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Transcript of Michael R. Chambers, Sr.

Date: February 21, 2025

Case: Weatherford U.S., L.P. -v- Halliburton Energy Services, Inc. (PTAB)

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WORLDWIDE COURT REPORTING & LITIGATION TECHNOLOGY

1 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

2
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD

4 WEATHERFORD U.S., L.P.
5 Petitioner

6 Vs.

7 HALLIBURTON ENERGY SERVICES, INC.
8 Patent Owner

9 Case No. IPR2024-00990
10 U.S. Patent 11,333,007

11 -----
12 REMOTE ORAL DEPOSITION OF

13 MICHAEL CHAMBERS, SR.

14 FEBRUARY 21, 2025
15 -----

16
17 ORAL DEPOSITION OF MICHAEL CHAMBERS, SR.,
18 produced as a witness at the instance of the Patent
19 Owner, and duly sworn, was taken in the above-styled and
20 numbered cause on February 21, 2025, from 9:01 a.m. to
21 11:23 a.m., via Zoom Videoconference, before Kim A.
22 McCann, RMR, CRR, CSR in and for the State of Texas,
23 reported by machine shorthand, pursuant to the Federal
24 Rules of Civil Procedure.
25

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1 P R O C E E D I N G S

2 (All exhibits premarked.)

3 MICHAEL CHAMBERS, SR.,

4 Having been first duly sworn, testified as
5 follows:

6 EXAMINATION

7 BY MR. WALTERS:

8 Q. Good morning, Mr. Chambers.

9 A. Good morning.

10 Q. My name is Chad Walters. I'm with
11 Baker Botts and I'll be deposing you this
12 morning.

13 Could you state your full name for
14 the record?

15 A. It is Michael Roy Chambers, Sr.

16 Q. And where are you physically located
17 right now?

18 A. I am in my study at 11328 County Road
19 4102 outside the city limits of Lindale, Texas.

20 Q. And are you by yourself?

21 A. I am. My dog's not happy about it
22 either.

23 Q. Have you been deposed before?

24 A. I have.

25 Q. You understand that you've been sworn

1 to testify truthfully to the best of your
2 ability?

3 A. I do.

4 Q. And is there any reason you cannot
5 testify truthfully today?

6 A. No, there's not.

7 Q. How many times have you been deposed?

8 A. I don't know. Less than probably
9 ten. I was -- you know, I think my CV showed --
10 I don't know, whatever it showed -- but I was --
11 just recently did a deposition in December so I
12 would need to add that to my CV. And then I was
13 also -- I was a witness at trial over in Scotland
14 in November. So I think those things were added
15 since my CV was added in 2024, something like
16 that.

17 Q. Okay. Well, what kind of case was
18 your recent deposition in December?

19 A. It had to do with fracturing.

20 Q. Was it a patent case?

21 A. It is a patent infringement case, I
22 believe. Yes, infringement.

23 Q. District court litigation?

24 A. I believe so.

25 Q. Who were the parties?

1 A. It is ProFrac and Liberty.

2 Q. And who was your client?

3 A. I'm sorry?

4 Q. Who -- who were you doing work for?

5 A. ProFrac. U.S. Wells/ProFrac.

6 Q. And what was the nature of the
7 deposition?

8 A. It was a claim construction,
9 terminology of those words used.

10 Q. Have you been deposed in IPR
11 proceedings before?

12 A. Yes.

13 Q. About how many times?

14 A. Oh, I don't know. I'd need to pull
15 up my CV. Probably like seven, something like
16 that. I remember I did five in one week one
17 time.

18 Q. And were -- were all seven -- or
19 excuse me.

20 In all seven depositions, were you
21 testifying on behalf of the petitioner?

22 A. Yes. Well, of those IPR, yes.

23 Q. Have you ever provided expert
24 testimony in an IPR on behalf of a patent owner?

25 A. ProFrac is the patent owner, you

1 know, for this case, but it's not an IPR.

2 Q. And how many times have you testified
3 at trial?

4 A. Three. Twice in Canada and one in
5 Scotland.

6 Q. Were those patent cases?

7 A. Yes -- well, the Scotland trial was a
8 -- a -- a little bit, you know, it was over
9 royalty rights and that sort of thing that tied
10 to a patent, but it wasn't directly, like, patent
11 infringement.

12 Q. Were the Canadian cases related to
13 Canadian -- infringement of Canadian patents?

14 A. Yes.

15 Q. You've never testified at trial in
16 the U.S.?

17 A. I have not.

18 Q. And -- and not at the ITC either?

19 A. No.

20 Q. What did you do to prepare for
21 today's deposition?

22 A. I went through my report and the -- I
23 looked at a lot of the supporting documents for
24 that report.

25 Q. And by report you're referring to

1 your declaration?

2 A. Yes.

3 Q. Did you meet with anyone to prepare
4 for today's deposition?

5 A. I -- I met with my attorneys.

6 Q. And who did you meet with?

7 A. I met with Doug Wilson and
8 Monica Arnold. And also I believe on some of the
9 calls was our Weatherford representative,
10 James Kurka.

11 Q. How many meetings did you have with
12 them?

13 A. Two. Well, we had an initial "you
14 need to look at this kind of thing" meeting and
15 then two -- two primary meetings to go through
16 the documents.

17 Q. And when were those meetings?

18 A. Wednesday and Thursday.

19 Q. And how long did those meetings last?

20 A. My first one was like four or five
21 hours, and then the second one, three or four
22 hours, something like that.

23 Q. Did you review documents in those
24 meetings?

25 A. Yes.

1 Q. What documents did you review?

2 A. Just the ones that we have here, the
3 -- you know, my declaration and the supporting
4 documents that I list in the declaration.

5 Q. So you're referring to documents that
6 are in the record of the IPR?

7 A. Yes.

8 Q. Did you review any other documents
9 that are not in the record of the IPR?

10 A. No. Don't believe so.

11 Q. I'd like to discuss your background.

12 Based on your CV, it looked like you
13 received your bachelor's degree in petroleum
14 engineering in 1979.

15 A. I did.

16 Q. And your first employment after
17 receiving your degree was at Mobil as an
18 operation's engineer?

19 A. My very first assignment, yes, was as
20 an operations engineer in Hobbs, New Mexico.

21 Q. Okay. And you were with Mobil for
22 roughly 20 years?

23 A. Yes.

24 Q. And after Mobil you worked at
25 Union Pacific around 2000?

1 A. I did for a very short time and then
2 they got purchased by Anadarko, and so that
3 transitioned into Anadarko. So I worked for
4 UPR/Anadarko, you know, during that period.

5 Q. What did you do for Union Pacific and
6 -- and Anadarko?

7 A. I initially went over to
8 Union Pacific as an operations engineer, and then
9 with Anadarko I was a producing manager for them
10 at one point over the Rockies operations,
11 East Texas operation, Central Texas, West Texas,
12 various operations.

13 Q. And what kind of work did you do in
14 that role at Anadarko?

15 A. Well, I was in charge in -- with
16 everything from the producing people to the
17 completions workovers, completions engineers,
18 anybody associated with it. I didn't have
19 drilling in that assignment, but basically
20 everything other than drilling and reservoir.

21 Q. And in 2007 you joined
22 EXCO Resources?

23 A. Yes. The -- at that time the chief
24 operating officer and I had both worked at Mobil
25 together. In fact, we started about the same day

1 at Mobil, and he acquired a property from
2 Anadarko, their Vernon field in East Texas in --
3 or Louisiana and I went with it.

4 Q. And what kind of work did you do at
5 EXCO Resources?

6 A. At EXCO I was in charge of all
7 operations from drilling, completions, reservoir,
8 everything except land, legal, and accounting
9 basically. Safety, I didn't have safety. But I
10 took that and up to operating in the Haynesville
11 where we had 25 rigs running at one time and
12 spending over \$2 billion a year in completion
13 operations and drilling, as well as at one point
14 I had the Marcellus area and also the Eagle Ford
15 area. So I had all the operations for -- for
16 EXCO.

17 Q. And did you leave EXCO around 2015?

18 A. I did.

19 Q. And since 2015 you've been an expert
20 consultant?

21 A. I've been doing that and then I also
22 have a geothermal startup company that I'm
23 president of.

24 Q. When did that company start?

25 A. About two and a half years ago.

1 Q. Is it fair to say you stopped
2 managing drilling operations around 2015?

3 A. Well, right now I have a drilling
4 engineer and he's doing cost estimates. So no,
5 I'm still drilling completions today.

6 Q. So -- and that's with your startup --
7 your geothermal startup?

8 A. Yes.

9 Q. And so your geothermal startup began
10 around 2022?

11 A. I believe so. I think it's
12 September-ish or something of that.

13 Q. So between 2015 and 2022, you were
14 not managing drilling operations; correct?

15 A. Not day to day, no.

16 Q. At all?

17 A. Well, we're -- I did -- I wouldn't
18 say managing -- up in the -- the northeast, you
19 know, I did a project for about a year. We were
20 looking at drilling some Utica shale in various
21 wells and things up there. But no, I wasn't
22 actively involved.

23 Q. You were not actively involved?

24 A. I was involved in it, but we didn't
25 have any drilling operations going on at that

1 time. But we were doing drilling cost estimates
2 and that sort of thing.

3 Q. Okay. You're familiar with gravel
4 packing?

5 A. I am.

6 Q. In what capacity are you familiar
7 with gravel packing?

8 A. Well, I have a paper on it. Probably
9 my biggest capacity was the completions in
10 Equatorial Guinea in the late '90s. We had
11 vertical wells and horizontal wells over there,
12 and it was the completions over there, I was in
13 charge of the completions.

14 I wrote a paper about it -- one about
15 wells we drilled over there. And I think Larry
16 Myers and Elias, they wrote another paper about
17 horizontal gravel packs over there a year or two
18 before my paper.

19 Q. Do you have experience with gravel
20 parking since the late 1990s?

21 A. No. No, the -- I've been more
22 fracturing.

23 Q. I'd like to turn to your declaration.
24 And as I understand, Mr. Chambers, you have
25 access to your declaration and the other exhibits

1 in the IPR; is that right?

2 A. Yes, I do. There -- is there a point
3 here, there are a few typos and things I wanted
4 to clarify on my declaration.

5 Q. Okay.

6 A. Could I go through those?

7 Q. That's fine with me.

8 A. Okay. The first one, if we go to
9 paragraph 124 on page 63, which is PDF, I
10 believe, 75 -- 64, page 64.

11 Q. Okay.

12 A. Okay. First, is the -- I hand drew
13 this or computer drew this graph that you see
14 there where it says at Figure 15 from data I took
15 from the IPTC 12549. And when I did it, you
16 know, my intent was to show that it wouldn't be
17 just a straight-lined relationship, that there
18 would -- you know, obviously you need -- when you
19 do these kind of operations, there's some bottles
20 and dip.

21 And so when I drew that -- those
22 pretty heavy dips in there, those sort of things
23 may or may not exist, you know, but my intent was
24 just to show that the trend from the heel to the
25 toe that's gravel slurry concentration increased

1 as it did in Yeh's graph.

2 I just wanted to clarify and show
3 that it could not -- you know, wouldn't
4 necessarily have those huge of pressure dips.
5 That's my only comment about that one.

6 And then turning to kind of a similar
7 sort of thing, if you'd turn to paragraph 140 --
8 let's see, let's turn here -- is on page 72, PDF
9 83. Same sort of thing, as you get down towards
10 the toe, it may not be that flat of relationship,
11 but I was just trying to show definitely that the
12 pressure as you go from the heel to the toe
13 decreases with time and probably have some
14 bottles and that sort of thing in it.

15 Okay. And then turning to
16 paragraph 288 -- let me get to it -- on page 153,
17 PDF 164, I want to note that -- let's see -- as
18 you get that -- I'm discussing in this paragraph
19 fluid flow, you know, through the primary and the
20 secondary tubes, and I just wanted to make it
21 clearer that when you do a gravel pack operations
22 like this, that there is two flows.

23 You know, there is flow down the
24 shunt tube, there's actually flow down the
25 annulus, and then there is return flow that's

1 coming back through the -- through the pipe
2 through the flow area 1005 there. So I just
3 wanted to make it clearer that there's flow going
4 in both directions here.

5 You know, that I think when you read
6 through the primary and secondary flow paths that
7 people think maybe the direction is all one
8 direction, but it's actually -- you know, there's
9 more of a circulation operation going on. I want
10 it made sure that that was clear to people when
11 they looked at that.

12 The next thing is on paragraph 319, a
13 typo over here. You can see there in the first
14 sentence where it says: For example, at
15 4,000 psi differential pressure in a 6-foot
16 distance from the manifold to the first nozzle,
17 the leak operate would be 0.3 barrels per minute.

18 Well, that is a typo. It should be
19 0.03 barrels per minute as it is down lower. If
20 you -- and the reason is if you look up at the
21 graph -- if think we're looking at the graph up
22 here at -- on page 172 where it talks about the
23 leak operate, you can see that it goes from 0 to
24 0.04. Well, obviously it is at the 0.03 point
25 that we're making the -- the note, not at 0.3.

1 So that's why that was a typo in that.

2 And then in paragraph 388 down toward
3 -- let's see -- where it starts the -- let's see
4 -- According to Yeh -- let me find that in
5 here -- on page 208, the second sentence:
6 "According to Figure 15," where it starts --
7 let's see -- according to -- let's see. Yeah,
8 according -- the pressure about 3 feet from the
9 -- it would -- should be "or 3,000 feet" -- let's
10 see -- horizontal feet -- "from the toe" -- I
11 think that instead of "toe" it should say "heel"
12 there. That's the only change. So that's the
13 changes I would like to make.

14 Q. So just to clarify, you're looking at
15 the first -- the second full sentence that's on
16 page 208?

17 A. Where -- no, let's see. Let me look
18 here. "A POSITA would have" -- let's see.

19 Q. The sentence that starts "According
20 to Figure 15"?

21 A. Oh, okay. Yeah. No, it's the -- the
22 last sentence here where it says, "3,000 feet
23 from the toe and the" -- it should be "from the
24 heel and the toe."

25 Q. Oh, the very last sentence of the

1 paragraph?

2 A. Yes.

3 Q. And you're saying it should be --

4 A. "Heel."

5 Q. -- "anywhere between 3,000 feet from
6 the heel and the toe"?

7 A. And the -- I think it's heel -- both
8 of those are heel because we're -- it should be
9 "heel" rather than "toe" because that, again, is
10 looking at a graph. When you look at the graph,
11 you measure from the -- the heel side, not the
12 toe side.

13 Q. So could you read the sentence in its
14 entirety and just let me know what it -- how it
15 should read.

16 A. I believe -- I'd have to go look at
17 the graph again, but "A POSITA would have
18 understood that Yeh's rec- -- anywhere between
19 3,000 feet from the heel and the" -- let's see --
20 oh, from the -- probably just "from the heel"
21 period. I think that sentence is confusing.

22 Q. Okay. Any other changes you'd like
23 to make?

24 A. No.

25 Q. And so as -- as I understand, you

1 have access to your declaration and the other
2 exhibits from the IPR?

3 A. Yes.

4 Q. You're looking at electronic
5 versions?

6 A. Yes.

7 Q. And those versions are clean, they
8 don't have any notes?

9 A. They do now from just the change I
10 made, but no.

11 Q. Other than the -- other than notes
12 directing you to the changes that you're making,
13 there's no other notes on the documents that
14 you're -- you're reviewing today?

15 A. No, they're clean.

16 Q. Okay. I'd like to stay with your
17 declaration, Exhibit 1003, and look at
18 paragraph 133, which is on page 68.

19 A. Okay. I'm there.

20 Q. And -- and I'm really more focused on
21 just generally this section that says,
22 "Section 5, Transition from Eccentric to
23 Concentric Designs."

24 A. Okay.

25 Q. Why did the industry transition to

1 concentric designs?

2 A. There's -- there's certain benefits
3 with concentric over eccentric. One is that you
4 can protect the two and so -- and potentially,
5 you know, with the eccentric design, a lot of
6 people were putting an outer shroud on the
7 outside of the pipe. So by putting a -- by going
8 of concentric and putting the tubes on the inside
9 of the screen, potentially you could get rid of
10 that outer shroud.

11 The other from a reservoir
12 standpoint, your -- when you put them on the
13 inside, the screen gets bigger, and so you have
14 more area open to flow from the reservoir. So
15 you also have less area to gravel pack, so it
16 potentially could use less gravel that --
17 however, the cost is going to go up to do that.
18 But there -- there's several mech- -- or
19 reservoir reasons as well as mechanical running
20 the screen reasons that you'd want to do that.

21 Q. And in paragraph 134 it's
22 describing the '476 patent, and it states that
23 "The concept of concentric transport and packing
24 tubes was presented to showcase the round
25 transport in packing tubes for withstanding

1 higher pressures associated with greater depth
2 wells."

3 Do you see that?

4 A. Yes.

5 Q. Is -- is to be able to withstand
6 higher pressures another reason for transitioning
7 to concentric screens?

8 A. It -- it wouldn't be limited. You
9 could go higher pressure with eccentric screens
10 or concentric screens.

11 Q. I'd like to turn to paragraph 286 of
12 your declaration.

13 A. Do you have a PDF page? That will
14 make it easier for me to --

15 Q. Page 152.

16 A. What paragraph did you say you
17 wanted?

18 Q. 286.

19 A. 286. Okay. It's on PDF 163. Okay.

20 Q. When I'm looking -- when I call it a
21 page number, I'm -- I'm referring to the exhibit
22 page --

23 A. Yeah.

24 Q. -- that's actually on the document.

25 A. Yeah, it -- you've got to add like 10

1 to it to get the PDF right. Okay.

2 Q. So the -- this paragraph addresses
3 limitation 1d, which requires first and second
4 sand screen assemblies.

5 Do you see that?

6 A. Yes. Let me -- I want to read it
7 again.

8 (Witness reviewing document.)

9 A. Okay.

10 Q. The first sand screen assembly in
11 this limitation is upstream and the second is
12 downstream; is that fair?

13 A. Yes.

14 Q. And it's your opinion that Yeh
15 discloses this limitation by describing a
16 concentric screen upstream and eccentric screen
17 downstream?

18 A. I believe Yeh described it when he
19 was discussing about a concentric screen and a
20 crossover tool to an eccentric screen, and I
21 believe at that time Leh -- Yeh had noted that
22 the eccentric screen was a lower pressure screen
23 that was available on the market at that time.
24 Yes.

25 Q. I'd like to turn to the Yeh

1 reference, which is Exhibit 1005.

2 A. Okay. I have it.

3 Q. And specifically at column 30,
4 line 15.

5 A. Okay. I see it here.

6 Q. And -- and if you could go ahead and
7 just read -- review lines 15 to 20.

8 A. 15 through 20.

9 (Witness reviewing document.)

10 A. Okay. I've read it.

11 Q. Here Yeh is teaching that concentric
12 screens may be beneficial for gravel packing long
13 intervals.

14 A. I believe Yeh is teaching that the
15 design he has come up with for concentric
16 screens, which is a higher-pressure screen, is --
17 is good for completing longer intervals, yes.

18 Q. And Yeh also explains that eccentric
19 screens are limited to 3,000 feet?

20 A. I believe at that time of his
21 writing -- when he wrote this at this time, that
22 most of the commercially available screens were
23 on the market at that time were limited to about
24 3,000 feet. I believe Hecker and others SPE
25 papers right about that same time were noting

1 that -- that at the time of this patent when it
2 was issued, that that was what was available was
3 eccentric screens of about 3,000 psi operating
4 working pressure for 3,000 feet long.

5 Q. I'd like to turn to column 28 of Yeh
6 and the paragraph from lines 10 to 24.

7 A. Okay. I'd like to read it.

8 Q. Sure. Go ahead.

9 (Witness reviewing document.)

10 A. Okay. I've read it.

11 Q. In this paragraph Yeh is discussing
12 the crossover joint located between screens; is
13 that fair?

14 A. Yes.

15 Q. Okay. I'd like to go back to your
16 declaration at paragraph 291, and the document
17 page is 155.

18 A. Okay.

19 Q. And this paragraph is addressing
20 claim limitation 1(e).

21 Do you see that?

22 A. Yes.

23 Q. And this limitation refers back to
24 the first and second sand screen assemblies
25 presented earlier in the claim?

1 A. Yes.

2 Q. And -- and so for this limitation
3 1(e), it's your opinion that Yeh's concentric
4 screen is the first screen?

5 A. Yes.

6 Q. And that's in the higher-pressure
7 heel side?

8 A. That's correct.

9 Q. And Yeh is teaching to use the
10 concentric screen on the heel side because the
11 concentric screen is rated to a higher pressure?

12 A. Yeh is teaching that his concentric
13 screen that he designed is rated to a higher
14 pressure, yes.

15 Q. And that's why Yeh is teaching to use
16 that screen on the heel side?

17 A. Yes. Hey -- Yeh is saying that he --
18 the design that he has come up here for his
19 concentric screen is a higher-pressure rated
20 screen and therefore it should be used on the
21 heel side.

22 Q. And Yeh's downstream eccentric screen
23 is the second screen in your analysis of
24 limitation 1(e)?

25 A. Yes, I believe that is what Yeh is

1 talking about.

2 Q. Okay. I'd like to turn to the Yeh 2
3 reference, which is Exhibit 1006.

4 A. Okay. Let me pull it up. Okay. I
5 have it.

6 Q. What does the Yeh 2 reference relate
7 to?

8 A. What does -- can you ask the question
9 again? What --

10 Q. Sure. What is the Yeh 2 reference
11 directed towards?

12 A. He is talking about how he has
13 extended the length of gravel packing at what --
14 or over what had been conventionally being done
15 at that time.

16 Q. Okay. Can you turn to page 3 of that
17 reference.

18 A. Okay.

19 Q. In the very last paragraph of that
20 page, and that's in the section for "Gravel
21 Packing in Extreme Lengths (5,000 feet or
22 longer)," in the third line, the reference states
23 that higher working pressures are demanded at --
24 at extreme lengths.

25 Do you see that?

1 A. Yes.

2 Q. Does that mean that a shunt tube
3 system must be rated to operate at higher
4 pressure at longer lengths such as greater than
5 5,000 feet?

6 A. I believe what Yeh is teaching here
7 is that when you look for the pressure rating, it
8 is the pressure rating of this system that is at
9 the heel. So if you're 5,000-foot, that would be
10 longer than a 3,000-foot gravel pack, so the
11 system at the heel of the well would have to be
12 at a higher pressure than for a 5,000-foot -- you
13 would need a higher pressure system for a
14 5,000-foot-long gravel pack than you would for a
15 3,000-foot. But that is the pressure of the
16 system near the heel.

17 Q. You're referring to the rated
18 pressure of the shunt tube system?

19 A. Or the working pressure of the shunt
20 tube system at the heel, yes.

21 Q. Why are you looking at the -- well,
22 strike that.

23 Why are you concerned about the
24 pressure of the system at the heel?

25 A. Well, Yeh it showed -- and I don't

1 know if he shows it on this figure -- but that
2 the pressure -- the working pressure of the
3 sunt -- shunt system is highest at the heel and
4 decreases as you go through the length of the
5 system to where down at the -- at the toe of the
6 well, you're basically at whatever the
7 circulating pressure would be at the system --
8 the pressure that the system sees due to friction
9 along that system.

10 So if you're designing a system for
11 5,000 feet, you would need a system that, you
12 know, has a pressure rating for 5,000 feet. If
13 you're at the heel but it is only for that
14 section at the heel. Obviously Yeh teaches that
15 the pressure declines over the length of the
16 whole assembly so that at other places along the
17 assembly you would not need pressure ratings that
18 high. Only at the heel.

19 Q. Okay. Can you turn to page 5 of
20 Yeh 2.

21 A. Okay. I'm there.

22 Q. So I'm looking it up since it's at
23 the end of the third paragraph on the page -- or
24 the second full paragraph on the page. The
25 paragraph starts "The leakoff effect."

1 A. Okay. All right. Let -- can I read
2 it? I'd like to read it.

3 Q. Sure. And I'm focused on the last
4 two sentences of that paragraph in particular.

5 A. Okay.

6 (Witness reviewing document.)

7 A. Okay. I read the paragraph.

8 Q. The -- this -- the last two sentences
9 state, "Transporting 5 bpm slurry at the heel
10 through the shunt tubes to the toe void requires
11 5,300 psi. Burst strength of shunt tubes must
12 therefore be capable of accommodating this high
13 hydraulic pressure."

14 Do you see that?

15 A. Yes.

16 Q. What does "bpm" stand for?

17 A. Barrels per minute.

18 Q. Okay. The -- the phrase "the burst
19 strength of shunt tubes must be capable of
20 accommodating this high hydraulic pressure," that
21 high pressure is at the heel; is that fair?

22 A. Yes.

23 Q. I'd like to turn to page 6.

24 A. Yes. In Yeh 2?

25 Q. In Yeh 2, yes. And in the

1 "Conclusions" section in the second bullet, it
2 refers to "an improved multiple-shunt manifold
3 design that unlocks the limits in gravel packing
4 extreme lengths of 5,000 feet and beyond."

5 Do you see that?

6 A. Yes.

7 Q. And I'm sorry for jumping around, but
8 going back to page 5, previous page, there's a
9 sentence -- or excuse me -- a paragraph that
10 starts with "The multiple-shunt manifold system."

11 A. Is that the one that says the
12 multiple-shunt manifold system in Figures 9
13 through 15?

14 Q. Yes.

15 A. Yes.

16 Q. And -- and -- and as you note, it's
17 referring to Figures 9 to 15 to illustrate
18 characteristics of that improved multiple-shunt
19 manifold system that's described in that
20 conclusion bullet.

21 A. Yes.

22 Q. So I'd like to look at Figure 10,
23 which is on page 10.

24 A. Okay.

25 Q. And that figure shows a cross-section

1 of the multiple -- multiple-shunt manifold
2 system; right?

3 A. Yes.

4 Q. And that's a concentric screen?

5 A. I believe so.

6 Q. So is it fair to say that Yeh 2's
7 improvement that extends gravel packing intervals
8 is an improvement of concentric screens?

9 A. I don't think Yeh's system as listed
10 -- limited to concentric or eccentric screens.

11 Q. Does Yeh describe eccentric screens
12 at all?

13 A. He lists them there in the paragraph
14 we just talked about, that he recognizes those
15 screens as being what was commercially available
16 at that time on the market.

17 Q. Which paragraph was that?

18 A. The ones you referred to earlier in
19 his patent.

20 Q. Not in this doc -- not in this
21 document Yeh -- strike that.

22 Yeh does not reference eccentric
23 screens in the Yeh 2 document; correct?

24 A. I would have to search. I don't -- I
25 don't -- I'd have to review the document to see

1 if it -- I haven't looked for that particular
2 thing in the document.

3 Q. Are you aware of any place in Yeh 2
4 where Yeh references eccentric screens?

5 A. I think -- well, Yeh is referring to
6 -- I mean, his whole paper is about 5,000 versus
7 3,000-foot, and the 3,000-foot system on the time
8 was eccentric screens. So I would say yes, he
9 does mention it.

10 Q. And -- and those eccentric screens
11 were limited to 3,000 psi?

12 A. I think what was a commercially
13 available at that time on the market was that,
14 yes.

15 Q. I'd like to look at Figure 15 of
16 Yeh 2.

17 A. Okay.

18 Q. In this figure Yeh 2 plots the
19 pressure profile in its concentric tubes as a
20 function of gravel pack length?

21 A. Yes.

22 Q. The max pressure is about 5,000 psi?

23 A. Well, in -- it's about 5,300. I
24 think you're looking at the -- the blue curve and
25 he also lists in there it's about 5,300. So

1 that's about where the -- the blue curve
2 terminates.

3 Q. Okay. And the length is about
4 5,000 feet?

5 A. Yes.

6 Q. And that's a pressure drop of roughly
7 1 psi per foot?

8 A. Yes.

9 Q. Is that a fair rule of thumb,
10 pressure drop of 1 psi per foot?

11 A. I think it is because some of the
12 other authors have written at that time that the
13 3,000-foot systems were about 3,000 -- 3,000-foot
14 systems were about 3,000 psi. I think Hecker and
15 some of the others had written at that time that
16 the conventional -- what was conventionally
17 available was about that. So it seems to be a
18 good rule of thumb.

19 Q. I'm focusing on the Yeh 2 reference.

20 A. Okay.

21 Q. Does the Yeh 2 ever discuss modifying
22 wall thickness of shunt tubes?

23 A. Does Yeh 2 -- Yeh 2 describes how to
24 build a system for higher pressure that was --
25 that would require higher-pressure tubes, and one

1 of the ways you get there is wall thickness. So
2 maybe yes indirectly, yes.

3 Q. Does Yeh 2 ever directly discuss
4 modifying wall thickness of shunt tubes?

5 A. I don't think that was the focus of
6 Yeh's design, although he shows the design where
7 he had designed tubes that are rated to 5,000
8 psi, and the way you get to 5,000 psi is size,
9 metallurgy, and wall thickness. I believe a
10 POSITA would know that.

11 Q. Can you look at Figure 9 of Yeh 2.

12 A. Okay.

13 Q. And this Figure 9 also illustrates
14 aspects of Yeh 2's multiple-shunt manifold
15 system.

16 Do you see that?

17 A. Yes.

18 Q. And the outer diameter of these shunt
19 tubes is constant as the shunt tubes move down
20 the well bore; is that fair?

21 MR. WILSON: Objection. Form.

22 A. I -- I don't know their constant.
23 This is a cartoon. I don't know that.

24 Q. Does Yeh 2 in Figure 9 illustrate any
25 change in outside diameter of the shunt tubes as

1 the shunt tubes move down the wellbore?

2 MR. WILSON: Objection. Form.

3 A. Here again, it's a cartoon so I
4 haven't scaled it. I don't see any dramatic
5 change, but there could be.

6 Q. In Figure 10 the cross-section of
7 multiple-shunt manifold system, Yeh 2 is -- this
8 figure illustrates a -- a wire wrap.

9 Do you see that?

10 A. Yes.

11 Q. Do the shunt tubes provide structural
12 support for that wire wrap at the outside
13 diameter?

14 A. They are providing some, but you can
15 also see all the rib pieces that are also. So
16 they would be -- I mean, they may or may not be
17 touching, you know. I mean, looking at this
18 picture, they kind of barely touch. But I would
19 think indirectly they may provide a little bit of
20 structural support.

21 Q. I mean, it's common for shunt tubes
22 to be designed to support the structure to resist
23 the collapse of the screen; is that right?

24 A. I think I show in my -- in my paper
25 another option -- another -- where another author

1 had done that same thing for a concentric string
2 like this, but in eccentric string, I don't think
3 they would provide support.

4 Q. Okay. I'd like to stay with Yeh 2
5 and look at Figure 9 again. This is -- is it
6 fair to say that this is the system Yeh 2
7 recommends for packing extreme lengths?

8 A. I think he is trying to -- in this
9 figure that he is trying to explain the -- the --
10 you know, his -- a lot of his paper talks about
11 the pressure drop in this sort of system, and
12 he's trying to help visualize how that works and
13 why there is a pressure drop and why you have
14 less pressure available down -- you know, in one
15 set of tubes versus another set of tubes.

16 I think his Figure 15 does that
17 extremely well, and I think this is a cartoon
18 trying to explain that same concept.

19 Q. The gravel flow here is from left to
20 right?

21 A. Yes, you can see the arrows going
22 from left to right.

23 Q. And the upstream is on the left and
24 the downstream would be on the right?

25 A. Yes.

1 Q. The packing tubes in this system have
2 closed ends; is that fair?

3 A. I don't know that. Yeh talks about
4 it, you know, and other authors have talked about
5 it. I think in most of Yeh's stuff is probably
6 closed, but it doesn't have to be.

7 Q. Yeh 2 does not illustrate here that
8 the packing tubes connect to the manifold at the
9 downstream end of the tubes; correct?

10 A. That's correct.

11 Q. Can you turn to page 4.

12 A. Of Yeh 2?

13 Q. Yeh 2, yes.

14 A. Okay.

15 Q. So I'm going to try to target a
16 sentence in the middle of the paragraph. The --
17 the section starts "Multiple-Shunt Manifold
18 System for Extreme Length."

19 Do you see that?

20 And the first paragraph says, "To
21 extend Alternate Path technology."

22 Do you see that?

23 A. I see that, "To extend Alternate
24 Path."

25 Q. Yeah. So this section's talking

1 about Yeh 2's improved multiple-shunt manifold
2 system; correct?

3 A. It's entitled "Multiple-Shunt," yes.

4 Q. The -- in that paragraph, the third
5 sentence from the end states, "The packing tubes
6 are closed-ended and are not connected to the
7 next manifold."

8 Do you see that?

9 A. Yes.

10 Q. And that's the same concept that's
11 illustrated in Yeh 2's Figure 9 -- correct? --
12 that we just discussed?

13 A. This paragraph that's talking about
14 Figure 9, yes. Okay.

15 Q. Okay. I'd like to look at Figure 7
16 of Yeh 2.

17 A. Okay.

18 Q. And this figure compares open-ended
19 and closed-ended packing tubes.

20 Do you see that?

21 A. Case A and B appear to be open-ended
22 and Case C is a closed-ended, yes.

23 Q. Is -- is Yeh 2 suggesting that Case C
24 is preferable to Cases A and B because Case C is
25 closed-ended?

1 A. Well, I don't know that -- you know,
2 Case A is 80-foot interval and Case B and C are
3 both 40-foot intervals. So I believe Yeh what he
4 is showing in Case C is that if it is
5 closed-ended -- because you're really comparing
6 Case B and C -- that assuming the rate is
7 constant, all these other things are constant,
8 that it would appear that you would have more
9 pressure in Case C being closed-ended.

10 Q. And -- and Case C would also provide
11 more uniform packing?

12 A. What do you mean by "uniform"?

13 Q. Let's go back to page 4.

14 A. Okay.

15 Q. So in the second paragraph that
16 starts with "Case A" --

17 Do you see that paragraph?

18 A. Yes.

19 Q. -- the very last sentence of that
20 paragraph states, "The characteristics of Case C
21 promotes uniform shunt packing across the 40-foot
22 interval."

23 Do you see that?

24 A. Okay.

25 Q. So that's what I'm referring to by

1 uniform packing.

2 A. Okay. That may be -- you know, the
3 -- in -- I think it would present the opportunity
4 for more uniform pressure. You know, shunt tube
5 packing is all designed around filling a void, so
6 even though we look at a cartoon like that where
7 we have each one taking fluid in equal
8 distribution and all that sort of thing, I think
9 a POSITA would understand that maybe over the
10 whole 40-foot interval there is only 5 feet that
11 needs packing.

12 So it -- you may only have -- in true
13 of fact only one orifice operating, you know. So
14 -- but he also shows that the pressure dropped,
15 so they're not all the -- the same. It is more
16 uniform but they are not -- here again, they
17 aren't at all the same pressure.

18 Q. And do you feel that Yeh 2 is
19 describing the more uniform packing as more
20 desirable or preferable?

21 A. I don't know if -- if that is the
22 driver here because, here again, the whole driver
23 is to fill voids, and so is to build a system
24 that has sufficient pressure that if you had to
25 pack the whole 40-foot, it would be able to do

1 that. If you only had to pack 5-foot, it could
2 do that, so I don't know that that's the total
3 focus.

4 Q. Okay. So if I read this whole
5 sentence, it says, "The characteristics of Case C
6 promotes uniform shunt packing across the 40-foot
7 interval, minimizing the amount of slurry passing
8 by any packed porthole, and avoiding the
9 potential plugging mechanism described in
10 Figure 4b."

11 Do you see that?

12 A. Yes.

13 Q. So -- so Yeh 2 also describes that
14 the closed-ended Case C also avoids potential
15 plugging; correct?

16 A. Yes.

17 Q. And the last -- I'd like to look at
18 the very last paragraph of that page that starts
19 with "Recall."

20 A. Okay.

21 Q. And that sentence -- the first
22 sentence of that paragraph states, "Recall from
23 Figures 7 and 8 that the closed-ended packing
24 tubes produce a rather even flow from the
25 portholes."

1 Is it fair to say Yeh 2 is describing
2 that rather even flow as desirable?

3 A. I -- I think he's explaining that
4 that would be available, you know, to do that.
5 But I think that the same sort of thing would
6 happen if -- if it's open-ended and the bottom of
7 the system doesn't take any fluid, then it would
8 act the same and pretty much act like it was a
9 closed system, you know, so...

10 Q. Okay.

11 MR. WALTERS: We've been going a
12 little more than an hour. Is it a good time to
13 take a break?

14 THE WITNESS: Sure.

15 MR. WALTERS: And if you ever -- you
16 ever need to take a break before I prompt one,
17 feel free to suggest that.

18 THE WITNESS: Okay.

19 MR. WALTERS: And -- And I know
20 you've been deposed in IPRs before, but do you
21 understand the rules in IPR procedures that
22 you're not to discuss the substance of your
23 testimony with your counsel between breaks?

24 THE WITNESS: Yes.

25 MR. WALTERS: Okay. Great.

1 Does ten minutes sound good?

2 THE WITNESS: Sure.

3 MR. WALTERS: Okay.

4 (Break from 10:07 a.m. to 10:19 a.m.)

5 Q. (BY MR. WALTERS) I'd like to turn to
6 the Hecker reference, which is Exhibit 1015.

7 A. 1005?

8 Q. 1015.

9 A. 1015, okay. I have it up.

10 Q. What is the Hecker reference directed
11 to?

12 A. Well, it's entitled "Extending
13 Openhole Gravel Packing Capability: Initial
14 Field Installation of an Internal Shunt Alternate
15 Path Technology," so talking about gravel packing
16 longer intervals.

17 Q. At page 1 of that reference, there's
18 a paragraph that starts "Although routinely
19 deployed."

20 Do you see that?

21 A. Yes.

22 Q. Okay. In that sentence there, Hecker
23 states, "The current eccentric 2x2 APT screens
24 have both technical and operational limitations."

25 Do you see that?

1 A. Yes, I do see it.

2 Q. In the -- in the first bullet, Hecker
3 describes one of those limitations is a maximum
4 shunt system working pressure of 3,000 psi which
5 limits the packable length to about 3,200 feet.

6 Do you see that?

7 A. Yes.

8 Q. And that's consistent with the rule
9 of thumb that you've got 1 psi of pressure drop
10 per foot; is that fair?

11 A. Yeah, for this size system that
12 they've been dealing with, I believe that's good.

13 Q. At page 3 of the Hecker reference --

14 A. Okay.

15 Q. -- there's a paragraph that starts
16 "ISAPT."

17 A. Yes.

18 Q. And it describes ISAPT as a new and
19 enhanced screen design.

20 Do you see that?

21 A. What paragraph are we referring to?

22 Q. That -- that -- that paragraph that
23 starts "ISAPT," the first few --

24 A. Oh.

25 Q. -- words of the sentence are, "A new

1 and enhanced screen design."

2 A. Okay.

3 Q. And if you look at Figures 5 and 6 on
4 page 7 of Hecker, do you see those figures?

5 A. Yes.

6 Q. I mean, this new and enhanced ISAPT
7 design in Hecker is the same concentric screen
8 design that's described in Yeh 2; is that fair?

9 A. I believe they're talking about the
10 same system, yeah.

11 Q. Okay. Going back to page 3.

12 A. Okay.

13 Q. That same paragraph we were looking
14 at that starts with "ISAPT."

15 A. Uh-huh.

16 Q. There's a sentence after the words
17 "Figure 6" that starts with "The transport
18 tubes."

19 Do you see that?

20 A. Yes.

21 Q. And that sentence states, "The
22 transport tubes and packing tubes are no longer
23 paired together as in the previous eccentric
24 2x2 design."

25 A. Yes.

1 Q. And then the next sentence says,
2 "This coaxial manifold increases shunt redundancy
3 and further decreases the risk of shunt
4 plugging."

5 Do you see that?

6 A. Yes.

7 Q. Hecker's describing how this ISAPT
8 design is an improvement over the eccentric
9 screen design; correct?

10 A. I believe he's describing a -- a
11 system that's higher pressure and has some
12 potential benefits over existing.

13 Q. Over the eccentric design; right?

14 A. For what was the eccentric currently
15 available on the market at that time design, yes.

16 Q. Looking at the next paragraph that
17 starts "The coaxial manifold."

18 A. Yes.

19 Q. It says, "The coaxial manifold not
20 only reduces the risk of plugging a single shunt
21 tube over the length of a completion, but it also
22 simplifies field make-up by eliminating the timed
23 connections and cross coupling jumper tubes of
24 the eccentric 2x2 design."

25 Do you see that?

1 A. Yes.

2 Q. In the -- in the next paragraph, the
3 last sentence states, "With the increase in
4 working pressure a length of 5,000 feet can now
5 be packed at a rate of 4.5 bpm extending the
6 length limit by more than 50 percent."

7 Do you see that?

8 A. Yeah.

9 Q. And that's referring to 50 percent
10 longer than the eccentric designs; correct?

11 A. I think it's rev- -- comparing to
12 what was currently available on the market at
13 that time, yeah.

14 Q. The ISAPT shunt tubes were rated to a
15 working pressure of 6,500 psi?

16 MR. WILSON: Objection. Form.

17 A. Yeah, that's what it -- what Hecker
18 says the working pressure of the shunt tube
19 increases from 3,000 to 6,500, yes.

20 Q. And this means that the concentric
21 ISAPT screens could be used to pack lengths of
22 5,000 feet?

23 A. If your 5,000-foot design require --
24 at that rate and whatever you were going to pump
25 was less than 6,500 psi, then yes, that would

1 work.

2 Q. The ISAPT concentric screen could
3 handle 6,500 psi at the heel?

4 A. It could handle at least that. That
5 would be the working pressure. It might handle
6 -- I think they had tested some of these sort of
7 things to 10,000 psi, but at -- that was the
8 working pressure.

9 Q. I'd like to turn to page 4 of the
10 Hecker reference. In the middle of that page,
11 there's a paragraph that starts "A total of 57
12 connections."

13 Do you see that?

14 A. Yes.

15 Q. Actually, I'd like to -- I'm sorry.
16 I'd like to first address the -- the paragraph at
17 the top of the page that starts "One drawback."

18 A. Yes.

19 Q. It states, (As read) "One drawback of
20 the current eccentric 2x2 design is related to
21 the complexity of the rig site connection make-up
22 given the need for -- for oriented connections."

23 A. Yes.

24 Q. Are eccentric screens hard to
25 connect?

1 A. You have to align them, you know,
2 when you're making up, they have to be aligned
3 properly. Bonner, I think, in one of the other
4 papers I came up with, he actually came up with a
5 quick connector from that, but you do have to
6 align them, you know, to properly connect.

7 Q. Does that make them more difficult to
8 install in the well?

9 A. I wouldn't say more difficult. It
10 can take more time. You know, time is money.

11 Q. I'd like to turn back to your
12 declaration.

13 A. Okay.

14 Q. And specifically paragraph 293, which
15 is on exhibit page 156.

16 A. Okay.

17 Q. This paragraph relates to your
18 analysis of the Yeh reference with respect to
19 limitation 1(e).

20 Do you see that?

21 A. Uh-huh.

22 Q. And that limitation requires that the
23 transport tube of the first sand screen assembly
24 have a wall thickness greater than a wall
25 thickness of the transport tube of the second

1 sand screen assembly.

2 Do you see that?

3 A. Yes.

4 Q. And in paragraph 293, you quote Yeh
5 at column 28, lines 20 to 23, and you're quoting
6 Yeh's phrase that a "certain surrounding wall
7 thickness is required." Correct?

8 A. (No verbal response.)

9 Q. And -- and feel free -- maybe we want
10 to go back and pick up Yeh and look at that
11 portion at column 28, lines 20 to 23; so that
12 would be Exhibit 1005.

13 A. Okay. All right.

14 Q. So my question is you're citing
15 column 28, lines 20 to 23 for this wall thickness
16 limitation of limitation 1(e).

17 Are there any other disclosures in
18 Yeh that, in your opinion, teach a POSITA about
19 shunt tube wall thickness?

20 A. I don't know. I'd have to go back
21 and look specifically for that.

22 Q. You don't cite to any other portion
23 of Yeh in your declaration to teach that
24 limitation; correct?

25 A. I thought this was sufficient that

1 Yeh stated something that is obvious, I think, to
2 people who design tubes that wall thickness is
3 one of the variables. As I think I mentioned
4 earlier, you can either use diameter or wall
5 thickness, metallurgy, those are the controlling
6 factors. So Yeh is acknowledging that, that wall
7 thickness is a controlling factor in shunt tube
8 design.

9 Q. And you're not aware right now of any
10 other portion of Yeh that teaches this wall
11 thickness limitation of limitation 1(e)?

12 A. Here again, I believe that Yeh is
13 designing system and teaching systems that can
14 handle higher pressure, and wall thickness is one
15 of those variables.

16 Q. So I'll ask my question again.

17 You reference column 28, lines 20 to
18 23 of Yeh for the wall thickness limitation of
19 limitation 1(e), and my question is: You're not
20 aware of any other portion of Yeh that, in your
21 opinion, teaches that wall thickness limitation;
22 correct?

23 A. I would have to go -- go back and
24 search Yeh. I thought that this was a great
25 example.

1 Q. Right now you're not aware of any
2 other portion; correct?

3 A. I would have to search.

4 Q. Okay. I'm happy for you to do that.

5 A. Okay.

6 (Witness reviewing document.)

7 A. Okay. I've looked through the
8 document. In paragraph 23, I believe it is --
9 well, number one, Yeh used the term "wall" 23 --
10 or 18 times, I think, in the document, and he --
11 most of the time he's talking about the casing
12 wall.

13 And in Section 23 he's talking about
14 the difference between the walls, which is the --
15 the wall thickness of the casing, that that
16 determines the through bore, and then obviously
17 the through bore would determine the pressure
18 rating.

19 So Yeh is acknowledging that the --
20 the wall sizes determine the bore and the bore is
21 obviously -- would be a function of the thickness
22 of the material.

23 Q. Okay. Anything else?

24 A. That's the primarily -- he does talk
25 about the casing walls, a lot of that, and here

1 again, they would also be a function to tell you
2 the thickness of the material.

3 Q. And specifically you're looking at
4 column 23, which lines?

5 A. Well, in column 23 -- let me find it
6 here again -- he's talking about the outer walls
7 and the inner walls of that. And at paragraph 23
8 right there at the last sentence in 24, 25, the
9 inner wall also forms a bore through the -- the
10 torque sleeve assembly, that those are
11 determining the bore of that assembly.

12 Q. Okay. Anything else in Yeh on wall
13 thickness?

14 A. What I believe a POSITA would know
15 wall thickness is part of the design, but, okay.

16 Q. You said you're not aware of anything
17 else in Yeh on wall thickness; correct?

18 A. I -- I said that 18 times in here,
19 and when I searched he uses the term "wall," so
20 Yeh is very much -- understands ID/OD wall in his
21 teachings here.

22 Q. Yeah. I'm asking because I think the
23 court reporter may have missed your response when
24 you said no to my question, so I'm going to ask
25 it again.

1 You've cited to a portion on column
2 23, lines 20 to 25. And my question is whether
3 you're aware of any other portion in Yeh that
4 teaches the wall thickness limitation of
5 limitation 1(e)?

6 A. I believe, yeah, that that is
7 sufficient but --

8 Q. I take your answer to be "no"?

9 A. No, with a caveat.

10 Q. Okay. I asked a bad question there.

11 A. Okay.

12 Q. I take that to mean that you're not
13 aware of any other portion in Yeh that teaches
14 the wall thickness limitation; correct?

15 A. I believe that Yeh is aware of wall
16 thickness. I believe Yeh is referring to wall
17 minimum -- many times, and each one of those
18 times when he refers to the wall, he's talking
19 about an ID or an OD and that is the wall
20 thickness. Okay?

21 Q. Okay. So you've cited to column 23,
22 lines 20 to 25 with respect to the wall thickness
23 limitation.

24 Are you aware of any other portion in
25 Yeh that teaches the wall thickness limitation of

1 limitation 1(e)?

2 A. No.

3 Q. Okay. I'd like to go back to your
4 declaration at paragraph 184, which is on page 96
5 of the exhibit.

6 A. Okay. 94.

7 Q. Paragraph 184.

8 A. 184, okay. Okay.

9 Q. At the end of paragraph 184, which is
10 on the next page, you provide a table to show how
11 size and wall thickness could be combined to
12 create a system of upstream higher-pressure tubes
13 and downstream lower-pressure tubes that would
14 both have the same cross-sectional area.

15 Do you see that?

16 A. Yes.

17 Q. When you refer to "same capacity" in
18 this paragraph and the -- and in the table,
19 you're referring to the same cross-sectional flow
20 area; correct?

21 A. Yes. Yeah, I did it over a foot
22 length so it comes out cubic inches, but if you
23 just take out a foot long, it would be square
24 inches, which would be the cross-section.

25 Q. And for each set of the rectangular

1 tubes and the circular tubes in this table, one
2 tube has a thicker wall than the other, but both
3 tubes in each set have the same cross-sectional
4 flow area; correct?

5 A. That's correct.

6 Q. And for the rectangular tubes in the
7 table, the 10-gauge would be the upstream tube;
8 right?

9 A. It is a greater wall thickness, so
10 yes.

11 Q. And the 13-gauge would be the
12 downstream tube?

13 A. Yes.

14 Q. And in your calculations for the
15 circular tubes in the table, the 13-gauge would
16 be the upstream tube; right?

17 A. Yes.

18 Q. And the 14-gauge would be the
19 downstream tube?

20 A. Yes.

21 Q. Looking at the round tubes, the
22 14-gauge round tube has a lower-burst pressure
23 than the 13-gauge round tube; correct?

24 A. It's 12,000 versus 14,700, yes.

25 Q. And that's because the 14-gauge has a

1 thinner wall than the 13-gauge?

2 A. Yes.

3 Q. And -- and both the 13-gauge and the
4 14-gauge have the same cross-sectional flow area?

5 A. Yes.

6 Q. And the inner diameter of both the
7 13-gauge and the 14-gauge is the same for both of
8 those round tubes; correct?

9 A. That's correct. 0.6 inches.

10 Q. And so it's the thinning of the wall
11 that reduces the burst pressure for the
12 downstream tube?

13 A. If the metallurgy's the same.

14 Q. A POSITA could also have reduced the
15 burst pressure by increasing the inner diameter
16 of the tube; right?

17 A. The -- a POSITA could have -- what's
18 your question again?

19 Q. A POSITA could also have reduced the
20 burst pressure by increasing the inner diameter
21 of the tube?

22 A. Yes, but then they wouldn't have the
23 same cross-sectional flow area.

24 Q. In -- in the combination of Yeh and
25 Yeh 2, would a POSITA have reduced the burst

1 pressure by increasing the cross-sectional flow
2 area in the downstream assembly?

3 A. You can, but they wouldn't -- it
4 wouldn't be the -- you know, the same, if that's
5 what you're re -- I thought the claim we were
6 talking about wanted the cross-sectional area to
7 be the same -- the cross-sectional flow area.

8 Q. And so when you were determining what
9 a POSITA would do, you determined that based on
10 the claim requiring the same cross-sectional flow
11 area?

12 A. No. I'm just saying if you -- this
13 is an example where you can have the same
14 cross-sectional flow area, and you -- in that
15 case you could have a thicker wall -- one could
16 have a thicker wall than the other. And obv- --
17 but obviously the dimensions would be slightly
18 different, too.

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

22 A. There could be. All these -- all
23 these shunt tubes must put -- fit in a certain
24 area, you know, so depending on the -- the
25 tolerance area. If they have an outer shroud

1 around them, I mean, that's going to confine your
2 ID, so you can't -- there's not an unlimited
3 number of possibilities that a POSITA could use.

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

11 Q. What are the various other reasons
12 why a POSITA would not want to increase the
13 cross-sectional flow area in the downstream
14 assembly?

15 A. Why he would not want to?

16 Q. You mentioned size constraint --
17 constraints.

18 A. Yes.

19 Q. Are there other reasons?

20 A. Maybe the burst pressure would be too
21 low. You -- you've got to also work -- these
22 things also have to work with all the -- the
23 ports and nozzles, and a lot of the ports and
24 nozzles and how those are designed and fit all go
25 through a lot of laboratory testing to arrive at

1 that specific thing.

2 So that's why the concentric tubes
3 were -- were used at the time they were because
4 that system works. And everybody knows that
5 system works with the -- because it's also a
6 function of the orifices in there.

7 So if you get too large a tube, it
8 may no -- be no longer in turbulent the flow.
9 You need to maintain turbulent flow in these.
10 You also -- the leakoff of the tubes, they all --
11 all those things act together so they're not
12 separately independent.

13 Q. Okay. I'd like to turn to a
14 different portion of your declaration,
15 paragraph 384. I believe it's on the exhibit
16 page 205.

17 A. Okay.

18 Q. And I'd actually like to turn to
19 paragraph 388 of that section.

20 A. Okay.

21 Q. The second sentence at that
22 paragraph 388 states, "When determining at what
23 point along a horizontal to install eccentric
24 screens, a POSITA would understand to place the
25 eccentric screens starting at a point along the

1 horizontal where the pressure dropped below the
2 pressure tolerance limits of Yeh's recommended
3 commercial eccentric screens. According to Yeh,
4 this transition point would be about 3,000 feet
5 down the horizontal from the heel."

6 Do you see that sentence?

7 A. Yes.

8 Q. Can you elaborate on -- on what
9 you're saying there?

10 A. When you look up at Figure 15 -- the
11 graph on Figure 15, it shows that the -- on the
12 left-hand scale it shows the pressure in the
13 transport tubes. Okay. So at 3,000 psi the
14 pressure intersects the pressure profile right at
15 2,000 feet. So from that point down, the
16 pressure would be low enough that you could
17 insert your eccentric strings right there.

18 Q. So --

19 A. And that's where we get in this
20 toe-heel where you're measuring from distance.

21 Q. So are -- are -- is it -- are you
22 saying that you would select your eccentric
23 screen based on the pressure that exists
24 2,000 feet from the heel?

25 A. Yes.

1 Q. Which would be 3,000 feet from the
2 toe?

3 A. Yes.

4 Q. Okay. I'd like to turn to
5 paragraph 298 in your declaration.

6 A. Okay. 2 -- paragraph 298 on
7 page 159?

8 Q. Yes. And I -- and I'd like to look
9 at claims 2 and 4; so claim 2 is on page 159 and
10 claim 4 is on page 176.

11 A. Okay.

12 Q. So starting at claim 2, so back to
13 page 159, that claim requires that a
14 cross-sectional flow area of a packing tube
15 nozzle in the first sand -- sand screen assembly
16 is less than a cross-sectional flow area of a
17 packing tube nozzle in the second sand screen
18 assembly; correct?

19 A. Let me get back to it.

20 Q. Sure.

21 A. Okay. The cross-sectional area
22 packing tube nozzle in the first sand screen
23 assembly is less than the second cross-sectional
24 flow, yes. So you have a bigger hole in the
25 bottom than on the top.

1 Q. And that -- and it's your opinion --
2 and it's your opinion that this would have been
3 obvious over Yeh and Yeh 2?

4 A. Yes.

5 Q. Okay. And turning to claim 4. I'll
6 -- I'll -- just let me know when you get there.

7 A. Okay. Okay. I'm there.

8 Q. So claim 4 requires that the number
9 of packing tube nozzles in the first sand screen
10 assembly is less than the number of packing tube
11 nozzles in the second sand screen assembly;
12 correct?

13 A. Yes.

14 Q. And it's your opinion that this would
15 have also been obvious over Yeh and Yeh 2?

16 A. Yes.

17 Q. So in claim 2 we have larger nozzles
18 in the downstream second sand screen assembly,
19 and in claim 4 we have a larger number of nozzles
20 in the downstream second sand screen assembly;
21 correct?

22 A. That's correct.

23 Q. Is it fair to say that having larger
24 nozzles in the downstream sand screen assembly
25 would lead to a larger friction pressure loss in

1 that downstream sand screen assembly?

2 A. Friction loss? But I don't -- I
3 don't understand what you're asking. Would it
4 have --

5 Q. Would -- would -- would the
6 downstream -- would the larger nozzles of the
7 downstream sand screen assembly lead to a larger
8 pressure loss in that downstream sand screen
9 assembly?

10 MR. WILSON: Objection. Form.

11 A. I'm not fully understanding the
12 question. In the downstream assembly you have
13 less pressure available, you know, for loss, and
14 so, you know, for a given flow rate across a
15 nozzle, the -- the flow rate's probably are --
16 could be identical. You know, if you're -- if
17 you're pumping at 5,000 psi versus a quarter-inch
18 hole and you're pumping at 3,000 psi versus a
19 half-inch hole, the actual flow rate through
20 those two holes may be the same. I don't know.
21 I -- I just threw that as a potential example.

22 But you have less pressure available,
23 so you need for -- to get the same flow rate --
24 for those to be the same flow rate, I think a
25 POSITA would know that that's an obvious

1 calculation to make.

2 Q. You're going to have a -- more of a
3 pressure loss when the nozzle hole gets larger;
4 correct?

5 MR. WILSON: Objection. Form.

6 A. Not necessarily because you have less
7 pressure available. That's what I'm saying, the
8 actual rate -- what -- what we're looking for
9 here is a rate through those nozzles, and the
10 rate could be identical.

11 Q. In -- in -- I'd like to look at
12 paragraph 325 on page 177.

13 A. Yes.

14 Q. Towards the end of that -- in the
15 middle of that paragraph towards the bottom,
16 there's a sentence that starts "Specifically."

17 Do you see that?

18 A. Yes.

19 Q. It says, "Specifically, Hurst
20 explained that for a given fluid composition and
21 gravel concentration, friction and thus the
22 pressure applied to each zone can be controlled
23 through the shunt tube dimensions (diameter and
24 length) as well as the nozzle diameter and
25 frequency."

1 A. Okay.

2 Q. What does that mean?

3 A. That means, just like what I was
4 trying to explain here, for a given set of
5 conditions, you know, here again, with the
6 downstream nozzles having probably higher
7 viscosity because they have higher loading of
8 sand, maybe they're at 6 pound versus 4 pound,
9 and you have less pressure available and all
10 those -- and then the number of holes that you're
11 going to take, if you want the frequency -- or
12 the flow rate to be the same, you're going to
13 have to adjust either the number or the size of
14 the nozzles to get an equivalent for a flow rate
15 because you have less pressure available.

16 Q. And you have less pressure available
17 because you have more nozzles with respect to
18 claim 4 and you have larger novels -- nozzles
19 with respect to claim 2?

20 A. No. No, you've got --

21 MR. WILSON: Objection. Form.

22 A. No, you have less pressure available
23 because of friction, you're at two totally
24 different points in the wellbore, and friction --
25 you have loss pressure to friction. You have

1 also loss pressure to leakoff, that fluid has
2 been leaking off.

3 So that's where we go back to the
4 Figure 15 of Yeh where he shows you how to
5 pressure declines from the heel to the toe as
6 you're pumping. And so that's why you have less
7 pressure available to go through the orifices.

8 Q. Okay.

9 MR. WALTERS: Is this a good time for
10 a break?

11 MR. WILSON: Sure.

12 MR. WALTERS: I may be about done,
13 just FYI.

14 MR. WILSON: Okay.

15 MR. WALTERS: But I'll let you know
16 once I come back.

17 MR. WILSON: Okay.

18 MR. WALTERS: So 15 minute -- or say
19 11:20 central time.

20 MR. WILSON: Yep. That sounds good.

21 MR. WALTERS: Okay. All right.

22 Thanks.

23 MR. WILSON: All right.

24 (Break from 11:06 a.m. to 11:21 a.m.)

25 Q. (BY MR. WALTERS) Okay. Welcome

1 back, Mr. Chambers. I'd like to look at
2 paragraph 304 of your declaration, which is on
3 page 163.

4 A. Okay. I'm there.

5 Q. There's a table or figure from the
6 Lagrone reference in that paragraph.

7 Do you see that?

8 A. Yes.

9 Q. Is it fair to say that this table
10 shows that as flow rate increases, the friction
11 pressure loss increases?

12 A. As flow rate increases, friction loss
13 -- yes.

14 Q. Okay.

15 MR. WALTERS: I do not have any
16 further questions, so I will pass the witness.

17 MR. WILSON: No questions from us,
18 but we reserve the right to read and sign.

19 MR. WALTERS: So I think we are
20 request -- we requested the transcript -- we can
21 go off the record.

22 MR. WILSON: Yep.

23 (Time noted - 11:23 a.m.)
24
25

1
2 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

3
4 BEFORE THE PATENT TRIAL AND REVIEW BOARD

5 WEATHERFORD U.S., L.P.
6 Petitioner

7 Vs.

8 HALLIBURTON ENERGY SERVICES, INC.
9 Patent Owner

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

12 REPORTER'S CERTIFICATION
13 ORAL DEPOSITION OF
14 MICHAEL CHAMBERS, SR.
15 FEBRUARY 21, 2025

16 I, Kim A. McCann, Certified Shorthand
17 Reporter in and for the State of Texas, hereby
18 certify to the following:

19 That the witness, MICHAEL CHAMBERS, SR., was
20 duly sworn by the officer and that the transcript
21 of the oral deposition is a true record of the
22 testimony given by the witness;

23 I further certify that pursuant to FRCP Rule
24 30(f)(1) that the signature of the deponent:

25 ___X___ was requested by the deponent or a
party before the completion of the deposition and

1 returned within 30 days from date of receipt of
2 the transcript. If returned, the attached
3 Changes and Signature Page contains any changes
4 and the reasons therefor;

5 I further certify that I am neither attorney
6 nor counsel for, related to, nor employed by any
7 of the parties to the action in which this
8 testimony was taken.

9 Further, I am not a relative or employee of
10 any attorney of record in this cause, nor do I
11 have a financial interest in the action.

12 Subscribed and sworn to on this the 27th day
13 of February, 2025.

14

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ERRATA SHEET

Case Name: *Weatherford U.S., L.P. v. Halliburton Energy Services, Inc.*
Case No.: IPR2024-00990
Witness Name: Michael R. Chambers, Sr.
Deposition Date: February 21, 2025

[illegible]

I, the undersigned, do hereby certify that I have read the foregoing transcript, and the same is a correct and complete transcription of the testimony given by me with the exception of the corrections listed above.

Date: _____

Michael R. Chambers, Sr.

3/9/2025