

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

DECLARATION OF RICHARD W. KLOPP, Ph.D., P.E., F.A.S.M.E.

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I, Richard W. Klopp, declare as follows:

I. ENGAGEMENT

1. I have been retained by Petitioner Meishan CRRC Fastening System Co., Ltd. (“Petitioner”) as an expert witness in an *inter partes* review (“IPR”) before the U.S. Patent Trial and Appeal Board (“PTAB”).

2. I have been asked to provide my opinions on whether a person of ordinary skill in the art (“POSITA”) would have found that claims 1-20 (the “Challenged Claims”) of U.S. Patent No. 11,885,358 (“the ’358 Patent”) (EX1001) were anticipated or obvious over the prior art. In particular, I have been asked to opine on (1) whether U.S. Patent Application 2018/0111184 (EX1006) (“Corbett 2018”) anticipates claims 1-3, 5, 8-17, and 19-20 of the ’358 Patent, (2) whether claims 1-3, 6-7, 11, 14-17, 20 were obvious over Corbett 2018 on its own, (3) whether claims 1-20 were obvious over Corbett 2018 in view of U.S. Patent 4,299,519 (EX1007) (“Corbett 1981”), (4) whether claims 6-7 are obvious over Corbett 2018 in view of Corbett 1981 and further in view of U.S. Patent 3,820,297 (EX1008) (“Hurd ’297”), and/or (5) whether claims 1-20 were obvious over U.S. Patent 5,178,502 (EX1009) (“Sadri ’502”) in view of the 2013 Huck BobTail Brochure (EX1010) (“BobTail 2013”).

3. My employer, Exponent, is being compensated by Petitioner at the rate of \$790 per hour, which is Exponent’s standard hourly consulting rate for my

time spent on this matter. This compensation is not contingent on my performance, my opinions, the outcome of this matter, or any other issues involved in or related to this matter. Neither Exponent nor I have a conflict of interest with respect to the Petitioner or Patent Owner.

4. I am over 18 years of age, I have personal knowledge of the facts stated in this declaration, and I could testify competently to them if asked to do so.

II. QUALIFICATIONS

5. A copy of my curriculum vitae is attached to this declaration as EX1005. This curriculum vitae lists publications I have authored over the past ten years. A list of all other cases in which I have testified as an expert during the last four years at trial or by deposition is also included.

6. Exponent is the world's largest engineering and scientific consulting firm dedicated to solving technology problems of all kinds. Exponent provides both proactive services aimed at preventing problems, as well as reactive services for investigating and understanding problems that have occurred. With more than 900 employees, including more than 500 with Ph.D.s, having expertise in dozens of engineering and scientific disciplines, located in more than 30 offices around the world, Exponent is able to assemble project teams with the appropriate expertise for any given problem. Exponent has investigated nearly every high-profile failure or disaster of the past several decades, including the World Trade Center collapse

in New York City, the Miller Park crane collapse in Milwaukee, Wisconsin, Boston's Big Dig, and Seattle's SR99 Tunnel.

7. I am a Principal Engineer based in Exponent's Menlo Park, California, office. I am a trained mechanical engineer holding professional engineer licenses in the states of California, Texas, Washington, Michigan, and Nevada. I received my undergraduate Bachelor of Science degree in mechanical engineering from Lehigh University; two Master of Science degrees, in engineering and applied mathematics, from Brown University; and a Ph.D. in engineering, also from Brown University. I currently mentor the local high school robotics team, teaching them aspects of mechanical engineering design, metal fabrication, and machine shop practice. I am also a Fellow of the American Society of Mechanical Engineers and have been practicing in the field of mechanical engineering for more than 40 years. I have specific expertise and regularly provide consulting services in mechanical engineering and mechanics, including product design, machine design, solid mechanics, failure analysis, fracture mechanics, and experimental mechanics.

8. I have been immersed my whole life in the area of mechanical engineering design, and I am also a skilled machinist and precision tool enthusiast. I am deeply familiar with all kinds of fasteners used in industrial, automotive, and aerospace applications. I have personally installed many blind rivets in the form of

commercially available “POP” rivets and similar competing brands using hand- and air-actuated tools. I have installed conventional rivets by upsetting the heads. I have also made many threaded fasteners by die-cutting, single-point turning, and thread milling.

9. I regularly provide consulting services in areas of mechanical engineering and mechanics including machine design, product design, solid mechanics, failure analysis, fracture mechanics, and experimental mechanics. I have been immersed my whole life in the area of industrial machinery, and I am also a skilled machinist and precision tool enthusiast. My failure analysis work has often involved fasteners, bolted connections, screw threads, and interference fits, all of which are relevant to tapered sleeved bolt technology. Examples include analyzing the nut and stud clamping forces that retained the giant roller bearing in the tunnel boring machine Bertha, and analyzing the interference fit between centerless-ground pins and side-plates in escalator chains. I have installed myriad different kinds of fasteners, including blind rivets and rivet nuts (“Rivnuts” and “Nutserts”).

10. Much of my current work relates directly to commercial disputes. The remainder is split between reactive failure analyses and proactive (non-litigation) engineering work supporting, specifically, product design, product improvement, and the prevention of failures. I have provided written analysis and oral testimony

in a wide variety of intellectual property matters, including patent infringement and invalidity analyses, trade secret misappropriation, design patent and trade dress functionality, and technology licensing disputes. Venues have included state and U.S. District Courts, the U.S. International Trade Commission, the U.S. Patent Trial and Appeal Board, Canadian courts, and seats of international arbitration.

III. INFORMATION CONSIDERED

11. My opinions are based on my years of education, research, personal experience, professional experience, and my investigation and study of the '358 Patent, its prosecution history, the documents identified in this declaration, and the following exhibits, in light of the general knowledge in the relevant art:

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
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 '297”)

Exhibit	Description
1009	U.S. Patent No. 5,178,502 (“Sadri ’502”)
1010	“The Next Generation Small Diameter HuckBolt®” (“BobTail 2013”)
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 <i>Howmet Aerospace Inc. v. Stanley Engineered Fastening, LLC, Avdel UK Ltd., and Avdel Holding Ltd.</i> (D. Del. 2025)
1014	Docket Report for <i>Howmet Aerospace Inc. v. Stanley Engineered Fastening, LLC, Avdel UK Ltd., and Avdel Holding Ltd.</i> (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, <i>available at</i> www.aerospacemetals.com/wp-content/uploads/2023/07/Titanium-Ti-6Al-4V-Grade-5-STA-Data-Sheet.pdf
1017	MingChuang Tungsten and Molybdenum, <i>The Ultimate Guide to Tungsten Fasteners: Durable Solutions for Modern Applications</i> , <i>available at</i> www.mcwmo.com/the-ultimate-guide-to-tungsten-fasteners-durable-solutions-for-modern-applications/

Exhibit	Description
1018	EXTREME Bolt & Fastener, <i>Aerospace Fasteners – NAS Screws</i> , available at www.extreme-bolt.com/aerospace-fasteners.html
1019	BORTROME, <i>Tungsten alloy properties</i> , available at www.wolframcarbide.com/tungsten-alloy-properties/
1020	Special Metals, <i>INCONEL alloy 718</i> , 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, <i>Install Large Diameter Fasteners Anywhere</i> , available at www.hfsindustrial.com/pub/media/resources/images/image/_/h/_h_o_howmet_bv17_bv13_flyer.pdf
1025	Joseph Shigley, <i>Standard Handbook of Machine Design</i> , Section 24.1
1026	ASME B18.12-2020 (ASME Standard)
1027	NAS 1728 (NAS Standard)
1028	SAE J429-2014 (SAE Standard)

Exhibit	Description
1029	NASM 21250 (NASM Standard)

IV. LEGAL PRINCIPLES

12. I understand that the Petitioner alleges that certain claims are unpatentable because they were “anticipated” under 35 U.S.C. §102 or “obvious” under 35 U.S.C. §103.

13. I am informed and understand that a patent claim is invalid if the claimed invention is not new. I am also informed and understand that for the claim to be invalid because it is not new, all of the requirements of the claim must have been described in a single previous publication or patent that predates the claimed invention. I am further informed and understand that, in patent law, these previous publications or patents are called “prior art references.” If a patent claim is not new, it is said to be “anticipated” by a prior art reference.

14. I understand that a reference is “prior art” if it was patented, described in a printed publication, in public use, on sale, or available to the public before the effective filing date of the claimed invention. I also understand that a reference is prior art if it was described in a patent or application for patent in which the patent or application names another inventor and was effectively filed before the effective filing date of the claimed invention.

15. I further understand that a patent claim is invalid if the claimed invention would have been obvious to a person of ordinary skill at the time the invention was made. I understand that “obvious” (in this context) means that even if

all the requirements of a claim cannot be found in a single prior art reference, a person of ordinary skill who knew about certain prior art would have come up with the claimed invention.

16. I understand that an obviousness analysis takes into account: (1) the level of skill possessed by a person of ordinary skill at the time the claimed invention was made; (2) the scope and content of the prior art; (3) what difference, if any, existed between the claimed invention and the prior art; and (4) secondary considerations of non-obviousness, to the extent such considerations exist.

17. I understand that, in determining the level of ordinary skill, the following factors may be considered: (a) the levels of education and experience of persons working in the field; (b) the types of problems encountered in the field; and (c) the sophistication of the technology.

18. I understand that, for a reference to be considered prior art, it must be reasonably related to the claimed invention. I further understand that a reference is reasonably related if it is in the same field as the claimed invention or is from another field to which a person of ordinary skill in the field would look to solve a known problem.

19. To assess the differences between prior art and the claimed subject matter, I understand that the claimed invention should be considered as a whole.

20. I have been advised that a patent claim composed of several elements is not proved obvious merely by demonstrating that each of its elements was independently known in the prior art. In evaluating whether such a claim would have been obvious, I understand that I may consider whether there is a motivation that would have prompted a person of ordinary skill in the art to combine the elements or concepts from the prior art in the same way as in the claimed invention.

21. I understand that, under the Supreme Court decision in *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398 (2007), the rationales which may support a conclusion of obviousness include:

- Combining prior art elements according to known methods to yield predictable results;
- Simple substitution of one known element for another to obtain predictable results;
- Use of known technique to improve similar devices (methods, or products) in the same way;
- Applying a known technique to a known device (method, or product) ready for improvement to yield predictable results;
- “Obvious to try” – choosing from a finite number of identified, predictable solutions, with a reasonable expectation of success;

- Known work in one field of endeavor may prompt variations of it for use in either the same field or a different one based on design incentives or other market forces if the variations are predictable to one of ordinary skill in the art; and
- Some teaching, suggestion, or motivation in the prior art that would have led one of ordinary skill to modify the prior art reference or to combine prior art reference teachings to arrive at the claimed invention.

22. I understand that, for an obviousness argument based on a combination of prior art references, a person of ordinary skill in the art must be shown to have a motivation to combine or modify a reference with a reasonable expectation of success. The showing of a motivation to combine helps avoid hindsight bias.

23. I understand that I must be careful not to determine obviousness using the benefit of hindsight; many true inventions might seem obvious after the fact. I understand that when conducting an obviousness analysis, I should put myself in the position of a person of ordinary skill in the field at the time the claimed invention was made. Using this perspective, I should not consider what is known today or what is learned from the teaching of the challenged patent.

24. I understand that secondary considerations of non-obviousness include, but are not limited to:

- commercial success of a product due to the merits of the claimed invention;
- a long felt need for the solution provided by the claimed invention;
- unsuccessful attempts by others to find the solution provided by the claimed invention;
- copying of the claimed invention by others;
- unexpected and superior results from the claimed invention
- acceptance by others of the claimed invention as shown by praise from others in the field or from the licensing of the claimed invention;
- other evidence tending to show non-obviousness; and
- independent invention of the claimed invention by others before or at about the same time as the named inventor thought of it.

25. I am also informed and understand that secondary considerations of non-obviousness must have a pertinent connection (“nexus”) to the asserted patent claims, and the patentee bears the burden of showing that such a nexus exists. Whereas I do not address secondary considerations of non-obviousness in this declaration, I reserve the right to do so at a future date to the extent Patent Owner argues that such secondary considerations exist.

V. THE RELEVANT TIMEFRAME FOR ANALYSIS

26. In performing this analysis, I have assumed that the priority date is February 7, 2019, the date of the earliest application in the chain leading to the '358 Patent. EX1001, Face. I take no position at this time whether that is the correct priority date for any of the challenged claims.

VI. PERSON OF ORDINARY SKILL IN THE ART ("POSITA")

27. I understand that a POSITA is a hypothetical person who is presumed to be aware of pertinent art including knowledge in the art, thinks along conventional wisdom in the art, and is a person of ordinary creativity. I understand that this hypothetical POSITA is considered to have the normal skills and knowledge of a person in the technical field.

28. I understand that, in determining the level of ordinary skill of a POSITA, the following factors may be considered: (a) the levels of education and experience of persons working in the field; (b) the types of problems encountered in the field; and (c) the sophistication of the technology.

29. It is my opinion that, at the time of the invention, a person of ordinary skill in the art related to the technologies of the '358 Patent would have had an undergraduate degree in Mechanical Engineering or Material Science, or an equivalent field, or at least two years of experience analyzing fastener system designs. This opinion is based on my understanding of the typical minimum

qualifications of those working in the field at that time. Additional education can compensate for less experience and vice versa.

30. Based on this definition, I consider myself at least a POSITA as of this writing and at the time of the earliest filing date/priority date of the '358 Patent, i.e., February 7, 2019. I have conducted my analysis from the perspective of this person of ordinary skill in the art as of that date.

VII. CLAIM CONSTRUCTION

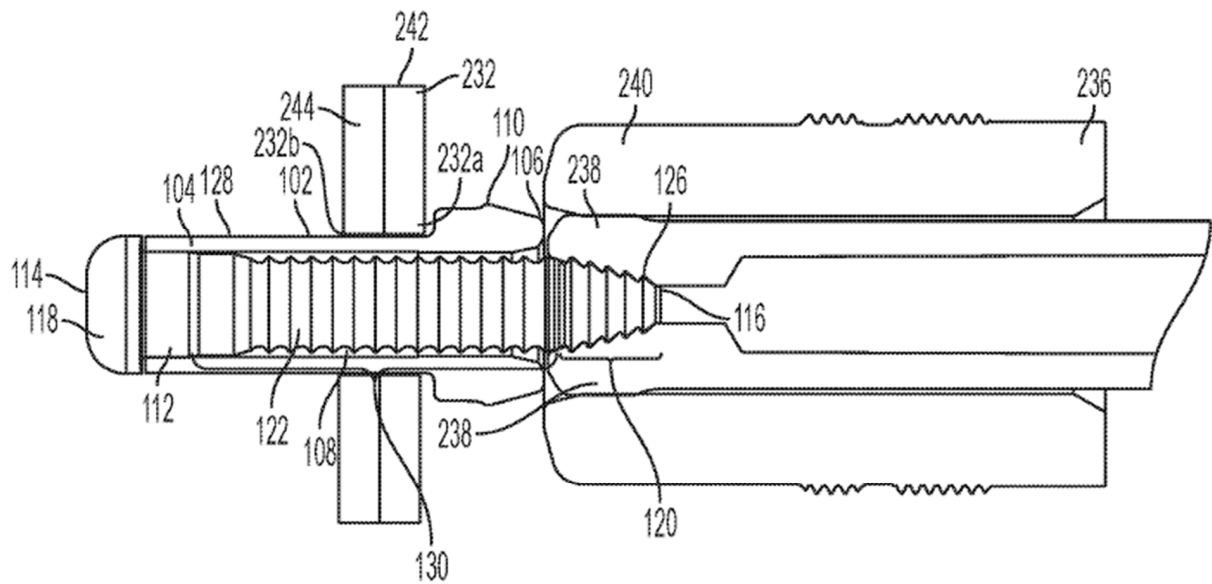
31. I understand that, in this proceeding, the claims are construed according to their ordinary and customary meaning, in light of the specification and prosecution history, as understood by a person of ordinary skill in the art at the time of the invention.

32. All Challenged Claims recite a “pull region” having “an axial length.” A POSITA would understand the “pull region” as the portion of the mandrel that, in the pre-installation configuration, is meant to be physically gripped by the installation tool, for multiple reasons.

33. First, the claims and specification tie the pull region to tool engagement: Claims 1 and 16 require the pull region to be “configured to be engaged by an installation tool,” and the specification likewise describes a “pull region 120 configured to be engaged by an installation tool.” EX1001, 4:27–32, 7:53 (claim 1), 8:48 (claim 15).

[illegible]

Petitioner's Ex. 1004-023



35. Third, consistent with ordinary understanding in the art, a POSITA would interpret a blind fastener’s “pull region” as the tool-engagement portion acted on by the installation tool during setting. A POSITA would understand “pull region” in a pull-type fastener to mean the portion of the mandrel designed to be gripped by the setting tool’s jaws/collet to transmit the tensile pulling force used during installation. In such tools, the jaws engage only a dedicated grip section—typically formed with pull grooves/serrations—to avoid slippage and distribute load during pulling. The axial length of that grip section is an engineering parameter that affects jaw engagement, load distribution, and installation reliability. Accordingly, “pull region” is naturally understood as the tool-

engagement portion of the mandrel, rather than some other region of the mandrel segment not contacted by the tool.

VIII. SUBJECT MATTER OF THE '358 PATENT

A. Background of the Alleged Invention

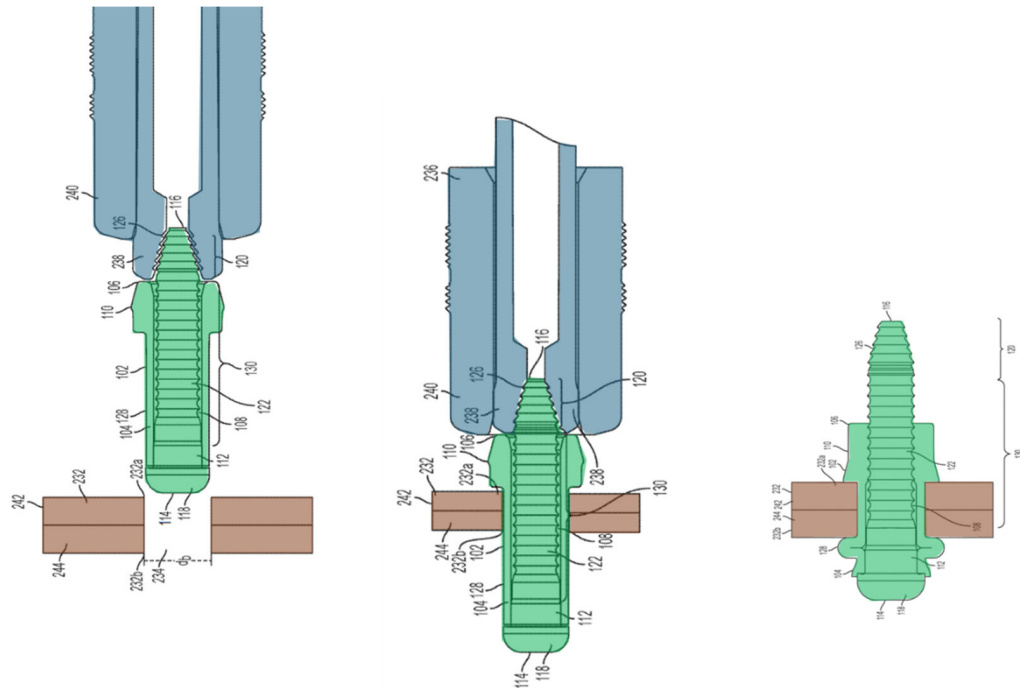
36. The '358 Patent discloses an invention in the field of blind fasteners. A blind fastener is defined by the American Society of Mechanical Engineers as a “mechanical device that has the capability to join component parts in an assembly in which access for fastener installation and activation is available only from one side.” EX1026 (ASME B18.12-2020), p. 82.

37. Blind fasteners typically include several components, including a sleeve (sometimes known as a body) surrounding a mandrel (sometimes known as a pin, or bolt) having a pull region engaged by an installation tool, wherein installation causes the sleeve to be deformed and expanded on the opposite side of the joined component from the installation tool to form a secure joint.

38. Specifically, the '358 Patent discloses a pull mandrel (colloquially referred to as “pull type”) blind fastener which comprises a sleeve (or rivet body) and a mandrel, with some embodiments comprising a “blind rivet.” EX1001, Abstract, 5:27. The American Society of Mechanical Engineers explicitly defines a pull mandrel blind rivet as “a multiple-piece assembly that consists of at least a rivet body and mandrel. In the setting operation, the rivet is inserted into the

components to be joined, and the mandrel is gripped and pulled axially. Its head upsets the rivet body, forming a blind head.” EX1026 (ASME B18.12-2020), p. 83. Some pull-type fasteners additionally include a portion of the sleeve on the pull side, or a separate member, that the pull tool deforms (“swages”) onto the mandrel to form a feature that opposes the blind head on the opposite side. By pulling the mandrel (applying a pulling force to the *pull region* disposed at a first end of the mandrel) with an installation tool while the anvil of the installation tool presses down on the portion of the sleeve nearest the pull region or a separate member, the sleeve swages onto the mandrel, forming a permanent connection. As supported by the teaching of the ’358 Patent (which defines the pull region as the region of the mandrel configured to be engaged by the collet of an installation tool, *see e.g.*, EX1001 at 4:27-30, 6:29-31), a POSITA would understand the “pull region” to be the region of the mandrel of a pull type fastener which is capable of being engaged (physically gripped) by an installation tool. At the same time, the other end of the sleeve deforms to create a *blind head* (an expanded region of the sleeve having a diameter greater than the bore into which the fastener is inserted). Some pull type fasteners comprise a *breakneck* (or breakneck groove) disposed directly below the pull region. A breakneck comprises a region of the mandrel wherein the diameter is smaller than the nominal diameter of the mandrel such that the pull region may be fractured off during or after the installation of the fastener. In many designs, the

breakneck is designed to fracture when a sufficient pulling force to install the fastener has been applied. The working principle of a pull mandrel blind fastener is depicted in the figure below using annotated versions of Figs. 2A, 2B, and 2C of the '358 Patent.



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39. The installation of blind fasteners only requires access to one side of the components which the fastener is intended to join. The speed and relative ease of installing pull type blind fasteners in particular has resulted in widespread use of these devices in industries ranging from aerospace to automotive. EX1025
(*Standard Handbook of Machine Design* by Joseph Shigley, Section 24.1).

40. Aerospace applications often require rigid, tightly jointed connections which are resistant to vibrations and extreme environments. As a result, fasteners

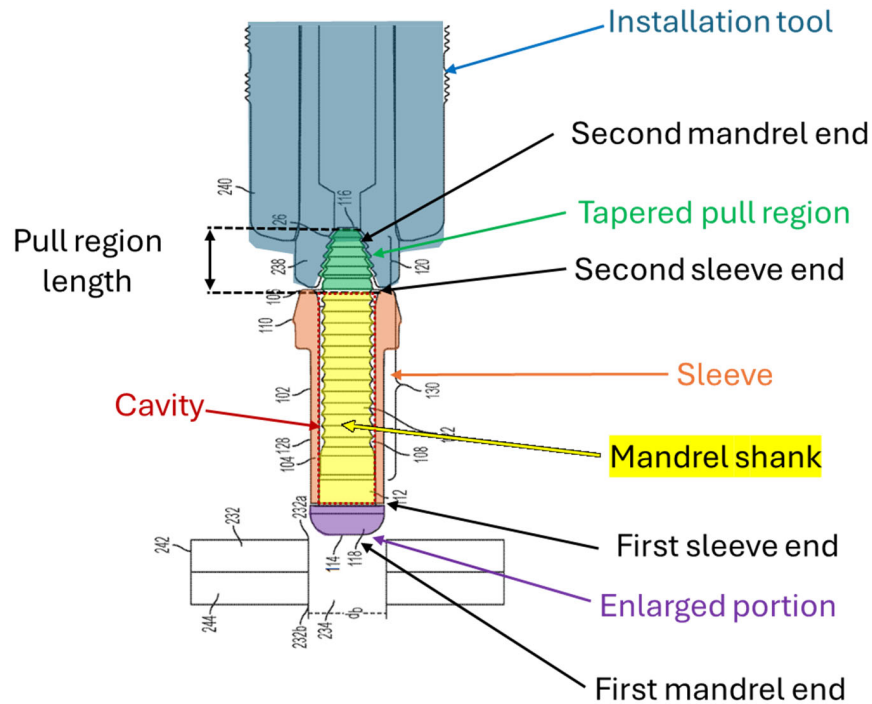
designed for use in the aerospace industry are commonly manufactured out of high hardness materials (e.g., tungsten-based alloys or nickel-chromium alloys such as Inconel 718) which can withstand greater clamping forces and are more resistant to vibrations and high temperatures.^{1, 2}

B. Description of the '358 Patent

41. The '358 Patent discloses a pull type blind fastener and method of installation for said fastener. Specifically, the fastener disclosed by the '358 Patent comprises a mandrel comprising a short, tapered pull region, no breakneck, a grooved or threaded shank, and an enlarged head. The fastener disclosed by the '358 Patent further comprises a sleeve which comprises a cavity that at least partially receives the fastener mandrel. This sleeve is configured to deform during fastener installation, with a second end of the sleeve swaging into the mandrel and a first end of the sleeve forming a blind head. EX1001, 4:17-26. An annotated copy of Fig. 2A of the '358 Patent is shown below. In this figure, key components and regions are labeled.

¹ Tungsten alloy fasteners are often used in high temperature applications in aerospace applications (e.g. fastening the nozzle of a rocket engine). See e.g. EX1017 (mcwmo.com/the-ultimate-guide-to-tungsten-fasteners-durable-solutions-for-modern-applications/).

² Similar to tungsten alloys, Inconel 718 fasteners are often used in high temperature aerospace applications (e.g. fastening the nozzle of a rocket engine). See e.g. EX1018 (extreme-bolt.com/aerospace-fasteners.html).



358 Patent

42. The '358 Patent describes a relationship between the fastener's "pull region" and the "diameter of the shank region," where the diameter of the shank region can be the major diameter " d_3 " of the shank region, as shown below in Figure 1 of the '358 Patent. EX1001, 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" and the "diameter, d_3 , of the shank region 122 can be the major diameter (e.g., root) of the shank region 122"), Fig. 1.

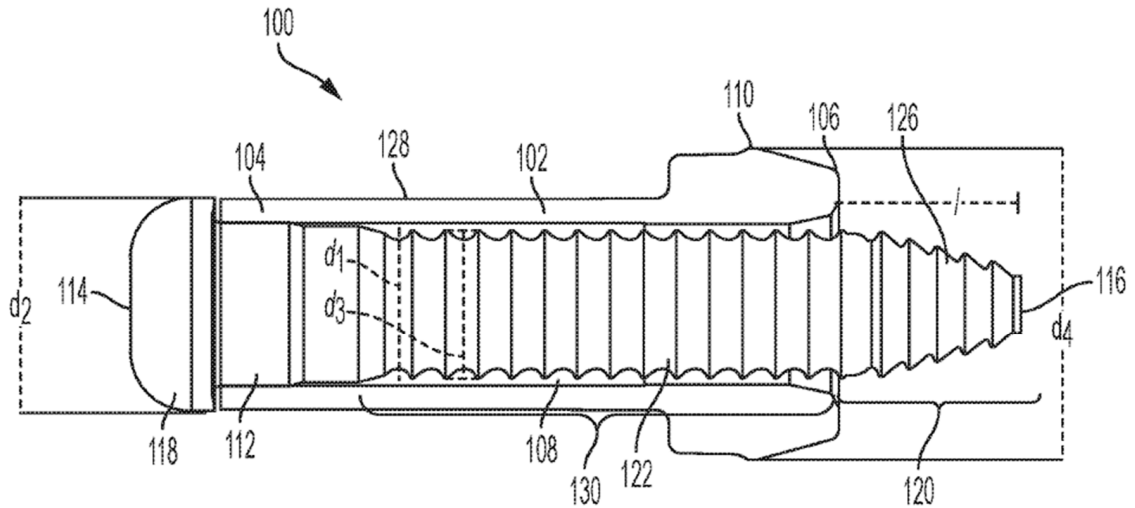


FIG. 1

43. The '358 Patent describes an important goal of its proposed fastener is to “reduce installation forces and increase corrosion resistance.” EX1001, 1:6-7, 3:46-48, 6:55-60, 7:28-31. The patent also states: “Reducing the installation force requirement and installing without a shock force occurring during fracture of the mandrel can enable lighter weight installation tools, longer life of installation tool components, limit damage to the structural components, and enhance ergonomics for operators using the installation tools.” EX1001, 3:51-57.

C. Blind and Non-Blind Pull Type Fasteners

44. As stated above, pull type fasteners are installed by applying an axial force to a mandrel, subsequently swaging a collar onto a mandrel. While a plethora of designs for pull type fasteners exist, these devices can largely be divided into two groups: blind and non-blind fasteners. Non-blind pull type fasteners require

access to both sides of a workpiece for installation, while blind fasteners can be installed with access to only one side. Despite this difference, blind and non-blind pull type fasteners share many common design attributes and applications.

45. Both blind and non-blind pull type fasteners solve similar problems. Firstly, both blind and non-blind pull type fasteners offer rapid installation speeds, in many cases being compatible with the same installation tooling.³ Additionally, both blind and non-blind pull type fasteners address the issue of permanently joining two workpieces. In both cases, a collar is swaged onto a mandrel during installation, creating a secure joint. On top of this, both blind and non-blind pull type fasteners provide a high clamping force between the workpieces to be joined, with the clamping force dictated by the axial force applied to the mandrel during installation. Given the similarities in their designs and the fact that both types of fasteners (blind and non-blind pull type fasteners) aim to solve similar problems, a POSITA in view of either type (blind and non-blind) of pull type fastener would be aware of both types of fasteners. Thus, a POSITA aiming to improve the design of either type of pull type fastener would consider design elements from both blind and non-blind pull type fasteners.

³ See e.g., EX1024, a promotional flyer for a pull type fastener installation tool compatible with both blind and two-piece (non-blind) pull type fasteners.
www.hfsindustrial.com/pub/media/resources/images/image/_/h/_h_o_howmet_bv17_bv13_flyer.pdf

46. The similarity between blind and non-blind pull type fasteners is further emphasized by the fact that many inventors have worked to improve the designs of both blind and non-blind pull type fasteners in parallel throughout their careers. For example, Keith Nordyke first submitted a patent for a non-blind pull type fastener (U. S. Patent No. 4,921,384 “SWAGE FASTENERS WITH A HIGH STAND OFF COLLAR”) in 1989. EX1021. Less than three years later, Keith Nordyke submitted U.S. Patent No. 5,213,460 “HIGH STRENGTH BLIND BOLT WITH UNIFORM HIGH CLAMP OVER AN EXTENDED GRIP RANGE,” which discloses a blind pull type fastener that leverages the collar design of his previous ’384 patent for a non-blind pull type fastener. EX1022. This example highlights that design elements of non-blind pull type fasteners have previously been integrated with blind pull type fastener designs to achieve advantageous effects. Another inventor who will be discussed at length in subsequent sections, Robert Corbett, has submitted several patents and patent publications pertaining to both blind and non-blind pull type fasteners over the past four decades. In one of these patents (U.S. Patent No. 6,241,443 B1 “FASTENER WITH STAGED LOCKING SYSTEM”), Corbett discloses a pull type fastener with both blind and non-blind embodiments, going so far as to acknowledge that “different configurations, constructions and options discussed above with respect to the non-

blind embodiments can be equally applied to the blind type embodiments as well.”⁴

This further underscores that a POSITA in view of either type of pull type fastener design (blind and non-blind) would be both aware of and motivated to combine design elements of both blind and non-blind pull type fasteners.

D. Challenged Claims

47. Challenged claims 1-20 are shown below:

Claim 1:

Limitation 1(pre): “A blind fastener comprising”

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; and”

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

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,”

Limitation 1(d): “a second mandrel end comprising a pull region, and”

Limitation 1(e): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

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.”

⁴ See EX1023, U.S. Patent No. 6,241,443, 8:5-8.

Claim 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.”

Claim 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.”

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

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

Claim 6: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25.”

Claim 7: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43.”

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.”

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.”

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

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.”

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.”

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.”

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.”

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.”

Claim 16:

Limitation 16(pre): “A method for fastening, the method comprising:”

Limitation 16(a): “inserting a first mandrel end of a blind fastener into a bore in a structure,”

Limitation 16(b): “the blind fastener comprising a sleeve comprising a first sleeve end, a second sleeve end, and a cavity extending from the first sleeve end to the second sleeve end, and”

Limitation 16(c): “a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising,”

Limitation 16(d): “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,”

Limitation 16(e): “a second mandrel end comprising a pull region, and”

Limitation 16(f): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

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;”

Limitation 16(h): “engaging a collet of the installation tool with the pull region of the blind fastener;”

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”

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.”

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.”

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

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

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.”

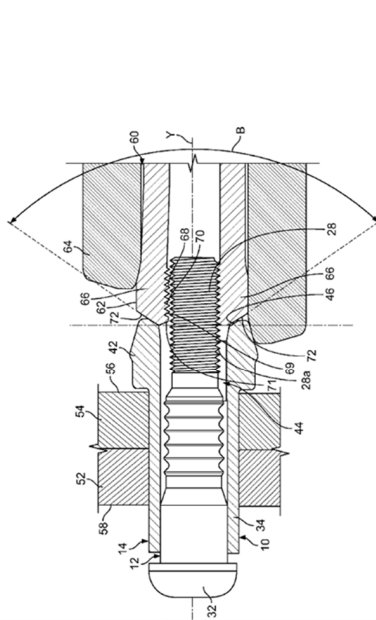
IX. SUMMARY OF PRIOR ART

48. The state of the art of pull type fasteners is reflected in the prior art as illustrated in my analysis and discussions below. The features of the ’358 blind fastener design were all well known in the prior art from Corbett 2018, Corbett 1981, and Hurd ’297.

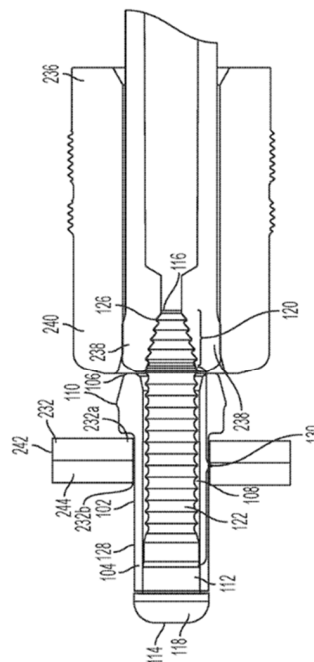
A. US Patent Publication 20180111184A1 (“Corbett 2018”)

49. US Patent Publication 20180111184A1 (“Corbett 2018”) was published on April 26, 2018. *See* EX1006. This predates the priority date of the ’358 Patent, February 7, 2019. *See* EX1001. I am informed that Corbett 2018 is therefore prior art.

50. Corbett 2018 teaches a pull type blind fastener, as does the '358 Patent. Both fasteners are pull type blind fasteners comprising a mandrel and a sleeve. The sleeve of both fasteners is configured to swage onto the shank of the mandrel after inserting the fastener into a bore that passes through the member(s) to be joined and applying a pulling force to a grooved pull region with an installation tool. After installation both the fastener of Corbett 2018 and the '358 Patent permanently join the member(s). An image comparing Fig. 2B of the '358 Patent and Fig. 1 of Corbett 2018 is shown below.



Corbett 2018



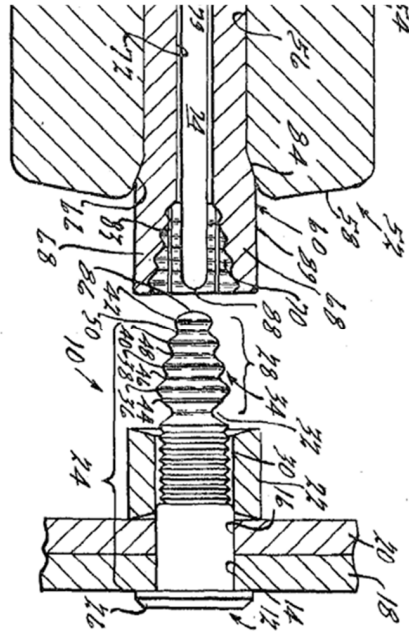
'358 Patent

B. US Patent No. 4,299,519 (“Corbett 1981”)

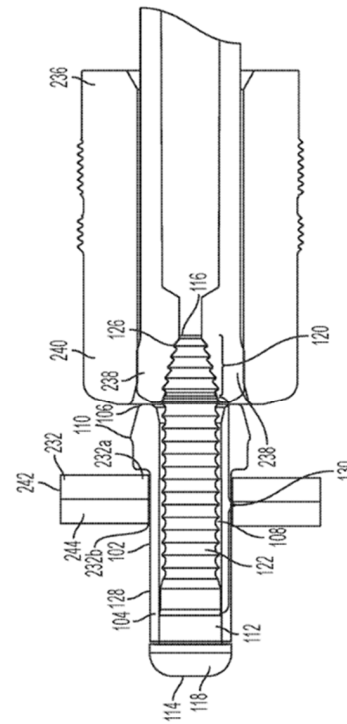
51. US Patent No. 4,299,519 (“Corbett 1981”) was published on November 10, 1981. *See* EX1007 [45]. This predates the priority date of the '358

Patent, February 7, 2019. *See* EX1001 (22). I am informed that Corbett 1981 is therefore prior art.

52. Corbett 1981 teaches a pull type fastener, as does the '358 Patent. Both fasteners are pull type fasteners comprising a mandrel and a sleeve. Both fasteners comprise a short, tapered pull region. The sleeve of both fasteners is configured to swage onto the shank of the mandrel after inserting the fastener into a bore that passes through the member(s) to be joined and applying a pulling force to a grooved pull region with an installation tool. After installation both the fastener of Corbett 1981 and the '358 Patent permanently join the member(s). An image comparing Fig. 2A of the '358 Patent and Fig. 1 of Corbett 1981 is shown below.



Corbett 1981



358 Patent

53. Corbett 1981, throughout its disclosure, repeatedly touts having a shortened pull region. For example, it teaches that “the present invention 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.” EX1007, 5:20-26. “Note that in order to optimize material usage and minimize the amount of material required the effective total shear area is selected to be a preselected minimum magnitude. Ideally the minimum effective shear area would be that just sufficient to accept the maximum shear stress imposed by the maximum anticipated loads. This minimum shear area,

however, is set greater than the ideal in order to accommodate variations in manufacturing, dimensional and material tolerances. With the above construction and by providing the minimum number of pull grooves having the minimum required total effective shear area, it is possible to reduce the length of the pintail portion 28 to a minimum; this can be a length generally equal to approximately the nominal diameter of the smooth shank portion of the pin 12.” EX1007, 5:35-51.

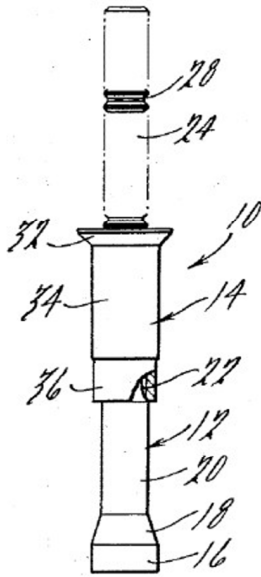
“Thus, the present invention provides a pull-type fastener which enables the length of the pintail to be substantially reduced to a minimum length just necessary to accept the pulling force necessary for installation of the fastener; in a different form of the invention the pintail is eliminated entirely.” EX1007, 7:6-11 and Fig. 6.

Reducing the length of the pintail affords significant cost savings particularly in fasteners fabricated from exotic metals such as titanium without any reduction of strength or ease of installation. Further, the pull grooves, and associated jaw portions of the installation tools are designed so as to effectively reduce the likelihood of the pull grooves being stripped due to improper positioning of or premature actuation of the installation tool.” EX1007, 7:6-19.

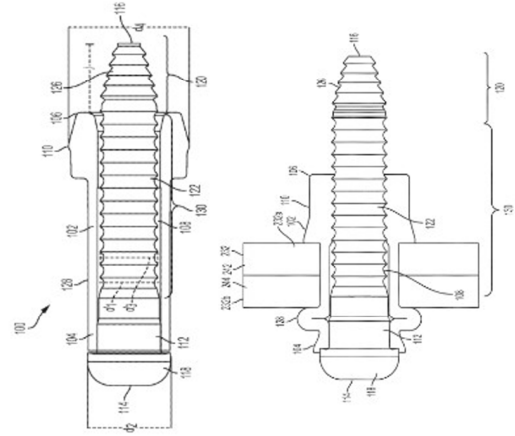
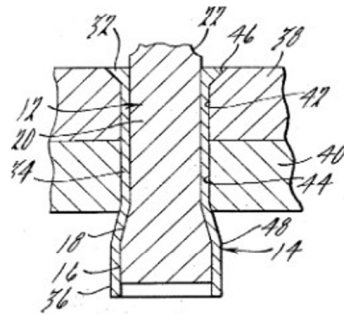
C. US Patent No. 3,820,297A (“Hurd ’297”)

54. US Patent No. 3,820,297A (“Hurd ’297”) was published on June 28, 1974. *See* EX1008 [45]. This predates the priority date of the ’358 Patent, February 7, 2019. *See* EX1001 (22). I am informed that Hurd ’297 is therefore prior art.

55. Hurd '297 teaches a pull type blind fastener, as does the '358 Patent. Both fasteners are pull type blind fasteners comprising a mandrel and a sleeve. The sleeve of both fasteners is configured to swage onto the shank of the mandrel after inserting the fastener into a bore that passes through the member(s) to be joined and applying a pulling force to a grooved pull region with an installation tool. After installation both the fastener of Hurd '297 and the '358 Patent permanently join the two work pieces. While Hurd '297 presents a blind fastener, with the mandrel having a smaller diameter than the bores, an interference fit is created between the sleeve and the bores during installation, with an enlarged head of the mandrel compressing the sleeve to apply a radial stress to the bores. An image comparing Figs. 1 and 2C of the '358 Patent and Figs. 1 and 4 of Hurd '297 is shown below.



Hurd 297



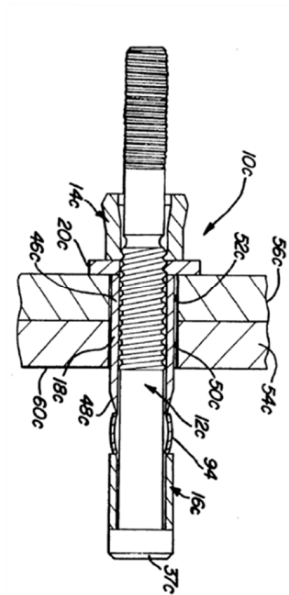
358 Patent

D. US Patent No. 5,178,502 (“Sadri ’502”)

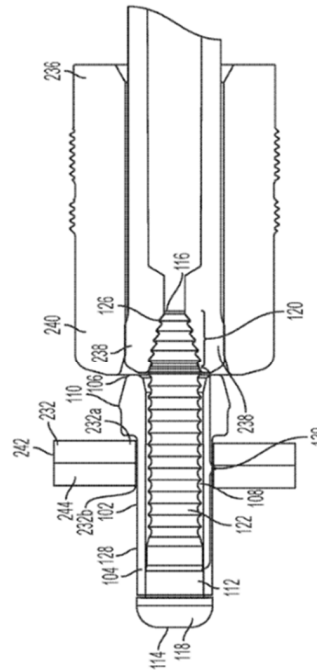
56. US Patent No. 5,178,502 (“Sadri ’502”) was issued on January 12, 1993. *See* EX1009 ([45]). This predates the priority date of the ’358 Patent, February 7, 2019. *See* EX1001 (22). I am informed that Sadri ’502 is therefore prior art.

57. Sadri ’502 teaches a pull type blind fastener, as does the ’358 Patent. Both fasteners are pull type blind fasteners comprising a mandrel, a sleeve, and a collar portion. The collar portion of both fasteners is configured to swage onto the shank of the mandrel after inserting the fastener into a bore that passes through the member(s) to be joined and applying a pulling force to a grooved pull region with an installation tool. After installation both the fastener of Sadri ’502 and the ’358

Patent permanently join the two work pieces. Sadri '502 comprises a breakneck groove such that the pull region of the fastener fractures away after installation. An image comparing Fig. 2B of the '358 Patent and Fig. 8 of Sadri '502 is shown below.



Sadri 502



358 Patent

58. In one embodiment disclosed in Sadri '502, the fastener has a main (secondary) sleeve, an expandable (primary) sleeve, and a collar—which together define 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 understand these components to operate as one sleeve system because they are coaxially assembled around the pin/mandrel, are axially engaged and load-

coupled during installation, and function cooperatively as the sleeve-side structure that reacts against the installation tool to form the installed joint (including blind-side deformation and collar swaging). EX1009, 1:13-18 (“multi-piece blind bolt fasteners [that] include a main sleeve, an expandable sleeve and a pin”), 1:57-59 (collar transmits axial force from the swage anvil to the main sleeve), 5:21-29, 6:49-7:15 (describing axial movement and radial expansion of the sleeve components to form the joint). In particular, during setting, the collar is swaged and simultaneously drives axial loading through the sleeve stack, while the expandable sleeve moves and expands radially to form the blind head—so the three components collectively provide the sleeve-side structure that bears installation loads and retains joint loads in substantially the same way after installation. EX1009, 6:49-7:15.

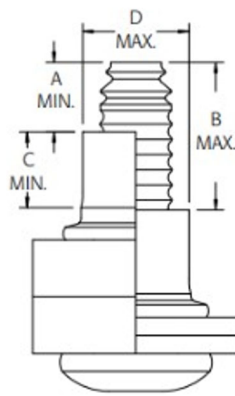
59. Sadri ’502 also explains that the “strength of the pin member 12 is very significant and hence the pin member 12 can be constructed of a ferrous or other material having a Rockwell hardness of between around 38 Rc to around 42 Rc or higher such as a 4130 steel of aircraft quality.” EX1009, 8:42-46.

E. Huck BobTail Brochure 2013 (“BobTail 2013”)

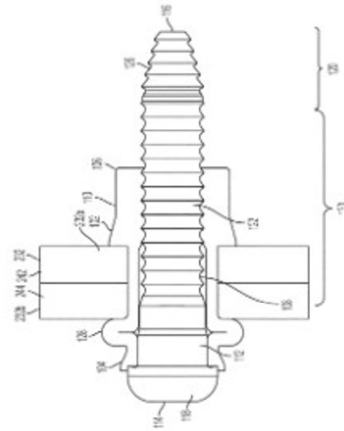
60. The Huck BobTail Brochure (“BobTail 2013”) was published in 2013. *See* EX1010. This predates the priority date of the ’358 Patent, February 7, 2019. *See* EX1001 (22). I am informed that BobTail 2013 is therefore prior art.

61. BobTail 2013 is a product brochure for the Huck BobTail series of fasteners. The Huck BobTail fastener is a pull type fastener which was first available for public sale as early as August 2012.⁵ This brochure introduces the Huck BobTail fastener and installation tool. The Huck BobTail fastener is a pull type fastener similar to the '358 Patent's pull type fastener. Both fasteners are pull type fasteners comprising a mandrel and a sleeve. Both fasteners comprise a short, tapered pull region. Furthermore, neither fastener comprises a breakneck. The sleeve of both fasteners is configured to swage onto the shank of the mandrel after inserting the fastener into a bore that passes through the member(s) to be joined and applying a pulling force to a grooved pull region with an installation tool. After installation both the fastener of BobTail 2013 and the '358 Patent permanently join the member(s). An image comparing Fig. 2C of the '358 Patent and a figure from page 5 of BobTail 2013 is shown below.

⁵ A YouTube video titled "Huck BobTail®" was published by Howmet Aerospace on August 29, 2012 demonstrating and promoting the BobTail fastening system. This video is available at www.youtube.com/watch?v=zY_dD0MSXsc.



BobTail 2013



358 Patent

X. INVALIDITY GROUNDS

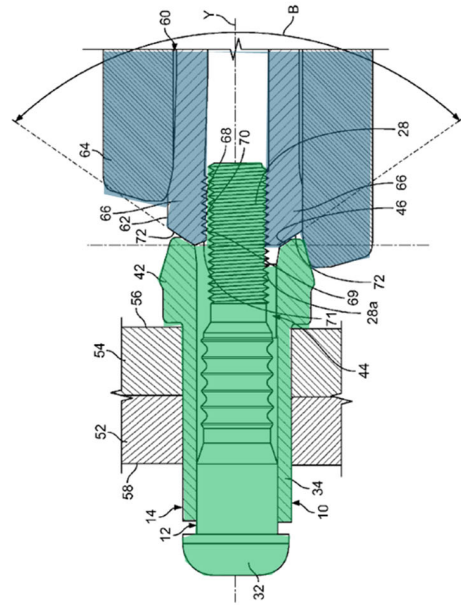
62. As shown below, it is my opinion that a person of ordinary skill in the art (“POSITA”) would have found that claims 1-20 (the “Challenged Claims”) of U.S. Patent No. 11,885,358 (“the ’358 Patent”) (EX1001) were anticipated or obvious over the prior art. In particular, (1) U.S. Patent Application 2018/0111184 (EX1006) (“Corbett 2018”) anticipates claims 1-3, 5, 8-17, and 19-20 of the ’358 Patent, (2) claims 1-3, 6-7, 11, 14-17, 20 were obvious over Corbett 2018 on its own, (3) claims 1-20 were obvious over Corbett 2018 in view of U.S. Patent 4,299,519 (EX1007) (“Corbett 1981”), (4) claims 6-7 are obvious over Corbett 2018 in view of Corbett 1981 and further in view of U.S. Patent 3,820,297 (EX1008) (“Hurd ’297”), and (5) claims 1-20 were obvious over U.S. Patent 5,178,502 (EX1009) (“Sadri ’502”) in view of the 2013 Huck BobTail Brochure

(EX1010) (“BobTail 2013”). A table summarizing the above is provided below in relation to the grounds in the petition:

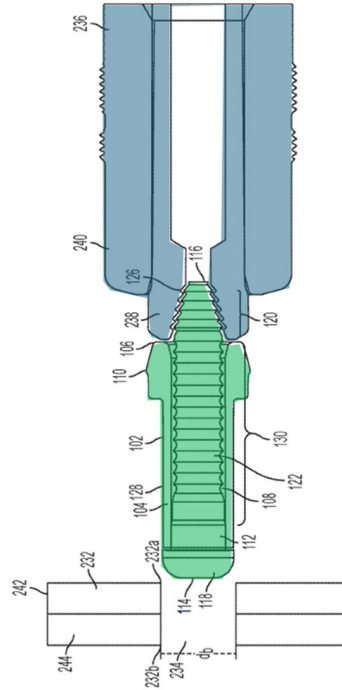
Ground	Type	Grounds
1	§ 102	Claims 1-3, 5, 8-17, 19-20 are anticipated by Corbett 2018.
2	§ 103	Claims 1-3, 6-7, 11, 14-17, 20 are rendered obvious by Corbett 2018.
3	§ 103	Claims 1-20 are rendered obvious by Corbett 2018 in view of Corbett 1981.
4	§ 103	Claims 6 and 7 are rendered obvious by Corbett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

A. Invalidity Grounds I (Anticipation) and II (Obviousness): Corbett 2018

63. Corbett 2018 and the ’358 Patent are both directed to fastening systems for pull type fasteners, as described in Section VIII, “Subject Matter of the ’358 Patent.” Corbett 2018, like the ’358 Patent, discloses a pull type fastener and an installation tool which simultaneously pulls on the inner mandrel portion of the fastener while engaging with the outer sleeve portion of the fastener. Below are annotated comparisons of Corbett 2018 Fig. 2 and the ’358 Patent Fig. 1. Hence, Corbett 2018 is in the same field of endeavor as the ’358 Patent.



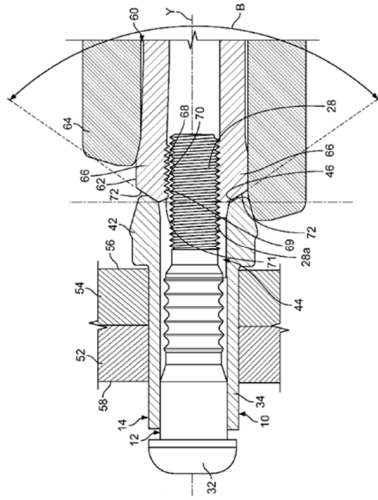
Corbett 2018



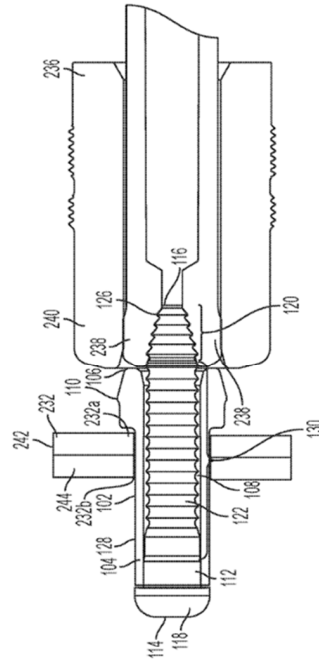
'358 Patent

EX1006, Fig. 1; EX1001, Fig. 1.

64. When comparing Corbett 2018 and the '358 Patent, it is immediately noticeable to a POSITA that the two share a substantially similar architecture.



Corbett 2018



358 Patent

1. Claim 1

a. Limitation 1(pre): “A blind fastener comprising”

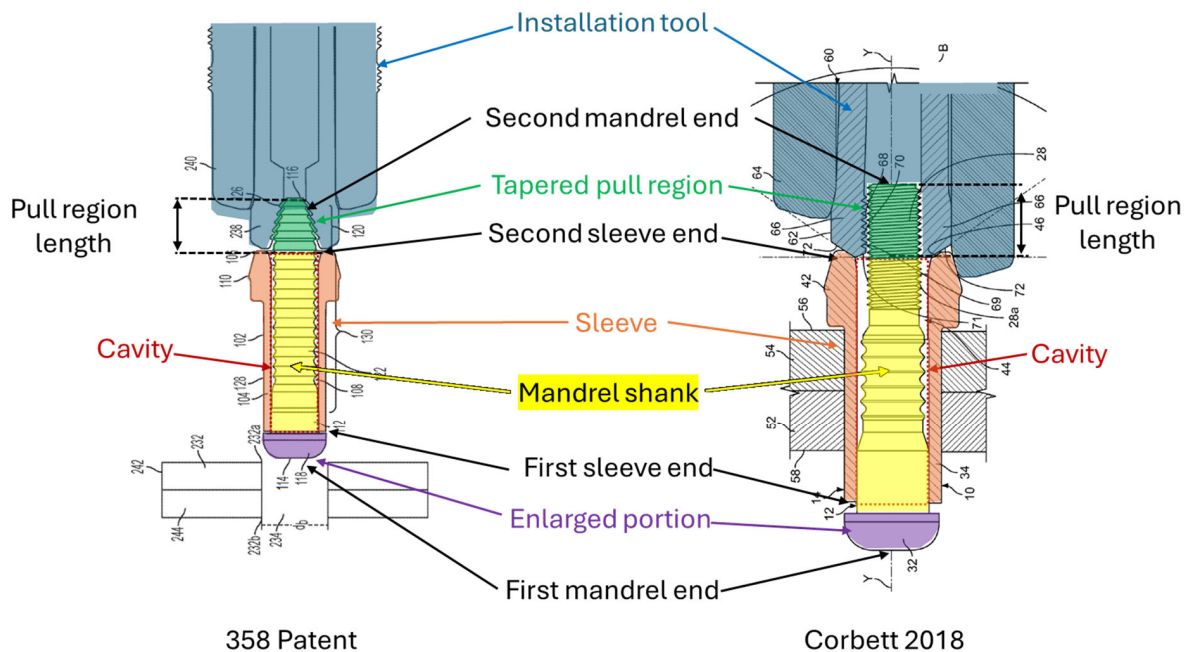
65. Corbett 2018 discloses “a blind fastener,” stating “the fastener 10 is a blind fastener.” EX1006, [0003, 0007, 0014-0015]. Accordingly, the Corbett 2018 fastener is “[a] blind fastener” as recited in this limitation. To the extent that the preamble is determined to be limiting, Corbett 2018 anticipates it.

b. 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; and”

66. Corbett 2018 anticipates this claim limitation. Corbett 2018 discloses a sleeve with a “first sleeve end,” a “second sleeve end,” and a “cavity extending from the first sleeve end to the second sleeve end.” Specifically, Corbett 2018

discloses that “the outer sleeve 14 includes an elongated body 34 having a first end 36 and a second end 38 opposite the first end 36.” *Id.*, [0009-0010]. Corbett 2018 further discloses (emphasis added) “[i]n an embodiment, the outer sleeve 14 includes an **internal aperture 44 that extends through the head 42 from the first end 48 to the second end 49 and through the body 34 from the first end 36 to the second end 38 thereof.**” *Id.*, [0010].

67. Furthermore, as shown in the below figure comparing the fastener of the '358 Patent and the Corbett 2018 fastener, the Corbett 2018 fastener comprises a sleeve comprising a first and second sleeve end, and a cavity extending between the two.



68. Thus, Corbett 2018 discloses this limitation. Accordingly, the Corbett 2018 fastener comprises “a sleeve comprising a first sleeve end, a second sleeve end, a cavity extending from the first sleeve end to the second sleeve end” as recited in this limitation.

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

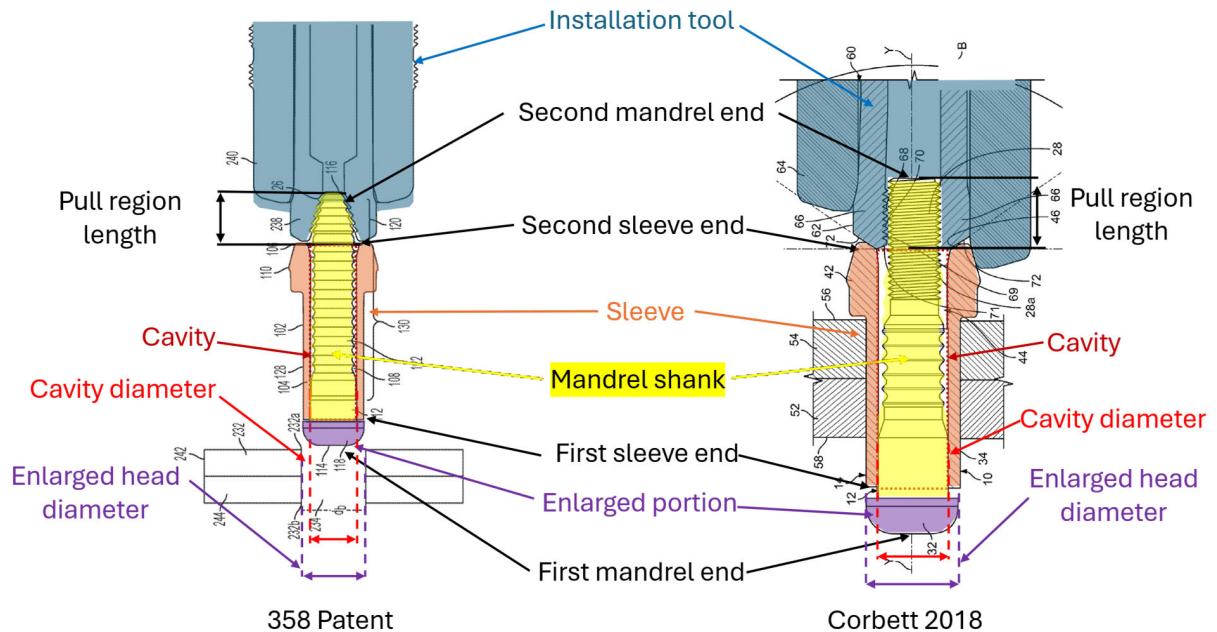
69. Corbett 2018 anticipates and discloses multiple embodiments that practice this limitation. In one such embodiment, Corbett 2018 describes that “the bolt 12 includes an elongated shank 16 having a first end 18 and a second end 20 opposite the first end 18, the shank 16 being sized and shaped to extend through the outer sleeve 14.” *Id.*, [0009]. In another embodiment, Corbett 2018 describes “the 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, and at least a portion of the pull portion 28 of the bolt 12 extends outwardly from the head 42 of the sleeve 14. In an embodiment, the entire pull portion 28 of the bolt 12 extends outwardly from the head 42 of the sleeve 14.” *Id.*, [0011].

70. My analysis of Limitation 1(a) also contains a figure showing the mandrel at least partially received by the cavity of the sleeve.

71. Accordingly, the Corbett 2018 fastener comprises “a mandrel configured to be at least partially received by the cavity of the sleeve” as recited in this limitation.

d. 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,”

72. Corbett 2018 anticipates this limitation and discloses multiple embodiments that practice this limitation. Corbett 2018 states “[i]n another embodiment, the pull portion 28 includes a helical groove. In an embodiment, the bolt 12 includes a head 32 located at the first end 18 of the shank 16 and adjacent to the smooth portion 22. In an embodiment, the head 32 is an enlarged head.” *Id.*, [0009]. Corbett 2018 goes on to describe an embodiment wherein “the 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.” EX1006, [0011]. This configuration is shown below in Figure 1 of Corbett 2018 (with annotations added). As shown below, the “enlarged head” (in purple) described in Corbett 2018 is of 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.”



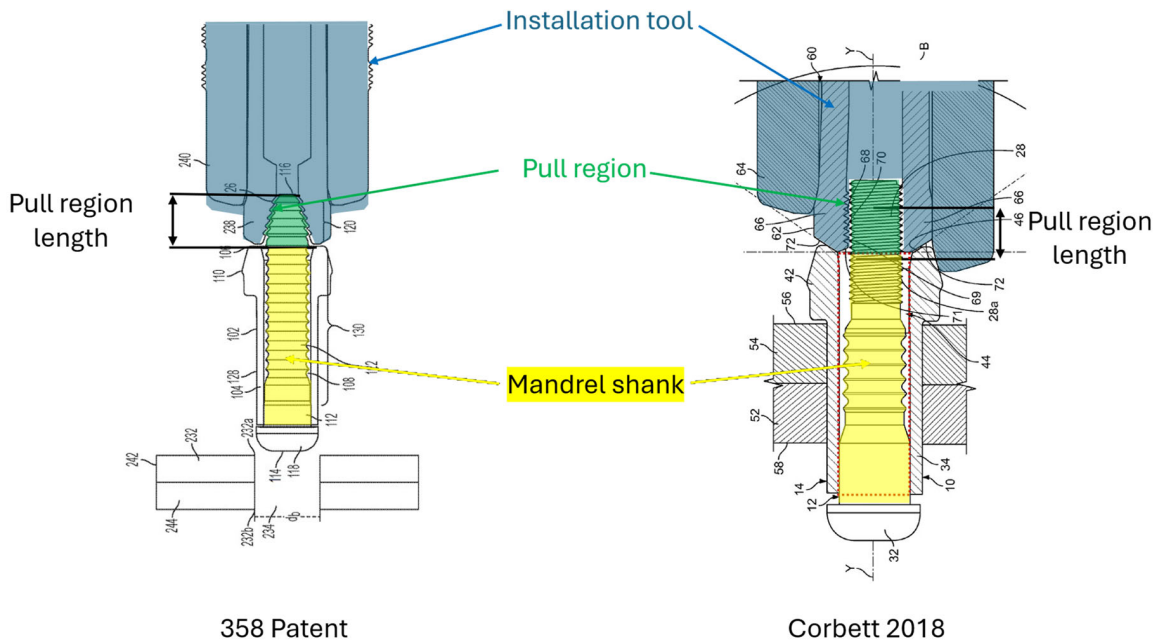
73. Accordingly, the Corbett 2018 fastener comprises a mandrel with “a first mandrel end disposed adjacent to the first sleeve end and comprising an enlarged portion having a diameter greater than a diameter of the cavity” as recited in this limitation.

e. **Limitation 1(d): “a second mandrel end comprising a pull region, and”**

74. Corbett 2018 anticipates this claim limitation. In fact, the abstract of Corbett 2018 discloses (emphasis added) “[a] fastening system includes a fastener having a bolt with a **pull portion** having at least one pull groove, and an outer sleeve having a head with an inner face, the bolt being inserted within the sleeve,” directly identifying the pull region. *Id.*, Abstract. Corbett 2018 goes on to identify an embodiment wherein (emphasis added) “the shank 16 of the bolt 12 includes a **pull portion** 28 located at the second end 20 of the shank 16, and a second

transition portion 30 located intermediate the grooved portion 24 and the pull portion 28.” *Id.*, [0009].

75. The Corbett 2018 fastener comprises pull region at the second mandrel end, as shown below in Fig. 2 of Corbett 2018 (with annotations added).



76. Accordingly, the Corbett 2018 fastener comprises a mandrel with “a second mandrel end comprising a pull region” as recited in this limitation.

f. Limitation 1(e): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

77. Corbett 2018 anticipates this limitation. In one embodiment, Corbett 2018 discloses “the bolt 12 includes an elongated shank 16 having a first end 18 and a second end 20 opposite the first end 18.” *Id.*, [0009]. In a further embodiment, Corbett 2018 discloses that the “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.” *Id.*, [0009]. The elongated shank taught by Corbett 2018 (including both the smooth the grooved portions) is analogous to the shank region described by the ’358 Patent. The ’358 Patent clarifies that that the “[t]he shank region 122 can comprise at least one of a generally smooth region, a threaded region, an annular shoulder, and a groove. The threaded region, annular shoulder, and/or the groove can be external relative to the mandrel 112.” ’358 Patent, 4:60-65.

78. Accordingly, the Corbett 2018 fastener comprises a mandrel with “a shank region extending intermediate the first mandrel end and the second mandrel end” as recited in this limitation.

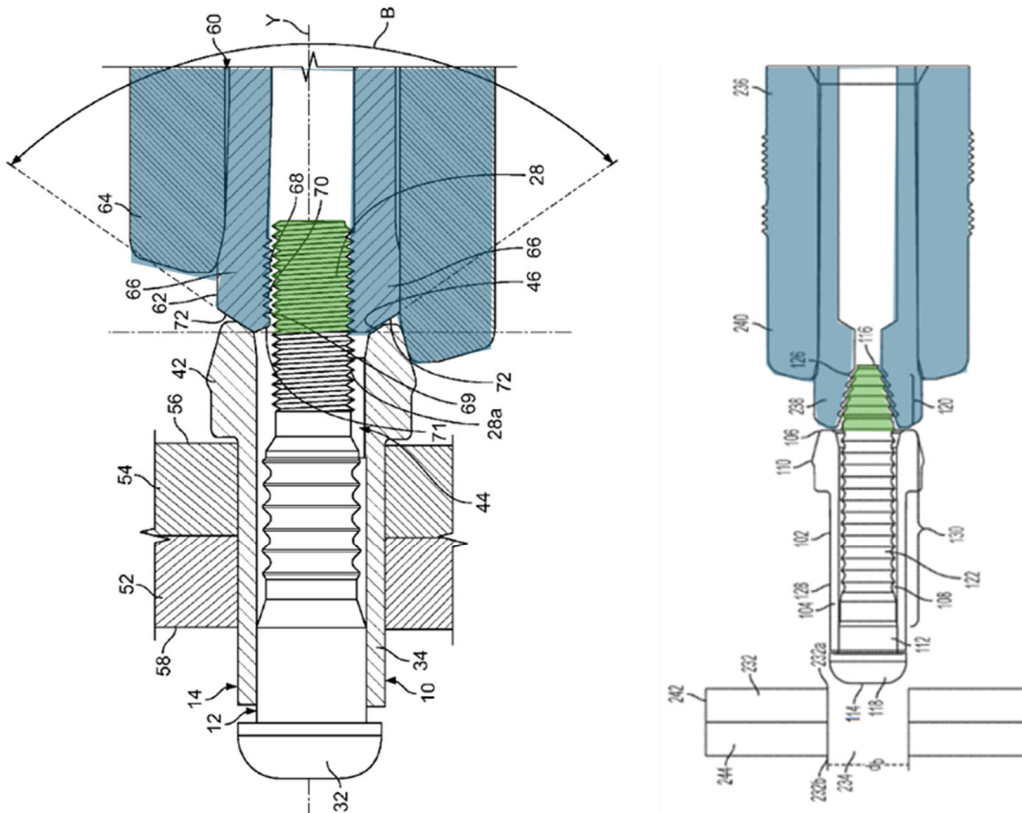
g. Limitation 1(f): “wherein the pull region comprises an axial length no greater than 4 times a diameter of the shank region and is configured to be engaged by an installation tool.”

79. Corbett 2018 anticipates this claim limitation.

80. As discussed in my analysis of the claim construction relate to the “pull region,” the “pull region” is the region of the mandrel configured to be physically engaged by an installation tool. As shown in Corbett 2018’s Figure 2, the pull region is at most the portion of the mandrel that protrudes from the sleeve

that is capable of being gripped by the installation tool when the fastener is in its pre-installation (as-manufactured) configuration.

81. As discussed in my analysis of claim limitation 1(d), Corbett 2018 discloses a mandrel with a “pull portion 28,” analogous to the “pull region” required by this limitation. Furthermore, the ’358 Patent discloses that “[t]he collet 238 of the installation tool 236 can engage with the pull region 120 of the blind fastener 100.” ’358 Patent, 7:14-16. Thus, as established by the ’358 Patent, the pull region is the region in which the collet of the installation tool engages with the fastener. This is demonstrated in the figure below comparing in Fig. 2A of the ’358 Patent to Fig. 2 of Corbett 2018 (with annotations added). In this figure, the pull region of each fastener is highlighted in green.



82. In this annotated figure, Corbett 2018’s pull region is substantially less than three times the major diameter of the shank region (the major diameter of Corbett 2018’s “grooved portion”). The pull region would still be less than twice the diameter of the shank region even when calculating the diameter of the shank region using the narrowest region of the mandrel (i.e., the threaded region directly connected to the pull region). By contrast, calculating the diameter of the shank region using the widest region of the mandrel (the smooth portion near the enlarged head), would result in the ratio to the pull region diameter being even less. Moreover, even if the length of Corbett 2018’s pull region was construed to be the entire narrow-diameter threaded region (rather than just the region

highlighted green above), the pull region would still have a length less than three times the diameter of the narrowest part of any shank region and substantially less than four times that diameter.

83. Even if patent figures should not be understood as being to accurate scale, here, nothing would suggest to a POSITA that the aspect ratios in Corbett 2018 could not be the ratios depicted nor that the ratios would somehow be undesirable. Moreover, Corbett 2018 discloses an embodiment where the installation tool “puller 62 includes a single pull groove 70” for physically engaging a single groove on the pull region of the fastener, which indicates a short pull region. EX1006, [0012]. As such, Corbett 2018 discloses a pull region which 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.”

84. A POSITA would also have understood that the axial length of a mandrel pull region, relative to the shank diameter, is a routine design parameter that is selected to ensure reliable installation performance. In particular, when designing a pull region intended to be gripped by an installation tool, the POSITA would size the pull length based on well-known engineering considerations such as: (i) consistent tool engagement and adequate grip length to support the applied shear stress and prevent slippage; (ii) controlled deformation and/or fracture behavior during the pull stroke; and (iii) sufficient load transfer through the

mandrel during installation without premature failure. These considerations are not unique to any single reference; they reflect ordinary fastener/tooling design practice that would have been readily applied when implementing Corbett 2018's blind fastener.

85. A POSITA would also have been motivated to reduce the axial length of the pull region when possible because doing so provides predictable, practical advantages. A shorter pull region reduces material usage and cost, and it can also reduce the required installation envelope, improving accessibility in confined spaces. Shortening the pull region additionally tends to improve coaxial engagement and reduce the likelihood of off-axis bending due to tool misalignment during installation, which in turn reduces the risk of damaging pull grooves, stripping the pull region, or prematurely fracturing the mandrel under high pull loads. A shorter pull segment likewise can improve installation repeatability by reducing compliance (reducing “excess stretching”) in the pulled portion of the mandrel and can avoid unnecessary protrusion that creates interference, safety, and corrosion concerns after installation. For these reasons, a POSITA would have found it obvious to design the pull region so that its axial length is no greater than a modest multiple of the shank diameter—e.g., four times, 3.8 times, or two times the shank diameter—while maintaining a reasonable expectation of success that the installation tool would reliably engage and install the fastener as intended.

86. As discussed above, Corbett 2018 also teaches that its “pull portion 28” is configured to be engaged by an installation tool. *Id.*, [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.” *Id.*, [0012].

87. Thus, the Corbett 2018 fastener practices each and every limitation of claim 1 of the '358 Patent.

2. Claim 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.”

88. As described in my analysis of limitation 1(f), Corbett 2018 comprises a pull region with a length less than twice the major diameter of the shank region. Thus, Corbett 2018 practices a blind fastener “wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region” as recited in claim 2.

3. Claim 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.”

89. As described in my analysis of limitation 1(f), Corbett 2018 obviously comprises a pull region with a length less than two times the major diameter of the shank region. Thus, Corbett 2018 practices a blind fastener “wherein the pull

region comprises an axial length no greater than 2 times the diameter of the shank region” as recited in claim 3.

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

90. Corbett 2018 discloses this claim. As discussed previously, Corbett 2018 discloses a blind fastener. Furthermore, Corbett 2018 does not comprise a breakneck groove. Corbett 2018 discloses an embodiment wherein “the pull portion 28 remains as part of the shank 16 after installation of the fastener 10.” EX1006, [0014]. Accordingly, the Corbett 2018 fastener comprises a blind fastener “wherein the mandrel does not comprise a breakneck groove” as recited in claim 5.

5. Claim 6: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25.”

91. Corbett 2018 renders obvious this claim. A POSITA would be well aware of the fact that the mandrel of a pull type fastener must comprise a material harder than that of the sleeve which deforms under the mandrel head and swages onto the mandrel. Pull type fasteners rely on the sleeve deforming substantially far more than the mandrel during installation. Corbett 2018 describes a high-strength, pull-type blind fastener for structural applications where the fastener must reliably generate high clamp loads and withstand substantial tensile and shear forces during both installation and in-service loading. A POSITA would understand that these performance requirements place significant demands on the mandrel, which is the

component that is directly loaded in tension by the installation tool and must transmit the pull load through the fastener without yielding, necking, thread/groove stripping, or premature fracture until the intended installation sequence is complete. In practice, achieving that level of pull strength and installation robustness is routinely associated with selecting hardened steel mandrel materials (e.g., heat-treated alloy steels) rather than softer steels, because higher hardness correlates with higher yield/ultimate strength and improved resistance to stripping, shearing, and localized plastic deformation at tool-engagement features. A POSITA would select from known mandrel steels routinely meeting HRC 25 and over HRC 43. EX1027 (NAS1728 standard), EX1028 (SAE J429-2014 standard), EX1029 (NASM 21250 standard).

92. Accordingly, in view of Corbett 2018's express focus on high-strength structural fastening, a POSITA would have found it routine and expected to specify a mandrel hardness well above HRC 25, and commonly in ranges extending to approximately HRC 43 or higher, consistent with conventional hardened-steel selections used for high-load pull-type fasteners and high-strength fasteners in general. Such hardness levels provide the necessary strength margin to prevent the mandrel from deforming at the pull region or other high-stress regions under the installation loads required to set a high-clamp-load, shear-resistant fastener, while

still permitting predictable, controlled failure (if desired) at a designed breakneck or fracture location.

93. Selecting an appropriate mandrel hardness within this range would have been a routine engineering choice for a POSITA. A POSITA would make that selection using well-known material-selection principles for pull-type blind fasteners, balancing predictable tradeoffs among tensile/yield strength, ductility and toughness (to avoid premature brittle fracture during installation), fatigue resistance under cyclic service loads, and resistance to localized damage at tool-engagement features (e.g., pull grooves/threads). This type of hardness selection is commonly achieved through established heat-treatment and alloy selection practices, and a POSITA would have expected to identify a suitable hardness level through ordinary design iteration and, if needed, straightforward validation testing—without technical difficulty or any inventive effort.

94. Additionally, a POSITA would have been aware that it is desirable to use hardened metals when designing fasteners for use in aerospace applications, which is one of the stated applications of the fastener described in the '358 Patent.⁶ High hardness and high strength go hand in hand. Aerospace applications often

⁶ See e.g., '358 Patent, claim 12. "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."

require rigid, tightly jointed, high strength connections which are resistant to axial and shear loads and vibrations. Given that using a hard material (e.g. with a Rockwell hardness greater than or equal to HRC 25) to comprise the mandrel of a pull type fastener would achieve the known benefit of increasing the strength and vibration resistance of a jointed connection, a POSITA would have found it obvious to design the mandrel disclosed in Corbett 2018 to comprise a material with a Rockwell hardness greater than or equal to HRC 25.

6. Claim 7: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43.”

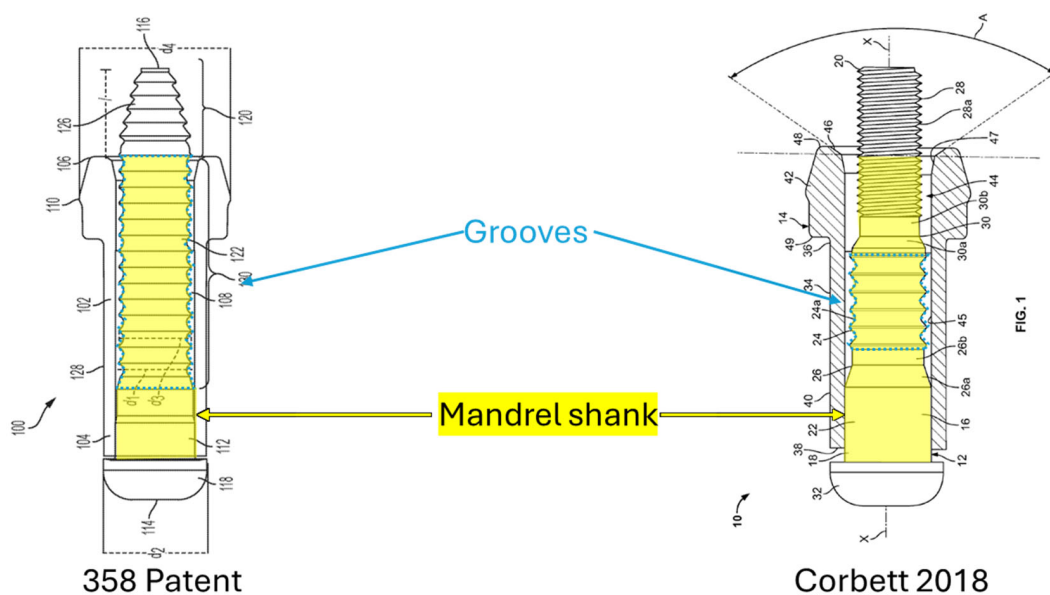
95. As explained in my analysis of claim 6, Corbett 2018 renders obvious this claim. Accordingly, Corbett 2018 teaches a blind fastener “wherein the mandrel comprises a Rockwell hardness of at least HRC 43” as recited in claim 7.

7. 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.”

96. Corbett 2018 discloses this claim, disclosing a shank region comprising a threaded region. Corbett 2018 discloses “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.” EX1006, [0009]. The elongated shank taught by Corbett 2018

(including both the smooth the grooved portions) is analogous to the shank region described by the '358 Patent and includes a plurality of grooves. As such, Corbett 2018 discloses this claim.

97. As shown in the annotated Figure 1 of Corbett 2018 (with color added), the Corbett 2018 fastener comprises a shank including at least a groove.



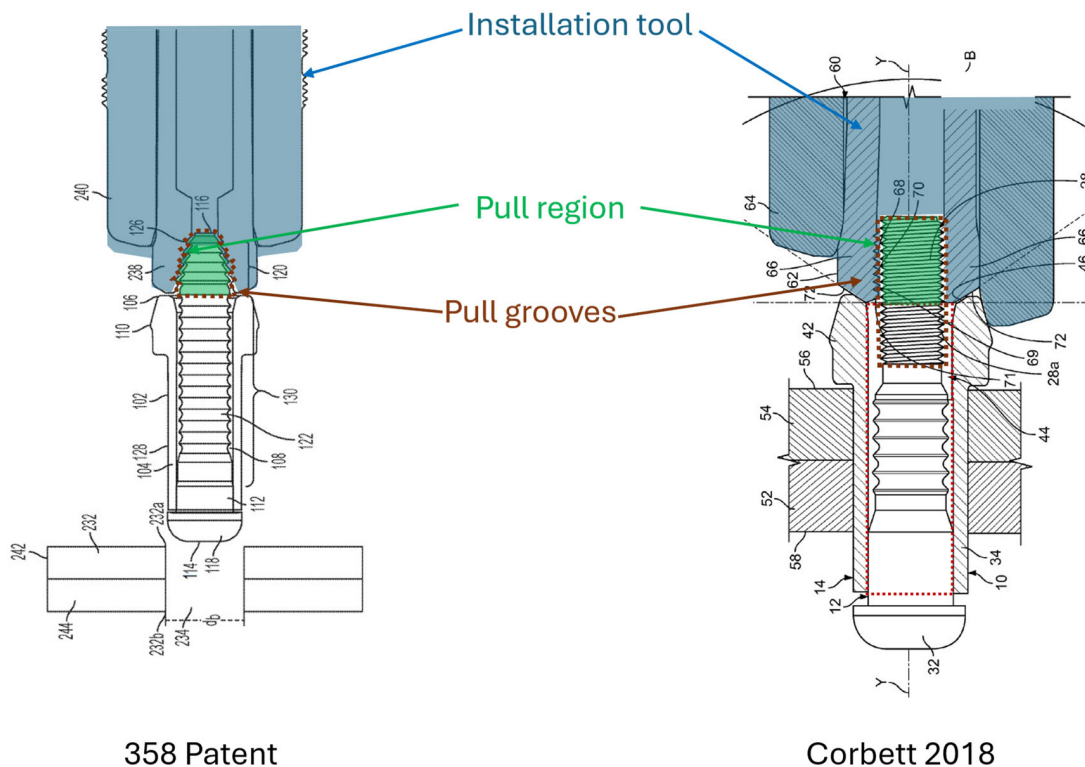
98. Accordingly, the Corbett 2018 fastener comprises a blind fastener “wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove,” as recited in claim 8.

8. 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.”

99. Corbett 2018 anticipates this claim. The abstract of Corbett 2018 discloses (emphasis added) “[a] fastening system includes a fastener having a bolt

with a **pull portion having at least one pull groove**, and an outer sleeve having a head with an inner face, the bolt being inserted within the sleeve,” directly identifying the pull region. EX1006, Abstract. Corbett 2018 goes on to identify one embodiment wherein “the pull portion 28 includes a plurality of pull grooves 28a,” and another embodiment wherein “each of the plurality of pull grooves 28 a is an annular groove.” *Id.*, [0009].

100. As shown in Figure 2 of Corbett 2018 below, the Corbett 2018 fastener comprises a pull region including at least a groove.



101. Accordingly, Corbett 2018 comprises a blind fastener “wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove” as recited in claim 9.

9. Claim 10: “The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical.”

102. Corbett 2018 anticipates this claim. Corbett 2018 discloses an embodiment a cylindrical sleeve stating “the outer sleeve 14 includes an elongated body 34 having a first end 36 and a second end 38 opposite the first end 36. In an embodiment, the body 34 has a cylindrical shape and a smooth exterior surface 40.” EX1006, [0010]. Corbett 2018 also discloses a generally cylindrical mandrel describing “the 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.” *Id.*, [0009].

103. To the extent that the fastener disclosed by the ’358 Patent, comprises a generally cylindrical sleeve and mandrel, a POSITA would also understand that the Corbett 2018 fastener comprises a generally cylindrical sleeve and mandrel.

104. Thus, Corbett 2018 comprises a blind fastener “wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical” as recited in claim 10.

10. 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.”

105. Corbett 2018 anticipates this claim. Corbett 2018 describes a pull-type blind fastener in which the sleeve and mandrel undergo plastic deformation⁷ during installation to create the installed joint. A POSITA would recognize that pull type fasteners rely on the plastic deformation of a sleeve generally comprised of a relatively soft metal around a mandrel comprised of a metal of equal or greater hardness. Corbett 2018 refers to “swage anvil 64,” which deforms the sleeve material. EX1006, [0012]-[0013]. A POSITA would understand that these installation mechanics necessarily require at least one fastener component—typically the sleeve, and often the mandrel or a deformable portion thereof—to be made from a ductile material capable of permanent (plastic) deformation under the setting loads without cracking or brittle fracture, while still providing sufficient strength to carry the installation and service loads.

106. Corbett 2018 also renders claim 11 obvious. Materials routinely used for blind fasteners exhibiting this type of controlled plastic deformation include metals and metal alloys (e.g., steels, stainless steels, aluminum alloys, titanium

⁷ Plastic deformation is permanent deformation. It does not refer to permanent deformation of plastics necessarily.

alloys, nickel-based alloys), and in some designs metal-based composite materials or clad constructions that combine desired strength, corrosion resistance, and formability. Moreover, a POSITA would know that metals used to make fastener components are nearly always alloys, that is, mixtures of more than one metal or a mixture of a metal with non-metal. Fasteners made of pure metals would be highly unusual. Thus, a POSITA would understand that Corbett 2018's disclosed fastener necessarily includes at least one component formed from a metal, a metal alloy, or a metal-based composite material, consistent with the disclosed swaging and radial expansion behavior during installation.

11. 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."

107. Corbett 2018 anticipates this claim. Corbett 2018 discloses one embodiment wherein "the 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." EX1006, [0011]. Given that the head of the blind fastener of Corbett 2018 is inserted through holes in the workpieces to be joined, Corbett 2018 discloses a fastener adapted to be installed in a bore of greater diameter than the head of the fastener itself.

108. Corbett 2018 further discloses an embodiment wherein “the body 34 includes an outer diameter that provides for a clearance fit through openings of work pieces” *Id.*, [0010]. A POSITA would recognize that, in a clearance fit, a component (e.g., the sleeve of a blind fastener) is received by a bore with a diameter greater than the component itself. Alternatively, an interference fit would mean the component is larger in diameter than the bore, such that a force would be required to drive the component into the bore during installation. Thus, clearance is obviously preferred for ease of installation.

109. Accordingly, Corbett 2018 comprises a blind fastener “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 recited in claim 12.

12. 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.”

110. Corbett 2018 anticipates this claim. Firstly, Corbett 2018 discloses a sleeve “configured to deform on a first side of the structure,” disclosing an embodiment wherein “the 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.” EX1006, [0014].

111. To the extent that the pictured embodiments of the '358 Patent comprise a sleeve comprising a collar, the fastener of Corbett 2018 also comprises a sleeve comprising a collar, with said "collar is configured to swage onto the shank region on an oppositely disposed second side of the structure." The "collar" required by this claim is analogous to the head of the outer sleeve of Corbett 2018 which describes "the outer sleeve 14 includes a head 42 located at the first end 36 of the body 34." The figure below compares an annotated version of Fig. 1 of the '358 Patent to Corbett 2018 in view of Corbett 1981. The collar in the pictured embodiment of the '358 Patent is directly analogous to the "head of the sleeve" of the fastener of Corbett 2018.

112. Furthermore, noting that the head of the sleeve of Corbett 2018 is analogous to the collar of the '358 Patent, the head of the sleeve of Corbett 2018 "is configured to swage onto the shank region on an oppositely disposed second side of the structure." Corbett 2018 discloses "[o]nce the puller 62 is aligned with the pull portion 28, namely, the teeth 68, grooves 70 and pull grooves 28a are aligned properly, the 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. The anvil 64 then engages and swages the sleeve 14." *Id.*, [0013]. Corbett 2018 further discloses an

embodiment 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 12.” *Id.*, [0014].

113. Accordingly, Corbett 2018 discloses a blind fastener “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 recited in claim 13.

13. 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.”

114. Corbett 2018 anticipates claim 14. Corbett 2018 describes blind fastening of rigid, load-bearing structures using a pull-type fastener that is installed by applying substantial axial force to the mandrel, causing portions of the fastener to plastically deform (e.g., radial expansion and swaging) and thereby clamp the “work pieces” together. EX1006, [0002–0003, 0008, 0011-0013]. A POSITA would understand that the “work pieces” in this context are structural components that must withstand both (i) the installation loads required to set the fastener and form the blind-side upset and (ii) the in-service loads the resulting joint is designed to carry (e.g., tensile, shear, vibration/fatigue). Materials commonly used for such rigid, load-bearing structural components include metals and metal alloys (e.g., steel, aluminum alloys, titanium alloys) and composite materials (e.g., fiber-reinforced polymer laminates), each of which provides the requisite stiffness and

strength for structural joints formed by blind fastening. Accordingly, a POSITA would understand that the structure into which Corbett 2018's blind fastener is installed comprises at least one of a metal, metal alloy, or composite material.

115. Independently, and in the alternative, Corbett 2018 renders claim 14 obvious. At the time of the invention, blind fasteners were routinely used to join structural components formed from metals, metal alloys, and composite materials, particularly in aerospace, automotive, transportation, and other structural applications where access is limited to one side of the joint and high joint strength is required. Given Corbett 2018's express focus on high-strength, structural blind fastening, a POSITA would have found it obvious to apply Corbett 2018's fastener to structures comprising any of the recited materials, and would have had a reasonable expectation of success because the disclosed installation mechanics (plastic deformation of the fastener to clamp rigid workpieces) are fully compatible with, and commonly employed for, joints in metal and composite structures.

14. 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."

116. Corbett 2018 anticipates claim 15. Corbett 2018, throughout its disclosure, describes a blind "fastener and a fastener installation tool for securing work pieces together." EX1006, [0002-0003, 0008, 0011-0013]. A POSITA would understand that pull-type blind fasteners of the type disclosed in Corbett 2018 are

general-purpose structural joining elements and are not confined to any single industry or end use. Such fasteners are routinely selected wherever access is available from only one side of the joint and a secure, load-bearing connection is required, including aerospace structures, automotive assemblies, transportation equipment, and building and construction components.

117. Independently, and in the alternative, Corbett 2018 renders claim 15 obvious. Given the well-known and widespread use of blind fasteners to secure structural components in a range of industries—including aerospace, automotive, transportation, and building and construction—a POSITA would have found it obvious to apply Corbett 2018’s blind fastener to, and thereby configure the receiving structure as, any of the structural components recited in claim 15, with a reasonable expectation of success.

118. Further, as explained in Section VIII, “Subject Matter of the ’358 Patent,” a POSITA would recognize that the blind fasteners, are often used for applications in the aerospace industry. Aerospace structures (e.g., the wing of an aircraft) often comprise complex structural geometries resulting in tight spaces around fastened components. This makes the installation of non-blind fasteners challenging. Corbett 2018 discloses a blind fastener which enables the joining of two components with limited space available around the joined components. As

such, a POSITA would be motivated to use the fastener of Corbett 2018 in an aerospace application.

15. Claim 16

a. Limitation 16(pre): “A method for fastening, the method comprising:”

119. To the extent that the preamble of claim 16 is limiting, Corbett 2018 anticipates this limitation. Corbett 2018 discloses a fastening method for installing the fastener of Corbett 2018, stating “the fastener 10 is adapted to secure a plurality of work pieces 52, 54 together. In an embodiment, the 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, and at least a portion of the pull portion 28 of the bolt 12 extends outwardly from the head 42 of the sleeve 14. In an embodiment, the entire pull portion 28 of the bolt 12 extends outwardly from the head 42 of the sleeve 14. In an embodiment, the 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.” EX1006, [0011]. Corbett 2018 further details the method for installing said fastener, stating:

Referring to FIG. 2, in an embodiment, the fastener 10 is positioned within the holes of the work pieces 52, 54 as described above. In an embodiment, the jaws 66 of the puller 62 are split and spread to an open position in order

to clear and slip over the pull portion 28 of the bolt 12. In an embodiment, the teeth 68 and the pull grooves 70 of the puller 62 engage the pull grooves 28a of the pull portion 28 of the bolt 12. In an embodiment, the face 72 of the jaws 66 of the puller 62 stops against the inner face 46 of the head 42 of the sleeve 14 to align the puller 62 properly with the pull portion 28 of the bolt 12. Along these lines, the inner face 46 of the head 42 of the sleeve 14 permits the puller 62 to shift forward toward the sleeve 14 at distance or backward away from the sleeve 14 at another distance, depending on how the teeth 68 of the puller 62 engage initially the pull grooves 28a of the pull portion 28 of the bolt 12 while closing, and align the teeth 68 of the puller 62 with the pull grooves 28a of the pull portion 28 of the bolt 12. The puller 62 can then slide downward and inward towards the face 46 at a distance as the puller 62 is driven forward when engaging the pull portion 28. Once the puller 62 is aligned with the pull portion 28, namely, the teeth 68, grooves 70 and pull grooves 28a are aligned properly, the 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. The anvil 64 then engages and swages the sleeve 14.

EX1006, [0013].

120. Accordingly, Corbett 2018 discloses “a method for fastening” as recited by this limitation.

b. Limitation 16(a): “inserting a first mandrel end of a blind fastener into a bore in a structure,”

121. Corbett 2018 anticipates this limitation. As discussed in my analysis of the preamble of claim 16, Corbett 2018 discloses a fastening method for installing the fastener of Corbett 2018. This fastening method includes “inserting a first mandrel end of a blind fastener into a bore in a structure,” stating “the fastener 10 is adapted to secure a plurality of work pieces 52, 54 together... In an embodiment, the 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.” EX1006, [0011]. Corbett 2018 further details the process of inserting a first mandrel end of a blind fastener into a bore, disclosing an embodiment in which “the fastener 10 is positioned within the holes of the work pieces 52, 54 as described above.” EX1006, [0013].

122. Accordingly, Corbett 2018 discloses a fastening method comprising “inserting a first mandrel end of a blind fastener into a bore in a structure” as recited by in this limitation.

c. Limitation 16(b): “the blind fastener comprising a sleeve comprising a first sleeve end, a second sleeve end, and a cavity extending from the first sleeve end to the second sleeve end, and”

123. Limitation 16(b) is substantially the same as limitation 1(a). For the reasons discussed in my analysis of limitation 1(a), Corbett 2018 anticipates this limitation.

d. Limitation 16(c): “a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising,”

124. Limitation 16(c) is substantially the same as limitation 1(b). For the reasons discussed in my analysis of limitation 1(b), Corbett 2018 anticipates this limitation.

- e. **Limitation 16(d): “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,”**

125. Limitation 16(d) is substantially the same as limitation 1(c). For the reasons discussed in my analysis of limitation 1(c), Corbett 2018 anticipates this limitation.

- f. **Limitation 16(e): “a second mandrel end comprising a pull region, and”**

126. Limitation 16(e) is substantially the same as limitation 1(d). For the reasons discussed in my analysis of limitation 1(d), Corbett 2018 anticipates this limitation.

- g. **Limitation 16(f): “a shank region extending intermediate the first mandrel end and the second mandrel end,”**

127. Limitation 16(f) is substantially the same as limitation 1(e). For the reasons discussed in my analysis of limitation 1(e), Corbett 2018 anticipates this limitation.

- h. **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;”**

128. Limitation 16(g) is substantially the same as limitation 1(f). For the reasons discussed in my analysis of limitation 1(f), Corbett 2018 anticipates and renders obvious this limitation.

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

129. Corbett 2018 anticipates this claim. In introducing the motivation for the invention of Corbett 2018, Corbett 2018 describes how a collet of the installation tool engages with the pull region of the blind fastener.” Corbett 2018 states “[c]ertain fasteners include a pull portion having pull grooves, while associated fastener installation tools include a puller (e.g., collet) having teeth that engage the pull grooves of the pull portion of the fastener. Alignment of the teeth of the puller and the pull grooves of the fastener is desired.” EX1006, [0003]. Corbett 2018 further details the method for engaging the pull region (described by Corbett 2018 as the “pull portion”) of a blind fastener with the collet of an installation tool (referred to by Corbett 2018 as the “puller”), stating (emphasis added):

*In an embodiment, the jaws 66 of the puller 62 are split and spread to an open position in order to clear and slip over the pull portion 28 of the bolt 12. **In an embodiment, the teeth 68 and the pull grooves 70 of the puller 62 engage the pull grooves 28a of the pull portion 28 of the bolt 12.** In an embodiment, the face 72 of the jaws 66 of the puller 62 stops against the inner face 46 of the head 42 of the sleeve 14 to align the puller 62 properly with the pull portion 28 of the bolt 12. Along these lines, the inner face 46 of the head 42 of the sleeve 14 permits the puller 62 to shift forward toward the sleeve 14 at distance or backward away from the sleeve 14 at another distance, **depending on how the teeth 68 of the puller 62 engage initially the pull grooves 28a of the pull portion 28 of the bolt 12 while closing, and align the teeth 68 of the puller 62 with the pull grooves 28a of the pull portion 28 of the bolt 12.** The puller 62 can then slide downward and inward towards the face 46 at a distance as **the puller 62 is driven forward when engaging the pull***

portion 28. Once the puller 62 is aligned with the pull portion 28, namely, the teeth 68, grooves 70 and pull grooves 28a are aligned properly, the 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.

EX1006, [0013].

130. After introducing principles of how pull type fasteners are installed, Corbett 2018 describes multiple embodiments that detail how the collet of the installation tool engages with the pull region (described by Corbett 2018 as the “pull portion”) of the fastener. Corbett 2018 discloses that:

In an embodiment, a fastener installation tool 60 includes a puller 62 and a swage anvil 64. In an embodiment, the puller 62 includes chuck jaws 66 having internal teeth 68 and pull grooves 70 that are sized, shaped and adapted to grip the pull grooves 28a of the pull portion 28 of the bolt 12. In an embodiment, the internal teeth 68 includes at least one tooth 69 proximate to an engagement end 71 of the puller 62 and having a first inner diameter, while the remainder of the teeth 68 each have a second inner diameter which is less than the first inner diameter. By opening up the first inner diameter of the at least one tooth 69, as shown, chipping of the tooth 69 is resisted. In an embodiment, the pull grooves 70 of the puller 62 are helical grooves. In another embodiment, the pull grooves 70 of the puller 62 are annular grooves. In another embodiment, the pull grooves 70 of the puller 62 match the pull grooves 28a of the pull portion 28 of the bolt 12. In another embodiment, the puller 62 includes at least one pull groove 70. In another embodiment, the puller 62 includes a single pull groove 70. In an embodiment, the pull grooves 70 of the puller 62 are formed by tapping. In an embodiment, the puller 62 is a split collet.

Id., [0012].

131. Accordingly, the Corbett 2018 fastener discloses “engaging a collet of the installation tool with the pull region of the blind fastener” as recited in limitation 16(h).

- j. 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”**

132. Corbett 2018 anticipates this limitation. Corbett 2018 discloses “[t]he puller 62 can then slide downward and inward towards the face 46 at a distance as the puller 62 is driven forward when engaging the pull portion 28. Once the puller 62 is aligned with the pull portion 28, namely, the teeth 68, grooves 70 and pull grooves 28 a are aligned properly, the 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. The anvil 64 then engages and swages the sleeve 14.” EX1006, [0013].

Accordingly, Corbett 2018 discloses an installation method for a blind fastener comprising “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” as recited in limitation 16(i).

- k. 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.”

133. Corbett 2018 anticipates this claim limitation. Corbett 2018 discloses a blind fastener wherein the sleeve deforms on the first side to form a blind head. Corbett 2018 discloses “the puller 62 continues to provide an axial force on the bolt 12. In embodiments, the 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.” EX1006, [0014]. Accordingly, Corbett 2018 discloses “deforming the sleeve on a first side of the structure” as recited in limitation 16(j).

134. Corbett 2018 discloses a blind fastener wherein the second sleeve end swages onto the shank of the fastener to create a secure jointed connection. Corbett 2018 discloses “[o]nce the puller 62 is aligned with the pull portion 28, namely, the teeth 68, grooves 70 and pull grooves 28 a are aligned properly, the 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. The anvil 64 then engages and swages the sleeve 14.” EX1006, [0013]. Corbett 2018 further discloses an embodiment 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 12.” *Id.*, [0014]. Accordingly, Corbett 2018 discloses “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” as recited in limitation 16(j).

16. 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.”

135. Claim 17 is substantially the same as claim 2. For the reasons discussed in my analysis of claim 2, Corbett 2018 anticipates and renders obvious claim 17.

17. Claim 19: “The method of claim 16, wherein the mandrel does not comprise a breakneck groove.”

136. Claim 19 is substantially the same as claim 5. For the reasons discussed in my analysis of claim 5, Corbett 2018 anticipates claim 19.

18. 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.”

137. Claim 20 is substantially the same as claim 11. For the reasons discussed in my analysis of claim 11, Corbett 2018 anticipates and renders obvious claim 20.

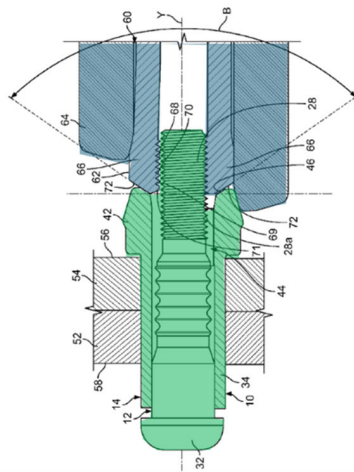
B. Invalidity Ground III: Corbett 2018 In View of Corbett 1981

1. Corbett 2018 And Corbett 1981 Are Analogous Art

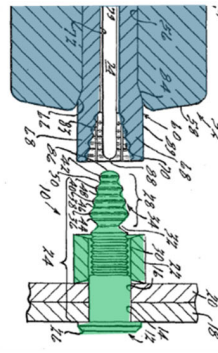
138. I understand that, for a reference to be considered relevant analogous prior art for obviousness purposes, it must be either (1) from the same field of endeavor as the invention, regardless of the problem addressed, or (2) if not within

the field of the inventor's endeavor, still reasonably pertinent to the particular problem with which the inventor is involved. Corbett 2018 and Corbett 1981 are analogous art under either condition.

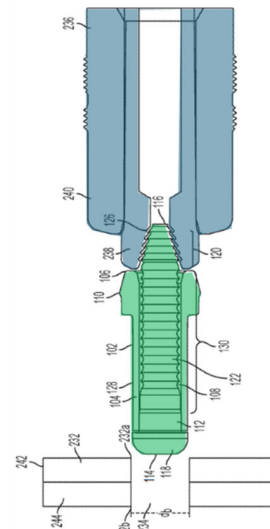
139. Corbett 2018 and Corbett 1981 are both directed to fastening systems for pull type fasteners, as described in Section VIII, "Subject Matter of the '358 Patent." In summary, both Corbett prior art references also disclose a pull type fastener and an installation tool which simultaneously pulls on the inner mandrel portion of the fastener while engaging with the outer sleeve portion of the fastener. Below are annotated comparisons of Corbett 2018 Fig. 2, Corbett 2018 Fig. 1, and Fig. 1 of the '358 Patent. Hence, both Corbett prior art references are in the same field of endeavor as the '358 Patent.



Corbett 2018



Corbett 1981



'358 Patent

140. Corbett 2018 and Corbett 1981 are also pertinent to the same problem faced by the '358 Patent's inventor. The '358 Patent seeks to address the problem

of designing a blind fastener and a “method of installation that can reduce installation forces and increase corrosion resistance.” ’358 Patent, 3:46-49. The ’358 Patent elaborates on the reduction of installation forces by describing that:

A partially engaged collet 238 may not be able to apply a force to the pull region 120 sufficiently to appropriately move the mandrel 112 relative to the sleeve 102. The grooves and taper of the pull region 120 can reduce potential stripping of the grooves 126 due to crest-to-crest engagement. ’358 Patent, 6:55-60, emphasis added.

The blind fastener according to the present disclosure can enable use of a smaller installation tool for installation since the force required to install the blind fastener may be less than a force that can fracture the mandrel. ’358 Patent, 7:28-31, emphasis added.

141. In comparison, Corbett 2018 explicitly refers to its fastener as a blind fastener. EX1006, [0007]. Corbett 1981 seeks to “eliminate the possibility of stripping of the grooves” in its pull type fastener. EX1007, 2:20-21. Hence, both inventions of Corbett 2018 and Corbett 1981 are reasonably pertinent to the problem disclosed by the ’358 Patent.

a. Motivation to Modify Corbett 2018 in View of Corbett 1981

142. A POSITA would have been motivated to consult and combine Corbett 1981 with Corbett 2018 because both references concern closely related blind-fastener designs and installation techniques, and Corbett 1981 teaches structural variations and material selections that a POSITA would readily apply to

Corbett 2018's fastener to achieve predictable improvements in strength, reliability, and installation performance.

143. As detailed above, both Corbett 2018 and Corbett 1981 describe structural fasteners for mechanically joining workpieces together similar to the fastener disclosed in the '358 Patent. Both references disclose a pull-type blind fastener having (i) a body or sleeve, (ii) a pulling member (mandrel) configured to extend through aligned apertures in two workpieces, (iii) a pull region adapted to be gripped by an installation tool, and (iv) an installation sequence in which the sleeve deforms and/or is swaged to form a blind-side upset that secures the fastener on the opposite side of the workpieces. Both Corbett 2018 and Corbett 1981 also address the same engineering problem as the '358 Patent—enabling reliable installation of a structural pull-type fastener by mechanically engaging a mandrel pull region with an installation tool to draw the mandrel, deform and/or swage the sleeve, and thereby secure two workpieces together—such that a POSITA would apply the teachings of Corbett 1981 to Corbett 2018's blind fastener.

144. Corbett 1981 aims to reduce the amount of material and costs required by disposable pintails for blind fasteners, especially with regards to costly materials used in the aerospace industry. EX1007, 1:55-67. Pintails are the portion of the mandrel that includes the pull region and fractures off during installation under the force of the installation tool. Note that in EX1007, the installation tool 52

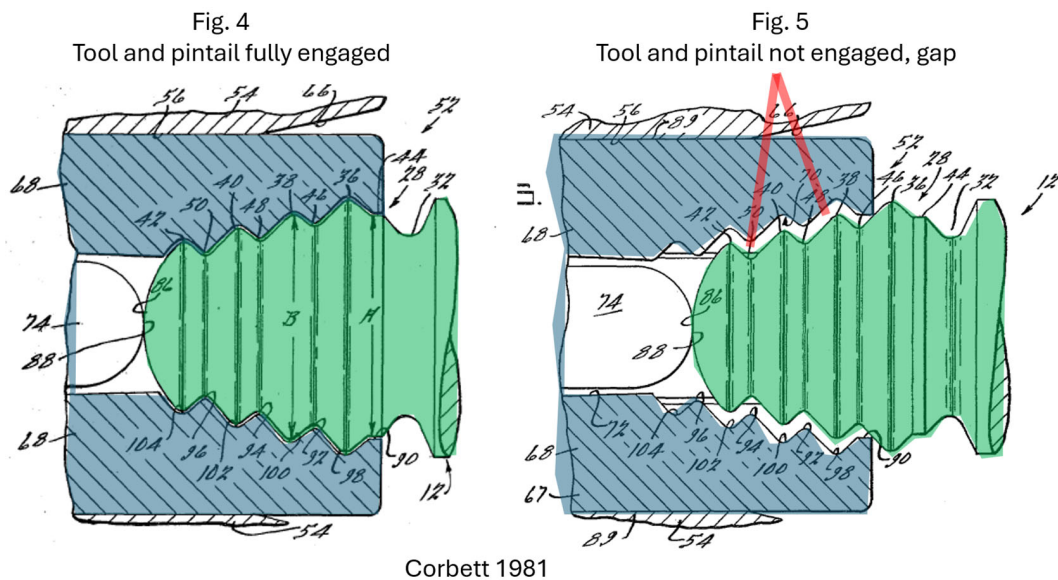
has jaw teeth 70 that engage the crests and valleys of pintail portion 28, which is designed to break off at the end of assembly. EX1007, 4:41-46. However, if a pintail cannot be fully engaged by the installation tool's grip, i.e. there is an "insufficient number of pull grooves engaged by the jaws," the pintail's remaining pull grooves cannot withstand the pull force and may be stripped. EX1007, 1:43-54. To address this issue, Corbett 1981 describes how the pintail portion can be reduced or "totally eliminated" by changing the geometry of the pintail:

*... The pull grooves being provided within an axially inward extending opening provided in the pin portion of the fastener... **the pull grooves are designed to cooperate with the jaws of the installation tool** in such a manner as to preclude engagement of less than the minimum number of pull grooves required before any pulling force can be generated thereby **eliminating the possibility of stripping of the grooves.***

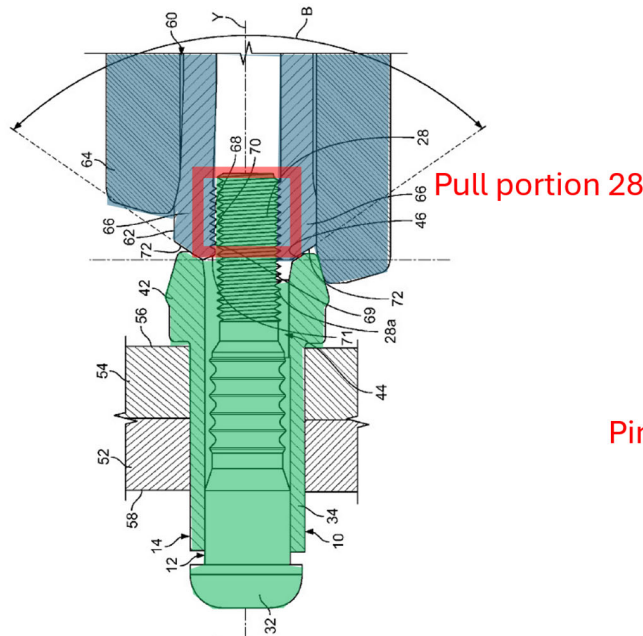
EX1007, 2:3-21(emphasis added).

145. Corbett 1981 describes this new pintail geometry has having a smaller diameter at a location B, which is closer to the tip of the fastener and towards the installation tool, than at location A, which is closer to the head of the fastener and away from the installation tool; in effect, this creates a grooved taper shape in the pintail and a corresponding grooved tapered shape in the installation tool. EX1007, 4:46-49. This tapered shape can be seen in Fig. 4 and Fig. 5 of Corbett 1981 reproduced below. Because of the tapered shape, Corbett 1981 ensures "gripping of all of the pintail crests by all of the jaw crests or gripping of none." EX1007,

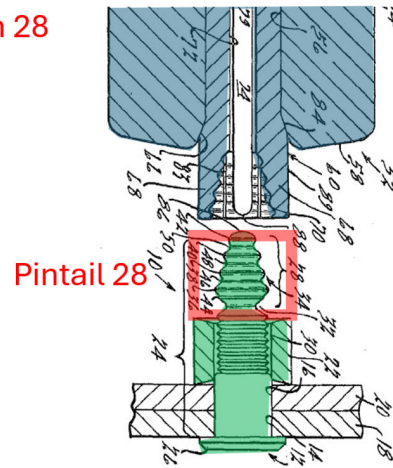
5:5-13. In Fig. 4 of Corbett 1981, all grooves of the installation tool (in blue) are engaged with all grooves of the pintail (in green). In Fig. 5 of Corbett 1981, because the grooves of the installation tool (in blue) are misaligned with the grooves of the pintail (in green), there is a gap between the grooves in the installation tool and pintail.



146. Similarly to Corbett 1981, Corbett 2018, the installation tool 60 has pull grooves 70 that engage the pull grooves 28a of the pull portion 28 of the fastener. EX1006, [0012].



Corbett 2018



Corbett 1981

147. A POSITA would be motivated to modify the pull portion 28 of Corbett 2018 to incorporate the grooved taper shape of Corbett 1981, as well as modifying the installation tool to incorporate a corresponding grooved taper shape. Corbett 2018 discloses that “alignment of the teeth of the puller and the pull grooves of the fastener is desired.” EX1006, [0003]. Although Corbett 2018 aims to improve alignment of the grooves by altering the angle of the plane at which the sleeve encounters the tool, a POSITA would understand that this goal can also be achieved by incorporating the grooved taper shape of Corbett 1981 into the pull portion 28. In this way, the invention of Corbett 2018 can also benefit from the material cost savings touted by Corbett 1981. Additionally, a POSITA would

understand that Corbett 1981's teachings of a shortened, tapered pull region essentially eliminates the risk of stripping by ensuring that the threaded region cannot be engaged by the tool on fewer than all threads/grooves.

148. To the extent that POSITA in view of any fastening device would be aware of the detrimental effects of corrosion on the longevity of a fastener, a POSITA would further be motivated to modify the pull portion 28 of Corbett 2018 to improve the corrosion resistance of the fastener (a key motivation of the '358 Patent). '358 Patent, 3:46-48. A POSITA would recognize that even minor stripping of the pull region during installation would result in scratching or abrading to the surface of the pull region. A POSITA would also know that scratching the surface of a metal fastener makes the fastener more susceptible to corrosion via the removal of any surface coatings and oxide layers on the fastener. Noting that stripping of the pull region results in abrasions on the pull region, a POSITA would understand that incorporating the grooved taper shape of Corbett 1981 into the pull portion 28 of Corbett 2018 would reduce the likelihood of stripping the pull region. As a result, this modification would provide the beneficial effect of improved corrosion resistance.

149. Accordingly, a POSITA would understand that adapting Corbett 2018's pull portion to incorporate Corbett 1981's shorter, tapered pull region would involve only routine dimensional and geometric adjustments to the

mandrel's pull segment (e.g., length, taper angle, and transition radii), without changing Corbett 2018's sleeve structure, overall installation sequence, or swaging mechanics. A POSITA would further expect this straightforward modification to yield the same predictable benefits discussed above (e.g., reduced material usage and tool stroke, improved coaxial engagement, and reduced risk of pull-feature damage) while preserving Corbett 2018's intended structural fastening performance.

150. A POSITA would further understand that this modification incorporating the grooved taper shape can be done without incorporating the "breakneck groove" located "between the locking grooves and the pull grooves." EX1007, 1:34-38. The grooved taper shape and breakneck groove relate to two different functionalities: the former relates to proper engagement of the installation tool to the pull portion, as described above, and the latter relates to allowing the pintail to separate once the installation is complete. EX1007, 4:23-26. In addition, designing and manufacturing the breakneck groove would be an additional step that is not necessary for accomplishing tool engagement.

151. Corbett 1981 further describes a titanium fastener. One of the underlying motivations in the invention of Corbett 1981 is that "[w]hile present material costs attributable to this lengthy pintail when such pull type fasteners are fabricated from low cost materials may not be significant enough to generate much

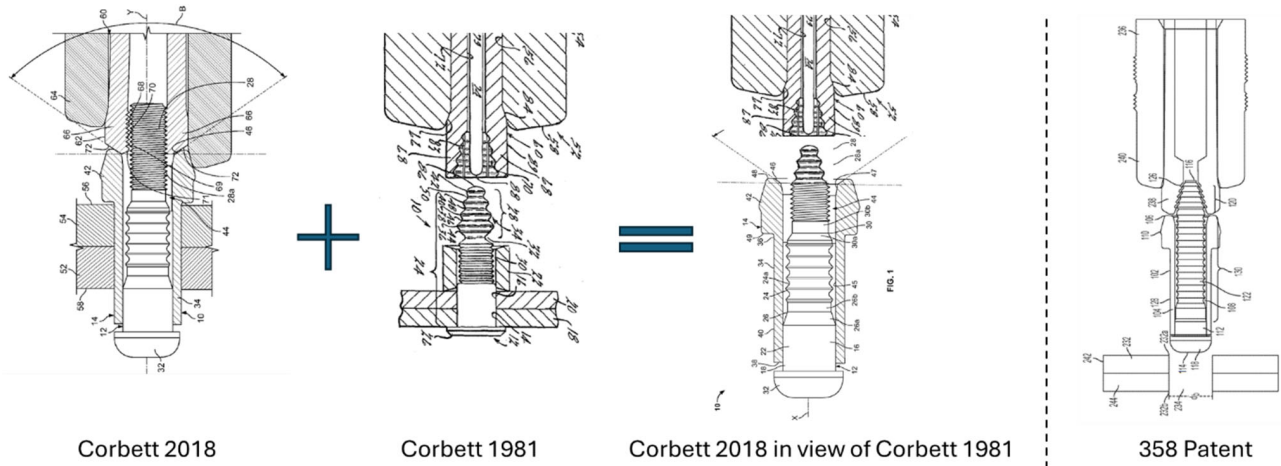
concern, this is not necessarily the case when the fasteners are fabricated from more costly, exotic metals such as titanium which are commonly used in the aerospace industry.” EX1007, 1:55-61.

152. Hence, Corbett 1981 is directed towards fasteners made of “exotic metals such as titanium,” further describing that “[r]educing the length of the pintail affords significant cost savings particularly in fasteners fabricated from exotic metals such as titanium without any reduction of strength or ease of installation.” EX1007, 7:11-14. A POSITA would recognize that high strength alloys such as titanium alloys are ideal for use in a wide range of applications, including but not limited to aerospace applications due to high strength-to-weight ratio and corrosion resistance. As such, a POSITA would understand the benefits of a fastener comprising a metal such as titanium. Thus, a POSITA would understand that Corbett 2018 in view of Corbett 1981, could be composed of titanium.

b. Simple Substitution of One Known Element for Another

153. A POSITA would have a reasonable expectation of success in the modification involving substituting Corbett 1981’s tapered pintail for Corbett 2018’s straight pintail, because this modification would amount to a simple substitution of one known element for another with no more than the predictable use of the elements according to their established functions. Below is an

illustration of the result of modifying the pull region 28 of Corbett 2018 with the grooved taper shape of Corbett 1981. A POSITA would understand that modifying the shape of the pull region for engagement purposes would not affect the operation of the rest of the fastener system. In the figure below (which features Fig. 2 of Corbett 2018, Fig.1 of Corbett 1981, and Fig. 2A of the '358 Patent), Corbett 2018 in view of Corbett 1981 is shown alongside the Corbett 2018, Corbett 1981, and '358 Patent fasteners.



154. Corbett 2018 in view of Corbett 1981 satisfies every limitation in the challenged claims, as shown below.

2. Claim 1

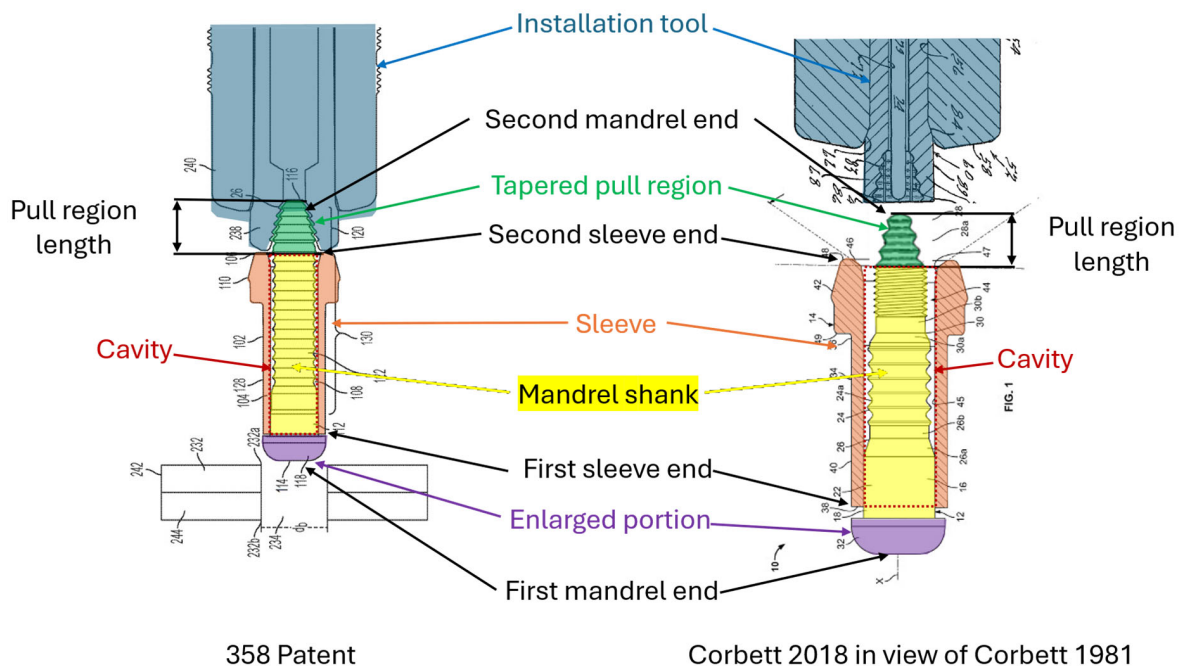
a. Limitation 1(pre): “A blind fastener comprising”

155. As described in Grounds 1-2, Corbett 2018 discloses “a blind fastener,” stating “the fastener 10 is a blind fastener.” EX1006, [0014]. Thus, Corbett 2018 in view of Corbett 1981 is also a blind fastener, as recited in this

limitation. As explained above, Corbett 2018 in view of Corbett 1981 would remain a blind fastener despite changes to the pull region.

b. 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; and”

156. As described in Grounds 1-2, Corbett 2018 anticipates this claim limitation. Accordingly, Corbett 2018 in view of Corbett 1981, shown below, also comprises “a sleeve comprising a first sleeve end, a second sleeve end, a cavity extending from the first sleeve end to the second sleeve end” as recited in this limitation, and thereby renders this limitation obvious.

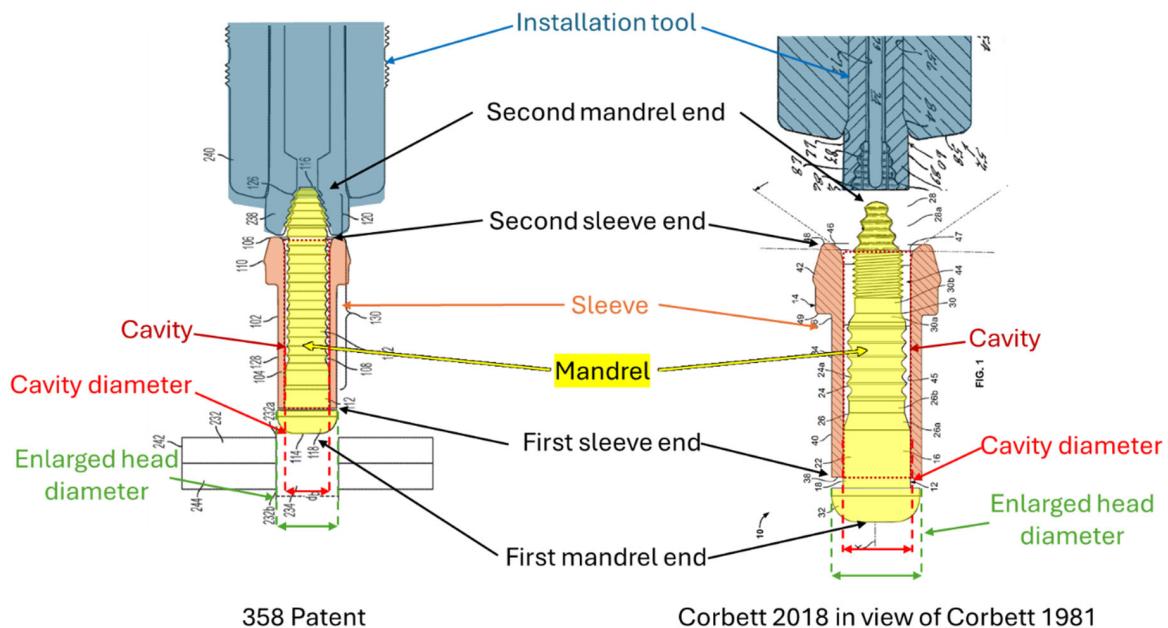


c. Limitation 1(b): “a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising”

157. As described in Grounds 1-2, Corbett 2018 anticipates this claim limitation. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises “a mandrel configured to be at least partially received by the cavity of the sleeve” as recited in this limitation, and thereby renders this limitation obvious.

d. 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,”

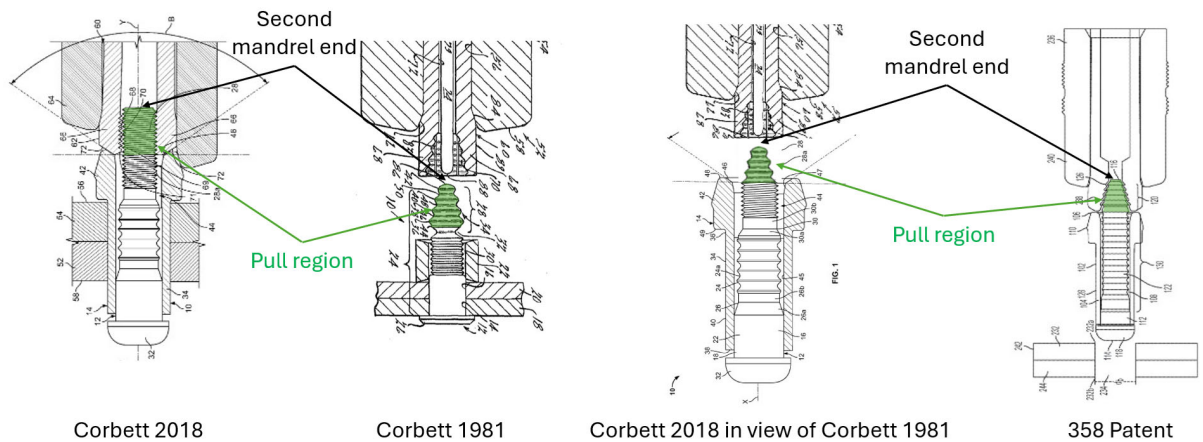
158. As described in Grounds 1-2, Corbett 2018 anticipates this claim limitation. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises “a first mandrel end disposed adjacent to the first sleeve end and comprising an enlarged portion having a diameter greater than a diameter of the cavity” as recited in this limitation and thereby renders this limitation obvious. This is explained below:



e. Limitation 1(d): “a second mandrel end comprising a pull region, and”

159. As described in Grounds 1-2, Corbett 2018 anticipates this claim limitation. Corbett 1981 also discloses a second mandrel end comprising a pull region. Noting that Corbett 1981 describes the pull region of a pull type fastener as the “pintail region,” Corbett 1981 discloses that “[p]in 12 includes a shank portion 24 having a head 26 provided at one end thereof, a pintail portion 28 at the other end thereof and a plurality of locking grooves 30 disposed therebetween.” EX1007, 2:65-68.

160. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises “a second mandrel end comprising a pull region,” and thereby renders this limitation obvious as further shown below:



f. Limitation 1(e): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

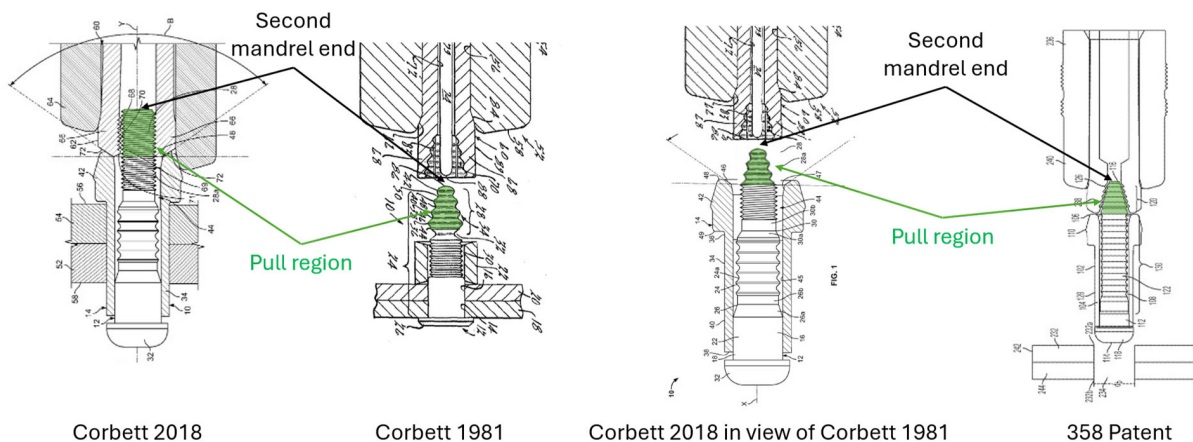
161. As described in Grounds 1-2, Corbett 2018 anticipates this claim limitation. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises “a shank region extending intermediate the first mandrel end and the second mandrel end” as recited in this limitation, and thereby renders this limitation obvious.

g. 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.”

162. As described in Grounds 1-2, Corbett 2018 anticipates and renders obvious this claim limitation. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a “pull region” that “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 recited in this limitation, and thereby renders this limitation obvious.

163. The “pintail portion” disclosed by Corbett 1981 is also analogous to the “pull region” required by this limitation.⁸ Corbett 1981 discloses “[a] fastener set forth in claim 15 with said pintail portion having a length equal to approximately the nominal diameter of said pin.” EX1007, 9:60-62 (claim 16). As is the case for the ’358 Patent, the motivation for minimizing the length of the pintail (pull region) is to “optimize material usage.” *Id.*, 5:35.

164. Accordingly, Corbett 2018 in view of Corbett 1981 discloses a pull region comprising an axial length no greater than the shank diameter, as shown below:



165. In addition to the motivations to combine Corbett 2018 and Corbett 1981 discussed above, a POSITA would have been independently motivated to apply Corbett 1981’s teachings regarding a short pull region (pintail) to Corbett

⁸ See e.g., EX1007, 4:63-66. “Accordingly, proper and full application of the installation tool 52 to the pintail portion 28 will result in full mutual engagement of jaw teeth 70 with pull grooves 34.”

2018's fastener to achieve predictable manufacturing and installation benefits. Corbett 1981 expressly teaches that the length of the pintail portion should be minimized to conserve material—specifically recommending that the pintail portion be “reduce[d] ... to a minimum,” and in certain embodiments made “generally equal to approximately the nominal diameter of the smooth shank portion,” in order to “optimize material usage and minimize the amount of material required.” Corbett 1981, 5:35-50, 9:60-62 (claim 16). Corbett 1981 further explains that excess pintail length—particularly where it breaks off and is discarded after setting—“represents a cost factor in the fastener which contributes nothing to the fastened joint.” *Id.*, 1:38-42. This cost concern is amplified when fasteners use relatively expensive materials, such as “more costly, exotic metals such as titanium ... commonly used in the aerospace industry,” where it becomes “very desirable to reduce to an absolute minimum the amount of material required” and, in particular, to reduce material that “does not contribute to the integrity or strength of the fastener as installed,” i.e., the disposable pintail. *Id.*, 1:55–66. A POSITA would have viewed these teachings as directly applicable to Corbett 2018 because both references address pull-type fasteners in which a tool engages a pull region and applies substantial tensile load during installation.

166. A POSITA also would recognize that these material-saving teachings translate into meaningful commercial benefits in the fastener industry, where high-

volume production makes even small reductions in material usage and cycle time economically significant. And beyond cost, a POSITA would understand that shortening and tapering the pull region can provide predictable installation advantages: reducing the length of the segment being gripped and pulled, reducing tool stroke requirements reducing the risk of stripping, and improve installation efficiency and repeatability. EX1007, 2:15-29. Accordingly, a POSITA would have been motivated to implement Corbett 1981's short pull-region teachings in Corbett 2018 with a reasonable expectation of success.

3. Claim 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."

167. As described in my analysis of limitation 1(f), Corbett 2018 alone and in view of Corbett 1981 comprises a pull region with a length approximately equal to or less than the diameter of the shank region. Thus, Corbett 2018 in view of Corbett 1981 teaches a blind fastener "wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region" as recited in claim 2.

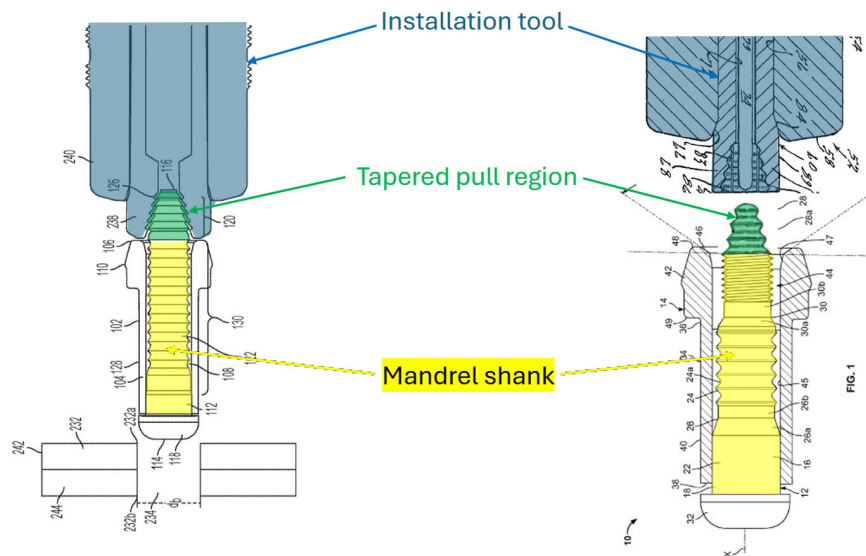
4. Claim 3: "The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region."

168. As described in my analysis of limitation 1(f), Corbett 2018 alone and in view of Corbett 1981 comprises a pull region with a length approximately equal

to or less than the diameter of the shank region. Thus, Corbett 2018 in view of Corbett 1981 teaches a blind fastener “wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region” as recited in claim 3.

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

169. Corbett 1981 teaches that the pull region (referred to by Corbett 1981 as the “pintail portion”) stating “[p]intail portion 28 of pin 12 is of a generally conical shape and has a plurality of pull grooves 34 provided there along, each of said pull grooves being defined by successively alternating crests 36 through 42 and valleys 44 through 50... Similarly, each of the valleys 44 through 50 has a diameter less than the diameter of any of the preceding valleys.” EX1007, 3:10-20. As shown in the figure below comparing Fig 2A of the '358 Patent to the modified figure illustrating Corbett 2018 in view of Corbett 1981 (with annotations added), Corbett 2018 in view of Corbett 1981 discloses a tapered pull region as described in Corbett 1981.



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Corbett 2018 in view of Corbett 1981

170. A POSITA would have been motivated to apply Corbett 1981’s teaching of a tapered pull region (pintail) to Corbett 2018’s pull portion to improve the reliability of tool engagement during installation. Corbett 1981 expressly explains that a tapered pintail geometry promotes an “all-or-nothing” engagement condition—i.e., either all of the pintail groove crests are gripped by the tool jaw crests, or none are—which prevents partial engagement that can otherwise lead to stripping of the pull grooves during the pull stroke. EX1007, 4:41–5:26. Corbett 1981 further teaches that the tapered geometry provides an “effective disabling feature” that allows the pintail length to be reduced without concern that the pull grooves will be stripped if the tool is positioned such that the jaw teeth are not fully engaged with all grooves. *Id.*, 5:20–26. A POSITA would have understood these teachings as directly relevant to Corbett 2018 because Corbett 2018 likewise

relies on an installation tool gripping a pull region to apply substantial tensile load to set the fastener.

171. A POSITA also would recognize that incorporating a tapered pull region provides predictable mechanical advantages during setting. The taper improves the likelihood of proper seating and full engagement of the tool jaws with the pull grooves, thereby reducing the risk of partial engagement, slippage or stripping, and uneven load distribution as the mandrel is pulled. By promoting full engagement, the tapered geometry also reduces localized overstress on individual jaw teeth and groove crests, which in turn decreases the likelihood of groove stripping, tooth chipping, or accelerated tool wear under high pull loads. These benefits—reduced stripping risk, improved engagement consistency, and improved tool durability—are precisely the type of predictable, installation-reliability improvements a POSITA would have sought when implementing Corbett 2018’s high-strength blind fastener, and a POSITA would have had a reasonable expectation of success in applying Corbett 1981’s tapered pull-region teachings to Corbett 2018.

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

172. As described in Grounds 1-2, Corbett 2018 anticipates and renders obvious this claim limitation.

173. Additionally, Corbett 1981 discloses an embodiment wherein the fastener does not comprise a breakneck groove. Corbett 1981 states, “while the present invention is illustrated as including a pin 12 having a breakneck groove 32 provided thereon, in some applications it may be possible to eliminate this breakneck and to allow pintail portion to remain attached to pin member 12.” EX1007, 5:61-65.

174. A POSITA also would have been motivated to omit a breakneck feature in configurations where post-installation break-off provides no meaningful benefit to the installed joint and instead introduces avoidable drawbacks. EX1007, 1:34-38. A POSITA would understand that Corbett 1981 describes distinct functions for (i) the grooved, tapered pull-region geometry, which is directed to reliable alignment and engagement of the installation tool with the pull portion, and (ii) a breakneck groove, which is directed to separating the disposable pintail after installation. *Id.*, 4:23–26). Because these features serve different purposes, a POSITA would recognize that the tapered, grooved pull region can provide the desired engagement and alignment benefits without requiring a breakneck when break-off is unnecessary for the intended installation sequence or final joint configuration.

175. A POSITA also would appreciate that including a breakneck adds manufacturing complexity—it requires forming an additional reduced-section

groove and controlling its geometry to achieve predictable fracture behavior—which is not needed to accomplish tool alignment or jaw engagement. Further, break-off can create a rough or irregular residual surface, and in many structural environments that residual edge can increase susceptibility to corrosion initiation, create handling and safety concerns (e.g., sharp edges), and pose a risk of interference or incidental damage to adjacent components or nearby personnel. For these reasons, and consistent with Corbett 1981’s discussion of the disposable pintail potentially contributing costs and drawbacks without improving the installed joint, a POSITA would have been motivated to omit a breakneck in appropriate applications while retaining the tapered, grooved pull-region features for reliable tool engagement.

176. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a “mandrel” that “does not comprise a breakneck groove,” as recited by claim 5.

7. Claim 6: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25.”

177. As described in Grounds 1-2, Corbett 2018 renders this claim obvious.

178. Corbett 2018 in view of Corbett 1981 also renders this claim obvious. One of the underlying motivations in the invention of Corbett 1981 is that “[w]hile present material costs attributable to this lengthy pintail when such pull type fasteners are fabricated from low cost materials may not be significant enough to

generate much concern, this is not necessarily the case when the fasteners are fabricated from more costly, exotic metals such as titanium which are commonly used in the aerospace industry.” EX1007, 1:55-61. Hence, Corbett 1981 is directed towards fasteners made of “exotic metals such as titanium,” further describing that “[r]educing the length of the pintail affords significant cost savings particularly in fasteners fabricated from exotic metals such as titanium without any reduction of strength or ease of installation.” EX1007, 7:11-14. Titanium alloys are known to have maximum Rockwell hardnesses in low HRC 40’s.⁹

179. A POSITA would also understand that many aerospace structural joints require rigid, tightly clamped, high-strength connections that maintain joint integrity under substantial dynamic and vibrational loading, as well as thermal cycling and long service lives. A POSITA also would be familiar with the material property ranges of the “exotic” metals commonly used for aerospace fasteners and would recognize that these materials are selected to balance strength, weight, corrosion resistance, and fatigue performance. In particular, a POSITA would know that commonly used titanium alloys for aerospace fasteners generally

⁹ See e.g. EX1016 (www.aerospacemetals.com/wp-content/uploads/2023/07/Titanium-Ti-6Al-4V-Grade-5-STA-Data-Sheet.pdf) which details the material properties of titanium alloy Ti-6Al-4V, an alloy commonly used in aerospace application

achieve maximum Rockwell hardness values in the low HRC 40s, depending on alloy and heat treatment.

180. A POSITA would further understand that other exotic fastener materials used in aerospace applications include tungsten-based alloys, which can exhibit Rockwell hardness values spanning at least the HRC 30-50 range, and nickel-based superalloys such as Inconel 718 (a nickel-chromium superalloy), which can reach Rockwell hardness values in the HRC 40s to 50s depending on processing and condition.^{10, 11, 12, 13} These commonly known hardness ranges confirm that specifying mandrel and fastener component hardness values in these ranges would have been within the expected design space for high-strength structural fastening applications.

181. A POSITA would have been motivated to apply Corbett 1981's teachings regarding the use of high-hardness, high-strength mandrel materials—including titanium and other high-strength alloys—having hardness values of at least approximately HRC 25 and, in certain implementations, extending to

¹⁰ Tungsten alloy fasteners are often used in high temperature aerospace applications (e.g. fastening the nozzle of a rocket engine). See e.g. EX1017 (mcwmo.com/the-ultimate-guide-to-tungsten-fasteners-durable-solutions-for-modern-applications/).

¹¹ Similar to tungsten alloys, Inconel 718 fasteners are often used in high temperature aerospace applications (e.g. fastening the nozzle of a rocket engine). See e.g. EX1018 (extreme-bolt.com/aerospace-fasteners.html).

¹² See e.g. EX1019 (www.wolframcarbide.com/tungsten-alloy-properties/) which details the material properties of tungsten alloys.

¹³ See e.g. EX1020 (specialmetals.com/documents/technical-bulletins/inconel/inconel-alloy-718.pdf) which details the material properties of Inconel 718.

approximately HRC 43 or higher, to the mandrel of Corbett 2018. A POSITA would understand that, in pull-type blind fasteners, material hardness and strength are closely correlated, and that the mandrel must be sufficiently strong and hard to withstand joint loads in the applications as well as transmit the tensile setting loads imposed by the installation tool while resisting localized deformation at high-stress features (e.g., tool engagement grooves) as the sleeve and/or collar is driven to deform and swage during installation. A POSITA also would understand that the mandrel is commonly selected to be harder than the deforming sleeve/collar material, so that the sleeve plastically deforms as intended during swaging while the mandrel maintains its geometry and load-carrying capability through the setting sequence.

182. Corbett 1981 emphasizes aerospace structural contexts where fasteners are subjected to demanding load and environment requirements, and a POSITA would recognize that aerospace fastener design often favors hardened, high-strength materials to achieve high clamp loads and maintain joint integrity under vibration and fatigue loading. In that regard, a POSITA would recognize titanium and similar high-strength alloys as attractive fastener materials because they provide a favorable strength-to-weight ratio, and they are routinely used in high-performance structural fastening applications. A POSITA would also expect that increasing mandrel hardness improves installation robustness by reducing the

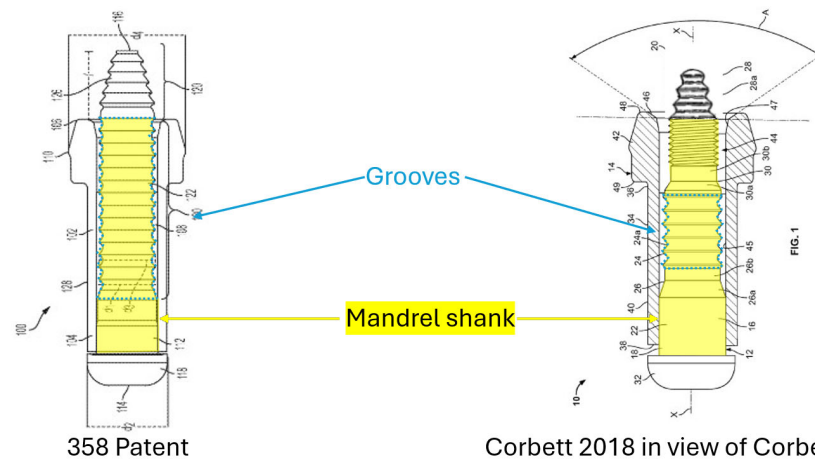
risk of mandrel damage during swaging and by improving the durability of tool-engagement features—particularly the pull grooves, which are subject to concentrated contact stresses from the tool jaws and are susceptible to stripping if the mandrel material is too soft. These predictable benefits align with Corbett 1981’s expressed concerns regarding reliable tool engagement and groove integrity during installation, and they would have motivated a POSITA to adopt Corbett 1981’s high-hardness mandrel material teachings in Corbett 2018.

8. Claim 7: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43.”

183. As described in Grounds 1-2, Corbett 2018 renders obvious this claim. As explained in my analysis of claim 6, Corbett 2018 in view of Corbett 1981 further renders obvious “wherein the mandrel comprises a Rockwell hardness of at least HRC 43,” as recited in claim 7.

9. 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.”

184. As described in Grounds 1-2, Corbett 2018 anticipates this claim. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a blind fastener “wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove,” as recited in claim 8, and thereby renders this claim obvious as shown below.

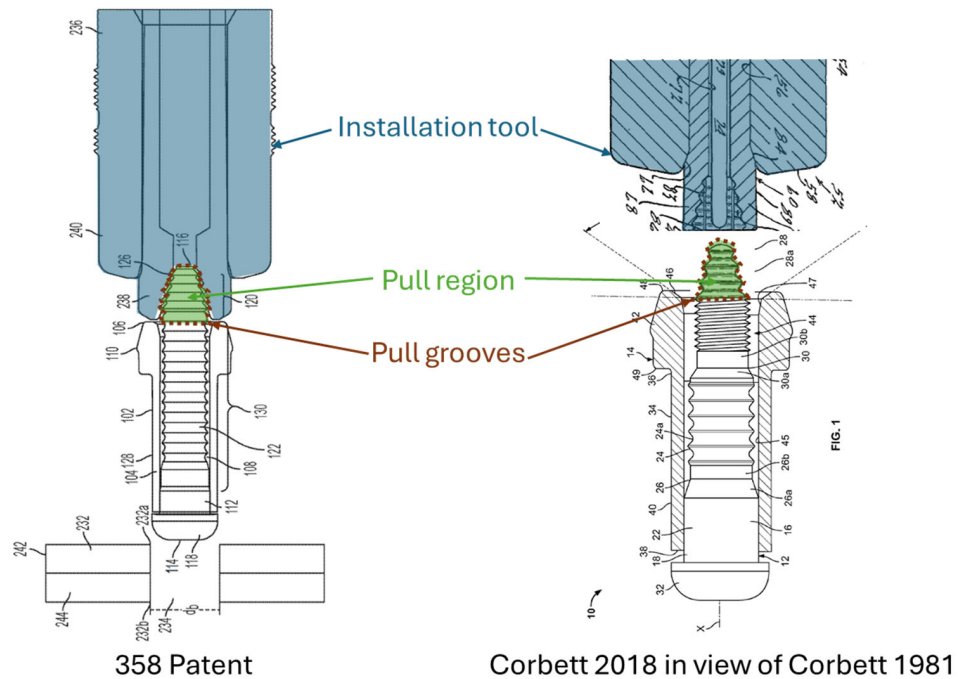


10. Claim 9: “The blind fastener of claim 1, wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove.”

185. As described in Grounds 1-2, Corbett 2018 anticipates this claim.

Corbett 1981 also discloses a grooved pull region. Noting that Corbett 1981 describes the pull region of a pull type fastener as the “pintail region,” Corbett 1981 discloses “[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.” EX1007, 3:10-14. Furthermore, Corbett 2018 in view of Corbett 1981 comprises the short, tapered pull region comprising a plurality of grooves (and thus “a groove”) at the second mandrel end taught by Corbett 1981.

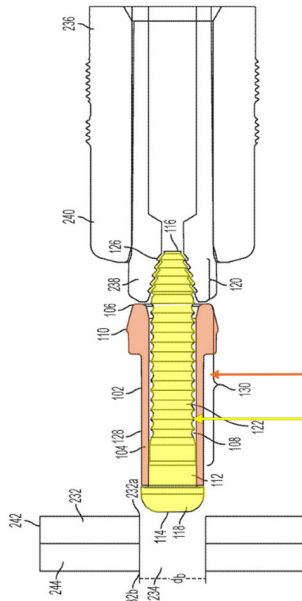
186. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a blind fastener “wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove,” as recited in claim 9, and thereby renders this claim obvious as illustrated below.



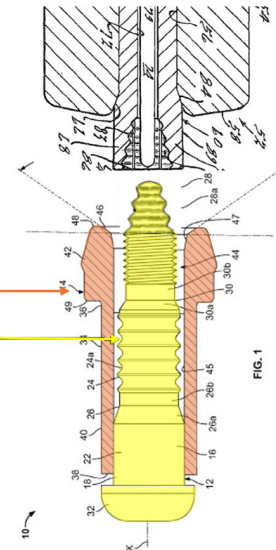
11. Claim 10: “The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical.”

187. As described in Grounds 1-2, Corbett 2018 anticipates this claim.

Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a blind fastener “wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical,” as recited in claim 10, and thereby renders this claim obvious as illustrated below.



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Corbett 2018 in view of Corbett 1981

12. 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.”

188. As described in Grounds 1-2, Corbett 2018 anticipates this claim. As further described in my discussion of claims 6 and 7, Corbett 1981 likewise discloses a pull type fastener comprised of “exotic metals such as titanium.” EX1007, 1:55-61. Moreover, a POSITA would understand that fastener components are typically manufactured from metals or metal alloys to provide the combination of strength, hardness, and toughness required for structural fastening applications. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a blind fastener “wherein the blind fastener comprises at least one of a metal, metal

alloy, and a composite material,” as recited in claim 11, and thereby renders this claim obvious.

13. 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.”

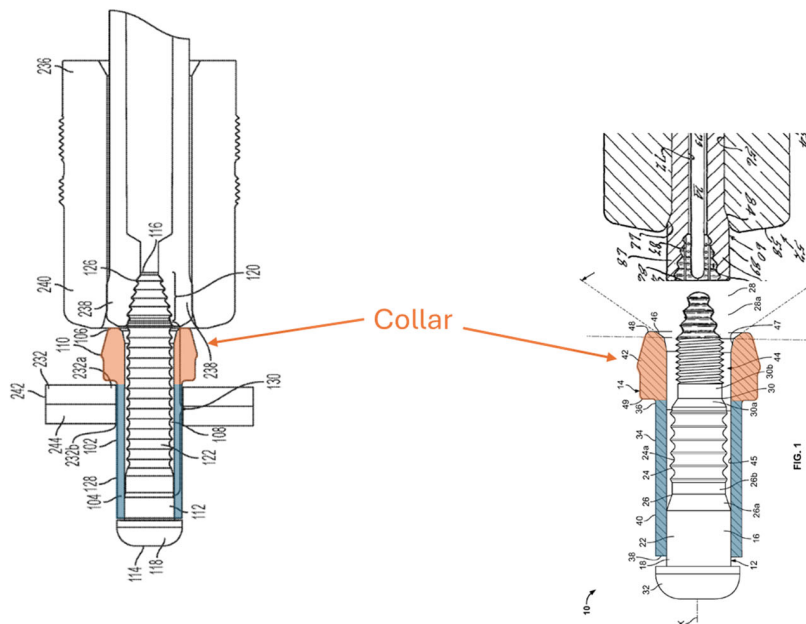
189. As described in Grounds 1-2, Corbett 2018 anticipates this claim. As further described in my discussion of claims 6 and 7, Corbett 1981 likewise discloses “wherein the blind fastener is adapted to be installed in a bore in a structure, the bore having a diameter greater than the diameter of the enlarged portion,” as recited in claim 12, and thereby renders this claim obvious.

14. 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.”

190. As described in Grounds 1-2, Corbett 2018 anticipates this claim.

191. Corbett 1981 further teaches that the installation tool includes a swaging anvil that engages the collar and swages the collar into locking engagement with grooves on the shank portion of the pin in reaction to the applied pulling force. EX1007, 1:31-34. Corbett 1981 likewise explains that a “swageable collar 120” is “swaged during setting of the fastener” into corresponding “annular lock grooves 122.” *Id.* 6:19-25.

192. Accordingly, Corbett 2018 in view of Corbett 1981 also comprises a blind fastener “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 recited in claim 13, and thereby renders this claim obvious as illustrated below.



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Corbett 2018 in view of Corbett 1981

As can be seen in this figure, the collar in the pictured embodiment of the '358 Patent is directly analogous to the “head of the sleeve” of the fastener of Corbett 2018 in view of Corbett 1981.

15. 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.”

193. As described in Grounds 1-2, Corbett 2018 anticipates and renders obvious this claim. Corbett 1981 further discloses that fasteners “fabricated from more costly, exotic metals such as titanium” “are commonly used in the aerospace industry.” EX1007, 1:55-67.

194. A POSITA would have understood that, in aerospace applications, the structural components being joined—such as aircraft skins/panels, frames, stringers, and other load-bearing members—are commonly fabricated from metals and metal alloys (e.g., aluminum and titanium alloys) and, increasingly, composite materials. Accordingly, a POSITA would understand that the types of structures into which Corbett 2018’s blind fastener is installed commonly comprise at least one of a metal, a metal alloy, or a composite material, as recited in claim 14, and thereby renders this claim obvious.

16. 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.”

195. As described in Grounds 1-2, Corbett 2018 anticipates and renders obvious this claim.

196. Corbett 1981 likewise explains that “[w]hile present material costs attributable to this lengthy pintail when such pull type fasteners are fabricated from

low cost materials may not be significant enough to generate much concern, this is not necessarily the case when the fasteners are fabricated from more costly, exotic metals such as titanium which are commonly used in the aerospace industry.”

EX1007, 1:55-61. As such, the fastener presented in Corbett 1981, which is intended to reduce material waste of expensive metals in the aerospace industry, is directed towards use in the aerospace industry. Accordingly, a POSITA would understand that applying Corbett 2018 in view of Corbett 1981 to aerospace fastening contexts entails securing structural “work pieces” that are aerospace components (i.e., aircraft structural parts), thereby meeting the “aerospace component” configuration recited in claim 15.

197. Moreover, a POSITA would recognize that blind fasteners are applicable to myriad joining applications regardless of the particular use of the component being joined. As explained in Section VIII, “Subject Matter of the ’358 Patent,” a POSITA would recognize that the blind fasteners are often used for applications in the aerospace industry. Accordingly, Corbett 2018 in view of Corbett 1981 comprises a blind fastener “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 recited in claim 15, and thereby renders this claim obvious.

17. Claim 16

a. Limitation 16(pre): “A method for fastening, the method comprising:”

198. As described in Grounds 1-2, Corbett 2018 anticipates the preamble. Accordingly, Corbett 2018 in view of Corbett 1981 likewise teaches “a method for fastening,” and thereby renders this claim obvious.

b. Limitation 16(a): “inserting a first mandrel end of a blind fastener into a bore in a structure,”

199. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Accordingly, Corbett 2018 in view of Corbett 1981 likewise teaches “inserting a first mandrel end of a blind fastener into a bore in a structure” as recited by in this limitation, and thereby renders this claim obvious.

c. Limitation 16(b): “the blind fastener comprising a sleeve comprising a first sleeve end, a second sleeve end, and a cavity extending from the first sleeve end to the second sleeve end, and”

200. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(b) is substantially the same as limitation 1(a). For the reasons discussed in those corresponding sections, Corbett 2018 renders obvious this limitation.

d. Limitation 16(c): “a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising,”

201. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(c) is substantially the same as limitation 1(b). For the reasons discussed in those corresponding sections, Corbett 2018 renders obvious this limitation.

e. Limitation 16(d): “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,”

202. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(d) is substantially the same as limitation 1(c). For the reasons discussed in those corresponding sections, Corbett 2018 renders obvious this limitation.

f. Limitation 16(e): “a second mandrel end comprising a pull region, and”

203. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(e) is substantially the same as limitation 1(d). For the reasons discussed in those corresponding sections, Corbett 2018 alone or in combination with Corbett 1981 renders obvious this limitation.

g. Limitation 16(f): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

204. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(f) is substantially the same as limitation 1(e). For the reasons discussed in those corresponding sections, Corbett 2018 renders obvious this limitation.

h. 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;”

205. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Moreover, limitation 16(g) is substantially the same as limitation 1(f). For the reasons discussed in those corresponding sections, Corbett 2018 alone or in combination with Corbett 1981 renders obvious this limitation.

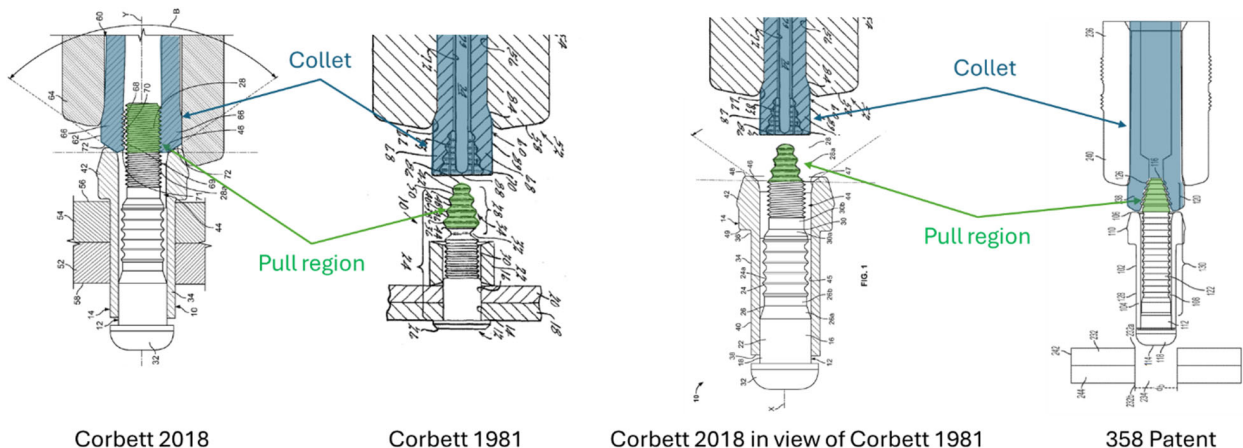
i. Limitation 16(h): “engaging a collet of the installation tool with the pull region of the blind fastener;”

206. As described in Grounds 1-2, Corbett 2018 anticipates this limitation.

207. Corbett 1981 likewise discloses “[a]s seen in Fig. 2, when installation tool 52 is applied to fastener 10, the 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 and compressing spring 78. Thereafter, the tool 52 is actuated to its pulling stroke causing collet carrying member 62 to move longitudinally relative to the anvil assembly 54. As 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.” EX1007, 4:1-14.

208. The engagement between the collet of an installation tool and the pull region of Corbett 2018 in view of Corbett 1981 is further shown in the figure below comparing Fig. 2A of the '358 Patent to Fig. 2 of Corbett 2018, Fig. 1 of Corbett 1981, and a combined figure illustrating Corbett 2018 in view of Corbett 1981.



209. Accordingly, Corbett 2018 in view of Corbett 1981, also discloses “engaging a collet of the installation tool with the pull region of the blind fastener” as recited in limitation 16(h), and thereby renders this limitation obvious.

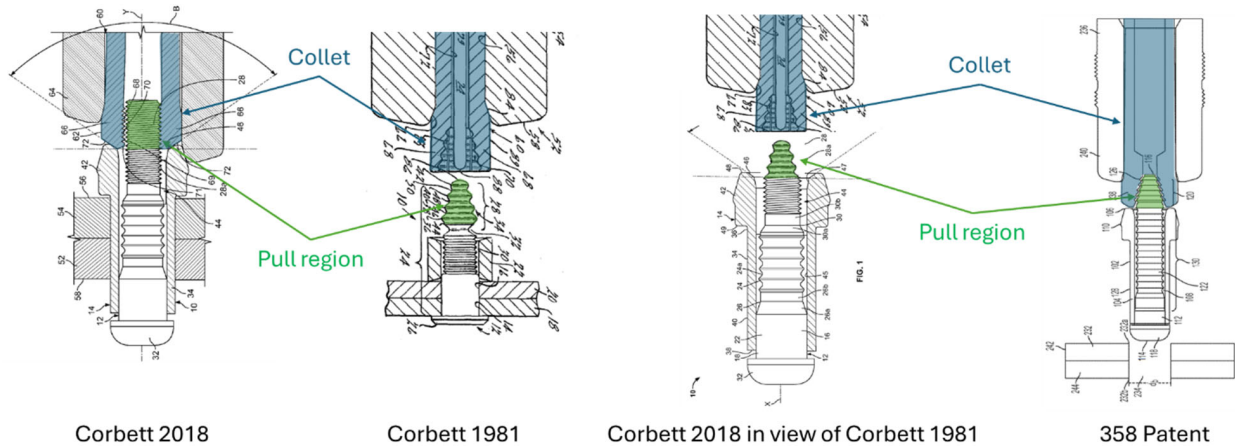
- j. **Limitation 16(i): “after the inserting, forcibly contacting the second sleeve end of the blind fastener with an anvil of the installation tool and moving the**

pull region distal from the second sleeve end utilizing the collet of the installation tool; and”

210. As described in Grounds 1-2, Corbett 2018 anticipates this limitation.

211. Corbett 1981 likewise describes that “[a]s seen in Fig. 2 when installation tool 52 is applied to fastener 10, the terminal end surface 86 of pintail portion 28 will engage... As 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. When jaw portion 68 is in a fully closed position, outer surface 89 engages the sidewall of bore 56 along its length axially outwardly from inclined surface 84 holding the fingers of jaw portion 68 closed as a pulling force is exerted on pin 12 pulling force is exerted on pin 12.” EX1007, 4:1-18.

212. Accordingly, Corbett 2018 in view of Corbett 1981 discloses that, after insertion, the second sleeve end of Corbett 2018’s blind fastener is forcibly contacted by a swaging anvil of Corbett 1981’s installation tool, while the modified pull region is pulled distally relative to the second sleeve end using the collet/jaws of Corbett 1981’s tool, as illustrated in the figures below comparing Fig. 2A of the ’358 Patent to Fig. 2 of Corbett 2018, Fig. 1 of Corbett 1981, and a combined figure illustrating Corbett 2018 in view of Corbett 1981. Corbett 2018 in view of Corbett 1981 thereby renders this limitation obvious.



- k. **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.”**

213. As described in Grounds 1-2, Corbett 2018 anticipates this limitation. Accordingly, Corbett 2018 in view of Corbett 1981 also discloses this limitation, and thereby renders this limitation obvious. Thus, Corbett 2018 in view of Corbett 1981 renders claim 16 obvious.

18. **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.”**

214. Claim 17 is substantially the same as claim 2. For the reasons discussed in my analysis of claim 2, Corbett 2018 alone and/or in combination with Corbett 1981 renders obvious claim 17.

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

215. Claim 18 is substantially the same as claim 4. For the reasons discussed in my analysis of claim 4, Corbett 2018 alone and/or in combination with Corbett 1981 renders obvious claim 18.

20. Claim 19: “The method of claim 16, wherein the mandrel does not comprise a breakneck groove.”

216. Claim 19 is substantially the same as claim 5. For the reasons discussed in my analysis of claim 5, Corbett 2018 renders obvious claim 19.

21. 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.”

217. Claim 20 is substantially the same as claim 11. For the reasons discussed in my analysis of claim 11, Corbett 2018 alone and/or in combination with Corbett 1981 renders obvious claim 20.

C. Invalidity Ground IV: Corbett 2018 In View of Corbett 1981 and the Knowledge of a POSITA (including Hurd '297)

1. Corbett 2018, Corbett 1981, and Hurd '297 Are Analogous Art

218. I understand that, for a reference to be considered relevant analogous prior art for obviousness purposes, it must be either (1) from the same field of endeavor as the invention, regardless of the problem addressed, or (2) if not within the field of the inventor’s endeavor, still reasonably pertinent to the particular

problem with which the inventor is involved. Corbett 2018 and Corbett 1981 are analogous art under either condition.

219. Corbett 2018 and Corbett 1981 are both directed to pull type fasteners and are relevant analogous art as described in my analysis in Section X.B. Hurd '297 is also directed to a blind fastener, and in particular a pull type fastener, and is therefore also analogous art to the '358 Patent. EX1008, 1:7-48.

a. Motivation to Modify Corbett 2018 in View of Corbett 1981 and the Knowledge of a POSITA (Hurd '297)

220. As explained above in reference to Invalidity Ground I, a POSITA would be motivated to and have reasonable expectation of success in modifying the pull region 28 of Corbett 2018 to incorporate the grooved taper shape of Corbett 1981 and use titanium for manufacturing the mandrel because Corbett 1981 explicitly discloses the use of titanium for the fastener and potential aerospace applications.

221. In addition to the disclosures within Corbett 2018 and Corbett 1981, a POSITA would have been motivated to incorporate Hurd's teachings regarding use of an alloy-steel mandrel having a Rockwell hardness of approximately HRC 49–52 into the mandrel of Corbett 2018, either alone or in view of Corbett 1981. Hurd '297 discloses that “the pin 12 must be of sufficient strength to withstand the frictional forces encountered during setting without significant wire drawing,”

where the pin 12 is the mandrel. EX1008, 3:1-3. Wire drawing refers to stretching and thinning of the mandrel due to plastic deformation. Hurd '297 then provides that “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.” EX1008, 3:14-16. “Rc” is an abbreviation of HRC as used in the Asserted Patent.

222. A POSITA would understand that Corbett 2018 is directed to a high-strength, pull-type blind fastener intended to achieve substantial clamp loads while maintaining reliability during installation and service, and that Corbett 1981 similarly addresses structural fastening considerations. In that context, specifying a hardened alloy-steel mandrel within Hurd’s disclosed hardness range would have been an ordinary design choice directed to improving installation robustness and joint reliability. This motivation would arise from predictable, well-understood benefits associated with increasing mandrel hardness in pull-type blind fasteners. For example, higher hardness provides increased resistance to plastic deformation (including localized “wire drawing” or necking) as the mandrel is tensioned by the installation tool; it improves resistance to stripping, rounding, or other damage at tool-engagement features such as pull grooves and threads under high pull loads; and it enhances wear resistance and durability at the pull region during repeated or high-friction tool engagement. Higher hardness also contributes to more consistent installation performance in demanding operating conditions (including high-load

and high-vibration environments) by reducing unintended deformation that can alter the pull sequence or compromise the designed failure location in cases where the mandrel includes a breakneck groove. These advantages are directly aligned with the performance objectives in Corbett 2018 and Corbett 1981—namely, reliable tool engagement, controlled installation behavior, and structural integrity of the installed joint—such that a POSITA would have had a reasonable expectation of success in applying Hurd’s hardened alloy-steel mandrel teachings to Corbett’s fastener designs.

223. Hence, a POSITA would understand that Corbett 2018 in view of Corbett 1981 would render obvious using a material with Rockwell hardness around 49-52 HRC to construct the mandrel of Corbett 2018 in view of the teachings of Corbett 1981.

b. Simple Substitution of One Known Element for Another

224. A POSITA also would have had a reasonable expectation of success in applying the Hurd ’297 high-hardness mandrel teachings to Corbett 2018, either alone or in view of Corbett 1981, because the modification is a straightforward substitution of a known material property—mandrel hardness—using conventional alloy-steel selections and heat-treatment techniques to achieve an established function in pull-type blind fasteners, namely resisting plastic deformation, unintended fracture, and frictional wear during the setting operation. Consistent

with the principles recognized in *KSR*, this type of substitution—where a POSITA selects a known alternative within the ordinary skill of the art to obtain predictable improvements in performance—would have been well within routine engineering practice.

225. Moreover, Hurd '297 does not merely suggest increased mandrel hardness in the abstract; it provides concrete implementation guidance by identifying suitable material pairings and compatible component materials (including sleeve and workpiece materials) for use with a hardened mandrel and discloses examples of combinations that operate reliably together. For example, Hurd '297 discloses specific materials for the sleeve and workpieces that are compatible with a mandrel with Rockwell hardness around 49-52 HRC and provides guidelines for material selection. EX1008, 3:1-27. This express guidance addresses the very compatibility considerations a POSITA would evaluate (e.g., avoiding galling, ensuring controlled deformation of the sleeve rather than the mandrel, and maintaining reliable tool engagement), and confirms that a POSITA would reasonably expect that incorporating Hurd's mandrel-hardness teachings into Corbett 2018 (or Corbett 2018 in view of Corbett 1981) would function as intended.

2. Claim 6: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25.”

226. To the extent that the Corbett 2018 fastener modified obviously in view of Corbett 1981 does not render obvious claim 6 as discussed previously in reference to Invalidity Ground II, Corbett 2018 in view of Corbett 1981 and in further view of Hurd '297 renders obvious this limitation. As discussed above, the Corbett 2018 in view of Corbett 1981 and further in view of Hurd '297 comprises the alloy steel mandrel comprising a Rockwell hardness of HRC 49-52 (abbreviated as Rc in Hurd '297) disclosed by Hurd '297. Hurd '297 discloses an embodiment comprising “a high hardness pin 12 made of alloy steel AISI 8740 and having a hardness of around 49-52 Rc.” EX1008, 3:15-16. Noting that Hurd '297 refers to the mandrel as a “pin,” Hurd '297 further discloses the composition of the mandrel of the pull type fastener, claiming “[t]he assembly of claim 1, with said pin being made of an alloy steel having a hardness of around 49-52 Rc.” EX1008, 4:20-22 (claim 5).

227. Given that Corbett 2018 in view of Corbett 1981 and in further view of Hurd '297 comprises the alloy steel mandrel of Hurd '297 (comprising a Rockwell hardness of HRC 49-52), the modified Corbett 2018 fastener comprises a blind fastener “wherein the mandrel comprises a Rockwell hardness of at least

HRC 25” as recited in claim 6, and Corbett 2018 in view of Corbett 1981 and in further view of Hurd ’297 thereby renders this claim obvious.

3. Claim 7: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43.”

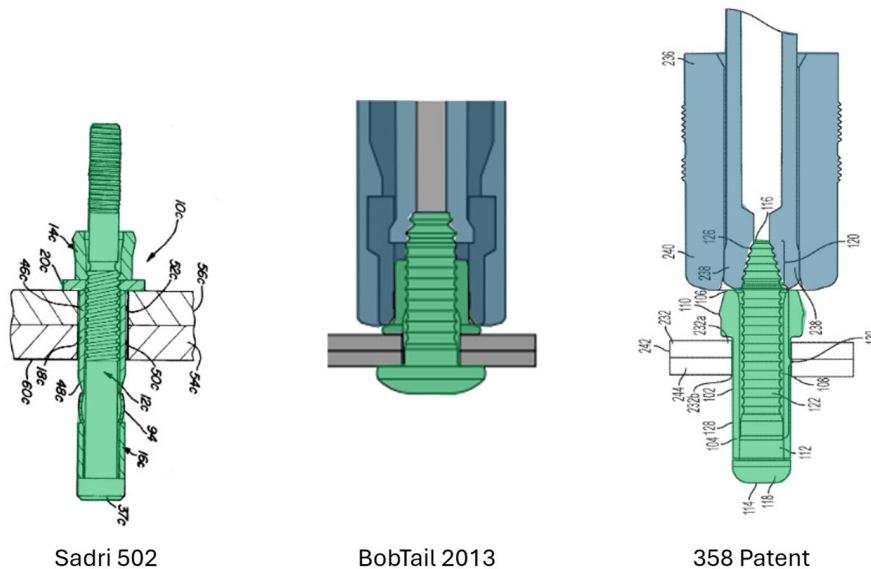
228. As discussed in my analysis of claim 6, Corbett 2018 in view of Corbett 1981 and further in view of Hurd ’297 comprises the alloy steel mandrel of Hurd ’297 (comprising a Rockwell hardness of HRC 49-52). Thus, the modified Corbett 2018 fastener comprises a blind fastener “wherein the mandrel comprises a Rockwell hardness of at least HRC 43” as recited in claim 7, and Corbett 2018 in view of Corbett 1981 and in further view of Hurd ’297 thereby renders this claim obvious.

D. Invalidity Ground V: Sadri ’502 in view of BobTail 2013

1. Sadri ’502 and BobTail 2013 are Analogous Art

229. I understand that, for a reference to be considered relevant analogous prior art for obviousness purposes, it must be either (1) from the same field of endeavor as the invention, regardless of the problem addressed, or (2) if not within the field of the inventor’s endeavor, still reasonably pertinent to the particular problem with which the inventor is involved. Sadri ’502 and BobTail 2013 are analogous art under either condition.

230. Sadri '502 and BobTail 2013 are both directed to fastening systems for pull type fasteners, as described in Section VIII, "Subject Matter of the '358 Patent." In summary, both Sadri '502 and BobTail 2013 disclose a pull type fastener and an installation tool which simultaneously pulls on the inner mandrel portion of the fastener while engaging with the outer sleeve portion of the fastener. Below are annotated comparisons of Sadri '502 Fig. 8, a figure from page 3 of BobTail 2013, and Fig. 1 of the '358 Patent. Hence, both Sadri '502 and BobTail 2013 are in the same field of endeavor as the '358 Patent.



231. Sadri '502 and BobTail 2013 are also pertinent to the same problem faced by the '358 Patent's inventor. The '358 Patent seeks to address the problem of designing a blind fastener and a "method of installation that can reduce installation forces and increase corrosion resistance." '358 Patent, 3:46-49. The '358 Patent elaborates on the reduction of installation forces by describing that:

A partially engaged collet 238 may not be able to apply a force to the pull region 120 sufficiently to appropriately move the mandrel 112 relative to the sleeve 102. The grooves and taper of the pull region 120 can reduce potential stripping of the grooves 126 due to crest-to-crest engagement. '358 Patent, 6:55-60, emphasis added.

The blind fastener according to the present disclosure can enable use of a smaller installation tool for installation since the force required to install the blind fastener may be less than a force that can fracture the mandrel. '358 Patent, 7:28-31, emphasis added.

232. In comparison, Sadri '502 explicitly refers to its fastener as a blind fastener. Sadri '502, Abstract. The pull-type fastener of BobTail 2013 also aims to offer “improved corrosion resistance” via “pintail-less design.” EX1010, p.3. Furthermore, the pull tool described in BobTail 2013 “makes the installation process quicker and easier by reducing the force required to install each fastener.” EX1010, p. 6. Hence, both invention of Sadri '502 and the product of BobTail 2013 are reasonably pertinent to the problem disclosed by the '358 Patent.

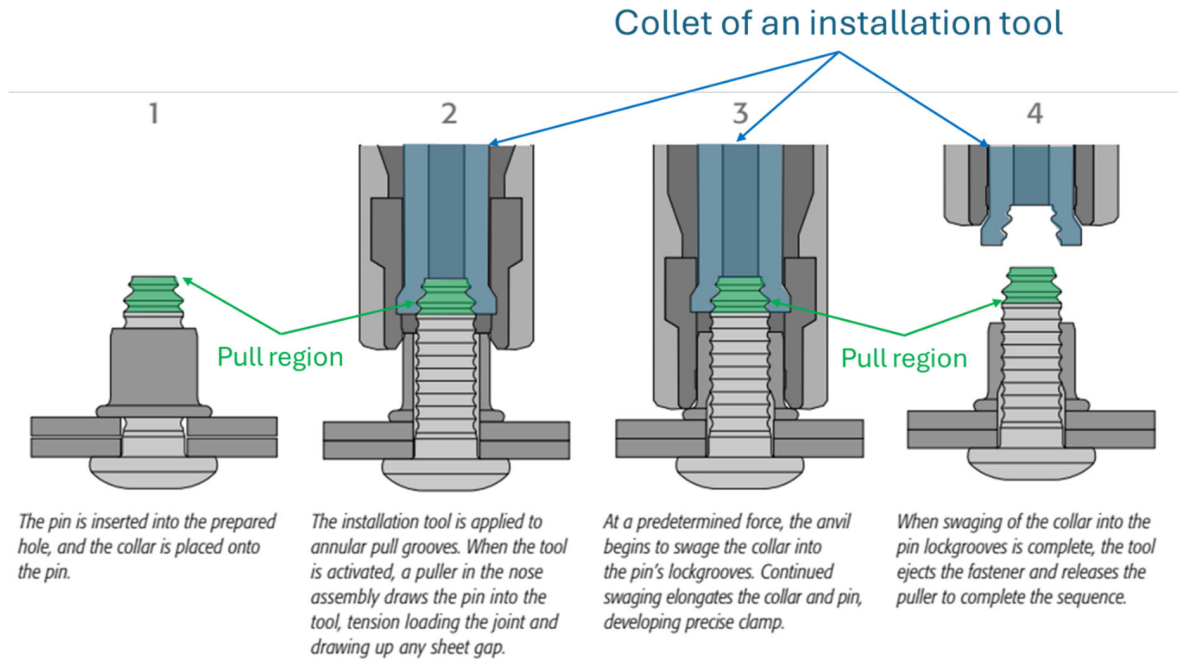
a. Motivation to Modify Sadri '502 in View of BobTail 2013

233. BobTail 2013 aims to reduce the amount of material used by a pull type fastener, aiming to reduce costs and increase installation speeds. EX1010, p. 2. BobTail 2013 remarks that a (emphasis added) “[p]intail-less design means reduced noise, no waste, and improved corrosion resistance.” EX1010, p. 3. As mentioned previously, pintails are the portion of the mandrel that includes the pull region and fractures off during installation under the force of the installation tool.

BobTail 2013 further describes an installation tool which “is applied to the annular pull grooves. When the tool is activated, a puller in the nose assembly draws the pin into the tool.” EX1010, p. 3.

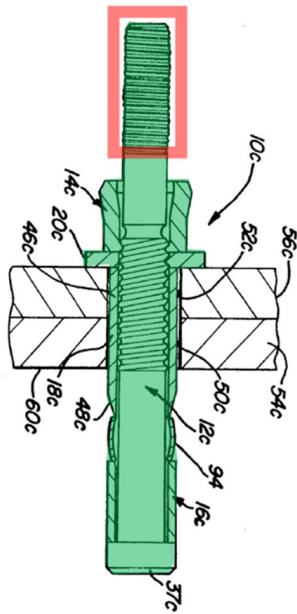
234. Similar to Corbett 1981 (discussed in “Motivation to Modify Corbett 2018 in View of Corbett 1981”), BobTail 2013 comprises a short, tapered pull region. Similar to Corbett 1981, this tapered geometry reduces the possibility of stripping the pull grooves during installation. As discussed previously in Sections VIII.C “Blind and Non-Blind Pull Type Fasteners” and X.B “Invalidity Ground III: Corbett 2018 In View of Corbett 1981”—which are expressly incorporated here—there is ample motivation to combine design elements from non-blind and blind pull type fasteners. Such combinations can be made with more than a reasonable expectation of success and have been made previously.

235. The geometry of the pull region (the region on the mandrel comprising pull grooves which is engaged by the installation tool), of BobTail 2013 is shown in an annotated graphic below from p. 3 of BobTail 2013. As can be seen below, the diameter closer to the tip of the fastener and towards the installation tool is smaller than the diameter of the grooves directly underneath it. As discussed previously, this geometry offers the benefit of reducing the possibility of stripping the pull grooves during installation by helping to ensure proper engagement between the tool and pull region.



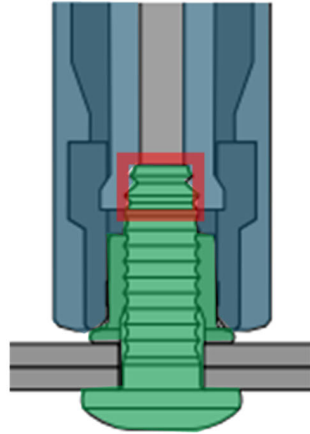
236. Similarly to BobTail 2013, Sadri '502 comprises pull grooves which are engaged by an installation tool during installation. EX1009, 24:38-41 (claim 17). Fig. 8 of Sadri '502 and a figure from p. 3 of BobTail 2013 are shown below with annotations added. For brevity, and in line with the teachings of the '358 Patent, the portion of the mandrel of BobTail 2013 comprising annular pull grooves which is engaged by the installation tool is henceforth referred to as the pull region of BobTail 2013.

Pintail portion 40



Sadri 502

Pull region



BobTail 2013

237. A POSITA would be motivated to modify the pintail portion 40 of Sadri '502 to incorporate the grooved, tapered pull region (as well as modifying the installation tool to incorporate a corresponding grooved taper shape) of BobTail 2013 for multiple reasons. Firstly, Sadri '502 discloses that it is “it is desirable to minimize stress concentrations at high load areas.” EX1009, 10:30-31. A POSITA would recognize that misalignment between the collet of an installation tool and the pull grooves of a pull type fastener would result in large stress concentrations and bending stresses when a misaligned installation load is applied. As such, a POSITA would be motivated to incorporate the tapered pull region of

BobTail 2013 into the design of Sadri '502, modifying the mating grooves on the installation tool of Sadri '502 accordingly.

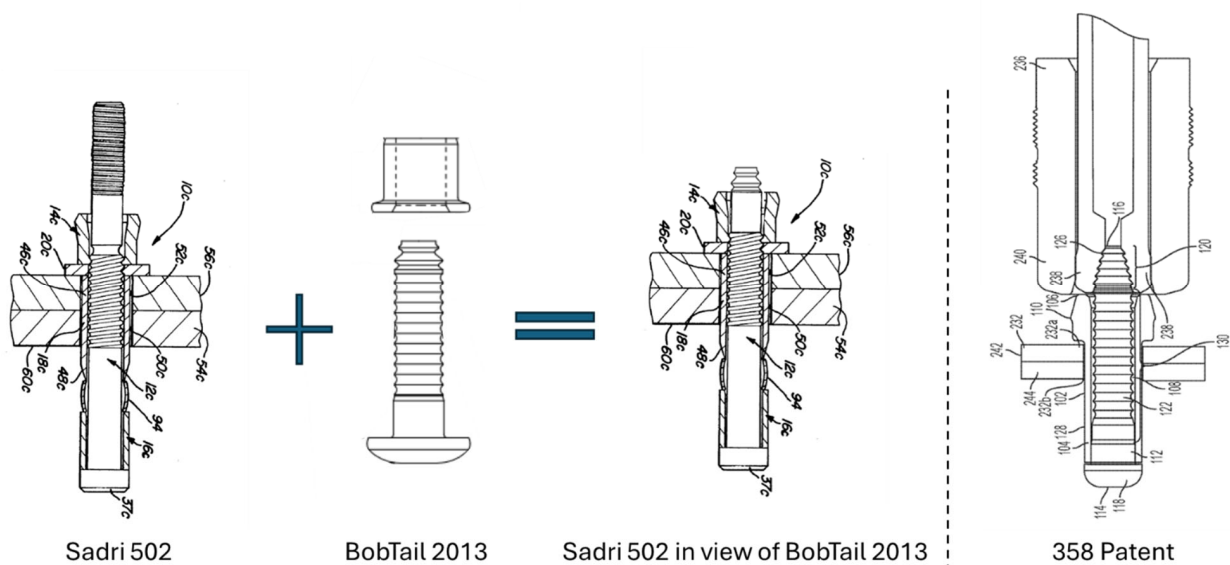
238. Additionally, Sadri '502 teaches a fastener comprised of "4130 steel of aircraft quality." EX1009, 8:42-46. A POSITA would recognize that such materials are costly and would be motivated to minimize material waste. Noting that the pintail of a blind fastener is typically discarded after use, a POSITA recognize the "pintail-less design" of BobTail 2013 reduces waste by avoiding the incorporation of a breakoff pintail. EX1010, p. 3. As such, a POSITA would be motivated to remove the breakneck groove 42 of Sadri '502, in line with BobTail 2013.

239. BobTail 2013 emphasizes that the "pintail-less design" offers "improved corrosion resistance." EX1010, p. 3. As such, a POSITA would be further motivated to incorporate the pintail-less mandrel design of BobTail 2013 into the design of Sadri '502 to eliminate the fresh metal surface subject to corrosion that emerges when Sadri's breakneck fractures during installation.

b. Simple Substitution of One Known Element for Another

240. A POSITA would have a reasonable expectation of success in this modification because this modification would amount to a simple substitution of one known element for another with no more than the predictable use and result of the elements according to their established functions. Below is an illustration of the

result of removing the breakneck groove 42 and modifying pintail portion 40 of Sadri '502 with the pull region of BobTail 2013. A POSITA would understand that modifying the shape of the pull region for the purposes of reducing installation tool engagement errors and removing the breakneck to reduce material waste and corrosion risk would not affect the operation of the rest of the fastener system. In the figure below (which features Fig. 8 of Sadri '502, figures from pp. 4-5 of BobTail 2013, and Fig. 2A of the '358 Patent), Sadri '502 in view of BobTail 2013 is shown alongside the Sadri '502, BobTail 2013, and '358 Patent fasteners.



241. Sadri '502 in view of BobTail 2013 satisfies every limitation in the challenged claims, as shown below.

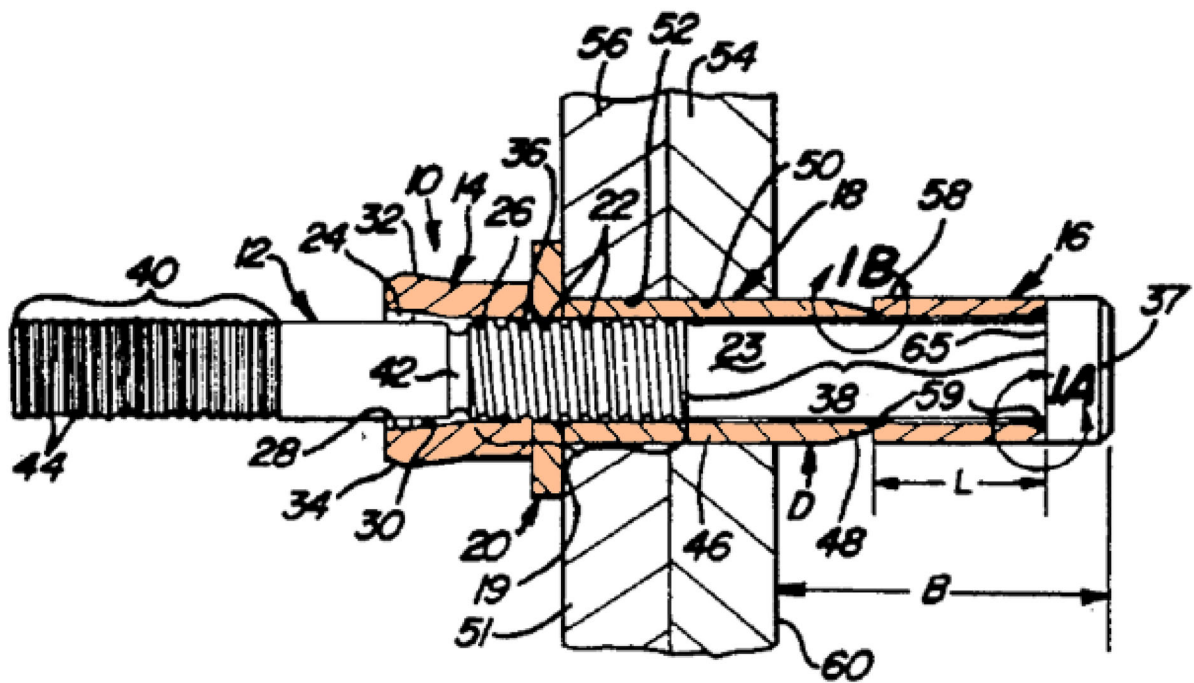
2. Claim 1

a. Limitation 1(pre): “A blind fastener comprising”

242. Sadri '502 discloses “a blind fastener,” with the patent itself titled “High Strength Blind Bolt.” EX1009, [54]. Accordingly, Sadri '502 in view of BobTail 2013 also comprises a blind fastener, as recited in this limitation. Despite incorporating BobTail 2013’s teachings regarding its pull region and removing the breakneck groove, Sadri '502 in view of BobTail 2013 would remain a blind fastener. Thus, Sadri '502 in view of BobTail 2013 renders this element obvious.

b. 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; and”

243. Sadri '502 discloses this claim limitation. As discussed in Section IX.D above, Sadri '502 discloses an embodiment comprising a blind fastener with a main (secondary) sleeve, an expandable (primary) sleeve, and a collar—which together define a sleeve system that performs the same structural and load-bearing functions attributed to the claimed “sleeve” in the '358 Patent. This configuration is illustrated in Sadri '502’s Figure 1 (annotated) below.



244. As discussed above, a POSITA would understand these components to operate as one sleeve system because they are coaxially assembled around the pin/mandrel, are axially engaged and load-coupled during installation, and function cooperatively as the sleeve-side structure that reacts against the installation tool to form the installed joint (including blind-side deformation and collar swaging).

EX1009, 1:13-18 (“multi-piece blind bolt fasteners [that] include a main sleeve, an expandable sleeve and a pin”), 1:57-59 (collar transmits axial force from the swage anvil to the main sleeve), 5:21-29, 6:49-7:15 (describing axial movement and radial expansion of the sleeve components to form the joint). In particular, during setting, the collar is swaged and simultaneously drives axial loading through the sleeve stack, while the expandable sleeve moves and expands radially to form the

blind head—so the three components collectively provide the sleeve-side structure that bears installation loads and remains in the joint after installation. EX1009, 6:49-7:15.

245. The end of Sadri '502's expandable sleeve on the right side of the annotated figure above corresponds to the claimed "first sleeve end," while Sadri '502's collar on the left side of the annotated figure corresponds to the claimed "second sleeve end." The hollow cavity extending throughout the sleeve system corresponds to the claimed "cavity extending from the first sleeve end to the second sleeve end." Specifically, Sadri '502 discloses that "collar 14 has a through bore 24" and that Sadri '502's "main sleeve member" has "a first through bore adapted to receive said pin shank" while the "expandable sleeve member" has "a second through bore adapted to receive said pin shank." EX1009, 5:30-40, 18:23-34. Sadri '502 also discloses that its pin can "move axially through the collar 14." EX1009, 6:58-7:15. The Sadri '502 figure above shows a washer 20 included in the sleeve system. Sadri '502 discloses that the washer may be integrated into the collar 14 or omitted altogether. EX1009, 5:41-44.

246. Sadri '502 also discloses that "[t]he secondary or main sleeve 18 has a straight shank portion 46 of generally constant outside diameter D and a tapered nose portion 48 at its inner end." EX1009, 6:28-30. Sadri '502 further discloses:

The shank portion 46 of secondary sleeve 18 extends through aligned openings 50 and 52 in a pair of work pieces 54 and 56, respectively, with the

first sleeve end, a second sleeve end, a cavity extending from the first sleeve end to the second sleeve end” as recited in this limitation, and thereby renders it obvious.

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

249. Sadri ’502 renders this claim limitation obvious. Sadri ’502 describes a blind fastener with a “main sleeve member having a first through bore adapted to receive said pin shank with said first bore having a central axis.” EX1009 ’502, 19:20-23. Sadri ’502 also discloses a “pin member” that includes the entire member extending through Sadri ’502’s sleeve system. That is, Sadri ’502’s pin member is received by the cavity of the sleeve. A POSITA would recognize the “pin member” disclosed by Sadri ’502 to be a mandrel.

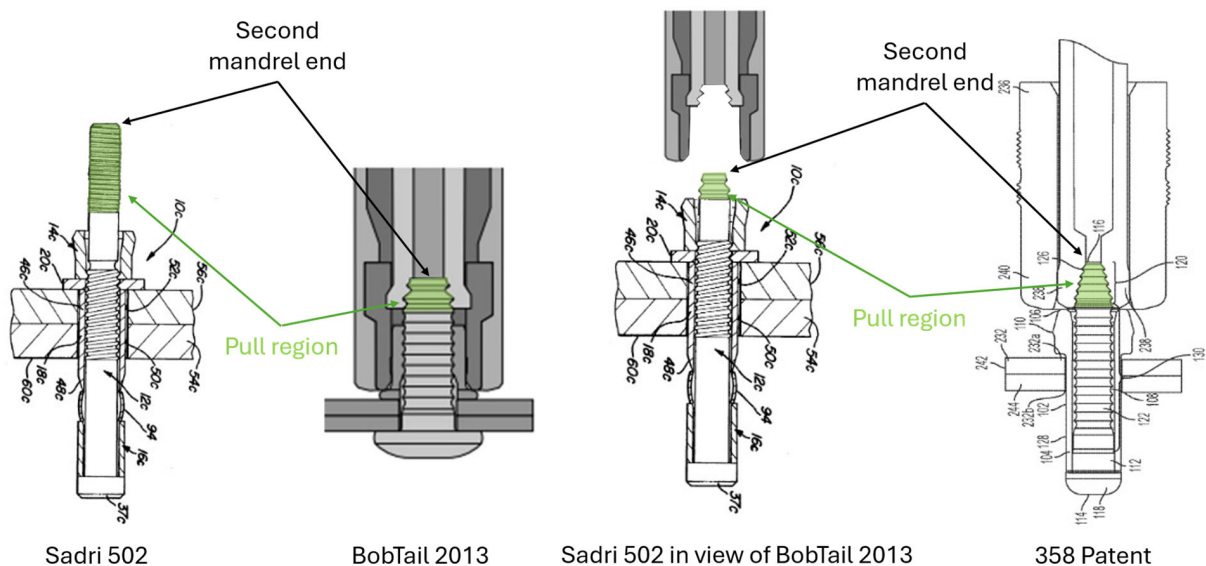
250. My analysis of Limitation 1(a) also contains a figure showing the mandrel at least partially received by the cavity of the sleeve.

d. 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,”

251. Sadri ’502 renders this claim limitation obvious. Sadri ’502 states “[t]he pin member 12 has an enlarged head 37 at one end of the pin shank 23.” EX1009, 6:19-20. As shown below, the “enlarged head” described in Sadri ’502 (which Sadri ’502 in view of BobTail 2013 comprises) is of a diameter greater than that of the cavity formed by the sleeve.

second mandrel end comprising a pull region. BobTail 2013 discloses that “[t]he installation tool is applied to the annular pull grooves. When the tool is activated a puller in the nose assembly draws the pin into the tool.” EX1010, p. 3. A POSITA would recognize the region of the “pin” of BobTail 2013 (which comprises annular pull grooves) comprises a pull region.

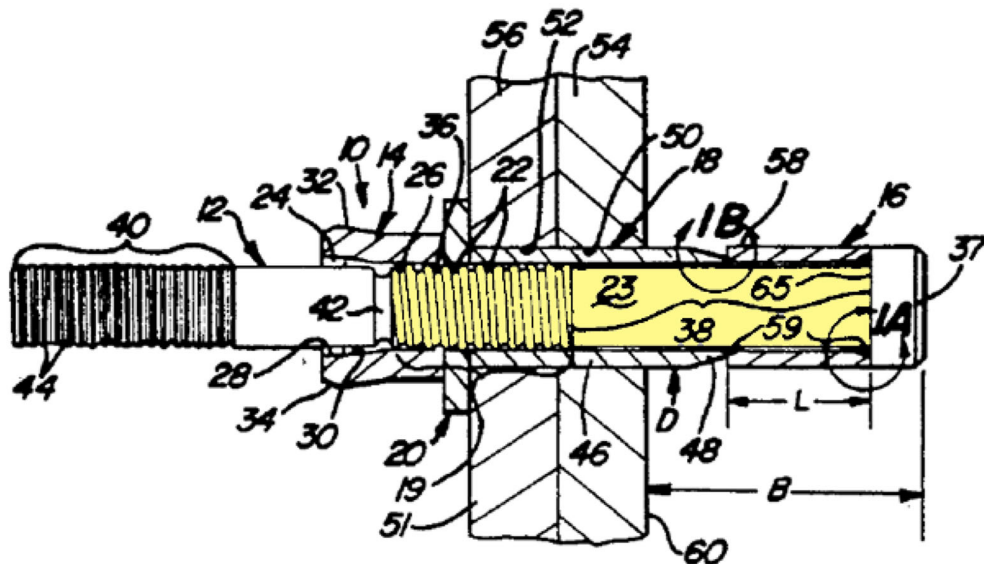
254. Furthermore, Sadri ’502 in view of BobTail 2013 comprises the short, tapered pull region at the second mandrel end taught by BobTail 2013 as shown below in a figure comparing Fig. 2A of the ’358 Patent to Fig. 8 of Sadri ’502, a figure from p. 3 of BobTail 2013, and Sadri ’502 in view of BobTail 2013 (with annotations added).



255. As such, Sadri ’502 in view of BobTail 2013 discloses this limitation. Accordingly, Sadri ’502 in view of BobTail 2013 comprises a mandrel with “a second mandrel end comprising a pull region” as recited in this limitation.

f. Limitation 1(e): “a shank region extending intermediate the first mandrel end and the second mandrel end,”

256. Sadri '502 renders this claim limitation obvious. Sadri '502 describes a blind fastener with a (emphasis added) “pin member having an elongated pin shank terminating at one end in an enlarged pin head.” EX1009, 18:18-19. As mentioned in my analysis of Limitation 1(d), the second end of the pin shank of Sadri '502 terminates in a “pull portion comprising a plurality of pull grooves.” EX1009, 18:18-19. Thus, the pin shank region disclosed by Sadri '502 extends intermediate to a first and second mandrel end, as shown in the annotated Figure 1 of Sadri '502 below.



257. As explained above, Sadri '502 in view of BobTail 2013 comprises the sleeve and the lower portion of the pin shank (mandrel) of Sadri '502 (the

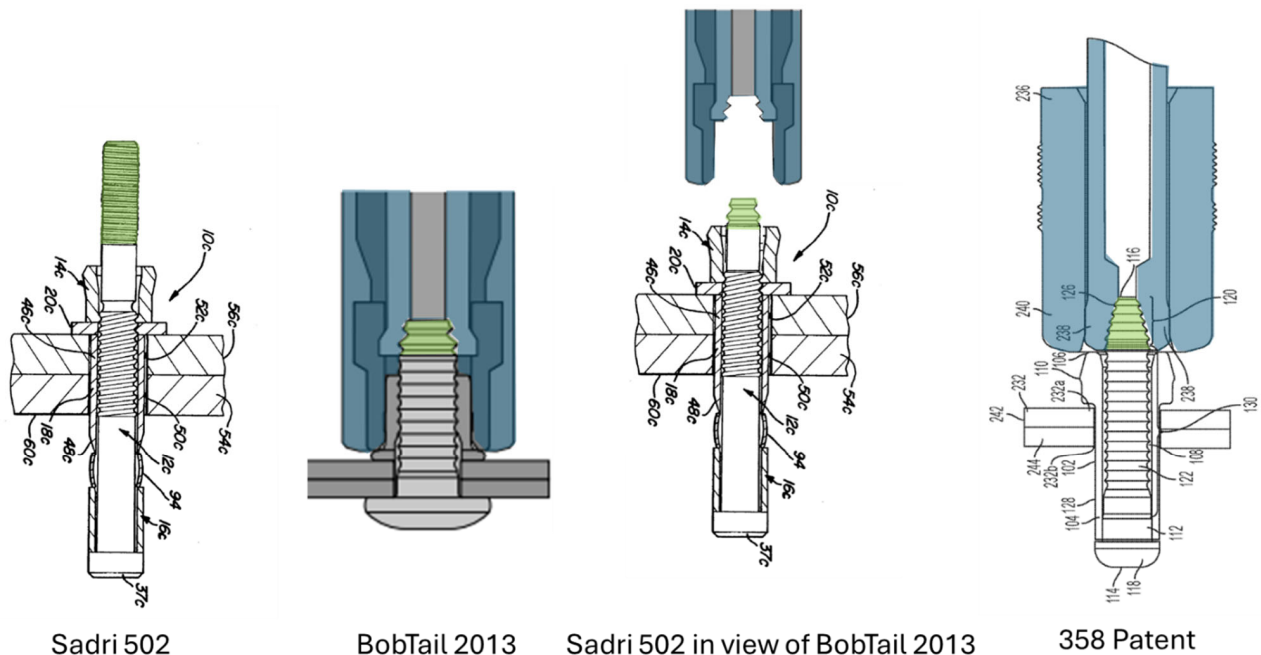
portion nearest to the enlarged head). The portion of the pin member comprising the breakneck groove 14 and pintail portion 40 of Sadri '502 is modified to remove the breakneck groove and comprise the pull region of BobTail 2013. Regardless of this modification, Sadri '502 in view of BobTail 2013 comprises a shank region intermediate to a first and second mandrel end. Accordingly, Sadri '502 in view of BobTail 2013 comprises a mandrel with “a shank region extending intermediate the first mandrel end and the second mandrel end” as recited in this limitation.

- g. 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.”**

258. Sadri '502 alone and/or in combination with BobTail 2013 renders obvious this claim limitation. As discussed in my analysis of claim limitation 1(d), Sadri '502 discloses a “reduced diameter pintail portion 40 [] formed with a plurality of pull grooves 44.” EX1009, 6:19-25, 24:38-41. A POSITA would recognize this “plurality of pull grooves” to comprise a pull region. Furthermore, Sadri '502 modified in view of BobTail 2013 comprises the short, tapered pull region disclosed by BobTail 2013.

259. The '358 Patent clarifies that “[t]he collet 238 of the installation tool 236 can engage with the pull region 120 of the blind fastener 100.” '358 Patent, 7:14-16. Thus, as established by the '358 Patent, the pull region is the region in which the collet of the installation tool engages with the fastener (i.e., the

“gripping portion” disclosed by Sadri ’502). The pull regions of the fasteners of the ’358 Patent, Sadri ’502, BobTail 2013, and Sadri ’502 in view of BobTail 2013 are shown in the figure below comparing Fig. 2A of the ’358 Patent to Fig. 8 of Sadri ’502, a figure from p. 3 of BobTail 2013, and Sadri ’502 in view of BobTail 2013 (with annotations added). In this figure, the pull region of each fastener is highlighted in green.



260. In the annotated figures above, length of the pull region in Sadri ’502 would be less than four times the diameter of the shank region, when calculating the diameter of the shank region using the smooth region under the head. Moreover, if the portion engaged by the installation tool in Sadri ’502 is shorter than the entire threaded region, the pull region could be less than even twice the diameter of the shank region and substantially less than four times that diameter.

261. Even if patent figures should not be understood as being to accurate scale, here, nothing would suggest to a POSITA that the aspect ratios in Sadri '502 could not be the ratios depicted nor that the ratios would somehow be undesirable. As such, Sadri '502 discloses a pull region which 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.”

262. A POSITA would also have understood that the axial length of a mandrel pull region, relative to the shank diameter, is a routine design parameter that is selected to ensure reliable installation performance. In particular, when designing a pull region intended to be gripped by an installation tool, the POSITA would size the pull length based on well-known engineering considerations such as: (i) consistent tool engagement and adequate grip length to prevent slippage; (ii) controlled deformation and/or fracture behavior during the pull stroke; and (iii) sufficient load transfer through the mandrel during installation without premature fracture. These considerations are not unique to any single reference; they reflect ordinary fastener/tooling design practice that would have been readily applied when implementing Sadri '502's blind fastener.

263. A POSITA would also have been motivated to reduce the axial length of the pull region when possible because doing so provides predictable, practical advantages. A shorter pull region reduces material usage and cost, and it can also

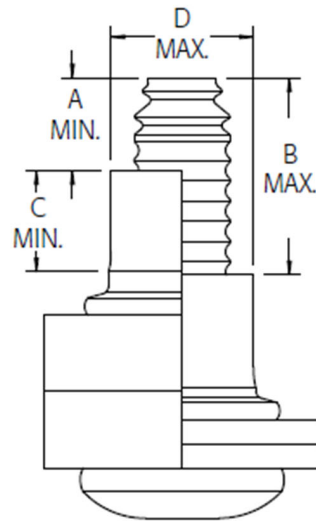
reduce the installation envelope, improving accessibility in confined spaces. Shortening the pull region additionally tends to improve coaxial engagement and reduce the likelihood of off-axis bending moments during installation, which in turn reduces the risk of damaging pull grooves, stripping the pull region, or premature fracture under high pull loads. A shorter pull segment likewise can improve installation repeatability by reducing compliance in the pulled portion of the mandrel and can avoid unnecessary protrusion that creates interference, safety, and corrosion concerns after installation. For these reasons, a POSITA would have found it obvious to design the pull region so that its axial length is no greater than a modest multiple of the shank diameter—e.g., less than four times, 3.8 times, or two times the shank diameter—while maintaining a reasonable expectation of success that the installation tool would reliably engage and install the fastener as intended.

264. To the extent that Sadri '502 does not render obvious this limitation, Sadri '502 in combination with BobTail 2013 renders this limitation obvious, as shown in the annotated figures above. Applying the definition of the pull region from the '358 Patent, the region of the mandrel shank of BobTail 2013 comprising “annular pull grooves” is analogous to the “pull region” required by this limitation. EX1010, p. 3. BobTail 2013 discloses a dimension “A min,” which indicates the minimum length that the mandrel shank must extend beyond the collar for the installation tool to grip the mandrel. EX1010, p. 5. This minimum length is

equivalent to the pull region of the BobTail 2013 fastener. A chart listing the values of “A min” for several fastener diameters (and a corresponding figure) from p. 5 of BobTail 2013 is shown below.

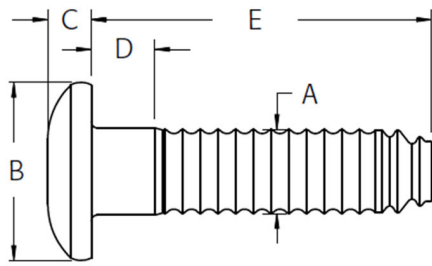
Inspection data				
Diameter	A min	B max	C min	D max
3/16"	0.155	0.461	0.195	0.271
1/4"	0.225	0.535	0.260	0.361
5/16"	0.280	0.600	0.325	0.457
3/8"	0.345	0.665	0.390	0.542

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.

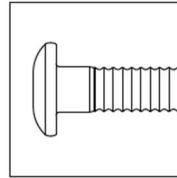


265. BobTail 2013 likewise discloses an “A” value corresponding to the maximum diameter of the shank region, as shown below. EX1010, p. 4.

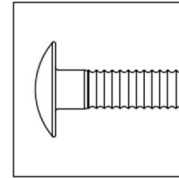
Head style options



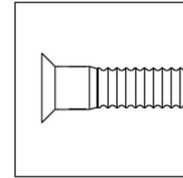
Trazier



98T



90°



Fastener dimensions

Diameter	A	Trazier		98T		90°	
		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

266. Comparing BobTail 2013’s pull region length (“A min”) of several fastener models to their corresponding maximum diameter of the shank region (“A”) confirms that the ratios of the pull region length to the diameter of the shank region for those models is approximately 0.90.

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

267. A POSITA would have been motivated to incorporate BobTail 2013’s teachings of its shortened pull region to Sadri ’502. Specifically, a POSITA would understand that BobTail 2013’s shortened pull region provides multiple installation and durability advantages, including reduced noise, elimination of pintail waste,

and improved corrosion resistance. BobTail 2013. These and other benefits are expressly detailed in BobTail 2013 as shown below. *See, e.g.,* EX1010, p. 3 (“Pintail-less design means reduced noise, no waste, and improved corrosion resistance.”), 6 (“The BobTail fastener is installed without a pin-break, contributing to the dramatic reduction of noise on the shop floor, and subsequently, improved worker hearing safety. Instances of foreign object damage (FOD) and loose pintail injuries are eliminated. Because BobTail tooling features a smooth, shock-free installation sequence, repetitive stress injuries are eliminated, and overall safety is increased.”).

268. A POSITA would credit BobTail 2013’s teachings above and further understand that benefits from the pintail-less, shortened-pull-region configuration include: (i) reduced noise because eliminating the break-off pintail (and the associated fracture event) and reducing the amount of mandrel material that must be pulled, deformed, and resisted during setting lowers installation energy and reduces noise generated during installation; (ii) no waste because eliminating a break-off pintail conserves material and avoids discarded mandrel fragments, thereby reducing manufacturing waste and post-installation debris; and (iii) improved corrosion resistance because using a mandrel that does not fracture during installation eliminate a freshly exposed fracture surface that can serve as corrosion-initiation sites. EX1010, p. 3.

269. Accordingly, Sadri '502 alone or in view of BobTail 2013 discloses each and every limitation of claim 1 of the '358 Patent and therefore renders obvious this claim limitation.

3. Claim 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.”

270. As described in my analysis of limitation 1(f), Sadri '502 alone and in view of BobTail 2013 renders obvious a blind fastener “wherein the pull region comprises an axial length no greater than 3.8 times the diameter of the shank region” as recited in claim 2.

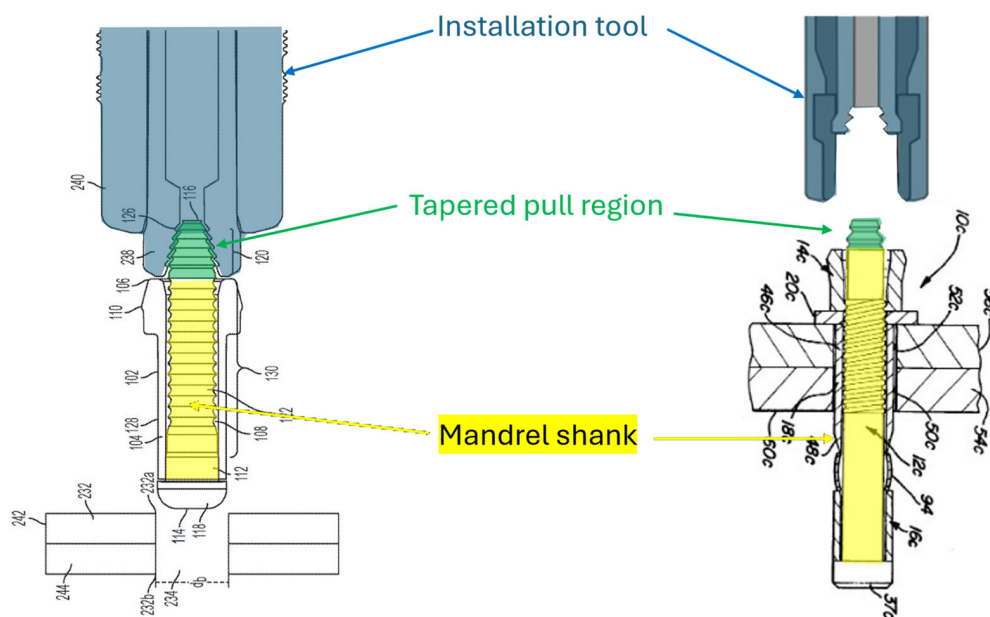
4. Claim 3: “The blind fastener of claim 1, wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region.”

271. As described in my analysis of limitation 1(f), Sadri '502 alone and in view of BobTail 2013 renders obvious a blind fastener “wherein the pull region comprises an axial length no greater than 2 times the diameter of the shank region” as recited in claim 3.

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

272. Sadri '502, in view of BobTail 2013, discloses this claim. As discussed above, BobTail 2013 expressly discloses a pull region comprising a taper extending from the shank region. Accordingly, as shown in the figure below comparing Fig 2A of the '358 Patent to Sadri '502 in view of BobTail 2013 (with

annotations added), Sadri '502 in view of BobTail 2013 teaches the short, tapered pull region of BobTail 2013.



358 Patent

Sadri 502 in view of BobTail 2013

273. A POSITA would have been motivated to incorporate BobTail 2013's tapered pull region into Sadri '502 for the same pull-type tool-engagement reasons discussed in Section IV.A and Ground 3. A POSITA would further credit BobTail 2013's express teaching that a short, tapered pull region "delivers a strong connection." EX1010, p. 3. A POSITA would understand that, during installation, any misalignment between the collet (or jaws) of a pull-type installation tool and the pull grooves of the fastener can lead to bending fracture, partial engagement, or uneven joint clamping, which in turn can create localized stress concentrations when axial load is applied to the joint. A POSITA would further understand that a

tapered pull region facilitates positive and more coaxial engagement between the tool and the pull grooves as the tool seats, reducing the likelihood of partial engagement, slippage, and uneven load distribution during setting. Likewise, a POSITA would also understand that by promoting more uniform load sharing across the engaged collet teeth, a tapered pull region reduces localized overstress on individual teeth in the case of insufficient engagement, thereby decreasing the risk of stripping, chipping, or premature tool wear, and improving installation reliability and tool longevity.

274. Implementing this substitution would have required only routine, corresponding adjustments to the mating tool jaws and groove geometry, and a POSITA would have had a reasonable expectation of success in doing so.

275. Accordingly, Sadri '502 in view of BobTail 2013 discloses a blind fastener “wherein the pull region comprises a taper extending from the shank region” as recited in claim 4 and thereby renders this claim obvious.

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

276. Sadri '502 in view of BobTail 2013 renders obvious this claim. While Sadri '502 comprises a “breakneck groove,” Sadri '502 is modified in view of BobTail 2013 by replacing pintail portion 40 with the pull region of BobTail 2013 and removing breakneck groove 42. BobTail 2013 explicitly does not comprise a pintail or breakneck groove, disclosing that the “BobTail fastener is installed

without a pin-break, contributing to the dramatic reduction of noise on the shop floor.” EX1010, p. 6. Thus, the mandrel of Sadri ’502 in view BobTail 2013 “does not comprise a breakneck groove” as recited in claim 5.

7. Claim 6: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 25.”

277. Sadri ’502 renders obvious this claim limitation. Sadri ’502 emphasizes the importance of comprising the pin member (mandrel) of a pull type fastener of a hard material. EX1009 at 2:15-40 (that “the blind bolt of the present invention has a high tensile strength” using “high strength ferrous materials having a high hardness”). Noting that Rc is a common abbreviation of HRC, Sadri ’502 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.” EX1009, 8:42-46. A POSITA would recognize that the pin member 12 of Sadri ’502 comprises the mandrel of Sadri ’502’s blind pull type fastener. Noting that this claim is satisfied by any blind fastener a mandrel having a hardness greater than or equal to HRC 25, Sadri ’502 discloses a blind fastener with a mandrel comprising a Rockwell hardness of HRC 42 *or higher*. Accordingly, Sadri ’502 discloses a blind fastener “wherein the mandrel comprises a Rockwell hardness of at least HRC 25” as recited in claim 6.

8. Claim 7: “The blind fastener of claim 1, wherein the mandrel comprises a Rockwell hardness of at least HRC 43.”

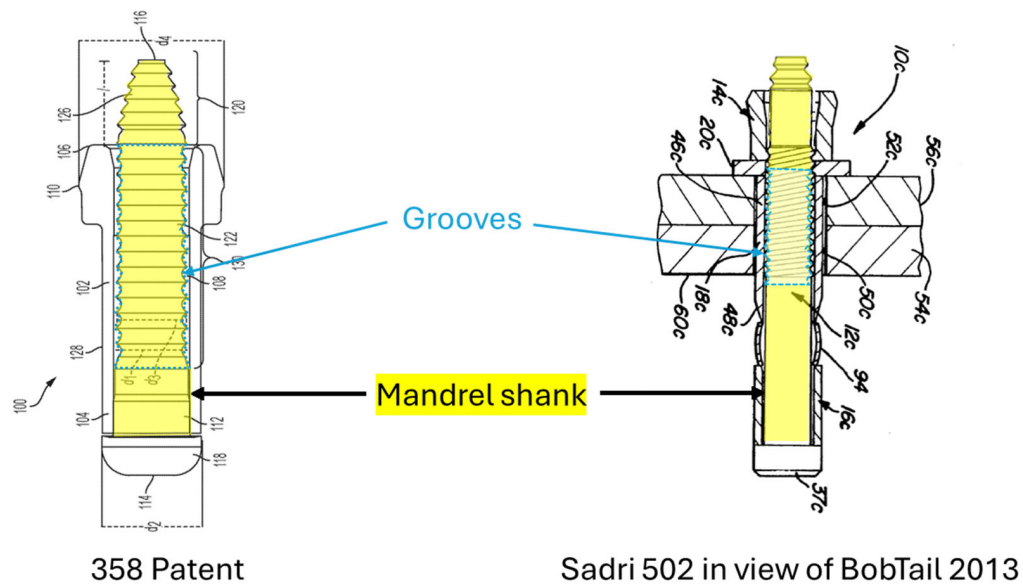
278. As discussed in my analysis of claim 6, Sadri '502 discloses a blind fastener with a mandrel comprised of a (emphasis added) “ferrous or other material having a Rockwell hardness of between around 38 Rc to around 42 Rc or higher.” EX1009, 8:44-46. As such, Sadri '502 discloses a blind fastener with a mandrel comprising a Rockwell hardness of around HRC 42 *or higher*, which includes a hardness of HRC 43. Accordingly, Sadri '502 discloses a blind fastener “wherein the mandrel comprises a Rockwell hardness of at least HRC 43” as recited in claim 7 and thereby renders claim 7 obvious.

9. 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.”

279. Sadri '502 alone and/or in combination with BobTail 2013 renders obvious this claim. Sadri '502 discloses “[t]he pin shank 23 has a relatively smooth portion 38, leading to the threaded lock groove portion 19.” EX1009, 6:19-22. The pin shank taught by Sadri '502 (including both smooth and grooved portions) is analogous to the shank region described by the '358 Patent and includes a threaded region comprising a plurality of grooves. As such, Sadri '502 discloses this claim.

280. Sadri '502 in view of BobTail 2013 comprises the smooth portion 38 and the threaded lock groove portion 19 of Sadri '502, replacing the pintail portion

40 (and the connecting breakneck groove) with the pull region of BobTail 2013 and removing breakneck groove 42. As shown in the annotated figure below comparing Fig. 1 of the '358 Patent with Sadri '502 in view of BobTail 2013 (with annotations added), both fasteners comprise a shank including at least a groove.



281. Accordingly, Sadri '502 alone or in view of BobTail 2013 comprises a blind fastener “wherein the shank region comprises at least one of, a threaded region, an annular shoulder, and a groove,” as recited in claim 8.

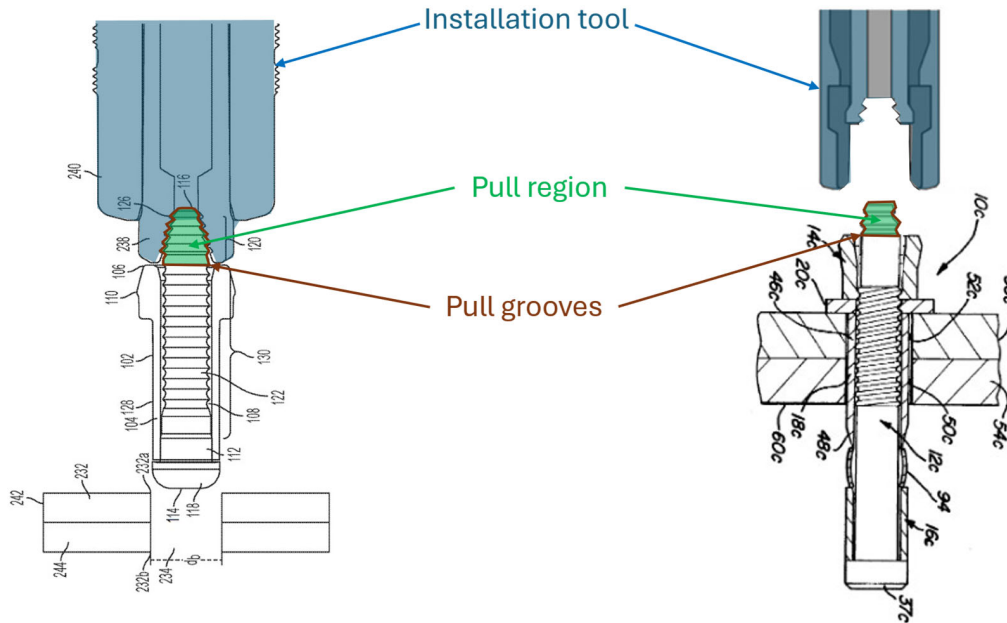
10. Claim 9: “The blind fastener of claim 1, wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove.”

282. Sadri '502 alone and/or in combination with BobTail 2013 renders obvious this claim. Reiterating that a POSITA would recognize the “pintail portion” disclosed by Sadri '502 to comprise a pull region, Sadri '502 discloses

that “pintail portion 40 is formed with a plurality of pull grooves 44.” EX1009, 6:20-23. Sadri ’502 further describes a blind fastener comprising “a pull portion comprising a plurality of pull grooves.” Sadri ’502, 18:23-24 (claim 1).

283. BobTail 2013 also discloses a grooved pull region. BobTail 2013 discloses that “[t]he installation tool is applied to the annular pull grooves. When the tool is activated a puller in the nose assembly draws the pin into the tool.” EX1010, p. 3. A POSITA would recognize that this region of the “pin” of BobTail 2013 which comprises annular pull grooves) comprises a pull region.

284. Furthermore, Sadri ’502 in view of BobTail 2013 comprises the short, tapered pull region comprising a plurality of annular pull grooves (and thus “a groove”) of BobTail 2013. As shown in the annotated figure below comparing Fig. 2A of the ’358 Patent with Sadri ’502 in view of BobTail 2013, both fasteners comprise a pull region including at least a groove.



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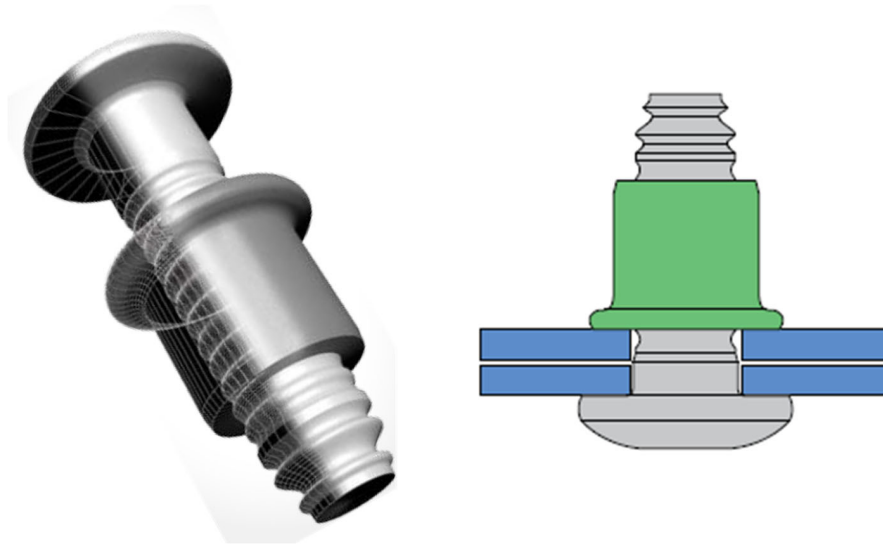
285. Accordingly, Sadri '502 alone or in view of BobTail 2013 comprises a blind fastener “wherein the pull region comprises at least one of a threaded region, an annular shoulder, and a groove” as recited in claim 9.

11. Claim 10: “The blind fastener of claim 1, wherein the sleeve is generally cylindrical and the mandrel is generally cylindrical.”

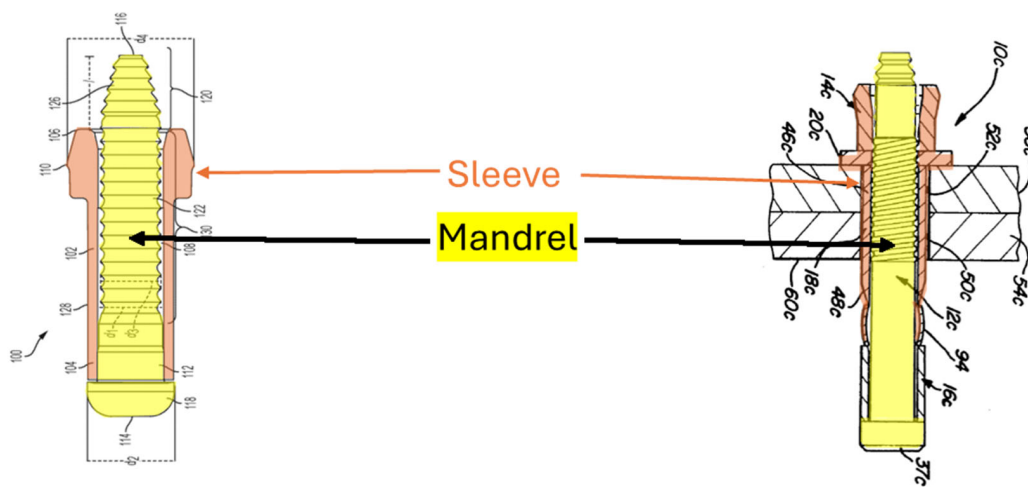
286. Sadri '502 alone and/or in combination with BobTail 2013 renders obvious this claim. First, Sadri '502 discloses a generally cylindrical sleeve stating, “[t]he secondary or main sleeve 18 has a straight shank portion 46 of generally constant outside diameter.” EX1009, 6:28-29. Sadri '502 further discloses a generally cylindrical mandrel, noting that the pin member (mandrel) comprises “an enlarged head 37 at one end of the pin shank 23,” with the pin shank 23 having a

“relatively smooth portion 38.” EX1009, 6:19-21. In one embodiment, Sadri ’502 discloses “a pin 12 having a pin shank portion with an outer diameter of around 0.450 inches and a pin head 37 having an outside diameter of around 0.685 inches.” EX1009, 11:9-11. A POSITA would recognize that these descriptions illustrate a roughly cylindrical sleeve and mandrel.

287. Furthermore, as shown in the below figures from p. 2 and p. 3 of BobTail 2013, BobTail 2013 discloses a generally cylindrical mandrel and sleeve.



288. To the extent that the fastener disclosed by the ’358 Patent, comprises a generally cylindrical sleeve and mandrel, a POSITA would understand that Sadri ’502 in view of BobTail 2013 comprises a generally cylindrical sleeve and mandrel. This is demonstrated in the annotated figure below comparing Fig. 2A of the ’358 Patent with Sadri ’502 in view of BobTail 2013.



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Sadri 502 in view of BobTail 2013

289. Thus, Sadri '502 alone or in view of BobTail 2013 comprises a blind fastener “wherein the sleeve is generally cylindrical, and the mandrel is generally cylindrical” as recited in claim 10.

12. 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.”

290. Sadri '502 discloses this claim. As discussed in my analysis of claim 6, Sadri '502 discloses a blind fastener, noting that that the (emphasis added) “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.” EX1009, 8:42-46. Sadri '502 further discloses that “[t]he secondary or main sleeve 18 can be constructed of a ferrous or other material such as a 4130

steel.” EX1009, 8:50-52. Sadri ’502 also 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.” EX1009, 2:15-19. Thus, Sadri ’502 discloses a blind fastener comprised of metal.

291. Accordingly, Sadri ’502 discloses a blind fastener “wherein the blind fastener comprises at least one of a metal, metal alloy, and a composite material” as recited in claim 11. Thus, Sadri ’502 in view of BobTail 2013 renders this claim obvious.

13. 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.”

292. Sadri ’502 discloses this claim. Sadri ’502 discloses a blind fastener that can be installed in “oversized holes”, stating:

The high strength fastener of the present invention may be utilized in applications where the hole sizes in the workpieces may be somewhat oversized or in applications where the material at the blind side of the workpieces is relatively soft and subject to deformation. Another form of the invention addresses such conditions by using an additional sleeve having a relatively thin wall and hence which is adapted to readily collapse around the blind side opening to thereby inhibit movement or extrusion of the expansion sleeve into an oversized hole and/or inhibit deformation of the blind side surface of a workpiece made of a soft material.

EX1009, 3:50-61.

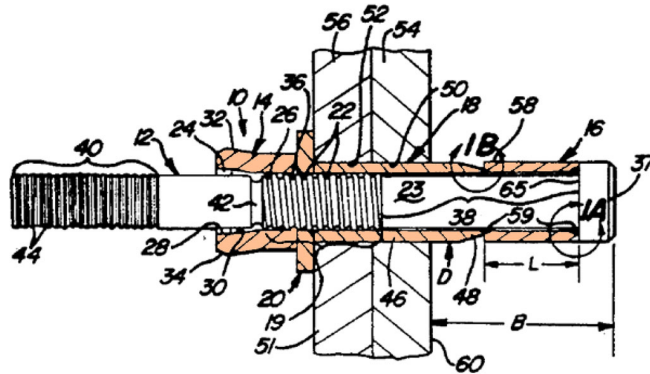
293. Noting that Sadri ’502 states that the “pin head 37” comprises an enlarged head, Sadri ’502 further clarifies that “the diameter of pin head 37 and the

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.” EX1009, 6:41-46. A POSITA would recognize that, in a clearance fit, a component (e.g., the sleeve of a blind fastener) is received by a bore with a diameter greater than the component itself.

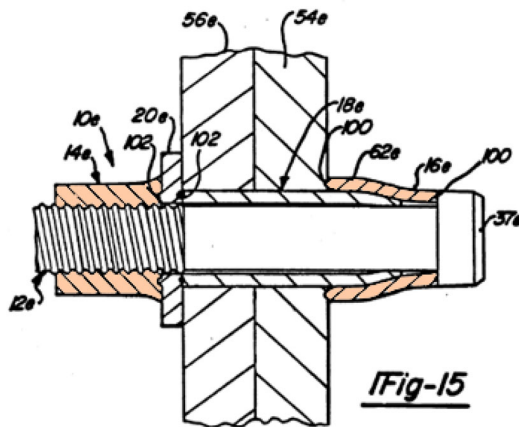
294. Accordingly, Sadri '502 discloses a blind fastener “wherein the blind fastener is adapted to be installed in a bore in a structure, the bore having a diameter greater than the diameter of the enlarged portion” as recited in claim 12. Thus, Sadri '502 in view of BobTail 2013 renders this claim obvious.

14. 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.”

295. Sadri '502 discloses this claim. As described in my analysis of limitation 1(a), Sadri '502 discloses a three-piece sleeve system composed of a collar, a main or secondary sleeve, and an expandable or primary sleeve, as shown in the colorized Figure 14 of Sadri '502 below.



296. Sadri '502 further teaches that the sleeve system is configured to deform on a first (blind) side of the structure—e.g., the expandable/primary sleeve moves axially and expands radially to form a blind head against the blind-side surface—while the collar is configured to swage onto the shank region on the opposite (accessible) side by being swaged into the pin's lock grooves. EX1009, Abstract; 5:21-27; 6:49-7:15 (describing the primary sleeve's axial/radial deformation to form blind head 62 and collar 14 swaged into lock grooves 22); *see also* Figure 15 (colorized) below. The Sadri '502 figure shows a washer 20 included in the sleeve system. Sadri '502 discloses that the washer may be integrated into the collar 14 or omitted altogether. EX1009, 5:41-44.



297. Sadri '502 also expressly explains that, after the blind head is formed, an installation tool applies increasing axial force to swage the collar into lock grooves in the pin. EX1009, 1:30-36. This confirms the claimed configuration: deformation on a first side of the structure and collar swaging onto the shank region on the oppositely disposed second side.

298. Consistent with the above, Sadri '502 further discloses embodiments in which additional sleeve components (e.g., an intermediate sleeve) deform/collapse during installation to bear against the blind-side surface, further confirming that the sleeve system is configured to deform on the first side of the structure (emphasis added):

*As shown in FIG. 9, in the first stage of the installation cycle, **buckling of the intermediate sleeve 94 has started** and it has not yet been radially expanded over the nose portion 48c. Note also that some radial expansion of the free end 58c of the expandable sleeve 16c may start as a result of its engagement with the intermediate sleeve 94. FIG. 10 depicts the fastener 10c after completion of the installation cycle. **Now the intermediate sleeve 94 has been completely collapsed into a flattened ring shape 94 which bears against the blind side surface 60c of workpiece 54c in close***

radial engagement with the outer surface of the shank portion 46c of the main sleeve 18c.

EX1009, 16:5-18.

299. Sadri '502 likewise discloses a sleeve comprising a collar configured to swage onto the shank region on an oppositely disposed side of a structure, stating (emphasis added):

*In the present invention the high strength blind bolt **includes a collar** which cooperates with the pin in the manner of a swage type fastener such that, after the blind head has been formed, the application of a relative axial force of increasing magnitude between the pin and collar causes an installation tool to **swage the collar into lock grooves in the pin.***

EX1009, 1:30-36.

*Looking now at FIG. 1, a blind fastener 10 includes a pin 12, **a tubular collar 14**, a primary or expansion sleeve 16, a secondary or main sleeve 18 and a hold-off washer 20. As will be seen the collar 14 is of a type shown in the '384 patent to Nordyke and is adapted to be **swaged into lock grooves 22 in a lock groove portion 19 on an elongated shank 23 of pin 12.***

EX1009, 5:21-27.

300. Accordingly, Sadri '502 discloses “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 recited in claim 13. Thus, Sadri '502 in view of BobTail 2013 renders this claim obvious.

15. 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.”

301. Sadri '502 discloses a structure “wherein the structure comprises at least one of a metal, a metal alloy, and a composite material.”

302. Sadri '502 expressly targets “workpieces” used in “constructions utilizing box beams or columns, bridges, and the like.” EX1009, 1:6-12, 2:20-26 (“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 (discussing “bridges and roadways” that “require the attachment of beams [and] support brackets”), 14:51-62, 15:19-27 (discussing “box beams” and related structural attachments). A POSITA would understand that structures used in these applications are routinely fabricated from metals, metal alloys, and occasionally composite materials because such materials provide the strength, stiffness, and durability required for load-bearing joints in buildings, bridges, and similar infrastructure.

303. Moreover, a POSITA would have understood that blind fasteners are commonly used to join structural components made from metals, metal alloys, and composite materials, particularly where access is available from only one side, and that these materials are well suited to accommodate the swaging/deformation mechanics used to create a high-strength joint. Accordingly, a POSITA would have

found it obvious to apply Sadri '502's teachings to structures comprising any of the recited materials, with a reasonable expectation of success. Thus, Sadri '502 in view of BobTail 2013 renders this claim obvious.

16. 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.”

304. Sadri '502 renders obvious this claim. A POSITA would recognize that blind fasteners are applicable to myriad joining applications regardless of the particular use of the component being joined. As explained in Section VIII, “Subject Matter of the '358 Patent” and with respect to claim 14, a POSITA would recognize that the blind fasteners, are often used for applications in the aerospace industry. Sadri '502 also discloses a blind fastener wherein the sleeve and pin member (mandrel) may be comprised of “4130 steel of aircraft quality.” EX1009, 8:42-46. Given that the fastener of Sadri '502 is a blind fastener comprised of an “aircraft quality” material, a POSITA would be motivated to use this fastener in the construction of an aircraft.

305. Furthermore, the fastener of Sadri '502 is, in at least one use-case, intended for installation in a “building and construction component.” Sadri '502 discloses as such, stating (emphasis added):

The high strength blind bolt of the present invention is adapted for use in applications in which high strength bolts, such as SAE Grade 5 (ASTM A325) or higher, are frequently used. It is also desirable for use where blind

welding, nut plates and other complex construction fastening systems are used. In this regard, the blind fastener of the present invention is especially suited for construction of buildings, bridges, and the like where high strength and durability are of considerable importance along with the capability of providing high clamp loads of the assembled parts.

EX1009, 2:16-26.

306. As described above, the blind fastener of Sadri '502 is both suited for aerospace applications as well as building and construction applications. As such, a POSITA would also recognize Sadri '502 is ideal for use in both aerospace and construction applications. Thus, Sadri '502 discloses a blind fastener “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 recited in claim 15. Thus, Sadri '502 in view of BobTail 2013 renders this claim obvious.

17. Claim 16

a. Limitation 16(pre): “A method for fastening, the method comprising:”

307. To the extent that the preamble of claim 16 is limiting, Sadri '502 renders obvious this limitation.

308. Sadri '502 discloses a fastener “for fastening structural workpieces” and describes this fastening method throughout various embodiments. EX1009, Abstract, 1:52-2:15, 6:49-7:15. Sadri also discloses “a collar located on said pin shank at the accessible surface side of the workpieces and adapted to be swaged

into said lock grooves in response to the relative axial force applied by the installation tool between said pin and said collar.” EX1009, claim 6. Sadri ’502 further details the method for installing said fastener, stating:

In order to set the fastener 10, a relative axial force is exerted by an installation tool between the pin member 12 and relative to the collar 14, secondary sleeve 18 and expandable primary sleeve 16. As the relative axial force is thus applied, the expandable, primary sleeve 16, which is located on the pin shank 23 adjacent the pin head 37, will be moved axially relative to the secondary sleeve 18 and into engagement with the blind side surface 60. The free end 58 of expandable sleeve 16 engages the tapered nose 48 on secondary sleeve 18. The inside diameter of sleeve 16 has a chamfer 59 at free end 58 at an angle substantially the same as that of nose portion 48. The chamfer 59 is slight, however, reducing the wall thickness at free end 58 by no more than around 25%. In this regard chamfer 59 is provided at both ends of the sleeve 16 whereby either end can serve as the free end 58 thereby simplifying assembly. Thus as sleeve 16 moves axially it overengages the surface of the tapered nose 48 and is radially expanded. As the relative axial force increases and the pin 12 begins to move axially through the collar 14, the limited collar thread 36 will shear or deform sufficiently to permit the pin 12 to move freely through the collar 14. In this condition, however, the swaging or deformation of the material of the collar 14 into the pin lock grooves 22 has not yet started and, hence, the pin 12 and collar 14 can now respond as a typical swage type fastener. The expandable 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 of workpiece 54. This engagement, in a sense, defines a stop surface. At the same time the now expanded end 58 of the expandable sleeve 16 defines a blind head 62.

EX1009, 6:49-7:15.

309. Moreover, Sadri ’502 discloses express, mathematical detail regarding the forces applied during the installation process, disclosing “a graph depicting the hydraulic load on the tool in pounds per square inch versus time and the clamp

load on the workpieces being fastened in pounds versus time both depicting the relationship between tool load and clamp load relative to the different stages of installation of a fastener of the present invention.” EX1009, 4:29-34. This graph (Fig. 3 of Sadri '502) is shown below, noting that “Vx” axis represents time (over the installation process) and “Vy” maps to both the hydraulic pressure of the installation tool and “the resultant magnitude of the clamp load in pounds (Vy axis) as developed by the fastener through the installation tool during the installation cycle.” EX1009, 12:28-38.

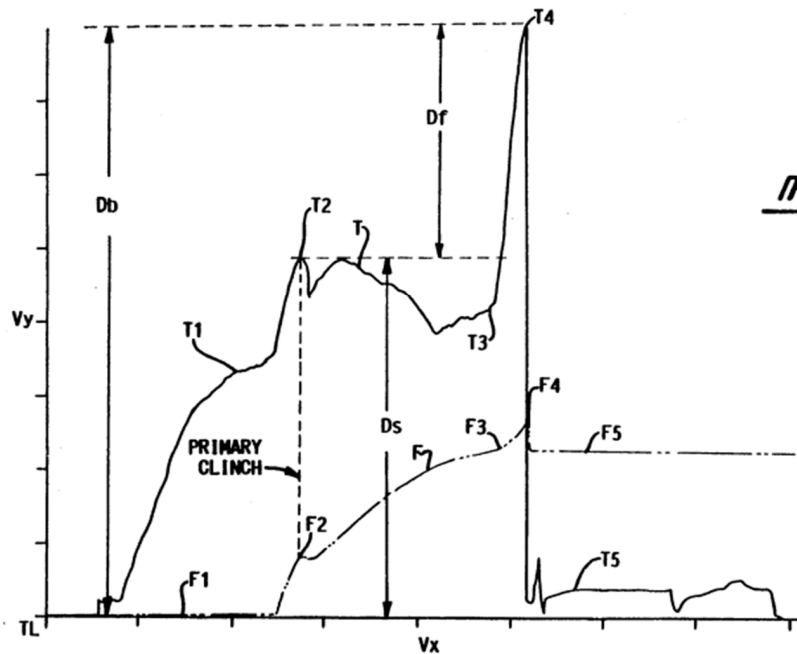
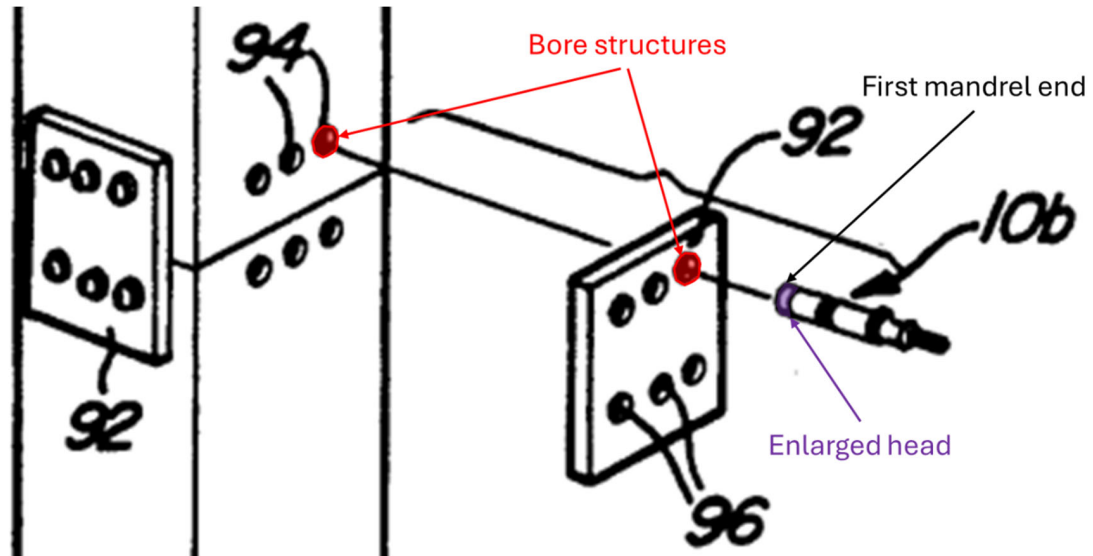


Fig-3

b. Limitation 16(a): “inserting a first mandrel end of a blind fastener into a bore in a structure,”

310. Sadri '502 renders obvious this limitation. As discussed in my analysis of the preamble of claim 16, Sadri '502 discloses a fastening method for installing the fastener of Sadri '502. This fastening method includes “inserting a first mandrel end of a blind fastener into a bore in a structure.” Noting that the “enlarged head 37” comprises the “first mandrel end” of Sadri '502, Sadri '502 discloses “[t]he shank portion 46 of secondary sleeve 18 extends through aligned openings 50 and 52 in a pair of work pieces 54 and 56, respectively.” EX1009, 6:35-37. Sadri '502 further details 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.” EX1009, 6:41-46. This understanding is further clarified in Fig. 7 of Sadri '502 (annotated below), which depicts the insertion of the fastener of Sadri '502 enlarged-head-first into the bore structure of a workpiece.



311. Accordingly, Sadri '502 discloses a fastening method comprising “inserting a first mandrel end of a blind fastener into a bore in a structure” as recited by in this limitation. Thus, Sadri '502 in view of BobTail 2013 renders this limitation obvious.

- c. **Limitation 16(b): “the blind fastener comprising a sleeve comprising a first sleeve end, a second sleeve end, and a cavity extending from the first sleeve end to the second sleeve end, and”**

312. Limitation 16(b) is substantially the same as limitation 1(a). For the reasons discussed in my analysis of limitation 1(a), Sadri '502 discloses and renders obvious this limitation.

- d. Limitation 16(c): “a mandrel configured to be at least partially received by the cavity of the sleeve, the mandrel comprising,”**

313. Limitation 16(c) is substantially the same as limitation 1(b). For the reasons discussed in my analysis of limitation 1(b), Sadri '502 discloses and renders obvious this limitation.

- e. Limitation 16(d): “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,”**

314. Limitation 16(d) is substantially the same as limitation 1(c). For the reasons discussed in my analysis of limitation 1(c), Sadri '502 discloses and renders obvious this limitation.

- f. Limitation 16(e): “a second mandrel end comprising a pull region, and”**

315. Limitation 16(e) is substantially the same as limitation 1(d). For the reasons discussed in my analysis of limitation 1(d), Sadri '502 alone and/or in combination with BobTail 2013 discloses and renders obvious this limitation.

- g. Limitation 16(f): “a shank region extending intermediate the first mandrel end and the second mandrel end,”**

316. Limitation 16(f) is substantially the same as limitation 1(e). For the reasons discussed in my analysis of limitation 1(e), Sadri '502 discloses and renders obvious this limitation.

- h. 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;”**

317. Limitation 16(g) is substantially the same as limitation 1(f). For the reasons discussed in my analysis of limitation 1(f), Sadri ’502 alone and/or in combination with BobTail 2013 discloses and renders obvious this limitation.

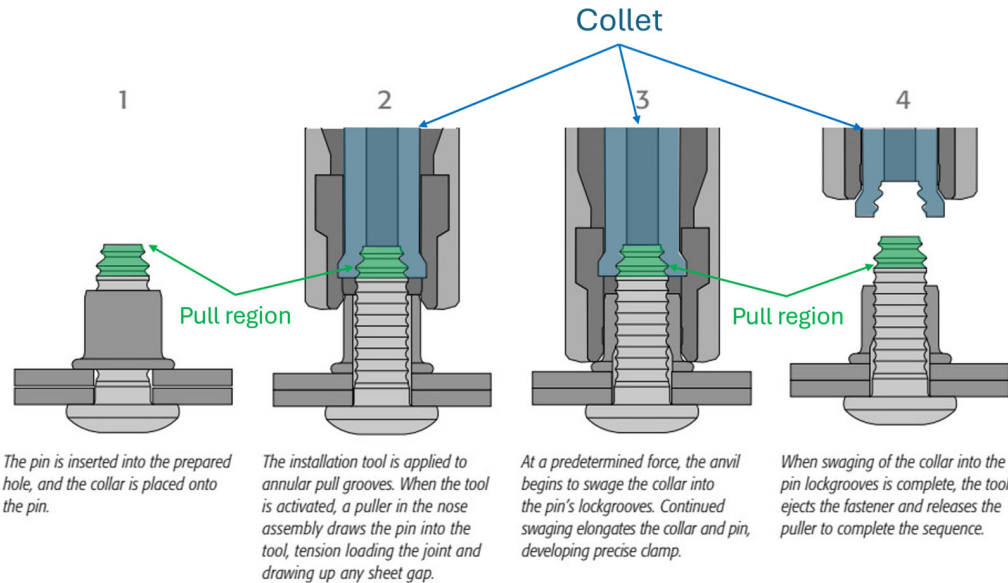
- i. Limitation 16(h): “engaging a collet of the installation tool with the pull region of the blind fastener;”**

318. Sadri ’502 alone and/or in combination with BobTail 2013 renders obvious this claim.

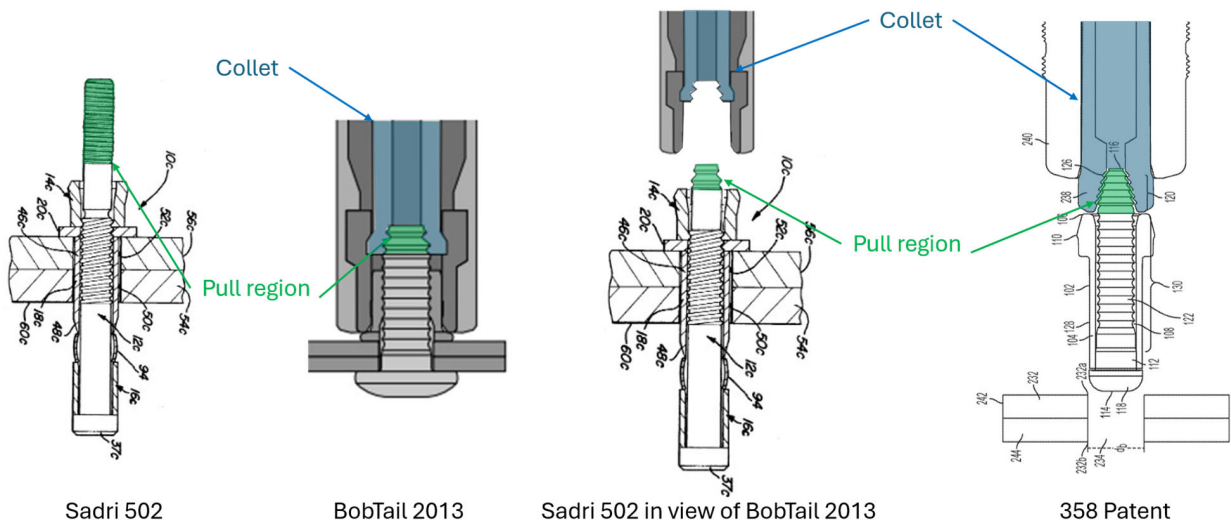
319. Sadri ’502 comprises a “pintail portion 40 is formed with a plurality of pull grooves 44.” EX1009, 6:23-24. While the installation tool itself is not shown in Sadri ’502, with Sadri ’502 disclosing “the installation tool and swage anvil can be of a construction generally known in the art and hence the details thereof have been omitted for purposes of simplicity,” a POSITA would recognize that the typical installation tool for a pull type fastener uses a collet to engage the pull region of a blind fastener via the pull grooves. EX1009, 5:60-63.

320. BobTail 2013 likewise discloses that an installation tool is “applied to the annular pull grooves” of the fastener of BobTail 2013. EX1010, p. 3. This is clarified by a graphic shown on p. 3 of BobTail 2013 (annotated below), which

illustrates a step-by-step installation process. The below figure shows how a collet of the installation tool of BobTail 2013 engages the short, tapered pull region.



321. The engagement between the collet of an installation tool and the pull region of Sadri '502 in view of BobTail 2013 is further shown in the figure below comparing Fig. 2A of the '358 Patent to Fig. 8 of Sadri '502, a figure from p. 3 of BobTail 2013, and Sadri '502 in view of BobTail 2013 (with annotations added).



322. Accordingly, Sadri '502 alone or in view of BobTail 2013 discloses “engaging a collet of the installation tool with the pull region of the blind fastener” as recited in limitation 16(h). Thus, Sadri '502 in view of BobTail 2013 renders this limitation obvious.

- j. **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”**

323. Sadri '502 alone and/or in combination with BobTail 2013 renders obvious this limitation.

324. Sadri '502 discloses a fastening method comprising “forcibly contacting the second sleeve end of the blind fastener with an anvil of the installation tool.” Sadri '502 discloses that (emphasis added) “[t]he magnitude of radially compressive force **applied by a swage anvil of an installation tool in swaging the collar 14 onto pin 12** is determined in part by the angle of the stand-off chamfer 34, which transfers load axially and radially for a given applied force via the anvil.” EX1009, 5:55-60. A POSITA would recognize that a swage anvil “swaging the collar 14 onto pin 12” necessitates the anvil forcibly contacting the second sleeve end.

325. Furthermore, as discussed above in my analysis of claim limitation 16(h), a collet of installation tool of Sadri '502 engages the pull region of the

fastener of Sadri '502, applying a pulling force and moving the pull region distal from the second sleeve end. Sadri '502 discloses this process, stating:

In order to set the fastener 10, a relative axial force is exerted by an installation tool between the pin member 12 and relative to the collar 14, secondary sleeve 18 and expandable primary sleeve 16. As the relative axial force is thus applied, the expandable, primary sleeve 16, which is located on the pin shank 23 adjacent the pin head 37, will be moved axially relative to the secondary sleeve 18 and into engagement with the blind side surface 60.

EX1009, 6:49-57 (emphasis added).

326. Sadri '502 in view of BobTail 2013 further renders obvious this limitation. As described in my analysis of claim limitation 16(h), the collet of the installation tool of BobTail 2013 “is applied to the annular pull grooves” of the fastener of BobTail 2013. EX1010, p. 3. While gripping these pull grooves, “a puller in the nose assembly draws the pin into the tool.” EX1010, p. 3. Following this step of the installation process, “the anvil begins to swage the collar into the pin’s lockgrooves. Continued swaging elongates the collar and pin, developing precise clamp.” EX1010, p. 3. This installation process is visually depicted in a figure shown in my analysis of claim limitation 16(h).

327. As such, Sadri '502 alone or in view of BobTail 2013 discloses an installation method for a blind fastener comprising “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” as recited in limitation 16(i). Thus, Sadri ’502 in view of BobTail 2013 renders this limitation obvious.

- k. 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.”**

328. Sadri ’502 alone or in view of BobTail 2013 renders obvious this claim limitation.

329. As detailed in limitation 1(a) and claim 13, Sadri ’502 discloses a sleeve system in which an expandable/primary sleeve deforms on a first side of the structure to form a blind head, and a collar at a second sleeve end is swaged into lock grooves on the shank region on the oppositely disposed second side of the structure. Sadri ’502 expressly confirms the sealing and locking effect of swaging, stating that “the soft collar 14 after swaging will provide a good seal with the shallow lock grooves 22 of the harder pin member 12,” and describing “a final high, residual clamp load upon swaging of the collar into the lock grooves of the pin member.” EX1009, 10:44-48, Abstract. *See also id.* at 5:25-27, 5:55-60.

330. BobTail 2013 likewise teaches a coordinated pull-and-swage installation sequence to form a high-integrity joint, including tool engagement with pull grooves and swaging the collar into the pin’s lockgrooves to develop clamp load. EX1010, p. 3. Accordingly, after formation of the blind head on the first side

of the structure, swaging the collar (i.e., the second sleeve end) into the shank lock grooves on the oppositely disposed second side secures at least a portion of the blind fastener in the structure. *Id.* Thus, Sadri '502 in view of BobTail 2013 renders this claim obvious.

18. 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.”

331. Claim 17 is substantially the same as claim 2. For the reasons discussed in my analysis of claim 2, Sadri '502 alone and/or in combination with BobTail 2013 renders obvious claim 17.

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

332. Claim 18 is substantially the same as claim 4. For the reasons discussed in my analysis of claim 4, Sadri '502 in combination with BobTail 2013 renders obvious claim 18.

20. Claim 19: “The method of claim 16, wherein the mandrel does not comprise a breakneck groove.”

333. Claim 19 is substantially the same as claim 5. For the reasons discussed in my analysis of claim 5, Sadri '502 in combination with BobTail 2013 renders obvious claim 19.

21. 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.”

334. Claim 20 is substantially the same as claim 11. For the reasons discussed in my analysis of claim 11, Sadri '502 renders obvious claim 20.

XI. SECONDARY CONSIDERATIONS

335. I am not aware of any secondary considerations that would weigh in favor of finding the challenged claims nonobvious. For example, I am not aware of any evidence of commercial success or copying.

XII. CONCLUDING STATEMENTS

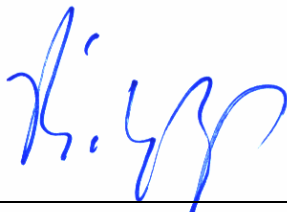
336. In summary, it is my opinion that a POSITA would have found that the Challenged Claims of the '358 Patent were anticipated or obvious over the prior art.

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

I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that

these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code.

Dated: February 20, 2026

By: 
Richard W. Klopp, Ph.D., P.E.

Attachments:

Curriculum Vitae

List of Prior Four Years Testimony Experience