

Viking Drill & Tool, Inc. v. Hongjia Wang

IPR2023-00473

IPR2023-00474

Petitioner's
Hearing Demonstratives

CARLSON

CASPERS

Argument Overview

- **IPR2023-00473, Ground 1:** Obviousness Based on Wang (All challenged claims);
- **IPR2023-00474, Ground 1:** Anticipation by Zhou (Claims 1, 2, 5, 8, 13-15 and 19);
- **IPR2023-00474, Ground 2:** Obviousness Based on Zhou in View of Bannister, Gentry or Durfee (All challenged claims)
- **IPR2023-00473, Ground 2:** Obviousness Based on Bannister in view of Zhou or Welty (Claims 1, 2, 5, 7, 8, 12, 14, 15, and 19)
- **IPR2023-00473, Ground 3:** Obviousness Based on Bannister in view of Zhou or Welty, and further in view of Korb (Claims 13, 18, and 22)
- **IPR2023-00474 , Ground 3:** Obviousness Based on Welty in view of Bannister, Durfee, and Korb (Claims 1, 2, 7, 19, and 22)
- **IPR2023-00474, Ground 4:** Obviousness Based on Welty in view of Bannister, Durfee, and Korb, and further in View of Zhou (Claims 5, 8, 12-15, and 18)
- **Secondary Considerations Do Not Refute Obviousness**

IPR2023-00473

**Ground 1: Obviousness Based on Wang
(All challenged claims)**

Ground 1 Summary

- PO does not dispute that if Wang is prior art, it renders all challenged claims obvious (IPR -473 Response at 6-21; IPR -473 Reply at 8)
- Wang is presumptively prior art under § 102(a)(1)
 - '583 Patent Application filed on November 28, 2019 (Ex. 1001)
 - Wang was published more than one year earlier (May 17, 2018) (Ex. 1009)
- The challenged claims are not entitled to filing date of the priority applications (IPR -473 Petition at 25-33; IPR -473 Reply at 1-8)
 - Substantial new matter was added to '583 Patent Application
 - Priority applications do not disclose “spirally formed” composite cutting blade groups

Wang Reference

(19) **United States**

(12) **Patent Application Publication**
Wang

(10) **Pub. No.: US 2018/0133808 A1**

(43) **Pub. Date: May 17, 2018**

(54) **EFFICIENT TWIST DRILL FOR LAYERED DRILLING**

(71) Applicant: **Hongjia Wang**, Shanghai (CN)

(72) Inventor: **Hongjia Wang**, Shanghai (CN)

(21) **Appl. No.: 15/847,900**

(22) Filed: **Dec. 19, 2017**

Related U.S. Application Data

(63) Continuation of application No. PCT/CN2016/073767, filed on Feb. 14, 2016.

Publication Classification

(51) **Int. Cl.**
B23B 51/02 (2006.01)
B23B 31/00 (2006.01)
B23B 51/10 (2006.01)

(52) **U.S. Cl.**
CPC **B23B 51/02** (2013.01); **B23B 2231/0268** (2013.01); **B23B 51/108** (2013.01); **B23B 31/005** (2013.01)

(57) **ABSTRACT**

An efficient twist drill for layered drilling comprises a drill bit body, wherein the drill bit body comprises a shank portion and an operation portion; the shank portion is connected with the operation portion; the operation portion has a cutting portion at a front end thereof; a plurality of flutes distributed in parallel and at intervals are symmetrically arranged along a flank surface of the cutting portion; the flutes divide main cutting blades into a plurality of first cutting blades and second cutting blades; and connecting lines of the first cutting blades and the second cutting blades form a step-like structure. During drilling, a drill bit of the twist drill requires a decreased drilling force, produces less cutting heat, is positioned easily and has improved processing efficiency so that a processed circular hole has high precision and few burrs at an edge where the drill bit exits.



Fig.7

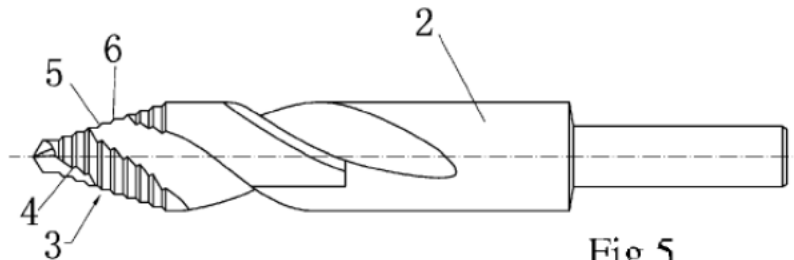


Fig.5

“Formed Spirally” Limitation

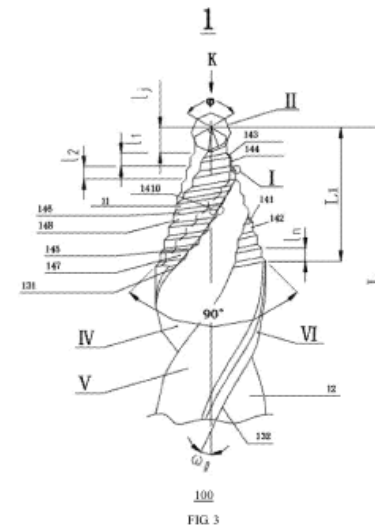
- Independent claims 1 and 8:

“a plurality of composite cutting blade groups **formed sequentially and spirally on a cone portion exterior** from a front end of the cone portion to a rear end of the cone portion...”

“Formed Spirally” Limitation

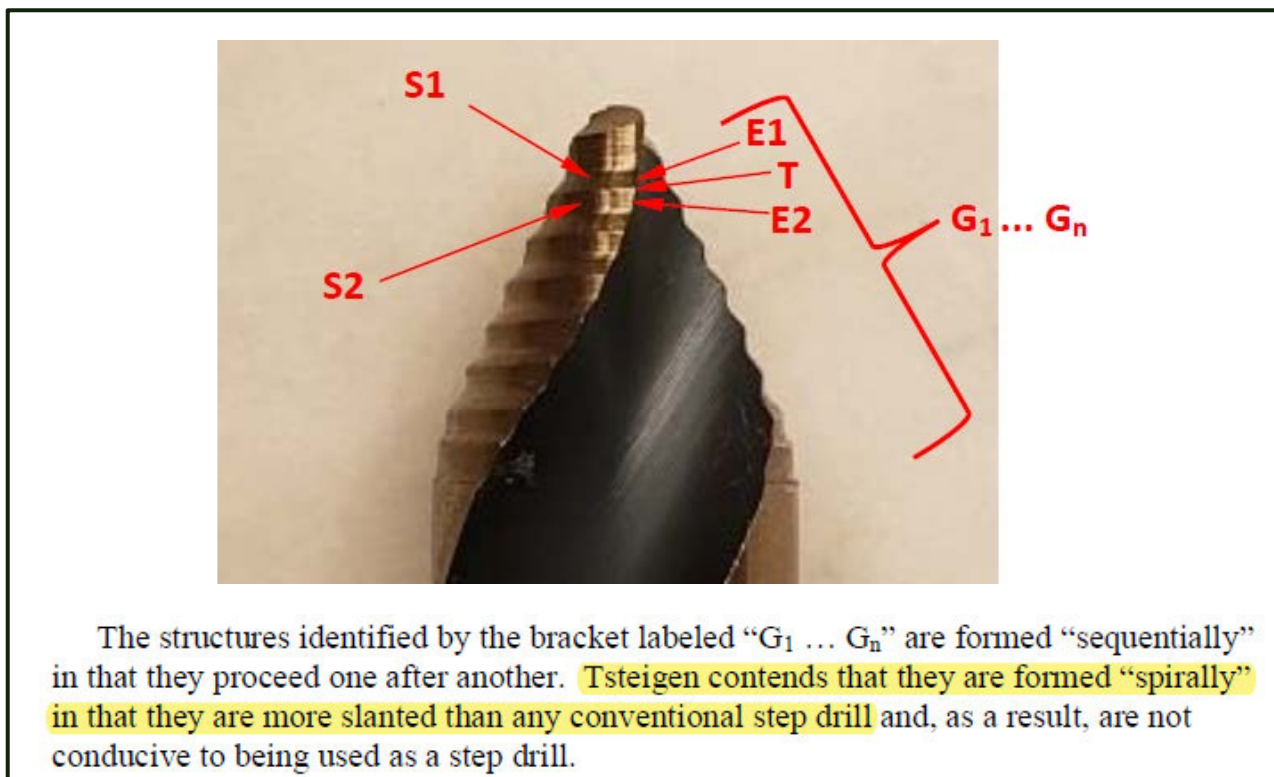
- During *ex parte* reexamination, PO explained that “formed spirally” refers to slanted orientation shown in Figure 3:

That is, according to this language in Claim 1, each conical surface and adjacent cylindrical surface is formed spirally on the exterior of the cone portion of the twist drill. This is shown in Figure 3 of Wang, in which the composite cutting blade groups are comprised of conical first step surfaces 141 and cylindrical second step surfaces 142, which are depicted as spiraling downward from the front end of the cone portion L_1 to the rear end of the cone portion, as recited in Claim 1.



“Formed Spirally” Limitation

- In litigation, PO confirmed that “formed spirally” limitation refers to slanted orientation when viewed from the side:

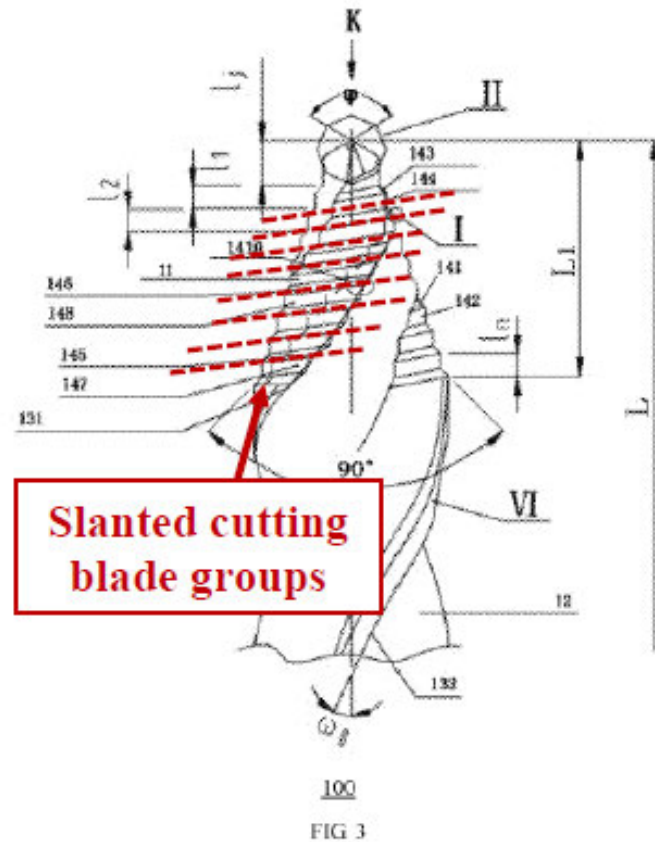


“Formed Spirally” Limitation

- PO agrees with the claim construction proposed by Petitioner for the purpose of these IPRs:

“Viking construes this ‘spirally’ limitation in this context to mean that the cutting blades are not perpendicular to the drill bit’s rotational axis, but rather have a ‘slant’ creating axial relief behind the cutting edges. **Patent Owner agrees with this construction in this context.**”

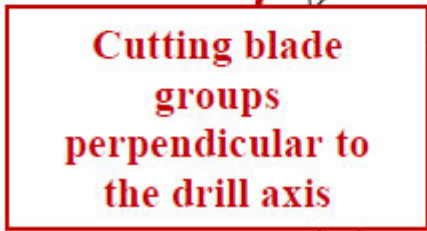
IPR -473 Response at 9.



- 2



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Legal Standard – Written Description

- The knowledge of a POSA cannot make up for the absence of disclosure

“Entitlement to a filing date does not extend to subject matter which is not disclosed, but would be obvious over what is expressly disclosed. It extends only to that which is disclosed. While the meaning of terms, phrases, or diagrams in a disclosure is to be explained or interpreted from the vantage point of one skilled in the art, all the limitations must appear in the specification. The question is not whether a claimed invention is an obvious variant of that which is disclosed in the specification. Rather, a prior application itself must describe an invention, and do so in sufficient detail that one skilled in the art can clearly conclude that the inventor invented the claimed invention as of the filing date sought.”

- *Lockwood v. Am. Airlines, Inc.*, 107 F.3d 1565, 1571-2 (Fed. Cir. 1997).

Legal Standard – Written Description

- Vague and/or ambiguous disclosure is insufficient to provide written description support

“It is insufficient as written description, for purposes of establishing priority of invention, to provide a specification that does not unambiguously describe all limitations of the count.”

- *Hyatt v. Boone*, 146 F.3d 1348, 1354 (Fed. Cir. 1998).

“We have explained that to satisfy the written description requirement, ‘the missing descriptive matter must necessarily be present in the [original] application's specification such that one skilled in the art would recognize such a disclosure.’ This requires that the written description actually or inherently disclose the claim element.”

- *PowerOasis, Inc. v. T-Mobile USA, Inc.*, 522 F.3d 1299, 1306-7 (Fed. Cir. 2008).

Legal Standard – Written Description

- A POSA must understand from the earlier application alone that the inventor possessed the later-claimed subject matter (no hindsight)

“The pertinent question is not whether a person skilled in the art could look at both Figure 3 and Figure 16 and determine that the resistors in the former perform a similar function to the resistors in the latter. Rather, the issue is whether a person skilled in the art would understand from the earlier application alone, without consulting the new matter in the '250 patent, that the inventor had possession of the claimed ‘other circuit’ in 1992 when the '323 application was filed.”

- *Tech. Licensing Corp. v. Videotek, Inc.*, 545 F.3d 1316, 1333-34 (Fed. Cir. 2008).

Priority Applications Do Not Disclose Cutting Blades Groups “Formed Spirally”

- PO relies on ambiguous disclosures in the priority applications

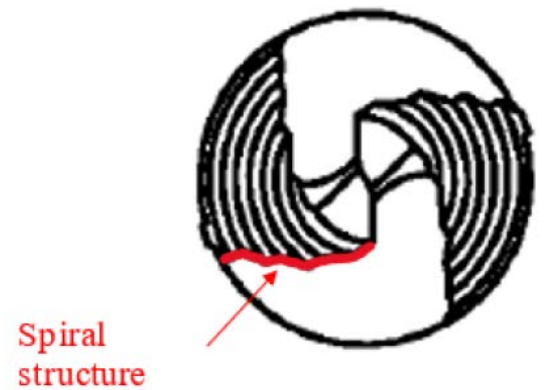
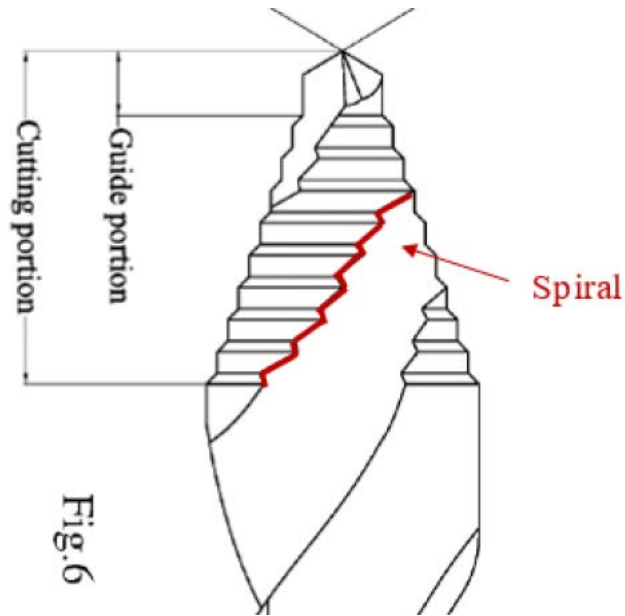
[0010] Preferably, connecting lines of the flutes form a spiral structure.

[0035] The flutes of the present disclosure may be arc-shaped flutes adapted to a radian of the flank surface, or the connecting lines of the flutes form a spiral structure, The

5. The efficient twist drill for layered drilling according to claim 1, wherein connecting lines of the flutes form a spiral structure.

Priority Applications Do Not Disclose Cutting Blades Groups “Formed Spirally”

- One possible meaning of “connecting lines of the flutes form a spiral structure”



This is consistent with the figures of the '900 Application

Priority Applications Do Not Disclose Cutting Blades Groups “Formed Spirally”

- Another possible meaning of “connecting lines of the flutes form a spiral structure”

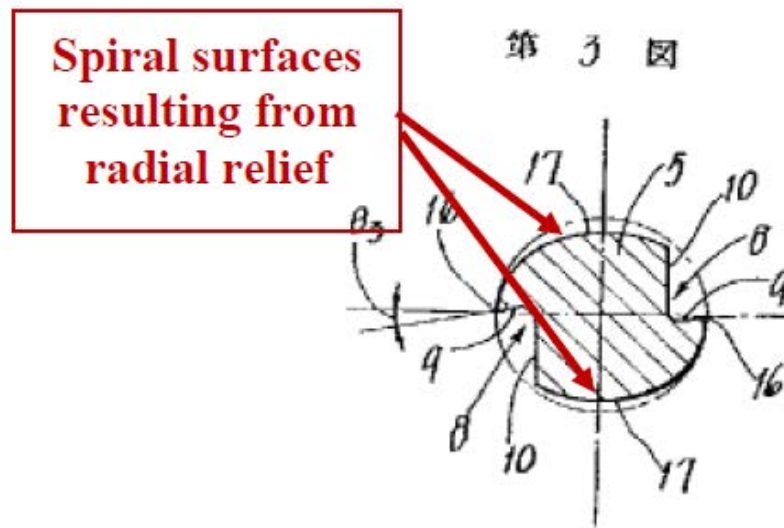


Figure 3 of Shibata

This is how the examiner interpreted the phrase during prosecution of the ‘900 application (Ex-1018, pp. 145, 274).

IPR2023-00474

**Ground 1: Anticipation by Zhou
(Claims 1, 2, 5, 8, 13-15 and 19)**

Zhou Reference

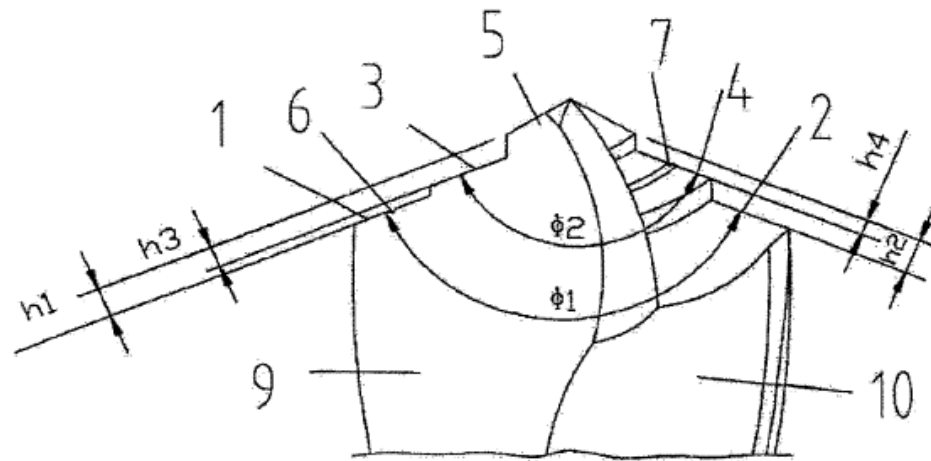


Fig. 1

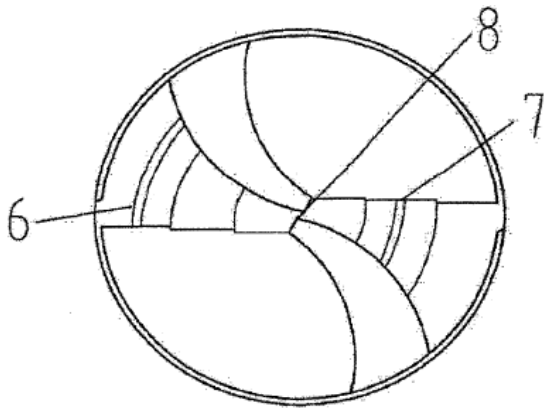


Fig. 2

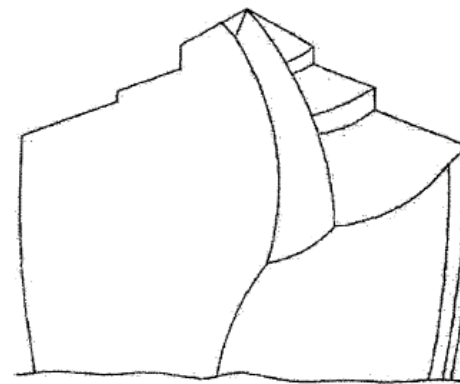


Fig. 3

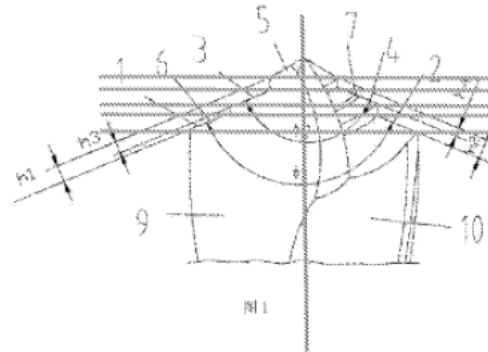
The First Reexamination

- The patentee described Zhou as having steps “oriented perpendicular to the central axis of rotation”

b. The Combined Teachings of Sheldon and Zhou Are Insufficient to Render Obvious Patent Claims 4 and 5

Additionally, Zhou also does not disclose composite cutting blade groups that are formed spirally on the cone exterior. Rather, Zhou teaches forming steps 4 and 7, which, like the steps in Sheldon, are oriented perpendicular to the central axis of rotation of the twist drill. That is, Zhou, like Sheldon, discloses conical surfaces whose inner and outer edges are perpendicular or orthogonal to the center line axis of rotation of the Zhou drill bit as shown in each of the Figures 1-5.

That is, if one takes Zhou's Figure 1, for example, (1) enlarges it, (2) draws a red line down the center axis of the drill bit, and (3) draws green lines to connect any landmark on one side of the red line (such as the shoulder formed by the inner edge of a given conical surface, its outer edge, the top edge of any cylindrical surface, or its bottom edge) to its counterpart on the other side of the red line -- the red line would intersect the green lines perpendicularly, as shown here.



The First Reexamination

- Patentee's description of Zhou was undisputedly wrong.

Twist drill having main cutting edge segments and
asymmetrical edge heights

* * * *

[0024] In Figs. 1 and 2, the drill bit diameter is 30 mm, the length of the segmented outer protruding edge 1 is 5.0 mm, the length of the segmented outer sunken edge 2 is 5.0 mm, the length of the segmented inner sunken edge 3 is 5.0 mm, and the length of the segmented inner protruding edge 4 is 5.0 mm. On the same circumference, the grinding height h_2 of the segmented outer sunken edge 2 is greater than the height h_1 of the segmented outer protruding edge 1, i.e. $h_2 - h_1 = 0.25$ mm. On the same circumference, the grinding height h_3 of the segmented inner sunken edge 3 is greater than the height h_4 of the segmented inner protruding edge 4, i.e. $h_3 - h_4 = 0.25$ mm. The height h_1 of the segmented outer protruding

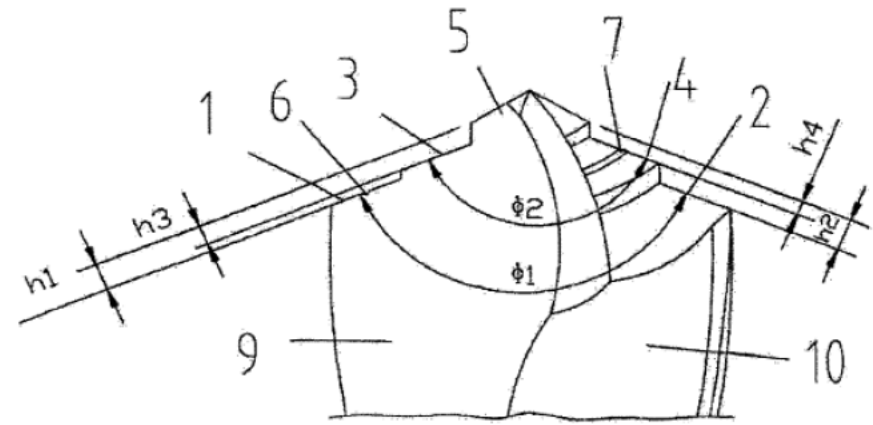


Fig. 1

Zhou Anticipates Claims 1, 2, 5, 8,13-15 and 19

- PO disputes only:
 1. “a major cutting edge defined by the intersection of the conical first step surface and the side wall of the spiral flute”; and
 2. “a minor cutting edge defined by the intersection of the cylindrical second step and the side wall of the spiral flute”.
- Based on the argument that:

“[A] POSA would understand that the major cutting edge and minor cutting edge, which are formed by the intersection with the sidewall of the spiral flute, must necessarily be curved when the claimed limitations are met.”

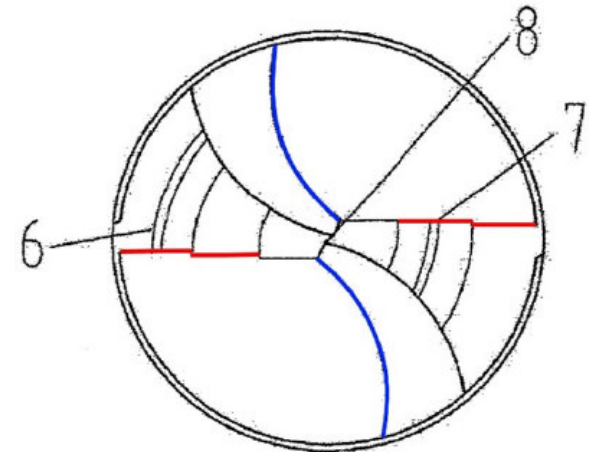


Fig. 2

Zhou Anticipates Claims 1, 2, 5, 8,13-15 and 19

■ PO's argument fails for three reasons:

1. Unsupported by the claim language

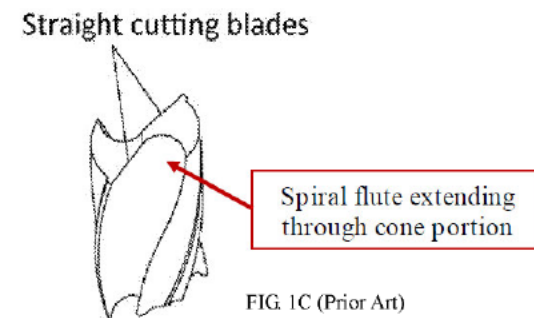
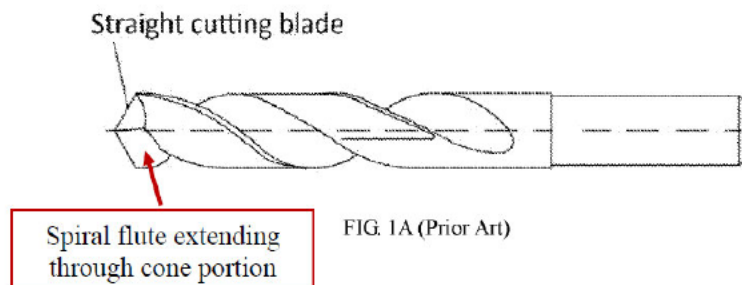
- The claims do not require major and minor cutting edges that are curved.
- No requirement that both side walls of flute spiral all the way to tip.

2. Unsupported by evidence

- The portion of PO's expert declaration on this point was stricken (*see* Paper 43).

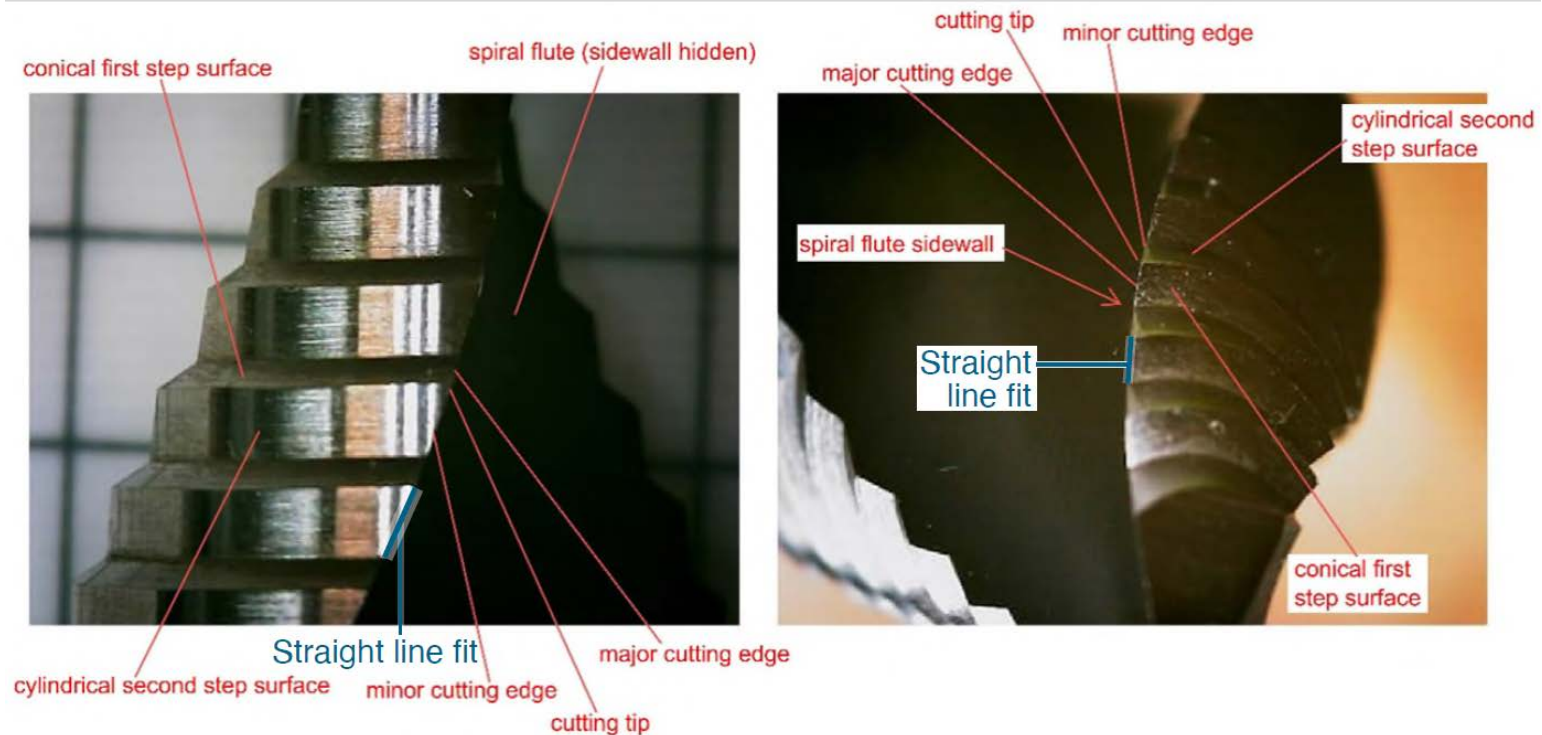
3. Factually incorrect

- Claimed configuration does not necessarily result in curved cutting edges.



PO's Remaining Arguments Are Unpersuasive – Curved Cutting Edges

- PO's evidence of spiral cutting edges is unconvincing



IPR2023-00474

**Ground 2: Obviousness Based on Zhou
in View of Bannister, Gentry or Durfee
(All challenged claims)**

Issues are Substantially Narrowed

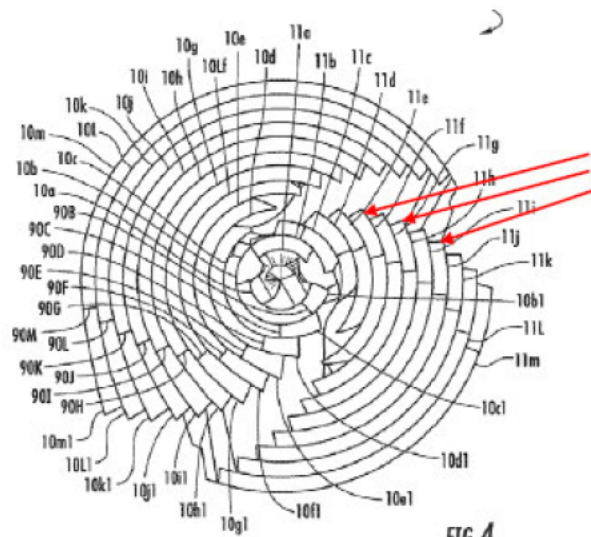
- For the independent claims, PO does not dispute that the claim limitations addressed by Petitioner in Ground 2 are literally met. (IPR -474 Reply at 8)
 - “spiral flute”
 - composite cutting blade groups “formed sequentially and spirally”
- For dependent claims 7 and 12, PO does not specifically address the claim limitations. (IPR -474 Reply at 8)
- PO’s only argument for independent claims 1 and 8 raises the same issue as that addressed by Petitioner with dependent claims 18 and 22. (IPR -474 Reply at 5-6)

18. The twist drill of claim 8 wherein the cutting tips of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion.

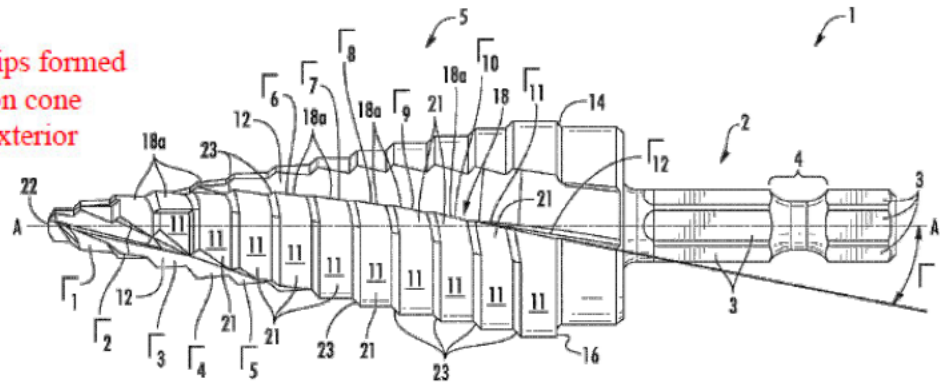
22. The twist drill of claim 1 wherein the cutting tips of the plurality of composite cutting blade groups are formed spirally on a cone portion exterior from a front end of the cone portion to a rear end of the cone portion.

IPR -474 Petition at 52-68; IPR -474 Response at 14-24; IPR -474 Reply at 5-8.

Cutting Edges Along a Spiral Flute are Known



Cutting tips formed
spirally on cone
portion exterior



Motivation to Combine

202. Cutting tips that are formed spirally are the natural result of having a flute on a cone portion of a stepped drill when the flute is cut at any angle other than parallel to the axis of a drill (i.e., perfectly vertical). This is a consequence of having the cutting tips be formed where the steps meet the side wall of the flute. As an example, having the cutting tips formed spirally on the cone portion is an inherent result of maintaining the spiral shape of the flute side walls all the way to the tip of the drill. A POSA would have known that maintaining the spiral shape of the flute side walls was desirable since it helps to lift chips, or swarf, away from the cutting surface and evacuate it from the hole being cut. Thus, a POSA would have been motivated to modify Zhou's flute to have the side walls maintain their spiral shape (resulting in the cutting tips also formed spirally) in order to obtain the known benefits of spiral flute side walls on a drill. A POSA would have had a reasonable expectation of success in doing so.

Schmid Declaration (Ex. 1004)

Motivation to Combine

15. Modifying Zhou to have a spiral flute sidewall along the cone portion, rather than having a straight cut along the leading edge, is a very minor modification to Zhou. Doing so would be a matter of routine engineering design choice. As I have previously explained, modifying Zhou to have a spiral flute sidewall along the cone portion leading edge would lead to improved swarf evacuation, Ex-1004, ¶¶201-202, which can result in reduced likelihood of tool fracture and improved workpiece finish. It would also eliminate a manufacturing step by allowing the flute to be ground in a single operation rather than two (i.e., one grind to form the spiral flute and a second to grind back the leading edge of the cone portion to be straight).

Supplemental Schmid Declaration (Ex. 1044)

Motivation to Combine

18. Modifying Zhou to have a flute with sidewalls that spiral up the entirety of the cone portion, rather than having a straight cut along the leading edge, would not fundamentally change Zhou's principle of operation. As described above, it would improve upon Zhou's design. It would not "destroy" Zhou's drills by creating "an extreme curve," as alleged by Patent Owner. Response at 12, 20. A POSA would recognize that numerous factors, including the height of the cone portion (in other words, the point angle of the cone portion) and the helix angle of the flute, would affect the "sharpness" of the last step. Simply making the leading edge of the cone portion have a spiral sidewall rather than a straight sidewall alone would not determine whether such a sharp edge would be created, as asserted by Patent Owner. The prior art has many examples of cone portions having a spiral flute with sidewalls that spiral up the cone portion. For example, Durfee shows this feature without any excessive sharpness at the last step:

Supplemental Schmid Declaration (Ex. 1044)

Motivation to Combine

17. This would not be a major redesign of Zhou, but would in fact simplify Zhou and give it advantages. It would make no sense that a POSA would not seek to improve upon Zhou's teachings just because Zhou already improves upon standard twist drills. Drills are competitive and commoditized products where innovators are always looking for improvements that can give even marginal advantages over the competition.

Supplemental Schmid Declaration (Ex. 1044)

IPR2023-00473

**Ground 2: Obviousness Based on Bannister in
view of Zhou or Welty
(Claims 1, 2, 5, 7, 8, 12, 14, 15, and 19)**

Ground 2 Summary

- Bannister teaches a twist drill having a stepped front cone section (Ex. 1006, FIGs. 1 and 2; IPR -473 Petition at 37)
- It would have been obvious to modify Bannister to use conical first step surfaces (IPR -473 Petition at 68-69; IPR -473 Reply at 8-10)
 - Conical first step surfaces were well known (IPR -473 Petition at 68-69; IPR -473 Reply at 8-9)
 - Only two options for first step surfaces: perpendicular and conical (IPR -473 Reply at 9)
- The other limitations disputed by PO are taught by Bannister
 - Cutting blade groups “configured to crush cutting chips into finer chips” (IPR -473 Petition at 76-7; IPR -473 Reply at 10-11)
 - There is no requirement that the cutting edges be curved (IPR -473 Reply at 11-14)

Bannister Reference

Patented Mar. 12, 1940

2,193,186

UNITED STATES PATENT OFFICE

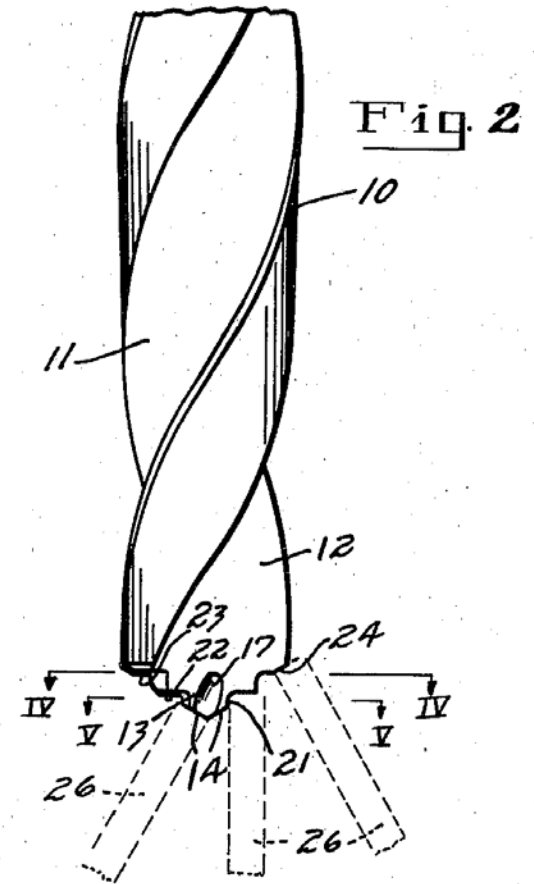
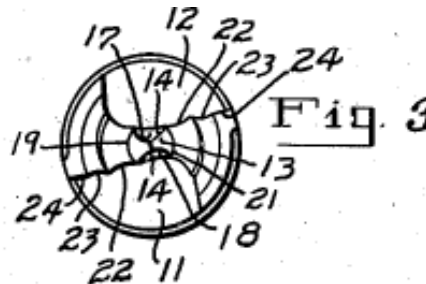
2,193,186

TWIST DRILL

Walter F. Bannister, Birmingham, Ala., assignor
of forty-nine per cent to Herbert G. Hard, Bir-
mingham, Ala.

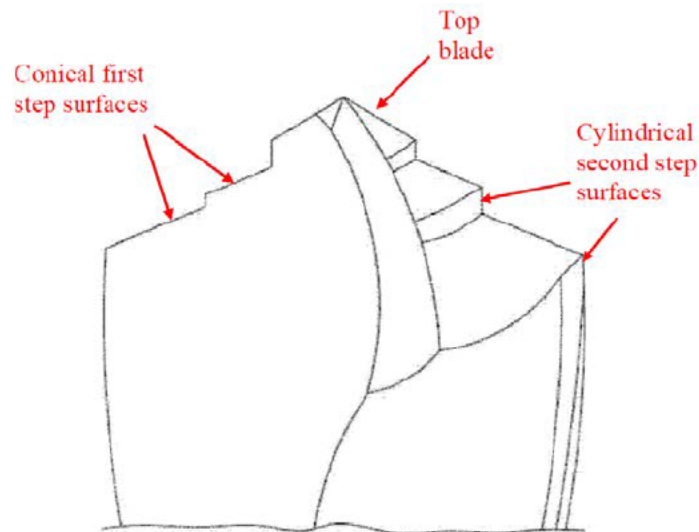
Application June 6, 1938, Serial No. 212,032

5 Claims. (Cl. 77-70)

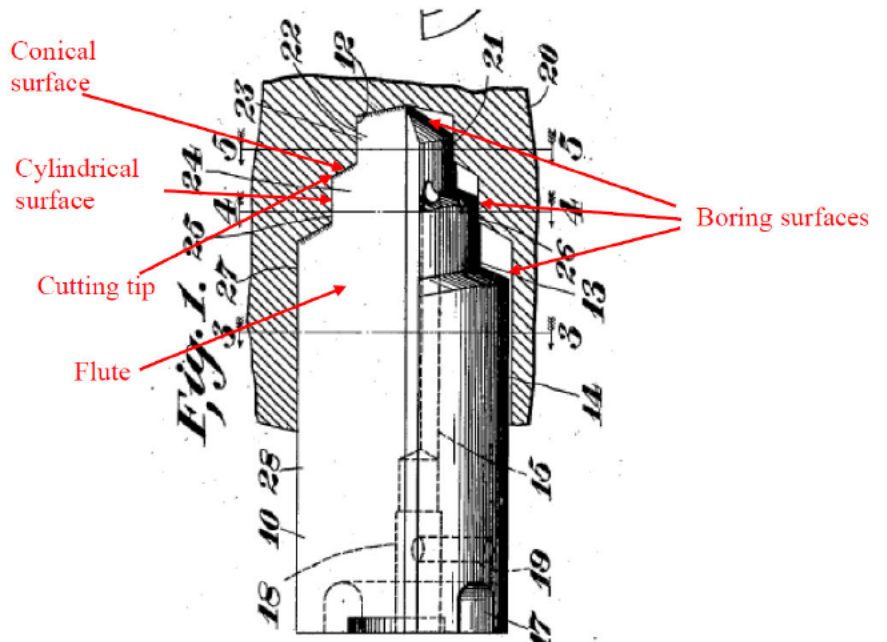


Conical First Step Surfaces Were Well-Known

Examples shown by Zhou and Welty (IPR -473 Petition at 39-40)



Ex. 1007, FIG. 3.



Ex. 1008, FIG. 1.

Motivation to Combine

A POSA would know that conical first step surfaces such as those shown in Zhou and Welty have advantages such as reduced drilling axial resistance and torque (because the major cutting edge more gradually engages the workpiece) and more accurate and round drilling holes. Also, a POSA would understand that a cutting edge wears more slowly when the cutting force is applied over a longer distance to cut the same amount of material, i.e. when the cutting edge is angled relative to the drill axis, rather than orthogonal to the drill axis. Furthermore, cylindrical conical surfaces aid in centering the drill and reducing torque because only the top-most portion of the cylindrical surface cuts into the workpiece when initially plunged into the workpiece, whereas the entirety of a horizontal cutting surface cuts into the workpiece when initially entering the workpiece. Additionally, a POSA would

Schmid Declaration (Ex. 1004)

Finite Number of Known Alternatives

Bannister in this way is not inconsistent with its disclosure. Furthermore, it would have been obvious to a POSA to modify the shape of the cutting edges to find an optimal configuration. I am informed that a solution is obvious if a POSA can choose from a finite number of identified, predictable solutions with a reasonable expectation of success. Only two different configurations for the major cutting edges are possible: perpendicular to the axis and non-perpendicular to the axis, i.e. conical. A POSA would understand from either Zhou or Welty, or from background knowledge, that it would be reasonable to expect success from the introduction of conical cutting blades. Modifying Bannister according to the teachings of Zhou or Welty would result in the drill of claims 1 or 8. Ex-1004, ¶¶189-244.

Supplemental Schmid Declaration (Ex. 1044)

PO's Teaching Away Argument is Not Persuasive

- Bannister merely states that major cutting surfaces are “preferably” normal to the drill axis:

weaken the drill. The cutting edges for the intermediate drill units are preferably substantially normal to the axis of the drill and accordingly
10 will produce short chips. The first, or small drill unit and the outer or largest drill unit are preferably ground to a bevelled or conical cutting edge whereby, when drilling soft metals, such as soft steel, copper and the like, long spiral chips
15 are produced. These long spiral chips thus formed take with them the short chips formed by the cutting edges which are substantially normal to the axis of the drill and thus rid the hole of the short chips which might otherwise clog it.

Bannister (Ex. 1006), p. 2, col. 1

PO's Teaching Away Argument is Not Persuasive

- A POSA in 2019 would be skeptical of Bannister's description of chip formation and chip transport

20. Furthermore, A POSA would understand that Bannister likely does not represent the chip formation mechanics of its drill accurately. Bannister was published in 1940, which is before the research of Eugene Merchant that transformed the understanding of cutting mechanics and chip formation. Ex-1050, 24. Bannister's description reflects an outdated and oversimplified understanding of chip formation. Bannister speaks in generalities about how it forms chips that are unlikely to be true in all circumstances in which Bannister's drill might be used (e.g., different cutting tool materials, workpiece materials, geometries such as rake angle and relief angles, feed rates, etc.). *See, e.g.*, Ex-1050, 14. Thus, a POSA would understand that cutting blades that are angled relative to a drill's axis and those that are normal to it can each create continuous or discontinuous chips based on these factors.

21. A POSA would also understand that Bannister's description of creating long, continuous chips that carry out short, discontinuous chips, Ex-1006 at 2, col 1:10-19, is likely not an accurate description of what would actually occur with Bannister's drill. It is unlikely that continuous chips would be able to impart a significant amount of force on and "engage" with smaller chips in such a way that they would be more easily evacuated from the flutes. A POSA would understand that the mechanical Archimedean screw action of the flutes would provide the majority of the force to remove chips. A POSA would also recognize that drilling in such a way that avoids continuous chips is often preferred because discontinuous chips interfere less with drilling and pose a smaller safety hazard to a user than continuous chips. Bannister's drill could thus be configured for

Supplemental Schmid Declaration (Ex. 1044)

PO's Redundancy Argument is Unpersuasive

- The fact that Bannister, Zhou and Welty discuss the same advantages supports, rather than detracts from, motivation to combine

“Plaintiffs argue that the ’046 patent and the ’612 patent both address internal crosstalk and, therefore, a [POSA] would have no reason to combine them because they would be cumulative.

* * * *

If anything, plaintiffs’ expert’s opinion that the technologies are interrelated provides a motivation to combine them to solve a known problem in the art. *In re Johnston*, 435 F.3d 1381, 1385 (Fed. Cir. 2006) (finding that many factors are relevant to the motivation to combine aspect of the obviousness inquiry, including the extent to which the references are in the same or related fields of technology).”

Belden Techs, Inc. v. Superior Essex Communs. LP,
802 F. Supp.2d 555, 572 (D. Del. 2011)

- References can always be further improved – particularly 75-year-old ones!

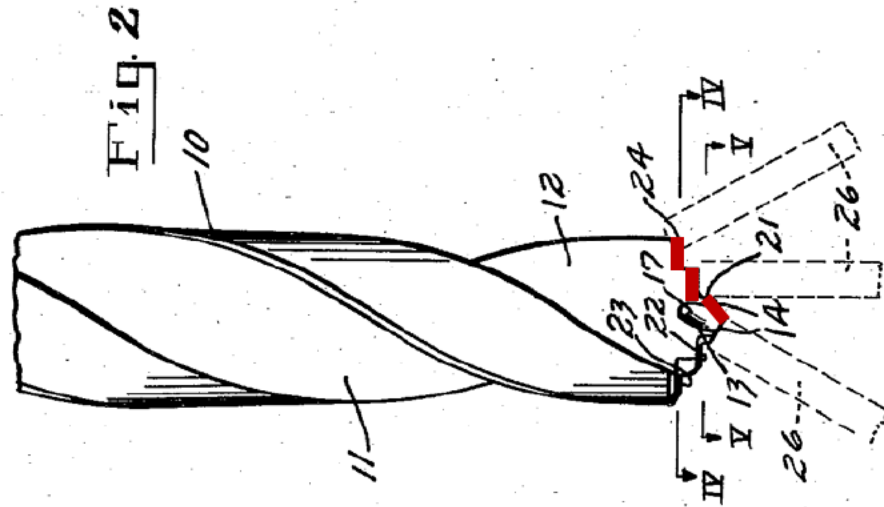
PO's Remaining Arguments Are Unpersuasive – “Configured to Crush”

- PO's argument is contrary to its construction in the district court:

Claim Term or Phrase	Asserted Patent and Asserted Claims	Tsteigen's Proposed Construction
“each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips”	'583 patent – asserted claims 1, 7-8, 12-15, 18-19, and 22.	“each composite cutting blade group is small, relative to the single major cutting edge that the cone portion would have if there were no composite cutting blade groups on the cone portion of the twist drill”

PO's Remaining Arguments Are Unpersuasive – “Configured to Crush”

- Bannister undisputedly creates cutting chips smaller than they would be without stepped tip (Ex.1004 ¶ 100; Ex. 1044 ¶¶ 22-24)



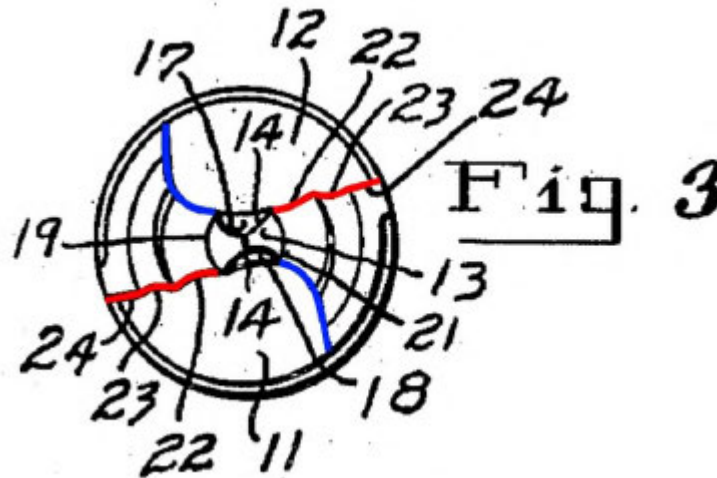
Ex. 1006 (marked up)

- Bannister's reference to reduced “crushing” refers to removal of less material by central tip due to reduced diameter (Ex.1044, ¶ 23)

PO's Remaining Arguments Are Unpersuasive – Curved Cutting Edges

- PO again argues that the independent claims require curved cutting edges:

“[Although the major cutting edge and the minor cutting edge being curved rather than straight is not explicitly recited in the claims, the curved major and minor cutting edges are necessarily present when the claim limitations are met.]”



PO's Remaining Arguments Are Unpersuasive – Curved Cutting Edges

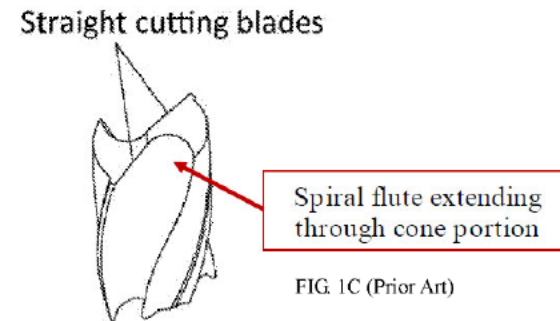
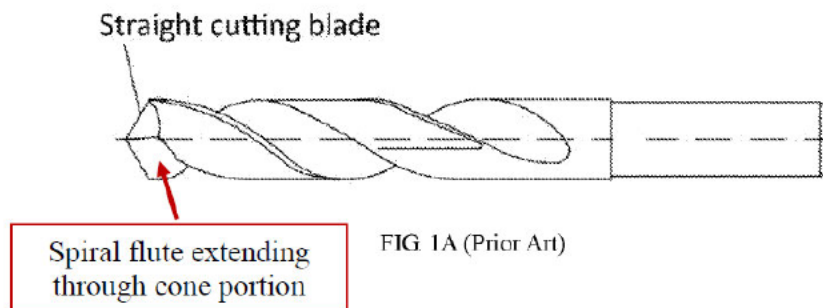
- PO's argument fails for three reasons:

- Unsupported by the claim language

- The claims do not require major and minor cutting edges that are curved.
- No requirement that both side walls of flute spiral all the way to tip.

- Factually incorrect

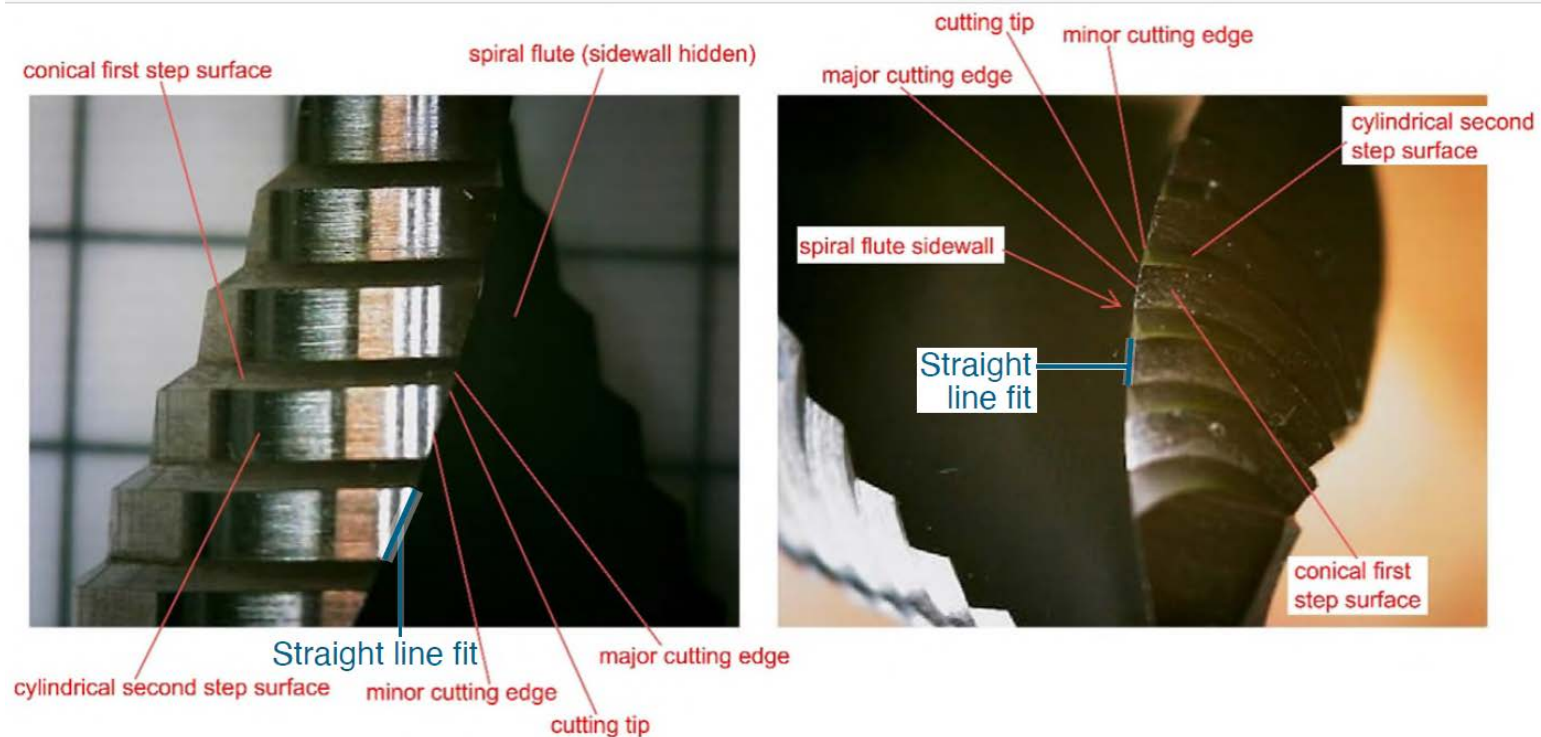
- Claimed configuration does not necessarily result in curved cutting edges.



- Regardless, obvious for the same reason as claims 18 and 22.

PO's Remaining Arguments Are Unpersuasive – Curved Cutting Edges

- PO's evidence of spiral cutting edges is unconvincing



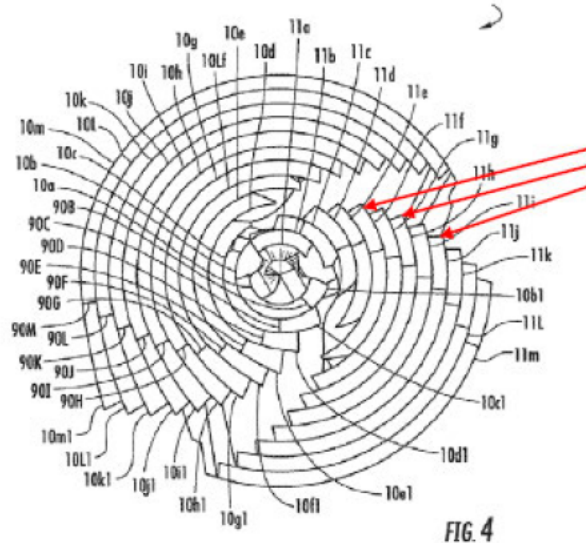
IPR2023-00473

**Ground 3: Obviousness Based on Bannister in view
of Zhou or Welty, and further in view of Korb
(Claims 13, 18, and 22)**

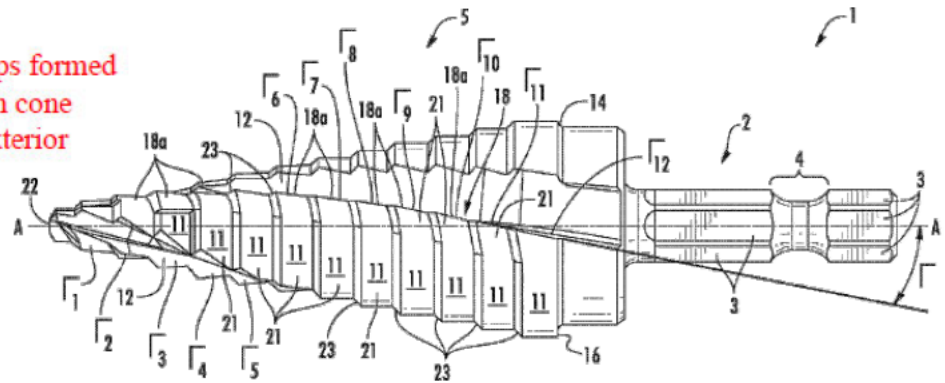
Ground 3 Summary

- PO does not dispute obviousness of dependent claim 13 (minor cutting edge of top blade longer than minor cutting edges of the composite cutting blade groups).
- Regarding claims 18 and 22, it would have been obvious to form cutting edges along spiral flute side wall as shown in Korb and other prior art.

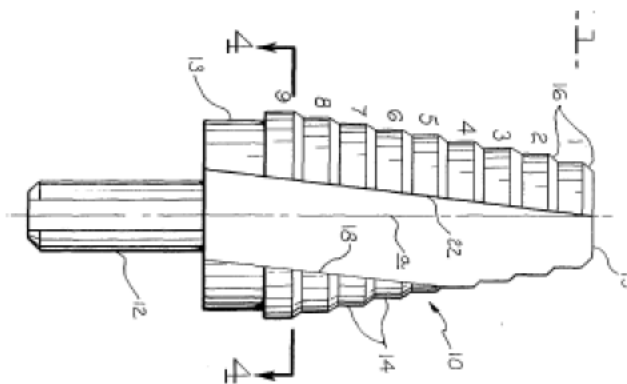
Cutting Edges Along a Spiral Flute are Known



Cutting tips formed
spirally on cone
portion exterior



Durfee (Ex. 1011)



Motivation to Combine

253. Cutting tips that are formed spirally are the natural result of having a flute on a cone portion of a stepped drill when the flute is cut at any angle other than parallel to the axis of a drill (i.e., perfectly vertical). This is a consequence of having the cutting tips be formed where the steps meet the side wall of the flute. As an example, having the cutting tips formed spirally on the cone portion is an inherent result of maintaining the spiral shape of the flute side walls all the way to the tip of the drill. A POSA would have known that maintaining the spiral shape of the flute side walls was desirable since it helps to lift chips, or swarf, away from the cutting surface and evacuate it from the hole being cut. Thus, a POSA would have been motivated to modify Bannister's flute to have the side walls maintain their spiral shape (resulting in the cutting tips also formed spirally) in order to obtain the known benefits of spiral flute side walls on a drill. Moreover, a POSA would have had a reasonable expectation of success in doing so, since the

Schmid Declaration (Ex. 1004)

Motivation to Combine

41. Modifying Bannister to have a spiral flute sidewall along the cone portion, rather than having a straight cut along the leading edge, is a very minor modification to Bannister. Doing so would be a matter of routine engineering design choice. As I have previously explained, modifying Bannister to have a spiral flute sidewall along the cone portion leading edge would lead to improved swarf evacuation, Ex-1004, ¶¶249-55, which can result in less likelihood of tool fracture and improved workpiece finish. It would also eliminate a manufacturing step by allowing the flute to be ground in a single operation rather than two (i.e., one grind to form the spiral flute and a second to grind back the leading edge of the cone portion to be straight). This would not be a major redesign of Bannister, but would in fact simplify Bannister and give it advantages. It would make no sense

Supplemental Schmid Declaration (Ex. 1044)

Known Interchangeability

The drill bit 10 is machined to provide two flutes 18 each of which removes a sector of about 50 degrees of the periphery of the drill, thus leaving an unfluted arcuate portion of about 260 degrees or 130 degrees following each cutting edge. The flutes may be cut helically about the drill or longitudinally at a fixed angle to the drill axis from about 0 to 15 degrees with the preferred angle being 7 degrees. The flutes define cutting edges 20 and 22, which as shown in FIG. 2, are adapted to drill holes of selected diameter in a clockwise rotating drill, as viewed from the shank end of the drill bit.

Korb (Ex. 1012), Col. 2, lines 37-47

PO's Arguments Against Korb are Unconvincing

- PO argues that at least 4 or 5 cutting tips are required to form a spiral
 - BUT the claims require only two cutting tips (Ex. 1046 at 79:21-80:6)
 - AND Bannister teaches that more steps may be used if desired (Ex. 1006, p. 2, 2:70-p. 3, 1:2)
- PO argues that a POSA would not look at step drill art
 - BUT the Patent Office has rejected this argument every time PO has made it. (Ex. 1002 at 200-14; Ex. 1003 at 498, 515)
 - AND step drills are not limited to drilling workpieces thinner than the drill step height (Ex. 1044 ¶¶ 37-38)
 - AND a POSA would use any feature compatible with a twist drill (Ex. 1044 ¶¶ 37-38, 40)

IPR2023-00474

**Ground 3: Obviousness Based on Welty in view of
Bannister, Durfee, and Korb
(Claims 1, 2, 7, 19, and 22)**

Welty Reference

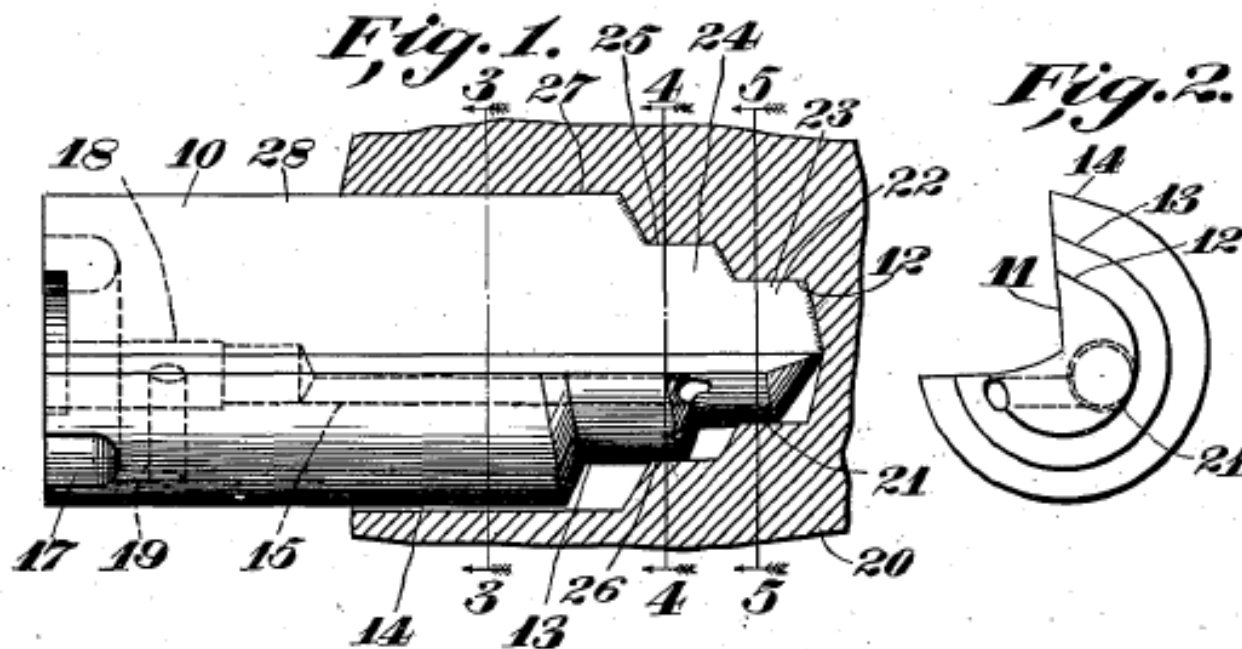
March 17, 1942.

E. P. WELTY

2,276,532

DRILL

Filed May 29, 1940



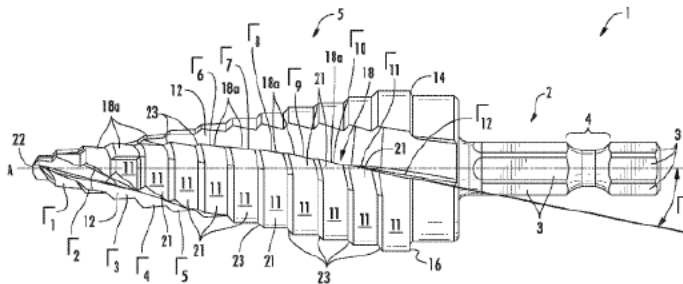
Ground 3 Summary

- Welty teaches all elements of claim 1 except for spiral flute (IPR - 474 Petition at 68)
 - Bannister, Durfee, and Korb teach spiral flutes (IPR -474 Petition at 70-71)
- Welty has cylindrical step surfaces (IPR -474 Petition at 74)
 - PO's position is inconsistent with its infringement position in litigation (IPR -474 Reply at 13-14)
- Welty meets the “configured to crush” limitation (IPR -474 Petition at 77-78)
 - Patent Owner's position is inconsistent with its construction in litigation (IPR -474 Reply at 11-12)
- Durfee and Korb teach cutting tips formed spirally (claim 22) (IPR - 474 Petition at 81-82)

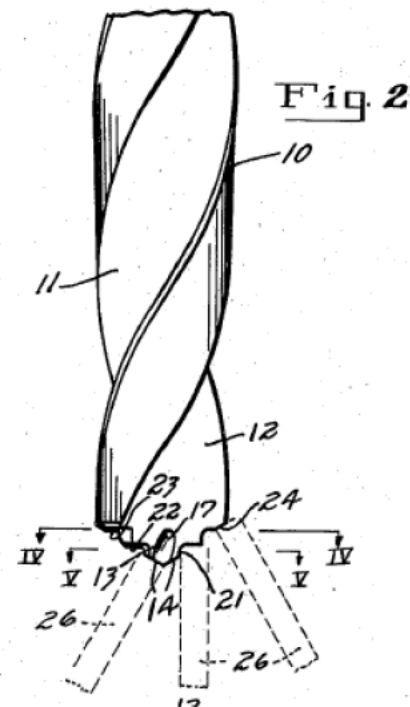
Spiral Flutes

203. Welty discloses all of the limitations of claims 1, 2, 7, 19 and 22, except that Welty's drill uses a straight flute for shunting and removing chips instead of a spiral flute. However, it would have been obvious to a POSA to modify Welty's drill profile to have a spiral flute. Spiral flutes are ubiquitous in the art. For example, Bannister, Durfee, and Korb all describe drills having spiral flutes. As demonstrated in these and other references, spiral flutes are known to have many advantages that make them a desirable feature to have on a twist drill.

Schmid Declaration (Ex. 1004)



Ex. 1011 at 1.



Ex. 1006 at 1.

Spiral Flutes Further Objectives of Welty

- Spiral flutes would not “render Welty’s drill inoperable for its intended purpose and destroy its basic objective” (IPR -474 Response at 44; IPR -474 Reply at 9-11)

One of the objects of my invention is to provide a drill for boring accurate diameters of great depth.

Another object of my invention is to provide a drill which requires a much smaller amount of power for its operation in comparison with drills of the prior art.

Another object of my invention is to provide a drill which is constructed to obviate binding during the drilling operation thus eliminating breakage of the drill in the job.

A further object of my invention is to provide a drill having three boring portions, the first of which can be reground several times thus greatly prolonging the life of the drill.

A still further object of my invention is to provide a drill having a plurality of boring portions which successively increase in diameter from the initial cutting step so that the work may be easily drilled.

Spiral Flutes – Motivation to Combine

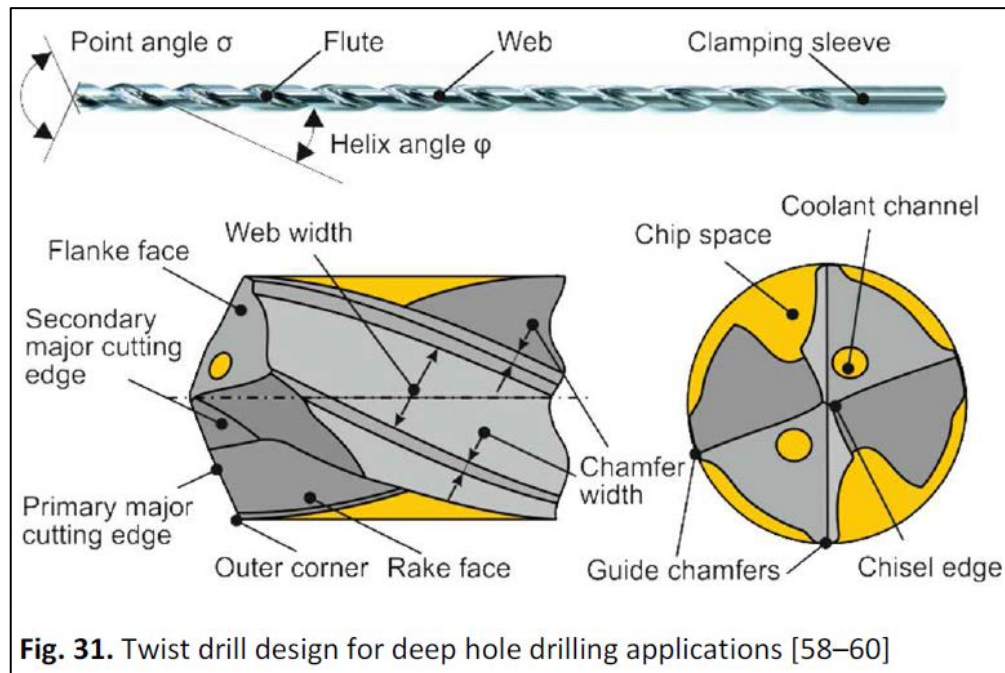
2; Ex-1012, Figures 1, 2 and 7, 1:33-35, and 2:37-44. Spiral flutes are known to be a superior geometry for evacuating chips. It was also known that drills having stepped front portions could have a straight flute or a spiral flute. *See e.g., id.*; Ex-1006, Figure 2. Replacing Welty's straight flute with a spiral flute would not diminish Welty's drill. Indeed, Korb teaches equivalency between a flute cut helically, and a flute cut at about zero degrees to the drill axis. Ex-1012, 2:41-44. Spiral flutes are much more common than straight flutes in a twist drill and, compared to a straight flute, have the benefit of more efficiently removing swarf from the hole being cut. Specifically, spiral flutes generally remove chips faster than other flute geometries. The spiral geometry also inherently drives chips away from the workpiece more effectively than straight flutes because an axial component of the normal force directing chips is greater than that with straight flutes. Also, cutting in a twist drill happens at the junction of the flute and the land, and by forming the flute spirally, the cutting force is advantageously spread around the circumference of the drill. Finally, spiral flutes are simple to manufacture as they can be formed by a single grinding cut. A POSA would have

Schmid Declaration (Ex. 1004)

Ex. 1004 ¶ 213; IPR -474 Petition at 70-71.

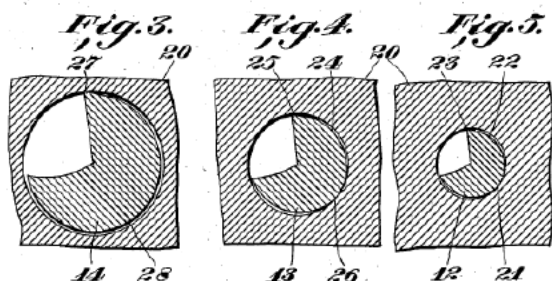
Spiral Flutes for Deep Holes

- Spiral flutes advantageous for holes on the order of 30:1 or 40:1 l/d and higher (IPR -474 Reply at 9-11; Ex. 1004 ¶ 24)
 - Superior chip evacuation (IPR -474 Reply at 9-11; Ex. 2101 at 13-14; Ex. 1044 ¶ 24)
 - Lower required coolant flow (IPR -474 Reply at 9-11; Ex. 2101 at 13-14; Ex. 1044 ¶ 24)
 - Higher feed rate (IPR -474 Reply at 9-11; Ex. 2101 at 13-14; Ex. 1050 at 4)
 - Lower radial force (IPR -474 Reply at 9-11; Ex. 2101 at 13-14; Ex. 1050 at 4)



Spiral Flutes and Heels

- Heels (21, 26) are unnecessary with two flutes and pairs of cutting edges (IPR -474 Reply at 11; Ex. 1044 ¶ 25)



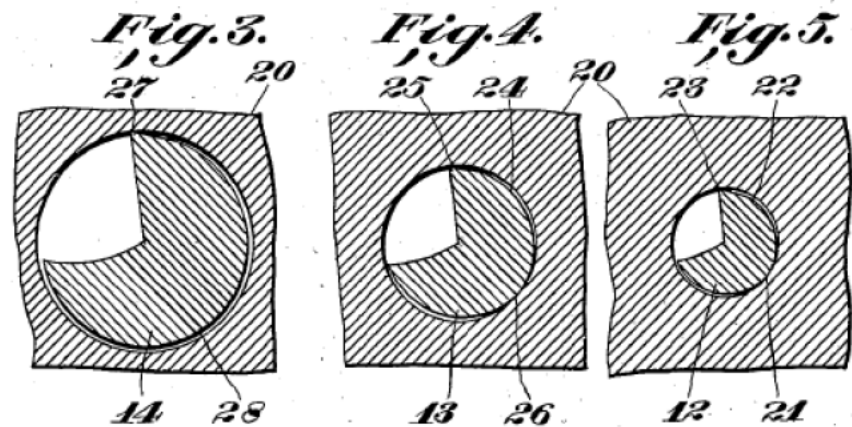
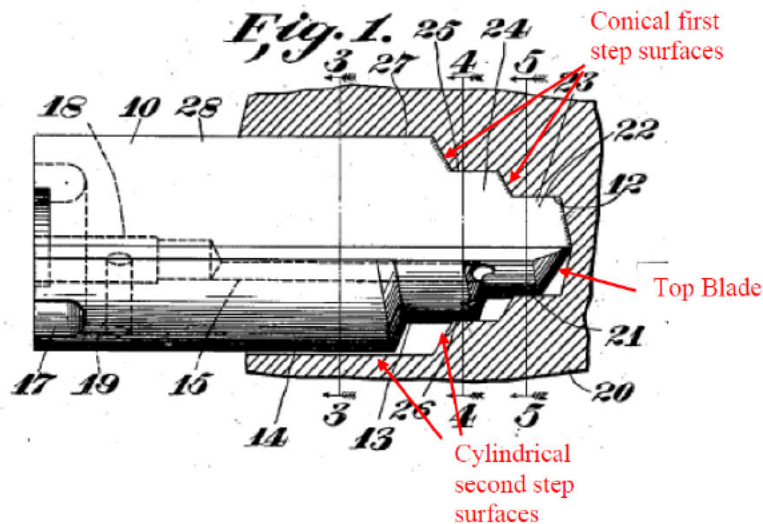
Ex-1008

for heels, modifying Welty to have two spiral flutes could also obviate the need for heels altogether while eliminating binding. In this case, as with the Vortex-Point drills that Patent Owner has accused of infringing the claims of the '583 patent, each cutting edge has a corresponding cutting edge at the same axial position and offset 180 degrees azimuthally, the opposing cutting edges provide bearing surfaces that balance each other. The flank surface behind each cutting edge also allows for radial relief, which reduces binding. Simply put, Welty's objectives can be met with or without heels; they are example features used in just one embodiment to prevent binding. Heels are not a "focus" of Welty. Modifying

Supplemental Schmid Declaration (Ex. 1044)

Cylindrical Second Step Surfaces

- Welty has cylindrical second step surfaces (IPR -474 Petition at 74; Ex. 1004 ¶¶ 220-21; IPR -474 Reply at 13-14)



IPR -474 Petition at 74; Ex. 1008.

Cylindrical Second Step Surfaces

A surface on which the back portion **146** of the major cutting edge is located can be approximately regarded as a conical surface, so the back portion **146** can be considered as a conical major cutting edge back. The back portion **148** of the minor cutting edge can be approximately regarded as a cylindrical minor cutting edge back. Although the axial minor cutting edge inclination angle is not 0° because the minor cutting edge has a certain chamfer, a surface on which the back portion **148** of the minor cutting edge is located can be approximately regarded as a cylindrical surface.

Cylindrical Second Step Surfaces

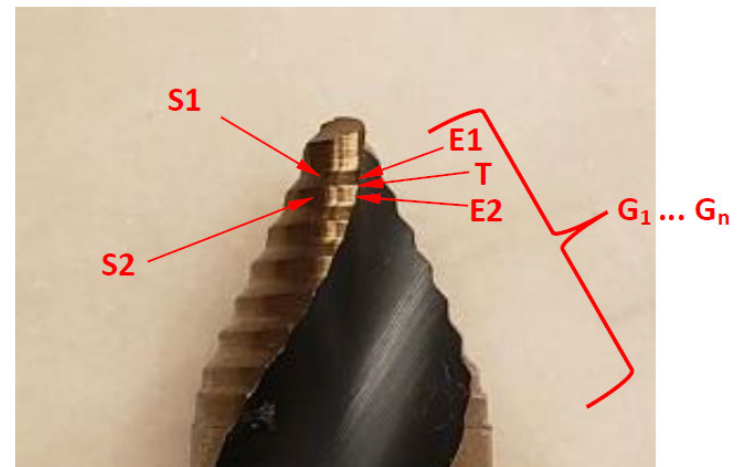
- Patent Owner's argument is inconsistent with its infringement allegations (IPR -474 Reply at 13-14)
 - Viking Vortex-Point drills uses diametral and radial relief (Ex. 1045 ¶ 27; IPR -474 Reply at 13-14)

a cylindrical second step surface (S2) adjacent to the conical first step surface;

a major cutting edge (E1) defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

a minor cutting edge (E2) defined by the intersection of the cylindrical second step and the sidewall of the spiral flute;

a cutting tip (T) defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute; and



Ex. 1022 at 7.

“Configured to Crush” Limitation

Independent claims 1 and 8:

“each of the plurality of composite cutting blade groups is **configured to crush cutting chips into finer chips...**”

Patent Owner Incorrectly Contends Welty Is Not Configured to Crush

- Patent Owner's incorrect contention is inconsistent with its construction of the term in litigation (IPR -474 Petition at 23-24, 77-78; IPR -474 Response at 46; IPR -474 Reply at 11-12)

Notably, because the chips are flushed away from the cutting tip as soon as they are formed, beyond any initial chip formation/chip breaking, there is no time nor desire to “crush cutting chips into finer chips” as claimed using any gundrill. In Welty, like most gundrills, a coolant duct 15 carries a large flow of coolant just below the front tip and opposite cutting edge 23 and 25. Any chips that are formed at the front tip or by cutting edges 23 and 25 are immediately flushed down the straight flute and out of the hole. In order for chips to be crushed into finer chips, the chips would need to be located at the front of the drill for a period of time sufficient for further crushing of the chips. Because Welty's body portion 28 is

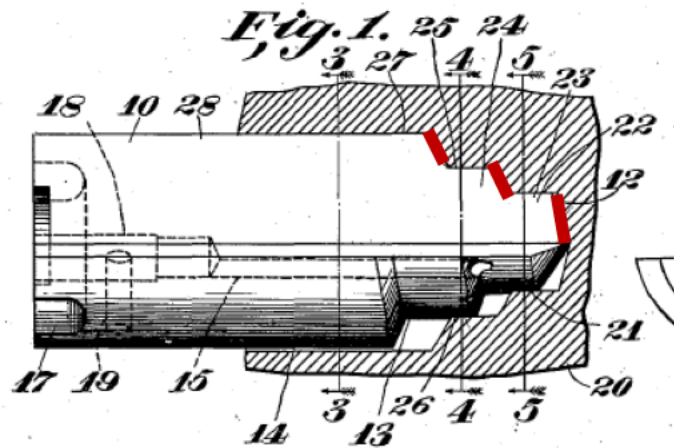
“each composite cutting blade group is **small, relative to the single major cutting edge that the cone portion would have if there were no composite cutting blade groups** on the cone portion of the twist drill”

Ex.1021 at 4 (Joint Claim Construction Statement).

IPR -474 Response at 46.

Configured to Crush

- Welty creates cutting chips smaller than they would be without stepped tip (IPR - 474 Petition at 77-78; Ex. 1004 ¶¶ 231-32; IPR -474 Reply at 11-13; Ex. 1044 ¶ 26)



Ex. 1008 (marked up).

to crush chips into finer chips. Specifically, Patent Owner contends that “chips are flushed away from the cutting tip as soon as they are formed” and “[i]n order for chips to be crushed into finer chips, the chips would need to be located at the front of the drill for a period of time sufficient for further crushing of the chips.”

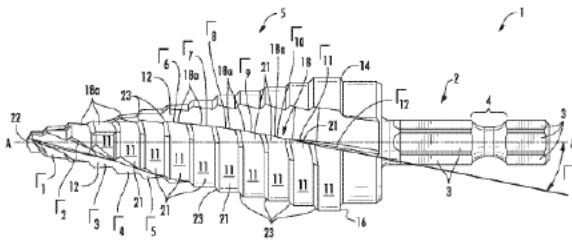
Response at 46. This is incorrect under the construction of the “crushing” term I laid out in my initial declaration, which was also advanced by Petitioner. Ex-1004, ¶96; Paper 1, Petition, 23-24. I understand that my construction is consistent with the construction proposed by Patent Owner in the litigation. Ex-1021, 4 (proposing

Supplemental Schmid Declaration (Ex. 1044)

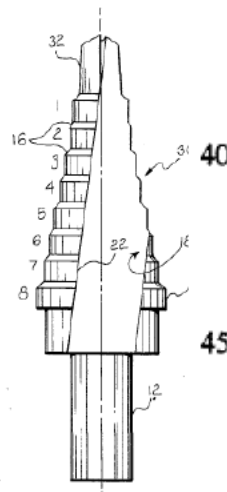
Ex. 1044 ¶ 26.

Cutting Tips Formed Spirally

- Known feature on drills with stepped tips (e.g., Durfee and Korb) (IPR -474 Petition at 81-82; Ex. 1004 ¶ 244)
- Result from flute spiraling to tip and obvious for same reasons (IPR -474 Petition at 82; Ex. 1004 ¶¶ 243-46)
 - Improved chip evacuation (IPR -474 Petition at 82; Ex. 1004 ¶ 245; IPR -474 Reply at 10-11; Ex. 1004 ¶ 24)
 - Distributed cutting force (Ex. 1004 ¶ 213)
 - Simple to manufacture (Ex. 1004 ¶¶ 213-14)



Ex. 1011 at 1.



The drill bit 10 is machined to provide two flutes 18 each of which removes a sector of about 50 degrees of the periphery of the drill, thus leaving an unfluted arcuate portion of about 260 degrees or 130 degrees following each cutting edge. The flutes may be cut helically about the drill or longitudinally at a fixed angle to the drill axis from about 0 to 15 degrees with the preferred angle being 7 degrees. The flutes define cutting edges 20 and 22, which as shown in FIG. 2, are adapted to drill holes of selected diameter in a clockwise rotating drill, as viewed from the shank end of the drill bit.

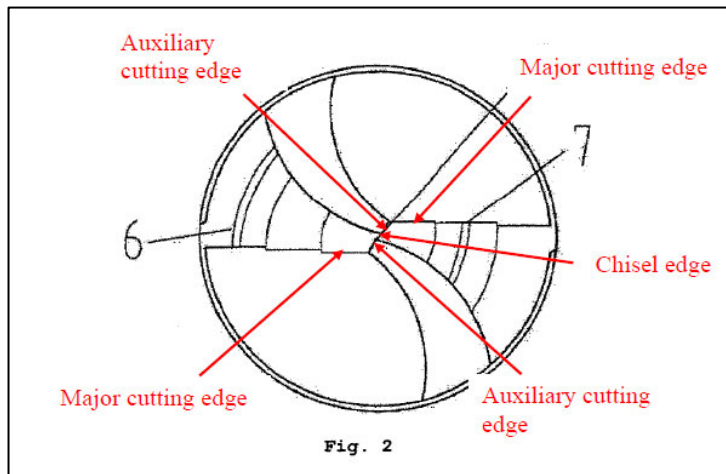
Korb (Ex. 1012) at FIG. 7, Col. 2, lines 37-47.

IPR2023-00474

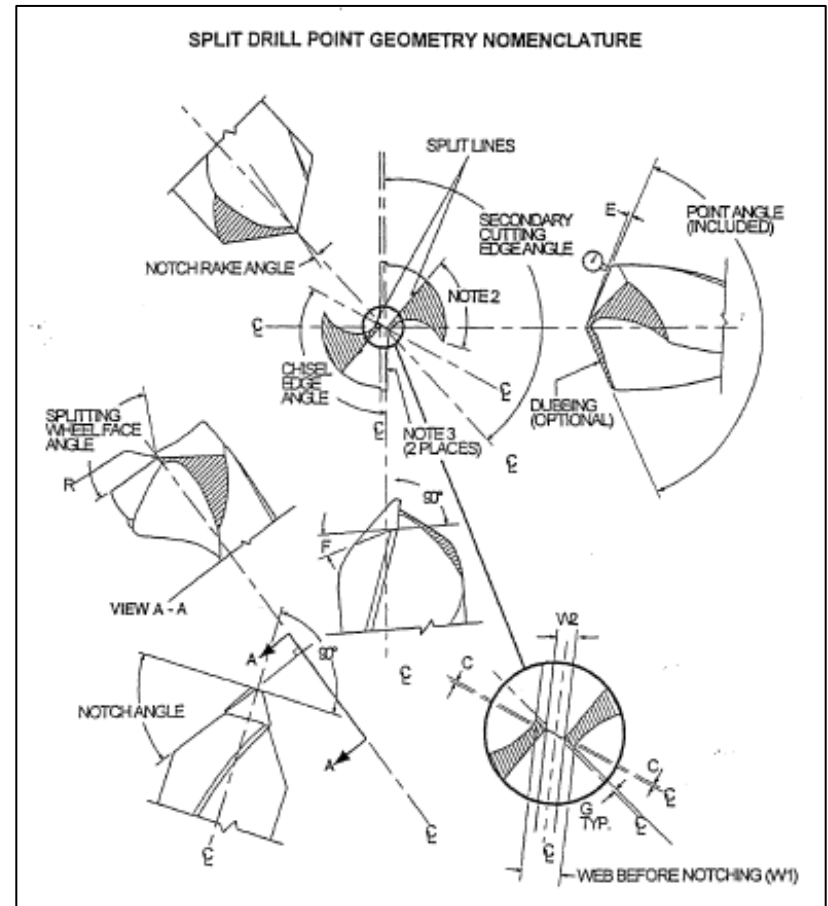
**Ground 4: Obviousness Based on Welty in view of
Bannister, Durfee, and Korb, and further in View
of Zhou
(Claims 5, 8, 12-15, and 18)**

Split Point Tip (Claims 5 & 8)

- Claimed top blade structure merely recites split point tip geometry (IPR -474 Petition at 83; Ex. 1004 ¶ 249)
 - E.g., Zhou, NAS 907 (IPR -474 Petition at 83-85; Ex. 1025 at 5)
 - Accurate starting (IPR -474 Petition at 84; IPR -474 Reply at 14-15; Ex. 1004 ¶ 250)
 - Faster penetration (IPR -474 Petition at 84; IPR -474 Reply at 14-15; Ex. 1004 ¶ 250)



IPR -474 Petition at 84 (from Ex. 1007).

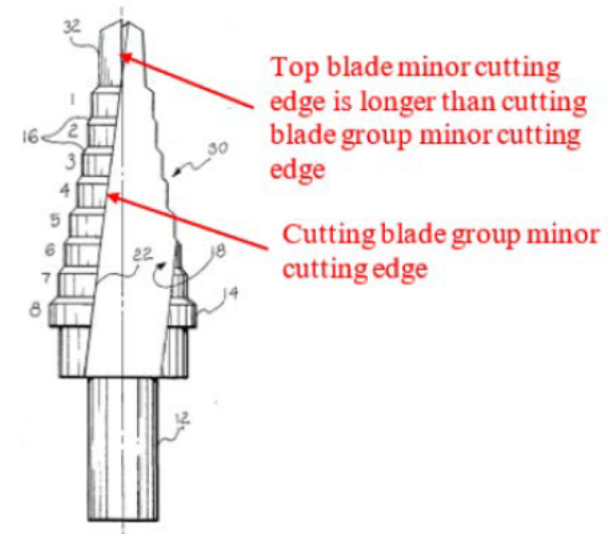


Ex. 1025 at 5.

Top Blade Taller than Steps (Claim 13)

routine engineering choice. It is among a limited number of known design options for the top blade: having a top blade that is taller than, shorter than, or the same height as the step height of the composite cutting blade groups. From these limited three choices, the claimed configuration is known in the art. An example of a drill with a top blade taller than the subsequent steps is shown in Korb. Korb's drill has a top blade with a minor cutting edge that is longer than each of the minor cutting edges of the composite cutting blade groups. See Ex-1012, Figure 7, annotated below.

Schmid Declaration (Ex. 1004)



Ex. 1012, Fig. 7

Top Blade Taller than Steps (Claim 13)

A POSA would have known that such a taller top blade would have the advantage of creating a deeper pilot hole to act as a guide for the drill before the cutting blade groups reach the workpiece during operation, and that such a configuration would provide increased stability and a straighter, more accurate, and more round hole, and would additionally provide for an initial drilling force that is relatively small. Ex-1004, ¶255, *see* Ex-1008, 1:6-22. Thus, a POSA would have been motivated to modify Welty to provide for such a taller top blade and would have had a reasonable expectation of success of doing so. Ex-1004, ¶¶254-56.

IPR2023-00473, Grounds 2-3
IPR2023-00474, Grounds 2-4

Secondary Considerations
Do Not Refute Obviousness

Legal Standard – Secondary Considerations

“[W]eak evidence of secondary considerations... simply cannot overcome [a] strong showing of obviousness.”

- *Becton, Dickinson & Co. v. Baxter Corp. Englewood*, 998 F.3d 1337, 1345 (Fed. Cir. 2021).

PO Has Not Established Nexus

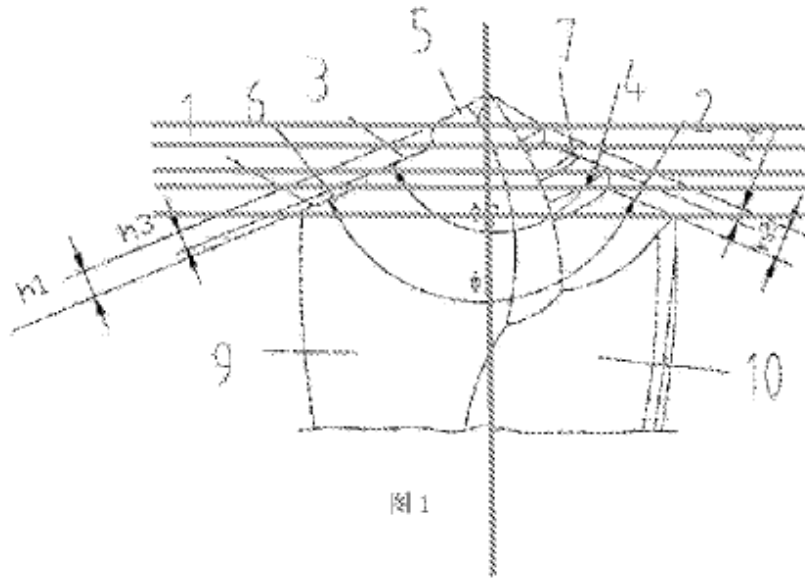
- No evidence that Hyper-Step drills meet the “formed spirally” limitation
 - PO’s expert conducted no measurements:

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.

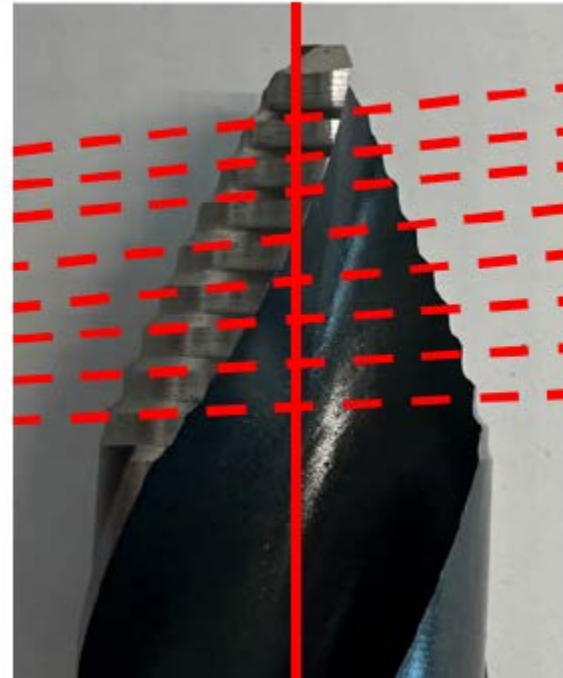
(Ex. 1046 at 133:6-8)

- Mr. Wang (inventor and manufacturer) testified that he did not know whether axial relief was present (Ex. 1049 at 81:11-83:7)
- PO’s attempt to gap-fill with inaccurate annotations is unpersuasive.

PO's Inaccurate Annotations

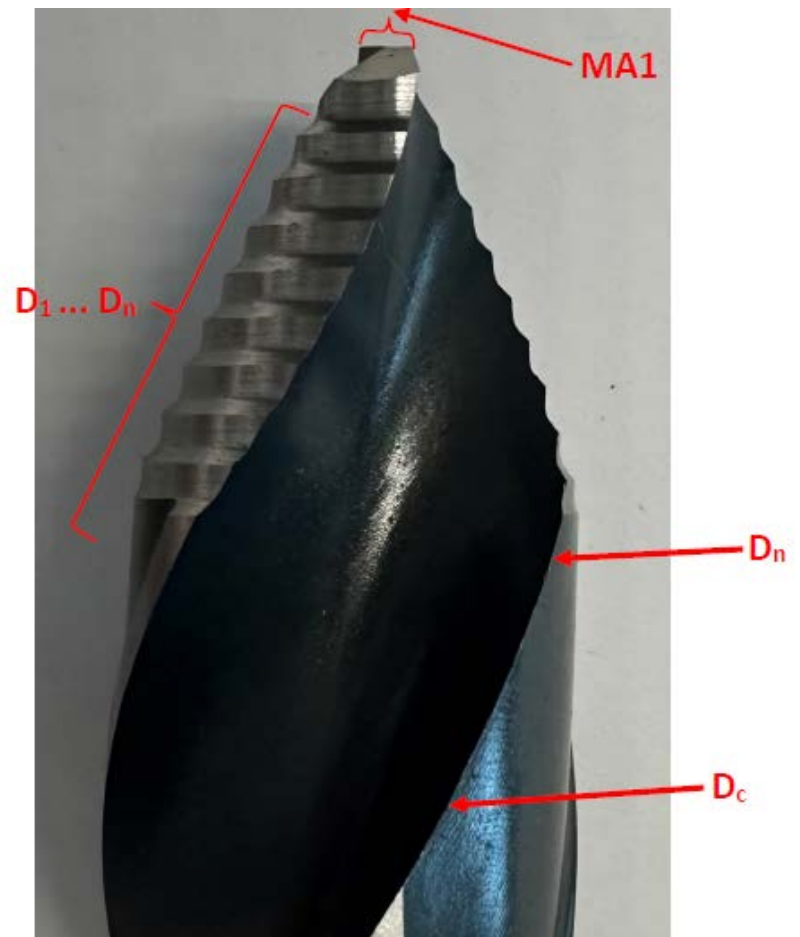
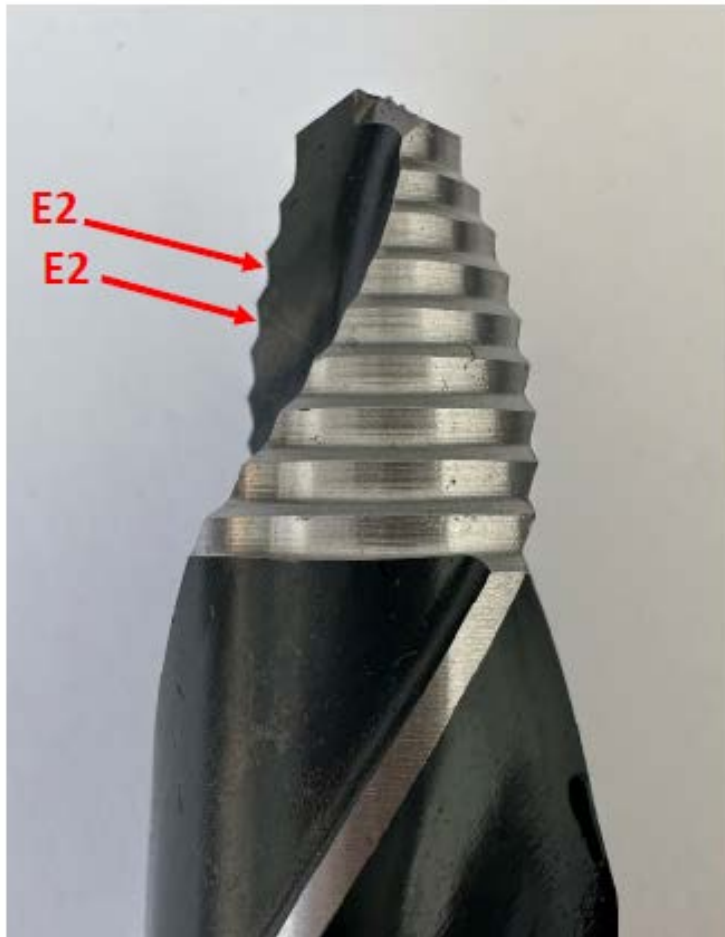


**PO's Undisputedly Inaccurate Annotation
of Zhou in Reexamination**



PO's Latest Inaccurate Annotation

Exemplary PO Product



PO Has Not Established Nexus

- No evidence that the Hyper-Step drills are co-extensive with the claims

“[P]resuming nexus is appropriate when the patentee shows that the asserted objective evidence is tied to a specific product and that product embodies the claimed features, and is coextensive with them.”

Fox Factory, Inc. v. SRAM, LLC, 994 F.3d 1366, 1373 (Fed. Cir. 2019) (cleaned up, emphasis added).

“[T]here must be a nexus to some aspect of the claim not already in the prior art.”

In re Huai-Hung Kao, 639 F.3d 1057, 1069 (Fed. Cir. 2011) (emphasis added).

PO Has Not Established Nexus

- Minor differences between the claims and the prior art shows claims not co-extensive

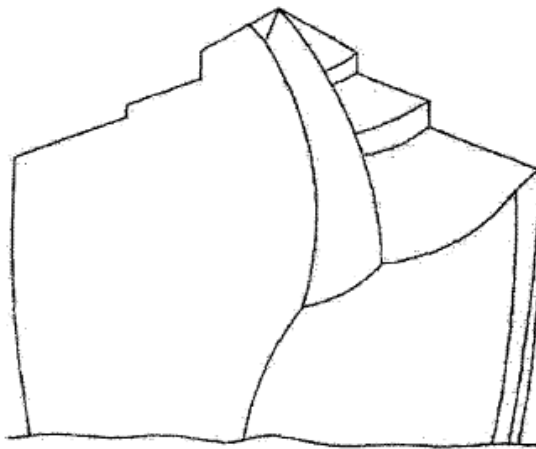
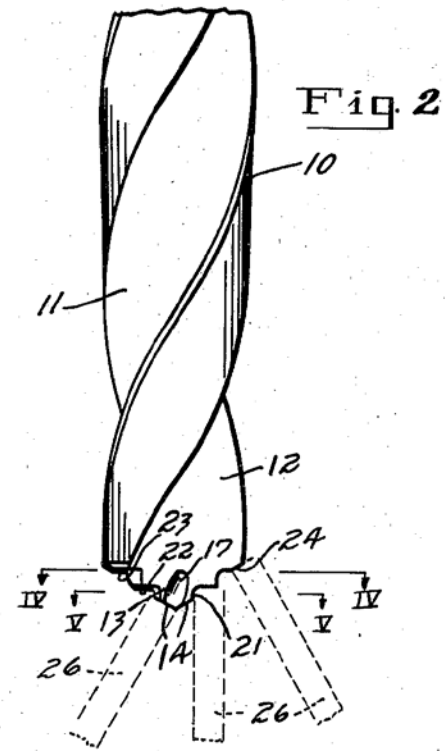


Fig. 3

Zhou (Ex. 1007)



Bannister (Ex. 1006)

Legal Standard – Commercial Success In Context

- Context, such as market share or profitability, is important.

“Generally, sales figures, in the absence of a defined market, are inadequate to establish commercial success.”

- *Red Diamond, Inc. v. Southern Visions, LLP*, IPR2019-01671, Paper 35 at 39-40 (PTAB Mar. 31, 2021).

“Just as the number of units sold without evidence of the market share is only weak evidence of commercial success, ... so too is an assertion of market share lacking in sales data.”

- *In re Applied Materials, Inc.*, 692 F.3d 1289, 1300 (Fed. Cir. 2012) (citation omitted).

- No commercial success where it is driven significantly by marketing and business practices.

- *In re DBC*, 545 F.3d 1373, 1384 (Fed. Cir. 2008).

Other Factors Have Driven Sales

Aggressive marketing

Q Has Matco been aggressive in its marketing of the Hyper-step products in your opinion?

A Yes.

Q And has that aggressive marketing been successful?

A Yes.

Q Has Wurth been as successful in its marketing of the step-tip drill products?

A Not if we're going by sales figures.

Q And Astro has not been as successful as Matco with its sales of the step-tip drill bits in terms of non-Matco products?

A Correct.

Q Do you have an opinion as to why Matco had this higher level of success?

A Yes.

Q What is that opinion?

A I believe they were the first to market with an item that was kind of -- had a potential that people have not seen in a while, and they were the only ones who somebody could get it from for quite some time.

Warranty

Q Have the -- have there been a lot of warranty claims on the Hyper-step drills?

A Yeah.

* * * *

Q Okay. And you indicated you do offer a lifetime warranty on non-Hyper-step drill bits as well. Have the warranty claims on those products been lower than those for the Hyper-step?

A Yes. There is the ability to sharpen other types of drill bits so they become a little bit more reusable over time.

* * * *

Q Am I correct that warranty claims don't hurt the profitability for Tec-Spiral? They don't replace them for free; correct?

A Correct.

Q They actually make money on warranty claims?

A Correct.

Other Factors Drive Higher Price



21 PIECE NITRO-TIP DRILL BIT SET
Part No. DB21NTS
★★★★★ 6 Reviews
\$181.95 **ADD TO CART**



COBALT DRILL BIT SET, 29 PIECE
Part No. DMC29A
★★★★☆ 2 Reviews
\$400.95 **ADD TO CART**



29 PIECE HIGH SPEED STEEL DRILL BIT SET
Part No. DM2938A
★★★★★ 1 Review
\$347.95 **ADD TO CART**



21 PIECE COBALT DRILL BIT SET
Part No. DMC21A
☆☆☆☆☆
\$189.95 **ADD TO CART**

Similar Products



HYPER-STEP COBALT MECHANIC'S LENGTH REDUCED SHANK DRILL BIT...
Part No. DBC29HSRM
★★★★★ 119 Reviews
\$614.95 **ADD TO CART**



HYPER-STEP HIGH-SPEED DRILL BIT SET, 21 PIECE
Part No. DB21HSG
★★★★★ 6 Reviews
\$219.95 **ADD TO CART**



HYPER-STEP COBALT STUBBY REDUCED SHANK DRILL BIT SET, 29...
Part No. DBC29HSRMS
★★★★★ 1 Review
\$554.95 **ADD TO CART**



HYPER-STEP HIGH-SPEED STEEL DRILL BIT SET, 29 PIECE
Part No. DB29HSG
★★★★★ 119 Reviews
\$399.95 **ADD TO CART**

Legal Standard – Copying

- Copying requires more than simply introducing a competing product

“Not every competing product that arguably fails within the scope of a patent is evidence of copying. Otherwise every infringement suit would automatically confirm the nonobviousness of the patent.”

- *Iron Grip Barbell Co. v. USA Sports, Inc.*, 392 F.3d 1317, 1325 (Fed. Cir. 2004)

- Mere review of competitor’s product or benchmarking does not establish copying

- *CaptionCall, L.L.C. v. Ultratec, Inc.*, IPR2015-00637, Paper 98 at 84-85 (PTAB Sept. 7, 2016) (finding that a “teardown” does not “establish copying and again appears to be nothing more than due diligence.”)
- *Jiaxing Super Lighting Elec. Appliance Co. v. CH Lighting Tech. Co.*, 2022 U.S. Dist. LEXIS 146033, at *15 (W.D. Tex. Aug. 16, 2022) (“[B]enchmarking your finished accused product against your competitor's product is not, [], strong evidence of copying.”)

Petitioner Did Not Copy PO's Product

9. In that Response, Patent Owner accuses Viking of copying the Hyper-Step products. That is wrong. We were certainly aware of the Hyper-Step products and were provided a set of the drills sold by Matco at the time we did our development work. However, we relied on our own experience and expertise (including our existing knowledge and experience manufacturing step drills) to design our products. We did not make any drawings or take any measurements of the Hyper-Step drills during our development work. We made no effort to replicate the exact design of the Hyper-Step drills – we believed that with our experience our product would be better than the Hyper-Step product (which in fact turned out to be true).

Fulk Declaration (Ex. 1045)

Legal Standard – Long-Felt Unmet Need

- Evidence must show that the prior art had a recognized need for a solution to the problem and that others had tried, and failed, to find a solution to that problem.

“[A]bsent a showing of long-felt need or the failure of others, the mere passage of time without the claimed invention is not evidence of nonobviousness.”

- *In re Kahn*, 441 F.3d 977, 990-91 (Fed. Cir. 2006) (citation omitted).

Weak, Unreliable “Industry” Praise Evidence

- PO’s evidence is based on anonymous, unsubstantiated, unreliable reviews and comments – No evidence re. “industry.”
- Evidence contradicts PO’s claims:

 **goylop** 1 year ago
My 80\$ cobalt set goes even faster lol no reason to spend premiums for fancy brand names, especially for consumables.

👍 🗨️ Reply

▲ 1 reply

 **Phil H** 10 months ago
What brand? Looking for a set but the matco ones seem steep

👍 1 🗨️ Reply

 **UpNorth** 1 year ago
Our shop has 3 complete sets including the add on sets that go to 3/4". They are an investment for sure but we drill several hundred holes a month. That lifetime warranty had almost paid for themselves already after the first year.

👍 🗨️ Reply

 **Cole B** 1 year ago
I have this set; they're great right up until they run into anything hardened. They're only HSS. They're priced like other brands' Cobalt steel (m35 or m42, both much harder) bits.

👍 8 🗨️ Reply

No Long Felt, Unmet Need or Unexpected Results

50. Many of the advantages that Patent Owner imputes to the allegedly inventive claims can be attributed to the prior art split point tip feature, which is not new or inventive. A POSA would recognize that split point tip geometry is known to provide at least these advantages:

- **Reduced Drilling Force:** Split point tips are designed to penetrate materials more easily, requiring less force during drilling. The geometry of the split point allows the bit to start cutting immediately upon contact with the material, minimizing the need for excessive pressure.
- **Faster Penetration:** The split point design helps to reduce the "walking" or wandering of the drill bit when it first contacts the material. This results in faster and more accurate drilling as the bit can quickly engage and maintain its position.
- **Self-Centering:** The split point design facilitates self-centering, meaning the bit is more likely to stay on target without the need for a center punch or pilot hole. This is particularly useful when starting a hole on a smooth or uneven surface.
- **Improved Precision:** Split point tips provide better precision. The immediate cutting action allows for more controlled drilling and minimizes the likelihood of the bit slipping off the intended drilling spot.

Supplemental Schmid Declaration (Ex. 1044)

No Long Felt, Unmet Need or Unexpected Results

51. Many of the advantages that Patent Owner imputes to the allegedly inventive claims can be attributed to the stepped design of prior art step drills. Step drills are not new or inventive. A POSA would recognize that step drills have at least the following advantages:

- **Reduced Cutting Force:** Because the successive cutting edges are engaged gradually, the axial force and torque are less than if the entire diameter were drilled at once.
- **Deburring:** Each step can act to deburr the hole created by the previous step, thus improving surface finish.
- **Reduced Chatter and Vibration:** Step drills may exhibit less chatter and vibration compared to twist drills. The stepped design can help distribute cutting forces more evenly, resulting in smoother drilling operation and improved surface finish.
- **Ability to Enlarge Existing Holes:** Step drills are particularly useful in enlarging existing holes, where they can start with a hole having a small diameter and then gradually increase it without the risk of catching or grabbing the material.

**Supplemental Schmid
Declaration (Ex. 1044)**

END