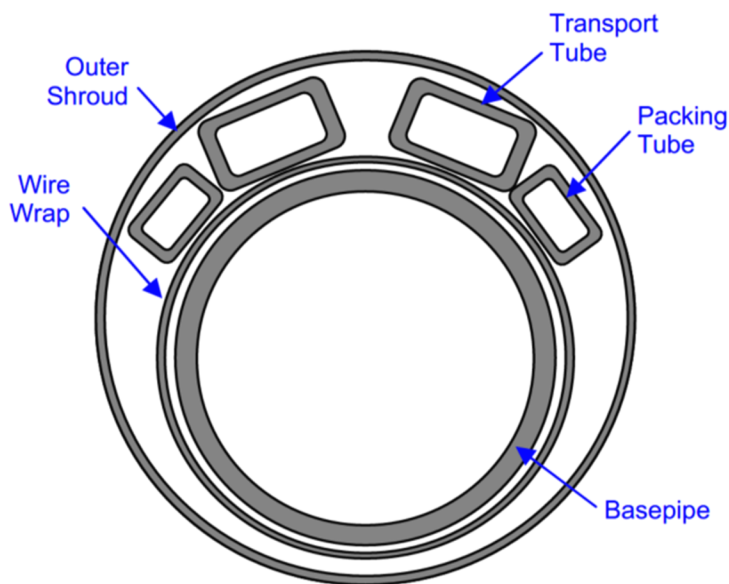


**Fig. 1. Alternate Path "Two-by-Two"
Screen Cross-Section**

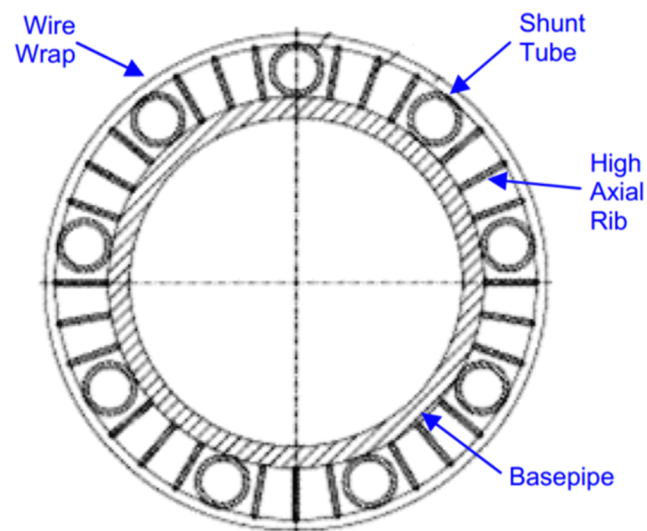
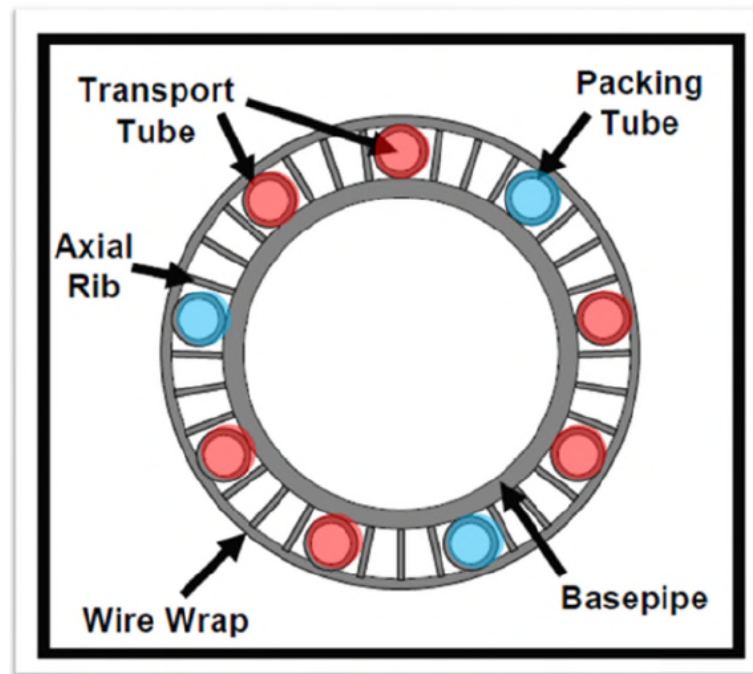


**Fig. 2. Internal Shunt Alternate Path
Screen Cross-Section**

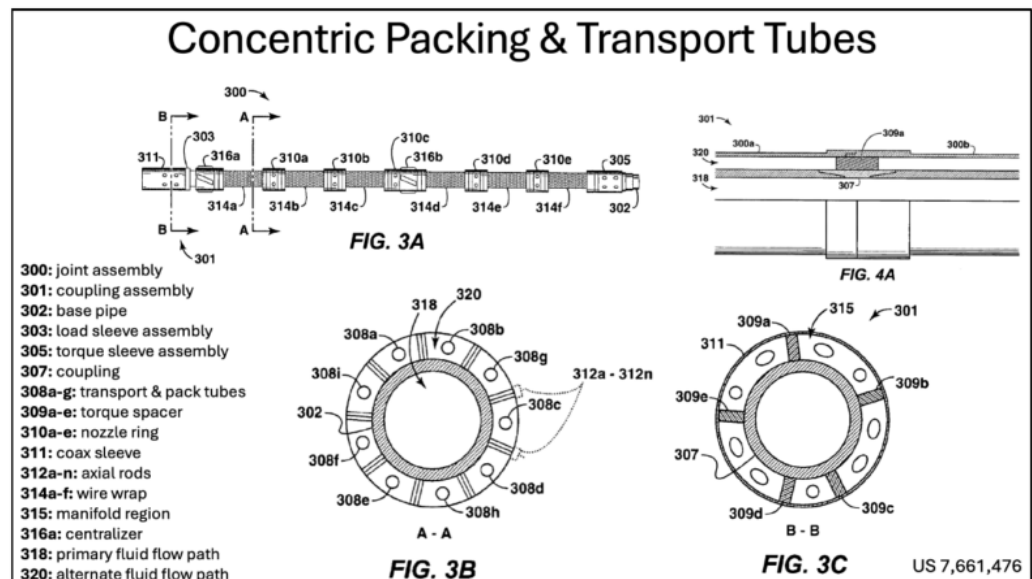
The Petition relies on 6x3 concentric screens upstream of 2x2 eccentric screens for Claim 1

- Petitioner's expert agreed: "**Yeh is referring to the ISAPT 6x3 concentric design**" when describing screens "capable of gravel packing 5,000 feet"
- Yeh2 confirms that "[t]o extend Alternate Path technology to extreme lengths," which it describes as "5,000 ft or longer," "the **number of shunt tubes was increased.**"



The Petition relies on 6x3 concentric screens upstream of 2x2 eccentric screens for Claim 1

- The Petition makes clear that *Yeh2*'s 6x3 concentric screen is the concentric screen it relies on in Ground 1, stating "***Yeh2* describes the same APT system as *Yeh*** in the same 5,000-foot horizontal wellbore"
- Petitioner's expert agreed that "number and size of shunt tubes" in **6x3 concentric** screens, like those shown below, enabled "increased pressure capacity up to **6,500 psi**" "for withstanding higher pressures associated with greater depth wells."



The *Yeh/Yeh2* combination had *thinner* walls in the upstream 6x3 concentric screen

- Petitioner's expert admits **6x3 concentric** screens (upstream) had ***thinner*** transport tube walls (2 mm) than in 2x2 eccentric screens (2.4 mm):

2x2 Eccentric:

162. By 2004, Hurst noted that the wall for rectangular tubes was 0.095" (*e.g.*, $(0.75-0.56)/2 = 0.095$). See EX1013 at 2 ("The tube dimensions were modified to 0.75×1.5-in external (0.56×1.31-in internal)

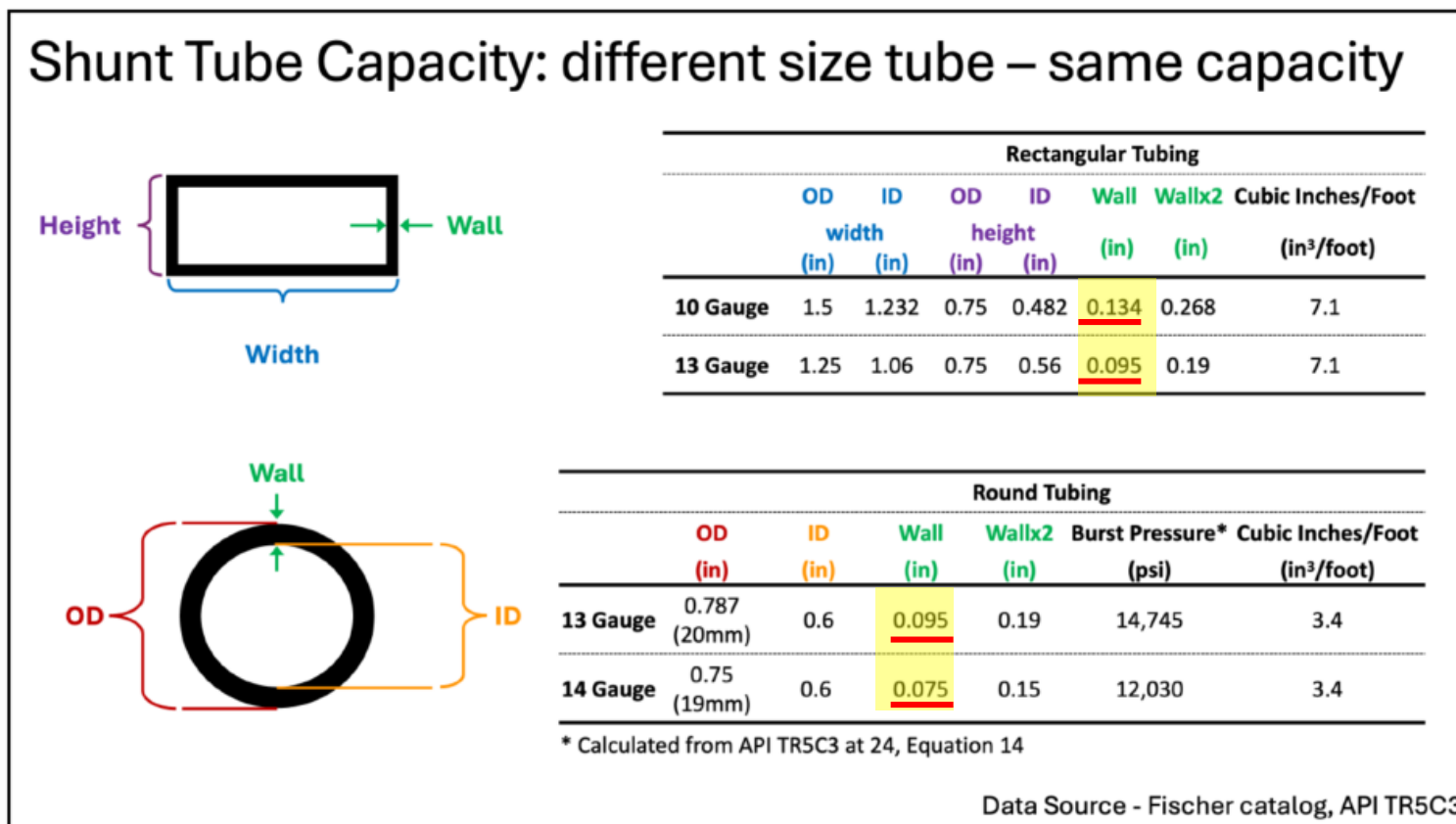
...

6x3 Concentric:

Barry reported in SPE 110460 that using six round 20mm outer diameter shunt tubes with a 16 mm inside diameter, which he targeted for use in early 2008. EX1027 at 1, 3.

The *Yeh/Yeh2* combination had *thinner* walls in the upstream 6x3 concentric screen

- Petitioner's expert analysis **confirms** that round tubes in 6x3 concentric screens would never have thicker walls than rectangular tubes in 2x2 eccentric screens



The *Yeh/Yeh2* combination had *thinner* walls in the upstream 6x3 concentric screen

- Petitioner's expert admits that **2x2 eccentric walls** (below at left) are "shown as ***thicker***" than **6x3 concentric walls** (shown at right):

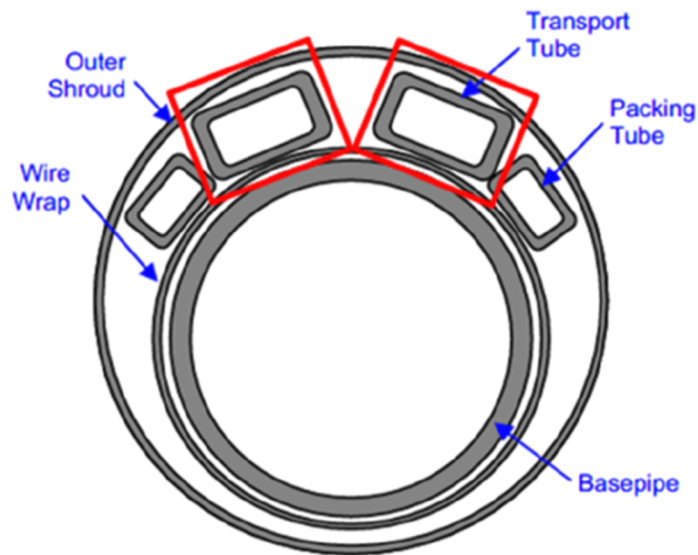


**Fig. 1. Alternate Path "Two-by-Two"
Screen Cross-Section**

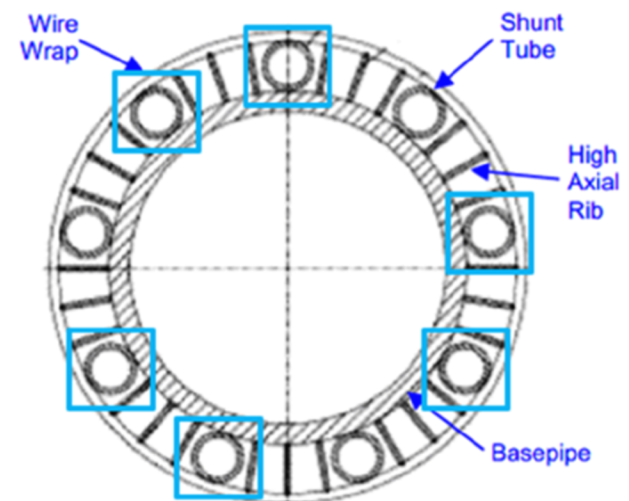


**Fig. 2. Internal Shunt Alternate Path
Screen Cross-Section**

Yeh & Yeh2 teach away from thicker walls upstream

- The Petition's only cite to *Yeh* about wall thickness refers to wall thickness of **the crossover joint**

In order to maintain the mechanical integrity (that is, to stay within the burst, bending, and collapse ratings) of the secondary flow paths, a **certain surrounding wall thickness is required**. This, in turn, **limits the inside diameter of the crossover joint**.

- Yeh thus identifies **limiting the crossover joint diameter as a problem**

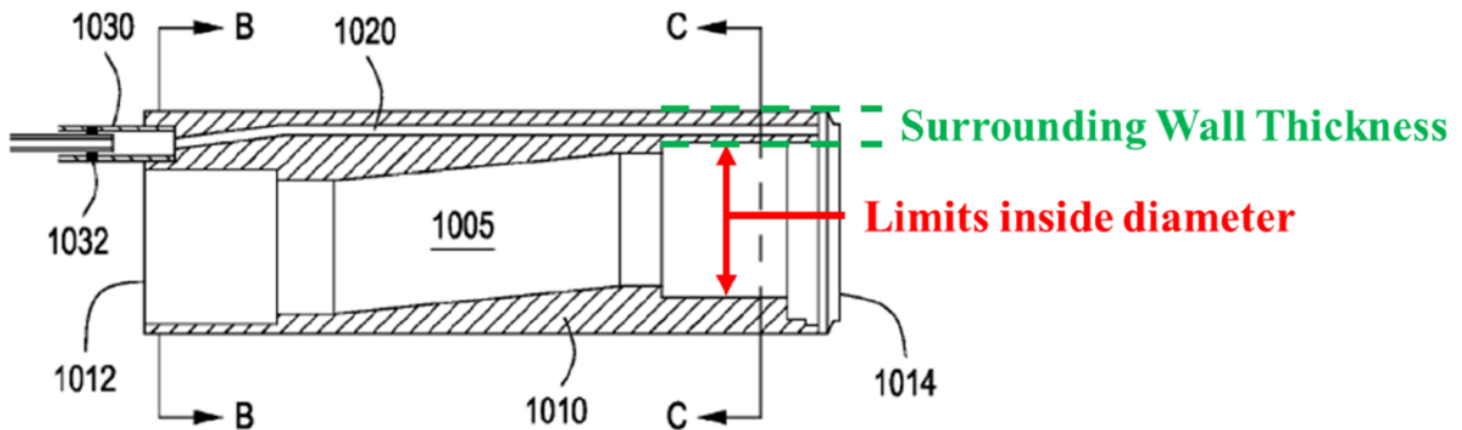


FIG. 10A

Yeh & Yeh2 teach away from thicker walls upstream

- *Yeh* desires to “**maximiz[e] inner diameter of the primary flow path,**” which limits shunt tube wall thickness

In order to maintain the mechanical integrity (that is, to stay within the burst, bending, and collapse ratings) of the secondary flow paths, a certain surrounding wall thickness is required. This, in turn, **limits the inside diameter of the crossover joint.**

Other considerations include minimizing length, providing an overall outer diameter that is less than or equal to the diameters of the adjacent wellbore tools, maximizing inner diameter of the primary flow path, and providing an overall mechanical integrity that is equal to or greater than that of the adjacent tools.

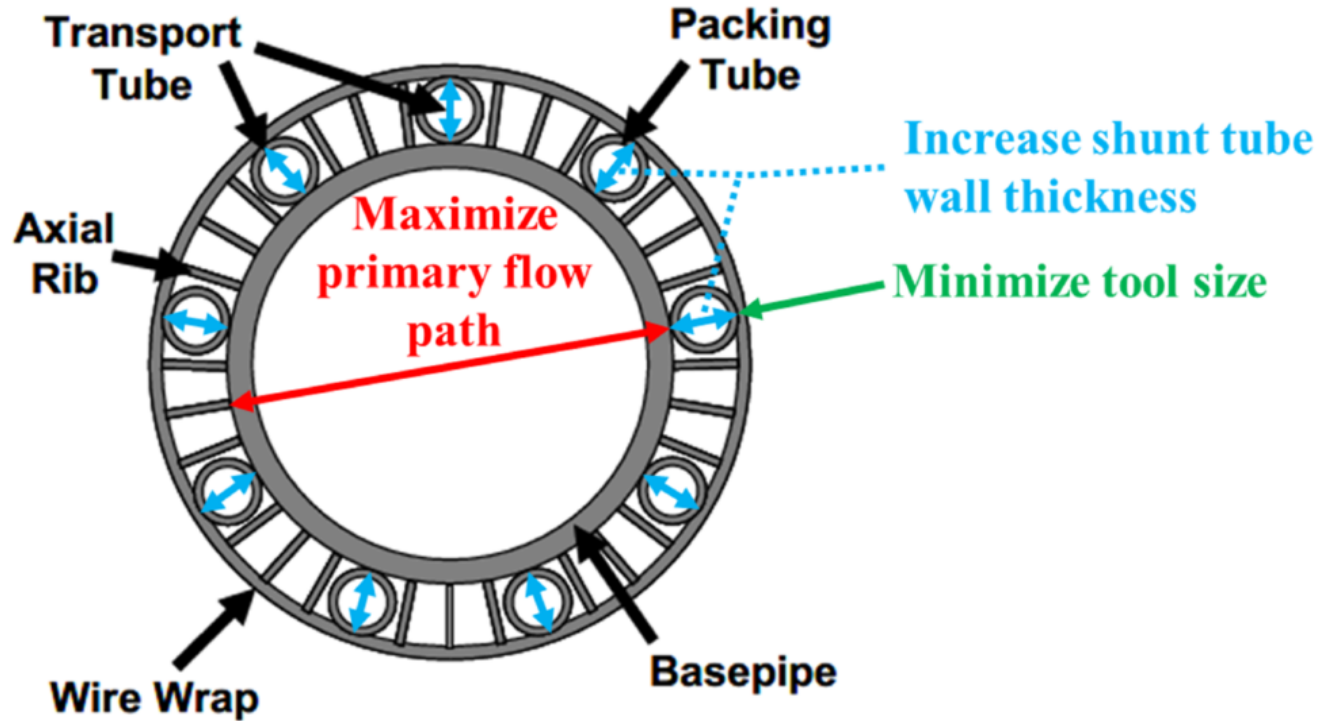
- Petitioner agrees: a POSITA would **maximize the primary flow path (base pipe)**

Sand screen base pipes are limited by the wellbore diameter and are generally

maximized within that constraint to maximize flow of production fluids out of the well.

Yeh & Yeh2 teach away from thicker walls upstream

- Yeh2*'s illustration of a 6x3 concentric screen shows that increasing shunt tube wall thickness **necessarily reduces the primary flow path or increases the tool size**



Yeh & Yeh2 teach away from thicker walls upstream

- *Petitioner's* expert agrees that shunt tube cross-sectional flow area is constrained because shunt tubes must "fit within [a] confining area"
- The same logic applies to shunt tube wall thickness

Q. Would there be reasons why a POSITA would not want to increase the cross-sectional flow area in order to reduce the burst pressure?

A. There could be. All these -- all these shunt tubes must put -- fit in a certain area, you know, so depending on the -- the tolerance area. If they have an outer shroud around them, I mean, that's going to confine your ID, so you can't -- there's not an unlimited number of possibilities that a POSITA could use.

They're going to be forced within a, you know, certain constraint. So yes, they could, but here again, it would have to fall within the certain constraints. And that's why the shunt tubes and all these designs are the way they are because they have to fit within this confining area.

Yeh & Yeh2 teach away from thicker walls upstream

- The *Barry* reference raised by Petitioner confirms that “larger shunt tubes” are **not an option** in 6x3 screens because “the screens become too large”

Six 20mm x 16mm (OD X ID) shunt tubes yielded frictional response comparable to the two 1.5 x 0.75-in transport tubes in the current “two-by-two” Alternate Path system. Although larger shunt tubes reduce the pressure drop and thus the pressure requirements for the Internal Shunt Alternate Path screens, the screens become too large for the desired application.

Yeh & Yeh2 teach away from thicker walls upstream

- By teaching to maximize use of eccentric screens, *Yeh* also ***discourages*** thinning transport tube walls of the downstream eccentric screen

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens. The new crossover tool allows the operator to use the less-expensive eccentric screens on the toe or lower-pressure side of the interval during gravel-packing operations, and to use the concentric screens on the heel or higher-pressure side of the interval during the gravel-packing operations. This reduces the overall cost of completion while still achieving the gravel packing goal.

It may be difficult to acquire more complex concentric sand screens in quantities needed for extended horizontal completions. Therefore, the crossover joint allows a horizontal completion to continue without delay by combining concentric screens with the more readily available eccentric screens. Thus, the use of crossover joints provides flexibility in maintaining and managing the inventory of sand screens.

Yeh & Yeh2 teach away from thicker walls upstream

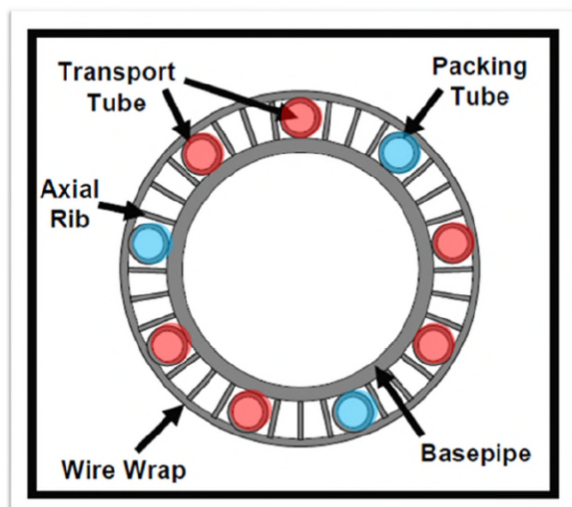
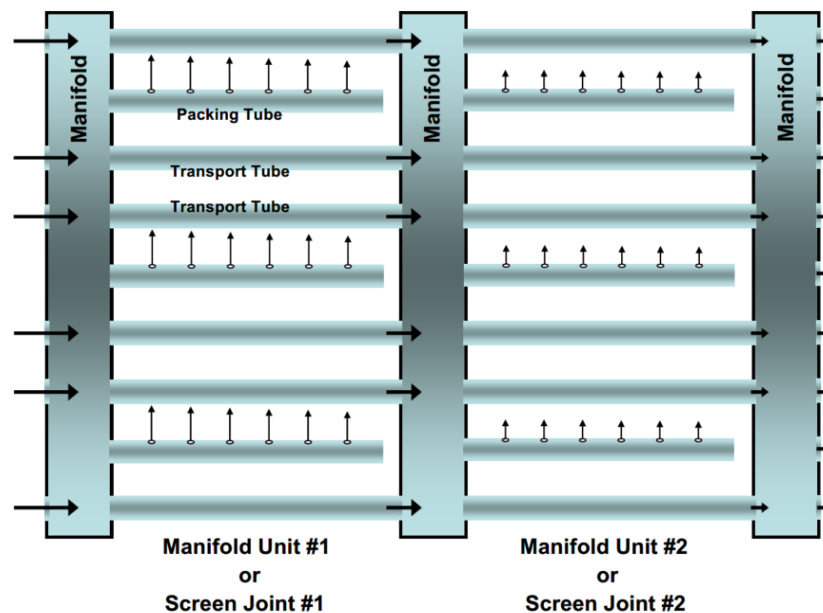
- A POSITA would not have reduced eccentric screen wall thickness, given their 3,000-ft, 3,000-psi limit and *Yeh's* teaching to use eccentric screens for the benefit of their lower friction

In one embodiment, an eccentric screen arrangement offers lower friction in the secondary flow paths when compared to shunt tubes in a concentric screen. It is believed that the use of eccentric screens at the toe of a horizontal completion will reduce the overall friction or extend the maximum gravel packing length of the completion.

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens.

Yeh & Yeh2 teach away from thicker walls upstream

- Yeh2's 6x3 screen achieves **higher pressure** rating **by changing design parameters other than shunt tube wall thickness**. As illustrated below, Yeh2:
 - Reduces tube cross section;
 - Changes tube shape from rectangular to round;
 - Increases the number of **transport tubes**, from two to six;
 - Increases the number of **packing tubes**, from two to three;
 - Adds manifolds;



Thicker walls upstream would not have been obvious to try

- An invention is not obvious when “the prior art gave only general guidance as to the particular form of the claimed invention or how to achieve it.” *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009).
- The Petition rests on “general guidance” about gravel packing:
 - “Burst strength of shunt tubes” must handle “high hydraulic pressure”
 - “[A]n eccentric screen arrangement offers lower friction”
 - “[C]oncentric screens may be beneficial when gravel packing long intervals”
- An invention is not obvious when it was “‘obvious to try’ ... to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.” *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009).

Thicker walls upstream would not have been obvious to try

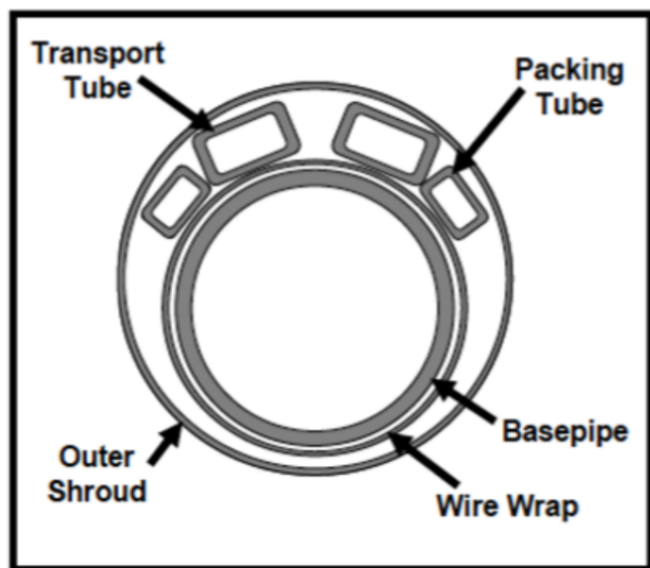
- Gravel packing systems involved **numerous performance metrics to balance**, including:
 - ***Extending packing length***
 - ***Increasing pressure rating***
 - Reducing friction pressure loss
 - Reducing leak-off
 - Maximizing the primary flow path
 - Maintaining or reducing tool size
 - Avoiding plugging, sand-bridging, and voids
 - Reducing cost and improving availability for the entire completion
- The art acknowledges that increased pressure rating had to be balanced against the other performance metrics

Thicker walls upstream would not have been obvious to try

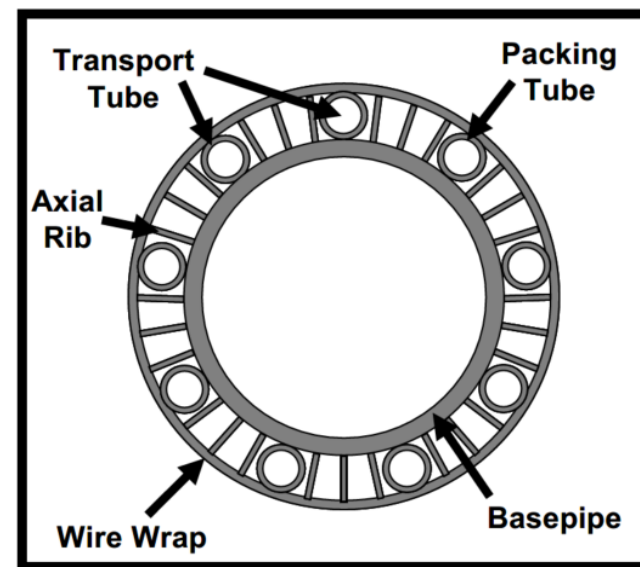
- The art teaches to modify **a host of parameters other than transport tube wall thickness**:
 - Screen configuration: concentric v. eccentric
 - Manifolding
 - Shunt tube cross-sectional flow area (CSFA)
 - Number of shunt tubes, for transport and packing
 - Shunt tube geometry, e.g., round v. rectangular
 - Open-ended and closed-ended tubes
 - Tube nozzle size
 - Tube nozzle spacing
 - Nozzle distance from manifold
 - Jumpers between tubes
 - Fluid engineering (e.g., viscosity, gravel size/concentration)

Yeh and Yeh2 used a different solution

- “Recognition of the problem ... does not render obvious the eventual solution. Recognition of a need does not render obvious the achievement that meets that need.” *Cardiac Pacemakers, Inc. v. St. Jude Med., Inc.*, 381 F.3d 1371, 1377 (Fed. Cir. 2004)
- Yeh/Yeh2 identify the need to pack longer lengths, but **met that need with 6x3 screens having *thinner walls***:



more, smaller,
round tubes



The Board should disregard Petitioner's pivot to a new obviousness theory based on 2x2 concentric screens

- “[A]n IPR petitioner may not raise in reply ‘an entirely new rationale’ for why a claim would have been obvious.” *Henny Penny Corp. v. Frymaster LLC*, 938 F.3d 1324, 1330–31 (Fed. Cir. 2019).
- The Petition relied on 6x3 concentric screens, rated to 6,500 psi, upstream of 2x2 eccentric screens:

Yeh taught that an example completion assembly can be “concentric screen → crossover tool → eccentric screen” wherein the crossover tool connects the primary and secondary flow paths of the sand screens. EX1005, 30:13-14, 25:41-65; EX1003 ¶¶262-63.

The “concentric screen” would be the first sand screen assembly.

On the high-pressure side, Yeh disclosed that the shunt tubes (including transport tubes) would have to contain a higher differential pressure, such as 6,500 psi near the heel in a 5,000-foot horizontal wellbore, than the shunt tubes in the lower-pressure side.

The Board should disregard Petitioner's pivot to a new obviousness theory based on 2x2 concentric screens

- In its Reply, Petitioner raised a new theory based on concentric 2x2 screens upstream of eccentric 2x2 screens:

In fact, as Dr. Durham conceded, Yeh discloses that both concentric and eccentric screens use “two or more shunt tubes,” EX1043, 47:19-48:21, meaning that they could have the same number of transport tubes and thus could require approximately the same cross-sectional flow area in those tubes.

Yeh disclosed that its concentric and eccentric screens included “two or more shunt tubes.” See EX1005, 16:26-34. Yeh also disclosed that the eccentric screen shunt tubes could be round.

- The Petition nowhere cites or describes “two or more shunt tubes”
- ***Neither the Petition nor Reply explains how 2x2 concentric screens would handle 6,500 psi***

2x2 concentric screens, not rated to 6,500 psi, were not suitable for use upstream of eccentric screens

- Petitioner's expert explains that eccentric 2x2 screens outperformed concentric 2x2 screens because they provided more space for shunt tubes:

102. Hurst's Figure 5, which I provide below, illustrated how using an eccentric design allowed for placement of the largest tubes,

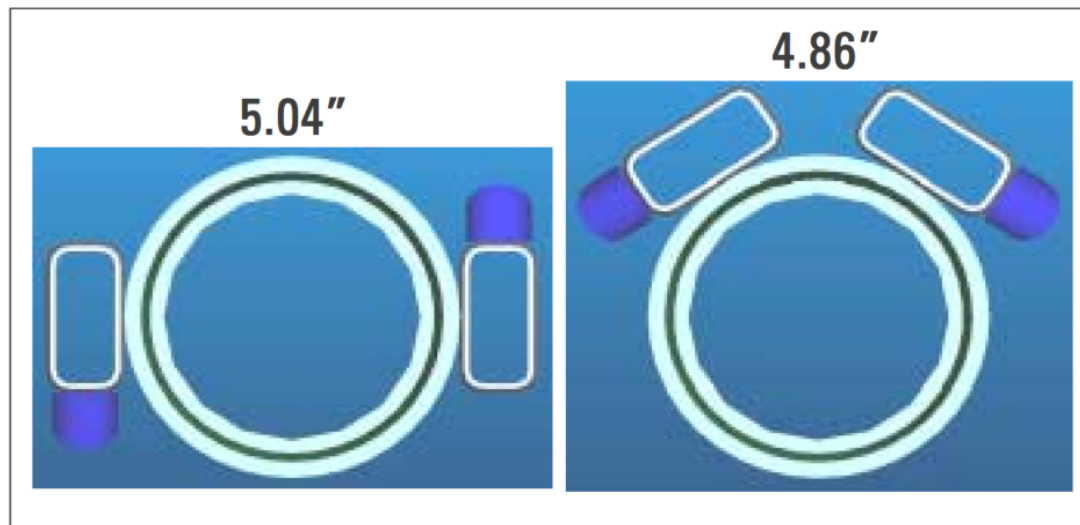


Figure 5 – Example of outer diameter reduction with eccentric design (right) versus concentric design (left).

2x2 concentric screens, not rated to 6,500 psi, were not suitable for use upstream of eccentric screens

- Petitioner agrees that eccentric 2x2 screens had more space for shunt tubes than concentric 2x2 screens:

A skilled artisan would understand that an eccentric arrangement can provide more annular space for shunt tubes while maintaining the same primary flow path diameter and overall sand screen assembly diameter, permitting the use of larger cross-sectional area shunt tubes than are typically used in a concentric sand screen assembly.

- With more space, eccentric 2x2 screens outperformed concentric 2x2 screens:

Q The 2x2 eccentric designs also had lower friction than 2x2 concentric designs?

A I don't know there was a 2x2 concentric design.

2x2 concentric screens, not rated to 6,500 psi, were not suitable for use upstream of eccentric screens

- As eccentric 2x2 screens were limited to about 3,000 psi and 3,200 feet, so were lower performance concentric 2x2 screens

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens.

132. Hecker described technological improvements made on the “current eccentric 2×2 APT screens.”

...

to 93°. *Id.* at 2. However, field data indicated that this system was limited to packing 3,200-ft horizontals “due to the friction pressure associated with pumping through shunt tubes along the entire openhole interval,” resulting in “[i]n-house best practices limit[ing] the shunt friction pressure to 3,000 psi to maintain reliability in the shunt packing system.” *Id.*

2x2 concentric screens, not rated to 6,500 psi, were not suitable for use upstream of eccentric screens

- Petitioner's expert confirms that concentric 2x2 screens rated to 3,000 psi would burst if exposed to 6,500 psi

Q So Yeh's concentric screens that could gravel pack 5,000 feet had to be rated to 6,500 PSI?

A For his design. The pump rate, the sand, everything he was doing, yes. It was a function of that.

Q And if they were not rated to 6,500 PSI, then they might burst?

A Potentially they could burst.

- "It is in such circumstances," where "the necessary reasoning is absent," "that it is especially important to guard against the dangers of hindsight bias." *Plantronics, Inc. v. Aliph, Inc.*, 724 F.3d 1343, 1354 (Fed. Cir. 2013).

Petitioner Admits *Yeh* and *Yeh2* say nothing about transport tube wall thickness

- Petitioner's Reply **acknowledges** that **neither *Yeh* nor *Yeh2* says anything about transport tube wall thickness**, much less thickening the walls:

Halliburton's first error is assuming that rectangular tubes always have a greater wall thickness than round tubes. POR, 17. But *Yeh* never specifies the wall thickness for any shunt tubes and thus provides no basis for Halliburton's assumption. *See generally* EX1005.

Second, Halliburton argues that *Yeh2* taught "achiev[ing] higher pressure ratings by changing numerous design parameters other than shunt tube wall thickness." POR, 18. But *Yeh2* says nothing about tubing wall thickness at all.

Dependent Claims 2 and 4 are Patentable

'007 Claim 2

The completion assembly of claim 1, wherein a cross-sectional flow area of the packing tube nozzle opening in the first sand screen assembly is ***less than a cross-sectional flow area of the packing tube nozzle opening in the second sand screen assembly.***

'007 Claim 4

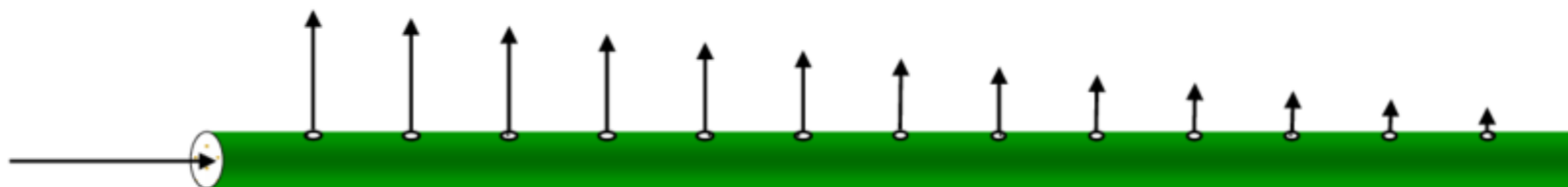
The completion assembly of claim 1, wherein the number of packing tube nozzles in the first sand screen assembly is ***less than the number of packing tube nozzles in the second sand screen assembly.***

- The *Yeh/Yeh2* combination fails to render obvious using more or larger nozzles in the downstream sand screen.

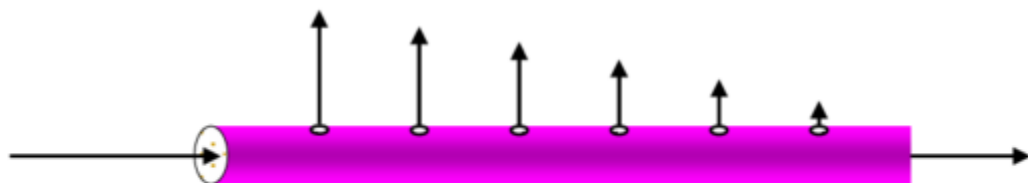
Yeh2 uses a different solution than Claims 2 and 4 to address declining flow rate

- Yeh2* teaches to use **closed-end** packing tubes to achieve more even flow

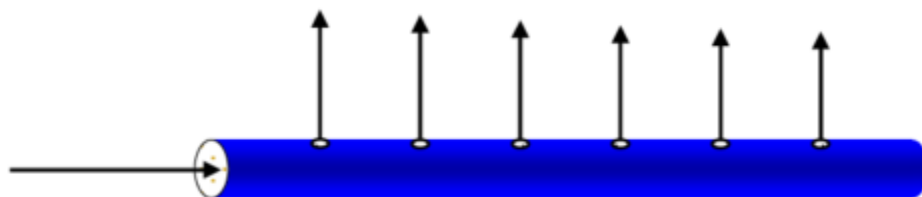
Case A Open-End Shunt with 6 mm Portholes over 80 ft Interval



Case B Open-End Shunt with 6 mm Portholes over 40 ft Interval



Case C Closed-End Shunt with 6 mm Portholes over 40 ft Interval



Yeh and *Yeh2* teach away from increasing nozzle size and number

- *Yeh* teaches to use eccentric screens downstream for their lower friction, **extending the packable length**

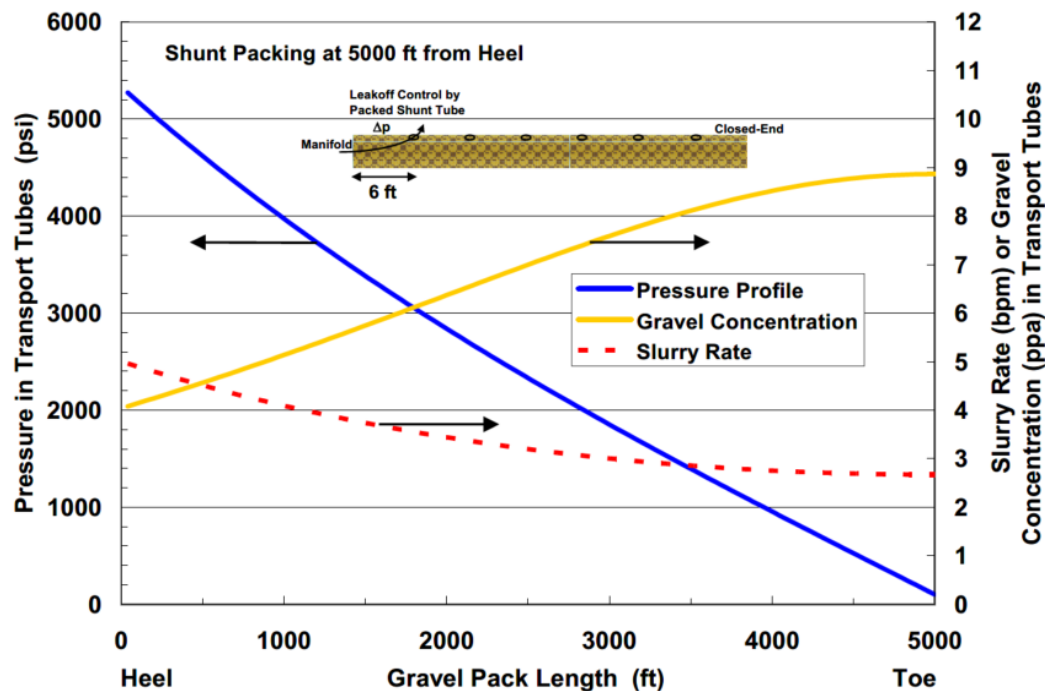
In one embodiment, an eccentric screen arrangement offers lower friction in the secondary flow paths when compared to shunt tubes in a concentric screen. It is believed that the use of eccentric screens at the toe of a horizontal completion will reduce the overall friction or extend the maximum gravel packing length of the completion.

- According to Petitioner's expert, increasing nozzle size or number would increase friction pressure drop, **reducing the packable length**

303. *Yeh2*'s examples illustrate a basic fluid dynamics concept a POSITA would have learned during their undergraduate engineering degree. Specifically, flow through a hole in a pipe is roughly directly proportional to the drop in pressure across that hole. This concept is shown in Figure 3 of SPE 530 ("Lagrone")

Yeh and *Yeh2* teach away from increasing nozzle size and number

- *Yeh2* teaches that “large portholes [i.e., nozzles] **allow excessive fluid leakoff** through the surrounding annular pack”
- *Yeh2* illustrates the effects of leakoff in increased gravel concentration



Petitioner has not shown nozzle size and number are result-effective variables obvious to optimize

- Petitioner relies on case law for “result-effective variables” to claim that increasing nozzle size and number was “routine optimization.” *R.J. Reynolds v. Philip Morris*, IPR2021-00585, Paper 36 at 47 (P.T.A.B. Sept. 8, 2022).
- As the Preliminary Guidance recognized, in view of numerous design parameters and performance metrics such as friction loss and fluid leakoff, Petitioner has not shown that nozzle size or number are result-effective:

Petitioner does not identify any clear disclosure in Yeh or Yeh2 that teaches or suggests varying nozzle spacing. *See id.* at 3–5. Rather, Petitioner focuses on declarant testimony to link various concepts together to argue how those concepts would render the claims obvious, presumably because nozzle spacing is a result-effective variable. *Id.*

At this stage we are not entirely persuaded that nozzle spacing was a result-effective variable in view of the teachings of Yeh or Yeh2.

Claims 2 and 4 are Patentable

- *Yeh2*, Petitioner's purported motivation for increasing nozzle size or number, does not identify declining flow rate as a problem
- *Yeh2* achieves more even flow rate with closed-ended packing tubes, a **different solution** than nozzle size or number
- Increasing nozzle size and number **works against *Yeh's* teaching** to use eccentric screens for their low friction, extending packing length
- *Yeh2* teaches to limit nozzle size to avoid excessive fluid leakoff
- At most, Petitioner offers reasons nozzle size and number would affect flow rate, but Petitioner offers no explanation why a POSITA would prioritize increasing downstream flow rate over reducing friction, extending packing length, and avoiding fluid leakoff

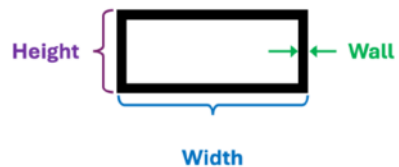
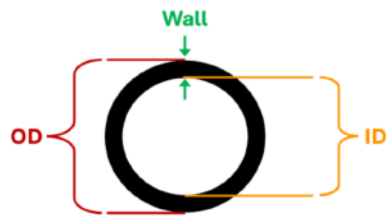
Dependent Claim 5 is Patentable

'007 Claim 2

The completion assembly of claim 1, wherein the **cross-sectional flow areas of the passageway in the first and second transport tubes is the same.**

- Petitioner's theory for claim 5 compares cross-sectional flow areas (CSFA) of round tubes to round tubes and rectangular tubes to rectangular tubes

Shunt Tube Capacity: different size tube – same capacity



Rectangular Tubing							
	OD (in)	ID (in)	OD (in)	ID (in)	Wall (in)	Wallx2 (in)	Cubic Inches/Foot (in ³ /foot)
10 Gauge	1.5	1.232	0.75	0.482	0.134	0.268	7.1
13 Gauge	1.25	1.06	0.75	0.56	0.095	0.19	7.1

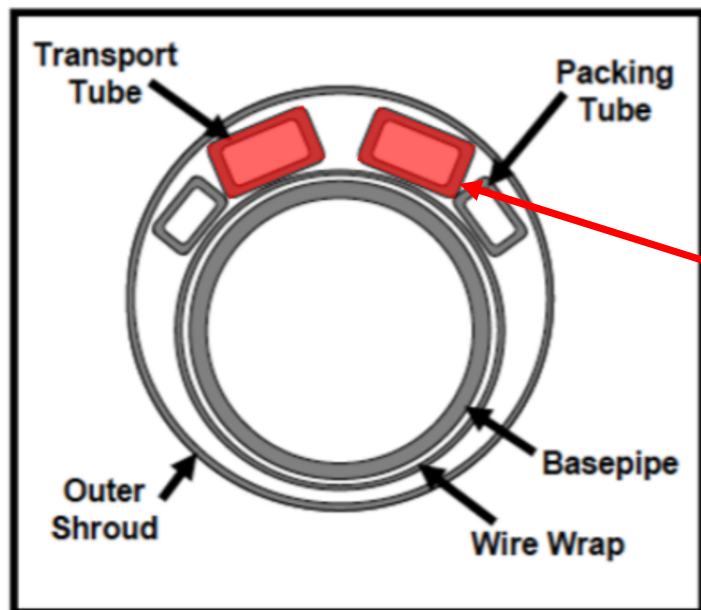
Round Tubing						
	OD (in)	ID (in)	Wall (in)	Wallx2 (in)	Burst Pressure* (psi)	Cubic Inches/Foot (in ³ /foot)
13 Gauge	0.787 (20mm)	0.6	0.095	0.19	14,745	3.4
14 Gauge	0.75 (19mm)	0.6	0.075	0.15	12,030	3.4

* Calculated from API TR5C3 at 24, Equation 14

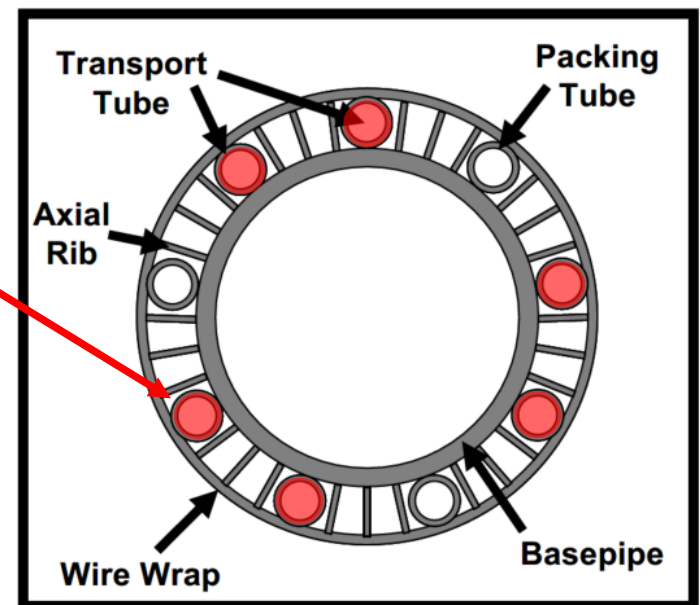
Data Source - Fischer catalog, API TR5C3

In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- But eccentric 2x2 screens used rectangular tubes and concentric 6x3 screens used round tubes
- Rectangular tubes sized 1.5" x 0.75" (1.31" x 0.56" flow area) were over 2X larger than round tubes of 16-mm ID (20-mm OD)



**Not the same
CSFA**



In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- Petitioner's expert established the tube dimensions for eccentric 2x2 screens (0.56" x 1.31" internal) and concentric 6x3 screens (16 mm ID)
- These different dimensions **yield differing CSFAs**

162. By 2004, Hurst noted that the wall for rectangular tubes was 0.095" (e.g., $(0.75-0.56)/2 = 0.095$). See EX1013 at 2 ("The tube dimensions were modified to 0.75×1.5-in external (0.56×1.31-in internal), yielding 3 times the flow area of the original design and reduction friction pressures over the rates of interest by approximately an order of magnitude, for long horizontal gravel packs."). Thus, Hurst noted an increase over the 0.0625" (1/16") wall of Jones' rectangular tube. Barry reported in SPE 110460 that using six round 20mm outer diameter shunt tubes with a 16 mm inside diameter, which he targeted for use in early 2008.

- The 6x3 concentric screen design compensates for smaller CSFA by using 3X as many transport tubes

In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- Petitioner's expert admits that round tubes in concentric 6x3 screens had **smaller CSFA** than rectangular tubes in eccentric screens

A Each tube -- each of the tube -- each of the -- let's see here. He's saying six 16-millimeter ID tubes. Okay. So that is a flow rate through each line. So obviously the 16-millimeter is a smaller tube than the current eccentric at the time was done, which were one-and-a-half by three-quarter, but that we're comparing a round to a rectangle. So the cross-sectional area is less for each one of these tubes. Is that your question?

Q Yes.

A Yeah, I'll just say the cross-sectional area is less.

In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- Petitioner's expert admits that round tubes in concentric 6x3 screens had **smaller CSFA** than rectangular tubes in eccentric screens

Q The size of the six tubes, Barry describes that they have a 16-millimeter inside diameter and a 20-millimeter outside diameter?

A Yes. It's the same information I put in my report.

Q And again, each of those six transport tubes is smaller than each of the two transport tubes in the eccentric 2x2 design, correct?

A Yes, but the overall cross-sectional area is greater than -- with the six is actually greater than the two.

Q On an individual basis each tube is smaller?

A On an individual basis if you're comparing a transport tube to a transport tube, that is correct.

In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- Petitioner's expert admits that eccentric 2x2 screens used rectangular tubes to achieve the greatest CSFA in shunt tubes

101. However, it appears the first installations were of a rectangular eccentric design to take advantage of achieving a large flow area.

...

102. Hurst's Figure 5, which I provide below, illustrated how using an eccentric design allowed for placement of the largest tubes,

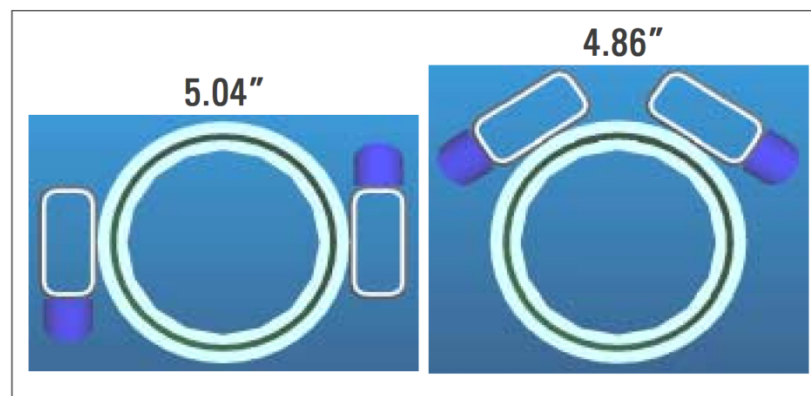


Figure 5 – Example of outer diameter reduction with eccentric design (right) versus concentric design (left).

In *Yeh/Yeh2*, upstream transport tube CSFA was much smaller than downstream transport tube CSFA

- Petitioner's expert admits concentric screens (upstream) had transport tubes with "smaller" CSFA and eccentric screens (downstream) had transport tubes with "greater" CSFA

45. A POSITA would understand that the eccentric orientation concentrated the annular space outside the base pipe, allowing for larger shunt tubes that had greater cross-sectional flow areas while still providing for a larger base pipe for the primary flow path. For example, Yeh disclosed a known design option for a concentric screen in which its shunt tubes had a smaller internal cross-sectional area offset by more shunt tubes compared to an eccentric screen, which had fewer shunt tubes with a larger internal cross-sectional area

[Petitioner's New Theory] Concentric 2x2 screens had less space for transport tubes than eccentric 2x2 screens

- Tubes in concentric 2x2 screens would not have the same CSFA as tubes in eccentric 2x2 screens because eccentric 2x2 screens provided more space

Concentric versus Eccentric Design

One disadvantage of the alternate path system is the reduced base-pipe diameter due to presence of the shunt tubes.

When the tubes are placed concentrically around a screen of fixed base-pipe diameter, the external dimensions become larger compared to when the tubes are placed eccentrically (Figure 5).

Q If you keep the overall tool size the same and the number of tubes the same, so we're comparing 2x2 screens, eccentric screens had more space for the shunt tubes than concentric screens in 2x2 designs?

A Yes.

[Petitioner's New Theory] Concentric 2x2 screens had less space for transport tubes than eccentric 2x2 screens

- ***Petitioner agrees concentric screens, whether 6x3 or 2x2, had smaller CSFAs*** than eccentric 2x2 screens

A skilled artisan would understand that an eccentric arrangement can provide more annular space for shunt tubes while maintaining the same primary flow path diameter and overall sand screen assembly diameter, permitting the use of larger cross-sectional area shunt tubes than are typically used in a concentric sand screen assembly. EX1044 ¶45. A skilled artisan seeking to reduce pressure drop in the transport tubes of the second sand screen assemblies would use larger cross-sectional area shunt tubes in the eccentric screen for the same reasons the skilled artisan would use a thinner shunt tube wall in the eccentric screens as explained in Claim 1[e]. Pet.,

...

A skilled artisan would also understand from Yeh that concentric screens could be designed to have fewer transport tubes to equate the same number of transport tubes as a conventional eccentric screen. See EX1005, 16:26-37.

Claims 5 is Patentable

- Petitioner compares round to round and rectangular to rectangular tubes
- In the relevant embodiment of *Yeh*, **the upstream concentric 6x3 screen has round tubes**, and **the downstream eccentric 2x2 screen has rectangular tubes** over twice as large
- The art consistently teaches that eccentric tubes used rectangular tubes to achieve the greatest CSFA in shunt tubes
- Petitioner's pivot to a new theory in its Reply, with concentric 2x2 screens upstream, **fails because eccentric screens had more space for shunt tubes**
- Petitioner admitted eccentric screens had **larger transport tube CSFAs, even when comparing concentric 2x2 screens to eccentric 2x2 screens**

Ground 2

The Petition has not shown that
Independent Claim 14 is Obvious

Independent Claim 14 is Patentable

'007 Claim 14
A method of installing a completion assembly in a wellbore, the method comprising:
identifying an elongated production zone having an upstream proximal end and a downstream distal end with respect to a source of pressurized working fluid;
determining a shunt tube system operating pressure associated with the proximal end of the production zone and selecting a high pressure shunt tube system based on the proximal end determined pressure;
<i>determining a shunt tube system operating pressure associated with the distal end of the production zone and selecting a low pressure shunt tube system based on the distal end determined pressure;</i>
installing a first sand screen assembly in a wellbore adjacent the distal downstream end of the elongated production zone;
attaching a second sand screen assembly to the first sand screen assembly at the proximal upstream end of the elongated production zone, wherein the first sand screen assembly has the low pressure shunt tube system and the second sand screen assembly has the high pressure shunt tube system, such that a downstream end of the high pressure shunt tube system is coupled to an upstream end of the low pressure shunt tube system; and
coupling the source of pressurized working fluid to an upstream end of the high pressure shunt tube system.

- The Petition fails to show “determining a shunt tube system operating pressure associated with the distal end of the production zone” or “selecting a low pressure shunt tube system based on the distal end determined pressure”

The Petition fails to show that the art meets its own construction

- The Petition identifies the claimed “distal end” as the “toe” of the production interval

Further, one of skill reading Yeh, including the '487 Patent, would understand that Yeh's horizontal 5,000-feet (elongated) production zone has an upstream proximal end at the heel and a downstream distal end at the toe. EX1005, 30:15-32 (calling this example “a horizontal completion”); EX1003 ¶¶374, 379.

The Petition fails to show that the art meets its own construction

- The Petition relies on using eccentric screens “at 3,000 feet from the toe” as teaching “determining a shunt tube system operating pressure associated with the distal end of the production zone” or “selecting a low pressure shunt tube system based on the distal end determined pressure”

Thus, one of skill would have implemented Yeh’s teaching to use eccentric screens toward the toe at any point at which the slurry pressure dropped below the pressure capacity of the eccentric screen shunt tubes, which is about 3,000 feet from the toe. EX1005, 30:16-20; EX1003 ¶388. Figure 15 of Yeh2 shows this operating pressure to be about 2,800 psi at 3,000 feet from the toe (2,000 feet on the x-axis). EX1006, Fig. 15.

- But “use” of a screen “3,000 feet from the toe” does not show “determining” an operating pressure “associated with” the toe or “selecting” a shunt tube system based on the determined toe pressure

Grounds 3-4

The Petition has not shown that
Independent Claim 21 is Obvious

Independent Claim 21 is Patentable

'007 Claim 21
A completion assembly for deployment in a wellbore, the completion assembly comprising:
a source of pressurized working fluid;
a first sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area; and
a second sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;
wherein the first and second sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with one another and the source of pressurized working fluid, the transport tube of the second sand screen assembly fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first sand screen assembly; and
wherein the transport tube of the first sand screen assembly is formed of a first material and the transport tube of the second sand screen assembly is formed of a second material, the first material having a greater tensile strength than the second material.

Yeh teaches away from downgrading eccentric screens

- Petitioner argues “[i]t would have been obvious that using **a lower tensile strength material**” in the downstream eccentric screen “would achieve a **lower pressure rating** and **save cost**.”
- A POSITA **would not have reduced** eccentric tube strength and thus their 3,000-ft, 3,000-psi limit, contradicting Yeh’s teaching to use eccentric screens for the benefit of their lower friction to extend packing length

In one embodiment, an eccentric screen arrangement offers lower friction in the secondary flow paths when compared to shunt tubes in a concentric screen. It is believed that the use of eccentric screens at the toe of a horizontal completion will reduce the overall friction or extend the maximum gravel packing length of the completion.

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens.

Yeh teaches away from downgrading eccentric screens

- Yeh teaches to use eccentric screens instead of concentric screens **to reduce “overall cost,”** suggesting concentric only for their higher pressure rating

The new crossover tool allows the operator to use the less-expensive eccentric screens on the toe or lower-pressure side of the interval during gravel-packing operations, and to use the concentric screens on the heel or higher-pressure side of the interval during the gravel-packing operations. This reduces the overall cost of completion while still achieving the gravel packing goal.

It may be difficult to acquire more complex concentric sand screens in quantities needed for extended horizontal completions. Therefore, the crossover joint allows a horizontal completion to continue without delay by combining concentric screens with the more readily available eccentric screens. Thus, the use of crossover joints provides flexibility in maintaining and managing the inventory of sand screens.

- Every foot not gravel packed with an eccentric screen would have to be packed with a more expensive, less available concentric screen

RMTA Grounds

Ground	'007 Substitute Claims	Statutory Basis
1a	24-27	Obvious under §103(a) over <i>Yeh</i> (EX1005) in view of <i>Yeh2</i> (EX1006)
1b	28-30	Obvious under §103(a) over <i>Yeh</i> in view of <i>Bonner</i> (EX1016) and optionally <i>Yeh2</i>
2	31-37	Obvious under §103(a) over <i>Yeh</i> in view of <i>Yeh2</i> , <i>Bonner</i> , and optionally <i>Jones2</i> (EX1008)
3	38-39	Obvious under §103(a) over <i>Yeh</i> in view of <i>Jones</i> (EX1007) and <i>Bonner</i>
4	40	Obvious under §103(a) over <i>Yeh</i> in view of <i>Jones</i> , <i>Yeh2</i> , and <i>Bonner</i>

RMTA Grounds

Ground	'007 Substitute Claims	Sand Screen Configuration
1a	24-27	Concentric Screen Upstream of Eccentric Screen
1b	28-30	<i>Bonner's</i> Eccentric Screen Upstream of <i>Yeh's</i> Eccentric Screen
2	31-37	<i>Bonner's</i> Eccentric Screen Upstream of <i>Yeh's</i> Eccentric Screen
3	38-39	<i>Bonner's</i> Eccentric Screen Upstream of <i>Yeh's</i> Eccentric Screen
4	40	<i>Bonner's</i> Eccentric Screen Upstream of <i>Yeh's</i> Eccentric Screen

The RMTA Claims Are Proper

- PO amended Claims 28-40 to recite **eccentric screens upstream and downstream**, which as explained further below, the *Yeh/Yeh2/Bonner* combination does not teach
- Additional amendments also recite elements not in the combination of *Yeh*, *Yeh2*, and *Bonner*:
 - Claims 26, 37: Upstream and downstream screens having **the same base pipe flow areas and outer diameters**
 - Claims 27, 33, 40: Packing tubes **interconnected** to downstream junction blocks
 - Claims 30, 39: Packing tubes in downstream screen having **greater cross sectional flow area**
- “Amended language” that overcomes the “references at issue” is “responsive to grounds of unpatentability.” See *Lectrosonics, v. Zaxcom*, IPR2018-01129, Paper 33, 46, 73 (P.T.A.B. Feb. 25, 2019).

Petitioner's RMTA opposition improperly incorporates by reference its earlier opposition

- The RMTA Opp. improperly incorporates 20 pages from Petitioner's original Opposition. *See Intellectual Ventures Mgmt., LLC v. Xilinx, Inc.*, IPR2012-00023, Paper 35, 41 (PTAB Feb. 11, 2014) (finding "incorporation of arguments ... by reference to" separate paper "is improper procedurally under 37 C.F.R. § 42.6(a)(3)")
- "Arguments must not be incorporated by reference from one document into another document. Combined motions, oppositions, replies, or other combined documents are not permitted." 37 C.F.R. § 42.6(a)(3).

Claims 29, 31, and 38 Are The Challenged Independent Claims

Limitation	Claim 29
29[p]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
29[a]	a source of pressurized working fluid;
29[b]	a first <u>eccentric</u> sand screen assembly attached to a second <u>eccentric</u> sand screen assembly,
29[c]	wherein the first <u>eccentric</u> sand screen assembly comprises a shunt tube assembly with a first burst pressure and the second <u>eccentric</u> sand screen assembly comprises a shunt tube assembly with a burst pressure less than the first burst pressure,
29[d]	and wherein the shunt tube assembly with the first burst pressure is fluidly coupled between the source of pressurized working fluid and the shunt tube assembly with the burst pressure less than the first burst pressure

Claims 29, 31, and 38 Are The Challenged Independent Claims

Limitation	Claim 31
31[p]	A method of installing a completion assembly in a wellbore, the method comprising:
31[a]	identifying an elongated production zone having an upstream proximal end and a downstream distal end with respect to a source of pressurized working fluid;
31[b]	determining a shunt tube system operating pressure associated with the proximal end of the production zone and selecting a high pressure shunt tube system based on the proximal end determined pressure;
31[c]	determining a shunt tube system operating pressure associated with the distal end of the production zone and selecting a low pressure shunt tube system based on the distal end determined pressure;
31[d]	installing a first <u>eccentric</u> sand screen assembly in a wellbore adjacent the downstream distal downstream end of the elongated production zone;
31[e]	attaching a second <u>eccentric</u> sand screen assembly to the first <u>eccentric</u> sand screen assembly at the proximal upstream end of the elongated production zone, wherein the first <u>eccentric</u> sand screen assembly has the low pressure shunt tube system and the second <u>eccentric</u> sand screen assembly has the high pressure shunt tube system,
31[f]	such that a downstream end of the high pressure shunt tube system is coupled to an upstream end of the low pressure shunt tube system; and
31[g]	coupling the source of pressurized working fluid to an upstream end of the high pressure shunt tube system.

Claims 29, 31, and 38 Are The Challenged Independent Claims

Limitation	Claim 38
38[p]	A completion assembly for deployment in a wellbore, the completion assembly comprising:
38[a]	a source of pressurized working fluid;
38[b]	a first <u>eccentric</u> sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, where each of the tubes has a passageway defined therein, the packing tube further including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area; and
38[c]	a second <u>eccentric</u> sand screen assembly comprising a base pipe having perforations therein and extending between a first end and a second ends, a sand screen disposed around a portion of the base pipe, and a shunt tube assembly disposed outwardly of the sand screen, the shunt tube assembly having a transport tube and a packing tube, the packing tube including a plurality of nozzles spaced apart from each other, wherein each of the tubes and each nozzle has a cross-sectional flow area;
38[d]	wherein the first and second <u>eccentric</u> sand screen assemblies are arranged end to end relative to one another so that the base pipes are in fluid communication with one another and the transport tubes are in fluid communication with one another and the source of pressurized working fluid, the transport tube of the second <u>eccentric</u> sand screen assembly fluidly coupled to the source of pressurized working fluid downstream of the transport tube of the first <u>eccentric</u> sand screen assembly; and
38[e]	wherein the transport tube of the first <u>eccentric</u> sand screen assembly is formed of a first material and the transport tube of the second <u>eccentric</u> sand screen assembly is formed of a second material, the first material having a greater tensile strength than the second material.

Claims 28-40: There is no motivation to combine *Yeh* and *Bonner*

- For claims reciting upstream and downstream eccentric screens, the Opp. relies on **substituting *Bonner's* eccentric screen for *Yeh's* concentric screen**

28[b]: Yeh in view of Yeh2 and Bonner disclosed or suggested this limitation.

EX1044 ¶63. It would have been obvious to substitute Bonner's high-pressure eccentric sand screen for Yeh's high-pressure concentric sand screen.

- The Opposition provides two motivations for substituting *Bonner's* screen for *Yeh's* concentric screen: removing *Yeh's* crossover tool and easing installation

Substituting Bonner's eccentric sand screen for Yeh's concentric sand screen would: (1) provide for a larger primary flow path because of the removal of Yeh's crossover tool restriction in the primary flow path when transitioning from a concentric to an eccentric primary flow path and (2) be more easily and quickly installed due to Bonner's improvements.

Bonner's eccentric screen is conventional, not high pressure

- As for the original claims, the *Yeh* reference requires an **upstream screen** rated to operate at **6,500 psi**

On the high-pressure side, *Yeh* disclosed that the shunt tubes (including transport tubes) would have to contain a higher differential pressure, such as 6,500 psi near the heel in a 5,000-foot horizontal wellbore, than the shunt tubes in the lower-pressure side.

For example, a 6,500 psi differential pressure is expected near the heel of when gravel packing a 5,000-foot horizontal completion interval.

Another tool sequence for use with a crossover joint is:
concentric screen→crossover tool→eccentric screen

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens.

Bonner's eccentric screen is conventional, not high pressure

- Despite *Yeh's* 6,500 psi requirement, the Opp. **admits** *Bonner's* eccentric screen **did not exceed 5,000 psi**

One of skill would understand that Yeh recommended using concentric sand screens near the heel because of their higher-pressure rating. EX1005, 28:18-24, 30:13-26, 30:44-45; Pet. at. 41; EX1003 ¶¶291-92; EX1044 ¶64. However, Bonner disclosed an eccentric screen rated to 5,000 psi, which is higher than the 3,000-psi ratings of eccentric screens of the time.

- The Opp. repeats the argument that a POSITA could have thickened the shunt tube walls of *Bonner's* screen to make it an acceptable substitute
- But *Bonner*, like *Yeh* and *Yeh2*, says nothing about transport tube wall thickness

Bonner's eccentric screen is conventional, not high pressure

- The Petition introduced *Bonner* as a **conventional eccentric screen**

Bonner disclosed

a shunt tube system designed to be “functionally the same as existing industry-proven designs, in order to enjoy the empirical evidence of years of successful application of shunt tube gravel-packing technology.”

155. Bonner’s shunt tube assembly used the 2×2 eccentric configuration that was “used across the industry and has well known flow characteristics. [Bonner’s] shunt tube system is using the same size, the same geometry of the transport and packing tubing, the same exit port spacing and arrangement....”

Bonner's eccentric screen is conventional, not high pressure

- To paint *Bonner's* eccentric screen as “high pressure,” the Opposition now **ignores *Bonner's* teaching of a 1.33 safety factor** between burst pressure and working pressure

Although a sample tube failed below 5000 psi in this burst testing, it was determined after the test that this sample was defective in manufacture, and consequently that test was discounted. The overall testing substantiated the goal rating of 5000 psi burst pressure. However, a 1.33 safety factor was judged to be advisable for a working burst pressure for the tube system in order to allow for variations in the manufacturing of the tubes.

Bonner's eccentric screen is conventional, not high pressure

- The art consistently applies a safety factor, ranging from 1.33 to about 1.5, to reduce "burst" or "test" pressure ratings to "working pressure" ratings

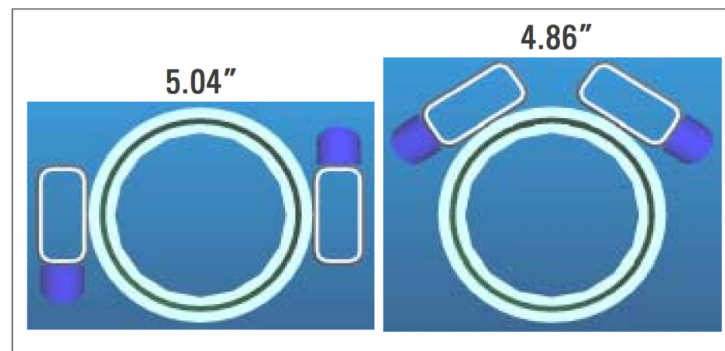
At 4 bbl/min, 6,000 psi would be required to pump through the entire 5,000 ft of shunt tubes, therefore, the pressure integrity of the shunt system must be rated higher than 6,000 psi. Individual shunt tubes welded to an end ring were designed and pressure tested to 10,000 psi. The manifold seals required a specially designed seal stack to withstand the 10,000 psi test. The entire system was pressure tested to 10,000 psi at ambient temperatures and 180°F. Six thousand five hundred (6,500) psi was held at 170°F for a period of eight hours simulating the pumping of an entire gravel pack job through the shunt tubes.

Bonner's eccentric screen is conventional, not high pressure

- The art confirms Bonner's 5,000 psi "burst pressure" corresponds to the 3,000 psi "working pressure" of conventional eccentric 2x2 screens in 2004-2011

2004: Similarly, long open hole horizontal gravel packs may limit the pump rates due to increased frictional pressure losses. In both cases, the limitation is the burst pressure of the shunt tubes, which is currently 5,000 psi.

Another issue that must be kept in mind in alternate path gravel packing treatments is the burst pressure limit of the shunt tubes, which is 5,000 psi. High friction in long intervals can necessitate reduction in flow rates in order to stay below this limit.



Bonner's eccentric screen is conventional, not high pressure

- The art confirms *Bonner's* 5,000-psi "burst pressure" corresponds to the 3,000-psi "working pressure" of conventional eccentric 2x2 screens in 2004-2011

2010:

Although routinely deployed, the current eccentric 2x2 APT screens have both technical and operational limitations. These limitations may include:

- Maximum shunt system working pressure of 3,000 psi which limits the packable length to ~3,200 ft pumping at 5 barrels per minute (bpm)

By migrating from rectangular shunt tubes to round shunt tubes, the working pressure of the shunt system increases from 3,000 to 6,500 psi. The shunt system of the new ISAPT screens has been tested to 10,000 psi. With the increase in working pressure, a length of 5,000 ft can now be packed at a rate of 4.5 bpm extending the length limit by more than 50%.

2011:

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens. The new crossover tool allows the

Bonner's eccentric screen is conventional, not high pressure

- Petitioner's expert agrees that **applying a safety factor is "Petroleum Engineering 101,"** but doesn't consider safety factor in his analysis

Q. You do not address this safety factor in your declaration when discussing Bonner, correct?

A. I don't believe so, no.

Q. Does Barry state that it's testing to 10,000 psi so that it could pack a longer interval or pump more barrels per minute?

A. I mean, this is Petroleum Engineering 101. You know, I mean, all casing we -- you know, you have a working pressure, you have a test pressure.

You know, you -- it -- you commonly test -- you commonly want to test to higher than whatever you're going to require. That throws in a safety factor, you know, for you. You have the ability to use a safety factor.

So I don't see it's anything uncommon about testing a system to 10,000 pounds. It's a brand-new system. He wanted to know what it would be good for.

Bonner's eccentric screen is conventional, not high pressure

- Applying a safety factor to *Bonner's* 5,000 psi demonstrates that *Bonner's* screen is conventional

Embodiment	Pressure Rating
<i>Yeh's</i> Requirement	6,500 PSI
<i>Bonner's</i> "Burst" Pressure	5,000 PSI
<i>Bonner's</i> "Working" Pressure (applying 1.33 safety factor)	3,760 PSI
<i>Yeh's</i> Conventional Eccentric	3,000 PSI

Bonner's eccentric screen is conventional, not high pressure

- *Yeh* uses conventional eccentric screens like *Bonner's* downstream near the toe, not upstream near the heel

Another tool sequence for use with a crossover joint is:
concentric screen→crossover tool→eccentric screen

The use of concentric screens may be beneficial when gravel packing long intervals. Concentric sand screens can be more robust for gravel packing long intervals. For example, known concentric screens are capable of gravel packing 5,000 feet, compared to 3,000 feet with the commercial eccentric screens. The new crossover tool allows the operator to use the less-expensive eccentric screens on the toe or lower-pressure side of the interval during gravel-packing operations, and to use the concentric screens on the heel or higher-pressure side of the interval during the gravel-packing operations.

Substituting *Bonner's* eccentric screen in *Yeh* renders *Yeh* inoperable for its intended use

- *Yeh* is titled “**CROSSOVER JOINT FOR CONNECTING ECCENTRIC FLOW PATHS TO CONCENTRIC FLOW PATHS**”
- *Yeh* repeatedly **recites the “crossover joint” as its invention**, for connecting eccentric flow paths to concentric flow paths

However, a crossover tool connecting concentric flow paths to eccentric flow paths (or vice versa) between two screen joints or between a screen joint and a packer has not yet been developed.

Therefore, a need exists for an improved sand control system utilizing a crossover joint for connecting an eccentric sand screen with a concentric packer, or vice versa.

Improved methods for completing an open-hole wellbore are provided, which use a crossover tool for fluidly connecting an eccentric flow path to a concentric flow path.

Substituting *Bonner's* eccentric screen in *Yeh* renders *Yeh* inoperable for its intended use

- Petitioner's motivation—"the removal of *Yeh's* crossover tool restriction"—removes *Yeh's* invention and **renders *Yeh* inoperable for connecting concentric and eccentric flow paths**
- "Such a change in a reference's 'principle of operation' is unlikely to motivate a person of ordinary skill to pursue a combination with that reference." *Plas-Pak Indus., Inc. v. Sulzer Mixpac AG*, 600 F. App'x 755, 759 (Fed. Cir. 2015)
- "[T]he destruction of [prior art reference's] entire purpose ... was probative of whether [Petitioner's] modifications would have been obvious." *Medtronic, Inc. v. Teleflex Innovations S.a.r.l.*, 69 F.4th 1341, 1350 (Fed. Cir. 2023).

There was no motivation to use *Bonner's* eccentric screen for easier installation

- The Opp. claims easier installation would also motivate substituting *Bonner's* eccentric screen for *Yeh's* concentric screen

Substituting Bonner's eccentric sand screen for Yeh's concentric sand screen would: (1) provide for a larger primary flow path because of the removal of Yeh's crossover tool restriction in the primary flow path when transitioning from a concentric to an eccentric primary flow path and (2) be more easily and quickly installed due to Bonner's improvements.

- But **concentric** screens were **already installed twice as fast as eccentric** screens

A total of 57 connections were made up while running the ISAPT screen assembly and a peak run time of 10 joints per hour was obtained. This make-up time is consistent with make-up times of conventional tubing and is a significant improvement over the five joints per hour average for the eccentric 2x2 design. Each joint was successfully made up and no screen joints were laid down due to handling or make-up issues. The peak running time validated the assumption of improved rig site efficiency with the ISAPT design by the elimination of the timed connections and cross coupling jumper tubes of the eccentric 2x2 design.

There was no motivation to use *Bonner's* eccentric screen for easier installation

- Petitioner claims PO has not rebutted its argument that *Bonner's* eccentric screen would have been “obvious to try” upstream
- *Bonner's* conventional eccentric screen was not obvious to try because **it was no substitute** for *Yeh's* high pressure concentric screen
- Petitioner has not shown that modifying *Bonner's* screen with thicker walls would have been obvious to try
 - The art modifies other parameters, such as shunt tube cross-sectional flow area, geometry, manifolds, and number of shunt tubes.
- An invention is not obvious when “what would have been ‘obvious to try’ would have been to vary all parameters or try each of numerous possible choices until one possibly arrived at a successful result, where the prior art gave either no indication of which parameters were critical or no direction as to which of many possible choices is likely to be successful.” *In re Kubin*, 561 F.3d 1351, 1359 (Fed. Cir. 2009).

Claim 24 recites different nozzle spacing on different shunt tube assemblies

Limitation	Claim 24
24[pre]	The completion assembly of claim 1,
24[a]	wherein the first sand screen assembly further comprises a junction block from which the transport tube and the packing tube extend, the plurality of nozzles being spaced apart from the junction block;
24[b]	and wherein the second sand screen assembly further comprises a junction block from which the transport tube and the packing tube extend, the plurality of nozzles being spaced apart from the junction block,
24[c]	wherein <u>a</u> [[the]] distance between the first sand screen assembly junction block and the packing tube nozzles is greater in the first sand screen assembly than <u>a</u> [[the]] distance between the second sand screen assembly junction block and the packing tube nozzles in the second sand screen assembly;
24[d]	<u>wherein the second sand screen assembly further comprises a second shunt tube assembly in addition to the shunt tube assembly of the second sand screen assembly; and wherein a spacing between adjacent nozzles of the second shunt tube assembly is different than a spacing between adjacent nozzles of the shunt tube assembly of the second sand screen assembly.</u>

Claim 24: the prior art does not teach varying nozzle size and spacing across packing tubes

- Petitioner argues decreasing flow motivated decreasing nozzle spacing along a particular packing tube

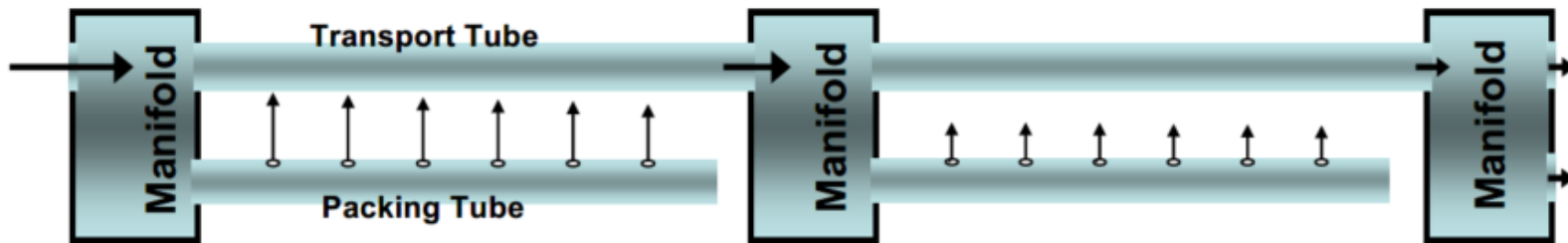
24[d]: Yeh2 shows that flow through nozzles decreases over the length of a packing tube. See EX1006, Fig. 7; EX1044 ¶34. Thus, it would have been obvious to decrease nozzle spacing toward the downstream end of a packing tube to provide greater cross-sectional flow area to maintain flow to the annulus with lower pressure.

- But Claim 24 requires two packing tubes, each with different (but uniform) nozzle spacing

Each packing tube 312 includes one or more nozzles 316. Each nozzle 316 is spaced apart from its respective junction block 314 a distance D1. Likewise, each nozzle 316 along a packing tube 312 may be spaced apart from adjacent nozzles a distance D2. The spacing D2 between nozzles 216 along a particular packing tube 312 may be the same or different. Likewise, the spacing D2 between nozzles 216 of shunt tube assemblies of the same sand screen assembly may be the same or different.

Claim 24: the prior art does not teach varying nozzle size and spacing across packing tubes

- *Yeh2* teaches **uniform** nozzle size (6 mm) and spacing (6 ft)



Previous gravel pack tests indicated that slurry exiting from a single shunt porthole could successfully pack up to an 8-10 ft annular void. Additional laboratory tests confirmed that shunt tubes with 6 ft porthole spacing fully packed an annulus in a 10" ID fixture. The 6 ft porthole spacing in Figure 9 utilizes six portholes to pack one screen joint (40 ft) interval.

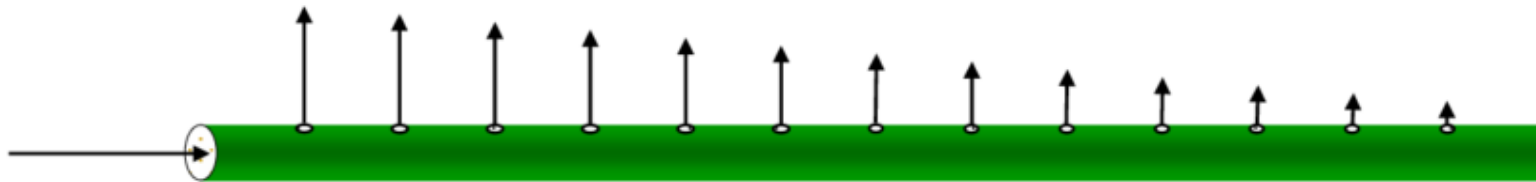
- So does *Hurst*

Consider an interval of 2,000 ft, that will be gravel packed with 2 transport tubes at 4-bbbls/min using 5.0 ppa VES slurry, with the transport tubes having 5 nozzles (1/4-in diameter) per shunt joint and each joint being 30-ft in length. Assume

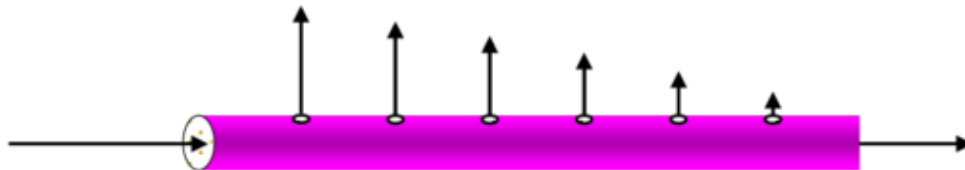
Claim 24: the prior art does not teach varying nozzle size and spacing across packing tubes

- *Yeh2* addresses declining flow rate with a **different** solution, **closed-end** packing tubes

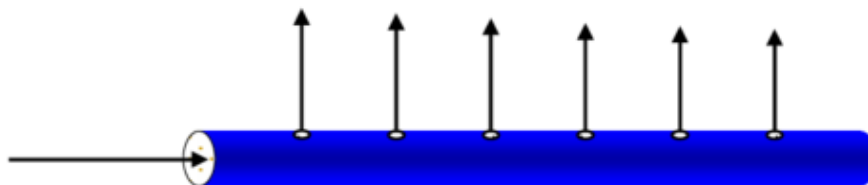
Case A Open-End Shunt with 6 mm Portholes over 80 ft Interval



Case B Open-End Shunt with 6 mm Portholes over 40 ft Interval



Case C Closed-End Shunt with 6 mm Portholes over 40 ft Interval



Claim 24: the prior art does not teach varying nozzle size and spacing across packing tubes

- Petitioner claims *Yeh2*'s closed-end tube is only a "partial solution" to declining flow, but its obviousness theory rests on varying nozzle spacing on a single packing tube

We further note that Petitioner interprets this limitation to mean that the spacing between nozzles along a particular packing tube is different. *See* Opp. 4.

Because of the known motivation to decrease nozzle spacing toward the end of a packing tube, *Yeh*'s conventional eccentric screen so modified would have a first packing tube with a pair of adjacent nozzles close to the upstream end that have a different (i.e., larger) spacing than another pair of adjacent nozzles close to the downstream end of the second packing tube.

Claim 26 recites upstream and downstream screens having the same size base pipes and outer diameters

Limitation	Claim 26
26[pre]	The completion assembly of claim 1,
26[a]	wherein the shunt tube assembly of the first sand screen assembly has a pressure rating between 5000 psi and 10000 psi, and the shunt tube assembly of the second sand screen assembly has a pressure rating of no more than 5000 psi;
26[b]	<u>wherein a cross-sectional flow area of the base pipe of the first sand screen assembly is the same as a cross-sectional flow area of the base pipe of the second sand screen assembly;</u>
26[c]	<u>and wherein an outer diameter of the first sand screen assembly is the same as an outer diameter of the second sand screen assembly.</u>

- As it depends from Claim 1, Claim 26 also requires thicker transport tube walls in the upstream screen
- Ground 1b for Claim 26 relies on concentric screens upstream and eccentric screens downstream

Claim 26: Petitioner admits eccentric screens had larger base pipes and smaller outer diameters than concentric screens

- Petitioner's obviousness theory requires an upstream concentric screen and a downstream eccentric screen with the same base pipe and same outer diameter
- The Opp. presents evidence of common outer diameters (8.5") and base pipe sizes (5.5")
- The Opp. addresses base pipe size and outer diameter in isolation, without explaining why an eccentric screen would have the same base pipe size and outer diameter as a concentric screen

Claim 26: Petitioner admits eccentric screens had larger base pipes and smaller outer diameters than concentric screens

- Petitioner has admitted that eccentric screens permitted larger base pipes and larger shunt tubes than concentric screens

Substituting Bonner's eccentric sand screen for Yeh's concentric sand screen would: (1) provide for a larger primary flow path both because eccentric screens provide for a larger primary flow path and because of the removal of Yeh's crossover tool restriction in the primary flow path when transitioning from a concentric to an eccentric primary flow path and (2) be more easily and quickly installed due to Bonner's improvements.

45. A POSITA would understand that the eccentric orientation concentrated the annular space outside the base pipe, allowing for larger shunt tubes that had greater cross-sectional flow areas while still providing for a larger base pipe for the primary flow path. For example, Yeh disclosed a known design option for a

Claim 26: Petitioner admits eccentric screens had larger base pipes and smaller outer diameters than concentric screens

- The Opp. equates 7.62" and 7.79" outer diameters

For the common 8.5" open-hole wellbore, numerous examples show that sand screen outside diameter would be from 7.62" to 7.79". EX1052 ¶¶47, 49-50; EX1045 ¶68 (7.625"); EX1049, 2 (7.620"); EX1050, 2 (7.73" or 7.79"); EX1027, 3 (7.76" or 7.65"). Most of these examples overlap with each other and thus are "the same," given a reasonable manufacturing tolerance of ± 0.125 ".

- The art makes clear that "larger shunt tubes" (i.e., thickening shunt tube walls) causes the screens outer diameter to "become too large"

Although larger shunt tubes reduce the pressure drop and thus the pressure requirements for the Internal Shunt Alternate Path screens, the screens become too large for the desired application.

Claim 26: Petitioner admits eccentric screens had larger base pipes and smaller outer diameters than concentric screens

- The Opp. incorporates the Petition and relies on 6x3 concentric screens upstream for Claim 26, which depends from Claim 1
- The Opp.'s single example of a 6x3 concentric screen has thinner walls, and fails to meet Claim 1's requirement of a thicker transport tube wall upstream

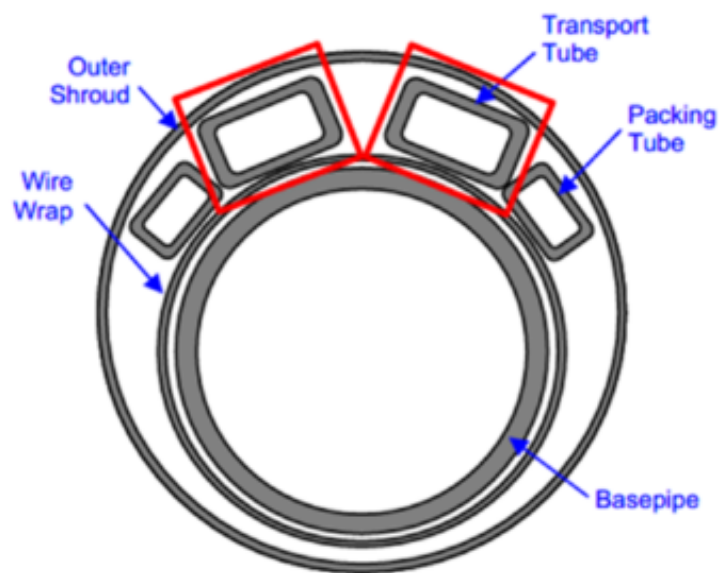


**Fig. 1. Alternate Path "Two-by-Two"
Screen Cross-Section**

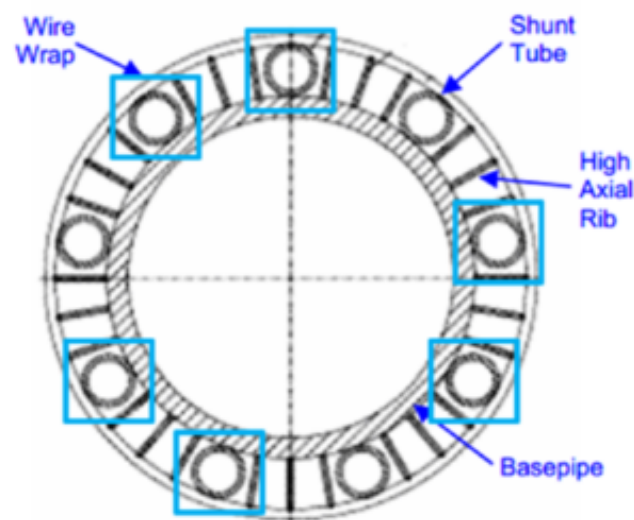
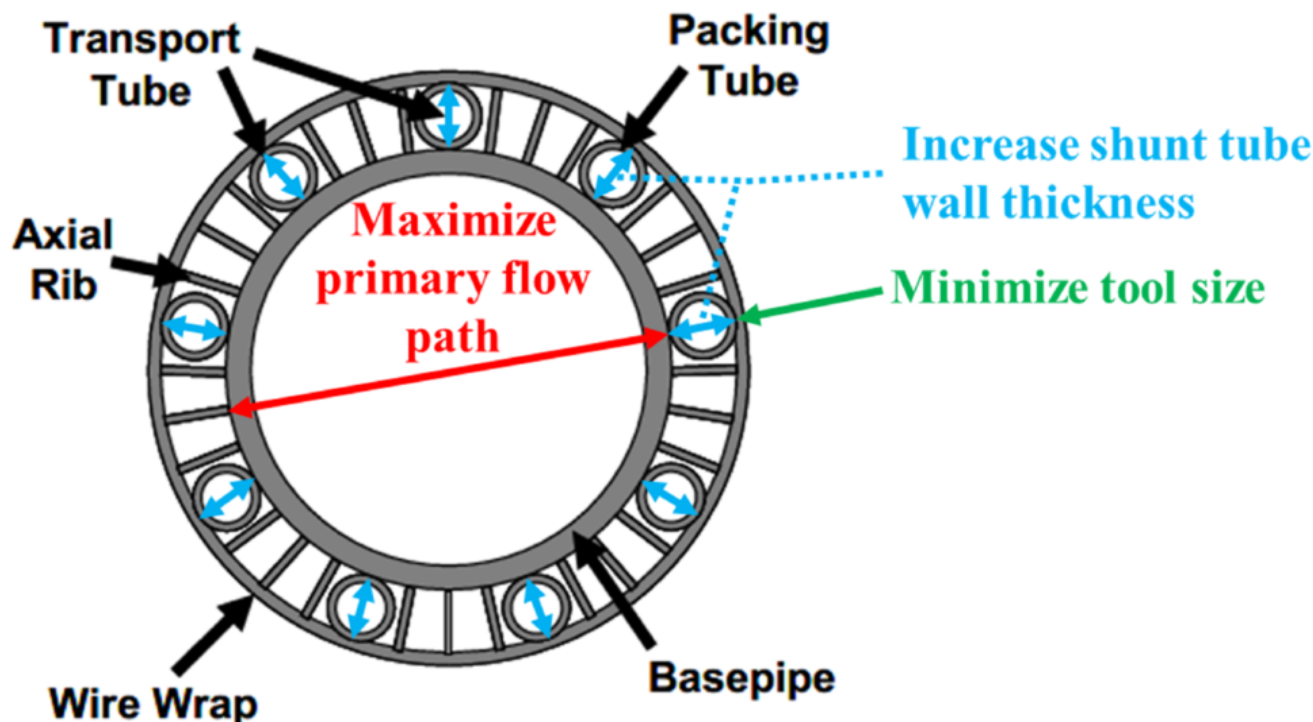


**Fig. 2. Internal Shunt Alternate Path
Screen Cross-Section**

Claim 26: Petitioner admits eccentric screens had larger base pipes and smaller outer diameters than concentric screens

- The Opp. nowhere explains how a POSITA could **thicken** the 6x3 transport tube walls, to meet the requirements of Claim 1, **while maintaining** the same base pipe size and outer diameter, to meet the requirements of Claim 26



Claim 37 recites upstream and downstream eccentric screens having the same size base pipes and outer diameters

Limitation	Claim 37
37[pre]	The method of claim [[14]]31,
37[a]	wherein installing the first <u>eccentric</u> sand screen assembly and attaching the second <u>eccentric</u> sand screen assembly include disposing the first <u>eccentric</u> sand screen assembly and the second <u>eccentric</u> sand screen assembly in a horizontal portion of the wellbore;
37[b]	and wherein a <u>cross-sectional flow area of a base pipe of the first eccentric sand screen assembly is the same as a cross-sectional flow area of a base pipe of the second eccentric sand screen assembly</u> ;
37[c]	and wherein an <u>outer diameter of the first eccentric sand screen assembly is the same as an outer diameter of the second eccentric sand screen assembly</u> .

Claim 37: Petitioner's incorporation of its arguments for Claim 26 fails to meet its burden

- For Claim 37, the Opp. relies on its arguments against Claim 26 based on *Yeh*

37[b]: Claim 37[b] is disclosed or suggested by *Yeh* in view of *Yeh*2 and optionally Jones 2 for the reasons discussed in Claim 26[b]; EX1055 ¶¶84-85.

- But **Claim 37 recites eccentric screens upstream** and downstream, while Ground RMTA 1a for **Claim 26 relies on concentric screens upstream** of eccentric screens
 - Petitioner relies on *Yeh*'s concentric screen upstream of an eccentric screen

The new crossover tool allows the operator to use the less-expensive eccentric screens on the toe or lower-pressure side of the interval during gravel-packing operations, and to use the concentric screens on the heel or higher-pressure side of the interval during the gravel-packing operations.

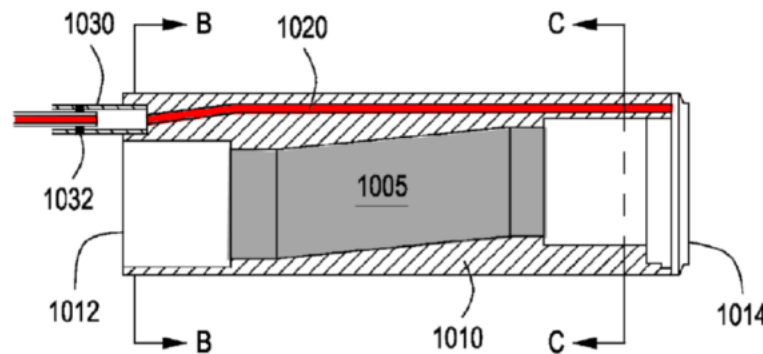
- Absent any showing of upstream and downstream eccentric screens having same base pipe and outer diameter sizes, Petitioner has not met its burden

Claims 27, 33, and 40 recite an upstream packing tube “interconnected” to a downstream junction block

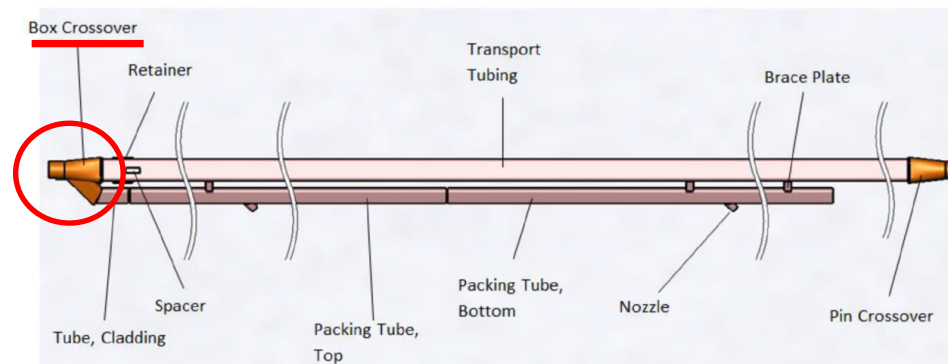
Limitation	Claim 27
27[a]	The completion assembly of claim 1, wherein the shunt tube assembly of the first sand screen assembly has a pressure rating of between 5000 and 10000 psi
27[b]	<u>and the packing tube of the shunt tube assembly of the first sand screen assembly is interconnected to a junction block of the second sand screen assembly.</u>
Limitation	Claim 33
33[a]	The method of claim [[14]]31, further comprising introducing a working fluid into the shunt <u>tube</u> systems, wherein the working fluid is pressurized in accordance with the operating pressure of the high pressure shunt tube system;
33[b]	<u>and wherein a packing tube of the high pressure shunt tube system is interconnected to a shunt tube junction block of the low pressure shunt tube system.</u>
Limitation	Claim 40
40[a]	The completion assembly of claim [[21]]38, wherein the first <u>eccentric</u> sand screen assembly has a shunt tube assembly with a first pressure rating and the second <u>eccentric</u> sand screen assembly has a shunt tube assembly with a second pressure rating less than the first pressure rating.
40[b]	<u>and the packing tube of the shunt tube assembly of the first eccentric sand screen assembly is interconnected to a shunt tube junction block of the second eccentric sand screen assembly.</u>

Claims 27, 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- For Claim 27, the Opp. argues *Yeh's* crossover tool “interconnects” an upstream packing tube to a downstream junction block



- For Claims 33 and 40, the Opp. argues *Bonner's* “box crossover” “interconnects” an upstream packing tube to a downstream junction block



Claims 27, 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- Petitioner misconstrues “interconnected” as permitting a packing tube indirectly “connected to a downstream manifold or junction block ***via transport tube***”
- Petitioner faults PO for construing “interconnected” as requiring “a direct connection between the ***distal end***” of the packing tube and downstream junction block
- But the '007 Patent makes clear that **interconnection establishes fluid flow from the packing tube to a downstream junction block**

In this regard, the base pipes of the assemblies are interconnected, and likewise, as described above, adjacent shunt tube assemblies are interconnected using jump tubes to establish fluid communication therebetween. In particular, the packing tube of an upstream sand screen assembly is interconnected to the shunt tube junction block of a downstream sandscreen assembly.

Claims 27, 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- To support its strained construction, Petitioner claims the '007 Patent's Figure 2 does not contain a junction block, and Figure 3 does not show direct connection to a packing tube's distal end

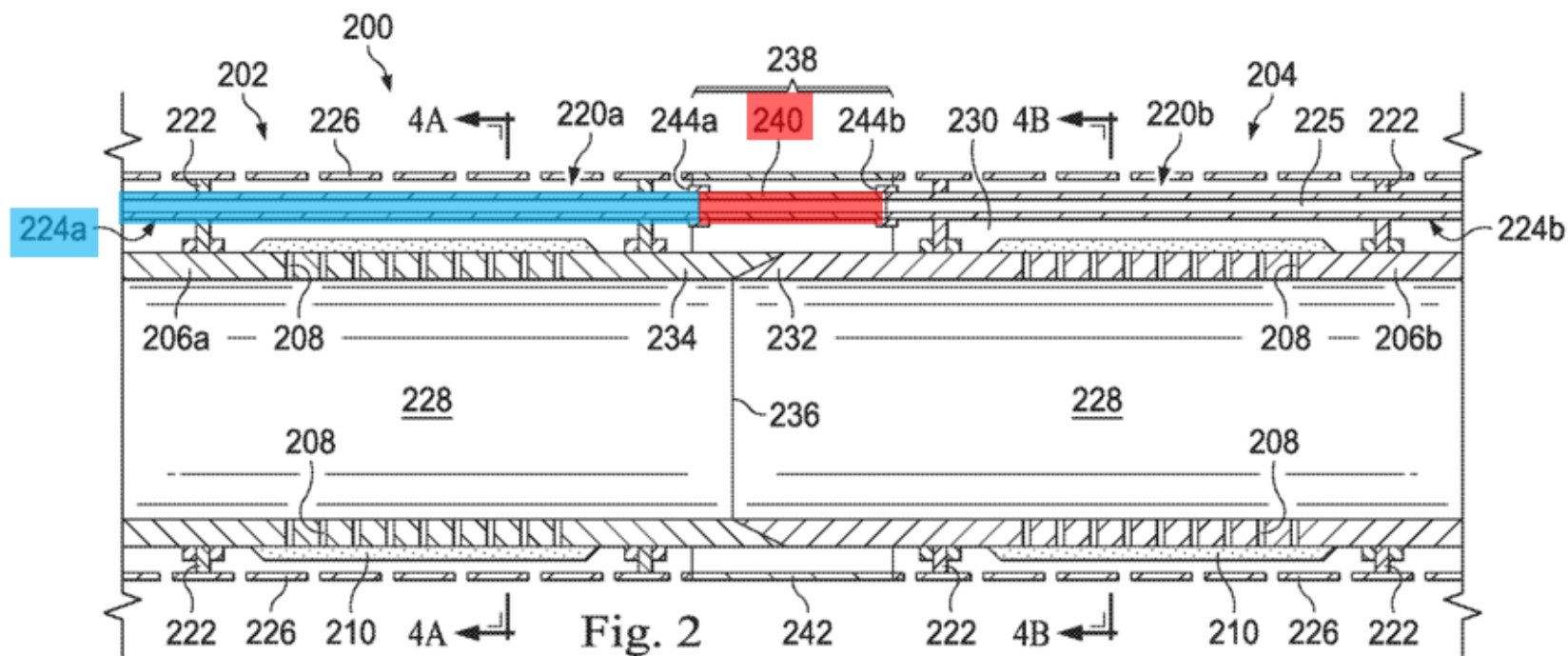
Although shunt tubes 224 in Figure 2 are “in the form of a transport tube or a packing tube,” EX1001, 5:22-26, the Figure 2 embodiment does not contain a junction block, precluding its disclosure of RMTA Claims 27, 33, and 40. *See* EX1001, 5:5-6:33, Fig. 2.

- The '007 Patent makes clear that Figure 2 contains a junction block

Each shunt tube assembly described herein, including shunt tube assemblies 220 of FIG. 2, generally include a transport tube 310 and a packing tube 312 extending from a junction block 314 so as to be in fluid communication with one another.

Claims 27, 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- Figure 2 illustrates fluid flow from the distal end of **packing tube 224a** to a downstream junction block via **jumper tube 240**



- Petitioner's theory that PO's construction is not disclosed by the '007 Patent fails

Claim 27: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- For Claim 27, the Opp. relies on *Yeh's* concentric 6x3 screen upstream of an eccentric 2x2 screen, with a packing tube "interconnected" to a junction block "using a crossover tool"
- Yeh's* crossover tool does not contain a packing tube because wall 1010 shows it is not exposed to the formation

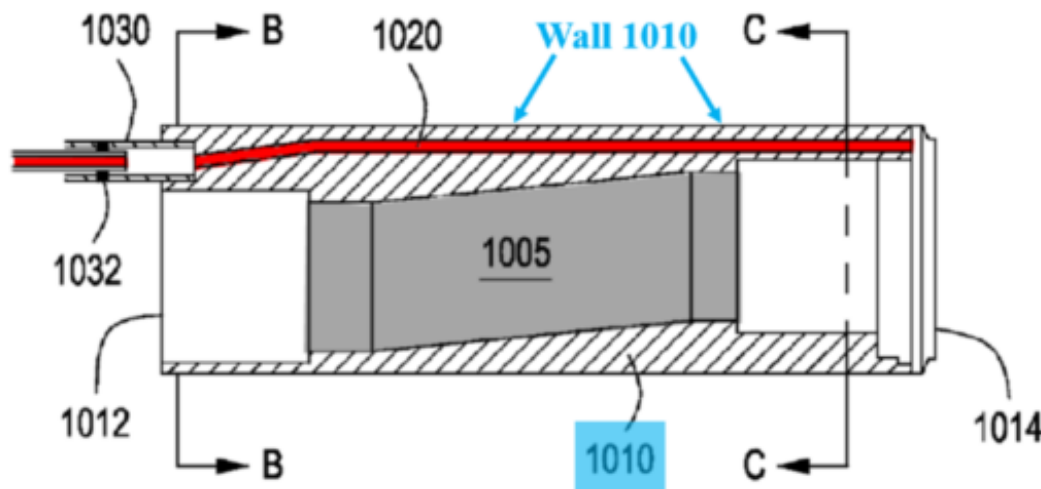


FIG. 10A

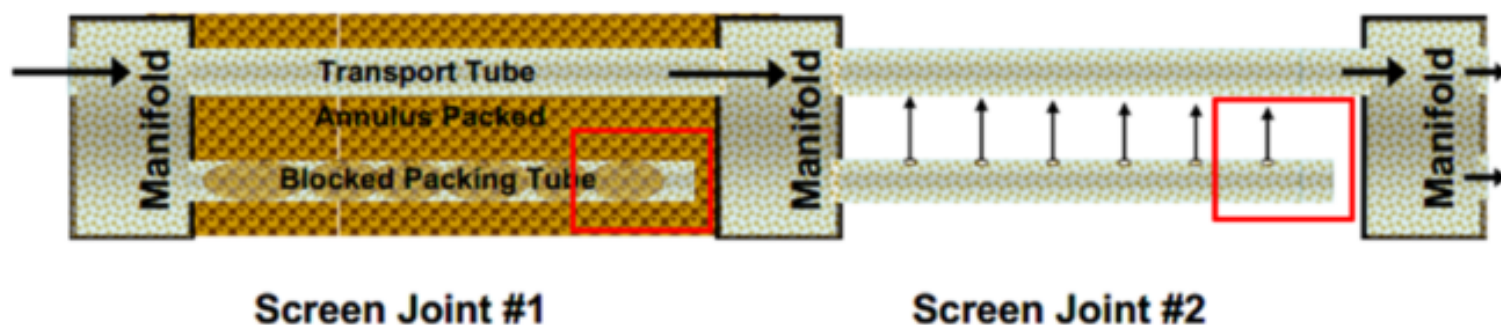
Claim 27: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- Petitioner admitted that the secondary flow path 1020 in *Yeh's* crossover tool **is a transport tube, not a packing tube**, and that it connects to upstream transport tubes, **not upstream packing tubes**

Yeh disclosed that the “concentric wellbore tool [first sand screen assembly] may connect to the second end 1014 of the crossover joint 1000 ... through the use of a *coupling*.” *Id.*, 26:28-32. Thus, the secondary flow path 1020 would fluidly connect the transport tubes of the concentric screen and the manifold of the downstream eccentric screen leading to the packing and transport tubes of the eccentric screen. EX1003 ¶¶339-40; *see* EX1005, 28:66-29:2.

Claim 27: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- *Yeh2* teaches a closed-ended packing tube that **could not be interconnected** to a downstream junction block (manifold)



- Petitioner's expert agrees *Yeh2's* packing tubes are not connected to a downstream junction block

Q. And Figure 13 also shows closed-ended packing tubes that do not connect to the downstream manifold?

A. Yes.

Claims 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- *Bonner* teaches a closed-ended packing tube that **could not be interconnected** to a downstream junction block

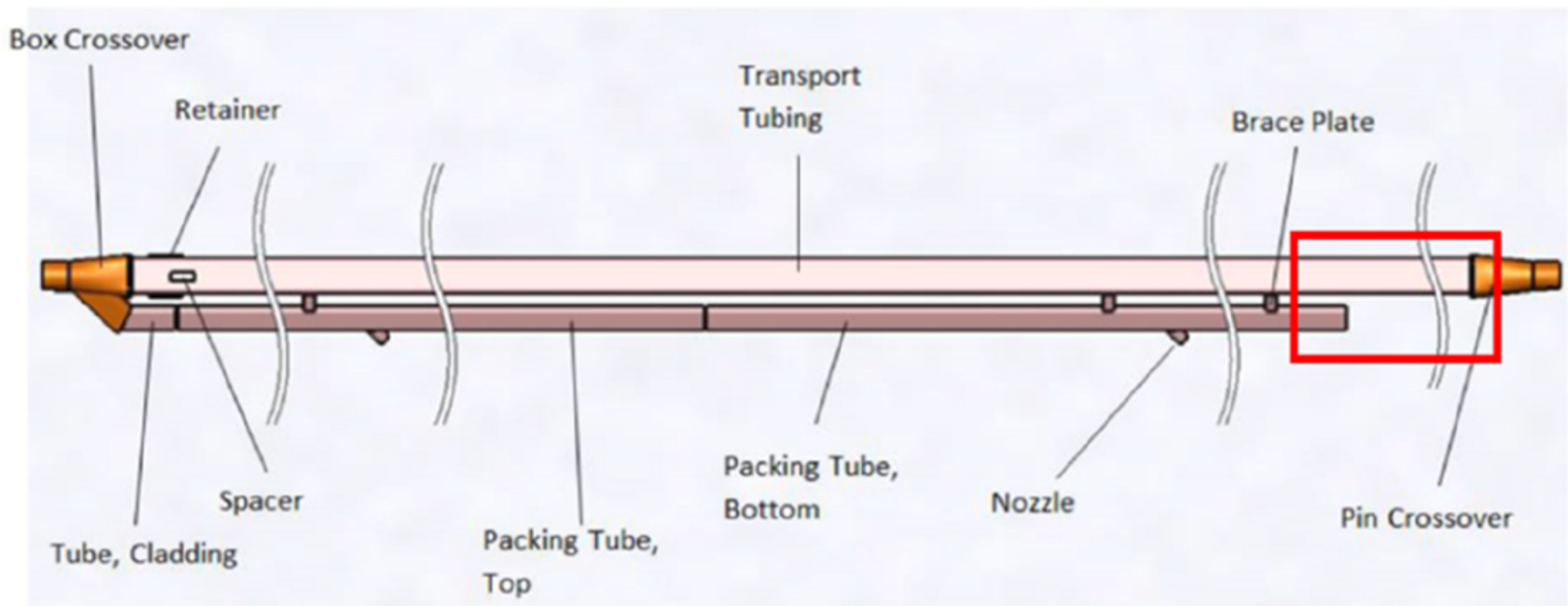


Figure 8—Shunt system tubing weldment with its components

Claims 33, 40: The prior art does not teach an upstream packing tube interconnected to a downstream junction block

- Petitioner's expert agrees *Bonner's* packing tubes are not connected to a downstream junction block

Q. And Figure 8 of Bonner also shows a close-ended packing tube?

A. It doesn't say it, that it's closed.

Q. Okay. The downstream end of the packing tube is not connected to the downstream junction?

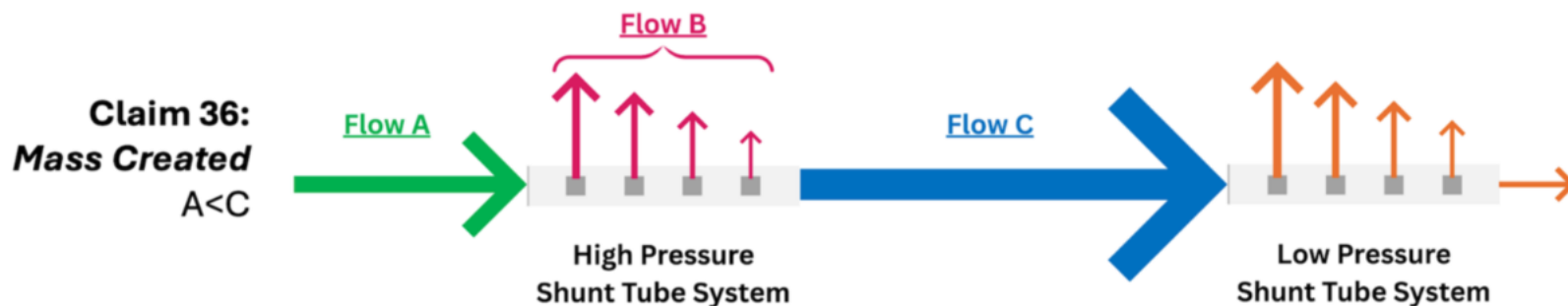
A. No, it is not.

Claim 36 recites a “larger volume of fluid” flow downstream

Limitation	Claim 36
36[a]	The method of claim [[14]]31, wherein the high pressure shunt tube system is disposed to operate at pressures above a select threshold and the low pressure shunt tube system is disposed to operate at pressures of no more than the select threshold;
36[b]	and wherein <i><u>the low pressure shunt tube system is disposed to allow a larger volume of fluid to flow therethrough than the high pressure shunt tube system is disposed to allow to flow therethrough.</u></i>

Claim 36 is possible, and Petitioner's expert admits it is novel

- The Opp. argues Claim 36 is impossible because more fluid cannot flow out of a tube than flowed into the tube

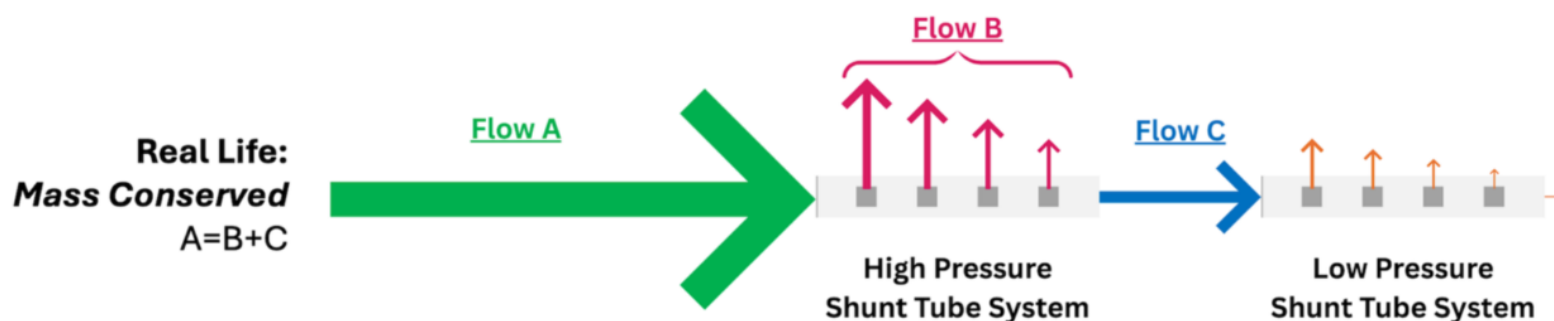


- But the '007 specification describes the claimed "larger volume of fluid" flow as **through the nozzles**, rather than as total flow into each shunt tube system

These drawbacks are addressed by above-described lower production assembly where the shunt tube system flow regime in the second sand screen assembly 204 is selected to allow a larger volume of fluid to flow therethrough than that of the first sand screen assembly 202 by adjusting cross-sectional flow areas, location and number of nozzles.

Claim 36 is possible, and Petitioner's expert admits it is novel

- Petitioner argues Claim 36 refers to Flow C exceeding Flow A, and PO argues the claim refers to Flow C exceeding Flow B



- Presented with two clear, distinct constructions, the Board may choose the narrower construction to preserve validity. *Athletic Alternatives, Inc. v. Prince Mfg., Inc.*, 73 F.3d 1573, 1581 (Fed. Cir. 1996)
- Petitioner claims PO's construction is not "practicable," but does not contradict the specification's clear teaching of "a larger volume of fluid" flow through nozzles of the shunt tube system

Claim 36 is possible, and Petitioner's expert admits it is novel

- Petitioner's expert agrees that the prior art had not achieved greater flow through the downstream nozzles

Q. At the time of the '007 patent, were there shunt tube systems in which flow C would have been larger than flow B?

A. I am not aware of any.

Q. Okay. And you're not aware of any prior art that shows flow C being larger than flow B?

A. I'm not aware even back to the Lloyd Jones initial work. This leakoff phenomenon was known that there would be nozzle leakoff and slurry concentration would increase, and so total flow would decrease.