

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

MEDTRONIC, INC.
Petitioner

v.

MOSKOWITZ FAMILY LLC.
Patent Owner

Patent No. 10,426,633

**DECLARATION OF MR. BRAD CULBERT
IN SUPPORT OF PETITION FOR *INTER PARTES* REVIEW
OF U.S. PATENT NO. 10,426,633**

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I, Brad Culbert, declare as follows:

I. INTRODUCTION

1. I have been retained as an independent expert consultant by Medtronic, Inc. (“Petitioner”) in this proceeding before the United States Patent and Trademark Office regarding U.S. Patent No. 10,426,633 (“the ’633 patent”) (Ex. 1001) assigned to Moskowitz Family LLC (“Patent Owner”).¹ I have been asked to consider whether prior art references disclose or suggest the features recited in claims 1, 2, 4, 7-14, and 16-20 (the “challenged claims”) of the ’633 patent. My opinions are set forth below.

2. I am being compensated at my standard rate for services provided in this matter and reimbursed for reasonable expenses, including travel. My compensation is not contingent upon my opinions, the outcome of this matter, or any of the technical positions I present in this declaration.

II. BACKGROUND AND QUALIFICATIONS

3. My qualifications are stated more fully in my curriculum vitae (“CV”), which is attached as Exhibit 1003. My CV also lists patents and publications in

¹ In this Declaration, I refer to exhibits that I understand are to be attached to the petition for *Inter Partes* Review of the ’633 patent.

which I am a named author and identifies parties on behalf of whom I have previously provided expert testimony.

4. I believe that I qualify as an expert in the field of intervertebral spinal implants, and as at least a person of ordinary skill in the art (*see infra* Section IV). Below is a summary of my education, work experience, and other qualifications.

5. I am a medical device engineer with substantial experience designing and developing spinal implants for treating damaged and diseased vertebrae.

6. I earned a Bachelor of Applied Science in Metals and Materials Engineering from the University of British Columbia in 1992, followed by a Master of Business Administration from California State University, Fullerton in 2001.

7. From 1994 to 1996, I worked as a manufacturing engineer and later served as the Angioplasty Product Team Leader at Vas-Cath, a medical device company specializing in dialysis and angioplasty catheters. In that role, I oversaw a multi-functional team of R&D, manufacturing, and quality engineers to improve the company's product lines.

8. From 1996 to 1998, I worked as an R&D Project Manager at CVD, a medical device company specializing in angioplasty balloons and stents. In that role, I designed and developed new catheters and stent delivery systems. I also contributed to the preparation and submission of regulatory documents for those products.

9. From 1998 to 2000, I worked as Senior R&D Project Manager at Endicor Medical, Inc, a medical device company specializing in percutaneous thrombectomy and atherectomy systems for cardiovascular and neurovascular applications. In that role, I designed and prototyped a new thrombectomy system, including developing animal models to satisfy FDA requirements.

10. From 2000 to 2010, I worked at Interventional Spine, Inc. (formerly known as Triage Medical, Inc.), a medical device company specializing in spinal and orthopedic trauma products. I was their first employee and started as Director of Engineering before being promoted to Vice President of R&D, and ultimately Chief Technology Officer. In these roles, I oversaw the design and development of a series of percutaneous spine procedures and devices, while leading and managing employees who were also considered persons of ordinary skill in the art.

11. With nearly 10 years of experience designing spinal fusion implants, I gained extensive familiarity with the surgical techniques used in these procedures. I attended many surgical conferences and lectures worldwide and was present for dozens of spinal fusion surgeries, collaborating closely with surgeons to develop implants, instruments, and surgical techniques. My work also included hosting hands-on cadaver laboratories, where I both assisted in surgical practice and trained new surgeons in the use of the implants, including performing cadaver surgeries myself as part of the training process.

12. Based on my experience at Interventional Spine, I am highly familiar with the anatomy of the spine and vertebrae, as well as intervertebral fusion devices designed for insertion into the intervertebral disc space. I also have extensive knowledge of supplemental fixation methods, such as anterior plates, used to secure implants after insertion, along with the surgical procedures and tools associated with intervertebral fusion devices.

13. Since 2010, I have operated a consulting business advising medical device companies, including those focused on spinal implant technology. My work spans a wide range of areas, including product development, regulatory approval, manufacturing, and intellectual property.

14. In addition to my professional experience and education discussed above, I am also listed as an inventor on over 30 U.S. patents relating to devices and methods for treating the spine. Many of my patents relate specifically to intervertebral spinal implants for insertion into the intervertebral space, including, for example, U.S. Patent Nos. 8,105,382; 8,568,481; and 10,390,963.

III. MATERIALS REVIEWED

15. The opinions contained in this Declaration are based on the documents I reviewed, my professional judgment, as well as my education, experience, and knowledge regarding spinal implants, including those that are inserted in the disc space between vertebrae.

16. In forming my opinions expressed in this Declaration, I reviewed the following materials:

Ex. 1001	U.S. Patent No. 10,426,633 to Moskowitz et al. (“the ’633 patent”)
Ex. 1004	File History for U.S. Patent No. 10,426,633
Ex. 1006	U.S. Patent Application Publication No. 2008/0249569 A1 to Waugh et al. (“Waugh”)
Ex. 1013	U.S. Patent Application Publication No. 2005/0278026 to Gordon et al. (“Gordon”)
Ex. 1020	Phulchand Prithvi Raj, <i>Intervertebral Disc: Anatomy-Physiology-Pathophysiology-Treatment</i> , 8(1) PAIN PRACT. 18 (2008)
Ex. 1021	Fabio Galbusera et al., <i>Ageing and degenerative changes of the intervertebral disc and their impact on spinal flexibility</i> , 23(3) EUR. SPINE J. 324 (2014)
Ex. 1022	Dil Patel et al., <i>Interbody options in lumbar fusion</i> , 5(1) J. SPINE SURG. S19 (2019)
Ex. 1024	U.S. Patent No. 9,585,766 to Robinson (“Robinson”)
Ex. 1047	U.S. Patent No. 6,342,074 to Simpson (“Simpson”)
Ex. 1053	Anne Polikeit et al., <i>The importance of the endplate for interbody cages in the lumbar spine</i> , 12(6) EUR. SPINE J. 556 (2003)
Ex. 1057	U.S. Patent No. 9,445,919 to Palmatier et al. (“Palmatier”)
Ex. 1058	U.S. Patent Application Publication No. 2011/0319997 A1 to Glerum et al. (“Glerum”)
Ex. 1059	Patent Owner’s Infringement Claim Charts, Exhibit F1, <i>Moskowitz Family, LLC v. Medtronic, Inc.</i> , No. 0:25-cv-00769 (D. Mass.), served October 30, 2025.

Ex. 1060	Senthil Eswaran et al., <i>The micro-mechanics of cortical shell removal in the human vertebral body</i> , 31 COMPUT. METHODS APPL. MECH. ENGRG. 3025 (2007)
Ex. 1061	Vivek Palepu et al., <i>Biomechanics of Disc Degeneration</i> , ADV. ORTHOP (2012)
Ex. 1062	Kai-Uwe Lewandrowski, <i>Surgical Technique of Endoscopic Transforaminal Decompression and Fusion with a Threaded Expandable Interbody Fusion Cage and A Report of 24 Cases</i> , 7(2) J. SPINE 1 (2018)
Ex. 1063	Erik Emstad et al., <i>The VariLift(®) Interbody Fusion System: expandable, standalone interbody fusion</i> , 8 MED. DEVICES (AUKL.) 219 (2015)
Ex. 1064	Gstoettner Michaela et al., <i>Footprint mismatch in lumbar total disc arthroplasty</i> , 17(11) EUR. SPINE J. 1470 (2008)
Ex. 1065	Thomas Steffen et al., <i>Cages: designs and concepts</i> , 9 EUR. SPINE J. S89 (2000)
Ex. 1066	Thomas Lowe et al., <i>A Biomechanical Study of Regional Endplate Strength and Cage Morphology as It Relates to Structural Interbody Support</i> , 29(21) SPINE 2389 (2004)

17. I also considered any other documents and materials I refer to in this Declaration.

18. My opinions have also been guided by my appreciation of how a person of ordinary skill in the art (a “POSITA”) would have understood the state of the art, the prior art, and the claims and the specification of the ’633 patent at the time of the alleged invention, which I discuss below.

19. I have been asked to consider that the time of the alleged invention of the '633 patent was early-2010s (including the time leading up to October 25, 2012).

20. Based on my experience and expertise, it is my opinion that certain references disclose or suggest all of the features recited in claims 1, 2, 4, 7-14, and 16-20 of the '633 patent, as I discuss in detail below.

IV. PERSON OF ORDINARY SKILL IN THE ART

21. I am familiar with the level of ordinary skill in the art regarding the '633 patent in the early-2010s. Considering the '633 patent, the technology, the educational level and experience of workers in the field relating to the patent, and problems and solutions in that field, and drawing on my own experience, I believe a POSITA at the time of the alleged invention (early-2010s, including the time leading up to October 25, 2012) would have a bachelor's or equivalent degree in Mechanical Engineering or a related discipline (*e.g.*, biomechanics, biomedical or metals and materials engineering), and at least five years of experience. A person could have qualified as a POSITA with some combination of (a) more formal education and less technical or professional experience in the listed fields, or (b) less formal education and more technical or professional experience in the listed fields. In other words, more education can supplement practical experience and *vice versa*. For example, a POSITA could have an advanced degree, in the technical disciplines

provided above, or a Doctor of Medicine, and at least two years of experience in the subject areas provided above.

22. My opinions in this Declaration regarding the '633 patent and the prior art (including the state of the art) are from the perspective of a POSITA during the relevant timeframe, as I defined above.

V. TECHNICAL BACKGROUND

23. Below, I present a brief overview of the anatomy of the spine and intervertebral fusion devices, including several advancements in the field. The functionalities and concepts I describe below in this technical background section reflect the state of the art that a POSITA would have understood prior to and at the time of the alleged invention of the '633 patent. I rely on and incorporate as applicable (even if not expressly mentioned below) the following disclosures and opinions to support my opinions in this Declaration, including those opinions relating to how the prior art discloses or suggests the subject matter of the challenged claim of the '633 patent, as I explain below in Section VIII and in the Appendices. The concepts below would have been within the knowledge and mindset of a POSITA during the relevant time frame (early-2010s, including the time leading up to October 25, 2012).

A. Anatomy of the Spine and Vertebral Bodies

24. The human spine, or spinal column, is the body's central support structure that protects the spinal cord and allows flexibility for movement. (See Ex. 1020, 18-19.) It is composed of a series of bones called vertebrae. Most vertebrae are separated by joints known as intervertebral discs. (See Ex. 1021, 3.) These discs act as cushions, absorbing shock and allowing flexibility for movement. (See, e.g., Ex. 1047, 1:46-61.) The figure below “shows a lateral view of a portion of a spinal column 10, illustrating a group of adjacent upper and lower vertebrae V1, V2, V3, V4 separated by natural intervertebral discs D1, D2, D3.” (Ex. 1006, [0025].)

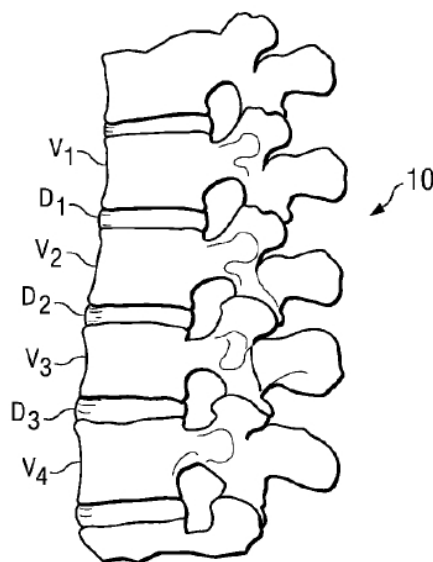


Fig. 1

(*Id.*, Fig. 1.)

25. Vertebrae consist primarily of a highly porous bone center and a thin bone shell. (Ex. 1060, 3025.) They are separated from the discs by an interface called a vertebral endplate, as shown in the figures below.

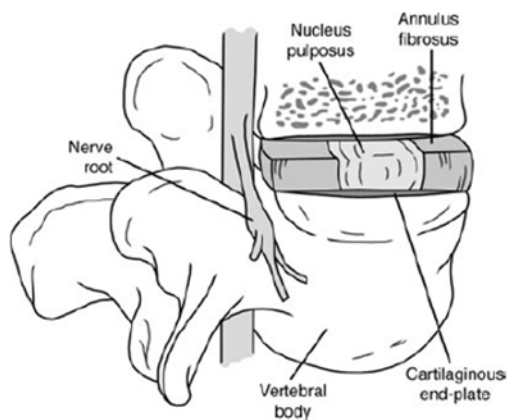


Figure 1. A line drawing of the spinal segment consisting of two vertebral bodies and a normal intervertebral disc sandwiched between them.

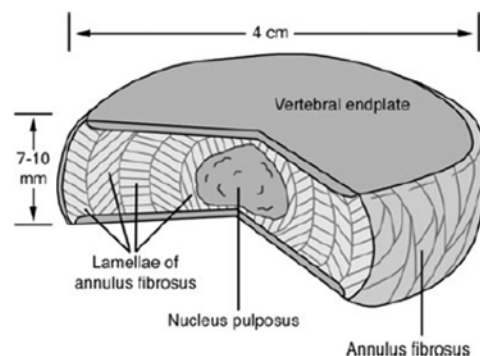


Figure 2. A cut out portion of a normal disc. Note the location of the Nucleus Pulposus, the vertebral end plate and the architecture of Annulus Fibrosis. The intervertebral disc is 4 cm wide and 7-10 mm thick.

(Ex. 1020, 19.) The shape and strength of the vertebral endplate varies across its surface, with the center as the weakest part. (Ex. 1053, 556.)

26. The intervertebral discs, however, can become damaged due to various reasons, including degenerative diseases, aging, trauma, and mechanical stress. (See Ex. 1020, 23-26; *see also* Ex. 1021, 2-3.) Damaged discs can bulge and lose height, which, in turn, can cause compression of nearby nerves, reduce the discs' ability to absorb mechanical loads, and lead to decreased mobility. (See Ex. 1020, 26-27.) When spinal disc injury is severe, surgical intervention may be needed.

B. Expandable Intervertebral Fusion Devices and Surgical Tools for Installing the Devices

27. Surgical intervention for severely damaged discs may involve a discectomy, in which the surgeon removes all or part of the damaged disc, followed by placement of an implant together with bone graft material that can fuse adjacent vertebrae through the implant. (*See id.*, 32-37; *see also* Ex. 1022, 20.) These implants, known as intervertebral or interbody fusion devices, are positioned between adjacent vertebrae and may employ various components, such as screws, to achieve fusion with the vertebrae. (*See* Ex. 1022, 19-21.) One technique, referred to as the lumbar interbody fusion (“LIF”) technique, uses standalone cages that are placed into the intervertebral disc space and filled with bone graft material to stabilize the spine and promote fusion of the adjacent vertebrae. (Ex. 1061, 4.) Cages for LIF techniques were initially designed as rigid structures. (*Id.*, 4, Fig. 2 (reproduced below).) However, “to overcome the problems associated with these rigid cages, . . . expandable cages” were developed. (*Id.*, 4, Fig. 3.)



FIGURE 2: Rigid interbody cages. (a) Ardis (Zimmer spine, Minneapolis, MN, USA), (b) Leopard (DePuy, Raynham, MA, USA), (c) Cougar (DePuy, Raynham, MA, USA), and (d) Jaguar (DePuy, Raynham, MA, USA) (website).

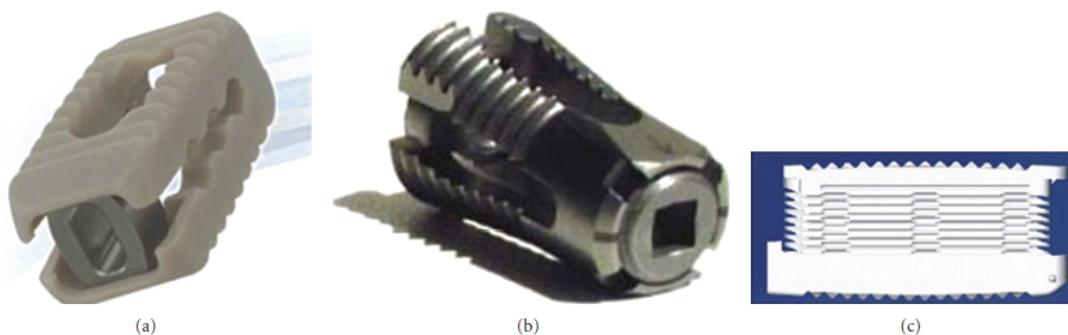
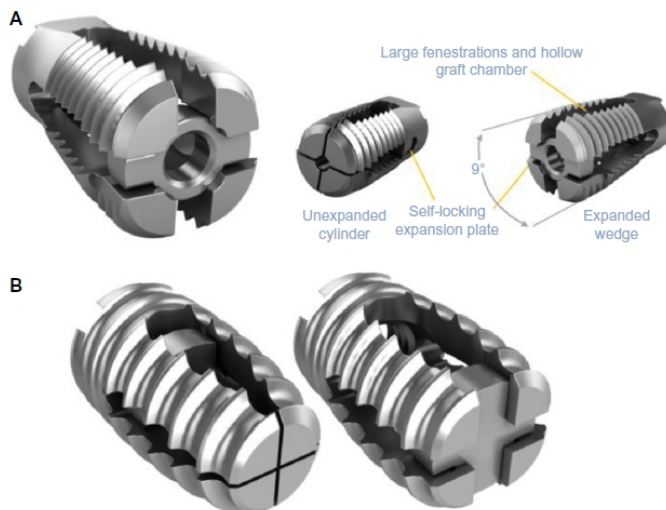


FIGURE 3: Expandable interbody cages. (a) Varian (Medyssey spine, Skokie, IL, USA), (b) VariLift-L (Wenzel spine, Austin, TX, USA), and (c) StaXx XDL (Spine wave, Shelton, CT, USA) (website).

(*Id.*, Figs. 2-3.)

28. One known expandable cage was the VariLift[®]-L (shown below). (*Id.*, 4-5.) The VariLift[®]-L device was designed to be expanded in the intervertebral space to offer stable engagement with the vertebral endplates over a large contact area. (*Id.*) VariLift[®]-L included a central expansion screw. (Ex. 1062, 4.) When

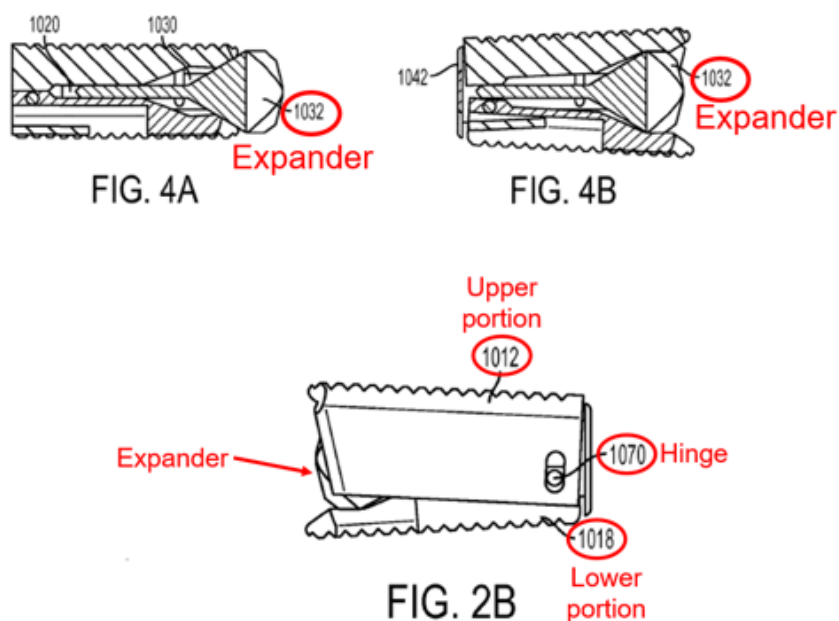
the expansion screw was turned, as shown in the figure below, a sliding expansion plate expanded the device. (Ex. 1063, 220.)



(*Id.*, Fig. 1.)

29. Another expandable device known by the early 2010s is described in U.S. Patent No. 9,585,766 (“Robinson”) (Ex. 1024). Robinson discloses an “expandable assembly for insertion into an intervertebral space” that includes “an upper portion 1012 and a lower portion 1018,” which are “joined together by a pin-in-slot joint or another type of hinge 1070 near the proximal end.” (Ex. 1024, 1:57-58, 4:1-10.) Robinson’s device also includes an expander 1032 that “is generally conical in cross-section with a rectangular or square end, like the head of a bolt, and tapered on both sides.” (*Id.*, 4:15-20.) As shown in figures 4A and 4B below, when expander 1032 is pulled along the longitudinal axis, “two portions 1012, 1018 of the cage body 1010 [] expand or spread open.” (*Id.*, 4:54-57.) “The

pin-in-slot joint or hinge 1070 may allow the two portions 1012, 1018 to expand or move vertically relative to one another, while also allowing the two portions 1012, 1018 to rotate about the hinge 1070.” (*Id.*, 4:57-62.)



(*Id.*, Figs. 4A-4B (top), and 2B (bottom) (all annotated).)

Expandable implants based on hinges were thus known in the art.

C. Design Considerations to Mitigate Subsidence

30. When intervertebral or interbody fusion devices are positioned between adjacent vertebrae, there is a risk that these devices can sink into the body of the vertebrae. This problem is referred to as “subsidence.” To mitigate the risk of subsidence, those in the art investigated how to better distribute stress caused by interbody cages. (Ex. 1053, 556; Ex. 1064, 1472.) Researchers observed that “[t]he shape, density and the strength of the [vertebral] endplate have been shown to vary

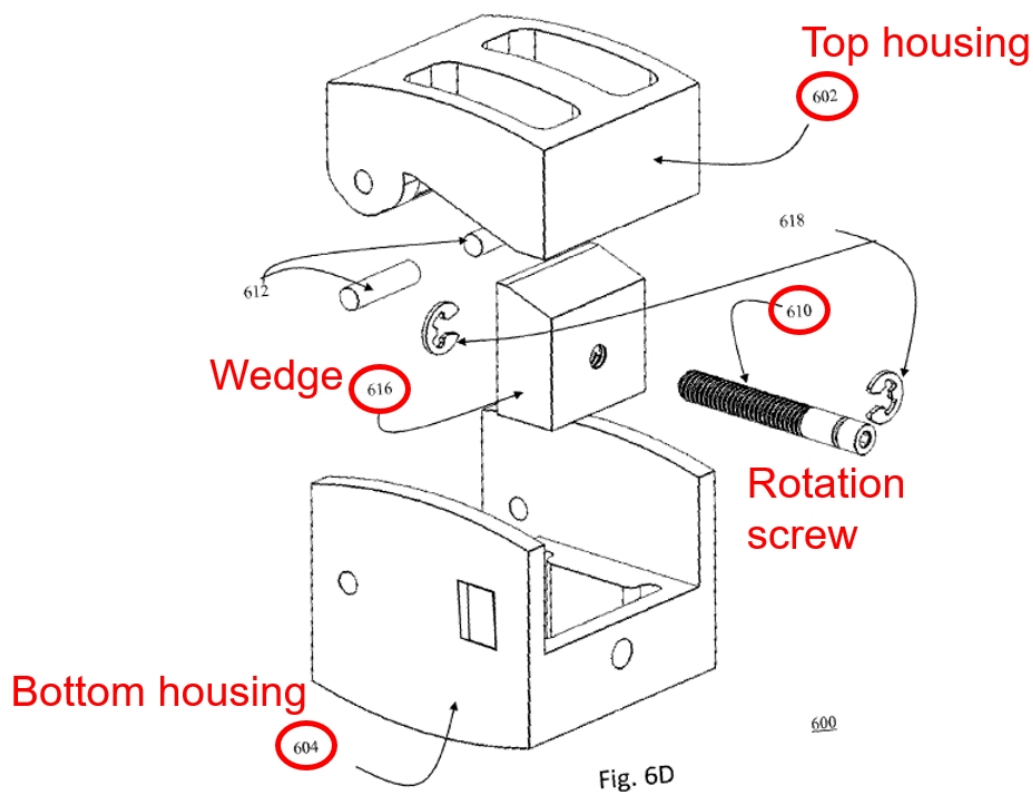
across its surface, with the centre being the thinnest and weakest area.” (Ex. 1053, 556.) Improper size and geometry of the interbody implant and placement of the implant in the porous **central area** of the vertebral body were factors that could cause subsidence. (*Id.*; Ex. 1066, 2389; Ex. 1064, 1472.) Those in the art concluded that implants should be designed “such that they rely on the strong peripheral part of the endplate to reduce the risk of subsidence” (Ex. 1053, 560.) Additionally, for “an optimal surface fit,” cages should “mimic the inverse shape of the endplate’s concave contour,” *i.e.*, have a convex surface. (Ex. 1065, 90.)

31. Moreover, it was known that “[t]he footprint size of the interbody fusion device is an important factor that determines the biomechanical stability afforded by these implants” and that “occurrence of subsidence is also influenced by the cage’s footprint.” (Ex. 1061, 4.) A larger footprint increases the biomechanical stability, lessens the occurrence of subsidence, and results in lower stress on the endplates after surgery. (*Id.*, 4-5.) “From a biomechanical point of view, an implant with the largest possible surface area appears to be best to avoid subsidence into the vertebral body as the circumference would provide a brace for the strongest areas in the periphery.” (Ex. 1064, 1473.)

VI. THE ’633 PATENT

32. The ’633 patent discloses an expandable intervertebral spacer for fusion and distraction, *i.e.*, a device placed between vertebrae to join them together or

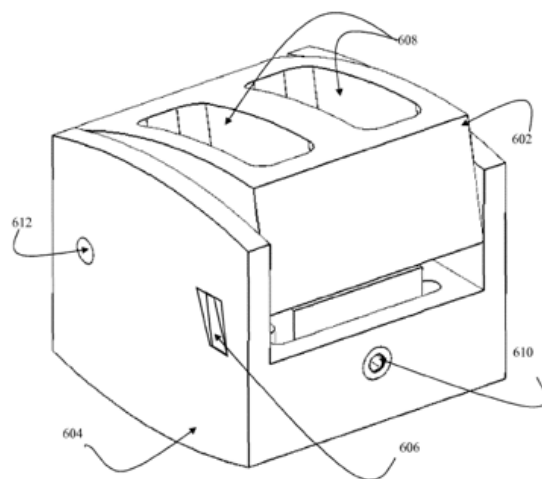
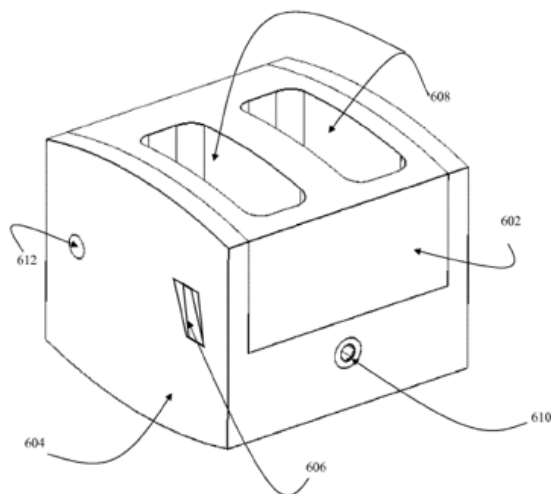
promote proper spacing. (Ex. 1001, Abstract.) As shown in figure 6D below, the device has two housings 602, 604, and a wedge 616 in between the housings. (*Id.*, 9:35-52.)



(*Id.*, Fig. 6D (annotated).)

33. The two housings are connected by one or more pins 612 that allow pivoting of the top housing 602 and bottom housing 604 relative to each other. (*Id.*, 9:35-39.) A rotation screw 610 “can control the relative angular orientation of the two housing pieces 602, 604.” (*Id.*, 9:44-49.) “When the screw 610 is rotated by an external tool, . . . the screw 610 causes lateral motion” of the wedge 616. (*Id.*, 9:49-52.) As the wedge moves, it engages “an inner tapered surface of the top

housing 602 and forces the top housing piece 602 to rotate away from the bottom housing 604,” *i.e.* expands the device. (*Id.*, 9:52-54.) Figure 6A below shows the device in its closed configuration, and figure 6C shows the device in its fully expanded configuration.



(*Id.*, Figs. 6A, 6C.)

34. The device 600 “can include indentions 606” on the lateral sides of the top housing 602 and the bottom housing 604 “to mate with the prongs” of the tool “to assist in grasping, inserting and impacting the device 600.” (*Id.*, 9:39-44.) The device 600 can also include “one or more bone cavities 608 incorporated into the top housing 602 and/or bottom housing 604 for bone fusion.” (*Id.*, 9:54-56.)

35. The '633 patent claims priority to U.S. Application No. 61/718,707 (“the '707 application”), filed on October 25, 2012. No application predating the '707 application in the '633 patent priority chain discloses an expandable implant with a wedge-based expansion mechanism for adjusting the spacing between two movable bodies that engage the vertebrae, as recited in each challenged claim, and described above with reference to figure 6D. For example, no application predating the '707 application discloses **“a first movable portion,” “a second movable portion,” a “wedge [] positioned between the first movable portion and the second movable portion,”** wherein an **“angled wedge surface [of the wedge] presses against the first interior surface of the first movable portion to hingedly open the first movable portion with respect to the second movable portion,”** as recited in claim 1.

VII. CLAIM CONSTRUCTION

36. I understand that when considering the meaning of patent claims, one must consider the language of the claims, the specification, and the prosecution

history of the patent. I also understand that claim terms are typically given their ordinary and customary meanings as would have been understood by a POSITA at the time of the invention for the patent. For purposes of my opinions in this Declaration, I have not expressly construed any claim term, other than those identified below, because the prior art discloses or suggests each claim limitation under any reasonable construction, particularly in view of Patent Owner's infringement contentions (see Ex. 1059). The terms I have identified below recite the phrase "means" for performing certain claimed functions. It is my understanding that the "means" should be construed as the corresponding structure in the specification.

37. **Claim 4** includes a means-plus-function limitation, *i.e.*, "means for mating the second movable portion with prongs of a tool." The specification discloses that "[t]he top housing 602 and/or the bottom housing 604 can include indentations 606 on their lateral sides close to the top of the device 600 to mate with the prongs of a tool." (Ex. 1001, 9:39-42.) Figure 6A below shows an indentation 606 in a lateral side of bottom housing 604. Thus, the corresponding structure for the claimed "means" is indentations on the lateral sides of the second movable portion.

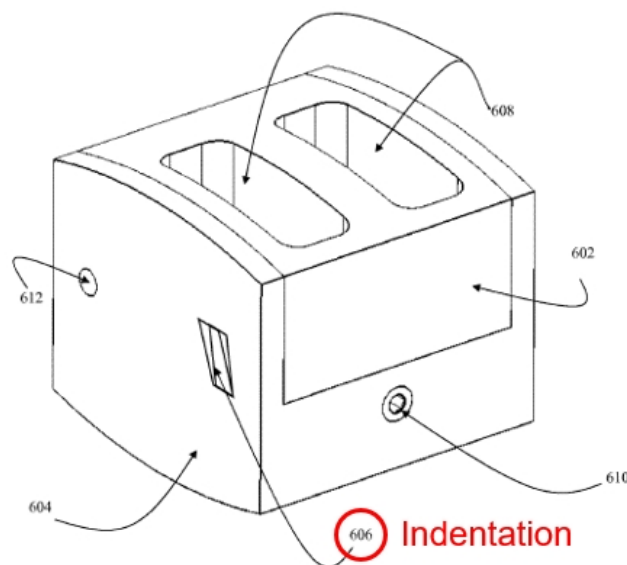


Fig. 6A

600

(*Id.*, Fig. 6A (annotated).)

38. **Claim 8** includes a means-plus-function limitation, *i.e.*, “means for gripping and inserting the device.” The specification discloses “[t]he top housing 602 and/or the bottom housing 604 can include indentations 606 on their lateral sides close to the top of the device 600 to mate with the prongs of a tool, such as prongs 806 of the universal tool shown in FIGS. 8A-8I, to assist in grasping, inserting and impacting the device 600.” (Ex. 1001., 9:39-43.) As shown in figure 8G below, “[t]he exemplary tool can include . . . a griper 804” which “includes griper prongs 806, which insert into” indentations, such as indentations 606. (*Id.*, 10:38-50.) Thus, the corresponding structure for the claimed “means” is a tool with prongs.

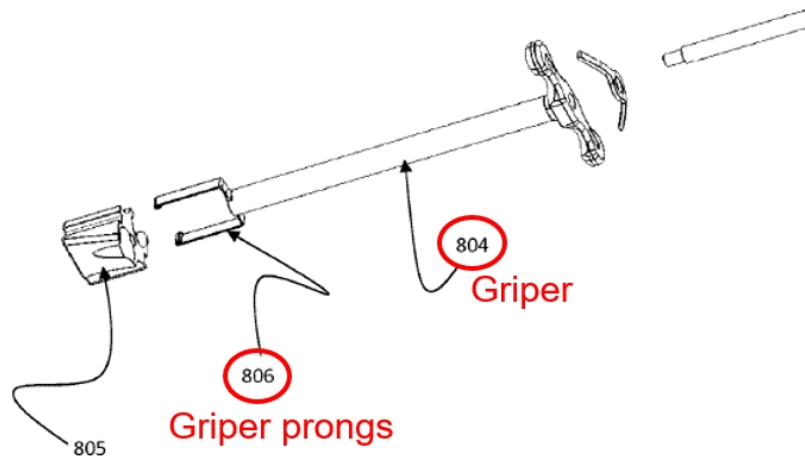


Fig. 8G

(*Id.*, Fig. 8G (annotated).)

39. **Claim 9** includes a means-plus-function limitation, *i.e.*, “means for turning the rotation screw with respect to the second movable portion and the wedge.” The specification discloses that “the screw 610 is rotated by an external tool (e.g., the tool shown in FIGS. 8A-8I).” (*Id.*, 9:49-51.) The tool could include, for example, an “Allen key 801.” (*Id.*, 10:38-43.) Thus, the corresponding structure for the claimed “means” is a rotatable tool (*e.g.*, an Allen key) with a screw engagement portion.

40. **Claim 10** includes a means-plus-function limitation, *i.e.*, “means for pivotably attaching the first movable portion to the second movable portion.” **Claim 17** includes a means-plus-function limitation, *i.e.*, “means for attaching the first end portion of the top housing to the third end portion of the bottom housing.” The specification discloses that “device 600 includes a top housing 602 and a bottom

housing 604 that can be attached or coupled by one or more pins, such as two pins 612, which allow rotation of the top housing 602 and the bottom housing 604 relative to each other about the axis of the pins 612.” (*Id.*, 9:35-39, Figs. 6A (reproduced below), 6D.) As shown in figure 6D, pins 612 pass through at least a portion of both the top and bottom housings thereby allowing the two housings to pivot about an axis of the pins. The corresponding structure for the claimed “means” in both claims 10 and 17 is therefore one or more pins, each of which passes through at least a portion of both the first and second movable portions.

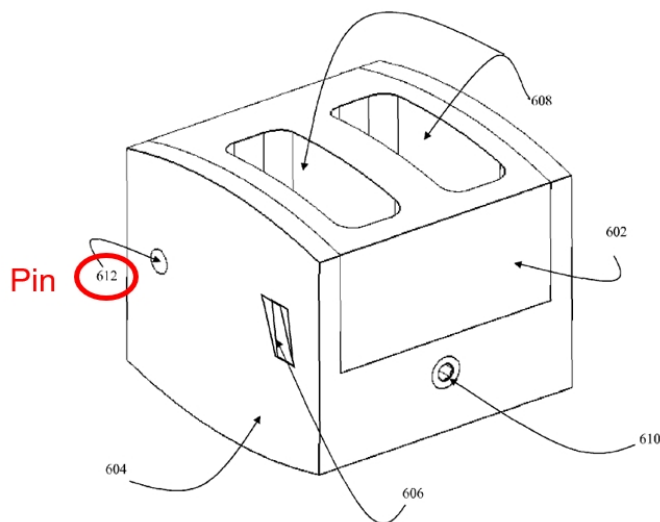
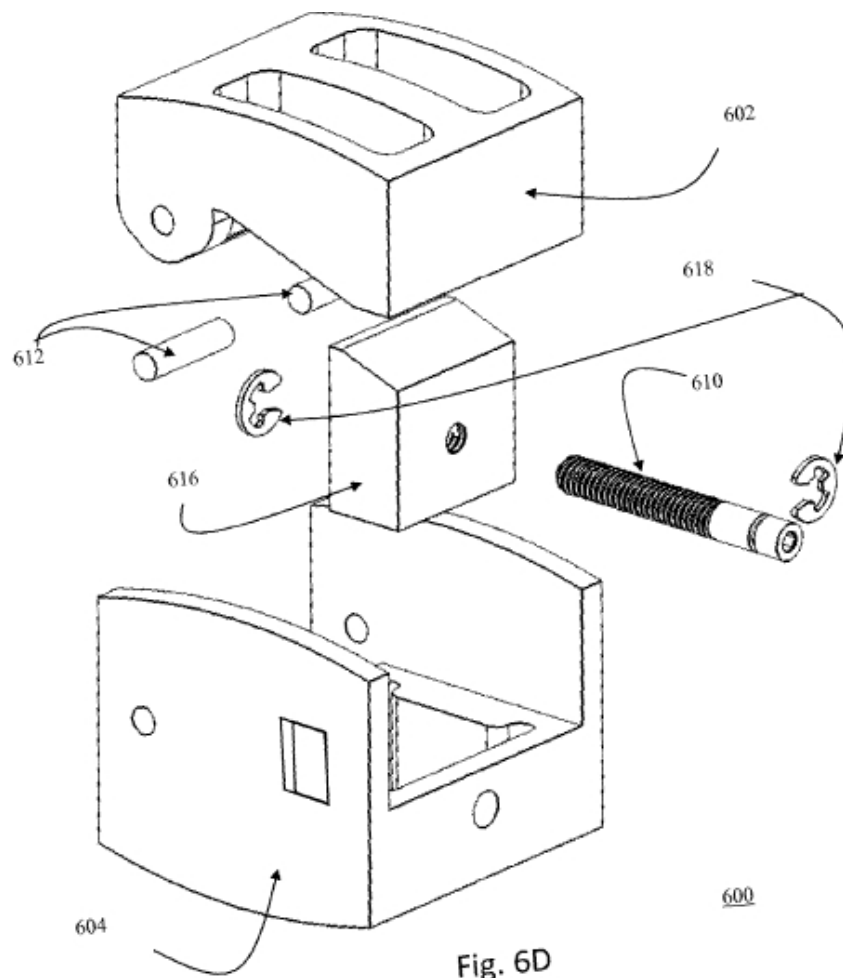


Fig. 6A

600

(*Id.*, Fig. 6A (annotated).)



(*Id.*, Fig. 6D.)

41. **Claim 20** includes three means-plus-function limitations, *i.e.*, “means for attaching the first end of the first housing to the third end of the second housing,” “means for gripping and inserting the device,” and “means for turning the rotation screw with respect to the second movable portion and the wedge.” For reasons discussed above with respect to claim 10, “means for attaching the first end portion of the top housing to the third end portion of the bottom housing” should be interpreted as one or more pins, each of which passes through at least a portion of

both the first and second housings. As discussed above with respect to claim 8, “means for gripping and inserting the device” should be interpreted as tool with prongs. As discussed above with respect to claim 9, “means for turning the rotation screw with respect to the second movable portion and the wedge” should be interpreted as a rotatable tool (*e.g.*, an Allen key) with a screw engagement portion.

VIII. THE PRIOR ART

42. I provide a detailed explanation of my opinions on each element of the challenged claims in the Appendices. In this section, I address the relevant disclosure of Palmatier, as well as concepts known in the art at the time of the alleged invention. I also address some of the key issues.

A. Palmatier

1. Overview

43. Palmatier discloses “an expandable interbody implant system.” (Ex. 1057, 1:35-37.) Palmatier’s intervertebral implant 40, described with references to figures 1-16, is one embodiment of the disclosed “expandable interbody implant system.” (*Id.*, 15:9-12 (“intervertebral implant 40 . . . described above with regards to FIGS. 1-16”).) Palmatier describes variations of implant 40 as implants 540 and 840, which have largely similar components as implant 40. (*Id.*, 15:9-12, 18:38-41.) For example, all three have a piston component 46/546/846, a base component 48/548/848, a wedge 58/558/858 between the two

components, and a rotating screw 92/592/892. (*Id.*, 6:28-31, 8:34-38, 15:15-20, 16:25-29, 18:42-45.²) As explained below, each embodiment has the same basic operating mechanism: the piston component is hingedly connected to the base component, and a wedge is axially translated between them by rotating the screw, which moves the distal portion of the piston component away from the base component to expand the implant. For example, the implant expands from a “collapsed configuration” (shown in figure 15) to an “expanded configuration” (shown in figure 16) by moving the wedge 58 from right to left, *i.e.*, in the direction of arrow D. (Ex. 1057, 13:54-14:2.)

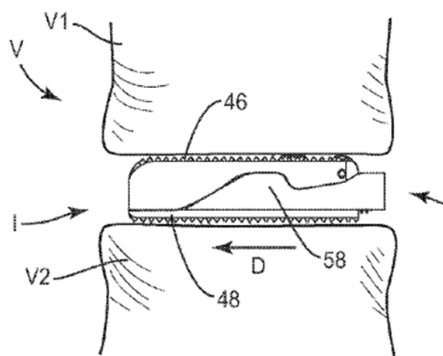


FIG. 15

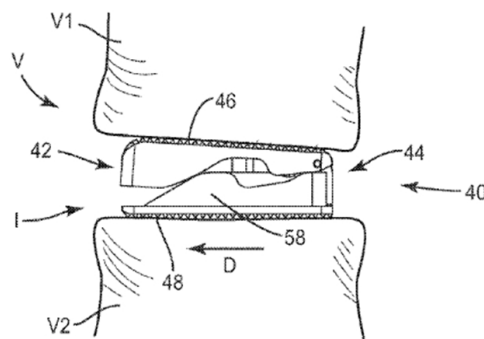
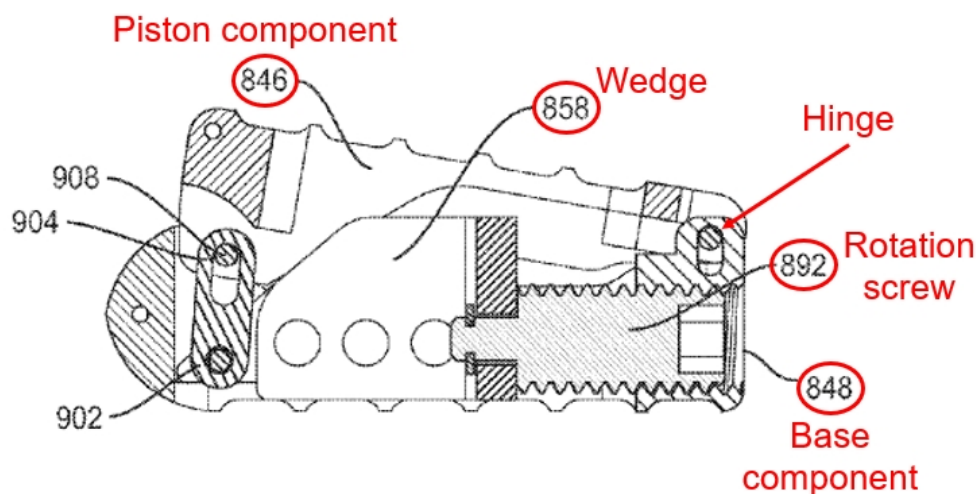


FIG. 16

(*Id.*, Figs. 15-16.)

² Analogous structures in Palmatier have the same ending digits. For example, piston component ends with “46,” base component ends with “48,” wedge ends with “58,” and screw ends with “92.”

44. The embodiment of figures 22-26 discloses an “intervertebral implant 840, similar to intervertebral implant 40” (*Id.*, 18:38-41.) Like implant 40, implant 840 has a base component 848 that is pivotably connected by a hinge with the piston component 846. (*Id.*, Fig. 24 (reproduced below), 18:42-48, 8:43-46 (“Base component 48 is pivotably connected to piston component 46 adjacent posterior ends 66, 86 with hinge 50 to facilitate a pivoting connection between components 46, 48.”), 15:9-23.)

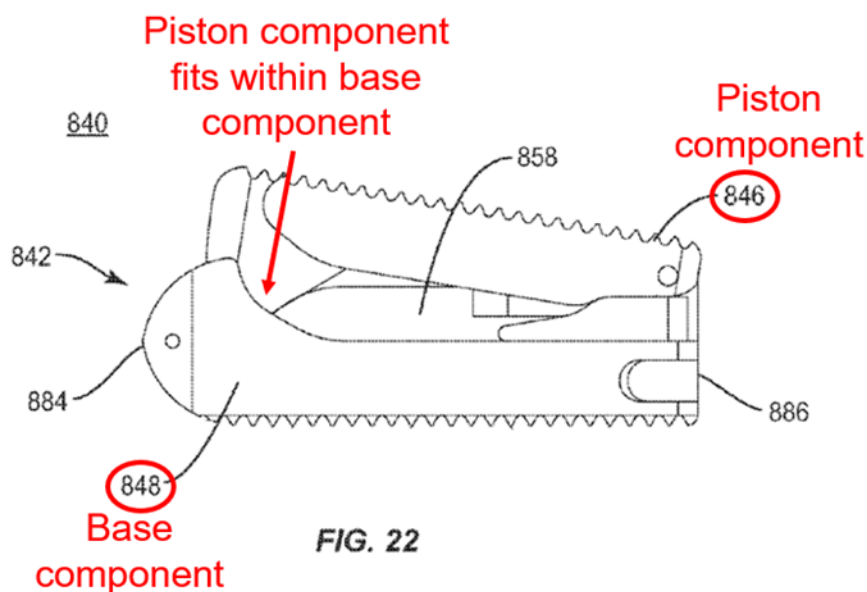


(*Id.*, Fig. 24 (annotated).)

45. To expand the implant, a tool rotates rotation screw 892, which then pushes wedge 858 along the longitudinal axis of the implant. (*Id.*, 18:42-45 (“an inserter or tool (not shown) [] engages a screw 892 for axially translating a wedge 858”); *compare, id.*, Fig. 26, with Fig. 24.) As wedge 858 moves longitudinally, the surface of wedge 858 engage an angled abutting surface of piston component 846 to

pivot piston component 846 relative to base component 848 about a hinge. (*Id.*, Figs. 24-26, 16:25-42.)

46. Palmatier's implant 840 differs from implants 40, 540 because, as shown in figures 22 and 23 below, base component 848 has side walls that create a slot to nest part of piston component 846 within base component 848. According to Palmatier, "[b]ase component 848 protects wedge 858 and screw 892 as intervertebral implant 840 is inserted into an intervertebral disc space." (*Id.*, 18:46-48.)



(*Id.*, Fig. 22 (annotated).)

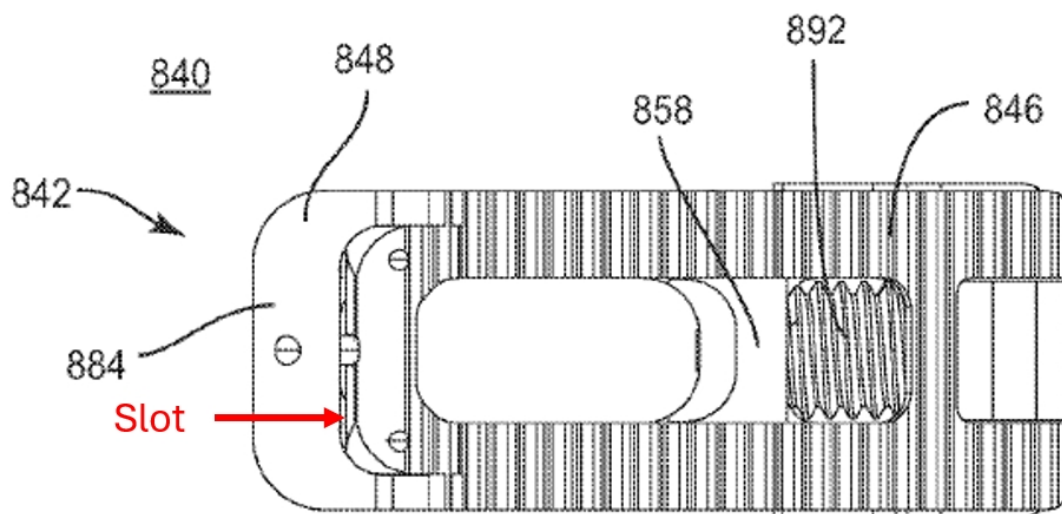


FIG. 23

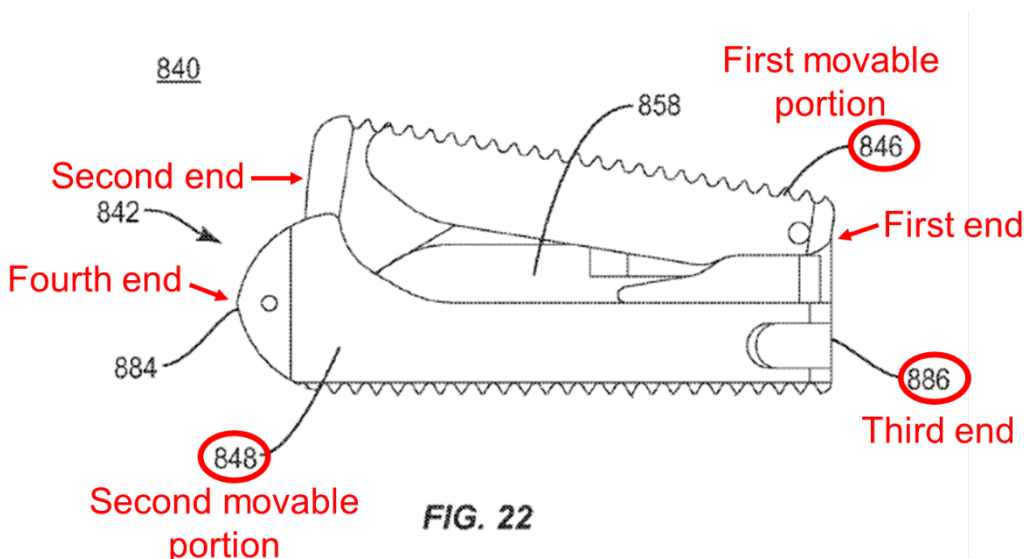
(*Id.*, Fig. 23 (annotated).)

2. Palmatier Discloses “End[s]” That Are “Axially Aligned” with Other “End[s]”

47. Limitation [1.f] require that **“the first movable portion is aligned with the second movable portion such that the first end of the first movable portion is axially aligned with the third end of the second movable portion and the second end of the first movable portion is axially aligned with the fourth end of the second movable portion.”**³ Palmatier discloses this limitation, as I explain below.

³ Claim language is bolded throughout.

48. As discussed below in Appendix A [1.b] and [1.d], and shown below in figure 22, implant 840 has a piston component 846 (**first movable portion**) extending from a “**first end**” to a “**second end**” and a base component 848 (**second movable portion**) extending from a “**third end**” to a “**fourth end**.”



(Ex. 1057, Fig. 22 (annotated).) Each of these ends is aligned relative to an “axis” of the implant, as shown in the figures below.⁴ Figure 23, which is a top view of implant 840, shows that the **second end** and **fourth end** are on the same axis, and further shows (in conjunction with figure 27) that the **first end** and the **third end**

⁴ Claim 1 does not define the “axis” or give any further clarity regarding what is required for ends to be “axially aligned.” For example, claim 1 does not specify if there is one or more than one axis relative to which the ends are aligned. The ’633 patent specification is similarly deficient.

are positioned on the same axis; thereby, all the ends are axially aligned.⁵ Palmatier thus discloses limitation [1.f].

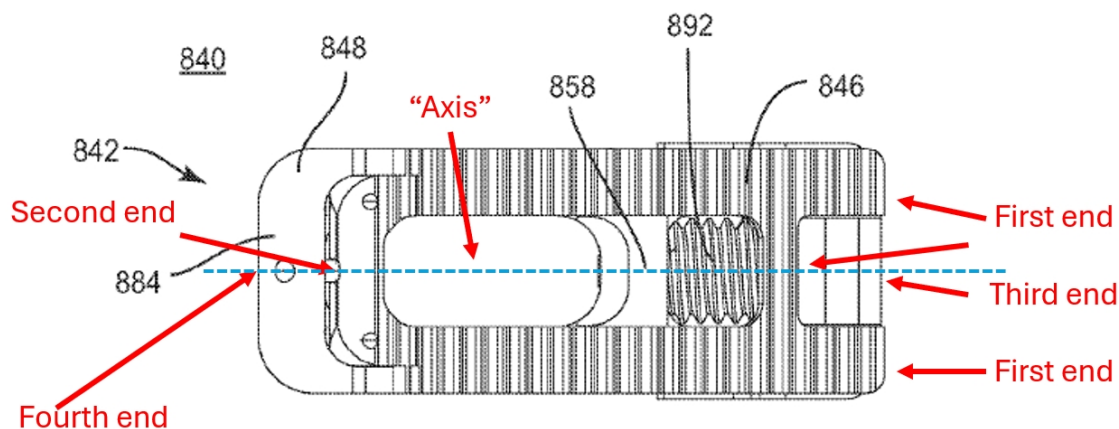


FIG. 23

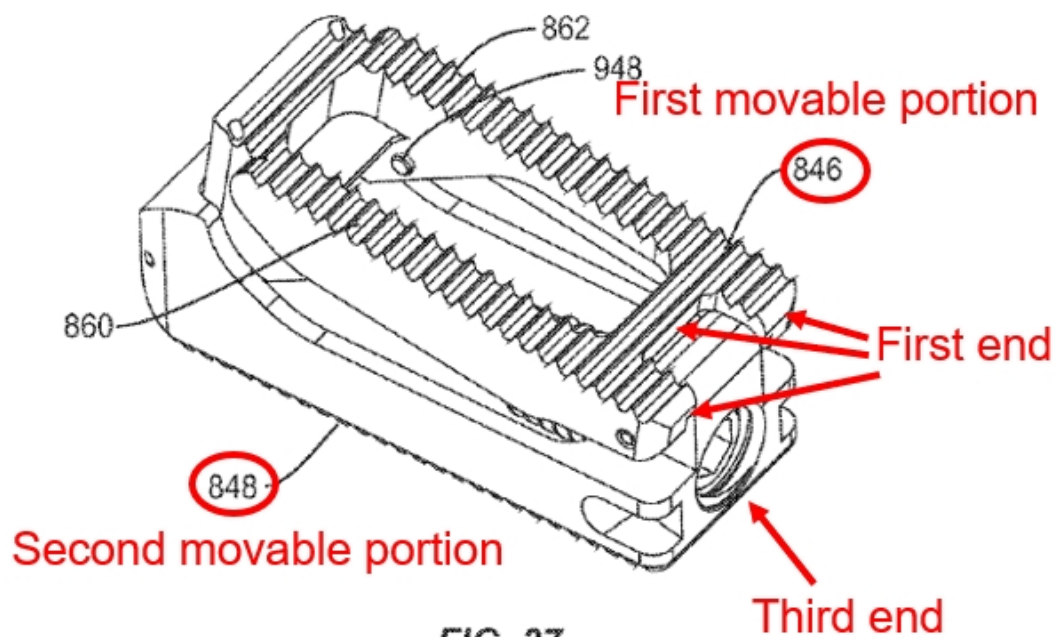


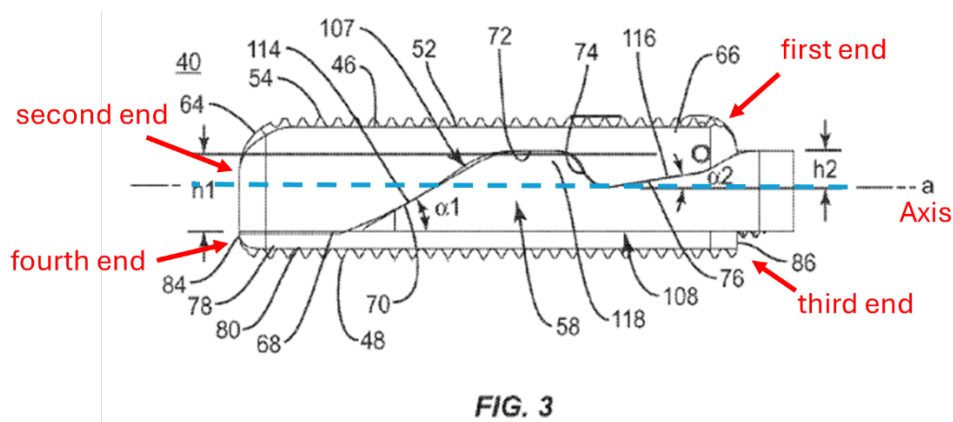
FIG. 27

⁵ Figure 27 is a “perspective view of one embodiment of the components of the implant shown in FIG. 22.” (*Id.*, 3:23-24, Fig. 27.)

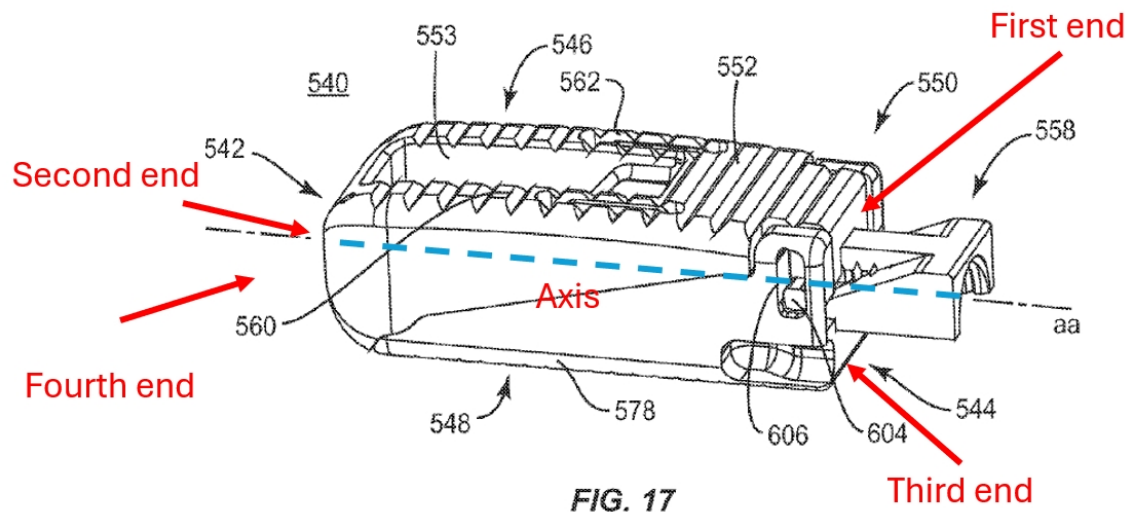
(*Id.*, Figs. 23, 27 (both annotated).)

**3. A POSITA Would Have Been Motivated to Modify
Palmatier's Implant 840, Extending the Anterior End of the
First Movable Portion All the Way to the Anterior End of
the Second Movable Portion Relative to the Axis of the
Implant**

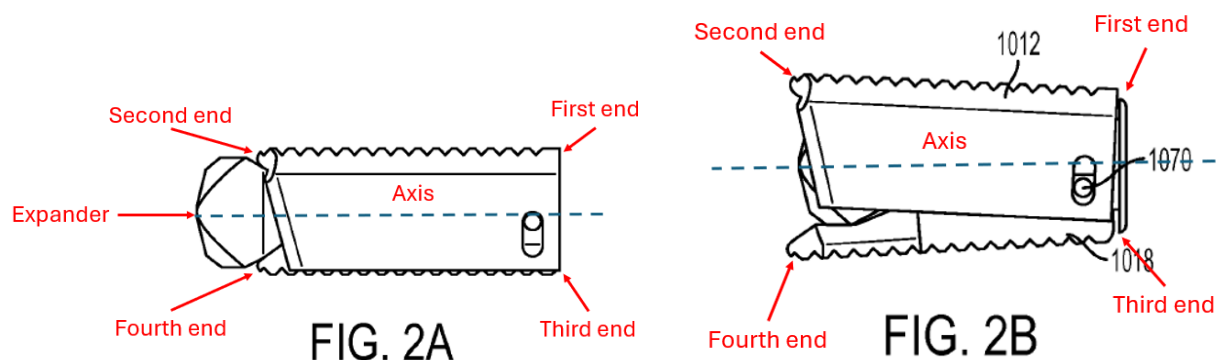
49. The other exemplary embodiments of Palmatier (shown in, *e.g.*, figure 3 as implant 40 and figure 17 as implant 540) are described as “similar” to implant 840. (Ex. 1057, 18:38-41.) All three exemplary embodiments are implementations of Palmatier's expandable implant having “base” and “piston components” sandwiching a translating “wedge” that expands the implant. And like implant 840 shown in figure 23, each of Palmatier's alternative exemplary embodiments are “axially aligned” in a manner consistent with Patent Owner's infringement contentions. For example, as shown in figure 3 of Palmatier below, the “first,” “second,” “third” and “fourth” ends of implant 40 are also axially aligned relative to a “longitudinal axis a” of the device. (*Id.*, 6:25-28, 7:14-18, 8:5-8.)



(*Id.*, Fig. 3 (annotated).) And as shown in figure 17 below, the “first,” “second,” “third” and “fourth” ends of implant 540 are axially aligned relative to a “longitudinal axis aa” of the device. (*Id.*, 15:12-14.)



(*Id.*, Fig. 17 (annotated).) Indeed, other “axially aligned” implants were well known in the art, for instance, in Robinson, discussed *supra*, Section V.B and below.



(Ex. 1024, Figs. 2A, 2B (both annotated).)

50. Among other subtle distinctions, implants 40, 540 and 840 of Palmatier differ in terms how the piston and the base components—including their respective

vertebral engagement surfaces—are configured, as well as with respect to their wedge components responsible for expansion. For instance, in both implant 40 and 540, the piston and base components have largely the same length as measured from the “first” to the “second” end and the “third” to the “fourth” end, and are arranged such that the “first” and “third” ends, and the “second” and “fourth” ends align vertically in the same plane. (See Ex. 1057, Figs. 3, 17 (annotated and reproduced above).) In contrast, in implant 840, the base and piston components have different lengths and are configured such that the “second end” of the piston component fits between sidewalls adjoining the “fourth end” of the base component.

51. Given the related disclosures in Palmatier, and for additional reasons discussed below, a POSITA would have been motivated to modify implant 840 to extend the anterior end of the piston component 846 all the way to the anterior end of the base component 848, like in implants 40 and 540. Palmatier envisions such modifications as it expressly teaches that “various modifications may be made to the embodiments disclosed herein.” (*Id.*, 19:27-28.) Modifying the base and piston components of implant 840 in this manner to match implants 40 and 540 would have increased the footprint (surface area) of the piston component 846 relative to the opposing vertebral body endplate. It was known that larger footprints increase the biomechanical stability, lessen the occurrence of subsidence (by distributing the amount of force over a greater surface area and loading the endplates at the denser

cortical edge), and result in lower stress on the endplates. (*Supra*, Section V.C.) As discussed in Section V.C, to reduce the risk of subsidence, a POSITA would have been motivated to maximize the footprint on piston component 846 and to ensure that the implant extends to the periphery of the vertebral body (the strongest part of the vertebral body) both above and below the implant. Therefore, a POSITA would have been motivated to extend the anterior end of piston component 846 towards the anterior end of base component 848.

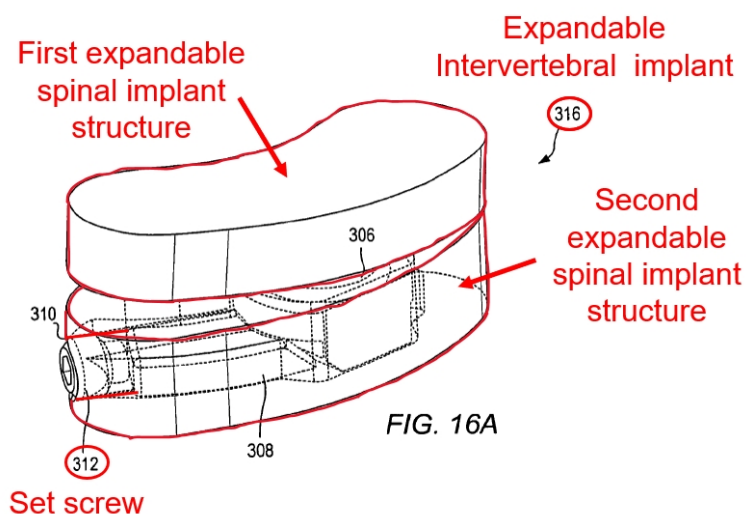
52. A POSITA would have had a reasonable expectation of success in modifying implant 840 in the above manner especially given that Palmatier's other embodiments expressly disclose such a design. Indeed, Palmatier's implant 840 differs from Palmatier's implants 40, 540 in that implant 840 has extended side walls on base component 848 and an opening, *i.e.*, slot, between the side walls that allows piston component 846 to nest within base component 848. That same arrangement could have been maintained while extending the anterior end of the piston component 846 to align with the anterior end of the base component 848. Nor would extending the anterior end of the piston component 846 to align with the anterior end of the base component 848 have required any alteration of the expansion mechanism in implant 840. (Ex. 1057, 18:63-66 (disclosing that implants 40, 540, 840 expand in the same manner).)

53. Therefore, because prior art expandable implants were generally known to have axially aligned ends and Palmatier expressly discloses multiple exemplary variations with such ends, a POSITA would have reasonably expected success in modifying implant 840 to have ends configured as in implant 40 or implant 540.

B. Palmatier-Gordon Combination

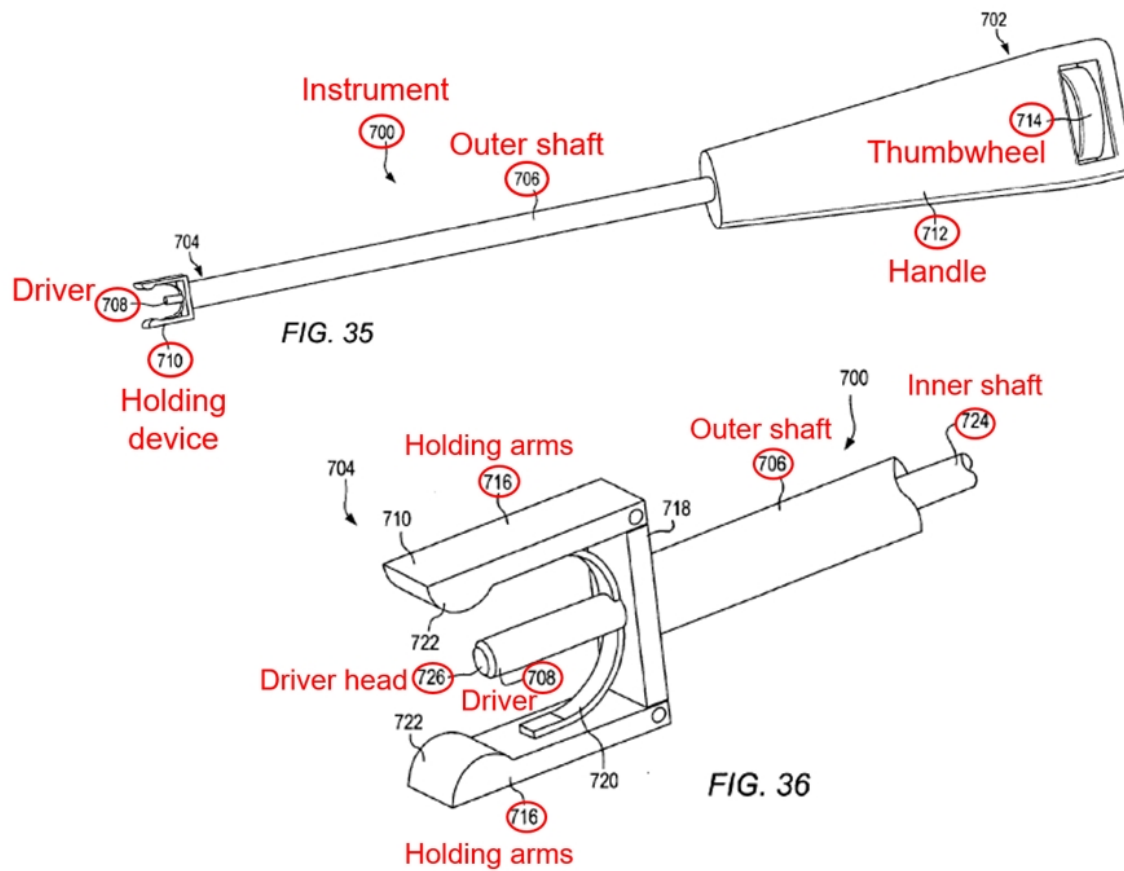
1. Overview of Gordon

54. Gordon is titled “Expandable Intervertebral Implant.” Gordon discloses an expandable intervertebral implant 316 for insertion between adjacent vertebrae. (Ex. 1013, [0178]; *see also id.*, [0006]-[0008], [0137]-[0139].) As shown in figure 16A below, implant 316 includes first and second expandable spinal implant structures, insert 306, expansion member 308, and advancing element 312, which may be “a set screw.” (*Id.*, [0177]-[0178], [0197], Fig. 16A.)



(*Id.*, Fig. 16A (annotated).)

55. Gordon also discloses a tool assembly for inserting implant 316 between adjacent vertebrae. (*Id.*, [0226]-[0243], Figs. 35-38; *see also id.*, Abstract, [0003], [0022], [0025], [0137]-[0144], Figs. 39-42.) With reference to figures 35-38 below, Gordon's tool assembly includes instrument 700, which comprises outer shaft 706, handle 712, and holding device 710 with holding arms 716. (*Id.*, [0227], [0230], Figs. 35-36.) Holding arms 716 have lobes 722 which fit into side recesses of the implant to secure the implant during insertion and/or expansion of the implant. (*Id.*, [0231]-[0237], Fig. 38.) The tool assembly also includes driver 708, which comprises an inner shaft 724 extending through outer shaft 706 and driver head 726 at the driver 708's distal end, which engages a set screw of the implant to expand the implant. (*Id.*, [0230], [0233]-[0238].)



(Id., Figs. 35-36 (annotated).)

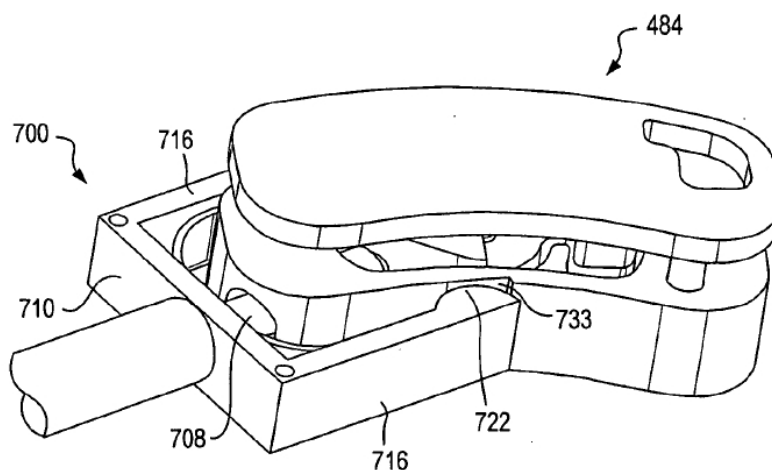


FIG. 38

(*Id.*, Fig. 38.)

2. Palmatier Discloses “Indentations”

56. Claim 4 requires “[t]he device of claim 1, and further comprising means for mating the second movable portion with prongs of a tool.” Palmatier discloses this limitation, as I explain below.

57. As discussed in Section VII, the structure corresponding to the means required by this limitation are indentations on the lateral sides of the second movable portion. Palmatier discloses that the “posterior end 886 [is] configured to attach to an inserter or tool (not shown) that engages a screw 892 for axially translating a wedge 858.” (Ex. 1057, 18:42-45.) As shown in figure 22 below, the base component 848 (second movable portion) has indentations, which a POSITA would have understood allow the base component to attach to prongs of an inserter or tool. (*Supra* Section VIII.B.1 (discussing Gordon’s holding arms 716).)

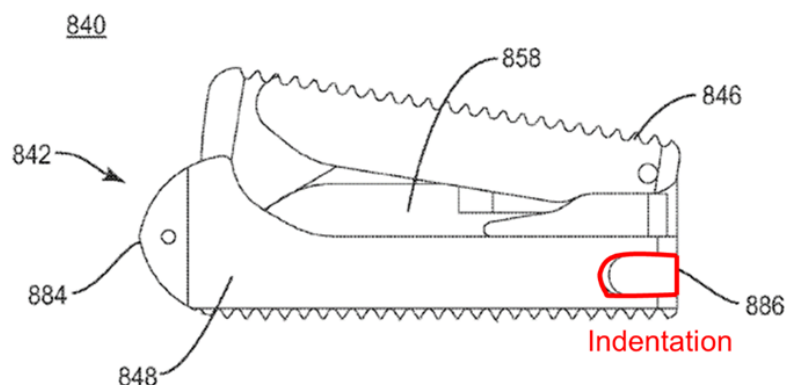


FIG. 22

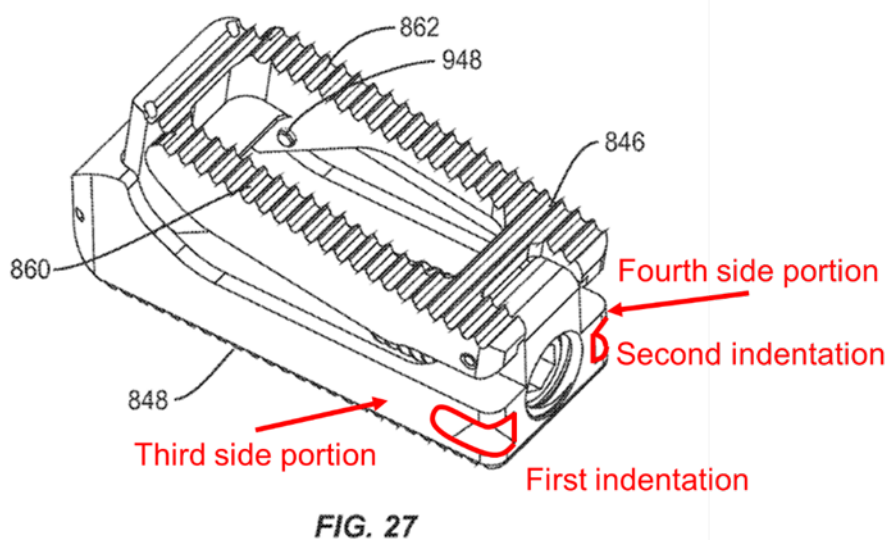
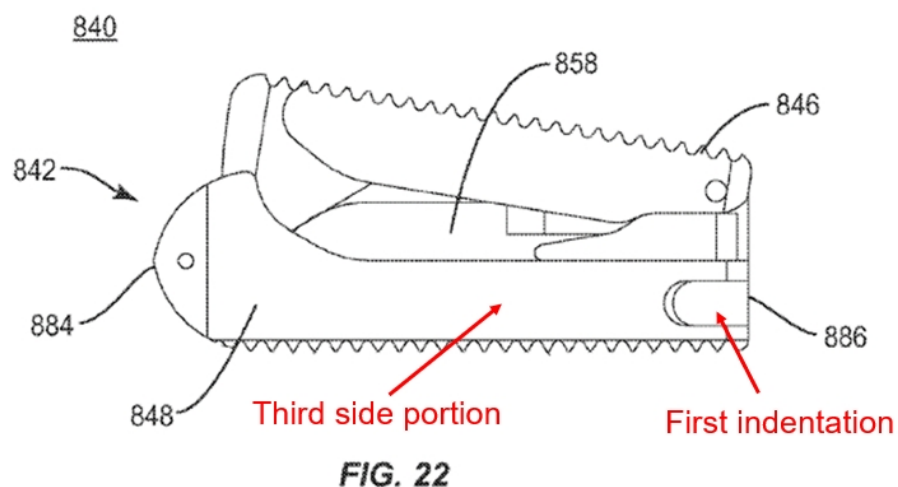
(*Id.*, Fig. 22 (annotated).)

58. While only one indentation is visible in figure 22, a POSITA would have understood that there is a second indentation identical to the first on the other side of the implant. This is confirmed by figure 27, which is a “perspective view of one embodiment of the components of the implant shown in FIG. 22.” (Ex. 1057, 3:23-24, Fig. 27.)

59. Claim 7 requires “[t]he device of claim 1, wherein the third and fourth side portions define first and second indentations that extend into but not through the third and fourth side portions and that are configured to be grabbed by an insertion tool.” Palmatier discloses this limitation, as I explain below.

60. As discussed in Appendix A [1.d], the base component in implant 840 has “third and fourth side portions.” Palmatier further discloses “first and second indentations” in “the third and fourth side portions” of the second movable portion “that are configured to be grabbed by an insertion tool.” As shown in figure 22 below, the first indentation has a back wall such that “the first . . . indentation . . . extend[s] into but not through the third . . . side portion.” This is further evident from figure 27, which is a “perspective view of one embodiment of the components of the implant shown in FIG. 22.” (Ex. 1057, 3:23-24, Fig. 27.) A POSITA would have understood that the second indentation is identical to the

first, which is again confirmed by figure 27. Palmatier thus discloses a “**second indentation[] that extend[s] into but not through the . . . fourth side portion.**”

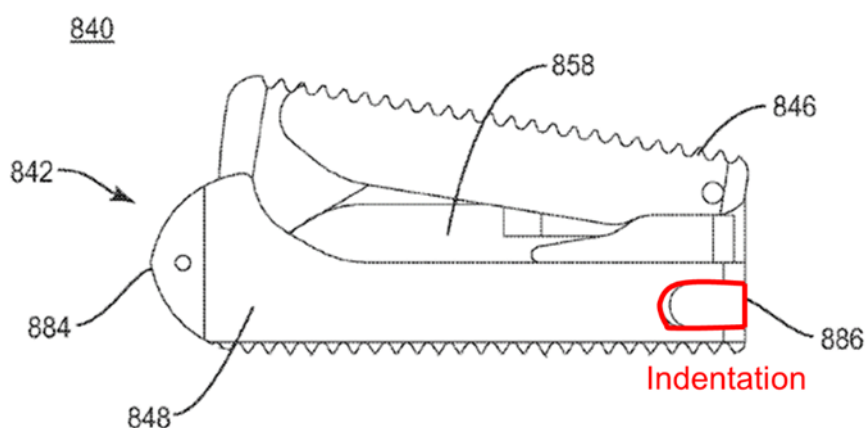


(*Id.*, Figs. 22, 27 (both annotated).)

3. Gordon Discloses “a Tool” with “Prongs”

61. Palmatier in view of Gordon discloses and suggests claim 4. As discussed above in Section VIII.B.2, Palmatier discloses indentations on the base

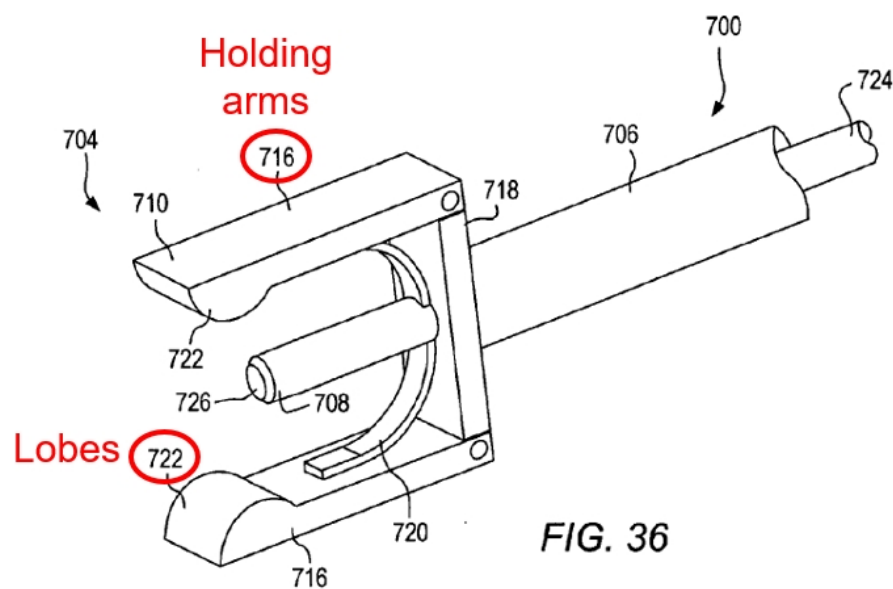
component that a POSITA would have understood are for mating with prongs of an insertion tool. Palmatier additionally discloses that “posterior end 886 [of base component 848 is] configured to attach to an inserter or tool (*not shown*) that engages a screw 892 for axially translating a wedge 858.” (Ex. 1057, 18:42-45 (emphasis added).) Palmatier, however, does not provide an illustration of the tool.



(Ex. 1057, Fig. 22 (annotated).).

62. Gordon discloses a tool for gripping and inserting an expandable implant like in Palmatier. Gordon discloses a “holding device 710 [that] may hold an implant during insertion of the implant between two vertebrae.” (Ex. 1013, [0230].) “[A]s shown in FIG. 36, holding device may include holding arms 716.” (*Id.*) “Lobes 722 on holding arms 716 may engage complementary surfaces (e.g., notches, grooves) on an implant or spacer. Engagement between lobes and complementary surfaces on an implant or spacer may promote engagement between

an instrument and an implant or spacer.” (*Id.*, [0231].) “Engagement of lobes 722 in holding recesses 733 may help maintain a position of the implant during insertion and/or expansion of the implant.” (*Id.*, [0237].) Gordon’s holding device 710 is a tool with prongs (holding arms 716). Gordon thus discloses prongs of a tool that can mate with the indentations in Palmatier’s implant.



(*Id.*, Fig. 36 (annotated).)

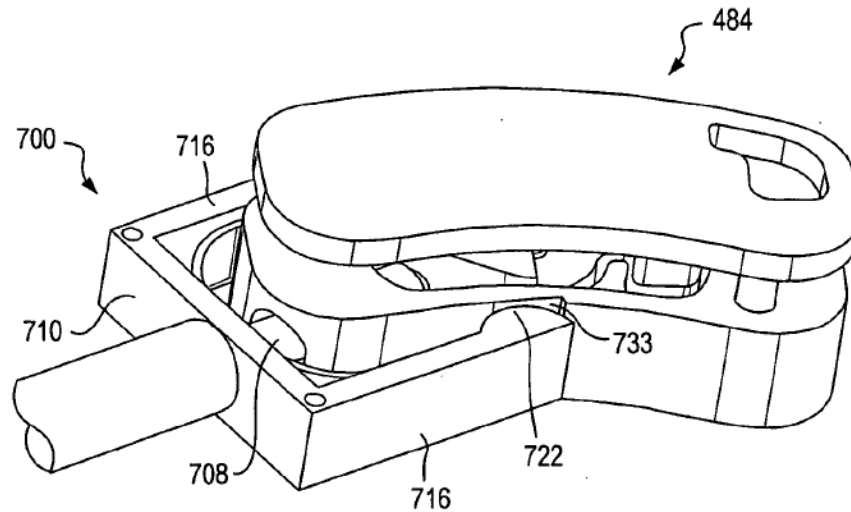


FIG. 38

(*Id.*, Fig. 38.)

4. A POSITA Would Have Been Motivated to Use Gordon's Tool with Palmatier's Implant 840

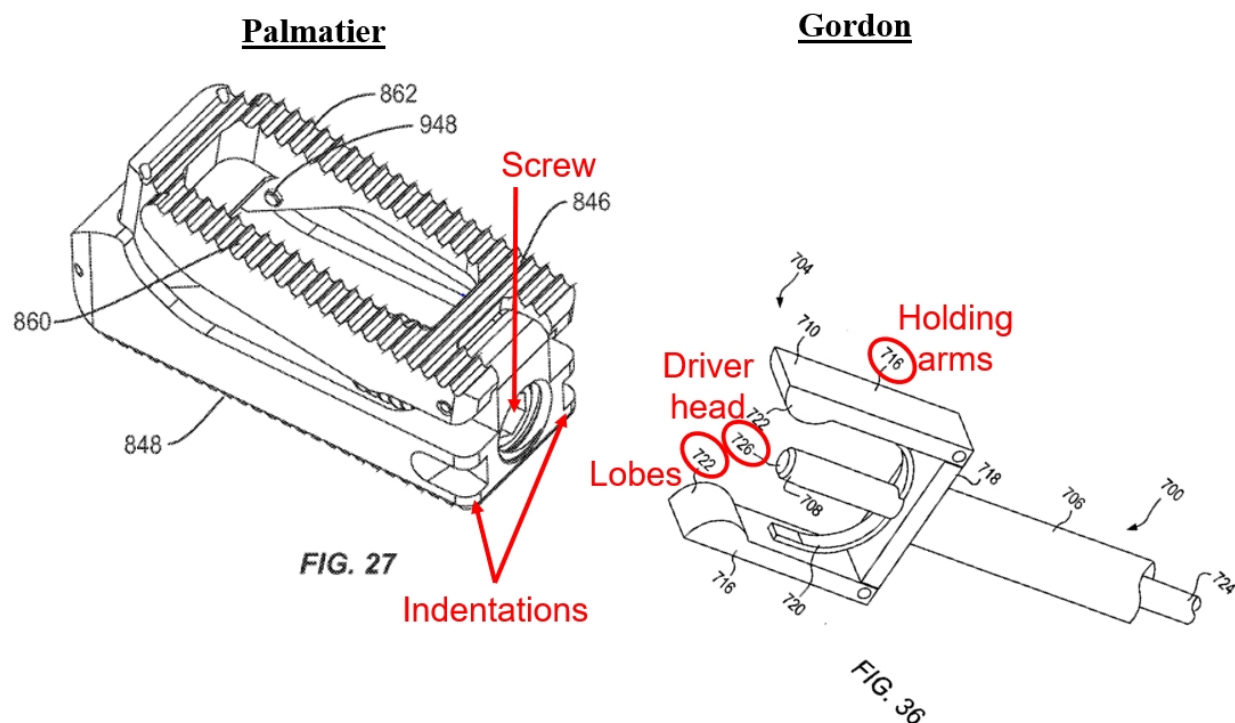
63. A POSITA would have been motivated to combine Gordon's tool with Palmatier's implant. Given Palmatier's statements about the tool used for inserting and expanding implant 840, and considering the indents on implant 840, a POSITA would have looked to a reference like Gordon, which discloses surgical tools that could mate with Palmatier's indentations to insert the implant 840 and engage Palmatier's screw 892 to expand implant 840. A POSITA would have been motivated to use a tool assembly like that disclosed in Gordon because the only modifications required to use Gordon's tool with Palmatier's implant 840 would be to account for the shape and size of the implant and the associated indentations in

Palmatier's implant 840. Like Palmatier's implant 840, the Gordon implant is also expanded in response to a driver rotating a screw located at the proximal end of the implant. (*Compare* Ex. 1013, [0177], [0233], Fig. 38 *with* Ex. 1057, 18:38-52, Figs. 24-26.) Thus, Gordon's tool assembly design would have been a suitable, if not ideal, choice for a POSITA to consider using with Palmatier's implant 840 given both Palmatier's and Gordon's implants have similar structures for securing the implant in place while expanding it.

64. A POSITA would have also been motivated to use the Gordon tool assembly with Palmatier's implant 840 because it offers the advantage of a single tool assembly that can both insert the implant and expand it when it is in the proper position. (Ex. 1013, [0226].) A tool that could be used for both insertion and expansion of the implant, like that disclosed by Gordon, would be preferred because use of multiple, separate tools could disrupt the patient's surgical opening and require more time and effort by the surgeon.

65. Given the apparent cooperative nature between Gordon's tool assembly and Palmatier's implant 840, a POSITA would have also had a reasonable expectation of success in using Gordon's tool assembly to implant and expand Palmatier's implant 840. For instance, Gordon discloses that driver head 726 in its tool assembly can take "various forms suitable for actuating (*e.g.*, rotating, advancing) a portion of an expansion member or insert" to expand the implant. (Ex.

1013, [0233], Figs. 36, 38.) As shown in the figures below, in the Palmatier-Gordon combination, Gordon's driver head 726 would have engaged the screw head of Palmatier's screw 892 to expand implant 840. Moreover, Gordon's holding device 710 includes holding arms 716, which as shown below, are shaped such that they would engage the indentations on the lateral sides of base component 848.



(Ex. 1057, Fig. 27 (annotated); Ex. 1013, Fig. 36 (annotated).)

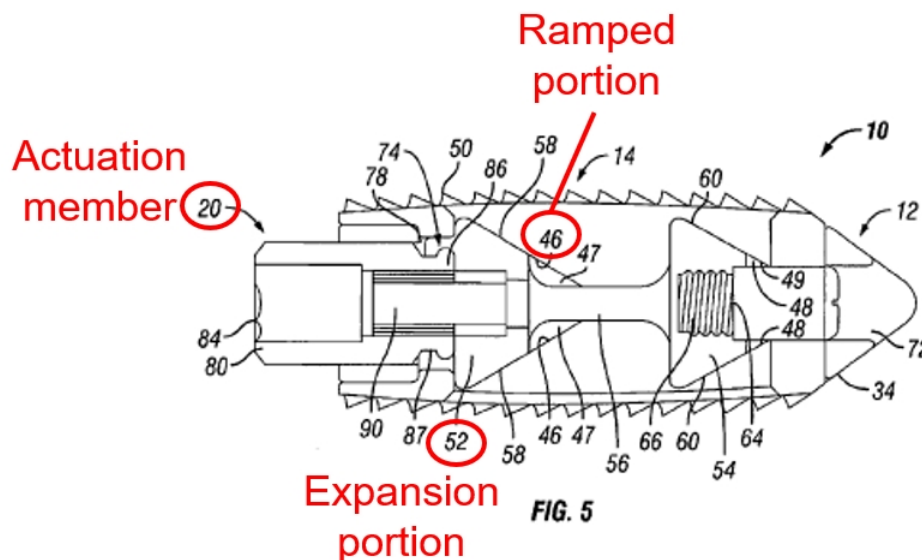
C. Palmatier-Glerum Combination

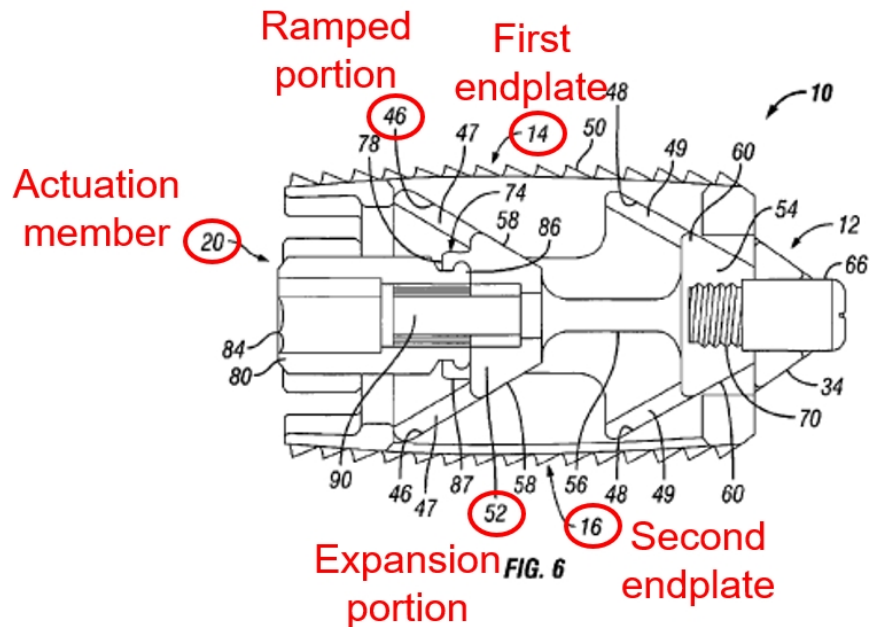
1. Overview of Glerum

66. Glerum discloses an “expandable fusion device capable of being installed inside an intervertebral disc space.” (Ex. 1058, Abstract.) The “fusion

device 10 includes a body portion 12, a first endplate 14, a second endplate 16, a translation member 18, an actuation member 20, and an inserter 22.” (*Id.*, [0037].)

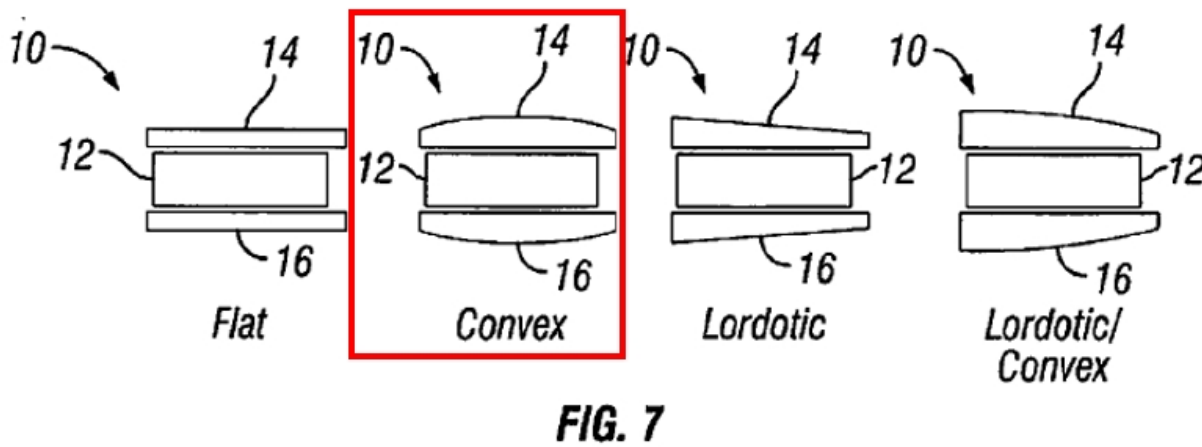
67. “To expand the fusion device 10, an instrument is engaged with recess 84 in the actuation member 20. The instrument is used to rotate actuation member 20 . . . [and] as the actuation member 20 is rotated in a first direction, the actuation member 20 and the translation member 18 move with respect to the body portion 12 toward the first end 22 of the body portion 12.” (*Id.*, [0049].) As shown in figures 5 and 6 below, “as the translation member 18 moves, the angled surfaces 58, 60 of the expansion portions 52, 54 push against the ramped portions 46, 48 of the endplates 14, 16 pushing endplates 14, 16 outwardly into the expanded position.” (*Id.*)





(*Id.*, Figs. 5, 6 (both annotated).)

68. The “upper surface” of endplate 14 “can be curved convexly or concavely to allow for a greater or lesser degree of engagement with the adjacent vertebral body 2.” (*Id.*, [0044], Fig. 7.) The lower surface 42 of the second endplate 16 can also be curved convexly. (*Id.*, [0041], Fig. 7.)



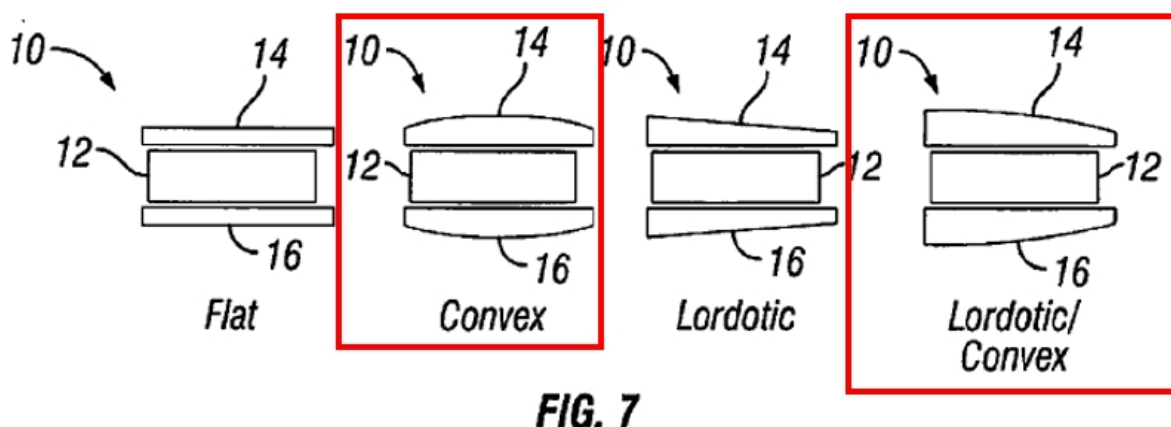
(*Id.*, Fig. 7 (annotated).)

**2. A POSITA Would Have Been Motivated to Modify
Palmatier's Implant 840 to Have Endplate Surfaces That
Are Partially Convex**

69. As discussed below in Appendix A, Palmatier discloses and/or suggests claim 14 and claims 16-18, which depend from claim 14. In particular, as discussed in Appendix A [14.c] and [14.f], Palmatier discloses that the first and second vertebral body engagement surfaces, *i.e.*, the endplate surfaces of implant 840, are “**partially convex**” consistent with Patent Owner’s infringement contentions. As discussed below, Glerum also discloses an expandable device with “**partially convex**” vertebral body engagement surfaces and a POSITA would have been motivated to configure Palmatier’s endplate surfaces to be “**partially convex**” in view of Glerum.

70. As discussed in Section VIII.C.1, Glerum discloses an “expandable fusion device” with two endplates, 14, 16 that engage with adjacent vertebral bodies. (Ex. 1058, [0041], [0044].) Glerum also discloses that “the upper surface” of first endplate 14 “can be curved convexly or concavely to allow for a greater or lesser degree of engagement with the adjacent vertebral body.” (*Id.*, [0044].) Glerum thus discloses “**a first vertebral body engagement surface that is at least partially convex**” (emphasis added). Glerum also states that while the relevant “discussion relates to the first endplate 14, it should be understood that it also equally applies to the second endplate 16 as the second endplate 16 is substantially identical to the first

endplate 14 in embodiments of the present invention.” (*Id.*) Glerum thus discloses
“a second vertebral body engagement surface that is at least partially convex.”



(*Id.*, Fig. 7 (annotated).)

71. A POSITA would have been motivated to combine the convex endplate of Glerum with the expansion mechanism in Palmatier’s implant 840. As discussed in Section V.C, the endplate of the vertebral body is a concave structure, and the geometry of interbody fusion devices was a factor known to influence fusion failure. According to Glerum, the upper surface of endplate 14 “can be curved convexly or concavely to allow for a greater or lesser degree of engagement with the adjacent vertebral body.” (*Id.*, [0044].) Moreover, as shown in the right most configuration in figure 7, which has a partially convex upper surface, “[t]he ramped surface [of upper surface 40] allows for engagement with the adjacent vertebral body 2 in a lordotic fashion.” (*Id.*) A POSITA thus would have been motivated to use Glerum’s

convex (or partially convex) vertebral body engaging surface with Palmatier's implant 840 to provide optimal fit between the implant and the endplate surface thereby mitigating the risk of fusion failure. (*See supra*, Section V.C.)

72. A POSITA would have reasonably expected success in using Glerum's convex endplate surface with Palmatier's implant 840. *First*, it was within ordinary skill to modify the outer surface of an implant like implant 840. In fact, Glerum discloses that flat vertebral body engagement surfaces are interchangeable with convex vertebral body engagement surfaces. (Ex. 1058, [0044].) *Second*, any required alteration from a flat to a convex endplate surface would not have impacted the functionality of implant 840, including its expansion mechanism based on axial translation of wedge 858 between the piston and base components.

73. Thus, Palmatier combined with Glerum, discloses or suggests claim limitations [14.c] and [14.f]. The analysis for the remaining limitations of claim 14 and its dependent claims 16-18 remains the same as set forth in Appendix A [14] and [16]-[18]. Hence, Palmatier combined with Glerum discloses or suggests claims 14 and 16-18 for the reasons discussed in Appendix A [14] and [16]-[18] and the analysis presented in this section concerning the "partially convex" limitation.

IX. CONCLUSION

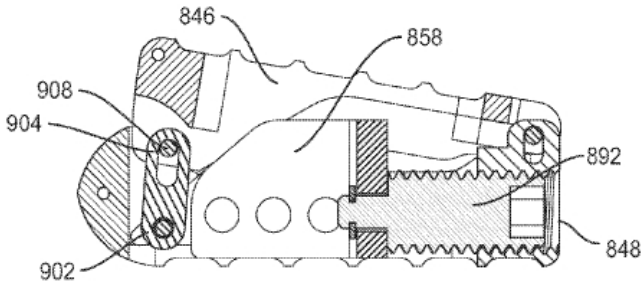
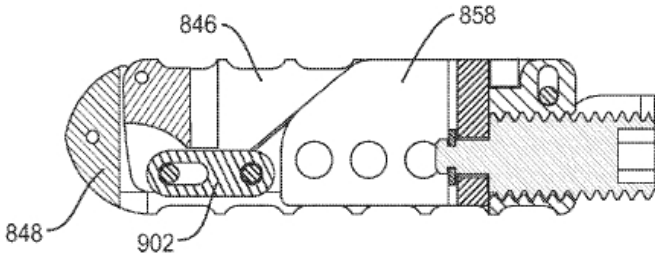
74. I declare that all statements made herein of my knowledge are true, and that all statements made on information and belief are believed to be true, and that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or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

Dated: January 15, 2026

By: 

Brad Culbert

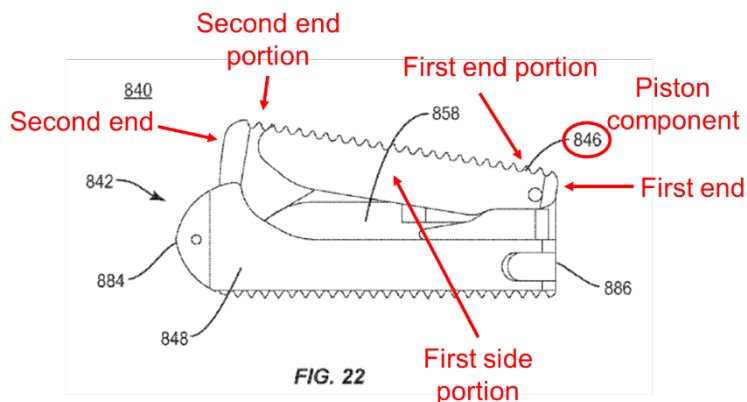
APPENDIX A

'633 Patent Claim Element	Prior Art Analysis
Claim 1	
[1.a] “An expandable intervertebral fusion device comprising:”	To the extent the preamble is limiting, Palmatier discloses this limitation. Palmatier discloses an intervertebral implant 840 with reference to figures 22-26, and, as shown in figures 24 (expanded configuration) and 26 (collapsed configuration) below, implant 840 is an “expandable interbody implant system.” (Ex. 1057, 1:35-37, 3:30-35, Figs. 22, 24, 26.) The “implant [] expands after insertion into an intervertebral disc space.” (<i>Id.</i>, 3:39-48; <i>supra</i> Section VIII.A.1.)  FIG. 24  FIG. 26 (Ex. 1057, Figs. 24, 26.) The implant further allows for “fusion” of the adjoining vertebrae. (<i>Id.</i>, 3:35-40, 4:5-15.) The implant packs bone graft material (<i>compare id.</i>, Fig. 10, with Fig. 23; <i>id.</i>, 19:6-10 (“linkage component 902 prevents bone graft and/or agents

	from undesirably engaging and/or interfering with wedge 858 during axial translation”); <i>infra</i> , Appendix A [2.a]), which enables bone “fusion.” (<i>Id.</i> , 11:1-4.) Palmatier thus discloses “[a]n expandable intervertebral fusion device.”
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⁶ Palmatier discloses three main embodiments (implant 40, implant 540, and implant 840). Palmatier explains that its statements about implant 40 and implant 540 also apply to implant 840. (Ex. 1057, 18:38-41 (“intervertebral implant 840 [is] similar to intervertebral 40 and intervertebral implant 540 and their components.”).) Palmatier also states that “intervertebral implant 840 is expanded . . . as described above with regard to intervertebral implants 40, 540.” (*Id.*, 18:63-66.) Where certain components are not expressly discussed with respect to implant 840, but are otherwise present in the figures for implant 840, as well as implants 40, 540, I cite disclosure for analogous components in implants 40, 540 that have, for example, been assigned the same ending digits.

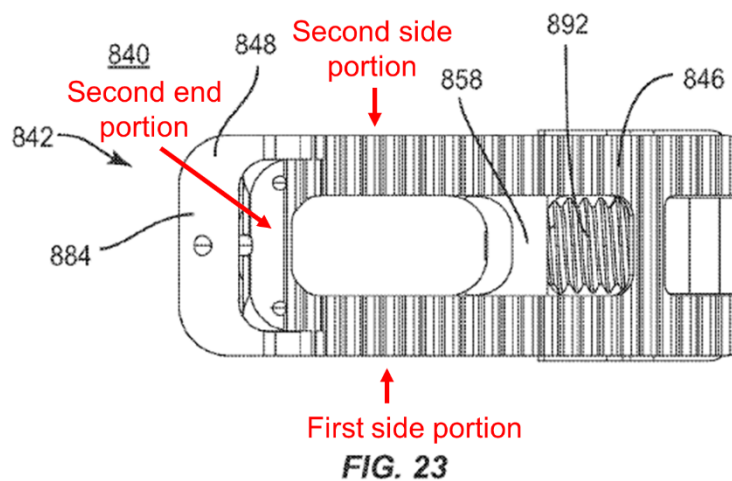
[1.b] “a first movable portion extending from a first end to a second end, wherein the first movable portion has first and second end portions positioned at the first and second ends, respectively, and has first and second side portions extending between the first and second end portions,”	Palmatier discloses this limitation. As seen in figure 22 below, implant 840 includes a piston component 846, which is a “first movable portion” because it moves between an expanded and collapsed configuration. (Ex. 1057, 18:38-19:2, Figs. 24-26; <i>see also id.</i>, 6:31-36 (“Base component 48 is movably mounted to piston component 46 with a hinge 50 to facilitate a pivoting connection between components 46, 48. Components 46, 48 are relatively movable to expand and collapse with [the] intervertebral implant.”).⁶⁾
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(*Id.*, Fig. 22 (annotated).)

As seen in figure 22 above, Palmatier's piston component 846 extends from a posterior end, *i.e.*, “**a first end**,” to an anterior end, *i.e.*, “**a second end**.” (*Id.*, Figs. 22, 24; *see also id.*, 6:25-38, Fig. 12.) Areas around the posterior end and anterior end are “**first and second end portions**,” respectively. Palmatier thus discloses “**a first movable portion extending from a first end to a second end, wherein the first movable portion has first and second end portions positioned at the first and second ends, respectively.**”

As shown in figure 22 above, Palmatier's piston component 846 includes “**first and second side portions extending between the first and second end portions.**” (*Id.*, 3:14-17.) While the “**second side portion**” is not visible in figure 22, a POSITA would have understood that there is a **second side portion** on the other side of the **second end portion** given the symmetrical nature of the device evident from figure 23 below.



(*Id.*, Fig. 23 (annotated).)

[1.c] “wherein the first movable portion has a first vertebral body engagement surface and has a first interior surface positioned on an opposite side of the first movable portion than the first vertebral body engagement surface;”

Palmatier discloses this limitation. As shown in figure 22 below, piston component 846 (**first movable portion**) has a ridged outer surface that contacts the vertebral body.

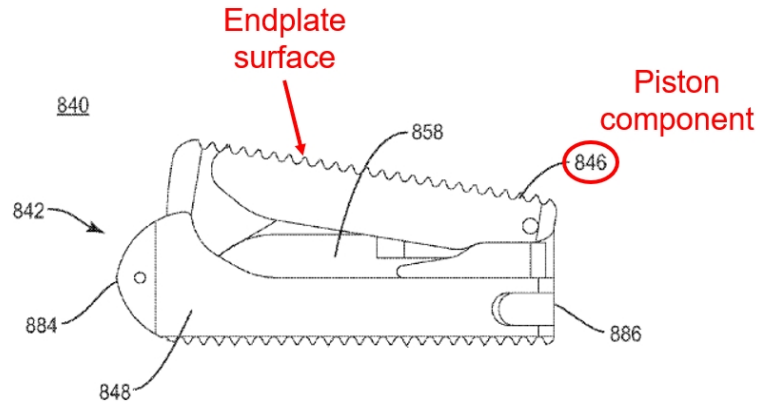


FIG. 22

(Ex. 1057, Fig. 22 (annotated).) As explained with reference to the corresponding parts of implant 40, this ridged outer surface is “an outer tissue engaging surface, such as, for example, an endplate surface 52,” which is “configured to engage an endplate of a vertebra.” (*Id.*, 6:46-60, Fig. 16; compare *id.*, Fig. 22, with *id.*, Fig. 5; Fig. 15.)

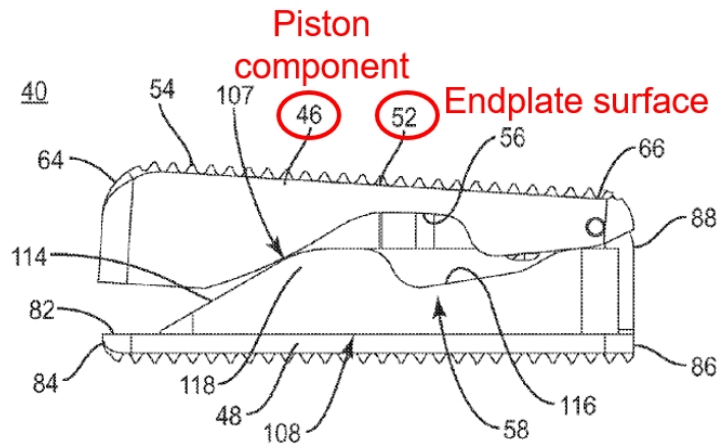
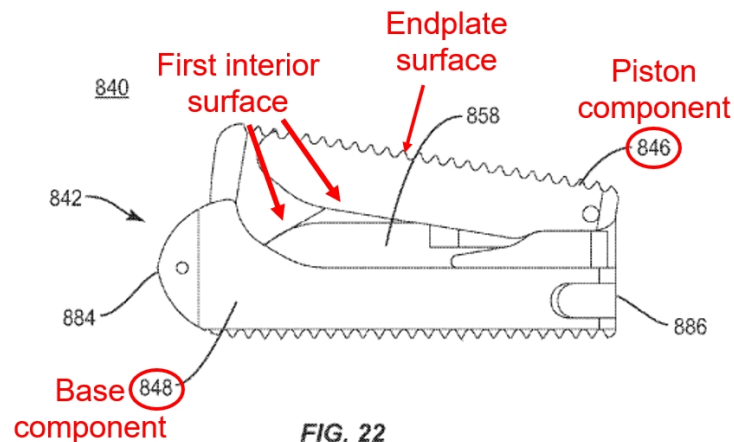


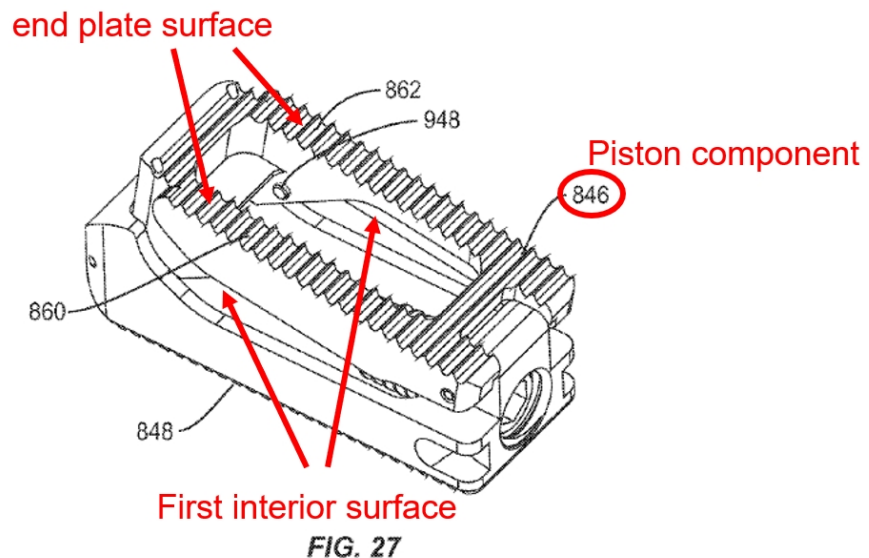
FIG. 4

(*Id.*, Fig. 4 (annotated).) Palmatier thus discloses “**the first movable portion has a first vertebral body engagement surface.**”

As shown in figure 22 below, piston component 846 has an inner surface (**the first interior surface**) opposite the endplate surface.

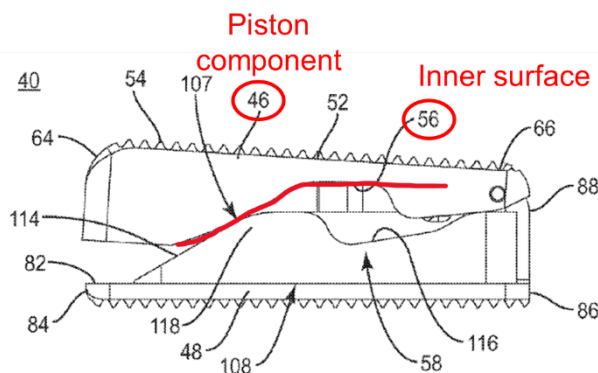


(*Id.*, Fig. 22 (annotated).) The first interior surface extends into the plane of the paper in figure 22 and is further visible in figure 27, which is a “perspective view of one embodiment of the components of the implant shown in FIG. 22.” (*Id.*, 3:23-24, Fig. 27.)



(*Id.*, Fig. 27 (annotated).)

As explained with respect to implant 40, which has a similar design as implant 840, the “[p]iston component 46 includes an inner surface 56 disposed to face an opposing orientation and/or direction relative to the facing orientation and/or direction of endplate surface 52.” (*Id.*, 7:4-7, Fig. 4.)



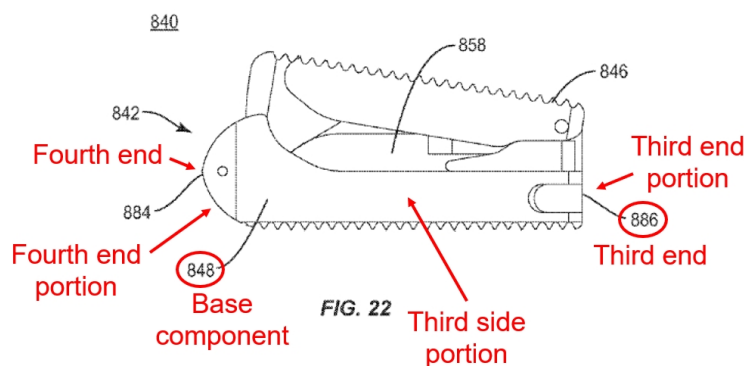
(*Id.*, Fig. 4 (annotated).)

Palmatier thus discloses “**wherein the first movable portion . . . has a first interior surface positioned on an opposite side of the first movable portion than the first vertebral body engagement surface.**”

[1.d] “a second movable portion extending from a third end to a fourth end, wherein the second movable portion has third and fourth end portions positioned at the third and fourth ends, respectively, and has third and fourth side portions extending between the third and fourth end portions,”

Palmatier discloses this limitation. Palmatier’s implant 840 includes a base component 848, which is a “**second movable portion.**” (Ex. 1057, 18:38-19:2, Figs. 24-26.) Base component 848 is “**movable**” because, when the implant is expanded, the wedge causes both the piston component and the base to pivot relative to one another. (See *id.*, 6:31-37 (“Base component 48 is movably mounted to piston component 46 with a hinge 50 to facilitate a pivoting connection between components 46, 48. Components 46, 48 are relatively movable to expand and collapse with [the] intervertebral implant.”); 18:63-66 (“intervertebral implant 840 is expanded . . . as described above with regard to intervertebral implants 40, 540.”).)

As shown in figure 22 below, Palmatier’s base component 848 extends from a posterior end 886, *i.e.*, “**a third end,**” to an anterior end 884, *i.e.*, “**a fourth end.**” (*Id.*, 18:38-46, Fig. 22.) Areas around the posterior end and anterior end are “**third and fourth end portions,**” respectively.



(*Id.*, Fig. 22 (annotated).)

Figure 22 above also shows that the base component 848 includes a “**third . . . side portion[] extending between the third and fourth end portions.**” A POSITA would have understood that there is an additional side portion on the opposite side of the implant, *i.e.*, on the side not shown in figure 22. Such symmetry is evident from figure 23. Palmatier thus discloses “**third and fourth side portions**

extending between the third and fourth end portions.”

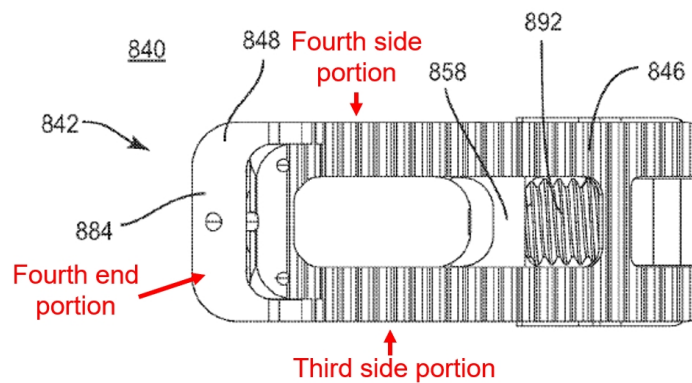
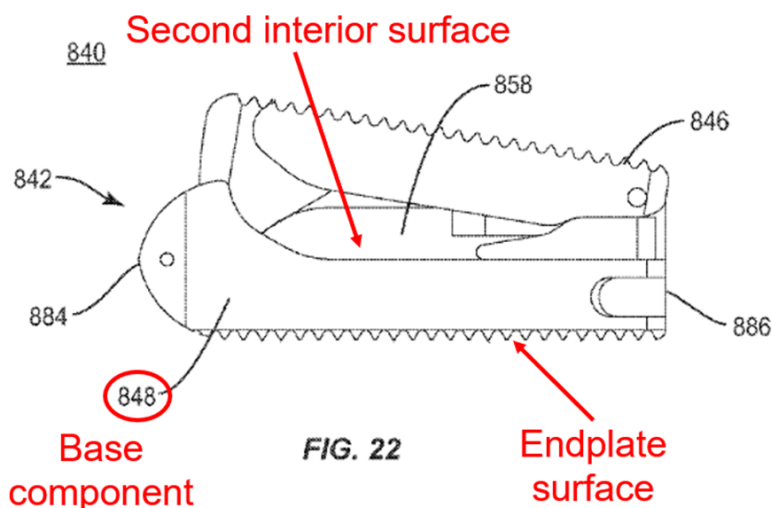


FIG. 23

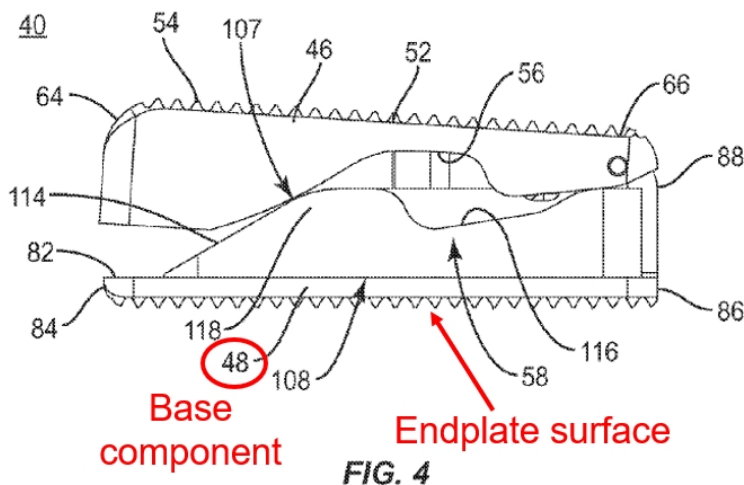
(Id., Fig. 23.)

[1.e] “wherein the second movable portion has a second vertebral body engagement surface and has a second interior surface positioned on an opposite side of the second movable portion than the second vertebral body engagement surface,”

Palmatier discloses this limitation. As shown in figure 22 below, base component 848 (**second movable portion**) has a ridged outer surface that contacts the vertebral body and is annotated as an “endplate surface.”



(Ex. 1057, Fig. 22 (annotated); *see also id.*, Fig. 27.) As explained with reference to implant 40, the ridged outer surface is “an outer tissue engaging surface, such as, for example, an endplate surface 78.” (*Id.*, 7:47-48; *compare id.*, Fig. 22, with *id.*, Fig. 5.) Endplate surface 78 is “configured to engage an endplate of a vertebrae.” (*Id.*, 7:51-54.)



	(<i>Id.</i>, Fig. 4 (annotated).) Palmatier thus discloses “wherein the second movable portion has a second vertebral body engagement surface.” As shown in figure 22 above, the base component 848 also has an inner surface that is opposite the endplate surface. Palmatier thus discloses “wherein the second movable portion . . . has a second interior surface positioned on an opposite side of the second movable portion than the second vertebral body engagement surface.”
[1.f] “wherein the first movable portion is aligned with the second movable portion such that the first end of the first movable portion is axially aligned with the third end of the second movable portion and the second end of the first movable portion is axially aligned with the fourth end of the second movable portion,”	Palmatier discloses and suggests this limitation. (<i>See supra</i>, Sections VIII.A.2-3.)

[1.g] “wherein the first end portion of the first movable portion is hingedly connected to the third end portion of the second movable portion such that the first movable portion can pivot with respect to the second movable portion so as to move the second end portion of the first movable portion away from the fourth end portion of the second movable portion,”

Palmatier discloses this limitation. As shown in figure 24 below, Palmatier discloses a hinge attaching the piston and base components.

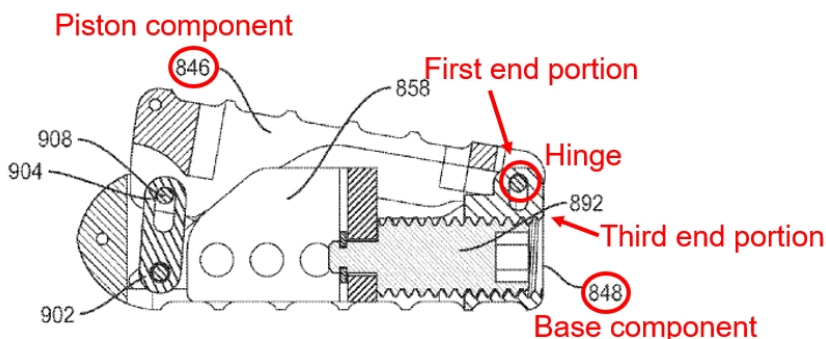


FIG. 24

(Ex. 1057, Fig. 24 (annotated).) This understanding is confirmed by Palmatier’s description of implant 40, which includes a similar hinge pivotably connecting the base and piston components and allowing “expansion and collapse of intervertebral implant 40 between a first configuration and a second configuration.” (*Id.*, 8:43-51, Figs. 5-6.) Palmatier thus discloses “**wherein the first end portion of the first movable portion is hingedly connected to the third end portion of the second movable portion.**” And as evident from figures 24 (expanded configuration) and 26 (collapsed configuration), “**the first movable portion can pivot with respect to the second movable portion so as to move the second end portion of the first movable portion away from the fourth end portion of the second movable portion.**”

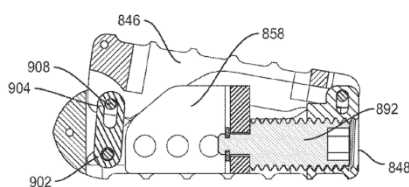


FIG. 24

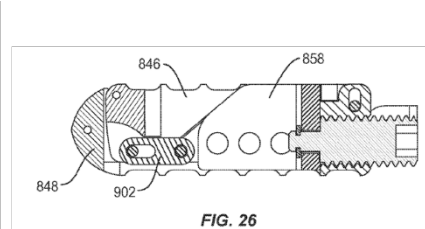
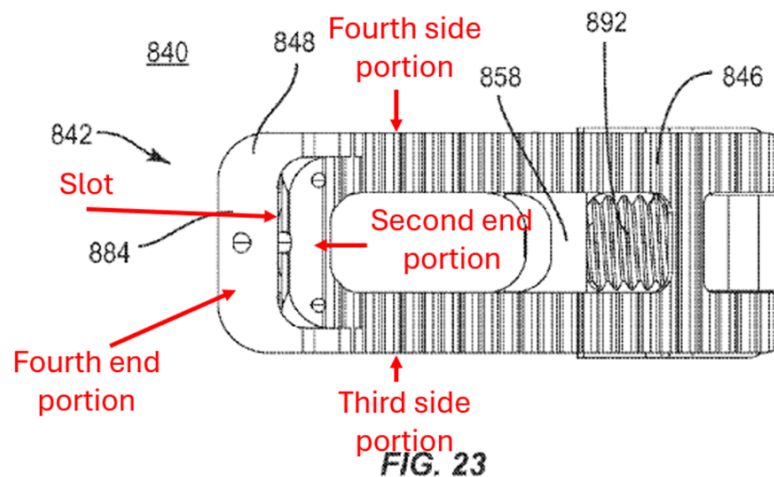
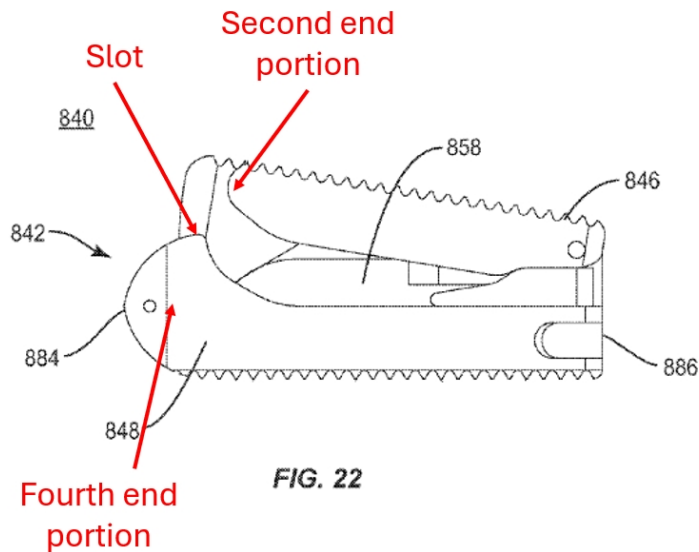


FIG. 26

(*Id.*, Figs. 24, 26.)

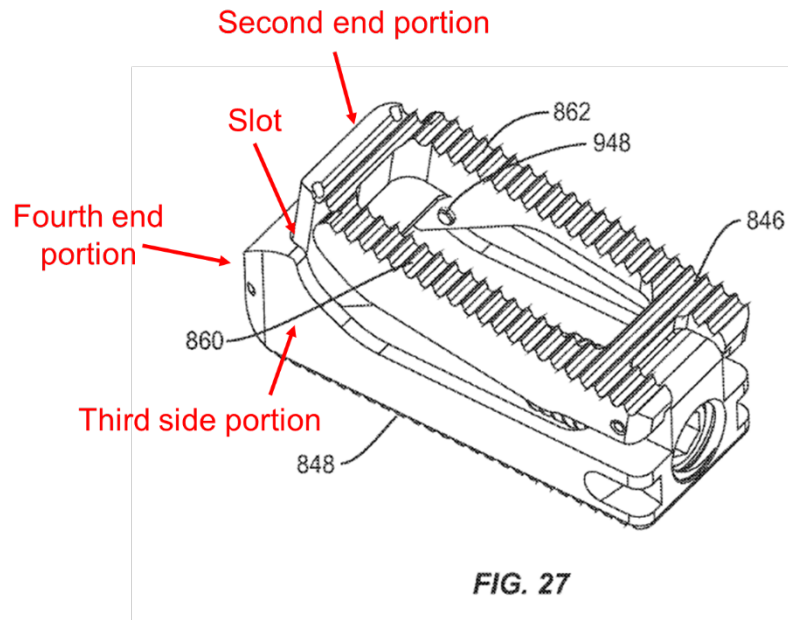
[1.h] “wherein the second movable portion defines a slot in the fourth end portion between the third and fourth side portions that is sized to receive the second end portion of the first movable portion such that the second end of the first movable portion and the fourth end of the second movable portion are axially aligned; and”

Palmatier discloses and suggests this limitation. As shown in figures 22 and 23 below, the anterior end portion of base component 848 (the **fourth end portion** of the **second movable portion**) has an opening, *i.e.*, a “slot,” that fits within it the anterior end portion of piston component 846 (**second end portion of the first movable portion**). As shown in figures 22 and 23 below, the slot is “**in the fourth end portion between the third and fourth side portions.**”



(Ex. 1057, Figs. 22-23 (annotated).)

This slot can be further seen in figure 27, which is a “perspective view of one embodiment of the components of the implant shown in FIG. 22.” (*Id.*, 3:23-24, Fig. 27.)



(*Id.*, Fig. 27 (annotated).)

Palmatier thus discloses “**the second movable portion defines a slot in the fourth end portion between the third and fourth side portions that is sized to receive the second end portion of the first movable portion.**”

As discussed in Section VIII.A.2, Palmatier discloses with reference to figure 23 that “**the second end of the first movable portion and the fourth end of the second movable portion are axially aligned.**” In fact, figure 23 shows that the slot with the fourth end therein such that the second and fourth ends are on the same axis. (*Supra*, Section VIII.A.2.)

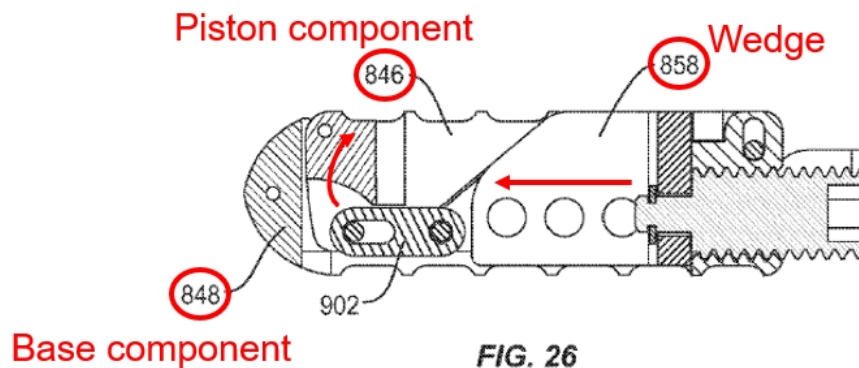
Alternatively, as discussed in Section VIII.A.3, a POSITA would have been motivated to modify implant 840 to have axially aligned “**second**” and “**fourth**” ends like in implants 40 and 540. As modified, Palmatier’s implant 840 discloses that “**the second movable portion defines a slot . . . such that the second end of the first movable portion and the fourth end of the second movable portion are axially**

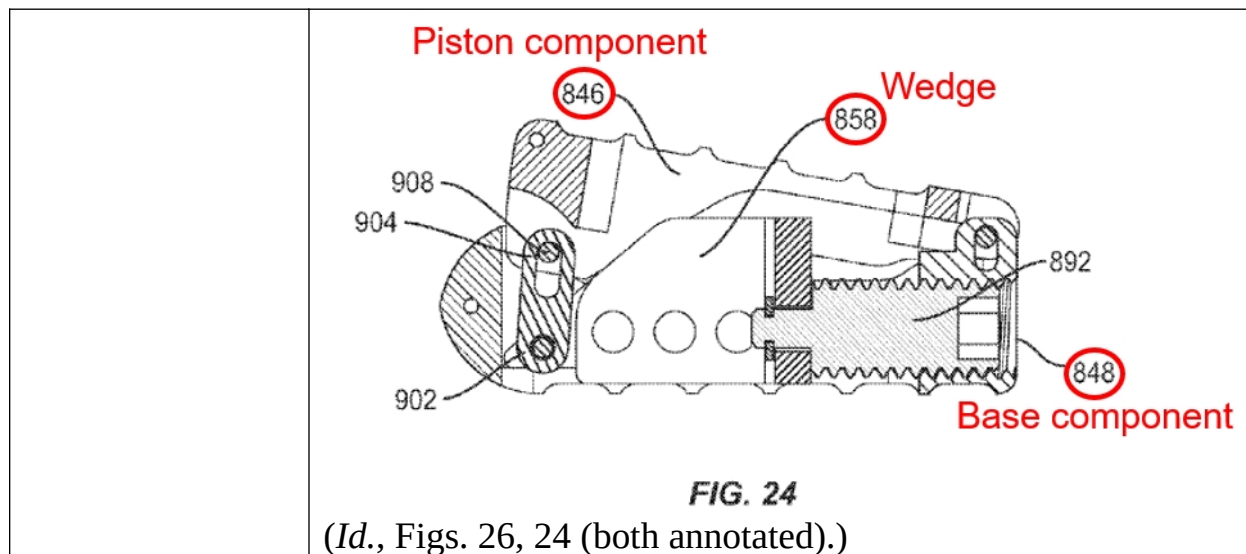
Declaration of Mr. Brad Culbert
U.S. Patent No. 10,426,633

	aligned.”
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[1.i] “a mechanism that pivotably moves the first movable portion and the second movable portion with respect to each other to expand a dimension of the expandable intervertebral fusion device,”

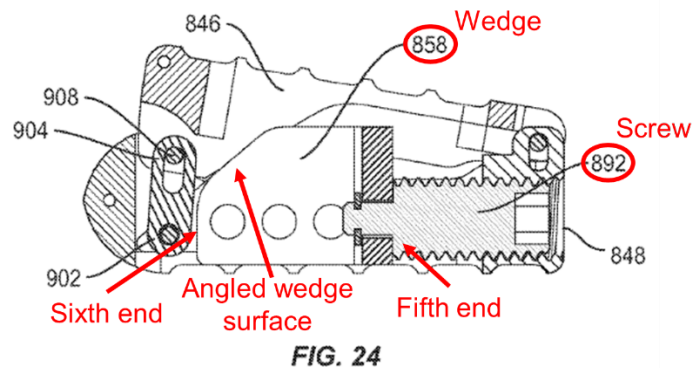
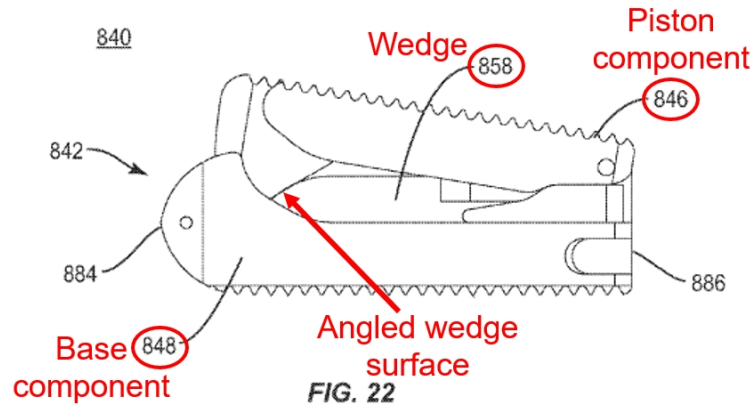
Palmatier discloses this limitation. As discussed in Appendix A [1.g], Palmatier discloses that piston component 846 (**first movable portion**) and base component 848 (**second movable portion**) are pivotably connected. Palmatier further discloses that the implant 840 expands like implants 40 and 540 via a mechanism comprising a screw and a wedge that pivots piston component 846 relative to the base component 848. (Ex. 1057, 18:42-45, 18:63-66; *see also id.*, 19:18-20.) For example, pushing wedge 858 along the longitudinal axis of implant 840 pivotably moves piston component 846 and base component 848 apart relative to one another, such that components 846 and 848 expand between a collapsed configuration and an expanded configuration. (*Id.*, 14:2-12, 18:9-17, 18:63-66 (“intervertebral implant 840 is expanded . . . as described above with regard to intervertebral implants 40, 540.”).) Palmatier thus discloses **“a mechanism that pivotably moves the first movable portion and the second movable portion with respect to each other to expand a dimension of the expandable intervertebral fusion device.”**





[1.j] “wherein the mechanism comprises: a wedge extending from a fifth end to a sixth end and having an angled wedge surface extending along at least a portion of a distance between the fifth end and the sixth end,”

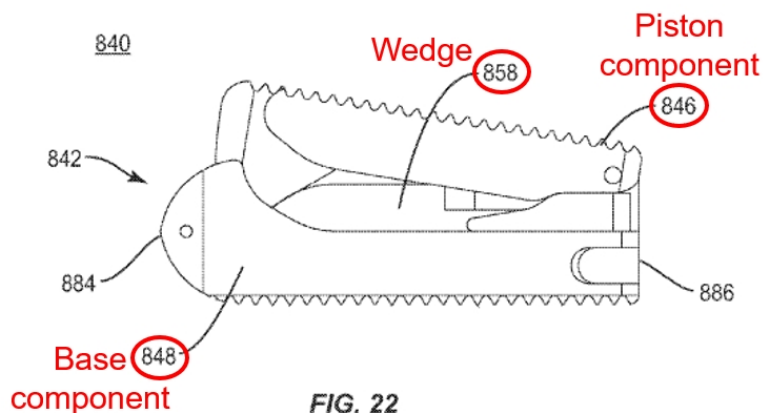
Palmatier discloses this limitation. As discussed in Appendix [1.i], Palmatier discloses an expansion mechanism comprising a wedge 858. As shown in figures 22 and 24 below, wedge 858 sits in between piston component 846 and base component 848 (*infra*, Appendix A [1.k]) and has one end (the “**fifth end**”) connected to a screw 892 and extends along an angled wedge surface to the other end (the “**sixth end**”).



(Ex. 1057, Figs. 22, 24 (both annotated).)

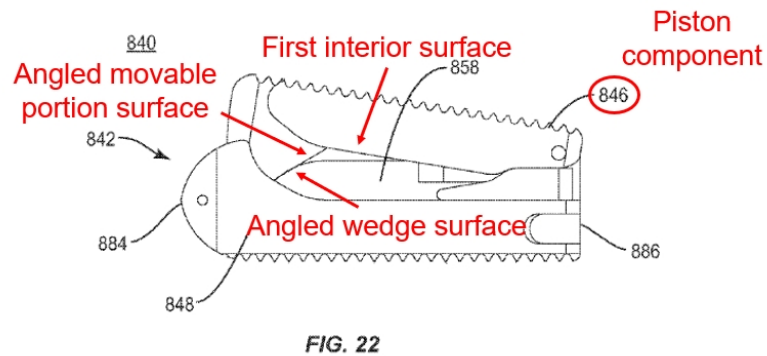
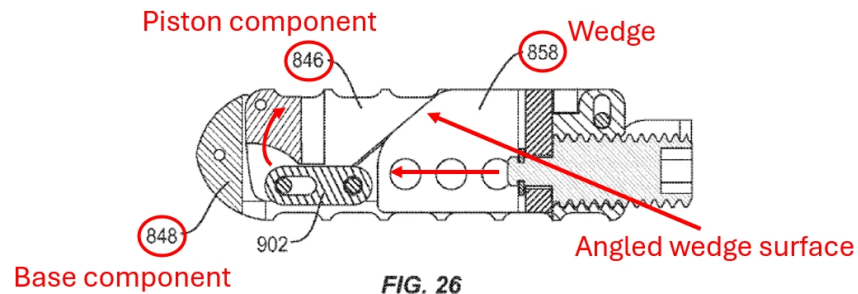
[1.k] “wherein the wedge is positioned between the first movable portion and the second movable portion with the angled wedge surface facing the first interior surface of the first movable portion, wherein the first interior surface of the first movable portion has an angled movable portion surface shaped to engage the angled wedge surface of the wedge,”

Palmatier discloses this limitation. As shown in figures 22, 24-26, Palmatier discloses “**the wedge is positioned between the first movable portion and the second movable portion.**” This is further confirmed by the description of implant 40, where Palmatier discloses that “[w]edge 58 is disposed in an intermediate orientation with components 46, 48.” (Ex. 1057, 8:52-53.)



(*Id.*, Fig. 22 (annotated).)

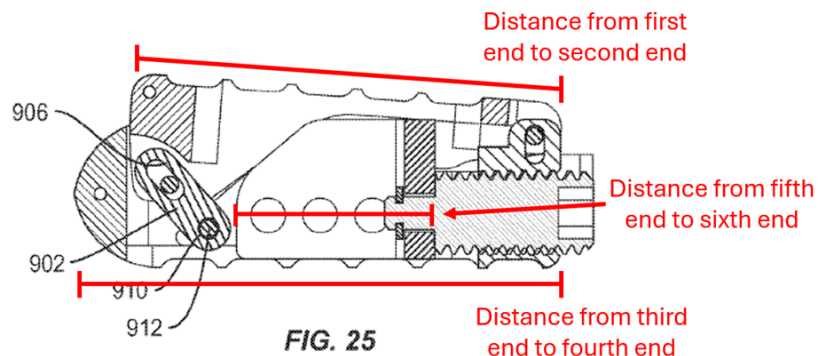
As shown in the figures below, “**the angled wedge surface [is] facing the first interior surface of the first movable portion**” and the inner surface of piston component 846 (**the first interior surface of the first movable portion**) “**has an angled movable portion surface shaped to engage the angled wedge surface of the wedge.**” As explained with reference to implant 40, this engagement between an angled surface of the wedge and an angled portion of the first interior surface allows the piston component to hingedly move relative to the base component. (See, e.g., *id.*, 14:2-12.)



(Ex. 1057, Figs. 26, 22 (both annotated).)

[1.1] “wherein a distance from the fifth end to the sixth end of the wedge is less than a distance from the first end to the second end of the first movable portion and is less than a distance from the third end to the fourth end of the second movable portion,”

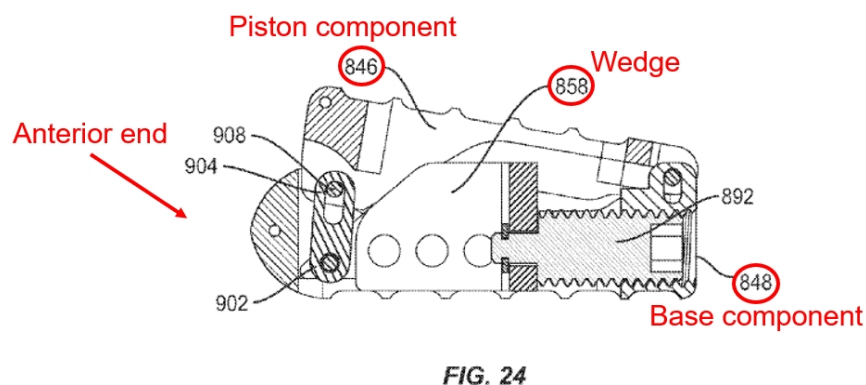
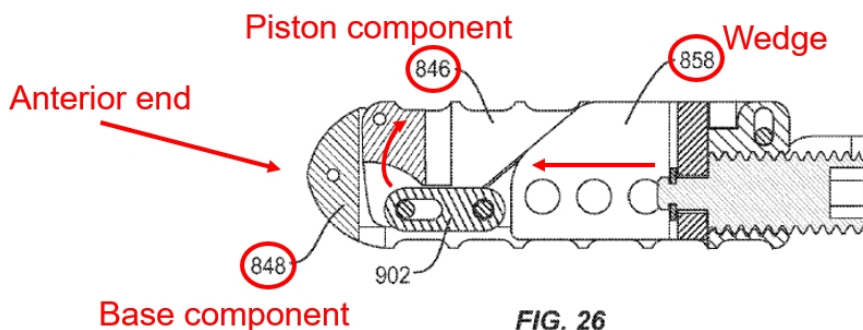
Palmatier discloses this limitation. As shown in figure 25, the length of the wedge (**distance from the fifth end to the sixth end of the wedge**) is less than the lengths of both piston component 846 (**distance from the first end to the second end of the first movable portion**) and the base component 848 (**distance from the third end to the fourth end of the second movable portion**).



(Ex. 1057, Fig. 25 (annotated).)

[1.m] “wherein the wedge is configured to slide within a space defined between the first and second movable portions in a direction toward the second and fourth ends of the first and second movable portions from a first wedge position that allows the first and second movable portions to pivot to a device position that is substantially closed to a second wedge position whereby the angled wedge surface presses against the first interior surface of the first movable portion to hingedly open the first movable portion with respect to the second movable portion whereby the wedge

Palmatier discloses this limitation. As discussed in Appendix A [1.k], wedge 858 sits in between piston component 846 (**first movable portion**) and base component 848 (**second movable portion**). As shown in figures 24 and 26 below, wedge 858 slides within the space between piston component 846 and base component 848. Palmatier thus discloses “**the wedge is configured to slide within a space defined between the first and second movable portions.**” As shown in figures 24 and 26 below, the wedge slides towards the anterior end, *i.e.*, the **second and fourth ends**, of implant 840. Palmatier thus discloses that “**the wedge is configured to slide . . . in a direction toward the second and fourth ends of the first and second movable portions.**”

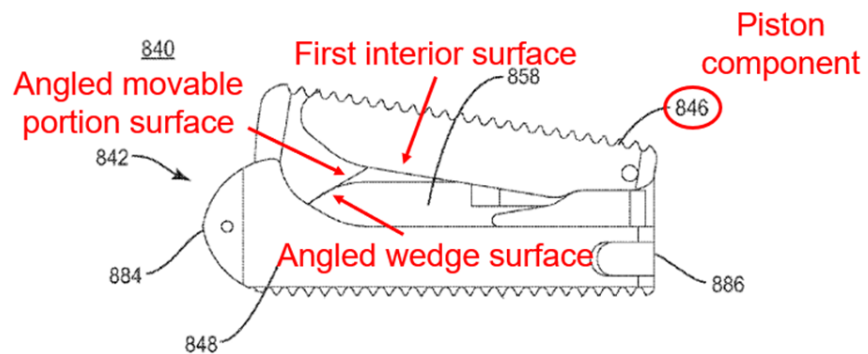


(*Id.*, Figs. 26, 24 (both annotated).)

The position of wedge 858 in figure 26 above is a “**first wedge position**” in which the “**device position [] is substantially closed.**” And the position of wedge 858 in figure 24 above is a “**second wedge position.**”

remains axially confined within the space defined by the first and second movable portions in the first and second wedge positions; and”

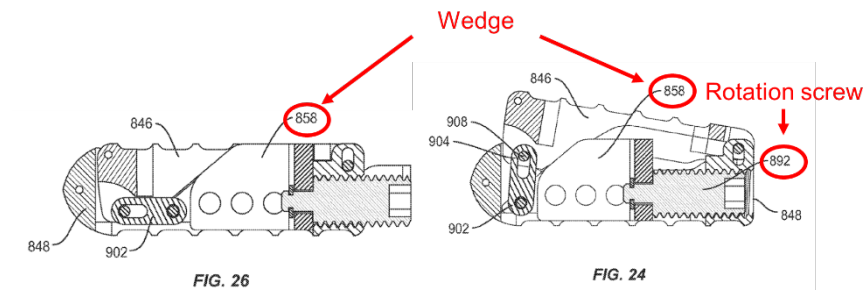
As shown in figure 22 below and explained above in Appendix A [1.k], wedge 858 has an “**angled**” surface that engages an angled portion of the inner surface (**first interior surface**) of piston component 846. And as explained above in Appendix A [1.k], the wedge pushes against the inner surface of piston component 846 “**to hingedly open the first movable portion with respect to the second movable portion.**”



(Id., Fig. 22 (annotated).)

[1.n] “a rotation screw operably connected to the wedge and to the second movable portion, wherein rotation of the rotation screw moves the wedge in an axially translating direction with respect to the first movable portion and the second movable portion within the space defined between the first and second movable portions from the first wedge position to the second wedge position.”

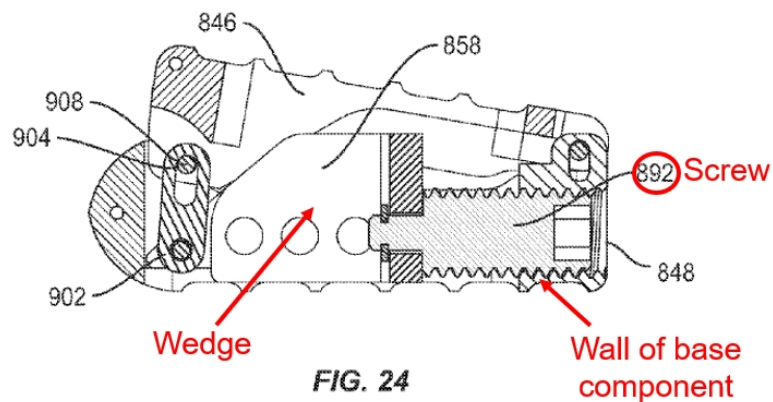
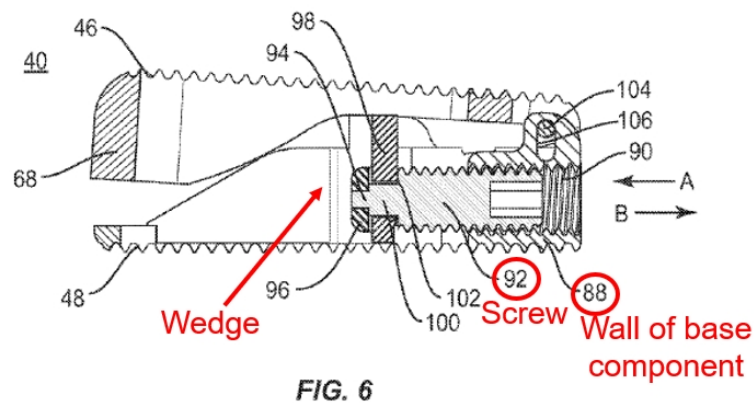
Palmatier discloses this limitation. Palmatier discloses that implant 840 has “a screw 892 for axially translating a wedge 858,” *i.e.*, screw 892 is a “**screw operably connected to the wedge.**” (Ex. 1057, 18:44-45, Fig. 24.) As discussed in Appendix A [1.m], wedge 858 is positioned between piston component 846 and base component 848 and slides along the longitudinal axis of implant 840 from a first wedge position (figure 26) to a second wedge position (figure 24). Specifically, as the screw 892 moves inwards from its position as seen in figure 26 to its position as seen in figure 24, screw 892 pushes wedge 858 from the **first wedge position** to the **second wedge position**, *i.e.*, the “**screw moves the wedge in an axially translating direction with respect to the first movable portion and the second movable portion within the space defined between the first and second movable portions from the first wedge position to the second wedge position.**”



(*Id.*, Figs. 24, 26 (annotated).)

A POSITA would have understood that screw 892 is a “**rotation**” screw and “**rotation of [the screw 892] moves the wedge**” based on the disclosure of screws 92 and 592 given the similarities between the implants 40, 540, and 840. (*Compare id.*, Fig. 6 (screw 92), *with id.*, Fig. 24 (screw 892).) For example, Palmatier discloses that “[s]crew 92 is rotatable” and “effect[s] axial translation of the wedge such that wedge 58 is movable relative to components 46, 48” (**the first movable portion and second movable portion**, respectively). (*Id.*, 8:14-16, 8:34-38; *see also id.*, 16:14-33.)

Furthermore, as seen in figures 24-26, the **“rotation screw [is] operably connected . . . to the second movable portion,”** i.e., base component 848. This is further confirmed by Palmatier’s description of implant 40, which states that “a threaded screw 92 is configured for disposal within threaded opening 90 and extends to a distal end 94 that is fixed with wedge 58.” (*Id.*, 8:10-13.) Threaded opening 90 exists as an elongated cavity within wall 88 of base component 48 and “threaded screw 92 is configured for disposal within threaded opening 90.” (*Id.*, 8:8-13.)



(*Id.*, Figs. 6, 24 (annotated).)

Claim 2

[2.a] “The device of claim 1, wherein the first movable portion defines a first bone material receiving area between the first and second end portions and the first and second side portions, wherein the second movable portion defines a second bone material receiving area between the third and fourth end portions and the third and fourth side portions, and”

Palmatier discloses this limitation. As shown in figure 23 below, Palmatier’s implant 840 has an opening, *i.e.*, “a **first bone material receiving area**.” (See also Ex. 1057, Fig. 27.)

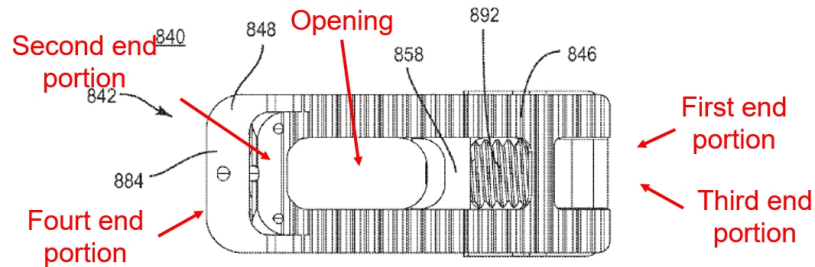


FIG. 23

(Ex. 1057, Fig. 23 (annotated).) A POSITA would recognize this opening as a claimed “**bone material receiving area**” because Palmatier’s implants “provide a cavity of relatively large volume for post-packing of . . . , for example, bone graft.” (*Id.*, 4:11-15.) This is confirmed by Palmatier’s description of implant 40, which has same kind of opening as shown in figure 10 below extending through both the base and piston components. (*Id.*, 10:30-36 (“implant 40 includes an opening 206 . . . configured for disposal of at least one agent, for example, bone graft”).)

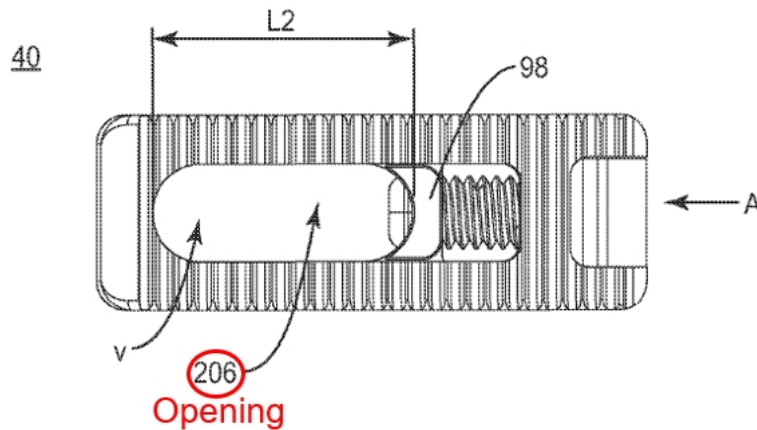


FIG. 10

(*Id.*, Fig. 10 (annotated).)

	Moreover, because figure 23 is a top-down “plan view” of implant 840, it is apparent that opening extends through the center of piston component 846, i.e., the opening is “between the first and second end portions and the first and second side portions.” Again, because figure 23 is a top-down “plan view,” the opening shown in figure 23 also extends through the center of base component 848 and is “a second bone material receiving area between the third and fourth end portions and the third and fourth side portions.” Palmatier confirms this understanding based on its disclosure that “opening 206” in figure 10 above “extend[s] through” piston component 46 and base component 48. (<i>Id.</i>, 10:33-35.)
[2.b] “wherein the first bone material receiving area is aligned with the second bone material receiving area and sized such that a path between the first and second bone material receiving areas is only partially blocked by the wedge.”	Palmatier discloses this limitation. As discussed in Appendix A [2.a], an opening extends through components 846 (the first bone material receiving area) and 848 (the second bone material receiving area) and through wedge 858. As shown in figure 23, Palmatier thus discloses “the first bone material receiving area is aligned with the second bone material receiving area.” As wedge 858 axially translates, as shown in figure 23 below, “a path between the first and second bone material receiving areas is only partially blocked by the wedge.” FIG. 23 (Ex. 1057, Fig. 23 (annotated).)
Claim 4	

“The device of claim 1, and further comprising means for mating the second movable portion with prongs of a tool.”	Palmatier discloses this limitation. (<i>See supra</i> , Section VIII.B.2.)
Claim 7	
“The device of claim 1, wherein the third and fourth side portions define first and second indentations that extend into but not through the third and fourth side portions and that are configured to be grabbed by an insertion tool.”	Palmatier discloses this limitation. (<i>See supra</i> , Section VIII.B.2.)
Claim 10	

“The device of claim 1, and further comprising: means for pivotably attaching the first movable portion to the second movable portion.”

Palmatier discloses this limitation. As discussed in Section VII, the structure corresponding to the means required by this limitation is one or more pins, each of which passes through at least a portion of both the first and second movable portions. As discussed in Appendix A [1.g], Palmatier’s piston 846 and base 848 components are pivotably connected. As shown in figure 24 below, this connection is via a pin.

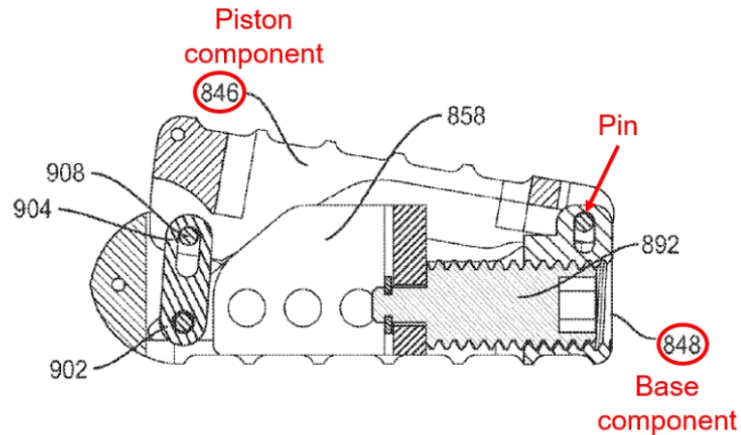
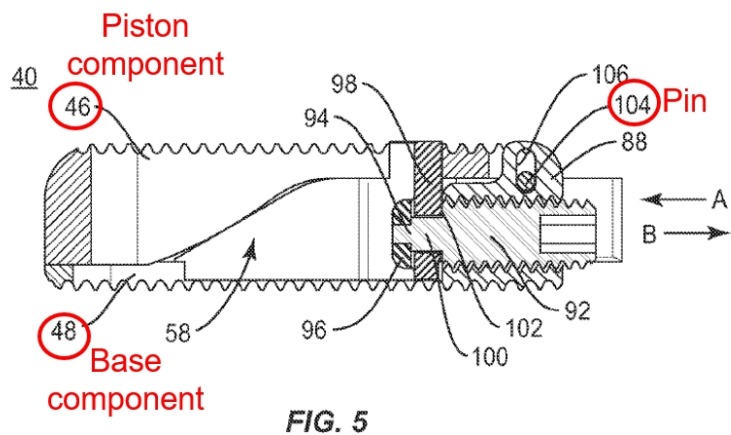


FIG. 24

(Ex. 1057, Fig. 24 (annotated).)

The identification of the pin in implant 840 is consistent with Palmatier’s disclosure with implant 40, which includes a similar pin 104 as shown below in figure 5. Palmatier discloses that for implant 40, “[p]osterior end 66 [of piston component 46] includes a pin 104 configured for disposal within an elongated slot 106 of posterior end 86 [of base component 48].” (*Id.*, 7:14-18, 8:5-8, 8:46-47.) The pin not only passes through a portion of the base component 848 but also passes through a portion of the piston component 848 because the pin is part of the hinge that pivotably attaches the base and piston components. (*Id.*, 8:43-51.)



(Id., Fig. 5 (annotated).)

Claim 11

“The device of claim 1, wherein the first movable portion has a thickness that varies between the first end and the second end such that the first interior surface comprises a curved portion and a straight portion.”

Palmatier discloses this limitation. As shown in figure 24 below, piston component 846 has a thinner straight portion near the first end and curves to make up a thicker portion near the second end. (See also Ex. 1057, Fig. 27.) Palmatier thus discloses **“wherein the first movable portion has a thickness that varies between the first end and the second end such that the first interior surface comprises a curved portion and a straight portion.”**

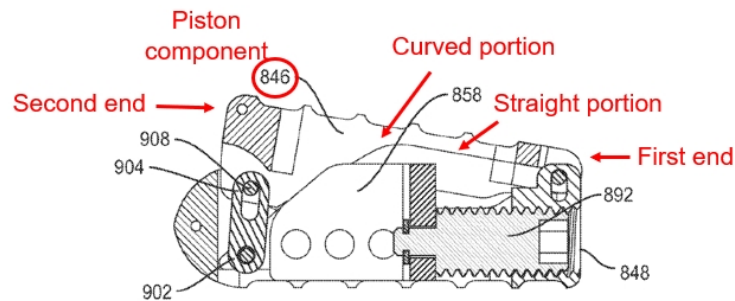


FIG. 24

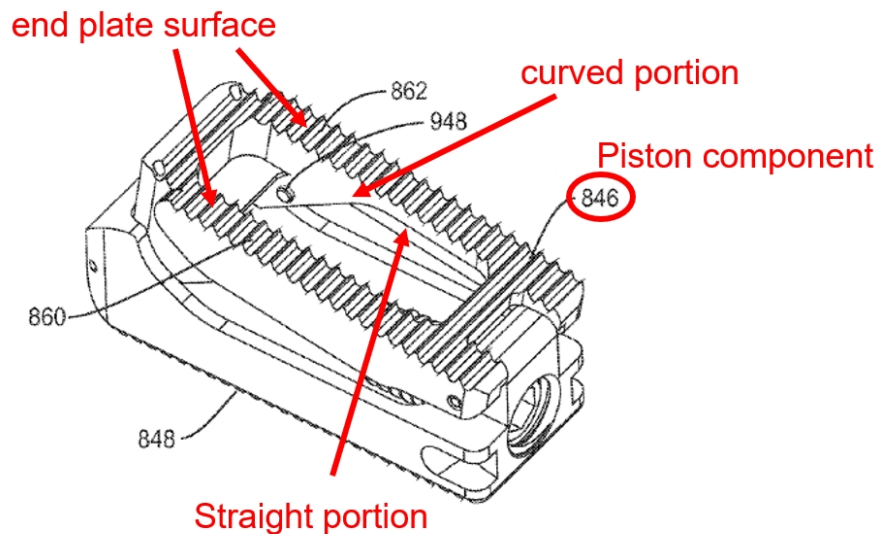


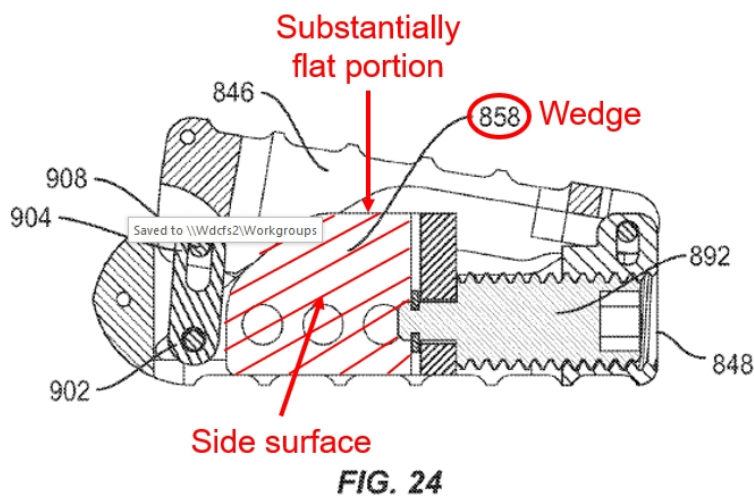
FIG. 27

(Ex. 1057, Figs. 24, 27 (both annotated).)

Claim 12

“The device of claim 1, wherein the wedge comprises opposing first and second side surfaces with first and second substantially flat portions, wherein the angled wedge surface extends between the first and second side surfaces and is substantially flat across the angled wedge surface from the first side surface to the second side surface.”

Palmatier discloses this limitation. As shown in figure 24 below, wedge 858 has a “**first [] side surface**” with a “**first [] substantially flat portion.**” Given the symmetric nature of Palmatier’s device, a POSITA would have understood that the surface opposite **the first side surface** of wedge 858 is a “**second side surface[]**” and that second side surface also has a “**second substantially flat portion[].**” The angled wedge surface, as identified in Appendix A [1.j], extends between the two side surfaces and also extends between the first and second substantially flat portions of the side surfaces, to make up a substantially flat portion of the angled wedge surface. (See Ex. 1057, Fig. 28.) Palmatier thus discloses “**wherein the wedge comprises opposing first and second side surfaces with first and second substantially flat portions, wherein the angled wedge surface extends between the first and second side surfaces and is substantially flat across the angled wedge surface from the first side surface to the second side surface.**”



(Ex. 1057, Fig. 24 (annotated).)

Claim 13

“A method of operating the device of claim 1, the method comprising: inserting the device in a target surgical location between two vertebrae of a human patient; and turning the rotation screw to drive the wedge against the first movable portion to push and pivot the first movable portion away from the second movable portion while the device is positioned between the vertebrae of the human patient.”	Palmatier discloses this limitation. Palmatier discloses that its implant 840 is an “intervertebral implant” that is “inserted into an intervertebral disc space.” (Ex. 1057, 18:46-48). Thus, Palmatier discloses “inserting the device in a target surgical location between two vertebrae of a human patient.” Following insertion of the implant into the desired surgical location, the implant is expanded by turning screw 892 (“rotation screw”) to axially translate wedge 858 to push against piston component 846 and pivot piston component 846 away from base component 848 (“turning the rotation screw to drive the wedge against the first movable portion to push and pivot the first movable portion away from the second movable portion while the device is positioned between the vertebrae of the human patient”). (<i>Id.</i>, 3:39-42 (“the system includes an interbody implant that expands after insertion into an intervertebral disc space”), 18:44-45 (“a screw 892 for axially translating a wedge 858”), <i>supra</i> Appendix A [1.j]-[1.n].) The above understanding is confirmed by Palmatier’s description of the process of operating implant 40. Specifically, Palmatier explains that a “driver delivers intervertebral implant 40 into the prepared intervertebral disc space I, between vertebrae V1 and vertebrae V2, according to the requirements of a particular surgical application.” (Ex. 1057, 13:59-62.) Then, “upon desired positioning of intervertebral implant 40 . . . [t]he driver engages screw 92 for rotation in a clockwise direction such that screw 92 translates axially to drive wedge 58 axially.” (<i>Id.</i>, 13:63-14:2.) A POSITA would have understood that the above-described process applies equally to implant 840 because implant 840 is similar to implant 40 and is expanded as described for implant 840. (<i>Id.</i>, 18:38-42, 18:63-66.)
Claim 14	

[14.a] “An expandable interbody device comprising:”	Palmatier discloses this limitation, as discussed above for limitation [1.a]. (<i>Supra</i> , Appendix A [1.a].)
[14.b] “a top housing extending from a first end to a second end, wherein the top housing has first and second end portions positioned at the first and second ends, respectively, and has first and second side portions extending between the first and second end portions,”	Palmatier discloses this limitation, as discussed above for limitation [1.b]. (<i>Supra</i> , Appendix A [1.b].) The piston component 846 is the “ top housing .”

[14.c] “wherein the top housing has a first vertebral body engagement surface that is at least partially convex and has a first interior surface positioned on an opposite side of the top housing than the first vertebral body engagement surface,”	Palmatier discloses this limitation. As discussed above for limitation [1.c], piston component 846 (top housing) “has a first interior surface positioned on an opposite side of the first movable portion than the first vertebral body engagement surface.” (<i>Supra</i>, Appendix A [1.c].) Consistent with Patent Owner’s infringement contentions (<i>see below</i>), piston component 846’s endplate surface (<i>i.e.</i>, first vertebral body engagement surface) is also partially convex. FIG. 22 (Ex. 1057, Fig. 22 (annotated); Ex. 1059, 43 (excerpted).)
[14.d] “wherein the top housing defines at least one first bone material receiving area extending through the top housing between the first and second end portions and the first and second side portions;”	Palmatier discloses this limitation, as discussed above for limitation [2.a]. (<i>Supra</i>, Appendix A [2.a].)

[14.e] “a bottom housing extending from a third end to a fourth end, wherein the bottom housing has third and fourth end portions positioned at the third and fourth ends, respectively, and has third and fourth side portions extending between the third and fourth end portions,”	Palmatier discloses this limitation, as discussed above for limitation [1.d]. (<i>Supra</i>, Appendix A [1.d].) The base component 848 is the “bottom housing.”
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[14.f] “wherein the bottom housing has a second vertebral body engagement surface that is at least partially convex and has a second interior surface positioned on an opposite side of the bottom housing than the second vertebral body engagement surface,”	Palmatier discloses this limitation. As discussed above for limitation [1.e], Palmatier’s base component 848 (second movable portion) “has a second interior surface positioned on an opposite side of the second movable portion than the second vertebral body engaging surface.” (<i>Supra</i>, Appendix A [1.e].) Consistent with Patent Owner’s infringement contentions (<i>see below</i>), base component 848’s endplate surface (<i>i.e.</i>, second vertebral body engagement surface) is also partially convex. FIG. 22 (annotated) shows a side view of a base component 848. The component includes an inner surface 858 and an endplate surface 886. The endplate surface is labeled "at least partially convex". A second view shows the second interior surface 846 and the second vertebral body engagement surface 886, with the engagement surface labeled "at least partially convex". (Ex. 1057, Fig. 22 (annotated); Ex. 1059, 47 (excerpted).)
[14.g] “wherein the bottom housing defines at least one second bone material receiving area extending through the bottom housing between the third and fourth end portions and the third and fourth side portions,”	Palmatier discloses this limitation, as discussed above for limitation [2.a]. (<i>Supra</i>, Appendix A [2.a].)

[14.h] “wherein the top housing is aligned with the bottom housing such that the first end of the top housing is axially aligned with the third end of the bottom housing and the second end of the top housing is axially aligned with the fourth end of the bottom housing,”	Palmatier discloses or suggests this limitation, as discussed above for limitation [1.f]. (<i>Supra</i>, Appendix A [1.f].)
[14.i] “wherein the first end portion of the top housing and the third end portion of the bottom housing are hingedly interconnected such that the top housing can pivot with respect to the bottom housing so as to move the second end portion of the top housing away from the fourth end portion of the bottom housing,”	Palmatier discloses this limitation, as discussed above for limitation [1.g]. (<i>Supra</i>, Appendix A [1.g].)

[14.j] “wherein a first length of the top housing from the first end to the second end is substantially equal to a second length of the bottom housing from the third end to the fourth end, and wherein the second end portion of the top housing is smaller than the fourth end portion of the bottom housing such that the second end portion of the top housing is positionable between the third and fourth side portions of the bottom housing at the fourth end of the bottom housing;”

Palmatier suggests this limitation. As shown below, Palmatier’s implants 40 and 540 each have “**a first length of the top housing from the first end to the second end**” and “**a second length of the bottom housing from the third end to the fourth end**” that are “**substantially equal**” in length. As discussed above in Section VIII.A.3, a POSITA would have been motivated to extend the **second end** of the piston component such that its ends line up like in implants 40 and 540 (reproduced below). Under this modification, the **first length** and the **second length** of implant 840 would be the same or **substantially equal** in length.

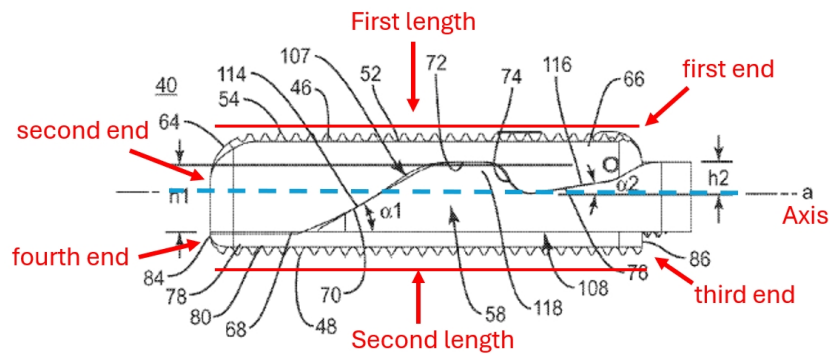


FIG. 3

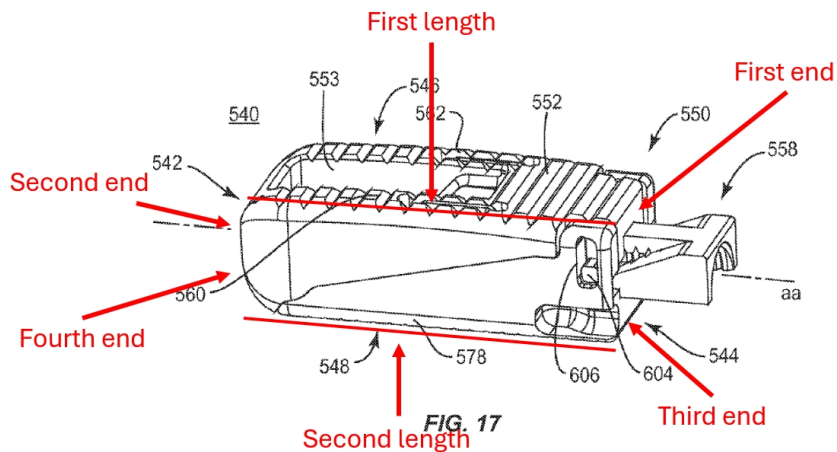
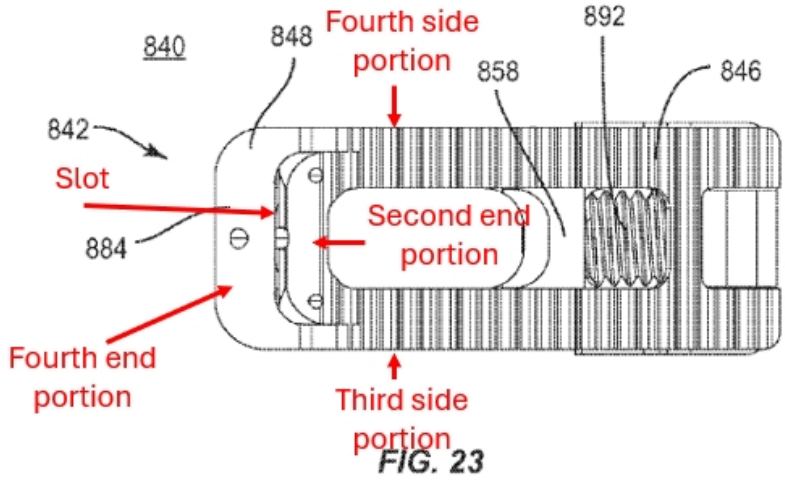


FIG. 17

(Ex. 1057, Fig. 3, 17 (both annotated).)

As discussed in Appendix A [1.h], Palmatier has a slot in the fourth end portion of the bottom housing that receives the second end portion of the top housing. To fit within this slot, as shown in figure 22 below, “**the second end portion of the top housing is smaller than the fourth end portion of the**

	bottom housing such that the second end portion of the top housing is positionable between the third and fourth side portions of the bottom housing at the fourth end of the bottom housing.”  (Id., Fig. 23 (annotated).)
[14.k] “a wedge extending from a fifth end to a sixth end and having an angled wedge surface extending along at least a portion of a distance between the fifth end and the sixth end,”	Palmatier discloses this limitation, as discussed above for limitation [1.j]. (<i>Supra</i>, Appendix A [1.j].)

[14.l] “wherein the wedge is positioned between the top housing and the bottom housing with the angled wedge surface facing the first interior surface of the top housing, wherein the first interior surface of the top housing has an angled housing surface shaped to engage the angled wedge surface of the wedge,”	Palmatier discloses this limitation, as discussed above for limitation [1.k]. (<i>Supra</i>, Appendix A [1.k].)
[14.m] “wherein a distance from the fifth end to the sixth end of the wedge is less than a distance from the first end to the second end of the top housing and is less than a distance from the third end to the fourth end of the bottom housing,”	Palmatier discloses this limitation, as discussed above for limitation [1.l]. (<i>Supra</i>, Appendix A [1.l].)

[14.n] “wherein the wedge is configured to slide within a space defined by the top and bottom housings in a direction toward the second and fourth ends of the top and bottom housings from a first wedge position that allows the top and bottom housings to pivot to a housing position that is substantially closed to a second wedge position whereby the angled wedge surface presses against the first interior surface of the top housing to hingedly open the top housing with respect to the bottom housing whereby the wedge remains axially confined within the space defined by the top and bottom	Palmatier discloses this limitation, as discussed above for limitation [1.m]. (<i>Supra</i>, Appendix A [1.m].)
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housings in the first and second wedge positions; and”	
[14.o] “a rotation screw operably connected to the wedge and to the bottom housing, wherein rotation of the rotation screw moves the wedge in an axially translating direction with respect to the top housing and the bottom housing within the space defined by the first and bottom housings from the first wedge position to the second wedge position.”	Palmatier discloses this limitation, as discussed above for limitation [1.n]. (<i>Supra</i> , Appendix A [1.n].)
Claim 16	

“The device of claim 14, wherein the top housing has a thickness that varies between the first end and the second end such that the first interior surface comprises a curved portion and a straight portion.”	Palmatier discloses this limitation, as discussed above for claim 11. (<i>Supra</i>, Appendix A [11].)
Claim 17	
“The device of claim 14, and further comprising means for attaching the first end portion of the top housing to the third end portion of the bottom housing.”	Palmatier discloses this limitation, as discussed above for claim 10. (<i>Supra</i>, Appendix A [10].)
Claim 18	

“A method of operating the device of claim 14, the method comprising: inserting the device in a target surgical location between two vertebrae of a human patient; and turning the rotation screw to drive the wedge to pivot the top housing away from the bottom housing while the device is positioned between the vertebrae of the human patient.”	Palmatier discloses this limitation, as discussed above for claim 13. (<i>Supra</i>, Appendix A [13].)
Claim 19	
[19.a] “An expandable interbody device comprising:”	Palmatier discloses this limitation, as discussed above for limitation [1.a]. (<i>Supra</i>, Appendix A [1.a].)

[19.b] “a first housing extending from a first end to a second end, wherein the first housing has first and second end portions positioned at the first and second ends, respectively, and has first and second side portions extending between the first and second end portions,”	Palmatier discloses this limitation, as discussed above for limitation [1.b]. (<i>Supra</i>, Appendix A [1.b].) The piston component 846 is the “first housing.”
[19.c] “wherein the first housing has a first vertebral body engagement surface and has a first interior surface positioned on an opposite side of the first housing than the first vertebral body engagement surface,”	Palmatier discloses this limitation, as discussed above for limitation [1.c]. (<i>Supra</i>, Appendix A [1.c].)

[19.d] “wherein the first housing defines a first bone material receiving area between the first and second end portions and the first and second side portions;”	Palmatier discloses this limitation, as discussed above for limitation [2.a]. (<i>Supra</i>, Appendix A [2.a].)
[19.e] “a second housing extending from a third end to a fourth end, wherein the second housing has third and fourth end portions positioned at the third and fourth ends, respectively, and has third and fourth side portions extending between the third and fourth end portions,”	Palmatier discloses this limitation, as discussed above for limitation [1.d]. (<i>Supra</i>, Appendix A [1.d].) The base component 848 is the “second housing.”

[19.f] “wherein the second housing has a second vertebral body engagement surface and has a second interior surface positioned on an opposite side of the second housing than the second vertebral body engagement surface,”	Palmatier discloses this limitation, as discussed above for limitation [1.e]. (<i>Supra</i> , Appendix A [1.e].)
[19.g] “wherein the second housing defines a second bone material receiving area between the third and fourth end portions and the third and fourth side portions,”	Palmatier discloses this limitation, as discussed above for limitation [2.a]. (<i>Supra</i> , Appendix A [2.a].)
[19.h] “wherein the third and fourth side portions define first and second indentations configured to be grabbed by an insertion tool,”	Palmatier discloses this limitation, as discussed above for claim 4. (<i>Supra</i> , Appendix A [4].)

[19.i] “wherein the first housing is aligned with the second housing such that the first end of the first housing is axially aligned with the third end of the second housing and the second end of the first housing is axially aligned with the fourth end of the second housing,”	Palmatier discloses this limitation, as discussed above for limitation [1.f]. (<i>Supra</i>, Appendix A [1.f].)
[19.j] “wherein the first end portion of the first housing is hingedly connected to the third end portion of the second housing such that the first housing can pivot with respect to the second housing so as to move the second end portion of the first housing away from the fourth end portion of the second housing,”	Palmatier discloses this limitation, as discussed above for limitation [1.g]. (<i>Supra</i>, Appendix A [1.g].)

[19.k] “wherein the second housing defines a slot in the fourth end portion between the third and fourth side portions that is sized to receive the second end portion of the first housing such that the second end of the first housing and the fourth end of the second housing are axially aligned;”	Palmatier discloses this limitation, as discussed above for limitation [1.h]. (<i>Supra</i>, Appendix A [1.h].)
[19.l] “a wedge extending from a fifth end to a sixth end with an angled wedge surface extending along a portion of a distance between the fifth end and the sixth end and with first and second opposing side surfaces on opposite sides of the angled wedge surface,”	Palmatier discloses this limitation, as discussed above for limitation [1.j] and claim 12. (<i>Supra</i>, Appendix A [1.j] and [12].)

[19.m] “wherein the wedge is positioned between the first housing and the second housing with the angled wedge surface facing the first interior surface of the first housing, wherein the first interior surface of the first housing has an angled housing surface shaped to engage the angled wedge surface of the wedge,”	Palmatier discloses this limitation, as discussed above for limitation [1.k]. (<i>Supra</i>, Appendix A [1.k].)
[19.n] “wherein a distance from the fifth end to the sixth end of the wedge is less than a distance from the first end to the second end of the first housing and is less than a distance from the third end to the fourth end of the second housing,”	Palmatier discloses this limitation, as discussed above for limitation [1.l]. (<i>Supra</i>, Appendix A [1.l].)

[19.o] “wherein the wedge is configured to slide within a space defined between the first and second housings in a direction toward the second and fourth ends of the first and second housings from a first wedge position that allows the first and second housings to pivot to a housing position that is substantially closed to a second wedge position whereby the angled wedge surface presses against the first interior surface of the first housing to hingedly open the first housing with respect to the second housing whereby the wedge remains axially confined within the space defined between the first	Palmatier discloses this limitation, as discussed above for limitation [1.m]. (<i>Supra</i>, Appendix A [1.m].)
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and second housings in the first and second wedge positions; and”	
[19.p] “a rotation screw operably connected to the wedge and to the second housing, wherein rotation of the rotation screw moves the wedge in an axially translating direction with respect to the first housing and the second housing within the space defined between the first and second housings from the first wedge position to the second wedge position.”	Palmatier discloses this limitation, as discussed above for limitation [1.n]. (<i>Supra</i> , Appendix A [1.n].)

APPENDIX B

'633 Patent Claim Element	Prior Art Analysis
Claim 4	
“The device of claim 1, and further comprising means for mating the second movable portion with prongs of a tool.”	Palmatier in view of Gordon discloses and suggests this limitation. (<i>See supra</i> , Sections VIII.B.3-4.)
Claim 8	
“A system comprising the device of claim 7, wherein the system further comprises: means for gripping and inserting the device.”	Palmatier in view of Gordon discloses and suggests this limitation. As discussed above in Section VII, the structure corresponding to the means required by this limitation is a tool with prongs. In the Palmatier-Gordon combination discussed above in Section VIII.B.3-4, Gordon’s tool includes holding arms with prongs, <i>i.e.</i> , means for gripping and inserting the device.
Claim 9	

“The system of claim 8, and further comprising: means for turning the rotation screw with respect to the second movable portion and the wedge.”	Palmatier in view of Gordon discloses and suggests this limitation. As discussed in Section VII, the structure corresponding to the means required by this limitation is a rotatable tool (<i>e.g.</i>, an Allen key) with a screw engagement portion. Palmatier discloses that implant 840 expands as discussed with respect to implant 40. (Ex. 1057, 18:63-66.) As discussed in Appendix A [1.n], Palmatier’s implants 40, 840 expand via a rotation screw. Palmatier discloses that “[u]pon desired positioning of intervertebral implant 40, the driver or other instrument engages intervertebral implant 40 to facilitate actuation of the component parts of intervertebral implant 40. The driver engages screw 92 for rotation in a clockwise direction.” (<i>Id.</i>, 13:63-14:2.) Palmatier thus discloses “means for turning the rotation screw with respect to the second movable portion and the wedge.” Gordon also discloses this limitation. As discussed in Section VIII.B.4, a POSITA would have been motivated to use Gordon’s tool with Palmatier’s implant 840 and would have reasonably expected success using this combination. As also discussed in Section VIII.B.4, Gordon discloses that its driver head 726 can take “various forms suitable for actuating (<i>e.g.</i>, rotating, advancing) a portion of an expansion member or insert” to expand the implant. (Ex. 1013, [0233], Figs. 36, 38.) In particular, “driver head 726 may engage a set screw.” (<i>Id.</i>, [0237].) Gordon thus discloses “means for turning the rotation screw.”
Claim 20	

“A system comprising the device of claim 19, wherein the device further comprises means for attaching the first end of the first housing to the third end of the second housing and wherein the system further comprises: means for gripping and inserting the device; and means for turning the rotation screw with respect to the second movable portion and the wedge.”	Palmatier in view of Gordon suggests this limitation. As discussed in Appendix A [10], Palmatier discloses “means for pivotably attaching the first movable portion to the second movable portion.” As discussed in Appendix A [1.g], Palmatier discloses that this attachment is between the first end of the first movable portion and the third end of the second movable portion. The “first movable portion” is a “first housing” and the “second movable portion” is a “second housing.” Palmatier thus discloses “means for attaching the first end of the first housing to the third end of the second housing.” As discussed in Appendix B [8], Palmatier in view of Gordon discloses “means for gripping and inserting the device.” As discussed in Appendix B [9], Palmatier and/or Palmatier in view of Gordon discloses “means for turning the rotation screw with respect to the second movable portion and the wedge.”
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