

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner

v.

HONGJIA WANG
Patent Owner

Case IPR2023-00474

U.S. Patent No. 11,007,583

**SUPPLEMENTAL DECLARATION OF STEVEN R. SCHMID, PH.D. IN
SUPPORT OF PETITIONER'S REPLY**

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I, Dr. Steven R. Schmid of Charlotte, North Carolina, declare that:

I. Overview

1. I have been retained on behalf of Petitioner Viking Drill & Tool, Inc. (“Petitioner”) as an independent expert consultant. As part of this engagement, I have been asked to provide my opinions regarding the subject matter claimed in U.S. Patent 11,007,583 (“’583 patent”) (Ex-1001),¹ including specifically the scope and content of the prior art relating to the subject matter of the ’583 patent and what the prior art would disclose and/or teach and suggest to a person of ordinary skill in the art (“POSA”) at the time of the purported invention. I previously submitted a declaration in support of the petition for *inter partes* review of the ’583 patent in this proceeding (Paper 1, the “Petition”), Ex-1004, as well as a declaration in support of the petition for *inter partes review* in the IPR2023-00473 proceeding (Ex-1004).

2. I set forth the information below as a supplement to my original declarations, as Patent Owner raised new issues in its response to the petition (Paper 30, the “Response”) on which I had not previously been given an

¹ In this Declaration, I refer to exhibits I understand will be attached to Petitioner’s Reply, in addition to those Petitioner and patent owner Hongjia Wang (“Patent Owner”) have already submitted in this proceeding.

opportunity to offer testimony. The legal standards I use here are the same as set forth in my previous declaration, Ex-1004, ¶¶18-30. Having considered Patent Owner's arguments, and the testimony of Patent Owner's declarants, my opinions on the invalidity of the '583 Patent remain the same. My additional opinions are set forth below.

II. Materials That I Reviewed

3. My opinions contained in this Declaration are based on my knowledge and experience gained from my education in the field of mechanical engineering, my experience in the field of machine tool design and engineering in both academia and industry over the last 30 years, and the specific references, documents, and other materials I discuss in this Declaration.

4. In forming my opinions, I reviewed the following (along with any other materials I discuss in my Declaration):

- Any materials I reviewed in connection with my original declaration. Ex-1004, ¶¶9-12.
- Patent Owner's Response (Paper 30) and exhibits submitted by Patent Owner in connection with its response.
- Exhibits 1045-1050 submitted in connection with Petitioner's Reply.

5. All of the papers and publications I reviewed in forming my opinions

for my Declaration are materials that experts in my field would have knowledge of and would reasonably rely on in forming certain opinions set forth in my Declaration. In addition, all of the papers and publications were widely available to a person of ordinary skill in the art (“POSA,” discussed further below) at least as of the time of the filing of the ’583 patent. Based on my experience, people in my field at the time of the alleged invention ordinarily and customarily relied on published papers and textbooks including those listed above, and ordinarily and customarily relied on such publications as having been published as of the publication date listed in the document. I am not aware of any facts or circumstances that call into question the authenticity of any of the above materials or the accuracy of their publication dates.

6. I formed my opinions discussed in this Declaration by placing myself in the position of a POSA back in November 28, 2019 (an easy task, as I have been at or above the level of ordinary skill for at least 30 years). My opinions are the same for a POSA in February 14, 2016.

III. Ground 1: Anticipation by Zhou

7. I understand that Patent Owner argues that Zhou does not disclose major and minor cutting edges that are curved. I do not agree with Patent Owner’s analysis because these features are not required by the claims. It is also my opinion that it would have been obvious to a POSA to combine Zhou with the teachings of

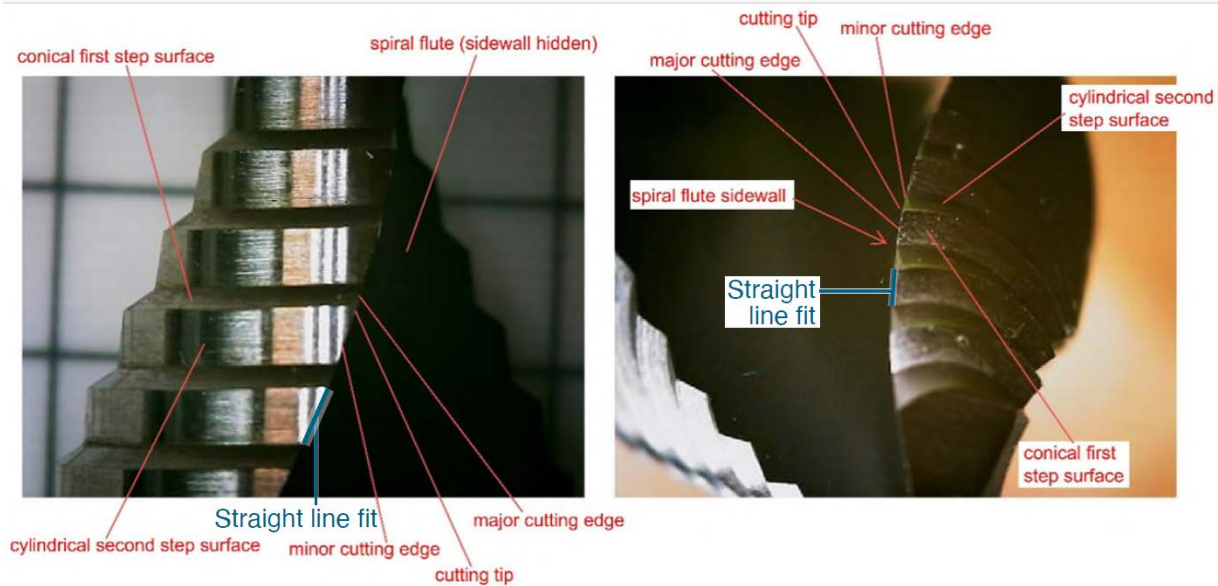
Gentry and Durfee to meet these limitations even if they are required elements of the claims, which I discuss below with respect to Ground 2.

8. The claims do not require the recited major and minor cutting edges to be curved. Instead, the claims more generally recite “a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute” and “a minor cutting edge defined by the intersection of the cylindrical second step and the and the sidewall of the spiral flute.” Ex-1001, Claims 1 and 8.

9. The claims do not recite anything that requires curved cutting edges. I understand Patent Owner’s position is that this necessarily results from the intersection of the sidewall of a spiral flute and the respective step surfaces. This is incorrect for numerous reasons. First, I disagree with Patent Owner’s conclusion that curved cutting edges must always result from the intersection of a spiral sidewall of a spiral flute and conical and cylindrical step surfaces. Patent Owner’s analysis fails to take into account the complex geometry that is used on actual drills. A POSA would recognize that an embodiment of the claims can have straight major and minor cutting edges formed by the intersection of a spiral flute sidewall and conical and cylindrical step surfaces by manipulating various geometries that are consistent with these features. Starting with the spiral flute, the flute can have various cross sectional shapes based on how it is manufactured. For example, it can be cut into the drill using a grinding wheel having a semicircular

cut pattern or that of another shape. The spiral flute can also be formed with a helix angle at any of an infinite number of angles between vertical and horizontal, relative to the axis of the drill. The conical step surfaces can also be formed at any of an infinite number of angles between vertical and horizontal, relative to the axis of the drill. The conical and cylindrical step surfaces can have axial, radial, and diametral relief with various geometries. By adjusting any of the above, a POSA can form cutting edges having any desired shape, including straight line segments.

10. To support its contention that the major and minor cutting edges of the claimed drill must be curved, Patent Owner presents two photographs of the ¾” Matco Tools Hyper-Step Part No. DBHS48 (alleged to be within the scope of at least claims 1 and 8 of the ’583 patent) allegedly showing this. These photos do not clearly show curved cutting edges. I have replicated the photos below and added straight lines in blue, which fit well to different cutting edges.



11. Regardless of any dispute about what the above images show, Patent Owner's expert concedes that this configuration does not necessarily require straight major cutting edges. According to Dr. Endres, for a given combination of major cutting edge angle and flute helix angle, the major cutting edges will be straight. Ex-1046, 85:20-88:5. Viewing prior art two-blade twist drills, it is readily apparent that the major cutting edges, which are formed by the intersection of conical flank surfaces (analogous to the claimed conical step surfaces) and spiral flute sidewalls, can be straight:

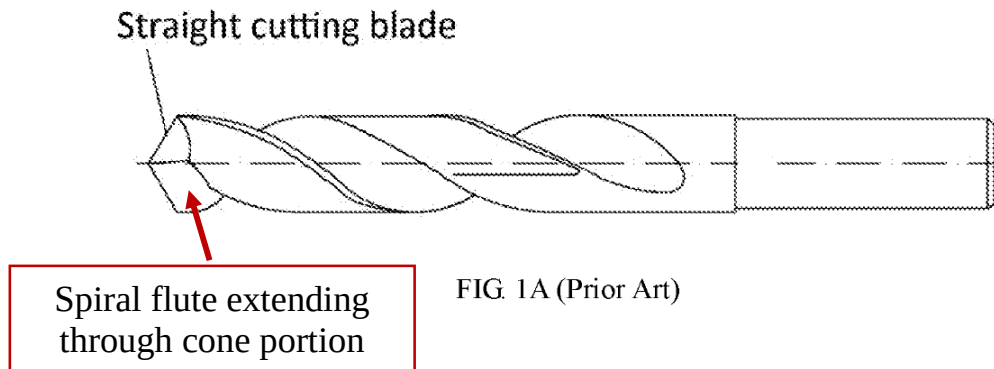
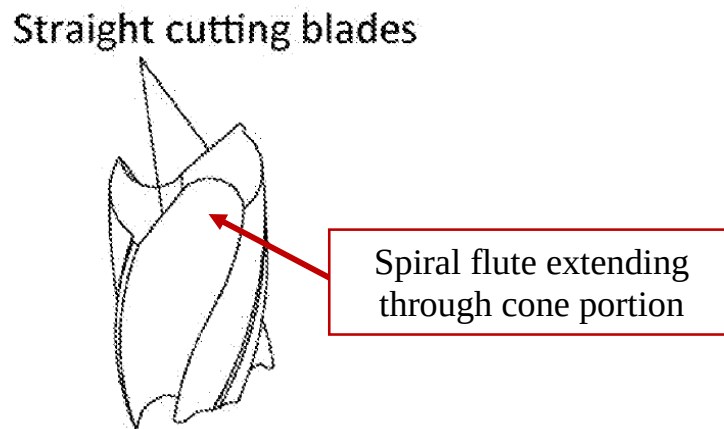


FIG. 1C (Prior Art)

Ex-1001, FIGs. 1A-1C.

12. I also disagree with Patent Owner's conclusion that the claims require curved major and minor cutting edges because there is no requirement that the claimed spiral flute have a sidewall that is spiral the entire length of the flute. In my opinion, the claims are broad enough to allow a spiral flute that, as in Zhou, has

a portion of its sidewall that is straight on the leading edge of the cone portion while still maintaining its generally spiral shape. I understand that Patent Owner does not actually challenge that Zhou has a spiral flute extending along the cone portion, and in fact admits that Zhou’s straight cutting edges are formed by “grind[ing] back the sidewall of the spiral flute (as in Zhou and Bannister).”

Response at 22. I interpret the claims to encompass a spiral flute that has a straightened sidewall with straight major and minor cutting edges, as in Zhou.

IV. Ground 2: Obviousness based on Zhou in View of Bannister, Gentry, Durfee, and knowledge of POSA

13. Even if curved major and minor cutting edges are inherent limitations of the independent claims, it would not change my conclusion that the challenged claims are invalid. The challenged claims would have been obvious, as set forth in my first declaration (Ex-1004). As I explained in connection with dependent claims 18 and 22, it would have been obvious to modify Zhou to have spirally formed cutting tips. Ex-1004, ¶¶201-202. For the same reasons, it would have been obvious to modify Zhou to have spirally formed cutting tips formed by a flute with a leading sidewall that maintains its helical shape all the way to the tip of the drill. Since that is the same feature that leads to the allegedly inherent “curved” major and minor cutting edges, the claims would have been obvious even if the Board accepts Patent Owner’s position that the claims require curved cutting edges. Ex-1004, ¶¶201-202.

14. I do not find Patent Owner's argument that it would not have been obvious to modify Zhou to have a flute with a sidewall that maintains its helical shape all the way to the tip of the drill to be persuasive. As one example, Durfee shows this feature. Ex-1011, FIGs 1, 4-6. Patent Owner's contention that "[i]t was not at all obvious to combine step-like features, similar in a way to those found in step drills, to the exterior of the cone portion of a twist drill," Response at 24, is not credible. I understand Zhou to teach a twist drill with step-like features, similar to those found on step drills, on the exterior of its cone portion. Numerous prior art references have done this as well, such as Welty, Bannister, and Sheldon. *See generally* Exs. 1006-1008, 1014. Likewise, the Tool and Manufacturing Engineers Handbook from 1983 shows and describes a twist drill with steps:



Ex-1017 at 23, 25 ("Step drills have two or more diameters ground into the lands of the drill. Normally, the drill will be of the two-flute style[.]").

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

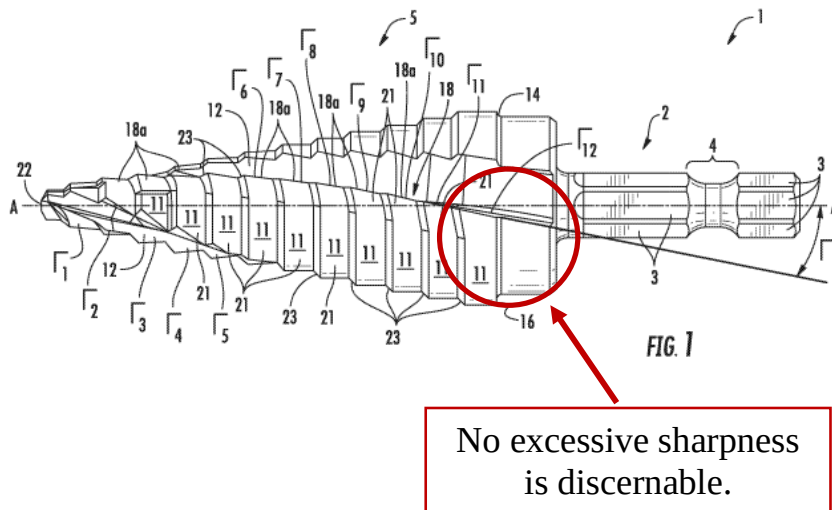
sidewall along the cone portion leading edge would lead to improved swarf evacuation, Ex-1004, ¶¶201-202, which can result in reduced likelihood of tool fracture and improved workpiece finish. It would also eliminate a manufacturing step by allowing the flute to be ground in a single operation rather 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).

16. In Zhou, it has been assumed that the leading edge is formed by grinding back the leading edge of the cone portion where it meets a spiral flute in order to form a straight leading edge with straight cutting edges. It is also possible that in the alternative, Zhou shows a spiral flute that intersects the leading edges of a cone portion in such a way that the major cutting edges are all straight as a natural consequence of the particular cone angle and flute helix angle in a manner similar to the twist drills having spiral flutes and straight cutting edges shown in FIGs. 1A-1C of the '583 Patent. If this is the case, even a trivial adjustment to the spiral flute helix angle or to the point angle of the cone portion would result in spirally-formed cutting tips and curved cutting edges if all other parameters are unchanged. Such an adjustment would be obvious for the same reasons discussed above.

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.

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:



Ex-1011, FIG. 1. Durfee does not identify this as a problem, and I am unaware of other references that have identified such a problem. The ubiquitous standard twist drill, which commonly has a 135° point angle (similar to the 135° and 140° angles of Zhou, Ex-1007 at [0024]) and a helical flute that with spiral sidewalls extending all along the cone portion, also does not have an “extreme curve” that causes problems. Ex-1001 at FIGS. 1A-1C; Ex-1017 at 47-52. Patent Owner has not demonstrated how Zhou would be any different from standard twist drills in this regard.

19. Thus, even assuming that independent claims 1 and 8 require curved major and minor cutting edges, I nevertheless conclude that these claims are obvious for the same reason as claims 18 and 22. Patent Owner has not disputed that all other limitations of claims 1, 2, 5, 7-8, 12-15, 18-19 and 22 are either disclosed in Zhou or would have been obvious to add to Zhou.

V. Ground 3: Obviousness Based on Welty in View of Bannister, Durfee, Korb, and/or Knowledge of a POSA

A. It would have been obvious to modify Welty to have a spiral flute and spiral cutting tips

20. I understand Patent Owner's first argument against obviousness by Welty is that Welty is a gun drill for drilling "very deep holes," and that a POSA would not be motivated to add a spiral flute to Welty's gun drill. Response at 41-46. I disagree with Patent Owner's premise that spiral flutes are not compatible with gun drills. Spiral flutes are known not only to be compatible with deep hole drilling, but to be advantageous for this purpose.

21. As an initial matter, gun drills do not have a single, particular configuration. Although many traditional gun drills are single-lipped, straight-fluted cutting tools with a pressure coolant chamber for providing coolant to the tip, they are not strictly defined as such. Gun drilling is used more generally in the industry to refer to drills used especially for drilling deep holes. As described below, certain modern twist drills are used for this purpose and can meet this definition. To the extent Patent Owner is contending that gun drills are by definition straight-fluted and single-lipped drills, which is not clear from its submissions, then my response is that Welty's drill is not limited to being a drill of this type. Welty is more generally a drill for drilling deep holes and is not at all

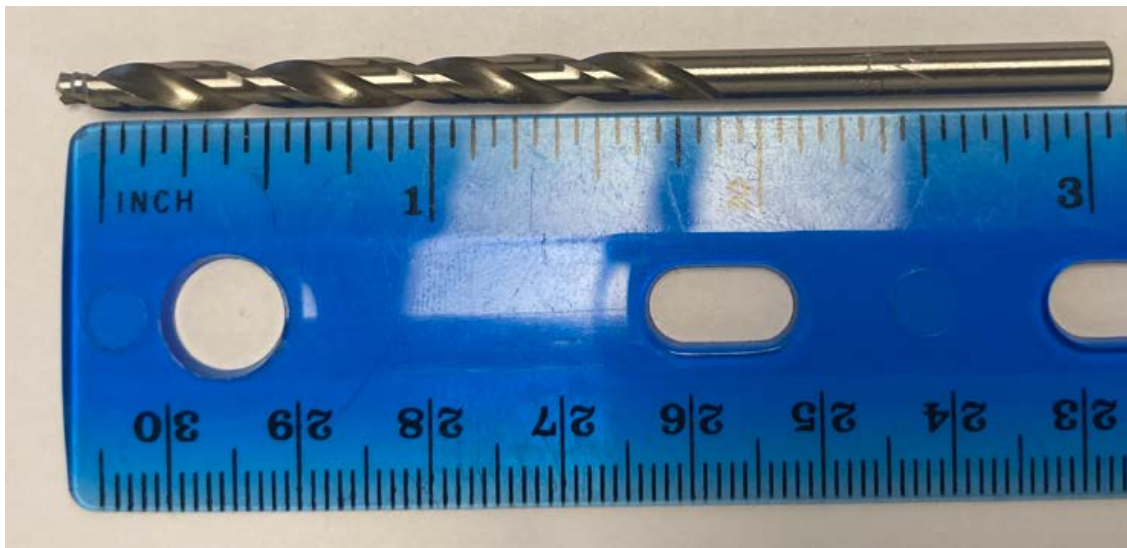
limited to being a “gun drill” or a straight-fluted, single-lipped drill, even though some embodiments might be described as a gun drill.

22. According to Welty, the objects of his invention are to provide a drill: (1) for boring accurate diameters of great depth, (2) that requires less power to operate, (3) that does not bind and break during use (4) that has three boring portions and (5) where the boring portions increase in diameter so that work can be easily drilled. Ex-1008 at 1, 1:3-22. Welty is not limited to drilling holes of any particular l/d,² such as “100:1 ... up to 300:1” as Patent Owner argues. Response at 41. Adding the features taught by Bannister, Durfee, Korb, and Zhou would improve Welty’s drill and advance the objectives of Welty’s invention.

23. There is no widely accepted threshold for what constitutes a deep hole. Some sources, such as those cited by Patent Owner, consider anything greater than a l/d ratio from 3:1 or 10:1 to be a deep hole. Ex-2102 at 1 (3:1); Ex-2101 at 1, Fig. 1 (6:1); Ex-2100 at 3 (10:1). Welty is silent on the depth of holes it is intended to cut, so it is my opinion that modifications to Welty consistent with drilling holes on the order of 3:1 to 10:1 are consistent with Welty’s intended use. Spiral flutes are consistent with drilling holes in this l/d range and are thus obvious modifications to Welty’s drill. Just as one example showing that spiral flutes are

² Length to diameter or depth to diameter, referred to as “l/d” in shorthand.

consistent with deep holes, I note that Patent Owner's own licensed twist drills from a Matco DB29HSG set,³ produced in the litigation as TS002068, are capable of drilling holes of at least 3:1 l/d. In fact, the smallest allegedly practicing size, 5/32", can drill holes of over 10:1 l/d. As shown in the image below, it has flutes extending along the cylinder portion for at least 1.75":



This drill is therefore capable of cutting holes up to at least 1.75" deep. A simple calculation shows that it can cut holes of up to at least 11.2 l/d:

$$\frac{l}{d} = \frac{1.75''}{\frac{5}{32}''} = \frac{1.75}{0.15625} = 11.2$$

³ Patent Owner contends that these practice the claims of the '583 patent. Ex-2074.

This is just one example of how spiral flutes can drill deep holes. Twist drills with spiral flutes can thus be used for deep hole drilling like that performed by Welty's drill, so it is no stretch to conclude that a POSA would find it obvious to modify Welty to have a spiral flute to enhance its performance as a deep hole drill.

24. Even if Welty's drill were intended only for drilling holes of greater than 10:1 l/d, it would still be obvious to add a spiral flute to Welty. In modern times, twist drills with spiral flutes are known to be useful and advantageous for drilling holes on the order of 30:1 or 40:1, and even as high as 60:1 or 70:1 l/d. Ex-2101 at 13 (describing twist drills as requiring less radial force and having higher feed rates than single lip drills); *see also* Ex-1050 at 4. The helical flutes allow for improved mechanical chip removal with lower required coolant flow rates. Ex-2101 at 13-14. In my opinion, a POSA would have found it obvious to incorporate helical flutes on Welty's drill to further improve upon Welty's stepped tip design for use in deep hole drilling.

25. I understand Patent Owner also argues that a spiral flute would be incompatible with Welty because "Welty is focused on providing . . . a heel opposite the cutting edge." Response at 41. Welty teaches heels, which can also be referred to as pads, opposite the cutting edges of each step. These heels each provide a bearing surface to constrain the drill and offset the cutting forces at the respective cutting edge opposite the heel. They also allow radial relief, or clearance

between the cylindrical step surfaces and a workpiece, to reduce binding. Reducing binding is one of the numerous objectives of Welty. Ex-1008 at 1, 1:3-22. Heels are compatible with a single spiral flute on Welty. In such a case, the heels could be formed on a drill opposite each cutting edge as they spiral around the cone portion of the drill. There would be no complex analysis required to determine the location of each heel. Rather, only a simple understanding of the cutting force vector based on well-known cutting mechanics would be required to determine the correct placement of each heel. This same analysis would be required to determine heel placement regardless of whether the flute spirals or is straight (i.e., in unmodified Welty). Adding two spiral flutes to Welty (consistent with twist drills known to be useful for deep hole drilling) could remove the need for heels or would still allow for heels, if desired, on flank surfaces between the cutting edges at each step height. Although there are many factors that might determine the need 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 Welty either to have one spiral flute with pads, or two or more spiral flutes without pads would accomplish Welty’s objective of preventing binding without departing from Welty’s teachings.

B. Configured to crush chips into finer chips

26. I understand Patent Owner argues that Welty’s drill is not configured 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 the construction “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-1004, ¶96. In the Petition, Petitioner construed this term based on Patent Owner’s own proposed construction of the term in the Litigation as meaning “creating cutting chips that

are smaller than they would be if the drill did not have composite cutting blade groups.” Petition at 23-24, Ex-1021 at 4. Under this construction, it does not matter whether chips are “flushed away from the cutting tip as soon as they are formed.” Response at 46. Because Welty comprises multiple cutting edges formed by its stepped tip, the chips formed by Welty would be smaller than if Welty had only a single cutting blade.

27. To the extent that Patent Owner is now proposing a different construction of this term in contradiction to the construction it proposed in the litigation, I do not agree with it. No other construction is described in the ’583 Patent. Furthermore, based on my understanding of cutting mechanics and chip formation, I do not believe a construction where “chips [] need to be located at the front of the drill for a period of time sufficient for further crushing of the chips” is practiced by any of the products that Patent Owner contends are embodiments of the challenged claims, whether its own licensed drills, *see* Ex-2074 to Ex-2089, or the Viking Vortex-Point drills it accuses of infringement in the Litigation. *See* Ex-1022. A POSA would recognize that as a general matter, chips are formed through shearing. Thus, in the context of the intrinsic record of the ’583 patent, a POSA would understand the term does not require actual “crushing,” which would result from compressive stress. Rather, a POSA would understand that chips are formed through shearing in the drills of the challenged claims, and that chips would flow

directly into the chip evacuation flutes of a drill as they are formed, where no appreciable compression occurs. A POSA would thus understand that in the context of the '583 Patent, the term means that, as opposed to the major cutting edge of a standard prior art twist drill, the claimed drill is broken up into a plurality of smaller major cutting edges along the exterior of the cone portion, which leads to narrower chips than in the standard prior art twist drill. *See* Ex-1004, ¶96. Once again, regardless of whether chips are flushed away immediately after cutting, Welty's chips are smaller than they would be if Welty had only a single cutting blade and not a stepped configuration. Ex-1004, ¶¶231-33.

28. To the extent that Patent Owner is actually advancing a construction where any further breaking of chips after they are initially formed occurs inside the chip evacuation flutes, Welty teaches this. I agree with Dr. Endres that it is at least possible that in some conditions, a drill's flute sidewalls interfere with chips and strain them sufficiently to break them. *See* Ex-1046, 68:24-71:12. To my knowledge, Patent Owner has not provided any evidence that Welty's drill is not theoretically capable of forming discontinuous chips in this manner. Welty's use of pressure coolant does not affect my conclusion on this point. If chips have not yet broken off from the workpiece, pressure coolant cannot flush them away. A flute sidewall could thus break the chips regardless of whether pressure coolant is used. That said, modern embodiments of Welty's drill would be operable without using

pressure coolant, which I explained in my previous declaration. Ex-1004, ¶212.

This is especially true with Welty's drill as modified to have a spiral flute. *Id.* To summarize, a POSA would understand that Welty's drill would be capable of forming discontinuous chips broken apart at least partially by interference between chips and the sidewall of Welty's flute regardless of whether pressure coolant is used to evacuate chips. Thus, even if Patent Owner attempts to rely on yet another construction of this term to salvage its position that Welty does not crush chips into finer chips, this position is without merit.

29. Patent Owner's arguments and evidence it has put forth in connection with its response to the Petition do not alter my conclusion that it would have been obvious to modify Welty to have a spiral flute. Likewise, they do not alter my conclusion that Welty teaches the crushing limitation and has cylindrical second step surfaces. I do not understand Patent Owner to have challenged Petitioner's contentions regarding any other limitations of claims 1, 2, 7, 19, and 22 of the '583 Patent. Therefore, it is my opinion that these claims are all unpatentable in view of the prior art.

VI. Ground 4: Obviousness Based on Welty in View of Bannister, Durfee, Korb, and/or Knowledge of a POSA, and Further in View of Zhou

30. Patent Owner's arguments and evidence it has put forth in connection with its response to the Petition do not alter my conclusion that it would have been obvious to modify Welty to have a split point tip geometry and top blade cutting

edge lengths as claimed in Claims 5, 8, and 12-13. I understand Patent Owner does not challenge that these features are all taught by the prior art. I also understand Patent Owner's challenge to this ground is solely as to whether a POSA would combine features of a twist drill with a gun drill. As I have explained above, twist drills are known to be useful for drilling deep holes, and it would have been obvious to a POSA to combine features of a twist drill with Welty's stepped-point drill. As I explained in my previous declaration, split point tips are known to be advantageous on drills because they provide fast penetration and accurate starting, both of which further the objectives of Welty's invention. Ex-1004, ¶250. Thus, it would have been obvious to modify Welty to have a split point tip.

31. I do understand Patent Owner has not challenged Petitioner's contentions regarding any other limitations of claims 5, 8, 12-15, and 18 are either disclosed in Welty or would have been obvious to add to Welty. Therefore, it is my opinion that these claims are all unpatentable in view of the prior art.

VII. Patent Owner's Arguments Regarding Secondary Considerations Do Not Alter My Opinion That the Challenged Claims Are Obvious

32. To the extent that Patent Owner claims that the design shown in the '583 patent allows a faster penetration rate and reduced time to produce a hole, this does not affect my opinion that the challenged claims are obvious. This advantage was disclosed known the prior art, *e.g.* "[an] 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.” Ex-1008, p. 1, col. 1:18-22. Furthermore, a POSA would have known that step drills can penetrate quickly into a workpiece and this so-called “advantage” could not have been unexpected.

33. To the extent that Patent Owner claims that the design shown in the ‘583 patent results in improved durability due to better distribution of the thermal load (heat) and mechanical load (force) generated at the cutting edge during cutting, this does not affect my opinion that the challenged claims are obvious. This was disclosed in the prior art, *e.g.* “shall generate less heat in cutting.” Ex-1006, p. 1, col. 1:5. A POSA would understand that mechanical load is distributed over the different steps of a stepped drill as shown in at least Ex-1006, Ex-1007, Ex-1008, Ex-1010, Ex-1011, and Ex-1012. This so-called “advantage” could not be considered unexpected.

34. To the extent that Patent Owner claims that the design shown in the ‘583 patent results in improved chip evacuation as a result of a plurality, and for larger bits many, chips having narrower width than for a standard twist drill where the chip width is approximately equal to the cutting lip length where the narrower chips are also weaker and have a tendency to fracture into short lengths, this does not affect my opinion that the challenged claims are obvious. A POSA would realize that the drills having stepped points as shown in at least Ex-1006, Ex-1007,

Ex-1008, Ex-1010, Ex-1011, and Ex-1012 would produce chips that are narrower than for a standard twist drill of similar diameter, and that such narrower chips would be weaker and tend to fracture into shorter lengths. Bannister explicitly states an object of his drill is to “be effective to clear the hole being drilled of chips as they are formed.” Ex-1006, p. 1, col. 1:9-11. This so-called “advantage” could not be considered unexpected.

35. To the extent that Patent Owner claims that the design shown in the ’583 patent results in reduced or eliminated bit walking during cutting, this does not affect my opinion that the challenged claims are obvious. A POSA would have known that the use of a split-tip point on a drill bit results in the reduction of elimination of bit walking, especially when the drill initially contacts the workpiece. This advantage was also discussed in the prior art, *e.g.* “[the drill] shall be readily started into the material to be drilled.” Ex-1006, p. 1, col. 1:7-8. This so-called “advantage” could not be considered unexpected.

36. To the extent that Patent Owner claims that the design shown in the ’583 patent results in allowing users to drill large-diameter holes in thin workpieces like sheet metal with a twist drill...without the need to first drill a pilot hole (and thus eliminating the need to switch drill bits), this does not affect my opinion that the challenged claims are obvious. A POSA would have known that the stepped drills shown in at least Ex-1006, Ex-1007, and Ex-1008 would permit

the drilling into a workpiece without requiring a pilot hole. Bannister explains this is exactly how his drill works. *See* Ex-1006, p. 2, col. 2:49-55. This so-called “advantage” could not be considered unexpected.

37. Many of the advantages that Patent Owner may impute 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.

38. Many of the advantages that Patent Owner may impute 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.

VIII. Conclusion

39. In signing this declaration, I understand that the declaration will be filed as evidence in the contested case before the Patent Trial and Appeal Board of the United States Patent and Trademark Office. I acknowledge that I may be subject to cross-examination in this case and that such cross-examination will take place within the United States. If cross-examination is required of me, I will appear for cross-examination within the United States during the time allotted for cross-examination.

40. I declare that all statements made herein of my knowledge are true, and all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Date: January 16, 2024

By: 
Steven R. Schmid Ph.D.