UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

Meishan CRRC Fastening System Co., Ltd.

Petitioner,

v.

Howmet Aerospace Inc.

Patent Owner

IPR2026-00268
U.S. Patent No. 11,885,358

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 11,885,358

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EXHIBIT LIST

Exhibit	Description
1001	U.S. Patent No. 11,885,358 ("the '358 Patent")
1002	Claim Listing for U.S. Patent No. 11,885,358
1003	File History of U.S. Patent No. 11,885,358
1004	Declaration of Dr. Richard W. Klopp ("Dr. Klopp"), Ph.D., P.E., F.A.S.M.E. ("Klopp Declaration")
1005	Curriculum Vitae of Dr. Klopp, Ph.D., P.E., F.A.S.M.E.
1006	U.S. Patent Publication 2018/0111184A1 ("Corbett 2018"):
1007	U.S. Patent No. 4,299,519 ("Corbett 1981")
1008	U.S. Patent No. 3,820,297 ("Hurd")
1009	U.S. Patent No. 5,178,502 ("Sadri")
1010	"The Next Generation Small Diameter HuckBolt®" ("BobTail")
1011	Declaration of Mina Ching ("Wayback Declaration")
1012	"Huck BOM®: The Highest Strength Blind Bolt in the World" ("BOM")
1013	Patent Owner's Complaint for Patent Infringement in *Howmet Aerospace Inc. v. Stanley Engineered Fastening, LLC, Avdel UK Ltd., and Avdel Holding Ltd.* (D. Del. 2025)
1014	Docket Report for *Howmet Aerospace Inc. v. Stanley Engineered Fastening, LLC, Avdel UK Ltd., and Avdel Holding Ltd.* (D. Del. 2025)
1015	U.S. Patent Application Publication No. 2014/0271024A1 ("Jones")
1016	ASM Aerospace Specification Metals Inc. on Titanium Ti-6Al-4V (Grade 5), STA, *available a*t www.aerospacemetals.com/wp-content/uploads/2023/07/Titanium-Ti-6Al-4V-Grade-5-STA-Data-Sheet.pdf
1017	MingChuang Tungsten and Molybdenum, *The Ultimate Guide to Tungsten Fasteners: Durable Solutions for Modern Applications*, *available at* www.mcwmo.com/the-ultimate-guide-to-tungsten-fasteners-durable-solutions-for-modern-applications/
1018	EXTREME Bolt & Fastener, *Aerospace Fasteners – NAS Screws*, *available at* www.extreme-bolt.com/aerospace-fasteners.html

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1019	BORTROME, *Tungsten alloy properties*, *available at* www.wolframcarbide.com/tungsten-alloy-properties/
1020	Special Metals, *INCONEL alloy 718*, *available at* www.specialmetals.com/documents/technical-bulletins/inconel/inconel-alloy-718.pdf
1021	U.S. Patent No. 4,921,384 ("Nordyke I")
1022	U.S. Patent No. 5,213,460 ("Nordyke II")
1023	U.S. Patent No. 6,241,443 ("Corbett 2001")
1024	Howmet Aerospace, *Install Large Diameter Fasteners Anywhere*, *available at* www.hfsindustrial.com/pub/media/resources/images/image/_/h/_h_o_howmet_bv17_bv13_flyer.pdf
1025	Joseph Shigley, *Standard Handbook of Machine Design*, Section 24.1
1026	ASME B18.12-2020 (ASME Standard)
1027	NAS 1728 (NAS Standard)
1028	SAE J429-2014 (SAE Standard)
1029	NASM 21250 (NASM Standard)

I. INTRODUCTION

Meishan CRRC Fastening System Co., Ltd. ("Petitioner") respectfully requests *inter partes* review ("IPR") of claims 1-20 ("Challenged Claims") of U.S. Pat. No. 11,885,358 ("the '358 Patent," Ex-1001).

The '358 Patent is entitled *Blind Fastener and Method of Installation Thereof* and is assigned to Howmet Aerospace Inc. ("Howmet"). Ex-1001, [54, 73]. The '358 Patent describes a well-known blind fastener and installation method—both popularized before the '358 Patent's 2019 priority date. In particular, U.S.P.A.P. 2018/0111184A1 (Ex-1006) ("Corbett 2018") and U.S. Patent No. 5,178,502 (Ex-1009) ("Sadri") teach similar blind fasteners, each with a deformable sleeve surrounding a mandrel with a grooved pull region:

'358 Patent
Ex-1001

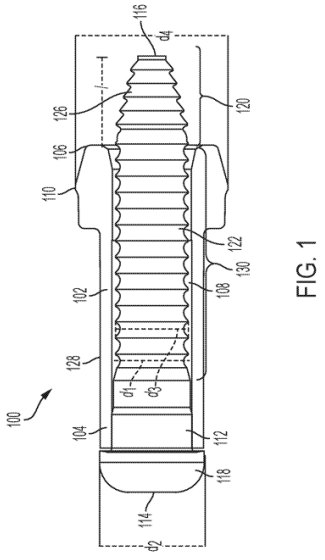


FIG. 1

Corbett (2018)
Ex-1006

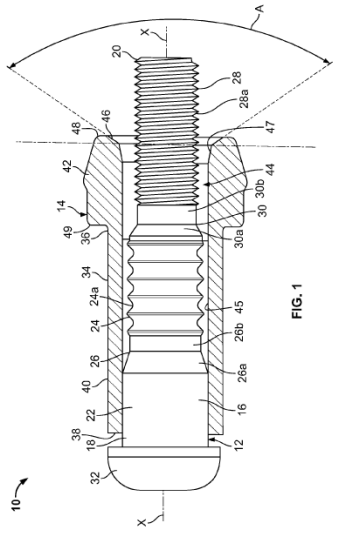


FIG. 1

Sadri (1993)
Ex-1009

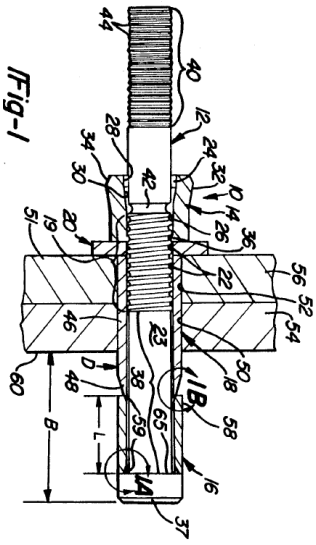
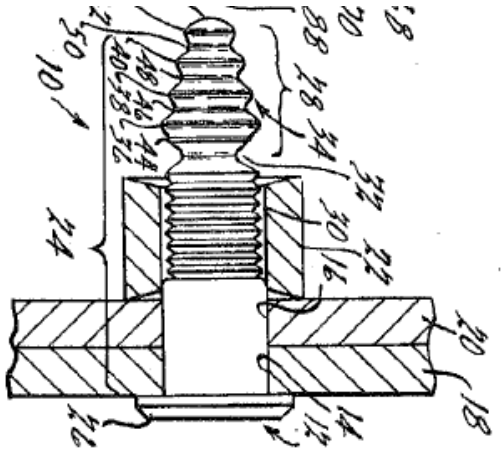


Fig-1

As detailed herein, Corbett 2018 anticipates almost every claim of the '358 Patent.

Howmet argued during prosecution of the ’358 Patent that the claims were purportedly novel because they recited: “the pull region comprises an axial length no greater than 4 times a diameter of the shank region.” The Examiner allowed the claims following this argument. However, a shortened pull region was also well-known in the art. As one of many examples, Corbett 2018 discloses a pull region with an axial length approximately the same as its shank diameter. Moreover, U.S. Patent No. 4,299,519 (Ex-1007) (“Corbett 1981”)—from the same inventor as Corbett 2018—described a shortened, tapered pull region decades earlier:



Corbett 1981 reduces the length of the pull region “to a minimum” “generally equal to approximately the nominal diameter of the smooth shank portion” to “optimize material usage and minimize the amount of material required.” Additionally, Sadri discloses a pull region approximately twice as long as its shank diameter. Finally, and contrary to Howmet’s argument during prosecution,

Howmet's earlier "BobTail" fastener comprises a shortened pull region less than the diameter of its shank region. *See* Huck BobTail System (Ex-1010) ("BobTail").

Thus, IPR should be instituted because there is a reasonable likelihood that the Challenged Claims are unpatentable.

II. MANDATORY NOTICES UNDER 37 C.F.R. § 42.8

A. Real Party-in-Interest

Pursuant to 37 C.F.R. § 42.8(b)(1), Petitioner identifies CRRC Meishan Co., Ltd. ("CRRC Meishan") and Nextpower Inc. (formerly Nextracker Inc.) as real parties-in-interest. CRRC Meishan is Petitioner's parent corporation.

B. Related Matters

Pursuant to 37 C.F.R. § 42.8(b)(2), Petitioner identifies that the '358 Patent is currently the subject of a pending *inter partes* review proceeding that has not been instituted yet: *Stanley Black & Decker, Inc. v. Howmet Aerospace Inc.*, IPR2025-01581. The '358 Patent is also the subject of a recently filed, pending district court proceeding: *Howmet Aerospace Inc. v. Stanley Engineered Fastening, LLC, Avdel UK Ltd., and Avdel Holding Ltd.,* No. 1:25-cv-01335 (D. Del.). *See* Ex-1014.

C. Lead and Backup Counsel Under 37 C.F.R. § 42.8(b)(3)

Petitioner identifies the following counsel of record:

Lead Counsel	**Back-Up Counsel**
Cyrus A. Morton (Reg. No. 44,954)	Li Zhu (Reg. No. 73,465)

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D. Service Information Under 37 C.F.R. § 42.8(b)(4)

A copy of this entire Petition, including all Exhibits, is being served by FEDERAL EXPRESS, costs prepaid, to the address of the attorney or agent of record at the USPTO:

K&L Gates LLP – Howmet Aerospace Inc.
K&L Gates Center
210 Sixth Avenue
Pittsburgh, PA 15222-2613

Petitioner consents to electronic service at the above-identified email addresses for lead and back-up counsel. A Power of Attorney is filed concurrently herewith under 37 C.F.R. § 42.10(b).

III. REQUIREMENTS FOR INTER PARTES REVIEW

A. Certification of Grounds for Standing

Petitioner certifies the ’358 Patent is eligible for IPR and Petitioner is not barred or estopped from requesting such review on the identified grounds.

B. Priority Date

The ’358 Patent claims the benefit of International Application No. PCT/US2019/016973, filed February 7, 2019. Ex-1001, Cover.

C. Precise Relief Requested and Asserted Grounds

Petitioner requests review/cancellation of claims 1-20 of the '358 Patent.[1]

Ground	Type	Grounds
1	§ 102	Claims 1-3, 5, 8-17, 19-20 are anticipated by Corbett 2018.
2	§ 103	Claims 1-3, 6-7, 11, 14-17, 20 are rendered obvious by Corbett 2018.
3	§ 103	Claims 1-20 are rendered obvious by Corbett 2018 in view of Corbett 1981.
4	§ 103	Claims 6 and 7 are rendered obvious by Corbett 2018 in view of Corbett 1981 and Hurd.
5	§ 103	Claims 1-20 are rendered obvious by Sadri in view of BobTail.

Each asserted ground herein is independently sufficient for the claims it addresses, and the grounds are presented in the alternative based on distinct legal theories and/or prior-art combinations.

IV. BACKGROUND

A. Overview of the Technology

Blind fasteners are mechanical fasteners configured to be installed from one accessible side of a workpiece—the opposite side being inaccessible. Ex-1004 ¶ 36 (citing Ex-1026). They generally comprise a ***sleeve*** ("body") surrounding a ***mandrel*** ("pin," "bolt") having a ***pull region*** engaged by a tool, causing the sleeve

[1] This petition is supported by the Declaration of Dr. Richard Klopp (Ex-1004). Petitioner also submits the declaration of Mina Ching (Ex-1011) to support the authenticity and public availability of exhibits cited herein.

to deform/expand on the opposite side to form a joint. *Id.* ¶¶ 37-38.

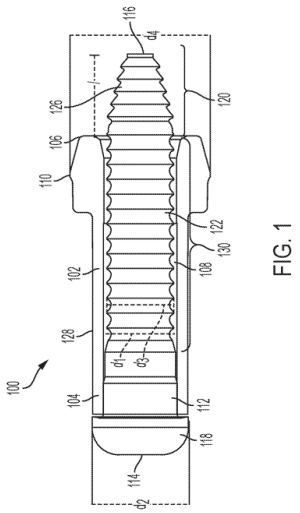
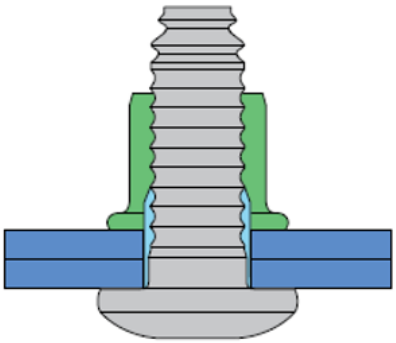
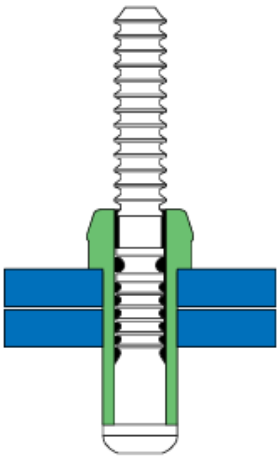
Pull-type blind and non-blind fasteners share many common design attributes and operate on the same basic mechanics on the pull-side: the tool applies tensile force through the mandrel, causing sleeve/collar deformation/swaging that generates compressive clamping. *Id.* ¶¶ 44-46. Both are, in many cases, compatible with the same tooling. *Id.* ¶ 45 (citing Ex-1024). Thus, from the standpoint of joint formation and applied forces, blind and non-blind pull-type fasteners operate in a materially identical manner. *Id.* ¶ 45. A POSITA would be familiar with both and would have considered design elements from each when improving the other. *Id*. Differences in access during installation would not deter cross-application given their shared axial-loading and swaging mechanics. *Id.* ¶ 44. Indeed, inventors commonly develop blind and non-blind designs in parallel. *Id.* ¶ 46 (citing Exs-1021-1023). For example, the inventor of Corbett 2018 and Corbett 1981 disclosed embodiments of both types, and U.S. Patent No. 6,241,443 ("Corbett 2001") teaches that "different configurations, constructions and options discussed above with respect to the non-blind embodiments can be equally applied to the blind type embodiments." Ex-1023 at 8:5-8. Corbett 2018 likewise teaches that it is "a blind fastener," but that it can "comprise other types of fasteners known in the art." Ex-1006, [0015].

Pull-type structural fasteners are widely used in high-load applications,

including aerospace, where installation reliability and in-service joint integrity are critical. *Id.* ¶¶ 39-40. Material and hardness selections for the mandrel are routine design choices informed by known strength and wear requirements. *Id.* ¶¶ 91-94.

B. Patent Owner Howmet Aerospace Inc.

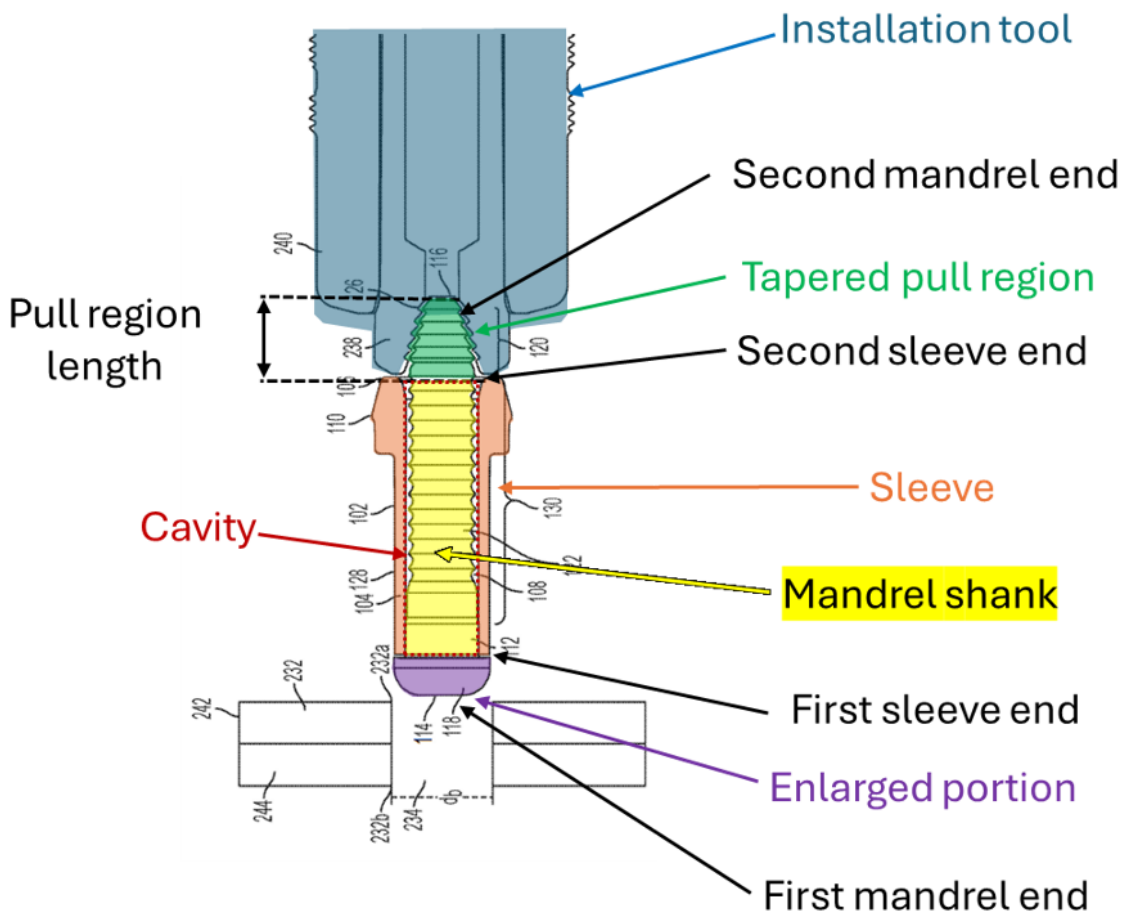
Before the asserted priority date, Patent Owner manufactured and sold structural fasteners using the same general pull-type architecture—an outer sleeve/collar around a mandrel with a grooved tool-engagement region:

'358 Patent Ex-1001	**BobTail (2013) Ex-1010**	**BOM (2008) Ex-1012**
 FIG. 1		

C. Overview of the '358 Patent

The '358 Patent relates to pull-type blind fasteners and aims to "reduce installation forces and increase corrosion resistance." Ex-1001 at 1:6-7, 3:46-57, 6:55-60, 7:28-31; Ex-1004 ¶¶ 41-43. It discloses a blind fastener "comprising a sleeve and a mandrel," including a short "pull region." Ex-1001 at 1:23-24, 9:25-

42 (claim 1), 10:21-53 (claim 16); Ex-1004 ¶ 41.



The purported distinguishing feature is the pull region's specified axial-length-to-shank-diameter relationship, where the shank diameter is represented by "d_3" in Figure 1 below. Ex-1001 at Fig. 1, 4:27-39 ("pull region 120 can comprise an axial length, l, that is no greater than 4 times a diameter, d_3, of the shank region 122" where "diameter, d_3, of the shank region 122 can be the major diameter (e.g., root) of the shank region 122"); Ex-1004 ¶ 42.

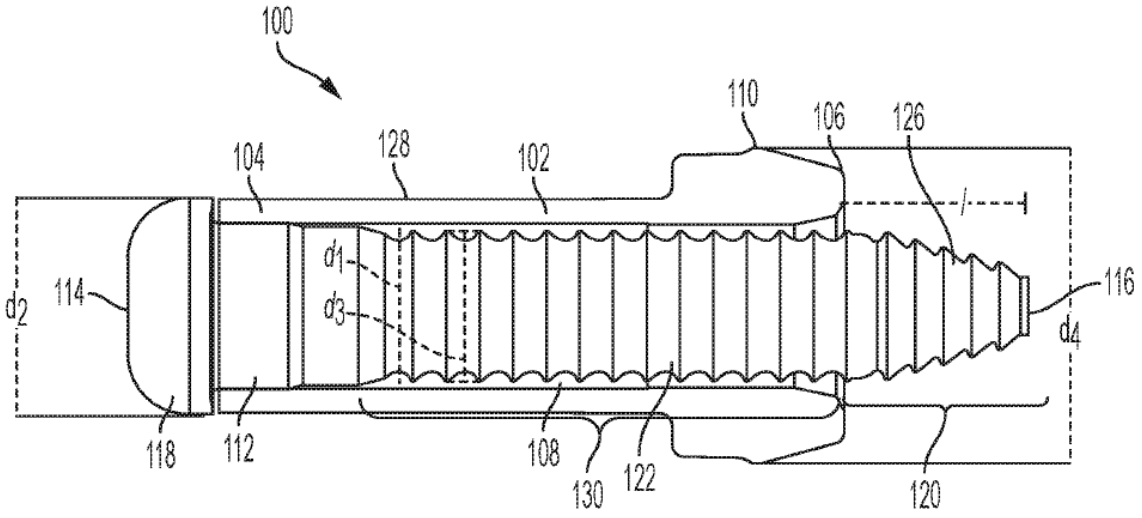
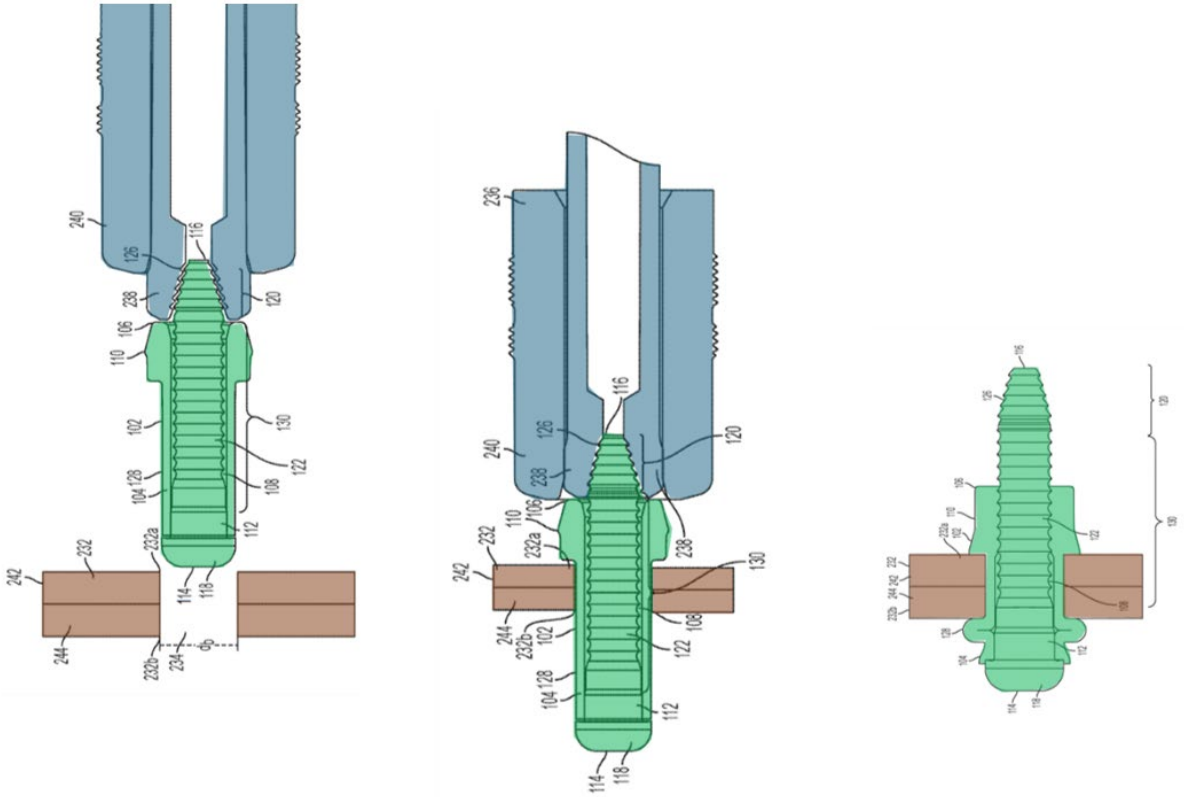


FIG. 1

The sleeve receives the mandrel and deforms during installation: one end forms a blind head while the other swages into the mandrel. *See* Ex-1001 at 4:17-26, 5:43-48. Figures 2A–2C (annotated) illustrate the installation sequence:



Ex-1004 ¶ 38. A full claim listing is provided as Ex-1002.

D. Relevant Prosecution History

Application 17/423,980, which issued as the '358 Patent on January 30, 2024, was filed July 19, 2021. Ex-1001, Cover. During prosecution, the Examiner relied on U.S. Patent Application Publication No. 2014/0271024 ("Jones"). Figures 1 and 9 from Jones are below:

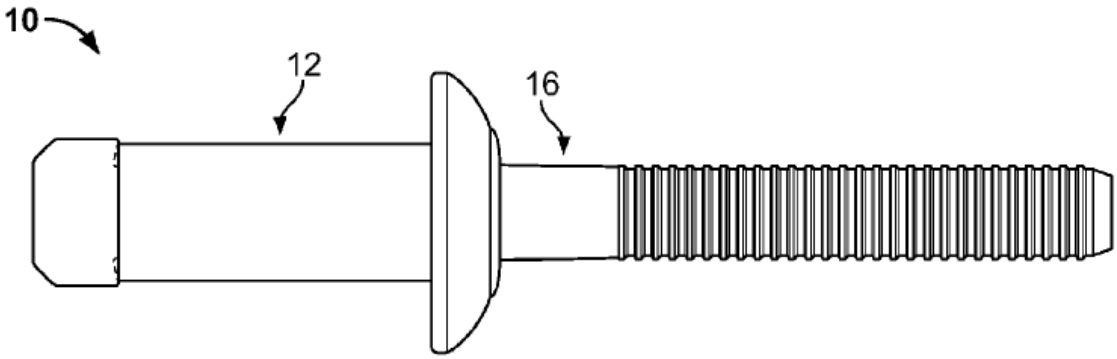


FIG. 1

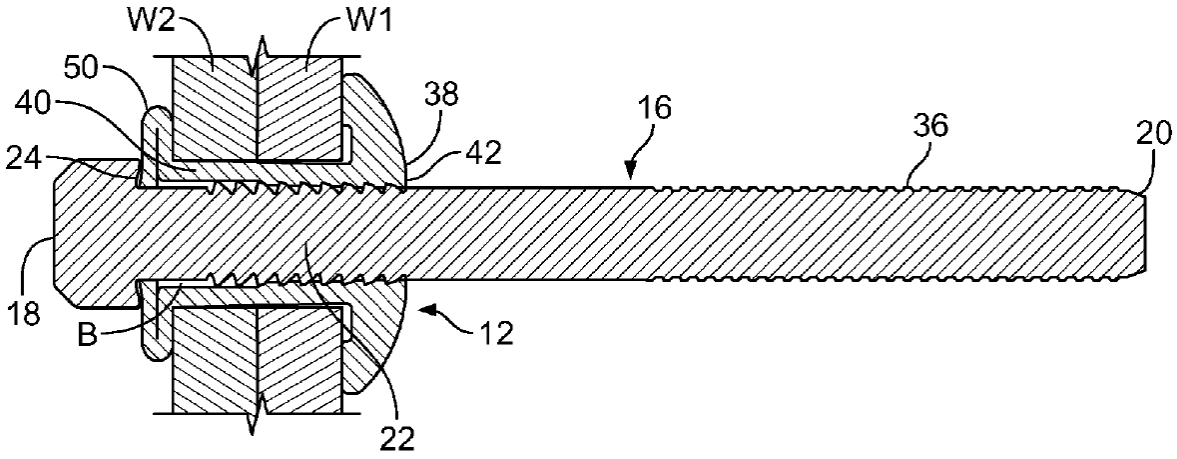


FIG. 9

Ex-1015 at Figs. 1, 9.

The Examiner found Jones disclosed the independent-claim limitations but did not "explicitly disclose" a pull region having an axial length no greater than four times the shank diameter, and concluded a POSITA would find it obvious to "contrive any number of desirable ranges wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region limitation." Ex-

1003 at 40-46. The applicant argued patentability based on Jones purportedly teaching the pin breaks during installation, while the claimed pull region "can remain intact after installation and reduce the shock force occurring during installation." *Id.* at 25-28.

The issued independent claims do not require the pull region to remain intact after installation, and the rationale for allowance cannot support patentability of the issued claims. Dependent claims 5 and 19 add "wherein the mandrel does not comprise a breakneck groove," confirming that feature is not required by the independent claims under claim differentiation. *AllVoice Computing PLC v. Nuance Communications, Inc.*, 504 F.3d 1236, 1247-48 (Fed. Cir. 2007). The Examiner therefore erred by crediting a dependent-claim feature as if it were part of the independent claims.

E. Person of Ordinary Skill In The Art ("POSITA")

A POSITA would have (a) an undergraduate degree in mechanical engineering/materials science or equivalent, or (b) two years industry experience analyzing fastener system designs. Ex-1004, ¶¶ 27-30. Additional education can compensate for less experience and vice versa.

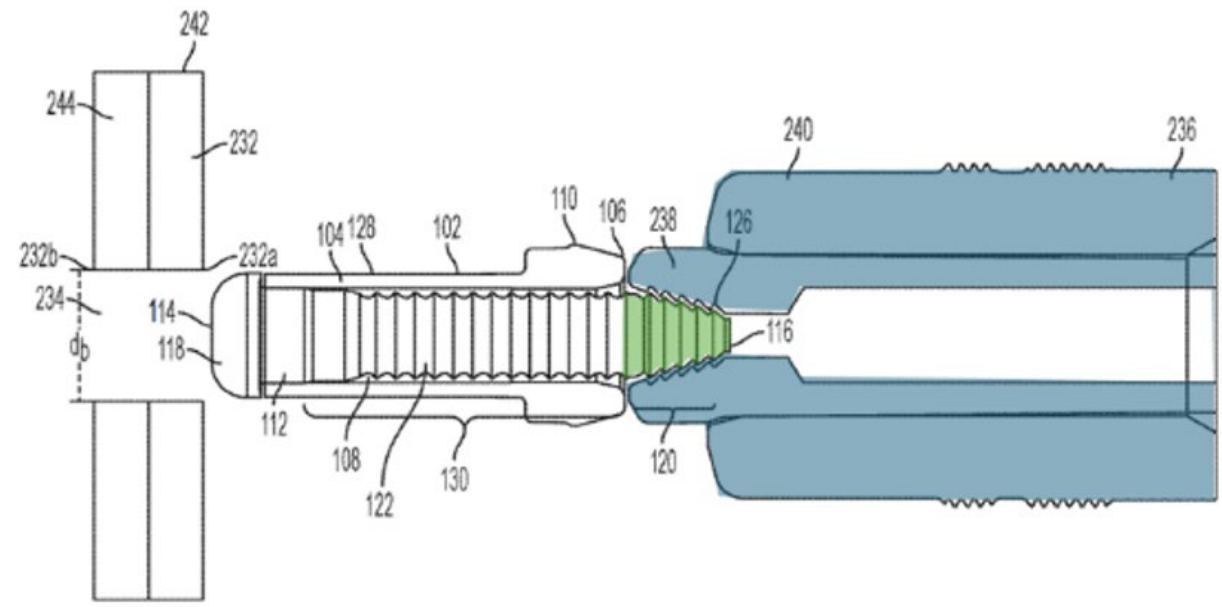
V. CLAIM CONSTRUCTION: "PULL REGION COMPRISES AN AXIAL LENGTH"

All Challenged Claims recite "a pull region" with "an axial length." Ex-

1002. A POSITA would have understood this "pull region" to be the mandrel portion configured to be physically gripped by the installation tool in the fastener's pre-installation configuration for several reasons. Ex-1004, ¶¶ 31-35.

First, the claims and specification define the pull region by tool engagement: Claims 1 and 16 require it to be "configured to be engaged by an installation tool," and the specification describes "pull region 120 configured to be engaged by an installation tool." Ex-1001 at 4:27-32, 7:53, 8:48.

Second, Figure 2A (below) depicts "pull region 120" as coextensive with the tool-engagement area.



Ex-1004 ¶ 34. No portion not contacted by the tool is identified as part of the pull region.

Third, a POSITA would understand that a blind fastener's "pull region" refers to the tool-engagement region acted on during installation, based on the ordinary understanding in the art related to pull-type fasteners. *Id.* ¶ 35.

Finally, the proposed construction is consistent with the Patent Owner's arguments raised in district court. Ex-1013 ¶¶ 53-55.

VI. PRIOR ART

A. U.S. Patent Publication 2018/0111184A1 ("Corbett 2018")

Corbett 2018 published on April 26, 2018 and is prior art under 35 U.S.C. § 102(a)(1). Ex-1006, [(43)]. Corbett 2018 anticipates nearly all Challenged Claims. It discloses a pull-type blind fastener with a deformable "outer sleeve 14" around a mandrel "bolt 12" having an "elongated shank 16" and grooved "pull portion 28." Ex-1006, Abstract, [0009], Figs. 1-2 (below).

Corbett 2018 **'358 Patent**

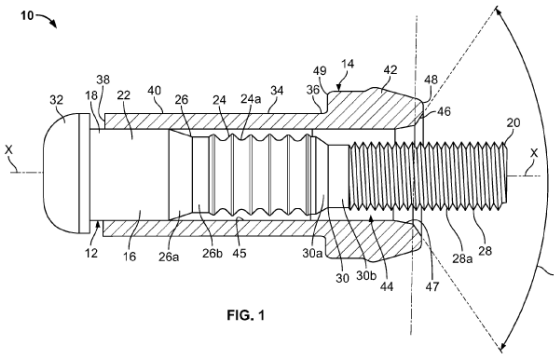


FIG. 1

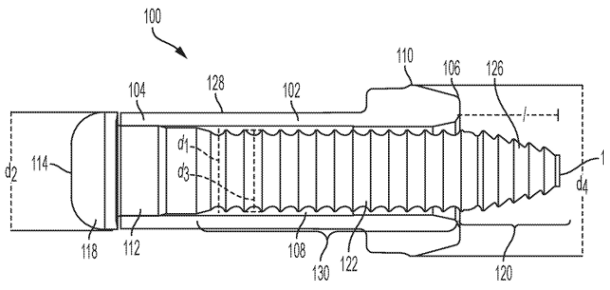


FIG. 1

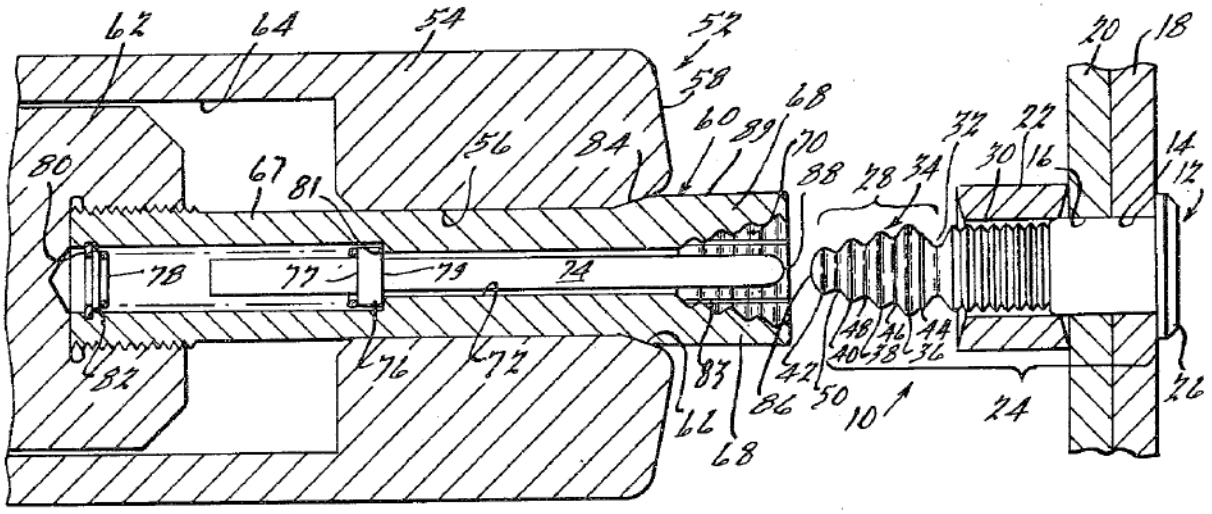
Compare Ex-1006, Fig. 1 *with* Ex-1001, Fig. 1.

Comparing each reference's Figure 1 highlights their shared architecture: a mandrel-and-sleeve pull-type blind fastener installed by gripping the grooved pull

region with a tool, applying an axial force, and swaging the sleeve onto the mandrel shank to permanently join the members. Ex-1004 ¶ 50.

B. U.S. Patent No. 4,299,519 ("Corbett 1981")

Corbett 1981 (November 10, 1981) is by the same inventor as Corbett 2018 and is prior art under at least 35 U.S.C. § 102(a)(1). Ex-1007. Like the '358 Patent and Corbett 2018, Corbett 1981 teaches inserting the fastener into a through-bore, pulling on a grooved pull region, and swaging the sleeve onto the shank. Ex-1004 ¶¶ 52-53, 63-64; Ex-1007, Abstract, Fig. 1.



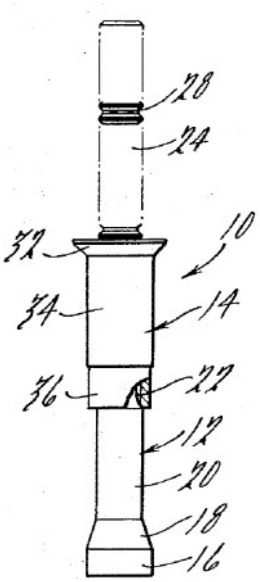
Corbett 1981 teaches reducing the pull region length "to a minimum" "generally equal to approximately the nominal diameter of the smooth shank portion" to "optimize material usage and minimize the amount of material required." Ex-1007 at 5:20-50, 7:6-19, Fig. 6.

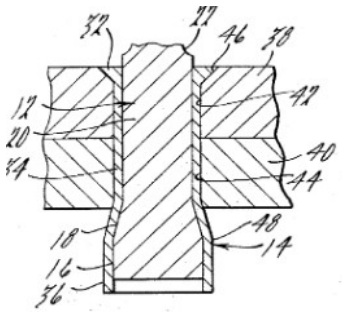
As detailed in § IV.A, Corbett 1981 teaches the same pull-side mechanics

recited in the Challenged Claims—tool engagement of a grooved pull region, transmission of tensile load through the mandrel, and sleeve/collar swaging onto the shank. Ex-1004 ¶ 52. These features are also designed for the same purpose—securing workpieces. *Id*. A POSITA would therefore apply Corbett 1981's pull-region teachings when designing a pull-type blind fastener. *Id.* ¶¶ 44-46, 53; *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 417-18 (2007).

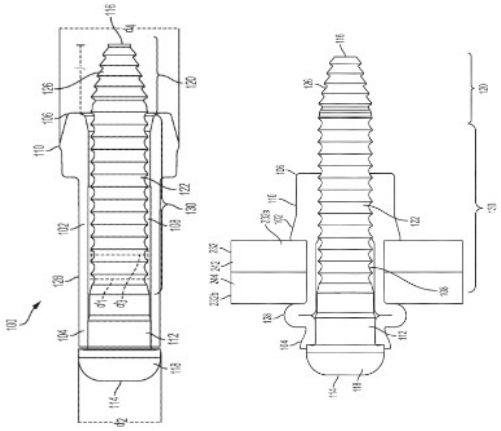
C. U.S. Patent No. 3,820,297 ("Hurd")

Hurd issued on June 28, 1974 and is prior art under at least 35 U.S.C. § 102(a)(1). Ex-1008, [45]. Hurd discloses a pull-type blind fastener similar to the '358 Patent, with "a high hardness pin 12 made of alloy steel AISI 8740 and having a hardness of around 49-52 Rc" or "49-53 Rc." *Id.* at 3:14-16, 4:47-49; Ex-1004 ¶ 55.





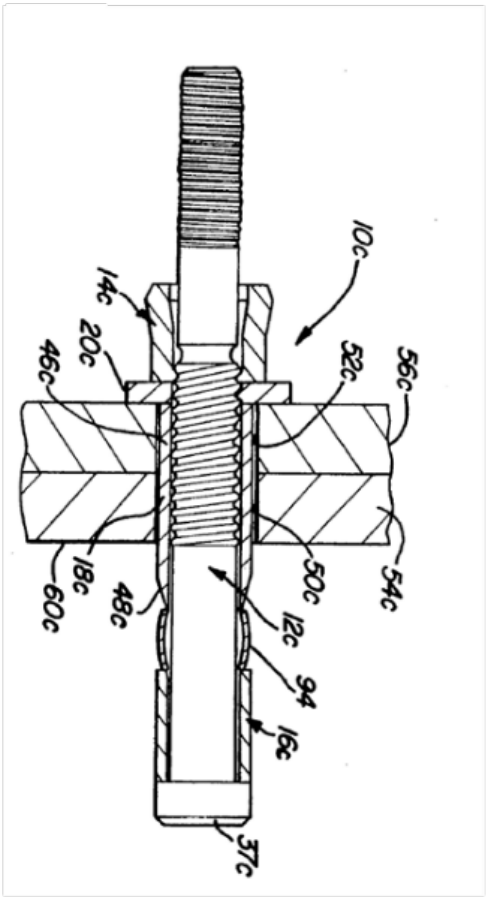
Hurd 297



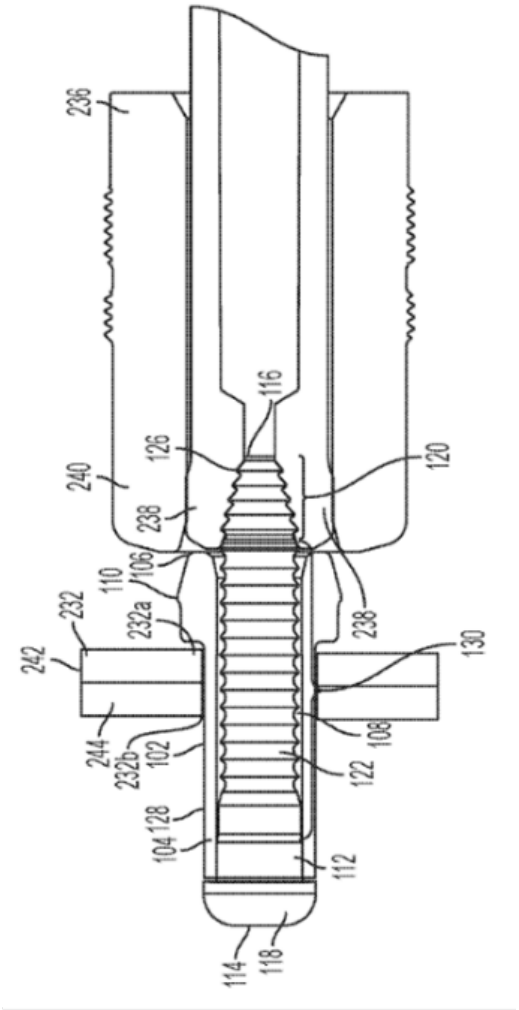
358 Patent

D. U.S. Patent No. 5,178,502 ("Sadri")

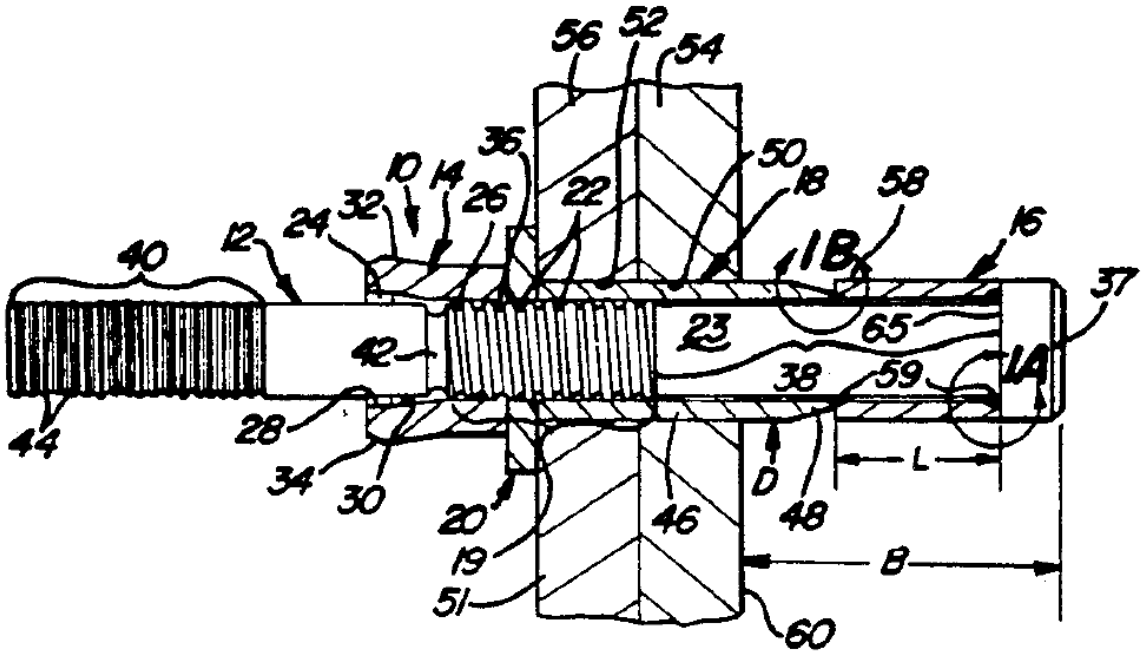
Sadri issued January 12, 1993 and is prior art under at least 35 U.S.C. § 102(a)(1). Ex-1009, Cover. Sadri discloses a high-strength, pull-type blind fastener. Ex-1004 ¶¶ 57-59.



Sadri 502



358 Patent



In one embodiment above, Sadri's main/secondary sleeve, expandable/primary sleeve, and collar form an integrated sleeve system that performs the same structural/load-bearing functions attributed to the claimed "sleeve" in the '358 Patent. *Id.* ¶ 58; Ex-1009 at 1:13-18, 1:57-59, 5:21-29, 6:49-7:15 (describing axial movement and radial expansion to form a joint), Fig. 1.

E. BobTail: "The Next Generation Small Diameter HuckBolt®" ("BobTail")

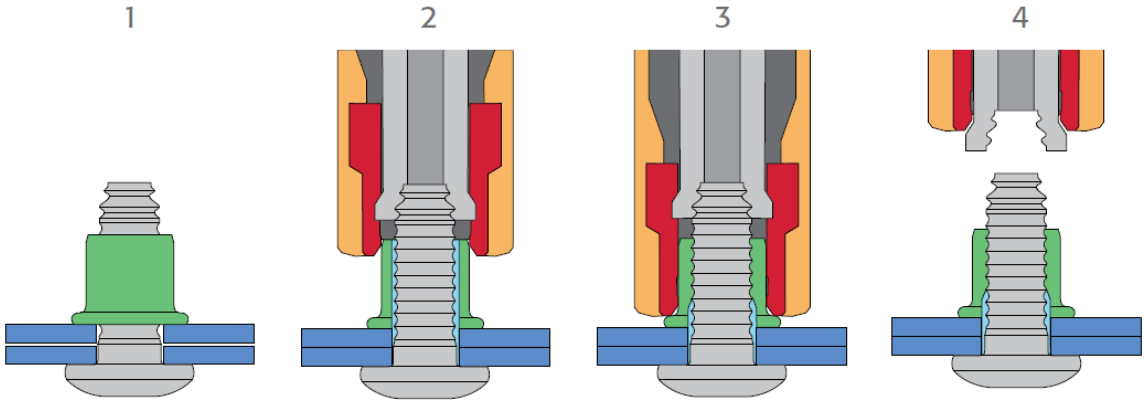
BobTail is a product catalog published by Alcoa Fastening Systems (now Howmet) describing its BobTail® swage-type lockbolt system. Ex-1010. BobTail qualifies as § 102(a)(1) art, because it was publicly available as early as June 16, 2013 and is authenticated by declaration. Ex-1011 at 4.

BobTail discloses a structural fastener system with an outer collar and an

inner pin, where an installation tool applies controlled axial pull to swage the collar into the pin's lockgrooves:

Unmatched speed of installation

The BobTail® System delivers a lightening-quick installation cycle time for greater productivity. This quick cycle is due, in part, to the short time required to apply the tool to the pin and complete the installation cycle. Once the operator engages the trigger, the swage sequence begins. Releasing the trigger ejects the fastener.



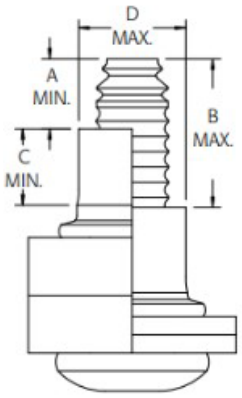
The pin is inserted into the prepared hole, and the collar is placed onto the pin.

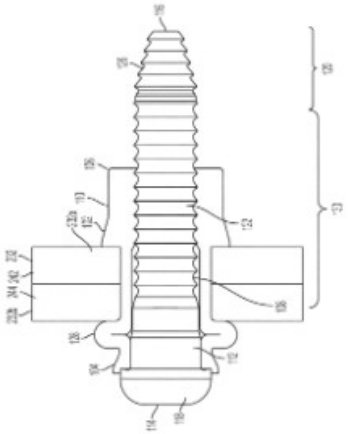
The installation tool is applied to annular pull grooves. When the tool is activated, a puller in the nose assembly draws the pin into the tool, tension loading the joint and drawing up any sheet gap.

At a predetermined force, the anvil begins to swage the collar into the pin's lockgrooves. Continued swaging elongates the collar and pin, developing precise clamp.

When swaging of the collar into the pin lockgrooves is complete, the tool ejects the fastener and releases the puller to complete the sequence.

Ex-1010 at 3; Ex-1004 ¶ 61. A comparison of BobTail (page 5) to Fig. 2C of the '358 Patent is provided below:



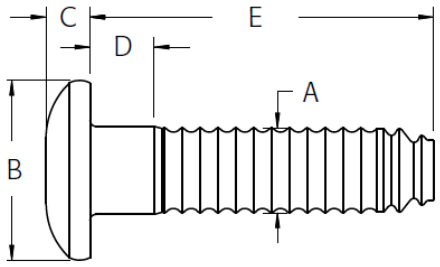


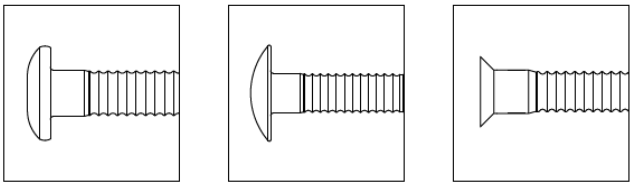
BobTail 2013 358 Patent

Ex-1004 ¶ 61.

BobTail provides the following shank diameters (A) and tool-engagement lengths (A min):

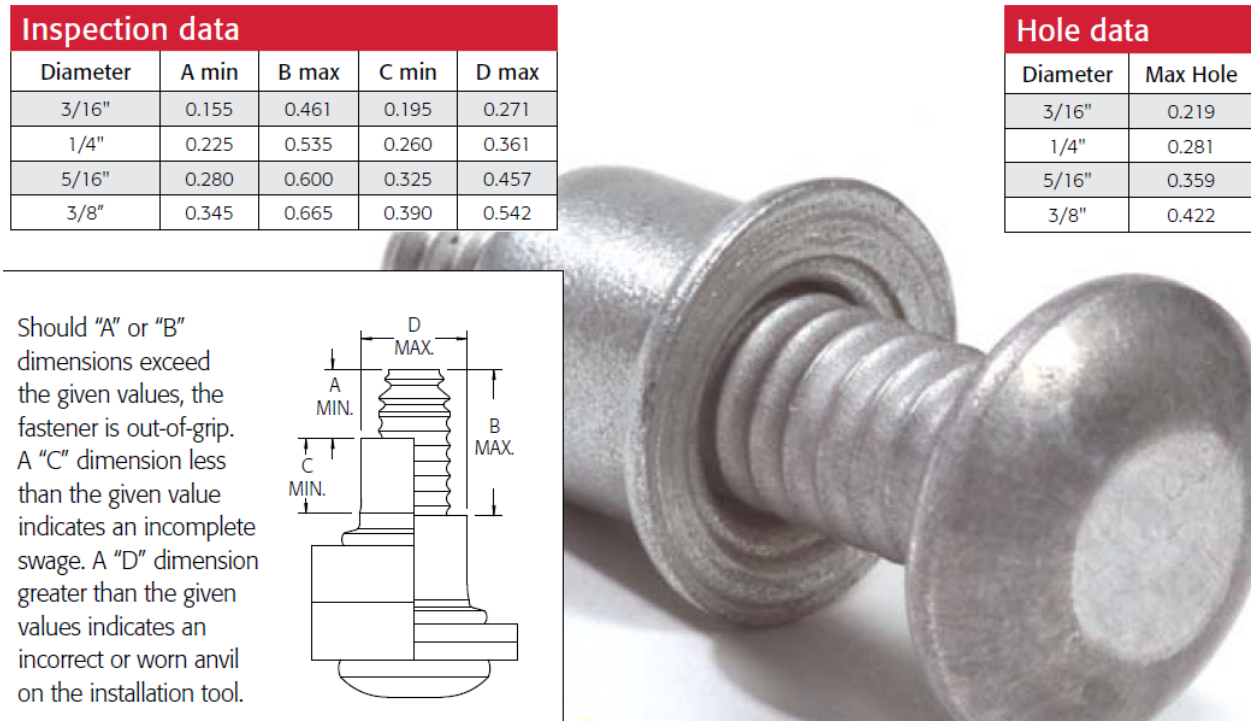
Head style options





Fastener dimensions

		Trazier		98T		90°	
Diameter	A	B	C	B	C	B	C
3/16"	.187 max	–	–	.488 – .468	.110 – .090	.354 – .328	.085 – .075
1/4"	.249 max	.537 – .507	.140 – .120	–	–	.473 – .437	.113 – .104
5/16"	.313 max	.680 – .640	.175 – .150	–	–	.589 – .547	.141 – .127
3/8"	.374 max	.820 – .780	.210 – .190	–	–	.709 – .656	.168 – .152



Inspection data

Diameter	A min	B max	C min	D max
3/16"	0.155	0.461	0.195	0.271
1/4"	0.225	0.535	0.260	0.361
5/16"	0.280	0.600	0.325	0.457
3/8"	0.345	0.665	0.390	0.542

Hole data

Diameter	Max Hole
3/16"	0.219
1/4"	0.281
5/16"	0.359
3/8"	0.422

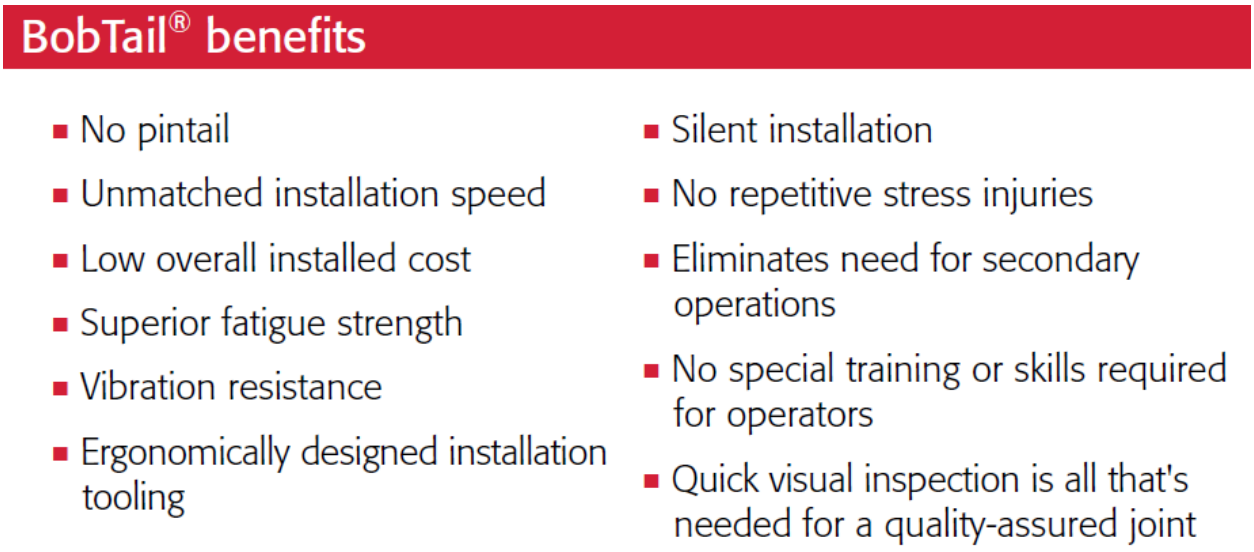
Should "A" or "B" dimensions exceed the given values, the fastener is out-of-grip. A "C" dimension less than the given value indicates an incomplete swage. A "D" dimension greater than the given values indicates an incorrect or worn anvil on the installation tool.

Id. at 4-5. Accordingly, BobTail's pull-region-length-to-diameter ratios are:

Diameter (A)	Pull Region Length (A min.)	Ratio of Pull Region Length to Diameter
0.249	0.225	0.90
0.313	0.280	0.89
0.374	0.345	0.92

See Ex-1010 at 4-5.

BobTail further teaches its "[p]intail-less design means reduced noise, no waste, and improved corrosion resistance," and the pin/mandrel may be "Grade 5 Carbon Steel." Ex-1010 at 3, 7. BobTail also describes other benefits:



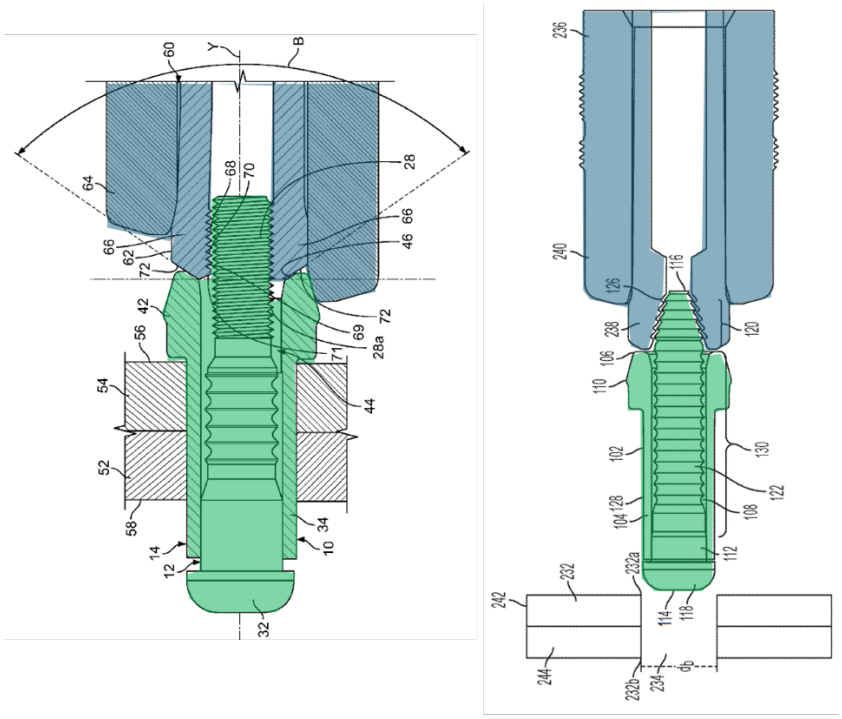
Id. A POSITA would have been motivated to apply BobTail's teachings to blind fasteners for the same reasons discussed *supra* § IV.A.

VII. GROUNDS 1-2: CORBETT 2018 ANTICIPATES AND RENDERS OBVIOUS CLAIMS 1-3, 5-17, 19-20.

Ground 1 asserts anticipation by Corbett 2018 for claims 1-3, 5, 8-17, and 19-20.

Ground 2 is pled in the alternative and asserts obviousness based on Corbett 2018. Should the Board conclude that the figures of Corbett 2018 do not expressly disclose the length of the pull region sufficient to meet the limitations of less than 4 times, 3.8 times, or 2 times the diameter of the shank region, those features are at least obvious. Ground 2 also independently challenges claims 6-7 based on routine selection of mandrel hardness for structural fasteners.

Corbett 2018 and the '358 Patent share a substantially similar architecture:



Corbett 2018 358 Patent

Compare Ex-1006, Fig. 1 *with* Ex-1001, Fig. 1; Ex-1004 ¶¶ 63-64.

A. Claim 1

1. Preamble: "A blind fastener comprising:"

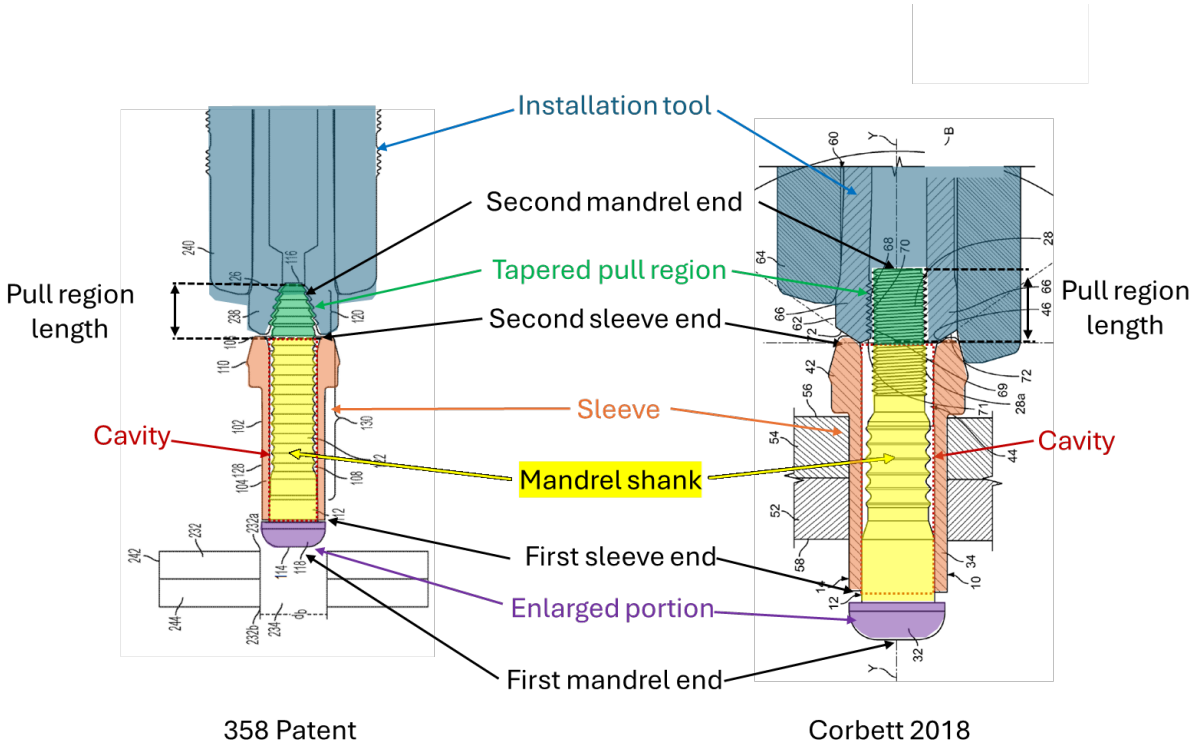
The preamble is not limiting at least because the claim "defines a structurally complete invention" and "uses the preamble only to state a purpose or intended use of the invention." *Rowe v. Dror*, 112 F.3d 473, 478 (Fed. Cir. 1997). The phrase "a blind fastener" in the preamble (1) merely identifies a general class and intended application; (2) does not impose structural limitations (claim itself recites a complete fastener whose components/mechanics are identical in blind and non-blind installations); (3) does not supply antecedent basis for any claim

element; and (4) was not used to overcome art during prosecution.

Regardless, Corbett 2018 describes "blind fasteners." Ex-1004 ¶ 65; Ex-1006, [0003], [0007], [0014-15].

2. <u>Limitation 1(a)</u>: "a sleeve comprising a first sleeve end, a second sleeve end, a cavity extending from the first sleeve end to the second sleeve end;"

Corbett 2018's "sleeve 14" has "a first sleeve end 36 and a second end 38 opposite the first end 36." Ex-1004 ¶ 66; Ex-1006, [0009-0010]. Corbett 2018 includes a cavity extending from the first sleeve end to the second sleeve end, because its "sleeve 14 includes an internal aperture 44 that extends" "through the body 34 from the first end 36 to the second end 38 thereof." Ex-1004 ¶¶ 66-68; Ex-1006, [0010].

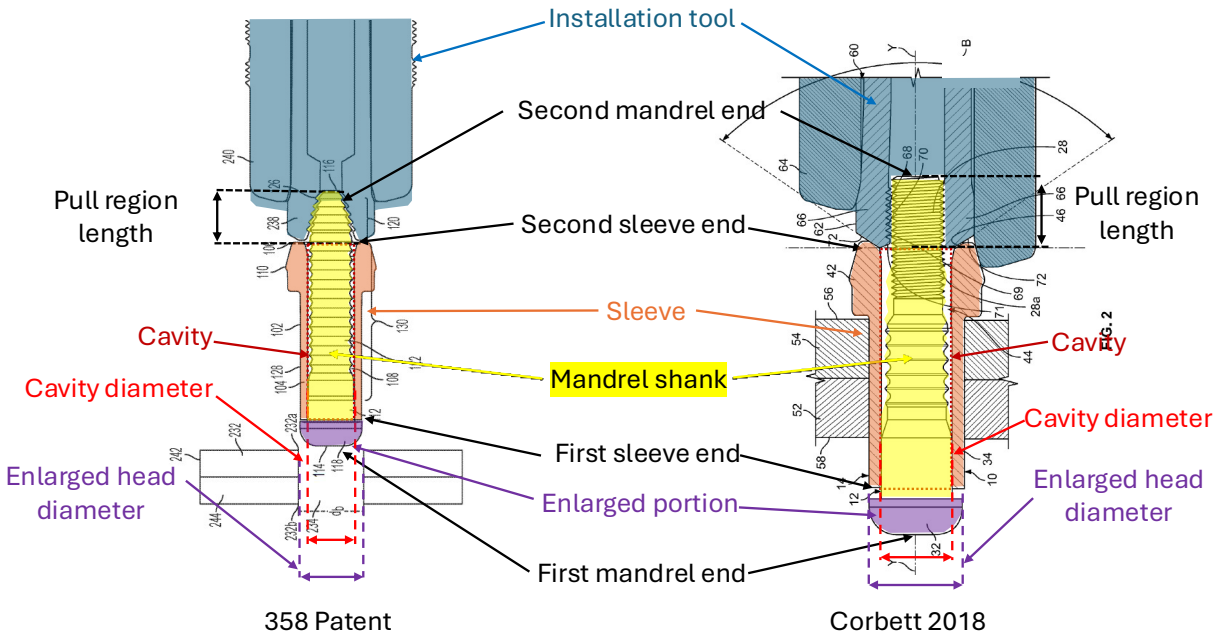


3. Limitation 1(b): "a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising"

Corbett 2018's "bolt 12" is a mandrel configured to be at least partially received by the cavity of the sleeve. Ex-1004 ¶¶ 69-71; Ex-1006, [0009]. Corbett 2018's "bolt 12 includes an elongated shank 16 having a first end 18 and a second end 20 opposite the first end 18, the shank 16 being sized and shaped to extend through the outer sleeve 14." Ex-1004 ¶¶ 69-70; Ex-1006, [0009]. Corbett 2018's "bolt 12 is inserted within the aperture 44 of the sleeve 14 such that the head 32 of the bolt 12 is adapted to sit on and be juxtaposed with the second end 38 of the sleeve 14." Ex-1004 ¶¶ 69-70; Ex-1006, [0011].

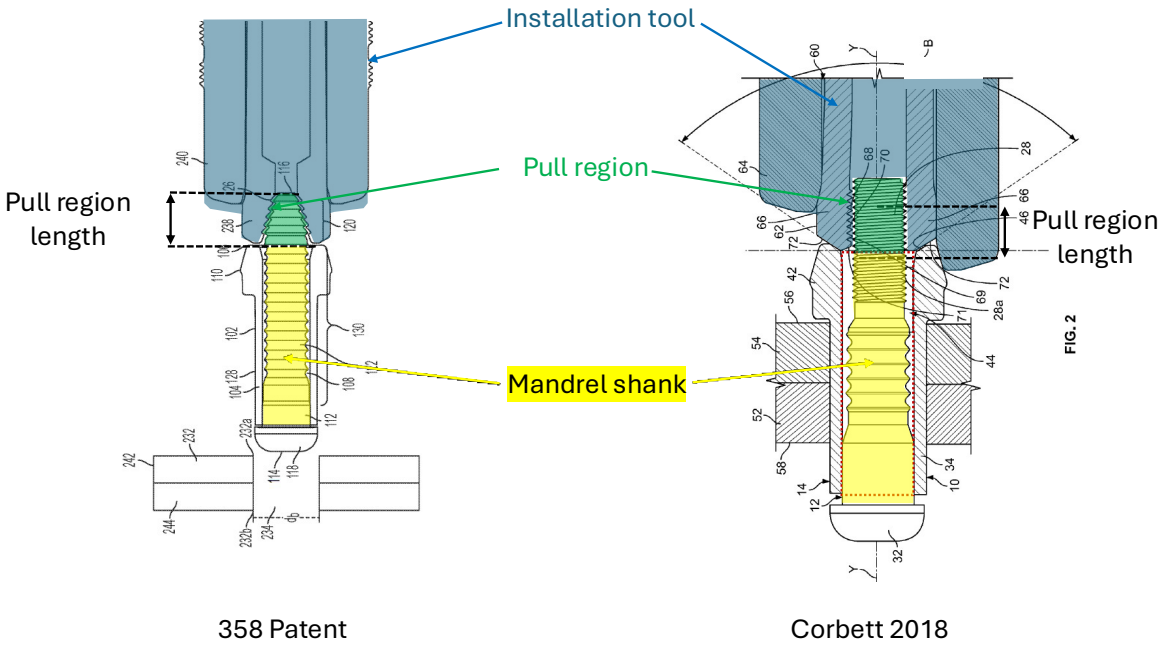
4. Limitation 1(c): "a first mandrel end disposed adjacent to the first sleeve end and comprising an enlarged portion having a diameter greater than a diameter of the cavity"

Corbett 2018's "bolt 12 includes a head 32 located at the first end 18 of the shank 16 and adjacent to the smooth portion 22," and that "head 32 is an enlarged head." Ex-1004 ¶¶ 72-73; Ex-1006, [0009-0011]. Corbett 2018's "enlarged head" (purple) has a diameter greater than that of "internal aperture 44" formed by the sleeve in order "to sit on and be juxtaposed with the second end of the sleeve." Ex-1004 ¶ 72; Ex-1006, [0011], Fig. 1.



5. Limitation 1(d): "a second mandrel end comprising a pull region"

Corbett 2018 includes "a bolt with a pull portion having at least one pull groove." Ex-1004 ¶¶ 74-76; Ex-1006, Abstract. Moreover, "the shank 16 of the bolt 12 includes a pull portion 28 located at the second end 20 of the shank 16." Ex-1004 ¶¶ 74-75; Ex-1006, [0009], Fig. 1.

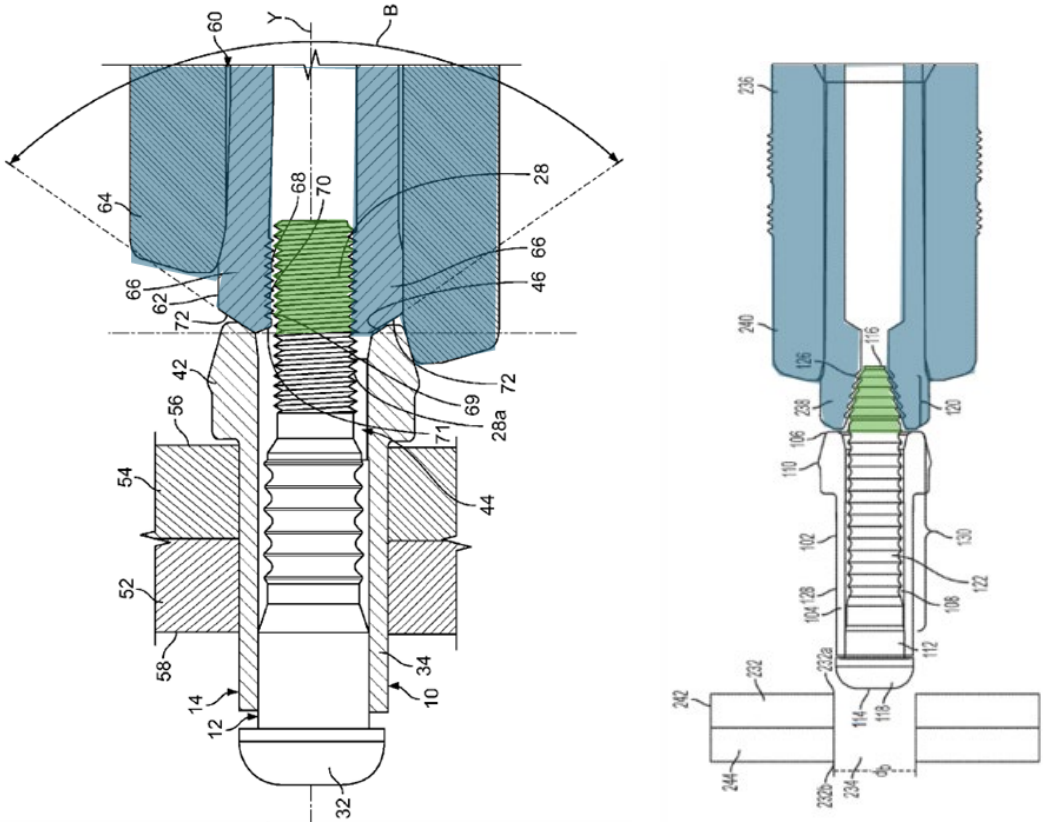


6. Limitation 1(e): "a shank region extending intermediate the first mandrel end and the second mandrel end"

Corbett 2018's "bolt 12 includes an elongated shank 16 having a first end 18 and a second end 20 opposite the first end 18." Ex-1004 ¶ 77; Ex-1006, [0009]. Further, "shank 16 includes a cylindrical-shaped smooth portion 22 located proximate to the first end 18, a grooved portion 24 located intermediate the first and second ends 18, 20, and a first transition portion 26 located intermediate the smooth portion 22 and the grooved portion 24." Ex-1004 ¶ 77; Ex-1006, [0009]. These portions collectively correspond to the "shank region" recited in the '358 Patent. Ex-1004 ¶¶ 77-78.

7. Limitation 1(f): "wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool."

As properly construed, the "pull region" is the region configured to be physically engaged by an installation tool—i.e., the portion of the mandrel that protrudes from the sleeve and is gripped by the installation tool when the fastener is in its pre-installation configuration. *See supra* § V. Corbett 2018's "pull portion 28" is a pull region having an axial length no greater than four times the diameter of the shank region. Ex-1004 ¶¶ 79-87. As illustrated in **green** in Corbett 2018's Fig. 1 on the left below, the axial length of "pull portion 28" is less than twice the major diameter of the mandrel (Corbett 2018's "grooved portion") or even the narrowest diameter of that region.



Ex-1004 ¶¶ 81-82. Indeed, Corbett 2018 discloses an embodiment where the puller "includes a single pull groove 70" for engaging the pull region, indicating a short pull region engaged at a single groove. Ex-1006, [0012]. If "pull region" were construed to be the entire threaded region, Figure 1 illustrates that it would still be substantially less than four times the diameter of the shank region. Ex-1004 ¶ 82. If the claimed "pull region" comprised the entire threaded region, it would still be shorter than three times the major diameter of the shank region. *Id.*

Petitioner does not rely on Corbett 2018's drawings for mathematical precision. Rather, consistent with Federal Circuit precedent, the drawings are cited to demonstrate the relative proportions and general configuration of the pull

portion and shank region as they would be understood by a POSITA. *See, e.g., Collabo Innovations, Inc. v. Sony Corp.*, 778 Fed. App'x. 954, 959-60 (Fed. Cir. 2019) (figures and corresponding discussion satisfied claimed "wider area"); *Application of Hopkins*, 342 F.2d 1010, 1012-15 (C.C.P.A. 1965) (prior art drawings satisfied claim's "approximately 150%" of "shank diameter" limitation). Corbett 2018's figures and the specification clearly convey to a POSITA that the pull region is nowhere near four times as long as the shank region is wide. Ex-1004 ¶¶ 83-85, Ex-1006, [0012].

Corbett 2018 also teaches that "pull portion 28" is configured for engagement by an installation tool. *Id.* ¶ 86; Ex-1006, [0012-0014]. Corbett 2018 discloses that "fastener installation tool 60 includes a puller 62" with "pull grooves 70 that are sized, shaped and adapted to grip the pull grooves 28a of the pull portion 28." Ex-1004 ¶ 86; Ex-1006, [0012].

Alternatively, Corbett 2018 renders this limitation obvious. A POSITA would have known how to select and design the axial length of a pull region relative to the shank diameter based on routine engineering considerations, including reliable engagement by an installation tool, adequate grip length to support applied shear stresses and prevent slippage, controlled deformation or fracture during installation, and sufficient load transfer. Ex-1004 ¶ 84. These

considerations reflect ordinary fastener/tooling design practice that a POSITA would readily apply when implementing Corbett 2018's blind fastener. *Id.*

A POSITA would be motivated to reduce the pull region length to save material and reduce costs. *Id.* ¶ 85. A shorter pull region would also reduce required installation envelope, improve accessibility in confined spaces, improve coaxial engagement and reduce off-axis bending due to tool misalignment, and decrease the risk of pull-groove damage or stripping, or prematurely fracturing the mandrel, under high pull loads. *Id*. A shorter pull region also improves installation repeatability by reducing compliance in the pulled segment and reduces unnecessary protrusion that can create interference/safety/corrosion concerns. *Id*. Accordingly, a POSITA would have been motivated to design a pull region with an axial length no greater than 4/3.8/2 times the diameter of the shank region, with a reasonable expectation of success. *Id*.

B. Claims 2-3: (2) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region." (3) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region."

For the reasons in 1(f), Corbett 2018's pull region comprises an axial length less than twice the diameter of the shank region. Alternatively, Corbett 2018 renders claims 2 and 3 obvious for the same reasons. *Id.* ¶¶ 88-89.

C. Claim 5: "The blind fastener of claim 1, wherein the mandrel does not comprise a breakneck groove."

Corbett 2018 anticipates claim 5, because it teaches that "the pull portion 28 remains as part of the shank 16 after installation of the fastener 10." *Id.* ¶ 90; Ex-1006, [0014]. Corbett 2018's mandrel does not comprise a breakneck groove.

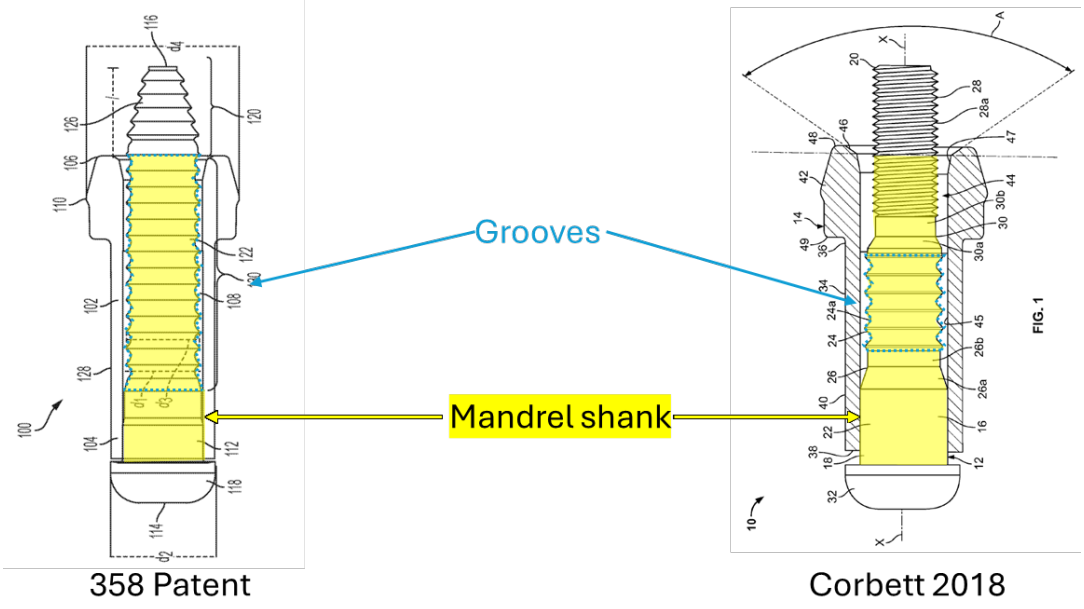
D. Claims 6-7: (6) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25." (7) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43."

Corbett 2018 renders claims 6 and 7 obvious. A POSITA would have known how to—and been motivated to—design a blind fastener with a mandrel with a Rockwell hardness of at least HRC 25 or HRC 43. Ex-1004 ¶¶ 91-95. Corbett 2018 teaches a high-strength pull-type blind fastener intended for structural applications requiring high clamp loads and resistance to failure during installation and service—conditions that a POSITA would understand routinely call for mandrels made from hardened steel materials having Rockwell hardness values well above HRC 25 and extending to HRC 43 or higher. *Id.* ¶¶ 92-93 (citing Exs-1025-1029). A POSITA would also understand that, in pull-type fasteners, the mandrel is typically harder than the sleeve so that the sleeve deforms while the mandrel transmits the installation load without yielding. *Id.* ¶ 91. Selecting a mandrel hardness within this range would have been a routine design choice for a POSITA, informed by well-known tradeoffs between strength, ductility, and fatigue

resistance, and would have involved no technical difficulty or inventive effort. *Id.* ¶ 93. Higher mandrel-hardness also improves resistance to stripping or localized deformation at pull grooves/threads under the loads needed to set a high-clamp-load fastener. *Id.* And because Corbett 2018 targets structural (including aerospace) applications, a POSITA would expect hardened, high-strength mandrel materials to meet axial/shear load and vibration demands. *Id.* ¶ 94.

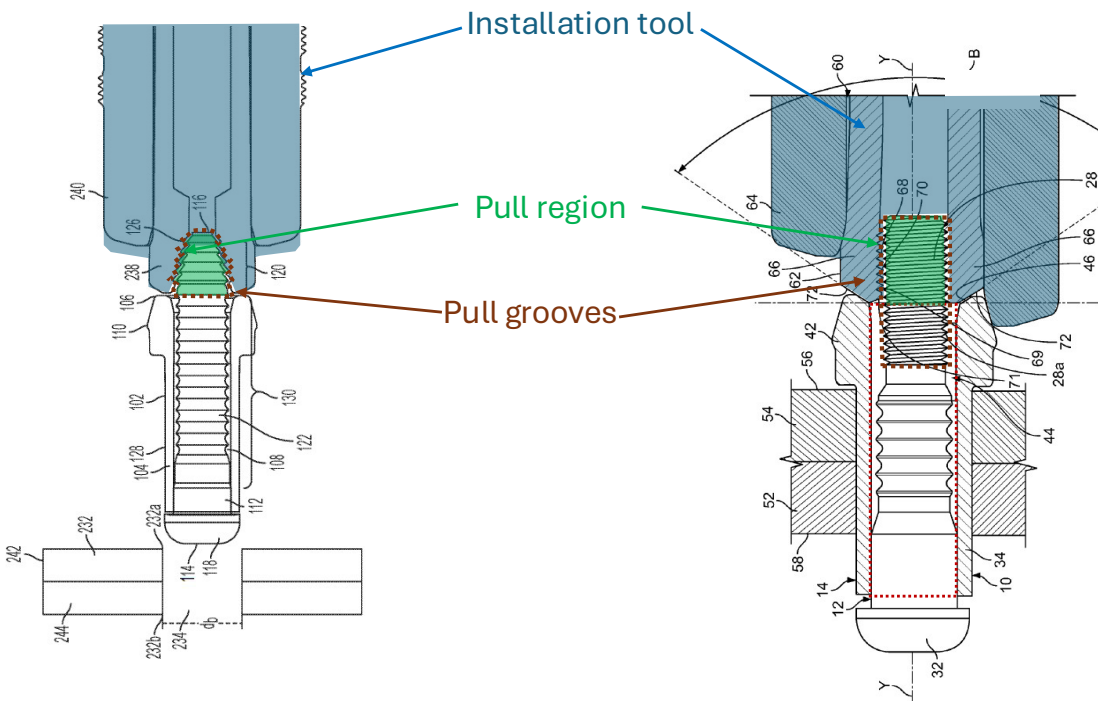
E. Claim 8: "The blind fastener of claim 1, wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove."

Corbett 2018 anticipates claim 8, because its shank region comprises "a grooved portion 24." *Id.* ¶¶ 96-98; Ex-1006, [0009]. As shown below, "each of the plurality of grooves 24a is an annular groove." Ex-1004 ¶¶ 96-97; Ex-1006, [0009].



F. Claim 9: "The blind fastener of claim 1, wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove."

Corbett 2018 anticipates claim 9, because it has "a pull portion having at least one pull groove" and "the pull portion 28 includes a plurality of pull grooves 28a" wherein "each of the plurality of pull grooves 28a is an annular groove." Ex-1004 ¶¶ 99-101; Ex-1006, Abstract, [0009]. Those annular "pull grooves 28a" are shown below. Ex-1004 ¶ 100.



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G. Claim 10: "The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical."

Corbett 2018 anticipates claim 10, because its "outer sleeve 14" has "a

cylindrical shape and a smooth exterior surface 40." *Id.* ¶¶ 102-04; Ex-1006, [0010]. Corbett 2018's "shank 16 includes a cylindrical-shaped smooth portion 22." Ex-1004 ¶ 102; Ex-1006, [0009]. A POSITA would understand that Corbett 2018 comprises a generally cylindrical sleeve and mandrel. Ex-1004 ¶ 103.

H. Claim 11: "The blind fastener of claim 1, wherein the blind fastener comprises at least one of a metal, metal alloy, and a composite material."

Corbett 2018 anticipates claim 11. Corbett 2018 discloses a blind fastener having a sleeve and mandrel that plastically deform during installation, including radial expansion/swaging on the blind-side. *Id.* ¶ 105; Ex-1006, [0012-0013]. A POSITA would understand that blind fasteners exhibiting this behavior are formed from materials capable of permanent deformation without fracture, including metals, metal alloys, and metal-based composite materials. Ex-1004 ¶ 105.

Alternatively, Corbett 2018 renders claim 11 obvious. A POSITA would have known that blind fasteners intended for structural applications are formed from metals, metal alloys—and in some applications metal-based composites—to provide the strength, ductility, and controlled plastic deformation required for installation and service loads. *Id.* ¶ 106. Accordingly, a POSITA would have found it obvious to form Corbett 2018's blind fastener from the above materials, with a reasonable expectation of success. *Id.*

I. Claim 12: "The blind fastener of claim 1, wherein the blind fastener is adapted to be installed in a bore in a structure, the bore having a diameter greater than the diameter of the enlarged portion."

Corbett 2018 anticipates claim 12. As detailed for limitation 1(c), Corbett 2018's mandrel includes an "enlarged head" having a diameter "greater than that of the cavity formed by the sleeve" in order "to sit on and be juxtaposed with the second end of the sleeve." *Id.* ¶ 107; Ex-1006, [0011], Fig. 1. Corbett 2018's "fastener 10 is inserted through holes of the work pieces 52, 54, with the head 42 of the sleeve 14 abutting one side 56 of the work piece 54." Ex-1004 ¶ 107; Ex-1006, [0011]. In addition, Corbett 2018's "body 34 includes an outer diameter that provides for a clearance fit through openings of work pieces," confirming that the bore is dimensioned to receive the sleeve body while the enlarged portions of the fastener prevent passage through the workpiece. Ex-1004 ¶ 108; Ex-1006, [0010].

J. Claim 13: "The blind fastener of claim 12, wherein the sleeve further comprises a collar, the sleeve is configured to deform on a first side of the structure, and the collar is configured to swage onto the shank region on an oppositely disposed second side of the structure."

Corbett 2018 anticipates claim 13. Its sleeve comprises a collar ("head 42," *see* Ex-1006, [0010], Fig. 2), where the sleeve is "configured to deform on a first side of the structure" and "can form various expanded blind side shapes as the bolt 12 is pulled into or against the outer sleeve's 14 blind side." Ex-1004 ¶ 110; Ex-

1006, [0014]. The installation tool's anvil "engages and swages the sleeve 14" and "a portion of the elongated body 34 of the outer sleeve 14 is compressed and swaged into the grooved portion 24 of the bolt 12." Ex-1004 ¶¶ 111-12; Ex-1006, [0013-0014], Fig. 2.

K. Claim 14: "The blind fastener of claim 12, wherein the structure comprises at least one of a metal, a metal alloy, and a composite material."

Corbett 2018 anticipates claim 14. Corbett 2018 discloses blind fastening of structures using a fastener that plastically deforms during installation to secure "work pieces" together. Ex-1004 ¶ 114; Ex-1006, [0002-0003, 0008, 0011-0013]. A POSITA would understand that the rigid, structural "work pieces" disclosed in Corbett 2018 are formed from materials capable of withstanding the installation forces/loads associated with blind fastening, including metals, metal alloys, or composite materials. Ex-1004 ¶ 114.

Alternatively, Corbett 2018 renders claim 14 obvious. A POSITA would have known that blind fasteners are used to join structural components made from metals, metal alloys, and composite materials, which provide the strength and rigidity required for such joints. *Id.* ¶ 115. A POSITA therefore would have found it obvious to apply the Corbett 2018 blind fastener to structures comprising any of the recited materials, with a reasonable expectation of success. *Id.*

L. Claim 15: "The blind fastener of claim 12, wherein the structure is configured as at least one of an aerospace component, an automotive component, a transportation component, and a building and construction component."

Corbett 2018 anticipates claim 15. Corbett 2018 discloses a blind "fastener and a fastener installation tool for securing work pieces together." *Id.* ¶ 116; Ex-1006, [0002-0003, 0008, 0011-0013]. A POSITA would recognize that blind fasteners of this type are not limited to any particular use and are routinely used to join structural workpieces in aerospace, automotive, transportation, and building and construction applications. Ex-1004 ¶ 116.

Alternatively, Corbett 2018 renders claim 15 obvious. Given the well-known and widespread use of blind fasteners to secure structural components across the above industries, it would have been obvious to a POSITA to configure the structure receiving the Corbett 2018 blind fastener as recited in claim 15. *Id.* ¶¶ 117-18.

M. Claim 16

Limitations 16(b)-16(g) correspond to limitations 1(a)-1(f), respectively, and are disclosed by Corbett 2018 for the same reasons/citations discussed above in Section VII.A (Claim 1). Limitations 16(h)-16(j) are addressed below.

1. Preamble: "A method for fastening, the method comprising:"

The preamble is not limiting. *See supra* § VII.A.1. Regardless, Corbett 2018

is titled "Fastener and Fastening System," and explains that [t]he present invention relates to a fastening system" "for securing work pieces together." Ex-1004 ¶ 119; Ex-1006, Title, [0002]. Corbett 2018's fastener "is adapted to secure a plurality of work pieces 52, 54 together" and to "close any gap between the work pieces." Ex-1004 ¶ 119; Ex-1006, [0011, 0013] (detailing fastening method).

2. Limitation 16(a): "inserting a first mandrel end of a blind fastener into a bore in a structure"

Corbett 2018's "fastener 10 is inserted through holes of the work pieces 52, 54, with the head 42 of the sleeve 14 abutting one side 56 of the work piece 54, and at least a portion of the elongated body 34 of the sleeve 14 extending outwardly from one side 58 (i.e., the blind side) of the work piece 52." Ex-1004 ¶ 121; Ex-1006, [0011, 0013].

3. Limitation 16(h): "engaging a collet of the installation tool with the pull region of the blind fastener;"

Corbett 2018 teaches that "[c]ertain fasteners include a pull portion having pull grooves, while associated fastener installation tools include a puller comprising a collet and teeth that engage the pull grooves of the pull portion of the fastener." Ex-1004 ¶ 129; Ex-1006, [0003], Fig. 2. "[T]eeth 68 and the pull grooves 70 of the puller 62 engage the pull grooves 28a of the pull portion 28." Ex-1004 ¶¶ 129-131; Ex-1006, [0012-0013] (detailing collet engagement).

4. Limitation 16(i): "after the inserting, forcibly contacting the second sleeve end of the blind fastener with an anvil of the installation tool and moving the pull region distal from the second sleeve end utilizing the collet of the installation tool; and"

Corbett 2018 teaches that once the puller engages the pull portion, "puller 62 is driven forward," "jaws 66 of the puller 62 are then moved inwardly to a closed position and clamp down on the pull portion 28 and provide an axial force on the bolt 12 and close any gap between the work pieces 52, 54," and "anvil 64 then engages and swages the sleeve 14." Ex-1004 ¶ 132; Ex-1006, [0013], Fig. 2.

5. Limitation 16(j): "deforming the sleeve on a first side of the structure, and swaging the second sleeve end onto the shank region on an oppositely disposed second side of the structure, thereby securing at least a portion of the blind fastener in the structure."

Corbett 2018's installation tool deforms the sleeve on a first side of the structure, and swages the second sleeve end onto the shank region on an oppositely disposed second side of the structure, thereby securing at least a portion of the blind fastener in the structure. Ex-1004 ¶¶ 133-34. Corbett 2018 teaches "puller 62 continues to provide an axial force on the bolt 12" and "sleeve 14 can form various expanded blind side shapes as the bolt 12 is pulled into or against the outer sleeve's 14 blind side," while "anvil 64 then engages and swages the sleeve 14" wherein "a portion of the elongated body 34 of the outer sleeve 14 is compressed and swaged into the grooved portion 24 of the bolt." *Id.* Ex-1006, [0013-0014].

N. Claim 17: "The method of claim 16, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region."

As detailed in 1(f), Corbett 2018 includes a pull region comprising an axial length no greater than 3.8 times the shank diameter and further renders this claim obvious. Ex-1004 ¶ 135.

O. Claim 19: "The method of claim 16, wherein the mandrel does not comprise a breakneck groove."

As detailed in claim 5, Corbett 2018 has a mandrel that does not comprise a breakneck groove. *Id.* ¶ 136.

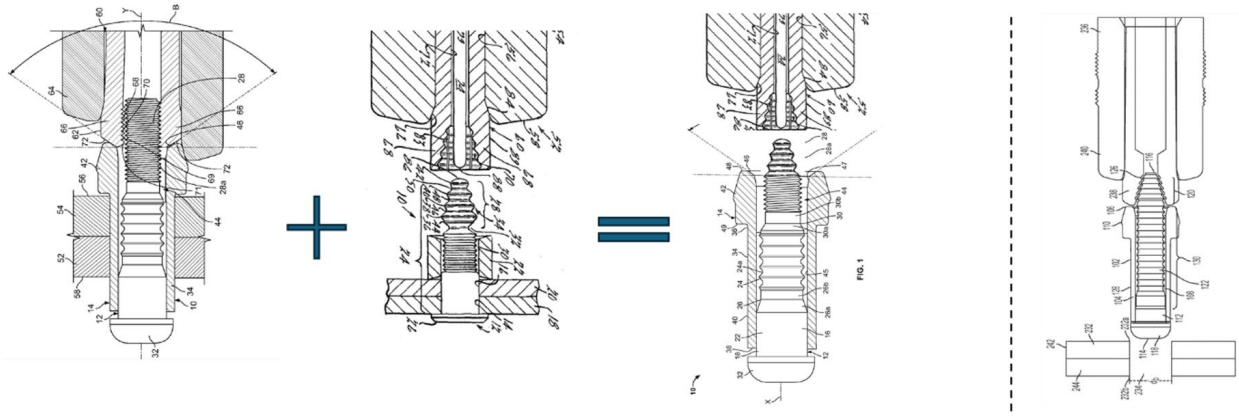
P. Claim 20: "The method of claim 16, wherein the blind fastener comprises at least one of a metal, a metal alloy, and a composite material."

As detailed in claim 11, Corbett 2018 comprises at least a metal or metal alloy and further renders this claim obvious. *Id.* ¶ 137.

VIII. GROUND 3: CORBETT 2018 IN VIEW OF CORBETT 1981 RENDERS OBVIOUS CLAIMS 1-3, 6-7, 11, 14-17, 20.

Corbett 2018 and Corbett 1981 are authored by the same inventor. As detailed in § VI.B, Corbett 2018 discloses the core structure and operation of the claimed blind fastener and satisfies the majority of the claim limitations. Corbett 1981 provides additional, express disclosures relating to a short pull region (all claims), a tapered pull region (claims 4, 18), and the use of hard metals and other materials (claims 6-7, 11, 14, 20).

As illustrated below, it would have been obvious to modify Corbett 2018's blind fastener by replacing its "**pull portion 28**" with Corbett 1981's shortened and tapered "**pintail 28**." Ex-1004 ¶¶ 153; Ex-1006, [0009]; Ex-1007, 4:34-39.



A POSITA would have been motivated to consult and combine Corbett 1981 with Corbett 2018 because both references address the same field/problem as the '358 Patent and closely-related fastener designs and installation techniques, and Corbett 1981 describes well-known structural variations and material selections directly applicable to Corbett 2018's blind fastener. Ex-1004 ¶¶ 139-143; Ex-1006 [0007]; Ex-1007 at 2:20-21 ("eliminate the possibility of stripping"); Ex-1001 at 3:46-49 ("reduce installation forces and increase corrosion resistance"), 6:55-60 ("reduce potential stripping"), 7:28-31 (avoid "fractur[ing] the mandrel").

Corbett 1981 and Corbett 2018—like the '358 Patent—each discloses a similar pull-type fastener for mechanically joining two workpieces. Ex-1004 ¶¶ 139, 143. Each reference teaches a fastener including (i) a body or sleeve; (ii) a

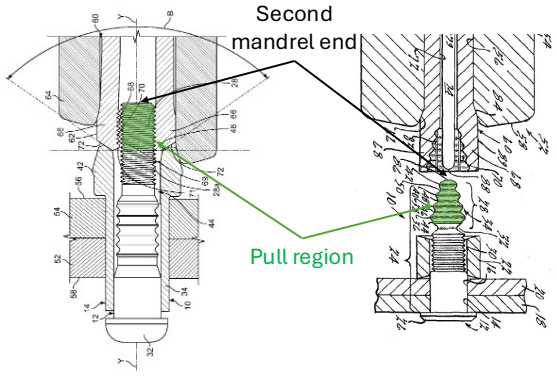
pulling member configured to pass through aligned apertures in two workpieces; (iii) a pull region configured to be engaged by an installation tool; and (iv) a deformation or swaging mechanism that secures the fastener on the opposite side of the workpieces. *Id*. Moreover, Corbett 1981 and Corbett 2018 address the same problem as the ’358 Patent—namely, reliable installation of a structural fastener by engaging a pull region with a mechanical fastening tool to secure two workpieces. *Id.* As discussed *supra* § IV.A, a POSITA would have applied these teachings because they relate to pull-type fastener features and related material selections, and would be motivated to combine design elements from non-blind and blind pull-type fasteners. *See also id.* ¶¶ 142-152. Such combinations have more than a reasonable expectation of success and have been made previously. *Id.* ¶¶ 153-54. Moreover, a POSITA would understand that modifying Corbett 2018’s pull portion to incorporate Corbett 1981’s short, tapered pull region would entail only routine adjustments to the mandrel geometry (and the simple substitution of a known element for another), without altering Corbett 2018’s sleeve structures, installation sequence, swaging mechanics, or the operation of the rest of the fastener system, while predictably providing the same benefits described above—as well as reduced material usage and tool stroke, improved engagement, and reduced risk of pull-feature damage. *Id.* ¶¶ 147-153.

A. Claim 1

The preamble and limitations 1(a)–1(c), 1(e), and the "installation tool engagement" portion of 1(f) are satisfied by Corbett 2018 for the same reasons/citations set out in Grounds 1-2. Petitioner incorporates those showings here and addresses the remaining claims/limitations.

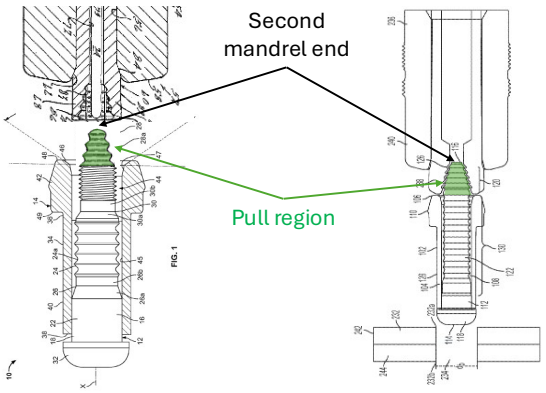
1. Limitation 1(d): "a second mandrel end comprising a pull region"

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation. Corbett 1981 likewise discloses a pull region, referred to as its "**pintail portion**." Ex-1004 ¶ 159. Specifically, Corbett 1981's "[p]in 12" has "**pintail portion 28** at the other end thereof." *Id.*; Ex-1007 at 2:65-68. Accordingly, Corbett 2018 in view of Corbett 1981 also discloses this limitation, as shown below. Ex-1004 ¶¶ 159-160.



Corbett 2018

Corbett 1981



Corbett 2018 in view of Corbett 1981

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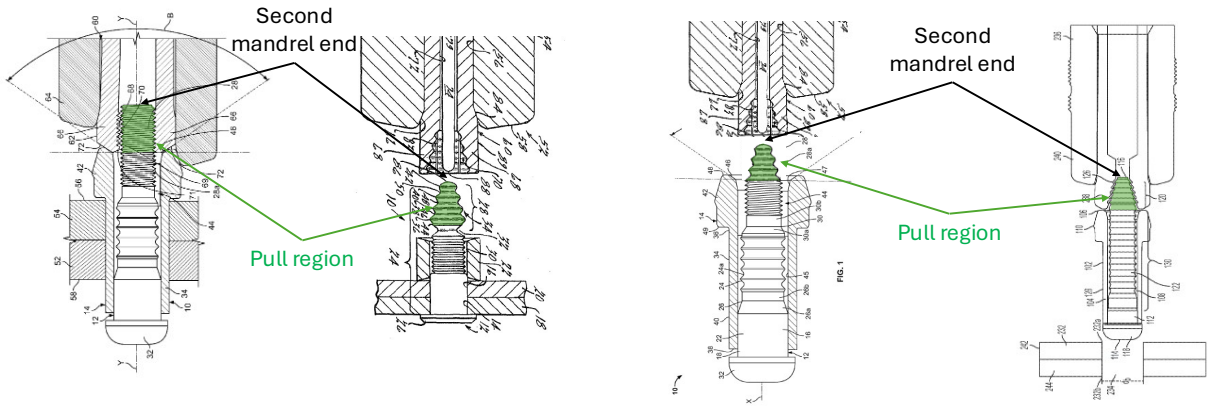
2. Limitation 1(f): "wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation. As further detailed herein regarding limitation 1(d), Corbett 1981's "**pintail portion**" is its pull region. Corbett 1981 further teaches that "in order to optimize material usage and minimize the amount of material required," it is preferable to "reduce the length of the **pintail portion**" to a "minimum" length equal to the shank diameter. Ex-1004 ¶ 163; Ex-1007 at 5:35-50, claim 16 ("A fastener as set forth in claim 15 with said pintail portion having a length equal to approximately the nominal diameter of said pin."). Corbett 2018 in view of Corbett 1981 discloses an axial length no greater than the shank diameter, shown below. Ex-1004 ¶ 164.



Corbett 2018 | Corbett 1981 | Corbett 2018 in view of Corbett 1981 | 358 Patent

In addition to the reasons to combine Corbett 2018 and Corbett 1981 discussed above, a POSITA would have been motivated to apply Corbett 1981's

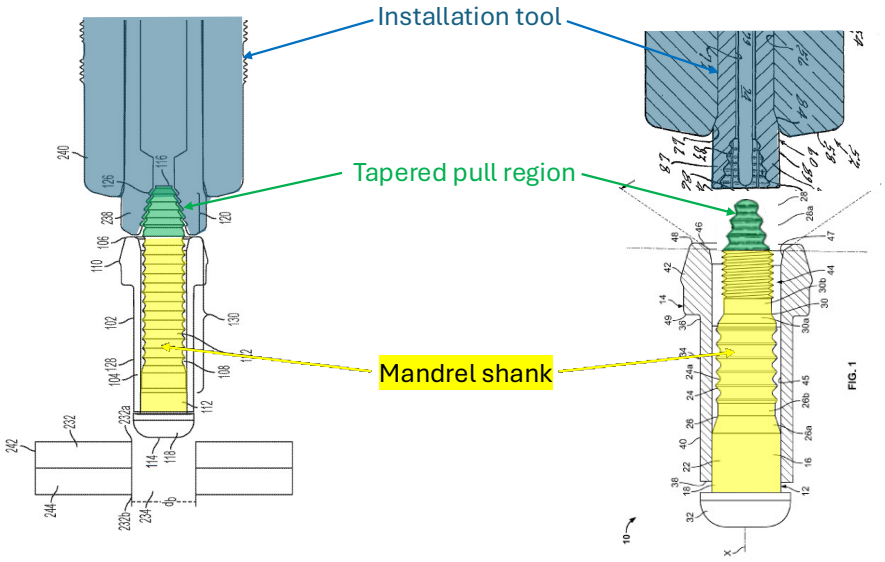
teaching of a short pull region to Corbett 2018. Ex-1004 ¶¶ 165-66. Corbett 1981 teaches to "reduce the length of the **pintail portion 28** to a minimum" "generally equal to approximately the nominal diameter of the smooth shank portion" to "***optimize material usage*** and ***minimize the amount of material*** required." *Id.* ¶¶ 144, 165; Ex-1007 at 5:35-50 (emphasis added), 9:60-62 (claim 16). Corbett 1981 also teaches that a longer pull region—including pintail portions that break off and are discarded—"represents a cost factor in the fastener which contributes nothing to the fastened joint." Ex-1004 ¶ 165 (citing Ex-1007 at 1:38-42). Corbett 1981 explains this is especially important, "when the fasteners are fabricated from more costly, exotic metals such as titanium which are commonly used in the aerospace industry." Ex-1004 ¶ 165 (citing Ex-1007 at 1:55-66). "[I]t is ***very desirable*** to reduce to an ***absolute minimum*** the amount of material required and hence the costs associated with the fastener and particularly to reduce the amount of that material and associated cost which does not contribute to the integrity or strength of the fastener as installed i.e. the disposable pintail." Ex-1004 ¶ 165; Ex-1007 at 1:61-66 (emphasis added). A POSITA would understand that saving material costs is a critical consideration in the high-volume fastener industry, and that a shortened pull region reduces the amount of material being plastically deformed/resisted during pulling, which lowers required installation force and improves efficiency/consistency of installation. Ex-1004 ¶ 166; Ex-1007 at 2:15-29.

B. Claims 2-3: (2) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region." (3) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region."

Claims 2-3 are met for the reasons stated above for 1(f). The combined Corbett 2018/Corbett 1981 pull-region length is less than twice the shank diameter. Ex-1004 ¶¶ 167-68.

C. Claim 4: "The blind fastener of claim 1, wherein the pull region comprises a taper extending from the shank region."

Corbett 1981 teaches a "**pintail portion 28**" with a "generally conical shape and has a plurality of pull grooves 34 provided therealong, each of said pull grooves being defined by successively alternating crests 36 through 42 and valleys 44 through 50" where "each of the valleys 44 through 50 has a diameter less than the diameter of any of the preceding valleys." Ex-1004 ¶ 169; Ex-1007 at 3:10-20. Corbett 2018 in view of Corbett 1981 also discloses a pull region comprising a taper extending from the shank region. Ex-1004 ¶¶ 169-171. Specifically, the tapered pull region extending from the shank region is shown in **green** below:



358 Patent

Corbett 2018 in view of Corbett 1981

A POSITA would have been motivated to apply Corbett 1981's teaching of a tapered pull region to Corbett 2018. *Id.* ¶¶ 144-48, 170. A POSITA would credit Corbett 1981's teachings about the advantages of the tapered pull region, such that "gripping of all of the pintail crests by all of the jaw crests or gripping of none" to prevent "stripping the pull grooves 34." *Id.*; Ex-1007 at 4:41-5:26. Corbett 1981 teaches that this tapered geometry, shown below, "provides an effective disabling feature which allows the pintail length to be reduced to a minimum without concern as to stripping of the pull grooves should the tool be positioned thereon so as to provide less than full engagement of jaw teeth 70 with all of the pull grooves 34." Ex-1004 ¶¶ 145, 170; Ex-1007 at 5:20-26.

Fig. 4
Tool and pintail fully engaged

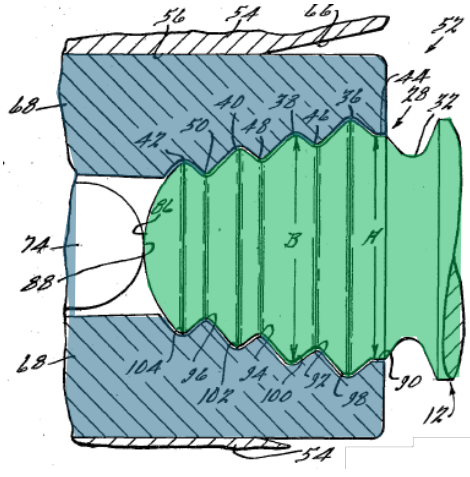
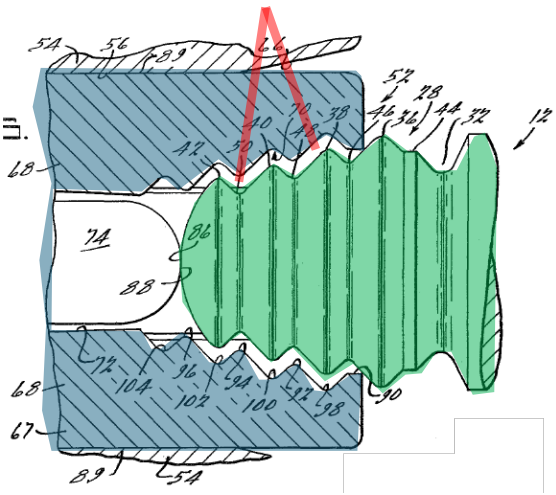


Fig. 5
Tool and pintail not engaged, gap



Corbett 1981

A POSITA would also recognize that a tapered pull region allows for better engagement between the pull grooves and the installation tool, reducing the risk of partial engagement, slippage/stripping, scratching/abrading/corrosion of the pull region, and uneven load distribution during installation. Ex-1004 ¶¶ 144-150, 170-71. Moreover, a POSITA would know that Corbett 1981's teaching of a tapered pull region would reduce localized overstress on individual teeth, thereby decreasing the risk of stripping, chipping, or premature tool wear, improving fastener reliability and tool longevity. *Id.* ¶ 171.

D. Claim 5: "The blind fastener of claim 1, wherein the mandrel does not comprise a breakneck groove."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

Corbett 1981 teaches the breakneck groove may be eliminated, and the pintail may remain attached. Ex-1004 ¶ 173; Ex-1007 at 5:61-65.

A POSITA would further be motivated to omit a breakneck where break-off provides no benefit to the installed joint and can increase corrosion/handling issues. Ex-1004 ¶¶ 150, 174 (citing Ex-1007 at 1:34-38). The grooved tapered pull-region and the breakneck groove serve two different functions: the former relates to reliable alignment and engagement of the installation tool to the pull portion, while the latter relates to separation of the pintail after installation. Ex-1004 ¶ 174 (citing Ex-1007 at 4:23-26). In addition, designing/manufacturing the breakneck groove would be an additional step not necessary for alignment. Ex-1004 ¶¶ 150, 175. Moreover, separating the pintail after installation can leave a rough/irregular edge, increasing the risk of corrosion and potential damage to adjacent components or injury to personnel. *Id*.

E. Claims 6-7: (6) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25." (7) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43."

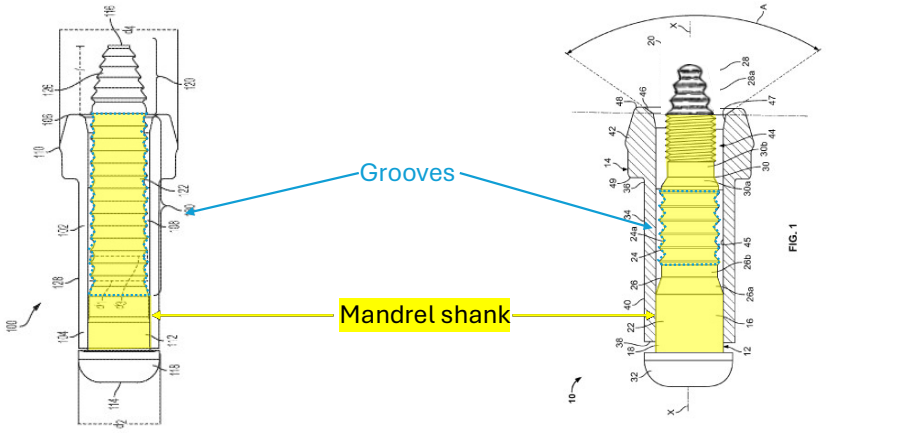
Corbett 1981 teaches that certain "fasteners are fabricated from more costly, exotic metals such as titanium which are commonly used in the aerospace industry." *Id.* ¶ 178 (citing Ex-1007 at 1:55-61, 7:11-14). A POSITA would understand that aerospace applications often require rigid, tightly-jointed, high strength connections which are resistant to vibrations, and that titanium alloys have a maximum Rockwell hardness in the low 40's. *Id.* ¶¶ 178-79. A POSITA would

have known that other exotic metals commonly used for aerospace fasteners include tungsten-based alloys (HRC 30-50+) and a nickel-chromium superalloy named Inconel 718 (HRC 40-50s). *Id.* ¶ 180 (citing Exs-1017-1020).

A POSITA would have been motivated to apply Corbett 1981's teaching of high-hardness materials such as titanium or similar high-strength alloys of at least HRC 25 and HRC 43, to Corbett 2018's mandrel, for several reasons. A POSITA would have known that high hardness and high strength go hand in hand, and that the mandrel of a pull-type fastener must comprise a material harder than that of the sleeve which deforms and swages onto the mandrel. Ex-1004 ¶ 181. Additionally, a POSITA would have been aware that it is desirable to use hardened metals when designing fasteners for use in aerospace applications as disclosed in Corbett 1981. *Id.* ¶¶ 180-82. A POSITA would recognize that high-strength alloys such as titanium alloys are desirable in a wide range of applications due to their high strength-to-weight ratio and corrosion resistance. *Id.* ¶¶ 151-52, 182. High-strength mandrels with a high Rockwell hardness are also more resistant to damage during installation, especially when the sleeve/collar is deformed and swaged onto the mandrel. *Id*. Moreover, high-strength mandrels have pull grooves that provide more reliable tool engagement and groove integrity during installation. *Id*.

F. Claim 8: "The blind fastener of claim 1, wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove."

As detailed in Grounds 1-2, and as further illustrated below, Corbett 2018 discloses this limitation. Ex-1004 ¶ 184.



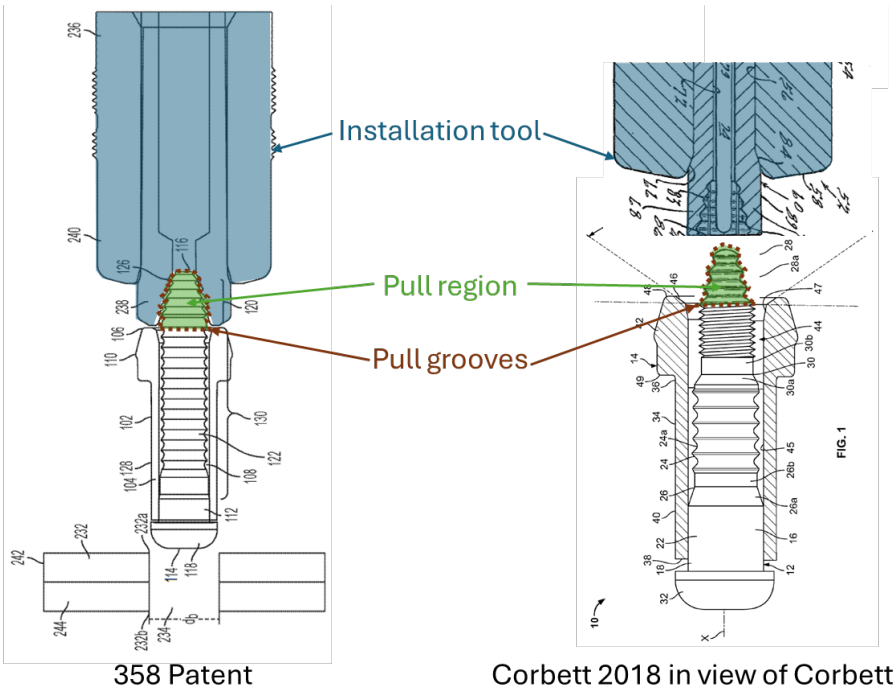
358 Patent

Corbett 2018 in view of Corbett 1981

G. Claim 9: "The blind fastener of claim 1, wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove."

As detailed in Grounds 1-2, Corbett 2018 discloses this claim.

Corbett 1981 likewise teaches that "[p]intail portion 28 of pin 12 is of a generally conical shape and has a plurality of pull grooves 34 provided therealong, each of said pull grooves being defined by successively alternating crests 36 through 42 and valleys 44 through 50." *Id.* ¶ 185; Ex-1007 at 3:10-14. Accordingly, Corbett 2018 in view of Corbett 1981 also discloses this claim, as shown below. Ex-1004 ¶ 186.



358 Patent | Corbett 2018 in view of Corbett 1981

H. Claim 10: "The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

I. Claim 11: "The blind fastener of claim 1, wherein the blind fastener comprises at least one of a metal, metal alloy, and a composite material."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

As further detailed in claims 6-7, Corbett 1981 teaches that the fastener can be comprised of titanium or other "exotic metals." *Id.* ¶ 188; Ex-1007 at 1:55-61. Moreover, a POSITA would know that metals used to make fastener components are nearly always metals or metal alloys. Ex-1004 ¶ 188. Accordingly, a POSITA would have been motivated to apply Corbett 1981's teaching of a blind fastener comprised of titanium or other exotic metals to Corbett 2018. *Id.*

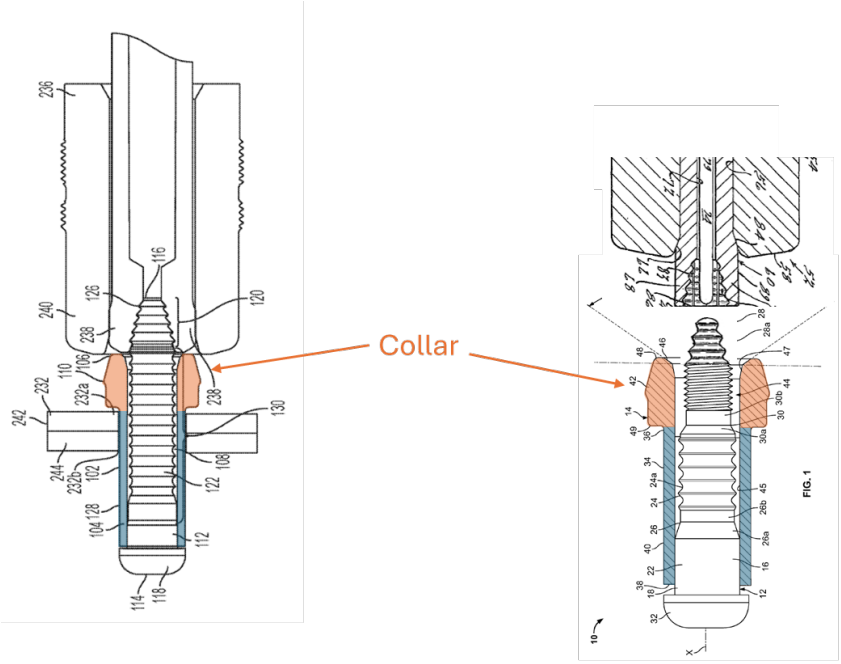
J. Claim 12: "The blind fastener of claim 1, wherein the blind fastener is adapted to be installed in a bore in a structure, the bore having a diameter greater than the diameter of the enlarged portion."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

K. Claim 13: "The blind fastener of claim 12, wherein the sleeve further comprises a collar, the sleeve is configured to deform on a first side of the structure, and the collar is configured to swage onto the shank region on an oppositely disposed second side of the structure."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

As shown below, Corbett 1981 teaches that the "installation tool also has a swaging anvil adapted to engage the collar and to swage the collar into engagement with locking grooves on the shank portion of the pin in reaction to the pulling force." *Id.* ¶¶ 191-92 (Corbett 2018's "head of the sleeve" matching claimed "collar"); Ex-1007 at 1:31-34, 6:19-25 ("swageable collar 120" is "swaged during setting of the fastener" into "annular lock grooves 122").



358 Patent | Corbett 2018 in view of Corbett 1981

L. Claim 14: "The blind fastener of claim 12, wherein the structure comprises at least one of a metal, a metal alloy, and a composite material."

As detailed in Grounds 1-2, Corbett 2018 discloses this claim.

Corbett 1981 teaches that "fasteners [] fabricated from more costly, exotic metals such as titanium [] are commonly used in the aerospace industry." Ex-1004 ¶ 193; Ex-1007 at 1:55-67. A POSITA would have understood that, in the aerospace industry, the structures being joined—including airplane panels and structural members—are frequently formed from metals, metal alloys, and composite materials. Ex-1004 ¶ 194. Accordingly, a POSITA would understand that the structures into which the Corbett 2018 blind fastener is installed commonly

comprise at least one of the materials in claim 14. *Id*.

M. Claim 15: "The blind fastener of claim 12, wherein the structure is configured as at least one of an aerospace component, an automotive component, a transportation component, and a building and construction component."

As detailed in Grounds 1-2, Corbett 2018 discloses this claim. *Id.* ¶¶ 195-97; Ex-1006, [0002-0003, 0008, 0011-0013].

Corbett 1981 further teaches "fasteners [] fabricated from more costly, exotic metals such as titanium [] are commonly used in the aerospace industry." Ex-1004 ¶ 196; Ex-1007 at 1:55-67. A POSITA would understand that, when deploying Corbett 2018 in view of Corbett 1981 in aerospace applications, the "structure" (i.e., work pieces/components being joined) being secured is configured as an aerospace component satisfying claim 15. Ex-1004 ¶¶ 196-97; Ex-1007 at 1:55-61.

N. Claim 16

Limitations 16(a)-16(d), 16(f), and 16(j) correspond to limitations 1(a)-1(f), respectively, and are disclosed by Corbett 2018 for the same reasons/citations discussed in Claim 1. Limitations 16(h)-16(j) further recite specific tool interactions and installation steps, addressed below.

1. Preamble: "A method for fastening, the method comprising:"

As detailed in Grounds 1-2, the preamble is not limiting, and Corbett 2018

teaches the preamble.

Corbett 1981 likewise discloses a "fastener assembled to workpieces to be joined." Ex-1004 ¶ 198; Ex-1007 at 2:36-40.

2. Limitation 16(e): "a second mandrel end comprising a pull region"

As detailed in 1(d), Corbett 2018 discloses this limitation.

As discussed therein, Corbett 1981 likewise discloses a pull region on a second mandrel end. Accordingly, Corbett 2018, either alone or as combined with Corbett 1981, satisfies this limitation.

3. Limitation 16(g): "wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool;"

As detailed in 1(f), Corbett 2018 discloses this limitation.

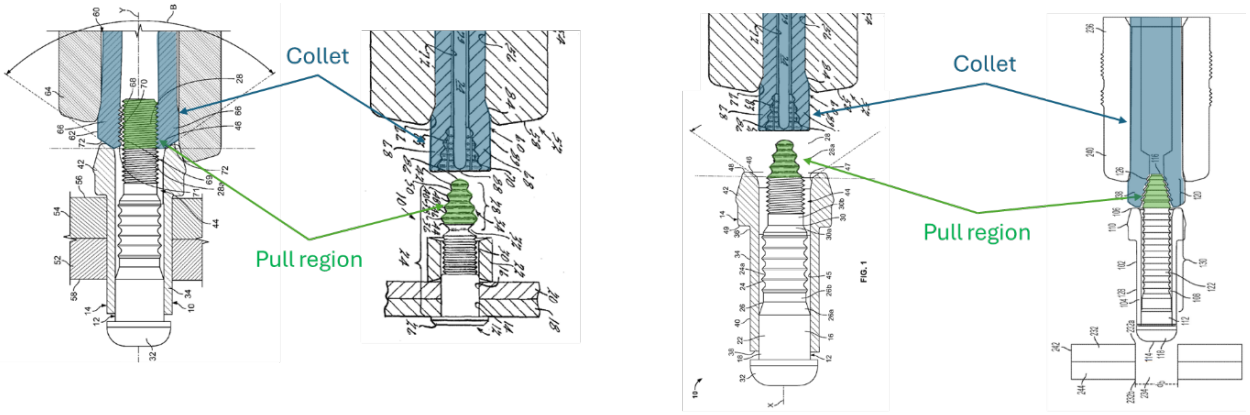
As discussed therein, Corbett 1981 likewise discloses a pull region with an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool. Accordingly, Corbett 201, either alone or as combined with Corbett 1981, satisfies this limitation.

4. Limitation 16(h): "engaging a collet of the installation tool with the pull region of the blind fastener;"

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

Corbett 1981 similarly teaches that, during installation, "the separate fingers of collet jaw portion 68 [] move radially inwardly and the teeth 70 [] move into

engaging relationship with pull grooves 34 of pintail portion 24." Ex-1004 ¶ 207; Ex-1007 at 4:1-14. Accordingly, Corbett 2018 in view of Corbett 1981 also discloses engaging a collet of Corbett 1981's installation tool with the modified pull region of Corbett 2018's blind fastener, as illustrated below:



Corbett 2018 | Corbett 1981 | Corbett 2018 in view of Corbett 1981 | 358 Patent

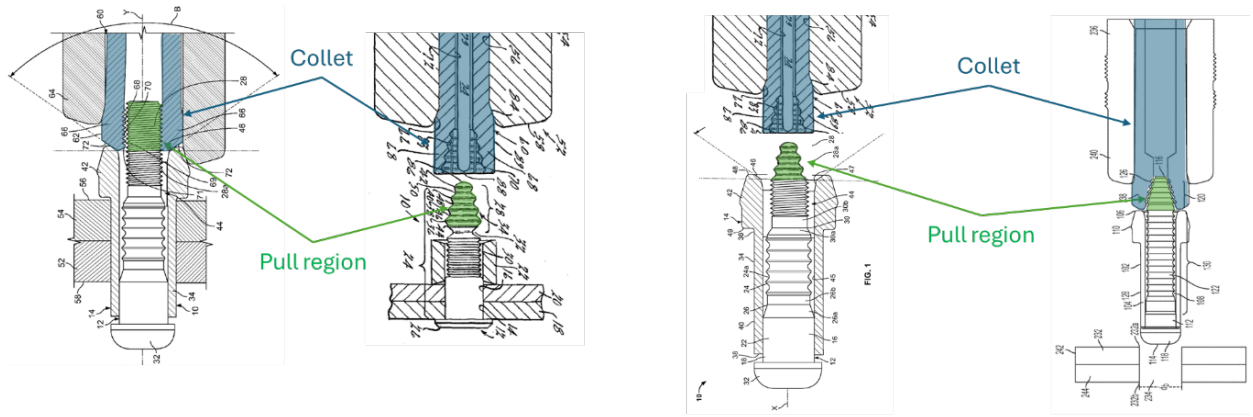
Ex-1004 ¶¶ 206-09.

5. <u>Limitation 16(i)</u>: "after the inserting, forcibly contacting the second sleeve end of the blind fastener with an anvil of the installation tool and moving the pull region distal from the second sleeve end utilizing the collet of the installation tool; and"

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

Corbett 1981 similarly discloses that, during installation, "terminal end surface 86 of pintail portion 28 will engage rounded end portion 88 of ejection pin 74 thereby moving ejection pin 74 longitudinally into bore 72," "tool 52 is actuated to its pulling stroke causing collet carrying member 62 to move longitudinally relative to anvil assembly 54," "jaw portion 68 moves longitudinally or axially

inwardly with respect to anvil 54, the engagement of surface 66 with inclined surface 84 causes the separate fingers of collet jaw portion 68 to move radially inwardly and the teeth 70 to move into engaging relationship with pull grooves 34 of pintail portion 24," after which "a pulling force is exerted on pin 12." *Id.* ¶ 211; Ex-1007 at 4:1-18. Corbett 2018 in view of Corbett 1981 discloses this limitation, as illustrated below.



Corbett 2018 | Corbett 1981 | Corbett 2018 in view of Corbett 1981 | 358 Patent

Ex-1004 ¶ 212.

O. Claim 17: "The method of claim 16, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region."

As detailed in 1(f), Corbett 2018 discloses this claim.

As discussed therein, Corbett 1981 likewise discloses a pull region comprising an axial length the same as the shank diameter. Accordingly, Corbett 2018, either alone or as combined with Corbett 1981, satisfies this claim.

P. Claim 18: "The method of claim 16, wherein the pull region comprises a taper or reverse taper extending from the shank region."

As detailed in claim 4, a POSITA would have been motivated to apply Corbett 1981's teaching of a tapered pull region to Corbett 2018.

Q. Claim 19: "The method of claim 16, wherein the mandrel does not comprise a breakneck groove."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

As further detailed in claim 5, Corbett 2018 in view of Corbett 1981 discloses a mandrel that does not comprise a breakneck groove.

R. Claim 20: "The method of claim 16, wherein the blind fastener comprises at least one of a metal, a metal alloy, and a composite material."

As detailed in Grounds 1-2, Corbett 2018 discloses this limitation.

As further detailed in claim 11, Corbett 2018 in view of Corbett 1981 discloses a blind fastener comprising at least one of a metal, a metal alloy, and a composite material.

IX. GROUND 4: CORBETT 2018, IN VIEW OF CORBETT 1981 AND HURD, RENDERS CLAIMS 6 AND 7 OBVIOUS.

Ground 4 is a targeted, claim-specific alternative for claims 6-7. To the extent the Board determines that Corbett 2018 and Corbett 1981 alone do not sufficiently establish the claimed Rockwell hardness thresholds, Hurd independently teaches hardness selections for structural fastener pulling members/mandrels, and a POSITA would have applied those teachings to Corbett 2018 with a reasonable expectation of success.

Hurd is directed to pull-type blind fasteners analogous to the '358 Patent. Ex-1004 ¶ 219, Ex-1008 at 1:7-48. Hurd teaches a mandrel ("pin 12") comprising a Rockwell hardness of at least HRC 25 (claim 6) and at least HRC 43 (claim 7). Ex-1004 ¶¶ 218-228. Hurd teaches that "the pin 12 must be of sufficient strength to withstand the frictional forces encountered during setting without significant wire drawing," thereby linking increased hardness to improved installation performance. *Id.* ¶ 221; Ex-1008 at 3:1-3. Hurd discloses "satisfactory results were obtained utilizing (a) a high hardness pin 12 made of alloy steel AISI 8740 and having a hardness around 49-52 Rc," where "Rc" denotes Rockwell hardness. Ex-1004 ¶¶ 221, 226-28; Ex-1008 at 3:14-16, 4:20-26 ("pin being made of an alloy steel having a hardness of around 49-52 Rc").

A POSITA would have been motivated to apply Hurd's teachings regarding an alloy steel mandrel having a Rockwell hardness of around HRC 49-52 to Corbett 2018 itself or in view of Corbett 1981. Ex-1004 ¶ 221. This motivation would arise from at least: (i) increased resistance to deformation and wire drawing during installation; (ii) improved resistance to stripping or damage of pull grooves under high installation loads; (iii) enhanced wear resistance and durability of the mandrel during tool engagement; and (iv) improved reliability in high-load and high-vibration environments. *Id.* ¶¶ 221-22. These advantages align with the functional objectives of Corbett 2018 and Corbett 1981, which likewise seek to improve reliability, tool engagement, and structural integrity during installation. *See supra* § VII.

A POSITA would also have had a reasonable expectation of success in applying Hurd's high-hardness mandrel teachings to Corbett 2018, or Corbett 2018 in view of Corbett 1981, because doing so amounts to a simple substitution of one known material property (mandrel hardness) for another using known materials for their established functions—i.e., resisting deformation and frictional forces during setting. Ex-1004 ¶¶ 224-25; *KSR*, 550 U.S. at 417-18. Hurd teaches compatible materials for the sleeve and workpieces when using a high-hardness and specific combinations that function reliably together. Ex-1004 ¶ 225; Ex-1008 at 3:1-27.

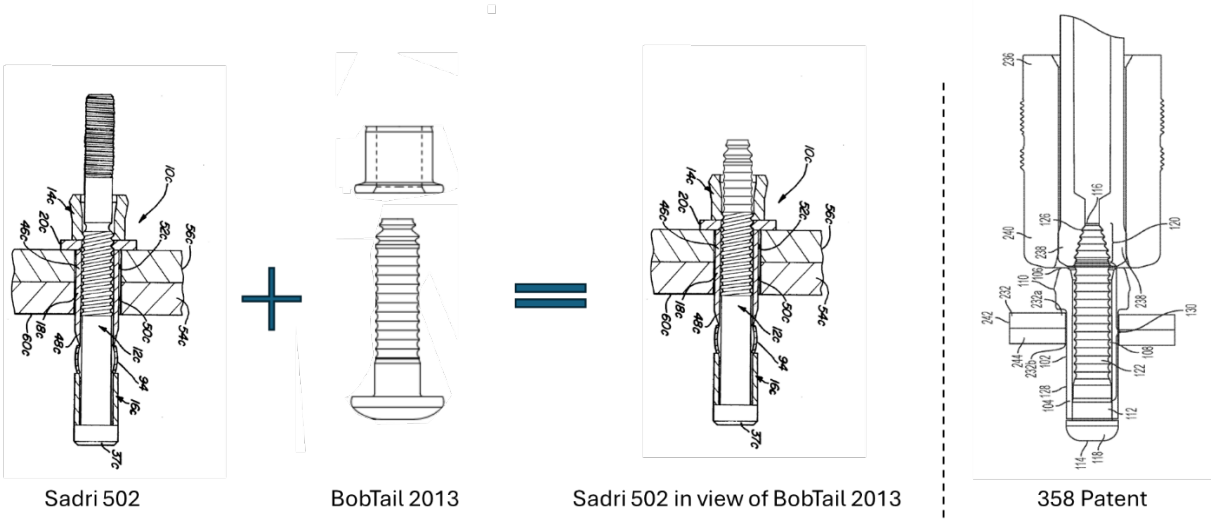
Accordingly, claims 6 and 7 are rendered obvious by Corbett 2018 and Corbett 1981 in view of Hurd.

X. GROUND 5: SADRI RENDERS CLAIMS 1-20 OBVIOUS IN VIEW OF THE BOBTAIL REFERENCE.

Ground 5 is an independent alternative ground based on different prior art (Sadri and BobTail) and challenges claims 1-20 regardless of the resolution of any Corbett-based grounds.

Sadri and BobTail are both directed to pull-type fasteners. Ex-1004 ¶ 230. Sadri discloses the core structure and operation of the claimed blind fastener and satisfies the majority of the claim limitations. BobTail is relied upon to provide additional, express disclosures relating to specific claimed features, including a short pull region (claims 1-20), a tapered pull region (claims 4, 18), and the use of hard metals and other materials (claims 6-7, 11, 14, 20).

As illustrated below, it would have been obvious to modify Sadri's blind fastener by replacing its "pintail portion" with BobTail's shortened and tapered pull region. *Id.* ¶¶ 229-241; Ex-1009 at 6:20-25.



For the general pull-type mechanics and the cross-application rationale (including why teachings from non-blind pull-type fasteners apply to blind fasteners), Petitioner relies on Section IV.A. For the governing motivation-to-combine and reasonable-expectation-of-success principles, Petitioner relies on the analysis applied in Ground 3 (Corbett 2018/Corbett 1981)—equally applicable here because Sadri/BobTail address the same pull-type installation mechanics and the same engineering objectives (tool engagement, pull-region geometry, and predictable swaging/clamping behavior).

Applying those principles, a POSITA would have been motivated to consult and combine Sadri with BobTail because both references address closely-related fastener designs and installation techniques related to the problem disclosed by the ’358 Patent. Ex-1004 ¶¶ 230-31, 233-39; Ex-1009 at Abstract; Ex-1010 at 3 (“improved corrosion resistance”), 6 (“makes the installation process quicker and

easier by reducing the force required to install each fastener"). As in Ground 3, the proposed modification is a predictable substitution of one known pull-region geometry for another, requiring only routine mandrel-geometry adjustments and not altering Sadri's sleeve structures, installation sequence, or swaging mechanics. Ex-1004 ¶ 240.

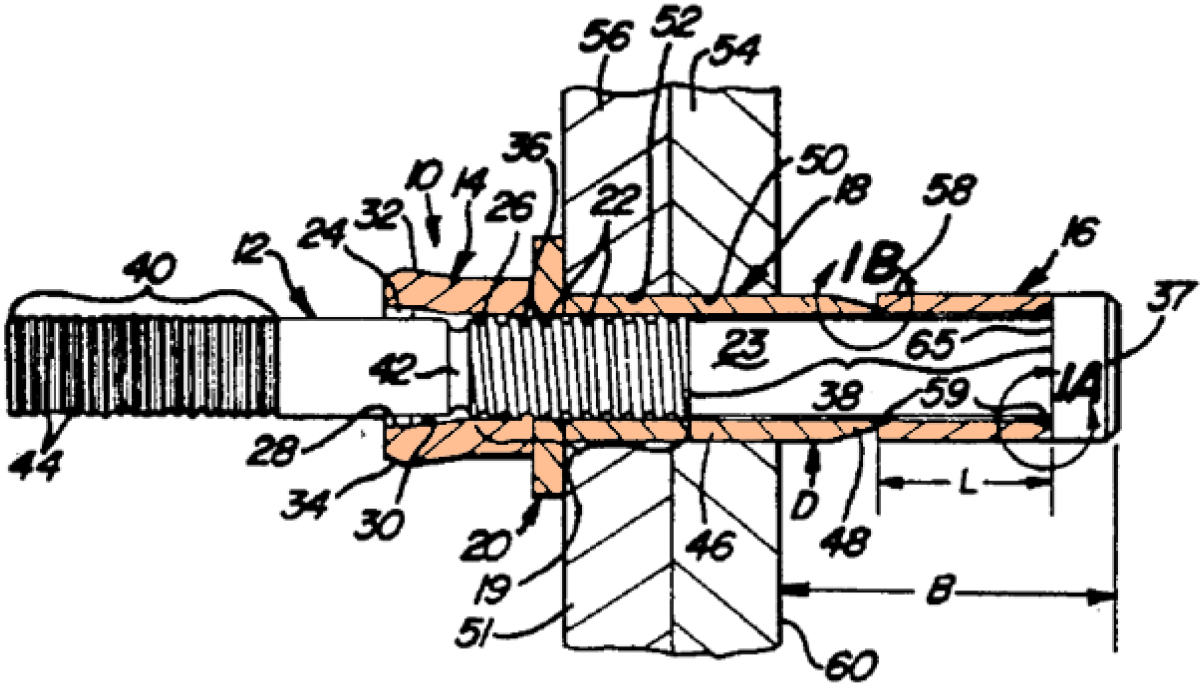
A. Claim 1

1. Preamble: "A blind fastener comprising:"

As detailed in Grounds 1-3, the preamble is not limiting. Sadri discloses a "blind fastener." Ex-1009, Title.

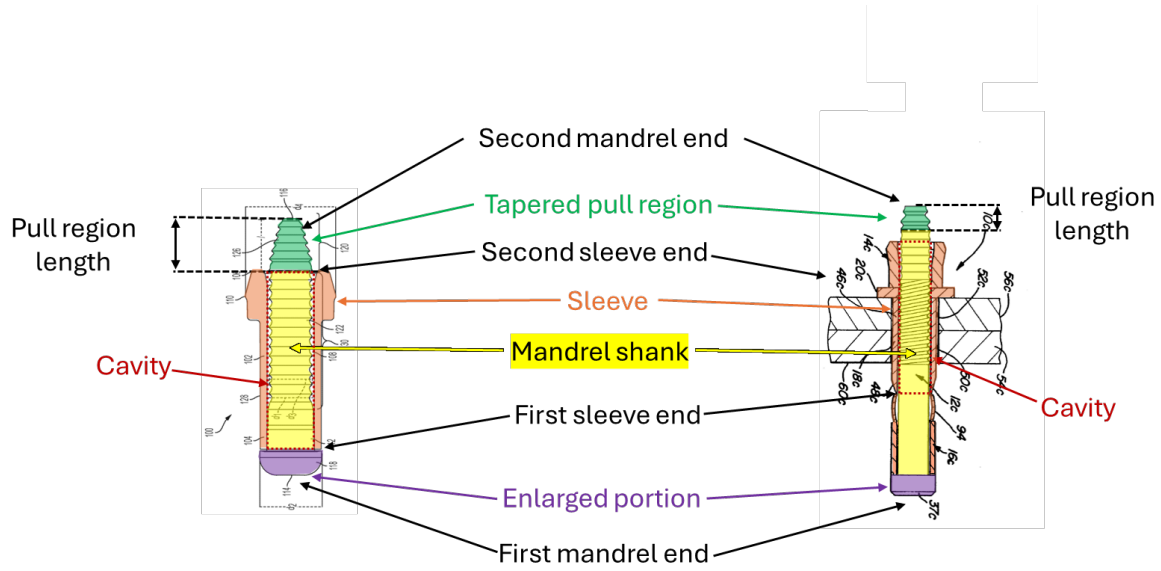
2. Limitation 1(a): "a sleeve comprising a first sleeve end, a second sleeve end, a cavity extending from the first sleeve end to the second sleeve end;"

Sadri discloses this limitation. As discussed *supra* § VI.D, Sadri discloses a main/secondary sleeve, expandable/primary sleeve, and collar that form an integrated sleeve system that performs the same structural and load-bearing functions attributed to the claimed "sleeve" in the '358 Patent. A POSITA would therefore understand Sadri's integrated sleeve system, shown below to be the functional/structural equivalent of the '358 Patent's sleeve. Ex-1004 ¶¶ 243-48.



Sadri's "collar 14," "main sleeve 18," and "expandable sleeve 16" are engaged in this integrated sleeve configuration. *Id.* ¶¶ 243-44; Ex-1009 at Fig. 1. A POSITA would understand they operate as one sleeve system because they are assembled around the mandrel, axially engaged and load-coupled during installation, and cooperatively operate as the sleeve-side structure to form an installed joint via blind-side deformation and collar swaging during installation. Ex-1004 ¶ 244; Ex-1009 at 1:13-18, 1:57-59, 5:21-29, 6:49-7:15.

As shown below, the end of Sadri's expandable sleeve on the right corresponds to the "first sleeve end," while Sadri's collar on the left corresponds to the "second sleeve end." Ex-1004 ¶¶ 245-47.



358 Patent

Sadri 502 in view of BobTail 2013

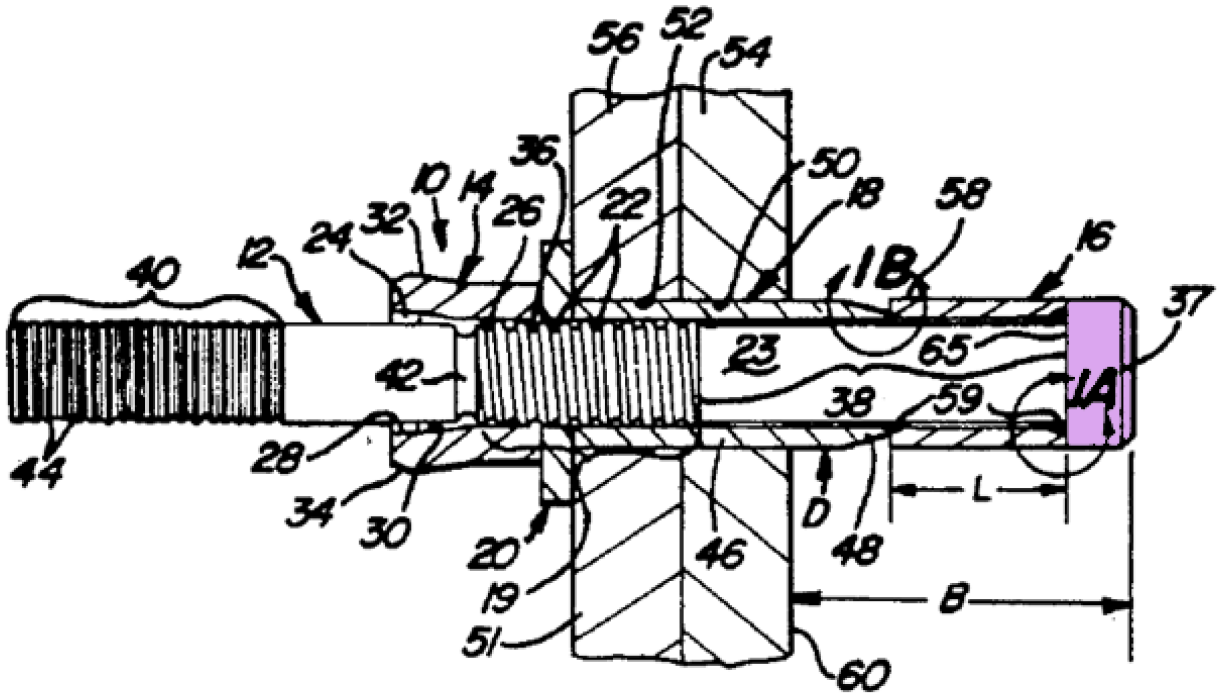
The hollow cavity extending throughout the length of Sadri's sleeve system receives "pin 12." Ex-1004 ¶ 245; Ex-1009 at Fig. 1, 5:30-40 ("The collar 14 has a through bore 24"), 6:28-48 (describing cavity inside sleeve system), 6:58-7:15 ("pin 12 begins to move axially through the collar 14"), 18:23-30 ("main sleeve member having a first through bore adapted to receive said pin shank"), 18:31-34 ("expandable sleeve member having a second through bore adapted to receive said pin shank"). Sadri's washer 20 may be integrated into collar 14 or omitted altogether. Ex-1004 ¶ 245; Ex-1009 at 5:41-44.

3. Limitation 1(b): "a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising"

Sadri discloses the "mandrel" as pin/pin member 12 (pin shank) received in the sleeve-system's through-bore. Ex-1004 ¶ 249; Ex-1009 at 15:46-52, 19:20-30, Figs. 1, 8.

4. Limitation 1(c): "a first mandrel end disposed adjacent to the first sleeve end and comprising an enlarged portion having a diameter greater than a diameter of the cavity"

Sadri discloses "an enlarged head 37" at a first end having a diameter greater than the sleeve-system bore. Ex-1004 ¶¶ 251-52; Ex-1009 at 6:19-20, Fig. 8.

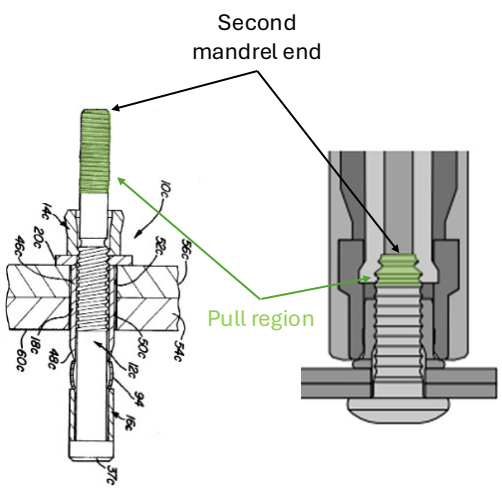


Sadri teaches "the diameter of pin head 37 and the outside diameter of the expandable sleeve 16 are generally the same," meaning the enlarged head must

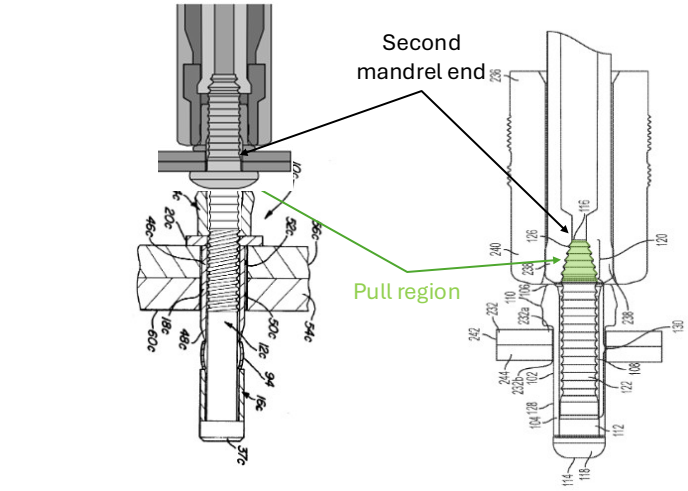
have a diameter greater than the cavity. Ex-1004 ¶ 251; Ex-1009 at 6:35-48, 12:39-42, Fig. 1.

5. Limitation 1(d): "a second mandrel end comprising a pull region"

Sadri discloses a pull region at the second mandrel end via its grooved pintail/"gripping portion" ("with a plurality of pull grooves 44") adapted to be engaged by the installation tool. Ex-1004 ¶¶ 253-55; Ex-1009 at Fig. 1 (annotated assuming tool engagement across entire grooved region), 6:19-27, 18:20-23, 24:39-41.



Sadri 502



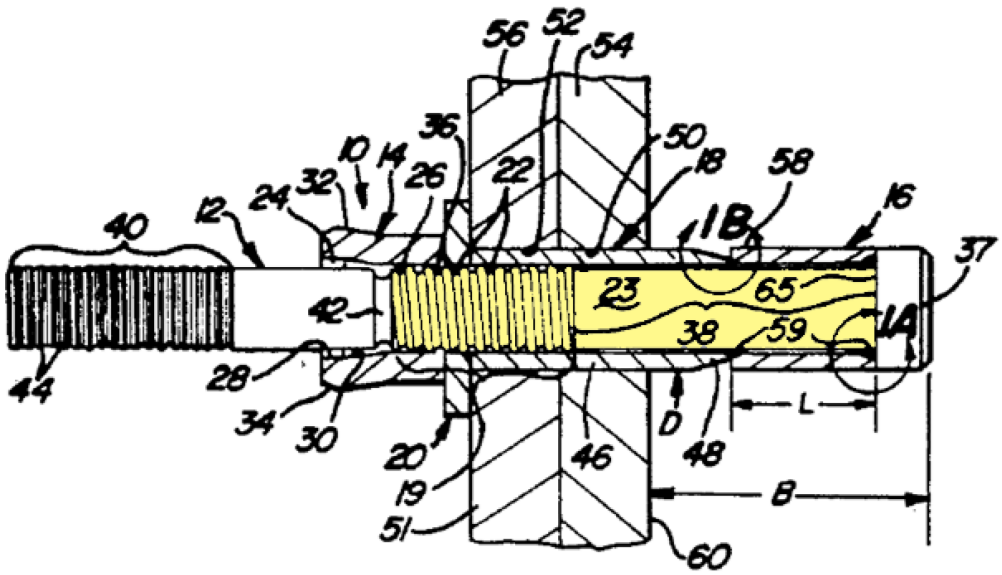
BobTail 2013

Sadri 502 in view of BobTail 2013

358 Patent

6. Limitation 1(e): "a shank region extending intermediate the first mandrel end and the second mandrel end"

Sadri has a region between the head 37 and the pull region that comprises an "elongated pin shank," satisfying the shank region, shown below in yellow. Ex-1004 ¶¶ 256-57; Ex-1009 at 18:18-19, Fig. 1. *See also* limitation 1(a) ("pin").

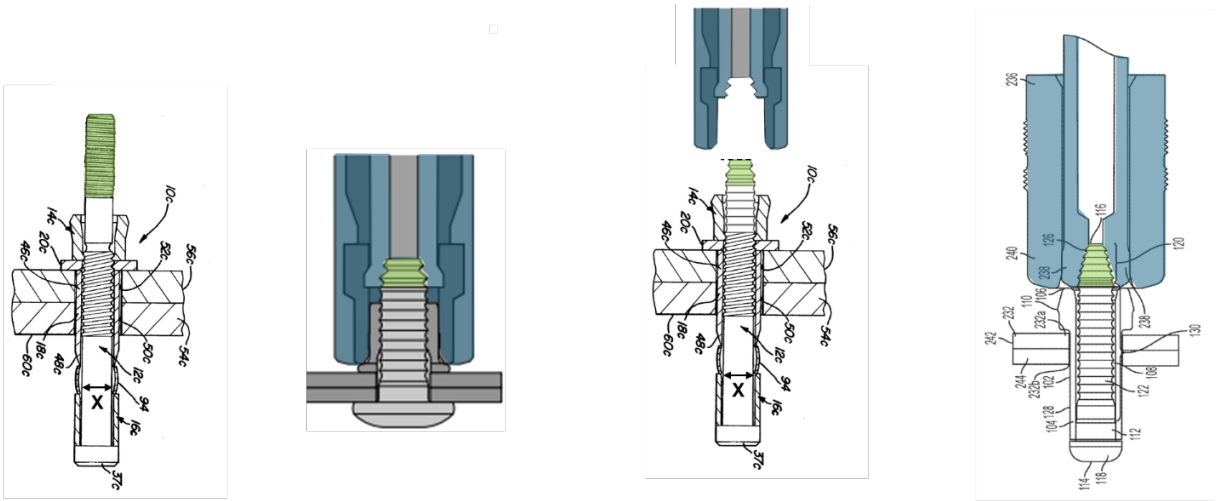


7. Limitation 1(f): "wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool."

Sadri, in view of BobTail, discloses this limitation.

Sadri's pull region is tool-engageable (*see* 1(d)). Assuming a maximum pull region length of the entire grooved region, Sadri's pull-region length would still be less than four times the major diameter of the shank region, when calculating

shank diameter using the smooth region under the head. Ex-1004 ¶¶ 258-269; Ex-1009 at Fig. 1 (annotated below).



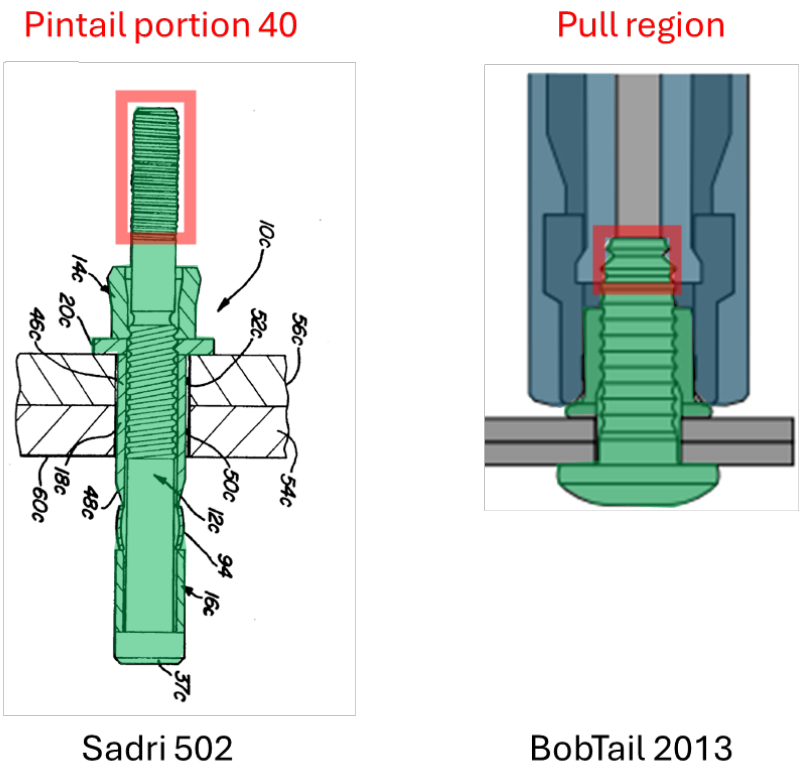
Sadri 502 | BobTail 2013 | Sadri 502 in view of BobTail 2013 | 358 Patent

Moreover, if the portion engaged by the tool is shorter than the entire threaded region, the pull region would be less than even twice the shank diameter and substantially less than four times that diameter. Ex-1004 ¶¶ 260-61.

Regardless, a POSITA would have known how to select and design the axial length of a pull region relative to the shank diameter based on routine engineering considerations, including reliable engagement by an installation tool, controlled deformation or fracture during installation, and sufficient load transfer. *Id.* ¶ 262. A POSITA would be motivated by numerous benefits of this design—including reducing material usage/cost, installation envelope, off-axis bending during installation, pull-groove damage, stripping, and premature fracture under high pull loads. *Id.* ¶ 263. Other benefits include improved installation repeatability and

avoiding unnecessary protrusions with safety and corrosion risks. *Id.* Accordingly, a POSITA would have been motivated to design a pull region with an axial length no greater than 4/3.8/2 times the shank diameter, with a reasonable expectation of success. *Id.* ¶¶ 233-39, 263.

In the alternative, BobTail teaches a short pull region (~0.9X), and a POSITA would substitute BobTail's pintail-less pull-region geometry into Sadri with predictable results. *Id.* ¶¶ 240, 263-68; Ex-1010 at 3. *See also* § VI.E.



A POSITA would be motivated to incorporate such a pull region (and modify Sadri's tool accordingly) to avoid misalignment between the installation tool and the pull grooves, based on Sadri's teachings to "minimize stress concentrations at

high load areas." Ex-1004 ¶ 237; Ex-1009 at 10:30-31. Moreover, a POSITA would recognize that BobTail's "[p]intail-less design means reduced noise, no waste, and improved corrosion resistance." Ex-1004 ¶ 233; Ex-1010 at 3.

Reduced noise: Shortening the pull region reduces the amount of mandrel material that must be pulled, deformed, or resisted during installation, thereby lowering the required installation force and reducing noise generated during setting. Ex-1004 ¶ 267; Ex-1010 at 3. A POSITA would recognize that reduced installation force improves installation efficiency/consistency. Ex-1004 ¶ 166.

No waste: Eliminating a break-off pintail conserves material and avoids discarded mandrel fragments, reducing manufacturing waste and post-installation debris. *Id.* ¶ 267; Ex-1010 at 6.

Improved corrosion resistance: Using a mandrel that does not fracture during installation eliminates freshly-exposed fracture surfaces serving as potential corrosion-initiation sites. Ex-1004 ¶ 267; Ex-1010 at 3.

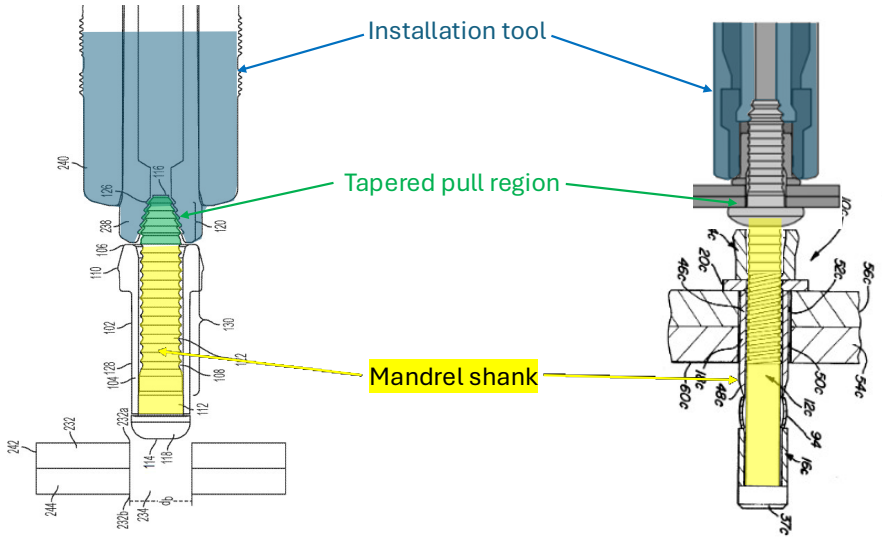
B. Claims 2-3: (2) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region." (3) "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region."

For the reasons in 1(f), Sadri (and alternatively Sadri/BobTail) discloses a pull-region length no greater than two times the shank diameter. Ex-1004 ¶¶ 270-71.

C. Claim 4: "The blind fastener of claim 1, wherein the pull region comprises a taper extending from the shank region."

Sadri, in view of BobTail, discloses this claim.

BobTail teaches a pull region comprising a taper extending from the shank region. Thus, modifying Sadri by substituting BobTail's pull-region geometry for Sadri's pintail/pull portion yields a pull region "compris[ing] a taper extending from the shank region. *Id.* ¶¶ 272-75. The taper is illustrated below.



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A POSITA would have been motivated to incorporate BobTail's tapered pull region into Sadri for the same pull-type tool-engagement reasons discussed in Section IV.A and Ground 3. Moreover, a POSITA would credit BobTail's express teaching that a short, tapered pull region "delivers a strong connection." *Id.* ¶ 273; Ex-1010 at 3. A POSITA would recognize that misalignment between the collet of

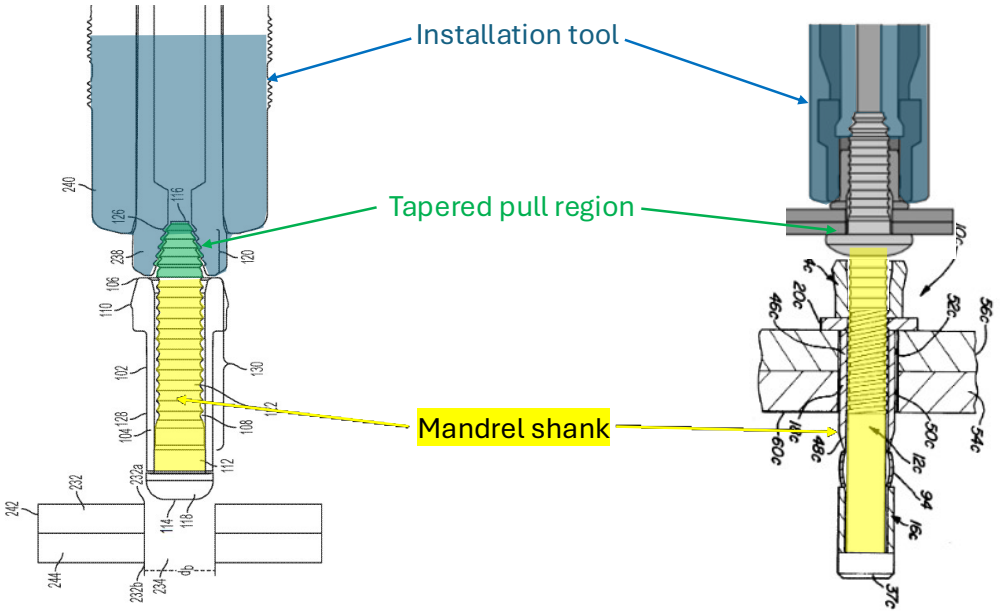
an installation tool and the pull grooves of a pull-type fastener can produce localized stress concentrations when an axial load is applied. Ex-1004 ¶ 273. A POSITA would also recognize that a tapered pull region improves axial alignment and engagement between the pull grooves and the installation tool, reducing the risk of bending-fracture, partial engagement, slippage, and uneven load distribution during installation. *Id*. Moreover, a POSITA would know that BobTail's teaching of a tapered pull region reduces localized overstress on individual collet teeth, thereby decreasing the risk of stripping, chipping, or premature tool wear, and improving fastener reliability and tool longevity. *Id*.

Implementing the substitution would require only routine, corresponding adjustments to the mating tool jaws/grooves, with a reasonable expectation of success. *Id.* ¶ 274.

D. Claim 5: "The blind fastener of claim 1, wherein the mandrel does not comprise a breakneck groove."

Sadri, in view of BobTail, discloses this limitation.

Although Sadri discloses embodiments that comprise a "breakneck groove 42" on its pintail portion, BobTail's mandrel does not comprise a breakneck groove. *Id.* ¶ 276; Ex-1009 at 6:25-27; Ex-1010 at 6. Accordingly, Sadri in view of BobTail comprises a mandrel without a breakneck groove, as shown below. Ex-1004 ¶ 272.



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As detailed in 1(f), a POSITA would have been motivated to apply BobTail's teaching of a mandrel without a breakneck groove by replacing Sadri's pintail portion 40 (including the breakneck groove 42) with BobTail's pull region and upper pin shank. *Id.* ¶¶ 237-39, 267.

E. Claims 6-7: (6) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25." (7) "The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43."

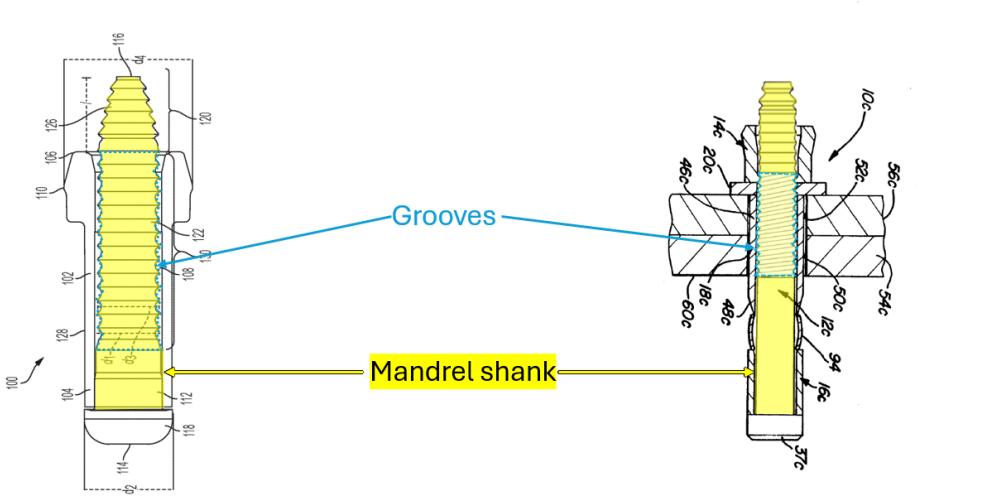
Sadri discloses these claims by supplying the mandrel hardness characteristics. *Id.* ¶ 277-78. Sadri discloses that "the blind bolt of the present invention has a high tensile strength" using "high strength ferrous materials having a high hardness." *Id.*; Ex-1009 at 2:15-40. Sadri discloses that the "strength of the

pin member 12 is very significant and hence the pin member 12 can be constructed of a ferrous or other material having a Rockwell hardness of between around 38 Rc to around 42 Rc or higher such as a 4130 steel of aircraft quality." Ex-1004 ¶ 277; Ex-1009 at 8:42-46. As detailed in 1(b)-(d), a POSITA would recognize that Sadri's "pin 12" and "pin member 12" are equivalent to a mandrel. Ex-1004 ¶ 277. Accordingly, the combined Sadri-BobTail fastener comprises a mandrel with Rockwell hardness of "42 Rc or higher," which is at least HRC 25 and HRC 43.

Even if a POSITA were to interpret Sadri's disclosure as teaching a hardness of HRC 42, a POSITA would have found it obvious to select a mandrel hardness of at least HRC 43 as a routine design choice to further increase strength and resistance to installation and service loads, as discussed in Grounds 1-4.

F. Claim 8: "The blind fastener of claim 1, wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove."

Sadri discloses this claim. Sadri discloses: "The pin shank 23 has a relatively smooth portion 38, leading to the threaded lock groove portion 19; a reduced diameter pintail portion 40 is formed with a plurality of pull grooves 44 and is connected to the lock groove portion 19 via a breakneck groove 42." *Id.* ¶ 279; Ex-1009 at 6:19-25. As further illustrated below, these features are all formed along the shank region of the mandrel and include at least a threaded region and grooves, thereby satisfying the requirements of the claim. Ex-1004 ¶ 280.



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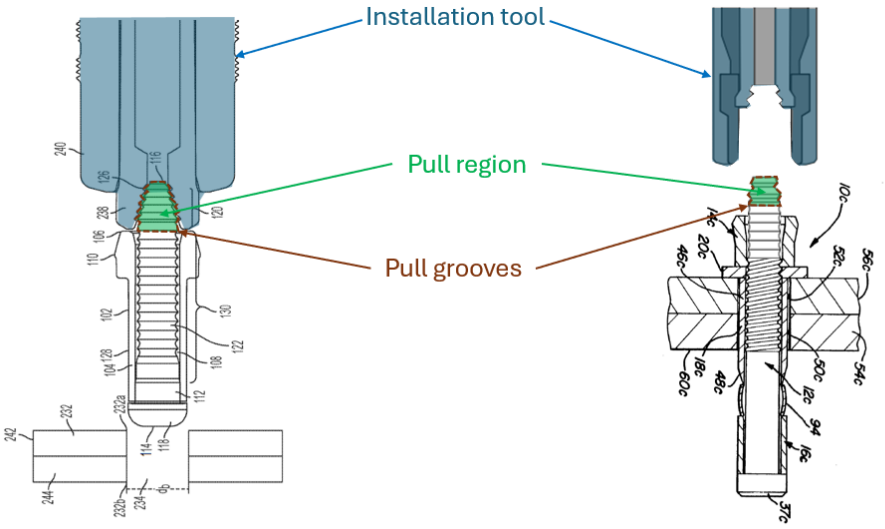
G. Claim 9: "The blind fastener of claim 1, wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove."

Sadri alone and/or in combination with BobTail renders this claim obvious.

Sadri discloses that "pintail portion 40 is formed with a plurality of pull grooves 44." *Id.* ¶ 282; Ex-1009 at 6:20-23, 18:23-24.

BobTail likewise discloses a grooved pull region. Ex-1004 ¶ 283; Ex-1010 at 3 ("The installation tool is applied to the annular pull grooves."). Accordingly, as shown below, Sadri in combination with BobTail discloses a blind fastener with a grooved pull region. Ex-1004 ¶ 284.



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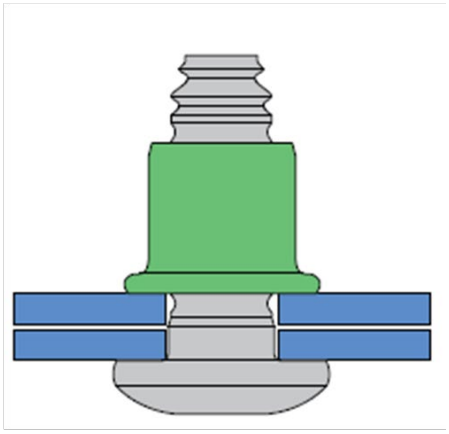
H. Claim 10: "The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical."

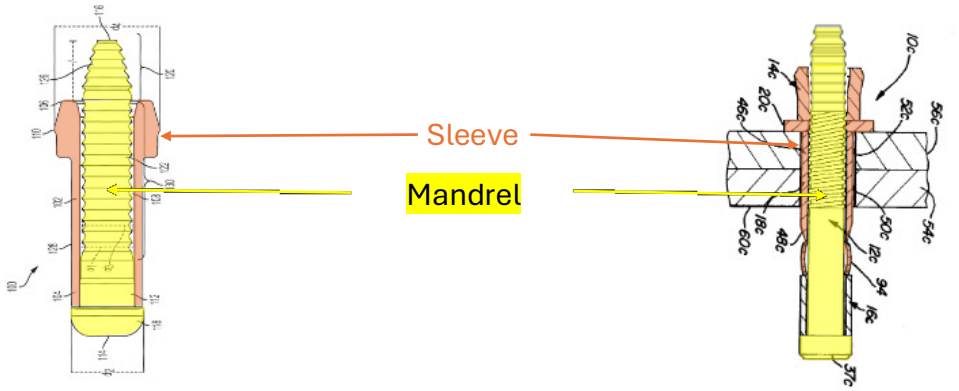
Sadri alone and/or in combination with BobTail renders this claim obvious.

Sadri discloses a generally cylindrical sleeve. *Id.* ¶ 286-89; Ex-1009 at 6:28-29 ("The secondary or main sleeve 18 has a straight shank portion 46 of generally constant outside diameter."). Sadri further discloses a cylindrical mandrel via its "pin shank 23" having a "relatively smooth portion 38." Ex-1004 ¶ 286; Ex-1009 at 6:19-21, 11:9-11. A POSITA would understand these disclosures recite a generally cylindrical sleeve and mandrel. Ex-1004 ¶ 286.

BobTail likewise discloses a generally cylindrical mandrel and sleeve, as shown below. *Id.* ¶ 287; Ex-1010 at 2-3.



Accordingly, as shown below, Sadri in combination with BobTail discloses a generally cylindrical sleeve and mandrel. Ex-1004 ¶ 288.



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I. Claim 11: "The blind fastener of claim 1, wherein the blind fastener comprises at least one of a metal, metal alloy, and a composite material."

Sadri discloses this claim. Sadri discloses "pin member 12 can be constructed of a ferrous or other material" "such as a 4130 steel of aircraft quality."

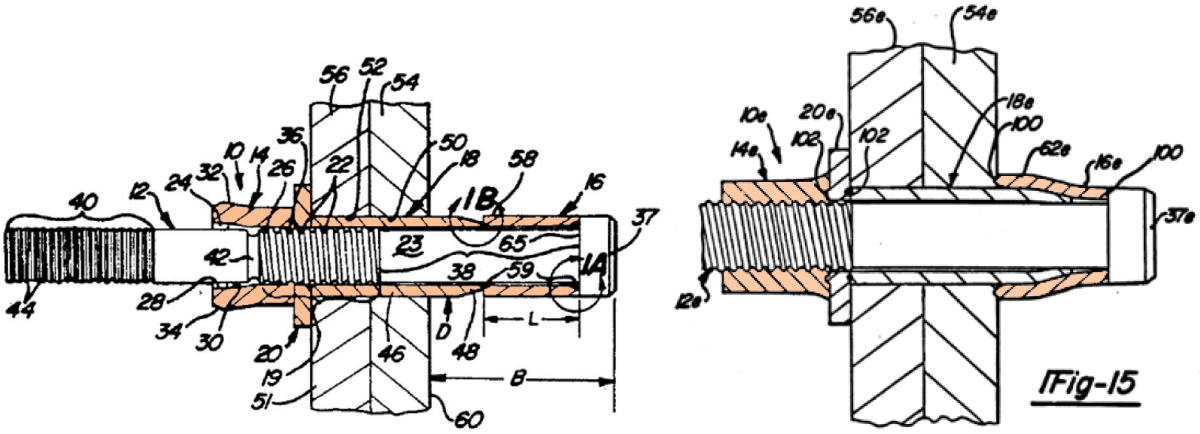
Id. ¶ 290; Ex-1009 at 8:42-46. Sadri further discloses that "secondary or main sleeve 18 can be constructed of a ferrous or other material such as a 4130 steel." Ex-1004 ¶ 290; Ex-1009 at 8:50-52. Similarly, Sadri discloses that it is "adapted for use in applications in which high strength bolts, such as SAE Grade 5 (ASTM A325) or higher, are frequently used." Ex-1004 ¶ 290; Ex-1009 at 2:15-19.

J. Claim 12: "The blind fastener of claim 1, wherein the blind fastener is adapted to be installed in a bore in a structure, the bore having a diameter greater than the diameter of the enlarged portion."

Sadri discloses this claim. Sadri discloses that the "pin head 37" comprises an enlarged head and that "the diameter of pin head 37 and the outside diameter of the expandable primary sleeve 16 are generally the same, i.e. diameter D, such that each can also be accepted through the openings 50 and 52 in a clearance relationship." Ex-1004 ¶¶ 292-94; Ex-1009 at 6:41-46. *See also* Ex-1009 at 3:50-61 (installing in "oversized holes"). A POSITA would recognize that, in the clearance fit embodiment disclosed in Sadri above, a component (e.g., the sleeve of a blind fastener) is received by a bore with a diameter greater than the component itself. Ex-1004 ¶ 293.

K. Claim 13: "The blind fastener of claim 12, wherein the sleeve further comprises a collar, the sleeve is configured to deform on a first side of the structure, and the collar is configured to swage onto the shank region on an oppositely disposed second side of the structure."

Sadri discloses this claim. As detailed in 1(a), Sadri discloses a three-piece sleeve configuration comprising a collar 14, main/secondary sleeve 18, and expandable/primary sleeve 16, as shown below in Figure 14 (left). *Id.* ¶ 295.



As shown in Figure 15 (right), Sadri's expandable/primary sleeve is configured to deform on a first side of the structure, while Sadri's collar is configured to swage onto the shank region on an oppositely disposed second side of the structure. *Id.* ¶¶ 296-300; Ex-1009 at Abstract ("A high strength blind bolt for fastening structural workpieces" comprising "a collar adapted to be swaged into the lock grooves" of the shank region and an "expandable sleeve" that deforms "in response to the application of a preselected axial force applied between the pin member and the collar"); Ex-1009 at 1:30-40 ("the application of a relative axial

force" "causes an installation tool to swage the collar into the lock grooves in the pin"), 6:49-7:15 ("primary sleeve 16 continues to move axially and expand radially over the blind end of straight shank portion 46 until its free end 58 engages the blind side surface 60" "expanded end 58 of the expandable sleeve 16 defines a blind head 62"). Sadri discloses washer 20 may be integrated into collar 14 or omitted altogether. Ex-1009 at 5:41-44.

L. Claim 14: "The blind fastener of claim 12, wherein the structure comprises at least one of a metal, a metal alloy, and a composite material."

Sadri discloses this claim. Sadri targets "workpieces" for "constructions utilizing box beams or columns, bridges, and the like." Ex-1004 ¶ 302; Ex-1009 at 1:6-12, 2:16-26 ("the present invention is especially suited for construction of buildings, bridges, and the like where high strength and durability are of considerable importance"), 14:40-46 ("bridges and roadways" "require the attachment of beams, support brackets"), 14:51-62, 15:19-27 ("box beams" secured together using "flat brackets," "weld nuts, nut plates, welding"). A POSITA would understand that structures used for such purposes routinely comprise metal, metal alloys, or composite materials. Ex-1004 ¶ 302.

Moreover, a POSITA would have known that blind fasteners are used to join structural components made from metals, metal alloys, and composite materials, which provide the strength and rigidity required for such joints. *Id.* ¶ 303. A

POSITA would have found it obvious to apply Sadri to structures comprising any of the recited materials, with a reasonable expectation of success. *Id.*

M. Claim 15: "The blind fastener of claim 12, wherein the structure is configured as at least one of an aerospace component, an automotive component, a transportation component, and a building and construction component."

Sadri discloses this claim. As detailed in claim 14, Sadri discloses using its blind fastener to secure structures configured as a variety of components, including building and construction components.

N. Claim 16

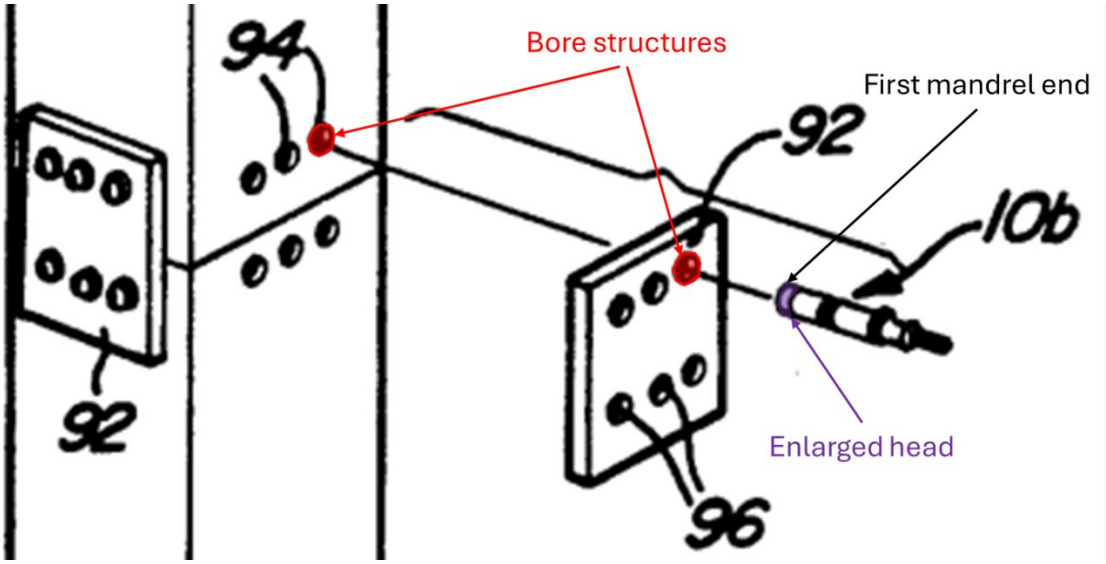
Limitations 16(b)-16(g) correspond to limitations 1(a)-1(f), respectively, and are disclosed by Sadri for the same reasons/citations discussed in Claim 1. Limitations 16(h)-16(j) further recite specific tool interactions and installation steps, addressed below.

1. Preamble: "A method for fastening, the method comprising:"

As detailed in Grounds 1-3, the preamble is not limiting. Regardless, Sadri discloses a fastening method for fastening workpieces together. *Id.* ¶ 308-09; Ex-1009 at Abstract ("for fastening structural workpieces"), 1:52-2:15 (describing fastening method), 4:29-34 (mathematical details for fastening method), 6:49-7:15 (fastening details), 12:28-38 and Fig. 3 (installation graph).

2. Limitation 16(a): "inserting a first mandrel end of a blind fastener into a bore in a structure"

As detailed in 1(b), Sadri discloses this limitation. Moreover, Sadri teaches inserting the fastener through aligned openings 50/52 until the sleeve extends through the workpieces. Ex-1004 ¶ 310; Ex-1009 at 6:35-37, 6:41-46, Fig. 7 (annotated below).



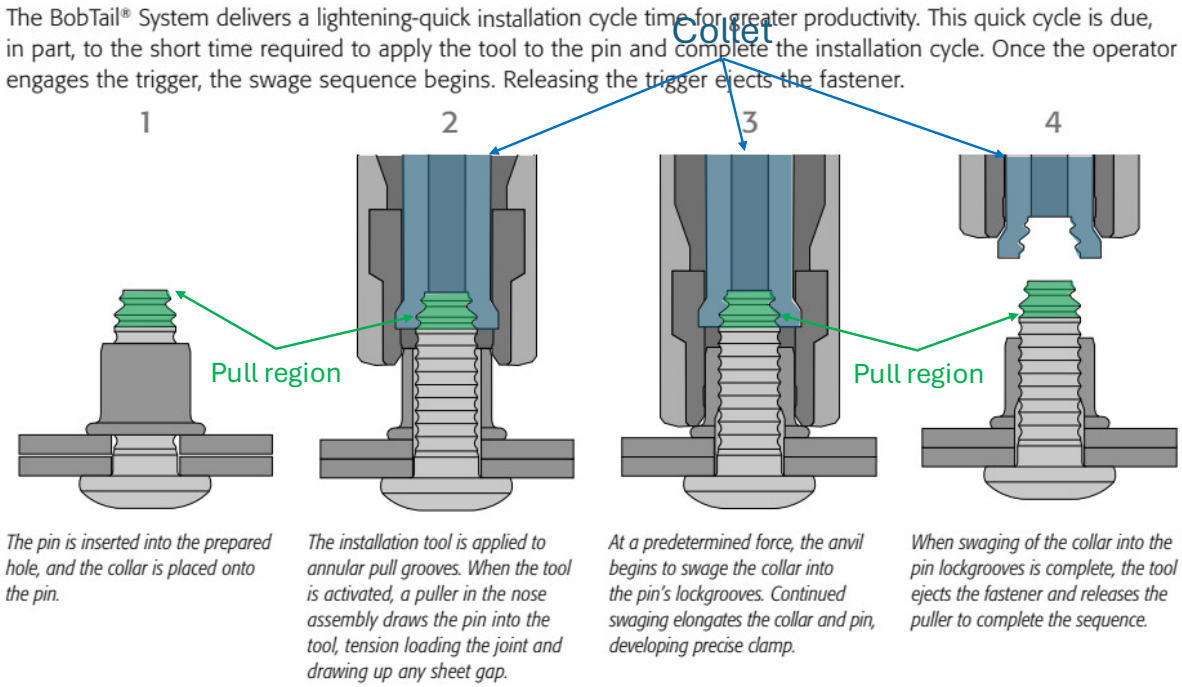
3. Limitation 16(h): "engaging a collet of the installation tool with the pull region of the blind fastener;"

Sadri, alone or in view of BobTail, renders this claim limitation obvious.

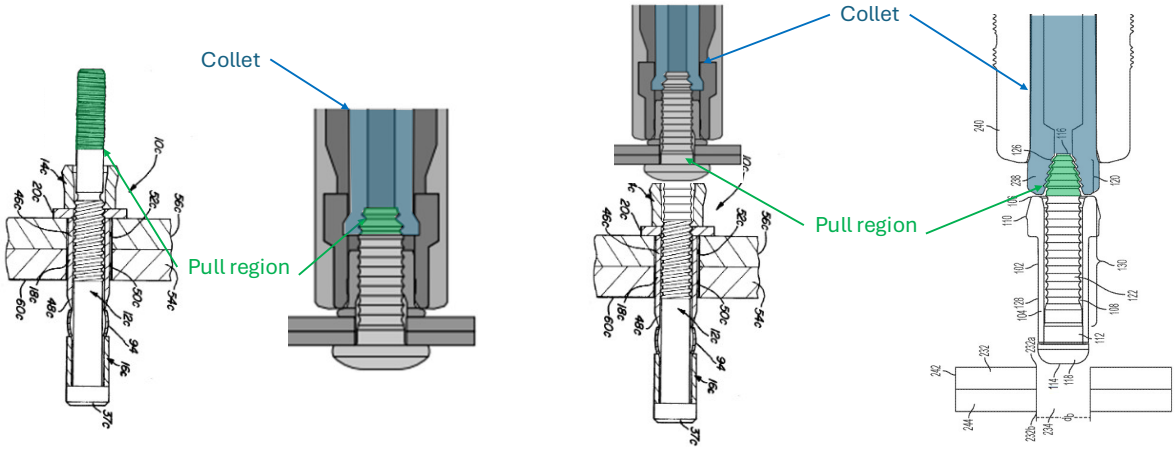
Sadri discloses that a pull region suitable for engagement by an installation tool is provided, namely that a "pintail portion 40 is formed with a plurality of pull grooves 44." Ex-1004 ¶ 319; Ex-1009 at Fig. 1, 6:19-27. Sadri further discloses that "[t]he installation tool and swage anvil can be of a construction generally known in the art and hence the details thereof have been omitted for purposes of

simplicity." Ex-1004 ¶ 319; Ex-1009 at 5:60-63. A POSITA would understand that, in such generally known pull-type installation tools, a collet is the component that engages the pull grooves of the pull region to apply an axial pulling force to the mandrel during installation. Ex-1004 ¶ 319.

BobTail likewise discloses an installation tool including a collet that engages the pull region and is "applied to the annular pull grooves," as shown below:



Id. ¶¶ 320-21; Ex-1010 at 3. Accordingly, Sadri—whose pull region is configured with pull grooves for engagement by a known installation tool—when considered alone or in view of BobTail, discloses engaging a collet of the installation tool with the pull region of the blind fastener, as shown below. Ex-1004 ¶¶ 320-22.



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4. <u>Limitation 16(i)</u>: "after the inserting, forcibly contacting the second sleeve end of the blind fastener with an anvil of the installation tool and moving the pull region distal from the second sleeve end utilizing the collet of the installation tool; and"

Sadri, alone or in view of BobTail, renders this claim limitation obvious.

Sadri discloses that, after inserting the fastener's first mandrel end into a bore in a structure, the installation tool's anvil forcibly contacts the fastener's second sleeve end. *Id.* ¶ 324; Ex-1009 at 1:57-59 ("the collar initially transmits an axial force from the swage anvil of the setting tool to the main sleeve"), 5:55-60. A POSITA would understand Sadri's swaging the collar against the pin necessarily requires the swage anvil to forcibly contact the second sleeve end. Ex-1004 ¶ 324.

As discussed in 16(h), the "collet" is the known pull-jaw/collet structure that engages pull grooves to apply this pulling force. Sadri further discloses that the installation tool applies an opposing axial force to the mandrel via the pull region,

thereby moving the pull region distal from the second sleeve end. *Id.* ¶ 325; Ex-1009 at 1:30-40 ("the application of a relative axial force" "causes an installation tool to swage the collar into the lock grooves in the pin"), 6:49-7:15 ("primary sleeve 16 continues to move axially and expand radially" "until its free end 58 engages the blind side surface 60" and "defines a blind head 62.").

BobTail confirms the same coordinated anvil-contact and collet/puller-driven movement during swaging. Ex-1004 ¶ 326; Ex-1010 at 3 (collet "applied to the annular pull grooves," "the nose assembly draws the pin into the tool," "the anvil begins to swage the collar into the pin's lockgrooves").

5. Limitation 16(j): "deforming the sleeve on a first side of the structure, and swaging the second sleeve end onto the shank region on an oppositely disposed second side of the structure, thereby securing at least a portion of the blind fastener in the structure."

Sadri, alone or in view of BobTail, renders this claim limitation obvious.

As detailed in 1(a) and claim 13, Sadri discloses an integrated sleeve system with an expandable/primary sleeve that deforms on a first side of the structure, and a collar at a second sleeve end that swages onto the shank region on a second side of the structure. Sadri confirms the locking effect of swaging: "the soft collar 14 after swaging will provide a good seal with the shallow lock grooves 22 of the harder pin member 12." Ex-1004 ¶ 329; Ex-1009 at 10:44-48, Abstract ("to provide a final high, residual clamp load upon swaging of the collar into the lock

grooves of the pin member"). *See also* Ex-1009 at 5:25-60 ("swaged into lock grooves"; "swaging the collar 14 onto pin 12"). BobTail confirms the same coordinated pull-and-swage sequence. Ex-1004 ¶ 330; Ex-1010 at 3.

O. Claim 17: "The method of claim 16, wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region."

As detailed in 1(f), Sadri, on its own and in view of BobTail, discloses a pull region comprising an axial length no greater than 3.8 times the shank diameter. Ex-1004 ¶ 331.

P. Claim 18: "The method of claim 16, wherein the pull region comprises a taper or reverse taper extending from the shank region."

As detailed in claim 4, Sadri in view of BobTail has a pull region comprising at least a taper extending from the shank region. *Id.* ¶ 332.

Q. Claim 19: "The method of claim 16, wherein the mandrel does not comprise a breakneck groove."

As detailed in claim 5, Sadri in view of BobTail discloses a mandrel that does not comprise a breakneck groove. *Id.* ¶ 333.

R. Claim 20: "The method of claim 16, wherein the blind fastener comprises at least one of a metal, a metal alloy, and a composite material."

As detailed in claim 11, Sadri discloses a blind fastener comprising at least one of a metal, metal alloy, and composite material. *Id.* ¶ 334.

XI. SECONDARY CONSIDERATIONS

Any purported evidence of secondary indicia should not preclude institution. *Lowe's, Cos., Inc. v. Nichia Corp.*, IPR2017-02011, Paper 13 at 18 (P.T.A.B. Mar. 12, 2018) (granting institution over Patent Owner's argument that Board should consider secondary indicia before trial). Even if secondary indicia of nonobviousness did exist, they could not overcome Petitioner's strong showing of obviousness. *ZUP, LLC v. Nash Mfg.*, 896 F.3d 1365, 1374 (Fed. Cir. 2018).

XII. CONCLUSION

Petitioner respectfully requests institution of trial and invalidation of the Challenged Claims.

Date: February 20, 2026

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CERTIFICATE OF COMPLIANCE WITH TYPE-VOLUME LIMITATION

I hereby certify that the Petition for *inter partes* review consists of 13,982 words in 14 point Times New Roman font as calculated by the word count feature of Microsoft Office 2016, in compliance with 37 C.F.R. § 42.24(a)(i). This word count is inclusive of all text and footnotes but not including a table of contents, a table of authorities, mandatory notices under § 42.8, a certificate of service or word count, or appendix of exhibits or claim listing.

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CERTIFICATE OF SERVICE

The undersigned certifies that the foregoing Petition and supporting evidence were served on February 20, 2026, by Federal Express mail to the USPTO correspondence address of record listed below:

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