

Viking Drill & Tool, Inc.

v.

Hongjia Wang

IPR2023-00473 and IPR2023-00474
(U.S. Patent No. 11,007,583)

PATENT OWNER'S
DEMONSTRATIVE
EXHIBIT

1

Contents (IPR2023-00473)

- The '583 Patent and Background of the Invention
- Priority
- Non-Obviousness
 - Wang in view of Gentry and Durfee
 - Bannister in view of Zhou or Welty
 - Bannister in view of Zhou or Welty and Korb
- Strong Secondary Considerations of Non-Obviousness

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Contents (IPR2023-00474)

- Lack of Anticipation by Zhou
- Non-Obviousness
 - Zhou in view of Bannister, Gentry and Durfee
 - Welty in view of Bannister, Durfee, and Korb
 - Welty in view of Bannister, Durfee, Korb, and Zhou

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

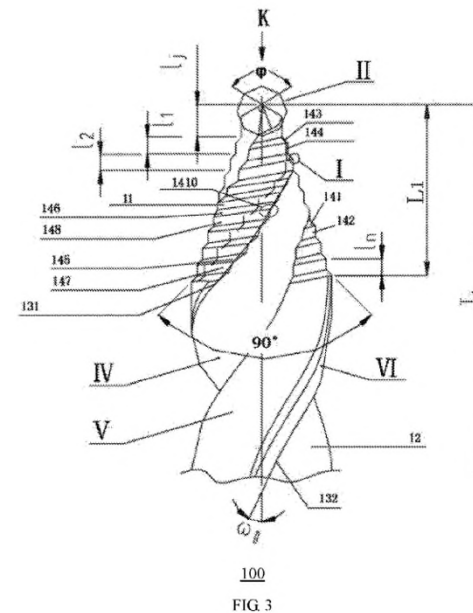
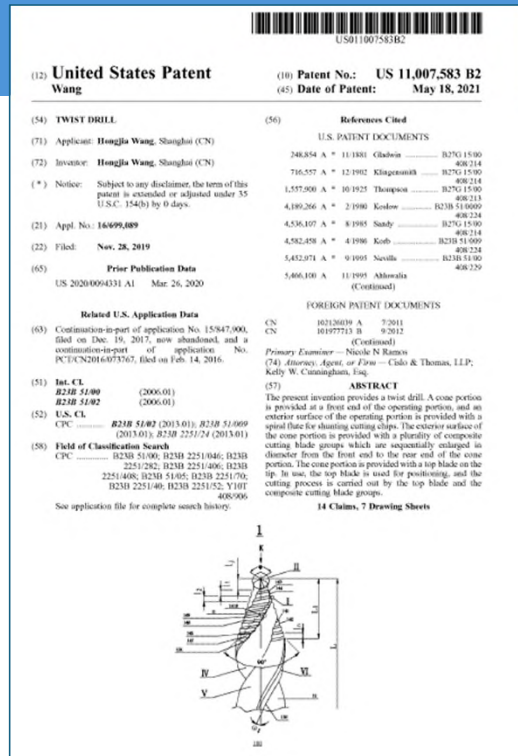
3

The '583 Patent and Background of Invention

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The '583 Patent



Ex. 1001 at Fig. 3

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

Types of Drill Bits – Twist Drills

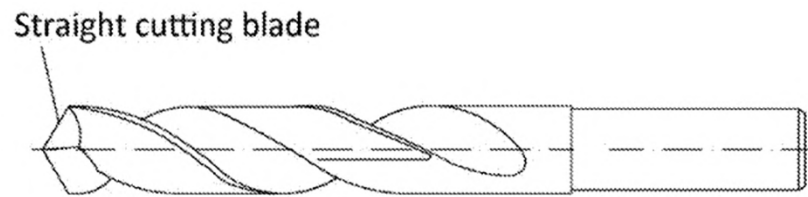


FIG. 1A (Prior Art)

Twist Drill

- Most common drill
- Drills holes of set diameter
- 29 standard sizes; 8 silver & deming sizes

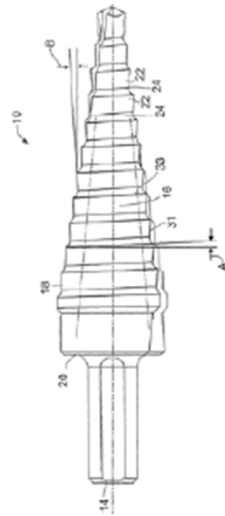
Ex. 1001 at Fig. 1A

Ex. 2034 (473) at ¶ 152; Ex. 1004 (473) at ¶ 37.

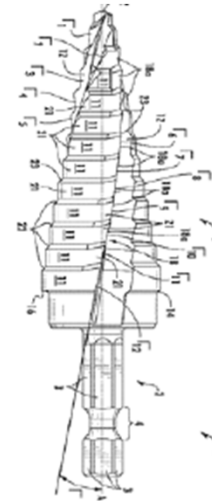
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

6

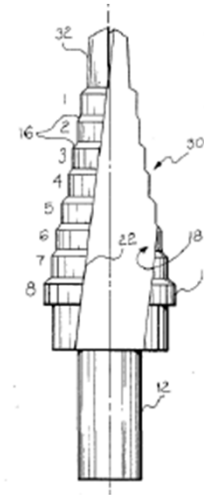
Types of Drill Bits – Step Drills



U.S. 8,029,215 (Gentry)
(FIG. 1)



U.S. 10,058,929 (Durfee)
(FIG. 1)



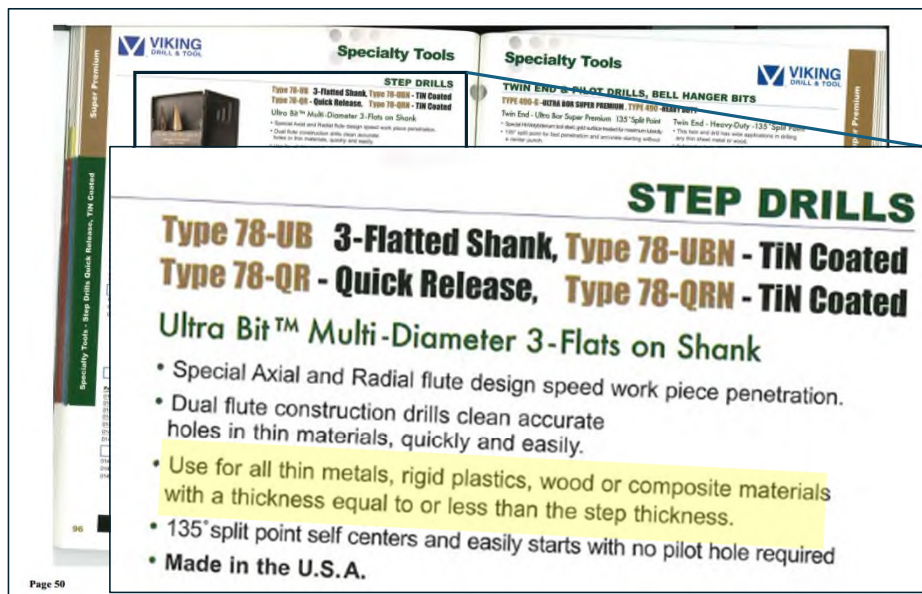
U.S. 4,582,458 (Korb)
(FIG. 7)

Paper 1 (473) at 2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Types of Drill Bits – Step Drills



Step Drills

- Used for thin materials (step thickness)
- Drills holes of multiple different diameters, depending on step
- Users typically drill slowly to feel number of steps

Paper 54 (473) at 14, 19

Ex. 1023 at p.50

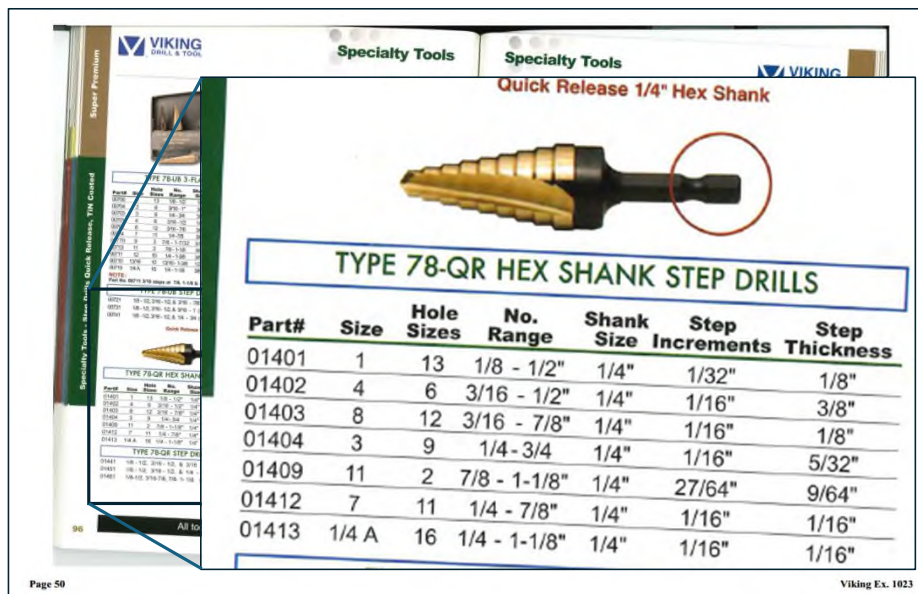
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

8

Types of Drill Bits – Step Drills

Step Drills

- Cylinder narrower than cone portion
- Cylinder shorter than cone portion
- Only one cutting blade engages at a time



Paper 54 (473) at 14, 19; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Types of Drill Bits – Gun Drills

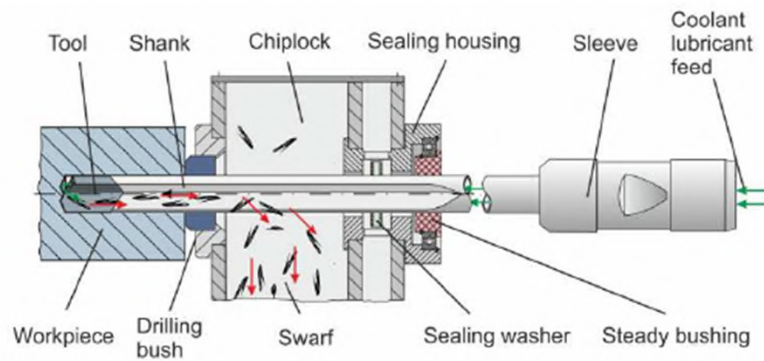
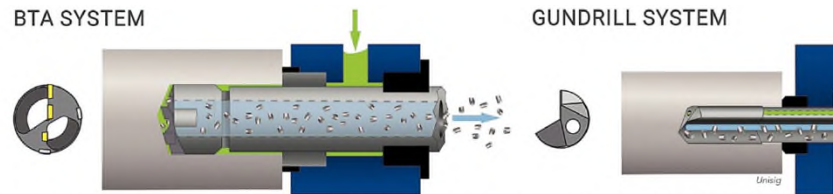


Fig. 20. Schematic process principle single-lip drilling [70,189]



Compared with gundrilling, in which through-tool coolant is introduced at the cutting zone and forces chips out through the drilled bore, the BTA system essentially operates in reverse.

Gun Drills

- Used to drill very deeply into material
- Lubricant used to remove swarf
- Single, straight V-shaped flute

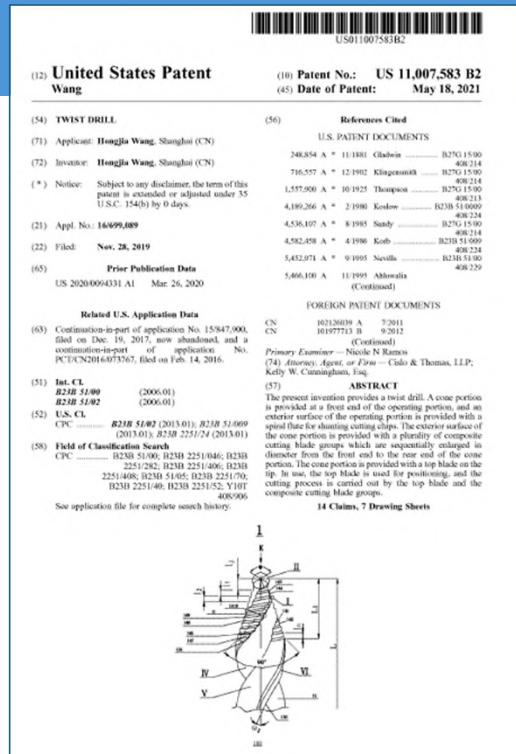
Ex. 2003 at ¶ 43; Ex. 2099 at 11-12

Ex. 2101 at 9; Ex. 2100 at 4; Ex. 2102 at 2.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The '583 Patent



Ex. 1001 ('583 Patent)

Advantages

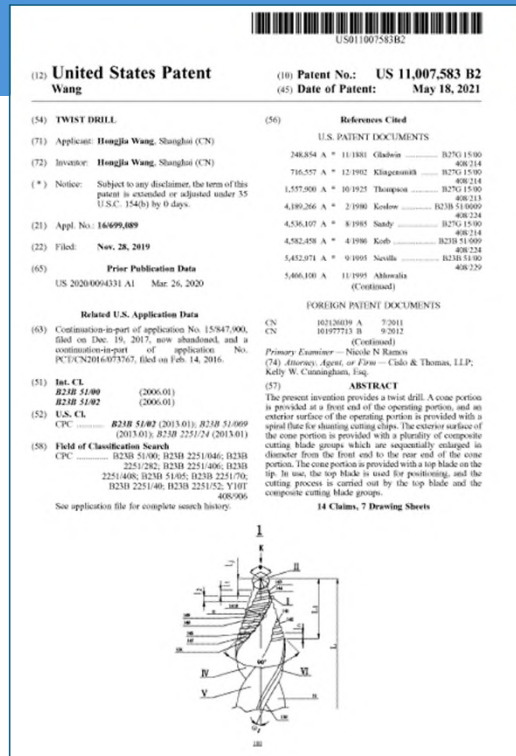
- Reduced cutting resistance
- Increased precision
- Smoother drilling
- Increased lifetime of drill bit
- Increased stability with even distribution of cutting force

Ex. 1001 at 9:14-31, 48-61

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The '583 Patent



Advantages

- Faster penetration rate
- Improved durability
- Improved chip evacuation
- Reduced or eliminated bit walking
- No pilot hole

Ex. 2034 at ¶ 164; Paper 28 (473) at 5-6

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Priority

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Priority Applications

PCT/CN2016/073767

• Filed February 14, 2016

Ex. 1019

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(30) World Intellectual Property Organization International Bureau

(43) International Publication Date
17 August 2017 (17.08.2017)

(51) International Patent Classification:
B21D 13/02 (2006.01)

(21) International Application Number: PCT/CN2016/073767

(22) International Filing Date: 14 February 2016 (14.02.2016)

(25) Filing Language: Chinese

(26) Publication Language: Chinese

(71) Applicant: SHANGHAI TEGAFRAL ENTERPRISES CO., LTD. (CN/CN); No. 204 Xinyang Road, Xinyang Town, Songjiang District, Shanghai, China 201612 (CN)

(72) Inventor: WANG, Hongjin; No. 288 Xinyang Road, Xinyang Town, Songjiang District, Shanghai, China 201612 (CN)

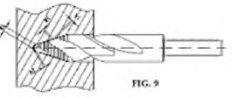
(74) Agent: FANG & ASSOCIATE; 710 Tower C, Yanghe Mansion, No. 28 Andingmen East Street, Dongcheng District, Beijing, 100007 (CN)

(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LU, LV, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SI, SK, SL, SV, SY, TH, TI, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, PG, SD, SI, ST, SZ, TZ, UG, ZM, ZW), Eurasia (AM, AZ, BY, KG, KZ, RU, TJ, TM), Europe (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GN, GD, GW, KM, ML, MR, NE, SN, TD, TG)

The international publication: — including international search report (PCT 21 (3))

(54) Title: HIGH EFFICIENCY STEP-STRUCTURED TWIST DRILL



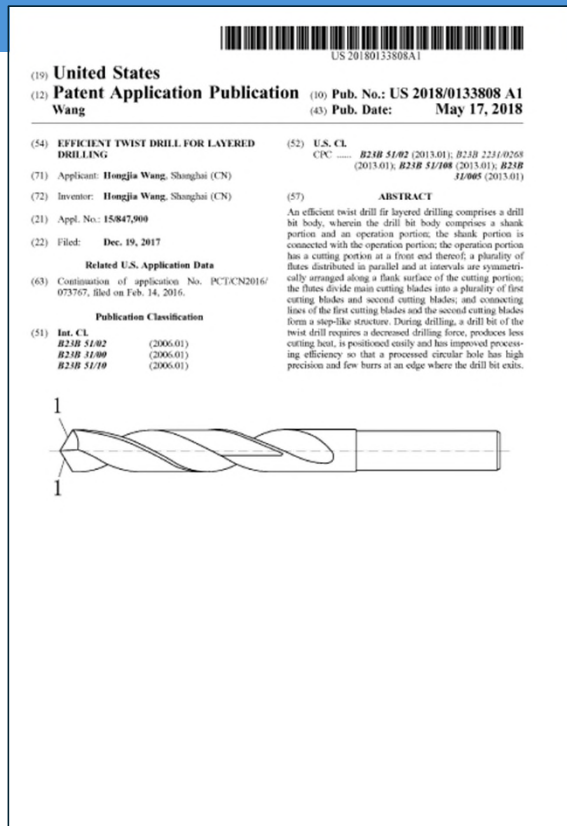
(57) Abstract: A high efficiency step-structured twist drill comprises a drill bit body (2). The drill bit body (2) comprises a shank portion and an operation portion. The shank portion is connected to the operation portion. The operation portion has a cutting portion at a front end thereof. A plurality of flutes (4) arranged in parallel and spaced apart from each other are provided symmetrically along a rear surface (3) of the cutting portion. The flutes (4) divide a main cutting blade into a plurality of first cutting blades (5) and second cutting blades (6). Connecting lines of the first cutting blades (5) and the second cutting blades (6) form a stepped structure. When drilling a hole, the drill bit of the twist drill requires a decreased drilling force, produces less drilling heat, can be positioned easily, and has improved processing efficiency, such that the drilled hole has a high precision and few burrs at an edge where the drill bit exits.

WO 2017/136966 A1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Priority Applications



U.S. App. No. 15/847,900

- Filed December 19, 2017
- Published May 17, 2018
- Claims priority to '767 Application

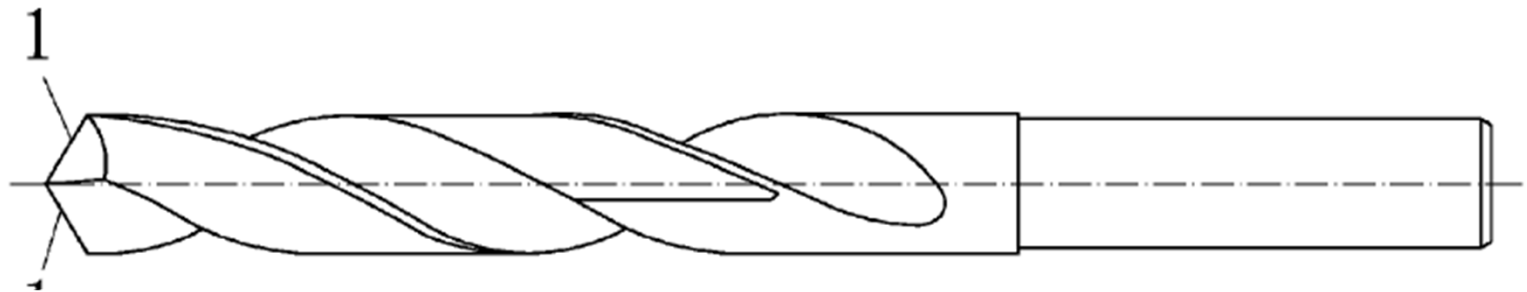
Ex. 1009

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

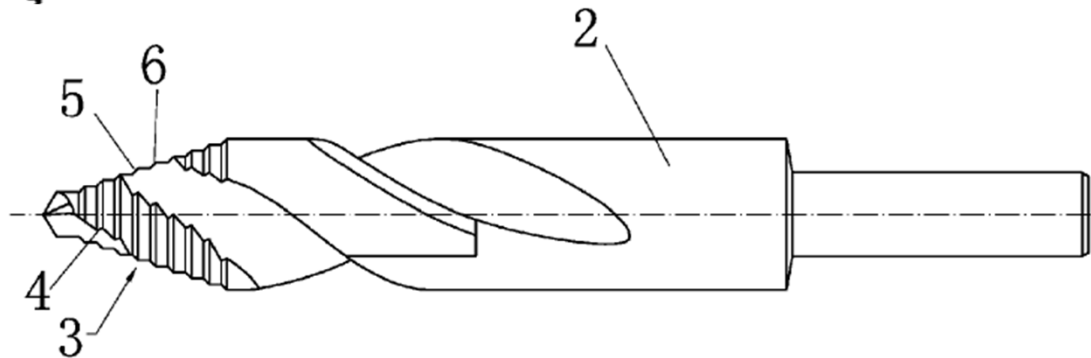
15

The '900 Application

Prior Art



Invention

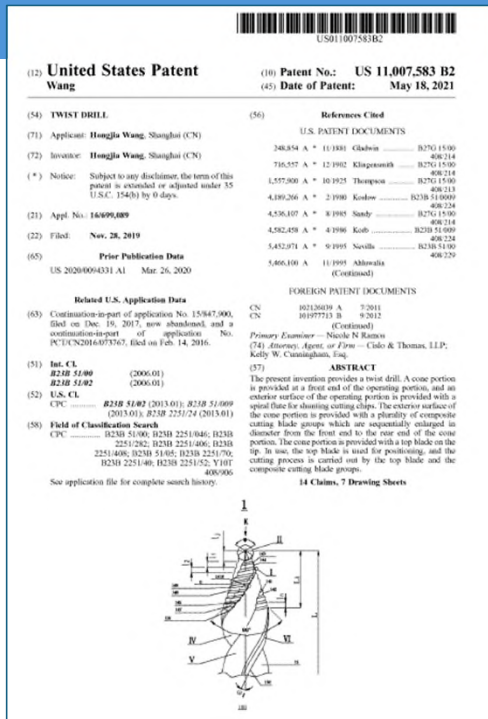


Ex. 1009 at Fig. 1 (Prior Art) and Fig. 5 (Invention)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Disputed Limitation



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, each of the plurality of composite cutting blade groups comprising:

Ex. 1001 at Cls. 1, 8 (pp. 14-15)

Ex. 2073 (Priority Claim Chart)

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Board's Construction

Trials@uspto.gov
571-272-7822

Paper 13
Date: July 10, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.,
Petitioner,

v.

HONGJIA WANG,
Patent Owner.

IPR2023-00473
Patent 11,007,583

Before WILLIAM V. SAINDON, JAMES J. MAYBERRY, and
CYNTHIAL. MURPHY, *Administrative Patent Judges*.

SAINDON, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

415 F.3d at 1312–13. We adopt Petitioner’s construction for purposes of this Decision, based on the visual disclosure in Figure 3 of the ’583 patent and the paucity of any further description. Specifically, we construe “spirally” formed cutting blades to be cutting blades that are not perpendicular to the drill bit’s rotational axis, which would include a cutting blade with axial relief.

Paper 13 (473) at 11

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Written Description Tested From Perspective Of POSA, With Understanding Of Art

Viking Admits Axial Relief Is Ubiquitous

workpiece surfaces is reduced. Ex-1004, ¶150. Additionally, the provision of such relief is common and well-known in the industry, and so a POSA would have a reasonable expectation that the provision of such relief would be successful at providing clearance between Wang's drill bit and the workpiece. Ex-1004, ¶151.

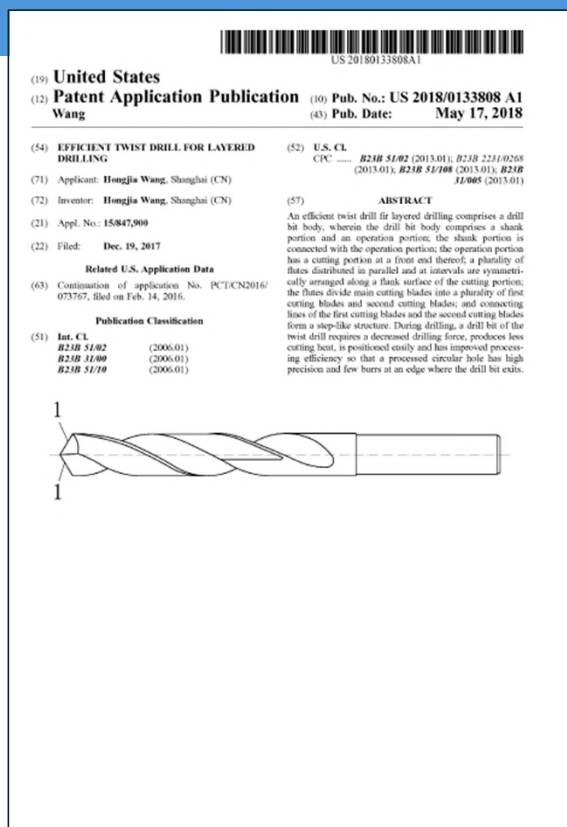
Paper 1 at 50; Ex. 1004 at ¶ 151; Ex. 2034 at ¶ 11; Paper 54 at 7-8; Paper 28 at 9

Hologic, Inc. v. Smith & Nephew, Inc., 884 F.3d 1357, 1362 (Fed. Cir. 2018); *Inphi Corp. v. Netlist, Inc.*, 805 F.3d 1350, 1354–55 (Fed. Cir. 2015)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Priority Application's Use of Flutes



[0006] 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, wherein 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.

Ex. 1009 at [0006]

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Priority Application's Use Of “Flutes”

Trials@uspto.gov
571-272-7822

Paper 13
Date: July 10, 2023

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.,
Petitioner,

v.

HONGJIA WANG,
Patent Owner.

IPR2023-00473
Patent 11,007,583

Before WILLIAM V. SAINDON, JAMES J. MAYBERRY, and
CYNTHIAL. MURPHY, *Administrative Patent Judges*.

SAINDON, *Administrative Patent Judge*.

DECISION
Granting Institution of *Inter Partes* Review
35 U.S.C. § 314

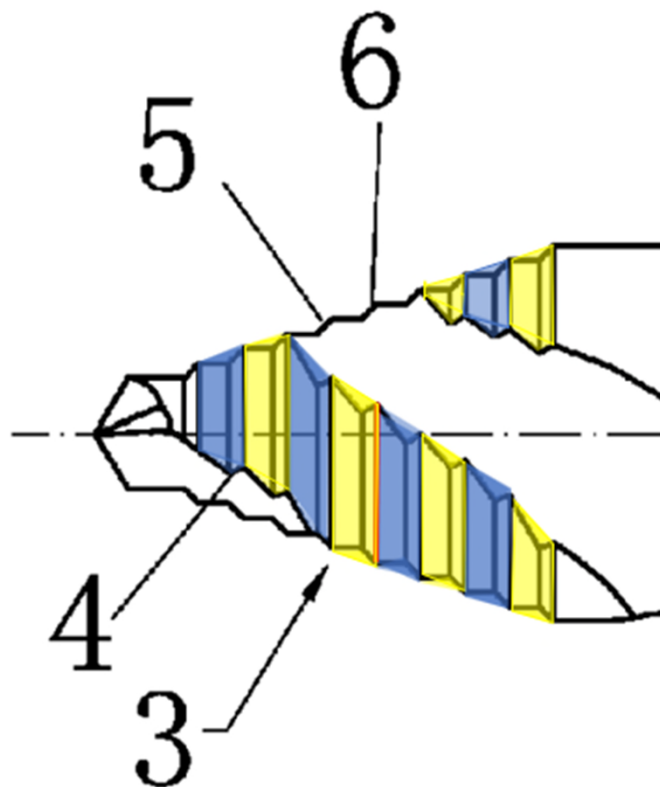
argument. Looking at paragraphs 6 and 10 of Wang, we agree with Patent Owner's characterization of the term *flute* here being a reference to the material removed in order to form the two cutting blades. *See also* Prelim. Resp. 16 (noting the blue triangles that create the conical and cylindrical

Paper 13 (473) at 17

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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“Flutes”



Paper 28 (473) at 11
Ex. 2034 at ¶ 15

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

22

The Priority Application Teach Axial Relief

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

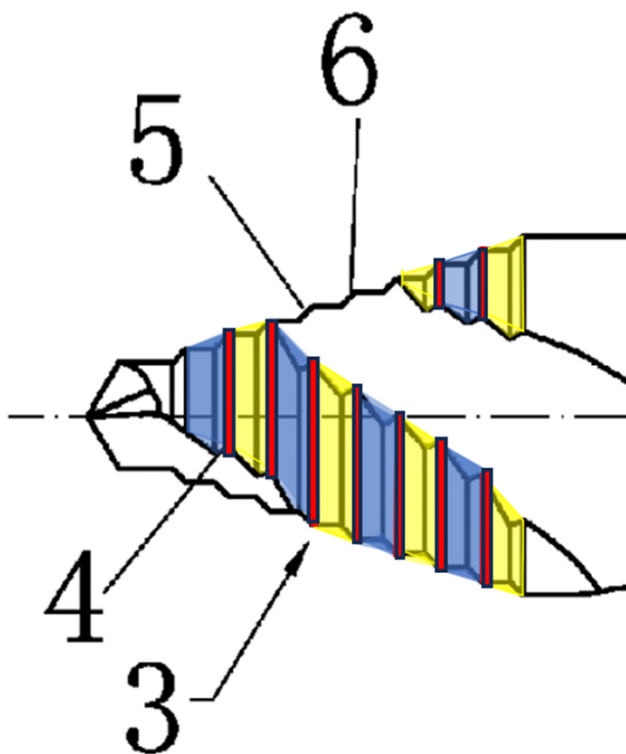
[0035] The flutes of the present disclosure may be arc-shaped flutes adapted to a radian of the flank surface, or the connecting lines of the flutes form a spiral structure, The ladder-like cutting blade of the present disclosure can be applied to drilling cutting tools such as screw taps, expanding drills, countersink drills, reamers, etc. Even only one ladder-like drill bit is arranged, While the ladder-like drill bit can be combined with different cutting tools.

Ex. 1009 at ¶¶ [0010], [0035]

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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“Connecting lines of the flutes”

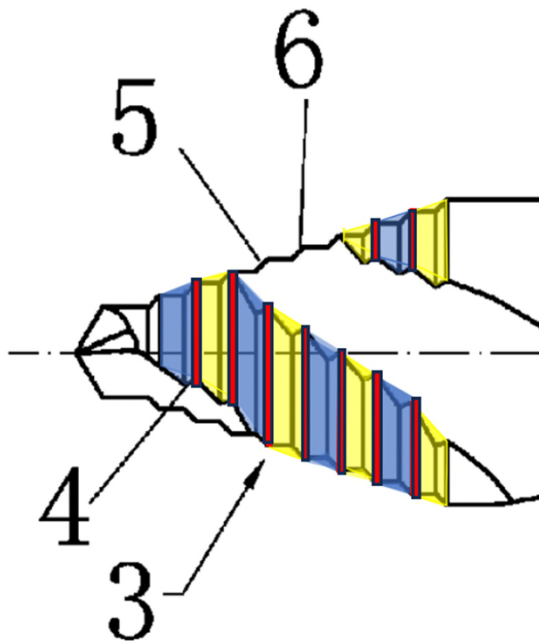


Paper 28 (473) at 12-13
Ex. 2034 at ¶¶ 18-19

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The “connecting lines of the flutes” form a spiral structure, i.e. axial relief



Paper 28 (473) at 12-13
Ex. 2034 at ¶¶ 18-19

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

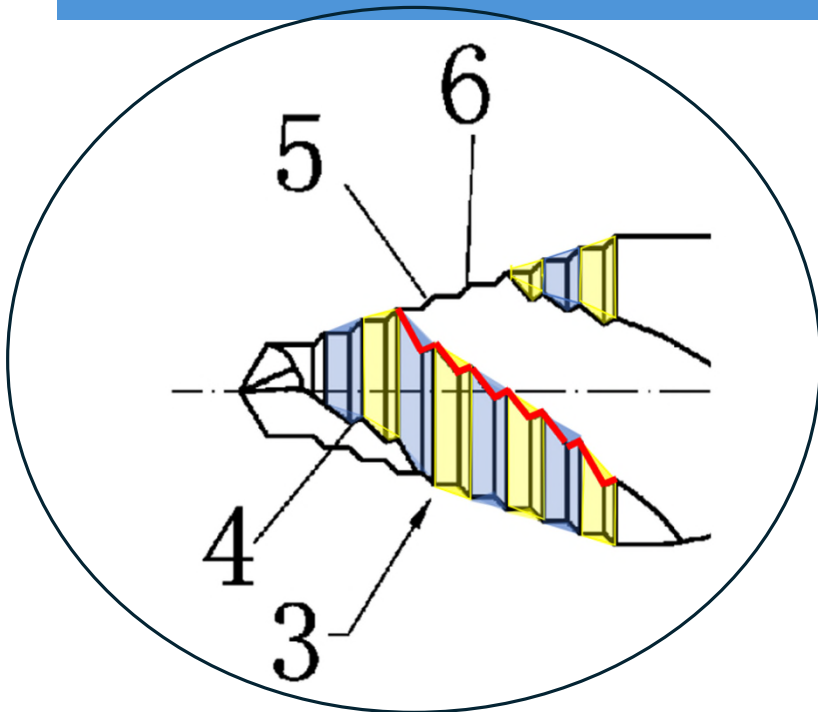
[0035] The flutes of the present disclosure may be arc-shaped flutes adapted to a radian of the flank surface, or the connecting lines of the flutes form a spiral structure. The ladder-like cutting blade of the present disclosure can be applied to drilling cutting tools such as screw taps, expanding drills, countersink drills, reamers, etc. Even only one ladder-like drill bit is arranged, While the ladder-like drill bit can be combined with different cutting tools.

Paper 28 (473) at 13
Ex. 2034 at ¶ 20

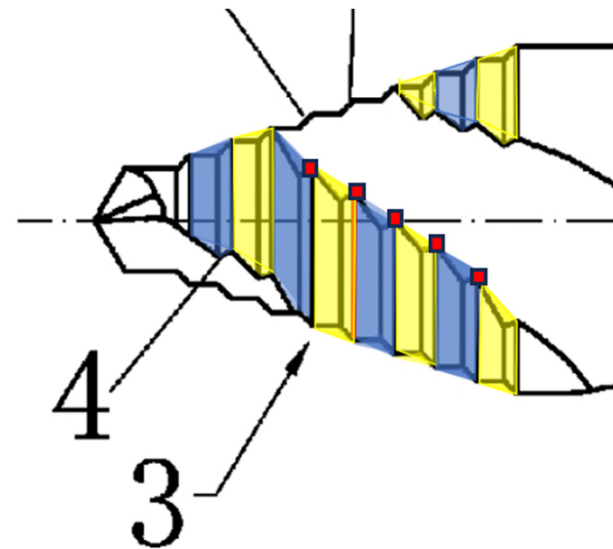
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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“Lines along the leading edge of the cutting blades”



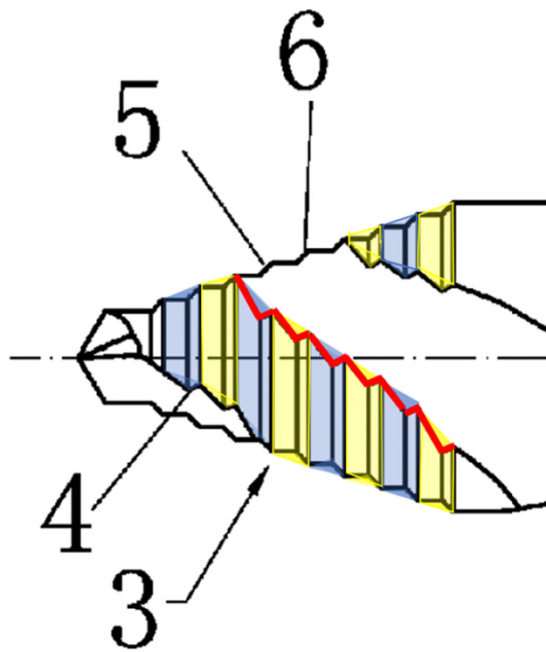
Paper 28 at 14-15; Paper 54 at 5; Ex. 2034 at ¶¶ 24-26
Paper 45 at 5



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The “connecting lines of the first cutting blades 5 and the second cutting blades 6”



Paper 54 (473) at 5
Ex. 2003 at ¶ 19

[0006] 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, wherein 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.

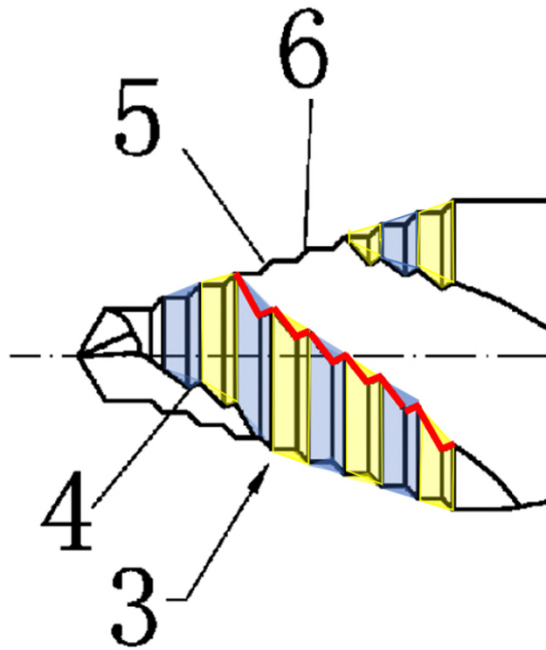
[0031] second cutting blades 6; and connecting lines of the first cutting blades 5 and the second cutting blades 6 form a step-like structure (which can also be called a ladder-like structure), i.e., the main cutting blades of the present disclosure are step-like structures. Meanwhile, a cross section

Ex. 1001 at ¶¶ [0006], [0031]

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking's Interpretation Makes No Sense



Paper 54 (473) at 5

- Inconsistent with use of “flutes”
- “Connecting lines of the flutes 4” is distinct from “connecting lines of the first cutting blades 5 and the second cutting blades 6”
- Renders meaningless “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”

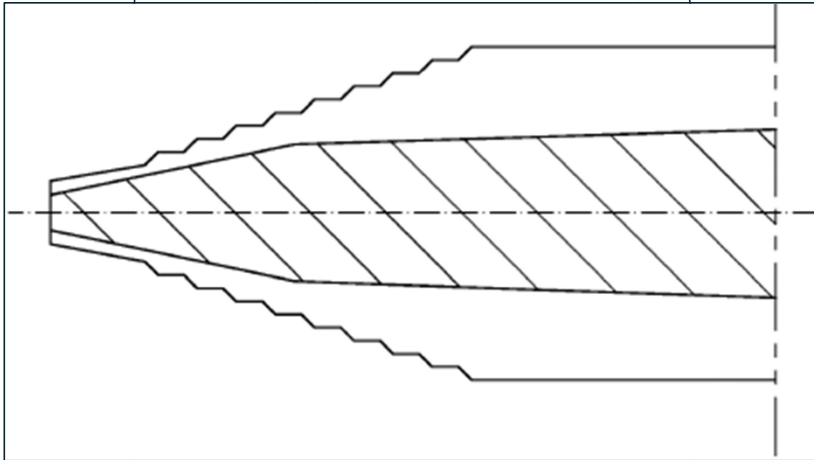
Paper 28 at 14-18; Ex. 2034 at ¶¶ 24-32, 38-40; Paper 54 at 3-6

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The '900 Application Teaches Axial Relief Elsewhere

(19) United States
(12) Patent Application Publication (10) Pub. No.: US 2018/0133808 A1
Wang (43) Pub. Date: May 17, 2018
(54) EFFICIENT TWIST DRILL FOR LAYERED DRILLING (52) U.S. CL. CPC B21B 51/02 (2013.01); B21B 223/0268 (2013.01); B21B 51/08 (2013.01); B21B 51/065 (2013.01)
(71) Applicant: Hongjia Wang, Shanghai (CN)



Ex. 1009 at Fig. 13

Certainly, except the main cutting blades, all flank surface portions can also be of other shapes. The flank surface adopts a ladder-like, structure so that the flank surface does not touch workpieces during cutting; secondly, the strength of the flank surface is enhanced; and thirdly, the flank surface is processed conveniently during manufacturing. The second cutting blades 6 are parallel to an axis line of the drill bit body, or an angle of 0-20 degrees is formed between the second cutting blades 6 and the axis line of the drill bit body so that tail ends of the second cutting blades 6 are inclined downwards, and only starting ends of the second cutting blades (i.e., tops of the first cutting blades) touch the workpieces during cutting, as shown in FIG. 13.

Ex. 1009 at ¶ [0031]; Paper 28 (473) at 20-21;
Paper 54 at 6-7.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Merely A Simplified Drawing

'900 Application

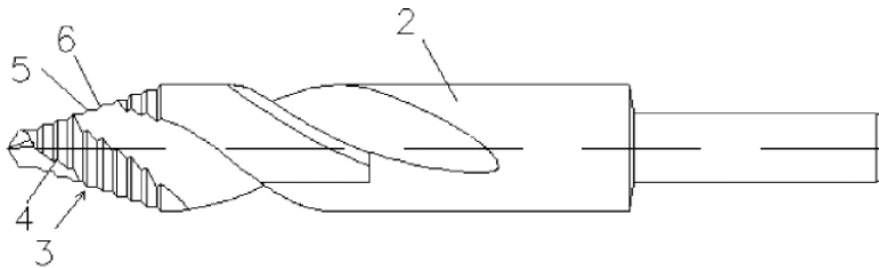
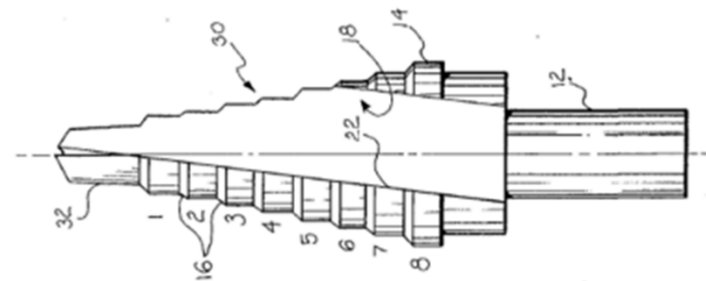


FIG. 5

Ex. 1009 at Fig. 5

Korb



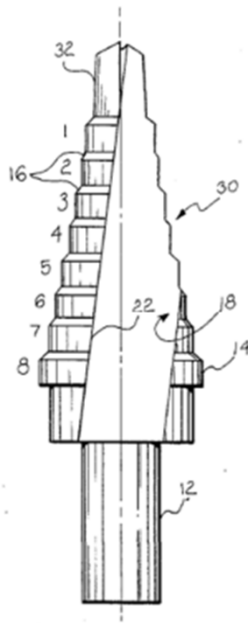
Ex. 1012 at Fig. 7

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Merely A Simplified Drawing

Korb



Axial Relief Unambiguously Taught

At each cutting edge the cylindrical surfaces are relieved radially and the conical surface is relieved axially over an acute circumferential angle. The major peripheral portions of the cylindrical and conical surfaces for each diameter are respectively concentric to the axis of the drill and of zero pitch angle.

surfaces of the drill. These radiused surfaces provide the cutting edges and each radiused cutting edge is “backed off” and axially “relieved” to provide clearance behind for cutting edges. In effect, the cutting edges thus have

Ex. 1012 at Abstract, 1:19-22

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Shibata (Wang '900 Application Exam)

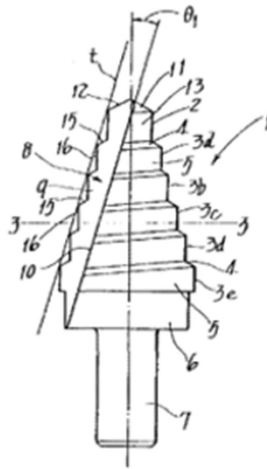


Fig. 1

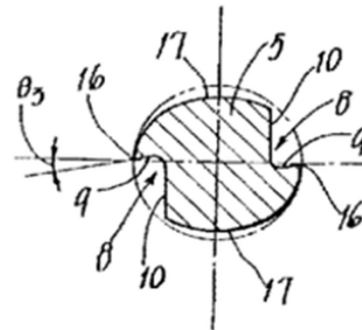


Fig. 3

Paper 28 at 18-20; Ex. 2034 at ¶¶ 35-37
Ex. 1018 at pp. 9, 145; Ex. 1015, Figs. 1 and 3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

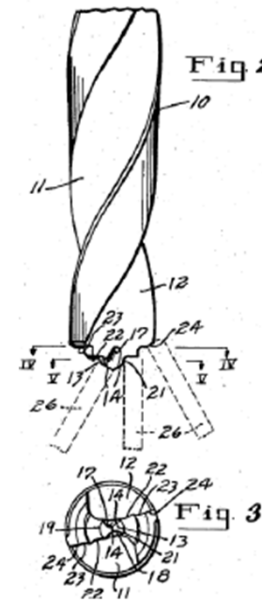
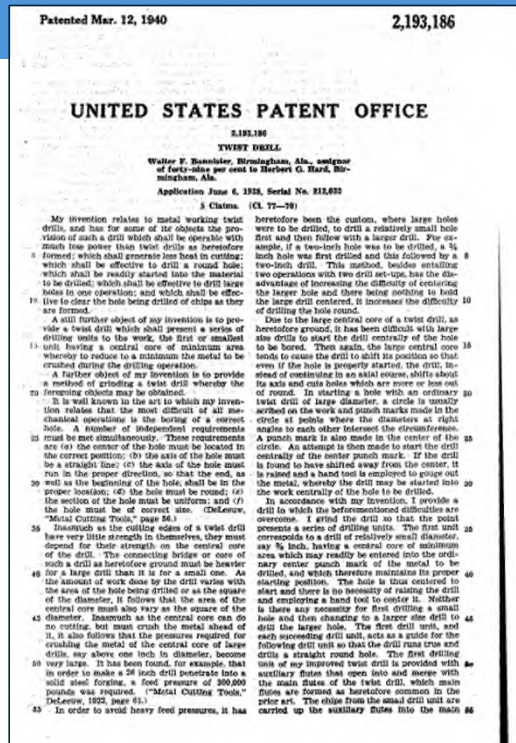
32

Bannister in View of Zhou, Welty, and/or Korb

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Bannister



Ex. 1006 at Figs. 2-3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Zhou

CN 203356678 U (19) National Intellectual Property Administration, PRC	
(12) Utility Model Patent	
(10) Grant announcement no.: CN 203356678 U (45) Grant announcement date: December 25, 2013	
(21) Application no.: 201320060502.4 (22) Filing date: February 1, 2013 (73) Patentee: ZHOU Anshan Address: 2nd Floor, Guoke Yuke Building, Xiyang District, Haikou City, Hainan Province 570314 (72) Inventor: ZHOU Anshan (74) Patent agency: Haikou Xiangxiang Patent Agency Co., Ltd. 46001 Agent: Li Yong (51) Int. Cl. B23B 51/02 (2006.01) (ESM) An application for an invention patent has been made on the same date for the same invention/creation (54) Title of utility model Twist drill having main cutting edge segments and asymmetrical edge heights (57) Abstract The present utility model is a twist drill having main cutting edge segments and asymmetrical edge heights. It comprises a twist drill body (9), an edge back (10), a central drill tip (5) and a chisel edge (8), characterized in that the twist drill further comprises two main cutting edge segments which have asymmetrical edge heights on the same circumference; wherein one main cutting edge segment is divided into one segment as a segmented outer protruding edge (1) and another segment as a segmented inner sunken edge (3), corresponding to said one main cutting edge segment on the same circumference, the other main cutting edge segment has one segment as a segmented outer sunken edge (2) and another segment as a segmented inner protruding edge (4); and the twist drill further comprises a segmented outer protruding edge swarf separation groove (6) and a segmented inner protruding edge swarf separation groove (7). Beneficial effects of the present utility model: reduced drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, further increasing drilling efficiency and drill bit durability.	Claims: 1 page Description: 2 pages Accompanying drawings: 3 pages

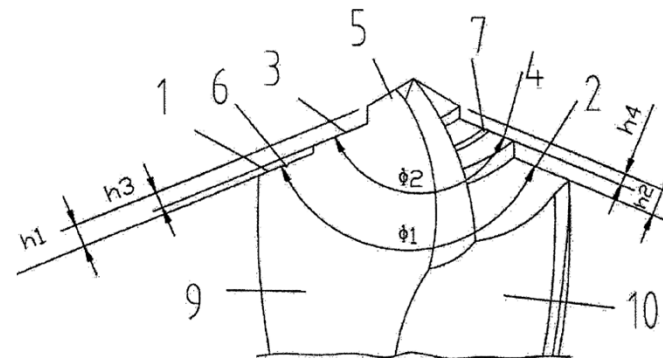


Fig. 1

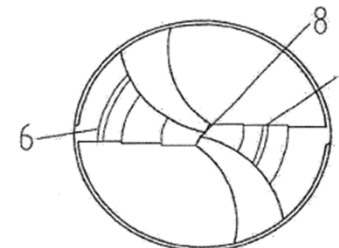


Fig. 2

Ex. 1007 at Figs. 1-2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

35

Welty

Patented Mar. 17, 1942

2,276,532

UNITED STATES PATENT OFFICE

2,276,532

DRILL

Earl F. Welty, Center Valley, Pa., assignor to
Schlumberger Steel Company, a corporation of
Pennsylvania

Application May 25, 1940, Serial No. 237,755

3 Claims. (Cl. 77-67)

My invention relates to drills and particularly drills for operating on metals.

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 automatically increase in diameter as from the initial cutting step so that the work may be easily drilled.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawing in which:

Figure 1 is a plan view of the drill shown in the material being drilled;

Figure 2 is an end view of the drill shown in Figure 1;

Figure 3 is a section taken along line 3-3 of Figure 1;

Figure 4 is a section taken along line 4-4 of Figure 1; and

Figure 5 is a section taken along line 5-5 of Figure 1.

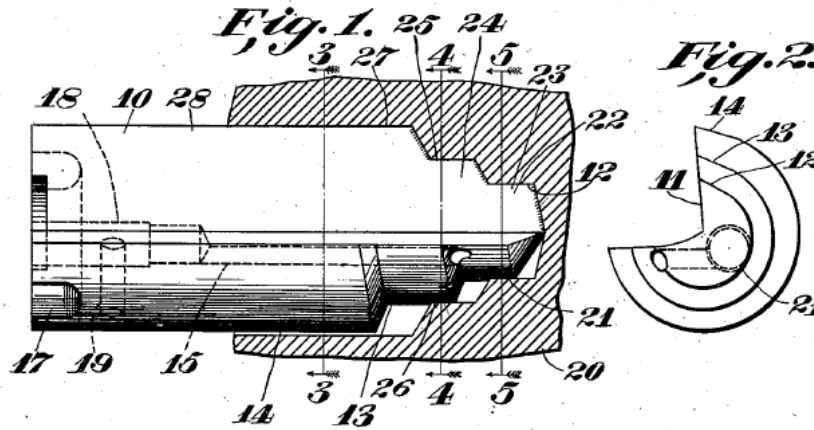
Referring to the drawing in detail, 18 designates a drill which is provided with a shank 11 for removing chips, which are used by the boring operation. Drill 18 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and cleaning the chips from the drill. Cross groove 16, hole 17, and hole 19 are provided to receive means for attaching the drill to a drill chuck.

Referring to Figures 1 and 2, the nose or cutting end of drill 18 is provided, as heretofore mentioned, with three boring portions 12, 13, and 14 which are substantially in the form of segments of a circle. The boring portion 12, is ground so as to form a heel 21 on a portion of the periphery of the body portion 22 approximately opposite the cutting edge 23 as is clearly shown in Figure 3. The heel 21 is so formed with relation to the cutting edge that the major por-

tion of the body portion is out of contact with the work 24 during the boring operation and therefore binding of the drill in the work is prevented. The boring portion 13 has a body portion 24 of larger diameter than body portion 22 of boring portion 12. The body portion 24 is provided on its periphery approximately opposite its cutting edge 25 with a heel portion 26 similar to heel 21. The heels 21 and 26 also serve as bearing supports for the cutting edges 23 and 25, respectively. Boring portion 14 is provided with a cutting edge 27 which merges into the body portion 28. The body portion 28 is of larger diameter than the body portion 24 of the boring portion 13.

Upon reference to Figure 2 it will be observed that the boring portion 14 is of circular formation and has a cutting edge 27 which extends an appreciable distance outside the normal circumference of the boring portion 14 to contact with the work during the boring operation. The body portion 14 does not have a heel portion provided on the periphery of its body portion 28 opposite its cutting edge 27 in contact with the work as do the boring portions 12 and 13. As a result the heels 21 and 26 of boring portions 12 and 13, respectively, will not only retain the cutting edges 23 and 25 of boring portions 12 and 13, respectively, in contact with the work but will retain the cutting edge 27 of boring portion 14 in contact with the work and also retain the body portion 28 in spaced relation with the work.

During the boring operation the boring portion 12 comes in contact with the work 24 and bores a preliminary hole therein, the boring portion 13 contacting the walls of the bore at its cutting edge 25 and at its heel 26. The boring portion 13 which has a cutting action similar to that of boring portion 12 then comes into operation. This portion 13 is of greater diameter than the boring portion 12 and will also contact the walls of the bore only at its cutting edge 25 and its heel 26 of its body portion 24. The cutting edge 27 of the boring portion 14 then comes into operation and contacts the work as shown in Figures 1 and 2, the body portion 28 being retained out of contact with the work due to the heel portions 21 and 26 of the boring portions 12 and 13, respectively, contacting with the walls of the bore. As only the cutting edge 27 of the body portion 28 comes into contact with the work the binding and breakage of the body portion of the drill which invariably occur in other known drills, are eliminated, and also it will require considerably less power to operate the drill.



PAGE 2

FIG. 10-13

Ex. 1008 at Figs. 1-2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking Drill & Tool Inc. v. Wang
IPR2023-00473
Page 36

Welty

Patented Mar. 17, 1942

2,276,532

UNITED STATES PATENT OFFICE

2,276,532

DRILL

Earl F. Welty, Center Valley, Pa., assignor to
Schlumberger Steel Company, a corporation of
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Application May 25, 1940, Serial No. 237,755

3 Claims. (Cl. 77-671)

My invention relates to drills and particularly drills for operating on metals.

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 as from the initial cutting step so that the work may be easily drilled.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawing in which:

Figure 1 is a plan view of the drill shown in the material being drilled;

Figure 2 is an end view of the drill shown in Figure 1;

Figure 3 is a section taken along line 3-3 of Figure 1;

Figure 4 is a section taken along line 4-4 of Figure 1; and

Figure 5 is a section taken along line 5-5 of Figure 1.

Referring to the drawing in detail, 10 designates a drill which is provided with a shank 11 for removing chips, which are used by the boring operation. Drill 10 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and clearing the chips from the drill. Cross groove 16, hole 18, and hole 19 are provided to receive means for attaching the drill to a drill chuck.

Referring to Figures 1 and 2, the nose or cutting end of drill 10 is provided, as heretofore mentioned, with three boring portions 12, 13, and 14 which are substantially in the form of segments of a circle. The boring portion 12, is ground so as to form a heel 21 on a portion of the periphery of the body portion 22 approximately opposite the cutting edge 23 as is clearly shown in Figure 5. The heel 21 is so formed with relation to the cutting edge that the major por-

tion of the body portion is out of contact with the work 24 during the boring operation and therefore binding of the drill in the work is prevented. The boring portion 13 has a body portion 24 of larger diameter than body portion 22 of boring portion 12. The body portion 24 is provided on its periphery approximately opposite its cutting edge 25 with a heel portion 26 similar to heel 21. The heels 21 and 26 also serve as bearing supports for the cutting edges 23 and 25, respectively. Boring portion 14 is provided with a cutting edge 27 which merges into the body portion 28. The body portion 28 is of larger diameter than the body portion 24 of the boring portion 13.

Upon reference to Figure 3 it will be observed that the boring portion 14 is of circular formation and has a cutting edge 27 which extends an appreciable distance outside the normal circumference of the boring portion 14 to contact with the work during the boring operation. The body portion 14 does not have a heel portion provided on the periphery of its body portion 28 opposite its cutting edge 27 to contact with the work as do the boring portions 12 and 13. As a result the heels 21 and 26 of boring portions 12 and 13, respectively, will not only retain the cutting edges 23 and 25 of boring portions 12 and 13, respectively, in contact with the work but will retain the cutting edge 27 of boring portion 14 in contact with the work and also retain the body portion 28 in spaced relation with the work.

During the boring operation the boring portion 12 comes in contact with the work 24 and bores a preliminary hole therein, the boring portion 13 contacting the walls of the bore at its cutting edge 25 and at its heel 26. The boring portion 13 which has a cutting action similar to that of boring portion 12 then comes into operation. This portion 13 is of smaller diameter than the boring portion 12 and will also contact the walls of the bore only at its cutting edge 25 and its heel 26 of its body portion 24. The cutting edge 27 of the boring portion 14 then comes into operation and contacts the work as shown in Figures 1 and 2, the body portion 28 being retained out of contact with the work due to the heel portions 21 and 26 of the boring portions 12 and 13, respectively, contacting with the walls of the bore. As only the cutting edge 27 of the body portion 28 comes into contact with the work the binding and breakage of the body portion of the drill which invariably occur in other known drills, are eliminated, and also it will require considerably less power to operate the drill.

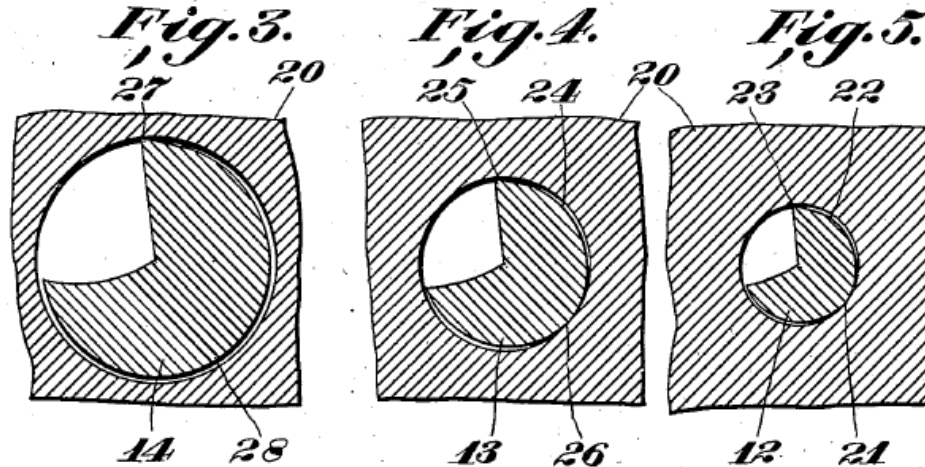


FIG. 2

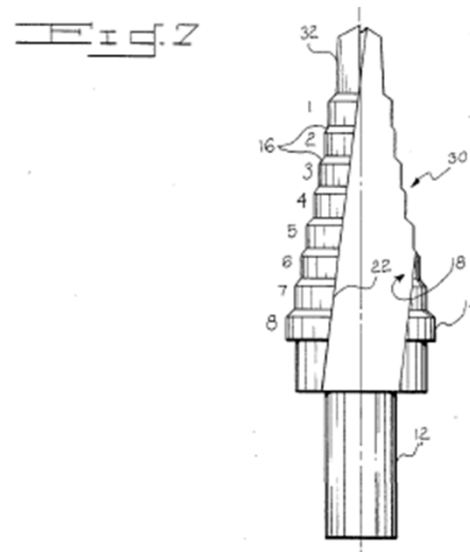
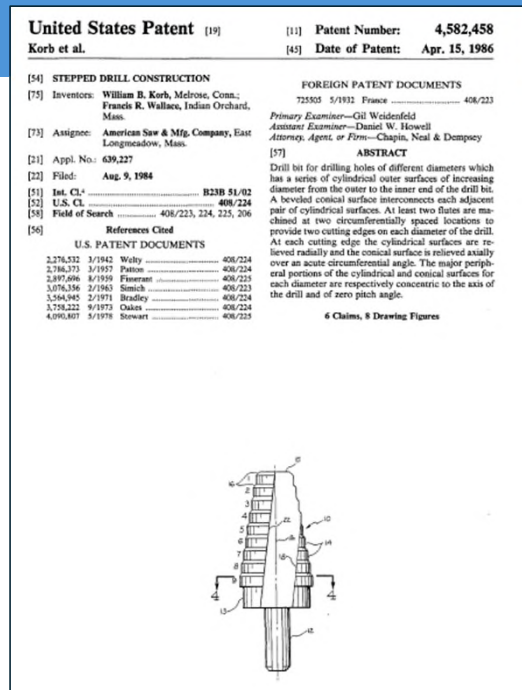
FIG. 3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

37

Ex. 1008 at Figs. 3-5

Korb

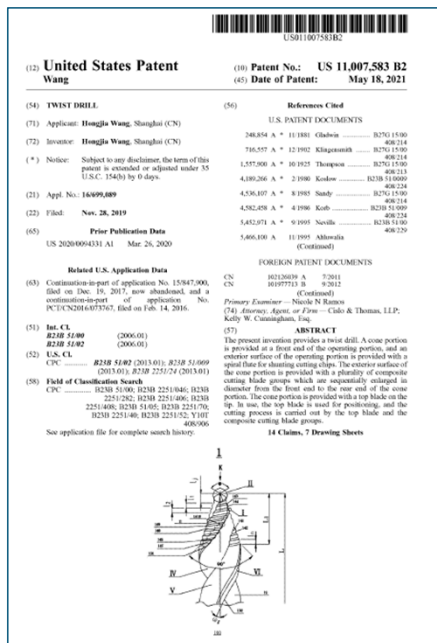


Ex. 1012 at Fig. 7

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

38

Conical First Step Surface



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, each of the plurality of composite cutting blade groups comprising:
a conical first step surface;

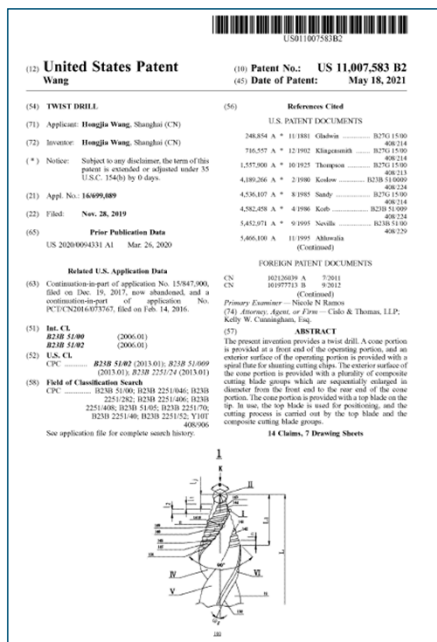
Ex. 1001 at Cls. 1, 8 (pp. 14-15)

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

39

Configured to crush cutting chips into finer chips



Ex. 1001 ('583 Patent)

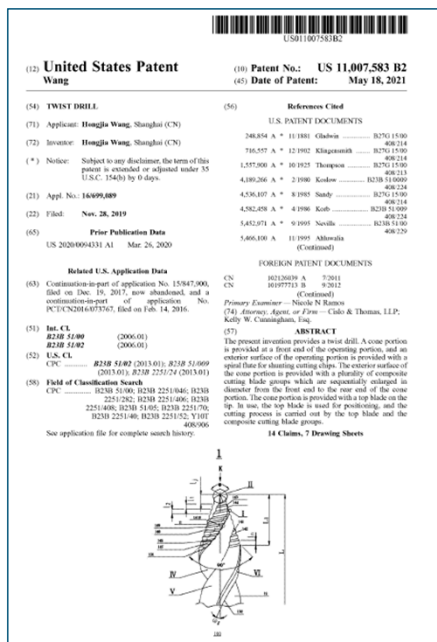
wherein a diameter of each of the plurality of composite cutting blade groups increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and

Ex. 1001 at Cls. 1, 8 (pp. 14-15)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

40

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



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

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

Ex. 1001 at Cls. 1, 8 (pp. 14-15)

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute

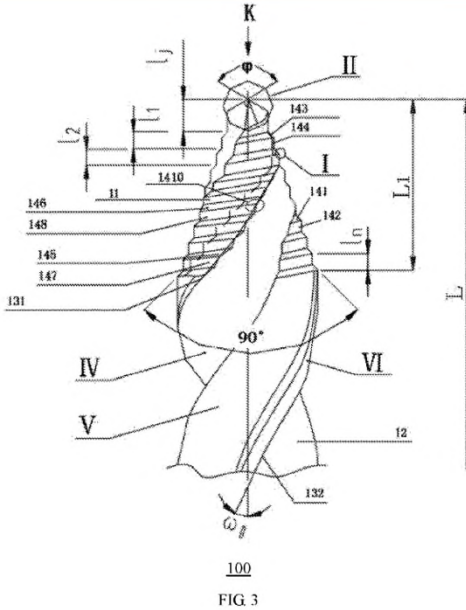
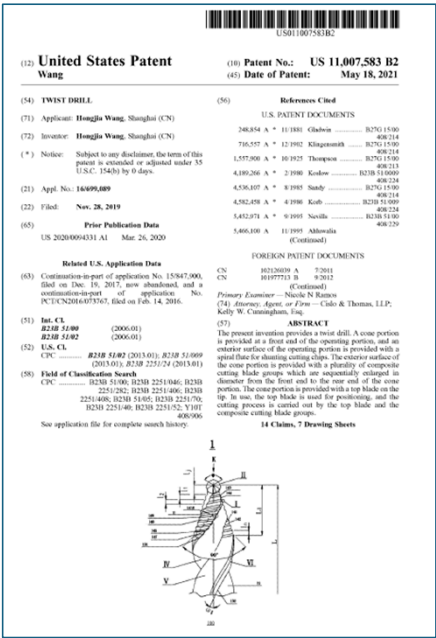
253. Cutting tips that are formed spirally are the natural result of having a flute on a cone portion of a stepped drill when the flute is cut at any angle other than parallel to the axis of a drill (i.e., perfectly vertical). This is a consequence of having the cutting tips be formed where the steps 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

Ex. 1004 at ¶ 253; Ex. 1001 at 5:9-11

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

42

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



Ex. 1001 at Fig. 3

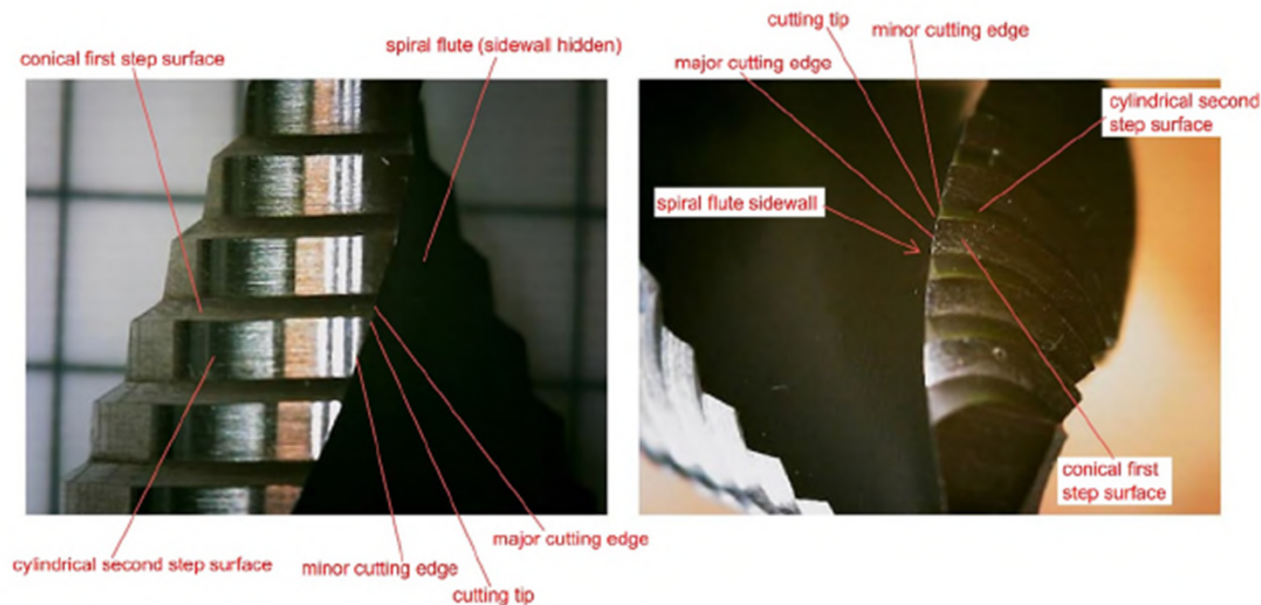
Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking Drill & Tool Inc. v. Wang
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Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute

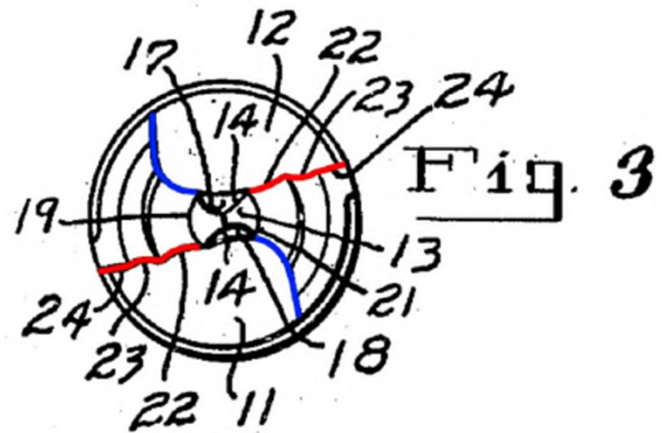


Paper 28 at 27-30; Paper 54 at 12; Ex. 2034 at ¶¶ 49-51
Ex. 1004 at ¶ 253; Ex. 1001 at 5:9-11

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

44

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



Paper 28 at 30

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

45

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Viking Drill & Tool Inc. v. Wang
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Improper Hindsight: Changing Principles of Operation

weaken the drill. The cutting edges for the intermediate drill units are preferably substantially normal to the axis of the drill and accordingly 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 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.

Paper 28 at 23-25; Ex. 2034 at ¶¶ 43-48; Ex. 1006 at 2, col. 1:10-19

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

46

Improper Hindsight: Redundant Functions

My invention relates to metal working twist drills, and has for some of its objects the provision of such a drill which shall be operable with much less power than twist drills as heretofore formed; which shall generate less heat in cutting; which shall be effective to drill a round hole; which shall be readily started into the material to be drilled; which shall be effective to drill large holes in one operation; and which shall be effective to clear the hole being drilled of chips as they are formed.

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.

Paper 28 at 31-38; Ex. 1006 at 1, col. 1:1-11, 2, col. 1:10-19

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

47

Improper Hindsight: Cherry Picking of Old and Erroneous Patent

Q. And you think the disclosure is inaccurate with respect to current understanding of drill bit cutting physics; is that what you are saying?...

A. I think that's substantially a correct statement. You could make it even better by saying that not enough information has been disclosed to make it particularly useful or to make it quantitative. But this is an old patent.

Paper 54 at 11-12; Ex. 2118 at 78:5-14; 75:23-78:14

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

48

Cutting Tips Formed Spirally on a Cone Portion Exterior (Cls. 18, 22)

[illegible]

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.

Ex. 1001 at Cls. 18, 23

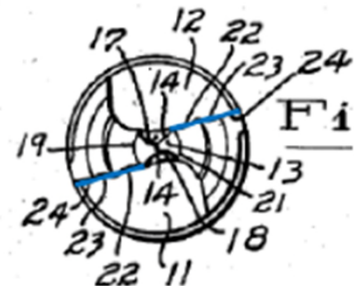
Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

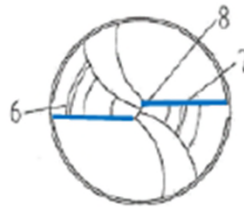
49

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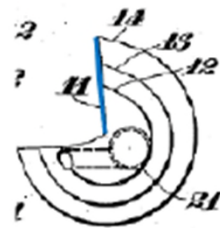
Feature Never Taught Outside Of Prior Art Step Drills



Bannister



Zhou



Welty



Wang

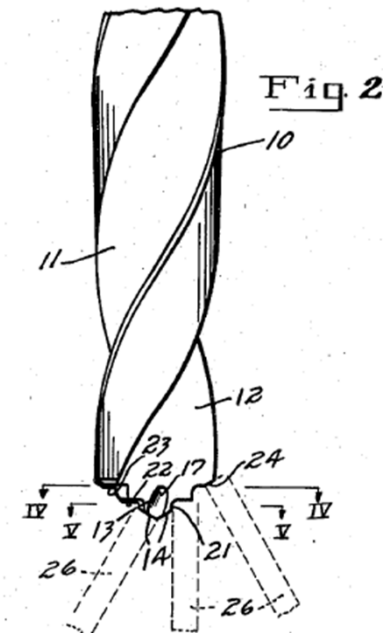
Paper 54 at 17-19; Paper 28 at 41-42; Ex. 2003 at ¶¶ 41-42

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

50

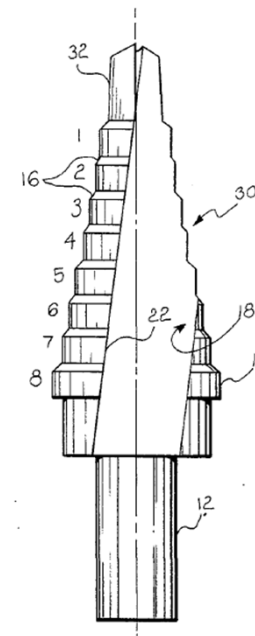
No Motivation To Combine

Bannister



Ex. 1006 at Fig. 2

Korb



Ex. 1012 at Fig. 7; *see also* Paper 28 at 42-44; Paper 54 at 14; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 2003 at ¶ 43; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

51

No Motivation To Combine

Bannister

2,193,186

TWIST DRILL

My invention relates to metal working twist drills, and has for some of its objects the provision of such a drill which shall be operable with much less power than twist drills as heretofore formed; which shall generate less heat in cutting; which shall be effective to drill a round hole; which shall be readily started into the material to be drilled; which shall be effective to drill large holes in one operation; and which shall be effective to clear the hole being drilled of chips as they are formed.

Ex. 1006 at Title, 1, col. 1:1-44

Korb

[54] STEPPED DRILL CONSTRUCTION

[57]

ABSTRACT

Drill bit for drilling holes of different diameters which has a series of cylindrical outer surfaces of increasing diameter from the outer to the inner end of the drill bit. A beveled conical surface interconnects each adjacent pair of cylindrical surfaces. At least two flutes are machined at two circumferentially spaced locations to provide two cutting edges on each diameter of the drill. At each cutting edge the cylindrical surfaces are relieved radially and the conical surface is relieved axially over an acute circumferential angle. The major peripheral portions of the cylindrical and conical surfaces for each diameter are respectively concentric to the axis of the drill and of zero pitch angle.

The present invention provides a stepped drill of the same general type as disclosed in the previous art but which is uniquely constructed to give improved cutting performance. In particular, the stepped drill bit has two cutting flutes which provides a pair of circumferentially spaced cutting edges for each different diameter. Each

Ex. 1012 at Title, Abstract, 1:30-50; see also Paper 28 at 42-44; Paper 54 at 14; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 2003 at ¶ 43; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

52

No Motivation To Combine

Bannister

2,193,186

TWIST DRILL

weaken the drill. The cutting edges for the intermediate drill units are preferably substantially normal to the axis of the drill and accordingly 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 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.

Ex. 1006 at 2, col. 1:7-19

Korb

[54] STEPPED DRILL CONSTRUCTION

STEP DRILLS

Type 78-UB 3-Flatted Shank, Type 78-UBN - TIN Coated
Type 78-QR - Quick Release, Type 78-QRN - TIN Coated

Ultra Bit™ Multi-Diameter 3-Flats on Shank

- Special Axial and Radial flute design speed work piece penetration.
- Dual flute construction drills clean accurate holes in thin materials, quickly and easily.
- Use for all thin metals, rigid plastics, wood or composite materials with a thickness equal to or less than the step thickness.
- 135° split point self centers and easily starts with no pilot hole required
- Made in the U.S.A.

Ex. 1012 at Title; Ex. 1023 at p.50; see also Paper 28 at 42-44; Paper 54 at 14; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 2003 at ¶ 43

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Secondary Considerations (Public)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

54



Presumption of Nexus

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

55

Tsteigen “Easy-Boost” Drill Bits

Matco Hyper-Step



Exs. 2041 at 1; Exs. 2011, 2041-2045
Ex. 2036 at ¶¶ 7-10

Astro TurboStep



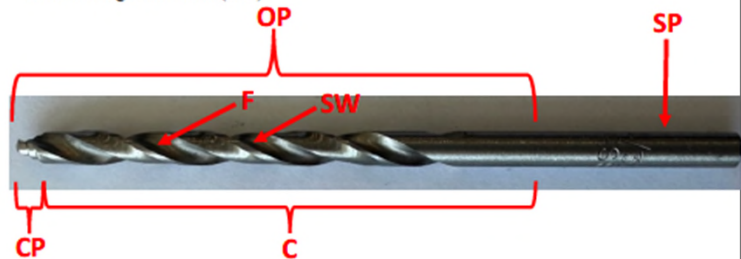
Ex. 2046 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Embody the '583 Patent Claims

Tsteigen v. Viking Drill & Tool, Inc.
Nexus Patent Claims Chart for U.S. Patent No. 11,007,583
For the Matco 5/32" Hyper-Step Twist Drill

Each Element of All Asserted Patent Claims	Matco's 5/32" Hyper-Step Twist Drill
1. A twist drill, comprising: an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion; a shank portion axially fixed to the cylinder portion opposite the cone portion; a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;	Matco's 5/32" Hyper-Step twist drill comprises an operation portion (OP) comprising a cone portion (CP) and a cylinder portion (C) axially fixed to the cone portion; a shank portion (SP) axially fixed to the cylinder portion opposite the cone portion; a spiral flute (F) formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall (SW): 

Ex. 2034 at ¶¶121-136; Exs. 2074-2089 (Nexus Patent Claim Charts)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking “Vortex Point” Drill Bits

Viking

Norseman

Type 250-VT Mechanics Length

VORTEX-POINT™



Type 250-VT Mechanics Length 135° Split Point

Ex. 2025 at 1

VORTEX-POINT™



**Type 175-VT VORTEX-Point™ Mechanics Length 135°
Split Point**

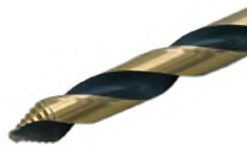
Ex. 2024 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking “Vortex Point” Drill Bits

Private Labels



Roll over image to zoom in



3/16" Mechanics Length Cyclone 3 Flats Step Drill

661.014.316

- 29 piece black Ultradex
- Split-point design gives accurate starting and is selfcentering eliminating the need for the use of a center punch
- Unique tip geometry reduces heat generation cutting tool wear increasing tool life
- Step drill design easily enlarges existing holes without damaging the point
- Mechanic length for shorter, sturdier construction of the bit
- Three flats ground onto sides of shank to reduce the slippage of the bit when used in drill chucks
- Precision ground points, flutes, body, clearance and drill diameter for accurate and precise cutting
- Ideal for hard steel, sheet metal, brass, and acrylics
- 1/16" – 1/2" in 1/64" increments
- Made in USA



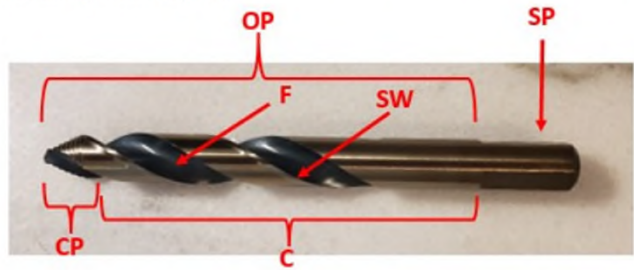
Ex. 2058 at 1; Ex. 2026 at 1, 3; Ex. 2027 at 1; Ex. 2048 at 1
Ex. 2071 at 29:15-30:24, 83:17-24, 90:11-14, 108:12-109:6, 117:2-12

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

59

Embody the '583 Patent Claims

Tsteigen v. Viking Drill & Tool, Inc.
Patent Claims Chart for U.S. Patent No. 11,007,583
For the Viking 1/2" Vortex-Point Twist Drill

Each Element of All Asserted Patent Claims	Viking's 1/2" Vortex-Point Twist Drill
1. A twist drill, comprising: an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion; a shank portion axially fixed to the cylinder portion opposite the cone portion; a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;	Viking's 1/2" Vortex-Point twist drill comprises an operation portion (OP) comprising a cone portion (CP) and a cylinder portion (C) axially fixed to the cone portion; a shank portion (SP) axially fixed to the cylinder portion opposite the cone portion; a spiral flute (F) formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall (SW): 

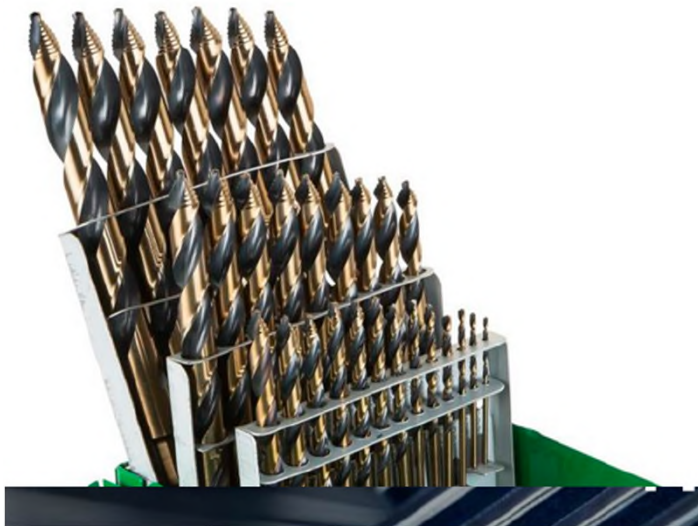
Ex. 2034 at ¶¶137-141; Exs. 2090 and 2064

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

60

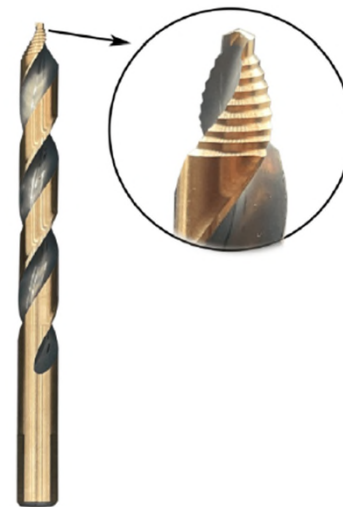
Additional Infringers

Steel Vision



Ex. 2028 at 1

VIM



Ex. 2029 at 3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

61

Embody the '583 Patent Claims

Tsteigen v. Viking Drill & Tool, Inc.
Infringer Patent Claims Chart for U.S. Patent No. 11,007,583
For the Steel Vision 1/2" M35 Tungsten-Cobalt Hi-Moly Alloy Drill

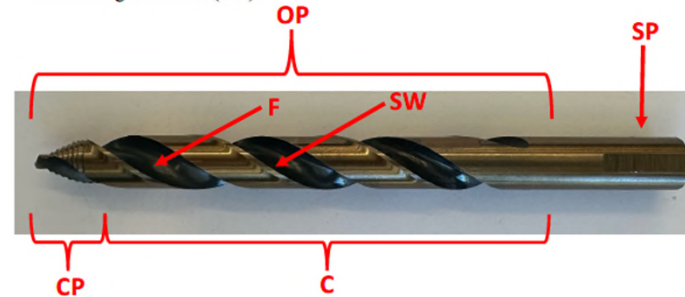
Each Element of All Asserted Patent Claims

1. A twist drill, comprising:
 - an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion;
 - a shank portion axially fixed to the cylinder portion opposite the cone portion;
 - a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;

Steel Vision's 1/2" M35 Tungsten-Cobalt Hi-Moly Alloy Drill

Steel Vision's 1/2" M35 Tungsten-Cobalt Hi-Moly Alloy Drill comprises

- an operation portion (OP) comprising a cone portion (CP) and a cylinder portion (C) axially fixed to the cone portion;
- a shank portion (SP) axially fixed to the cylinder portion opposite the cone portion;
- a spiral flute (F) formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall (SW):



Ex. 2034 at ¶¶142-148; Exs. 2094-2097

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

62

No Meaningful Rebuttal

U.S. 11,007,583
IPR2023-00473

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner

v.

HONGJIA WANG
Patent Owner

Case IPR2023-00473

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

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

See generally Ex. 1044 at ¶¶ 45-51

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

63

No Meaningful Rebuttal

Viking Misrepresents Endres' Testimony Regarding Performance Testing

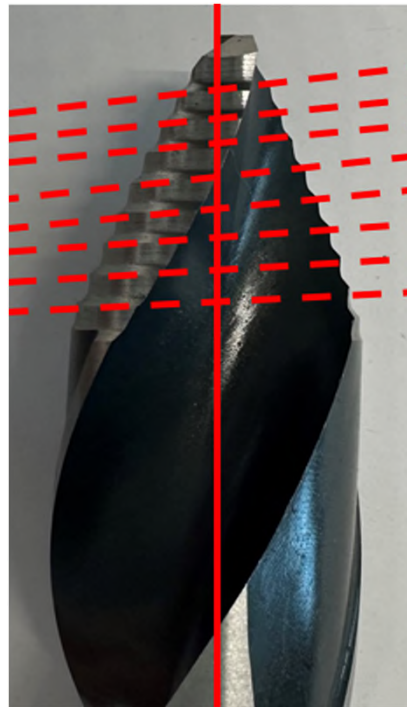
Paper 43 at 25-26
Ex. 1046 at 131:21-133:24

1	Q Okay. But you said -- okay. So you said
2	it relates to the split point nature of it, but
3	you're saying you get an advantage because you've
4	got the split point tip on the drill?
5	A That is one contributor.
6	Q Okay. Did you do any measurements on any
7	of the drills that were supplied to you?
8	A No, I did not.
9	Q So you haven't tested to see whether the
10	penetration of it is actually faster?
11	A I have not personally, nor am I aware of
12	we'll call it direct knowledge of a measured
13	comparison of say a standard twist drill to this.
14	I had a student, he had an application
15	last spring to have a drill through a plate that
16	was already attached to a prototype steel plate,
17	and I said huh, I've got something; try this. And
18	he came back and said something like wow, that was
19	amazing how fast that went through.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

64

Axial Relief is Readily Apparent



Paper 54 at 16 (annotating Ex. 2081 at 3)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

65

Co-Extensive

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner

v.

HONGJIA WANG
Patent Owner

IPR2023-00473

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

CORRECTED AND SUPPLEMENTAL DECLARATION OF WILLIAM J.
ENDRES IN SUPPORT OF PATENT OWNER'S RESPONSE TO
VIKING DRILL & TOOL'S PETITION FOR
INTER PARTES REVIEW OF U.S. PATENT NO. 11,007,583

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner
v.

HONGJIA WANG
Patent Owner

IPR2023-00473
IPR2023-00474¹

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

CORRECTED DECLARATION² OF DAVID FISHER IN SUPPORT
OF PATENT OWNER'S RESPONSE TO THE
PETITION FOR INTER PARTES REVIEW
OF U.S. PATENT NO. 11,007,583

1. A twist drill, comprising:
an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion;
a shank portion axially fixed to the cylinder portion opposite the cone portion;
a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;
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, each of the plurality of composite cutting blade groups comprising:
a conical first step surface;
a cylindrical second step surface adjacent to the conical first step surface,
a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;
a minor cutting edge defined by the intersection of the cylindrical second step and the sidewall of the spiral flute; and
a cutting tip defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute; and
a top blade provided on the front end of the cone portion;
wherein a diameter of each of the plurality of composite cutting blade groups increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and
wherein at least one cylindrical second step surface is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter.

Ex. 2034 at ¶¶ 149-161; Ex. 2036 at ¶¶ 7-10; Ex. 1001 at Cls. 1, 8

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

66

No Meaningful Rebuttal

U.S. 11,007,583
IPR2023-00473

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner

v.

HONGJIA WANG
Patent Owner

Case IPR2023-00473

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

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

See generally Ex. 1044 at ¶¶ 45-51

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

67



Strong Evidence of Secondary Considerations

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

68



Copying and Industry Praise

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

69

Viking Admits to Copying

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VIKING DRILL & TOOL, INC.
Petitioner

v.

HONGJIA WANG
Patent Owner

IPR2023-00473
IPR2023-00474
U.S. Patent No. 11,007,583
Issued: May 18, 2021

DECLARATION OF TAYLOR FULK IN SUPPORT OF PETITIONER'S
REPLY IN *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,007,583

I, Taylor Fulk, being duly sworn, declare as follows:

3. The cutting tool business is highly competitive. Most products in our catalog have existed in some form for decades. However, cutting tool companies (including Viking) are regularly coming up with modifications or variations of cutting tools in an effort to improve some aspect of their functionality or to serve a particular market or application. When that happens, it is common in the industry for competitors to quickly develop and introduce their own competing version of the modified tool design.

4. That is what happened with Viking's stepped tip twist drill product. ■

■
■ At the time, we did not consider the product to be particularly unique. The drill was nothing more than a step drill cut into the tip of a twist drill. Step drills were well-known at the time – Viking has manufactured and sold step drills for many years (examples are shown on pages 96 and 127 of the Viking Catalog of Exhibit 1023). In terms of their cutting operation, the Hyper-Step drills cut in the same way and according to the same principles as existing step drills.

Ex. 1045 at ¶¶ 3-4

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

70

Advertising of Patented Features/Benefits

Type 250-VT Mechanics Length

VORTEX-POINT™



Type 250-VT Mechanics Length 135° Split Point

Mechanics Length

VORTEX-POINT™

3-Flats on Shank

135° Split point

- **Stays sharp up to 4X longer** compared to conventional and other specialty tip designs.
- Multi-stepped tip acts like a step drill , allowing for laser like holes through sheet metal and prevents walking on curved surfaces.
- **VORTEX-POINT™ tip design cuts 45% faster & excels at sheet metal and hardened metals like broken fasteners.**
- Three-flatted shanks to reduce slippage common with keyless chucks.
- **Recommended for use in Cast Iron, Brass, Sheet Metal, Plastic, Mild Steel, Copper, Hardened Steel.**
- **Proudly manufactured in the USA**

with globally sourced material

Ex. 2025 at 1

Ex. 2034 at ¶¶ 162-164, 179-180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

71

Advertising of Patented Features/Benefits

VORTEX-POINT™



Type 175-VT VORTEX-Point™ Mechanics Length 135°
Split Point

- ✓ Unique tip geometry reduces heat generation & cutting tool wear increasing tool life.
- ✓ Easily enlarges existing holes without damaging the point.
- ✓ 3-Flat on Shank, eliminates slippage
- ✓ Stay sharp up to 4x longer compared to conventional and other specialty tip designs.
- ✓ Recommended for Cast Iron, Brass, Sheet Metal, Acrylic, Mild Steel, Copper, Hard Steel.
- ✓ Proudly manufactured in the USA
with globally sourced material

Ex. 2024 at 1

Ex. 2034 at ¶¶ 162-164, 179-180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

72

Advertising of Patented Features/Benefits

KnKut USA Made Step Point drill bits combine a split tip point with a step drill design for accurate starting without the need of a center punch. This distinctive design reduces heat to increase the tool life of the drill bit and can be used to enlarge existing holes without damaging the drill bit point. The shorter Mechanics Length gives you a sturdier drill bit with 3-Flats on the shanks, sizes 3/16" and above, to help eliminate slippage in your chuck. Our KnKut Step Point Drill Bit is great for hard steel, brass, sheet metal and acrylics.

- Made In USA
- Great for hard steel, brass, sheet metal and acrylics
- Split point step design starts on contact, self-centers and eliminates the need for a center punch
- Can be used to enlarge existing holes without damaging the point
- Mechanics length provides a shorter sturdier construction
- 29 Piece Set Sizes: 1/16 - 1/2 by 64ths

Ex. 2026 at 1

Ex. 2034 at ¶¶ 162-164, 179-180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

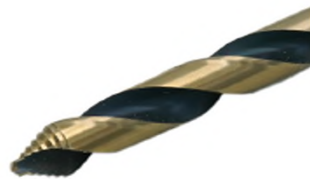
73

Advertising of Patented Features/Benefits

3/16" Mechanics Length Cyclone 3 Flats Step Drill

661.014.316

- 29 piece black Ultradex
- Split-point design gives accurate starting and is selfcentering eliminating the need for the use of a center punch
- Unique tip geometry reduces heat generation cutting tool wear increasing tool life
- Step drill design easily enlarges existing holes without damaging the point
- Mechanic length for shorter, sturdier construction of the bit
- Three flats ground onto sides of shank to reduce the slippage of the bit when used in drill chucks
- Precision ground points, flutes, body, clearance and drill diameter for accurate and precise cutting
- Ideal for hard steel, sheet metal, brass, and acrylics
- 1/16" - 1/2" in 1/64" increments
- Made in USA



Roll over image to zoom in



Ex. 2027 at 1

Ex. 2034 at ¶¶ 162-164, 179-180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

74

Advertising of Patented Features/Benefits



CTD29TMS - 29 Piece Tempest Point Mechanic's Length Drill Bit Set

Store / Power Tool
Accessories / Drill Bit Sets &
Sharpeners

\$449.95

Product Details

Tempest drill bit design runs cooler with less friction. Heat treated M2 high speed steel construction. Drills 2x faster than traditional drill bits while lasting 4x longer. Stepped tip prevents drill bit walking on rounded surfaces. Easily drills complete holes or enlarges existing holes through hardened steel, stainless steel, aluminum, & grade 8 bolts. Three flat shank design eliminates slippage. Sizes 1/16"

Ex. 2048 at 1

Ex. 2034 at ¶¶ 162-164, 179-180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

75

Advertising of Patented Features/Benefits



Ex. 2058 at 10

Ex. 2034 at ¶¶
162-164, 179-
180

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

76

Industry Praise



Tool Showcase

Matco Cobalt Hyper-Step Drill Bits

The Matco Exclusive Hyper-Step tip design cuts 45% faster and stays sharp four times longer.



By **TechShop Staff Writers**
October 14, 2021

Ex. 2012 at 1; Ex. 2013; Ex. 20

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

77

Industry Praise



Ex. 2015
Ex. 2051

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

78

Industry Praise



Ex. 2012; Ex. 2049

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

79

Industry Praise

Jun 25, 2018

**Co-worker gets Matco's new "Hyper-Step" drill bits:
"These drill though everything"**

Says he.

So I say "Prove it, that size is lifetime isn't it?"

He proceeds to dig out of his tool box a spare lonely flarenut wrench and does this



kythri said:

Interesting - I wonder who the manufacturer of these are?

I imagine now that Irwin is owned by Stanley which owns Mac and others, likely not Irwin for this new set from Matco. I deal **a lot** in drill bits and industrial supply and haven't seen these at all. There must be a patent or the like. Also gotta be China I would think, nothing new coming out of the states in the last decade regarding drills bits outside of coatings and "hey we use a special alloy which is like totally different"

Jun 26, 2018



kelpaso1
MEMBER EVERITUS

Joined: Sep 28, 2009
Messages: 3,962
Location: New Brunswick

**Re: Co-worker gets Matco's new "Hyper-Step" drill bits:
"These drill though everythin"**

Interesting design, a step drill incorporated in a normal drill bit. Good for thinner materials I would say. But sharpening would be out of the question since I have no idea how to sharpen a step drill.

Ex. 2021 at 1, 7, 17

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

80

Industry Praise

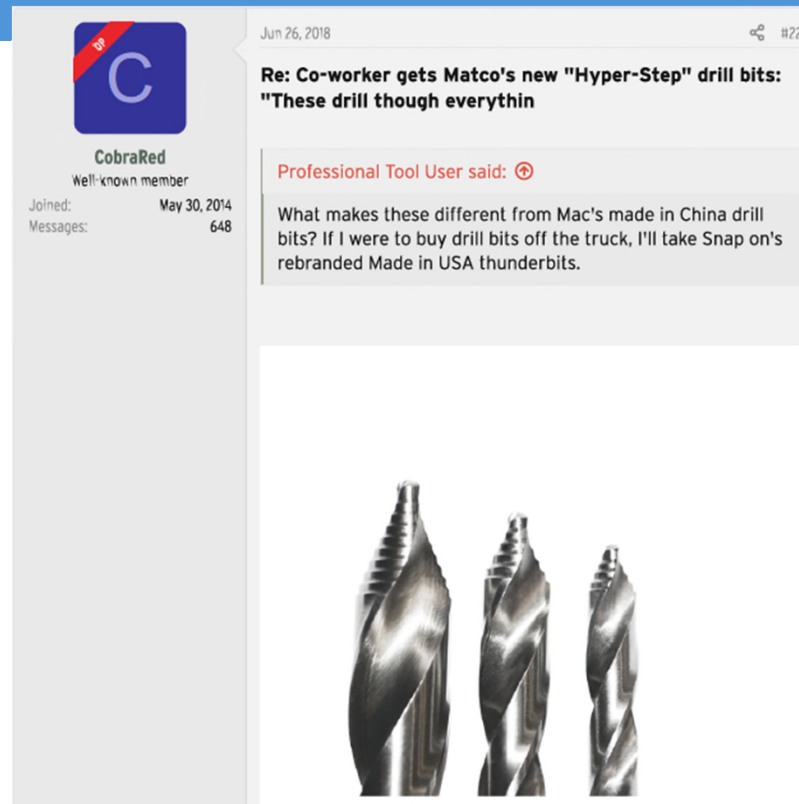


Ex. 2016; Ex. 2052

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

81

Industry Praise



Ex. 2021 at 10

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

82

Industry Praise



Ex. 2021 at 14

dr_clyde
Well-known member

Joined: Jan 7, 2009
Messages: 5,595
Location: Holland, MI

Tinner said:

They look to me like non sharpenable drills marketed to people who don't know how to drill holes in metal. The dunce in the video doesn't even have the sense to use cutting oil.

You would be amazed at what you can drill with a good HSS 118 degree drill. That includes grade 8 bolts, 300 series stainless, AR plate, and ~~click~~ [Click to expand...](#) But first you must

While I agree with everything you said, i will argue these may have a place in maintenance and repair, especially with enlarging existing holes.

When enlarging a hole, the majority of cutting force is focused on the outside edges of the drill flutes and not on the chisel edge. This usually results in a aggressive self feed and a chipped drill.

A sheet metal step drill's geometry is designed to enlarge holes and not break, but they are very limited to depth of cut unless you can go to the major OD of the drill.

These Matco bits look to be a blend between the two. I think these would be a good way to drill out existing holes or drill a larger hole out of position with no pilot.

I wouldn't want these in the machine shop. But they may be a good solution for maintenance and repair.

And \$260 is ridiculous. That's just price gouging.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

83

Industry Praise

That was my thought as well. Whoever came up with that tip geometry had to have patented it. Perhaps Matco gets exclusive rights to distribute via the patent holder, and got someone in taiwan to make them? Or the patent ran out, but they last 20 years.... it's a mystery for sure.



Ex. 2022 at 2-3, 6



2ndGearRubber
Well-known member

Joined: Mar 24, 2014
Messages: 8,859
Location: Pittsburgh

Mar 17, 2021

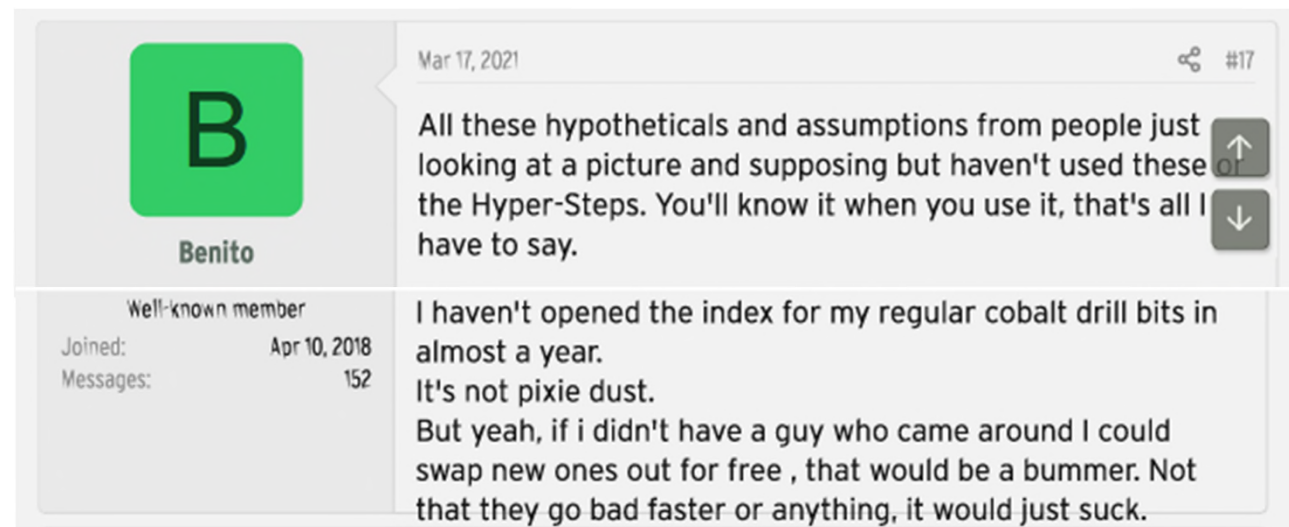
No need to pilot drill, smaller amount of material removal per cutting "level" on the bit. If you've ever seen the Matco hyper step bits, they just plunge through material.

I'm just as likely to pick up a fresh index of 3 flat moly.bits like I normally buy.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

84

Industry Praise



Ex. 2022 at 6-7

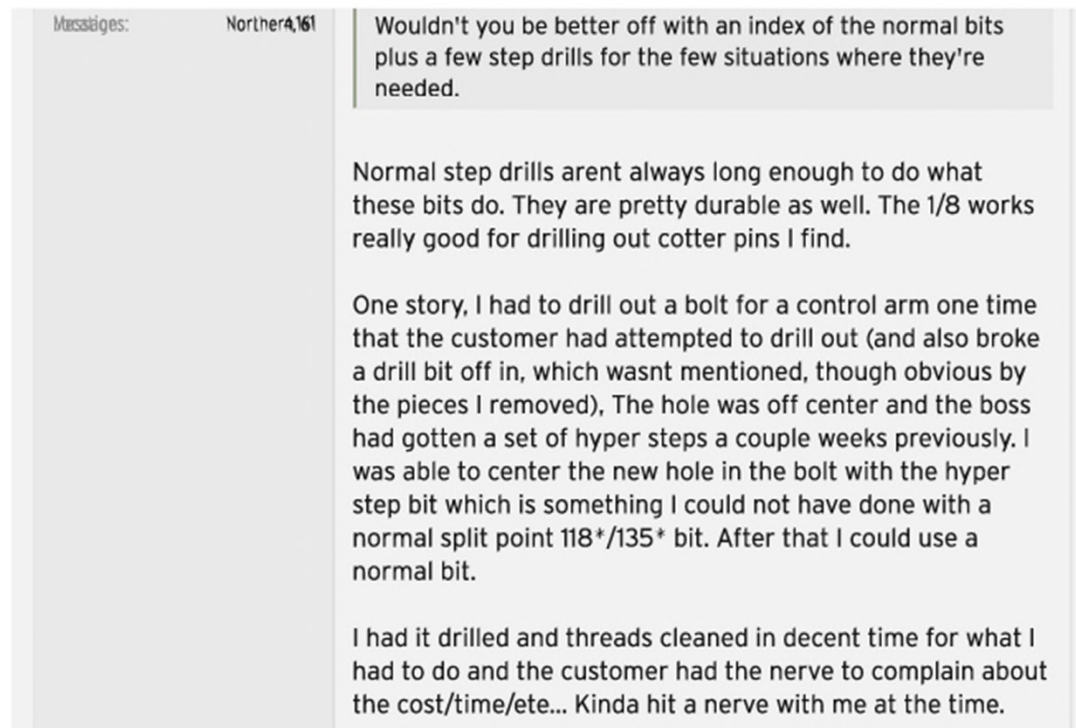
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

85

Industry Praise



Ex. 2022 at 8



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

86

To Be Addressed Further in Confidential Argument



Commercial Success

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

88

To Be Addressed Further in Confidential Argument



Long-Felt Need

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

90

Viking “Vortex Point” Drill Bits

Step Drills

- Existed since the mid-1900s

Twist Drills

- Existed since the 1800s

Ex. 2003 at ¶ 44; Ex. 2034 at ¶¶ 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

91

To Be Addressed Further in Confidential Argument

Secondary Considerations Confidential

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

93

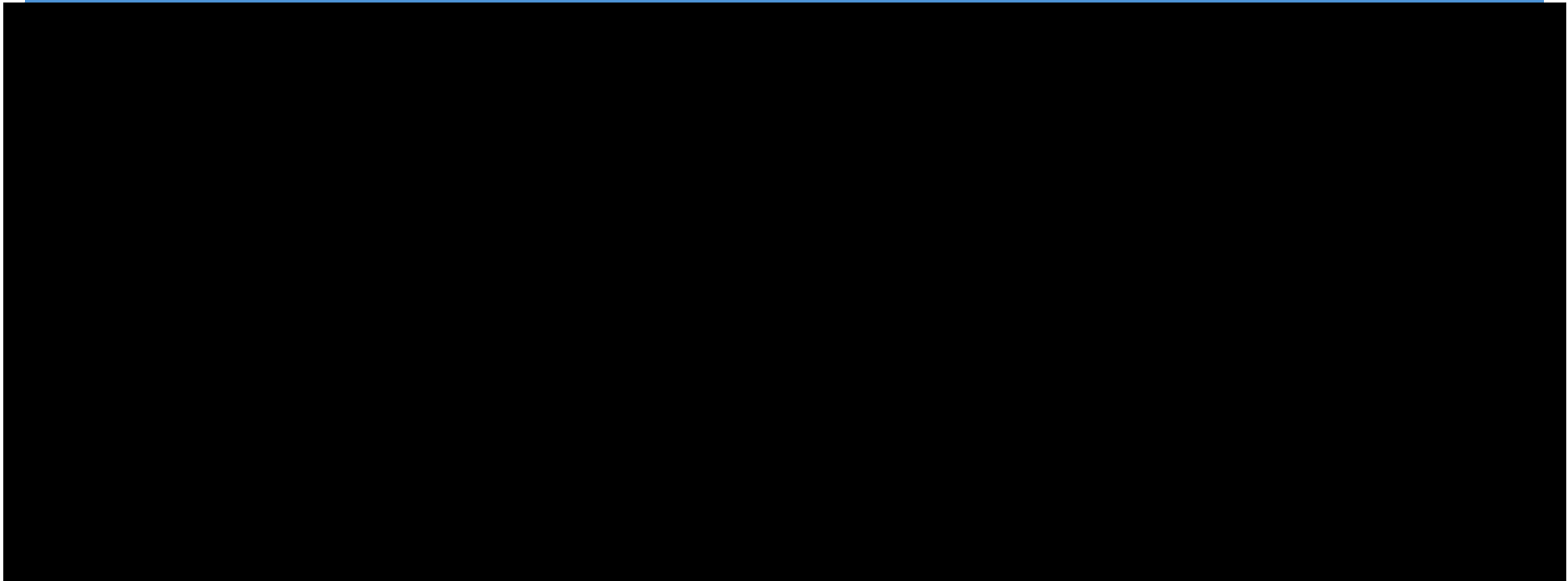


Copying and Industry Praise

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

94

Industry Praise and Copying

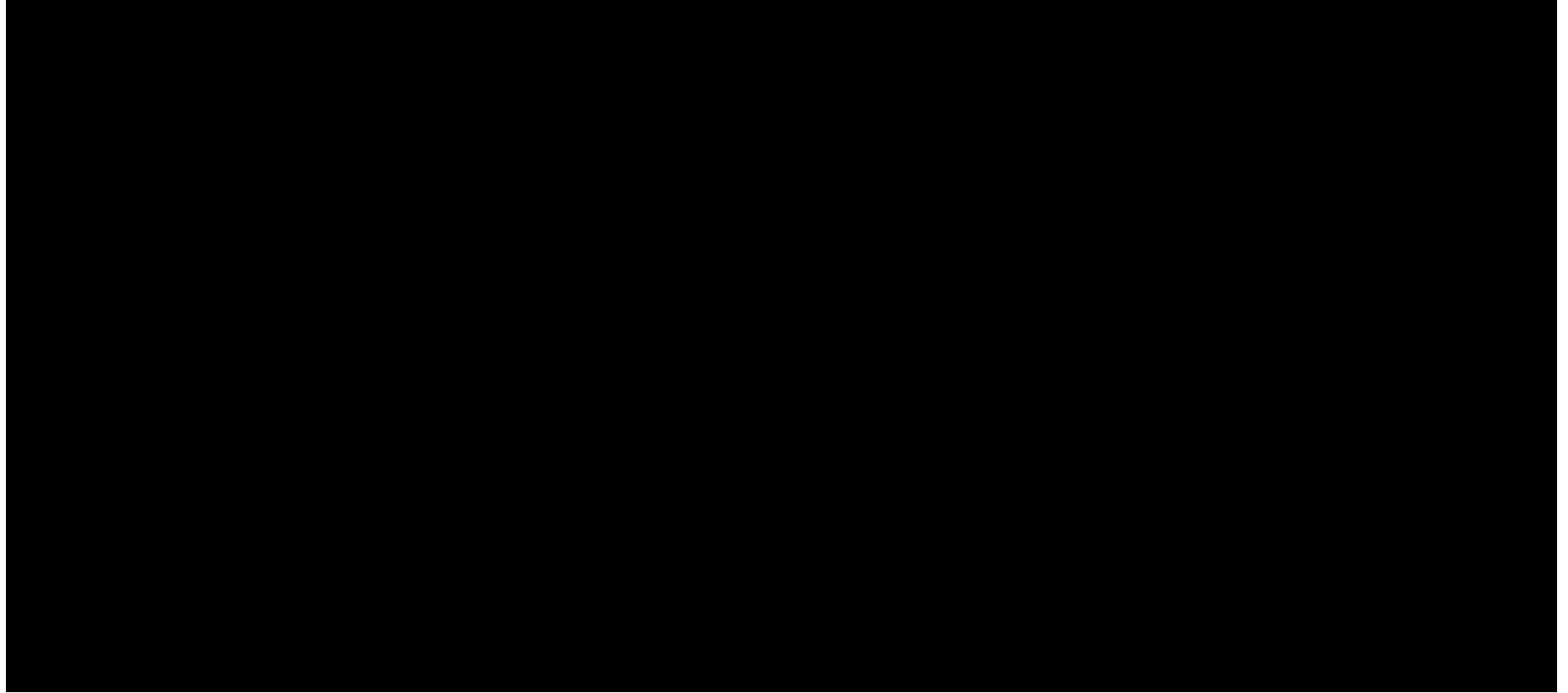


Ex. 2055 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

95

CONFIDENTIAL – ATTORNEYS’ EYES ONLY

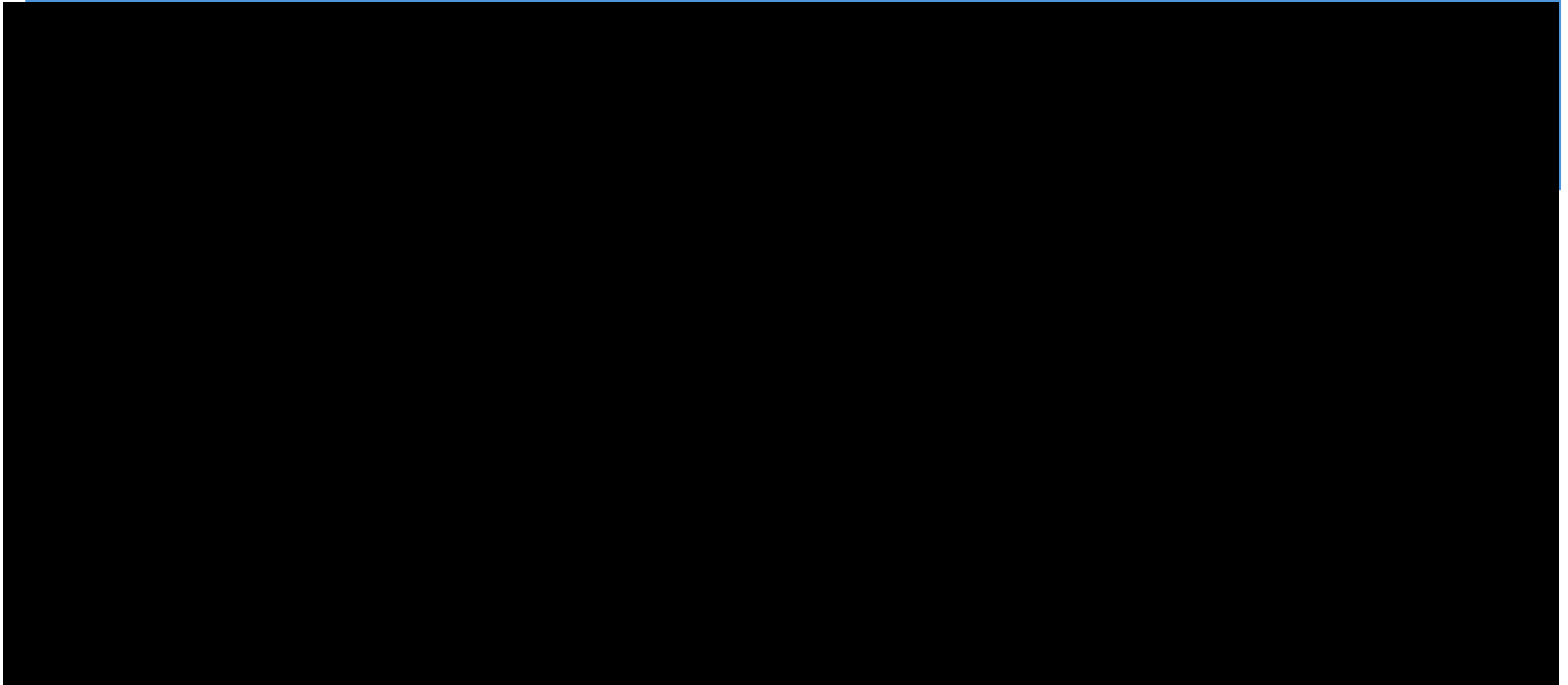


Ex. 2059 at 4

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

96

CONFIDENTIAL – ATTORNEYS’ EYES ONLY

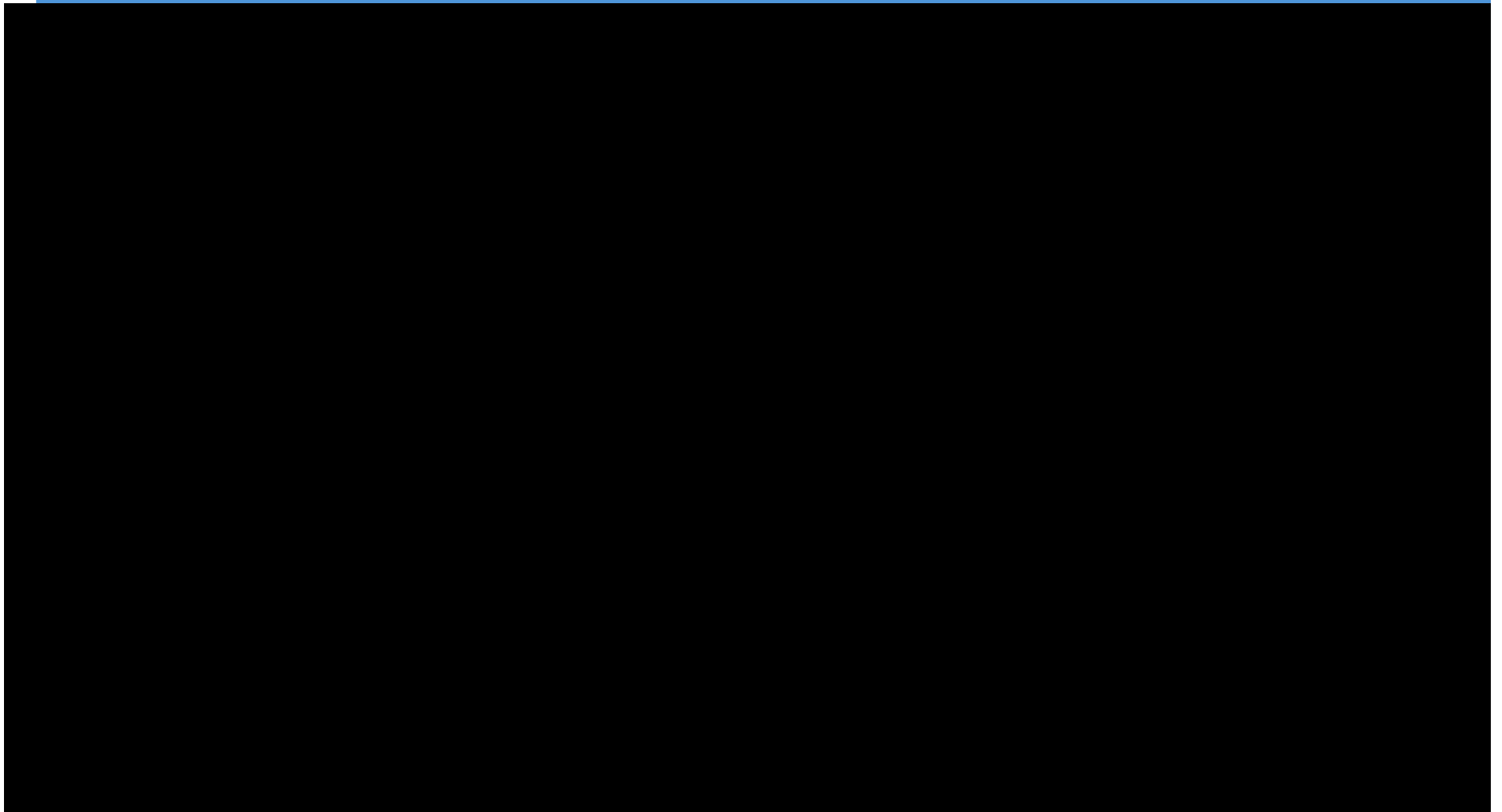


Ex. 2059 at 5

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

97

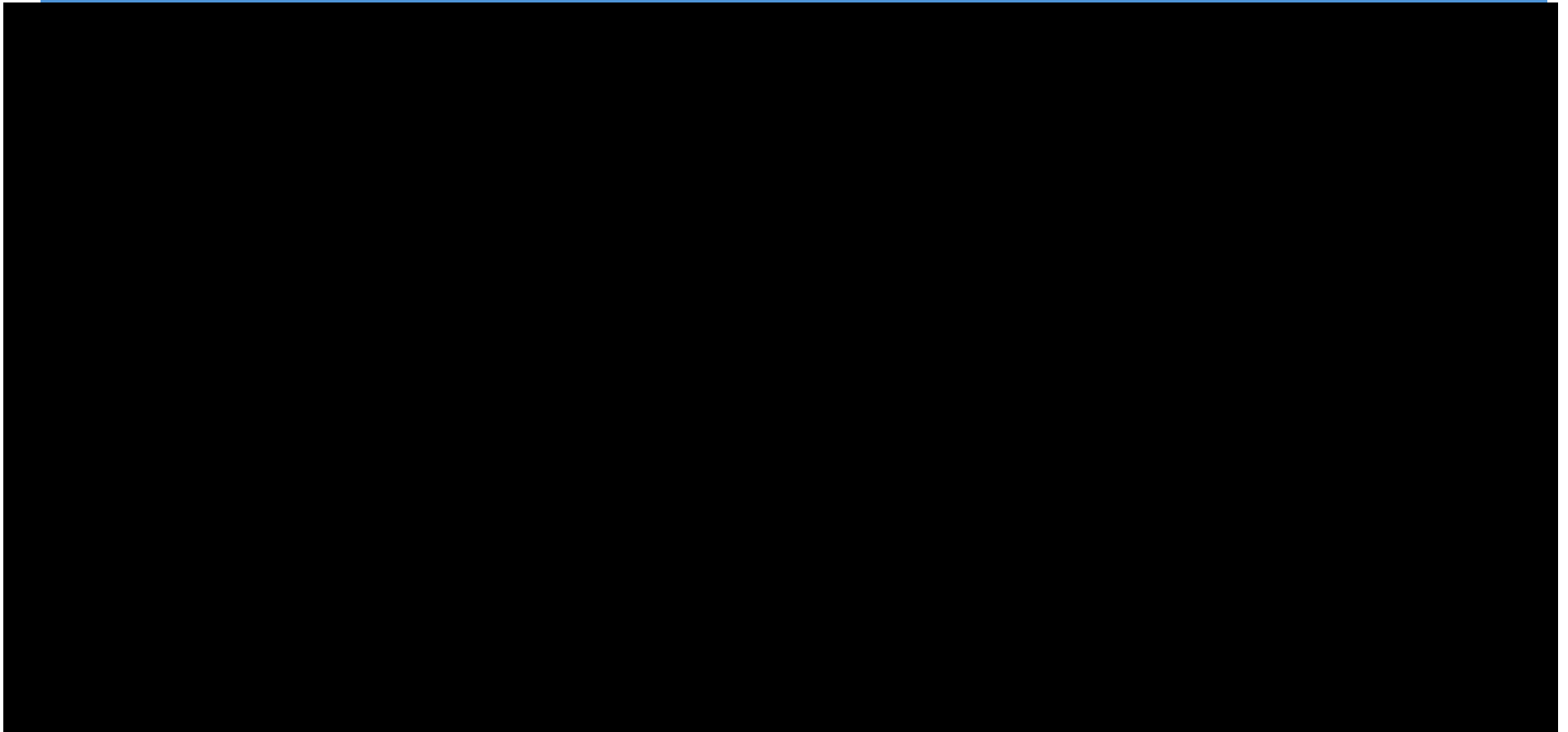
CONFIDENTIAL – ATTORNEYS’ EYES ONLY



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

98

CONFIDENTIAL – ATTORNEYS’ EYES ONLY

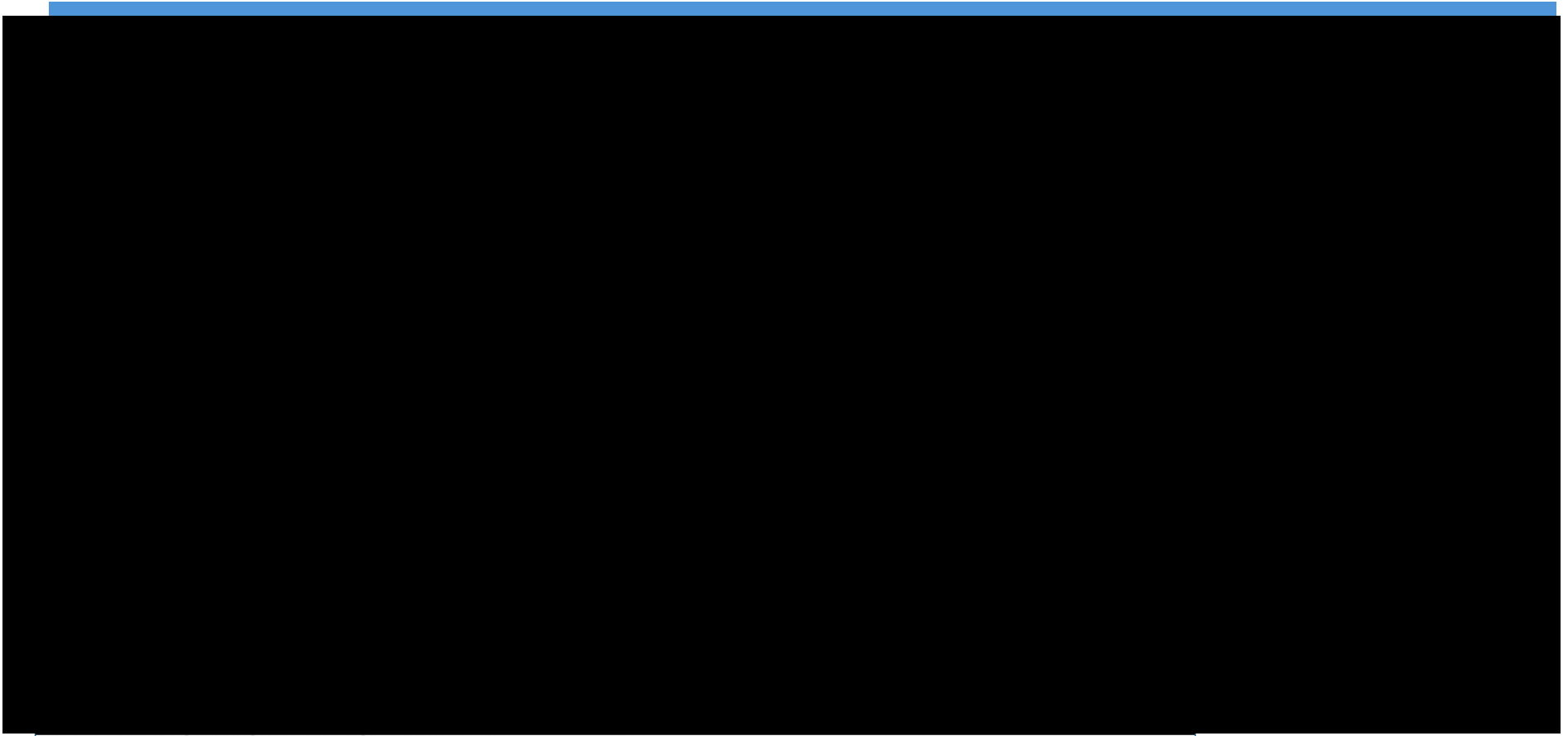


Ex. 2056 at 6

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

99

CONFIDENTIAL – ATTORNEYS’ EYES ONLY



Ex. 2057 at 2-3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

100

CONFIDENTIAL – ATTORNEYS’ EYES ONLY

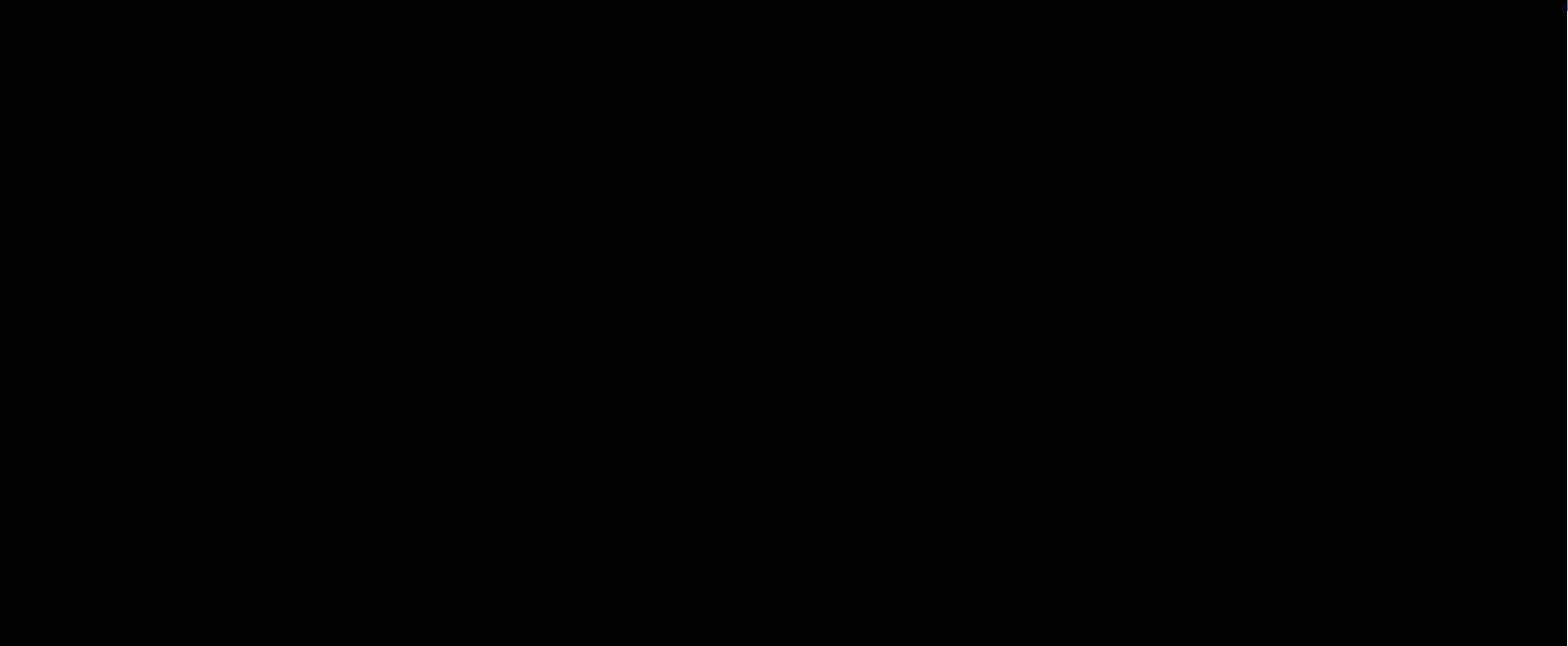


Ex. 2057 at 2-3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

101

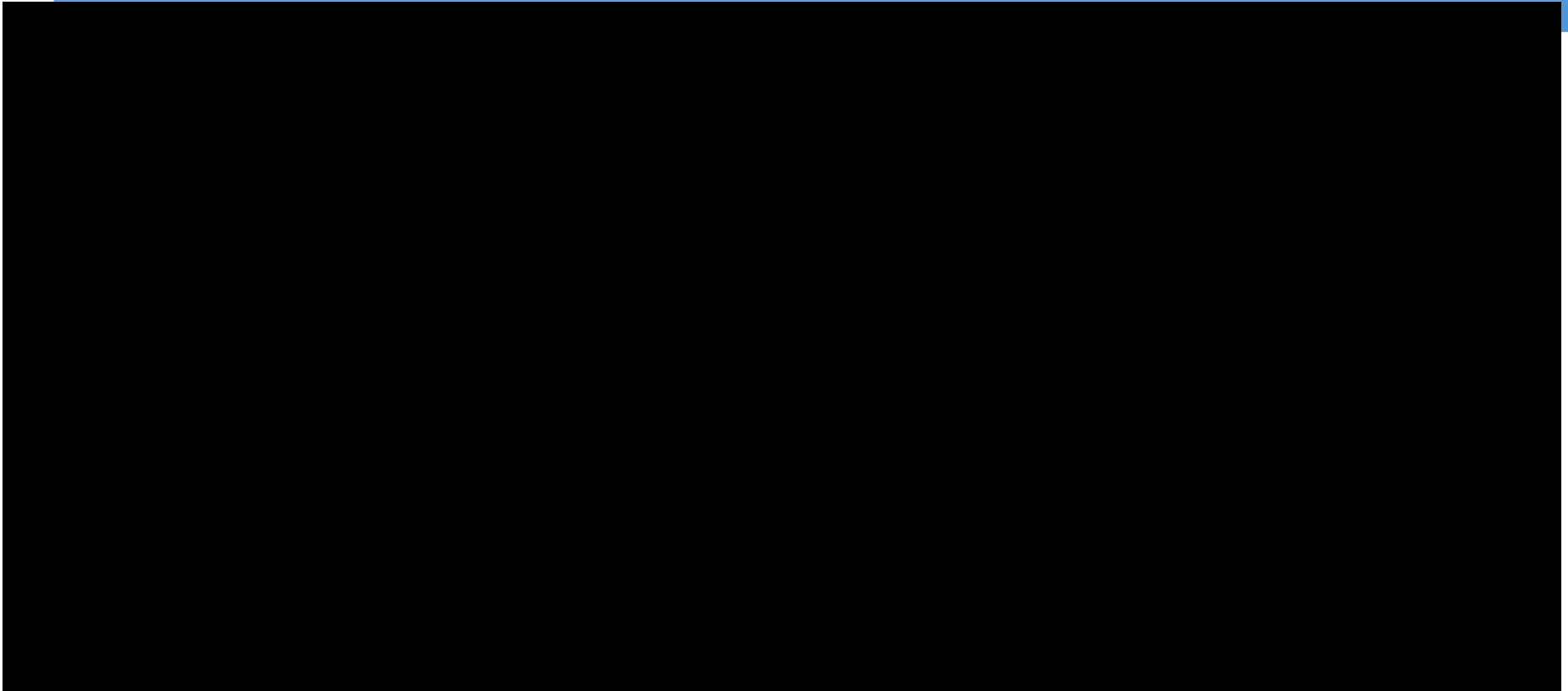
Industry Praise and Copying



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

102

Industry Praise and Copying



Ex. 2063 at 1-2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

103

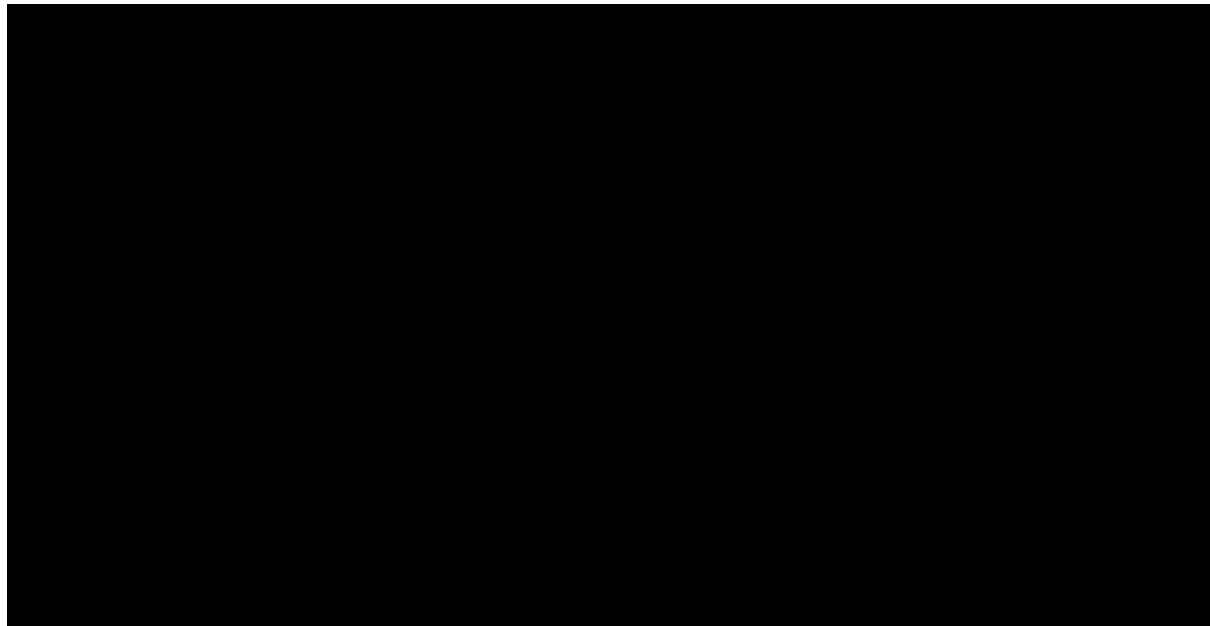


Commercial Success and Long- Felt Need

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

104

Commercial Success – Tsteigen

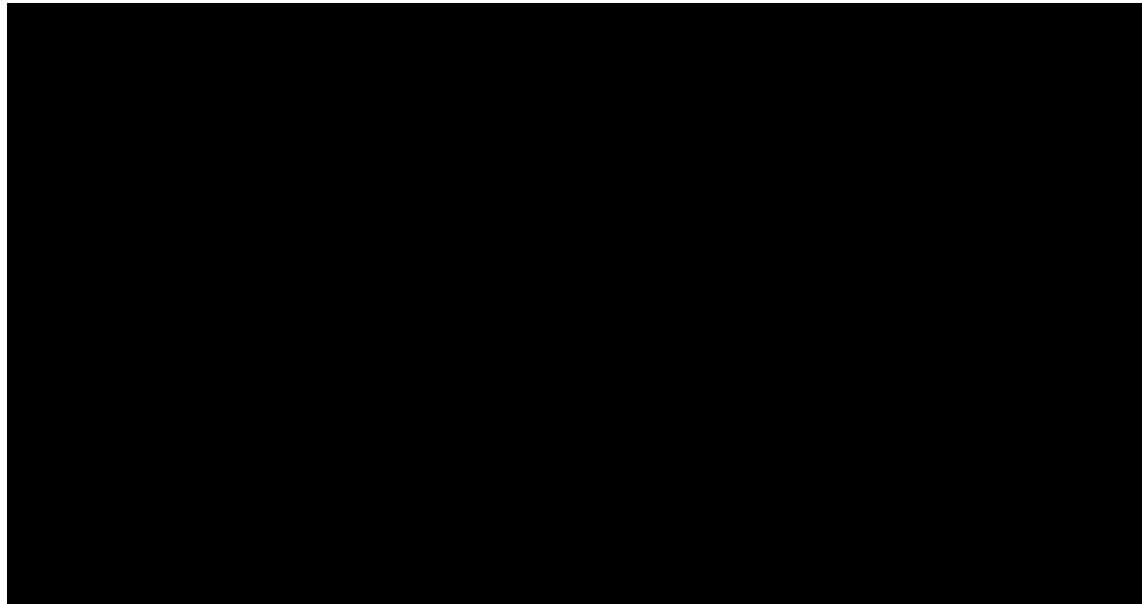


Paper 54 at 24; Ex. 2039; Ex. 2036 at ¶ 12

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

105

Commercial Success – Viking



Paper 54 at 24-25; Ex. 2066

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

106

Commercial Success – Price Premium

Astro: 57% Price Premium

Practicing

9 Q And so it looks like, if we compare
10 the standard 29-piece high speed drill Hyper-step
11 drills, they have gone up from a 339.95 list to a
12 399.95 list; is that correct?
13 MR. CUNNINGHAM: Same objection.
14 THE WITNESS: Yes. That appears to be the
15 case.

Non-Practicing

23 Q On this Exhibit 42 you'll also see
24 that there is the non-Hyper-step drill called the
25 "NITRO-TIP REDUCED SHANK DRILL BIT SET, 29 PIECE"
1 selling for 254.95. Do you see that?
2 A Yes.

Paper 54 at 24-25; Ex. 1048 at 69:2-15 and 84:23-85:2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

107

Commercial Success – Price Premium

Kimball: 30-55% Price Premium

Ultra Step

Standard

29-piece

Ultra Index	\$385.00 Set
HD Index	

Fractional Ultra Index		\$294.00 ea
------------------------	---	-------------

Silver & Deming

PCS	STORAGE	PRICE
8	Plastic Case	\$854.00 Set
4	Plastic Case	\$404.00 Set

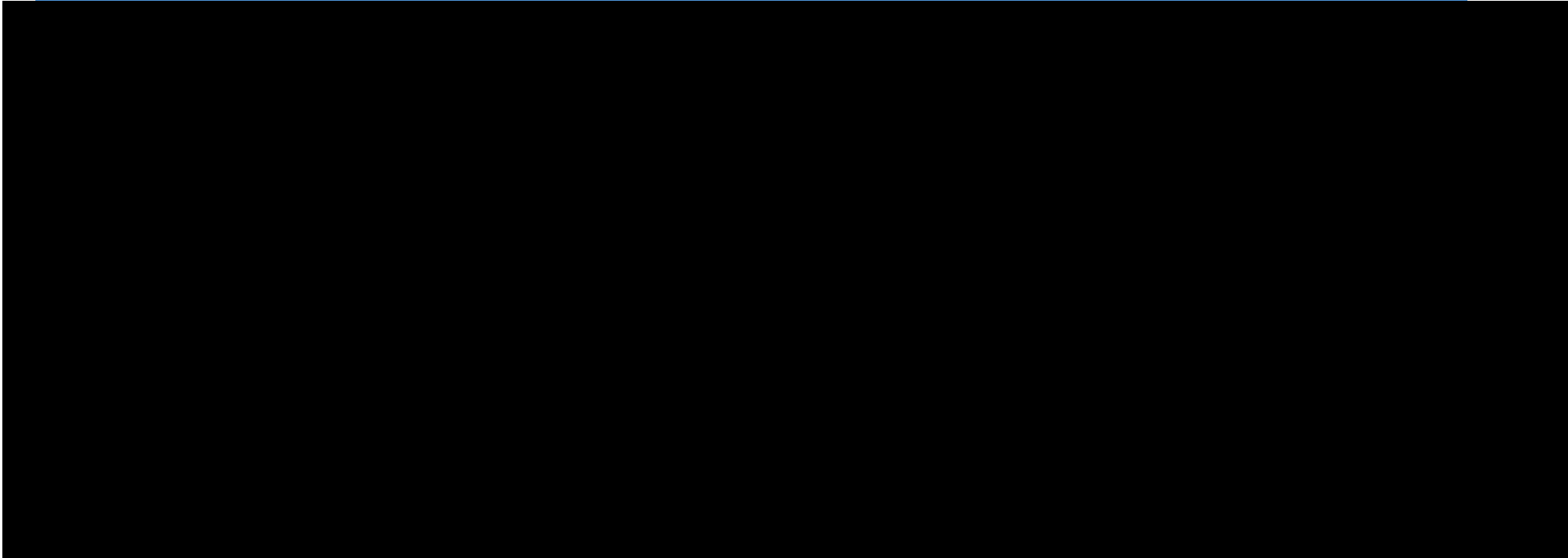
PCS	STORAGE	PRICE
4	Fractional Plastic Case	\$294.00 ea
8	Fractional Plastic Case	\$554.00 ea

Paper 54 at 24-25; Ex. 2071 at 87:19-24 (Viking); Ex. 2058 at pp. 10-11 (Kimball)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

108

Commercial Success – Viking

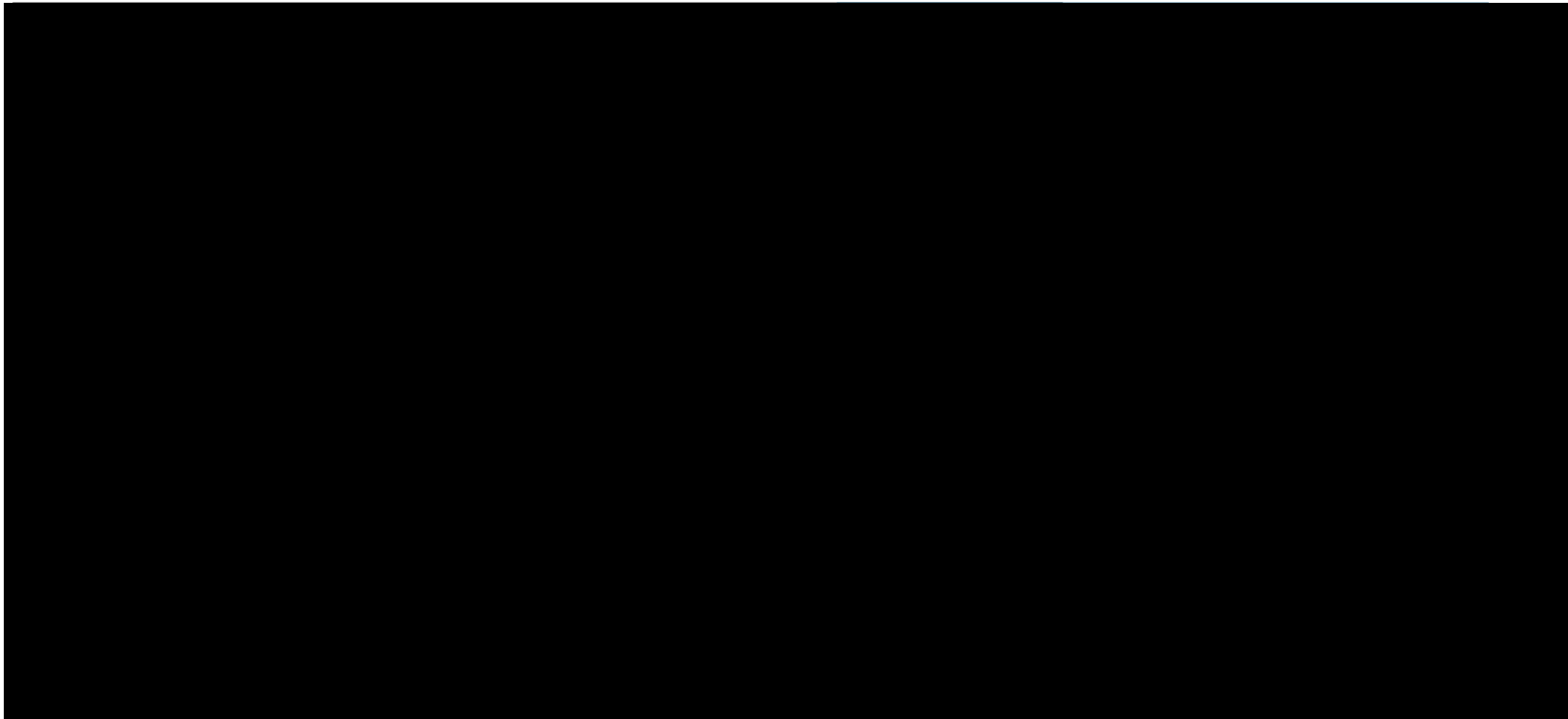


Ex. 2067 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

109

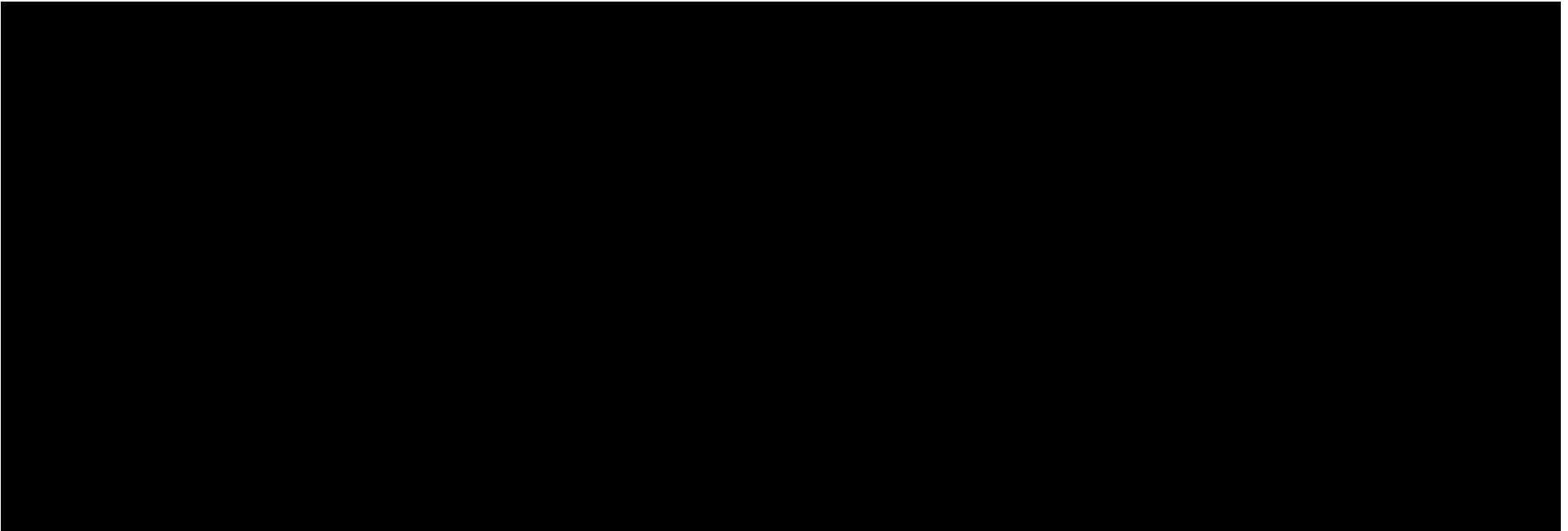
Commercial Success – Viking



DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

110

Commercial Success – Viking

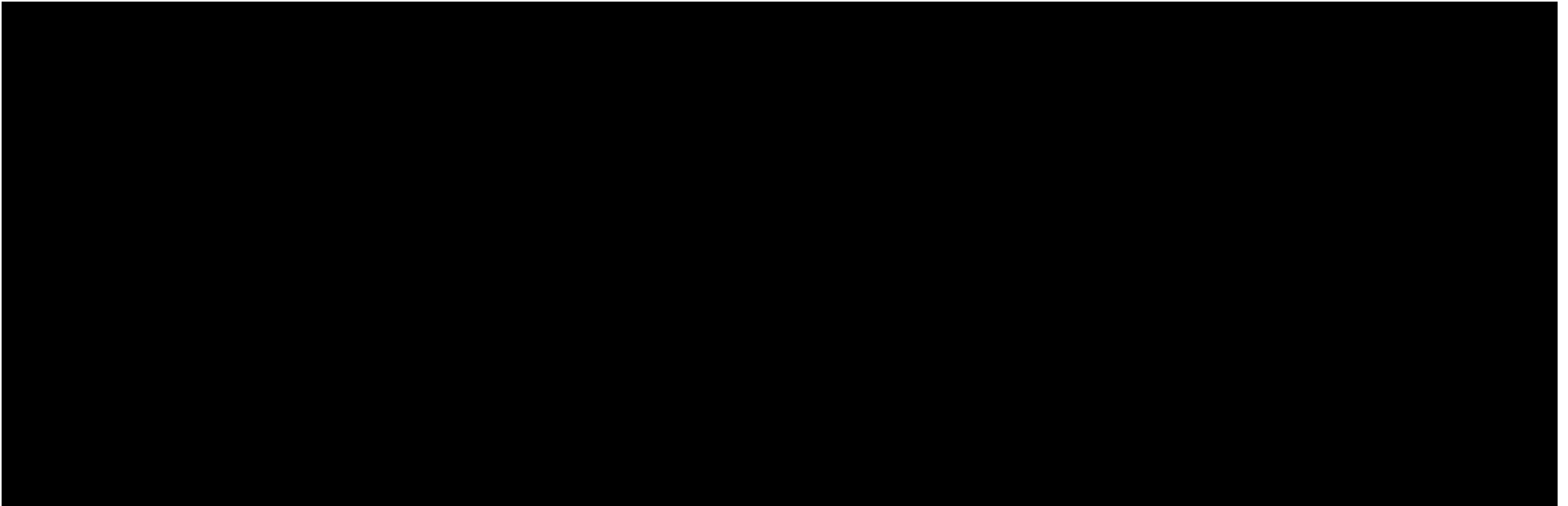


Ex. 2068 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

111

Commercial Success – Viking

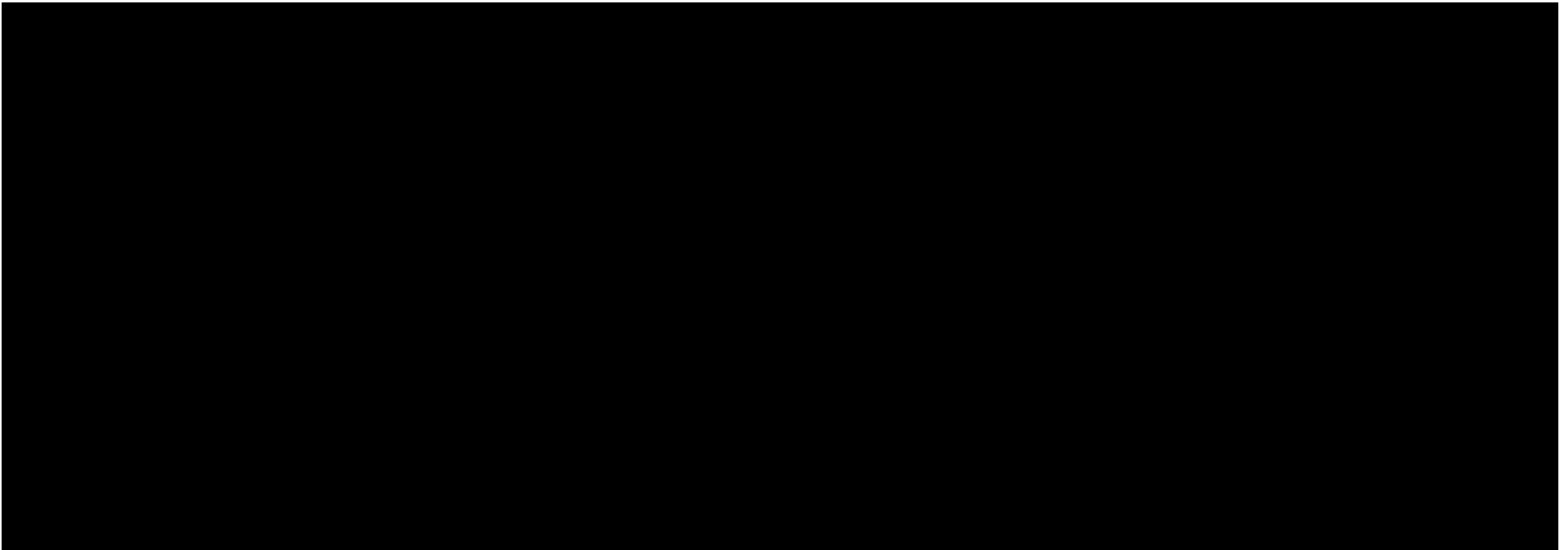


Ex. 2069 at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

112

Commercial Success – Viking



Ex. 2070 at 1

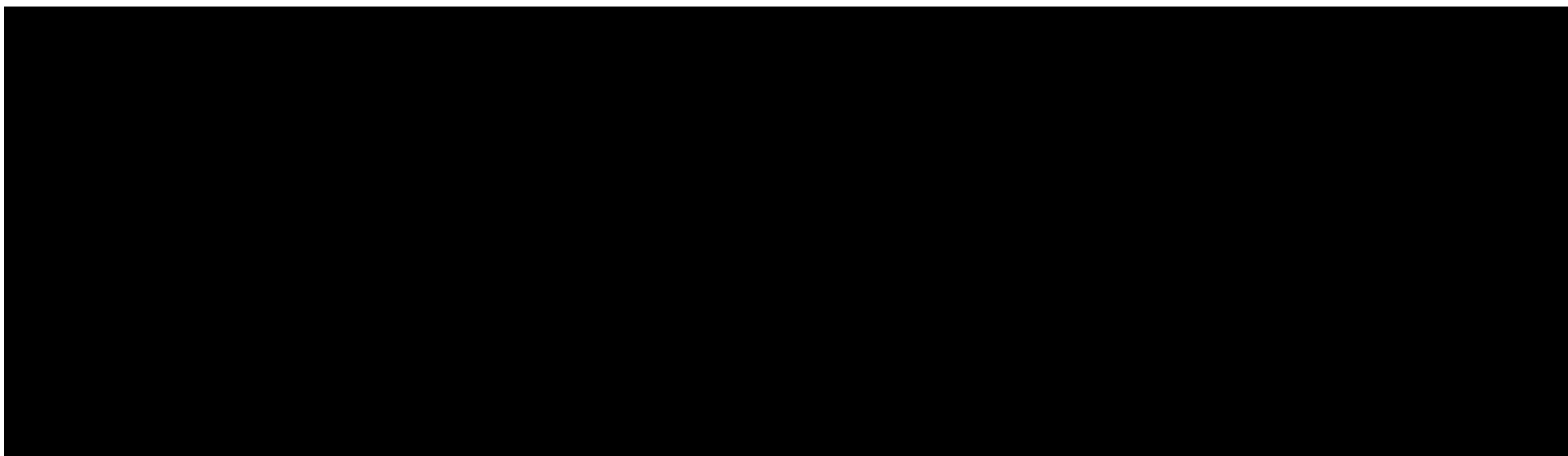
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

113

Viking’s Post-Litigation Claims Are Not Credible

Fulk Declaration

Evidence



Ex. 1045 at ¶ 4

Ex. 2055 at 1; Ex. 2056 at 6 (Emails from Kimball Midwest)

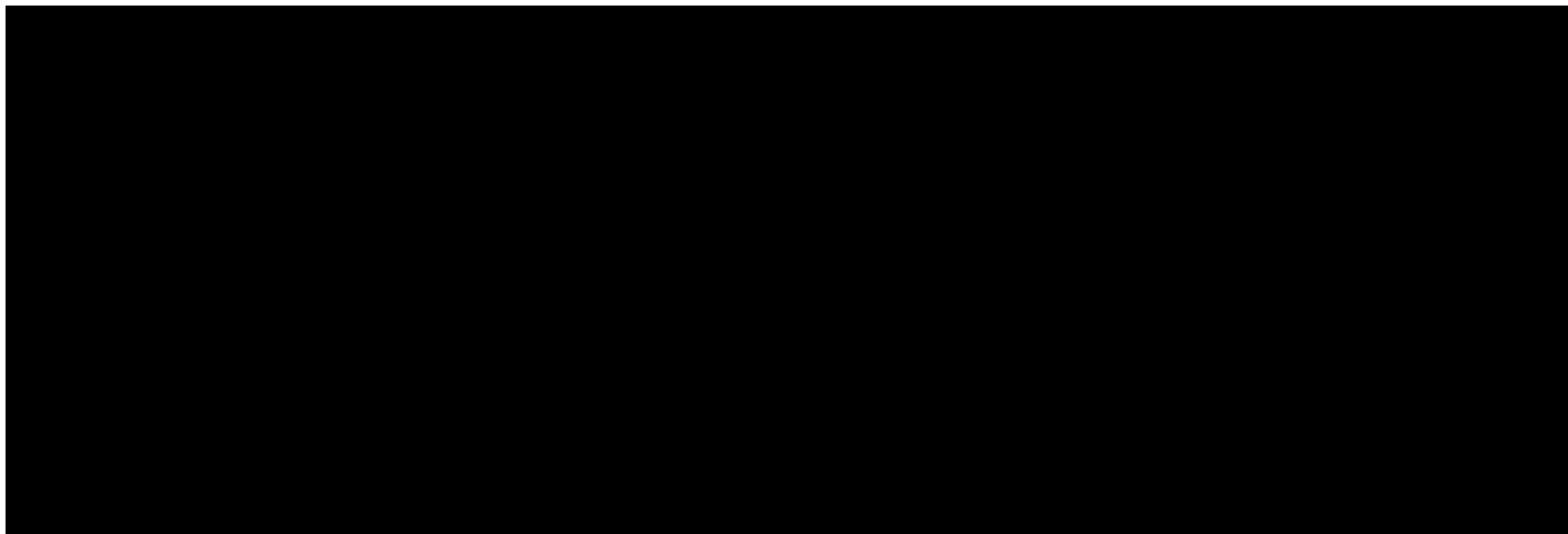
DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

114

Viking’s Post-Litigation Claims Are Not Credible

Fulk Declaration

Evidence



Ex. 1045 at ¶ 15

Ex. 2067 (Email from Scott Roussin) at 1; Ex. 2071 (Roussin Dep. Tr.) at 87:2-24

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

115

Viking's Post-Litigation Claims Are Not Credible

14 Q. Mr. Fulk, does Viking sell the
15 Vortex-Point drill bit as an improved twist drill or
16 is it as an improved step drill?
17 MS. TRICHI: Objection to form. Scope.
18 Lacks foundation and vague.
19 A. I'm not involved with the marketing. So
20 we sell it as a cutting tool, an improved cutting
21 tool or a cutting tool. I don't know how it's
22 stated.

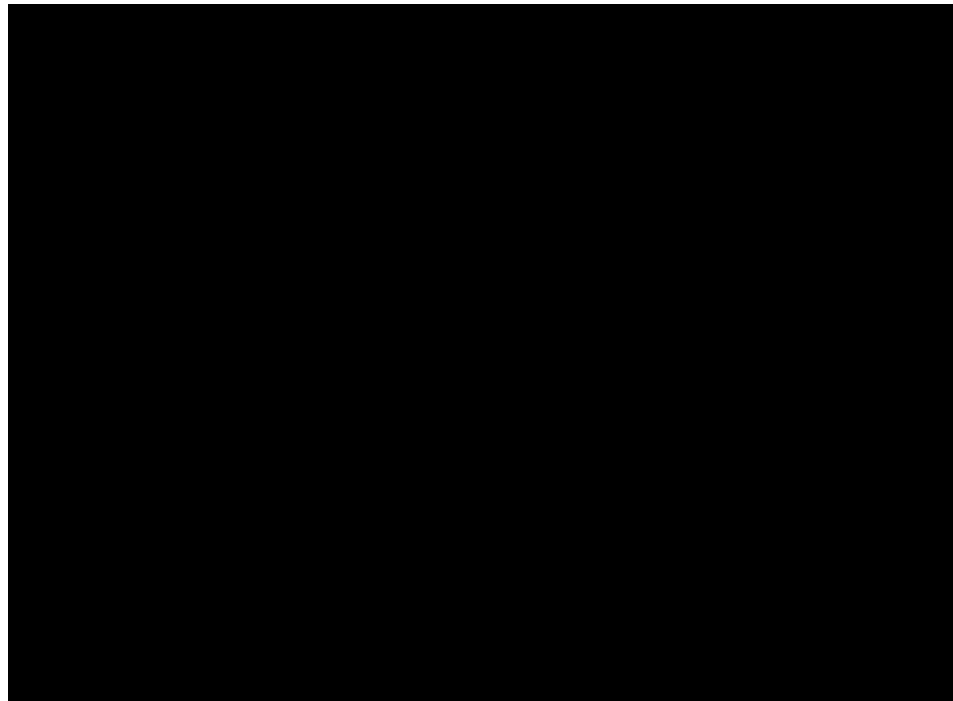
Ex. 2119 at 22:14-22

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

116

CONFIDENTIAL – ATTORNEYS' EYES ONLY

Viking's Post-Litigation Claims Are Not Credible



Ex. 2119 at 28:4-17

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

117

Viking's Post-Litigation Claims Are Not Credible

2 Q. Why didn't you compare it to your
3 specialty drills?
4 MS. TRICHI: Objection to form.
5 A. Because we don't sell it as a specialty
6 drill.
7 BY MR. CUNNINGHAM:
8 Q. What do you sell it as?
9 A. The Vortex-Point drill with a
10 multi-diameter cutting tip on a drill bit.
11 Q. And an improved twist drill?
12 MS. TRICHI: Objection to form. Asked and
13 answered.
14 A. Not to my -- to my knowledge, I don't do
15 the marketing. I don't know.

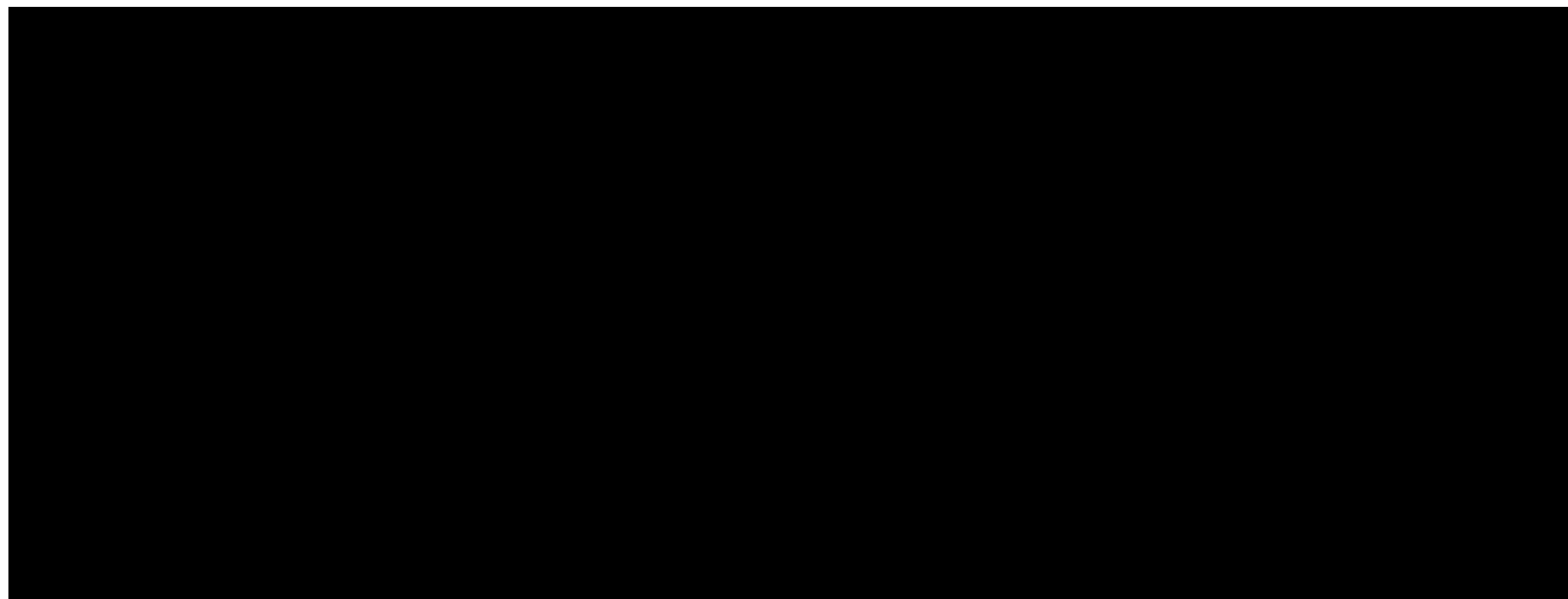
Ex. 2119 at 76:2-15

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

118

CONFIDENTIAL – ATTORNEYS' EYES ONLY

Viking's Post-Litigation Claims Are Not Credible



Ex. 2119 at 77:8-79:18

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

119

Viking's Post-Litigation Claims Are Not Credible

7 Q. So are they just normally successful?
8 MS. TRICHI: Objection to form.
9 A. Yes, most of our cutting tools are
10 successful. We're American-made and we make a high
11 precision product.
12 BY MR. CUNNINGHAM:
13 Q. Then you say, "Viking is certainly pleased
14 with the sales of its Vortex drills."
15 Do you see that?
16 A. Yes.
17 Q. Are you personally pleased with the sales
18 of its Vortex drills?
19 MS. TRICHI: Objection to form. Scope.
20 A. I'm not involved in sales. So to say I'm
21 pleased or not pleased, I don't know.
22 I would say that the product has -- we've
23 had some success with it, yes.
24 BY MR. CUNNINGHAM:
25 Q. So you're not being offered as an expert

1 on commercial success or highly commercial
2 successful products; is that correct?
3 MS. TRICHI: Objection to form.
4 A. Not -- yes.
5 BY MR. CUNNINGHAM:
6 Q. So what's your personal knowledge as to
7 the commercial success of the Viking point drill
8 bits?
9 MS. TRICHI: Objection to form.
10 A. Well, the knowledge is written here, you
11 know, what we've done in sales, and that compared to
12 what we've done in other sales over the same
13 three-year period. And it shows, you know, that --
14 it's depicting success rate as -- it's not showing
15 as a percentage, but that's what's being said here
16 is, you know, it didn't slow down any of our normal
17 twist drill sales by offering this product. And we,
18 you know, we've had some success with this.

Ex. 2119 at 83:7-84:18

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

120

Viking's Post-Litigation Claims Are Not Credible

4 Q. In the next paragraph you say, "To further
5 put the sales of stepped tip twist drills into
6 context, the annual sales of all twist drills in the
7 United States is conservatively estimated to be over
8 \$300 million per year."

9 Do you see that?

10 A. Yes.

11 Q. Do you stand by that statement?

12 A. That it's an estimated number, correct,
13 yes.

14 Q. Did you come up with this number or did
15 accounting come up with this number?

16 MS. TRICHI: Objection to form.

17 A. No.

18 BY MR. CUNNINGHAM:

19 Q. Who came up with this number?

20 MS. TRICHI: Same objection.

21 A. It was a number that had been generated by
22 USCTI, United States Cutting Tool Institute.

23 BY MR. CUNNINGHAM:

24 Q. Did you provide any of that information
25 attached to your declaration?

1 A. No. It does say in here -- no.

2 Q. You identify the source of your
3 information?

4 MS. TRICHI: Objection to form.

5 A. It was, like I said, United States Cutting
6 Tool Institute, and I believe the guy's name was
7 Mark.

Ex. 2119 at 80:4-81:7

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

121

Zhou Invalidity Grounds

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

122

Zhou

CN 203356678 U (19) National Intellectual Property Administration, PRC	
(12) Utility Model Patent	
(10) Grant announcement no.: CN 203356678 U (45) Grant announcement date: December 25, 2013	
(21) Application no.: 201320060502.4 (22) Filing date: February 1, 2013 (73) Patentee: ZHOU Anshan Address: 2nd Floor, Guoke Yuke Building, Xiyang District, Haikou City, Hainan Province 570314 (72) Inventor: ZHOU Anshan (74) Patent agency: Haikou Xiangxiang Patent Agency Co., Ltd. 46001 Agent: Li Yong (51) Int. Cl. B23B 51/02 (2006.01) (ESM) An application for an invention patent has been made on the same date for the same invention/creation (54) Title of utility model Twist drill having main cutting edge segments and asymmetrical edge heights (57) Abstract The present utility model is a twist drill having main cutting edge segments and asymmetrical edge heights. It comprises a twist drill body (9), an edge back (10), a central drill tip (5) and a chisel edge (8), characterized in that the twist drill further comprises two main cutting edge segments which have asymmetrical edge heights on the same circumference; wherein one main cutting edge segment is divided into one segment as a segmented outer protruding edge (1) and another segment as a segmented inner sunken edge (3), corresponding to said one main cutting edge segment on the same circumference, the other main cutting edge segment has one segment as a segmented outer sunken edge (2) and another segment as a segmented inner protruding edge (4); and the twist drill further comprises a segmented outer protruding edge swarf separation groove (6) and a segmented inner protruding edge swarf separation groove (7). Beneficial effects of the present utility model: reduced drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, further increasing drilling efficiency and drill bit durability.	Claims: 1 page Description: 2 pages Accompanying drawings: 3 pages

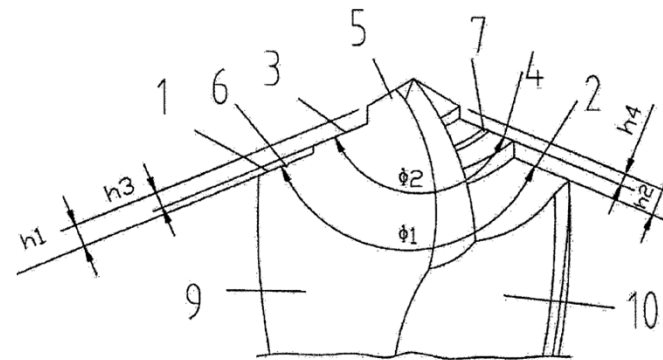


Fig. 1

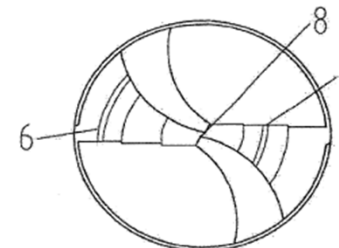


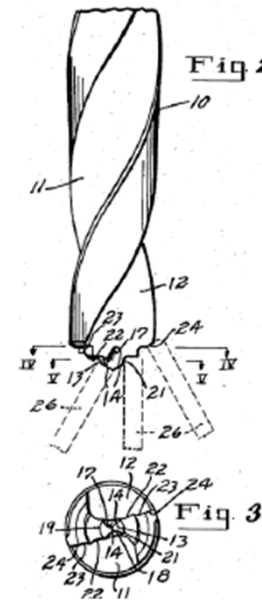
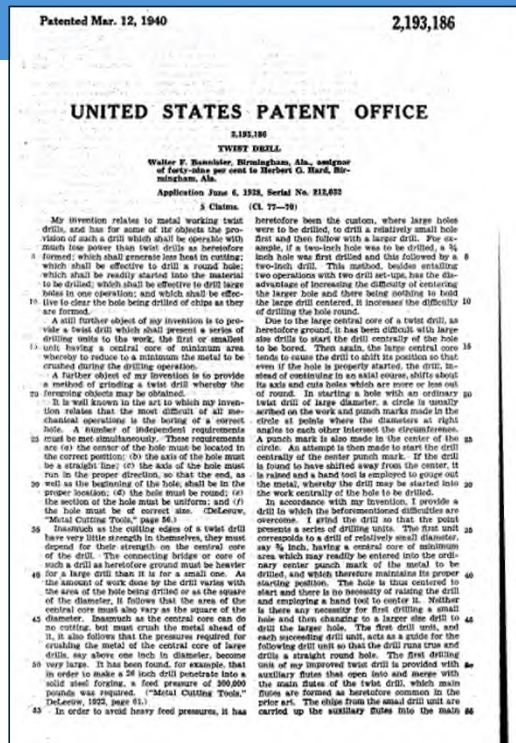
Fig. 2

Ex. 1007 at Figs. 1-2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

123

Bannister



Ex. 1006 at Figs. 2-3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

124

Gentry

US008029215B2

(12) **United States Patent**
Gentry et al.

(10) **Patent No.:** **US 8,029,215 B2**
(45) **Date of Patent:** **Oct. 4, 2011**

(54) **SPRAL DRILL BIT AND METHOD OF FORMING SAME**

(75) **Inventors:** **Charles L. Gentry**, Macheney Park, IL (US); **William F. Norellin**, Poplar Grove, IL (US)

(73) **Assignee:** **Greiner Texttron Inc.**, Rockford, IL (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 344 days.

(21) **Appl. No.:** **11/965,622**

(22) **Filed:** **Jan. 4, 2008**

(65) **Prior Publication Data**
US 2008/0166195 A1 Jul. 10, 2008

Related U.S. Application Data
(66) Provisional application No. 60/878,846, filed on Jan. 5, 2007.

(51) **Int. Cl.** **B23D 51/02** (2006.01)

(52) **U.S. Cl.** **408/224; 76/108.6**

(58) **Field of Classification Search** **408/223, 225, 408/227, 230, 76/101.1, 108.1, 108.6, 115; 408/238, 240, 242**
See application file for complete search history.

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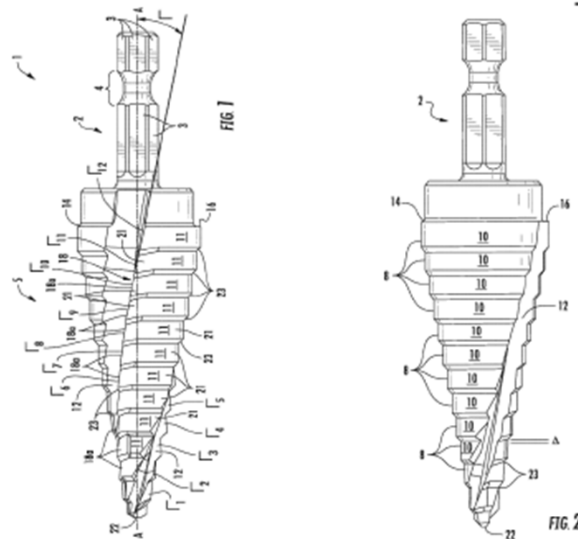
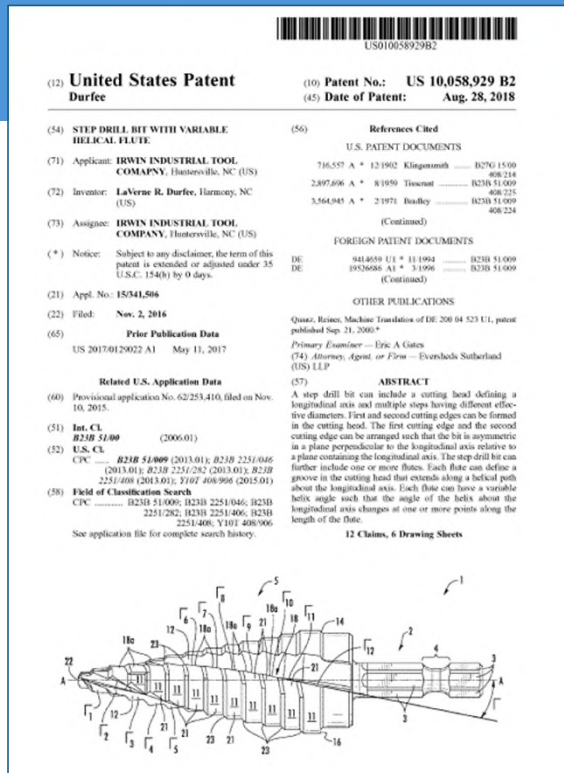
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* cited by examiner

ABSTRACT
(57) A spiral drill bit for forming holes of a variety of sizes has a main body which provides first and second helical grooves. First and second flutes extend along the length of the main body to provide first and second helical groove segments. Cutting segments are provided between the helical groove segments. The method for forming the spiral drill bit includes turning the helical groove segments onto a round stock. An axial clearance and an initial diametral clearance are provided upon turning the helical grooves. A grinding process is used to form a radial clearance and a final diametral clearance. The reduction to the amount of grinding required to form the spiral drill bit results in a reduction to the cost of production and a reduction in the time necessary to produce the spiral drill bit.

21 Claims, 8 Drawing Sheets

Durfee



Ex. 1011 at Figs. 1 and 2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

126

Cutting Tips Formed Spirally on a Cone Portion Exterior (Cls. 18, 22)

US/1007583B2

(12) **United States Patent**
Wang

(11) **Patent No. US 11,007,583 B2**
(45) **Date of Patent:** May 18, 2021

(54) **TWIST DRILL**

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

(72) Invention: **Hongfa Wang, Shanghai (CN)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) to 0 days.

(41) Appl. No.: 14/699,999

(21) Filed: Nov. 28, 2019

(56) **Prior Publication Data**
US 2020/0094331 A1 Mar. 26, 2020

Related U.S. Application Data

(63) Continuation-in-part of application No. 15/547,900, filed on Dec. 19, 2017, now abandoned, and a continuation-in-part of application No. PCT/CN2018/075767, filed on Feb. 14, 2018.

(57) **Int. Cl.**
B23D 1/80 (2006.01)
B23D 1/802 (2006.01)

(57) **U.S. Cl.**
CPC — **B23D 1/802** (2013.01); **B23D 1/8069** (2013.01); **B23D 221/52** (2013.01)

(57) **Field of Classification Search**
CPC — **B23D 1/80**; **B23D 221/40**; **B23D 221/52**; **B23D 221/58**; **B23D 221/60**; **B23D 221/62**; **B23D 221/64**; **B23D 221/66**; **B23D 221/68**; **B23D 221/70**; **B23D 221/72**; **B23D 221/74**; **B23D 221/76**; **B23D 221/78**; **B23D 221/80**; **B23D 221/82**; **B23D 221/84**; **B23D 221/86**; **B23D 221/88**; **B23D 221/90**; **B23D 221/92**; **B23D 221/94**; **B23D 221/96**; **B23D 221/98**; **B23D 222/10**; **B23D 222/12**; **B23D 222/14**; **B23D 222/16**; **B23D 222/18**; **B23D 222/20**; **B23D 222/22**; **B23D 222/24**; **B23D 222/26**; **B23D 222/28**; **B23D 222/30**; **B23D 222/32**; **B23D 222/34**; **B23D 222/36**; **B23D 222/38**; **B23D 222/40**; **B23D 222/42**; **B23D 222/44**; **B23D 222/46**; **B23D 222/48**; **B23D 222/50**; **B23D 222/52**; **B23D 222/54**; **B23D 222/56**; **B23D 222/58**; **B23D 222/60**; **B23D 222/62**; **B23D 222/64**; **B23D 222/66**; **B23D 222/68**; **B23D 222/70**; **B23D 222/72**; **B23D 222/74**; **B23D 222/76**; **B23D 222/78**; **B23D 222/80**; **B23D 222/82**; **B23D 222/84**; **B23D 222/86**; **B23D 222/88**; **B23D 222/90**; **B23D 222/92**; **B23D 222/94**; **B23D 222/96**; **B23D 222/98**; **B23D 223/10**; **B23D 223/12**; **B23D 223/14**; **B23D 223/16**; **B23D 223/18**; **B23D 223/20**; **B23D 223/22**; **B23D 223/24**; **B23D 223/26**; **B23D 223/28**; **B23D 223/30**; **B23D 223/32**; **B23D 223/34**; **B23D 223/36**; **B23D 223/38**; **B23D 223/40**; **B23D 223/42**; **B23D 223/44**; **B23D 223/46**; **B23D 223/48**; **B23D 223/50**; **B23D 223/52**; **B23D 223/54**; **B23D 223/56**; **B23D 223/58**; **B23D 223/60**; **B23D 223/62**; **B23D 223/64**; **B23D 223/66**; **B23D 223/68**; **B23D 223/70**; **B23D 223/72**; **B23D 223/74**; **B23D 223/76**; **B23D 223/78**; **B23D 223/80**; **B23D 223/82**; **B23D 223/84**; **B23D 223/86**; **B23D 223/88**; **B23D 223/90**; **B23D 223/92**; **B23D 223/94**; **B23D 223/96**; **B23D 223/98**; **B23D 224/10**; **B23D 224/12**; **B23D 224/14**; **B23D 224/16**; **B23D 224/18**; **B23D 224/20**; **B23D 224/22**; **B23D 224/24**; **B23D 224/26**; **B23D 224/28**; **B23D 224/30**; **B23D 224/32**; **B23D 224/34**; **B23D 224/36**; **B23D 224/38**; **B23D 224/40**; **B23D 224/42**; **B23D 224/44**; **B23D 224/46**; **B23D 224/48**; **B23D 224/50**; **B23D 224/52**; **B23D 224/54**; **B23D 224/56**; **B23D 224/58**; **B23D 224/60**; **B23D 224/62**; **B23D 224/64**; **B23D 224/66**; **B23D 224/68**; **B23D 224/70**; **B23D 224/72**; **B23D 224/74**; **B23D 224/76**; **B23D 224/78**; **B23D 224/80**; **B23D 224/82**; **B23D 224/84**; **B23D 224/86**; **B23D 224/88**; **B23D 224/90**; **B23D 224/92**; **B23D 224/94**; **B23D 224/96**; **B23D 224/98**; **B23D 225/10**; **B23D 225/12**; **B23D 225/14**; **B23D 225/16**; **B23D 225/18**; **B23D 225/20**; **B23D 225/22**; **B23D 225/24**; **B23D 225/26**; **B23D 225/28**; **B23D 225/30**; **B23D 225/32**; **B23D 225/34**; **B23D 225/36**; **B23D 225/38**; **B23D 225/40**; **B23D 225/42**; **B23D 225/44**; **B23D 225/46**; **B23D 225/48**; **B23D 225/50**; **B23D 225/52**; **B23D 225/54**; **B23D 225/56**; **B23D 225/58**; **B23D 225/60**; **B23D 225/62**; **B23D 225/64**; **B23D 225/66**; **B23D 225/68**; **B23D 225/70**; **B23D 225/72**; **B23D 225/74**; **B23D 225/76**; **B23D 225/78**; **B23D 225/80**; **B23D 225/82**; **B23D 225/84**; **B2**

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.

Ex. 1001 at Cls. 18, 23

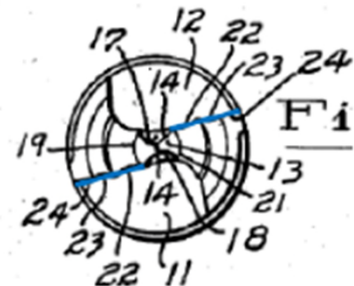
Ex. 1001 ('583 Patent)

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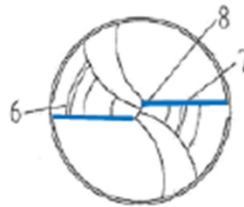
127

Wang Ex. 2122
Viking Drill & Tool Inc. v. Wang
IPR2023-00473
Page 127

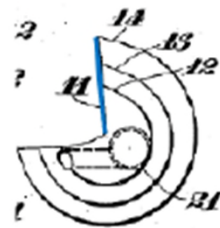
Feature Never Taught Outside Of Prior Art Step Drills



Bannister



Zhou



Welty



Wang

Paper 65 (474) at 16-17; Paper 30 at 22-24; Ex. 2003 (474) at ¶¶ 27-30; Ex. 2003 (473) at ¶¶ 41-42

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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No Motivation To Combine

Zhou

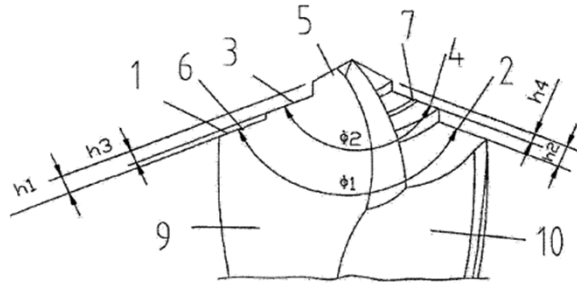


Fig. 1

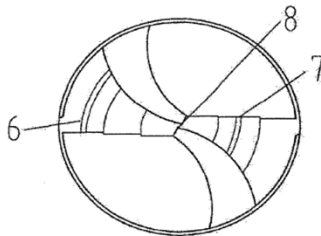
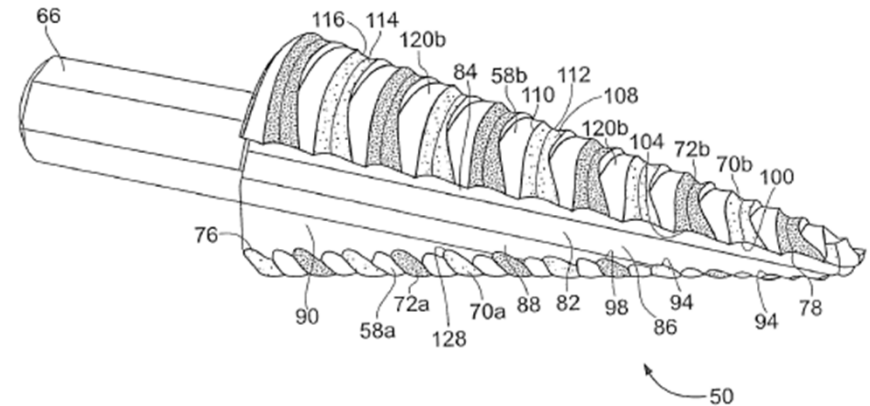


Fig. 2

Ex. 1007 at Figs. 1 & 2

Gentry



Ex. 1010 at Fig. 5; *see also* Paper 30 (474) at 18-24; Paper 65 at 8-9; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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No Motivation To Combine

Zhou

(54) Title of utility model

Twist drill having main cutting edge segments and asymmetrical edge heights

(57) Abstract

The present utility model is a twist drill having main cutting edge segments and asymmetrical edge heights. It comprises a twist drill body (9), an edge back (10), a central drill tip (5) and a chisel edge (8), characterized in that the twist drill further comprises two main cutting edge segments which have asymmetrical edge heights on the same circumference; wherein one main cutting edge segment is divided into one segment as a segmented outer protruding edge (1) and another segment as a segmented inner sunken edge (3); corresponding to said one main cutting edge segment on the same circumference, the other main cutting edge segment has one segment as a segmented outer sunken edge (2) and another segment as a segmented inner protruding edge (4); and the twist drill further comprises a segmented outer protruding edge swarf separation groove (6) and a segmented inner protruding edge swarf separation groove (7). Beneficial effects of the present utility model: reduced drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, further increasing drilling efficiency and drill bit durability.

Ex. 1007 at Title & Abstract

Gentry

BACKGROUND OF THE INVENTION

For a number of years, step drill bits have been commonly used, for example in the electrical industry, for cutting holes in panels made of sheet metal. One of the advantages that these step bits provide is that they can be used to cut a variety of holes of different diameters without requiring different drill bits to be mounted to and dismounted from a chuck of a powered tool. This, of course, saves time and money in the field.

Ex. 1010 at 1:15-23 (cited in Paper 1 (474) at p. 32); *see also* Paper 30 (474) at 18-24; Paper 65 at 8-9; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

130

No Motivation To Combine

Zhou (Cont.)

[0003] In order to increase drilling efficiency and drill bit life, experts in various countries have many methods of grinding the drill tips (i.e. chisel edges) and main cutting edges of twist drills, which help considerably in increasing drilling efficiency and drill bit life; examples are the Chinese "multi-facet drill", and cross-sharpened drill types commonly used in America.

[0004] Would it be possible to take advantage of progress in modern processing techniques to achieve a further reduction in the drilling axial resistance and torque of a twist drill by precisely changing the technical parameters of the main cutting edges thereof, so that swarf is separated and expelled more smoothly, and the new drill type is suitable for large-scale industrial production? People engaged in drilling work everywhere desperately hope so.

Technical field

[0001] The present utility model is a twist drill, in particular a twist drill having main cutting edge segments and asymmetrical edge heights, which can be manufactured from high-speed steel or a hard alloy.

[0005] An object of the present utility model is to provide a twist drill which exhibits a further significant reduction in drilling axial resistance and torque and thereby achieves significantly increased drilling efficiency and drill life.

Ex. 1007 at ¶¶[0001], [0003], [0004], [0005]; see also Paper 30 (474) at 18-24; Paper 65 at 8-9; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

131

No Motivation To Combine

Zhou (Cont.)

[0014] Compared with world standard twist drills, and cross-sharpened twist drills in common use throughout the world, the most notable distinguishing features of the present utility model are the main cutting edge segmentation and the asymmetrical edge heights, which are intended to achieve a further reduction in the drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, making it possible to further increase drilling efficiency and drill bit durability.

[0029] Summarizing embodiments 1 - 3, the present utility model represents an improvement to twist drill structure and parameters. The twist drill of the present utility model, in which the main cutting edges are segmented and the cutting edge heights are asymmetrical, is intended to achieve a further reduction in the drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, making it possible to further increase drilling efficiency and drill bit durability.

tip 5, with a diameter of 10 mm. V-shaped swarf separation grooves of depth 0.5 mm are ground in middle regions of the segmented outer protruding edge 1 and segmented inner protruding edge 4; these are the segmented outer protruding edge swarf separation groove 6 and the segmented inner protruding edge swarf separation groove 7, respectively.

Ex. 1007 at ¶¶[0014], [0029], [0024]; see also Paper 30 (474) at 18-24; Paper 65 at 8-9; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

132

No Motivation To Combine

Zhou

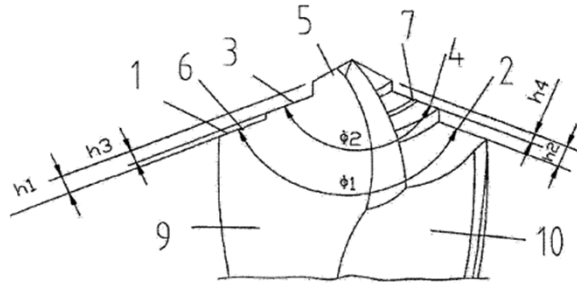


Fig. 1

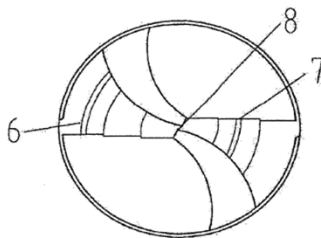


Fig. 2

Ex. 1007 at Figs. 1 & 2

Durfee

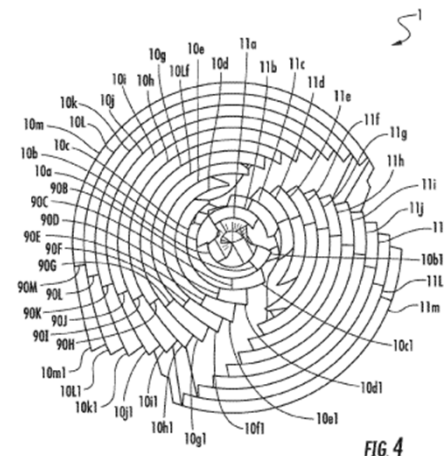


FIG. 4

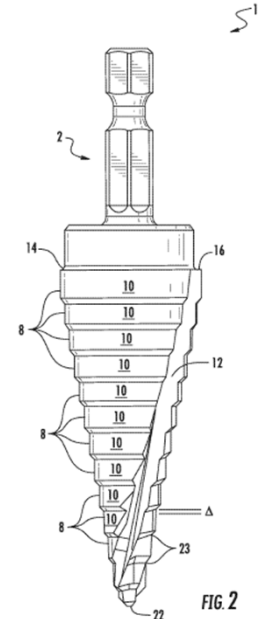


FIG. 2

Ex. 1011 at Figs. 2 & 4 (cited in Paper 1 (474) at pp. 34, 66); see also Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

133

No Motivation To Combine

Zhou

(54) Title of utility model

Twist drill having main cutting edge segments and asymmetrical edge heights

[0014] Compared with world standard twist drills, and cross-sharpened twist drills in common use throughout the world, the most notable distinguishing features of the present utility model are the main cutting edge segmentation and the asymmetrical edge heights, which are intended to achieve a further reduction in the drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, making it possible to further increase drilling efficiency and drill bit durability.

Ex. 1007 at Title, Abstract, ¶¶ [0001], [0003], [0004], [0005], [0014], [0024], [0029]; Claim preambles

Durfee

(54) STEP DRILL BIT WITH VARIABLE HELICAL FLUTE

(57)

ABSTRACT

A step drill bit can include a cutting head defining a longitudinal axis and multiple steps having different effective diameters. First and second cutting edges can be formed in the cutting head. The first cutting edge and the second cutting edge can be arranged such that the bit is asymmetric in a plane perpendicular to the longitudinal axis relative to a plane containing the longitudinal axis. The step drill bit can further include one or more flutes. Each flute can define a groove in the cutting head that extends along a helical path about the longitudinal axis. Each flute can have a variable helix angle such that the angle of the helix about the longitudinal axis changes at one or more points along the length of the flute.

Ex. 1011 at Title, Abstract (cited in Paper 1 (474) at p. 33); *see also* Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185; Ex. 1023 at p.50

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

134

Straight Major Cutting Edge Length (Cls. 7, 12, 13)

US11,007,583B2

(12) **United States Patent**
Wang

(54) **TWIST DRILL**

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

(72) Invention: **Hongtao Wang, Shanghai (CN)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Filed: **Nov. 16, 2019, 2019**

(22) **Appl. No. 28, 2019**

(65) **Priority Declaration Data**
 US 2020/040331 A1 Mar. 26, 2020

Related U.S. Application Data
 (63) Continuation-in-part of application No. 15,947,000, filed on Dec. 19, 2017, now abandoned, and a continuation-in-part of application No. PCT/CN2016/073767, filed on Feb. 14, 2016.

(51) **Int. Cl.**
 B27B 5/00 (2006.01)
 B27B 5/02 (2006.01)

(52) **U.S. Cl.**
 ———— **2019 51:02 (2013.01); B27B 5/009 (2013.01); B27B 5/012 (2013.01)**

(56) **Field of Classification Numbers**
 CPC: B27B 5/00; B27B 221/04; B27B 221/06; B27B 221/22; B27B 221/40; B27B 221/46; B27B 221/50; B27B 221/52; B27B 221/54; B27B 221/56; B27B 221/58; B27B 221/60; B27B 221/62; B27B 221/64; B27B 221/66; B27B 221/68; B27B 221/70; B27B 221/72; B27B 221/74; B27B 221/76; B27B 221/78; B27B 221/80; B27B 221/82; B27B 221/84; B27B 221/86; B27B 221/88; B27B 221/90; B27B 221/92; B27B 221/94; B27B 221/96; B27B 221/98; B27B 222/00; B27B 222/02; B27B 222/04; B27B 222/06; B27B 222/08; B27B 222/10; B27B 222/12; B27B 222/14; B27B 222/16; B27B 222/18; B27B 222/20; B27B 222/22; B27B 222/24; B27B 222/26; B27B 222/28; B27B 222/30; B27B 222/32; B27B 222/34; B27B 222/36; B27B 222/38; B27B 222/40; B27B 222/42; B27B 222/44; B27B 222/46; B27B 222/48; B27B 222/50; B27B 222/52; B27B 222/54; B27B 222/56; B27B 222/58; B27B 222/60; B27B 222/62; B27B 222/64; B27B 222/66; B27B 222/68; B27B 222/70; B27B 222/72; B27B 222/74; B27B 222/76; B27B 222/78; B27B 222/80; B27B 222/82; B27B 222/84; B27B 222/86; B27B 222/88; B27B 222/90; B27B 222/92; B27B 222/94; B27B 222/96; B27B 222/98; B27B 223/00; B27B 223/02; B27B 223/04; B27B 223/06; B27B 223/08; B27B 223/10; B27B 223/12; B27B 223/14; B27B 223/16; B27B 223/18; B27B 223/20; B27B 223/22; B27B 223/24; B27B 223/26; B27B 223/28; B27B 223/30; B27B 223/32; B27B 223/34; B27B 223/36; B27B 223/38; B27B 223/40; B27B 223/42; B27B 223/44; B27B 223/46; B27B 223/48; B27B 223/50; B27B 223/52; B27B 223/54; B27B 223/56; B27B 223/58; B27B 223/60; B27B 223/62; B27B 223/64; B27B 223/66; B27B 223/68; B27B 223/70; B27B 223/72; B27B 223/74; B27B 223/76; B27B 223/78; B27B 223/80; B27B 223/82; B27B 223/84; B27B 223/86; B27B 223/88; B27B 223/90; B27B 223/92; B27B 223/94; B27B 223/96; B27B 223/98; B27B 224/00; B27B 224/02; B27B 224/04; B27B 224/06; B27B 224/08; B27B 224/10; B27B 224/12; B27B 224/14; B27B 224/16; B27B 224/18; B27B 224/20; B27B 224/22; B27B 224/24; B27B 224/26; B27B 224/28; B27B 224/30; B27B 224/32; B27B 224/34; B27B 224/36; B27B 224/38; B27B 224/40; B27B 224/42; B27B 224/44; B27B 224/46; B27B 224/48; B27B 224/50; B27B 224/52; B27B 224/54; B27B 224/56; B27B 224/58; B27B 224/60; B27B 224/62; B27B 224/64; B27B 224/66; B27B 224/68; B27B 224/70; B27B 224/72; B27B 224/74; B27B 224/76; B27B 224/78; B27B 224/80; B27B 224/82; B27B 224/84; B27B 224/86; B27B 224/88; B27B 224/90; B27B 224/92; B27B 224/94; B27B 224/96; B27B 224/98; B27B 225/00; B27B 225/02; B27B 225/04; B27B 225/06; B27B 225/08; B27B 225/10; B27B 225/12; B27B 225/14; B27B 225/16; B27B 225/18; B27B 225/20; B27B 225/22; B27B 225/24; B27B 225/26; B27B 225/28; B27B 225/30; B27B 225/32; B27B 225/34; B27B 225/36; B27B 225/38; B27B 225/40; B27B 225/42; B27B 225/44; B27B 225/46; B27B 225/48; B27B 225/50; B27B 225/52; B27B 225/54; B27B 225/56; B27B 225/58; B27B 225/60; B27B 225/62; B27B 225/64; B27B 225/66; B27B 225/68; B27B 225/70; B27B 225/72; B27B 225/74; B27B 225/76; B27B 225/78; B27B 225/80; B27B 225/82; B27B 225/84; B27B 225/86; B27B 225/88; B27B 225/90; B27B 225/92; B27B 225/94; B27B 225/96; B27B 225/98; B27B 226/00; B27B 226/02; B27B 226/04; B27B 226/06; B27B 226/08; B27B 226/10; B27B 226/12; B27B 226/14; B27B 226/16; B27B 226/18; B27B 226/20; B27B 226/22; B27B 226/24; B27B 226/26; B27B 226/28; B27B 226/30; B27B 226/32; B27B 226/34; B27B 226/36; B27B 226/38; B27B 226/40; B27B 226/42; B27B 226/44; B27B 226/46; B27B 226/48; B27B 226/50; B27B 226/52; B27B 226/54; B27B 226/56; B27B 226/58; B27B 226/60; B27B 226/62; B27B 226/64; B27B 226/66; B27B 226/68; B27B 226/70; B27B 226/72; B27B 226/74; B27B 226/76; B27B 226/78; B27B 226/80; B27B 226/82; B27B 226/84; B27B 226/86; B27B 226/88; B27B 226/90; B27B 226/92; B27B 226/94; B27B 226/96; B27B 226/98; B27B 227/00; B27B 227/02; B27B 227/04; B27B 227/06; B27B 227/08; B27B 227/10; B27B 227/12; B27B 227/14; B27B 227/16; B27B 227/18; B27B 227/20; B27B 227/22

7. The twist drill of claim 1 wherein, a straight major cutting edge length of the top blade is greater than each of the major cutting edges of the plurality of composite cutting blade groups.

12. The twist drill of claim 8 wherein, a straight major cutting edge length of the top blade is greater than each of the major cutting edges of the plurality of composite cutting blade groups.

13. The twist drill of claim 8 wherein, a straight minor cutting edge length of the top blade is greater than each of the minor cutting edges of the plurality of composite cutting blade groups.

Ex. 1001 at Cls. 7, 12, 13

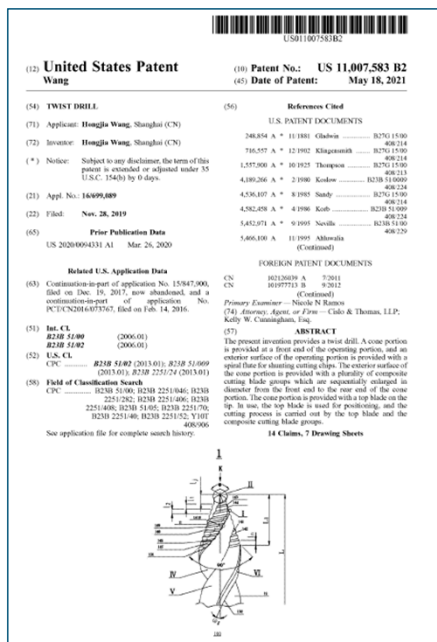
Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Page 135

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;
a minor cutting edge defined by the intersection of the cylindrical second step and the and the sidewall of the spiral flute; and

Ex. 1001 at Cls. 1, 8 (pp. 14-15)

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute

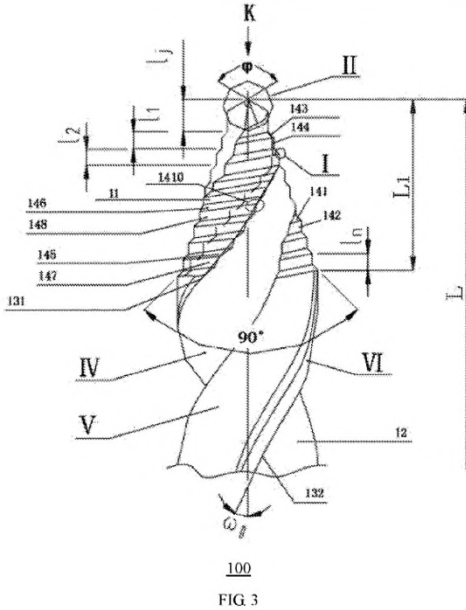
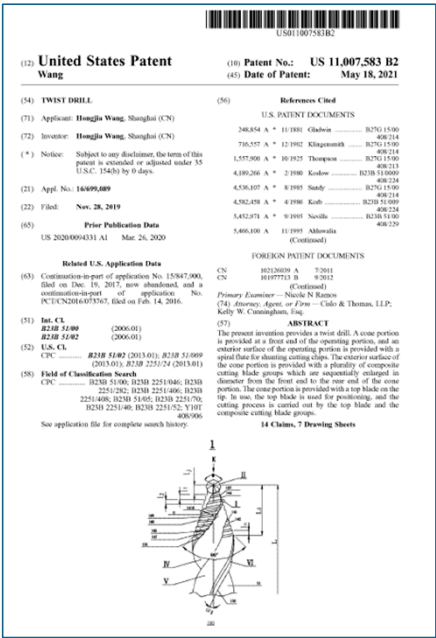
253. Cutting tips that are formed spirally are the natural result of having a flute on a cone portion of a stepped drill when the flute is cut at any angle other than parallel to the axis of a drill (i.e., perfectly vertical). This is a consequence of having the cutting tips be formed where the steps 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

Ex. 1004 at ¶ 253; Ex. 1001 at 5:9-11

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

137

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



Ex. 1001 at Fig. 3

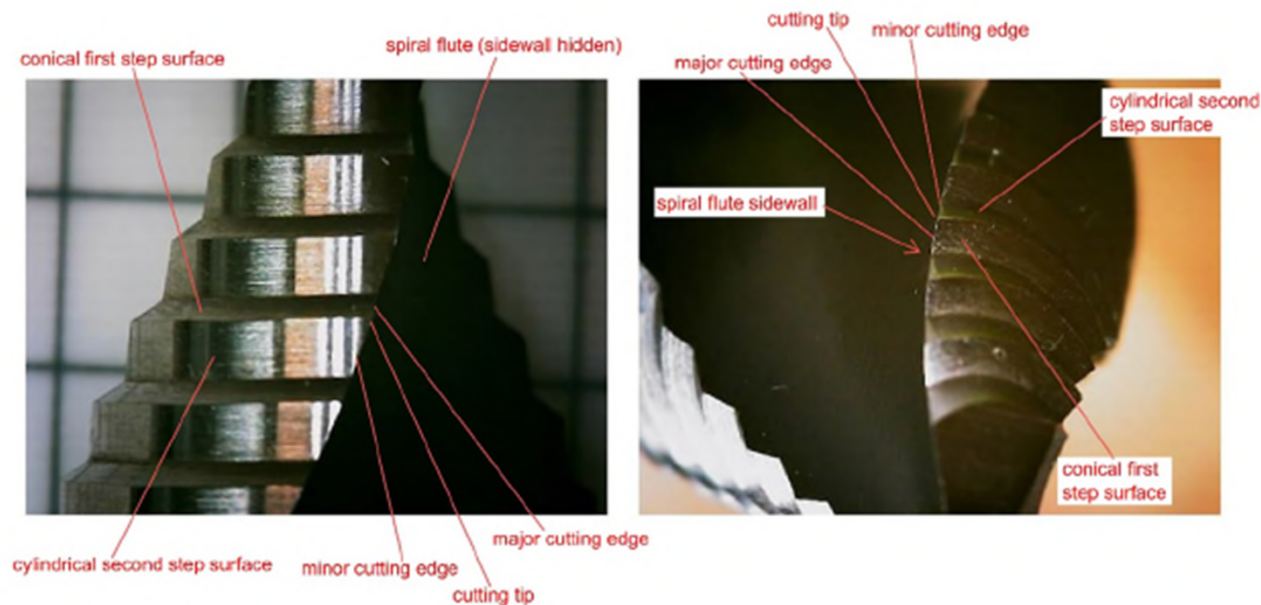
Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute



Paper 28 at 27-30; Paper 54 at 12; Ex. 2034 at ¶¶ 49-51
Ex. 1004 at ¶ 253; Ex. 1001 at 5:9-11

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

139

Cutting Edges Defined By Intersection With Sidewall Of The Spiral Flute

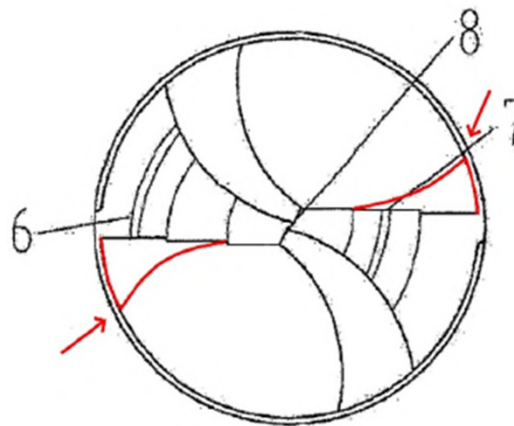


Fig. 2

Paper 30 at 20

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

140

Viking Oversimplifies The '583 Patent

Paper No. __

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

PETITIONER'S REPLY

Regarding Ground 2, PO does not dispute that Zhou in view of the secondary references teaches each and every element of all the challenged claims (including those disputed in connection with Ground 1). Rather, PO contends that it would not have been obvious to add features from step drills onto Zhou. This ignores that Zhou already incorporates step drill features on a twist drill. The further modifications needed to meet the claim language would have been both minor and obvious to a POSA.

Paper 45 (474) at 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

141

Zhou Does Not Incorporate Features Of A Step Drill

22 Q. Correct. So, the edges following the top
23 blade are the edges I'm looking at and they formed
24 one or more cutting tips on either side of top
25 blade 5. Do you agree?

1 A. I believe that's correct.

2 Q. At most they show two cutting tips on
3 either side of top blade 5; is that correct?

4 A. I believe that's correct. Depending on
5 feed rate.

6 Q. And if the feed rate is slow enough then
7 you've got only one cutting tip on either side of
8 top blade 5; is that correct?

9 MR. MCINTYRE: Objection. Vague.

10 A. I believe that's correct. But, again, I
11 haven't studied this in great depth.

Ex. 2118 at 121:22-122:11

See also Ex. 2118 at 108:6-111:20, 111:23-112:10

21 Q. I'm asking if the edges 2 or 3, which are
22 called sunken edges, are they performing any cutting
23 at all?

24 MR. MCINTYRE: Objection. Form. Asked
25 and answered.

1 A. Right. Again, it depends on your feed
2 rate. We've been through this. At low feed rates,
3 you're right, some of the surfaces may not engage.
4 But you have to tell the whole story. It's these
5 segmented heights plus process parameters.

Ex. 2118 at 116:21-117:5

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

142

Welly Invalidity Grounds

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

143

Welty

Patented Mar. 17, 1942

2,276,532

UNITED STATES PATENT OFFICE

2,276,532

DRILL

Earl F. Welty, Center Valley, Pa., assignor to
Schickelmeier Steel Company, a corporation of
Pennsylvania

Application May 25, 1940, Serial No. 137,755

3 Claims. (Cl. 77-67)

My invention relates to drills and particularly drills for operating on metals.

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 automatically increase in diameter as from the initial cutting step so that the work may be easily drilled.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawing in which:

Figure 1 is a plan view of the drill shown in the material being drilled;

Figure 2 is an end view of the drill shown in Figure 1;

Figure 3 is a section taken along line 3-3 of Figure 1;

Figure 4 is a section taken along line 4-4 of Figure 1; and

Figure 5 is a section taken along line 5-5 of Figure 1.

Referring to the drawing in detail, 18 designates a drill which is provided with a shank 11 for removing chips, which are used by the boring operation. Drill 18 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and cleaning the chips from the drill. Cross groove 16, hole 17, and hole 19 are provided to receive means for attaching the drill to a drill chuck.

Referring to Figures 1 and 2, the nose or cutting end of drill 18 is provided, as heretofore mentioned, with three boring portions 12, 13, and 14 which are substantially in the form of segments of a circle. The boring portion 12, is ground so as to form a heel 21 on a portion of the periphery of the body portion 22 approximately opposite the cutting edge 23 as is clearly shown in Figure 3. The heel 21 is so formed with relation to the cutting edge that the major por-

tion of the body portion is out of contact with the work 24 during the boring operation and therefore binding of the drill in the work is prevented. The boring portion 13 has a body portion 24 of larger diameter than body portion 22 of boring portion 12. The body portion 24 is provided on its periphery approximately opposite its cutting edge 25 with a heel portion 26 similar to heel 21. The heels 21 and 26 also serve as bearing supports for the cutting edges 23 and 25, respectively. Boring portion 14 is provided with a cutting edge 27 which merges into the body portion 28. The body portion 28 is of larger diameter than the body portion 24 of the boring portion 13.

Upon reference to Figure 2 it will be observed that the boring portion 14 is of circular formation and has a cutting edge 27 which extends an appreciable distance outside the normal circumference of the boring portion 14 to contact with the work during the boring operation. The body portion 14 does not have a heel portion provided on the periphery of its body portion 28 opposite its cutting edge 27 in contact with the work as do the boring portions 12 and 13. As a result the heels 21 and 26 of boring portions 12 and 13, respectively, will not only retain the cutting edges 23 and 25 of boring portions 12 and 13, respectively, in contact with the work but will retain the cutting edge 27 of boring portion 14 in contact with the work and also retain the body portion 28 in spaced relation with the work.

During the boring operation the boring portion 12 comes in contact with the work 24 and bores a preliminary hole therein, the boring portion 13 contacting the walls of the bore at its cutting edge 25 and at its heel 26. The boring portion 13 which has a cutting action similar to that of boring portion 12 then comes into operation. This portion 13 is of greater diameter than the boring portion 12 and will also contact the walls of the bore only at its cutting edge 25 and its heel 26 of its body portion 24. The cutting edge 27 of the boring portion 14 then comes into operation and contacts the work as shown in Figures 1 and 2, the body portion 28 being retained out of contact with the work due to the heel portions 21 and 26 of the boring portions 12 and 13, respectively, contacting with the walls of the bore. As only the cutting edge 27 of the body portion 28 comes into contact with the work the binding and breakage of the body portion of the drill which invariably occur in other known drills, are eliminated, and also it will require considerably less power to operate the drill.

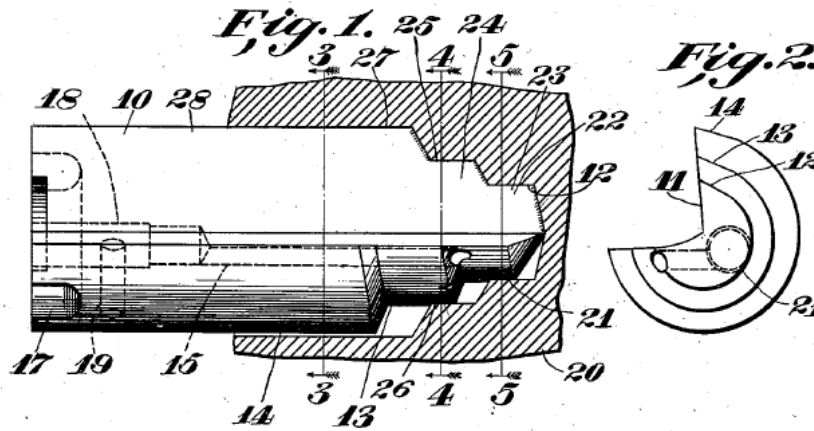


FIG. 1

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Ex. 1008 at Figs. 1-2

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Welty

Patented Mar. 17, 1942

2,276,532

UNITED STATES PATENT OFFICE

2,276,532

DRILL

Earl F. Welty, Center Valley, Pa., assignor to
Schlumberger Steel Company, a corporation of
Pennsylvania

Application May 25, 1940, Serial No. 237,755

3 Claims. (Cl. 77-67)

My invention relates to drills and particularly drills for operating on metals.

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 automatically increase in diameter as from the initial cutting step so that the work may be easily drilled.

The novel features of my invention will be more fully understood from the following description and claims taken with the drawing in which:

Figure 1 is a plan view of the drill shown in the material being drilled;

Figure 2 is an end view of the drill shown in Figure 1;

Figure 3 is a section taken along line 3-3 of Figure 1;

Figure 4 is a section taken along line 4-4 of Figure 1; and

Figure 5 is a section taken along line 5-5 of Figure 1.

Referring to the drawing in detail, 10 designates a drill which is provided with a shank 11 for removing chips, which are used by the boring operation. Drill 10 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and cleaning the chips from the drill. Cross groove 16, hole 18, and hole 19 are provided to receive means for attaching the drill to a drill chuck.

Referring to Figures 1 and 2, the nose or cutting end of drill 10 is provided, as heretofore mentioned, with three boring portions 12, 13, and 14 which are substantially in the form of segments of a circle. The boring portion 12, is ground so as to form a heel 21 on a portion of the periphery of the body portion 22 approximately opposite the cutting edge 23 as is clearly shown in Figure 5. The heel 21 is so formed with relation to the cutting edge that the major por-

tion of the body portion is out of contact with the work 24 during the boring operation and therefore binding of the drill in the work is prevented. The boring portion 13 has a body portion 24 of larger diameter than body portion 22 of boring portion 12. The body portion 24 is provided on its periphery approximately opposite its cutting edge 25 with a heel portion 26 similar to heel 21. The heels 21 and 26 also serve as bearing supports for the cutting edges 23 and 25, respectively. Boring portion 14 is provided with a cutting edge 27 which merges into the body portion 28. The body portion 28 is of larger diameter than the body portion 24 of the boring portion 13.

Upon reference to Figure 3 it will be observed that the boring portion 14 is of circular formation and has a cutting edge 27 which extends an appreciable distance outside the normal circumference of the boring portion 14 to contact with the work during the boring operation. The body portion 14 does not have a heel portion provided on the periphery of its body portion 28 opposite its cutting edge 27 to contact with the work as do the boring portions 12 and 13. As a result the heels 21 and 26 of boring portions 12 and 13, respectively, will not only retain the cutting edges 23 and 25 of boring portions 12 and 13, respectively, in contact with the work but will retain the cutting edge 27 of boring portion 14 in contact with the work and also retain the body portion 28 in spaced relation with the work.

During the boring operation the boring portion 12 comes in contact with the work 24 and bores a preliminary hole therein, the boring portion 13 contacting the walls of the bore at its cutting edge 25 and at its heel 26. The boring portion 13 which has a cutting action similar to that of boring portion 12 then comes into operation. This portion 13 is of smaller diameter than the boring portion 12 and will also contact the walls of the bore only at its cutting edge 25 and its heel 26 of its body portion 24. The cutting edge 27 of the boring portion 14 then comes into operation and contacts the work as shown in Figures 1 and 2, the body portion 28 being retained out of contact with the work due to the heel portions 21 and 26 of the boring portions 12 and 13, respectively, contacting with the walls of the bore. As only the cutting edge 27 of the body portion 28 comes into contact with the work the binding and breakage of the body portion of the drill which invariably occur in other known drills, are eliminated, and also it will require

considerably less power to operate the drill.

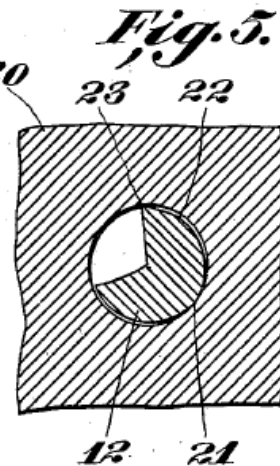
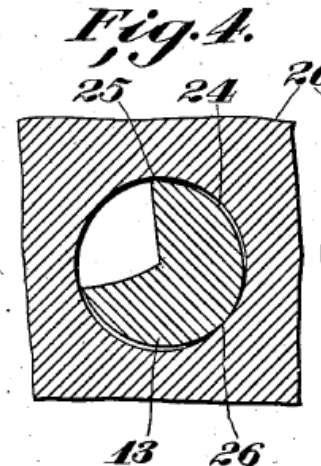
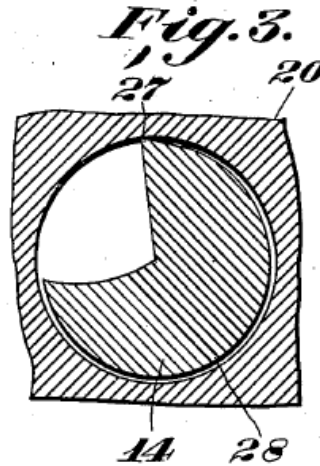


FIG. 2

FIG. 3

FIG. 4

FIG. 5

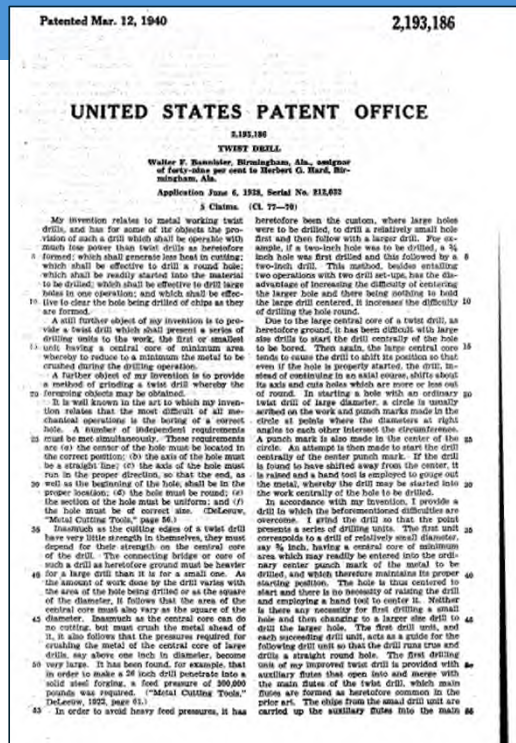
Ex. 1008 at Figs. 3-5

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Wang Ex. 2122
Viking Drill & Tool Inc. v. Wang
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Page 145

Bannister

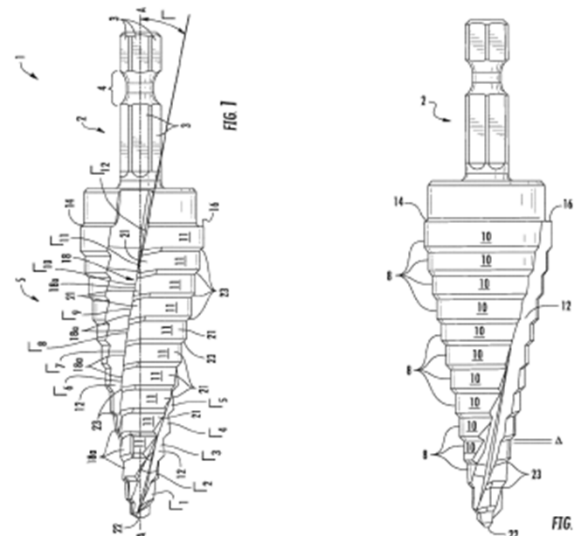
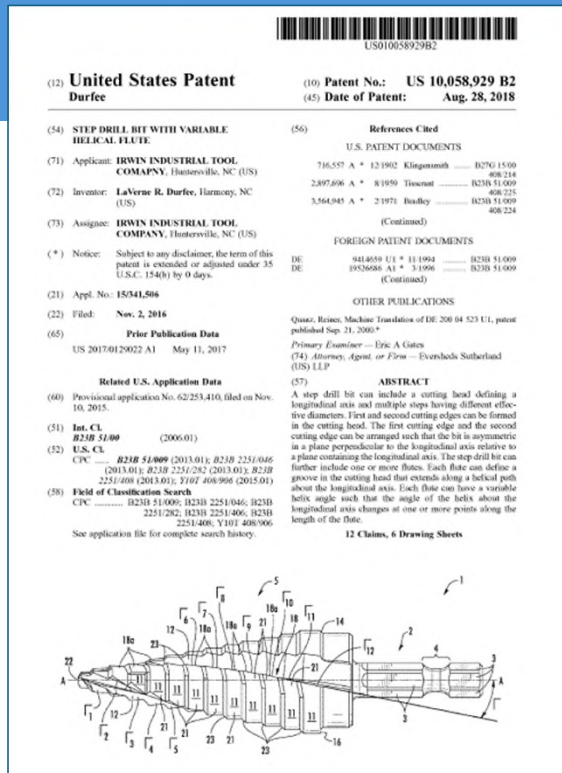


Ex. 1006 at Figs. 2-3

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

146

Durfee

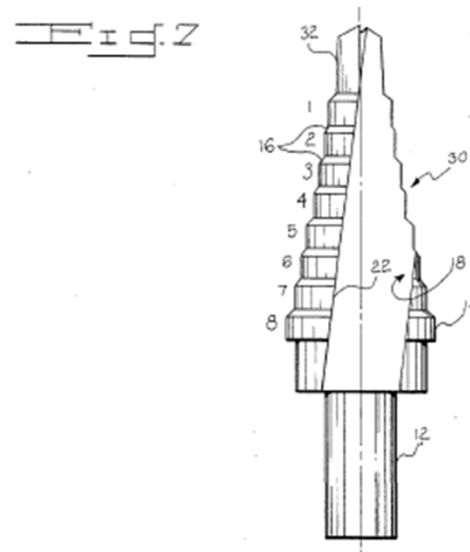
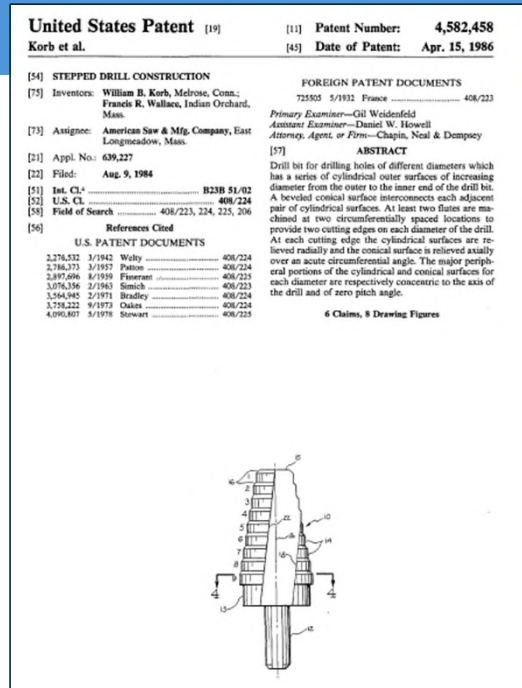


Ex. 1011 at Figs. 1 and 2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

147

Korb



Ex. 1012 at Fig. 7

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

148

Zhou

CN 203356678 U (19) National Intellectual Property Administration, PRC	
(12) Utility Model Patent	
(10) Grant announcement no.: CN 203356678 U (45) Grant announcement date: December 25, 2013	
(21) Application no.: 201320060502.4 (22) Filing date: February 1, 2013 (73) Patentee: ZHOU Anshan Address: 2nd Floor, Guoke Yuke Building, Xiuying District, Haikou City, Hainan Province 570314 (72) Inventor: ZHOU Anshan (74) Patent agency: Haikou Xiangxiang Patent Agency Co., Ltd. 46001 Agent: Li Yong (51) Int. Cl. B23B 51/02 (2006.01) (ESM) An application for an invention patent has been made on the same date for the same invention/creation (54) Title of utility model Twist drill having main cutting edge segments and asymmetrical edge heights (57) Abstract The present utility model is a twist drill having main cutting edge segments and asymmetrical edge heights. It comprises a twist drill body (9), an edge back (10), a central drill tip (5) and a chisel edge (8), characterized in that the twist drill further comprises two main cutting edge segments which have asymmetrical edge heights on the same circumference; wherein one main cutting edge segment is divided into one segment as a segmented outer protruding edge (1) and another segment as a segmented inner sunken edge (3), corresponding to said one main cutting edge segment on the same circumference, the other main cutting edge segment has one segment as a segmented outer sunken edge (2) and another segment as a segmented inner protruding edge (4); and the twist drill further comprises a segmented outer protruding edge swarf separation groove (6) and a segmented inner protruding edge swarf separation groove (7). Beneficial effects of the present utility model: reduced drilling axial resistance and torque, so that swarf is separated and expelled more smoothly, further increasing drilling efficiency and drill bit durability.	Claims: 1 page Description: 2 pages Accompanying drawings: 3 pages

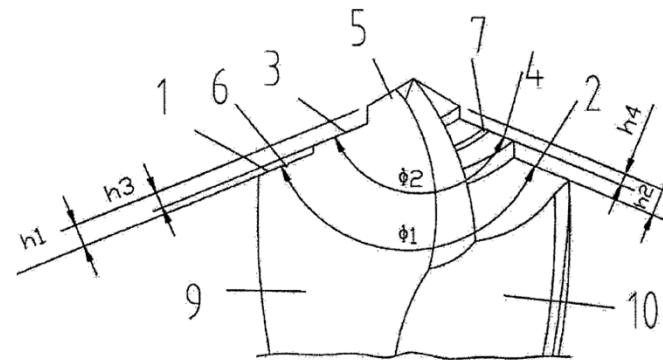


Fig. 1

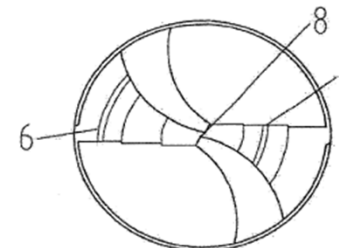


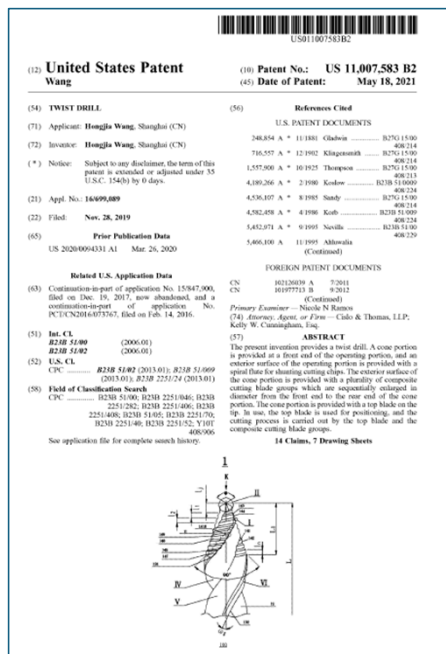
Fig. 2

Ex. 1007 at Figs. 1-2

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

149

Spiral Flute (All Claims)



1. A twist drill, comprising:
 an operation portion comprising a cone portion and a cylinder portion axially fixed to the cone portion;
 a shank portion axially fixed to the cylinder portion opposite the cone portion;
 a spiral flute formed on an exterior surface of the operating portion extending from a front end of the cone portion and at least partway up the cylinder portion, the spiral flute having a sidewall;
 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, each of the plurality of composite cutting blade groups comprising:
 a conical first step surface;
 a cylindrical second step surface adjacent to the conical first step surface,
 a major cutting edge defined by the intersection of the conical first step surface and the sidewall of the spiral flute;

a minor cutting edge defined by the intersection of the cylindrical second step and the and the sidewall of the spiral flute; and
 a cutting tip defined by the intersection of the major cutting edge, the minor cutting edge, and the sidewall of the spiral flute; and
 a top blade provided on the front end of the cone portion;
 wherein a diameter of each of the plurality of composite cutting blade groups increases sequentially from the front end of the cone portion to the rear end of the cone portion; and each of the plurality of composite cutting blade groups is configured to crush cutting chips into finer chips and the spiral flute is configured to shunt the finer chips; and
 wherein at least one cylindrical second step surface is immediately adjacent to a conical first step surface of a next composite cutting blade group; and the diameter of the last composite cutting blade group located at the rear end of the cone portion immediately adjacent to the cylinder portion is equal to the cylinder portion diameter.

Ex. 1001 at Cls. 1, 8

Ex. 1001 ('583 Patent)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

150

Welty Is A Gun Drill

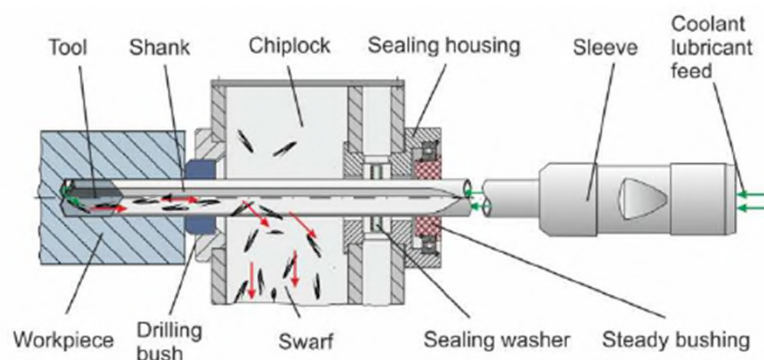
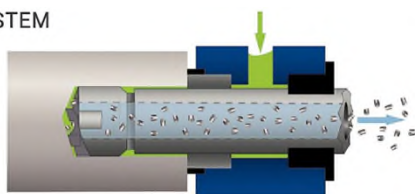
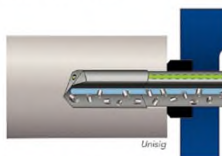


Fig. 20. Schematic process principle single-lip drilling [70,189]

BTA SYSTEM



GUNDRILL SYSTEM



Compared with gundrilling, in which through-tool coolant is introduced at the cutting zone and forces chips out through the drilled bore, the BTA system essentially operates in reverse.

Gun Drills

- Used to drill very deeply into material
- Lubricant used to remove swarf
- Single, straight V-shaped flute

Ex. 2003 at ¶ 43; Ex. 2099 at 11-12

Ex. 2101 at 9; Ex. 2100 at 4; Ex. 2102 at 2.

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

151

The Use Of A Single Straight Flute Is Integral To The Operation Of Gun Drills, Like Welty

Gun drills (Fig. 12m), which are used in horizontal deep-hole drilling machines (see the section "Deep-Hole Drilling Machines" in this article), have a single V-shaped flute; the single cutting face is sharpened offset to form two cutting angles. When drilling, these angles form two chips broken into short lengths for easier expulsion. The drill body is usually a steel tube through which a cutting fluid passes under pressure and in sufficient volume to cool and lubricate the cutting area and flush out chips. To counter the unbalanced cutting force of the single cutting edge, wear pads (usually carbide) are provided in the drill opposite the cutting face to keep the drill on center. Gun drills are used to drill soft as well as hard material.

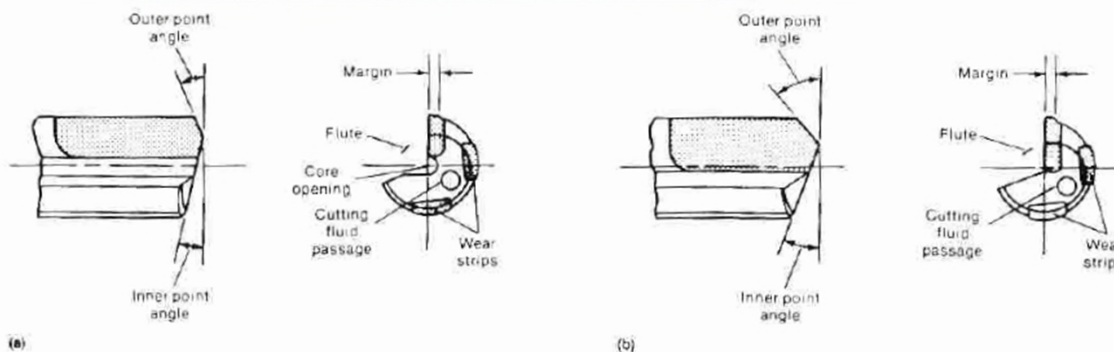


Fig. 17 Two types of straight-flute gun drills used in deep-hole drilling. (a) Trepanning drill, (b) Center-cut drill

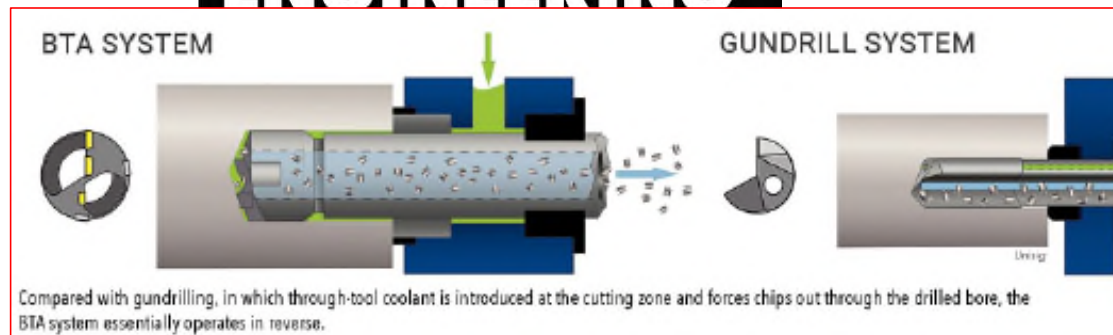
Ex. 2099 at pp. 11-12 [222-223] (cited at Paper 30 (474) at p. 43)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Use Of A Single Straight Flute Is Integral To The Operation Of Gun Drills, Like Welty

CUTTING TOOL ENGINEERING



A true gundrill is a single-flute, self-piloting tool that also burnishes the hole that it generates. Unlike the spiral flutes of twist drills, the straight flute of a gundrill extends for the length of the drill, and through-tool coolant reaches the cutting zone via an outlet at the drill tip. High-pressure coolant then pushes chips up the bore, along the straight flute and out of the hole.

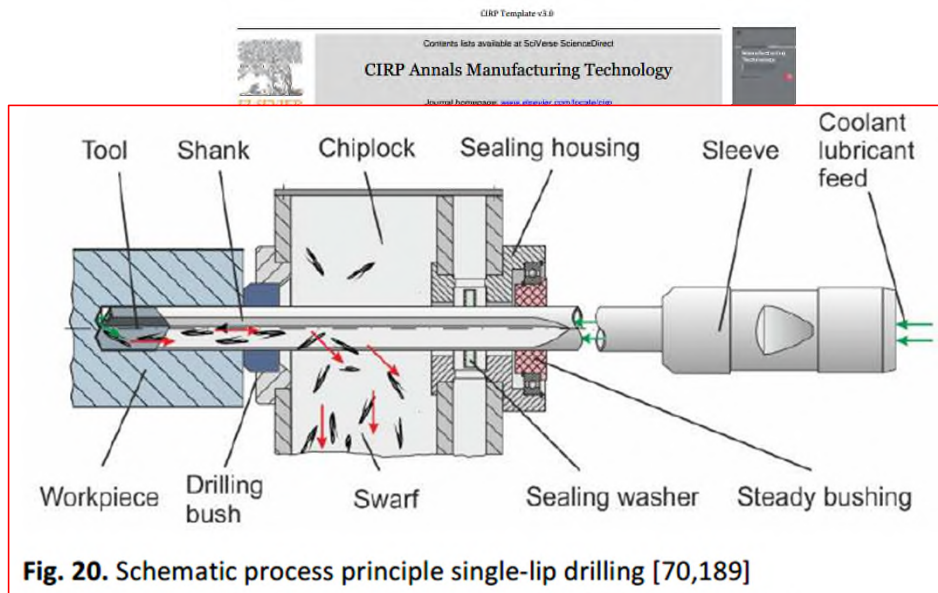


Ex. 2100 at pp. 3-4 [35-36] (cited at Paper 65 (474) at p. 13)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

153

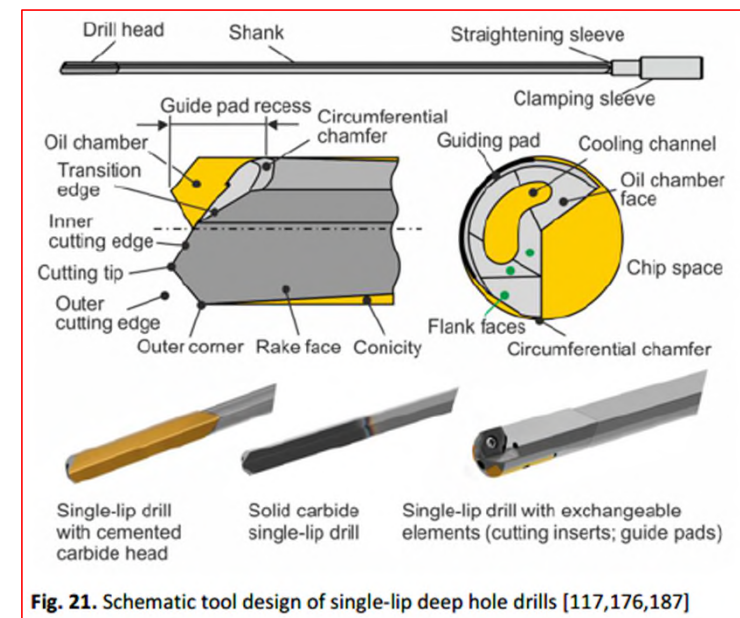
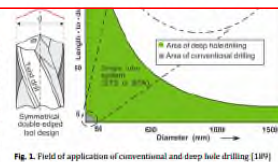
The Use Of A Single Straight Flute Is Integral To The Operation Of Gun Drills, Like Welty



that deep hole drilling methods dominate the whole field of drilling [189].

For the production of deep bore holes based on mechanical processes, two different tool designs are used: Tools with an asymmetrical single-edged design (Fig. 1/top left), which include drilling methods with single-lip deep hole drill heads (SLD), single-tube system (STS) drilling, also known as BTA (Boring and Trepanning Association) drilling, and double-tube system (DTS) drilling. On the other hand, there are tools with two symmetrical cutting edges, which are used in the case of twist and double-flute drilling (Fig. 1/bottom left). Due to the realizable drilling depth, they can also be assigned to the deep hole drilling methods.

* Corresponding author.
E-mail address: burmann@fs.de (D. Burmann).



Ex. 2101 at p. 9 [¶¶ 3.1.1-3.1.2] (cited at Paper 65 (474) at p. 13)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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The Use Of A Single Straight Flute Is Integral To The Operation Of Gun Drills, Like Welty



Technical Bulletin

Gun Drilling

Having enough coolant flow to gun drill with a CNC machine

Gun drilling is intrinsically designed for drilling. It is one of the most dependable, undemandable, and used in the many gun drilling, as well as many other industries automotive, machine tool and gas exploration.

Deep hole drilling times their diameter, length, as well as rigidity used with this process to metals to ceramic.

Advantages of
Compared to other

- deep, accurate
- the best method when
- and/or straightness is required
- guide pads
- secondary
- reduced cost and labor time
- gun drill tips can be reground
- life

Gun drilling process is achieved by:

- specially
- carbide
- internally-fed coolant systems

A hole through the drill delivers coolant that is sent to the cutting edge to lubricate the point of contact and cleanly flush chips through a v-shaped groove or flute (also known as single-flute drilling). Guides on the tool head burnish the hole while drilling, resulting in a precise, round hole and desired diameter. This internal coolant/exhaust feature distinguishes gun drilling from other deep hole drilling methods with its accuracy and precision. Ordinary twist drills do not compare to the precision of gun drilling.

Advantages of gun drilling

Compared to other drilling methods

- deep, accurate holes in a
- the best method when very
- and/or straightness is required
- guide pads burnish the hole
- secondary finishing
- reduced cost and labor time
- gun drill tips can be reground
- life

Milling machines are typically equipped with high-pressure coolant systems. It does not guarantee that the volume needed for gun drilling operations will be delivered to the point-of-cut. Pressure does not ensure volume. With either a CNC or milling machine, to attain desired volume and good results, calculations and adjustments must be made.

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IPR2023-00473 and IPR2023-00474

Precision is achieved in deep hole drilling with the use of:

- specially engineered shank shapes
- carbide cutting edges
- internally-fed coolant systems

A hole through the drill delivers coolant that is sent to the cutting edge to lubricate the point of contact and cleanly flush chips through a v-shaped groove or flute (also known as single-fluted drilling). Guides on the tool head burnish the hole while drilling, resulting in a precise, round hole and desired diameter. This internal coolant/external exhaust feature distinguishes gun drilling from other deep hole drilling methods with its accuracy and precision. Ordinary twist drills do not compare to the precision of gun drilling.

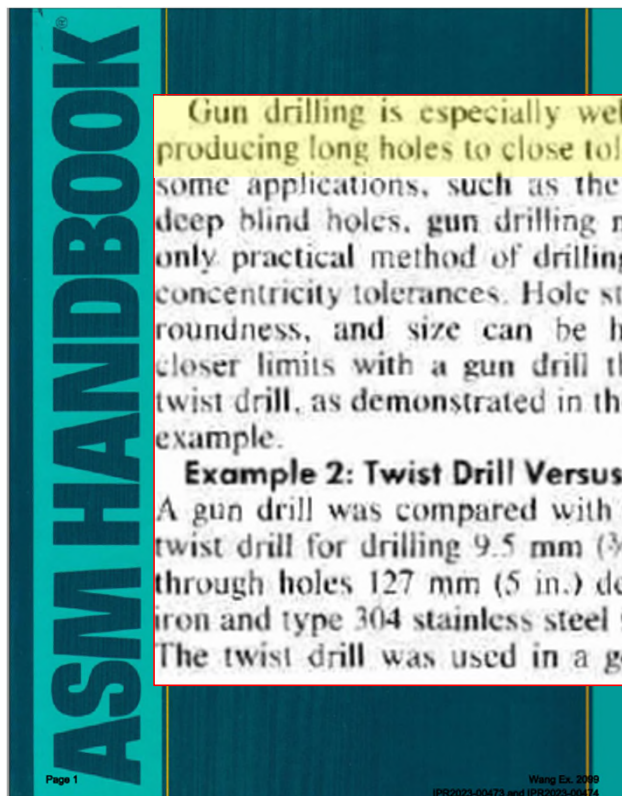
Ex. 2104 at p. 1 (cited at Paper 30 (474) at p. 44)

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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No Motivation To Combine Gun Drill With Twist Drill



pose 1.5 kW (2 hp) vertical drill press; the gun drill, in a 3.8 kW (5 hp) modified boring machine with hydraulic feed. Processing details and results for each material drilled are given in Table 3. As these data show, the gun drill not only produced markedly better finish and dimensional accuracy than the twist drill but also drilled twice as many pieces per grind, under production conditions.

Ex. 2009 at p. 12 [223]; Paper 30 (474) at pp. 43-44; Paper 65 (474) at p. 13

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

156

Cutting Tips Formed Spirally on a Cone Portion Exterior (Cls. 18, 22)

US11,007,583B2

(12) **United States Patent**
Wang

(36) **Patent No. US 11,007,583 B2**

(45) **Date of Patent: May 18, 2021**

(54) **TWIST DRILL**

(56)

References Cited

UNITED STATES PATENTS

(17) Applicant: **Hongtao Wang, Shanghai (CN)**

(17) Invention: **Hongtao Wang, Shanghai (CN)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Filed: Nov. 16, 2019, 2019

(22) April 28, 2019

(45) **Priority Publication Data**
 US 2020/049331 A1 Mar. 26, 2020

Related U.S. Application Data
 (63) Continuation-in-part of application No. 15,947,000, filed on Dec. 19, 2017, now abandoned, and a continuation-in-part of application No. 16,000,000, filed on Feb. 14, 2018.

(1) **Int. Cl.**
 B23D 51/00 (2006.01)
 B23D 51/02 (2006.01)

(1) **U.S. Cl.**
 (2019) 011: 8218 51/00 (2013.01); 8218 51/09 (2013.01); 8218 51/12 (2013.01)

(58) **Field of Classification Number**
 CPC: B23D 51/00; B23D 225/04; B23D 225/06; B23D 225/12; B23D 225/16; B23D 225/18; B23D 225/20; B23D 225/22; B23D 225/24; B23D 225/26; B23D 225/28; B23D 225/30; B23D 225/32; B23D 225/34; B23D 225/36; B23D 225/38; B23D 225/40; B23D 225/42; B23D 225/44; B23D 225/46; B23D 225/48; B23D 225/50; B23D 225/52; B23D 225/54; B23D 225/56; B23D 225/58; B23D 225/60; B23D 225/62; B23D 225/64; B23D 225/66; B23D 225/68; B23D 225/70; B23D 225/72; B23D 225/74; B23D 225/76; B23D 225/78; B23D 225/80; B23D 225/82; B23D 225/84; B23D 225/86; B23D 225/88; B23D 225/90; B23D 225/92; B23D 225/94; B23D 225/96; B23D 225/98; B23D 226/00; B23D 226/02; B23D 226/04; B23D 226/06; B23D 226/08; B23D 226/10; B23D 226/12; B23D 226/14; B23D 226/16; B23D 226/18; B23D 226/20; B23D 226/22; B23D 226/24; B23D 226/26; B23D 226/28; B23D 226/30; B23D 226/32; B23D 226/34; B23D 226/36; B23D 226/38; B23D 226/40; B23D 226/42; B23D 226/44; B23D 226/46; B23D 226/48; B23D 226/50; B23D 226/52; B23D 226/54; B23D 226/56; B23D 226/58; B23D 226/60; B23D 226/62; B23D 226/64; B23D 226/66; B23D 226/68; B23D 226/70; B23D 226/72; B23D 226/74; B23D 226/76; B23D 226/78; B23D 226/80; B23D 226/82; B23D 226/84; B23D 226/86; B23D 226/88; B23D 226/90; B23D 226/92; B23D 226/94; B23D 226/96; B23D 226/98; B23D 227/00; B23D 227/02; B23D 227/04; B23D 227/06; B23D 227/08; B23D 227/10; B23D 227/12; B23D 227/14; B23D 227/16; B23D 227/18; B23D 227/20; B23D 227/22; B23D 227/24; B23D 227/26; B23D 227/28; B23D 227/30; B23D 227/32; B23D 227/34; B23D 227/36; B23D 227/38; B23D 227/40; B23D 227/42; B23D 227/44; B23D 227/46; B23D 227/48; B23D 227/50; B23D 227/52; B23D 227/54; B23D 227/56; B23D 227/58; B23D 227/60; B23D 227/62; B23D 227/64; B23D 227/66; B23D 227/68; B23D 227/70; B23D 227/72; B23D 227/74; B23D 227/76; B23D 227/78; B23D 227/80; B23D 227/82; B23D 227/84; B23D 227/86; B23D 227/88; B23D 227/90; B23D 227/92; B23D 227/94; B23D 227/96; B23D 227/98; B23D 228/00; B23D 228/02; B23D 228/04; B23D 228/06; B23D 228/08; B23D 228/10; B23D 228/12; B23D 228/14; B23D 228/16; B23D 228/18; B23D 228/20; B23D 228/22; B23D 228/24; B23D 228/26; B23D 228/28; B23D 228/30; B23D 228/32; B23D 228/34; B23D 228/36; B23D 228/38; B23D 228/40; B23D 228/42; B23D 228/44; B23D 228/46; B23D 228/48; B23D 228/50; B23D 228/52; B23D 228/54; B23D 228/56; B23D 228/58; B23D 228/60; B23D 228/62; B23D 228/64; B23D 228/66; B23D 228/68; B23D 228/70; B23D 228/72; B23D 228/74; B23D 228/76; B23D 228/78; B23D 228/80; B23D 228/82; B23D 228/84; B23D 228/86; B23D 228/88; B23D 228/90; B23D 228/92; B23D 228/94; B23D 228/96; B23D 228/98; B23D 229/00; B23D 229/02; B23D 229/04; B23D 229/06; B23D 229/08; B23D 229/10; B23D 229/12; B23D 229/14; B23D 229/16; B23D 229/18; B23D 229/20; B23D 229/22; B23D 229/24; B23D 229/26; B23D 229/28; B23D 229/30; B23D 229/32; B23D 229/34; B23D 229/36; B23D 229/38; B23D 229/40; B23D 229/42; B23D 229/44; B23D 229/46; B23D 229/48; B23D 229/50; B23D 229/52; B23D 229/54; B23D 229/56; B23D 229/58; B23D 229/60; B23D 229/62; B23D 229/64; B23D 229/66; B23D 229/68; B23D 229/70; B23D 229/72; B23D 229/74; B23D 229/76; B23D 229/78; B23D 229/80; B23D 229/82; B23D 229/84; B23D 229/86; B23D 229/88; B23D 229/90; B23D 229/92; B23D 229/94; B23D 229/96; B23D 229/

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.

Ex. 1001 at Cls. 18, 23

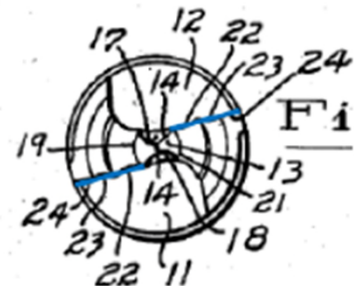
Ex. 1001 ('583 Patent)

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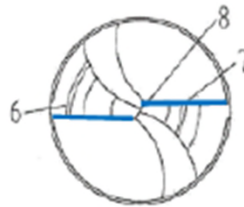
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Feature Never Taught Outside Of Prior Art Step Drills



Bannister



Zhou



Welty



Wang

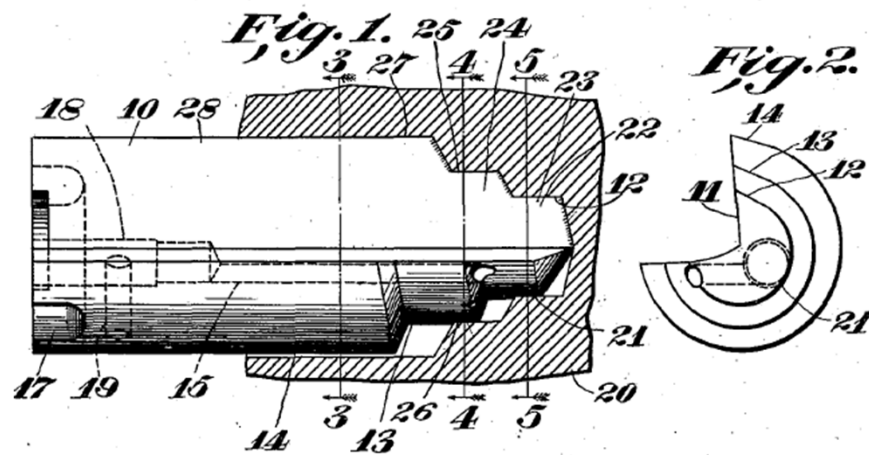
Paper 65 (474) at 16-17; Paper 30 at 22-24; Ex. 2003 (474) at ¶¶ 27-30; Ex. 2003 (473) at ¶¶ 41-42

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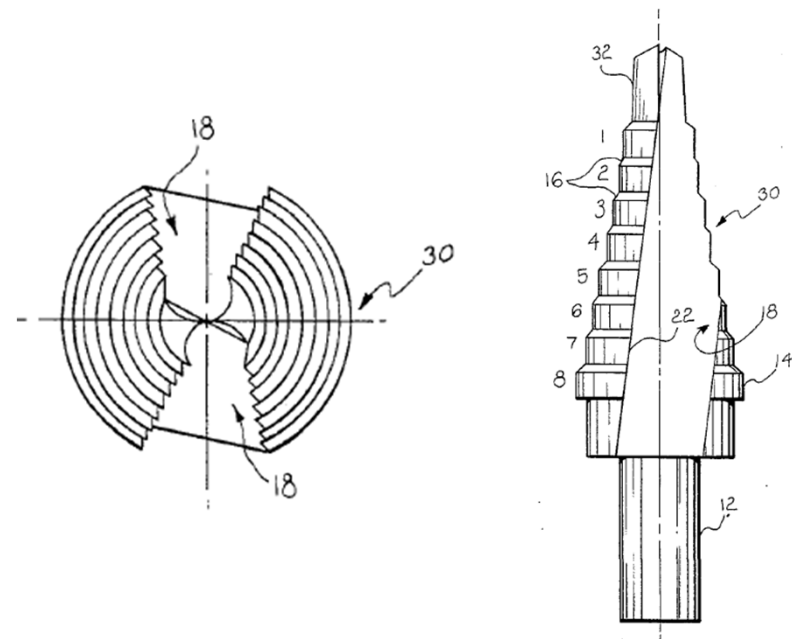
No Motivation To Combine

Welty



Ex. 1008 at Figs. 1 & 2

Korb



Ex. 1012 at Figs. 7 & 8; see also Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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No Motivation To Combine

Welty

My invention relates to drills and particularly drills for operating on metals.

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

Referring to the drawing in detail, 10 designates a drill which is provided with a single flute 11 for removing chips, which are used by the boring operation. Drill 10 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and cleaning the chips from the drill. Cross groove 17, hole 18, and hole 19 are provided to receive means for attaching the drill to a drill shank.

Ex. 1008 at 1, col. 1:3-5; 1, col. 1:36-43

Korb

[54] STEPPED DRILL CONSTRUCTION

[57] ABSTRACT

Drill bit for drilling holes of different diameters which has a series of cylindrical outer surfaces of increasing diameter from the outer to the inner end of the drill bit. A beveled conical surface interconnects each adjacent pair of cylindrical surfaces. At least two flutes are machined at two circumferentially spaced locations to provide two cutting edges on each diameter of the drill. At each cutting edge the cylindrical surfaces are relieved radially and the conical surface is relieved axially over an acute circumferential angle. The major peripheral portions of the cylindrical and conical surfaces for each diameter are respectively concentric to the axis of the drill and of zero pitch angle.

Ex. 1012 at Title, Abstract; *see also* Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

160

No Motivation To Combine

Welty

During the boring operation the boring portion 12 comes in contact with the work 20 and bores a preliminary hole therein, the boring portion 12 contacting the walls of the bore at its cutting edge 23 and at its heel 21. The boring portion 13 which has a cutting action similar to that of boring portion 12 then comes into operation. This portion 13 is of greater diameter than the boring portion 12 and will also contact the walls of the bore only at its cutting edge 25 and its heel 26 of its body portion 24. The cutting edge 27 of the boring portion 14 then comes into operation and contacts the work as shown in Figures 1 and 3, the body portion 28 being retained out of contact with the work due to the heel portions 21 and 26 of the boring portions 12 and 13, respectively, contacting with the walls of the bore. As only the cutting edge 25 of the

Korb

[54] STEPPED DRILL CONSTRUCTION

The present invention provides a stepped drill of the same general type as disclosed in the previous art but which is uniquely constructed to give improved cutting performance. In particular, the stepped drill bit has two cutting flutes which provides a pair of circumferentially spaced cutting edges for each different diameter. Each

Ex. 1008 at 1, col. 2:32-50

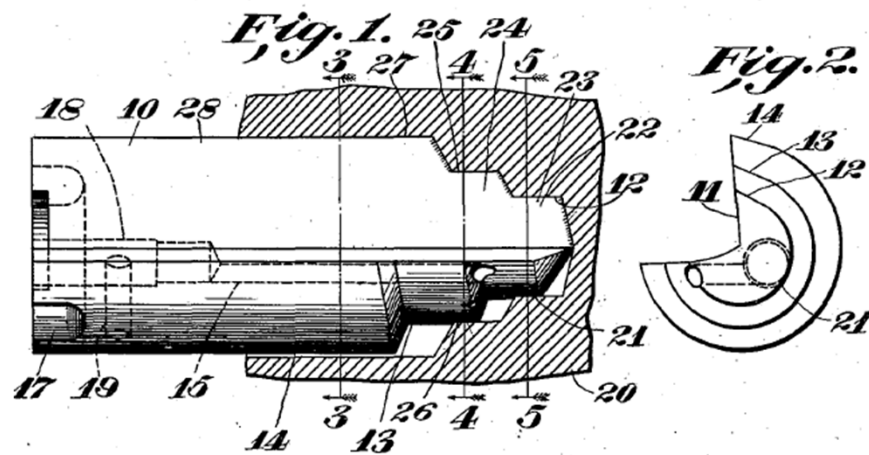
Ex. 1012 at Title, 1:30-50; *see also* Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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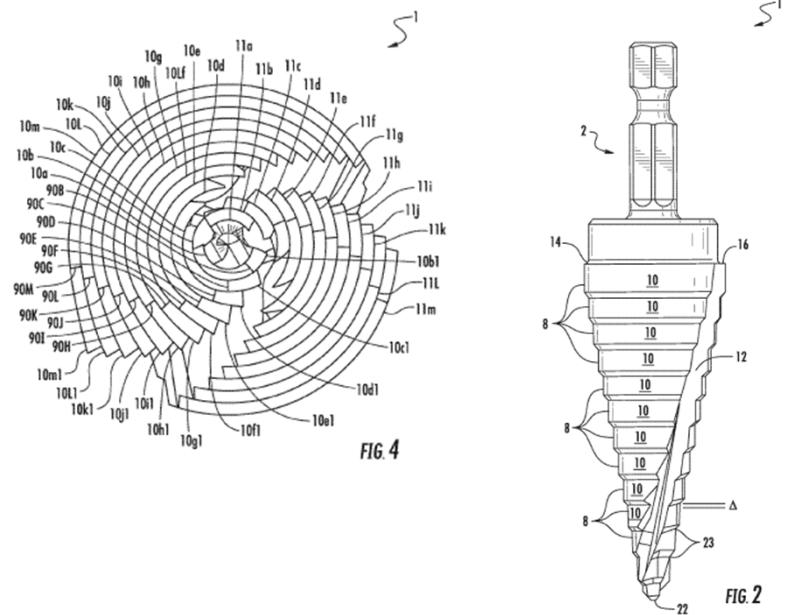
No Motivation To Combine

Welty



Ex. 1008 at Figs. 1 & 2

Durfee



Ex. 1011 at Figs. 2 & 4 (cited in Paper 1 (474) at pp. 34, 66); see also Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

162

No Motivation To Combine

Welty

My invention relates to drills and particularly drills for operating on metals.

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

Referring to the drawing in detail, 10 designates a drill which is provided with a single flute 11 for removing chips, which are used by the boring operation. Drill 10 is further provided at its nose end with three boring portions 12, 13, and 14. A duct 15 is provided to furnish oil for lubricating the drill and cleaning the chips from the drill. Cross groove 17, hole 18, and hole 19 are provided to receive means for attaching the drill to a drill shank.

Ex. 1008 at 1, col. 1:3-5; 1, col. 1:36-43

Durfee

(54) **STEP DRILL BIT WITH VARIABLE
HELICAL FLUTE**

(57) **ABSTRACT**

A step drill bit can include a cutting head defining a longitudinal axis and multiple steps having different effective diameters. First and second cutting edges can be formed in the cutting head. The first cutting edge and the second cutting edge can be arranged such that the bit is asymmetric in a plane perpendicular to the longitudinal axis relative to a plane containing the longitudinal axis. The step drill bit can further include one or more flutes. Each flute can define a groove in the cutting head that extends along a helical path about the longitudinal axis. Each flute can have a variable helix angle such that the angle of the helix about the longitudinal axis changes at one or more points along the length of the flute.

Ex. 1011 at Title, Abstract (cited in Paper 1 (474) at p. 33); *see also* Paper 30 (474) at 42-48; Paper 65 at 11-13; Ex. 2034 at ¶¶ 162-164, 181-185

DEMONSTRATIVE EXHIBIT - NOT EVIDENCE

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Viking Drill & Tool, Inc.
v.
Hongjia Wang

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

PATENT OWNER'S
DEMONSTRATIVE
EXHIBIT

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