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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FREEDOM INNOVATIONS, LLC.,
Petitioner

v.

BLATCHFORD, INC., BLATCHFORD PRODUCTS LTD., & CHAS. A. BLATCHFORD & SONS, LTD.
Patent Owner

Case No. IPR2015-00642
Patent No. 8,574,312
Title: PROSTHETIC ANKLE JOINT MECHANISM

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,574,312

TABLE OF CONTENTS

TABLE OF AUTHORITIES

Page(s)

CASES

STATUTES

OTHER AUTHORITIES

LIST OF EXHIBITS

Exhibit	Description
EX1001	U.S. Patent No. 8,574,312 to David Moser et al, titled, "Prosthetic Ankle Joint Mechanism," filed on Dec. 14, 2007, and issued on Nov. 5, 2013 ('312 patent).
EX1002	File History of U.S. Patent No. 8,574,312.
EX1003	U.S. Patent No. 8,740,991 to David Moser et al., titled "Prosthetic Ankle Joint Mechanism," filed Nov. 6, 2013, and issued June 3, 2014 ('991 patent).
EX1004	File History of U.S. Patent No. 8,740,991.
EX1005	Declaration of Professor John Michael.
EX1006	Complaint, *Blatchford Products Ltd. v. Freedom Innovations, LLC*, No. 1:14-cv-00529, ECF No. 1 (S.D. Ohio filed June 25, 2014).
EX1007	Order, *Freedom Innovations, LLC, v. Chas A. Blatchford & Sons, Ltd.*, No. 1:14-cv-01028, ECF No. 28 (D. Nev. dismissed Oct. 15, 2014).
EX1008	U.S. Patent Application Publication US2004/0044417 to Gramnas et al., titled "Device in a Leg Prosthesis," filed Aug. 22, 2001, published on Mar. 4, 2004 (*Gramnas*).
EX1009	U.S. Patent Application Publication US2005/0171618 to Christensen et al., titled "Prosthetic Foot with Energy Transfer Including Variable Orifice," filed Apr. 4, 2005, published on Aug. 4, 2005 (*Christensen*).
EX1010	U.S. Patent No. 6,443,993 to Koniuk et al., titled, "Self-Adjusting Prosthetic Ankle Apparatus," filed Mar. 23, 2001, and issued on Sept. 3, 2002 (*Koniuk*).
EX1011	U.S. Patent Application Publication US2004/0117036 to Townsend et al., titled "Prosthetic Foot with Tunable Performance," filed Mar. 29, 2002, and published on June 17, 2004 (*Townsend*).
EX1012	U.S. Patent No. 4,212,087 to Mortensen et al., titled, "Prosthetic Leg with a Hydraulic Control," filed, Nov. 16, 1978, and issued on July 15, 1980 (*Mortensen*).
EX1013	U.S. Patent Application Publication US2006/0224248 to Lang et al., titled "Prosthetic Knee Joint Mechanism," filed Mar. 12, 2004, and published on Oct. 5, 2006 (*Lang*).
EX1014	U.S. Patent No. 6,398,817 to Hellberg et al., titled, "Locking Device for a Prosthesis," filed Mar. 21, 2000, and issued on June 4, 2002 (*Hellberg*).

EX1015	DAVID ROYLANCE, ENGINEERING VISCOELASTICITY (Oct. 24, 2001).
EX1016	Eugene F. Murphy, *The Swing Phase of Walking with Above-Knee Prostheses*, BULLETIN OF PROSTHETICS RESEARCH, Spring 1964.
EX1017	BESS FURMAN, PROGRESS IN PROSTHETICS (1964).
EX1018	Edmond M. Wagner, *Contributions of the Lower-Extremity Prosthetics Program*, 1 ARTIFICIAL LIMBS 8 (1954).
EX1019	John Michael et al., *Hip Disarticulation and Transpelvic Amputation: Prosthetic Management*, in ATLAS OF LIMB PROSTHETICS: SURGICAL, PROSTHETIC, AND REHABILITATION PRINCIPLES, Ch. 21B (1992).
EX1020	U.S. Patent No. 2,470,480 to Fogg, titled "Artificial Foot," filed Apr. 23, 1946, and issued May 17, 1949 (*Fogg*).
EX1021	U.S. Patent No. 2,843,853 to Mauch, titled "Control Mechanism for an Artificial Ankle," filed Nov. 26, 1956, and issued July 22, 1958 (*Mauch*).
EX1022	T.T. Sowell, *A preliminary clinical evaluation of the Mauch hydraulic foot-ankle system*, 5 PROSTHETIC ORTHOTICS INT'L. 87 (1987).
EX1023	Felix Starker et al., *Remaking the Mauch Hydraulic Ankle*, CAPABILITIES, Winter 2010, at 1.
EX1024	U.S. Patent No. 2,541,234 to Fulton et al., titled "Hydraulic Buffer Assembly," filed Dec. 13, 1949, and issued Feb. 13, 1951 (*Fulton*).
EX1025	Certified English translation of German Patent DE818828C to Schwarz, with original and Affidavit of Certification (*Schwarz*).
EX1026	U.S. Patent No. 6,517,585 to Zahedi et al., titled "Lower Limb Prosthesis," filed Aug. 13, 1998, and issued Feb. 11, 2003 (*Zahedi*).
EX1027	U.S. Patent No. 2,851,694 to Valenti et al., titled "Artificial Leg," filed June 20, 1955, and issued Sept. 16, 1958 (*Valenti*).
EX1028	U.S. Patent Application Publication US 2006/0235544 to *Iversen* et al., titled "Device and System for Prosthetic Knees and Ankles," filed Mar. 29, 2006, and published Oct. 19, 2006 (*Iversen*).
EX1029	U.S. Patent No. 5,383,939 to James et al., titled "System for Controlling Artificial Knee Joint Action in an Above Knee Prosthesis," filed Dec. 5, 1991, and issued Jan. 24, 1995 (*James*).
EX1030	U.S. Patent 3,659,294 to Glabiszewski et al., titled "Adjustable Link for Prosthetic Limb," filed May 1, 1970, and issued May 2, 1972 (*Glabiszewski*).

I. INTRODUCTION

Petitioner Freedom Innovations, LLC ("Freedom") requests *Inter Partes* Review ("IPR") of claims 1-22 of U.S. Patent No. 8,574,312 (EX1001).

The '312 patent describes a prosthetic ankle joint mechanism that "provides a continuously hydraulically damped range of motion," such that "over at least part of the range, movement in the dorsi and plantar directions is substantially unbiased resiliently." EX1001 at 2:27-32.

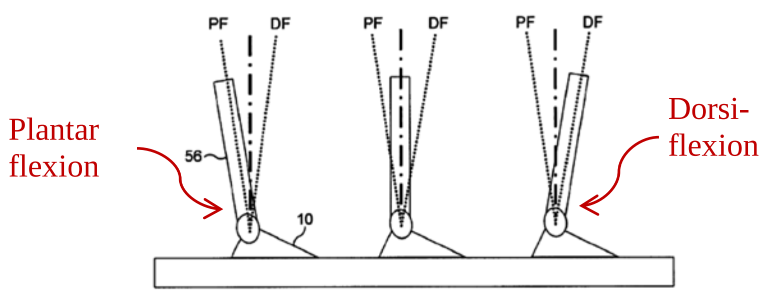

FIG. 5

The prior art, however, is replete with hydraulically damped prosthetic ankle joints, including those in which both dorsi- and plantar-flexion are predominantly provided by hydraulic damping, as required by the claims. *See, e.g.*, EX1008 (*Gramnas*).

Prosecution of the '312 patent lasted nearly six years and included repeated rejections based on prior art and several Examiner interviews. Eventually, the Examiner allowed claims 1-22, but only after Applicants added a limitation requiring that resistance to ankle flexion be "predominantly provided by hydraulic damping whenever the joint is flexed in both dorsi and plantar directions." EX1001 at cl. 1, 16, 20; *see also* EX1004 at 1292. As will be demonstrated in this Petition, however, that feature was already disclosed in the prior art, along with all the other limitations of the claims.

Accordingly, for the reasons explained below, Freedom respectfully requests that the Board institute IPR, review this patent, and cancel the claims.

II. GROUNDS FOR STANDING

Freedom certifies that the '312 patent is available for IPR and that the Petitioner is not barred or estopped from requesting IPR challenging the '312 patent on the grounds identified. *See* 37 C.F.R. § 42.104(a). Specifically: (1) Petitioner is not the owner of the '312 patent; (2) Petitioner is not barred or estopped from requesting IPR; and (3) Petitioner files this Petition less than a year after being with a complaint alleging infringement of the '312 patent.

III. MANDATORY NOTICES

1. Real Party-in-Interest

Freedom Innovations, LLC is the real party-in-interest. 37 C.F.R. § 42.8(b)(1).

2. Related Matters

The '312 patent is the subject of a lawsuit filed by patent owner Blatchford Products Ltd. on June 25, 2014, against Freedom in the U.S. District Court for the

Southern District of Ohio. EX1006.

The ’312 patent was the subject of an earlier-filed declaratory judgment action by Freedom Innovations, LLC in the District of Nevada. EX1007 at 2. That action was dismissed without prejudice on October 15, 2014. *See id.* at 11 (“Defendants’ motion to dismiss is GRANTED without prejudice.”).

Declaratory judgment actions dismissed without prejudice do not invoke the § 315(a)(1) bar against *inter partes* review. *See* 35 U.S.C. § 315(a)(1) (2014); *InVue Sec. Prods., Inc. v. Merchandising Techs., Inc.*, IPR2013-00122, Paper 17, at 9 (June 27, 2013) (“dismissals without prejudice . . . leav[e] the parties as though the action had never been brought.”) (citing *Graves v. Principi*, 294 F.3d 1350, 1356 (Fed. Cir. 2002)). Thus, the Nevada action does not bar this Petition.

Freedom is concurrently filing one additional IPR petition for the ’312 patent, IPR2015-00641, and an IPR petition addressing similar claims in related U.S. Patent No. 8,740,991, IPR2015-00640.

3. Lead and Back-up Counsel; Consent to Electronic Service

The signature block of this petition designates lead counsel, back-up counsel, and service information for Petitioner. Freedom designates James Barney (Reg. No. 46,539) as lead counsel, and Jonathan R.K. Stroud (72,518) and Daniel Chung (63,553) as back-up counsel at Finnegan, Henderson, Farabow, Garrett &

Dunner, LLP, 901 New York Ave. NW, Washington, DC 20001. Petitioner consents to electronic service at Freedom_Ankle_IPRs@Finnegan.com.

IV. FEE PAYMENT

The required fees are submitted under 37 C.F.R. §§ 42.103(a) and 42.15(a). If any additional fees are due during this proceeding, the Office may charge such fees to Deposit Account No. 06-0916.

V. STATEMENT OF PRECISE RELIEF REQUESTED

1. Claims for Which Review Is Requested

Freedom requests IPR and cancellation of claims 1-22 of the ’312 patent under 35 U.S.C. § 311.

2. Statutory Grounds of Challenge

Freedom requests that the Board hold claims 1-22 unpatentable under 35 U.S.C. §§ 102 and 103 because:

Ground	Proposed Statutory Rejections for the ’312 Patent
1	Claims 1-6 are **anticipated** under §102(b) by *Gramnas*
2	Claims 1-6 are rendered **obvious** under § 103(a) by *Gramnas*
3	Claim 8 is rendered **obvious** under §103(a) by *Gramnas* in view of *Hellberg*
4	Claims 16-22 are rendered **obvious** under §103(a) by *Gramnas* in view of *Christensen*

5	Claims 7 and 9-15 are rendered **obvious** under §103(a) by *Gramnas* in view of *Mortensen*
6	Claims 1, 3-7, and 20-22 are rendered **obvious** under §103(a) by *Christensen*
7	Claims 2, 8, and 16-19 are rendered **obvious** under §103(a) by *Christensen* in view of *Hellberg*.
8	Claims 9-15 are rendered **obvious** under §103(a) by *Christensen* in view of *Mortensen.*

3. Claim Construction

In an IPR, an unexpired patent's claims receive the "broadest reasonable construction in light of the specification of the patent in which it appears." 37 C.F.R. § 42.100(b). Unless otherwise noted, Freedom proposes that the claim terms of the '312 patent be given their ordinary and customary meanings in the art.[1] The following phrases, however, require construction, as dictated by the intrinsic evidence and traditional canons of claim construction. Freedom uses these

[1] No court has yet construed the claims. This claim construction analysis is not, and should not be viewed as, a concession as to the proper scope of any claim term in any litigation. Freedom does not waive the right to argue—in other litigations or proceedings—that the claims in the '312 patent are indefinite or otherwise unpatentable.

constructions in its grounds for unpatentability. *See id.*, § 42.104(4).

(i) *"said resistance"*

Independent claims 1, 16, and 20 use the term "said resistance." Based on traditional canons of claim construction, "said resistance" refers to the antecedent basis for the word "resistance," which appears in claim 1 as "a joint mechanism providing resistance to ankle flexion" (EX1001 at cl. 1) and in claims 16 and 20 as "a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion" (*id*. at cls. 16, 20). Accordingly, "said resistance" should be construed to mean: *resistance to ankle flexion provided by the joint mechanism*. This construction is necessary to make clear that "said resistance" is provided by the claimed *joint mechanism* and not by some other feature outside of the joint mechanism.

(ii) *"predominantly provided by hydraulic damping"*

Independent claims 1, 16, and 20 recite that said resistance is "predominantly provided by hydraulic damping." This term should be construed to mean that *during motion of the ankle joint, resistance to movement in the dorsi and plantar direction by the joint mechanism is predominantly provided by hydraulic damping rather than resilient biasing*.

The specification supports this construction. It discloses a joint mechanism that provides a "hydraulically damped range of ankle flexion, the mechanism being constructed and arranged such that, over at least part of the range, *movement in the dorsi and plantar directions is substantially unbiased resiliently*." *Id.* at 2:26-33 (emphasis added); *see also id.* at 3:3-7 ("[T]he ankle allows dorsi-plantar flexion over a limited range of movement with largely damped, as opposed to resilient, resistance to motion results in an ankle which is able easily to flex under load."). The specification describes this feature as "advantageous" because the "yielding ankle" has "minimal, preferably zero elastic biasing in the dorsi- or plantar directions." *Id.* at 9:20-25. Similarly, the Abstract describes hydraulic damping "such that, over the major part of the range of damped movement, *there is no resilient biasing in either the dorsi or the plantar direction*." *Id.* at Abstract (emphasis added).

4. The Level of Ordinary Skill in the Art at the Time of the Claimed Invention

The earliest possible effective filing date of the '312 patent is December 14, 2006, based on Provisional Application No. 60/869/959. A person having ordinary skill in the art at that time ("POSA") would have had at least five years of experience in prosthetics and would have been familiar with hydraulics. *See* EX1005 at ¶17.

5. State of the Art at the Time of the Claimed Invention

Doctors, engineers, and clinicians have been developing prosthetic limbs and joints for millennia. EX1016 at 1, 13, 26; EX1017 at 1. Hydraulically controlled or dampened prosthetic ankle joints have been successful since at least the 1940s. *See, e.g.*, EX1020 (*Fogg*, 1958); EX1021 at 1 (*Mauch*, 1956); EX1025 (*Schwarz*, 1949); EX1015 at 8-11 (explaining basic hydraulic damping). Fifty years ago, scholars noted "[t]he obvious and considerable virtues of fluid-controlled mechanisms for providing smooth control of the artificial knee joint over a wide range of cadences." EX1016, at 39. The commercially successful Hydraulik Ankle ("Mauch Ankle") has been available for more than fifty years. EX1021 at 1; EX1023 at 1. The Mauch, the Stewart-Vickers, EX1018 at Fig. 3 (hydraulic "ankle cylinder"), and the Schwarz ankle, EX1025 at Abstract, among others, successfully combined adjustable hydraulic dampening with ankle flexion fifty years ago. EX1019 at 544. As the '991 patent acknowledges, various means of hydraulic damping were known for prosthetic ankle joints, such as the "dual piston and cylinder assembly" of *Karas*, the "ball-and-socket joint with a chamber filled with a silicone-based hydraulic substance" of *O'Byrne*, the "adjustable hydraulic damping and resilient biasing members" of *Chen*, the "hydraulic piston and linkage arrangement" of *Gramtec*, and the "hydraulic ankle mechanism with a rotary vane" of *Iverson*. EX1003 at 1:52-2:2.

The use of complex hydraulic damping to resist motion of an ankle joint in both the dorsi and plantar directions was also well known in 1996. For instance, *Gramnas* disclosed a prosthetic ankle joint in which the range of motion is controlled by a two-chamber adjustable hydraulic piston, such that movement in both the dorsi and plantar direction is hydraulically damped and substantially unbiased resiliently. *See* Fig. 2a-2c.

EX1008 at Figs. 2a-2c; *see also* §§ VII.1.-2., *infra*. Similarly, *Koniuk* taught hydraulically damped ankle flexion powered by a two-chamber hydraulic mechanism. *See* EX1010. As early as 1964, research was discussing the basic adjustable separate-bypass passageway design. *See* EX1016 at 34 (in 1964, hydraulically damped joints designed by "providing separate bypass tubes or passages and independently adjustable valves for controlling flexion and extension" in lower-limb prostheses). Likewise, pyramid alignment interfaces have been long common in prosthetics. For instance, *Glabiszewski* (EX1030), *Hellberg* (EX1014), *Townsend* (EX1011), and *Iversen* (EX1028) all taught using pyramid alignment interfaces to modularly adjust existing prostheses long ago. And *Christensen* (EX1009) and *Townsend* (EX1011), among many others, taught using leaf spring foot keels having resilient toe portions. The art recognizes foot keels are modular. *E.g.*, EX1011 at [0073] ("The prosthetic foot of the invention is a modular system preferably constructed with standardized units or dimensions for flexibility and variety in use.").

VI. SUMMARY OF THE ’312 PATENT

1. Specification and Claims of the ’312 Patent

The ’312 patent describes an external prosthetic foot and ankle assembly. Ex. 1001 at Abstract. Pivotally mounted, it uses a hydraulic piston-and-cylinder assembly to contribute to “stabilization of standing, balance control, and improved stair-walking and ramp-walking.” *Id.* The specification discloses “a prosthetic ankle joint mechanism [that] provides a continuously hydraulically damped range of ankle flexion, the mechanism being constructed and arranged such that, over at least part of the range, movement in the dorsi and plantar directions is substantially unbiased resiliently.” *Id.* at 2:27-33.

Claims 1-7 recite a “prosthetic foot and ankle assembly” comprising “a foot component,” “an ankle joint,” and “a joint mechanism providing resistance to ankle flexion.” *Id.* at 11:10-22. Claim 8 includes a “pyramid alignment interface.” *Id.* at 11:60-64. Claims 9-15 refer to an assembly as in 1-7, but with a two-chamber hydraulic fluid valve arrangement capable of allowing individual setting of the dorsi- and plantar-flexion damping resistances. *Id.* at 12:8-40. Claims 16-22 refer to such an assembly as claims 1-7, having a “resilient section” allowing some “resilient dorsi-flexion of at least an anterior portion of the foot component relative to the shin access,” *id.* at 12:41-54 (claim 16), such as an “energy-storing spring,” *id.* at 12:65 (claim 17), part of "a Maxwell-model damper/spring combination," *id.* at 13:1-10 (claim 20), or a "leaf spring," *id.* at 13:14 (claim 22).

2. The '312 Patent Prosecution

On December 14, 2007, Applicants requested 37 claims, claiming priority to provisional application 60/869,959, filed December 14, 2006. EX1002 at 1, 4. In September 2009, the Examiner rejected Claims 1-14, 16-29, and 31-34 under 35 U.S.C. § 103(a) as being unpatentable over *Zahedi* (EX1026) in view of *Valenti* (EX1027), and claim 15 over a tripartite combination of *Zahedi*, *Valenti*, and *Iversen*. *See* EX1002 at 574. The Examiner noted that "Iversen was used to provide evidence that pyramid adapters are well known in the art." *Id.* at 711.

Applicants amended the claims to recite a mechanism "providing resistance to ankle flexion, wherein the mechanism" has a resistance "predominantly provided by hydraulic damping." *Id.* at 596. Applicants emphasized that *Zahedi* teaches a knee joint. *Id.* at 606. Unconvinced, the Examiner issued a final Office Action in June 2010, maintaining the rejections and noting that knee and ankle joints have "similar" "stress and load requirements" and "bending characteristics" and that "it is known in the art that the joints used for knees may be adjusted in a multitude of obvious ways to function as an ankle joint." *Id.* at 619-21. Applicants filed a Notice of Appeal in November 2010. *Id.* at 655, 661.

The USPTO reopened prosecution in May 2011, and the Examiner applied new prior art rejections. *Id.* at 709. She rejected certain claims under *Zahedi*, arguing that "the apparatus *must be distinguished from the prior art in terms of structure rather than function*." *Id.* (emphasis in original). She rejected claims 7-14, 16-29, and 31-34 over *Valenti* in view of *Zahedi* (*id.* at 715), and applied *Valenti, Zahedi,* and *Iversen* to claim 15, again noting that "pyramid adapters are well known in the art" (*id.* at 711). She rejected claim 30 over *Valenti* in view of *Zahedi*, and further in view of *Philips*, relying on *Philips* for a leaf spring "because leaf springs are a known spring that can be resilient and would function to help the ankle joint mimic the function of a normal ankle." *Id.* at 731.

Applicants responded with claim amendments reciting a "prosthetic ankle joint" and added 18 claims. *Id.* at 747-756. Applicants did not challenge or rebut the finding that both leaf springs and pyramid alignment interfaces were well known and obvious. The Examiner then issued another final rejection, withdrawing new claims 38-50 as constructively drawn to non-elected species and accepting the amendment cancelling claims 1-7. *Id.* at 976, 980. She maintained her rejection of claims 8-34 as obvious over *Valenti* in view of *Zahedi*, noting that "a Maxwell-model damper-spring combination is simply a spring and damper element being arranged in series." *Id.* at 978, 980.

The Examiner further found that "[h]ydraulically dampened joints are well known in the art for mimicking the feel of a natural foot for users, and would result in a more comfortable walk for the user." *Id.* at 981. They "would result in [a leg prosthesis] having a more comfortable and natural feel while a user is walking." *Id.* at 988. She therefore found that "including the hydraulic damping joint mechanism, including the pistons, hydraulic fluids, locking mechanisms, controllers etc [sic]" would have been obvious to a POSA. *Id.* at 944.

Applicants filed an RCE cancelling claims 38-50, further amending claims 8, 17, 23, 24, 28, 31, and 32, and challenging the prior-art rejections. *Id.* at 1216. Soon thereafter, Applicants initiated an examiner interview. *Id.* at 1230. The Interview Summary states that the Examiner agreed that "if the 'continuous hydraulic dampening' requires a velocity-dependent dampening mechanism . . . then Valenti would no longer be used as a main reference," and that "a new search would have to be made." *Id.*

In June 2013, Applicants submitted a Preliminary Amendment with a Request for Prioritized Examination, which the USPTO granted, issuing another non-final rejection in July 2013. *Id.* at 1257-1258. In it, the Examiner rejected many of the claims as anticipated by US2004/0054423 to *Martin* (*id.* at 1260) or obvious over *Martin* in view of *James* (EX1029). *See* EX1002 at 1266. And she rejected dependent claims under § 103 in view of *Martin*, *James*, and *Townsend*.

For claim 30, she applied *Martin* in view of *Phillips*, again for disclosing a leaf spring.

In August 2013, Applicants initiated another interview with the Examiner. In the August 14, 2013 Interview Summary, the Examiner indicated that only § 102 rejections were discussed and that Applicants proposed amending the claims to include that:

> "the ankle joint is mounted to the foot component, the ankle joint comprising: a mechanism providing resistance to ankle flexion, wherein the mechanism is constructed and arranged such that said resistance is predominately provided by hydraulic damping whenever the ankle joint is flexed in both dorsi and plantar directions."

Id. at 1292. The "Examiner agreed that this language would overcome the prior art of Martin, but noted that a further search would have to be made." *Id.*

On August 17, 2013, Applicants filed a proposed amendment, adding new claims and including their own summary of the interview of August 7, 2013. *Id.* at 1302. The Examiner issued another final rejection based on the previous restriction requirement but otherwise indicated, without explanation, that the remaining claims were allowable. *Id.* at 1315. Shortly thereafter, the Examiner allowed the non-withdrawn claims, providing no Reasons for Allowance. *Id.* at 1321-1332.

VII. CLAIMS 1-22 OF THE ’312 PATENT ARE UNPATENTABLE

1. Ground 1: *Gramnas* Anticipates Claims 1-6 Under 35 U.S.C. § 102(b)

Gramnas discloses a hydraulically damped rotatable ankle prosthesis 1 that meets the limitations and anticipates claims 1-6 of the ’312 patent. Based on a priority application filed in Sweden in August 2000, *Gramnas* was published in the U.S. on March 4, 2004, and is prior art under 35 U.S.C. § 102(b). *Gramnas* was cited via IDS during prosecution. EX1002 at 83, 588.

Gramnas explains that “[i]t is well-known among prosthesis wearers that walking in downhill slopes is problematic.” EX1008 at [0002]. To solve this problem, *Gramnas* discloses an adjustable hydraulic ankle prosthesis 1 with a joint 4 in which range of motion can be limited via a two-chamber hydraulic piston(18)-and-cylinder(24) assembly 17. Thus, during motion of the foot 3, the resistance to that motion provided by the ankle joint mechanism is predominantly via hydraulic damping in both the dorsi and plantar direction, rather than resilient biasing.

Referring to Figure 1, *Gramnas* discloses a prosthesis 1 with a prosthetic leg 2 connected to a prosthetic foot 3 via pivot axle 4. *Id.* at [0012]. Lever arm 10 extends substantially parallel to the foot blade 7 and preferably has a rhomb-shaped cross section that allows it to rotate about axle 4 between certain limits without bumping into foot blade 7 or the piston-and-cylinder mechanism 17. *Id.* at

[0014]. The front end 15 of lever arm 10 cooperates with "second means" 17, comprising a piston-and-cylinder mechanism, to "permit a stepless adjustment of the angle between the prosthesis and the foot in the initial position." *Id.* at [0013]. Collectively, the device will "limit a free rotatability between the leg prosthesis and the foot." *Id.*

"Second means" 17 (i.e., the hydraulic ankle joint comprising piston-and-cylinder mechanism shown by items 18-25) is designed to operate in two modes. Specifically, "the second means 17 are arranged to take a first condition in which rotation between the lever arm 10 and the leg prosthesis 2 is permitted and a second condition in which an unrotatable connection is created between the lever arm 10 and the leg prosthesis 2." *Id.* at [0015]. In this manner, ankle joint 17 can be set to allow hydraulically damped rotation in both directions, but it can also be set to lock the foot in place at a desired angle relative to the leg, e.g., to facilitate walking up or down a slope. *See id.* at [0015], [0017]. A user switches between open and closed by a "two-way valve 19 which in open position permits flow of medium between the chambers 20, 21 [of cylinder 24] and in closed position prevents such flow of medium." *Id.* at [0015].

When two-way valve 19 is open, "leg prosthesis 2 can be brought from a first extreme position in which the leg prosthesis is angled maximally forwards, which in one embodiment amounts to about 10^{o} forwards from a vertical position .

. . to a second extreme position in which the leg prosthesis is angled maximally backwards, which in one embodiment amounts to about 25^{o} backwards from a vertical position . . . without the piston 18 being locked in the cylinder 24 or the link 26 being locked against the cylinder 24." *Id.* at [0017]. Put differently, this range of motion is achievable in the first mode of operation because piston 18 remains free to move back and forth in cylinder 24, with fluid being exchanged through open valve 19 between chambers 20 and 21 on either side of the piston. *Id.* This provides hydraulic damping in both the dorsi- and plantar directions during operation of the device in the first mode. EX1005 at ¶95. Hydraulic damping occurs because, during this range of motion, fluid is forced through the relatively small orifice shown in Figs. 2a-2c (detail reproduced here). *See, e.g.*, EX1008, Figs.2a-2c; *see also* EX1005 at ¶98.

In this first mode of operation, i.e., when two-way valve 19 is open, *Gramnas* satisfies the "hydraulic damping" limitation of claim 1 of the '312 patent, which requires "a joint mechanism providing resistance to ankle flexion, wherein the joint mechanism is constructed and arranged such that during walking said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions."

First, during “rollover” (i.e., heel off, weight on front of foot, foot in dorsi-flexion relative to leg), link 26 of *Gramnas* pushes movable piston 18 toward the rear of cylinder 24, forcing fluid through valve 19 to equalize pressure on either side of the piston and thereby creating hydraulic damping in the dorsi-flexion direction. EX1005 at ¶100. This is evident from Fig. 2a of *Gramnas* and the description in the specification. *See e.g.*, EX1001 at [0017].

Then, during and after “heel strike” (i.e., heel on the ground, weight on rear of foot, foot in plantar-flexion relative to leg), the upward force acting on the heel creates a moment that “will rotate the foot downward until the foot blade will be in contact with the ground.” *Id.* at [0023]. As *Gramnas* explains, a moment arm is created that “will rotate the foot downward.” *Id.* at [0023]. Then, the resistance to plantar-flexion in *Gramnas* is provided by link 26 pulling piston 18 forward in cylinder 24, forcing fluid through valve 19 to equalize pressure, thereby creating hydraulic damping in the plantar-flexion direction. *See Id.* at Fig. 2c; EX1008 at [0015]; *see also* EX1005 at ¶105.

In sum, if valve 19 of *Gramnas* is open during motion of prosthetic leg 2 (e.g., walking), the joint mechanism of the device will predominantly provide damping by the hydraulic piston 18 rather than resilient biasing, resisting ankle flexion in both the dorsi- and plantar direction.[2] EX1005 at ¶107.

Gramnas teaches a hydraulic cylinder with a mechanical end-stop ring wall 25. *Id.* at [0025] ("said ring wall dividing the space between the ring flanges of the piston"). Ring flanges 22 and 23 (which make up piston 18) can move in their respective chambers 20, 21 until they physically abut ring wall 25 at the end of their travel. Thus, ring wall 25 provides a mechanical end-stop for the hydraulically controlled range of motion around pivot axle 4. *Id.*; *see also id.* at

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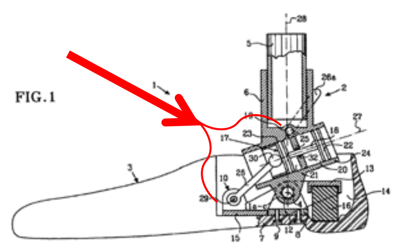
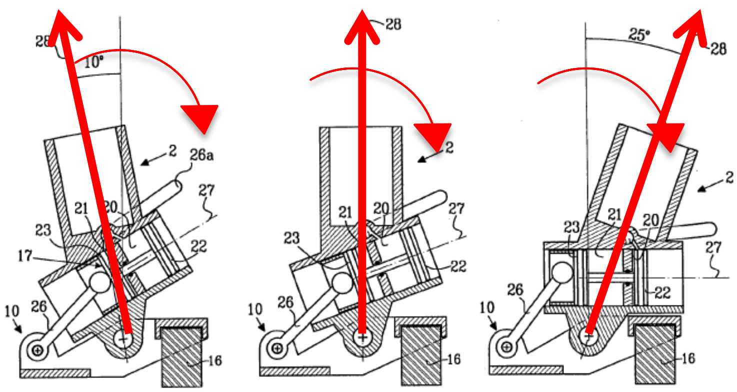
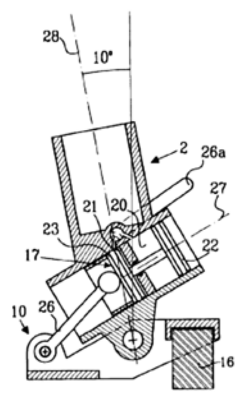
[2] To the extent Patent Owner argues that *Gramnas* does not disclose that valve 19 is open "during walking," this does not distinguish apparatus claims 1-6. *Gramnas* discloses a structure capable of meeting the limitations when valve 19 is open. As the Examiner correctly noted, "apparatus claims cover what a device *is,* not what a device *does*." *Hewlett-Packard*, 909 F.2d at 1469 (emphasis in original). Features of an apparatus may be recited either structurally or functionally, but claims directed to an apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Schreiber*, 128 F.3d 1473, 1477-78 (Fed. Cir. 1997) (prior art disclosure of structure, silent on functional limitation, still anticipates); *see also In re Swinehart*, 439 F.2d 210, 212-813 (CCPA 1971); *In re Danly*, 263 F.2d 844, 847 (CCPA 1959).

Fig. 2a. The ring wall 25 is associated with the shin component interface, and the ring flanges 22 and 23 are associated with the foot component. *Id.*

The charts below show that *Gramnas* discloses the limitations claims 1-6, making them unpatentable under § 102(b).

Independent Claim 1	**Citations in *Gramnas***
[1.0] A prosthetic foot and ankle assembly comprising the combination of:	EX1008 (*Gramnas*) at [0012] ("In FIG. 1 there is shown a prosthesis generally denoted 1.").
[1.1] a foot component; and	EX1008 (*Gramnas*) at [0012] ("The prosthesis comprises a leg prosthesis 2 and a foot 3. . . . The foot 3 is also constructed in a manner well-known to the person skilled in the art.").
[1.2] an ankle joint mounted to the foot component, the ankle joint comprising:	EX1008 (*Gramnas*) at Abstract ("A device in a leg prosthesis which via a pivot axle is connected to the leg prosthesis."). FIG.1  *Id.* at [0015] ("[T]he second means 17 are arranged to take a first condition in which rotation between the lever arm 10 and the leg prosthesis 2 is permitted.").
[1.3] a joint mechanism providing resistance to ankle flexion,	EX1008 (*Gramnas*) at [0015] ("[T]he second means comprises an element 18 which is displaceable with respect to the leg prosthesis and members 19, 20, 21 for keeping the displaceable element in a desired displacement position."). *Id.* at [0013] (the device will via feature "10 *limit a free rotatability* between the leg prosthesis and the foot.").

[1.4] wherein the joint mechanism is constructed and arranged such that during walking said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions.	 FIG.2a FIG.2b FIG.2c EX1008 (*Gramnas*) at [0013] ("second means" of *Gramnas* can provide dynamic, stepless rotation, hydraulically limiting "a free rotatability between the leg and prosthesis and the foot" during walking); *id.* at Abstract (providing "limited rotation of the foot with respect to the leg prosthesis."); Fig. 1, 2a-2c. *Id.* at [0015] ("In a preferred embodiment the displaceable element 18 consists of a piston 18 with outwardly projecting ring flanges 22, 23 and which is displaceable in a cylinder 24 attached to the leg prosthesis 2. The members 19, 20, 21 for the piston in a desired displaced position with respect to the cylinder 24 further comprise a ring wall 25 in the cylinder, said ring wall dividing the space between the ring flanges of the piston into two chambers 20, 21 and a two-way valve 19 which in open position permits flow of 30 medium between the chambers 20, 21.") *see also* discussion at § VII.1, *supra;* EX1005 at ¶107.

Dependent Claim 2	
[2.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface, wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	EX1008 (*Gramnas*) at [0012] ("tubular lower leg portion 5 which is attached in a socket 6."). *Id.* at [0015] ("The members 19, 20, 21 for the  FIG.2a

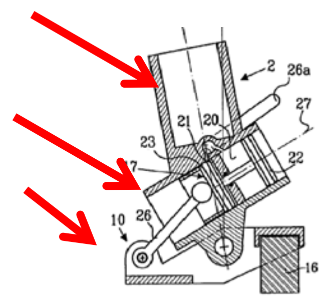
	piston in a desired displaced position with respect to the cylinder 24 further comprise *a ring wall 25* in the cylinder, said ring wall dividing the space between the ring flanges of the piston into two chambers 20, 21 and a two-way valve 19 which in open position permits flow of 30 medium between the chambers 20, 21.") (emphasis added).
[2.2] wherein the shin connection interface is arranged to allow connection of a shin component at different anterior-posterior tilt angles, including angles resulting in the shin component having an anterior tilt of at least 3 degrees with respect to the vertical when the joint mechanism is flexed to the dorsi-flexion limit.	EX1008 (*Gramnas*) at [0016]-[0017] ("[T]he leg prosthesis 2 can be brought from a first extreme position in which the leg prosthesis is angled maximally forwards*, which in one embodiment amounts to about 10° forwards from a vertical position*.").

Dependent Claim 3	
[3.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* Limitation [2.1] above; *see also* EX1008 (*Gramnas*) at [0012] ("tubular lower leg portion 5 which is attached in a socket 6.").
[3.2] wherein the joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* Limitation [2.1] above.
[3.3] wherein the assembly is arranged such that the dorsi-flexion limit corresponds to a predetermined relative orientation of the shin component interface relative to the foot component.	EX1008 (*Gramnas*) at [0017] ("The lengths of the lever arm 10 and the link 26 are so adapted that the leg prosthesis 2 can be brought from a *first extreme position* in which the leg prosthesis is angled *maximally forwards*, which in one embodiment amounts to *about 10^{o} forwards* from a vertical position, this position being shown in FIG. 2a.") (emphasis added).

Dependent Claim 4

[4.1] A prosthetic foot and ankle assembly according to claim 3, wherein the dorsi-flexion limit is defined by a mechanical end-stop operative by the abutment of one part of the assembly associated with the shin component interface against another part of the assembly associated with the foot component.	EX1008 (*Gramnas*) at Fig. 2a (ring wall 25).

Dependent Claim 5	
[5.1] A prosthetic foot and ankle assembly according to claim 4, wherein the joint mechanism comprises a hydraulic linear piston and cylinder assembly, wherein the piston has a distal connection and the cylinder has a proximal connection, and wherein the end stop is defined by the piston and an end wall of the cylinder.	*See* Limitation [4.1], *supra*. (Ring wall 25 is an end wall of the cylinder defined by chamber 21).

Dependent Claim 6	
[6.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* Limitation [2.1] above.
[6.2] wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* Limitation [3.2] above.
[6.3] wherein the assembly is arranged such that the relative position of the foot component and the shin connection interface at the dorsi-flexion limit is defined independently of the orientation of the assembly in space.	*See* Limitations [2.1]-[2.2] above; EX1008 (*Gramnas*) at Fig. 2a; EX1005 at ¶113.  FIG.2a

2. Ground 2: Claims 1-6 Are Rendered Obvious under U.S.C. § 103(a) by *Gramnas*

Claim 1 recites a joint mechanism for providing resistance to foot motion that is "constructed and arranged such that during walking said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar flexion directions." To the extent *Gramnas* does not expressly disclose this limitation "during walking" (and assuming *arguendo* that "during walking" is a limitation that can be used to distinguish apparatus claim 1 from otherwise anticipatory prior art), it would have been obvious to a POSA that *Gramnas* could be used to meet this limitation during walking. *See In re Best*, 562 F.2d 1252, 1255 n.4 (CCPA 1977) ("There is nothing inconsistent in concurrent [grounds] for obviousness under 35 U.S.C. 103 and for anticipation under 35 U.S.C. 102.").

As explained above, when two-way valve 19 in *Gramnas* is open, the piston-and-cylinder mechanism 17 provides hydraulic damping over a range of motion from 10^{o} forward to 25^{o} backwards. *See* Section VII.1, *supra*. A POSA would recognize that the device of *Gramnas*, with valve 19 open, provides the added benefit of hydraulic resistance to ankle flexion and extension during walking, such that, during walking, hydraulic resistance is the predominant resistance. *See* EX1005 at ¶116.

A POSA would have been motivated to leave valve 19 open during walking on level ground to achieve damped but flexible rotation during normal gait for the same reason explained in the Background section of the ’312 patent, i.e., to “allow[] dynamic hydraulic control of the angular position of a prosthetic foot with respect to a shin component.” Indeed, this same motivation is evident in the numerous hydraulically damped devices cited in the ’312 patent, including *Mauch*, *Karas*, *O’Byrne*, *Chen*, *Gramtec*, and *Iverson*—all of which are admitted prior art. Moreover, Examiner found, unrebutted, that “[h]ydraulically dampened joints are well known in the art for mimicking the feel of a natural foot for users, and would result in a more comfortable walk for the user.” EX1002 at 981. Thus, a POSA would have been motivated to use the *Gramnas* device during walking with valve 19 open and would have expected success in doing so. *See* EX1005 at ¶¶116-119.

3. Ground 3: Claim 8 Is Rendered Obvious under 35 U.S.C. § 103(a) by *Gramnas* in view of *Hellberg*

To the extent *Gramnas* does not explicitly disclose a “pyramid alignment interface,” as recited in claim 8, *Hellberg* (EX1014) does. *Hellberg* was published on June 4, 2002, and is prior art to the ’312 patent under § 102(b). *Hellberg* discloses an analogous leg prosthesis including a pyramid alignment interface. The teachings of *Gramnas* (as discussed in § VII.1., *supra*) in view of *Hellberg* would have rendered claim 8 obvious under § 103(a). *Hellberg* was not cited in prosecution. EX1002.

Hellberg relates to "an adjustment device for an artificial arm or leg." EX1014 at 1:9-10. *Hellberg* recognizes the importance of the prosthesis "be[ing] adjusted in both the angular and translatory direction, so that the user does not apply load in an unnatural way to the prosthesis." *Id.* at 1:19-22. *Hellberg* teaches that the adjustment device includes an "angular adjustment means . . . comprised of . . . a pyramid adapter . . . which is attached . . . to a . . . prosthesis member." *Id.* at 2:57-63. In one embodiment (Fig. 2, reproduced above), *Hellberg* discloses an artificial foot 10 and a pyramid adapter 20 coupling the artificial foot 10 with a lower leg prosthesis sleeve 60 having an axis. *See also id.* at 3:48-54, 4:44-47. Based on these teachings, a POSA would understand that *Hellberg*'s pyramid adapter 20 adjusts the tilt of the lower leg prosthesis sleeve 60 to any appropriate angle, including at least 3° relative to the vertical towards the front of the artificial foot 10, for a user to properly apply load to the prosthesis. EX1005 at ¶¶156-158.

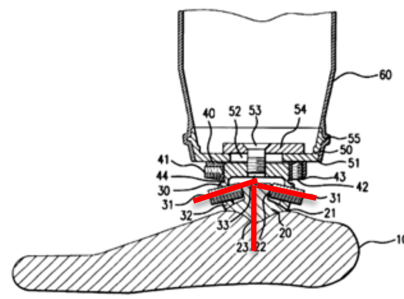


FIG.2

i. **Rationale to Combine *Gramnas* and *Hellberg***

It would have been routine for a POSA to modify the *Gramnas* device such that its socket 6 includes a pyramid adapter 20 attached to a lower leg prosthesis sleeve 60, as disclosed by *Hellberg*, for angular adjustment and proper positioning of the lower leg prosthesis. EX1014 at 1:19-22; EX1005 at ¶¶163-165. There would have been nothing unpredictable or unexpected in developing the claimed pyramid alignment interface allowing adjustment of the shin component axis in the anterior and posterior directions relative to the foot component because the ’312 patent itself recognizes that such interfaces were conventional and well known to POSA. EX1001 at 2:66-3:2 (“[a]djustment of the shin axis orientation in the anterior-posterior direction with respect to the foot component may be performed using at least one *conventional pyramid alignment interface*, preferably the shin component interface”); *id.* at 6:53-54 (“The shin connection interface 20 is *conventional*, being of pyramid construction.”) (emphases added); *see also* EX1005 at ¶164. The Examiner likewise recognized that “pyramid adapters are well known in the art.” EX1002 at 711.

The combination of *Gramnas* and *Hellberg* teaches the elements of claim 8, and therefore, claim 8 should be found unpatentable under § 103(a).

4. Ground 4: Claims 16-22 Are Rendered Obvious under 35 U.S.C. § 103(a) by *Gramnas* in View of *Christensen*

While *Gramnas* discloses a foot blade 7 part of foot 3 that is “constructed in a manner well-known to the person skilled in the art,” EX1008 (*Gramnas*) at [0012], to the extent the Board finds it fails to disclose a resilient or spring section

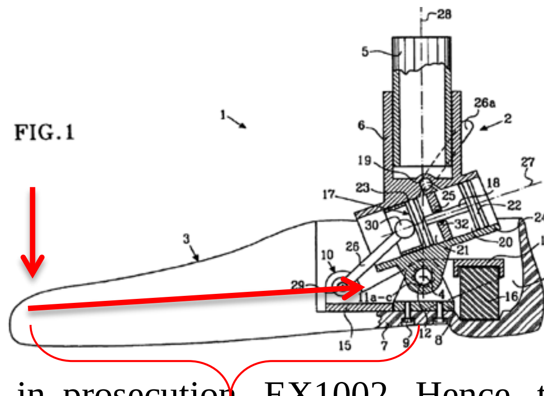


FIG. 1

as in claims 16-19, or a spring element as recited in claims 20-22, *Christensen* (EX1009) supplies these teachings. *Christensen* was published on August 4, 2005, and is prior art to the ’312 patent under § 102(b). *Christensen* was not cited in prosecution. EX1002. Hence, the teachings of *Gramnas*, as discussed above in Section VII.1, *supra*, in view of *Christensen* would have rendered obvious claims 16-22 under § 103(a).

Similar to *Gramnas*, *Christensen* relates to a prosthetic ankle foot device including first and second prosthetic members and a foot blade. *See* EX1009 at Abstract. In one embodiment (Fig. 7, reproduced below), *Christensen* discloses that the device includes a “resilient and energy storing foot member [422].” *Id.* at [0064]. The foot member 422 curves “downwardly and forwardly to a toe section 444 at a toe location of toes of a natural foot, and [] downwardly and rearwardly to a heel section 438 at a heel location of a natural heel.” *Id.* *Christensen* also describes an ankle member 418 pivotally attached to the foot member 422 and including an attachment section 426 for a lower leg prosthesis of an amputee. *See id.* (“The first member 418 can be an upper attachment member with an attachment section 426 for coupling to a stump of an amputee. . . . The second member 422 can be pivotally attached to the first member 418, such as with a pivot pin 450.”).

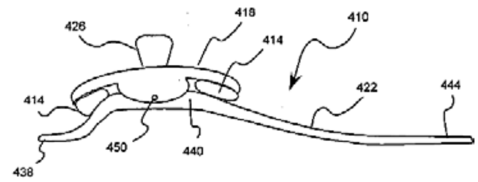


FIG. 7

Christensen describes the foot member 422 as “an elongated spring capable of storing energy during deflection,” *id.* at [0011], that is “much like a leaf spring,” *id.* at [0040]. *Christensen* further teaches that at least a toe portion 444 of the foot member 422 resiliently flexes towards the ankle member 418 and the attachment section 426 for the lower leg prosthesis as a load is applied onto the toe portion 444. *See id.* at [0053] (“as the user continues to step, or walk, on the foot device 10, the toe portion 44 of the second member 22 deflects . . . . [T]he second member 22 or toe portion 44 [] deflect[s] and/or move[s] with respect to the first member 18”); *id.* at [0064]; *see also* EX1005 at ¶¶137-138.

As discussed in Section VII.1, *supra*, *Gramnas* discloses that socket 6 of leg prosthesis 2 attaches to the prosthetic lower leg portion 5, which includes a longitudinal axis 28 and a foot blade 7. *Gramnas* is silent on whether foot blade 7 is resilient. To the extent resiliency is not implied, modifying *Gramnas*’ foot blade 7 to be resilient in at least its front portion, as disclosed by *Christensen*, allows the front portion of the foot blade 7 to “deflect and/or move with respect to the” leg prosthesis 2 and the axis 28 of the prosthetic lower leg portion 5. *See* EX1009 at [0053]; EX1005 at ¶183. The resilient front portion of the foot blade 7 would be associated with the coupling point between the foot blade 7 and the leg prosthesis 2 and the coupling point between the leg prosthesis 2 and the prosthetic lower leg portion 5 by deflecting relative to these points. *See* EX1009 at Fig. 7; EX1005 at ¶184.

And as discussed in Section VII.1, *supra*, *Gramnas* discloses that the two-chamber adjustable hydraulic mechanism provides hydraulic damping to ankle flexion at the joint 4. The modified foot blade 7 of *Gramnas* being "an elongated spring capable of storing energy during deflection," EX1009 at [0011], as taught by *Christensen*, would be arranged and act in series with the two-chamber adjustable hydraulic mechanism in that as a "load is applied to the [] foot member . . . , the [] foot member defines a spring that deflects," *id.* at [0067], and the hydraulic mechanism "limit[s] a free rotatability between the leg prosthesis and the foot," EX1008 at [0013]. *See also* EX1005 at ¶185.

i. **Rationale for Combining *Gramnas* and *Christensen***

Christensen teaches that the toe portion 444 of the foot member 422 deflects relative to the ankle member 418 to "provid[e] a soft, cushioned feel." EX1009 at [0053]. It teaches modular foot blades, as does other relevant art. *E.g.*, *Townsend* (EX1011) at [0073] (resilient foot blade is a "modular system preferably constructed with standardized units or dimensions for flexibility and variety in use."). Hence, a POSA would have been motivated, with a reasonable expectation of success, to modify the foot blade 7 to include a resilient section for at least its front portion, as disclosed by *Christensen*, to provide a soft and cushioned feel for the user of *Gramnas'* prosthetic device, and for flexibility and variety of use. *Id.*; *see also* EX1005 at ¶¶180-181. There would have been nothing unpredictable or unexpected in developing the claimed resilient foot component because it is "constructed in a manner well-known to the person skilled in the art," EX1008 (*Gramnas*) at [0012] and the '312 patent recognizes that such a resilient foot component was conventional and well known to POSA. EX1001 at 9:64-67 ("[t]he yielding action is provided by a hydraulic damper coupled to *conventional foot elements* (i.e. keel, carrier and independent carbon fibre composite heel-toe springs)") (emphasis added); *see also* EX1005 at ¶¶ 182.

The combination of *Gramnas* and *Christensen* teaches the element of claims 16-22, and so these claims should be found unpatentable under § 103(a).

Independent Claim 16	**Citations in *Gramnas* and *Christensen***
[16.0] A lower limb prosthesis comprising:	*See* § VII.1 (table) at Limitation [1.0], *supra*.
[16.1] a shin component defining a shin axis,	*See* §VII.1 (table) at Limitations [2.1]-[2.2], *supra*.
[16.2] a foot component, and	*See* § VII.1 (table) at Limitation [1.1], *supra*.
[16.3] a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* § VII.1 (table) at Limitations [1.2]-[1.3], *supra*.
[16.4] wherein the mechanism is constructed and arranged such that said resistance is predominantly	*See* §VII.1 (table) at Limitation [1.4], *supra*.

provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar flexion directions,	
[16.5] said ankle joint coupling the shin component to the foot component,	*See* § VII.1 (table) at Limitation [3.1], *supra*.
[16.6] wherein at least one of the foot component and the shin component includes a resilient section allowing resilient dorsi-flexion of at least an anterior portion of the foot component relative to the shin axis.	*Christensen* (EX1009) at Fig. 7; [0053] ("[A]s the user continues to step, or walk, on the foot device 10, the toe portion 44 of the second member 22 deflects . . . . [T]he second member 22 or toe portion 44 [] deflect[s] and/or move[s] with respect to the first member 18."); [0064] ("The first member 418 can be an upper attachment member with an attachment section 426 for coupling to a stump of an amputee. . . . The second member 422 can be pivotally attached to the first member 418, such as with a pivot pin 450. . . . The second member 422 can be resilient and energy storing foot member that deflects or flexes."); *see also* EX1005 at ¶143.

Dependent Claim 17	
[17.1] A prosthesis according to claim 16, wherein the foot component comprises an energy-storing spring arranged to be deflected when a dorsi-flexion load is applied to the foot anterior portion.	*See Gramnas* (EX1008), Fig. 1 (foot blade 7). *Christensen* (EX1009) at [0011] (The "foot member defines an elongated spring capable of storing energy during deflection.").

Dependent Claim 18	
[18.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the foot component and the ankle joint.	*See Christensen* (EX1009) at Fig. 7 (showing resilient toe portion 444 of the foot member 422 associated with the coupling point between the foot member 422 and the ankle member 426); EX1005 at ¶¶167-168.

Dependent Claim 19	
[19.1] A prosthesis according to claim 16, wherein the resilient section is associated with the coupling of the shin component to the ankle joint.	*See Christensen* (EX1009) at Fig. 7 (showing the resilient toe portion 444 of the foot member 422 associated with the coupling point between the ankle member 426 and the lower leg prosthesis); EX1005 at ¶¶167-168.

Independent Claim 20	
[20.0] A prosthetic foot/ankle assembly comprising the combination of	*See* § VII.1 (table) at Limitation [1.0], *supra*.
[20.1] (a) a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* § VII.1 (table) at Limitations [1.2]-[1.3], *supra*.
[20.2] wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions, and	*See* § VII.1 (table) at Limitation [1.4], *supra*.
[20.3] (b) a prosthetic foot having an anterior portion, a posterior portion and an ankle-mounting portion,	*See* § VII.1(table) at Limitation [1.1], *supra*. *See also Christensen* (EX1009) at [0064] ("The second member 422 can include a lower foot member with an attachment section 440 curving both 1) downwardly and forwardly to a toe section 444 at a toe location of toes of a natural foot, and 2) downwardly and rearwardly to a heel section 438 at a heel location of a natural heel.").
[20.4] wherein the assembly constitutes a Maxwell-model damper/spring combination comprising a damper element and a spring element, wherein the damper element is said ankle joint	*See* § VII.1 (table) at Limitation [1.4], *supra*. *Christensen* (EX1009) at [0011] (The "foot member defines an elongated spring capable of storing energy during deflection."); [0067] (As a "load is applied to the [] foot member .

and the spring element is a spring component arranged in series with the ankle joint.	. . , the [] foot member defines a spring that deflects.”). *Gramnas* (EX1008) at [0013] (via“ the lever arm 10” the device will “limit a free rotatability between the leg prosthesis and the foot.”); *see also* EX1005 at ¶185.

Dependent Claim 21	
[21.1] An assembly according to claim 20, wherein the spring component is located distally of said ankle joint.	*Christensen* (EX1009) at [0011] (The “foot member defines an elongated spring capable of storing energy during deflection.”); [0053] (“[A]s the user continues to step, or walk, on the foot device 10, the toe portion 44 of the second member 22 deflects.”).

Dependent Claim 22	
[22.1] An assembly according to claim 20, wherein the spring component is a leaf spring supporting the anterior portion of the foot on the ankle-mounting portion thereof.	*Christensen* (EX1009) at [0040] (“The first and second members 18 and 22 can be resilient and energy storing foot members that deflect or flex, storing energy, much like a leaf spring.”).

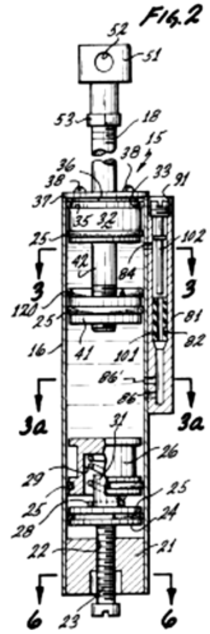
5. Ground 5: Claims 7 and 9-15 Are Rendered Obvious under 35 U.S.C. § 103(a) by *Gramnas* in View of *Mortensen*

To the extent *Gramnas* does not explicitly disclose certain features recited in claims 7 and 9-15, *Mortensen* (EX1012) supplies these teachings. *Mortensen* was published on July 15, 1980, and is prior art to the ’312 patent under § 102(b). *Mortensen* was not cited in prosecution. EX1002. Hence, the teachings of *Gramnas*, as discussed above in Section VII.1, *supra*, in view of *Mortensen* would have rendered obvious claims 7 and 9-15 under § 103(a).

a. Claims 7 and 9-14

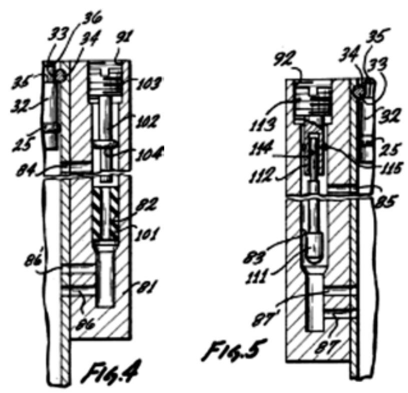
Gramnas' damping means disclosed in Fig. 1 includes a single valve-controlled hydraulic cylinder. *Gramnas* discloses that the single hydraulic cylinder includes "two chambers 20, 21" for a hydraulically acting piston 18. EX1008 at [0015]. *Gramnas* also discloses that the single hydraulic "cylinder 24 and the piston 18 are provided in the leg prosthesis above the pivot axle 4," and is "preferably arranged with a symmetry axis 27 making an angle with a longitudinal axis 28 of the leg prosthesis in the direction of the leg" where "[p]referably, the symmetry axis 27 crosses the foot blade 7 or close to a toe region of the foot blade 7." EX1008 at [0015]-[0016]. Thus, *Gramnas*' pivot axle 4 is positioned to the anterior of the central axis of the hydraulic cylinder and piston assembly. EX1008 at Figs. 1 and 2c; *see also* EX1005 at ¶215.

Fig. 2



Like *Gramnas*, *Mortensen* discloses a single, linear hydraulic cylinder and piston for controlling prosthetic flexion. *See* EX1012 at Abstract (a "hydraulic knee control for a prosthetic leg has a cylinder and piston"); *id.* at 1:35-38 ("a hydraulic knee control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension"). Fig. 2 of *Mortensen* (below) illustrates *Mortensen*'s hydraulic cylinder and piston. Particularly, *Mortensen* describes that a hydraulic cylinder 16 and a piston 41 control the relative pivoting motion between two components of the prosthesis. *Id.* at 2:6-15 ("[T]he shank portion 13 and the thigh portion 12 pivot relative to each other about bolt 14 in a standard manner. This pivot or knee action is controlled by . . . a cylinder 16 . . . and [] a connective rod 18.").

Mortensen discloses two hydraulic passageways and a valve system for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder 16 caused by linear movement of the piston 41 within the cylinder 16. *Id.* at Abstract ("[O]ne end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve . . . , and the other passageway has a one-way adjustable valve."); *see also id.* at 3:44-45. The two-valve system allows a user to control the resistance to relative flexing or pivoting between the two components of the prosthesis. *See id.* at 1:35-38 ("A primary object of this invention is . . . control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension."). *Mortensen* teaches that the valve system includes "a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and . . . a one-way adjustable



valve which allows the liquid to move only from the crank end to the head end in a controlled manner." *Id.* at Abstract.

As illustrated in Figs. 4-5 of *Mortensen*, the one-way valves include adjustable heads 103, 113 that each individually control the hydraulic fluid flow between the opposite regions in the hydraulic cylinder 16 by screwing into and out of wells 82, 83 of the passageways, which controls the resistance and the rate at which the two components of the prosthesis flex or pivot relative to each other in a first and a second direction. *See id.* at 3:11-13, 3:44-66.

Mortensen further describes that one passageway includes a sleeve 101 that moves and urges against a pin 102 to block the flow of hydraulic fluid during flexion in the first direction, and that the other passageway includes a pin 111 that moves and urges against a shoulder to block the flow of hydraulic fluid during flexion in the second direction. *Id.* at 3:44-48, 3:56-62. Thus, the area between the sleeve 101 and the pin 102 reduces with flexion in the first direction, and the area between the pin 111 and the shoulder reduces with flexion in the second. *Id.*; *see also* EX1005 at ¶196.

i. **Rationale for Combining *Gramnas* and *Mortensen***

Gramnas and *Mortensen* both teach fluid passageway-valve systems to control hydraulic fluid flow between regions of a single hydraulic cylinder. EX1008 at [0015]; EX1012 at Abstract; *see also* §§ VII.3.i. *supra*. *Mortensen*'s valve system allows a user to control and adjust the resistance to relative flexion between two components of a prosthesis, *see* § VII.5.a, *supra*; EX1005 at ¶188-190, and *Gramnas* recognizes the desire for "[i]ndividual adaption of the foot [prosthesis]." EX1008 at [0003].

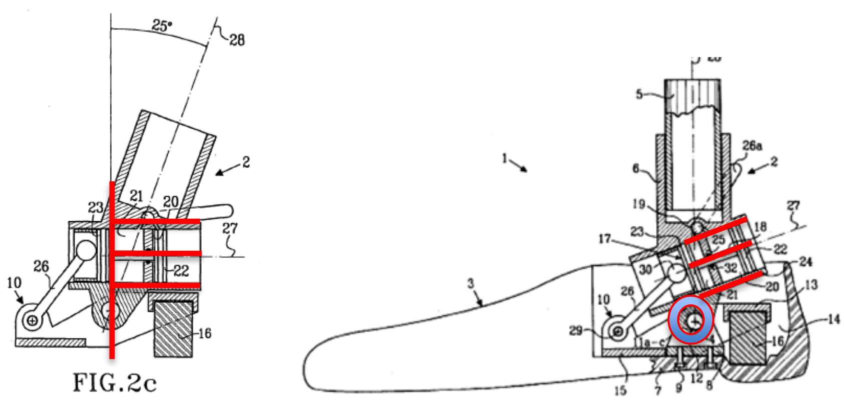
Consistent with these teachings, a POSA would have been motivated to incorporate the features of *Mortensen*'s valve system to the hydraulic mechanism of *Gramnas* for adapting the *Gramnas* prosthesis to a variety of users and applications. EX1005 at ¶211. For example, a POSA would have been motivated to incorporate the *Mortensen* valve system to the *Gramnas* hydraulic mechanism to adapt the *Gramnas* prosthesis for users of varying weight by adjusting the resistance to ankle flexion, as taught by *Mortensen*, depending on the user's weight. *See*, *e.g.*, EX1009 at [0009] (*Christensen* teaching that "users may have different weights. Thus, prosthetic feet may require a high degree of custom design, or be particularly tailored to the individual user. However, it is desirable from a cost and manufacturing standpoint to create a foot that is usable by many sizes of individuals."); *see also* EX1005 at ¶¶210-221.

In addition, a POSA would have been motivated to incorporate the *Mortensen* valve system to the *Gramnas* prosthesis for "individual adaption" of ankle flexion resistance depending on the user's activities. *See, e.g.*, EX1009 at [0008] (*Christensen* teaching that "[t]he stiffness of prosthetic feet typically varies according to the intended use. Feet intended for everyday use typically require a soft feel . . . . Feet intended for athletic use typically require strength."); *see also See* EX1016 at 34; EX1005 at ¶212. There would have been nothing unpredictable or unexpected in incorporating the *Mortensen* valve system into the *Gramnas* hydraulic mechanism as both *Gramnas* and *Mortensen* teach a known system of a single hydraulic cylinder and piston for hydraulically damping the flexion of two components of a prosthesis. *See* § VII.4; EX1005 at ¶218.

The combination of *Gramnas* and *Mortensen* teaches every element of claims 9-14. Thus, these claims should be found unpatentable under § 103(a).

Dependent Claim 7	
[7.1] A prosthetic foot and ankle assembly according to claim 1, arranged such that the resistance to flexion of said joint mechanism in a direction of dorsi-flexion is adjustable.	*See* § VII.1 (table) at Limitations [1.1]-[1.4], *supra*; *see also Mortensen* (EX1012) at 3:11-13 ("Bypass well 82 controls the rate at which the leg extends itself and well 83 controls the rate at which the leg flexes."); 3:44-66 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out . . . . To control the rate of flow, head 113 is screwed into or out of well 83. . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out . . . . To control this rate of oil flow, head 103 is screwed into or out of the well 82.").

Dependent Claim 9	**Citations in *Gramnas* and *Mortensen***
[9.1] A prosthetic foot and ankle assembly according to claim 1, wherein said joint	*Gramnas* (EX1008) ("… two chambers 20, 21 and a one-way valve 19 which in open position permits flow of medium between the chambers 20, 21 . . ."). *Mortensen* (EX1012) at Abstract ("[A] hydraulic knee control for a prosthetic leg has a cylinder and piston . . . .

mechanism comprises a hydraulic linear piston and cylinder assembly and a valve arrangement controlling the flow of hydraulic fluid between chambers of the piston and cylinder assembly on opposite sides of the piston thereof, the valve arrangement allowing individual setting of dorsi- and plantar-flexion damping resistances, and	Disposed outside of the cylinder are two bypass passageways wherein one end of each passageway communicates with the cylinder in the region between the piston and crank end and the other end of each passageway communicates with the cylinder in the region between the piston and the floating plug. One of the passageways has a one-way adjustable valve which allows the liquid to move only from the head end to the crank end in a controlled manner, and the other passageway has a one-way adjustable valve which allows the liquid to move only from the crank end to the head end in a controlled manner.") *Id.* at 1:35-38 ("[A] hydraulic knee control for a leg prosthetic wherein the resistance of flexion is not the same as the resistance to extension."); 2:6-15 ("[T]he shank portion 13 and the thigh portion 12 pivot relative to each other about bolt 14 in a standard manner. This pivot or knee action is controlled by . . . a cylinder 16 . . . and [] a connective rod 18."); 3:44-66 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out . . . . When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out."); *see also* EX1005 at ¶¶187-198.
[9.2] wherein the joint mechanism defines a medial-lateral joint flexion axis, and the joint flexion axis is to the anterior of the said central axis of the piston and cylinder assembly.	*Gramnas* (EX1008) at Figs. 1 and 2c.  FIG.2c *Id.* at [0015]-[0016] (hydraulic "cylinder 24 and the piston 18 are provided in the leg prosthesis above the pivot axle 4," and is "preferably arranged with a symmetry axis 27 making an angle with a longitudinal axis 28 of the leg prosthesis in the direction of the leg"); *see also* EX1005 at ¶¶88-89.

Dependent Claim 10	
[10.1] A prosthetic foot and ankle assembly according to claim 9, wherein said joint mechanism includes two passages in communication with a variable-volume chamber of the piston and cylinder assembly, each passage containing a respective non-return valve, one oriented to prevent the flow of fluid from the chamber through its respective passage and the other oriented to prevent the admission of fluid to the chamber through the other passage.	*See* Limitation [9.1] above.

Dependent Claim 11	
[11.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping orifice in at least one of the two passages.	*See* Limitation [7.1] above.

Dependent Claim 12	
[12.1] A prosthetic foot and ankle assembly according to claim 10, including an adjustable damping orifice that forms part of a passage in communication with the chamber and through which fluid flows during flexion of the ankle joint in a dorsi direction.	*See* Limitation [11.1] above.

Dependent Claim 13	
[13.1] A prosthetic foot and ankle assembly according to claim 12, wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* § VII.1 (table) at Limitation [2.1], *supra*.
[13.2] wherein the adjustable damping orifice has a dorsi-flexion orifice area that is variable according to joint flexion, the area reducing as dorsi-flexion of the joint mechanism approaches the dorsi-flexion limit.	*Mortensen* (EX1012) at 3:44-48 ("When the knee flexes or bends, piston 41 moves down into the cylinder 16 while urging oil out of apertures 86, 86', 87, and 87'. . . . [A]s the oil tends to flow into apertures 86 and 86', sleeve 101 is urged against pin 102, blocking any flow of oil."); 3:56-62 ("When the leg tends to extend, the piston 41 moves towards the crank end, urging oil out of the apertures 84 and 85. . . . [W]hen oil is moving from

	cylinder 16 into the well 83 through aperture 85, pin 111 is urged against the shoulder formed by the reduced portion therein, thereby blocking oil flow.”); *see also* EX1005 at ¶195.

Dependent Claim 14	
[14.1] A prosthetic foot and ankle assembly according to claim 12, including a second adjustable damping orifice through which fluid flows during flexion of the joint mechanism in a plantar direction.	*See* Limitation [11.1] above.

b. Claim 15

Mortensen teaches a “resilient O-ring 120 disposed floating between piston 41 and sleeve 32 to absorb any force between the two members when they come in contact.” EX1012 at 4:13-15. The sleeve is part of the crank end of the hydraulic cylinder. *See id.* at 2:31-32 (“[t]he crank end of the cylinder has a sleeve 32”).

A POSA, reading *Mortensen*’s teachings that the O-ring 120 is resilient and absorbs force from mechanical contact, would have understood that the O-ring 120 is a cushioning structure that increases resistance to the piston’s 41 movement towards the crank end of the hydraulic cylinder 16. *Id.*, Fig. 2, 4:13-15; EX1005 at ¶¶197-198. As the piston 41 moves toward the crank end of the hydraulic cylinder 16 and causes contact between the O-ring 120 and the sleeve 32, the O-ring 120 functions to increase resistance to the piston’s 41 movement because it resiliently absorbs the force applied by the piston 41 on the sleeve 32. EX1012, Fig. 2, 4:13-15; EX1005 at ¶198. Hence, *Mortensen* discloses this claimed feature.

i. Rationale for Combining *Gramnas* and *Mortensen*

A POSA would have been motivated to incorporate the resilient O-ring 120 described in *Mortensen* to the *Gramnas* hydraulic cylinder and piston assembly, for absorbing contact forces between the piston 18 and the ring wall 25 of the hydraulic cylinder 24. EX1012 at 4:13-15; EX1005 at ¶219. Under *Mortensen*'s teachings, a POSA would have recognized to dispose the resilient O-ring 120 on the faces of *Gramnas*' piston 18 facing the ring wall 25 to resiliently absorb contact between the piston 18 and the ring wall 25. *Id*. *Mortensen*'s resilient O-ring 120 incorporated with *Gramnas*' hydraulic cylinder 24 and piston 18 would increase resistance to the pivoting or flexing of the leg prosthesis 2 as it reaches the pivot or flexion limit, and would prevent trauma, wear, and sudden step-changes in gait. EX1005 at ¶220. And because both *Gramnas* and *Mortensen* teach hydraulic cylinder and piston assemblies with the piston abutting or contacting a mechanical end of the cylinder, *see* §§ VII.1. and VII.5.b., *supra*, one of ordinary skill in the art would have a reasonable expectation of successfully incorporating the resilient O-ring 120 from *Mortensen*'s hydraulic cylinder and piston assembly to *Gramnas*' hydraulic cylinder and piston assembly.

The combination of *Gramnas* and *Mortensen* teaches every element of claim 15, rendering this claim unpatentable under § 103(a).

6. Ground 6: Claims 1, 3-7, and 20-22 Are Rendered Obvious under 35 U.S.C. § 103(a) by *Christensen*

Christensen relates to a prosthetic foot device including the ankle member 418 and the foot member 422 having at least a resilient toe portion 444. *See* Section VII.4, *supra*. *Christensen* also teaches that the resilient toe portion 444 is associated with the coupling point between the foot member 422 and the ankle member 418 by deflecting relative to that coupling point. *Id.*; *see also* EX1005 at ¶168. The resilient toe portion 444 of the foot member 422 is also associated with the coupling point between the ankle member 418 and the lower leg prosthesis by deflecting relative to that coupling point. *See id.*

Christensen further discloses energy transfer mediums 414 disposed between the ankle member 418 and the foot member 422. *See* EX1009 at [0064] ("The energy transfer medium 414 can be disposed between the first and second members 418 and 422."); *id.* at Abstract (a "mechanism . . . to transfer a variable amount of energy from the second member to the first member during use"). *Christensen* describes that "energy is transferred between the first and second member[s], and thus through the energy transfer medium, during use." *Id.* at [0036]. Each medium 414 "variably transfers energy between the first and second members to vary stiffness of the prosthetic foot device." *Id.* at Abstract.

Regarding "hydraulic damping," *Christensen* discloses "an energy transfer mechanism . . . that variably resists flow of a fluid through a variable orifice." *Id.* at [0066]. As shown in Fig. 9a of *Christensen* (reproduced below), the energy transfer mechanism includes "first and second enclosures 636 and [532] . . . formed by chambers [654] and pistons 656" with the pistons 656 coupled to a first member 618, 626 away from the user, and the chambers 654 coupled to a second member 622, 632 closer to the user. *Id.* at [0078]. *Christensen* also discloses that the first and second enclosures 636, 532 are "fluidly connected by a fluid path 646" such that fluid disposed in the first and second enclosures 636, 532 can flow therebetween. *Id.* at [0076]. The fluid path 646 includes a valve mechanism 652 to vary the resistance to fluid flow through the fluid path. *See id.* at [0077] ("The variable orifice 652 can increase resistance to fluid flow between the first enclosure [532] and the second enclosure 642 with an increase in the applied force to transfer more load . . . . The variable orifice 652 can also decrease resistance to fluid flow during a decrease in the applied force to transfer less load."); *id.* at [0071] (The variable orifice "can be any variably sizable flow restriction device such as a servo-valve, a check valve, a needle valve, or a gate valve, as is generally known in the art.").

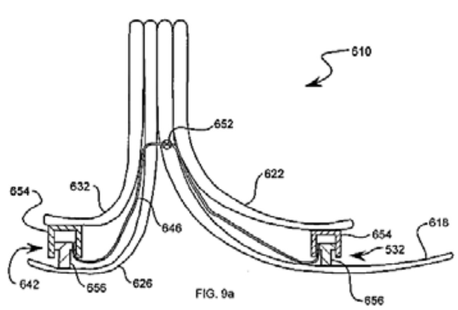


FIG. 9a

Like the energy transfer medium 414 of *Christensen*'s Fig. 7 embodiment, the fluid chambers 654, pistons 656, fluid path 646, and valve mechanism 652 of the energy transfer mechanism positioned between the ankle member 418 and the foot member 422 would provide resistance to the ankle member 418 pivoting or flexing relative to the heel or toe portion 438, 444 of the foot member 422. *Compare id.* at [0036] ("energy transfer medium . . . is located between first and second members of the foot so that energy is transferred between the first and second member") *with* [0067] ("the overall resistance response applied by the foot (and stiffness or feel of the foot) . . . varies based on the amount of energy or applied load transferred from the primary foot member to the secondary foot member by the energy transfer mechanism"); *see also* EX1005 at ¶134. *Christensen* further teaches during pivoting or flexing of the ankle member 418 relative to the heel or toe portion 438, 444 of the foot member 422 provided by the energy transfer mechanism (fluid chambers 654, pistons 656, fluid path 646, and valve mechanism 652) does not include resilient biasing of the ankle member 418 towards either the heel or toe portion 438, 444 of the foot member 422. *Id.* at [0036]; *see also* EX1005 at ¶135.

Christensen describes that with an increase in force against the foot member 422, the energy transfer mechanism increases the resistance provided by hydraulic damping, which increases the load or energy transferred to the ankle member 418.

See EX1009 at [0067] ("the energy transfer mechanism . . . transfer[s] a greater amount of energy or load . . . in response to a greater applied load, thus providing a stiffer feel and greater resistance response"); *id.* at [0069] (the energy transfer mechanism "increase[s] resistance against the forces applied to the primary foot member 518 when the forces increase so that more load can be transferred between the primary foot member 518 and the secondary foot member 522"). That increase in resistance provided by the hydraulic chamber 654 and piston 656 near the heel or toe portion 438, 444 of the foot member 422 transfers more load to the ankle member 418, which provides greater resistance to the pivoting movement of the ankle member 418 relative to the heel or toe portion 438, 444. EX1005 at ¶131. Likewise, *Christensen* teaches that with a decrease in force against the foot member 422, the energy transfer mechanism decreases the resistance provided by hydraulic damping, which decreases the load or energy transferred to the ankle member 418. *See* EX1009 at [0067]; EX1005 at ¶134. Based on these teachings of *Christensen*, it is clear that the energy transfer mechanism provides resistance by hydraulic damping that is adjustable. EX1005 at ¶150-152.

Christensen further discloses that the enclosures 636, 532 formed by the hydraulic chambers 654 and pistons 656 are "compressible between a first position in response to a relatively larger load or force, and a second position in response to a relatively smaller load or force." EX1009 at [0078]. *Christensen* describes that the enclosures 636, 532 "in the first position can have a larger dimension, such as height," and "a smaller dimension, such as height," in the second position. *Id.* A POSA, reading *Christensen*'s teachings that the enclosures 636, 532—formed by the hydraulic chambers 654 and pistons 656—are limited to the first and second positions, would have understood that the pivoting or flexing of the ankle member 418 is likewise limited to predetermined orientations relative to the foot member 422. EX1005 at ¶149. The top portion of the pistons 656 and the top end walls of the chambers 654 form mechanical end stops to define the pivoting or flexing limit of the ankle member 418 relative to the heel or toe portion 438, 444 of the foot member 422. *See* EX. 1009 at Figs. 7 and 9a; EX1005 at ¶¶150-152.

Christensen also discloses that when the ankle member 418 is pivoted or flexed to the limit in the toe portion direction, the position of the attachment section 426 on the ankle member 418 relative to the foot member 422 is independent of the orientation of the prosthetic device. *See* EX. 1009 at Fig. 7; EX1005 at ¶167-168.

And *Christensen* discloses that the energy transfer mechanism "disposed between" the foot member 422 and the ankle member 418, EX1009 at [0064], provides resistance by hydraulic damping, while the foot member 422 "defines an elongated spring capable of storing energy during deflection," *id.* at [0011]. The spring configuration of the foot member 422 is arranged and acts in series with the hydraulic damping of the energy transfer mechanism in that as a "load is applied to the [] foot member . . . , the [] foot member defines a spring that deflects" and the energy transfer mechanism "variably transfers energy" to the ankle member 418. *Id.* at [0066]-[0067]; *see also* EX1005 at ¶139.

i. **Rationale to Modify *Christensen***

The energy transfer mechanism of *Christensen*'s Fig. 9a embodiment serves the same purpose as the energy transfer medium 414 of *Christensen*'s Fig. 7 embodiment—to variably adjust the stiffness or response of the foot member. *See* EX1009 at [0036]:

> [E]mbodiments of . . . the present invention are shown with an energy transfer medium . . . , or an energy transfer mechanism . . . . The energy transfer medium . . . allows the energy transferred between the members to be varied, thus varying the stiffness or response of the foot. . . . The energy transfer mechanism . . . variably restrict[s] the fluid flow through the orifice, and thus allows the energy transferred between the primary and secondary foot members to be varied.

This common purpose would have provided the motivation for a POSA to substitute, with a reasonable expectation of success, *Christensen*'s energy transfer medium 414 with *Christensen*'s energy transfer mechanism (including the fluid chambers 654, pistons 656, fluid path 646, and valve mechanism 652) to arrive at the claimed apparatus. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 420 (2007) ("any need or problem known in the field of endeavor at the time of invention and addressed by the patent can provide a reason for combining the elements in the manner claimed”); EX1005 at ¶¶133-136.

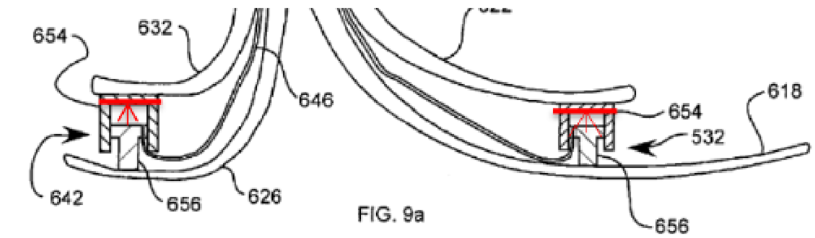
Christensen would have rendered obvious claims 1, 3-7, and 20-22 of the ’312 patent, as discussed above and shown in the detailed chart below.

Independent Claim 1	**Citations in *Christiansen***
[1.0] A prosthetic foot and ankle assembly comprising the combination of:	*Christensen* (EX1009) at Abstract (“A prosthetic foot device . . . includes a variable energy transfer mechanism . . . disposed between first and second foot members.”); [0064] (“Referring to FIG. 7, another prosthetic foot device 410 is shown with an energy transfer medium 414. . . . The foot device 410 also includes first and second members 418 and 422.”).
[1.1] a foot component; and	EX1009 at [0064] (“The second member 422 can be resilient and energy storing foot member that deflects or flexes, storing energy, and can be formed of a fiber reinforced resin material, such as a graphite-reinforced resin.”).
[1.2] an ankle joint mounted to the foot component, the ankle joint comprising:	EX1009 at [0064] (“The first member 418 can be an upper attachment member with an attachment section 426 for coupling to a stump of an amputee. . . . The second member 422 can be pivotally attached to the first member 418, such as with a pivot pin 450.”).
[1.3] a joint mechanism providing resistance to ankle flexion,	EX1009 at Abstract (The medium “variably transfers energy between the first and second members to vary stiffness of the prosthetic foot device.”). *Id.* at [0036] (“[E]nergy is transferred between the first and second member[s], and thus through the energy transfer medium, during use.”); [0052] (“The secondary member 22 applies a force to the energy transfer medium 14 . . . that may be a lesser force . . . . The energy transfer medium 14 compresses to a greater extent, dissipating some of the force, and transferring less force to the first member 18. Thus, the energy transfer medium 14 . . . allows the second

	member 22 or heel portion 38 to . . . move with respect to the first member 18, providing a soft, cushioned feel.”); [0054] (“The secondary member 22 applies a force to the energy transfer medium 14 . . . that may be a greater force . . . . The energy transfer medium 14 . . . dissipate[s] less or no force, and transfers more or all of the force to the first member 18.”); [0064] (“The energy transfer medium 414 can be disposed between the first and second members 418 and 422.”); [0065] (“[T]he second member 440 can pivot about the pivot pin 450 with respect to the first member 418. The energy transfer medium 414 can . . . adjust the feel or softness of the foot.”); *see also* EX1005 at ¶223.
[1.4] wherein the joint mechanism is constructed and arranged such that during walking said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions.	*Christensen* (EX1009) at [0066] (“[P]rosthetic foot devices are shown with an energy transfer mechanism . . . that variably resists flow of a fluid through a variable orifice.”). *Id.* at [0067] (“[T]he overall resistance response applied by the foot (and stiffness or feel of the foot) . . . varies based on the amount of energy or applied load transferred from the primary foot member to the secondary foot member by the energy transfer mechanism . . . . The energy transfer mechanism . . . is configured to transfer a greater amount of energy or load from the primary to the secondary foot member in response to a greater applied load, thus providing a stiffer feel and greater resistance response. Thus, the variable orifice can reduce in size to increase resistance to the flow of fluid. Conversely, the energy transfer mechanism . . . is configured to transfer a lesser amount or energy or load from the primary to the secondary foot member in response to a lesser applied load, thus providing a softer feel and a lesser resistance response.”); [0069] (“The means for variably transferring energy can increase resistance against the forces applied to the primary foot member 518 when the forces increase so that more load can be transferred . . . . The means for variably transferring

	energy can also decrease resistance against the forces applied to the primary foot member 518 when the forces decrease so that less load is transferred."); [0077] ("The variable orifice 652 can increase resistance to fluid flow between the first enclosure [532] and the second enclosure 642 with an increase in the applied force to transfer more load . . . . The variable orifice 652 can also decrease resistance to fluid flow during a decrease in the applied force to transfer less load."); [0078] ("The first and second enclosures [532] and 642 can each be formed by chambers [654] and pistons 656 as shown in FIG. 9a."); *see also* EX1005 at ¶134.

Dependent Claim 3	
[3.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	EX1009 at [0064] ("The first member 418 can be an upper attachment member with an attachment section 426 for coupling to a stump of an amputee.").
[3.2] wherein the joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and wherein the assembly is arranged such that the dorsi-flexion limit corresponds to a predetermined relative orientation of the shin component interface relative to the foot component.	EX1009 at [0078] ("[T]he first and second enclosures [532] and 642 can be compressible between a first position in response to a relatively larger load or force, and a second position in response to a relatively smaller load or force. The first and second enclosures [532] and 642 in the first position can have a larger dimension, such as height, in which a lesser amount of the fluid passes through the variable orifice 652. The first and second enclosures [532] and 642 in the second position can have a smaller dimension, such as height, in which a greater amount of fluid passes through the variable orifice 652."). *Id.* at Figs. 7 and 9a (below).

	 *See also* EX1005 at ¶143.

Dependent Claim 4	
[4.1] A prosthetic foot and ankle assembly according to claim 3, wherein the dorsi-flexion limit is defined by a mechanical end-stop operative by the abutment of one part of the assembly associated with the shin component interface against another part of the assembly associated with the foot component.	*See* § VII.1, *supra* (table) at Limitation [3.2].

Dependent Claim 5	
[5.1] A prosthetic foot and ankle assembly according to claim 4, wherein the joint mechanism comprises a hydraulic linear piston and cylinder assembly, wherein the piston has a distal connection and the cylinder has a proximal connection, and wherein the end stop is defined by the piston and an end wall of the cylinder.	*See* § VII.1, *supra* (table) at Limitation [3.2].

Dependent Claim 6	
[6.1] A prosthetic foot and ankle assembly according to claim 1, further comprising a shin connection interface,	*See* §VII.1, *supra* (table) at Limitation [3.1].
[6.2] wherein said joint mechanism includes a flexion limiter limiting dorsi-flexion of the joint mechanism to a dorsi-flexion limit, and	*See* §VII.1, *supra* (table) at Limitation [3.2].
[6.3] wherein the assembly is arranged such that the relative position of the foot component and the shin connection interface at the dorsi-flexion limit is defined independently of the orientation of the assembly in	*Christensen* teaches that when the ankle member 418 portion is pivoted or flexed to the limit in the toe portion direction, the position of the attachment section 426 on the ankle member 418 relative to the foot member 422 is independent of the orientation of the prosthetic device. EX1009 at Fig. 7;

space.	EX1005 at ¶149.

Dependent Claim 7	
[7.1] A prosthetic foot and ankle assembly according to claim 1, arranged such that the resistance to flexion of said joint mechanism in a direction of dorsi-flexion is adjustable.	EX1009 at [0067] ("[T]he overall resistance response applied by the foot (and stiffness or feel of the foot) is a combination of the primary and secondary foot members, and varies based on the amount of energy or applied load transferred from the primary foot member to the secondary foot member by the energy transfer mechanism."); *see also* EX1005 at ¶150.

Independent Claim 20	
[20.0] A prosthetic foot/ankle assembly comprising the combination of	*See* § VII.1, *supra* (table) at Limitation [1.0].
[20.1] (a) a prosthetic ankle joint comprising a mechanism providing resistance to ankle flexion,	*See* § VII.1, *supra* (table) at Limitations [1.2] and [1.3].
[20.2] wherein the mechanism is constructed and arranged such that said resistance is predominantly provided by hydraulic damping whenever the ankle joint is flexed in both dorsi- and plantar-flexion directions, and	*See* § VII.1, *supra* (table) at Limitation [1.4].
[20.3] (b) a prosthetic foot having an anterior portion, a posterior portion and an ankle-mounting portion,	EX1009 at [0064] ("The second member 422 can include a lower foot member with an attachment section 440 curving both 1) downwardly and forwardly to a toe section 444 at a toe location of toes of a natural foot, and 2) downwardly and rearwardly to a heel section 438 at a heel location of a natural heel.").
[20.4] wherein the assembly constitutes a Maxwell-model damper/spring combination	*See* § VII.1, *supra* (table) at Limitation [1.4]. EX1009 at [0011] (The "foot member defines an

comprising a damper element and a spring element, wherein the damper element is said ankle joint and the spring element is a spring component arranged in series with the ankle joint.	elongated spring capable of storing energy during deflection.”). *Id.* at [0066]-[0067] (“As an applied load is applied to the [] foot member . . . , the [] foot member defines a spring that deflects” and “[t]he energy transfer mechanism . . . variably transfers energy” to the ankle member 418.); EX1005 at ¶139.

Dependent Claim 21	
[21.1] An assembly according to claim 20, wherein the spring component is located distally of said ankle joint.	EX1009 at [0011] (The “foot member defines an elongated spring capable of storing energy during deflection.”); [0053] (“[A]s the user continues to step, or walk, on the foot device 10, the toe portion 44 of the second member 22 deflects.”).

Dependent Claim 22	
[22.1] An assembly according to claim 20, wherein the spring component is a leaf spring supporting the anterior portion of the foot on the ankle-mounting portion thereof.	EX1009 at [0040] (“The first and second members 18 and 22 can be resilient and energy storing foot members that deflect or flex, storing energy, much like a leaf spring.”).

7. Ground 7: Claims 2, 8, and 16-19 Are Rendered Obvious under 35 U.S.C. § 103(a) by *Christensen* in View of *Hellberg*

To the extent *Christensen* does not explicitly disclose certain features recited in claims 2, 8, and 16-19, *Hellberg* supplies these teachings. Hence, the teachings of *Christensen*, as discussed above in §§ VII.4. and VII.6, in view of *Hellberg* would have rendered claims 2, 8, and 16-19 obvious under § 103(a).

Hellberg teaches a lower leg prosthesis 60 having an axis and a pyramid adapter 20 for angular adjustment of the lower leg prosthesis 60 relative to a foot component 10 at several tilt angles, including the tilt angle of claim 2. *See*

Section VII.3, *supra*. For at least the reasons discussed in Section VII.3, a POSA would have been motivated, with a reasonable expectation of success, to incorporate *Hellberg*'s teachings into *Christensen*'s prosthetic device such that *Christensen*'s attachment section 426 includes a pyramid adapter to attach to a lower leg prosthesis 60 having an axis and adjust the angular orientation of the lower leg prosthesis relative to the heel or toe portion 438, 444 of the foot member 422, including at an angle of least 3° relative to the vertical towards the toe portion 444, for proper positioning of the lower leg prosthesis. EX1014 at 1:19-22; *see also* EX1005 at ¶166. Accordingly, claims 2, 8, and 16-18 should be cancelled as unpatentable under § 103(a).

8. Ground 8: Claims 9-15 Are Rendered Obvious under 35 U.S.C. § 103(a) by *Christensen* in view of *Mortensen*.

To the extent *Christensen* does not explicitly disclose certain features recited in claims 9-15, *Mortensen* supplies these teachings. Hence, the teachings of *Christensen*, as discussed above in Sections VII.4. and VII.6, *supra*, in view of *Mortensen* would have rendered obvious claims 9-15 under § 103(a).

a. Claims 9-14

As explained above, *Mortensen* teaches a bolt 14 acting as a pivot for two components of the prosthesis, the bolt 14 positioned in front of the hydraulic cylinder 16 and piston 41 relative to the user. *See* EX1012 at Fig. 1; *id.* at 4:30-39.

Christensen also discloses a hydraulic chamber 654 and piston 656 positioned at the heel portion 438 and behind the ankle pivot pin 450 relative to the user. *See* EX1009 at Fig. 7; *id.* at [0076] ("a second enclosure 642 disposed between the primary heel member 626 and the secondary heel member 632"). The combined teachings of *Christensen* and *Mortensen* teach an ankle flexion axis positioned to the anterior of the central axis of the hydraulic cylinder and piston assembly. EX1005 at ¶224.

Mortensen further teaches a single, linear hydraulic cylinder 16 and piston 41 for controlling flexion and extension between two components of a prosthesis, including two hydraulic passageways and an adjustable valve system for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder 16. *See* § VII.5, *supra*. Although not relied upon for Ground 8, *Koniuk*, as evidence of what a POSA would have known, teaches that "[t]he damping means may be provided . . . with a plurality of hydraulic cylinders having fluidic couplings" but recognizes that "[a]lternately, a single hydraulic cylinder may be employed . . . having a plurality of internal pressure chambers . . . [and] fluidic couplings, through which the flow rate of fluid can be set to at least two levels." EX1012 at 9:23-28.

Like *Mortensen* and *Koniuk*, *Christensen* discloses a two-chamber hydraulic mechanism 654 and a piston 656 that provides hydraulic damping resistance to the ankle member 418 pivoting or flexing relative to the heel or toe portion 438, 444 of the foot member 422 and a valve mechanism 452 to vary the resistance, where the hydraulic mechanism alternatively could have employed a single hydraulic cylinder, piston, and a valve assembly as *Mortensen* discloses. *See* § VII.6, *supra*; EX1005 at ¶222. Both *Christensen* and *Mortensen* teach a hydraulic damping assembly for providing resistance to relative movement between two components of a prosthesis, *see* §§ VII.5 and VII.6, *supra*. It would have been routine for a POSA to substitute, with a reasonable expectation of success, *Christensen*'s energy transfer mechanism with a single, linear hydraulic cylinder and piston assembly, as taught by *Mortensen*, because the prior art expressly suggests such an arrangement. EX1012 at 9:23-28; EX1005 at ¶226.

For at least the reasons discussed in Section VII.6, *supra*, a POSA would have been motivated to modify *Christensen*'s valve mechanism 452 and fluid path 646 to include an adjustable valve system with two hydraulic passageways for controlling the flow of hydraulic fluid between opposite regions in the hydraulic cylinder, as taught by *Mortensen*, for adjusting the *Christensen* prosthesis for a variety of users and applications. *See* EX1009 at [0003] ("[U]sers may have different weights. Thus, prosthetic feet may require a high degree of custom design, or be particularly tailored to the individual user. However, it is desirable from a cost and manufacturing standpoint to create a foot that is usable by many sizes of individuals."); [0008] ("The stiffness of prosthetic feet typically varies according to the intended use."); EX1005 at ¶¶226-228. There would have been nothing unpredictable or unexpected for a POSA to incorporate the adjustable valve system with two hydraulic passageways to *Christensen* prosthesis because both *Christensen* and *Mortensen* teach valve mechanisms for varying hydraulic resistance. *See* §§ VII.5 and VII.6, *supra*; EX1005 at ¶226-228.

The combination of *Christensen* and *Mortensen* teaches the elements of claims 9-14, thereby rendering these claims unpatentable under § 103(a).

b. ***Claim 15***

As explained above, *Mortensen* teaches a resilient O-ring 120 to resiliently absorb the force applied by the piston 41 as it contacts an end portion of the hydraulic cylinder 16, increasing resistance to the piston's 41 movement towards the end portion. *See supra* § VII.5. For the same reasons discussed in § VII.5, a POSA would have been motivated, with a reasonable expectation of success, to incorporate the resilient O-ring 120 taught in *Mortensen* to the top ends of *Christensen*'s pistons 656 to resiliently absorb contact between the pistons 656 and the top end walls of the hydraulic chambers 654, preventing wear to the prosthesis components and trauma to the device and user. *See* EX1012 at 4:13-15; EX1005 at ¶229-230. Thus, Claim 15 is unpatentable as obvious over *Christensen* in view of *Mortensen*.

VIII. CONCLUSION

Freedom respectfully requests *inter partes* review of claims 1-22 of U.S. Patent No. 8,574,312.

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CERTIFICATE OF SERVICE

I certify that on Monday, February 02, 2015, this Petition for *Inter Partes* Review of U.S. Patent No. 8,574,312 and Exhibits 1001-1030 were served via EXPRESS MAIL® on the following counsel of record for patent owner.

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