

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

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VIKING DRILL & TOOL, INC.,)
)
Petitioner,)
) IPR 2023-00474
vs.)
)
HONGJIA WANG,)
)
Patent Owner.)

THE VIDEO DISCOVERY DEPOSITION OF
WILLIAM J. ENDRES, Ph.D
November 21, 2023
9:00 A.M.

Called as a witness by the Petitioner
herein, pursuant to the Rules of the United States
Patent and Trademark Office, pertaining to the
taking of depositions for the purpose of discovery,
before GLORIA APOSTOLOS SIOLIDIS, C.S.R. License
#084-001205, duly qualified and commissioned for
the State of Illinois.

1 that's primarily radial.

2 Q Okay. I think we referred to that earlier
3 as a flank surface, perhaps? Is that possible?

4 A The flank surface exists before the flutes
5 are applied. And by applying these flutes 4, by
6 applying the flutes 4, the plank surface is largely
7 replaced with the flutes 4.

8 Q Can I ask you now to look at figure 8?

9 A Okay.

10 Q And what do you see there? Can you
11 describe what's in that figure?

12 A I see a zoomed inverse of the cone portion
13 of the drill.

14 Q Okay. And there's an angle B represented
15 by two dashed lines. Can you describe those two
16 dashed lines?

17 A That would be the what we're calling the
18 cone angle. It's an included angle.

19 Q Can you go down to Paragraph 32?

20 A Okay.

21 Q And just over halfway down, there's a
22 sentence that begins, "Since flutes need to be dug
23 in the flank surface to form the latter like main
24 cutting blades, the area of the flank surface 3

1 will be set slightly larger and an angle B formed
2 by the connecting lines of the top end points of
3 the first cutting blades 5."

4 A And where did you start that reading, what
5 words?

6 Q There's a sentence just over halfway down
7 Paragraph 32 that starts, "Since flutes need."

8 A Okay. Can you please give me a moment to
9 read that? Okay.

10 Q So what do you think is meant by the term
11 connecting lines here in this context?

12 A In this case it's described specifically to
13 be connecting points.

14 Q So the connecting lines here are connecting
15 between points on the different steps on the cone
16 portion; is that right?

17 A In this case they are lines that don't
18 actually exist. They don't exist on the drill.
19 They are drawn to show this angle and described to
20 connect a series of points.

21 Q Okay. But do you agree again in this
22 context that the phrase connecting lines is shown
23 to connect between points?

24 A Yes.

1 Q Okay. So what you said earlier, that
2 connecting lines with regard to the first and
3 second cutting blades meant the edge where
4 different surfaces come together?

5 A Yes.

6 Q But here the term connecting lines is
7 connecting different points on different surfaces?

8 A Yes. It states that explicitly.

9 Q Let's go to Paragraph 35. That first
10 sentence in Paragraph 35 says, "The flutes of the
11 present disclosure may be arc-shaped flutes adapted
12 to a radian of the flanked surface or the
13 connecting lines of the flutes form a spiral
14 structure." Do you see that?

15 A Yes.

16 Q What do you understand the phrase
17 arc-shaped flutes adapted to a radian of the
18 flanked surface means?

19 A The one that we're talking about these
20 flukes 4, not the chip evacuation flute. And this
21 is saying that they are arc shaped, which means
22 they come around the axis, rotate around the axis
23 of the drill, because they can only contact the
24 body. The structure of the drill, the material

1 a straight intermediate, or maybe a perpendicular
2 cutting edge, right?

3 A In Paragraph 42, intermediate major cutting
4 edges, preferably normal, perpendicular to the
5 axis, yes.

6 Q Okay. Have you ever seen a step drill with
7 something that wasn't conical?

8 A No, not that I recall.

9 Q Okay. So if one of ordinary skill was to
10 look at Bannister and say maybe we should change
11 that intermediate cutting edge for something, they
12 could make it conical, because you said there are
13 conical cutting surfaces out there. Are there any
14 other types of cutting surfaces out there that it
15 could be changed to?

16 MR. CUNNINGHAM: Objection.

17 THE WITNESS: Nothing comes to mind to
18 revolve around the axis; it's going to be conical
19 or not.

20 BY MR. McINTYRE:

21 Q Okay. So straight or perpendicular and
22 conical, those are the two options here?

23 A Yes.

24 Q Looking at Paragraph 47, you say that,

1 "Each composite cutting blade group is not
2 configured to crush cutting chips into finer
3 chips." Do you see that?

4 A Yes.

5 Q And this language of crushing cutting
6 chips into finer chips, you understand that to be
7 one of the elements of things 1 and 8 in the 583
8 patent?

9 A Correct.

10 Q What does that mean, crushing and cutting
11 chips into finer chips?

12 A In 583?

13 Q Well, as you used the language here in
14 Paragraph 47.

15 A Okay. To allow chips to break as they are
16 formed and beyond formation, so forming and
17 flowing, they break up into shorter lengths.

18 Q So you say that a chip is first formed, and
19 then it breaks or is fractured. How does it break,
20 or how is it fractured?

21 A Which invention are you talking about
22 here?

23 Q You're telling me what the phrase crush
24 cutting chips into finer chips means.

1 A But you're now getting into how it happens.

2 Q Yes.

3 A The means of accomplishing that are
4 different.

5 Q Well, can you explain how it happens?

6 A In the case of Bannister, those
7 intermediate edges, as I was stating earlier, on
8 any cutting edge the chip curls the head of the
9 tool as it's formed, right? And if it curls back
10 on itself, in this case in a drill, there's
11 something there, the wall of the hole. And if it
12 hits that wall and bends backward, chips will break
13 by bending backward, not forward, because they
14 create these stress concentrations on, call it the
15 error side of the chip.

16 Q Okay.

17 A So that's the mechanism of breaking the
18 chips into shorter pieces in Bannister, as I
19 understand his intent, and that is totally
20 plausible in my understanding of mechanics. That's
21 a different mechanism of crushing chips as
22 accomplished in 583.

23 Q What does the word crush mean?

24 A In this context, I think of it like a

1 blender. In the 583 context, like a blender, you
2 crush ice, it's spinning around and breaking it
3 into smaller pieces.

4 Q So rather than using a mortar pestle to
5 crush something with compressive pressure, you're
6 saying that crush doesn't mean that?

7 MR. CUNNINGHAM: Objection.

8 THE WITNESS: I'd have to look in a
9 dictionary, but I imagine there's different
10 definitions of crush.

11 One could think of crushing a can by
12 compressing it, if that's what you mean.

13 BY MR. MCINTYRE:

14 Q I think we'll probably come back to this at
15 some point. Let's keep going.

16 So did you say that Bannister does not
17 show a composite cutting blade group configured to
18 crush cutting chips into finer chips?

19 A The inner ones are, the intermediate ones
20 are intended to cause chip breaking, if we want to
21 call that crushing. The outer ones are
22 intentionally by their bevel, which then dictates
23 their chip flow in such a way that they would not
24 be breaking.

1 BY MR. MCINTYRE:

2 Q So would you agree that the idea to crush
3 cutting chips into finer chips suggests first you
4 create cutting chips, and then those are broken
5 down into smaller pieces?

6 A Yes.

7 Q Okay.

8 A So this is my position. Again, smaller is
9 vague. A chip size is width, thickness and length.
10 I know from my experience, this is talking about
11 length.

12 The mechanisms of Bannister, actually
13 it's not breaking the chip because they are
14 narrower, it's breaking the chip, crushing the chip
15 into shorter pieces in an intermediate by
16 controlling its direction of flow into an
17 obstruction, versus 583, that patent owner's
18 invention is by making many narrow chips, they
19 become narrow enough that they are broken by this
20 whirling colliding as they make their way up,
21 because they become much more fragile.

22 Q Would you agree that Bannister intermediate
23 cutting blade generates a chip that is narrower
24 than a conventional drill of the same diameter?

1 spinning stuff around.

2 Q Okay. Well, how would one determine where
3 the crushing is going on?

4 A Could you repeat that, please?

5 Q How would one determine where the crushing
6 is occurring?

7 A They are very fragile because they are very
8 narrow. And at what point do they have enough
9 obstruction, enough battering by adjacent chips
10 and/or the hole wall or the drill body, it would be
11 a research project to actually try to understand
12 exactly where it's happening.

13 Q Okay. You say they are very narrow, the
14 cutting blades are very narrow. I'm presuming
15 this is the conical cutting edges you're referring
16 to?

17 A Yes, the conical, the main cutting edges.

18 Q Is there any limitation in the claim of 583
19 patent, claim 1, on the diameter of the drill?

20 A No.

21 Q Is there any limitation in claim 1 on the
22 number of cutting blade groups that the drill has?

23 A Just a plurality.

24 Q A plurality. And what do you understand a

1 plurality to mean?

2 A Two or more.

3 Q Okay. So it could be that this claim
4 covers a drill that has only two composite cutting
5 blade groups?

6 A Yes.

7 Q And there's no size limit on this drill, is
8 there? Diameter I mean, drill diameter?

9 A Not as claimed.

10 Q Okay. So is it possible that you could
11 have a drill that's one inch in diameter and has
12 two cutting blade groups?

13 MR. CUNNINGHAM: Objection, form of the
14 question.

15 THE WITNESS: Certainly manufacturable, if
16 that's what you mean.

17 BY MR. MCINTYRE:

18 Q Would that be covered by this claim?

19 A Yes, I think so. I don't know of anything
20 in there that would preclude.

21 Q Okay.

22 MR. CUNNINGHAM: Objection. Calls for a
23 legal conclusion.

24 THE WITNESS: I would say as I'm now

1 A Oh, I saw this in reviewing this this
2 weekend. Yes. I don't know where it went. I have
3 to read ahead of that.

4 Bannister is looking to reduce all
5 these different performance metrics that are
6 typical for drills; chips clogging, penetration
7 rate. He wants to reduce the minimum, reduce to a
8 minimum the metal to be crushed during the drilling
9 operation. If it's all broken up into little
10 pieces, that can cause problems. If it's all big
11 long pieces, that creates problems. It's a
12 balancing act.

13 Q Let's go on to Paragraph 49. You say,
14 "Claims 1 and 8, by contrast, recite a spiral
15 flute." Is it your position that Bannister does
16 not have a spiral flute?

17 A No. It then goes beyond that.

18 No, I'm not contending that he does not
19 have a spiral flute.

20 Q Okay. In Paragraph 51 you talk about
21 photographs of Matco drills showing, and I'm
22 quoting from the paragraph, "The uninterrupted
23 curvature of the major cutting edges and the minor
24 cutting edges along a spiral line of the flute, due

1 to being, in part, defined by the side wall of the
2 spiral flute where the side wall must also be
3 spiral." Can you explain what you mean by that?

4 A Yes. The inner section of the surfaces
5 that create the two edges. There's a major edge
6 and a minor edge to each of the composite cutting
7 blade groups. Those edges also are, those
8 connecting lines of the blades are an intersection
9 of two surfaces, right? One of those surfaces for
10 both cases is the spiral flute. And only under
11 very special circumstances, certain combinations,
12 do you get an intersection of that helical spiral
13 flute and a point surface, a drill point surface
14 that is straight.

15 Q What are those circumstances?

16 A There is combinations of what's called a
17 point angle, so that's a conventional standard
18 twist drill. It's called the point angle. It's
19 the included angle which is the same as the
20 included angle on these conical surfaces. It's the
21 same concept. There is a single angle, a point
22 angle paired with a particular -- let me state
23 this.

24 For a given helix of the chip

1 evacuation group, there is a particular point angle
2 that will result in the cutting lips being
3 straight. You deviate from that point angle, they
4 will start either curving forward, or curving
5 backward. It's a special case of the general.

6 I'm just stating here that as these
7 drills are manufactured, you end up with curved
8 edges, major and minor, because that special
9 combination is just not there, which is something
10 visibly different than we see in others where they
11 end up straight.

12 Q So are you saying that the major cutting
13 edge and the minor cutting edge have to be curved
14 if the drill is covered by the claim?

15 A No. No, they don't have to be.

16 Q Okay. So they can be straight?

17 A They can be. They can be straight. The
18 major edges can be straight or curved. The minor
19 edges, by consequence, are going to be curved.

20 Q And why is that?

21 A Because if you were to assign a point angle
22 to them, they are zero, the included angle, because
23 they are basically vertical in these images. The
24 conical surfaces have that angle. Like in

1 Bannister, the outer one has that bevel angle, call
2 it a bevel angle?

3 Q Yes. So you're saying that the major
4 cutting edges could be straight?

5 A Yes.

6 Q Okay. Let's go to Paragraph 108. Can you
7 read the title of that paragraph just before
8 Paragraph 108, please?

9 A Yes. "Viking's rounds based on Bannister
10 in view of Zhou and/or Welty and/or Korb are
11 erroneous, (continued)."

12 Q Okay. Thank you.

13 Can you then read out the first
14 sentence of that paragraph? And you can omit the
15 footnote.

16 A Okay. "In my opinion, the POSA would not
17 be motivated to modify Bannister's beveled cutting
18 edge with the angled segment the edges of Zhou or
19 with the angled steps of Welty."

20 Q Thank you.

21 In the title it discusses three
22 different prior art references. It uses secondary
23 references with Bannister, Zhou, Welty and Korb.
24 But this paragraph only addresses Zhou and Welty;

1 But anyway, the gradual step-wise
2 engagement and disengagement factors reduce that
3 shock of something catching, the likelihood of that
4 shock happening.

5 Q Okay. And would the design of the drill
6 also affect the likelihood that the drill might
7 break?

8 A Say that again, please.

9 Q Would the 583 patent drill, would that
10 design possibly reduce the chance that the drill
11 would break during operation?

12 A There's multiple ways a drill can break.
13 Can you be more specific?

14 Q I'm not sure if there are.

15 A Okay.

16 Q I'm just talking in general.

17 A Okay.

18 Q Is this a design of drill that might help
19 reduce breakage?

20 A Yes, in both ways that come to my mind.

21 Q Okay. So in Paragraph 163 you list the
22 advantages that are set forth in the 583 patent,
23 and then in 164 you list another five under the
24 column merits of advantages. I don't think it

1 matters what we label them.

2 And you say, "This configuration leads
3 to, one, a faster penetration rate and thus,
4 reduced time to produce a hole." Does that follow
5 from number 1 in Paragraph 163, that easier
6 drilling allows you to go faster?

7 A Number 1 above?

8 Q Yes.

9 A Oh, okay. I see.

10 I was not suggesting a one-to-one
11 connection to those. And we've been getting into
12 these, right?

13 The earlier ones I would say are
14 putting them in quotes, they are either stated.
15 They are not diving deep into, I'm able to bring a
16 more academic perspective here as an expert.

17 So faster penetration rate and thus
18 reduced times to produce a hole. Your question is
19 does that relate to number 1 above, easier drilling
20 due to the fact that it disperses cutting forces?

21 Q Yes.

22 A It relates to that. It also relates to
23 some degree to the split point nature of it.
24 Anything that reduces the axial resistance.

1 Q Okay. But you said -- okay. So you said
2 it relates to the split point nature of it, but
3 you're saying you get an advantage because you've
4 got the split point tip on the drill?

5 A That is one contributor.

6 Q Okay. Did you do any measurements on any
7 of the drills that were supplied to you?

8 A No, I did not.

9 Q So you haven't tested to see whether the
10 penetration of it is actually faster?

11 A I have not personally, nor am I aware of
12 we'll call it direct knowledge of a measured
13 comparison of say a standard twist drill to this.

14 I had a student, he had an application
15 last spring to have a drill through a plate that
16 was already attached to a prototype steel plate,
17 and I said huh, I've got something; try this. And
18 he came back and said something like wow, that was
19 amazing how fast that went through.

20 Q Okay.

21 A There's other evidence that I've seen in
22 some exhibit somewhere of videos and product
23 reviews that attest to those, but again, I didn't
24 test them myself. As an academic and an engineer,

1 Q It says, "Twist drills and step drills have
2 different purposes and different applications.
3 Specifically, twist drills such as those disclosed
4 by Zhou and Bannister are configured to bore deep
5 into relatively thick work pieces." What do you
6 mean by deep and relatively thick in this context?

7 A Greater than -- typically, greater than one
8 times the diameter. They are capable of drilling
9 deeper than that.

10 The sentence really needs the next
11 sentence to make sense of it.

12 Q We'll get to the next sentence. I'm still
13 trying to figure out what this first sentence
14 means.

15 A Okay. Go ahead.

16 Q So you're saying that the length to
17 diameter ratio is one or greater, typically?

18 A Not necessarily.

19 Q So it could be less than one?

20 A It could be less. I'm talking about of the
21 hole itself, not the drill, of course.

22 Q Yes, yes, we're talking about the hole.

23 A You could use a -- a twist drill will work
24 at a shallower hole, and it will work as a much