

1  
2 IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
3 BEFORE THE PATENT TRIAL AND APPEAL BOARD  
4

5 VOLKSWAGEN GROUP OF AMERICA, INC.,  
6 Petitioner  
7

8 v  
9

10 YECHEZKAL EVAN SPERO,  
11 Patent Owner  
12

13 Case IPR2023-00335  
14 US Patent No. 10,894,503  
15  
16

17 WITNESS: MATTHEW A. TURK, PhD

18 DATE: Friday, December 8, 2023

19 TIME: 9:31 a.m.

20 LOCATION: BROOKS KUSHMAN, PC

21 1000 Town Center, 22nd Floor

22 Southfield, Michigan

23 REPORTER: Karen Fortna, CRR/RMR/RPR/CSR-5067

24 JOB NO: 27210  
25

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,  
Petitioner

v

YECHEZKAL EVAN SPERO,  
Patent Owner

Case IPR2023-00328  
US Patent No. 10,894,503

WITNESS: MATTHEW A. TURK, PhD

DATE: Friday, December 8, 2023

TIME: 9:31 a.m.

LOCATION: BROOKS KUSHMAN, PC

1000 Town Center, 22nd Floor  
Southfield, Michigan

REPORTER: Karen Fortna, CRR/RMR/RPR/CSR-5067

JOB NO: 27210

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE PATENT TRIAL AND APPEAL BOARD

VOLKSWAGEN GROUP OF AMERICA, INC.,  
Petitioner

v

YECHEZKAL EVAN SPERO,  
Patent Owner

Case IPR2023-00197  
US Patent No. 10,894,503

WITNESS: MATTHEW A. TURK, PhD

DATE: Friday, December 8, 2023

TIME: 9:31 a.m.

LOCATION: BROOKS KUSHMAN, PC

1000 Town Center, 22nd Floor  
Southfield, Michigan

REPORTER: Karen Fortna, CRR/RMR/RPR/CSR-5067

JOB NO: 27210

1 APPEARANCES:

2  
3 STERNE, KESSLER, GOLDSTEIN & FOX, PLLC

4 By: Mr. Jason A. Fitzsimmons

5 Mr. John D. Higgins

6 1101 K Street, NW, Tenth Floor

7 Washington, DC 20005

8 202.371.2600

9 jfitzsimmons@sternekessler.com

10 jhiggins@sternekessler.com

11 Appearing on behalf of Petitioner

12  
13 BROOKS KUSHMAN, PC

14 By: Mr. Andrew B. Turner

15 1000 Town Center, 22nd Floor

16 Southfield, Michigan 48075

17 248.358.4400

18 aturner@brookskushman.com

19 Appearing on behalf of Patent Owner

I N D E X

W I T N E S S

| MATTHEW TURK, PhD                      | PAGE |
|----------------------------------------|------|
| Examination by Mr. Fitzsimmons         | 7    |
| Examination by Mr. Turner              | 143  |
| Further examination by Mr. Fitzsimmons | 145  |

E X H I B I T S

| EXHIBIT      | DESCRIPTION                               | PAGE |
|--------------|-------------------------------------------|------|
| Exhibit 1001 | US Patent No. 10,894,503 . . . . .        | .23  |
| Exhibit 1005 | US Patent No. 6,144,158 . . . . .         | .84  |
| Exhibit 1006 | US Publication No. 2001/0019486 . . . . . | .99  |
| Exhibit 1010 | PCT International Publication . . . . .   | 115  |
|              | No. WO 98/54030                           |      |
| Exhibit 1011 | PCT International Publication . . . . .   | 128  |
|              | No. WO 01/01038                           |      |
| Exhibit 2001 | Turk IPR2023-00197 Declaration . . . . .  | .14  |
| Exhibit 2001 | Turk IRP2023-00328 Declaration . . . . .  | .15  |
| Exhibit 2001 | Turk IPR2023-00335 Declaration . . . . .  | .16  |
| Exhibit 2006 | Turk IPR2023-00197 Second . . . . .       | .14  |
|              | Declaration                               |      |
| Exhibit 2006 | Turk IPR2023-00328 Second . . . . .       | .15  |
|              | Declaration                               |      |
| Exhibit 2006 | Turk IPR2023-00335 Second . . . . .       | .16  |
|              | Declaration                               |      |

Friday, December 8, 2023

Southfield, Michigan

9:31 a.m.

\* \* \* \*

MATTHEW TURK, PhD,

having first been duly sworn, was examined and  
testified as follows:

MR. FITZSIMMONS: Good morning, Dr. Turk.

THE WITNESS: Good morning.

MR. FITZSIMMONS: Good morning again. I  
know you know the drill here, but we'll go through  
a few preliminary matters and then we'll get  
started.

EXAMINATION

BY MR. FITZSIMMONS:

Q. Can you please state your full name for the record?

A. My name is Matthew Alan Turk.

Q. Okay. And do you know why you're here at this  
deposition today?

A. Yes, I do.

Q. And what's your understanding of that?

A. To respond to your questions about my declarations.

Q. Okay. And those declarations are in three separate  
IPR proceedings; is that your understanding?

A. That's correct.

1 Q. And they all relate to the same patent, though,  
2 correct?

3 A. Right.

4 Q. And just for the record, those three IPR  
5 proceedings are IPR2022-00197, IPR2022-00328 and  
6 IPR2022-00335. Does that sound familiar to you?

7 A. I think so.

8 Q. And those three proceedings all relate to the same  
9 US Patent No. 10,894,503. Does that sound  
10 accurate?

11 A. That sounds right.

12 Q. Is it okay if I refer to that patent as the '503  
13 patent?

14 A. Yes.

15 Q. And I'm going to do my best to try to keep us in  
16 order here on proceedings, so is it okay if I refer  
17 to the proceedings by their last three digits? So  
18 that would be the 197 proceeding, the 328  
19 proceeding and the 335 proceeding.

20 A. Yes.

21 Q. And I'll try to direct you to the appropriate  
22 document or documents. As you know, many of the  
23 exhibits are the same in each of these. I'll try  
24 to guide us as to where we are on those, but if  
25 you're at any point unsure of what document you

1           should be looking at, please just let me know.

2   A.       Okay.

3   Q.       And you understand that you are under oath today,  
4           correct?

5   A.       Yes, I do.

6   Q.       Okay. Is there any reason that would prevent you  
7           from testifying truthfully or accurately today?

8   A.       No.

9   Q.       And are you under any medication or substance that  
10          may impair your testimony in any way today?

11   A.       No, I'm not.

12   Q.       Again, just for housekeeping purposes and for  
13          record keeping purposes, I would just ask that we  
14          don't speak over each other, so please allow me to  
15          finish my question before you begin your answer.  
16          Is that fair?

17   A.       Yes.

18   Q.       Okay. And if you don't understand my question,  
19          please let me know. Do you agree to that?

20   A.       Yes.

21   Q.       So if you don't ask for clarification, I'll assume  
22          that you understood my question. Is that fair?

23   A.       Yes.

24   Q.       And we'll take periodic breaks today. If you need  
25          a break at any time, just please let me know. I

1 would just ask that you allow me to finish a  
2 question and then for you to provide a response  
3 before we take a break so there's no question  
4 pending. Is that fair?

5 A. Yes, it is.

6 Q. Now since your last deposition in this sort of  
7 series of matters -- that was for the '551 patent,  
8 if you recall, back in November -- have you been  
9 deposed in any other matters?

10 A. No, I have not.

11 Q. And since your deposition for that '551 patent,  
12 have you submitted any reports to courts or the  
13 PTABs?

14 A. No, I don't believe so.

15 Q. How did you prepare for the deposition today?

16 A. I reviewed the materials listed in the exhibit for  
17 my depositions, reviewed the three deposition --  
18 excuse me, declarations -- reviewed my three  
19 declarations and discussed things with the  
20 attorneys I'm working with.

21 Q. And there's a list of materials in your  
22 declarations. Is that the materials you're  
23 referring to?

24 A. Yes.

25 Q. Okay. Are there any other materials that you

1 reviewed in preparing for the deposition today?

2 A. I might have looked at some of the materials in the  
3 exhibit list of the petitions as well, but I don't  
4 recall offhand which ones.

5 Q. Did you review any documents that you recall are  
6 outside of the exhibits or papers in these three  
7 proceedings in preparing for the deposition today?

8 A. I don't think so.

9 Q. How much time would you say you spent preparing for  
10 today's deposition?

11 A. I spent much of yesterday and some meetings leading  
12 up to yesterday. It's hard to estimate precisely,  
13 but I would guess 10 to 15 hours perhaps.

14 Q. You said you had some meetings. Who were those  
15 meetings with?

16 A. With the attorneys that I'm working with on these  
17 cases.

18 Q. Anyone other than the attorneys from Brooks  
19 Kushman?

20 A. No.

21 Q. And when did those meetings occur?

22 A. Over the last couple weeks, various days, mostly  
23 afternoons.

24 Q. Were those meetings remote or in person?

25 A. They were remote until yesterday.

1 Q. Who is retaining you in the 197, 328 and 335  
2 proceedings?

3 A. I believe the official retaining is from Torchlight  
4 Technologies.

5 Q. And when were you contacted about potentially  
6 working on these three matters related to the '503  
7 patent?

8 A. The whole family of matters, I was contacted, I  
9 believe, towards the beginning of 2022.

10 Q. And who contacted you?

11 A. I don't recall exactly. It might have been the  
12 attorney, Ms. Shah.

13 Q. And you mentioned Torchlight Technologies, you  
14 believe, is retaining you. Are they an entity that  
15 you considered when you were determining whether  
16 you had any potential conflicts in working on these  
17 matters?

18 A. I'm sure that I would have considered them.

19 Q. And the inventor on the '503 patent is Yechezkal  
20 Evan Spero, Y-E-C-H-E-Z-K-A-L; is that correct?

21 A. That sounds right.

22 Q. I'll refer to the inventor here as Mr. Spero.

23 Have you ever communicated with Mr. Spero?

24 A. Not to my knowledge.

25 Q. Your declarations say that you're making this

1 declaration at the request of Mr. Spero. How do  
2 you know that it's at Mr. Spero's request?

3 A. Through discussions with the attorneys that I'm  
4 working with. They communicated that to me.

5 Q. So the attorneys told you that you're providing the  
6 declarations on behalf of Mr. Spero; is that  
7 correct?

8 A. I don't remember how it was communicated  
9 specifically, but that is my understanding based on  
10 discussions with the attorneys.

11 Q. Did you find anything odd about the fact that you  
12 believe you're being retained by a company,  
13 Torchlight Technologies, yet you were providing  
14 declarations on behalf of the inventor, Mr. Spero,  
15 in these matters?

16 MR. TURNER: Objection. Relevance.

17 THE WITNESS: I guess I didn't find it  
18 odd.

19 BY MR. FITZSIMMONS:

20 Q. Have you ever provided a declaration on behalf of  
21 an inventor before yet were retained by some other  
22 third party?

23 A. I don't know. I would have to look through my  
24 prior cases to determine that, but I don't know  
25 offhand.

1 MR. FITZSIMMONS: Okay. I'm going  
2 to pull out a lot of documents to get them into  
3 your hands and on the record so that we can  
4 expedite things, I think, a little bit in terms of  
5 what we're going to be looking at today.

6 So the first one will be your  
7 declarations in the 197 proceeding. So this first  
8 one is Exhibit 2001 in the 197 proceeding, and this  
9 is Exhibit 2006, your second declaration in the 197  
10 proceeding. I'll just have you hold onto that for  
11 a moment.

12 (Marked for identification:

13 Deposition Exhibit Nos. 2001, 2006.)

14 BY MR. FITZSIMMONS:

15 Q. So if you could please look at Exhibit 2001 from  
16 the 197 proceeding first, Dr. Turk. And this is  
17 your first declaration in the 197 proceeding. Can  
18 you please confirm that for me?

19 A. Yes, it looks like it is.

20 Q. And if you go to the last page, is that your  
21 signature there?

22 A. Yes, it is.

23 Q. And then if you look at Exhibit 2006 from the 197  
24 proceeding, that is your second declaration in the  
25 197 proceeding, correct?

1 A. Yes, it looks like it.

2 Q. And if you go to the last page there, is that your  
3 signature on the last page?

4 A. Yes, it is.

5 MR. FITZSIMMONS: The next documents  
6 we'll look at are from the 328 proceeding. And the  
7 first document here is Exhibit 2001 from the 328  
8 proceeding. This is your first declaration in that  
9 proceeding. And the other document I will hand you  
10 here is Exhibit 2006 from the 328 proceeding. This  
11 is your second declaration in the 328 proceeding.

12 (Marked for identification:

13 Deposition Exhibit Nos. 2001, 2006.)

14 BY MR. FITZSIMMONS:

15 Q. And if you look at Exhibit 2001 for me. Can you  
16 please confirm for me that is your first  
17 declaration in the 328 proceeding?

18 A. It appears to be.

19 Q. And if you go to the last page there, is that your  
20 signature on the last page?

21 A. Yes, it is.

22 Q. And Exhibit 2006 from the 328 proceeding, your  
23 second declaration in the 328 proceeding, can you  
24 confirm that for me?

25 A. That seems to be right.

1 Q. And if you turn to the last page, can you please  
2 confirm for me that's your signature on the last  
3 page?

4 A. Yes, it is.

5 MR. FITZSIMMONS: And the last  
6 declarations here are from the 335 proceeding.  
7 The first one here is Exhibit 2001, your first  
8 declaration in the 335 proceeding. And the  
9 document here is Exhibit 2006, which is your second  
10 declaration in the 335 proceeding.

11 (Marked for identification:

12 Deposition Exhibit No. 2001, 2006.)

13 BY MR. FITZSIMMONS:

14 Q. And if you'll just look at Exhibit 2001 from the  
15 335 proceeding first, can you please just confirm  
16 for me that is your first declaration in that  
17 proceeding?

18 A. Yes, I think it is.

19 Q. And is that your signature there on the last page?

20 A. Yes, it is.

21 Q. And Exhibit 2006 from the 335 proceeding, this is  
22 your second declaration in that proceeding. Can  
23 you confirm that for me, please?

24 A. Yes, I think it is.

25 Q. And if you turn to the last page, is that your

1 signature there?

2 A. Yes.

3 MR. FITZSIMMONS: Thank you.

4 BY MR. FITZSIMMONS:

5 Q. Okay. Now I'll be focusing today mostly on your  
6 second declarations in each proceeding, so that's  
7 Exhibit 2006 in each proceeding. And you would  
8 agree that there is significant overlap in your  
9 opinions between the three proceedings; is that  
10 fair?

11 A. Yes, it's reasonable.

12 Q. To your knowledge, do you take any opinions in the  
13 three declarations, the Exhibits 2006, that are  
14 conflicting?

15 A. No, I don't believe I do.

16 Q. Did you write all three of your declarations that  
17 are labeled Exhibit 2006 in the proceeding?

18 A. I didn't write all of them.

19 Q. What do you mean by you didn't write all of them?

20 A. They all came about based on extensive discussions  
21 with the attorneys that I've been working with. I  
22 believe in all three cases, they wrote the first  
23 draft and we discussed all of the points, and  
24 there were many edits from there, so it was a  
25 collaborative process in terms of writing the

1 actual documents, but I agree with everything that  
2 is written here in my declaration.

3 Q. About how long would you say you spent preparing  
4 these three declarations? Give me an approximate  
5 total amount of time.

6 A. I really don't recall very well.

7 Q. Is it accurate that you have reviewed all six of  
8 these documents, three labeled Exhibits 2001 and  
9 three labeled Exhibits 2006, in preparing for  
10 today's deposition?

11 A. Yes.

12 Q. And after reviewing these documents, is there  
13 anything that you no longer believe to be accurate  
14 in them?

15 A. Only some minor typos, but nothing substantial.

16 Q. Let's start with your 197 declaration,  
17 Exhibit 2006. Do you have that one?

18 A. Yes.

19 Q. And let's turn to paragraph 145, please.

20 A. Okay.

21 Q. In the last sentence there, you state, "Petitioner  
22 has simply fallen short of meeting its burden of  
23 proof." Do you see that?

24 A. Yes.

25 Q. What burden of proof are you referring to there?

1 A. I think I generally mean the -- a clear enough and  
2 compelling enough motivation to combine different  
3 components or different references to make a  
4 reasonable obviousness argument.

5 Q. Do you know if there is a standard burden of proof  
6 for showing a motivation to combine references in  
7 an obviousness combination?

8 A. I think I do discuss that earlier. I talk about  
9 rationales to show obviousness in paragraph 24. I  
10 don't use the phrase burden of proof, but it's that  
11 topic.

12 Q. So my question was, do you know if there's a  
13 standard burden of proof for showing a motivation  
14 to combine references in an obviousness  
15 combination?

16 MR. TURNER: Objection. Asked and  
17 answered.

18 THE WITNESS: I think there are  
19 decisions, to my knowledge, about that, but I don't  
20 know them particularly offhand.

21 BY MR. FITZSIMMONS:

22 Q. Prior to submitting your declarations, the three  
23 that are Exhibit 2006 in these proceedings, did you  
24 review all of the prior art references that were  
25 applied in the grounds of the petitions?

1 A. Yes, I did.

2 Q. Now the '503 patent claims are directed to adaptive  
3 vehicle headlight systems, correct?

4 A. That's right.

5 Q. In paragraph 56 of your 197 declaration, you  
6 acknowledge the petitioner's proposed level of  
7 ordinary skill in the art, correct?

8 A. Yes.

9 Q. And then in paragraph 57, you acknowledge the  
10 Board's, what you say, modified version of  
11 petitioner's proposed level of ordinary skill in  
12 the art, correct?

13 A. Yes.

14 Q. The only difference between those levels of  
15 ordinary skill is the two words "at least" before  
16 "two years of industry experience," correct?

17 A. I think that's right.

18 Q. In your opinion, does removing "at least" from that  
19 definition of a POSA change how that person of  
20 ordinary skill in the art would analyze and  
21 understand the '503 patent claims and the prior art  
22 applied in the three proceedings we're discussing  
23 today?

24 A. I haven't considered until just now the  
25 implications of the difference here, but off the

1 top of my head, I don't think it would be  
2 significant.

3 Q. Paragraph 58 of your 197 declaration, you state  
4 that "Patent owner accepts the Board's proposed  
5 level of ordinary skill." Do you see that?

6 A. That I understand that, yes.

7 Q. Okay. And do you -- are you also accepting that  
8 level of ordinary skill which is in paragraph 57?

9 A. Maybe I need a little more clarity on the question.  
10 What I state here is my understanding of petitioner  
11 and the Board. I don't believe that I state  
12 anywhere or that anybody asks me to propose  
13 something. So do you mean do I agree with it?

14 Q. That's fair. Let me phrase it this way: Is the  
15 level of ordinary skill in paragraph 57 the level  
16 of skill that you applied when analyzing and  
17 understanding the '503 patent claims and the prior  
18 art applied in the three proceedings that we're  
19 discussing today?

20 A. Yes.

21 Q. And you agree that is the appropriate level of  
22 ordinary skill?

23 A. For this IPR case, yes.

24 Q. And just to be clear, for all three of these IPRs  
25 related to the '503 patent?

1 A. For all three of these, I believe it's the same  
2 wording, so yes.

3 Q. Section II in your 197 declaration is your  
4 understanding of the law section. Do paragraphs 23  
5 and 24 represent your complete understanding of  
6 obviousness?

7 MR. TURNER: Objection. Vague.

8 THE WITNESS: I wouldn't say that they  
9 represent my complete understanding. They are a  
10 summary of my understanding for the context of this  
11 declaration.

12 BY MR. FITZSIMMONS:

13 Q. How would you say that your complete understanding  
14 differs from this summary of your understanding?

15 A. I presume by complete understanding you mean  
16 everything that I know and understand about the  
17 topic and I don't really know how to answer the  
18 question how everything I know and understand  
19 differs from these two paragraphs except that all  
20 the stuff that's not written here, I guess, is the  
21 difference.

22 Q. Paragraphs 23 and 24, does that represent a summary  
23 in your words of the understanding of obviousness  
24 that you applied in your three Exhibit 2006  
25 declarations?

1 A. Well, these two paragraphs were not intended to  
2 necessarily list every aspect of my understanding  
3 that I applied. I do think these two paragraphs  
4 are well representative of the understanding that I  
5 applied.

6 (Marked for identification:

7 Deposition Exhibit No. 1001.)

8 BY MR. FITZSIMMONS:

9 Q. Now I'm going to hand you the '503 patent, so this  
10 is Exhibit 1001 in all three proceedings. For the  
11 record, this is US Patent No. 10,894,503 to  
12 Mr. Spero.

13 Can you just confirm that is Exhibit 1001,  
14 the '503 patent, for me?

15 A. Yes, it is.

16 Q. And I think to make things simpler, moving forward,  
17 unless I refer otherwise, when I say "your  
18 declarations," I'm referring to Exhibits 2006 in  
19 each proceeding, not 2001. Is that fair?

20 A. Understood.

21 Q. If I'm referring to the 2001 exhibit declarations,  
22 I'll let you know so that I don't have to keep  
23 repeating myself.

24 A. That's fine.

25 Q. In preparing all of your declarations, did you read

1 the specification of the '503 patent before  
2 submitting them?

3 A. Yes.

4 Q. And the '503 patent is rather lengthy. Did you  
5 read the entire specification before submitting  
6 your declarations?

7 A. Yes, I have read the entire specification prior to  
8 submitting these declarations.

9 Q. And did you review all of the drawings?

10 A. Yes.

11 Q. And to your recollection, the '503 patent  
12 specification is the same as the '029 patent and  
13 '551 patents that we've discussed in previous  
14 depositions; is that correct?

15 MR. TURNER: Objection. Vague.

16 THE WITNESS: I believe there might be  
17 minor differences, but substantially, I believe  
18 that's correct.

19 BY MR. FITZSIMMONS:

20 Q. And so the vast majority of the disclosure in the  
21 '503 patent is something that you have reviewed in  
22 both the '029, '551 and now '503 patent  
23 proceedings, correct?

24 A. Yes, I think so.

25 Q. Okay. And this is your third deposition in the

1 Volkswagen matters, correct?

2 A. Yes, it is.

3 Q. And you have provided declarations in six IPR  
4 proceedings related to the three patents I  
5 mentioned, correct?

6 A. I don't recall the number.

7 Q. That's fine.

8 Given that the substantive disclosure in  
9 all these proceedings is essentially the same, how  
10 many times would you say you've reviewed the  
11 disclosure that is presented in the '503 patent?

12 A. For that question, what do you mean specifically by  
13 "reviewed"?

14 Q. How do you interpret the term "review"?

15 A. Well, I'm just wanting to know what you meant by  
16 the question.

17 Q. I'm meaning read the specification.

18 A. Read the full specification?

19 Q. Yes. Start there.

20 A. I don't really know, but I would guess a few times.

21 Q. Did you read all of the claims of the '503 patent?

22 A. Yes.

23 Q. And there are 70 total claims in the '503 patent;  
24 is that correct?

25 A. Yes.

1 Q. And there are six independent claims, if you just  
2 want to confirm that for me. It's claims 1, 20,  
3 26, 37, 59 and 65; is that correct?

4 A. That's correct.

5 Q. And did you develop an understanding of each of the  
6 terms in the claims of the '503 patent before  
7 providing your opinions?

8 A. Yes, I think so.

9 Q. What was your process for developing an  
10 understanding of the claim terms in the '503  
11 patent?

12 A. I don't know that I had a general process for that.  
13 My understanding probably came from the multiple  
14 readings of the patent and especially the claims  
15 and my general knowledge of the area and  
16 discussions with the attorneys I work with on this  
17 case.

18 Q. Are there any terms of the '503 patent claims that  
19 you didn't understand?

20 A. You mean prior to the declarations?

21 Q. Yes.

22 A. I don't think so.

23 Q. And just so that I'm clear, are there any terms in  
24 the '503 patent claims that you didn't understand  
25 after your declarations?

1 A. No.

2 Q. Are there any terms in the '503 patent that you  
3 found were unclear to you?

4 A. I don't think so; not that I recall.

5 Q. Were there any terms in the '503 patent claims that  
6 you thought a person of ordinary skill in the art  
7 would not understand?

8 MR. TURNER: Objection. Vague.

9 THE WITNESS: I don't think so.

10 BY MR. FITZSIMMONS:

11 Q. Were there any terms in the '503 patent claims that  
12 you had difficulty determining a meaning for?

13 A. I don't think so.

14 Q. Was there any standard under which you interpreted  
15 the claims of the '503 patent?

16 MR. TURNER: Objection. Vague.

17 THE WITNESS: Not any specific standard  
18 that I recall.

19 BY MR. FITZSIMMONS:

20 Q. Let's turn to the claims and let's start with  
21 claim No. 20 of the '503 patent. And this is at  
22 the bottom of column 97. Do you see that?

23 A. Yes.

24 Q. You would agree that claim 20 is directed to a  
25 vehicle headlight system that has one or more

1 headlamps, correct?

2 A. Yes.

3 Q. And if we're looking in column 97, starting at  
4 around line 60, do you see where it says, "...each  
5 headlamp including at least three directional light  
6 sources aimed at different angles relative to the  
7 vehicle..."?

8 A. Yes.

9 Q. What does the term "light source" mean in the '503  
10 patent?

11 A. I believe I quote the Board's construction of that  
12 term in my declaration. Let me find that. Yes,  
13 it's in paragraph 59. "...proposed construction of  
14 the term 'light source' is any system that is  
15 capable of receiving an electrical signal and  
16 producing light in response to the signal."

17 Q. And is that the interpretation of the term "light  
18 source" that you applied in your analysis?

19 A. I don't recall when I heard of this construction,  
20 so I might have not been applying that exactly  
21 before I heard it, but it's consistent with my  
22 understanding, so generally I've applied that  
23 throughout.

24 Q. In your three declarations, Exhibits 2006 in this  
25 proceeding, is the proposed construction there in

1 paragraph 59 the one that you applied in your  
2 opinions in your declarations?

3 A. Yes, it is.

4 Q. This is the only term "light source" that you  
5 present a specific definition for; is that right?

6 MR. TURNER: Objection. Vague.

7 THE WITNESS: I seem to recall providing  
8 other definitions. I don't remember in which  
9 declarations offhand, so I don't think this is the  
10 only one.

11 BY MR. FITZSIMMONS:

12 Q. Referring to paragraph 59 here, is it fair to say  
13 that this proposed construction has two  
14 requirements, one being capable of receiving an  
15 electrical signal, and two, producing light in  
16 response to that signal?

17 A. Yes, that seems reasonable.

18 Q. Is there anything else that's required for a light  
19 source, in your opinion?

20 A. As far as the general term, nothing that I can  
21 think of. In any particular context, there might  
22 be additional requirements of a light source.

23 Q. So in the context of the '503 patent claims, is  
24 there anything else that's required for a light  
25 source, in your opinion?

1 A. Well, there are requirements of light sources in  
2 various places, but I think you mean just to be a  
3 light source, and no, I don't think there are any  
4 other stated requirements.

5 Q. Does it matter whether the light exits the  
6 headlamp?

7 A. Does what matter?

8 Q. Under the proposed construction of light source,  
9 does it matter whether the light that's produced  
10 exits the headlamp?

11 A. This proposed construction doesn't say anything  
12 about a headlamp, so the question sounds irrelevant  
13 to me.

14 Q. In the context here, you said you understood the  
15 claims to be referring to vehicle headlamps, right,  
16 and so the light source is in the context of a  
17 vehicle headlamp; do you agree?

18 A. There is discussion in the patent specification  
19 about other light sources besides those in  
20 vehicles.

21 Q. Right. Claim 20, which we're referring to -- and  
22 we were just going over the phrase "directional" --  
23 "three directional light sources aimed at different  
24 angles relative to the vehicle," correct?

25 A. That's right.

1 Q. So in that context in the claims, does it matter  
2 whether the light that's produced exits the  
3 headlamp?

4 MR. TURNER: Objection. Vague.

5 THE WITNESS: Are you asking whether that  
6 would help determine whether something is a light  
7 source or not?

8 MR. FITZSIMMONS: Yes, that's fair.

9 THE WITNESS: So my understanding of your  
10 question is that you're not asking about the  
11 source, you're asking about the light produced by  
12 the source and then what can happen to that. I  
13 think that's independent of what the source is and  
14 what defines the source.

15 BY MR. FITZSIMMONS:

16 Q. Okay. The same phrase, "three directional light  
17 sources aimed at different angles relative to the  
18 vehicle." What is your understanding of what  
19 "aimed at different angles" means in claim 20?

20 A. Generally, that would be distribution of a light  
21 energy coming out of the source. The three sources  
22 in this case would not be the same and they would  
23 be different based on direction of travel or  
24 direction of being observed relative to the  
25 source -- or in this case I think it says relative

1 to the vehicle.

2 Q. Okay. If we go to the next limitation in claim 20,  
3 it recites, "controllable light characteristics,"  
4 column 97, approximately lines 62 to 63. Do you  
5 see that?

6 A. Yes.

7 Q. And my questions here are in the context of the  
8 claims. What is a light characteristic?

9 MR. TURNER: Objection. Vague.

10 THE WITNESS: I don't think this claim  
11 defines it, but I believe other parts of the patent  
12 talk about light characteristics, so I would have  
13 to look on those other parts.

14 BY MR. FITZSIMMONS:

15 Q. Do you know any examples of what light  
16 characteristics are in the '503 patent?

17 A. I will look.

18 Q. It is a long patent, so I will refer you to  
19 column 16 as at least one example, line 47,  
20 beginning there. It says "light characteristic,"  
21 and then it goes on to list some terms. Do you see  
22 those?

23 A. Yes.

24 Q. So the '503 patent there, again in column 16, lines  
25 approximately 47 through 50, it says, "...the

1 resultant light characteristic, be in its  
2 intensity, spatial intensity distribution, spectral  
3 energy content and spectral intensity  
4 distribution," is that correct?

5 A. Yes, I see that.

6 Q. Are those examples, in your opinion, of what  
7 claim 20 means by light characteristics?

8 A. Yes, I think those are examples.

9 Q. What is the '503 patent -- what does the '503  
10 patent mean by intensity as a light characteristic  
11 there?

12 A. It generally means the power of the emission, and  
13 intensity is a technical term that brings in  
14 various things about function of direction and  
15 solid angle and unit area, I believe, and it can be  
16 used generically or very technically, but in this  
17 case, I believe it is generally referring to how  
18 much light energy is being output, which an  
19 observer would then see it's pertaining to the  
20 perception of brightness because of the intensity  
21 of its output.

22 Q. And what is spatial intensity distribution?

23 A. That would be the intensity at different directions  
24 emitting the -- from the light source.

25 Q. And what is spectral intensity distribution?

1 A. It's basically a function of wave length, so things  
2 that are emitted from the source at various angles  
3 can have what we would think of as different colors  
4 or different functions of wave length.

5 Q. Turn back to the claims, still claim 20, column 97,  
6 lines 63 through 67. Can you read those for me,  
7 please? Starting with "first light source."

8 A. "...wherein a first light source of the more than  
9 one light sources at a first angle is less visually  
10 disturbing to traffic than a second light source of  
11 the more than one light sources aimed at a second  
12 angle, different from the first angle."

13 Q. What's your understanding of the phrase "less  
14 visually disturbing to traffic" in claim 20?

15 A. Generally, not annoying to drivers of other cars,  
16 not being considered bothersome glare, for example.

17 Q. How do you determine if something is annoying to  
18 drivers of other cars?

19 A. You could ask them.

20 Q. So is that something that would be subjective? And  
21 by that, I mean what might be annoying to one  
22 person may not be annoying to another person.

23 A. Any perceptual matter -- any human perceptual  
24 matter is subjective by definition, so yes.

25 Q. If we now go to column 98, still claim 20, lines 4

1 through 7, can you read that element for me,  
2 please?

3 A. "One or more sensors configured to sense  
4 information defined as pertinent to determining  
5 illumination output from the one or more headlamps  
6 and communicating the sensed information to a  
7 processor as sensor data."

8 Q. Does claim 20 specify what type of sensor is used  
9 with the recited headlamp system?

10 A. No, claim 20 doesn't.

11 Q. Does claim 20 specify what type of information is  
12 pertinent to determining illumination output?

13 MR. TURNER: Objection. Vague.

14 THE WITNESS: Can you repeat the  
15 question, please?

16 MR. FITZSIMMONS: Sure.

17 BY MR. FITZSIMMONS:

18 Q. Referring to the part of the claim element you just  
19 read for me and more specifically the part  
20 "information defined as pertinent to determining  
21 illumination output," my question was, does  
22 claim 20 specify what type of information is  
23 pertinent to determining illumination output?

24 A. No, it doesn't specify that specifically.

25 Q. To your recollection, does the '503 patent describe

1           what type of information is pertinent to  
2           determining illumination output?

3   A.     Yeah, it generally describes light energies being  
4           information pertinent to that.

5   Q.     So in your opinion, light energy is at least one  
6           example of information that would be pertinent to  
7           determining illumination output?

8   A.     Yes.

9   Q.     Are there any other examples of pertinent  
10          information with respect to claim 20 here that you  
11          can provide?

12   A.     There may be other examples. I hadn't thought  
13          about this -- hadn't thought about examples of  
14          that, so I don't have a good response at the  
15          moment.

16   Q.     Would ambient light outside of the vehicle be  
17          pertinent to determining illumination output in the  
18          context of claim 20 here?

19   A.     I suppose it could, but it would depend on how the  
20          determining is done, I guess.

21   Q.     Would the location of light sources relative to  
22          the vehicle be information that is pertinent to  
23          determining illumination output in the context of  
24          claim 20?

25   A.     Location of lights, which is what I think you asked

1 about, is what claim 20 here is discussing  
2 determining, or at least relevant to that, so  
3 broadly, it seems to be pertinent.

4 Q. Would the intensity of light sources outside the  
5 vehicle be information that is pertinent to  
6 determining illumination output in the context of  
7 claim 20?

8 A. Yes, light intensity can be pertinent to that  
9 determination.

10 Q. Without going through a number of more examples,  
11 would you agree that there are many things that  
12 could be considered information that is pertinent  
13 to determining illumination output in the context  
14 of claim 20?

15 A. Some things would certainly be much more pertinent  
16 than others, but in general, I think yes, there  
17 could be several things that are pertinent.

18 Q. How would a person skilled in the art determine  
19 what is pertinent versus what is not pertinent in  
20 the context of claim 20?

21 A. I think a person of ordinary skill in the art would  
22 understand how sensor data is processed and what is  
23 useful or not useful in terms of determining a  
24 desired -- the answer to a desired question, so I  
25 think such a person would go through that process

1 and decide what is going to be helpful and what may  
2 not be helpful.

3 Q. Regarding the last term in that same clause,  
4 "sensor data." Do you see that in column 98 at  
5 line 7?

6 A. Yes.

7 Q. Where it says "communicating the sensed information  
8 to a processor as sensor data," do you see that?

9 A. I do.

10 Q. Would light detected by an optical sensor be  
11 considered sensor data in that context?

12 A. I wouldn't consider the light as being sensor data,  
13 so no.

14 Q. So when light is sensed by a sensor and there's  
15 some data transferred, what, in your opinion, is  
16 the actual sensor data?

17 A. It depends at what point in the pipeline you're  
18 looking at. At some point it's electrons, your  
19 typical system; at a later point, it could be an  
20 analogue or digital value.

21 Q. So the light itself, you're saying, is not sensor  
22 data, it's something that's -- the sensor data  
23 would be something produced by the sensor in  
24 response to detecting the light; is that fair?

25 A. That sounds fair.

1 Q. And the next element there, starting with, "the  
2 processor, in communication," through -- let's  
3 see -- line -- I think it's about 13. Do you see  
4 that?

5 A. Yes.

6 Q. Can you read that?

7 A. "The processor, in communication with at least the  
8 sensors and the control circuitry, configured to:  
9 Process the sensor data to determine, within a  
10 field of view, at least a first subsection,  
11 including a detected vehicle and at least a second  
12 subsection not including the detected vehicle."

13 Q. So the processor recited here in claim 20 detects a  
14 vehicle based on the sensor data from the one or  
15 more sensors; is that correct?

16 A. Yes.

17 Q. In your opinion, does claim 20 require that the  
18 entire detected vehicle is located in the first  
19 subsection?

20 A. It doesn't say specifically either way, it just  
21 says "including a detected vehicle."

22 Q. The processor cited in claim 20 determines a second  
23 subsection not including the detected vehicle based  
24 on the sensor data from the one or more sensors; is  
25 that correct?

1 A. That's correct.

2 Q. Claim 20 does not explicitly recite how a vehicle  
3 is detected; is that correct?

4 A. That is correct.

5 Q. Claim 20 recites that the processor determines the  
6 first and second subsections; is that right?

7 A. Yes; that's right.

8 Q. Claim 20 does not recite that the processor detects  
9 the vehicle; is that correct?

10 MR. TURNER: Objection. Vague.

11 THE WITNESS: Well, it says a detected  
12 vehicle. I don't think there's anything in this  
13 claim that specifies how that vehicle was detected.

14 BY MR. FITZSIMMONS:

15 Q. And claim 20 does not specify any particular type  
16 of sensor data that is required to determine a  
17 detected vehicle; is that correct?

18 A. I think that's correct.

19 Q. The next element of claim 20, column 98, starting  
20 at line 14 through about 19, starting with  
21 "determine," can you read that element for me,  
22 please?

23 A. "Determine optimal use of the differently aimed  
24 directional light sources to maximize vehicle  
25 operator visibility in at least the second

subsection while minimizing a disturbing effect  
resulting from the illumination output on the  
vision of the other traffic in at least the first  
subsection."

Q. What is your understanding of the phrase "optimal  
use of the differently aimed directional light  
sources to maximize vehicle operator visibility" in  
claim 20?

A. Generally, to determine how to control the light  
sources to best illuminate the second subsection  
for the driver.

Q. And how would a person skilled in the art know how  
to best illuminate a second subsection for the  
driver?

MR. TURNER: Objection. Vague.

THE WITNESS: That knowledge could be  
gained experimentally, it could also be understood  
from various specifications and/or regulations  
about what kind of visibility is desirable, so  
there are probably a number of ways that could be  
determined.

BY MR. FITZSIMMONS:

Q. So the kind of visibility that is desirable, as you  
said, that is not the same for every driving  
situation; is that correct?

1 A. Well, good visibility for the driver is desirable  
2 in all driving situations, but exactly what that  
3 means in terms of the illumination can vary.

4 Q. You said "exactly what that means in terms of the  
5 illumination can vary." How would the illumination  
6 vary based on the driving situation?

7 A. Well, as an example, if you're driving at noon on a  
8 nice bright sunny day, I think you probably don't  
9 need illumination to provide good visibility for a  
10 driver, but in the middle of the night in a dark  
11 area, you do need illumination to provide good  
12 visibility to the driver.

13 Q. Take us back to this phrase in claim 20, starting  
14 with the optimal use. What factors would a person  
15 skilled in the art use in determining the optimal  
16 use of vehicle headlamps in the context here of  
17 claim 20?

18 A. What factors?

19 MR. TURNER: Objection. Calls for  
20 speculation.

21 THE WITNESS: I think there are  
22 potentially a lot of factors. At least just  
23 thinking about this off the top of my head, the  
24 light sources themselves, the time of day, the  
25 brightness, the brightness or lightness of the sky

1           and area, the field of view. There are a number of  
2           things that could go into determining this.

3 BY MR. FITZSIMMONS:

4 Q.       The claims here recite at least three directional  
5           light sources. Would determining -- would the  
6           optimal use require that you operate those three  
7           light sources in the same way?

8                       MR. TURNER: Objection. Calls for  
9           speculation.

10                      THE WITNESS: I don't know.

11 BY MR. FITZSIMMONS:

12 Q.       So you don't know whether operating the three light  
13           sources in the same way fits the term "optimal use"  
14           in claim 20 of the '503 patent?

15 A.       I'm not sure what "fits the term 'optimal use'"  
16           means.

17 Q.       So claim 20 recites "determine optimal use of the  
18           differently aimed directional light sources,"  
19           correct?

20 A.       Yes.

21 Q.       Would that be satisfied if the at least three  
22           directional light sources were operated in the same  
23           way?

24                      MR. TURNER: Objection. Vague. Calls  
25           for speculation.

1 THE WITNESS: I don't think this claim  
2 puts any particular constraints on how these light  
3 sources are operated. I suppose, you know,  
4 thinking about your question off the top of my  
5 head, there might be a specific situation where  
6 operating them in the same way would be the  
7 optimal, but I don't really know.

8 BY MR. FITZSIMMONS:

9 Q. In your opinion, might there also be a specific  
10 situation where operating the at least three light  
11 sources at different intensities would provide  
12 optimal use as recited here in claim 20?

13 MR. TURNER: Objection. Vague.

14 THE WITNESS: Well, again, the claim  
15 doesn't specify anything about how they're  
16 controlled, but given that it doesn't, I suppose  
17 there would be cases where controlling them  
18 differently would be the right thing to do.

19 BY MR. FITZSIMMONS:

20 Q. Okay. Still in the same general clause -- just as  
21 a refresher, back in column 98, lines 14 through  
22 19.

23 What is your understanding that the phrase  
24 "maximize vehicle operator visibility" means?

25 A. I think to provide illumination that does the best

1 job it can to make the scene in front of the driver  
2 very visible.

3 Q. And how would a person skilled in the art determine  
4 what maximize is, vehicle operator visibility?

5 MR. TURNER: Objection. Calls for  
6 speculation.

7 THE WITNESS: Sorry. The question is how  
8 are they determined? I suppose it could be  
9 determined through experimentation, there may well  
10 be guidelines available, there may be regulations  
11 available that would be helpful in determining good  
12 and maximal visibility in certain situations.

13 BY MR. FITZSIMMONS:

14 Q. Does maximizing vehicle operator visibility as  
15 recited here in claim 20 require that the light  
16 sources are all operating at their maximum  
17 intensities?

18 A. That would depend on the sources and the situation.

19 Q. And so you're saying that it would be situationally  
20 dependent; is that fair?

21 A. Yeah, as an example, like I said earlier, at midday  
22 on a bright sunny day, it would not require the  
23 sources be run at full intensity, so yeah, there  
24 are times when it would not.

25 Q. Does maximizing vehicle operator visibility then

1 require that all of the light sources are on?

2 MR. TURNER: Objection. Vague.

3 THE WITNESS: I haven't thought through  
4 all of the contingencies or possible situations in  
5 maximizing vehicle operator visibility, but off the  
6 top of my head, I would say again, in certain  
7 circumstances they wouldn't have to be on, like in  
8 midday, but that's a -- it depends on the  
9 situation.

10 MR. TURNER: We've been going about an  
11 hour and a half here. Can we do a break?

12 MR. FITZSIMMONS: Can we go like five  
13 more minutes? That will be a good stopping point.

14 BY MR. FITZSIMMONS:

15 Q. Still on this term "maximize vehicle operator  
16 visibility." So from what we've discussed, would  
17 that change depending on weather conditions, for  
18 example, rain or snow or fog, how you maximize the  
19 vehicle operator visibility?

20 A. In general, yes, it could, depending on things like  
21 that.

22 Q. And the term here "minimizing a disturbing effect  
23 resulting from the illumination output," do you see  
24 that one in column 98, about lines 17 or 18?

25 A. Yes.

1 Q. Is minimizing a disturbing effect the same thing as  
2 reducing glare, in your opinion?

3 A. I don't know if they're the same thing, but I think  
4 reducing glare would be an example of this.

5 Q. How would a person skilled in the art determine how  
6 to minimize a disturbing effect resulting from  
7 illumination output?

8 MR. TURNER: Objection. Vague. Calls  
9 for speculation.

10 THE WITNESS: I guess it would depend on  
11 the particular situation, but in general, someone  
12 could, on experiments, determine what is annoying  
13 to people in different situations. There is  
14 also -- at various points of time, there have  
15 been regulations or standards regarding glare  
16 specifically, so there are various potential  
17 sources of information for that.

18 BY MR. FITZSIMMONS:

19 Q. The last part here in claim 20, and then we can  
20 take a break. It says "Direct the control  
21 circuitry to adjust the directional light sources  
22 to achieve the determined optimal use." Do you see  
23 that there in claim 20?

24 A. Yes.

25 Q. How does the control circuitry in claim 20 adjust

1 the directional light sources?

2 A. I don't recall how much detail there is  
3 specifically about this in the patent  
4 specification, but in general, I think that's  
5 generally done by modifying the voltage level that  
6 would go to a light source.

7 Q. Is there anything else?

8 A. Anything else that might be done to control?

9 Q. Correct. Of how the control circuitry would adjust  
10 the directional light sources.

11 A. I think any adjustments would be made through  
12 voltage changes, so that's the only direct way of  
13 doing it that I can consider, that I can think of  
14 at the moment.

15 MR. FITZSIMMONS: Okay. Let's take a  
16 break.

17 (Whereupon a break was taken  
18 from 11:00 a.m. to 11:16 a.m.)

19 MR. FITZSIMMONS: Welcome back.

20 BY MR. FITZSIMMONS:

21 Q. We'll now turn to claim 59 in the '503 patent,  
22 column 102, starting at line 14. And you would  
23 agree that claim 59 is directed to a vehicle  
24 headlight system like claim 20?

25 A. Yes.

1 Q. And if we look at column 102, lines 21 to 24, do  
2 you see where it says, "One or more sensors  
3 configured to sense information, at least a portion  
4 of the sensed information indicating a second  
5 vehicle..." Do you see that?

6 A. Yes.

7 Q. Claim 59 recites "indicating a second vehicle"  
8 whereas claim 20 recited "a detected vehicle." Do  
9 you recall that?

10 A. Yes.

11 Q. In your opinion, is there any difference between a  
12 detected vehicle in claim -- sorry. In claim 20,  
13 where sensor data was processed to determine, first  
14 subsection, "including the detected vehicle" and  
15 the language in claim 59 "indicating the second  
16 vehicle"?

17 MR. TURNER: Objection. Vague.

18 THE WITNESS: So these two phrases seem  
19 to be in different contexts, different parts of the  
20 claims and they're different words, so I would say  
21 they're different.

22 BY MR. FITZSIMMONS:

23 Q. How would you say that they're different?

24 A. Those things I just said. I think they're in  
25 different parts of the claims and they are

1 different words, so used different, so they're just  
2 different.

3 Q. What do you mean by they're in different parts of  
4 the claims?

5 A. If I'm looking at the right places, in claim 20,  
6 the phrase "detected vehicle," which I think is the  
7 phrase you were referring to, is maybe two thirds  
8 down in -- two thirds into the claim, talking about  
9 in the first subsection "including a detected  
10 vehicle."

11 In 59, it's in what I think is the second  
12 limitation of the claim and the wording is just  
13 different around it, so maybe I just need a more  
14 precise question if you want me to compare them.

15 Q. No, that's fine.

16 Let's go to claim 59, line -- starting at  
17 line 29 and break this into -- parse this into two  
18 pieces here starting with the term "light output."  
19 Can you read that for me through the first  
20 subsection?

21 A. Through that in line 35?

22 Q. Line 33, I believe it is.

23 A. Okay.

24 Q. Before "and."

25 A. "Determine light output for the headlight system

1           that aims illumination at the first subsection, the  
2           illumination aimed at the first subsection  
3           substantially resulting in light below a first  
4           predefined illuminance in the first subsection."

5 Q.       And what is your understanding of the term

6           "illumination aimed" at the first subsection?

7 A.       I would understand that to mean illumination that  
8           is coming from the vehicle headlight system that is  
9           primarily in the direction of this first  
10          subsection.

11 Q.      And can that illumination be from multiple light  
12          sources?

13 A.      It seems like it can.

14 Q.      In claim 59 here, what does -- what is your  
15          understanding of the term "predefined illuminance"?

16 A.      Generally, a level, perhaps a numeric level,  
17          defined in advance related to how much light energy  
18          is hitting the area out in the world that it's  
19          aimed at.

20 Q.      You said "perhaps a numeric level." Is a numeric  
21          level or value required for the predefined  
22          illuminance recited in claim 59?

23 A.      Claim 59 doesn't state any requirement on it.

24 Q.      If a light source is off, would the illuminance in  
25          it be below a predefined illuminance?

1 A. No, because it wouldn't be emitting any  
2 illuminance.

3 Q. So is not emitting illuminance below a predefined  
4 illuminance?

5 A. They're just different animals. Predefined  
6 illuminance is with respect to a certain amount of  
7 illuminance, so something that doesn't emit  
8 illuminance is not a certain amount of illuminance,  
9 so they're just comparing different things.

10 Q. Would the amount be zero illuminance?

11 A. I don't think that's a feasible way of thinking  
12 about this. We could all say an amount is zero  
13 elephants, but it's not really -- measuring  
14 elephants here wouldn't make sense.

15 Q. So in your analogy, if my predefined level of  
16 elephants is five, isn't zero elephants below that  
17 predefined level?

18 A. Something that doesn't emit elephants is not  
19 comparable on the scale of elephants. To complete  
20 that analogy, it would be the elephant aimed at the  
21 first subsection and in this case there is no  
22 elephant aimed at the first subsection, so we can't  
23 really compare these things.

24 Q. Does the '503 patent, from your recollection,  
25 define the term "predefined illuminance"?

1 A. I would have to look through it. I don't recall.

2 Q. Turn to the sort of second piece of that larger  
3 element of claim 59, so now column 102, starting at  
4 line 33, I believe it is. It says, "and that aims  
5 illumination." Do you see that?

6 A. Yes.

7 Q. Can you read that remaining part of that larger --  
8 down through "second subsections"?

9 A. "...and that aims illumination at one or more  
10 second subsections of the field of view to either  
11 side of the first subsection, the illumination  
12 aimed at the one or more second subsections  
13 substantially resulting in light above the first  
14 predefined illuminance and the one or more second  
15 subsections."

16 Q. What is your understanding of "light above the  
17 first predefined illuminance" in claim 59?

18 A. An amount of light that is higher than the  
19 threshold or the level that has been defined.

20 Q. Both of these two parts of this element that we  
21 were discussing recite "substantially resulting in  
22 the light either below or above that first  
23 predefined illuminance level."

24 What does claim 59 mean by substantially  
25 resulting in that light level above or below that

1 illuminance?

2 A. I think in general it means -- it's a meaningful  
3 difference in terms of -- in terms of the  
4 subsection overall and in terms of level of the  
5 light. So for example, just a little bit of the  
6 light being above that level would not be adequate,  
7 so a good amount of it has to be.

8 Q. How much of the light subsection needs to be either  
9 below or above the predefined illuminance to be a  
10 good amount of it, as you call it?

11 MR. TURNER: Objection. Calls for  
12 speculation.

13 THE WITNESS: I don't know if I have a  
14 precise answer to that. When light is being  
15 measured, to know, for example, the quantity of  
16 light or the location of light, quantity at a  
17 particular location, there are different ways it  
18 can be measured temporally and spatially and such,  
19 so I think, for example, one could measure light  
20 where at a particular moment of time and a  
21 particular tiny location, there would not be an  
22 adequate reading, but that overall in any  
23 substantial, non-trivial period of time and spatial  
24 area, it would clearly be above the threshold in  
25 this case. So I haven't thought too much about the

1 particular details of that word in this context  
2 here, but that makes sense to me.

3 BY MR. FITZSIMMONS:

4 Q. What's your understanding of the purpose of having  
5 this predefined illuminance that's recited in claim  
6 59?

7 MR. TURNER: Objection. Vague. Calls  
8 for speculation.

9 THE WITNESS: I don't think I wrote about  
10 its purpose in my declaration and I haven't really  
11 thought about that, but in general, it would seem  
12 to be to make sure that some areas are receiving  
13 more light and some areas are receiving less light,  
14 being compatible with the other things we've  
15 already talked about in terms of optimum lighting  
16 and being annoying to drivers, whatever terms we  
17 used for that before.

18 BY MR. FITZSIMMONS:

19 Q. Let's turn now to claim 26, column 98 of the '503  
20 patent, starting around line 43. And you would  
21 agree that claim 26 is directed to an -- excuse  
22 me -- generating a headlight beam in an adaptive  
23 headlight system, correct?

24 A. Yes.

25 Q. And if we look in column 98, lines 59 -- starting

1 at line 59, do you see the term there "directional  
2 light clusters"?

3 A. Yes.

4 Q. And what's your understanding of a light cluster in  
5 the context of claim 26?

6 A. A grouping of light elements.

7 Q. Does the grouping of light elements need to have  
8 more than one light element to be a light cluster?

9 MR. TURNER: Objection. Calls for  
10 speculation.

11 THE WITNESS: I don't know if that is  
12 defined in the patent, so I'm not sure.

13 BY MR. FITZSIMMONS:

14 Q. Claim 26 recites here "one or more directional  
15 clusters," correct?

16 A. Yes.

17 Q. So the claim is actually only requiring one light  
18 cluster, correct? There could be more, but  
19 claim 26 only requires one light cluster to be  
20 satisfied, correct?

21 MR. TURNER: Objection. Compound.

22 THE WITNESS: That part of claim 26 says  
23 one or more, so I guess it doesn't require more.  
24 Is that your question?

25 MR. FITZSIMMONS: Correct.

1 THE WITNESS: That part of the claim.

2 BY MR. FITZSIMMONS:

3 Q. And so claim 26 doesn't require more than one light  
4 cluster, correct?

5 MR. TURNER: Objection. Vague.

6 THE WITNESS: In the phrase we were just  
7 talking about, it doesn't require more than one.

8 BY MR. FITZSIMMONS:

9 Q. What makes a light cluster directional as recited  
10 there on line 60 of column 98?

11 A. Generally that there's more light energy being  
12 emitted in some directions than others.

13 Q. Look at the next element in claim 26, line 63,  
14 where it says, "...the headlight beam spatial light  
15 distribution shaped to provide high beam  
16 illumination for a driver of the vehicle." Do you  
17 see that?

18 A. Yes.

19 Q. What does the phrase -- what's your understanding  
20 of the phrase there "shaped to provide high beam  
21 illumination" mean?

22 A. In general, there tend to be different kinds of  
23 lights, light devices in vehicles that are used for  
24 different purposes -- for example, high beams, low  
25 beams, parking lights, et cetera -- and they all

1           tend to have somewhat different spatial light  
2           distributions, so I believe here it's essentially  
3           saying that the spatial light distribution for this  
4           one would be similar to a headlight high beam  
5           illumination, not one of the others.

6   Q.       And how is the headlight beam shaped in order to  
7           provide high beam illumination?

8                       MR. TURNER:  Objection.  Vague.  Calls  
9           for speculation.

10                      THE WITNESS:  You're asking what the  
11           shape or how is the light modified?  Maybe be more  
12           specific, please.

13  BY MR. FITZSIMMONS:

14  Q.       How would the headlight beam spatial distribution  
15           be shaped differently between high beam  
16           illumination and low beam illumination?

17                      MR. TURNER:  Objection.  Vague.  Calls  
18           for speculation.

19                      THE WITNESS:  I don't believe I provide  
20           an opinion on the distinctions between these  
21           distributions in my declaration, but off the top  
22           of my head, they tend to be pointed somewhat  
23           differently in the vertical direction.  There  
24           might be a difference in the overall light level as  
25           well and the overall shape that the light would

1 produce.

2 BY MR. FITZSIMMONS:

3 Q. What do you mean by "the overall shape that the  
4 light would produce"?

5 A. In that comment there, I meant essentially the  
6 boundary within which it produces light.

7 Q. Let's go now to claim 65, back in column 102,  
8 starting there, but it goes on to column 103.

9 You would agree that claim 65 is  
10 directed to a method for generating a  
11 headlight beam and adaptive headlight system,  
12 correct?

13 A. That's right.

14 Q. Okay. And if we go down to column 103 for  
15 claim 65, lines 1 through 9 again recite an  
16 element where -- or "substantially illuminating  
17 below and above a predefined illuminance," is that  
18 correct?

19 A. I see that it talks about that, yes.

20 Q. Is your understanding of the element here in  
21 column 103, line 1 through line 9, the same as it  
22 was for the terms in claim 59?

23 MR. TURNER: Objection. Vague.

24 THE WITNESS: The term "predefined  
25 illuminance" seems to be about the same.

1 BY MR. FITZSIMMONS:

2 Q. And if we look at column 103, lines 10 through 14,  
3 more specifically where it says "Determining  
4 control instructions for controlling one or more  
5 directional light sources included in the adaptive  
6 headlight system," there. The term "directional  
7 light sources."

8 A. Yes.

9 Q. Does a directional light source, from your  
10 understanding of the claim, include an optical  
11 element?

12 A. The claim doesn't say anything about an optical  
13 element.

14 Q. So in your opinion then, the claim doesn't  
15 specifically include or exclude an optical element  
16 as part of a directional light source?

17 A. The claim doesn't say that specifically.

18 Q. And go now to claim 1, which is column 95. It  
19 starts around line 40. And you agree that claim 1  
20 is directed to a vehicle headlight system that has  
21 one or more headlamps, correct?

22 A. Yes.

23 Q. Now claim 1 here also recites a plurality of light  
24 clusters, line 40 through 43, I believe it is,  
25 column 95. Is your understanding of light clusters

1 here the same as it was for claim 26?

2 A. Yes, I think the phrase "light clusters" is  
3 basically the same thing.

4 Q. Is there a difference between a light cluster and a  
5 light source, in your opinion?

6 A. They're not the same words; they're not exactly the  
7 same thing.

8 Q. In the context of the '503 patent claims, is there  
9 a difference between the terms "light clusters" and  
10 "light sources"?

11 A. Yes, they're not exactly the same thing.

12 Q. What, in your opinion, is the difference between  
13 light clusters and light sources in the '503 patent  
14 claims?

15 A. I don't think I opine on that difference in my  
16 declaration, but off the top of my head, they're  
17 just different phrases. One is focusing on a  
18 grouping aspect and one is focusing on light  
19 emitting from something.

20 Q. When you say "a grouping aspect," what do you mean  
21 by that?

22 A. I think I responded to an earlier question about  
23 light clusters, something like it's a grouping.  
24 The word cluster is about organization -- a spatial  
25 organization; the word source is about something

1           that provides light.

2   Q.     So light clusters is something like grouping. A  
3           grouping of what?

4   A.     The grouping of light sources.

5   Q.     Still in claim 1, column 95, now down at lines 55  
6           through 60. Can you read there for me, starting  
7           at "Logical controller" through the beginning of  
8           line 61?

9   A.     "Logical controller including a processor, the  
10           processor in communication with a memory storing  
11           one or more algorithms with the sensors and with  
12           the control circuitry, wherein the processor is  
13           configured to process the one or more algorithms  
14           and the sensor data to determine an illumination  
15           for at least two of the subsections."

16   Q.     To your recollection, the '503 patent doesn't  
17           disclose any actual underlying algorithms to  
18           determine illumination for headlights, correct?

19                   MR. TURNER: Objection. Vague.

20                   THE WITNESS: I don't recall at the  
21           moment what it says or may not say about the  
22           algorithms.

23   BY MR. FITZSIMMONS:

24   Q.     You agree that algorithms to determine illumination  
25           for headlights are something that a person skilled

1 in the art would have understood how to implement,  
2 correct?

3 A. When specifically?

4 Q. What do you mean by when?

5 A. You asked me if a person of ordinary skill in the  
6 art would understand. That understanding of a  
7 person of ordinary skill in the art changes over  
8 time, so when are you referring to?

9 Q. Sure.

10 As of the earliest possible priority date  
11 of the '503 patent, which I believe is 2002, would  
12 a person skilled in the art have understood how to  
13 implement algorithms to determine illumination for  
14 headlights?

15 A. Such a person would understand that that kind of  
16 thing might be possible, but it would depend on the  
17 specific situation of the imaging details, what  
18 range of road and driving conditions would have  
19 been of interest, so there are a number of things  
20 that it could perhaps depend on.

21 Q. You used the term "range of road." What do you  
22 mean by that?

23 A. I think I said "range of road conditions."

24 Q. I see. "Range of road and driving conditions."

25 I see.

1 A. Do you want me to explain that?

2 Q. Now I understand.

3 So a person skilled in the art would take  
4 into account this range of road and driving  
5 conditions when implementing an algorithm to  
6 control the illumination of headlights; is that  
7 correct?

8 A. That's not specifically what I said, but it would  
9 be wise for such a person to take that sort of  
10 thing into consideration.

11 Q. Now we're to claim 37, so that's column 100,  
12 starting at line 3. And you would agree that  
13 claim 37 is directed to a vehicle headlight system  
14 having a plurality of -- sorry. Rephrase that.

15 You would agree that claim 37 is directed  
16 to a vehicle headlight system having one or more  
17 headlamps, correct?

18 A. Yes.

19 Q. Okay. Now if we look at lines 19 through 26,  
20 column 100, can you read that for me starting with  
21 "such that"?

22 A. "...such that a headlight beam adapted to the  
23 pattern substantially illuminates the first  
24 subsection of the field of view, including at least  
25 a portion of the second vehicle with an illuminance

1 below a predefined threshold value, while the beam  
2 substantially illuminates at least the one or more  
3 second subsections of the field of view to either  
4 side of the first subsection with an illuminance  
5 above the predefined threshold value."

6 Q. Thanks.

7 And so here, claim 37 recites an  
8 illuminance below and above a predefined threshold  
9 value, correct?

10 A. Yes.

11 Q. The claim doesn't specify what that threshold value  
12 is, correct?

13 A. The claim does not state a specific threshold  
14 value; that's correct.

15 Q. Would a person skilled in the art know if there  
16 are units associated with that threshold value?

17 MR. TURNER: Objection. Calls for  
18 speculation.

19 THE WITNESS: I haven't thought about  
20 that question before and it seems a little  
21 complicated because that threshold value is  
22 specific to a system and a general person skilled  
23 in the art wouldn't necessarily know all the  
24 details of that system, so it's just hard to answer  
25 what that person might know.

1 BY MR. FITZSIMMONS:

2 Q. And that system you're referring to here is the  
3 system recited in claim 37 of the '503 patent,  
4 right?

5 A. I think that's the system you were asking about,  
6 right.

7 Q. And you reviewed the '503 patent specification,  
8 right?

9 A. I have, yes.

10 Q. So I'm asking you what your understanding of that  
11 term "threshold value" is and whether it has units  
12 associated with it. So what is your response to  
13 that?

14 MR. TURNER: Objection. Vague.

15 THE WITNESS: The claim doesn't say  
16 anything about units. I don't recall offhand if  
17 the specification talks about units, so I'm just  
18 not sure.

19 BY MR. FITZSIMMONS:

20 Q. In your opinion, would a person of ordinary skill  
21 in the art understand whether or not the threshold  
22 value in claim 37 has units associated with it?

23 A. This is not something I thought about before,  
24 again, but it just doesn't say anything about  
25 units, so I'm not sure.

1 Q. You said you haven't thought about this before.

2 Then how did you determine whether or not this  
3 limitation was disclosed in the prior art?

4 A. I think these are two separate issues. The  
5 question was about limits. I don't believe the  
6 claim uses that word, right? Sorry, did I --

7 Q. Units.

8 A. Units. Sorry.

9 Q. So if we're looking at the term "threshold value,"  
10 "predefined threshold value," here in claim 37,  
11 right?

12 A. Right.

13 Q. How did you determine whether or not the prior art  
14 you evaluated disclosed a predefined threshold  
15 value?

16 A. I would have to look in my declaration to see what  
17 I stated about that. I don't recall offhand about  
18 predefined threshold values.

19 Q. In order to make that determination, you would need  
20 to understand what the term "predefined threshold  
21 value" means; do you agree?

22 A. We need to have an understanding of that term, yes.

23 Q. So what's your understanding of "predefined  
24 threshold value" here in claim 37?

25 A. Generally, it means a value that is determined

1 ahead of time and is going to be used to decide if  
2 something is above it or below it.

3 Q. Does a value require there to be a number?

4 A. I don't believe this patent says anything  
5 specifically about numbers in this context, so just  
6 generally, as a general question, I suppose there  
7 are a number of ways one could determine whether  
8 something is below a threshold or not, including  
9 numbers, but other quantities as well, but again,  
10 that's not really relevant to the details of the  
11 patent.

12 Q. Well, it is relevant to the details of the patent  
13 because we're talking about the term "predefined  
14 threshold value" and I'm trying to understand what  
15 your understanding of that term is.

16 So in the context of claim 37 in the  
17 '503 patent, is it your opinion that predefined  
18 threshold value requires that there be a number  
19 below and above which there's an illuminance?

20 A. Well, the claim here does not use the word  
21 "number," and as I think I said, I don't recall  
22 what the patent specification might say about that,  
23 but I don't recall any discussion about numbers.  
24 So yeah, I don't know if this requires a number or  
25 not.

1 Q. Let's put down the '503 patent for now and have you  
2 locate there your 197 proceeding second  
3 declaration, so Exhibit 2006 in the 197 proceeding.  
4 Do you have that one?

5 A. Yes.

6 Q. And let's go to page 40. This is -- you have a  
7 heading there, "Overview of the '503 Patent." Do  
8 you see that?

9 A. Yes.

10 Q. As a general matter -- and you can check if you'd  
11 like -- your overview of the '503 patent in  
12 your 197 declaration is consistent with the  
13 overview of the '503 patent provided in your 328  
14 and 335 declarations; is that correct?

15 A. I believe that's correct.

16 Q. If you could please refer to the last sentence of  
17 paragraph 48 on the next page -- actually two pages  
18 down, so page 42. It scans the pages. I believe  
19 the very bottom of page 41, starting with, "The  
20 '503 patent..." Can you read that for me, please?

21 A. "The '503 patent describes using a digital light  
22 fixture (DLF) to provide multiple functions, for  
23 example, 'in A DLF, it is possible to combine a  
24 task light having a very narrow spot beam at the  
25 correct aiming with a general area lighting flood

1 beam into one fixture.'" "

2 Q. What is a digital light fixture in the '503 patent?

3 A. Sorry, you said what is it? I believe the '503  
4 patent defines that. Let me find it.

5 Q. Sure.

6 A. Well, I can't quickly find and don't recall if  
7 there's a specific definition for digital light  
8 fixture, but there is, in column 2, a definition of  
9 a lighting fixture, and then further down in  
10 level 2, a discussion about the term digital and  
11 how it is used here. So these two together give a  
12 good sense of that. I mean, whether there's a  
13 specific definition of DLF or digital light fixture  
14 elsewhere, I don't recall at the moment.

15 Q. Okay. The claims of the '503 patent do not recite  
16 the term "digital light fixture," is that correct?

17 A. I would have to look to check, but from my  
18 recollection, they don't.

19 Q. The passage we just read from your declaration  
20 talks about a very narrow -- where you recite a  
21 very narrow spot beam. Do you see that?

22 A. Yes.

23 Q. Okay. What is a very narrow spot beam?

24 A. I think in general it's referring to a relatively  
25 high intensity beam that doesn't have a large field

1 of view or extant.

2 Q. It says here the spot beam is provided at the  
3 correct aiming. In the context of a headlamp  
4 system, how would you correctly aim a very narrow  
5 spot beam?

6 A. It depends on what kind of headlamp system it is.

7 Q. How would the type of headlamp system impact that?

8 A. Well, for example, if it's an incandescent  
9 lamp-based headlight system, it might be done by  
10 the reflectors in the housing that it's in  
11 primarily, a mechanical orientation of it. In a  
12 different technology, like an LED-based array, it  
13 could be based on the control of the various LEDs  
14 or their -- any number of possibilities of how it  
15 could be done.

16 Q. In the next paragraph, paragraph 49 -- and for now  
17 we're still in your 197 declaration, Exhibit 2006,  
18 so I'll try to let us know if we change from that.

19 You mentioned the '503 patent described  
20 using a multi-LED light source that provides  
21 optimized illumination. Do you see that?

22 A. Yes.

23 Q. What do you consider to be optimized illumination  
24 as you refer to it there?

25 A. Well, a statement in the patent talks about

1 optimized illumination and I'm trying to recall if  
2 it defines it in the specification or not. My use  
3 of it there would certainly be consistent with how  
4 the patent uses it, so I would have to look through  
5 the patent.

6 Q. You have a few cites there, so perhaps it's one of  
7 those, if you'd like to look at that.

8 A. I don't recall if any of those would be the first  
9 usage or the definition of it, if that does exist  
10 in the patent, but I'll check those.

11 Yeah, those citations don't include a  
12 definition or a description of optimize, which is  
13 what you're asking about. So again, I don't recall  
14 if that is anywhere in the patent. If it is,  
15 that's what I would have been focused on and using  
16 in this statement and other places that I use it  
17 here.

18 Q. The term "optimized illumination" is not in quotes  
19 here. Is there a reason that you chose the term  
20 "optimized illumination"?

21 A. I think I chose it because it is in the patent.

22 Q. So your understanding is that the patent refers to  
23 optimized illumination?

24 A. My recollection is that it does. Again, like I  
25 said, I don't know for sure what it says about that

1 word.

2 Q. Okay. From your understanding, how would a person  
3 skilled in the art go about achieving optimized  
4 illumination when discussing what the '503 patent  
5 describes here?

6 MR. TURNER: Objection. Calls for  
7 speculation.

8 THE WITNESS: The general -- the patent  
9 describes lots of different kinds of illumination  
10 and illumination situations. I expect that some of  
11 them might have standards that a person of ordinary  
12 skill in the art could refer to; in other cases,  
13 there might be experimentation that a person of  
14 ordinary skill in the art would do testing to  
15 determine that, but I'm not really sure exactly  
16 what someone would do.

17 BY MR. FITZSIMMONS:

18 Q. In the next paragraph here, paragraph 50, you have  
19 a quote from a section of the '503 patent, column  
20 52, line 58 to column 53, line 2, correct?

21 A. Yes.

22 Q. This quoted section describes detecting headlights  
23 of another vehicle to determine where to aim the  
24 light beam, correct?

25 A. Yes.

1 Q. And in parentheses there in that quote, it states  
2 that headlights are used for the basis of the  
3 analysis that it says in that sentence; is that  
4 correct?

5 A. That it's an example of that.

6 Q. And so using headlights as an example, the '503  
7 patent includes for a way to detect another  
8 vehicle, correct?

9 A. In this discussion here, it's proposing using  
10 headlights as an example of determining vehicle  
11 position.

12 Q. Okay.

13 A. And I would need to read the full context to know  
14 if there are other constraints here, but for  
15 example, this could be if a system had detected a  
16 car previously using maybe some other methods, its  
17 headlights could perhaps be tracked and used to  
18 know the position -- this is particularly about  
19 position -- so I don't know if this is referring to  
20 a specific part of a system or a full detection or  
21 what, but it does discuss this using headlights as  
22 an example.

23 Q. Okay. Those other things you just mentioned though  
24 aren't described in this passage, correct, that you  
25 quoted?

1 A. Not in the passage itself. That's why I was  
2 wondering about the context of this.

3 Q. Okay. And in this passage, it also says you're  
4 determining "which exact beaming is the maximum  
5 allowable for any given traffic situation and road  
6 layout." Do you see that?

7 A. Yes.

8 Q. So then the '503 patent here is describing that the  
9 maximum light allowed may be different depending on  
10 certain variables such as traffic situation and  
11 road layout, correct?

12 A. Yeah, that sounds right.

13 Q. Paragraph 51 of your 197 declaration, you have  
14 another quote here from the '503 patent. Do you  
15 see that?

16 A. Yes.

17 Q. It's actually on the next page, page 43. You're  
18 quoting from the '503 patent, column 53, lines 3  
19 through 8.

20 Now this quote discusses using patent  
21 recognition to determine a road sign, for example,  
22 correct?

23 A. Yes.

24 Q. At the time of the '503 patent, would a person  
25 skilled in the art have known the pattern

1 recognition techniques for recognizing or  
2 determining a road sign?

3 A. A person would generally know what kind of pattern  
4 recognition techniques should be explored or looked  
5 at to try to achieve that.

6 Q. This quote also discusses properly aiming the light  
7 beam; is that right?

8 A. It doesn't discuss the aiming, but it says there  
9 are properly aimed beams, sources.

10 Q. So this passage discusses having properly aimed  
11 sources to follow and illuminate, for example, road  
12 signs, right?

13 A. That's right.

14 Q. In the '503 patent claims, the LEDs or light  
15 sources in the headlamps are fixed in their  
16 position; is that correct?

17 A. Yes; that's correct.

18 Q. So they don't physically move or rotate; is that  
19 correct?

20 A. That's correct.

21 Q. Okay. So if the light sources in the '503 patent  
22 are fixed, what's your understanding of how the  
23 '503 patent's headlamp systems aim the light here,  
24 the SLS, to follow and illuminate distant overhead  
25 and roadside signs?

1 MR. TURNER: Objection. Vague.

2 THE WITNESS: I haven't thought about the  
3 specific way they do it or might do it, but in  
4 general, in this kind of setup, it would be  
5 changing the control of the LEDs in order to make  
6 sure the illumination follows the sign.

7 BY MR. FITZSIMMONS:

8 Q. And when you say by changing the control of the  
9 LEDs, what do you mean by that?

10 A. Modifying the control signals being sent to the  
11 LEDs.

12 Q. What does modifying the control signal to the LEDs  
13 do?

14 A. It changes their output.

15 Q. And how does changing the output of the LEDs allow  
16 the system to follow and illuminate, for example, a  
17 roadside sign?

18 A. Well, I'll give you an analogy and you can ask for  
19 more if you'd like, but we could have a projector  
20 projecting on the wall there and that projector  
21 could be showing a white ball moving from left to  
22 right on the wall there and that would be done,  
23 that -- illuminating the wall, which is essentially  
24 tracking or sorry, following the -- what's the  
25 phrase here? Following the illuminate, this ball

1 along the wall, would be being done by the LED or  
2 whatever SLS or ray by changing the controls to  
3 the elements. So when you change the outputs, when  
4 you control the outputs, you can produce a  
5 situation like is being described in this  
6 paragraph.

7 Q. When you're changing the outputs, are you turning  
8 some of the LEDs off to do that?

9 A. It would depend on the situation exactly, what  
10 changes are being made, so I can't say in general.

11 Q. In paragraph now 52, you mentioned anti-glaring  
12 illumination output. Do you see that?

13 A. Yes.

14 Q. What do you mean by that?

15 A. Illumination that won't -- coming from the headlamp  
16 that won't be too annoying or distracting to  
17 drivers of other vehicles.

18 Q. How would a person skilled in the art achieve  
19 anti-glaring illumination output in the -- with the  
20 headlamp systems claimed in the '503 patent?

21 MR. TURNER: Objection. Calls for  
22 speculation.

23 THE WITNESS: I don't recall what  
24 specifically the patent discloses or says about  
25 this process, so I'm not sure.

1 BY MR. FITZSIMMONS:

2 Q. In the same paragraph, 52, you say that this output  
3 is to "optimize illumination for the vehicle  
4 operator under a myriad of driving situations  
5 whilst reducing glaring illumination for oncoming  
6 vehicles." Do you see that?

7 A. Yes.

8 Q. What are some examples of the myriad of driving  
9 situations that the headlamp system should account  
10 for?

11 A. I don't know if the patent lists them. In general,  
12 there are all kinds of driving situations which I  
13 think the patent would be applicable to. So just  
14 as an example -- I've not really thought through a  
15 list or anything before -- generally driving at  
16 night, of course, as we're talking about headlamps  
17 here, driving when there are cars close in front of  
18 you at night, driving when there are cars coming at  
19 you in oncoming traffic, a driving situation where  
20 there's a turn coming up or a curve coming up and  
21 you want to be illuminated, really numerous  
22 driving conditions, so I think generally this is  
23 saying that the patent aims to work in those  
24 situations.

25 Q. And a person skilled in the art would be aware of

1 all these conditions that you would be trying to  
2 account for; is that right?

3 A. Well, again, I don't know if the patent lists them  
4 specifically, so I think this is -- if not, I don't  
5 think it does -- this would be a general term, so I  
6 don't know if the person of ordinary skill in the  
7 art would have the same list exactly or not.

8 Q. You say there are a myriad of -- myriad of driving  
9 situations. What driving situations did you mean  
10 that to encompass?

11 A. Well, the ones I've already listed. And I don't  
12 think that I, you know, thought through a certain  
13 number and said "That's a myriad." I think what I  
14 mean by that is there are a lot. I think everybody  
15 who drives understands there are a lot of driving  
16 conditions and the patent is not intended to only  
17 work in, you know, one or something like that.

18 Q. Would those driving situations include driving in  
19 fog?

20 A. It could.

21 Q. Would it include driving in heavy traffic?

22 A. Whatever I say to you, if you're going to keep  
23 going on a list, again, we should keep in mind  
24 that, like I said, I did not come up with a  
25 particular list, so this is just sort of off the

1 top of my head at the moment, but yes, I think so.

2 Q. Would it include driving in rain?

3 A. With the same caveat, I think you could include  
4 that.

5 Q. I'm going to ask you a series of questions here and  
6 I want to provide you the context for it as being  
7 as of the earliest possible priority date of the  
8 '503 patent, which is July of 2002.

9 From your understanding, did vehicles at  
10 that time already include headlight systems having  
11 one or more headlamps?

12 A. I believe most did.

13 Q. And did headlamps already include a plurality of  
14 directional light sources?

15 A. The ones that were around then tended to have two  
16 directions vertically, but nothing -- no different  
17 directions horizontally.

18 Q. So did headlamps already include a plurality of  
19 directional light sources at the time?

20 A. In a very limited understanding of directional,  
21 directional only up or down, but not a general  
22 understanding.

23 Q. Now are you, in this context, considering only  
24 vehicle headlamps that were on the market and on  
25 the road? Is that how you were thinking of this?

1 A. So I'm forgetting how you started your original  
2 question, which if you want to remind me of that,  
3 that would help me answer this question.

4 Q. Sure.

5 I believe it was that this was in the  
6 context of as of the earliest possible priority  
7 date of the '503 patent, which was July 2002.

8 A. And then what?

9 Q. And then I asked, did headlamps -- was it known  
10 that headlamps already included a plurality of  
11 directional light sources?

12 A. So are you referring to existing headlamps?

13 Q. On the road you mean?

14 A. Yes.

15 Q. I was referring to was it known in the art more  
16 than a physical product. So I'll rephrase that.

17 So as of the earliest priority date of the  
18 '503 patent, was it known in the art to include a  
19 plurality of directional light sources in  
20 headlamps?

21 A. I still find that a little hard to answer because  
22 of the phrase "to include." Can you be more  
23 specific about what you're asking?

24 Q. To have directional light sources in vehicle  
25 headlamps.

1 A. "To have." That it might be desired, that people  
2 produced it? It still seems a little vague, "to  
3 have."

4 Q. I'm not sure what you find confusing about it.

5 A. For whom to have in what circumstance? It seems  
6 very open-ended, so I'm trying to answer the right  
7 question.

8 Q. Were vehicle headlamps with directional light  
9 sources known in the art before the earliest  
10 priority date of the '503 patent?

11 A. Yes, as I've described before, certainly the  
12 limited case of high beams and low beams having two  
13 vertical directions was known in the art.

14 Q. Are LEDs, in your opinion, directional light  
15 sources?

16 A. They can be.

17 Q. So were vehicle headlamps with LEDs known in the  
18 art before the earliest priority date of the '503  
19 patent?

20 A. They were being considered. I don't believe there  
21 were practical systems being sold and implemented  
22 in cars at the time, although I don't recall for  
23 100 percent certainty, but it was -- the topic was  
24 of interest to people.

25 Q. You would agree at least that there were prior art

1 references, including patents and printed  
2 publications, that disclosed LED light sources in  
3 headlamps before the earliest priority date,  
4 possible priority date of the '503 patent,  
5 correct?

6 A. Some of the references in here are examples of  
7 that, so yes.

8 MR. FITZSIMMONS: Now would be a good  
9 time to break for lunch.

10 MR. TURNER: Okay.

11 (Whereupon a break was taken  
12 from 12:47 p.m. to 1:22 p.m.)

13 MR. FITZSIMMONS: We're back from lunch.  
14 We are now going to turn to the Beam  
15 reference, which is Exhibit 1005 in all three  
16 proceedings. Beam is US Patent No. 6,144,158.

17 (Marked for identification:  
18 Deposition Exhibit No. 1005.)

19 MR. FITZSIMMONS: I'll hand that to you,  
20 Dr. Turk.

21 BY MR. FITZSIMMONS:

22 Q. If you can just confirm that is what we'll refer to  
23 as the Beam reference.

24 A. Yes, it is.

25 Q. And you can see there on the cover page, the title

1 of Beam is "Adaptive/Anti-Blinding Headlights,"  
2 correct?

3 A. Yep.

4 Q. And you would agree that Beam is directed to an  
5 adaptive headlight system for a vehicle, correct?

6 A. Yes.

7 Q. We're going to be talking about Beam and also some  
8 of your declaration here. So if you could turn to  
9 your 197 declaration, Exhibit 2006, and go to  
10 paragraph 66, you are discussing Beam.

11 So in paragraph 66, you identify what you  
12 call a first embodiment of Beam's system, which you  
13 say is shown in Figures 2 and 5, correct?

14 A. That's correct.

15 Q. Okay. And can you provide to me the components  
16 that are shown that are in Figure 2 of Beam's  
17 system?

18 A. It's primarily composed of a lamp and a spatial  
19 light modulator, a camera or sensor, a beam  
20 splitter and a lens or optical system.

21 Q. Can you refer to the reference numbers for those?

22 A. Yeah. The lamp is 202, the spatial light modulator  
23 is 203, the camera or sensor is 107, optical system  
24 is 106. It also includes a beam splitter, 201.

25 Q. Okay. And now if we look in the Beam reference

1           itself and turn to column 4. Column 4, lines 36  
2           through 47, starting with, "Rays from a lamp  
3           202..." Do you see that?

4   A.    Yes.

5   Q.    Could you read that passage for me?

6   A.    Until --

7   Q.    Until line 47, where it ends "controller 108."

8   A.    "Rays from a lamp 202 fall on the surface of the  
9           spatial light modulator 203, mounted on a support  
10          204, where they are either reflected through or  
11          blanked (attenuated by being either absorbed or  
12          deflected to an absorbing surface). If reflected,  
13          they pass through beam splitter 201 and out optical  
14          system 106. Thus, we produce an overall beam  
15          pattern comprising many (in this embodiment, about  
16          300,000) individual narrow-angle microbeams of  
17          light as contrasted with conventional headlights  
18          which produce only a single beam. These microbeams  
19          are arranged in an XY matrix. The angular position  
20          or attenuation of each of these microbeams is  
21          independently set by the controller 108."

22   Q.    And so Beam here is describing that the light rays  
23          from lamp 202 are reflected by the spatial light  
24          modulator, which is 203, in order to produce what  
25          it calls the narrow-angled microbeams of light,

1 correct?

2 A. Correct.

3 Q. And if we look in column 4, a little further down,  
4 still in actually the part you read, so lines 46  
5 through 48, where it says, "The angular position or  
6 attenuation of each of these microbeams is  
7 independently set by the controller 108." Do you  
8 see that?

9 A. Yes.

10 Q. And so Beam is disclosing that the angular position  
11 of the microbeams is independently set by the  
12 controller, correct?

13 A. Not really. It's saying the angular position or  
14 attenuation is independently set by the controller,  
15 so it's making a choice for each one whether it's  
16 attenuated or not.

17 Q. And so that's independently set by the controller  
18 for each of the microbeams, correct?

19 A. Yes.

20 Q. Okay. And if we look a little further down in  
21 column 4 still, lines 48 through 50, it says,  
22 "Controller 108 selectively commands reduction of  
23 the energy of the microbeams falling on a  
24 particular object or objects." Do you see that?

25 A. Yes.

1 Q. Okay. And so this is describing that the energy  
2 of the individual microbeams is set by the  
3 controller 108; is that right?

4 A. By altering its direction. That's how a controller  
5 commands that reduction, yes.

6 Q. Can you explain that for me?

7 A. Yes. I don't think Beam teaches the controller  
8 reducing the microbeams by any other means except  
9 for diverting them by mirror to go out of the  
10 device or to be absorbed inside the device.

11 Q. So when Beam says "Controller 108 selectively  
12 commands reduction of the energy of the  
13 microbeams," it's your opinion the only way Beam  
14 does that is by diverting them by a mirror; is that  
15 correct?

16 A. Yes. And it's the energy of the microbeams falling  
17 on an object, not just the energy itself, but the  
18 energy of the microbeams falling on a particular  
19 object or objects.

20 Q. And so the energy of the microbeams, you're saying,  
21 is adjusted by way of the spatial light modulator;  
22 is that correct?

23 A. The energy of microbeams falling on an object --  
24 and they give eyes of the drivers as an example of  
25 that -- is controlled by the spatial light

modulator.

Q. Okay. In column 4, lines 53 to 57, can you read those for me? "To accomplish this..."

A. "To accomplish this, the spatial locations of the sources are mapped into controller 108 which then commands spatial light modulator 203 and illuminator 109 to either divert the selected microbeams or to attenuate them, depending on the implementation of spatial light modulator 203 chosen."

Q. What's your understanding of what the Beam reference means by "divert the selected microbeams"?

A. To have them reflect off the tiny micro mirror so that they don't leave the device; they're absorbed inside the device.

Q. And what's your understanding of what Beam means by -- let me start there. It also says "or to attenuate them." So what is your understanding of what Beam means by "attenuate the selected microbeams"?

A. Generally when Beam uses the word attenuation of the beams, Beam's referring to this diverting and absorbing.

Q. So is it your opinion that Beam, for example, in

1 the passage we just read here in column 4, lines 53  
2 through 57, divert and attenuate mean the same  
3 thing?

4 A. In this passage here, I actually need to recall  
5 whether it might be discussing another SLM, another  
6 type of SLM, and I'm not remembering at the moment,  
7 so I can look for that.

8 Yeah, I don't recall if Beam talks about  
9 another type of SLM, but above this -- I think  
10 maybe we read this passage before. On line 37 of  
11 column 4, it says "...where they are either  
12 reflected through or blanked (attenuated by being  
13 either absorbed or deflected to an absorbing  
14 surface)."

15 So I think that's the context in which  
16 what we more recently read is to be understood,  
17 that they are either reflected through, meaning  
18 leaving the device to go out into the world, or  
19 blanked, which here in parentheses is referred to  
20 as attenuated by being either absorbed or deflected  
21 to an absorbing surface. So in this context,  
22 blanked does mean attenuated -- I'm sorry,  
23 attenuated does mean blanked, being absorbed or  
24 deflected, deflected to be absorbed.

25 Q. So my question was, what about where Beam is

1           talking about -- at columns 4, lines 53 through 57,  
2           where it says to either divert the microbeams or to  
3           attenuate them, are you taking the position that  
4           divert and attenuate also mean the same thing?

5                     MR. TURNER: Objection. Compound.

6                     THE WITNESS: Yes, in the context of the  
7           paragraph above that I just cited, diverting and  
8           attenuating and blanking are all the same thing.  
9           They're describing the light being diverted by a  
10          mirror to a place that's going to be absorbed and  
11          not end up exiting the device.

12 BY MR. FITZSIMMONS:

13 Q.       Wouldn't it be redundant for the Beam reference  
14       here to say to either divert the selected  
15       microbeams or to attenuate them if divert and  
16       attenuate meant the same thing?

17 A.       I can't speak for how Beam writes, but given the  
18       context of what I just described, it seems to be  
19       the appropriate understanding of that.

20                     And in general, people often say A or B,  
21       where A and B can mean the same thing. I mean, not  
22       everybody speaks that way, but there are plenty of  
23       examples of that. But again, I can't really speak  
24       to how he writes, but in the context of this whole  
25       patent and particularly the paragraph above, that

1           seems to be what is being described here.

2   Q.     In column 4, up above a little bit, line 15 or so,  
3           it says, "Data from sensor 107 are input to a  
4           controller 108, which uses them to determine which  
5           microbeams must be reduced in intensity to protect  
6           the other drivers." Do you see that?

7   A.     Yes.

8   Q.     What is your understanding of the Beam reference  
9           saying that the microbeams must be reduced in  
10          intensity?

11   A.     In general, that means the intensity must be  
12          lowered, and then take the rest of the teaching of  
13          Beam in context, the way it describes doing that is  
14          by blanking it.

15   Q.     In your opinion, what does blanking do to the  
16          intensity of a microbeam?

17   A.     As it's described here, it reduces it completely,  
18          eliminates it.

19   Q.     So if we go back to the passage in column 4,  
20          lines 53 through 57, it's talking about the  
21          controller 108, which then commands spatial light  
22          modulator 203. Do you see that?

23   A.     Yes.

24   Q.     In sending a command controller to the spatial  
25          light modulator, the controller is sending an

1 electronic signal to the spatial light modulator;  
2 is that correct?

3 A. I think so.

4 Q. And therefore the spatial light modulator 203 is  
5 capable of receiving that electronic signal from  
6 the controller 108, correct?

7 A. It should be, yes.

8 Q. I think you mentioned before that the spatial light  
9 modulator 203 can be a digital mirror device; is  
10 that correct?

11 A. Yes.

12 Q. Would each microbeam that's produced by the spatial  
13 light modulator be associated with a particular  
14 digital mirror within that digital mirror device?

15 MR. TURNER: Objection. Vague.

16 THE WITNESS: Yes, each microbeam in the  
17 SLM is associated with a mirror element in the SLM.

18 BY MR. FITZSIMMONS:

19 Q. Still in the Beam reference now, but we'll go to  
20 column 5, towards the bottom, line 61 through 64.  
21 Starting with, "In operation..." Can you read that  
22 for me, please?

23 A. "In operation, the AABH produces a multiplicity of  
24 individually directed narrow-angle beams which are  
25 herein referred to as microbeams, each beam

1 controlled by a processor responsive to incoming  
2 data from an imaging sensor."

3 Q. And so here, Beam is describing that the microbeams  
4 are individually directed, correct?

5 A. Yes.

6 Q. Okay. And here Beam is also describing that  
7 processor is what controls that individual  
8 direction; is that correct?

9 A. Yes, the processor controls whether it's directed  
10 out or to the absorbing surfaces inside.

11 Q. Okay. And still column 5, lines 55 [sic]  
12 through 66, could you read that for me, please?  
13 Starting with "Any microbeams..."

14 A. Fifty-five? So I don't see that in line 55.

15 Q. Sixty-five. I'm sorry.

16 A. To where?

17 Q. Sixty-six.

18 A. "Any microbeams that would blind the oncoming  
19 driver are diverted or attenuated at the source."

20 Q. And so here, Beam is describing that any microbeams  
21 in the system that would blind the driver, they  
22 would be diverted or attenuated at the source; is  
23 that correct?

24 A. That's what it says. It's not the light source  
25 there, but at the source of the beam.

1 Q. Let's turn to your declaration, 197 declaration.  
2 You might already be close to where we're talking  
3 about, paragraph 65.

4 A. Okay.

5 Q. In paragraph 65, you see there you provided an  
6 annotated version of Figure 2 of Beam; is that  
7 right?

8 A. Yes.

9 Q. Okay. And in your annotated drawing of Figure 2,  
10 there is a red line and arrow there, correct?

11 A. Correct.

12 Q. And your annotated red line is intended to  
13 represent a blanked microbeam; is that correct?

14 A. It's intended to represent the path of a microbeam  
15 being diverted, which the patent does refer to as  
16 being attenuated.

17 Q. In red letters, you have "Blanked Microbeam" in  
18 your annotated drawing, right?

19 A. Yes.

20 Q. And that intended to be a label corresponding to  
21 the red line with the arrow?

22 A. The path of the microbeam.

23 Q. Okay. And so your red line is intended to  
24 represent the path of a blanked microbeam; is that  
25 fair?

1 A. Yes.

2 Q. And your annotated red line there shows that the  
3 microbeam that's being blanked is diverted at the  
4 spatial light modulator 203; is that correct?

5 A. Yeah, to be clearer about it, it's not really a  
6 microbeam until it hits the mirror, so it's showing  
7 the path up until there of some light, and then  
8 once it hits the mirror, it is a microbeam and  
9 showing the path of that microbeam from that point  
10 on.

11 Q. And so the spatial light modulator 203 is where the  
12 diversion occurs; is that correct?

13 A. That's right.

14 Q. Does drawing -- this annotated drawing in Beam,  
15 it's not describing or showing that a light beam is  
16 diverted at lamp 202, correct?

17 MR. TURNER: Objection. Vague.

18 THE WITNESS: No, the lamp is the light  
19 source and it's presumably sending light in all  
20 directions, or at least a wide range of directions,  
21 and the red is showing one of those paths and that  
22 path does get diverted by the SLM.

23 BY MR. FITZSIMMONS:

24 Q. In your declaration, skip to paragraph 162. Again,  
25 we're in Exhibit 2006 of your 197 proceeding. So

paragraph 162. Can you read the first sentence there for me, please?

A. "In Beam, incoming light -- which may be associated with any light source, e.g., house lights, street lights, motorcycles, interior vehicle lights, headlights of an oncoming vehicle and/or taillights of a preceding vehicle -- is transmitted through the optical system 106 and detected by a sensor (camera) 107."

Q. Is it your position that Beam will create the dimmed area towards any of the example lights that you list here in paragraph 162?

A. I don't know exactly what Beam would do because there's not much detail about how this works, but Beam could in those cases.

Q. If we look down at paragraph 163, you say, "Beam's AABH system is agnostic to whether the incoming light is from a vehicle, a street light or another light source; it simply blanks all LEDs correlated with the position of the incoming light."

You just said you don't know exactly what Beam would do, but here in paragraph 163, you seem to be saying what you think Beam would do in those situations; is that not correct?

A. Well, what I was saying before is I don't know when

1 Beam would be successful in detecting those things  
2 or not. There's not enough detail for me to  
3 determine that. But if Beam works as described in  
4 general, what it is attempting to do, if it did  
5 detect light from any of those things, it would  
6 blank the LEDs associated with them.

7 Q. So it's your position that if Beam detected a  
8 street light, then it would blank LEDs associated  
9 with that area; is that right?

10 A. I would say if it detected light that came from a  
11 street light, it would do that. It wouldn't know  
12 that it's a street light or a car or whatever.

13 Q. If you go to paragraph 196 in the declaration.  
14 Paragraph 196. Do you see there are two drawings  
15 here between paragraphs 196 and 197?

16 A. Yes.

17 Q. Did you create these drawings?

18 A. I don't think I created them. I created similar  
19 drawings to this and they might have been edited  
20 in -- PowerPoint is what mine were in -- to end up  
21 with these, but I didn't create these initially.

22 Q. Is it your opinion that the drawings shown here  
23 after paragraph 196 are an accurate representation  
24 of how you believe light from Beam's headlamps  
25 would project to the scene?

1 A. So these drawings are, I believe, showing not only  
2 Beam, but a combination of Beam, Thominet and  
3 Kobayashi, but having said that, it is using the  
4 Beam LED array, I believe, and so what's being  
5 shown here is that combination, using Beam, would  
6 behave in this way.

7 MR. FITZSIMMONS: I'm now going to hand  
8 you Exhibit 1006, which is the same exhibit number  
9 in all three proceedings. This is the Thominet  
10 reference. It's US Publication No. 2001/0019486.

11 (Marked for identification:

12 Deposition Exhibit No. 1006.)

13 BY MR. FITZSIMMONS:

14 Q. Can you just confirm that is the Thominet  
15 reference?

16 A. Yes, it is.

17 Q. Okay. At the top of the page, the abstract of  
18 Thominet describes that there is a lighting device,  
19 in particular a headlight, for a motor vehicle,  
20 correct?

21 A. I'm not seeing the phrase "motor vehicle."

22 Q. For a vehicle.

23 A. Sorry. Could you repeat that, please?

24 Q. Sure.

25 The abstract here in Thominet says, "An

1 illumination device for a vehicle..." Do you see  
2 that?

3 A. Yes.

4 Q. Okay. If we look at Figure 1, please, of Thominet.  
5 Figure 1 is showing an illumination device for a  
6 vehicle according to Thominet's invention, correct?

7 A. Correct.

8 Q. And as shown there, Thominet discloses there is a  
9 plurality of semiconductor light sources which are  
10 indicated by reference No. 10 in Figure 1, correct?

11 A. I believe that's right.

12 Q. And in Figure 1, there's at least six of these  
13 light sources that are designated by reference  
14 Nos. 10, correct?

15 A. Yes.

16 Q. And there are more light sources, I'm just saying  
17 that the reference Nos. 10 there point to multiple  
18 of the light sources; is that right?

19 A. That's right.

20 Q. And Thominet discloses arranging the semi-conductor  
21 light sources 10 in a matrix on a support element,  
22 which is reference No. 12 there in Figure 1; is  
23 that correct?

24 A. That's right.

25 Q. And Figure 1 shows that the semiconductor light

1 sources 10 are mounted on a curved surface of  
2 support element 12, correct?

3 A. It does show that, yes.

4 Q. And if we look at paragraph 18 of Thominet,  
5 Thominet describes distributing the light  
6 sources 10 on a concavely curved surface, correct?

7 A. Or a stepped surface, it says.

8 Q. But you would agree that Thominet does describe  
9 disposing the light sources 10 on a concavely  
10 curved surface, correct?

11 A. Yes, that's one of the surface types that is in  
12 Thominet.

13 Q. Okay. And in your opinion, would a person skilled  
14 in the art have understood how to implement light  
15 sources on a curved substrate such as shown in  
16 Thominet?

17 MR. TURNER: Objection. Calls for  
18 speculation.

19 THE WITNESS: I think a person of  
20 ordinary skill in the art would know how to mount  
21 them and probably connect them electronically and  
22 some other things you would want to do. I don't  
23 know if there -- what else they would know about  
24 it, I guess, but they would know some things about  
25 it at least.

1 BY MR. FITZSIMMONS:

2 Q. If we look at paragraph 4 of Thominet, the last  
3 part of that paragraph says, "...the characteristic  
4 of the light beam exiting the illumination device  
5 can be changed so that it can be used for different  
6 functions." Do you see that?

7 A. I do.

8 Q. And if we look up -- so here at paragraph 4,  
9 Thominet is stating that one of the purposes of the  
10 invention is to change the characteristic of the  
11 outputted light beam; is that correct?

12 A. Well, the purpose, I think as described here, is  
13 to provide illumination for a vehicle and then  
14 changing the characteristic is an advantage of  
15 that.

16 Q. In the paragraph above, paragraph 3, Thominet says  
17 that, "The term 'characteristic' of light beam  
18 includes here a light color, its direction, its  
19 reaching distance, dispersion with and  
20 illumination intensity distribution produced by  
21 it," correct?

22 A. It does say that, yes.

23 Q. Okay. And so in paragraph 4, when Thominet is  
24 referring to the characteristic of the light, you  
25 agree that it's referring to the examples in

paragraph 3 where it defines the term

"characteristic," is that fair?

A. Those are characteristics that can change among  
different LEDs, yes.

Q. And in these paragraphs, Thominet's describing that  
changing the characteristic of the outputted light  
allows the illumination device to provide different  
lighting functions; is that correct?

A. I want to remind myself of my summary on this, so  
just a moment. Sorry, will you repeat the  
question, please?

Q. I said, in these paragraphs, Thominet is describing  
that changing the characteristic of the outputted  
light allows the illumination device to provide  
different lighting functions; is that correct?

A. Yes, specifically for Thominet, different lighting  
functions for different groups of LEDs.

Q. If we look at paragraph 6 of Thominet, one of those  
functions is providing strong illumination for far  
distances at the end of that paragraph there,  
right?

A. Yes, essentially.

Q. Okay. And in paragraph 7, it describes another  
function that would be "specifically advantageous  
at those speeds" and for fog conditions, correct?

1 A. Yes; that's right.

2 Q. Would you agree that a person skilled in the art  
3 would want a vehicle's headlamp to be able to  
4 disperse a wider beam as described in Thominet for  
5 fog conditions?

6 MR. TURNER: Objection. Calls for  
7 speculation.

8 THE WITNESS: Wider than what  
9 specifically?

10 MR. FITZSIMMONS: Wider than high beams.

11 THE WITNESS: I think a person of  
12 ordinary skill in the art would understand that  
13 it's generally desirable to have beams when driving  
14 slower distributed more widely than beams when  
15 driving faster, so fog lights tend to be in that  
16 category, so it would be a general understanding,  
17 not of Thominet in particular, but of what is  
18 typically done and desirable.

19 BY MR. FITZSIMMONS:

20 Q. Are you saying because a driver would typically be  
21 driving at slower speeds in fog conditions; is that  
22 the association?

23 A. Yeah, that's the association.

24 Q. In paragraph 8, Thominet is describing another  
25 function which would be to produce at one side a

1 light beam oriented to the right or to the left and  
2 it says it's advantageous during driving a curve,  
3 correct?

4 A. That's right. Just like in the previous paragraph,  
5 it's pointing out various car lighting  
6 functionalities that these groups should ideally be  
7 able to accomplish.

8 Q. Okay. In Figure 2 of Thominet, we see that  
9 Thominet shows certain regions here which are  
10 indicated by reference Nos. 22, 24, 26 and 28. Do  
11 you see that?

12 A. Yes.

13 Q. Okay. And in paragraph 26 of Thominet, Thominet  
14 describes the control device that automatically  
15 actuates these regions 22, 24, 26 and 28  
16 independent of each other to achieve the different  
17 light functions; is that correct?

18 A. It describes switching, it doesn't actually use the  
19 word control -- no, it says control device, so I  
20 think that's a reasonable summary.

21 Q. Okay.

22 A. A control device can essentially turn on and off  
23 these fixed function areas.

24 Q. In your opinion, would a person skilled in the art  
25 understand how to program the controller to

1 automatically actuate these different segments of  
2 the light sources in the headlamp?

3 A. Yes, since the segments are predefined in terms of  
4 their functionality, it would really be just a  
5 question of turning them on and off, so a POSA  
6 would know how to do that.

7 Q. Paragraph 26, in the middle there, also describes  
8 that this switchover can occur based on the  
9 vehicle's operational parameters, correct?

10 A. That's right.

11 Q. For example, one instance when the automatic  
12 switchover can occur is when the wiper is  
13 activated, right?

14 A. It mentions the wiper. It doesn't really say what  
15 about the wiper, but it does mention the wiper.

16 Q. What do you think a person skilled in the art would  
17 understand about the wiper from reading this  
18 paragraph 26 of Thominet about how it relates to an  
19 operational parameter?

20 MR. TURNER: Objection. Calls for  
21 speculation.

22 THE WITNESS: Well, people of skill in  
23 the art would know a lot of things about wipers,  
24 but in terms of what Thominet is teaching with  
25 wipers, they would go by the words here and it

1 doesn't say anything in particular about the wiper  
2 except it just -- "such as, for example, the  
3 wiper." That's all it says about a wiper. So I  
4 don't know that a person of ordinary skill in the  
5 art should assume anything about it except what  
6 these words say.

7 BY MR. FITZSIMMONS:

8 Q. Do you think a person skilled in the art would read  
9 this to mean that Thominet's describing performing  
10 the switchover when the windshield wiper is turned  
11 off?

12 A. It seems to me that would be reading more into it  
13 than what is actually here. Thominet is indicating  
14 that something about the wiper can be involved  
15 here.

16 Q. What else can there be about the wiper, whether  
17 it's turned on or off?

18 A. Well, I haven't thought through a list of such  
19 things in this context before, but just an example  
20 would be the speed of the wipers, maybe if there's  
21 wiper fluid, at least a few other things probably.

22 Q. Would you agree a reasonable operational parameter  
23 of a vehicle would be whether a wiper is on or off?

24 A. I would say that can be considered an operational  
25 parameter of the vehicle. I don't know what

1 reasonable means in that context.

2 Q. So whether a wiper is on or off would be an example  
3 of an operational parameter of the vehicle?

4 A. It seems like it would be fair to call it that.

5 Q. And in your opinion, why would a person skilled in  
6 the art want to switch operation of light sources  
7 in a vehicle headlamp when a windshield wiper was  
8 activated?

9 A. I don't know that I've ever thought about why a  
10 person of ordinary skill in the art would want to  
11 do that, so I don't know.

12 Q. When your windshield wipers are on, there's a  
13 requirement that your headlamps also be on, at  
14 least from my understanding, in most states. Is  
15 that your understanding as well?

16 A. It's not my understanding. I'm not aware of any  
17 such requirement.

18 Q. Would a person of skill in the art want a vehicle's  
19 headlamp system to adjust light output when it's  
20 raining versus when it's not raining?

21 A. I don't think a person of ordinary skill in the art  
22 as someone who wants something independent of  
23 anything else. In particular context, if a person  
24 of ordinary skill in the art is tasked with  
25 designing something, maybe that would be an

appropriate context to ask the question, but the question sounds too general to me.

Q. In paragraph 72 of your 197 declaration, you state that Thominet does not suggest any advantages, disadvantages, functional differences or other reasons to select any of the possible arrangements for a particular application; is that right?

A. That's what it says there.

Q. Okay. You're stating that Thominet does not suggest any advantages, disadvantages or functional differences. In your opinion, would a person skilled in the art have known any advantages or functional differences between having a curved substrate for headlamp light sources instead of a planar substrate?

A. I'm not aware of any particular known or known at that time advantages of one or another. There could be disadvantages. For example, a curved substrate might take up more space, so in terms of packaging. Maybe a curved substrate would be more expensive or maybe a step-substrate would be more expensive, I don't know, but these would perhaps be things to consider.

Q. So to your knowledge, you're not aware of any advantages or functional differences between a

1 curved and flat substrate for headlight sources; is  
2 that correct?

3 A. At that time and in the context of Thominet; that's  
4 correct.

5 Q. I'm asking more generally, outside of the context  
6 of Thominet, whether you have any understanding of  
7 whether a person skilled in the art would have  
8 known of any advantages or functional differences  
9 between having a curved substrate versus a planar  
10 substrate for vehicle headlamp light sources?

11 A. Well, I mentioned some potential disadvantages that  
12 I think a person of ordinary skill in the art would  
13 probably think about.

14 Q. My question was relating to advantages.

15 A. I'm sorry.

16 Q. Advantages or functional differences. So I'll  
17 start with advantages then. Do you know --  
18 rephrase that.

19 In your opinion, would a person skilled in  
20 the art have known any advantages of having a  
21 curved substrate for headlamp light sources instead  
22 of a planar substrate?

23 A. I don't know if a person of ordinary skill in the  
24 art would know that.

25 Q. So you're not familiar with whether a person of

1 ordinary skill in the art would have known of  
2 advantages; is that correct? Is that what you're  
3 saying?

4 A. I think that's right. I don't know specifically  
5 what a POSA would think about advantages of the  
6 curved substrate.

7 Q. In paragraph 142 of your declaration, 197  
8 proceeding, page 88, it goes from page 7 -- excuse  
9 me, from page 87 to page 88, you provide a quote  
10 from the petition at page 32; is that right?

11 A. Yes, that's right.

12 Q. And for this statement, you do not cite Dr. Jiao's  
13 declaration; is that correct?

14 A. It looks like I don't.

15 Q. You said that you reviewed Dr. Jiao's declarations  
16 in these three proceedings, correct?

17 A. The ones that are listed in my exhibits.

18 Q. I actually don't know if you specifically cite  
19 Dr. Jiao's declaration here, but you reviewed  
20 Dr. Jiao's declarations in the three proceedings  
21 that we're discussing today; is that correct?

22 A. I thought I just answered that. The ones that are  
23 listed in my exhibits. I'm not sure if they're all  
24 listed in my exhibits.

25 Q. So if we go to your list of exhibits, which is on

page -- starts on page 6 of your 167 [sic]  
proceeding declaration and goes on to page 7, I  
don't believe any of these exhibits are Dr. Jiao's  
expert declaration, which -- for the three  
proceedings related to the '503 patent. It's  
Exhibit 1003 in each of the '503 patent  
proceedings. Just as a refresher, the three '503  
patents ended 197, 328 and 335. That's why I  
wanted to confirm this.

A. Sorry. Is there a question?

Q. My question is, did you review Dr. Jiao's  
declarations for the three proceedings related to  
the '503 patent?

A. I believe I did, but it doesn't seem to be in here  
in the list of exhibits. I'm not sure why that  
is -- at least for that one. I'd have to check the  
other two.

Q. Okay. Go ahead. Can you please check the other  
two?

A. I think that the 318 is the only one that's listed  
in my exhibits. I don't know why the others are  
not in there.

Q. The 318 proceeding note does not relate to the '503  
patent, correct?

A. I believe that's correct.

1 Q. So none of your three declarations, Exhibits 2006  
2 in the three proceedings for the '503 patent, list  
3 Dr. Jiao's declaration in the respective  
4 proceedings from the '503 patent; is that correct?

5 A. They don't seem to and I'm confused why.

6 Q. Well, my question was -- maybe you can't answer it.  
7 My question was, did you review Dr. Jiao's  
8 declarations for the three proceedings related to  
9 the '503 patent or do you not know if that's the  
10 case?

11 A. I believe that I did, but it's a little confusing  
12 why they're not in my exhibits, so I'm confused by  
13 it. I don't recall for sure since they're not  
14 here. It's making me second guess.

15 Q. We've discussed some situations where headlamp  
16 illumination might be adjusted today and I'm  
17 wondering if you have a sense of, would a person  
18 skilled in the art want to deliver forward  
19 illumination from the head beam -- at a high beam  
20 level when driving at a slow speed in a well-lit  
21 neighborhood?

22 A. Well, as I said before, when you asked would a POSA  
23 want to -- without context, that's a very vague  
24 question for me. I don't know what a POSA would  
25 want to do in general, so maybe I need more

context.

Q. Would a person skilled in the art have found delivering forward illumination at a high beam level when driving at a slow speed in a well-lit neighborhood to be the optimal use, to use a phrase from the '503 patent, of headlamps?

MR. TURNER: Objection. Vague.

THE WITNESS: I think if that POSA's goal was to design a system that would provide the best visibility to a driver, then the POSA probably would want to do that.

BY MR. FITZSIMMONS:

Q. You said would?

A. Yes.

Q. So they would want high beam light at slow speeds on a well-lit neighborhood?

A. If their specific goal was providing the best visibility for the driver, I think maybe they would. The reason it's hard to respond to questions like this is because there's so many design considerations when a POSA is actually thinking about designing a system, so in general, if that's their main goal, I think they would.

Q. Maybe this is a better example that would be easier for you to consider. Would a POSA want -- would a

1 POSA want to design a headlamp system that provided  
2 illumination at a high beam level for driving in  
3 fog conditions?

4 MR. TURNER: Objection. Vague. Calls  
5 for speculation. Incomplete hypothetical.

6 THE WITNESS: Well, again, I don't know  
7 what a POSA would want to do or want to design.  
8 Just abstractly without any particular goal or  
9 constraint, that's a pretty broad question. I can  
10 imagine that a POSA would be mindful that there are  
11 situations -- that there are exceptions to probably  
12 most driving situations, but again, in general, I  
13 don't know what a POSA wants to do or wants to  
14 design.

15 MR. FITZSIMMONS: Let's take a short  
16 break.

17 (Whereupon a break was taken  
18 from 2:41 p.m. to 2:50 p.m.)

19 MR. FITZSIMMONS: Dr. Turk, we will  
20 now turn to the Karlsson reference. And Karlsson  
21 is Exhibit 1010 in each of the three proceedings  
22 and it is PCT International Publication  
23 No. WO 98/54030.

24 (Marked for identification:  
25 Deposition Exhibit No. 1010.)

1 BY MR. FITZSIMMONS:

2 Q. Please confirm for me that that is what we'll call  
3 the Karlsson reference.

4 A. Yes, it is.

5 Q. All right. And if you look at the abstract there  
6 on the first page of Karlsson, it describes, "A  
7 lighting device, in particular a headlight of a  
8 motor vehicle," to start off the abstract there; is  
9 that right?

10 A. That's correct.

11 Q. You agree that Karlsson is directed to a headlight  
12 of a motor vehicle, right?

13 A. Yes.

14 Q. All right. Let's look at Figure 1 of Karlsson.  
15 Figure 1 of Karlsson shows a lighting device or a  
16 schematic of a lighting device and that's indicated  
17 by reference No. 1, correct?

18 A. Yes.

19 Q. Okay. And that device includes a light source  
20 indicated by reference No. 2, correct?

21 A. That's right.

22 Q. And in Figure 1, it shows a light modulator, which  
23 is indicated by reference No. 3, correct?

24 A. That's right.

25 Q. And Karlsson shows a controller or what it also

1           refers to as a control means and that's indicated  
2           by reference No. 14, correct?

3   A.     I think so.

4   Q.     And Figure 1 shows that light source 2 is  
5           electrically connected to controller 14 and that's  
6           indicated by No. 16, correct?

7   A.     Yes, I believe so.

8   Q.     And Figure 1 also shows a light sensitive sensor  
9           that's indicated by No. 9, correct?

10   A.    Correct.

11   Q.     And Figure 1 shows sensor 9 is electrically  
12           connected to controller 14, which is pointed out by  
13           reference No. 15, correct?

14   A.     Yes, I think so.

15   Q.     Okay. Let's go to page 9 of Karlsson. And page 9,  
16           starting at line 9, "According to the invention,"  
17           that paragraph there in Karlsson. Line 9 through  
18           line through 17.

19                   Karlsson controller is figured so that it  
20           adjusts the characteristics of its light beam by  
21           way of the light source; is that correct?

22   A.     Did you say "by way of the light source"?

23   Q.     Yeah, that's what I said.

24   A.     I'm not sure what that means, but otherwise, yes.

25   Q.     Karlsson's controller is configured to adjust the

1 output to create a light beam 7 with the desired  
2 pattern and desired intensity; is that correct, as  
3 described in that paragraph?

4 A. Yes.

5 Q. Okay. And Karlsson sensor 9 is configured to sense  
6 information and that information is communicated to  
7 the controller 14, right?

8 A. Yes, I believe so.

9 Q. And then Karlsson's controller 14 uses that  
10 information from the optical sensor -- excuse me --  
11 from light sensitive sensor 9 to control light  
12 source 2, correct?

13 A. Yes; that's correct.

14 Q. If we look at Figure 6 of Karlsson, Figure 6 shows  
15 a number of what Karlsson has described as  
16 individual spotlight beams indicated by reference  
17 No. 34, correct?

18 A. Yes.

19 Q. And those individual spotlight beams form light  
20 beam and that's indicated by reference No. 3,  
21 correct -- excuse me, 33, correct?

22 A. Yes.

23 Q. If we go to page 13 of Karlsson, lines 27  
24 through 29, can you read that for me starting with  
25 "In this context..."?

1 A. "In this context, the term spotlight beam is  
2 understood to mean a light beam of limited physical  
3 dimension, for example, a light beam from LED as  
4 shown in principle in Figure 6."

5 Q. And so Karlsson discloses that the spotlight beams  
6 which are indicated by reference 34, again in  
7 Figure 6, can be produced by a respective LED; is  
8 that right?

9 A. They can be produced by LEDs, yes.

10 Q. Page 14 now, lines 1 through 4, can you read those  
11 for me, please?

12 A. "The spotlight beams 34 can be obtained, for  
13 example, by using a light source 2, which is  
14 composed of a grid of separate light sources, such  
15 as LEDs, which can preferably be controlled either  
16 individually or in groups."

17 Q. And here, Karlsson describes that the light  
18 source 2 can be made up of a plurality of spotlight  
19 beams 34, which we discussed can be LEDs, correct?

20 A. Will you repeat the question, please?

21 Q. Sure. Let me maybe state it -- so Karlsson  
22 describes light source 2 can be made up of a  
23 plurality of separate LED light sources, correct?

24 A. I think this is inelegant language here in the  
25 Karlsson reference. I think what it means, given

1 the rest of Karlsson, is that these spotlight beams  
2 can be LEDs. Bringing in the term light source and  
3 being composed of a grid of light sources, I don't  
4 think is taught in the rest of Karlsson and it  
5 seems confusing in the context of the rest of  
6 Karlsson, but it does say what you're quoting here.

7 Q. So Karlsson discloses light source 2, which is  
8 composed of a grid of separate light sources such  
9 as LEDs, correct?

10 A. This passage uses those words, but as I explained,  
11 I think what it's actually describing is the LED  
12 array, being consistent with the rest of Karlsson's  
13 reference.

14 Q. Karlsson's also describing that the LEDs can be  
15 controlled individually or in groups, correct?

16 A. That's right.

17 Q. And the controller is what would control the LED  
18 either individually or in groups, correct?

19 A. In the particular embodiment that we were  
20 discussing earlier, yes, in that embodiment.

21 Q. On page 13 of Karlsson, lines 33 to 36, can you  
22 read that for me? Starting with, "A desired  
23 pattern..."

24 A. "A desired pattern and/or a desired intensity of  
25 the light beam 33 to be emitted can be simply

1       effected by switching one or more of the spotlight  
2       beams 34 on and/or off or by adapting the intensity  
3       of the light emitted by a spotlight beam 34."

4   Q.   Karlsson discloses here that it can achieve the  
5       desired beam pattern and/or the desired intensity  
6       by turning the light sources on and/or off,  
7       correct?

8   A.   By turning at least some of them on or off.

9   Q.   Karlsson also discloses here that it can achieve  
10       the desired beam pattern and/or desired intensity  
11       by adapting the intensity of the light emitted from  
12       the light source, correct?

13   A.   It does say by adapting the intensity of the light  
14       emitted by the spotlight beam.

15   Q.   If we go to paragraph -- excuse me -- Figure 14 of  
16       Karlsson now. So Figure 14 shows a spatial  
17       distribution of light sources and sensors in  
18       Karlsson's headlamp; is that right?

19   A.   That's right.

20   Q.   Okay. The circles here in the filling indicated by  
21       the letter "S," those represent the spotlight  
22       sensors; is that right?

23   A.   I believe so.

24   Q.   Okay. And the other dots are light sources; is  
25       that right? Sorry. I'll call them circles.

1                   The other circles are light sources,  
2           correct?

3   A.     Yes; that's right.

4   Q.     The non-shaded circles there towards the bottom of  
5           Figure 14, those represent what Karlsson refers to  
6           as dipped light sources, right; light sources for  
7           dipped beam functionality?

8   A.     That's right.

9   Q.     And the circles indicated by the letter "I"  
10           arranged mostly at the top of Figure 14 there,  
11           those represent the sources for main beam  
12           functions; is that right?

13   A.     Yes; that's right.

14   Q.     And then there's some circles indicated by both  
15           letters "D" and "I" or "D/I" and those are  
16           generally arranged sort of in the middle of  
17           Figure 14 and those represent light sources with a  
18           dipped and main beam functionality; is that right?

19   A.     That's right.

20   Q.     Let's go to page 19 of Karlsson, lines 22 through  
21           28. This describes what we were just talking about  
22           with respect to Figure 14 -- here it's referring to  
23           Figure 13 -- but this dipped and main beam and sort  
24           of dual-function sources, correct?

25   A.     Yes; that's right.

1 Q. Does this passage in Karlsson discuss the intensity  
2 of those light sources?

3 A. No, intensity is not mentioned in there.

4 Q. Okay. Go to page 1 of Karlsson, line 20. It says  
5 that the main beams are designed and optimized for  
6 long-range illumination; do you see that?

7 A. Yes, I see that.

8 Q. Okay. Main beams is also known as high beams,  
9 correct?

10 A. That's right.

11 Q. And a person skilled in the art would understand  
12 that main beams or high beams are optimized for  
13 long-range illumination, right?

14 A. Yes; that's right.

15 Q. In your opinion, are main beams or high beams  
16 optimized for low speed driving conditions?

17 A. They can be very useful for low speed driving  
18 conditions. I don't think that's what they were  
19 originally designed for.

20 Q. Page 1 still, lines 21 through 24. Can you read  
21 those for me, please? Starting, "In many cases..."

22 A. "In many cases, in particular when driving on dark  
23 unilluminated roads, it is highly desirable to be  
24 able to utilize the higher light intensity and the  
25 longer range main beam constantly, which

1 contributes towards increased road safety and  
2 driving comfort."

3 Q. You would agree that Karlsson's describing the  
4 desirability of using main beams constantly when  
5 driving on dark unilluminated roads, right?

6 A. Among other cases, but yes.

7 Q. Karlsson does not describe using main beams  
8 constantly for well-illuminated roads, correct?

9 A. I don't know if it describes it anywhere else, but  
10 right here it doesn't list that as one of the  
11 cases, but it says there are many cases, so that  
12 could be one.

13 Q. Karlsson does not describe the desirability of  
14 using main beams in all cases, correct?

15 A. In this passage here?

16 Q. Correct.

17 A. It does not say in all cases.

18 Q. Page 2 of Karlsson, lines 7 through 9. Can you  
19 read those for me, please?

20 A. "That is, that part of the light beam which might  
21 cause inconvenience to oncoming traffic is  
22 automatically expressed whilst retaining an optimum  
23 lighting effect for the driver of the vehicle  
24 himself."

25 Q. And so here, Karlsson is disclosing to create an

1 optimum lighting effect; is that right?

2 A. He's talking about retaining an optimal lighting  
3 effect, so keeping something that you already had,  
4 not creating one specifically.

5 Q. So Karlsson is disclosing having an optimum  
6 lighting effect; is that right?

7 A. Not stopping one, so yes, having one sounds good.

8 Q. Okay. Page 4 of Karlsson, lines 17 through 21.  
9 Could you read those for me, please?

10 A. "In a preferred embodiment of the invention, the  
11 average intensity of the light emitted by the  
12 lighting means is controlled such to provide a  
13 light beam, the intensity of which is optimally  
14 adapted to the road and to the ambient light,  
15 thereby increasing the driving comfort and road  
16 safety."

17 Q. So here, Karlsson is describing to optimally adapt  
18 the intensity of the light in accordance with road  
19 conditions, correct?

20 A. Correct.

21 Q. And it's also disclosing to optimally adapt the  
22 intensity of the light according to the ambient  
23 light, correct?

24 A. According to the road and the ambient light.

25 Q. Not all roads share the same lighting conditions;

1 is that correct?

2 A. What do you mean by sharing lighting conditions?

3 Q. So ambient light conditions are not always the same  
4 for different roads; is that right?

5 A. I think that's right.

6 Q. Would a person skilled in the art want to adapt the  
7 light intensity of the headlamp on an illuminated  
8 urban road differently from an unilluminated  
9 country road?

10 MR. TURNER: Objection. Vague. Calls  
11 for speculation. Incomplete hypothetical.

12 THE WITNESS: In general, I don't know  
13 what a person of ordinary skill in the art wants to  
14 do, so that question seems too broad for me to  
15 address.

16 BY MR. FITZSIMMONS:

17 Q. A person skilled in the art would understand that  
18 the intensity from a headlamp should be different  
19 on an illuminated urban road versus an illuminated  
20 country road in order to provide the best  
21 visibility for the driver, correct?

22 A. I'm not sure that it should always be different, so  
23 I don't think a person of ordinary skill in the art  
24 would know that.

25 Q. Your declaration, 197 proceeding, paragraph 95. In

1 the middle of the paragraph, the second sentence,  
2 "Karlsson even explains..." Can you read that for  
3 me, please?

4 A. "Karlsson even explains, in the context of  
5 Figure 14, that 'an emitted light beam 50 is  
6 represented as a window which can shift left to  
7 right and top to bottom' in dependence on the  
8 desired pattern and direction of the beam."

9 Q. And here you're quoting Karlsson's description of  
10 beam 50 as it relates to Figure 14 as having the  
11 ability to shift from left to right and top to  
12 bottom, correct?

13 A. That's correct.

14 Q. In paragraph 95 of your 197 declaration, the last  
15 sentence there, you assert that Karlsson's beam 50  
16 would expand "to the greatest extent possible" when  
17 there's no risk of glare; is that right?

18 A. That's what it says.

19 Q. Okay. You don't cite Karlsson for this assertion  
20 in your declaration; is that correct?

21 A. That's correct.

22 Q. Karlsson does not explicitly describe expanding  
23 beam 50, as you call it, "to the greatest extent  
24 possible" when there's no glare; is that correct?

25 A. I'm not sure if Karlsson uses that phrase. I

1 believe that phrase, when it's first -- when it  
2 first appears in paragraph 91 of my declaration is  
3 a quote from the petition. It's possible it's from  
4 a deposition that's quoted in the petition.

5 Q. Let's go to paragraph 213 of your 197 declaration.  
6 In paragraph 213, you say, "Petitioner's 'full  
7 usage of the array except when accommodating glare'  
8 interpretation..." Is that a term that you coin  
9 here in your declaration or is that from somewhere  
10 else?

11 A. I don't recall -- you're talking about the words in  
12 the quotes?

13 Q. Yes; that's right.

14 A. I don't recall specifically where that phrase comes  
15 from. I use it here because it is descriptive of  
16 what I'm describing.

17 MR. FITZSIMMONS: All right. We're  
18 now going to look at the Harbers reference,  
19 Exhibit 1011 in all three proceedings. And  
20 Harbers is PCT International Publication  
21 No. WO 01/01038.

22 (Marked for identification:

23 Deposition Exhibit No. 1011.)

24 BY MR. FITZSIMMONS:

25 Q. Can you just confirm that this is the Harbers

1 reference for me?

2 A. Yes, it is.

3 Q. And if you refer to the abstract of Harbers on the  
4 cover page there, it recites, "A headlamp (2;3) of  
5 a vehicle (1) has a light source (4;5)." Do you  
6 see that?

7 A. Yes.

8 Q. You agree that Harbers is directed to a headlamp  
9 system for a vehicle, right?

10 A. Yes.

11 Q. Please refer to Figure 1B of Harbers. Do you see  
12 that?

13 A. Yes.

14 Q. Figure 1B of Harbers shows two headlamps indicated  
15 by Nos. 2 and 43 on the vehicle, right?

16 A. I think so.

17 Q. And Figure 1B shows that headlamps 2 and 3 each  
18 have light source indicated by Nos. 4 and 5,  
19 correct?

20 A. I think that's right.

21 Q. Let's go to page 7 of Harbers, lines 20 through 21.  
22 Can you read that for me, please?

23 A. "Figure 2 is a sectional view of the light source 4  
24 comprising a plurality of optoelectronic elements  
25 11; 12; 13; 14 which are arranged in accordance

1 with a regular pattern."

2 Q. Okay. And Harbers discloses that light source,  
3 which is No. 4, and includes a plurality of light  
4 sources which are indicated as the optoelectronic  
5 elements 11, 12, 13 and 14, correct?

6 A. Yes.

7 Q. Okay. And if we go to lines 27 through 29, still  
8 on page 7, starting with, "The array..." Can you  
9 read that for me, please?

10 A. "The array of optoelectronic elements 11; 12; 13;  
11 14 does not have to be provided on a flat  
12 substrate. It may alternatively be provided on a  
13 curved substrate."

14 Q. So Harbers discloses that the light sources 11, 12,  
15 13 and 14 can be arranged on a curved substrate,  
16 correct?

17 A. Yes.

18 Q. Go to page 10 of Harbers now. Skip down. And  
19 page 10, line 26 through 31. Can you read that for  
20 me, please? Starting with, "In principle..."

21 A. "In principle, the dimensions of the light beams  
22 are adjustable at will, for example, by creating a  
23 broader light beam (illuminating the shoulder of  
24 the road) at a lower speed of the vehicle or by  
25 narrowing the beam at a relatively high speed. In

1        addition, as a result of the large freedom of  
2        choice resulting from the use of (exclusively)  
3        optoelectronic elements, the location of the  
4        vehicle headlamp is no longer limited to the  
5        conventional location at the front of the vehicle  
6        just above the road surface."

7    Q.    So here, Harbers is describing that its  
8        headlight system is capable of adjusting the  
9        dimensions of the output of the light beam; is  
10       that fair?

11   A.    Yes.

12   Q.    Harbers suggests here creating a broader light beam  
13        at a lower vehicle speed, correct?

14   A.    Yes.

15   Q.    And Harbers also suggests narrowing the light beam  
16        at a relatively high speed, correct?

17   A.    That's correct.

18   Q.    So you'd agree that Harbers is suggesting to a  
19        person skilled in the art to adjust the dimensions  
20        of the light beam based on the speed of the  
21        vehicle, correct?

22                MR. TURNER: Objection. Vague.

23                THE WITNESS: What we just read says  
24        that, in principle, these things are possible. I  
25        don't know if that's a suggestion necessarily.

1 BY MR. FITZSIMMONS:

2 Q. By saying, "In principle, the dimensions of the  
3 light beams are adjustable at will," do you think  
4 that this passage of Karlsson suggests, to a person  
5 of ordinary skill in the art reading it, a  
6 desirability of creating a broader light beam at  
7 lower speeds and a narrower light beam at higher  
8 speeds?

9 A. I think you said Karlsson. This is Harbers.

10 Q. I'm sorry. I did. Harbers. Thank you.

11 A. And so sorry, that --

12 Q. I can repeat that.

13 So Harbers says here, "In principal, the  
14 dimensions of the light beams are adjustable at  
15 will." And my question is, do you think that this  
16 passage of Harbers suggests, to a person of  
17 ordinary skill in the art reading it, the  
18 desirability of creating broader light beams at  
19 lower speeds and narrower light beam at higher  
20 speeds?

21 A. I think it suggests to someone reading it that the  
22 author might think that's desirable, which is why  
23 the author would be listing them here.

24 Q. Do you think a person skilled in the art would  
25 agree with the author that they are desirable?

1 MR. TURNER: Objection. Calls for  
2 speculation.

3 THE WITNESS: Not having thought about  
4 this before, off the top of my head, I would say it  
5 depends on the goals of that person, so I'm not  
6 sure what they would think.

7 BY MR. FITZSIMMONS:

8 Q. Paragraph 223 of your declaration, the 197  
9 declaration, so it's Exhibit 2006 again.  
10 Paragraph 223.

11 At the end of paragraph 223, you use the  
12 phrase "color shifting issues."

13 A. Is there a question?

14 Q. I just -- do you see the phrase "color shifting  
15 issues"?

16 A. I do see that, yes.

17 Q. What do you mean by the phrase "color shifting  
18 issues"?

19 A. Yeah, this sentence is bringing up a particular  
20 issue in a larger context, which is that Harbers  
21 makes claims like we were just talking about or  
22 brings things up like we were just talking about as  
23 if they could be done, but I think there are  
24 technical difficulties and these things are not  
25 enabled in Harbers.

1                   And this is an example, given the array --  
2       LED array in Harbers where there are various colors  
3       of elements, when things are shifted around in the  
4       ways that are being suggested, they're very likely  
5       to cause color problems, unanticipated color  
6       changes, and that would be a significant issue in  
7       actually trying to implement Harbers in the way  
8       that it describes things.

9   Q.    Okay. Can you refer to paragraph 165 in your 197  
10       declaration? And here is a heading, it says,  
11       "Because a vehicle is not a species of the light  
12       genus, genus/species law does not apply."

13                   What is genus/species law that you refer  
14       to here in that declaration?

15   A.   My understanding of this comes from discussions  
16       with my attorneys I've been working with on this  
17       where it's a series of questions related to does --  
18       does teaching something about a broad category --  
19       or what's the relationship between teaching  
20       something about a broad category and teaching  
21       something about a specific thing that may or may  
22       not be fundamentally part of that category and that  
23       there is standard law about reasoning about these  
24       kinds of issues.

25   Q.    What's your understanding about what you just

1       called standard law about the reasoning about these  
2       kinds of issues which I've seen referred as the  
3       genus/species issues?

4   A.   Are you asking my understanding of the law or --  
5       sorry, can you just repeat the question?

6   Q.   You say that it's your understanding that there is  
7       standard law about these kinds of issues. My  
8       question is, what is your understanding about what  
9       that standard law includes?

10   A.   My understanding, based on discussions I've had  
11       with my attorneys that I've been working with, is  
12       that includes -- it includes rulings related to  
13       when a specific thing may or may not be anticipated  
14       and it, again, relates to a larger category that  
15       thing might be a part of and the specific matter of  
16       that thing and whether it's in that category or not  
17       or whether it's someone's teaching that's in that  
18       category or not, but related to the relationship  
19       between these two things, the larger category of  
20       things that may be taught and then how that relates  
21       to the more specific things and whether that --  
22       what that has to say, what that infers about  
23       whether they are anticipated or not.

24               There might be more things, too, but  
25       that's just an example of the kinds of things we

1           talked about.

2   Q.     So your understanding includes "rulings related  
3           when a specific thing may or may not be  
4           anticipated." By "rulings," do you mean court  
5           decisions?

6   A.     I believe there are probably court decisions about  
7           these matters which have led to this category of  
8           genus/species law, but I don't know the history of  
9           it particularly myself.

10   Q.    So then what is your understanding of when a prior  
11           art genus disclosure anticipates a narrower  
12           species?

13   A.    What I wrote here is really my summary of my  
14           understanding of this. I don't know if I wrote  
15           here a specific answer to that question. In  
16           particular, we were applying these, to my view,  
17           general ideas to the questions of lights and  
18           headlights in vehicles and I focused my general  
19           understanding of this on those technical questions.

20   Q.    In your paragraph 166, you say, "The prior art  
21           genus disclosure of light anticipates the narrower  
22           species of headlights." Why is that the case?

23   A.    I would say that if something was disclosed about  
24           light, since headlight is a subset, a kind of  
25           light, a more specific thing, then at least in most

1 cases, that disclosure would apply to headlights as  
2 well. The disclosure about the broad category  
3 would apply to the specifics. I think there is  
4 some exceptions and maybe requirements, but at  
5 least in general, that's typically the case.

6 Q. Headlights are a standard component on an  
7 automotive vehicle, correct?

8 MR. TURNER: Objection. Vague.

9 THE WITNESS: As far as I know, they're  
10 standard. I've never seen a vehicle without  
11 headlights.

12 BY MR. FITZSIMMONS:

13 Q. In fact, regulations require vehicles to have  
14 headlights, correct?

15 A. I don't know a specific regulation that does, but  
16 it certainly wouldn't surprise me.

17 Q. Paragraph 170 now in your 197 declaration. Did you  
18 review this paragraph of your declaration before  
19 you signed it?

20 A. Yes, I'm sure I did.

21 Q. Okay. Did you write this paragraph of your  
22 declaration?

23 A. I don't think I was the one who wrote the draft of  
24 this.

25 Q. Do you know who did?

1 A. Not offhand.

2 Q. You provide a quote here that mentions the Federal  
3 Circuit and what it has found, correct?

4 A. That's correct.

5 Q. Where is this quote from?

6 A. That is something that I noticed last night, in  
7 fact, that I didn't provide a citation here, so I  
8 don't recall. It's a typo, I think.

9 Q. So a typo is like a wrong spelling.

10 A. Okay. I probably should have included a citation  
11 here; I just didn't notice that.

12 Q. Do you usually cite -- perhaps this is from a case;  
13 I'm not sure where it's from.

14 Do you usually provide case law citations  
15 in your declarations?

16 A. I don't know about usually; I probably have before.  
17 In this case, it specifically comes out, as I said,  
18 of discussions with the attorneys who educated me  
19 on this matter, so they would be the ones to know  
20 the most relevant quotes here.

21 Q. Can you read the paragraph for me, please?  
22 Paragraph 170.

23 A. "Even if genus/species laws applied, the Federal  
24 Court and its predecessor court, the CCPA, have  
25 found anticipation of a species by a genus in this

1 context only when the genus itself is narrowly  
2 defined, i.e., the genus is so small that a person  
3 of skill would immediately recognize the defined  
4 and limited class of species as falling within the  
5 genus."

6 Q. And you have the phrase "narrowly defined"  
7 underlined here, correct?

8 A. Yes.

9 Q. What makes a genus narrowly defined?

10 MR. TURNER: Objection. Vague.

11 THE WITNESS: I don't know specifically  
12 in terms of the legal definition of this.  
13 Intuitively, I think a genus, which is a -- which  
14 describes a range of things can be described as a  
15 very large range of things or a medium range of  
16 things or a small range of things, so it's a  
17 relative term in terms of the possibilities of the  
18 size that a genus can be.

19 BY MR. FITZSIMMONS:

20 Q. So you included a quote here in your declaration,  
21 emphasized the phrase "narrowly defined," but you  
22 said you don't know what the legal definition would  
23 be of that; is that right?

24 MR. TURNER: Objection. Asked and  
25 answered.

1                   THE WITNESS: Yeah, that's what I said, I  
2                   don't know a specific legal definition of that, but  
3                   I understand intuitively what it means. And the  
4                   point of underlying it specifically is the next  
5                   paragraph, which talks about the genus of light not  
6                   really being narrowly defined, or at least implies  
7                   that.

8 BY MR. FITZSIMMONS:

9 Q.       Paragraph 171. Here you state a POSA would not  
10           immediately recognize vehicle headlights as falling  
11           within the light genus; is that correct?

12 A.       That's what it says, yes.

13 Q.       And a definition of a person -- POSA, right, person  
14           of ordinary skill in the art -- that you said that  
15           you applied is someone with two years of industry  
16           experience in an area of automotive lighting and  
17           lighting control systems, correct?

18 A.       That sounds right.

19 Q.       And so it's your opinion that someone with two  
20           years of industry experience in the area of  
21           automotive lighting and lighting control systems  
22           would not immediately recognize vehicle headlights  
23           as falling within the light genus; is that right?

24 A.       That's right.

25 Q.       That's your opinion that you're going to testify to

1           today under oath?

2   A.       Yes, that's what I wrote here.

3   Q.       That's what you wrote there, but is that still your  
4           opinion?

5   A.       Yes, it is.

6   Q.       If headlights don't fall within the light genus,  
7           according to you, what genus do vehicle headlights  
8           fall under?

9   A.       I don't know. And just to back up about the first  
10           part of your question there, I'm not sure if that's  
11           an accurate statement or summary of what I said or  
12           write here. Would you like to point me to that?

13   Q.       What are you referring to?

14   A.       The first part of your last question.

15   Q.       The last question I said was, "If headlights don't  
16           fall within the light genus, according to you, what  
17           genus do vehicle headlights fall under?"

18   A.       I don't think I say here that headlights don't fall  
19           under the light genus, do I? You said according to  
20           me.

21   Q.       You say, "A POSA would not immediately recognize  
22           vehicle headlights as falling within the light  
23           genus."

24   A.       Right. That's different.

25   Q.       How is that different?

1 A. It's different. It's different words. It's about  
2 POSA, it's about immediately recognizing. It's  
3 recognizing not beam or whatever you said in  
4 the first -- anyway, I think it's somewhat of a  
5 misstatement of what I said.

6 Q. Vehicle headlights provide light, correct?

7 A. Yes, they provide light at times, at least.

8 Q. If vehicle headlamps or vehicle headlights are on,  
9 they provide light, correct?

10 A. Yes.

11 Q. Vehicles driving at night are typically exposed to  
12 light from other vehicles on the road; is that  
13 fair?

14 A. That sounds fair.

15 Q. A person skilled in the art would expect optical  
16 sensors on a vehicle to detect light from other  
17 vehicles on the road; is that fair?

18 A. In general? In a particular context? I don't know  
19 if drivers have a particular expectation of that.

20 Q. You said drivers and I said POSA.

21 A. I'm sorry.

22 Q. So a person skilled in the art would expect  
23 optical sensors located on a vehicle to detect  
24 light from other vehicles on the road; is that  
25 correct?

1 MR. TURNER: Objection. Vague. Calls  
2 for speculation.

3 THE WITNESS: If we're still talking  
4 about a POSA at the time of -- I forget what year;  
5 2001-ish or so, '02 -- there were references that  
6 taught that, so I do think a POSA would know that  
7 that has been taught.

8 MR. FITZSIMMONS: Let's take a break.

9 (Whereupon a break was taken  
10 from 3:56 p.m. to 4:13 p.m.)

11 MR. FITZSIMMONS: I have no further  
12 questions. The witness is yours.

13 MR. TURNER: All right. I guess if we  
14 could, we'll take another five-minute break then.

15 (Whereupon a break was taken  
16 from 4:13 p.m. to 4:24 p.m.)

17 MR. TURNER: So I do have a couple  
18 questions for redirect.

19 EXAMINATION

20 BY MR. TURNER:

21 Q. All right. Dr. Turk, are you a technical expert?

22 A. Yes, I am.

23 Q. Okay. Are you a patent attorney?

24 A. I am not a patent attorney.

25 Q. Okay. We discussed a number of legal issues

1           today. Is your understanding of the technical  
2           issues in your declaration informed by your  
3           understanding of the legal issues referenced in  
4           your declaration?

5                   MR. FITZSIMMONS: Objection. Form.  
6           Leading.

7                   THE WITNESS: No, they're separate. My  
8           understanding of the technical issues are not due  
9           to an understanding of legal issues.

10 BY MR. TURNER:

11 Q.       Is your understanding of the technical issues  
12       informed by your understanding of the legal  
13       issues?

14                   MR. FITZSIMMONS: Objection. Form.  
15       Objection. Leading. Asked and answered.

16                   THE WITNESS: How to think about and  
17       interpret some technical aspects is informed by a  
18       legal understanding, for example, of a POSA, is a  
19       simple example, which is a legal concept, not a  
20       technical concept.

21                   MR. TURNER: Okay. No further  
22       questions.

23                   MR. FITZSIMMONS: Two minutes.

24                   (Whereupon a break was taken  
25                   from 4:26 p.m. to 4:27 p.m.)

FURTHER EXAMINATION

BY MR. FITZSIMMONS:

Q. Dr. Turk, during any of the breaks we've had today,  
did you have any conversations with counsel about  
the substance of your testimony given or to be  
given here today?

A. No, I did not.

Q. Did you have any conversations with anyone else  
about the substance of your testimony here today?

A. No, I did not.

MR. FITZSIMMONS: I have no further  
questions.

MR. TURNER: Good.

(Deposition concluded at 4:27 p.m.)

STATE OF MICHIGAN)

COUNTY OF OAKLAND)

Certificate of Notary Public

I do hereby certify the witness, whose attached testimony was taken in the above matter, was first duly sworn to tell the truth; the testimony contained herein was reduced to writing in the presence of the witness, by means of stenography; afterwards transcribed; and is a true and complete transcript of the testimony given. I further certify that I am not connected by blood or marriage with any of the parties, their attorneys or agents, and that I am not interested directly, indirectly or financially in the matter of controversy.

In witness whereof, I have hereunto set my hand this day at Clarkston, Michigan, State of Michigan.

I hereby set my hand this day, December 10, 2023.

*Karen Fortna*

Karen Fortna, CRR/RMR/RPR/CSR-5067

Notary Public, Oakland County, Michigan

My Commission expires 4/30/2025

DEPOSITION ERRATA SHEET

Our Assignment No.: 27210

Case Caption: Volkswagen Group of America v Spero

DECLARATION UNDER PENALTY OF PERJURY

I declare under penalty of perjury that I have read the entire transcript of my deposition taken in the captioned matter or the same has been read to me, and the same is true and accurate, save and except for changes and/or corrections, if any, as indicated by me on the DEPOSITION ERRATA SHEET hereof, with the understanding that I offer these changes as if still under oath.

Signed on the \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_\_\_.

MATTHEW A. TURK, PhD

DEPOSITION ERRATA SHEET

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

MATTHEW A. TURK, PhD

DEPOSITION ERRATA SHEET

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

Page No. \_\_\_\_\_ Line No. \_\_\_\_\_ Change to: \_\_\_\_\_

Reason for change: \_\_\_\_\_

SIGNATURE: \_\_\_\_\_ DATE: \_\_\_\_\_

MATTHEW A. TURK, PhD

| Exhibits                             |                                      |                                       |
|--------------------------------------|--------------------------------------|---------------------------------------|
| <b>Exhibit 2001 (IPR 328)</b> 6:13   | <b>1010</b> 115:21,25                | 112:8 126:25 127:14 128:5             |
| <b>Exhibit 2001 (IPR 335)</b> 6:14   | <b>1011</b> 128:19,23                | 133:8 134:9 137:17                    |
| <b>Exhibit 2006 (IPR 328)</b> 6:17   | <b>102</b> 48:22 49:1 53:3 59:7      | <b>1:22</b> 84:12                     |
| <b>Exhibit 2006 (IPR 335)</b> 6:19   | <b>103</b> 59:8,14,21 60:2           | <b>1B</b> 129:11,14,17                |
| <b>Exhibit 1001</b> 6:5 23:7,10,13   | <b>106</b> 85:24 86:14 97:8          | <b>2</b>                              |
| <b>Exhibit 1005</b> 6:6 84:15,18     | <b>107</b> 85:23 92:3 97:9           | <b>2</b> 70:8,10 73:20 85:13,16 95:6, |
| <b>Exhibit 1006</b> 6:7 99:8,12      | <b>108</b> 86:7,21 87:7,22 88:3,11   | 9 105:8 116:20 117:4 118:12           |
| <b>Exhibit 1010</b> 6:8 115:21,25    | 89:5 92:4,21 93:6                    | 119:13,18,22 120:7 124:18             |
| <b>Exhibit 1011</b> 6:10 128:19,23   | <b>109</b> 89:7                      | 129:15,17,23                          |
| <b>Exhibit 2001 (IPR 197)</b> 6:12   | <b>11</b> 129:25 130:5,10,14         | <b>20</b> 26:2 27:21,24 30:21 31:19   |
| 14:8,15 15:7,15 16:7,12,14           | <b>11:00</b> 48:18                   | 32:2 33:7 34:5,14,25 35:8,10,         |
| <b>Exhibit 2006 (IPR 197)</b> 6:15   | <b>11:16</b> 48:18                   | 11,22 36:10,18,24 37:1,7,14,          |
| 14:9,23 15:10,22 16:9,21 17:7,       | <b>12</b> 100:22 101:2 129:25 130:5, | 20 39:13,17,22 40:2,5,8,15,19         |
| 17 18:17 19:23 22:24 69:3            | 10,14                                | 41:8 42:13,17 43:14,17 44:12          |
| 71:17 85:9 96:25 133:9               | <b>12:47</b> 84:12                   | 45:15 47:19,23,25 48:24 49:8,         |
| (                                    | <b>13</b> 39:3 118:23 120:21 122:23  | 12 50:5 123:4 129:21                  |
| <b>(1)</b> 129:5                     | 129:25 130:5,10,15                   | <b>2001</b> 14:8,13,15 15:7,13,15     |
| 0                                    | <b>14</b> 40:20 44:21 48:22 60:2     | 16:7,12,14 18:8 23:19,21              |
| <b>01/01038</b> 128:21               | 117:2,5,12 118:7,9 119:10            | <b>2001-ish</b> 143:5                 |
| <b>02</b> 143:5                      | 121:15,16 122:5,10,17,22             | <b>2001/0019486</b> 99:10             |
| <b>029</b> 24:12,22                  | 127:5,10 129:25 130:5,11,15          | <b>2002</b> 63:11 81:8 82:7           |
| 1                                    | <b>142</b> 111:7                     | <b>2006</b> 14:9,13,23 15:10,13,22    |
| <b>1</b> 26:2 59:15,21 60:18,19,23   | <b>145</b> 18:19                     | 16:9,12,21 17:7,13,17 18:9,17         |
| 62:5 100:4,5,10,12,22,25             | <b>15</b> 11:13 92:2 117:13          | 19:23 22:24 23:18 28:24 69:3          |
| 116:14,15,17,22 117:4,8,11           | <b>16</b> 32:19,24 117:6             | 71:17 85:9 96:25 113:1 133:9          |
| 119:10 123:4,20                      | <b>162</b> 96:24 97:1,12             | <b>201</b> 85:24 86:13                |
| <b>10</b> 11:13 60:2 100:10,14,17,21 | <b>163</b> 97:16,22                  | <b>202</b> 85:22 86:3,8,23 96:16      |
| 101:1,6,9 130:18,19                  | <b>165</b> 134:9                     | <b>2022</b> 12:9                      |
| <b>10,894,503</b> 8:9 23:11          | <b>166</b> 136:20                    | <b>2023</b> 7:1                       |
| <b>100</b> 64:11,20 83:23            | <b>167</b> 112:1                     | <b>203</b> 85:23 86:9,24 89:6,9 92:22 |
| <b>1001</b> 23:7,10,13               | <b>17</b> 46:24 117:18 125:8         | 93:4,9 96:4,11                        |
| <b>1003</b> 112:6                    | <b>170</b> 137:17 138:22             | <b>204</b> 86:10                      |
| <b>1005</b> 84:15,18                 | <b>171</b> 140:9                     | <b>21</b> 49:1 123:20 125:8 129:21    |
| <b>1006</b> 99:8,12                  | <b>18</b> 46:24 101:4                | <b>213</b> 128:5,6                    |
|                                      | <b>19</b> 40:20 44:22 64:19 122:20   | <b>22</b> 105:10,15 122:20            |
|                                      | <b>196</b> 98:13,14,15,23            | <b>223</b> 133:8,10,11                |
|                                      | <b>197</b> 8:18 12:1 14:7,8,9,16,17, | <b>23</b> 22:4,22                     |
|                                      | 23,25 18:16 20:5 21:3 22:3           | <b>24</b> 19:9 22:5,22 49:1 105:10,15 |
|                                      | 69:2,3,12 71:17 75:13 85:9           | 123:20                                |
|                                      | 95:1 96:25 98:15 109:3 111:7         | <b>26</b> 26:3 55:19,21 56:5,14,19,22 |
|                                      |                                      | 57:3,13 61:1 64:19 105:10,13,         |
|                                      |                                      | 15 106:7,18 130:19                    |

**27** 118:23 130:7

**28** 105:10,15 122:21

**29** 50:17 118:24 130:7

**2:41** 115:18

**2:50** 115:18

**2;3** 129:4

---

**3**

---

**3** 64:12 75:18 102:16 103:1  
116:23 118:20 129:17

**300,000** 86:16

**31** 130:19

**318** 112:20,23

**32** 111:10

**328** 8:18 12:1 15:6,7,10,11,17,  
22,23 69:13 112:8

**33** 50:22 53:4 118:21 120:21,  
25

**335** 8:19 12:1 16:6,8,10,15,21  
69:14 112:8

**34** 118:17 119:6,12,19 121:2,3

**35** 50:21

**36** 86:1 120:21

**37** 26:3 64:11,13,15 65:7 66:3,  
22 67:10,24 68:16 90:10

**3:56** 143:10

---

**4**

---

**4** 34:25 86:1 87:3,21 89:2 90:1,  
11 91:1 92:2,19 102:2,8,23  
119:10 125:8 129:18,23 130:3

**40** 60:19,24 69:6

**41** 69:19

**42** 69:18

**43** 55:20 60:24 75:17 129:15

**46** 87:4

**47** 32:19,25 86:2,7

**48** 69:17 87:5,21

**49** 71:16

**4:13** 143:10,16

**4:24** 143:16

**4:26** 144:25

**4:27** 144:25 145:15

**4;5** 129:5

---

**5**

---

**5** 85:13 93:20 94:11 129:18

**50** 32:25 73:18 87:21 127:5,10,  
15,23

**503** 8:12 12:6,19 20:2,21  
21:17,25 23:9,14 24:1,4,11,21,  
22 25:11,21,23 26:6,10,18,24  
27:2,5,11,15,21 28:9 29:23  
32:16,24 33:9 35:25 43:14  
48:21 52:24 55:19 61:8,13  
62:16 63:11 66:3,7 68:17 69:1,  
7,11,13,20,21 70:2,3,15 71:19  
73:4,19 74:6 75:8,14,18,24  
76:14,21,23 78:20 81:8 82:7,  
18 83:10,18 84:4 112:5,6,7,13,  
23 113:2,4,9 114:6

**51** 75:13

**52** 73:20 78:11 79:2

**53** 73:20 75:18 89:2 90:1 91:1  
92:20

**55** 62:5 94:11,14

**551** 10:7,11 24:13,22

**56** 20:5

**57** 20:9 21:8,15 89:2 90:2 91:1  
92:20

**58** 21:3 73:20

**59** 26:3 28:13 29:1,12 48:21,23  
49:7,15 50:11,16 51:14,22,23  
53:3,17,24 55:6,25 56:1 59:22

---

**6**

---

**6** 103:18 112:1 118:14 119:4,7

**6,144,158** 84:16

**60** 28:4 57:10 62:6

**61** 62:8 93:20

**62** 32:4

**63** 32:4 34:6 57:13

**64** 93:20

**65** 26:3 59:7,9,15 95:3,5

**66** 85:10,11 94:12

**67** 34:6

---

**7**

---

**7** 35:1 38:5 103:23 111:8 112:2  
118:1 124:18 129:21 130:8

**70** 25:23

**72** 109:3

---

**8**

---

**8** 7:1 75:19 104:24

**87** 111:9

**88** 111:8,9

---

**9**

---

**9** 59:15,21 117:9,11,15,16,17  
118:5,11 124:18

**91** 128:2

**95** 60:18,25 62:5 126:25  
127:14

**97** 27:22 28:3 32:4 34:5

**98** 34:25 38:4 40:19 44:21  
46:24 55:19,25 57:10

**98/54030** 115:23

**9:31** 7:3

---

**A**

---

**a.m.** 7:3 48:18

**AABH** 93:23 97:17

**ability** 127:11

**able** 104:3 105:7 123:24

**about** 7:22 12:5 13:11 17:20  
18:3 19:8,19 22:16 30:12,19  
31:10,11 32:12 33:14 36:13  
37:1 39:3 40:20 41:19 42:23  
44:4,15 46:10,24 48:3 50:8

52:12 54:25 55:9,11,15 57:7  
 59:19,25 60:12 61:22,24,25  
 62:21 65:19 66:5,16,17,23,24  
 67:1,5,17 68:5,13,22,23 70:10,  
 20 71:25 72:13,25 73:3 74:18  
 75:2 77:2 78:24 79:16 82:23  
 83:4 85:7 86:15 90:8,25 91:1  
 92:20 95:3 96:5 97:14 101:23,  
 24 106:15,17,18,23 107:1,3,5,  
 14,16 108:9 110:13 111:5  
 114:22 122:21 125:2 128:11  
 133:3,21,22 134:18,20,21,23,  
 25 135:1,7,8,22 136:1,6,23  
 137:2 138:16 140:5 141:9  
 142:1,2 143:4 144:16 145:4,9  
**above** 53:13,16,22,25 54:6,9,  
 24 59:17 65:5,8 68:2,19 90:9  
 91:7,25 92:2 102:16 131:6  
**absorbed** 86:11 88:10 89:15  
 90:13,20,23,24 91:10  
**absorbing** 86:12 89:24 90:13,  
 21 94:10  
**abstract** 99:17,25 116:5,8  
 129:3  
**abstractly** 115:8  
**accepting** 21:7  
**accepts** 21:4  
**accommodating** 128:7  
**accomplish** 89:3,4 105:7  
**accordance** 125:18 129:25  
**according** 100:6 117:16  
 125:22,24 141:7,16,19  
**account** 64:4 79:9 80:2  
**accurate** 8:10 18:7,13 98:23  
 141:11  
**accurately** 9:7  
**achieve** 47:22 76:5 78:18  
 105:16 121:4,9  
**achieving** 73:3  
**acknowledge** 20:6,9  
**activated** 106:13 108:8  
**actual** 18:1 38:16 62:17  
**actually** 56:17 69:17 75:17  
 87:4 90:4 105:18 107:13  
 111:18 114:21 120:11 134:7

**actuate** 106:1  
**actuates** 105:15  
**adapt** 125:17,21 126:6  
**adapted** 64:22 125:14  
**adapting** 121:2,11,13  
**adaptive** 20:2 55:22 59:11  
 60:5 85:5  
**Adaptive/anti-blinding** 85:1  
**addition** 131:1  
**additional** 29:22  
**address** 126:15  
**adequate** 54:6,22  
**adjust** 47:21,25 48:9 108:19  
 117:25 131:19  
**adjustable** 130:22 132:3,14  
**adjusted** 88:21 113:16  
**adjusting** 131:8  
**adjustments** 48:11  
**adjusts** 117:20  
**advance** 51:17  
**advantage** 102:14  
**advantageous** 103:24 105:2  
**advantages** 109:4,10,12,17,  
 25 110:8,14,16,17,20 111:2,5  
**after** 18:12 26:25 98:23  
**afternoons** 11:23  
**again** 7:10 9:12 32:24 44:14  
 46:6 59:15 66:24 68:9 72:13,  
 24 80:3,23 91:23 96:24 115:6,  
 12 119:6 133:9 135:14  
**agnostic** 97:17  
**agree** 9:19 17:8 18:1 21:13,21  
 27:24 30:17 37:11 48:23 55:21  
 59:9 60:19 62:24 64:12,15  
 67:21 83:25 85:4 101:8 102:25  
 104:2 107:22 116:11 124:3  
 129:8 131:18 132:25  
**ahead** 68:1 112:18  
**aim** 71:4 73:23 76:23  
**aimed** 28:6 30:23 31:17,19  
 34:11 40:23 41:6 43:18 51:2,6,

19 52:20,22 53:12 76:9,10  
**aiming** 69:25 71:3 76:6,8  
**aims** 51:1 53:4,9 79:23  
**Alan** 7:17  
**algorithm** 64:5  
**algorithms** 62:11,13,17,22,24  
 63:13  
**allow** 9:14 10:1 77:15  
**allowable** 75:5  
**allowed** 75:9  
**allows** 103:7,14  
**along** 78:1  
**already** 55:15 80:11 81:10,13,  
 18 82:10 95:2 125:3  
**also** 21:7 41:17 44:9 47:14  
 60:23 75:3 76:6 85:7,24 89:18  
 91:4 94:6 106:7 108:13 116:25  
 117:8 120:14 121:9 123:8  
 125:21 131:15  
**altering** 88:4  
**alternatively** 130:12  
**although** 83:22  
**always** 126:3,22  
**am** 143:22,24  
**ambient** 36:16 125:14,22,24  
 126:3  
**among** 103:3 124:6  
**amount** 18:5 52:6,8,10,12  
 53:18 54:7,10  
**analogue** 38:20  
**analogy** 52:15,20 77:18  
**analysis** 28:18 74:3  
**analyze** 20:20  
**analyzing** 21:16  
**and/or** 41:18 97:6 120:24  
 121:2,5,6,10  
**angle** 33:15 34:9,12  
**angles** 28:6 30:24 31:17,19  
 34:2  
**angular** 86:19 87:5,10,13

|                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>animals</b> 52:5                                                                                                                                                                                                                                                              | 109:1                                                                                                                                                                                                                                                                                                                                                | <b>association</b> 104:22,23                                                                                                                                                                                                                                                                                                         |
| <b>annotated</b> 95:6,9,12,18 96:2,14                                                                                                                                                                                                                                            | <b>approximate</b> 18:4                                                                                                                                                                                                                                                                                                                              | <b>assume</b> 9:21 107:5                                                                                                                                                                                                                                                                                                             |
| <b>annoying</b> 34:15,17,21,22 47:12 55:16 78:16                                                                                                                                                                                                                                 | <b>approximately</b> 32:4,25                                                                                                                                                                                                                                                                                                                         | <b>attempting</b> 98:4                                                                                                                                                                                                                                                                                                               |
| <b>another</b> 34:22 73:23 74:7 75:14 90:5,9 97:18 103:23 104:24 109:17 143:14                                                                                                                                                                                                   | <b>area</b> 26:15 33:15 42:11 43:1 51:18 54:24 69:25 97:11 98:9 140:16,20                                                                                                                                                                                                                                                                            | <b>attenuate</b> 89:8,19,20 90:2 91:3,4,15,16                                                                                                                                                                                                                                                                                        |
| <b>answer</b> 9:15 22:17 37:24 54:14 65:24 82:3,21 83:6 113:6 136:15                                                                                                                                                                                                             | <b>areas</b> 55:12,13 105:23                                                                                                                                                                                                                                                                                                                         | <b>attenuated</b> 86:11 87:16 90:12,20,22,23 94:19,22 95:16                                                                                                                                                                                                                                                                          |
| <b>answered</b> 19:17 111:22 139:25 144:15                                                                                                                                                                                                                                       | <b>aren't</b> 74:24                                                                                                                                                                                                                                                                                                                                  | <b>attenuating</b> 91:8                                                                                                                                                                                                                                                                                                              |
| <b>anti-glaring</b> 78:11,19                                                                                                                                                                                                                                                     | <b>argument</b> 19:4                                                                                                                                                                                                                                                                                                                                 | <b>attenuation</b> 86:20 87:6,14 89:22                                                                                                                                                                                                                                                                                               |
| <b>anticipated</b> 135:13,23 136:4                                                                                                                                                                                                                                               | <b>around</b> 28:4 50:13 55:20 60:19 81:15 134:3                                                                                                                                                                                                                                                                                                     | <b>attorney</b> 12:12 143:23,24                                                                                                                                                                                                                                                                                                      |
| <b>anticipates</b> 136:11,21                                                                                                                                                                                                                                                     | <b>arranged</b> 86:19 122:10,16 129:25 130:15                                                                                                                                                                                                                                                                                                        | <b>attorneys</b> 10:20 11:16,18 13:3,5,10 17:21 26:16 134:16 135:11 138:18                                                                                                                                                                                                                                                           |
| <b>anticipation</b> 138:25                                                                                                                                                                                                                                                       | <b>arrangements</b> 109:6                                                                                                                                                                                                                                                                                                                            | <b>author</b> 132:22,23,25                                                                                                                                                                                                                                                                                                           |
| <b>any</b> 8:25 9:6,9,10,25 10:9,12,25 11:5 12:16 17:12 26:18,23 27:2,5,11,14,17 28:14 29:21 30:3 32:15 34:23 36:9 40:15 44:2 48:11 49:11 51:23 52:1 54:22 62:17 68:23 71:14 72:8 75:5 88:8 94:13,18,20 97:4,11 98:5 108:16 109:4,6,10,12,16,24 110:6,8,20 112:3 115:8 145:3,4,8 | <b>arranging</b> 100:20                                                                                                                                                                                                                                                                                                                              | <b>automatic</b> 106:11                                                                                                                                                                                                                                                                                                              |
| <b>anybody</b> 21:12                                                                                                                                                                                                                                                             | <b>array</b> 71:12 99:4 120:12 128:7 130:8,10 134:1,2                                                                                                                                                                                                                                                                                                | <b>automatically</b> 105:14 106:1 124:22                                                                                                                                                                                                                                                                                             |
| <b>anyone</b> 11:18 145:8                                                                                                                                                                                                                                                        | <b>arrow</b> 95:10,21                                                                                                                                                                                                                                                                                                                                | <b>automotive</b> 137:7 140:16,21                                                                                                                                                                                                                                                                                                    |
| <b>anything</b> 13:11 18:13 29:18,24 30:11 40:12 44:15 48:7,8 60:12 66:16,24 68:4 79:15 107:1,5 108:23                                                                                                                                                                           | <b>art</b> 19:24 20:7,12,20,21 21:18 27:6 37:18,21 41:12 42:15 45:3 47:5 63:1,6,7,12 64:3 65:15,23 66:21 67:3,13 73:3,12,14 75:25 78:18 79:25 80:7 82:15,18 83:9,13,18,25 101:14,20 104:2,12 105:24 106:16,23 107:5,8 108:6,10,18,21,24 109:12 110:7,12,20,24 111:1 113:18 114:2 123:11 126:6,13,17,23 131:19 132:5,17,24 136:11,20 140:14 142:15,22 | <b>available</b> 45:10,11                                                                                                                                                                                                                                                                                                            |
| <b>anyway</b> 142:4                                                                                                                                                                                                                                                              | <b>ask</b> 9:13,21 10:1 34:19 77:18 81:5 109:1                                                                                                                                                                                                                                                                                                       | <b>average</b> 125:11                                                                                                                                                                                                                                                                                                                |
| <b>anywhere</b> 21:12 72:14 124:9                                                                                                                                                                                                                                                | <b>asked</b> 19:16 36:25 63:5 82:9 113:22 139:24 144:15                                                                                                                                                                                                                                                                                              | <b>aware</b> 79:25 108:16 109:16,24                                                                                                                                                                                                                                                                                                  |
| <b>appears</b> 15:18 128:2                                                                                                                                                                                                                                                       | <b>asking</b> 31:5,10,11 58:10 66:5,10 72:13 82:23 110:5 135:4                                                                                                                                                                                                                                                                                       | <hr/> <b>B</b> <hr/>                                                                                                                                                                                                                                                                                                                 |
| <b>applicable</b> 79:13                                                                                                                                                                                                                                                          | <b>asks</b> 21:12                                                                                                                                                                                                                                                                                                                                    | <b>back</b> 10:8 34:5 42:13 44:21 48:19 59:7 84:13 92:19 141:9                                                                                                                                                                                                                                                                       |
| <b>application</b> 109:7                                                                                                                                                                                                                                                         | <b>aspect</b> 23:2 61:18,20                                                                                                                                                                                                                                                                                                                          | <b>ball</b> 77:21,25                                                                                                                                                                                                                                                                                                                 |
| <b>applied</b> 19:25 20:22 21:16,18 22:24 23:3,5 28:18,22 29:1 138:23 140:15                                                                                                                                                                                                     | <b>aspects</b> 144:17                                                                                                                                                                                                                                                                                                                                | <b>based</b> 13:9 17:20 31:23 39:14,23 42:6 71:13 106:8 131:20 135:10                                                                                                                                                                                                                                                                |
| <b>apply</b> 134:12 137:1,3                                                                                                                                                                                                                                                      | <b>assert</b> 127:15                                                                                                                                                                                                                                                                                                                                 | <b>basically</b> 34:1 61:3                                                                                                                                                                                                                                                                                                           |
| <b>applying</b> 28:20 136:16                                                                                                                                                                                                                                                     | <b>assertion</b> 127:19                                                                                                                                                                                                                                                                                                                              | <b>basis</b> 74:2                                                                                                                                                                                                                                                                                                                    |
| <b>appropriate</b> 8:21 21:21 91:19                                                                                                                                                                                                                                              | <b>associated</b> 65:16 66:12,22 93:13,17 97:3 98:6,8                                                                                                                                                                                                                                                                                                | <b>beam</b> 55:22 57:14,15,20 58:4,6,7,14,15,16 59:11 64:22 65:1 69:24 70:1,21,23,25 71:2,5 73:24 76:7 84:14,16,23 85:1,4,7,10,19,24,25 86:13,14,18,22 87:10 88:7,11,13 89:11,17,20,22,25 90:8,25 91:13,17 92:8,13 93:19,25 94:3,6,20,25 95:6 96:14,15 97:3,10,13,15,22,23 98:1,3,7 99:2,4,5 102:4,11,17 104:4 105:1 113:19 114:3,15 |

115:2 117:20 118:1,20 119:1,  
2,3 120:25 121:3,5,10,14  
122:7,11,18,23 123:25 124:20  
125:13 127:5,8,10,15,23  
130:23,25 131:9,12,15,20  
132:6,7,19 142:3

**Beam's** 85:12,16 89:23 97:16  
98:24

**beaming** 75:4

**beams** 57:24,25 76:9 83:12  
89:23 93:24 104:10,13,14  
118:16,19 119:5,12,19 120:1  
121:2 123:5,8,12,15 124:4,7,  
14 130:21 132:3,14,18

**because** 33:20 52:1 65:21  
68:13 72:21 82:21 97:13  
104:20 114:20 128:15 134:11

**been** 7:6 10:8 12:11 17:21  
28:20 46:10 47:15 53:19 63:19  
72:15 98:19 134:16 135:11  
143:7

**before** 9:15 10:3 13:21 20:15  
24:1,5 26:6 28:21 50:24 55:17  
65:20 66:23 67:1 79:15 83:9,  
11,18 84:3 90:10 93:8 97:25  
107:19 113:22 133:4 137:18  
138:16

**begin** 9:15

**beginning** 12:9 32:20 62:7

**behalf** 13:6,14,20

**behave** 99:6

**being** 13:12 29:14 31:24 33:18  
34:16 36:3 38:12 54:6,14  
55:14,16 57:11 77:10 78:1,5,  
10 81:6 83:20,21 86:11 90:12,  
20,23 91:9 92:1 95:15,16 96:3  
99:4 120:3,12 134:4 140:6

**believe** 10:14 12:3,9,14 13:12  
17:15,22 18:13 21:11 22:1  
24:16,17 28:11 32:11 33:15,17  
50:22 53:4 58:2,19 60:24  
63:11 67:5 68:4 69:15,18 70:3  
81:12 82:5 83:20 98:24 99:1,4  
100:11 112:3,14,25 113:11  
117:7 118:8 121:23 128:1  
136:6

**below** 51:3,25 52:3,16 53:22,  
25 54:9 59:17 65:1,8 68:2,8,19

**besides** 30:19

**best** 8:15 41:10,13 44:25  
114:9,17 126:20

**better** 114:24

**between** 17:9 20:14 49:11  
58:15,20 61:4,9,12 98:15  
109:13,25 110:9 134:19  
135:19

**bit** 14:4 54:5 92:2

**blank** 98:6,8

**blanked** 86:11 90:12,19,22,23  
95:13,17,24 96:3

**blanking** 91:8 92:14,15

**blanks** 97:19

**blind** 94:18,21

**Board** 21:11

**Board's** 20:10 21:4 28:11

**both** 24:22 53:20 122:14

**bothersome** 34:16

**bottom** 27:22 69:19 93:20  
122:4 127:12

**bottom'** 127:7

**boundary** 59:6

**break** 9:25 10:3 46:11 47:20  
48:16,17 50:17 84:9,11  
115:16,17 143:8,9,14,15  
144:24

**breaks** 9:24 145:3

**bright** 42:8 45:22

**brightness** 33:20 42:25

**bringing** 120:2 133:19

**brings** 33:13 133:22

**broad** 115:9 126:14 134:18,20  
137:2

**broadly** 130:23 131:12 132:6,  
18

**broadly** 37:3

**Brooks** 11:18

**burden** 18:22,25 19:5,10,13

---

**C**

---

**call** 54:10 85:12 108:4 116:2  
121:25 127:23

**called** 135:1

**calls** 42:19 43:8,24 45:5 47:8  
54:11 55:7 56:9 58:8,17 65:17  
73:6 78:21 86:25 101:17 104:6  
106:20 115:4 126:10 133:1  
143:1

**came** 17:20 26:13 98:10

**camera** 85:19,23 97:9

**can** 7:16 14:3,17 15:15,23  
16:1,15,22 23:13 29:20 31:12  
33:15 34:3,6 35:1,14 36:11  
37:8 39:6 40:21 42:3,5 45:1  
46:11,12 47:19 48:13 50:19  
51:11,13 53:7 54:18 62:6  
64:20 69:10,20 77:18 78:4  
82:22 83:16 84:22,25 85:15,21  
88:6 89:2 90:7 91:21 93:9,21  
97:1 99:14 102:5 103:3 105:22  
106:8,12 107:14,16,24 112:18  
115:9 118:24 119:7,9,10,12,  
15,18,19,22 120:2,14,21,25  
121:4,9 123:17,20 124:18  
127:2,6 128:25 129:22 130:8,  
15,19 132:12 134:9 135:5  
138:21 139:14,18

**can't** 52:22 70:6 78:10 91:17,  
23 113:6

**capable** 28:15 29:14 93:5  
131:8

**car** 74:16 98:12 105:5

**cars** 34:15,18 79:17,18 83:22

**case** 21:23 26:17 31:22,25  
33:17 52:21 54:25 83:12  
113:10 136:22 137:5 138:12,  
14,17

**cases** 11:17 13:24 17:22  
44:17 73:12 97:15 123:21,22  
124:6,11,14,17 137:1

**category** 104:16 134:18,20,22  
135:14,16,18,19 136:7 137:2

**cause** 124:21 134:5

**caveat** 81:3

|                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                |                                                                                                                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------|
| <b>CCPA</b> 138:24                                                                                                                                                                                                                                                 | 23 53:3,17,24 55:5,19,21 56:5,<br>14,17,19,22 57:1,3,13 59:7,9,<br>15,22 60:10,12,14,17,18,19,23<br>61:1 62:5 64:11,13,15 65:7,11,<br>13 66:3,15,22 67:6,10,24<br>68:16,20                                                     | 79:18,20                                                                                                          |
| <b>certain</b> 45:12 46:6 52:6,8<br>75:10 80:12 105:9                                                                                                                                                                                                              |                                                                                                                                                                                                                                | <b>command</b> 92:24                                                                                              |
| <b>certainly</b> 37:15 72:3 83:11<br>137:16                                                                                                                                                                                                                        |                                                                                                                                                                                                                                | <b>commands</b> 87:22 88:5,12<br>89:6 92:21                                                                       |
| <b>certainty</b> 83:23                                                                                                                                                                                                                                             | <b>claimed</b> 78:20                                                                                                                                                                                                           | <b>comment</b> 59:5                                                                                               |
| <b>cetera</b> 57:25                                                                                                                                                                                                                                                | <b>claims</b> 20:2,21 21:17 25:21,23<br>26:1,2,6,14,18,24 27:5,11,15,<br>20 29:23 30:15 31:1 32:8 34:5<br>43:4 49:20,25 50:4 61:8,14<br>70:15 76:14 133:21                                                                     | <b>communicated</b> 12:23 13:4,8<br>118:6                                                                         |
| <b>change</b> 20:19 46:17 71:18<br>78:3 102:10 103:3                                                                                                                                                                                                               | <b>clarification</b> 9:21                                                                                                                                                                                                      | <b>communicating</b> 35:6 38:7                                                                                    |
| <b>changed</b> 102:5                                                                                                                                                                                                                                               | <b>clarity</b> 21:9                                                                                                                                                                                                            | <b>communication</b> 39:2,7 62:10                                                                                 |
| <b>changes</b> 48:12 63:7 77:14<br>78:10 134:6                                                                                                                                                                                                                     | <b>class</b> 139:4                                                                                                                                                                                                             | <b>company</b> 13:12                                                                                              |
| <b>changing</b> 77:5,8,15 78:2,7<br>102:14 103:6,13                                                                                                                                                                                                                | <b>clause</b> 38:3 44:20                                                                                                                                                                                                       | <b>comparable</b> 52:19                                                                                           |
| <b>characteristic</b> 32:8,20 33:1,<br>10 102:3,10,14,17,24 103:2,6,<br>13                                                                                                                                                                                         | <b>clear</b> 19:1 21:24 26:23                                                                                                                                                                                                  | <b>compare</b> 50:14 52:23                                                                                        |
| <b>characteristics</b> 32:3,12,16<br>33:7 103:3 117:20                                                                                                                                                                                                             | <b>clearer</b> 96:5                                                                                                                                                                                                            | <b>comparing</b> 52:9                                                                                             |
| <b>check</b> 69:10 70:17 72:10<br>112:16,18                                                                                                                                                                                                                        | <b>clearly</b> 54:24                                                                                                                                                                                                           | <b>compatible</b> 55:14                                                                                           |
| <b>choice</b> 87:15 131:2                                                                                                                                                                                                                                          | <b>close</b> 79:17 95:2                                                                                                                                                                                                        | <b>compelling</b> 19:2                                                                                            |
| <b>chose</b> 72:19,21                                                                                                                                                                                                                                              | <b>cluster</b> 56:4,8,18,19 57:4,9<br>61:4,24                                                                                                                                                                                  | <b>complete</b> 22:5,9,13,15 52:19                                                                                |
| <b>chosen</b> 89:10                                                                                                                                                                                                                                                | <b>clusters</b> 56:2,15 60:24,25<br>61:2,9,13,23 62:2                                                                                                                                                                          | <b>completely</b> 92:17                                                                                           |
| <b>circles</b> 121:20,25 122:1,4,9,14                                                                                                                                                                                                                              | <b>coin</b> 128:8                                                                                                                                                                                                              | <b>complicated</b> 65:21                                                                                          |
| <b>Circuit</b> 138:3                                                                                                                                                                                                                                               | <b>collaborative</b> 17:25                                                                                                                                                                                                     | <b>component</b> 137:6                                                                                            |
| <b>circuitry</b> 39:8 47:21,25 48:9<br>62:12                                                                                                                                                                                                                       | <b>color</b> 102:18 133:12,14,17<br>134:5                                                                                                                                                                                      | <b>components</b> 19:3 85:15                                                                                      |
| <b>circumstance</b> 83:5                                                                                                                                                                                                                                           | <b>colors</b> 34:3 134:2                                                                                                                                                                                                       | <b>composed</b> 85:18 119:14<br>120:3,8                                                                           |
| <b>circumstances</b> 46:7                                                                                                                                                                                                                                          | <b>column</b> 27:22 28:3 32:4,19,24<br>34:5,25 38:4 40:19 44:21<br>46:24 48:22 49:1 53:3 55:19,<br>25 57:10 59:7,8,14,21 60:2,18,<br>25 62:5 64:11,20 70:8 73:19,<br>20 75:18 86:1 87:3,21 89:2<br>90:1,11 92:2,19 93:20 94:11 | <b>Compound</b> 56:21 91:5                                                                                        |
| <b>citation</b> 138:7,10                                                                                                                                                                                                                                           | <b>columns</b> 91:1                                                                                                                                                                                                            | <b>comprising</b> 86:15 129:24                                                                                    |
| <b>citations</b> 72:11 138:14                                                                                                                                                                                                                                      | <b>combination</b> 19:7,15 99:2,5                                                                                                                                                                                              | <b>concavely</b> 101:6,9                                                                                          |
| <b>cite</b> 111:12,18 127:19 138:12                                                                                                                                                                                                                                | <b>combine</b> 19:2,6,14 69:23                                                                                                                                                                                                 | <b>concept</b> 144:19,20                                                                                          |
| <b>cited</b> 39:22 91:7                                                                                                                                                                                                                                            | <b>come</b> 80:24                                                                                                                                                                                                              | <b>concluded</b> 145:15                                                                                           |
| <b>cites</b> 72:6                                                                                                                                                                                                                                                  | <b>comes</b> 128:14 134:15 138:17                                                                                                                                                                                              | <b>conditions</b> 46:17 63:18,23,24<br>64:5 79:22 80:1,16 103:25<br>104:5,21 115:3 123:16,18<br>125:19,25 126:2,3 |
| <b>claim</b> 26:10 27:21,24 30:21<br>31:19 32:2,10 33:7 34:5,14,25<br>35:8,10,11,18,22 36:10,18,24<br>37:1,7,14,20 39:13,17,22 40:2,<br>5,8,13,15,19 41:8 42:13,17<br>43:14,17 44:1,12,14 45:15<br>47:19,23,25 48:21,23,24 49:7,<br>8,12,15 50:5,8,12,16 51:14,22, | <b>comfort</b> 124:2 125:15                                                                                                                                                                                                    | <b>configured</b> 35:3 39:8 49:3<br>62:13 117:25 118:5                                                            |
|                                                                                                                                                                                                                                                                    | <b>coming</b> 31:21 51:8 78:15                                                                                                                                                                                                 | <b>confirm</b> 14:18 15:16,24 16:2,<br>15,23 23:13 26:2 84:22 99:14<br>112:9 116:2 128:25                         |

**confusing** 83:4 113:11 120:5  
**connect** 101:21  
**connected** 117:5,12  
**consider** 38:12 48:13 71:23  
 109:23 114:25  
**consideration** 64:10  
**considerations** 114:21  
**considered** 12:15,18 20:24  
 34:16 37:12 38:11 83:20  
 107:24  
**considering** 81:23  
**consistent** 28:21 69:12 72:3  
 120:12  
**constantly** 123:25 124:4,8  
**constraint** 115:9  
**constraints** 44:2 74:14  
**construction** 28:11,13,19,25  
 29:13 30:8,11  
**contacted** 12:5,8,10  
**content** 33:3  
**context** 22:10 29:21,23 30:14,  
 16 31:1 32:7 36:18,23 37:6,13,  
 20 38:11 42:16 55:1 56:5 61:8  
 68:5,16 71:3 74:13 75:2 81:6,  
 23 82:6 90:15,21 91:6,18,24  
 92:13 107:19 108:1,23 109:1  
 110:3,5 113:23 114:1 118:25  
 119:1 120:5 127:4 133:20  
 139:1 142:18  
**contexts** 49:19  
**contingencies** 46:4  
**contrasted** 86:17  
**contributes** 124:1  
**control** 39:8 41:9 47:20,25  
 48:8,9 60:4 62:12 64:6 71:13  
 77:5,8,10,12 78:4 105:14,19,  
 22 117:1 118:11 120:17  
 140:17,21  
**controllable** 32:3  
**controlled** 44:16 88:25 94:1  
 119:15 120:15 125:12  
**controller** 62:7,9 86:7,21  
 87:7,12,14,17,22 88:3,4,7,11  
 89:5 92:4,21,24,25 93:6

105:25 116:25 117:5,12,19,25  
 118:7,9 120:17  
**controlling** 44:17 60:4  
**controls** 78:2 94:7,9  
**conventional** 86:17 131:5  
**conversations** 145:4,8  
**correct** 7:25 8:2 9:4 12:20  
 13:7 14:25 20:3,7,12,16 24:14,  
 18,23 25:1,5,24 26:3,4 28:1  
 30:24 33:4 39:15,25 40:1,3,4,  
 9,17,18 41:25 43:19 48:9  
 55:23 56:15,18,20,25 57:4  
 59:12,18 60:21 62:18 63:2  
 64:7,17 65:9,12,14 69:14,15,  
 25 70:16 71:3 73:20,24 74:4,8,  
 24 75:11,22 76:16,17,19,20  
 84:5 85:2,5,13,14 87:1,2,12,18  
 88:15,22 93:2,6,10 94:4,8,23  
 95:10,11,13 96:4,12,16 97:24  
 99:20 100:6,7,10,14,23 101:2,  
 6,10 102:11,21 103:8,15,25  
 105:3,17 106:9 110:2,4 111:2,  
 13,16,21 112:24,25 113:4  
 116:10,17,20,23 117:2,6,9,10,  
 13,21 118:2,12,13,17,21  
 119:19,23 120:9,15,18 121:7,  
 12 122:2,24 123:9 124:8,14,16  
 125:19,20,23 126:1,21 127:12,  
 13,20,21,24 129:19 130:5,16  
 131:13,16,17,21 137:7,14  
 138:3,4 139:7 140:11,17  
 142:6,9,25  
**correctly** 71:4  
**correlated** 97:19  
**corresponding** 95:20  
**could** 14:15 34:19 36:19  
 37:12,17 38:19 41:16,17,20  
 43:2 45:8 46:20 47:12 52:12  
 54:19 56:18 63:20 68:7 69:16  
 71:13,15 73:12 74:15,17  
 77:19,21 80:20 81:3 85:8 86:5  
 94:12 97:15 99:23 109:18  
 124:12 125:9 133:23 143:14  
**counsel** 145:4  
**country** 126:9,20  
**couple** 11:22 143:17  
**course** 79:16  
**court** 136:4,6 138:24

**courts** 10:12  
**cover** 84:25 129:4  
**create** 97:10 98:17,21 118:1  
 124:25  
**created** 98:18  
**creating** 125:4 130:22 131:12  
 132:6,18  
**curve** 79:20 105:2  
**curved** 101:1,6,10,15 109:13,  
 18,20 110:1,9,21 111:6  
 130:13,15

## D

**D/i** 122:15  
**dark** 42:10 123:22 124:5  
**data** 35:7 37:22 38:4,8,11,12,  
 15,16,22 39:9,14,24 40:16  
 49:13 62:14 92:3 94:2  
**date** 63:10 81:7 82:7,17 83:10,  
 18 84:3,4  
**day** 42:8,24 45:22  
**days** 11:22  
**December** 7:1  
**decide** 38:1 68:1  
**decisions** 19:19 136:5,6  
**declaration** 13:1,20 14:9,17,  
 24 15:8,11,17,23 16:8,10,16,  
 22 18:2,16 20:5 21:3 22:3,11  
 28:12 55:10 58:21 61:16 67:16  
 69:3,12 70:19 71:17 75:13  
 85:8,9 95:1 96:24 98:13 109:3  
 111:7,13,19 112:2,4 113:3  
 126:25 127:14,20 128:2,5,9  
 133:8,9 134:10,14 137:17,18,  
 22 139:20 144:2,4  
**declarations** 7:22,23 10:18,  
 19,22 12:25 13:6,14 14:7 16:6  
 17:6,13,16 18:4 19:22 22:25  
 23:18,21,25 24:6,8 25:3 26:20,  
 25 28:24 29:2,9 69:14 111:15,  
 20 112:12 113:1,8 138:15  
**define** 52:25  
**defined** 35:4,20 51:17 53:19  
 56:12 139:2,3,6,9,21 140:6

**defines** 31:14 32:11 70:4 72:2  
103:1

**definition** 20:19 29:5 34:24  
70:7,8,13 72:9,12 139:12,22  
140:2,13

**definitions** 29:8

**deflected** 86:12 90:13,20,24

**deliver** 113:18

**delivering** 114:3

**depend** 36:19 45:18 47:10  
63:16,20 78:9

**dependence** 127:7

**dependent** 45:20

**depending** 46:17,20 75:9  
89:8

**depends** 38:17 46:8 71:6  
133:5

**deposed** 10:9

**deposition** 7:19 10:6,11,15,  
17 11:1,7,10 14:13 15:13  
16:12 18:10 23:7 24:25 84:18  
99:12 115:25 128:4,23 145:15

**depositions** 10:17 24:14

**describe** 35:25 101:8 124:7,  
13 127:22

**described** 71:19 74:24 78:5  
83:11 91:18 92:1,17 98:3  
102:12 104:4 118:3,15 139:14

**describes** 36:3 69:21 73:5,9,  
22 92:13 99:18 101:5 103:23  
105:14,18 106:7 116:6 119:17,  
22 122:21 124:9 134:8 139:14

**describing** 75:8 86:22 88:1  
91:9 94:3,6,20 96:15 103:5,12  
104:24 107:9 120:11,14 124:3  
125:17 128:16 131:7

**description** 72:12 127:9

**descriptive** 128:15

**design** 114:9,21 115:1,7,14

**designated** 100:13

**designed** 123:5,19

**designing** 108:25 114:22

**desirability** 124:4,13 132:6,

18

**desirable** 41:19,23 42:1  
104:13,18 123:23 132:22,25

**desired** 37:24 83:1 118:1,2  
120:22,24 121:5,10 127:8

**detail** 48:2 97:14 98:2

**details** 55:1 63:17 65:24  
68:10,12

**detect** 74:7 98:5 142:16,23

**detected** 38:10 39:11,12,18,  
21,23 40:3,11,13,17 49:8,12,  
14 50:6,9 74:15 97:8 98:7,10

**detecting** 38:24 73:22 98:1

**detection** 74:20

**detects** 39:13 40:8

**determination** 37:9 67:19

**determine** 13:24 31:6 34:17  
37:18 39:9 40:16,21,23 41:9  
43:17 45:3 47:5,12 49:13  
50:25 62:14,18,24 63:13 67:2,  
13 68:7 73:15,23 75:21 92:4  
98:3

**determined** 41:21 45:8,9  
47:22 67:25

**determines** 39:22 40:5

**determining** 12:15 27:12  
35:4,12,20,23 36:2,7,17,20,23  
37:2,6,13,23 42:15 43:2,5  
45:11 60:3 74:10 75:4 76:2

**develop** 26:5

**developing** 26:9

**device** 88:10 89:15,16 90:18  
91:11 93:9,14 99:18 100:1,5  
102:4 103:7,14 105:14,19,22  
116:7,15,16,19

**devices** 57:23

**did** 10:15 11:5,21 13:11 17:16  
19:23 20:1 23:25 24:4,9 25:21  
26:5 67:2,6,13 80:9,24 81:9,  
12,13,18 82:9 98:4,17 112:11,  
14 113:7,11 117:22 132:10  
137:17,20,21,25 145:4,7,8,10

**didn't** 13:17 17:18,19 26:19,  
24 98:21 138:7,11

**difference** 20:14,25 22:21  
49:11 54:3 58:24 61:4,9,12,15

**differences** 24:17 109:5,11,  
13,25 110:8,16

**different** 19:2,3 28:6 30:23  
31:17,19,23 33:23 34:3,4,12  
44:11 47:13 49:19,20,21,23,25  
50:1,2,3,13 52:5,9 54:17  
57:22,24 58:1 61:17 71:12  
73:9 75:9 81:16 102:5 103:4,7,  
15,16,17 105:16 106:1 126:4,  
18,22 141:24,25 142:1

**differently** 40:23 41:6 43:18  
44:18 58:15,23 126:8

**differs** 22:14,19

**difficulties** 133:24

**difficulty** 27:12

**digital** 38:20 69:21 70:2,7,10,  
13,16 93:9,14

**digits** 8:17

**dimension** 119:3

**dimensions** 130:21 131:9,19  
132:2,14

**dimmed** 97:11

**dipped** 122:6,7,18,23

**direct** 8:21 47:20 48:12

**directed** 20:2 27:24 48:23  
55:21 59:10 60:20 64:13,15  
85:4 93:24 94:4,9 116:11  
129:8

**direction** 31:23,24 33:14 51:9  
58:23 88:4 94:8 102:18 127:8

**directional** 28:5 30:22,23  
31:16 40:24 41:6 43:4,18,22  
47:21 48:1,10 56:1,14 57:9  
60:5,6,9,16 81:14,19,20,21  
82:11,19,24 83:8,14

**directions** 33:23 57:12 81:16,  
17 83:13 96:20

**disadvantages** 109:5,10,18  
110:11

**disclose** 62:17

**disclosed** 67:3,14 84:2  
136:23

**discloses** 78:24 100:8,20  
119:5 120:7 121:4,9 130:2,14

**disclosing** 87:10 124:25  
125:5,21

**disclosure** 24:20 25:8,11  
136:11,21 137:1,2

**discuss** 19:8 74:21 76:8  
123:1

**discussed** 10:19 17:23 24:13  
46:16 113:15 119:19 143:25

**discusses** 75:20 76:6,10

**discussing** 20:22 21:19 37:1  
53:21 73:4 85:10 90:5 111:21  
120:20

**discussion** 30:18 68:23  
70:10 74:9

**discussions** 13:3,10 17:20  
26:16 134:15 135:10 138:18

**disperse** 104:4

**dispersion** 102:19

**disposing** 101:9

**distance** 102:19

**distances** 103:20

**distant** 76:24

**distinctions** 58:20

**distracting** 78:16

**distributed** 104:14

**distributing** 101:5

**distribution** 31:20 33:2,4,22,  
25 57:15 58:3,14 102:20  
121:17

**distributions** 58:2,21

**disturbing** 34:10,14 41:1  
46:22 47:1,6

**diversion** 96:12

**divert** 89:7,12 90:2 91:2,4,14,  
15

**diverted** 91:9 94:19,22 95:15  
96:3,16,22

**diverting** 88:9,14 89:23 91:7

**DLF** 69:22,23 70:13

**document** 8:22,25 15:7,9  
16:9

**documents** 8:22 11:5 14:2  
15:5 18:1,8,12

**does** 8:6,9 20:18 22:22 28:9  
30:5,7,9 31:1 33:9 35:8,11,21,  
25 39:17 40:2,8,15 44:25  
45:14,25 47:25 51:14 52:24  
53:24 56:7 57:19 60:9 65:13  
68:3,20 72:9,24 74:21 77:12,  
15 80:5 88:14 90:22,23 92:15  
95:15 96:14,22 101:3,8 102:22  
106:15 109:4,9 112:23 120:6  
121:13 123:1 124:7,13,17  
127:22 130:11 134:12,17,18  
137:15

**doesn't** 30:11 35:10,24 39:20  
44:15,16 51:23 52:7,18 56:23  
57:3,7 60:12,14,17 62:16  
65:11 66:15,24 70:25 76:8  
105:18 106:14 107:1 112:14  
124:10

**doing** 48:13 92:13

**don't** 9:14,18,21 10:14 11:3,8  
12:11 13:8,23,24 17:15 18:6  
19:10,19 21:1,11 22:17 23:22  
25:6,20 26:12,22 27:4,9,13  
28:19 29:8,9 30:3 32:10 36:14  
40:12 42:8 43:10,12 44:1,7  
47:3 48:2 52:11 53:1 54:13  
55:9 56:11 58:19 61:15 62:20  
66:16 67:5,17 68:4,21,23,24  
70:6,14,18 72:8,11,13,25  
74:19 76:18 78:23 79:11 80:3,  
4,6,11 83:20,22 88:7 89:15  
90:8 94:14 97:13,21,25 98:18  
101:22 107:4,25 108:9,11,21  
109:22 110:23 111:4,14,18  
112:3,21 113:5,13,24 115:6,13  
120:3 123:18 124:9 126:12,23  
127:19 128:11,14 131:25  
136:8,14 137:15,23 138:8,16  
139:11,22 140:2 141:6,9,15,18  
142:18

**done** 36:20 48:5,8 71:9,15  
77:22 78:1 104:18 133:23

**dots** 121:24

**down** 50:8 53:8 59:14 62:5  
69:1,18 70:9 81:21 87:3,20  
97:16 130:18

**Dr** 7:8 14:16 84:20 111:12,15,  
19,20 112:3,11 113:3,7 115:19  
143:21 145:3

**draft** 17:23 137:23

**drawing** 95:9,18 96:14

**drawings** 24:9 98:14,17,19,22  
99:1

**drill** 7:11

**driver** 41:11,14 42:1,10,12  
45:1 57:16 94:19,21 104:20  
114:10,18 124:23 126:21

**drivers** 34:15,18 55:16 78:17  
88:24 92:6 142:19,20

**drives** 80:15

**driving** 41:24 42:2,6,7 63:18,  
24 64:4 79:4,8,12,15,17,18,19,  
22 80:8,9,15,18,21 81:2  
104:13,15,21 105:2 113:20  
114:4 115:2,12 123:16,17,22  
124:2,5 125:15 142:11

**dual-function** 122:24

**due** 144:8

**duly** 7:6

**during** 105:2 145:3

---

## E

---

**e.g.** 97:4

**each** 8:23 9:14 17:6,7 23:19  
26:5 28:4 86:20 87:6,15,18  
93:12,16,25 105:16 112:6  
115:21 129:17

**earlier** 19:8 45:21 61:22  
120:20

**earliest** 63:10 81:7 82:6,17  
83:9,18 84:3

**easier** 114:24

**edited** 98:19

**edits** 17:24

**educated** 138:18

**effect** 41:1 46:22 47:1,6  
124:23 125:1,3,6

**effected** 121:1

**either** 39:20 53:10,22 54:8  
65:3 86:10,11 89:7 90:11,13,  
17,20 91:2,14 119:15 120:18

**electrical** 28:15 29:15

**electrically** 117:5,11

**electronic** 93:1,5

**electronically** 101:21

**electrons** 38:18

**element** 35:1,18 39:1 40:19,  
21 53:3,20 56:8 57:13 59:16,  
20 60:11,13,15 93:17 100:21  
101:2

**elements** 56:6,7 78:3 129:24  
130:5,10 131:3 134:3

**elephant** 52:20,22

**elephants** 52:13,14,16,18,19

**eliminates** 92:18

**else** 29:18,24 48:7,8 101:23  
107:16 108:23 124:9 128:10  
145:8

**elsewhere** 70:14

**embodiment** 85:12 86:15  
120:19,20 125:10

**emission** 33:12

**emit** 52:7,18

**emitted** 34:2 57:12 120:25  
121:3,11,14 125:11 127:5

**emitting** 33:24 52:1,3 61:19

**emphasized** 139:21

**enabled** 133:25

**encompass** 80:10

**end** 91:11 98:20 103:20  
133:11

**ended** 112:8

**ends** 86:7

**energies** 36:3

**energy** 31:21 33:3,18 36:5  
51:17 57:11 87:23 88:1,12,16,  
17,18,20,23

**enough** 19:1,2 98:2

**entire** 24:5,7 39:18

**entity** 12:14

**especially** 26:14

**essentially** 25:9 58:2 59:5  
77:23 103:22 105:22

**estimate** 11:12

**et** 57:25

**evaluated** 67:14

**Evan** 12:20

**even** 127:2,4 138:23

**ever** 12:23 13:20 108:9

**every** 23:2 41:24

**everybody** 80:14 91:22

**everything** 18:1 22:16,18

**exact** 75:4

**exactly** 12:11 28:20 42:2,4  
61:6,11 73:15 78:9 80:7 97:13,  
21

**EXAMINATION** 7:14 143:19  
145:1

**examined** 7:6

**example** 32:19 34:16 36:6  
42:7 45:21 46:18 47:4 54:5,15,  
19 57:24 69:23 71:8 74:5,6,10,  
15,22 75:21 76:11 77:16 79:14  
88:24 89:25 97:11 106:11  
107:2,19 108:2 109:18 114:24  
119:3,13 130:22 134:1 135:25  
144:18,19

**examples** 32:15 33:6,8 36:9,  
12,13 37:10 79:8 84:6 91:23  
102:25

**except** 22:19 88:8 107:2,5  
128:7

**exceptions** 115:11 137:4

**exclude** 60:15

**exclusively** 131:2

**excuse** 10:18 55:21 111:8  
118:10,21 121:15

**exhibit** 10:16 11:3 14:8,9,13,  
15,23 15:7,10,13,15,22 16:7,9,  
12,14,21 17:7,17 18:17 19:23  
22:24 23:7,10,13,21 69:3  
71:17 84:15,18 85:9 96:25  
99:8,12 112:6 115:21,25

128:19,23 133:9

**exhibits** 8:23 11:6 17:13 18:8,  
9 23:18 28:24 111:17,23,24,25  
112:3,15,21 113:1,12

**exist** 72:9

**existing** 82:12

**exiting** 91:11 102:4

**exits** 30:5,10 31:2

**expand** 127:16

**expanding** 127:22

**expect** 73:10 142:15,22

**expectation** 142:19

**expedite** 14:4

**expensive** 109:21,22

**experience** 20:16 140:16,20

**experimentally** 41:17

**experimentation** 45:9 73:13

**experiments** 47:12

**expert** 112:4 143:21

**explain** 64:1 88:6

**explained** 120:10

**explains** 127:2,4

**explicitly** 40:2 127:22

**explored** 76:4

**exposed** 142:11

**expressed** 124:22

**extant** 71:1

**extensive** 17:20

**extent** 127:16,23

**eyes** 88:24

---

## F

---

**fact** 13:11 137:13 138:7

**factors** 42:14,18,22

**fair** 9:16,22 10:4 17:10 21:14  
23:19 29:12 31:8 38:24,25  
45:20 95:25 103:2 108:4  
131:10 142:13,14,17

**fall** 86:8 141:6,8,16,17,18

**fallen** 18:22

**falling** 87:23 88:16,18,23  
 139:4 140:10,23 141:22

**familiar** 8:6 110:25

**family** 12:8

**far** 29:20 103:19 137:9

**faster** 104:15

**feasible** 52:11

**Federal** 138:2,23

**few** 7:12 25:20 72:6 107:21

**field** 39:10 43:1 53:10 64:24  
 65:3 70:25

**Fifty-five** 94:14

**Figure** 85:16 95:6,9 100:4,5,  
 10,12,22,25 105:8 116:14,15,  
 22 117:4,8,11 118:14 119:4,7  
 121:15,16 122:5,10,17,22,23  
 127:5,10 129:11,14,17,23

**figured** 117:19

**Figures** 85:13

**filling** 121:20

**find** 13:11,17 28:12 70:4,6  
 82:21 83:4

**fine** 23:24 25:7 50:15

**finish** 9:15 10:1

**first** 7:6 14:6,7,16,17 15:7,8,16  
 16:7,15,16 17:22 34:7,8,9,12  
 39:10,18 40:6 41:3 49:13 50:9,  
 19 51:1,2,3,4,6,9 52:21,22  
 53:11,13,17,22 64:23 65:4  
 72:8 85:12 97:1 116:6 128:1,2  
 141:9,14 142:4

**fits** 43:13,15

**FITZSIMMONS** 7:8,10,15  
 13:19 14:1,14 15:5,14 16:5,13  
 17:3,4 19:21 22:12 23:8 24:19  
 27:10,19 29:11 31:8,15 32:14  
 35:16,17 40:14 41:22 43:3,11  
 44:8,19 45:13 46:12,14 47:18  
 48:15,19,20 49:22 55:3,18  
 56:13,25 57:2,8 58:13 59:2  
 60:1 62:23 66:1,19 73:17 77:7  
 79:1 84:8,13,19,21 91:12  
 93:18 96:23 99:7,13 102:1

104:10,19 107:7 114:12  
 115:15,19 116:1 126:16  
 128:17,24 132:1 133:7 137:12  
 139:19 140:8 143:8,11 144:5,  
 14,23 145:2,11

**five** 46:12 52:16

**five-minute** 143:14

**fixed** 76:15,22 105:23

**fixture** 69:22 70:2,8,9,13,16

**fixture.'** 70:1

**flat** 110:1 130:11

**flood** 69:25

**fluid** 107:21

**focused** 72:15 136:18

**focusing** 17:5 61:17,18

**fog** 46:18 80:19 103:25 104:5,  
 15,21 115:3

**follow** 76:11,24 77:16

**following** 77:24,25

**follows** 7:7 77:6

**forget** 143:4

**forgetting** 82:1

**form** 118:19 144:5,14

**forward** 23:16 113:18 114:3

**found** 27:3 114:2 138:3,25

**freedom** 131:1

**Friday** 7:1

**from** 9:7 11:18 12:3 14:15,23  
 15:6,7,10,22 16:6,14,21 17:24  
 20:18 22:14,19 26:13 33:24  
 34:2,12 35:5 39:14,24 41:2,18  
 46:16,23 47:6 48:18 51:8,11  
 52:24 60:9 61:19 70:17,19  
 71:18 73:2,19 75:14,18 77:21  
 78:15 81:9 84:12,13 86:2,8,23  
 92:3 93:5 94:2 96:9 97:18  
 98:5,10,24 106:17 108:14  
 111:8,9,10 113:4,19 114:6  
 115:18 118:10,11 119:3  
 121:11 126:8,18 127:11 128:3,  
 9,15 131:2 134:15 138:5,12,13  
 142:12,16,24 143:10,16  
 144:25

**front** 45:1 79:17 131:5

**full** 7:16 25:18 45:23 74:13,20  
 128:6

**function** 33:14 34:1 103:24  
 104:25 105:23

**functional** 109:5,10,13,25  
 110:8,16

**functionalities** 105:6

**functionality** 106:4 122:7,18

**functions** 34:4 69:22 102:6  
 103:8,15,17,19 105:17 122:12

**fundamentally** 134:22

**further** 70:9 87:3,20 143:11  
 144:21 145:1,11

## G

**gained** 41:17

**general** 26:12,15 29:20 37:16  
 44:20 46:20 47:11 48:4 54:2  
 55:11 57:22 65:22 68:6 69:10,  
 25 70:24 73:8 77:4 78:10  
 79:11 80:5 81:21 91:20 92:11  
 98:4 104:16 109:2 113:25  
 114:22 115:12 126:12 136:17,  
 18 137:5 142:18

**generally** 19:1 28:22 31:20  
 33:12,17 34:15 36:3 41:9 48:5  
 51:16 57:11 67:25 68:6 76:3  
 79:15,22 89:22 104:13 110:5  
 122:16

**generating** 55:22 59:10

**generically** 33:16

**genus** 134:12 136:11,21  
 138:25 139:1,2,5,9,13,18  
 140:5,11,23 141:6,7,16,17,19,  
 23

**genus/species** 134:12,13  
 135:3 136:8 138:23

**give** 18:4 70:11 77:18 88:24

**given** 25:8 44:16 75:5 91:17  
 119:25 134:1 145:5,6

**glare** 34:16 47:2,4,15 127:17,  
 24

**glare'** 128:7

**glaring** 79:5

**go** 7:11 14:20 15:2,19 32:2  
34:25 37:25 43:2 46:12 48:6  
50:16 59:7,14 60:18 69:6 73:3  
85:9 88:9 90:18 92:19 93:19  
98:13 106:25 111:25 112:18  
117:15 118:23 121:15 122:20  
123:4 128:5 129:21 130:7,18

**goal** 114:8,17,23 115:8

**goals** 133:5

**goes** 32:21 59:8 111:8 112:2

**going** 8:15 14:1,5 23:9 30:22  
37:10 38:1 46:10 68:1 80:22,  
23 81:5 84:14 85:7 91:10 99:7  
128:18 140:25

**good** 7:8,9,10 36:14 42:1,9,11  
45:11 46:13 54:7,10 70:12  
84:8 125:7 145:13

**greatest** 127:16,23

**grid** 119:14 120:3,8

**grounds** 19:25

**grouping** 56:6,7 61:18,20,23  
62:2,3,4

**groups** 103:17 105:6 119:16  
120:15,18

**guess** 11:13 13:17 22:20  
25:20 36:20 47:10 56:23  
101:24 113:14 143:13

**guide** 8:24

**guidelines** 45:10

---

## H

---

**had** 11:14 12:16 26:12 27:12  
74:15 125:3 135:10 145:3

**hadn't** 36:12,13

**half** 46:11

**hand** 15:9 23:9 84:19 99:7

**hands** 14:3

**happen** 31:12

**Harbers** 128:18,20,25 129:3,  
8,11,14,21 130:2,14,18 131:7,  
12,15,18 132:9,10,13,16  
133:20,25 134:2,7

**hard** 11:12 65:24 82:21 114:19

**has** 18:22 27:25 29:13 53:19  
54:7 60:20 66:11,22 118:15  
129:5 135:22 138:3 143:7

**have** 10:8,10,12 11:2 12:11,  
18,23 13:20,23 14:10 18:7,17  
23:22 24:7,21 25:3 28:20  
32:12 34:3 36:14 46:7 47:14  
53:1 54:13 56:7 58:1 63:1,12,  
18 66:9 67:16,22 69:1,4,6  
70:17,25 72:4,6,15 73:11,18  
75:13,25 77:19 80:7 81:15  
82:24 83:1,3,5 89:14 95:17  
98:19 101:14 104:13 109:12  
110:6,7,20 111:1 112:16  
113:17 114:2 129:18 130:11  
136:7 137:13 138:10,16,24  
139:6 142:19 143:11,17 145:4,  
8,11

**haven't** 20:24 46:3 54:25  
55:10 65:19 67:1 77:2 107:18

**having** 7:6 55:4 64:14,16  
69:24 76:10 81:10 83:12 99:3  
109:13 110:9,20 125:5,7  
127:10 133:3

**He's** 125:2

**head** 21:1 42:23 44:5 46:6  
58:22 61:16 81:1 113:19 133:4

**heading** 69:7 134:10

**headlamp** 28:5 30:6,10,12,17  
31:3 35:9 71:3,6,7 76:23  
78:15,20 79:9 104:3 106:2  
108:7,19 109:14 110:10,21  
113:15 115:1 121:18 126:7,18  
129:4,8 131:4

**headlamps** 28:1 30:15 35:5  
42:16 60:21 64:17 76:15 79:16  
81:11,13,18,24 82:9,10,12,20,  
25 83:8,17 84:3 98:24 108:13  
114:6 129:14,17 142:8

**headlight** 20:3 27:25 48:24  
50:25 51:8 55:22,23 57:14  
58:4,6,14 59:11 60:6,20 64:13,  
16,22 71:9 81:10 85:5 99:19  
110:1 116:7,11 131:8 136:24

**headlights** 62:18,25 63:14  
64:6 73:22 74:2,6,10,17,21  
85:1 86:17 97:6 136:18,22  
137:1,6,11,14 140:10,22  
141:6,7,15,17,18,22 142:6,8

**heard** 28:19,21

**heavy** 80:21

**help** 31:6 82:3

**helpful** 38:1,2 45:11

**here** 7:11,18 8:16 12:22 15:7,  
10 16:6,7,9 18:2 20:25 21:10  
22:20 29:12 30:14 32:7 36:10,  
18 37:1 39:13 42:16 43:4  
44:12 45:15 46:11,22 47:19  
50:18 51:14 52:14 55:2 56:14  
58:2 59:20 60:23 61:1 65:7  
66:2 67:10,24 68:20 70:11  
71:2 72:17,19 73:5,18 74:9,14  
75:8,14 76:23 77:25 79:17  
81:5 84:6 85:8 86:22 90:1,4,19  
91:14 92:1,17 94:3,6,20 97:12,  
22 98:15,22 99:5,25 102:8,12,  
18 105:9 106:25 107:13,15  
111:19 112:14 113:14 119:17,  
24 120:6 121:4,9,20 122:22  
124:10,15,25 125:17 127:9  
128:9,15 131:7,12 132:13,23  
134:10,14 136:13,15 138:2,7,  
11,20 139:7,20 140:9 141:2,  
12,18 145:6,9

**herein** 93:25

**high** 57:15,20,24 58:4,7,15  
70:25 83:12 104:10 113:19  
114:3,15 115:2 123:8,12,15  
130:25 131:16

**higher** 53:18 123:24 132:7,19

**highly** 123:23

**history** 136:8

**hits** 96:6,8

**hitting** 51:18

**hold** 14:10

**horizontally** 81:17

**hour** 46:11

**hours** 11:13

**house** 97:4

**housekeeping** 9:12

**housing** 71:10

**how** 10:15 11:9 13:1,8 18:3  
20:19 22:13,17,18 25:9,14  
33:17 34:17 36:19 37:18,22  
40:2,13 41:9,12 42:5 44:2,15

45:3,7 46:18 47:5,25 48:2,9  
49:23 51:17 54:8 58:6,11,14  
63:1,12 67:2,13 70:11 71:4,7,  
14 72:3 73:2 76:22 77:15  
78:18 81:25 82:1 88:4 91:17,  
24 97:14 98:24 101:14,20  
105:25 106:6,18 135:20  
141:25 144:16

**human** 34:23

**hypothetical** 115:5 126:11

---

## I

---

**I'D** 112:16

**I'LL** 8:21,23 9:21 12:22 14:10  
17:5 23:22 71:18 72:10 77:18  
82:16 84:19 110:16 121:25

**I'M** 8:15 9:11 10:20 11:16  
12:18 13:3 14:1 23:9,18,21  
25:15,17 26:23 43:15 50:5  
56:12 66:10,17,25 68:14 72:1  
73:15 78:25 81:5 82:1 83:4,6  
90:6,22 94:15 99:7,21 100:16  
108:16 109:16 110:5,15  
111:23 112:15 113:5,12,16  
117:24 126:22 127:25 128:16  
132:10 133:5 137:20 138:13  
141:10 142:21

**I'VE** 17:21 28:22 79:14 80:11  
83:11 108:9 134:16 135:2,10,  
11 137:10

**i.e.** 139:2

**ideally** 105:6

**ideas** 136:17

**identification** 14:12 15:12  
16:11 23:6 84:17 99:11 115:24  
128:22

**identify** 85:11

**II** 22:3

**illuminance** 51:4,15,22,24,25  
52:2,3,4,6,7,8,10,25 53:14,17,  
23 54:1,9 55:5 59:17,25 64:25  
65:4,8 68:19

**illuminate** 41:10,13 76:11,24  
77:16,25

**illuminated** 79:21 126:7,19

**illuminates** 64:23 65:2

**illuminating** 59:16 77:23  
130:23

**illumination** 35:5,12,21,23  
36:2,7,17,23 37:6,13 41:2  
42:3,5,9,11 44:25 46:23 47:7  
51:1,2,6,7,11 53:5,9,11 57:16,  
21 58:5,7,16 62:14,18,24  
63:13 64:6 71:21,23 72:1,18,  
20,23 73:4,9,10 77:6 78:12,15,  
19 79:3,5 100:1,5 102:4,13,20  
103:7,14,19 113:16,19 114:3  
115:2 123:6,13

**illuminator** 89:7

**imagine** 115:10

**imaging** 63:17 94:2

**immediately** 139:3 140:10,22  
141:21 142:2

**impact** 71:7

**impair** 9:10

**implement** 63:1,13 101:14  
134:7

**implementation** 89:9

**implemented** 83:21

**implementing** 64:5

**implications** 20:25

**implies** 140:6

**incandescent** 71:8

**include** 60:10,15 72:11 80:18,  
21 81:2,3,10,13,18 82:18,22

**included** 60:5 82:10 138:10  
139:20

**includes** 74:7 85:24 102:18  
116:19 130:3 135:9,12 136:2

**including** 28:5 39:11,12,21,  
23 49:14 50:9 62:9 64:24 68:8  
84:1

**incoming** 94:1 97:3,17,20

**Incomplete** 115:5 126:11

**inconvenience** 124:21

**increased** 124:1

**increasing** 125:15

**independent** 26:1 31:13  
105:16 108:22

**independently** 86:21 87:7,  
11,14,17

**indicated** 100:10 105:10  
116:16,20,23 117:1,6,9  
118:16,20 119:6 121:20 122:9,  
14 129:14,18 130:4

**indicating** 49:4,7,15 107:13

**individual** 86:16 88:2 94:7  
118:16,19

**individually** 93:24 94:4  
119:16 120:15,18

**industry** 20:16 140:15,20

**inelegant** 119:24

**infers** 135:22

**information** 35:4,6,11,20,22  
36:1,4,6,10,22 37:5,12 38:7  
47:17 49:3,4 118:6,10

**informed** 144:2,12,17

**initially** 98:21

**input** 92:3

**inside** 88:10 89:16 94:10

**instance** 106:11

**instead** 109:14 110:21

**instructions** 60:4

**intended** 23:1 80:16 95:12,14,  
20,23

**intensities** 44:11 45:17

**intensity** 33:2,3,10,13,20,22,  
23,25 37:4,8 45:23 70:25 92:5,  
10,11,16 102:20 118:2 120:24  
121:2,5,10,11,13 123:1,3,24  
125:11,13,18,22 126:7,18

**interest** 63:19 83:24

**interior** 97:5

**International** 115:22 128:20

**interpret** 25:14 144:17

**interpretation** 28:17 128:8

**interpreted** 27:14

**intuitively** 139:13 140:3

**invention** 100:6 102:10  
117:16 125:10

**inventor** 12:19,22 13:14,21**involved** 107:14**IPR** 7:24 8:4 21:23 25:3**IPR2022-00197** 8:5**IPR2022-00328** 8:5**IPR2022-00335** 8:6**IPRS** 21:24**irrelevant** 30:12**isn't** 52:16**issue** 133:20 134:6**issues** 67:4 133:12,15,18

134:24 135:2,3,7 143:25

144:2,3,8,9,11,13

**it's** 11:12 13:2 17:11 19:10

22:1 26:2 28:13,21 33:19 34:1

38:18,22 39:3 50:11 51:18

52:13 54:2 58:2 61:23 65:24

70:24 71:8,10 72:6 74:5,9

75:17 85:18 87:13,15 88:13,16

92:17,20 94:9,24 95:14 96:5,6,

15,19 98:7,12 99:10 102:25

104:13 105:2,5 107:17 108:16,

19,20 112:5 113:11,14 114:19

120:11 122:22 125:21 128:1,3

133:9 134:17 135:6,16,17

138:8,13 139:16 140:19 142:1,

2,4

**itself** 38:21 75:1 86:1 88:17

139:1

---

**J**

---

**Jiao's** 111:12,15,19,20 112:3,

11 113:3,7

**job** 45:1**July** 81:8 82:7**just** 8:4 9:1,12,13,25 10:1

14:10 16:14,15 20:24 21:24

23:13 25:15 26:1,23 30:2,22

35:18 39:20 42:22 44:20 49:24

50:1,12,13 52:5,9 54:5 57:6

61:17 65:24 66:17,24 68:5

70:19 74:23 79:13 80:25 84:22

88:17 90:1 91:7,18 97:21

99:14 100:16 103:10 105:4

106:4 107:2,19 111:22 112:7

115:8 122:21 128:25 131:6,23

133:14,21,22 134:25 135:5,25

138:11 141:9

---

**K**

---

**Karlsson** 115:20 116:3,6,11,

14,15,25 117:15,17,19 118:5,

14,15,23 119:5,17,21,25

120:1,4,6,7,21 121:4,9,16

122:5,20 123:1,4 124:7,13,18,

25 125:5,8,17 127:2,4,19,22,

25 132:4,9

**Karlsson's** 117:25 118:9

120:12,14 121:18 124:3 127:9,

15

**keep** 8:15 23:22 80:22,23**keeping** 9:13 125:3**kind** 41:19,23 63:15 71:6 76:3

77:4 136:24

**kinds** 57:22 73:9 79:12 134:24

135:2,7,25

**know** 7:11,18 8:22 9:1,19,25

13:2,23,24 19:5,12,20 22:16,

17,18 23:22 25:15,20 26:12

32:15 41:12 43:10,12 44:3,7

47:3 54:13,15 56:11 65:15,23,

25 68:24 71:18 72:25 74:13,

18,19 76:3 79:11 80:3,6,12,17

97:13,21,25 98:11 101:20,23,

24 106:6,23 107:4,25 108:9,11

109:22 110:17,23,24 111:4,18

112:21 113:9,24 115:6,13

124:9 126:12,24 131:25 136:8,

14 137:9,15,25 138:16,19

139:11,22 140:2 141:9 142:18

143:6

**knowledge** 12:24 17:12 19:19

26:15 41:16 109:24

**known** 75:25 82:9,15,18 83:9,

13,17 109:12,16 110:8,20

111:1 123:8

**Kobayashi** 99:3**Kushman** 11:19

---

**L**

---

**label** 95:20**labeled** 17:17 18:8,9**lamp** 85:18,22 86:2,8,23

96:16,18

**lamp-based** 71:9**language** 49:15 119:24**large** 70:25 131:1 139:15**larger** 53:2,7 133:20 135:14,

19

**last** 8:17 10:6 11:22 14:20

15:2,3,19,20 16:1,2,5,19,25

18:21 38:3 47:19 69:16 102:2

127:14 138:6 141:14,15

**later** 38:19**law** 22:4 134:12,13,23 135:1,4,

7,9 136:8 138:14

**laws** 138:23**layout** 75:6,11**leading** 11:11 144:6,15**least** 20:15,18 28:5 32:19 36:5

37:2 39:7,10,11 40:25 41:3

42:22 43:4,21 44:10 49:3

62:15 64:24 65:2 83:25 96:20

100:12 101:25 107:21 108:14

112:16 121:8 136:25 137:5

140:6 142:7

**leave** 89:15**leaving** 90:18**led** 78:1 84:2 99:4 119:3,7,23

120:11,17 134:2 136:7

**LED-BASED** 71:12**LEDs** 71:13 76:14 77:5,9,11,

12,15 78:8 83:14,17 97:19

98:6,8 103:4,17 119:9,15,19

120:2,9,14

**left** 77:21 105:1 127:6,11**legal** 139:12,22 140:2 143:25

144:3,9,12,18,19

**length** 34:1,4**lengthy** 24:4**lens** 85:20**less** 34:9,13 55:13**let** 9:1,19,25 21:14 23:22 28:12

70:4 71:18 89:18 119:21

**let's** 18:16,19 27:20 39:2

48:15 50:16 55:19 59:7 69:1,6  
95:1 115:15 116:14 117:15  
122:20 128:5 129:21 143:8

**letter** 121:21 122:9

**letters** 95:17 122:15

**level** 20:6,11 21:5,8,15,21  
48:5 51:16,20,21 52:15,17  
53:19,23,25 54:4,6 58:24  
70:10 113:20 114:4 115:2

**levels** 20:14

**light** 28:5,9,14,16,17 29:4,15,  
18,22,24 30:1,3,5,8,9,16,19,23  
31:2,6,11,16,20 32:3,8,12,15,  
20 33:1,7,10,18,24 34:7,8,9,  
10,11 36:3,5,16,21 37:4,8  
38:10,12,14,21,24 40:24 41:6,  
9 42:24 43:5,7,12,18,22 44:2,  
10 45:15 46:1 47:21 48:1,6,10  
50:18,25 51:3,11,17,24 53:13,  
16,18,22,25 54:5,6,8,14,16,19  
55:13 56:2,4,6,7,8,17,19 57:3,  
9,11,14,23 58:1,3,11,24,25  
59:4,6 60:5,7,9,16,23,25 61:2,  
4,5,9,10,13,18,23 62:1,2,4  
69:21,24 70:2,7,13,16 71:20  
73:24 75:9 76:6,14,21,23  
81:14,19 82:11,19,24 83:8,14  
84:2 85:19,22 86:9,17,22,23,  
25 88:21,25 89:6,9 91:9 92:21,  
25 93:1,4,8,13 94:24 96:4,7,  
11,15,18,19 97:3,4,18,19,20  
98:5,8,10,11,12,24 100:9,13,  
16,18,21,25 101:5,9,14 102:4,  
11,17,18,24 103:6,14 105:1,17  
106:2 108:6,19 109:14 110:10,  
21 114:15 116:19,22 117:4,8,  
20,21,22 118:1,11,19 119:2,3,  
13,14,17,22,23 120:2,3,7,8,25  
121:3,6,11,12,13,17,24 122:1,  
6,17 123:2,24 124:20 125:11,  
13,14,18,22,23,24 126:3,7  
127:5 129:5,18,23 130:2,3,14,  
21,23 131:9,12,15,20 132:3,6,  
7,14,18,19 134:11 136:21,24,  
25 140:5,11,23 141:6,16,19,22  
142:6,7,9,12,16,24

**lighting** 55:15 69:25 70:9  
99:18 103:8,15,16 105:5  
116:7,15,16 124:23 125:1,2,6,  
12,25 126:2 140:16,17,21

**lightness** 42:25

**lights** 36:25 57:23,25 97:4,5,  
11 104:15 136:17

**like** 14:19 15:1 45:21 46:7,12,  
20 48:24 51:13 61:23 62:2  
69:11 71:12 72:7,24 77:19  
78:5 80:17,24 105:4 108:4  
111:14 114:20 133:21,22  
138:9 141:12

**likely** 134:4

**limitation** 32:2 50:12 67:3

**limited** 81:20 83:12 119:2  
131:4 139:4

**limits** 67:5

**line** 28:4 32:19 38:5 39:3  
40:20 48:22 50:16,17,21,22  
53:4 55:20 56:1 57:10,13  
59:21 60:19,24 62:8 64:12  
73:20 86:7 90:10 92:2 93:20  
94:14 95:10,12,21,23 96:2  
117:16,17,18 123:4 130:19

**lines** 32:4,24 34:6,25 44:21  
46:24 49:1 55:25 59:15 60:2  
62:5 64:19 75:18 86:1 87:4,21  
89:2 90:1 91:1 92:20 94:11  
118:23 119:10 120:21 122:20  
123:20 124:18 125:8 129:21  
130:7

**list** 10:21 11:3 23:2 32:21  
79:15 80:7,23,25 97:12 107:18  
111:25 112:15 113:2 124:10

**listed** 10:16 80:11 111:17,23,  
24 112:20

**listing** 132:23

**lists** 79:11 80:3

**little** 14:4 21:9 54:5 65:20  
82:21 83:2 87:3,20 92:2  
113:11

**locate** 69:2

**located** 39:18 142:23

**location** 36:21,25 54:16,17,21  
131:3,5

**locations** 89:4

**Logical** 62:7,9

**long** 18:3 32:18

**long-range** 123:6,13

**longer** 18:13 123:25 131:4

**look** 13:23 14:15,23 15:6,15  
16:14 32:13,17 49:1 53:1  
55:25 57:13 60:2 64:19 67:16  
70:17 72:4,7 85:25 87:3,20  
90:7 97:16 100:4 101:4 102:2,  
8 103:18 116:5,14 118:14  
128:18

**looked** 11:2 76:4

**looking** 9:1 14:5 28:3 38:18  
50:5 67:9

**looks** 14:19 15:1 111:14

**lot** 14:2 42:22 80:14,15 106:23

**lots** 73:9

**low** 57:24 58:16 83:12 123:16,  
17

**lower** 130:24 131:13 132:7,19

**lowered** 92:12

**lunch** 84:9,13

---

## M

---

**made** 48:11 78:10 119:18,22

**main** 114:23 122:11,18,23  
123:5,8,12,15,25 124:4,7,14

**majority** 24:20

**make** 19:3 23:16 45:1 52:14  
55:12 67:19 77:5

**makes** 55:2 57:9 133:21 139:9

**making** 12:25 87:15 113:14

**many** 8:22 17:24 25:10 37:11  
86:15 114:20 123:21,22  
124:11

**mapped** 89:5

**marked** 14:12 15:12 16:11  
23:6 84:17 99:11 115:24  
128:22

**market** 81:24

**materials** 10:16,21,22,25 11:2

**matrix** 86:19 100:21

**matter** 30:5,7,9 31:1 34:23,24  
69:10 135:15 138:19

**matters** 7:12 10:7,9 12:6,8,17  
13:15 25:1 136:7

**Matthew** 7:5,17

**maximal** 45:12

**maximize** 40:24 41:7 44:24  
45:4 46:15,18

**maximizing** 45:14,25 46:5

**maximum** 45:16 75:4,9

**may** 9:10 34:22 36:12 38:1  
45:9,10 62:21 75:9 97:3  
130:12 134:21 135:13,20  
136:3

**maybe** 21:9 50:7,13 58:11  
74:16 90:10 107:20 108:25  
109:20,21 113:6,25 114:18,24  
119:21 137:4

**mean** 17:19 19:1 21:13 22:15  
25:12 26:20 28:9 30:2 33:10  
34:21 50:3 51:7 53:24 57:21  
59:3 61:20 63:4,22 70:12 77:9  
78:14 80:9,14 82:13 90:2,22,  
23 91:4,21 107:9 119:2 126:2  
133:17 136:4

**meaning** 25:17 27:12 90:17

**meaningful** 54:2

**means** 31:19 33:7,12 42:3,4  
43:16 44:24 54:2 67:21,25  
88:8 89:12,17,20 92:11 108:1  
117:1,24 119:25 125:12 140:3

**meant** 25:15 59:5 91:16

**measure** 54:19

**measured** 54:15,18

**measuring** 52:13

**mechanical** 71:11

**medication** 9:9

**medium** 139:15

**meeting** 18:22

**meetings** 11:11,14,15,21,24

**memory** 62:10

**mention** 106:15

**mentioned** 12:13 25:5 71:19  
74:23 78:11 93:8 110:11 123:3

**mentions** 106:14 138:2

**method** 59:10

**methods** 74:16

**Michigan** 7:2

**micro** 89:14

**microbeam** 92:16 93:12,16  
95:13,14,17,22,24 96:3,6,8,9

**microbeams** 86:16,18,20,25  
87:6,11,18,23 88:2,8,13,16,18,  
20,23 89:8,13,21 91:2,15 92:5,  
9 93:25 94:3,13,18,20

**midday** 45:21 46:8

**middle** 42:10 106:7 122:16  
127:1

**might** 11:2 12:11 24:16 28:20  
29:21 34:21 44:5,9 48:8 58:24  
63:16 65:25 68:22 71:9 73:11,  
13 77:3 83:1 90:5 95:2 98:19  
109:19 113:16 124:20 132:22  
135:15,24

**mind** 80:23

**mindful** 115:10

**mine** 98:20

**minimize** 47:6

**minimizing** 41:1 46:22 47:1

**minor** 18:15 24:17

**minutes** 46:13 144:23

**mirror** 88:9,14 89:14 91:10  
93:9,14,17 96:6,8

**misstatement** 142:5

**modified** 20:10 58:11

**modifying** 48:5 77:10,12

**modulator** 85:19,22 86:9,24  
88:21 89:1,6,9 92:22,25 93:1,  
4,9,13 96:4,11 116:22

**moment** 14:11 36:15 48:14  
54:20 62:21 70:14 81:1 90:6  
103:10

**more** 21:9 27:25 34:8,11 35:3,  
5,19 37:10,15 39:15,24 46:13  
49:2 50:13 53:9,12,14 55:13  
56:8,14,18,23 57:3,7,11 58:11  
60:3,4,21 62:11,13 64:16 65:2  
77:19 81:11 82:15,22 90:16  
100:16 104:14 107:12 109:19,

20,21 110:5 113:25 121:1  
135:21,24 136:25

**morning** 7:8,9,10

**most** 81:12 108:14 115:12  
136:25 138:20

**mostly** 11:22 17:5 122:10

**motivation** 19:2,6,13

**motor** 99:19,21 116:8,12

**motorcycles** 97:5

**mount** 101:20

**mounted** 86:9 101:1

**move** 76:18

**moving** 23:16 77:21

**Mr** 7:8,10,15 12:22,23 13:1,2,  
6,14,16,19 14:1,14 15:5,14  
16:5,13 17:3,4 19:16,21 22:7,  
12 23:8,12 24:15,19 27:8,10,  
16,19 29:6,11 31:4,8,15 32:9,  
14 35:13,16,17 40:10,14  
41:15,22 42:19 43:3,8,11,24  
44:8,13,19 45:5,13 46:2,10,12,  
14 47:8,18 48:15,19,20 49:17,  
22 54:11 55:3,7,18 56:9,13,21,  
25 57:2,5,8 58:8,13,17 59:2,23  
60:1 62:19,23 65:17 66:1,14,  
19 73:6,17 77:1,7 78:21 79:1  
84:8,10,13,19,21 91:5,12  
93:15,18 96:17,23 99:7,13  
101:17 102:1 104:6,10,19  
106:20 107:7 114:7,12 115:4,  
15,19 116:1 126:10,16 128:17,  
24 131:22 132:1 133:1,7  
137:8,12 139:10,19,24 140:8  
143:1,8,11,13,17,20 144:5,10,  
14,21,23 145:2,11,13

**Ms** 12:12

**much** 11:9,11 33:18 37:15  
48:2 51:17 54:8,25 97:14

**multi-led** 71:20

**multiple** 26:13 51:11 69:22  
100:17

**multiplicity** 93:23

**must** 92:5,9,11

**my** 7:17,22 8:15 9:15,18,22  
10:17,18 12:24 13:9,23 18:2  
19:12,19 21:1,10 22:9,10 23:2

26:13,15 28:12,21 31:9 32:7  
 35:21 42:23 44:4 46:6 52:15  
 55:10 58:21,22 61:15,16 67:16  
 70:17 72:2,24 81:1 90:25  
 103:9 108:14,16 110:14  
 111:17,23,24 112:11,21 113:6,  
 7,12 128:2 132:15 133:4  
 134:15,16 135:4,7,10,11  
 136:13,16,18 144:7

**myriad** 79:4,8 80:8,13

**myself** 23:23 103:9 136:9

---

## N

---

**name** 7:16,17

**narrow** 69:24 70:20,21,23  
 71:4

**narrow-angle** 86:16 93:24

**narrow-angled** 86:25

**narrower** 132:7,19 136:11,21

**narrowing** 130:25 131:15

**narrowly** 139:1,6,9,21 140:6

**necessarily** 23:2 65:23  
 131:25

**need** 9:24 21:9 42:9,11 50:13  
 56:7 67:19,22 74:13 90:4  
 113:25

**needs** 54:8

**neighborhood** 113:21 114:5,  
 16

**never** 137:10

**next** 15:5 32:2 39:1 40:19  
 57:13 69:17 71:16 73:18 75:17  
 140:4

**nice** 42:8

**night** 42:10 79:16,18 138:6  
 142:11

**no** 8:9 9:8,11 10:3,10,14 11:20  
 16:12 17:15 18:13 23:7,11  
 27:1,21 30:3 35:10,24 38:13  
 50:15 52:1,21 81:16 84:16,18  
 96:18 99:10,12 100:10,22  
 105:19 115:23,25 116:17,20,  
 23 117:2,6,9,13 118:17,20  
 123:3 127:17,24 128:21,23  
 130:3 131:4 143:11 144:7,21

145:7,10,11

**non-shaded** 122:4

**non-trivial** 54:23

**none** 113:1

**noon** 42:7

**Nos** 14:13 15:13 100:14,17  
 105:10 129:15,18

**note** 112:23

**nothing** 18:15 29:20 81:16

**notice** 138:11

**noticed** 138:6

**November** 10:8

**number** 25:6 37:10 41:20 43:1  
 63:19 68:3,7,18,21,24 71:14  
 80:13 99:8 118:15 143:25

**numbers** 68:5,9,23 85:21

**numeric** 51:16,20

**numerous** 79:21

---

## O

---

**oath** 9:3 141:1

**object** 87:24 88:17,19,23

**Objection** 13:16 19:16 22:7  
 24:15 27:8,16 29:6 31:4 32:9  
 35:13 40:10 41:15 42:19 43:8,  
 24 44:13 45:5 46:2 47:8 49:17  
 54:11 55:7 56:9,21 57:5 58:8,  
 17 59:23 62:19 65:17 66:14  
 73:6 77:1 78:21 91:5 93:15  
 96:17 101:17 104:6 106:20  
 114:7 115:4 126:10 131:22  
 133:1 137:8 139:10,24 143:1  
 144:5,14,15

**objects** 87:24 88:19

**observed** 31:24

**observer** 33:19

**obtained** 119:12

**obviousness** 19:4,7,9,14  
 22:6,23

**occur** 11:21 106:8,12

**occurs** 96:12

**odd** 13:11,18

**off** 20:25 42:23 44:4 46:5  
 51:24 58:21 61:16 78:8 80:25  
 89:14 105:22 106:5 107:11,17,  
 23 108:2 116:8 121:2,6,8  
 133:4

**offhand** 11:4 13:25 19:20 29:9  
 66:16 67:17 138:1

**official** 12:3

**often** 91:20

**okay** 7:18,23 8:12,16 9:2,6,18  
 10:25 14:1 17:5 18:20 21:7  
 24:25 31:16 32:2 44:20 48:15  
 50:23 59:14 64:19 70:15,23  
 73:2 74:12,23 75:3 76:21  
 84:10 85:15,25 87:20 88:1  
 89:2 94:6,11 95:4,9,23 99:17  
 100:4 101:13 102:23 103:23  
 105:8,13,21 109:9 112:18  
 116:19 117:15 118:5 121:20,  
 24 123:4,8 125:8 127:19  
 130:2,7 134:9 137:21 138:10  
 143:23,25 144:21

**once** 96:8

**oncoming** 79:5,19 94:18 97:6  
 124:21

**one** 14:6,8 16:7 18:17 27:25  
 29:1,10,14 32:19 34:9,11,21  
 35:3,5 36:5 39:14,24 46:24  
 49:2 53:9,12,14 54:19 56:8,14,  
 17,19,23 57:3,7 58:4,5 60:4,21  
 61:17,18 62:11,13 64:16 65:2  
 68:7 69:4 70:1 72:6 80:17  
 81:11 87:15 96:21 101:11  
 102:9 103:18 104:25 106:11  
 109:17 112:16,20 121:1  
 124:10,12 125:4,7 137:23

**ones** 11:4 80:11 81:15 111:17,  
 22 138:19

**only** 18:15 20:14 29:4,10  
 48:12 56:17,19 80:16 81:21,23  
 86:18 88:13 99:1 112:20 139:1

**onto** 14:10

**open-ended** 83:6

**operate** 43:6

**operated** 43:22 44:3

**operating** 43:12 44:6,10  
 45:16

|                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>operation</b> 93:21,23 108:6                                                                                                                                                                              | 16,23 78:17 88:8 92:6 101:22                                                                                                                                                                                                                                                           | 127:1,14 128:2,5,6 133:8,10,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>operational</b> 106:9,19 107:22,<br>24 108:3                                                                                                                                                              | 105:16 107:21 109:5 112:17,<br>18 121:24 122:1 124:6 142:12,<br>16,24                                                                                                                                                                                                                  | 11 134:9 136:20 137:17,18,21<br>138:21,22 140:5,9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>operator</b> 40:25 41:7 44:24<br>45:4,14,25 46:5,15,19 79:4                                                                                                                                               | <b>others</b> 37:16 57:12 58:5<br>112:21                                                                                                                                                                                                                                               | <b>paragraphs</b> 22:4,19,22 23:1,<br>3 98:15 103:5,12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>opine</b> 61:15                                                                                                                                                                                           | <b>otherwise</b> 23:17 117:24                                                                                                                                                                                                                                                          | <b>parameter</b> 106:19 107:22,25<br>108:3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>opinion</b> 20:18 29:19,25 33:6<br>36:5 38:15 39:17 44:9 47:2<br>49:11 58:20 60:14 61:5,12<br>66:20 68:17 83:14 88:13 89:25<br>92:15 98:22 101:13 105:24<br>108:5 109:11 110:19 123:15<br>140:19,25 141:4 | <b>output</b> 33:18,21 35:5,12,21,23<br>36:2,7,17,23 37:6,13 41:2<br>46:23 47:7 50:18,25 77:14,15<br>78:12,19 79:2 108:19 118:1<br>131:9                                                                                                                                               | <b>parameters</b> 106:9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>opinions</b> 17:9,12 26:7 29:2                                                                                                                                                                            | <b>outputs</b> 78:3,4,7                                                                                                                                                                                                                                                                | <b>parentheses</b> 74:1 90:19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>optical</b> 38:10 60:10,12,15<br>85:20,23 86:13 97:8 118:10<br>142:15,23                                                                                                                                  | <b>outputted</b> 102:11 103:6,13                                                                                                                                                                                                                                                       | <b>parking</b> 57:25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>optimal</b> 40:23 41:5 42:14,15<br>43:6,13,15,17 44:7,12 47:22<br>114:5 125:2                                                                                                                             | <b>outside</b> 11:6 36:16 37:4 110:5                                                                                                                                                                                                                                                   | <b>parse</b> 50:17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>optimally</b> 125:13,17,21                                                                                                                                                                                | <b>over</b> 9:14 11:22 30:22 63:7                                                                                                                                                                                                                                                      | <b>part</b> 35:18,19 47:19 53:7 56:22<br>57:1 60:16 74:20 87:4 102:3<br>124:20 134:22 135:15 141:10,<br>14                                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>optimize</b> 72:12 79:3                                                                                                                                                                                   | <b>overall</b> 54:4,22 58:24,25 59:3<br>86:14                                                                                                                                                                                                                                          | <b>particular</b> 29:21 40:15 44:2<br>47:11 54:17,20,21 55:1 80:25<br>87:24 88:18 93:13 99:19<br>104:17 107:1 108:23 109:7,16<br>115:8 116:7 120:19 123:22<br>133:19 136:16 142:18,19                                                                                                                                                                                                                                                                                                                                                 |
| <b>optimized</b> 71:21,23 72:1,18,<br>20,23 73:3 123:5,12,16                                                                                                                                                 | <b>overhead</b> 76:24                                                                                                                                                                                                                                                                  | <b>particularly</b> 19:20 74:18<br>91:25 136:9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>optimum</b> 55:15 124:22 125:1,<br>5                                                                                                                                                                      | <b>overlap</b> 17:8                                                                                                                                                                                                                                                                    | <b>parts</b> 32:11,13 49:19,25 50:3<br>53:20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| <b>optoelectronic</b> 129:24 130:4,<br>10 131:3                                                                                                                                                              | <b>overview</b> 69:7,11,13                                                                                                                                                                                                                                                             | <b>party</b> 13:22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>order</b> 8:16 58:6 67:19 77:5<br>86:24 126:20                                                                                                                                                            | <b>owner</b> 21:4                                                                                                                                                                                                                                                                      | <b>pass</b> 86:13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| <b>ordinary</b> 20:7,11,15,20 21:5,<br>8,15,22 27:6 37:21 63:5,7<br>66:20 73:11,14 80:6 101:20<br>104:12 107:4 108:10,21,24<br>110:12,23 111:1 126:13,23<br>132:5,17 140:14                                  | <hr/> <b>P</b> <hr/>                                                                                                                                                                                                                                                                   | <b>passage</b> 70:19 74:24 75:1,3<br>76:10 86:5 90:1,4,10 92:19<br>120:10 123:1 124:15 132:4,16                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>organization</b> 61:24,25                                                                                                                                                                                 | <b>p.m.</b> 84:12 115:18 143:10,16<br>144:25 145:15                                                                                                                                                                                                                                    | <b>patent</b> 8:1,9,12,13 10:7,11<br>12:7,19 20:2,21 21:4,17,25<br>23:9,11,14 24:1,4,11,12,21,22<br>25:11,21,23 26:6,11,14,18,24<br>27:2,5,11,15,21 28:10 29:23<br>30:18 32:11,16,18,24 33:9,10<br>35:25 43:14 48:3,21 52:24<br>55:20 56:12 61:8,13 62:16<br>63:11 66:3,7 68:4,11,12,17,22<br>69:1,7,11,13,20,21 70:2,4,15<br>71:19,25 72:4,5,10,14,21,22<br>73:4,8,19 74:7 75:8,14,18,20,<br>24 76:14,21 78:20,24 79:11,<br>13,23 80:3,16 81:8 82:7,18<br>83:10,19 84:4,16 91:25 95:15<br>112:5,6,13,24 113:2,4,9 114:6<br>143:23,24 |
| <b>orientation</b> 71:11                                                                                                                                                                                     | <b>packaging</b> 109:20                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>oriented</b> 105:1                                                                                                                                                                                        | <b>page</b> 14:20 15:2,3,19,20 16:1,<br>3,19,25 69:6,17,18,19 75:17<br>84:25 99:17 111:8,9,10 112:1,<br>2 116:6 117:15 118:23 119:10<br>120:21 122:20 123:4,20<br>124:18 125:8 129:4,21 130:8,<br>18,19                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>original</b> 82:1                                                                                                                                                                                         | <b>pages</b> 69:17,18                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>originally</b> 123:19                                                                                                                                                                                     | <b>papers</b> 11:6                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>other</b> 9:14 10:9,25 11:18<br>13:21 15:9 29:8 30:4,19 32:11,<br>13 34:15,18 36:9,12 41:3<br>55:14 68:9 72:16 73:12 74:14,                                                                               | <b>paragraph</b> 18:19 19:9 20:5,9<br>21:3,8,15 28:13 29:1,12 69:17<br>71:16 73:18 75:13 78:6,11<br>79:2 85:10,11 91:7,25 95:3,5<br>96:24 97:1,12,16,22 98:13,14,<br>23 101:4 102:2,3,8,16,23<br>103:1,18,20,23 104:24 105:4,<br>13 106:7,18 109:3 111:7<br>117:17 118:3 121:15 126:25 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |

|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                       |                                                                                                                                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
| <b>patent's</b> 76:23                                                                                                                                                                                                                                                                                                                                                 | 128:1,14 133:12,14,17 139:6, 21                                                                                                                                                                                                       | <b>power</b> 33:12                                                                                                                   |
| <b>patents</b> 24:13 25:4 84:1 112:8                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                       | <b>Powerpoint</b> 98:20                                                                                                              |
| <b>path</b> 95:14,22,24 96:7,9,22                                                                                                                                                                                                                                                                                                                                     | <b>phrases</b> 49:18 61:17                                                                                                                                                                                                            | <b>practical</b> 83:21                                                                                                               |
| <b>paths</b> 96:21                                                                                                                                                                                                                                                                                                                                                    | <b>physical</b> 82:16 119:2                                                                                                                                                                                                           | <b>preceding</b> 97:7                                                                                                                |
| <b>pattern</b> 64:23 75:25 76:3<br>86:15 118:2 120:23,24 121:5,<br>10 127:8 130:1                                                                                                                                                                                                                                                                                     | <b>physically</b> 76:18                                                                                                                                                                                                               | <b>precise</b> 50:14 54:14                                                                                                           |
| <b>PCT</b> 115:22 128:20                                                                                                                                                                                                                                                                                                                                              | <b>piece</b> 53:2                                                                                                                                                                                                                     | <b>precisely</b> 11:12                                                                                                               |
| <b>pending</b> 10:4                                                                                                                                                                                                                                                                                                                                                   | <b>pieces</b> 50:18                                                                                                                                                                                                                   | <b>predecessor</b> 138:24                                                                                                            |
| <b>people</b> 47:13 83:1,24 91:20<br>106:22                                                                                                                                                                                                                                                                                                                           | <b>pipeline</b> 38:17                                                                                                                                                                                                                 | <b>predefined</b> 51:4,15,21,25<br>52:3,5,15,17,25 53:14,17,23<br>54:9 55:5 59:17,24 65:1,5,8<br>67:10,14,18,20,23 68:13,17<br>106:3 |
| <b>percent</b> 83:23                                                                                                                                                                                                                                                                                                                                                  | <b>place</b> 91:10                                                                                                                                                                                                                    | <b>preferably</b> 119:15                                                                                                             |
| <b>perception</b> 33:20                                                                                                                                                                                                                                                                                                                                               | <b>places</b> 30:2 50:5 72:16                                                                                                                                                                                                         | <b>preferred</b> 125:10                                                                                                              |
| <b>perceptual</b> 34:23                                                                                                                                                                                                                                                                                                                                               | <b>planar</b> 109:15 110:9,22                                                                                                                                                                                                         | <b>preliminary</b> 7:12                                                                                                              |
| <b>performing</b> 107:9                                                                                                                                                                                                                                                                                                                                               | <b>please</b> 7:16 9:1,14,19,25<br>14:15,18 15:16 16:1,15,23<br>18:19 34:7 35:2,15 40:22<br>58:12 69:16,20 93:22 94:12<br>97:2 99:23 100:4 103:11<br>112:18 116:2 119:11,20<br>123:21 124:19 125:9 127:3<br>129:11,22 130:9,20 138:21 | <b>prepare</b> 10:15                                                                                                                 |
| <b>perhaps</b> 11:13 51:16,20 63:20<br>72:6 74:17 109:22 138:12                                                                                                                                                                                                                                                                                                       | <b>plenty</b> 91:22                                                                                                                                                                                                                   | <b>preparing</b> 11:1,7,9 18:3,9<br>23:25                                                                                            |
| <b>period</b> 54:23                                                                                                                                                                                                                                                                                                                                                   | <b>plurality</b> 60:23 64:14 81:13,18<br>82:10,19 100:9 119:18,23<br>129:24 130:3                                                                                                                                                     | <b>present</b> 29:5                                                                                                                  |
| <b>periodic</b> 9:24                                                                                                                                                                                                                                                                                                                                                  | <b>point</b> 8:25 38:17,18,19 46:13<br>96:9 100:17 140:4 141:12                                                                                                                                                                       | <b>presented</b> 25:11                                                                                                               |
| <b>person</b> 11:24 20:19 27:6<br>34:22 37:18,21,25 41:12 42:14<br>45:3 47:5 62:25 63:5,7,12,15<br>64:3,9 65:15,22,25 66:20 73:2,<br>11,13 75:24 76:3 78:18 79:25<br>80:6 101:13,19 104:2,11<br>105:24 106:16 107:4,8 108:5,<br>10,18,21,23 109:11 110:7,12,<br>19,23,25 113:17 114:2 123:11<br>126:6,13,17,23 131:19 132:4,<br>16,24 133:5 139:2 140:13<br>142:15,22 | <b>pointed</b> 58:22 117:12                                                                                                                                                                                                           | <b>presumably</b> 96:19                                                                                                              |
| <b>pertaining</b> 33:19                                                                                                                                                                                                                                                                                                                                               | <b>pointing</b> 105:5                                                                                                                                                                                                                 | <b>presume</b> 22:15                                                                                                                 |
| <b>pertinent</b> 35:4,12,20,23 36:1,<br>4,6,9,17,22 37:3,5,8,12,15,17,<br>19                                                                                                                                                                                                                                                                                          | <b>points</b> 17:23 47:14                                                                                                                                                                                                             | <b>pretty</b> 115:9                                                                                                                  |
| <b>petition</b> 111:10 128:3,4                                                                                                                                                                                                                                                                                                                                        | <b>portion</b> 49:3 64:25                                                                                                                                                                                                             | <b>prevent</b> 9:6                                                                                                                   |
| <b>petitioner</b> 18:21 21:10                                                                                                                                                                                                                                                                                                                                         | <b>POSA</b> 20:19 106:5 111:5<br>113:22,24 114:10,21,25 115:1,<br>7,10,13 140:9,13 141:21<br>142:2,20 143:4,6 144:18                                                                                                                  | <b>previous</b> 24:13 105:4                                                                                                          |
| <b>petitioner's</b> 20:6,11 128:6                                                                                                                                                                                                                                                                                                                                     | <b>POSA's</b> 114:8                                                                                                                                                                                                                   | <b>previously</b> 74:16                                                                                                              |
| <b>petitions</b> 11:3 19:25                                                                                                                                                                                                                                                                                                                                           | <b>position</b> 74:11,18,19 76:16<br>86:19 87:5,10,13 91:3 97:10,<br>20 98:7                                                                                                                                                          | <b>primarily</b> 51:9 71:11 85:18                                                                                                    |
| <b>Phd</b> 7:5                                                                                                                                                                                                                                                                                                                                                        | <b>possibilities</b> 71:14 139:17                                                                                                                                                                                                     | <b>principal</b> 132:13                                                                                                              |
| <b>phrase</b> 19:10 21:14 30:22<br>31:16 34:13 41:5 42:13 44:23<br>50:6,7 57:6,19,20 61:2 77:25<br>82:22 99:21 114:5 127:25                                                                                                                                                                                                                                           | <b>possible</b> 46:4 63:10,16 69:23<br>81:7 82:6 84:4 109:6 127:16,<br>24 128:3 131:24                                                                                                                                                | <b>principle</b> 119:4 130:20,21<br>131:24 132:2                                                                                     |
|                                                                                                                                                                                                                                                                                                                                                                       | <b>potential</b> 12:16 47:16 110:11                                                                                                                                                                                                   | <b>printed</b> 84:1                                                                                                                  |
|                                                                                                                                                                                                                                                                                                                                                                       | <b>potentially</b> 12:5 42:22                                                                                                                                                                                                         | <b>prior</b> 13:24 19:22,24 20:21<br>21:17 24:7 26:20 67:3,13<br>83:25 136:10,20                                                     |
|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                       | <b>priority</b> 63:10 81:7 82:6,17<br>83:10,18 84:3,4                                                                                |
|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                       | <b>probably</b> 26:13 41:20 42:8<br>101:21 107:21 110:13 114:10<br>115:11 136:6 138:10,16                                            |
|                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                       | <b>problems</b> 134:5                                                                                                                |

**proceeding** 8:18,19 14:7,8,  
10,16,17,24,25 15:6,8,9,10,11,  
17,22,23 16:6,8,10,15,17,21,  
22 17:6,7,17 23:19 28:25 69:2,  
3 96:25 111:8 112:2,23 126:25

**proceedings** 7:24 8:5,8,16,  
17 11:7 12:2 17:9 19:23 20:22  
21:18 23:10 24:23 25:4,9  
84:16 99:9 111:16,20 112:5,7,  
12 113:2,4,8 115:21 128:19

**process** 17:25 26:9,12 37:25  
39:9 62:13 78:25

**processed** 37:22 49:13

**processor** 35:7 38:8 39:2,7,  
13,22 40:5,8 62:9,10,12 94:1,  
7,9

**produce** 59:1,4 78:4 86:14,  
18,24 104:25

**produced** 30:9 31:2,11 38:23  
83:2 93:12 102:20 119:7,9

**produces** 59:6 93:23

**producing** 28:16 29:15

**product** 82:16

**program** 105:25

**project** 98:25

**projecting** 77:20

**projector** 77:19,20

**proof** 18:23,25 19:5,10,13

**properly** 76:6,9,10

**propose** 21:12

**proposed** 20:6,11 21:4 28:13,  
25 29:13 30:8,11

**proposing** 74:9

**protect** 92:5

**provide** 10:2 36:11 42:9,11  
44:11,25 57:15,20 58:7,19  
69:22 81:6 85:15 102:13  
103:7,14 111:9 114:9 125:12  
126:20 138:2,7,14 142:6,7,9

**provided** 13:20 25:3 69:13  
71:2 95:5 115:1 130:11,12

**provides** 62:1 71:20

**providing** 13:5,13 26:7 29:7  
103:19 114:17

**PTABS** 10:13

**Publication** 99:10 115:22  
128:20

**publications** 84:2

**pull** 14:2

**purpose** 55:4,10 102:12

**purposes** 9:12,13 57:24  
102:9

**put** 69:1

**puts** 44:2

---

## Q

---

**quantities** 68:9

**quantity** 54:15,16

**question** 9:15,18,22 10:2,3  
19:12 21:9 22:18 25:12,16  
30:12 31:10 35:15,21 37:24  
44:4 45:7 50:14 56:24 61:22  
65:20 67:5 68:6 82:2,3 83:7  
90:25 103:11 106:5 109:1,2  
110:14 112:10,11 113:6,7,24  
115:9 119:20 126:14 132:15  
133:13 135:5,8 136:15 141:10,  
14,15

**questions** 7:22 32:7 81:5  
114:20 134:17 136:17,19  
143:12,18 144:22 145:12

**quickly** 70:6

**quote** 28:11 73:19 74:1 75:14,  
20 76:6 111:9 128:3 138:2,5  
139:20

**quoted** 73:22 74:25 128:4

**quotes** 72:18 128:12 138:20

**quoting** 75:18 120:6 127:9

---

## R

---

**rain** 46:18 81:2

**raining** 108:20

**range** 63:18,21,23,24 64:4  
96:20 123:25 139:14,15,16

**rather** 24:4

**rationales** 19:9

**ray** 78:2

**rays** 86:2,8,22

**reaching** 102:19

**read** 23:25 24:5,7 25:17,18,21  
34:6 35:1,19 39:6 40:21 50:19  
53:7 62:6 64:20 69:20 70:19  
74:13 86:5 87:4 89:2 90:1,10,  
16 93:21 94:12 97:1 107:8  
118:24 119:10 120:22 123:20  
124:19 125:9 127:2 129:22  
130:9,19 131:23 138:21

**reading** 54:22 106:17 107:12  
132:5,17,21

**readings** 26:14

**really** 18:6 22:17 25:20 44:7  
52:13,23 55:10 68:10 73:15  
79:14,21 87:13 91:23 96:5  
106:4,14 136:13 140:6

**reason** 9:6 72:19 114:19

**reasonable** 17:11 19:4 29:17  
105:20 107:22 108:1

**reasoning** 134:23 135:1

**reasons** 109:6

**recall** 10:8 11:4,5 12:11 18:6  
25:6 27:4,18 28:19 29:7 48:2  
49:9 53:1 62:20 66:16 67:17  
68:21,23 70:6,14 72:1,8,13  
78:23 83:22 90:4,8 113:13  
128:11,14 138:8

**receiving** 28:15 29:14 55:12,  
13 93:5

**recently** 90:16

**recite** 40:2,8 43:4 53:21 59:15  
70:15,20

**recited** 35:9 39:13 44:12  
45:15 49:8 51:22 55:5 57:9  
66:3

**recites** 32:3 40:5 43:17 49:7  
56:14 60:23 65:7 129:4

**recognition** 75:21 76:1,4

**recognize** 139:3 140:10,22  
141:21

**recognizing** 76:1 142:2,3

**recollection** 24:11 35:25  
52:24 62:16 70:18 72:24

**record** 7:16 8:4 9:13 14:3  
23:11

**red** 95:10,12,17,21,23 96:2,21

**redirect** 143:18

**reduced** 92:5,9

**reduces** 92:17

**reducing** 47:2,4 79:5 88:8

**reduction** 87:22 88:5,12

**redundant** 91:13

**refer** 8:12,16 12:22 23:17  
32:18 69:16 71:24 73:12 84:22  
85:21 95:15 129:3,11 134:9,13

**reference** 84:15,23 85:21,25  
89:12 91:13 92:8 93:19 99:10,  
15 100:10,13,17,22 105:10  
115:20 116:3,17,20,23 117:2,  
13 118:16,20 119:6,25 120:13  
128:18 129:1

**referenced** 144:3

**references** 19:3,6,14,24 84:1,  
6 143:5

**referred** 90:19 93:25 135:2

**referring** 10:23 18:25 23:18,  
21 29:12 30:15,21 33:17 35:18  
50:7 63:8 66:2 70:24 74:19  
82:12,15 89:23 102:24,25  
122:22 141:13

**refers** 72:22 117:1 122:5

**reflect** 89:14

**reflected** 86:10,12,23 90:12,  
17

**reflectors** 71:10

**refresher** 44:21 112:7

**regarding** 38:3 47:15

**regions** 105:9,15

**regular** 130:1

**regulation** 137:15

**regulations** 41:18 45:10  
47:15 137:13

**relate** 8:1,8 112:23

**related** 12:6 21:25 25:4 51:17  
112:5,12 113:8 134:17 135:12,  
18 136:2

**relates** 106:18 127:10 135:14,  
20

**relating** 110:14

**relationship** 134:19 135:18

**relative** 28:6 30:24 31:17,24,  
25 36:21 139:17

**relatively** 70:24 130:25  
131:16

**Relevance** 13:16

**relevant** 37:2 68:10,12 138:20

**remaining** 53:7

**remember** 13:8 29:8

**remembering** 90:6

**remind** 82:2 103:9

**remote** 11:24,25

**removing** 20:18

**repeat** 35:14 99:23 103:10  
119:20 132:12 135:5

**repeating** 23:23

**rephrase** 64:14 82:16 110:18

**reports** 10:12

**represent** 22:5,9,22 95:13,14,  
24 121:21 122:5,11,17

**representation** 98:23

**representative** 23:4

**represented** 127:6

**request** 13:1,2

**require** 39:17 43:6 45:15,22  
46:1 56:23 57:3,7 68:3 137:13

**required** 29:18,24 40:16  
51:21

**requirement** 51:23 108:13,17

**requirements** 29:14,22 30:1,  
4 137:4

**requires** 56:19 68:18,24

**requiring** 56:17

**respect** 36:10 52:6 122:22

**respective** 113:3 119:7

**respond** 7:22 114:19

**responded** 61:22

**response** 10:2 28:16 29:16  
36:14 38:24 66:12

**responsive** 94:1

**rest** 92:12 120:1,4,5,12

**result** 131:1

**resultant** 33:1

**resulting** 41:2 46:23 47:6  
51:3 53:13,21,25 131:2

**retained** 13:12,21

**retaining** 12:1,3,14 124:22  
125:2

**review** 11:5 19:24 24:9 25:14  
112:11 113:7 137:18

**reviewed** 10:16,17,18 11:1  
18:7 24:21 25:10,13 66:7  
111:15,19

**reviewing** 18:12

**right** 8:3,11 12:21 15:25 20:4,  
17 29:5 30:15,21,25 40:6,7  
44:18 50:5 59:13 66:4,6,8  
67:6,11,12 75:12 76:7,12,13  
77:22 80:2 83:6 88:3 95:7,18  
96:13 98:9 100:11,18,19,24  
103:21 104:1 105:1,4 106:10,  
13 109:7 111:4,10,11 116:5,9,  
12,14,21,24 118:7 119:8  
120:16 121:18,19,22,25 122:3,  
6,8,12,13,18,19,25 123:10,13,  
14 124:5,10 125:1,6 126:4,5  
127:7,11,17 128:13,17 129:9,  
15,20 139:23 140:13,18,23,24  
141:24 143:13,21

**risk** 127:17

**road** 63:18,21,23,24 64:4 75:5,  
11,21 76:2,11 81:25 82:13  
124:1 125:14,15,18,24 126:8,  
9,19,20 130:24 131:6 142:12,  
17,24

**roads** 123:23 124:5,8 125:25  
126:4

**roadside** 76:25 77:17

**rotate** 76:18

**rulings** 135:12 136:2,4

**run** 45:23

**S**

**safety** 124:1 125:16

**said** 11:14 30:14 41:24 42:4  
 45:21 49:24 51:20 63:23 64:8  
 67:1 68:21 70:3 72:25 80:13,  
 24 97:21 99:3 103:12 111:15  
 113:22 114:13 117:23 132:9  
 138:17 139:22 140:1,14  
 141:11,15,19 142:3,5,20

**same** 8:1,8,23 22:1 24:12 25:9  
 31:16,22 38:3 41:24 43:7,13,  
 22 44:6,20 47:1,3 59:21,25  
 61:1,3,6,7,11 79:2 80:7 81:3  
 90:2 91:4,8,16,21 99:8 125:25  
 126:3

**satisfied** 43:21 56:20

**say** 11:9 12:25 18:3 20:10  
 22:8,13 23:17 25:10 29:12  
 30:11 39:20 46:6 49:20,23  
 52:12 60:12,17 61:20 62:21  
 66:15,24 68:22 77:8 78:10  
 79:2 80:8,22 85:13 91:14,20  
 97:16 98:10 102:22 106:14  
 107:1,6,24 117:22 120:6  
 121:13 124:17 128:6 133:4  
 135:6,22 136:20,23 141:18,21

**saying** 38:21 45:19 58:3 79:23  
 87:13 88:20 92:9 97:23,25  
 100:16 104:20 111:3 132:2

**says** 28:4 31:25 32:20,25 38:7  
 39:21 40:11 47:20 49:2 53:4  
 56:22 57:14 60:3 62:21 68:4  
 71:2 72:25 74:3 75:3 76:8  
 78:24 87:5,21 88:11 89:18  
 90:11 91:2 92:3 94:24 99:25  
 101:7 102:3,16 105:2,19 107:3  
 109:8 123:4 124:11 127:18  
 131:23 132:13 134:10 140:12

**scale** 52:19

**scans** 69:18

**scene** 45:1 98:25

**schematic** 116:16

**second** 14:9,24 15:11,23  
 16:9,22 17:6 34:10,11 39:11,  
 22 40:6,25 41:10,13 49:4,7,15  
 50:11 53:2,8,10,12,14 64:25  
 65:3 69:2 113:14 127:1

**section** 22:3,4 73:19,22

**sectional** 129:23

**see** 18:23 21:5 27:22 28:4  
 32:5,21 33:5,19 38:4,8 39:3  
 46:23 47:22 49:2,5 53:5 56:1  
 57:17 59:19 63:24,25 67:16  
 69:8 70:21 71:21 75:6,15  
 78:12 79:6 84:25 86:3 87:8,24  
 92:6,22 94:14 95:5 98:14  
 100:1 102:6 105:8,11 123:6,7  
 129:6,11 133:14,16

**seeing** 99:21

**seem** 29:7 49:18 55:11 97:22  
 112:14 113:5

**seems** 15:25 29:17 37:3 51:13  
 59:25 65:20 83:2,5 91:18 92:1  
 107:12 108:4 120:5 126:14

**seen** 135:2 137:10

**segments** 106:1,3

**select** 109:6

**selected** 89:7,12,20 91:14

**selectively** 87:22 88:11

**semi-conductor** 100:20

**semiconductor** 100:9,25

**sending** 92:24,25 96:19

**sense** 35:3 49:3 52:14 55:2  
 70:12 113:17 118:5

**sensed** 35:6 38:7,14 49:4

**sensitive** 117:8 118:11

**sensor** 35:7,8 37:22 38:4,8,  
 10,11,12,14,16,21,22,23 39:9,  
 14,24 40:16 49:13 62:14  
 85:19,23 92:3 94:2 97:8 117:8,  
 11 118:5,10,11

**sensors** 35:3 39:8,15,24 49:2  
 62:11 121:17,22 142:16,23

**sent** 77:10

**sentence** 18:21 69:16 74:3  
 97:1 127:1,15 133:19

**separate** 7:23 67:4 119:14,23  
 120:8 144:7

**series** 10:7 81:5 134:17

**set** 86:21 87:7,11,14,17 88:2

**setup** 77:4

**several** 37:17

**Shah** 12:12

**shape** 58:11,25 59:3

**shaped** 57:15,20 58:6,15

**share** 125:25

**sharing** 126:2

**shift** 127:6,11

**shifted** 134:3

**shifting** 133:12,14,17

**short** 18:22 115:15

**should** 9:1 76:4 79:9 80:23  
 93:7 105:6 107:5 126:18,22  
 138:10

**shoulder** 130:23

**show** 19:9 101:3

**showing** 19:6,13 77:21 96:6,  
 9,15,21 99:1 100:5

**shown** 85:13,16 98:22 99:5  
 100:8 101:15 119:4

**shows** 96:2 100:25 105:9  
 116:15,22,25 117:4,8,11  
 118:14 121:16 129:14,17

**sic** 94:11 112:1

**side** 53:11 65:4 104:25

**sign** 75:21 76:2 77:6,17

**signal** 28:15,16 29:15,16  
 77:12 93:1,5

**signals** 77:10

**signature** 14:21 15:3,20 16:2,  
 19 17:1

**signed** 137:19

**significant** 17:8 21:2 134:6

**signs** 76:12,25

**similar** 58:4 98:18

**simple** 144:19

**simpler** 23:16

**simply** 18:22 97:19 120:25

**since** 10:6,11 106:3 113:13  
 136:24

|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>single</b> 86:18                                                                                                                                                                                                                                                                                                                                                                                                         | 17,25 67:9,23 68:5,16,24 69:3,<br>18 70:11 71:18 72:4,6,13,22<br>74:6,19 75:8 76:10,18,21 78:3,<br>10,25 79:13,22 80:4,5,25 81:1,<br>18 82:1,12,16,17 83:6,17 84:7<br>85:8,11 86:22 87:4,10,15,17<br>88:1,11,20 89:14,19,25 90:7,<br>15,21,25 92:2,19 93:3 94:3,14,<br>20 95:23 96:6,11,25 98:7 99:1,<br>4 102:5,8,23 103:9 104:15,16<br>105:19 106:5 107:3 108:2,11<br>109:19,24 110:16,25 111:25<br>113:1,12,25 114:15,20,22<br>117:3,7,14,19 118:8 119:5,21<br>120:7 121:16,23 124:11,25<br>125:3,5,7,17 126:3,14,22<br>129:16 130:14 131:7,18<br>132:11,13 133:5,9 136:2,10<br>138:7,9,19 139:2,16,20 140:19<br>142:22 143:5,6,17 | <b>source</b> 28:9,14,18 29:4,19,22,<br>25 30:3,8,16 31:7,11,12,13,14,<br>21,25 33:24 34:2,7,8,10 48:6<br>51:24 60:9,16 61:5,25 71:20<br>94:19,22,24,25 96:19 97:4,19<br>116:19 117:4,21,22 118:12<br>119:13,18,22 120:2,7 121:12<br>129:5,18,23 130:2 |
| <b>situation</b> 41:25 42:6 44:5,10<br>45:18 46:9 47:11 63:17 75:5,<br>10 78:5,9 79:19                                                                                                                                                                                                                                                                                                                                      | <b>sources</b> 28:6 30:1,19,23<br>31:17,21 34:9,11 36:21 37:4<br>40:24 41:7,10 42:24 43:5,7,13,<br>18,22 44:3,11 45:16,18,23<br>46:1 47:17,21 48:1,10 51:12<br>60:5,7 61:10,13 62:4 76:9,11,<br>15,21 81:14,19 82:11,19,24<br>83:9,15 84:2 89:5 100:9,13,16,<br>18,21 101:1,6,9,15 106:2<br>108:6 109:14 110:1,10,21<br>119:14,23 120:3,8 121:6,17,24<br>122:1,6,11,17,24 123:2 130:4,<br>14                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                        |
| <b>situationally</b> 45:19                                                                                                                                                                                                                                                                                                                                                                                                  | <b>Southfield</b> 7:2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                                                        |
| <b>situations</b> 42:2 45:12 46:4<br>47:13 73:10 79:4,9,12,24 80:9,<br>18 97:24 113:15 115:11,12                                                                                                                                                                                                                                                                                                                            | <b>space</b> 109:19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                        |
| <b>six</b> 18:7 25:3 26:1 100:12                                                                                                                                                                                                                                                                                                                                                                                            | <b>spatial</b> 33:2,22 54:23 57:14<br>58:1,3,14 61:24 85:18,22 86:9,<br>23 88:21,25 89:4,6,9 92:21,24<br>93:1,4,8,12 96:4,11 121:16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                        |
| <b>Sixty-five</b> 94:15                                                                                                                                                                                                                                                                                                                                                                                                     | <b>spatially</b> 54:18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                        |
| <b>Sixty-six</b> 94:17                                                                                                                                                                                                                                                                                                                                                                                                      | <b>speak</b> 9:14 91:17,23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                        |
| <b>size</b> 139:18                                                                                                                                                                                                                                                                                                                                                                                                          | <b>speaks</b> 91:22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                        |
| <b>skill</b> 20:7,11,15,20 21:5,8,15,<br>16,22 27:6 37:21 63:5,7 66:20<br>73:12,14 80:6 101:20 104:12<br>106:22 107:4 108:10,18,21,24<br>110:12,23 111:1 126:13,23<br>132:5,17 139:3 140:14                                                                                                                                                                                                                                 | <b>species</b> 134:11 136:12,22<br>138:25 139:4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
| <b>skilled</b> 37:18 41:12 42:15 45:3<br>47:5 62:25 63:12 64:3 65:15,<br>22 73:3 75:25 78:18 79:25<br>101:13 104:2 105:24 106:16<br>107:8 108:5 109:12 110:7,19<br>113:18 114:2 123:11 126:6,17<br>131:19 132:24 142:15,22                                                                                                                                                                                                  | <b>specific</b> 27:17 29:5 44:5,9<br>58:12 63:17 65:13,22 70:7,13<br>74:20 77:3 82:23 114:17<br>134:21 135:13,15,21 136:3,15,<br>25 137:15 140:2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                        |
| <b>skip</b> 96:24 130:18                                                                                                                                                                                                                                                                                                                                                                                                    | <b>specifically</b> 13:9 25:12 35:19,<br>24 39:20 47:16 48:3 60:3,15,<br>17 63:3 64:8 68:5 78:24 80:4<br>103:16,24 104:9 111:4,18<br>125:4 128:14 138:17 139:11<br>140:4                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                        |
| <b>sky</b> 42:25                                                                                                                                                                                                                                                                                                                                                                                                            | <b>specification</b> 24:1,5,7,12<br>25:17,18 30:18 48:4 66:7,17<br>68:22 72:2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                        |
| <b>SLM</b> 90:5,6,9 93:17 96:22                                                                                                                                                                                                                                                                                                                                                                                             | <b>specifications</b> 41:18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                        |
| <b>slow</b> 113:20 114:4,15                                                                                                                                                                                                                                                                                                                                                                                                 | <b>specifics</b> 137:3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                        |
| <b>slower</b> 104:14,21                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
| <b>SLS</b> 76:24 78:2                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
| <b>small</b> 139:2,16                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
| <b>snow</b> 46:18                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
| <b>so</b> 8:7,16,17 9:14,21 10:3,14<br>11:8 13:5 14:3,6,7,15 17:6,24<br>19:12 21:13 22:2 23:9,22<br>24:20,24 26:8,22,23 27:4,9,13<br>28:20,22 29:9,23 30:12,16<br>31:1,9 32:12,18,24 34:1,20,24<br>36:5,14 37:2,24 38:13,14,21<br>39:13 41:19,23 43:12,17<br>45:19,23 46:16 47:16 48:12<br>49:18,20 50:1,13 52:3,7,9,15,<br>22 53:3 54:5,7,19,25 56:12,17,<br>23 57:3 58:2 60:14 62:2 63:8,<br>19 64:3,11 65:7,24 66:10,12, |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                        |

**specifies** 40:13

**specify** 35:8,11,22,24 40:15  
44:15 65:11

**spectral** 33:2,3,25

**speculation** 42:20 43:9,25  
45:6 47:9 54:12 55:8 56:10  
58:9,18 65:18 73:7 78:22  
101:18 104:7 106:21 115:5  
126:11 133:2 143:2

**speed** 107:20 113:20 114:4  
123:16,17 130:24,25 131:13,  
16,20

**speeds** 103:25 104:21 114:15  
132:7,8,19,20

**spelling** 138:9

**spent** 11:9,11 18:3

**Spero** 12:20,22,23 13:1,6,14  
23:12

**Spero's** 13:2

**splitter** 85:20,24 86:13

**spot** 69:24 70:21,23 71:2,5

**spotlight** 118:16,19 119:1,5,  
12,18 120:1 121:1,3,14,21

**standard** 19:5,13 27:14,17  
134:23 135:1,7,9 137:6,10

**standards** 47:15 73:11

**start** 18:16 25:19 27:20 89:18  
110:17 116:8

**started** 7:13 82:1

**starting** 28:3 34:7 39:1 40:19,  
20 42:13 48:22 50:16,18 53:3  
55:20,25 59:8 62:6 64:12,20  
69:19 86:2 93:21 94:13 117:16  
118:24 120:22 123:21 130:8,  
20

**starts** 60:19 112:1

**state** 7:16 18:21 21:3,10,11  
51:23 65:13 109:3 119:21  
140:9

**stated** 30:4 67:17

**statement** 71:25 72:16  
111:12 141:11

**states** 74:1 108:14

**stating** 102:9 109:9

**step-substrate** 109:21

**stepped** 101:7

**still** 34:5,25 44:20 46:15 62:5  
71:17 82:21 83:2 87:4,21  
93:19 94:11 123:20 130:7  
141:3 143:3

**stopping** 46:13 125:7

**storing** 62:10

**street** 97:4,18 98:8,11,12

**strong** 103:19

**stuff** 22:20

**subjective** 34:20,24

**submitted** 10:12

**submitting** 19:22 24:2,5,8

**subsection** 39:10,12,19,23  
41:1,4,10,13 49:14 50:9,20  
51:1,2,4,6,10 52:21,22 53:11  
54:4,8 64:24 65:4

**subsections** 40:6 53:8,10,12,  
15 62:15 65:3

**subset** 136:24

**substance** 9:9 145:5,9

**substantial** 18:15 54:23

**substantially** 24:17 51:3  
53:13,21,24 59:16 64:23 65:2

**substantive** 25:8

**substrate** 101:15 109:14,15,  
19,20 110:1,9,10,21,22 111:6  
130:12,13,15

**successful** 98:1

**such** 37:25 54:18 63:15 64:9,  
21,22 75:10 101:15 107:2,18  
108:17 119:14 120:8 125:12

**suggest** 109:4,10

**suggested** 134:4

**suggesting** 131:18

**suggestion** 131:25

**suggests** 131:12,15 132:4,16,  
21

**summary** 22:10,14,22 103:9  
105:20 136:13 141:11

**sunny** 42:8 45:22

**support** 86:9 100:21 101:2

**suppose** 36:19 44:3,16 45:8  
68:6

**sure** 12:18 35:16 43:15 55:12  
56:12 63:9 66:18,25 70:5  
72:25 73:15 77:6 78:25 82:4  
83:4 99:24 111:23 112:15  
113:13 117:24 119:21 126:22  
127:25 133:6 137:20 138:13  
141:10

**surface** 86:8,12 90:14,21  
101:1,6,7,10,11 131:6

**surfaces** 94:10

**surprise** 137:16

**switch** 108:6

**switching** 105:18 121:1

**switchover** 106:8,12 107:10

**sworn** 7:6

**system** 27:25 28:14 35:9  
38:19 48:24 50:25 51:8 55:23  
59:11 60:6,20 64:13,16 65:22,  
24 66:2,3,5 71:4,6,7,9 74:15,  
20 77:16 79:9 85:5,12,17,20,  
23 86:14 94:21 97:8,17 108:19  
114:9,22 115:1 129:9 131:8

**systems** 20:3 76:23 78:20  
81:10 83:21 140:17,21

---

## T

---

**taillights** 97:6

**take** 9:24 10:3 17:12 42:13  
47:20 48:15 64:3,9 92:12  
109:19 115:15 143:8,14

**taken** 48:17 84:11 115:17  
143:9,15 144:24

**taking** 91:3

**talk** 19:8 32:12

**talked** 55:15 136:1

**talking** 50:8 57:7 68:13 79:16  
85:7 91:1 92:20 95:2 122:21  
125:2 128:11 133:21,22 143:3

**talks** 59:19 66:17 70:20 71:25  
90:8 140:5

|                                       |                                 |                                      |
|---------------------------------------|---------------------------------|--------------------------------------|
| <b>task</b> 69:24                     | 19:8,10,19,23,24 20:18,19       | 124:3,10,11,20 125:1,3,6             |
| <b>tasked</b> 108:24                  | 21:4,5,6,7,11,12,16,18,21       | 126:1,4,14,17,22,24 127:2,5,         |
| <b>taught</b> 120:4 135:20 143:6,7    | 22:8,13,16,19,22,24 23:3,4,13,  | 15,17,20,24,25 128:1,8,9,14,         |
| <b>teaches</b> 88:7                   | 19,22 24:13,14,21 25:8,11,12,   | 25 129:6,8,12,17,22 130:2,9,         |
| <b>teaching</b> 92:12 106:24          | 24 26:2,3,12,18,23,24 27:2,4,   | 14,19 131:7,10,18,24 132:4,          |
| 134:18,19,20 135:17                   | 5,11,18,22,24,25 28:11,12,14,   | 11,12,15,21,25 133:5,16,20           |
| <b>technical</b> 33:13 133:24         | 17,18,20,22 29:1,4,5,13,16,17,  | 134:4,6,8,13,14,21,22 135:6,9,       |
| 136:19 143:21 144:1,8,11,17,          | 20 31:1,5,10,12,20 32:5 33:4,   | 11,12,14,16,17,20,21,22              |
| 20                                    | 5,13,23 34:2,20,21 35:1,24      | 136:15,22,23 137:1,15 138:2,         |
| <b>technically</b> 33:16              | 36:4,6,10,14,22 37:2,5,8,11,    | 6,7,11 139:2,18,23 140:2,7,11,       |
| <b>techniques</b> 76:1,4              | 12,17,25 38:3,4,8,11,24,25      | 14,18,19,23,25 141:3,12,18,25        |
| <b>Technologies</b> 12:4,13 13:13     | 39:4,6,15,17,25 40:3,4,5,6,8,9, | 142:12,14,17,19,24 143:5,6,7         |
| <b>technology</b> 71:12               | 13,16,17,21 41:16,20,23,24,25   | <b>that's</b> 7:25 16:2 17:6 20:4,17 |
| <b>temporally</b> 54:18               | 42:2,4 43:2,6,21 44:16,23,25    | 21:14 22:20 23:24 24:18 25:7         |
| <b>tend</b> 57:22 58:1,22 104:15      | 45:11,15,18,19,20 46:1,13,17,   | 26:4 29:18,24 30:9,25 31:2,8,        |
| <b>tended</b> 81:15                   | 21,24 47:17,23 48:5,8,13,23     | 13 38:22 40:1,7,18 46:8 48:4,        |
| <b>term</b> 25:14 28:9,12,14,17 29:4, | 49:5,9,23 50:19,21 51:1,7,8,    | 12 50:15 52:11 55:5 59:13            |
| 20 33:13 38:3 43:13,15 46:15,         | 11,18 52:7,16,18,20 53:2,4,5,   | 64:8,11 65:14 66:5 68:10             |
| 22 50:18 51:5,15 52:25 56:1           | 7,9,18,19,20,22,25 54:6,14,22   | 69:15 72:15 75:1 76:13,17,20         |
| 59:24 60:6 63:21 66:11 67:9,          | 55:1,2,11,12,17,21 56:11,22,    | 80:13 85:14 87:17 88:4 90:15         |
| 20,22 68:13,15 70:10,16               | 24 57:1,11,17,23 58:3,25 59:3,  | 91:10 93:12 94:24 96:3,13            |
| 72:18,19 80:5 102:17 103:1            | 5,9,17,19 60:17,19,20 61:15,    | 100:11,19,24 101:11 104:1,23         |
| 119:1 120:2 128:8 139:17              | 21 62:1,24,25 63:6,15,20,22     | 105:4,20 106:10 107:3 109:8          |
| <b>terms</b> 14:4 17:25 26:6,10,18,   | 64:1,6,9,12,14,15,20,21,22      | 110:3 111:4,11 112:8,20,25           |
| 23 27:2,5,11 32:21 37:23 42:3,        | 65:11,16,20,21,24,25 66:2,10,   | 113:9,23 114:23 115:9 116:10,        |
| 4 54:3,4 55:15,16 59:22 61:9          | 13 67:6,17,19,22,25 68:15,17,   | 16,21,24 117:1,5,9,23 118:13,        |
| 106:3,24 109:19 139:12,17             | 18,22 69:4,8,14,20 70:4,12,16,  | 20 120:16 121:19 122:3,8,13,         |
| <b>testified</b> 7:7                  | 21,25 71:7,10,18,20,21 72:7,9,  | 19,25 123:10,14,18 126:5             |
| <b>testify</b> 140:25                 | 14,16,19,22,24,25 73:10,11,     | 127:13,18,21 128:4,13 129:20         |
| <b>testifying</b> 9:7                 | 13,15 74:1,2,3,5,24 75:6,8,12,  | 131:17,25 132:22 135:17,25           |
| <b>testimony</b> 9:10 145:5,9         | 15 76:5,7,16,18 77:9,20,22,23   | 137:5 138:4 140:1,12,24,25           |
| <b>testing</b> 73:14                  | 78:8,12,14,15,16 79:2,6,9,23    | 141:2,3,10,24                        |
| <b>than</b> 11:18 34:8,10,11 37:16    | 80:1,2,10,12,14,17,24 81:4,10,  | <b>their</b> 8:17 45:16 71:14 76:15  |
| 53:18 56:8 57:3,7,12 82:16            | 15,24,25 82:2,3,5,10,16,21      | 77:14 106:4 114:17,23                |
| 104:8,10,14 107:13                    | 83:1,25 84:2,7,19,22 85:4,16    | <b>them</b> 12:18 14:2 17:18,19      |
| <b>Thank</b> 17:3 132:10              | 86:3,5,22 87:8,10,24 88:1,3,5,  | 18:14 19:20 24:2 34:19 44:6,         |
| <b>Thanks</b> 65:6                    | 6,14,22,25 89:15,25 90:7,17     | 17 50:14 73:11 79:11 80:3            |
| <b>that</b> 7:21,24 8:6,9,11,12,18    | 91:3,7,19,22,23,25 92:6,9,11,   | 88:9,14 89:8,14,19 91:3,15           |
| 9:3,6,9,13,16,19,22 10:1,4,7,         | 13,22 93:2,5,8,10,14,21 94:3,   | 92:4 98:6,18 101:21 106:5            |
| 11,22,25 11:5,16 12:14,18,20,         | 6,7,8,12,14,18,20,21,23 95:6,   | 121:8,25 132:23                      |
| 21,25 13:2,3,4,5,6,9,11,24            | 13,20,24 96:2,4,9,12,15,21      | <b>themselves</b> 42:24              |
| 14:3,10,18,20,24 15:2,8,16,19,        | 97:10,11,24 98:3,7,9,10,11,12,  | <b>then</b> 7:12 10:2 14:23 20:9     |
| 24,25 16:16,19,22,23,25 17:8,         | 22 99:3,5,14,18,23 100:2,13,    | 31:12 32:21 33:19 45:25 47:19        |
| 9,13,16,21 18:1,7,13,17,23            | 17,18,23,25 101:3,8,11 102:3,   | 60:14 67:2 70:9 75:8 81:15           |
|                                       | 5,6,9,11,15,17,22,25 103:2,3,   | 82:8,9 89:5 92:12,21 96:7 98:8       |
|                                       | 5,8,13,15,20,24 104:2,12,15,    | 102:13 110:17 114:10 118:9           |
|                                       | 21 105:6,8,11,14,17 106:6,8     | 122:14 135:20 136:10,25              |
|                                       | 107:4,9,12,14,24 108:1,4,9,11,  | 143:14                               |
|                                       | 13,15,25 109:4,7,9,17 110:2,3,  | <b>there</b> 9:6 10:25 14:21 15:2,19 |
|                                       | 11,18,24 111:2,10,13,15,17,     | 16:19 17:1,8,24 18:12,21,25          |
|                                       | 21,22 112:15,16,20 113:4,11     | 19:5,18 24:16 25:19,23 26:1,         |
|                                       | 114:8,9,11,24 115:1,10,11       | 18,23 27:2,5,11,14 28:25             |
|                                       | 116:2,9,11,19 117:4,17,19,21,   | 29:18,21,24 30:1,3,18 32:20,         |
|                                       | 24 118:2,3,6,9,24 119:5,8,17    |                                      |
|                                       | 120:1,14,19,20,22 121:4,9,18,   |                                      |
|                                       | 22,25 122:12,18 123:5,6,7,12    |                                      |

24 33:11 36:9,12 37:11,16  
39:1 41:20 42:21 43:1 44:5,9,  
17 45:9,10,23 47:13,14,16,23  
48:2,7 49:11 52:21 54:17,21  
56:1,18 57:10,20,22 58:23  
59:5,8 60:6 61:4,8 62:6 63:19  
65:15 68:3,6,18 69:2,7 70:8  
71:24 72:3,6,19 73:13 74:1,14  
76:8 77:20,22 79:12,17,18  
80:8,14,15 83:20,25 84:25  
89:18 91:22 94:25 95:5,10  
96:2,7 97:2 98:14 99:18 100:8,  
16,17,22 101:23 103:20 106:7  
107:16 109:8,17 112:10,22  
115:10,11 116:5,8 117:17  
122:4,10 123:3 124:11 127:15  
129:4 133:13,23 134:2,23  
135:6,24 136:6 137:3 141:3,10  
143:5

**there's** 10:3,21 19:12 38:14  
40:12 57:11 68:19 70:7,12  
79:20 97:14 98:2 100:12  
107:20 108:12 114:20 122:14  
127:17,24

**thereby** 125:15

**therefore** 93:4

**these** 8:23 11:6,16 12:6,16  
13:15 18:4,8,12 19:23 21:24  
22:1,19 23:1,3 24:8 25:9 44:2  
49:18 52:23 53:20 58:20 67:4  
70:11 80:1 86:18,20 87:6  
98:17,21 99:1 100:12 103:5,12  
105:6,15,23 106:1 107:6  
109:22 111:16 112:3 120:1  
131:24 133:24 134:23 135:1,7,  
19 136:7,16

**they** 8:1 11:25 12:14 13:4  
17:20,22 22:8,9 31:22 45:8  
46:7 49:25 57:25 58:22 70:18  
76:18 77:3 83:16,20 86:10,13  
88:24 89:15 90:11,17 94:21  
98:19 101:23,24 106:25 113:5  
114:15,18,23 119:9 123:17,18  
132:25 133:6,23 135:23  
138:19 142:7,9

**they're** 44:15 47:3 49:20,21,  
23,24 50:1,3 52:5,9 61:6,11,16  
89:15 91:9 111:23 113:12,13  
134:4 137:9 144:7

**thing** 44:18 47:1,3 61:3,7,11  
63:16 64:10 90:3 91:4,8,16,21  
134:21 135:13,15,16 136:3,25

**things** 10:19 14:4 23:16 33:14  
34:1 37:11,15,17 43:2 46:20  
49:24 52:9,23 55:14 63:19  
74:23 98:1,5 101:22,24 106:23  
107:19,21 109:23 131:24  
133:22,24 134:3,8 135:19,20,  
21,24,25 139:14,15,16

**think** 8:7 11:8 14:4 16:18,24  
19:1,8,18 20:17 21:1 23:3,16  
24:24 26:8,22 27:4,9,13 29:9,  
21 30:2,3 31:13,25 32:10 33:8  
34:3 36:25 37:16,21,25 39:3  
40:12,18 42:8,21 44:1,25 47:3  
48:4,11,13 49:24 50:6,11  
52:11 54:2,19 55:9 61:2,15,22  
63:23 66:5 67:4 68:21 70:24  
72:21 79:13,22 80:4,5,12,13,  
14 81:1,3 88:7 90:9,15 93:3,8  
97:23 98:18 101:19 102:12  
104:11 105:20 106:16 107:8  
108:21 110:12,13 111:4,5  
112:20 114:8,18,23 117:3,14  
119:24,25 120:4,11 123:18  
126:5,23 129:16,20 132:3,9,  
15,21,22,24 133:6,23 137:3,23  
138:8 139:13 141:18 142:4  
143:6 144:16

**thinking** 42:23 44:4 52:11  
81:25 114:22

**third** 13:22 24:25

**thirds** 50:7,8

**this** 7:18 10:6 12:25 14:7,8,16  
15:8,10 16:21 21:14,23 22:10,  
14 23:9,11 24:25 26:16 27:21  
28:19,24 29:4,9,13 30:11  
31:22,25 32:10 33:16 36:13  
40:12 42:13,23 43:2 44:1  
46:15 47:4 48:3 50:17 51:9  
52:12,21 53:20 54:25 55:1,5  
58:3 64:4 66:23 67:1,2 68:4,5,  
24 69:6 72:16 73:22 74:9,15,  
18,19,21,24 75:2,3,20 76:6,10  
77:4,25 78:5,25 79:2,22 80:4,  
5,25 81:23,25 82:3,5 86:15  
88:1 89:3,4,23 90:4,9,10,21  
91:24 96:14 97:14 98:19 99:6,  
9 103:9 106:8,17 107:9,19  
111:12 112:9 114:20,24  
118:25 119:1,24 120:10  
122:21,23 123:1 124:15  
127:19 128:25 132:4,9,15  
133:4,19 134:1,15,16 136:7,  
14,19 137:18,21,24 138:5,12,

17,19,25 139:12

**Thominet** 99:2,9,14,18,25  
100:4,8,20 101:4,5,8,12,16  
102:2,9,16,23 103:12,16,18  
104:4,17,24 105:8,9,13  
106:18,24 107:13 109:4,9  
110:3,6

**Thominet's** 100:6 103:5  
107:9

**those** 7:23 8:4,8,24 11:14,21,  
24 20:14 30:19 32:13,22 33:6,  
8 34:6 43:6 49:24 72:7,8,10,11  
74:23 79:23 80:18 85:21 89:3  
96:21 97:15,23 98:1,5 103:3,  
18,25 118:19 119:10 120:10  
121:21 122:5,11,15,17 123:2,  
21 124:19 125:9 136:19

**though** 8:1 74:23

**thought** 27:6 36:12,13 46:3  
54:25 55:11 65:19 66:23 67:1  
77:2 79:14 80:12 107:18 108:9  
111:22 133:3

**three** 7:23 8:4,8,17 10:17,18  
11:6 12:6 17:9,13,16,22 18:4,  
8,9 19:22 20:22 21:18,24 22:1,  
24 23:10 25:4 28:5,24 30:23  
31:16,21 43:4,6,12,21 44:10  
84:15 99:9 111:16,20 112:4,7,  
12 113:1,2,8 115:21 128:19

**threshold** 53:19 54:24 65:1,5,  
8,11,13,16,21 66:11,21 67:9,  
10,14,18,20,24 68:8,14,18

**through** 7:11 13:3,23 32:25  
34:6 35:1 37:10,25 39:2 40:20  
44:21 45:9 46:3 48:11 50:19,  
21 53:1,8 59:15,21 60:2,24  
62:6,7 64:19 72:4 75:19 79:14  
80:12 86:2,10,13 87:5,21 90:2,  
12,17 91:1 92:20 93:20 94:12  
97:7 107:18 117:17,18 118:24  
119:10 122:20 123:20 124:18  
125:8 129:21 130:7,19

**throughout** 28:23

**Thus** 86:14

**time** 9:25 11:9 18:5 42:24  
47:14 54:20,23 63:8 68:1  
75:24 81:10,19 83:22 84:9  
109:17 110:3 143:4

**times** 25:10,20 45:24 142:7

**tiny** 54:21 89:14

**title** 84:25

**today** 7:19 9:3,7,10,24 10:15  
11:1,7 14:5 17:5 20:23 21:19  
111:21 113:16 141:1 144:1  
145:3,6,9

**today's** 11:10 18:10

**together** 70:11

**told** 13:5

**top** 21:1 42:23 44:4 46:6 58:21  
61:16 81:1 99:17 122:10  
127:7,11 133:4

**topic** 19:11 22:17 83:23

**Torchlight** 12:3,13 13:13

**total** 18:5 25:23

**towards** 12:9 93:20 97:11  
122:4 124:1

**tracked** 74:17

**tracking** 77:24

**traffic** 34:10,14 41:3 75:5,10  
79:19 80:21 124:21

**transferred** 38:15

**transmitted** 97:7

**travel** 31:23

**truthfully** 9:7

**try** 8:15,21,23 71:18 76:5

**trying** 68:14 72:1 80:1 83:6  
134:7

**Turk** 7:5,8,17 14:16 84:20  
115:19 143:21 145:3

**turn** 16:1,25 18:19 27:20 34:5  
48:21 53:2 55:19 79:20 84:14  
85:8 86:1 95:1 105:22 115:20

**turned** 107:10,17

**TURNER** 13:16 19:16 22:7  
24:15 27:8,16 29:6 31:4 32:9  
35:13 40:10 41:15 42:19 43:8,  
24 44:13 45:5 46:2,10 47:8  
49:17 54:11 55:7 56:9,21 57:5  
58:8,17 59:23 62:19 65:17  
66:14 73:6 77:1 78:21 84:10  
91:5 93:15 96:17 101:17 104:6  
106:20 114:7 115:4 126:10  
131:22 133:1 137:8 139:10,24

143:1,13,17,20 144:10,21  
145:13

**turning** 78:7 106:5 121:6,8

**two** 20:15,16 22:19 23:1,3  
29:13,15 49:18 50:7,8,17  
53:20 62:15 67:4 69:17 70:11  
81:15 83:12 98:14 112:17,19  
129:14 135:19 140:15,19  
144:23

**type** 35:8,11,22 36:1 40:15  
71:7 90:6,9

**types** 101:11

**typical** 38:19

**typically** 104:18,20 137:5  
142:11

**typo** 138:8,9

**typos** 18:15

---

## U

---

**unanticipated** 134:5

**unclear** 27:3

**under** 9:3,9 27:14 30:8 79:4  
141:1,8,17,19

**underlined** 139:7

**underlying** 62:17 140:4

**understand** 9:3,18 20:21  
21:6 22:16,18 26:19,24 27:7  
37:22 51:7 63:6,15 64:2 66:21  
67:20 68:14 104:12 105:25  
106:17 123:11 126:17 140:3

**understanding** 7:21,24 13:9  
21:10,17 22:4,5,9,10,13,14,15,  
23 23:2,4 26:5,10,13 28:22  
31:9,18 34:13 41:5 44:23 51:5,  
15 53:16 55:4 56:4 57:19  
59:20 60:10,25 63:6 66:10  
67:22,23 68:15 72:22 73:2  
76:22 81:9,20,22 89:11,17,19  
91:19 92:8 104:16 108:14,15,  
16 110:6 134:15,25 135:4,6,8,  
10 136:2,10,14,19 144:1,3,8,9,  
11,12,18

**understands** 80:15

**understood** 9:22 23:20 30:14  
41:17 63:1,12 90:16 101:14  
119:2

**unilluminated** 123:23 124:5  
126:8

**unit** 33:15

**units** 65:16 66:11,16,17,22,25  
67:7,8

**unless** 23:17

**unsure** 8:25

**until** 11:25 20:24 86:6,7 96:6,7

**up** 11:12 79:20 80:24 81:21  
91:11 92:2 96:7 98:20 102:8  
109:19 119:18,22 133:19,22  
141:9

**urban** 126:8,19

**us** 8:9,15,24 23:11 42:13 71:18  
84:16 99:10

**usage** 72:9 128:7

**use** 19:10 40:23 41:6 42:14,  
15,16 43:6,13,17 44:12 47:22  
68:20 72:2,16 105:18 114:5  
128:15 131:2 133:11

**use'** 43:15

**used** 33:16 35:8 50:1 55:17  
57:23 63:21 68:1 70:11 74:2,  
17 102:5

**useful** 37:23 123:17

**uses** 67:6 72:4 89:22 92:4  
118:9 120:10 127:25

**using** 69:21 71:20 72:15 74:6,  
9,16,21 75:20 99:3,5 119:13  
124:4,7,14

**usually** 138:12,14,16

**utilize** 123:24

---

## V

---

**vague** 22:7 24:15 27:8,16 29:6  
31:4 32:9 35:13 40:10 41:15  
43:24 44:13 46:2 47:8 49:17  
55:7 57:5 58:8,17 59:23 62:19  
66:14 77:1 83:2 93:15 96:17  
113:23 114:7 115:4 126:10  
131:22 137:8 139:10 143:1

**value** 38:20 51:21 65:1,5,9,11,  
14,16,21 66:11,22 67:9,10,15,  
21,24,25 68:3,14,18

**values** 67:18

**variables** 75:10

**various** 11:22 30:2 33:14 34:2  
 41:18 47:14,16 71:13 105:5  
 134:2

**vary** 42:3,5,6

**vast** 24:20

**vehicle** 20:3 27:25 28:7 30:15,  
 17,24 31:18 32:1 36:16,22  
 37:5 39:11,12,14,18,21,23  
 40:2,9,12,13,17,24 41:7 42:16  
 44:24 45:4,14,25 46:5,15,19  
 48:23 49:5,7,8,12,14,16 50:6,  
 10 51:8 57:16 60:20 64:13,16,  
 25 73:23 74:8,10 79:3 81:24  
 82:24 83:8,17 85:5 97:5,6,7,18  
 99:19,21,22 100:1,6 102:13  
 107:23,25 108:3,7 110:10  
 116:8,12 124:23 129:5,9,15  
 130:24 131:4,5,13,21 134:11  
 137:7,10 140:10,22 141:7,17,  
 22 142:6,8,16,23

**vehicle's** 104:3 106:9 108:18

**vehicles** 30:20 57:23 78:17  
 79:6 81:9 136:18 137:13  
 142:11,12,17,24

**version** 20:10 95:6

**versus** 37:19 108:20 110:9  
 126:19

**vertical** 58:23 83:13

**vertically** 81:16

**very** 18:6 33:16 45:2 69:19,24  
 70:20,21,23 71:4 81:20 83:6  
 113:23 123:17 134:4 139:15

**view** 39:10 43:1 53:10 64:24  
 65:3 71:1 129:23 136:16

**visibility** 40:25 41:7,19,23  
 42:1,9,12 44:24 45:4,12,14,25  
 46:5,16,19 114:10,18 126:21

**visible** 45:2

**vision** 41:3

**visually** 34:9,14

**Volkswagen** 25:1

**voltage** 48:5,12

## W

**wall** 77:20,22,23 78:1

**want** 26:2 50:14 64:1 79:21  
 81:6 82:2 101:22 103:9 104:3  
 108:6,10,18 113:18,23,25  
 114:11,15,25 115:1,7 126:6

**wanted** 112:9

**wanting** 25:15

**wants** 108:22 115:13 126:13

**was** 7:6 10:7 12:8 13:8 17:24  
 19:12 26:9 27:14 35:21 40:13  
 48:17 49:13 59:22 61:1 67:3,5  
 75:1 82:5,7,9,15,18 83:13,23  
 84:11 90:25 97:25 108:7  
 110:14 113:6,7 114:9,17  
 115:17 136:23 137:23 141:15  
 143:9,15 144:24

**wave** 34:1,4

**way** 9:10 21:14 39:20 43:7,13,  
 23 44:6 48:12 52:11 74:7 77:3  
 88:13,21 91:22 92:13 99:6  
 117:21,22 134:7

**ways** 41:20 54:17 68:7 134:4

**we'll** 7:11,12 9:24 15:6 48:21  
 84:22 93:19 116:2 143:14

**we're** 14:5 20:22 21:18 28:3  
 30:21 64:11 67:9 68:13 71:17  
 79:16 84:13 85:7 95:2 96:25  
 111:21 128:17 143:3

**we've** 24:13 46:10,16 55:14  
 113:15 145:3

**weather** 46:17

**weeks** 11:22

**Welcome** 48:19

**well** 11:3 18:6 23:1,4 25:15  
 30:1 40:11 42:1,7 44:14 45:9  
 58:25 68:9,12,20 70:6 71:8,25  
 77:18 80:3,11 97:25 102:12  
 106:22 107:18 108:15 110:11  
 113:6,22 115:6 137:2

**well-illuminated** 124:8

**well-lit** 113:20 114:4,16

**were** 11:14,24,25 12:5,15  
 13:13,21 17:24 19:24 23:1

27:3,5,11 30:22 43:22 50:7  
 53:21 57:6 66:5 81:15,24,25  
 83:8,17,20,21,25 98:20 120:19  
 122:21 123:18 133:21,22  
 136:16 143:5

**what** 8:25 14:5 17:19 18:25  
 20:10 21:10 25:12,15 26:9  
 28:9 30:7 31:12,13,14,18 32:8,  
 15 33:6,9,22,25 34:3,21 35:8,  
 11,22 36:1,25 37:1,19,22 38:1,  
 15,17 41:5,19 42:2,4,14,18  
 43:15 44:23 45:4 46:16 47:12  
 50:3,11 51:5,14 53:16,24 57:9,  
 19 58:10 59:3 61:12,20 62:3,  
 21 63:4,17,21 64:8 65:11,25  
 66:10,12 67:16,20 68:14,22  
 70:2,3,23 71:6,23 72:13,15,25  
 73:4,16 74:21 76:3 77:9,12  
 78:9,14,23 79:8 80:9,13 82:8,  
 23 83:4,5 84:22 85:11 86:24  
 89:11,17,19,20 90:16,25 91:18  
 92:1,8,15 94:7,24 97:13,21,23,  
 25 98:4,20 101:23 104:8,17  
 106:14,16,24 107:5,13,16,25  
 109:8 111:2,5 113:24 115:7,13  
 116:2,25 117:23,24 118:15  
 119:25 120:6,11,17 122:5,21  
 123:18 126:2,13 127:18  
 128:16 131:23 133:6,17  
 134:13,25 135:8,22 136:10,13  
 138:3 139:9,22 140:1,3,12  
 141:2,3,7,11,13,16 142:5  
 143:4

**what's** 7:21 34:13 55:4 56:4  
 57:19 67:23 76:22 77:24  
 89:11,17 99:4 134:19,25

**whatever** 55:16 78:2 80:22  
 98:12 142:3

**when** 11:21 12:5,15 21:16  
 23:17 28:19 38:14 45:24 54:14  
 61:20 63:3,4,8 64:5 73:4 77:8  
 78:3,7 79:17,18 88:11 89:22  
 97:25 102:23 104:13,14  
 106:11,12 107:10 108:7,12,19,  
 20 113:20,22 114:4,21 123:22  
 124:4 127:16,24 128:1,7 134:3  
 135:13 136:3,10 139:1

**where** 8:24 28:4 38:7 44:5,10,  
 17 49:2,13 54:20 57:14 59:16  
 60:3 70:20 73:23 79:19 86:7,  
 10 87:5 90:11,25 91:2,21  
 94:16 95:2 96:11 103:1 113:15  
 128:14 134:2,17 138:5,13

|                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>whereas</b> 49:8                                                                                                                                                                                                                                                                                                                                                                        | <b>witness</b> 7:9 13:17 19:18 22:8<br>24:16 27:9,17 29:7 31:5,9<br>32:10 35:14 40:11 41:16 42:21<br>43:10 44:1,14 45:7 46:3 47:10<br>49:18 54:13 55:9 56:11,22<br>57:1,6 58:10,19 59:24 62:20<br>65:19 66:15 73:8 77:2 78:23<br>91:6 93:16 96:18 101:19<br>104:8,11 106:22 114:8 115:6<br>126:12 131:23 133:3 137:9<br>139:11 140:1 143:3,12 144:7,<br>16                                                                                                                                                                                                                                                                                                                                                                                                                                 | 110:7,12,19,24 111:1,5<br>113:17,22,24 114:2,9,11,13,<br>15,19,23,24,25 115:7,10<br>120:17 123:11 124:3 126:6,17,<br>24 127:16 132:23,24 133:4,6<br>134:6 136:23 137:1,3 138:19<br>139:3,22 140:9,22 141:12,21<br>142:15,22 143:6                                                                                                                                                                                                    |
| <b>wherein</b> 34:8 62:12                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>wouldn't</b> 22:8 38:12 46:7<br>52:1,14 65:23 91:13 98:11<br>137:16                                                                                                                                                                                                                                                                                                                                                               |
| <b>whereupon</b> 48:17 84:11<br>115:17 143:9,15 144:24                                                                                                                                                                                                                                                                                                                                     | <b>WO</b> 115:23 128:21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>write</b> 17:16,18,19 137:21<br>141:12                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>whether</b> 12:15 30:5,9 31:2,5,6<br>43:12 66:11,21 67:2,13 68:7<br>70:12 87:15 90:5 94:9 97:17<br>107:16,23 108:2 110:6,7,25<br>135:16,17,21,23                                                                                                                                                                                                                                        | <b>won't</b> 78:15,16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>writes</b> 91:17,24                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>which</b> 11:4 16:9 21:8 27:14<br>29:8 30:21 33:18 36:25 50:6<br>59:6 60:18 63:11 68:19 72:12<br>75:4 77:23 79:12 81:8 82:2,7<br>84:15 85:12 86:18,24 89:5<br>90:15,19 92:4,21 93:24 95:15<br>97:3 99:8 100:9,22 104:25<br>105:9 111:25 112:4 116:22<br>117:12 119:6,13,15,19 120:7<br>123:25 124:20 125:13 127:6<br>129:25 130:3,4 132:22 133:20<br>135:2 136:7 139:13 140:5<br>144:19 | <b>wondering</b> 75:2 113:17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>writing</b> 17:25                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>while</b> 41:1 65:1                                                                                                                                                                                                                                                                                                                                                                     | <b>word</b> 55:1 61:24,25 67:6 68:20<br>73:1 89:22 105:19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>written</b> 18:2 22:20                                                                                                                                                                                                                                                                                                                                                                                                            |
| <b>whilst</b> 79:5 124:22                                                                                                                                                                                                                                                                                                                                                                  | <b>wording</b> 22:2 50:12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>wrong</b> 138:9                                                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>white</b> 77:21                                                                                                                                                                                                                                                                                                                                                                         | <b>words</b> 20:15 22:23 49:20 50:1<br>61:6 106:25 107:6 120:10<br>128:11 142:1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>wrote</b> 17:22 55:9 136:13,14<br>137:23 141:2,3                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>who</b> 11:14 12:1,10 80:15<br>108:22 137:23,25 138:18                                                                                                                                                                                                                                                                                                                                  | <b>work</b> 26:16 79:23 80:17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <hr/> <b>X</b> <hr/>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>whole</b> 12:8 91:24                                                                                                                                                                                                                                                                                                                                                                    | <b>working</b> 10:20 11:16 12:6,16<br>13:4 17:21 134:16 135:11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>XY</b> 86:19                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>whom</b> 83:5                                                                                                                                                                                                                                                                                                                                                                           | <b>works</b> 97:14 98:3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <hr/> <b>Y</b> <hr/>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <b>why</b> 7:18 75:1 108:5,9 112:8,<br>15,21 113:5,12 132:22 136:22                                                                                                                                                                                                                                                                                                                        | <b>world</b> 51:18 90:18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Y-E-C-H-E-Z-K-A-L</b> 12:20                                                                                                                                                                                                                                                                                                                                                                                                       |
| <b>wide</b> 96:20                                                                                                                                                                                                                                                                                                                                                                          | <b>would</b> 8:18 9:6,13 10:1 11:9,<br>13 12:18 13:23 17:7 18:3<br>20:20 21:1 22:13 25:10,20<br>27:7,24 31:6,20,22 32:12<br>33:19,23 34:3,20 36:6,16,19,<br>21 37:4,11,15,18,21,25 38:10,<br>23 41:12 42:5,14 43:5,21 44:6,<br>11,17,18 45:3,11,18,19,22,24<br>46:6,16 47:4,5,10 48:6,9,11,22<br>49:20,23 51:7,24 52:10,20<br>53:1 54:6,21,24 55:11,20 58:4,<br>14,25 59:4,9 63:1,6,11,15,16,<br>18 64:3,8,12,15 65:15 66:20<br>67:16,19 70:17 71:4,7 72:3,4,<br>8,15 73:2,14,16 74:13 75:24<br>76:3 77:4,22 78:1,9,18 79:13,<br>25 80:1,5,7,18,21 81:2 82:3<br>83:25 84:8 85:4 93:12 94:18,<br>21,22 97:13,22,23 98:1,5,8,10,<br>11,25 99:5 101:8,13,20,22,23,<br>24 103:24 104:2,3,12,16,20,25<br>105:24 106:4,6,16,23,25<br>107:8,12,20,22,23,24 108:2,4,<br>5,10,18,25 109:11,20,21,22 | <b>yeah</b> 36:3 45:21,23 68:24<br>72:11 75:12 85:22 90:8 96:5<br>104:23 117:23 133:19 140:1                                                                                                                                                                                                                                                                                                                                         |
| <b>widely</b> 104:14                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>year</b> 143:4                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>wider</b> 104:4,8,10                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>years</b> 20:16 140:15,20                                                                                                                                                                                                                                                                                                                                                                                                         |
| <b>window</b> 127:6                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Yechezkal</b> 12:19                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>windshield</b> 107:10 108:7,12                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Yep</b> 85:3                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>wiper</b> 106:12,14,15,17 107:1,<br>3,10,14,16,21,23 108:2,7                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>yes</b> 7:20 8:14,20 9:5,17,20,23<br>10:5,24 14:19,22 15:1,4,21<br>16:4,18,20,24 17:2,11 18:11,<br>18,24 20:1,8,13 21:6,20,23<br>22:2 23:15 24:3,7,10,24 25:2,<br>19,22,25 26:8,21 27:23 28:2,8,<br>12 29:3,17 31:8 32:6,23 33:5,8<br>34:24 36:8 37:8,16 38:6 39:5,<br>16 40:7 43:20 46:20,25 47:24<br>48:25 49:6,10 53:6 55:24 56:3,<br>16 57:18 59:19 60:8,22 61:2,<br>11 64:18 65:10 66:9 67:22<br>69:5,9 70:22 71:22 73:21,25 |
| <b>wipers</b> 106:23,25 107:20<br>108:12                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>wise</b> 64:9                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>within</b> 39:9 59:6 93:14 139:4<br>140:11,23 141:6,16,22                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>without</b> 37:10 113:23 115:8<br>137:10                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                      |

75:7,16,23 76:17 78:13 79:7  
81:1 82:14 83:11 84:7,24 85:6  
86:4 87:9,19,25 88:5,7,16 91:6  
92:7,23 93:7,11,16 94:5,9  
95:8,19 96:1 98:16 99:16  
100:3,15 101:3,11 102:22  
103:4,16,22 104:1 105:12  
106:3 111:11 114:14 116:4,13,  
18 117:7,14,24 118:4,8,13,18,  
22 119:9 120:20 122:3,13,25  
123:7,14 124:6 125:7 128:13  
129:2,7,10,13 130:6,17  
131:11,14 133:16 137:20  
139:8 140:12 141:2,5 142:7,10  
143:22

**yesterday** 11:11,12,25

**yet** 13:13,21

**you'd** 69:10 72:7 77:19 131:18

**you'll** 16:14

**you're** 7:18 8:25 10:22 12:25

13:5,12 31:10,11 38:17,21  
42:7 45:19 58:10 66:2 72:13  
75:3,17 78:7 80:22 82:23  
88:20 109:9,24 110:25 111:2  
120:6 127:9 128:11 140:25

**you've** 25:10

**your** 7:16,21,22,24 9:10,15

10:6,11,21 12:25 14:3,6,9,17,  
20,24 15:2,8,11,16,19,22 16:2,  
7,9,16,19,22,25 17:5,8,12,16  
18:16 19:22 20:5,18 21:3 22:3,  
5,13,14,23,24 23:17,25 24:6,  
11,25 26:7,9,25 28:18,24 29:1,  
2,19,25 31:9,18 33:6 34:13  
35:25 36:5 38:15,18 39:17  
41:5 44:4,9,23 47:2 49:11  
51:5,14 52:15,24 53:16 55:4  
56:4,24 57:19 59:20 60:9,14,  
25 61:5,12 62:16 66:10,12,20  
67:23 68:15,17 69:2,11,12,13  
70:19 71:17 72:22 73:2 75:13  
76:22 81:9 82:1 83:14 85:8,9  
88:13 89:11,17,19,25 92:8,15  
95:1,9,12,18,23 96:2,24,25  
97:10 98:7,22 101:13 105:24  
108:5,12,13,15 109:3,11,24  
110:19 111:7,25 112:1 113:1  
123:15 126:25 127:14,20  
128:5,9 133:8 134:9,25 135:6,  
8 136:2,10,20 137:17,18,21  
138:15 139:20 140:19,25  
141:3,10,14 144:1,2,4,11,12

145:5,9

**yours** 143:12

---

**Z**

---

**zero** 52:10,12,16