Docket No.: Unassigned
Filed on behalf of ThermiGen, LLC and ThermiAesthetics
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

THERMIGEN, LLC AND THERMIAESTHETICS, LLC

Petitioners,

v.

Viveve, Inc.,
Patent Owner.

Case No. Unassigned

PETITION FOR *INTER PARTES* REVIEW OF U.S. PATENT NO. 8,961,511 UNDER 35 U.S.C. §§ 311-319 AND 37 C.F.R. § 42

Claims 43-58

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I. INTRODUCTION

Pursuant to 35 U.S.C. §§ 311-319 and 37 C.F.R. § 42, Petitioner ThermiGen, LLC and ThermiAesthetics, LLC, (collectively "Petitioner") requests *inter partes* review of claims 43-58 ("Challenged Claims") of U.S. Patent No. 8,961,511 (the "'511 patent"), and cancellation of those claims as unpatentable. The '511 patent is attached to this petition as Exhibit 1001.

The '511 patent is titled "Vaginal Remodeling Device and Methods." The Challenged Claims of the '511 patent generally recite a method for remodeling female genital tissue by applying heat. The Challenged Claims are unpatentable as obvious over the prior art (under the pre-AIA) 35 U.S.C. §103, including prior art that was not before the examiner during prosecution.

There is a reasonable likelihood that Thermi will prevail since the prior art teaches the use of heat through the application of radiant energy to remodel collagen containing tissue, including the use of RF energy to heat and remodel vaginal tissue. It would have been obvious to a person of ordinary skill ("POSITA") in the art that any human tissue containing collagen could be remodeled by the application of heat as taught in the prior art. The limitations in the '511 patent claims recite standard parameters disclosed in the prior art.

II. MANDATORY NOTICES

A. REAL PARTY-IN-INTEREST

The real parties-in-interest are ThermiGen, LLC, ThermiAesthetics, LLC, and Almirall, S.A. ThermiGen is a limited liability company organized under the laws of the State of Texas with its principal place of business at 3131 West Royal Lane, Suite 100, Irving, Texas 75063. ThermiAesthetics is a limited liability company organized under the laws of the State of Texas with its principal place of business at 3131 West Royal Lane, Suite 100, Irving, Texas 75063. Almirall, S.A., a pharmaceutical company headquartered in Barcelona, Spain, acquired ThermiGen, LLC and Thermi Aesthetics, LLC in 2016.

B. RELATED MATTERS

Patent Owner filed a patent infringement action against ThermiGen, LLC, ThermiAesthetics, LLC, and an associated physician and consultant to Thermi, Red Alinsod, M.D., asserting infringement of U.S. Patent Nos. 8,961,511 (the "'511 patent") on October 21, 2016 in the Eastern District of Texas, entitled *Viveve Inc. v. ThermiGen, LLC, ThermiAesthetics, LLC, and Red Alinsod, M.D.*, Case No. 16-cv-1189-JRG. Petitioner has filed, or will file, concurrently with the present Petition, a second petition for *inter partes* review of claims 43-58 of the '511 patent.

C. NOTICE OF COUNSEL AND SERVICE INFORMATION

Petitioners' counsel is:

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A Power of Attorney is filed herewith under 37 C.F.R. § 42.10(b). Petitioner consents to electronic service. Pursuant to 37 C.F.R. § 42.8(b)(4), all services and communications can be sent to jtrainor@whitecase.com and ddrivas@whitecase.com.

III. FEES

Petitioners authorize the United States Patent and Trademark Office to charge the fees enumerated in 37 C.F.R. § 42.15(a) regarding this Petition and any additional fees that may be due in connection with this Petition from Deposit Account No. 503672.

IV. CERTIFICATION OF GROUNDS FOR STANDING

Petitioners certify pursuant to Rule 42.104(a) that the patent for which review is sought is available for *inter partes* review and that Petitioners are not barred or estopped from requesting an *inter partes* review on the grounds identified in this Petition.

V. OVERVIEW OF CHALLENGE AND RELIEF REQUESTED

Pursuant to Rules 42.22(a)(1) and 42.104(b)(1)-(2), Petitioners challenge claims 43-58 of the ’511 patent.

A. THE ’511 PATENT DESCRIBES A METHOD FOR REMODELING FEMALE GENITAL TISSUE

Application No. 11/704,067 was filed on February 7, 2007 and issued as the ’511 patent on February 24, 2015. The ’511 patent claims priority to Provisional Application No. 60/743,247, filed on February 7, 2006. The sole named inventor is Jonathan B. Parmer. However, at least certain claims of the ’511 patent are not supported by the Provisional Application and are thus not entitled to this earlier date. *Dynamic Drinkware, LLC v. National Graphics, Inc.*, 800 F. 3d 1375 (Fed. Cir. 2015).

For example, the limitations recited in the “wherein” clause in claims 43 and 51 requiring “heating a portion radiating outward from the introitus to Hart’s line” and “heating a mucosal surface of the labia minora” are absent from the Provisional Application. As such, support for these independent claims and the claims depending therefrom, is not present in the disclosure of the Provisional Application as required by 35 U.S.C. § 112. In addition the specific limitations recited in claim 56 are not supported by the Provisional Application in accordance with § 112. Thus the effective filing date for independent claims 43 and 51, as well as their respective dependent claims, is February 7, 2007.

The ’511 patent is directed to the “approaches to treating a loose vagina and introitus with a non-invasive procedure.” (EX. 1001, 2:17-21.) The ’511 patent discloses remodeling target tissues by applying heat to surface tissue to denature collagen and deposit new collagen in the tissue underlying the mucosal epithelium of a female genital tissue. (EX. 1001, 2:25-28.)

The remodeling of the target tissues is achieved by “passing energy through the mucosal surface and into the underlying tissue” creating heat in the target tissue and this heat has the effect of denaturing or partially-denaturing collagen in the tissue. (EX. 1001, 8:39-42.) “The application of heat to the connective tissue during a treatment procedure is understood to result in a subsequent depositing of new or nascent collagen by cells of the connective tissue, as part of a biological process that may take place over the course of weeks or months following the procedure.” (EX. 1001, 12:44-49.) The applied heat, “[w]hether by denaturation of existing collagen, or by later deposition of new collagen” causes remodeling of the target tissue, generally in the form of “tissue contraction or tightening.” (EX. 1001, 5:2-5.)

The ’511 patent describes that “[t]he method includes contacting the mucosal epithelium with a treatment tip that has an energy delivering element and a cooling mechanism. By delivering energy to the tissue while cooling the epithelial surface, a reverse thermal gradient is created. The RF energy penetrates through the cooled epithelium and into the underlying target tissue,

and heats the tissue." (EX. 1001, 4:7-13.) This heating causes a zone of tissue called the "therapeutic zone" to heat to a "therapeutic temperature that causes remodeling." (EX. 1001, 4:14-16.) Meanwhile, the cooling of the epithelial surface "protects it from potentially damaging effects of excess heat that would accumulate in the absence of cooling." (EX. 1001, 13:16-19.)

In sum, the '511 patent describes a method which at its core entails a single step: heat is passed through the epithelial surface of a female genital tissue to underlying collagen-containing target tissues and, as a result of the application of heat, the natural process of remodeling collagen occurs, which tightens the female genital tissue, *e.g.*, the vagina. (EX. 1001, 5:2-6.)

B. THE CHALLENGED CLAIMS RECITE KNOWN TECHNIQUES AND CONVENTIONAL PROCESSES

That heat could be used to denature collagen and remodel tissue was well- known before the filing of the application leading to the '511 patent. (EX. 1003, ¶¶ 30-35; EX. 1004, ¶¶10, 38-41.)

The '511 patent itself incorporates by reference several prior art patents and published patent applications that it characterizes as "relevant to" aspects of "collagen denaturation and the exploitation of this for medical or cosmetic purposes." (EX. 1001, 1:35-61.) The '511 patent acknowledges that it "build[s] on those of prior art such as those described by Knowlton, including U.S. 2004/0000316 ("Knowlton '316"), and others cited in the background, all incorporated by this reference." (EX. 1001, 5:65-6:2.) The Knowlton prior art

references, and specifically ("Knowlton '316"), disclose methods for remodeling tissue through the delivery of energy and creation of a reverse thermal gradient. (*See e.g.*, EX. 1005, [0003], [0021]; EX. 1006, 3:37-42, 3:65-4:2.) The '511 patent also incorporates by reference U.S. Patent No. 6,350,276 ("Knowlton '276"). (EX. 1001, 1:47-49.)

Knowlton '276 was issued on February 26, 2002, nearly four years before the Provisional Application date. Knowlton '276 discloses the delivery of electromagnetic energy and mechanical energy to "selected body structures" to achieve "both molecular and cellular remodeling of collagen containing tissues." (EX. 1007, 11:40-64.) Knowlton '276 discloses an embodiment where the treated "tissue structure 9 includes any collagen containing tissue structure." (EX. 1007, 6:56-57.) Knowlton '276 specifically describes the treatment of pre-term cervical dilation by applying an energy delivery device to the cervix leading to the tightening of the dilated cervix. (EX. 1007, 13:35-47; *see also* EX. 1003, ¶¶ 66-69, EX. 1004, ¶¶20-21.))

During prosecution of the '511 patent, the Examiner repeatedly rejected the proposed claims of the '511 patent as anticipated and/or obvious in light of Knowlton '276. (EX. 1002, Thermi033903-3910; Thermi033958-3969; Thermi034149-4160; Thermi034149-4160.) The applicant attempted to overcome the Examiner's rejection by arguing that Knowlton '276 fails to disclose the treatment of "tissue underlying a mucosal epithelium of female

genital tissue." (EX. 1002, Thermi033946-3947.) In response, the Examiner issued a final rejection noting that 1) the cervix is "female genital tissue", and 2) Knowlton '276 discloses the treatment of the cervix and the underlying tissues. (EX. 1002, Thermi033969-3970.)

The applicant filed a request for continued examination and amended the independent claims to include an additional limitation of "remodeling a therapeutic zone including at least one of vulva, introitus or vagina" and arguing that Knowlton '276 does not disclose treating these tissues. (EX. 1002, Thermi033994-3995.) The Examiner once again rejected applicant's arguments, explaining that even as amended claim 1 fails to "positively require that any of the tissue of the vulva, the introitus or the vagina is actually required to be heated and/or remodeled." (EX. 1002, Thermi034161.)

Ultimately the Examiner allowed further-revised claims including claims requireing that "the heating includes heating a portion of the vagina extending from the introitus inwardly to a location from 1 cm to 3.5 cm in from the introitus," an area that typically excludes the cervix. (EX. 1002, Thermi034149-4160.) As explained by the Examiner in the Notice of Allowance:

> As set forth in the February 13th, 2014 Non-Final Office Action, Knowlton fails to contemplate the specific areas of treatment set forth in independent claims 2 and 27-29. No other reference has been found which discloses, fairly suggests or makes obvious this area of treatment whether taken alone or in combination with the Knowlton reference.

(EX. 1002, Thermi034562.)

While the Examiner determined that Knowlton ’276 did not expressly disclose the specific areas of treatment of the above-referenced limitation, there is no doubt Knowlton ’276 discloses the treatment of female genital tissue (the cervix) by way of an energy delivery device inserted into the vagina causing the remodeling of collagen containing tissues adjacent to or underlying the vagina. Issued independent claim 35, moreover, is not limited to treatment of any particular depth of the vagina. Thus, the core of the Challenged Claims was already known as of June 30, 1999 when the application which issued as Knowlton ’276 was filed, and was certainly in the prior art and well-known no later than February 26, 2002 when the Knowlton ’276 patent issued. (EX. 1003, ¶¶ 66-69, EX. 1004, ¶¶20-21.)

C. OVERVIEW OF EXPERT DECLARATIONS

Roger Dmochowski, M.D., is a board-certified urologist and urogynecologist with almost thirty years of experience treating patients, including using RF and other forms of radiant energy. Since 2002, Dr. Dmochowski has been a Professor of Urology and of Obstetrics and Gynecology at Vanderbilt University, where he is currently the Director of the Section of Female Pelvic Medicine, and program director of the Fellowship in Pelvic Medicine. Dr. Dmochowski has written and presented on the fields of urology and urogynecology and, more specifically, has authored a number of

publications concerning the use of RF technology in the treatment of urogynecological conditions. Dr. Dmochowski has also consulted with companies in the development of treatments for incontinence and other urogynecological conditions, serving, for example, as the lead investigator for SURx in clinical trials for an RF delivery device designed to treat genuine stress incontinence. Dr. Dmochowski will provide background on the state of the art as of February 2006 for RF and radiant energy devices designed to treat female genital tissue and provide his expert opinion as to why, by then, the treatment method to remodel female genital tissue claimed in the '511 patent would have been obvious to a person of ordinary skill. (EX. 1003, ¶¶1-8, 10.)

Robert D. Tucker, Ph.D., M.D., is a pathologist with a doctorate in biophysics and a professor of Pathology and Biomedical Engineering at the University of Iowa. Dr. Tucker has worked on the development of RF devices for treating various conditions since medical school in 1979, and has served as a principal investigator in pursuit of clinical approval for different RF and thermal devices, including for electrosurgery and the treatment of soft tissue. Dr. Tucker has published extensively on the use of RF energy to treat tissue and is intimately familiar with the technology and its application to epidermal and other dermal tissue. Dr. Tucker, as a physician and researcher using RF prior art up to February 2006, will provide insight as to what was known about RF technology and its effect on tissue at that time, what temperature was known to

be effective in inducing remodeling and how the technology safeguarded against undesired effects resulting from the application of RF energy. Dr. Tucker further details the secondary effects on tissue where RF energy was used to ablate and will offer his expert opinion as to why it would have been obvious to a POSITA as of February 2006 to treat female genital tissue with RF energy with the expectation that remodeling would occur. (EX. 1004, ¶¶1-8, 10.)

D. PRIOR ART AND PRINTED PUBLICATIONS

The following references are pertinent to the grounds of unpatentability explained below (references identified with a × were not before the examiner and references with a ᵞ are cited on the face of the patent, but were not cite by the examiner):

1. U.S. Patent No. 6,463,331 to Stuart D. Edwards× (EX. 1008, "Edwards"), filed March 30, 2000, and issued October 8, 2002, is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. §§ 102(b) and 102(e).

2. U.S. Published Application 2004/0193238 to Mosher et al. (EX. 1009, "Mosher"), filed January 15, 2004, published on September 30, 2004, and ultimately issued on January 1, 2008. The published application is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. § 102(b) and the issued patent is prior art under 102(e).

3. U.S. Patent No. 6,216,704 to Ingle et al.[v] (EX. 1010, "Ingle '704"), filed August 12, 1998, and issued April 17, 2001, is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. §§ 102(b) and 102(e).

4. An article from Salon entitled "Designer vaginas"[×] (EX. 1011, "Ollivier" authored by Debra Ollivier and published on November 14, 2000, available at http://www.salon.com/2000/11/14/vagina_3/ (last visited March 9, 2017), is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. § 102(b).

5. Alexander Kreuter et al.[×] (EX. 1012, "Kreuter") "Low-dose ultraviolet A1 phototherapy for extragenital lichen sclerosus: Results of a preliminary study, 46 J. Am. Acad. Dermatol. 251 (2002), is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. § 102(b).

6. P.E. Beattie et al. [v] (EX. 1013, "Beattie") "UVA1 phototherapy for genital lichen sclerosus" authored by P.E. Beattie, Clin Exp Dermatol. 2006 May; 31(2):343-7, is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. § 102(b).

7. Yolanda R. Smith and Hope K. Haefner[v] (EX. 1014, "Smith") "Vulvar Lichen Sclerosus" American Journal of Clinical Dermatology 2004, is prior art to the Challenged Claims of the '511 patent under 35 U.S.C. § 102(b).

8. Screen captures from various dates prior to February 2006 of the website of Dr. Matlock and the Laser Vaginal Rejuvenation Institute of Los Angeles[v] (EX. 1015, "Matlock") as retrieved from https://web.archive.org/web.

E. GROUNDS FOR CHALLENGE

There is a reasonable likelihood that Petitioners will prevail with respect to at least one of the Challenged Claims and that each of the Challenged Claims is not patentable. *See* 35 U.S.C. § 314(a). Petitioners request cancellation of claims 43-58 of the '511 patent under the following statutory grounds:

1. Ground 1: Claims 43-58 are obvious in light of the combination of Edwards, Ingle, Mosher, and the knowledge of a POSITA under 35 U.S.C. § 103(a).

2. Ground 2: Claims 43-58 are obvious in light of Edwards in combination with Kreuter, Beattie, Smith, and the knowledge of a POSITA under 35 U.S.C. § 103(a).

VI. OVERVIEW OF THE PRIMARY PRIOR ART REFERENCES

A. OVERVIEW OF EDWARDS

Edwards discloses a method and system for applying energy to targeted tissues to selectively ablate, tighten, shrink or reshape the tissue and thereby correct an unwanted condition. (EX. 1008, 2:32-39.) Edwards discloses several different embodiments, including an embodiment directed to vaginal remodeling. (EX. 1008, 3:5-13; 7:14-8:5; 13:12-14:4; Figs. 4 and 9.)

Edwards describes that "the RF energy is delivered to the anterior and posterior regions of the vaginal wall. This has the effect of tightening of vaginal walls so as to increase support of the bladder outlet, proximal and mid-urethra. Moreover, circumferential tightening of the vaginal wall may provide physical and psychological improvement in the area of sexual function." (EX. 1008, 3:5-13.) The anterior region of the vagina encompasses the area which is 1-cm to 3.5-cm in from the introitus. (EX. 1004, ¶71; EX. 1003, ¶¶88.) Edwards describes the vaginal remodeling embodiment in more detail later in the specification disclosing:

> A method 900 is performed to create a series of lesions in either the anterior vaginal wall, the posterior vaginal wall or both. Remodeling of the anterior wall treats incontinence based on bladder outlet hypermobility by increasing support for the bladder outlet, as well as the proximal and mid-urethra. Remodeling both the anterior wall and posterior wall provide circumferential vaginal wall tightening, resulting physical and psychological improvement in the area of sexual function.

(EX. 1008, 13:12-23.)

The text above refers to Figure 9 (below), a process flow diagram showing a method for using a fourth embodiment for vaginal remodeling. (EX. 1008, Fig. 9.)

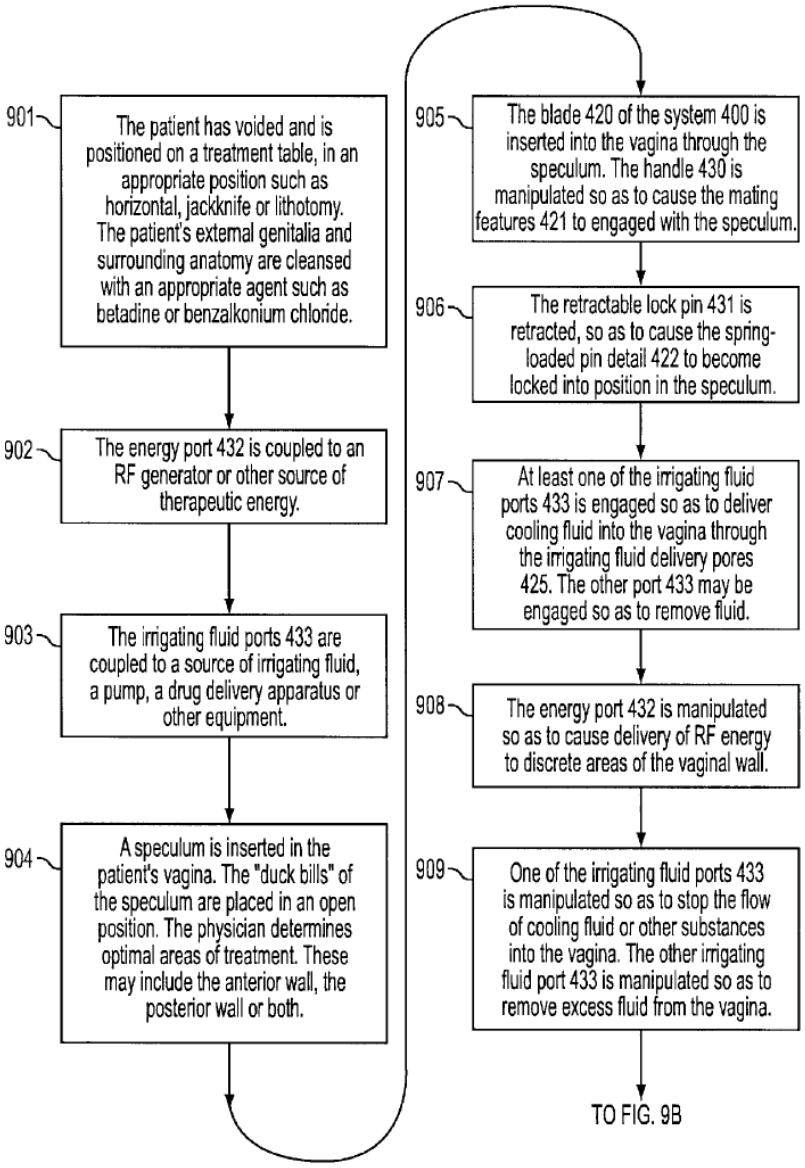

FIG. 9A

As described in Figure 9A, Edwards discloses the use of cooling fluid before, during, and after the heating process as the cooling is started before the application of energy (block 907), and is not stopped until after the RF energy has been delivered to the vaginal wall (block 909). (EX. 1008, Fig. 9.) Edwards also explains that the cooling fluid, "serves to minimize thermal

damage to tissues when the electrodes **225** are deployed." (EX. 1008, 4:59-61; *see generally,* EX. 1003, ¶¶77-86; EX. 1004, ¶¶17-19, 53.)

B. OVERVIEW OF MOSHER

Mosher is entitled "Non-surgical incontinence treatment system and method" and describes its invention as providing:

> [M]ethods, devices, and systems which enhance the structural support provided by a body's tissues, particularly for treatment of incontinence. The techniques of the invention generally involve directing energy from a probe into collagenous tissues of the pelvic support system. The energy will often cause contraction of the collagenous tissue.

(EX. 1009, ¶0045.)

Mosher describes that, in its non-invasive embodiment, "RF current is transmitted between the electrodes of the probe body to heat the endopelvic fascia." (EX. 1009, ¶0058.) Mosher notes that "the techniques of the present invention will be effective for controllably and repeatably enhancing the structural support of a wide variety of fascia and other collagenous tissues throughout the body, they will find applications in a wide variety of therapies." (EX. 1009, ¶0046.) Mosher describes the broad range of tissues that can be treated by its method of "directing energy from a probe into collagenous tissues" including the lamina propria, explaining that:

> [T]he treatment of the present invention may be directed at a variety of tissue structures defining the pelvic floor and/or diaphragm (including: …); structures of the bladder and urethra (including …); structures of the vagina (including: vagino-uterine fascia, lamina propria—the dense connective tissue layer just under

> the epithelium; pubo-urethral or puboprostatic ligaments; pubo-vesicle ligament and posterior pubo-urethral or puboprostatic ligament; pubovesicle muscle, a smooth muscle that is integrated with the pubovesicle ligament; and pubocervical fascia which attaches to the ATFP); structures of the uterus (including…); and structures of the bowel (including: …).

(EX. 1009, ¶0048.)

Figures 6 and 6a of Mosher "illustrate non-invasive vaginal probes and a method for non-invasively treating endopelvic fascia using cooled electrodes." (EX. 1009, ¶0027.) Figures 10A-C and 11 show temperature studies, including studies where the feedback temperature was increased to 85° C, done using the non-invasive treatment probe described in Figures 6 and 6a. (EX. 1009, ¶¶0031-0032; ¶0073.) Mosher also describes that a "non-invasive cooled electrode probe similar to that shown in Figures 6 and 6A heats tissue until the temperature sensing needle at 4.5-mm depth reaches a set point of 75° C. at 185 seconds." (EX. 1009, ¶0085; *see generally,* EX. 1003, ¶¶56-64; EX. 1004, ¶¶31-32, 49-51, 60.)

C. OVERVIEW OF INGLE '704

Ingle '704 is entitled "Noninvasive devices, methods, and systems for shrinking of tissues" and it discloses the use of directed heating to cause the shrinking of collagenous tissues. (EX. 1010, 2:59-67.) Ingle '704 states:

> This energy heats fascia and other collagenated support tissues, causing them to contract without substantial necrosis of adjacent tissues. The energy will preferably be applied through a large, cooled electrode having a substantially flat electrode surface. Such a cooled plate electrode is capable of directing electrical energy

> through an intermediate tissue and into fascia, while the cooled electrode surface prevents injury to the intermediate tissue.

(EX. 1010, 2:59-67.)

Ingle '704 discloses that "the tissue contraction energy of the present invention can be applied as intermittent pulses of radiofrequency (RF) electrical current transmitted between cooled electrodes." (EX. 1010, 7:1-4) Ingle '704 specifically provides an exemplary embodiment of a vaginal probe that applies energy to the target tissue through the vaginal wall:

> In another aspect, the present invention provides a probe for applying energy to fascia from within the vagina of a patient body. The fascia is separated from the vagina by a vaginal wall. The probe comprises a probe body having a proximal end and a distal end, the probe having a length and a cross-section selected to permit introduction into the vagina. An energy transmitting element is mounted to the probe body. The transmitting element is capable of transmitting sufficient heating energy through the vaginal wall to heat and contract the fascia. A cooling system is disposed adjacent to the transmitting element. The cooling system is capable of maintaining the vaginal wall adjacent the probe below a maximum safe temperature when the fascia is heated by the transmitting element.

(EX. 1010, 3:36-50.)

Ingle '704 describes the breadth of possible applications noting that it can be used to treat "a wide variety of alternative conditions … and may even be used in cosmetic procedures such as abdominoplasty (through selectively shrinking of the abdominal wall), to remove wrinkles by shrinking the collagenated skin tissues, or to lift sagging breasts by shrinking their support

ligaments." (EX. 1010, 17:66-18:7; *see generally* EX. 1003, ¶¶43-55; EX. 1004, ¶¶28-30.)

Ingle '704 includes Figure 12L which shows a cross-sectional view of the treatment head with electrodes (86D), cooling system (89), temperature sensor (95), endopelvic fascia (EF), and vaginal wall (VW). (EX. 1010, 23:40-65.)

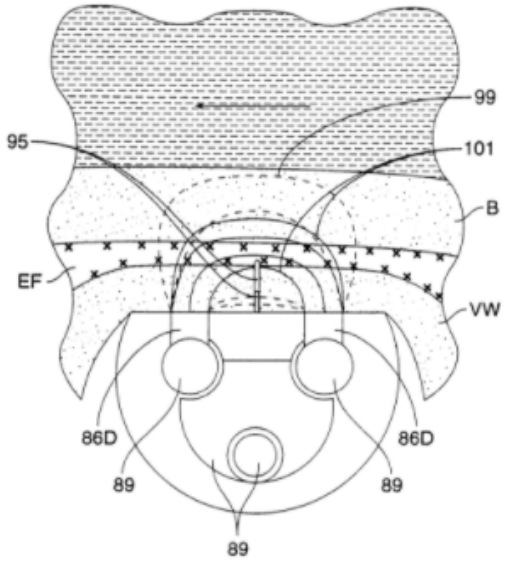

FIG. 12L

Ingle '704 also discloses the use of an ultrasonic heating probe as shown in Figure 13. (EX. 1010, 24:41-58; Fig. 13.)

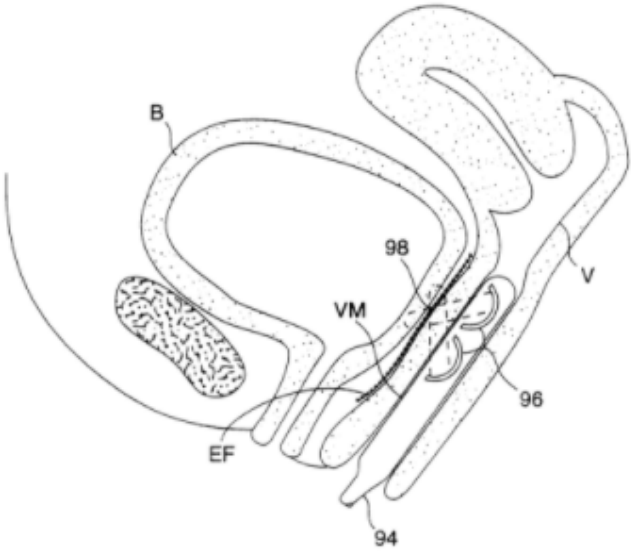

FIG. 13

D. OVERVIEW OF OLLIVIER ARTICLE/MATLOCK WEBSITE

Ollivier is an article entitled "Designer vaginas" authored by Debra Ollivier and published on November 14, 2000 by Salon.com. The article describes the practice of Dr. David Matlock and his Vaginal Rejuvenation clinic in Los Angeles. It discusses Laser Vaginal Rejuvenation ("LVR") used to tighten a patient's vagina and "enhance sexual gratification" and Designer Laser Vaginoplasty ("DLV") used to "aesthetically modify" a patient's labia. (EX. 1011, p. 1; *see also* EX. 1003, ¶¶93-99; EX. 1004, ¶¶33-35.) The Ollivier article described LVR as:

> [A] modification of a traditional gynecological vaginal surgery for stress urinary incontinence. The procedure, which has been a standard gynecological surgery for decades, involves the tightening of the vaginal muscles and support tissues, as well as the reduction of redundant vaginal mucosa (relaxed vaginal lining). By reconstructing the 'optimum structural architecture' of the vagina -- namely, by reconstructing the outer third of the vagina: the

> orgasmic platform, internal and external vaginal diameter (introitus) and the perineal body -- Matlock claims that women not only are relieved of incontinence, but they also enjoy increased levels of sexual gratification.

(EX. 1011, p. 2.)

The Ollivier article described LVR as providing "a tighter vagina not just to end incontinence, but for better sex" and noted that some patients also requested "Matlock do a little cosmetic surgery as well -- a plumping up of a flaccid vulva here, a trimming back of a labium there." (EX. 1011, p. 2.) The Ollivier article states that "there is nothing new about LVR and DLV. Vaginal tightening has been done for decades …. 'Labial surgery?' says ob/gyn Dr. Cornelia Daly. 'There's nothing to it. It's been around for 30 years. Lasers have even fallen out of favor. We have more sophisticated tools that do the same thing these days.' According to the ob/gyn community, Matlock has simply put a new spin (sex sells) on an old procedure." (EX. 1011, pp. 6-7.)

Dr. Matlock's webpage also described DLV as being directed to "Laser Reduction Labioplasty of the labia minora, Aesthetic Reconstruction and Enhancement of the Vulvar structures damaged by childbirth, trauma, aging, and certain deformities, and Laser Perineoplasty for the aesthetic rejuvenation of the aging (sagging) vulvar structures and introitus. (EX. 1015, 9 (Services).) Dr. Matlock's webpage also describes that LVR can be performed in combination with any of the DLV procedures and that multiple procedures in the DLV category can be combined. (EX. 1015, 9 (Services).)

With respect to DLV, Dr. Matlock's website stated that DLV "is the aesthetic surgical enhancement of the vulvar structures, labia minora, labia majora, mons pubis, perineum, introitus, hymen, (*see* figure)." (EX. 1015, 19 (Designer Laser Vaginoplasty).) The website described the most common DLV procedures including "Laser Reduction Labioplasty" which the website described "can sculpture the elongated or unequal labial minora (small inner lips) according to ones specification." (EX. 1015, 19 (Designer Laser Vaginoplasty).)

E. OVERVIEW OF KREUTER

Kreuter is a paper published by Alexander Kreuter et al. entitled "Low-dose ultraviolet A1 phototherapy for extragenital lichen sclerosus: Results of a preliminary study, 46 J. Am. Acad. Dermatol. 251 (2002) ("Kreuter").

Kreuter describes the use of radiant energy, specifically UVA1 phototherapy, to treat lichen sclerosus, a chronic inflammatory skin disease that can result in genital and extra-genital skin lesions. EX. 1012, 251. Lichen sclerosus is characterized by epidermal atrophy and homogenization and hyalinization of collagen in the upper dermis. UVA1 is a high intensity, long-wavelength, ultraviolet light used in phototherapy. Kreuter described the localized irradiation of the affected extra-genital skin, in order to soften and repigment the formerly affected skin. EX. 1012, 252. Kreuter describes the treatment of patients with LS with low dose UVA1 phototherapy 4 times

weekly with single UVA1 doses of 20 J/cm². EX. 1012, 251. These 20 J/cm² doses would penetrate the surface layer and heat underlying tissue. (EX. 1003, ¶¶106-108; EX. 1004, ¶¶77, 81.)

The post UVA1 treatment image of Figure 1 shows normalization of dermal architecture, regularly sized collagen bundles and reduction of inflammatory infiltration. EX. 1012, 253, Fig. 1. Figure 1 also shows fibroblasts synthesizing new collagen represented by the pink coloration in the dermal in the bottom half of Figure B, which was not occurring to the necessary degree prior to UVA1 phototherapy. EX. 1012, 253, Fig. 1; (EX. 1004, ¶59.). The synthesis of new collagen by the fibroblasts contributes to the normalization of the dermal architecture and leads to the return to normal size of the collagen bundles. (*See* EX. 1012, at 253, Fig. 1; *see also* EX. 1003, ¶¶105-109; EX. 1004, ¶¶36-37, 77-81.)

F. OVERVIEW OF BEATTIE

Beattie is a publication entitled "UVA1 phototherapy for genital lichen sclerosus" authored by P.E. Beattie, R.S. Dawe, J. Ferguson, and S.H. Ibbotson. The treatments described in Beattie were designed to follow-up on the earlier works such as Kreuter which showed that UVA1 phototherapy was effective in treating extragenital LS. (Ex. 1013, Beattie 343, Background, Aim.) Beattie notes that as disclosed in Kreuter (discussed above), in a study of 10 patients, given 40 exposures of 20 J/cm2 UVA1, softening and repigmentation were

obvious after 10 and 20 exposures, respectively, and most lesions had cleared after 40 exposures. This was associated with reduced thickness and increased density of the dermis, assessed by ultrasound and histologically. Eight of the 10 were still in remission a year after treatment. (Ex. 1013, Beattie 344.) Beattie describes that the patients received a variable number of total exposures from 15-65 to whole body and perineum, given 3-5 times per week. (Ex. 1013, Beattie 344.) Beattie describes that for "light delivery to the perineum, the patient was positioned in stirrups in the lithotomy position to expose the inner labia and vulva on an adjustable gynaecological examination couch.) (Ex. 1013, Beattie 344-45.) Beattie described that of the seven women treated after one course of therapy, three obtained moderate improvement in their perineal disease severity and two obtained minimal improvement. (Ex. 1013, Beattie 345.) Beattie concluded that UVA1 therapy may be of benefit in the management of vulval LS. (*See also* EX. 1003, ¶¶ 109-112; EX. 1004, ¶¶82-83.)

G. OVERVIEW OF SMITH

Smith is a 2004 review article entitled "Vulvar Lichen Sclerosus: Pathophysiology and Treatment" by Smith & Haefner in the American Jounal of Clinical Dermatology. (Ex. 1014, 105.) Smith notes that the "entire vulvar area (from the clitoris to the anus) may be involved" and going on to note that the "most common areas where lichen sclerosus is found are on the labia majora

and labia minora." (Ex. 1014, 106.) Smith describes that LS can lead to the "fusion of labia minora" and can cause the vaginal opening to become smaller and interfer with intercourse. (Ex. 1014, 106.) Smith notes that LS is characterized by homogenization and hyalinization (translucence) of the dermal collagen with bands of infiltrate (inflammatory cells) just beneath the squamous epithelial lining. (Ex. 1014, 107). Smith describes phototherapy as an effective treatment and points to Kreuter's results described above.

VII. PERSON HAVING ORDINARY SKILL IN THE ART

The level of skill of a POSITA of the '511 patent is a medical doctor practicing in the field of plastic surgery and in particular, in urogynecology or a similar field. In the absence of practicing in these fields, a POSITA is a medical doctor who has at least ten years of knowledge and experience in the treatment or research regarding treatment of tissue with radiant energy.

VIII. CLAIM CONSTRUCTION

A claim in *inter partes* review is given the "broadest reasonable construction in light of the specification." (37 C.F.R. § 42.100(b).) This standard requires that the challenged claims be read in light of the specification as interpreted by a POSITA. *In re Suitco Surface, Inc*., 603 F.3d 1255, 1260 (Fed. Cir. 2010). In *Microsoft Corp. v. Proxyconn, Inc*., the Federal Circuit explained that the broadest reasonable interpretation does not mean that the Board can construe the claim terms "so broadly that its constructions are

unreasonable under general claim constructions principles," and that the construction must not be "divorced from the specification and the record evidence" and consistent with "the [construction] that those skilled in the art would reach." 789 F.3d 1292, 1298 (Fed. Cir. 2015) (quoting *In re NTP, Inc.*, 654 F.3d 1279, 1288 (Fed. Cir. 2011); *In re Cortright*, 165 F.3d 1353, 1358 (Fed. Cir. 1999). Consistent with 37 C.F.R. § 42.100(b), Petitioner submits the following claim term constructions.[1] Any claim terms not included in the following discussion are to be given their broadest reasonable construction in light of the specification as commonly understood by a POSITA.

A. TARGET TISSUE

Term (Claims 1, 35, 43, and 51)	Proposed Construction
"target tissue"	tissue underlying the epithelium

In accordance with the broadest reasonable interpretation standard, the term "target tissue" means "tissue underlying the epithelium."

The '511 patent repeatedly describes the "target tissue" as the tissue "underlying the mucosal epithelium." (EX. 1001, 2:25-28, 3:41-47 ("The target tissue lies immediately beneath the mucosal epithelium of genital tissues, and includes the lamina propria, a connective tissue that includes collagen in the

[1] Petitioner reserves the right to pursue different constructions in a district court, where a different standard applies.

extracellular space, and the muscularis, which includes smooth muscle."); 11:11-14 ("In particular, the target tissues (Fig. 8) are the connective tissue layers such as the lamina propria or submocosa 102 and the muscularis 104 underlying the mucosal epithelium 100 of genital tissues.").) The '511 patent further states:

> The target tissue of embodiments of this invention include the connective tissue underlying these mucosal epithelial surfaces of the genitalia which, progressing down from the epithelial surface, are known as the lamina propria 102 and the muscularis 104 (FIG. 8), respectively (see, for example, Netter, Atlas of Human Anatomy, 4th edition, Saunders, 2006). The lamina propria includes a mixture of cells types that populate connective tissue, such as fibroblasts, and the muscularis is a layer of smooth muscle. Collagen is secreted or deposited into the extracellular space in these tissues by cells such as fibroblasts.

(EX. 1001, 12:2-13.)

IX. SPECIFIC GROUNDS FOR PETITION

Pursuant to Rule 42.104(b)(4)-(5), the below sections demonstrate in detail how the prior art discloses each and every limitation of claims 43-58 of the '511patent, and how those claims are rendered obvious by the prior art.

A. GROUND I: CLAIMS 43-58 ARE OBVIOUS IN LIGHT OF EDWARDS, INGLE, AND MOSHER UNDER 35 U.S.C. § 103(a)

1. Claim 43

a. Claim 43a: A method for remodeling a therapeutic zone within a target tissue, the target tissue comprising tissue underlying an epithelium of female genital tissue comprising at least one of vulva, introitus and vagina tissue, the method comprising:

Edwards, Ingle, and Mosher all disclose the application of energy to targeted tissues underlying an epithelium of female genital tissue.

Edwards discloses a method and system for applying energy to targeted tissues to selectively ablate, tighten, shrink or reshape the tissue and thereby correct an unwanted condition. (EX. 1008, 2:32-39; EX. 1003, ¶79; EX. 1004, ¶¶18-19.) Edwards describes that radiofrequency (RF) energy can be applied to "target tissue" such as uro-genital tissues so as to cause shrinkage and remodeling, reshaping, bulking and other treatment effects. (*See e.g.* EX. 1008, 2:26-30.) Specifically, Edwards describes that it "provides a method and system for the curative treatment of female uro-genital disorders by application of radiofrequency (RF) energy to targeted tissues … so as to ablate, tighten, shrink or reshape the tissue and thereby correct an unwanted condition." (*See e.g.* EX. 1008, 2:33-39.)

Edwards includes a process flow diagram describing an application of its disclosed method for vaginal remodeling noting that remodeling "both the

anterior wall and posterior wall provide circumferential vaginal wall tightening, resulting physical and psychological improvement in the area of sexual function." (EX. 1008, 13:12-23, Fig. 9.)

Mosher states the techniques of its invention "generally involve directing energy from a probe into collagenous tissues of the pelvic support system" to "cause contraction of the collagenous tissue." (EX. 1009, ¶0045.) Mosher also describes the broad range of tissues that can be treated by its method of "directing energy from a probe into collagenous tissues" including the "lamina propria—the dense connective tissue layer just under the epithelium." (EX. 1009, ¶0045; *see also* EX. 1003, ¶¶56-59.) Mosher discloses a non-invasive vaginal probe embodiment delivering RF energy to and through the epithelium of the vaginal wall to heat and tighten contract adjacent or underlying female genital tissue. *Id*.

Ingle describes that it utilizes energy to "heats fascia and other collagenated support tissues, causing them to contract without substantial necrosis of adjacent tissues." (EX. 1010, 2:59-67.) Further, Ingle specifically provides an exemplary embodiment of a non-invasive transvaginal delivery device that applies energy to the target tissue through the vaginal wall. (EX. 1010, 3:36-50; EX. 1003, ¶¶48-54.)

b. Claim 43b: heating the target tissue, and

Edwards, Ingle, and Mosher all disclose methods for heating the tissue underlying the epithelium and thus disclose this limitation as properly construed. (*See* § VIII.A *supra*.) With respect to the vaginal remodeling embodiment, Edwards describes that:

> The RF energy is delivered to the anterior and posterior regions of the vaginal wall. This has the effect of tightening of vaginal walls so as to increase support of the bladder outlet, proximal and mid-urethra. Moreover, circumferential tightening of the vaginal wall may provide physical and psychological improvement in the area of sexual function.

(EX. 1008, 3:5-13.)

As described in Figure 9a of Edwards, the "energy port 432 is manipulated so as to cause delivery of RF energy to discrete areas of the vaginal wall." (*See, e.g.*, EX. 1008, 13:54-56.) A POSITA would understand that Edwards' "delivery of RF energy to discrete areas of the vaginal wall" causes the heating of the tissues below the epithelium and thus discloses heating the target tissue. (EX. 1003, ¶81; EX. 1004, ¶18.) The fact that the RF electrodes put off a significant amount of heat is confirmed by the inclusion of a cooling system in Edwards as described below.

Edwards includes a process flow diagram showing a method for vaginal remodeling. (EX. 1008, Fig. 9.) As described in block 907 of Figure 9a, the vaginal remodeling process disclosed in Edwards includes the use of cooling fluid during the treatment process. (EX. 1008, Fig. 9) ("At least one of the

irrigating fluid ports 433 is engaged so as to deliver cooling fluid into the vagina through the irrigating fluid delivery pores 425.") Edwards also explains that the cooling fluid, "serves to minimize thermal damage to tissues when the electrodes **225** are deployed." (EX. 1008, 4:59-61.) Edwards discloses that "Each electrode 423 includes at least one thermocouple 424 that is used to monitor the temperature of each electrode 423. This constant temperature monitoring, combined with a computerized control algorithm, is utilized to independently control the electrodes 423. If one of the electrodes 423 exceeds temperature safety limits, that particular one of the electrodes 423 can be disengaged without aborting the entire procedure." (EX. 1008, 7:43-50.)

Mosher describes the broad range of tissues that can be targeted by its method of "directing energy from a probe into collagenous tissues" including the "lamina propria—the dense connective tissue layer just under the epithelium." (EX. 1009, ¶¶0045, 0048.) Figures 6 and 6a of Mosher "illustrate non-invasive vaginal probes and a method for non-invasively treating endopelvic fascia using cooled electrodes." (EX. 1009, ¶0027.) Mosher describes that a "non-invasive cooled electrode probe similar to that shown in FIGS. 6 and 6A heats tissue until the temperature sensing needle at 4.5 mm depth reaches a set point of 75° C. at 185 seconds." (EX. 1009, ¶0085; *see also* EX. 1003, ¶¶56-59.)

Ingle similarly discloses that it provides a method for "therapeutically

heating a target zone of a tissue" where the "target zone is heated by directing energy from the probe, through the pre-cooled adjacent tissue, and into the target zone." (EX. 1010, 4:4-10.) Ingle also describes that its "energy heats the target tissue so that the target tissue contracts" while cooling the intermediate tissue. (EX. 1010, 3:51-58; EX. 1003, ¶48.)

c. Claim 43c: remodeling the therapeutic zone of target tissue,

The remodeling, as admitted in the '511 patent and taught in the cited references, is a natural phenomenon that results from the heating of the tissue. The "remodeling" is the *result* caused when heated tissue reaches a sufficient temperature (*see* EX. 1001, 4:15-16, 5:2-5, 11:22), not an independent active step carried out by the person administering the claimed method.

Edwards discloses the selective heating of targeted tissues by application of RF energy to remodel the underlying tissue thereby correcting an unwanted condition. (EX. 1008, 2:26-30 (describing the application of RF energy to "uro-genital tissues so as to cause shrinkage and remodeling, reshaping, bulking and other treatment effects"); (EX. 1008, 2:33-40) (describing the use of RF energy to "ablate, tighten, shrink or reshape the tissue and thereby correct an unwanted condition").) Edwards discloses that "[t]he tiny cites of treated muscle resorb, remodel and shrink in the weeks that follow treatment…." (EX. 1008, 2:53-56.)

Edwards discloses "vaginal remodeling." (EX. 1008, 3:26-28 ("FIG. 4 is a block diagram showing a fourth embodiment of the distal end of a system that

can be used for vaginal remodeling"; s*ee also* EX. 1008, 3:38-39 ("FIG. 9 is a process flow diagram showing a method for using a fourth embodiment for vaginal remodeling"); EX. 1008, 7:14-15 ("FIG. 4 is a block diagram showing a fourth embodiment of a device that can be used for vaginal remodeling."); EX. 1008, 13:13-23 ("FIG. 9 is a process flow diagram showing a method for using a fourth embodiment for vaginal remodeling.").) A detailed description of this fourth embodiment explains that the remodeling of "both the anterior wall and posterior wall provide circumferential vaginal wall tightening, resulting physical and psychological improvement in the area of sexual function." (EX. 1008, 13:14-23; EX. 1003, ¶¶82-86; EX. 1004, ¶19.)

Mosher notes that the "techniques of the invention generally involve directing energy from a probe into collagenous tissues of the pelvic support system. The energy will often cause contraction of the collagenous tissue." (EX. 1009, ¶0045; EX. 1003, ¶36, 57.) Mosher describes the broad range of tissues that can be treated by its method of "directing energy from a probe into collagenous tissues" including the "propria—the dense connective tissue layer just under the epithelium." (EX. 1009, ¶0048; EX. 1003, ¶56-58.)

Ingle similarly discloses that it provides a method for "therapeutically heating a target zone of a tissue" where the "target zone is heated by directing energy from the probe, through the pre-cooled adjacent tissue, and into the target zone." (EX. 1010, 4:4-10.) Ingle notes that its methods can be used to

heat “target zones” to “a significantly higher temperature than intermediate tissue **36**.” (EX. 1010, 15:65-16:4; *see also* EX. 1003, ¶¶48-50.)

Ingle discloses an exemplary embodiment of a vaginal probe that applies energy to the target tissue through the vaginal wall to cause contraction of the underlying collagen tissue. (EX. 1010, 8:53-65) Ingle also discloses that the heating energy remodels the targeted collagenated tissue. (EX. 1010, 3:51-58; EX. 1003, ¶¶ 49-51.)

As described above, Edwards, Mosher, and Ingle all disclose the tightening or contracting the collagen tissue underlying the epithelium of female genital tissue and thus disclose remodeling of the therapeutic zone of target tissue as construed by Petitioners. Thus the combination of Edwards, Mosher, and Ingle discloses the remodeling of the therapeutic zone of target tissue limitation.

Additionally, the remodeling, as admitted in the ’511 patent and taught in the cited references, is a natural phenomenon that results from the heating of the tissue. Edwards, Ingle ’704, and Mosher all describe heating of the target tissue, thus necessarily disclose this limitation as the “remodeling” that is the *result* caused when heated tissue reaches a sufficient temperature (*see* EX. 1001, 4:15-16, 5:2-5, 11:22), not an independent active step carried out by the person administering the claimed method.

d. Claim 43d: wherein the heating includes heating a portion radiating outward from the introitus to Hart's line.

Edwards, Mosher, and Ingle all disclose non-invasive transvaginal delivery of energy through the epithelium of the vagina to the underlying collagen containing tissue to remodel the collagen tissues. (*See e.g.* EX. 1008, Edwards at 2:26-40, 3:5-14, 7:14-19, 13:14-23, 13:54-56; EX. 1009, ¶0027, ¶0048, ¶0066, ¶0074, Figs. 6 and 6A; EX. 1010, 3:36-50, 23:40-65, Fig. 12L.)

All three of these references note that their methods can be used to treat a variety of tissues. For example, Edwards discloses that the physician determines the optimal areas for treatment and that these areas may include "the anterior wall, the posterior wall or both." (EX. 1008, 13:38-42.) Mosher discloses a method for "controllably and repeatably enhancing the structural support of a wide variety of fascia and other collagenous tissues throughout the body…." (EX. 1009, ¶0046; EX. 1003, ¶60.) Mosher describes the broad range of tissues that can be treated by its method of "directing energy from a probe into collagenous tissues" including the lamina propria and other "tissue structures defining the pelvic floor." (EX. 1009, ¶0048.)

Ingle similarly notes that its treatment method has a variety of uses, and expressly notes that it "may even be used in cosmetic procedures … to remove wrinkles by shrinking the collagenated skin tissues…." (EX. 1010, 18:1-7.) Ingle further contemplates the use of its methods on "exposed skin, or near the

major cavities and orifices of the body" describing specific electrode gaps in those instances. (EX. 1010, 14:57-62.) Ingle described the treatment of various tissue structure including "the urethral wall, the bladder neck, the bladder, the urethra, bladder suspension ligaments, the sphincter, pelvic ligaments, pelvic floor muscles, fascia, and the like" to treat urinary incontinence. (EX. 1010, 11:8-24.)

In light of the variety of procedures and target tissue structures disclosed in Edwards, Mosher, and Ingle, and the knowledge of a POSITA, it would have been obvious to apply energy to heat target tissue located radiating outward from the introitus to Hart's line. (EX. 1003 ¶¶70, 89; EX. 1004, ¶76.) A POSITA would understand that the recited tissue in the claim is simple squamous epithelial tissue as found on the face and elsewhere in the body and would react to heat in a similar manner. (EX. 1003, ¶¶70, 110,121.)

Further, a POSITA would know that prior art procedures, such as Laser Vaginal Rejuvenation ("LVR") described in Olliver were used to tighten a patient's vagina and enhance sexual gratification, and Designer Laser Vaginoplasty (DVL) used to aesthetically modify a patient's labia were well known and utilized similar methods of treatment on the vaginal wall and on the tissue radiating outward from the introitus to Hart's line. (*See* Section VI.D *supra* ; EX. 1011, pp.1, 2; EX. 1003, ¶¶14, 70, 96-102, 110, 121.)

The Ollivier article describes that the methods used for vaginal tightening

could also be used for treatments on the vulva and labi. For example, the Ollivier describes Dr. Matlock's practice and the relationship between vaginal tightening and cosmetic surgery on the vulva or labi:

> Some requested that, once on the surgery table, Matlock do a little cosmetic surgery as well -- a plumping up of a flaccid vulva here, a trimming back of a labium there. 'I hesitated at first,' says Matlock of those fledgling days, when a growing interest in sexual gratification and designer vaginas slowly brought women flocking to his office. 'Then I modified my thoughts. I thought, OK.'"

(EX. 1011, p.2.) The article goes on to note that the laser procedures practiced by Dr. Matlock was not novel and was already falling out of favor for more advanced techniques:

> Vaginal tightening has been done for decades to help women with extremely compromised vaginal integrity. For the even fewer women out there with true genital 'deformities' -- extraordinarily long or protruding labia, for example, or excessive vaginal flesh -- surgery has also been an option for years. 'Labial surgery?' says ob/gyn Dr. Cornelia Daly. 'There's nothing to it. It's been around for 30 years. Lasers have even fallen out of favor. We have more sophisticated tools that do the same thing these days.'' According to the ob/gyn community, Matlock has simply put a new spin (sex sells) on an old procedure.

(EX. 1011, pp.6-7.)

A POSITA would understand that the laser techniques practiced by Dr. Matlock, in addition to any ablative aspects, necessarily heated the target tissue. (EX. 1003, ¶¶92-102.) This heating of the target tissue necessarily caused a remodeling of at least a portion of the therapeutic zone of the target tissue by way of the denaturation of collagen and induction of new collagen. (EX. 1003,

¶¶97-102.)

That heat could be used to denature collagen and remodel tissue was well known before the filing of the application leading to the '511 patent. (EX. 1001, 1:35-61; EX. 1003, ¶¶32, 36-38, 50.) Further, Ingle expressly discloses that it can be used both within genital tissue and in "normal" skin tissue to tighten collagen containing tissues. (EX. 1010, 18:1-7 (the disclosed treatment "may even be used in cosmetic procedures … to remove wrinkles by shrinking the collagenated skin tissues ….").)

In light of the above disclosures, a POSITA in February of 2006 would have found it obvious to use the methods of Edwards, Mosher, and/or Ingle, such as the RF energy of Edwards, to heat a portion of the tissue radiating outward from the introitus to Hart's line, in order to cause the desired remodeling with a reasonable expectation of success. (EX. 1003, ¶70, 89; EX. 1004, ¶76.)

e. Reasons to combine Edwards, Mosher, and Ingle.

Further to Sections IX.B.1(a)-(d) above, it would have been obvious to a POSITA to combine the treatment methods of Edwards, Mosher, and Ingle. (EX. 1003, ¶36.) Edwards, Mosher, and Ingle all disclose non-invasive treatment probes that can be used to provide RF energy to and through the vaginal wall to denature the underlying collagen containing tissue to tighten it. (*See e.g.* EX. 1008, Edwards at 2:26-40, 3:5-14, 7:14-19, 13:14-23, 13:54-56;

EX. 1009, ¶0027, ¶0045, ¶0048, ¶0066, ¶0074, Figs. 6 and 6A; EX. 1010, 3:36-50, 23:40-65, Fig. 12L.) Edwards, Mosher, and Ingle '704 all describe methods of cooling the intermediate tissue while heating the underlying tissue. (*See e.g.* EX. 1008, 4:59-61, Fig. 9; EX. 1009, ¶0058, ¶0069;EX. 1010, 2:59-67, 3:36-50, 4:4-10, 20:59-63.) All three references relate to the same field as they all disclose non-invasive treatments that can be used to treat urinary incontinence as well as other uro-genital disorders and Ingle specifically teaches application of the same treatment methods for non-medical cosmetic uses in other parts of the body, *i.e.*, in extra genital tissue. (*See e.g.* EX. 1008, 13:12-23; EX. 1009, ¶0045; EX. 1010, 8:53-65.) Accordingly, it would be obvious to a POSITA to combine Edwards, Mosher, and Ingle because they relate to the same field of applying radiant energy for use in medical/cosmetic treatment of female genital tissue and disclose devices with overlapping functionality designed to cure overlapping medical issues.

A POSITA would have been motivated to combine the treatment tips of Ingle and Mosher, including their cooling mechanisms, with the teaching of Edwards because Edwards explains that its cooling fluid, "serves to minimize thermal damage" to the mucosal epithelium "when the electrodes **225** are deployed." (EX. 1008, 4:59-61, 7:51-53.) Ingle describes that "heat should be removed from the housing adjacent the transducer so as to prevent the surface of the transducer housing from rising above about 45 nC. As described above, it

will often be desirable to chill the intermediate tissue engaged by the probes of the present invention to temperatures significantly lower than this. It should at least be possible to maintain the housing below a maximum safe tissue temperature by using an adequate flow a cooling liquid such as water, and still further cooling may be possible." (EX. 1010, 26:28-37.) Mosher describes that its probe "makes use of cooling prior to and during RF energy application, and all measurement locations were maintained at or below standard tissue temperatures at the offset locations. Hence, these studies indicate there is no tissue heating beyond the footprint of probe 54, and lateral heat dispersion can be well controlled for the non-invasive application of RF energy using a cooled electrode non-invasive applicator." (EX. 1009, 12:44-51.) Given Edwards' stated goal of minimizing thermal damage to the mucosal epithelium, it would have been obvious to combine the more robust cooling mechanisms described in the female urogenital treatments of Ingle and Mosher with the non-invasive urogential treatment probe in Edwards to better meet this stated goal. (EX. 1004, ¶47-54; EX. 1003, ¶36.)

Further, a POSITA would have been motivated to combine the more robust cooling mechanisms of Ingle and Mosher with Edwards because Edwards explicitly contemplates the overheating of the RF electrode while in use resulting in thermal damage to the intermediate tissue. (EX. 1008, 7:43-53.) Edwards discloses "constant temperature monitoring" of the electrodes because

of the possibility that the cooling fluid could fail to keep the electrodes within "temperature safety limits." (EX. 1008, 7:43-50.) Ingle and Mosher both disclose cooling the probe through the circulation of coolant within the housing of the probe to prevent unwanted overheating of the probe and damage to the intermediate tissue. (EX. 1010, 26:18-37; EX. 1009, ¶0058.) Likewise, both Ingle and Mosher disclose pre-cooling the probe and intermediate tissue to reduce the possibility of overheating the probe and intermediate tissue. (EX. 1010, 20:56-63, 26:18-37; EX. 1009, ¶0058, ¶0069.) Additionally, Ingles informs that the internal cooling and pre-cooling mechanisms allow the treatment tissue to be heated to greater temperature by the probe than the intermediate tissue. (*See* EX. 1010, 7:7-15.) Accordingly, it would have been obvious to a POSITA to combine the internal cooling and pre-cooling mechanisms of Ingle and Mosher with Edwards to avoid overheating the probe and intermediate tissue and to help produce a reverse thermal gradient between the treatment and intermediate tissue. (EX. 1003, ¶¶73-76, 129; EX. 1004, ¶¶46-54)

A POSITA would have been motivated to combine the non-invasive vaginal probe of Ingle, including its use of ultrasound energy, with the teaching of Edwards because Edwards states that the electrodes of its non-invasive vaginal probe may deliver "forms of therapeutic energy" other than RF to achieve the vaginal remodeling. (EX. 1008, 7:39-42.) Ingle notes that

"ultrasound energy is particularly well suited for heating and shrinking the pelvic support tissues from a vaginal probe." (EX. 1010, 8:45-52.) Accordingly, a POSITA would be motivated to combine the benefits of Ingle's ultrasound vaginal probe with Edwards.

Because Edwards, Mosher, and Ingle are all directed toward the same types of treatment for the same groups of medical issues, it would be obvious to a POSITA to review and combine Edwards, Mosher, and Ingle when looking to improve non-invasive treatments for remodeling female genital tissue. A treatment with the non-invasive vaginal remolding capabilities of Edwards paired with the benefits provided by Ingle and Mosher, including their internal cooling and pre-cooling mechanisms, would be more desirable to the medical market than Edwards, Mosher, or Ingle alone thus a POSITA would be motivated to combine Edwards, Mosher, and Ingle for the commercial opportunities the resulting combination would present. A POSITA would also be motivated to combine Edwards, Mosher, and Ingle because the cooled electrode treatment would lead to a safer treatment for the patients and easier treatments to administer by physicians.

2. Claim 51

a. Claim 51a-c

Claim 51a-c is identical to claim 43a-c, and are obvious for the reasons described above in Sections IX.A.1.a-c.

b. Claim 51d: wherein the heating includes heating a mucosal surface of the labia minora.

In light of the disclosures of Edwards, Mosher, and Ingle and motivated by Ollivier and other generic knowledge of one of skill in the art, it would be obvious to heat "a mucosal surface of the labia minora" so as to remodel the tissue. (EX. 1003, ¶70.) That heat could be used to denature collagen and remodel tissue was well known before the filing of the application leading to the '511 patent. (EX. 1001, 1:35-61; EX. 1003, ¶32.)

Ingle expressly notes that it can be used for "cosmetic procedures" including to "remove wrinkles by shrinking the collagenated skin tissues …." (EX. 1010, 18:1-7.) Ingle further contemplates the use of its methods on "exposed skin, or near the major cavities and orifices of the body" describing specific electrode gaps in those instances. (EX. 1010, 14:57-62.)

Ollivier describes the use of radiant energy – specifically lasers – by physicians performing electrosurgery on female genital tissue. (EX. 1011, Ollivier at 2.) In response to patients' complaints regarding urinary incontinence and subpar sexual function, physicians were surgically modifying the vulva, labia, and vagina to achieve their pre-pregnancy function and appearance. (*Id*. at 2-3; EX. 1004, ¶85.)

A POSITA would have understood that the labia simple squamous surface tissues and would expect the labia to be remodeled in a similar fashion as the squamous urogenital tissues located throughout the body, including the

vagina, cervix, endopelvic fascia, and extra-genital tissue. (EX. 1003, ¶¶69, 70; EX. 1004, ¶84.)

A POSITA would have understood that during the performance of these ablative female genital tissue electrosurgeries, thermal affects were necessarily occurring in the areas surrounding the ablated tissue. (EX. 1004 ¶86; EX. 1003 ¶¶92-102.) In other words, the remodeling of collagen-containing dermal tissue was a necessary consequence of these surgeries by virtue of the properties of the heat used and its proliferation to nearby tissues that were not ablated, but were nonetheless at a sufficient temperature to effectuate change. (EX. 1004, ¶86; EX. 1003 ¶¶92-102.)

A POSITA would have understood that RF energy could be applied to female genital tissue to cause collagen denaturation, thus remodeling it. (EX. 1004, ¶87.) A POSITA would have understood that the application of heat to sub-surface, dermal tissue throughout the body to induce collagen growth – one component of remodeling – and further suggested its curative properties when applied to the vulva. (EX. 1004, ¶88.)

Further, a POSITA would have understood that RF energy can be applied to the surface epithelium, as well as the surface mucosal epithelium to remodel underlying tissues. (EX.1004, ¶62, 75, 84, 88.)

In light of the above disclosures, a POSITA in February of 2006 would have found it obvious to use the methods of Edwards, Mosher, and/or Ingle,

such as the RF energy of Edwards, to heat the labia in order to cause the desired remodeling with a reasonable expectation of success. (EX. 1004, ¶76, 84, 87.)

3. Claims 44 and 52: The method of claim [] wherein heating the target tissue comprises heating it to a temperature between 45 degrees C and 80 degrees C.

The '511 itself incorporates by reference several prior art patents and published patent applications that it characterizes as "relevant to" aspects of "collagen denaturation and the exploitation of this for medical or cosmetic purposes." (EX. 1001, 1:35-61.)

In addition, a POSITA would have had an understanding of the temperatures necessary to effectuate changes to collagen, including denaturation. (*See* EX. 1004, ¶¶57-62; EX. 1003, ¶¶32, 49-50, 90, 100, 102, 125.)

Because the optimal conditions for the denaturation of collagen were already known to those in the field, a POSITA would understand that the descriptions in Edwards calling for "the curative treatment of female uro-genital disorders by application of radiofrequency (RF) energy to targeted tissues … so as to ablate, tighten, shrink or reshape the tissue and thereby correct an unwanted condition" to entail that the target tissue be heated to a temperature above 45° C and thus within the range of 45° C and 80° C. (EX. 1008, 2:33-40; EX. 1004, ¶¶57-62; EX. 1003, ¶¶90, 125.)

Further, as noted by the Examiner during prosecution of the '511 patent:

> It would have been obvious to one of ordinary skill in the art at the time of the invention was made to heat the target tissue to the claimed temperature ranges since the claims temperature ranges are well known and commonly utilized temperature ranges in the art to provide the desired remodeling and thermal treatment disclosed in Knowlton. Additionally it would have been obvious to one having ordinary skill in the art at the time the invention was made to provide the disclosed ranges, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art."

(EX. 1002, Thermi022911.)

Mosher and Ingle also expressly disclose this limitation. Ingle discloses that "[p]referably, the target tissue will be raised to a temperature of about 60 nC or more, while the intermediate tissue remains at or below a maximum safe temperature of about 45 nC." (EX. 1010, 8:39-44; *see also* 7:7-15; 8:66-9:11.) Ingle further notes that "[p]reliminary work in connection with the present invention has shown that fascia and other collagenated tissues which are heated to a temperature range of between about 60 nC and 140 nC, often being in a range from about 60 nC to about 110 nC, and preferably between about 60 nC and 80 nC, will contract." (EX. 1010, 12:64-13:2.) Mosher states that "to effect significant, repeatable tissue shrinkage, it is generally desirable to subject the treatment volume to temperatures of at least 70° C. for a time of about 30 seconds or more." (EX. 1009, ¶0065.)

Thus Edwards in combination with Ingle and Mosher discloses this limitation. (EX. 1004, ¶¶58; EX. 1003, ¶¶32, 49,115, 127.)

4. Claims 45 and 53: The method of claim [], wherein heating comprises delivering energy by contacting the epithelium with a treatment tip, the tip including an energy delivery element.

Edwards, Ingle, and Mosher all disclose this limitation. For example, figure 4 of Edwards (below) depicts the distal end of the treatment system for vaginal remodeling.

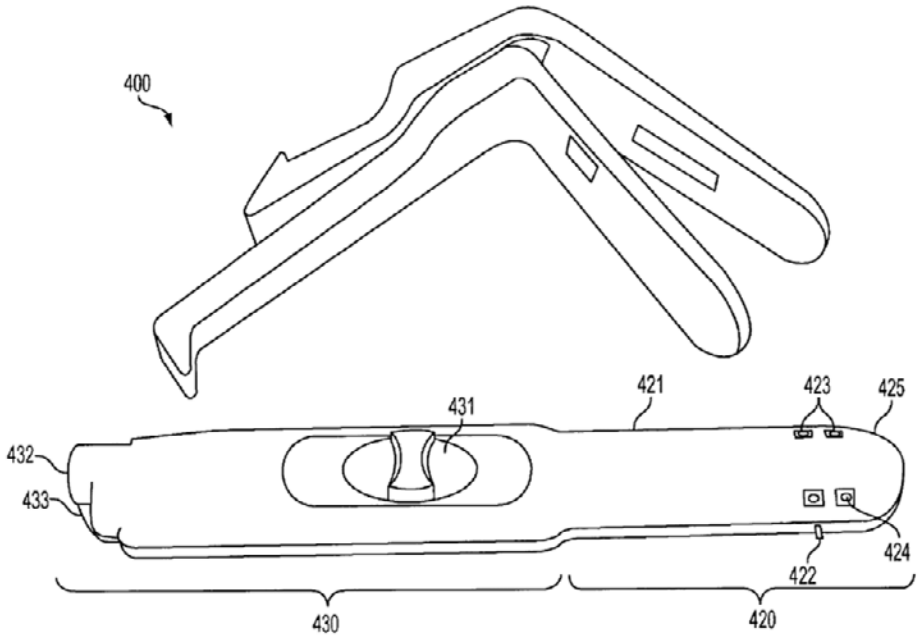

FIG. 4

Edwards describes that the "system 400 includes a treatment element 410. The proximal end of the treatment element 410 is coupled to an RF generator. The distal end of the treatment element 410 is inserted into a vagina using a speculum." (EX. 1008, 7:14-19.) Edwards describes that "In a preferred embodiment, these electrodes 423 are disposed to deliver RF energy. However, in other embodiments the electrodes 423 may also deliver microwave energy,

ELF (extremely low frequency energy), laser and other forms of therapeutic energy." (EX. 1008, 7:37-42.) Edwards also discloses that the vaginal probe is "manipulated so as to cause delivery of RF energy to discrete areas of the vaginal wall." (EX. 1008, 13:54-56.) Edwards discloses that its method creates a "series of lesions in either the anterior vaginal wall, the posterior vaginal wall or both." (EX. 1008, 13:14-16.) A POSITA would understand that the "delivery of RF energy to discrete areas of the vaginal wall" along with the "presence of lesions" language discloses that the vaginal wall is contacted by a treatment tip. (EX. 1004, ¶¶18, 63; EX. 1003, ¶51.) Therefore, Edwards discloses the "wherein heating comprises delivering energy by contacting the epithelium with a treatment tip, the tip including an energy delivery element" limitation of claim 5.

Mosher depicts its non-invasive treatment probe in Figures 6 and 6A where elements 56 are the electrodes.

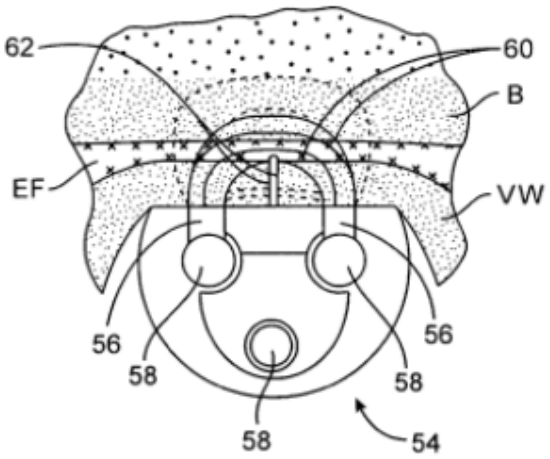

FIG. 6

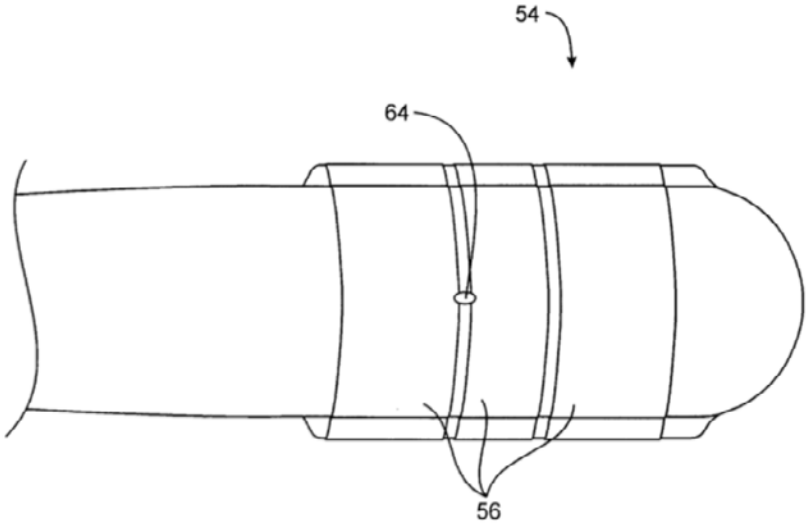

FIG. 6A

Mosher describes that pre-cooling can "inhibit heating of the intervening tissue to a temperature causing surface lesions within the vagina" and that "a relatively flat tissue-engaging electrode surface helps direct electrical current flux." (EX. 1009, ¶0058.) The use of the phrase tissue engaging electrode makes clear that the electrodes described in Mosher deliver energy by

contacting the epithelium.

Ingle discloses that its "probe for therapeutically heating a target tissue of a patient body through an intermediate tissue" includes "an electrode with an electrode surface which is engagable against the intermediate tissue." (EX. 1010, 3:11-20.)

5. Claims 46 and 54: The method of claim [], wherein the heating is controlled by a feedback control, such that temperature does not go higher than a predetermined temperature

Edwards discloses that "Each electrode 423 includes at least one thermocouple 424 that is used to monitor the temperature of each electrode 423. This constant temperature monitoring, combined with a computerized control algorithm, is utilized to independently control the electrodes 423. If one of the electrodes 423 exceeds temperature safety limits, that particular one of the electrodes 423 can be disengaged without aborting the entire procedure." (EX. 1008, 7:43-50; EX. 1004, ¶64.)

Ingle discloses that a "control system will often selectively energize the electrode and/or cooling system in response to the monitored temperature." (EX. 1010, 3:32-35.) Ingle also discloses that "needle mounted temperature sensors will ideally provide direct feedback of the tissue temperature so that selected treatment zone is heated to about 60 nC or more, while heating of the tissues adjacent the electrodes is limited to about 45 nC or less." (EX. 1010, 7:7-15.)

Mosher describes that "[f]eedback on the pre-cooling and heating temperatures may be provided by needle-mounted temperature sensors 62" and that its "feedback loop from the probe-supported temperature sensing needle" can be set a "probe feedback temperature." (EX. 1009, ¶0073.)

6. Claims 47 and 55: The method of claim [], wherein the method further comprises cooling the epithelium.

Element 907 of Figure 9a of Edwards describes its vaginal remodeling method and includes a description of the use of cooling fluid during the treatment process. (EX. 1008, Fig. 9 ("At least one of the irrigating fluid ports 433 is engaged so as to deliver cooling fluid into the vagina through the irrigating fluid delivery pores 425."). Edwards also explains that the cooling fluid, "serves to minimize thermal damage to tissues when the electrodes **225** are deployed." (EX. 1008, 4:59-61; EX. 1003, ¶86; EX. 1004, ¶¶53.) Therefore, Edwards discloses the cooling of the epithelium.

Mosher and Ingle also disclose this limitation. Ingle discloses the use of a "controlled regimen of timed pre-cooling and then heating" to selectively raise the temperature of endopelvic fascia EF (or any other target tissue), while the vaginal mucosa adjacent probe **84** is protected by the cooled probe." (EX. 1010, 20:59-63.) Ingle also describes that the "tissue will preferably be pre-cooled by the surfaces of electrodes 12, 14, generally using an electrode surface temperature of at or above 0 nC." (EX. 1010, 15:27-39.)

Mosher describes its non-invasive probe 54 "makes use of cooling prior to and during RF energy application." (EX. 1009, ¶0069.) Mosher depicts its non-invasive treatment probe in Figures 6 and 6A where elements 56 are the electrodes.

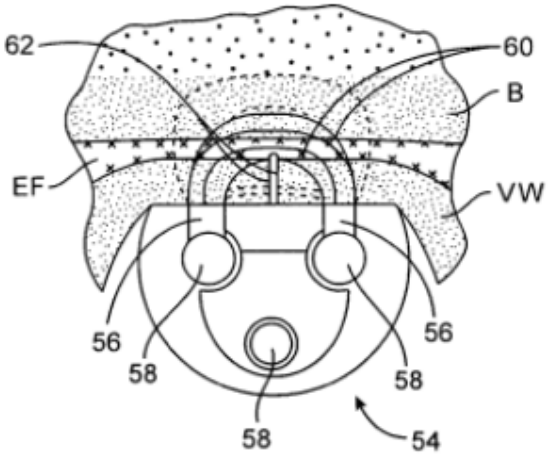

FIG. 6

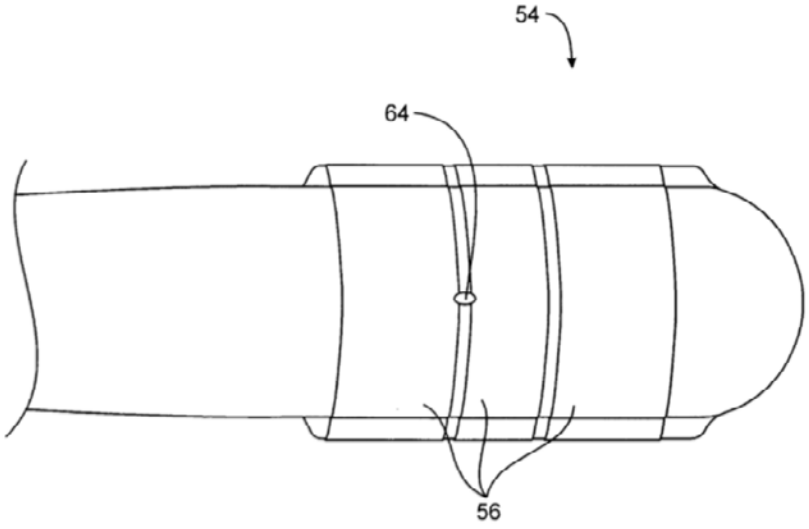

FIG. 6A

Mosher describes that pre-cooling can "inhibit heating of the intervening tissue to a temperature causing surface lesions within the vagina" and that "a relatively flat tissue-engaging electrode surface helps direct electrical current flux." (EX. 1009, ¶0058.) The use of the phrase tissue engaging electrode makes clear that the electrodes described in Mosher deliver energy by contacting the epithelium. Ingle discloses that its "probe for therapeutically heating a target tissue of a patient body through an intermediate tissue" includes "an electrode with an electrode surface which is engagable against the intermediate tissue." (EX. 1010, 3:11-20.) A POSITA would understand that in the context of the Mosher disclosure "intermediate tissue" mean the epithelial surface. (EX. 1003 ¶50.)

7. Claims 48 and 56: The method of claim [], wherein the method comprises contacting the epithelium with a treatment tip at a one or more contact sites during a procedure, the tip comprising an energy delivery element adapted to heat the target tissue.

As discussed above in section IX.B.4 these references disclose treatment tips contacting the epithelium. Further, Edwards further discloses that "In a preferred embodiment, the blade 420 may be disengaged and relocked into another position in the speculum, so as to delivry [sic] energy to another area of the vagina." (EX. 1008, 13:60-62.)

Edwards also describes the ability to shrink tissue by delivery of RF energy to multiple contact sites (e.g., by "circumferentially treating"), and

where the "physician may repeat the treatment sequence." (EX. 1008, 3:5-13, 11:28-31; EX. 1003, ¶130; EX. 1004, ¶¶66-67..) Multiple contact sites and multiple treatments would additionally have been obvious to skilled artisans in view of the embodiment of Mosher where a cooling mechanism was employed reason would suggest that particularly where RF treatment employs a cooling mechanism, multiple contact sites and/or multiple treatments would be obvious to attain optimal shrinkage of tissue. (EX. 1003, ¶130.)

8. Claims 49 and 57: The method of claim [], wherein the energy includes any of radiofrequency energy, microwave energy, or ultrasound energy.

Edwards describes that "In a preferred embodiment, these electrodes 423 are disposed to deliver RF energy. However, in other embodiments the electrodes 423 may also deliver microwave energy, ELF (extremely low frequency energy), laser and other forms of therapeutic energy." (EX. 1008, 7:37-42.) Ingles noted that "focused ultrasound energy is particularly well suited for heating and shrinking the pelvic support tissues from a vaginal probe." (EX. 1010, 8:45-52; Fig. 13.) Mosher describes a vaginal probe utilizing "bipolar RF energy between alternating pairs of electrodes." (EX. 1009, ¶0058; *see also* EX. 1003, ¶ ¶40, 84; EX. 1004, ¶ ¶42-45.)

9. Claims 50 and 58: The method of claim [], wherein heating comprises delivering energy by ultrasound energy.

Edwards describes the use of various energy sources including ultrasound. (EX. 1008, 5:29-33.) Ingle also describes the delivery of ultrasound

energy. (EX. 1010, 10:36-38; 24:48-58.)

B. GROUND II: CLAIMS 43-58 ARE OBVIOUS IN LIGHT OF THE COMBINATION OF EDWARDS IN LIGHT OF KREUTER, SMITH, AND BEATTIE UNDER 35 U.S.C. § 103(a)

The basis for this Ground II can be summarized as follows. As described above, Edwards teaches the "remodeling" of the vagina insofar as it teaches that delivering RF energy to and through the vaginal wall heats supporting, connective tissue underlying/adjacent to the vaginal wall, resulting in the tightening and/or contraction of such supporting tissue, which in turn causes the tightening or contraction of the vaginal canal itself. (Supra IX.A.1.a). Because it was well-known in the art that the nature of the mucosal epithelium of the vaginal wall is the same type of simple squamous epithelial tissue which makes up not only the epithelia of other, non-vaginal female genital tissue, but also the epithelial surface of *extra*genital tissue– i.e., "normal" skin surface tissue all over the body – the vaginal tissue remodeling teachings of Edwards were obviously applicable to remodel any other bodily tissue where the dermal surface is likewise simple squamous epithelial tissue. (EX. 1003, ¶69-70.) As, e.g., Ingle teaches, this is the case in the facial, abdominal, and breast tissue. (EX. 1003, ¶54, 69, 91.) This was also well-known to be the case with the "external" female genital tissue which extends beyond the introitus – i.e. the vulva – including the labia, and specifically the labia minora. (EX. 1003, ¶54, 69, 91.)

As such, vulva-specific claims 43 (requiring heating genital tissue radiating outward from the introitus to the Hart's line), and 51 (heating the labia) are obvious over Edwards in view of the art as set forth in Ground I. But even assuming a skilled artisan's uncertainty that Edwards's vaginal teachings wee applicable to all genital tissue with simple squamous epithelia Krueter and Beattie, confirmed that application of radiant energy specifically to the vulvar tissue sufficient to heat collagenous sub-dermal tissue likewise remodels such tissue by induction of new collagen. (EX. 1003, ¶123.) Smith confirms Kreuter/Beattie teaching of vulvar remodeling were understood to apply to non-mucosal *and* the mucosal vulvar tissue nearest to the introitus, including the labia minora. (EX. 1003, ¶123.) That is, Kreuter with Beattie and Smith confirmed that the same method of heating to remodel vaginal tissuein Edwards will also remodel neighboring mucosal vulvar tissues: the genital tissue extending to the Hart's line and the labia minora.

1. Claim 43

a. Claim 43a: A method for remodeling a therapeutic zone within a target tissue the target tissue comprising tissue underlying an epithelium of female genital tissue comprising at least one of vulva, introitus and vagina tissue, the method comprising:

As described in more detail above in Section IX.A.1.a Edwards discloses this limitation.

Similarly Kreuter discloses the application of energy (Ultraviolet radiation) to treat extragenital tissues affected by lichen sclerosis. (*See generally* EX. 1010.) Kreuter and Smith disclose that LS results in epidermal atrophy, sub-epidermal (or dermal) homogenization, and hyalinization (translucence) of dermal collagen with bands of infiltrate (inflammatory cells) just beneath the squamous epithelial lining. (EX. 1014, 107; EX. 1010, 252.)). Smith notes that the "entire vulvar area (from the clitoris to the anus) may be involved" noting that the "most common areas where lichen sclerosus is found are on the labia majora and labia minora," (EX. 1014, 106) and that LS can cause the vaginal opening to become smaller and interfere with intercourse. (EX. 1014, 106.) Beattie explicitly expands on Kreuter reporting treatment of *vulvar* LS with ultraviolet radiation. (*See e*.g. EX. 1013, Beattie 343.)

b. Claim 43b: heating the target tissue, and

As described above in section IX.A.1.b., Edwards discloses this limitation.

Kreuter describes treating extra-genital LS with low dose UVA1 phototherapy at doses of 20 J/cm². (EX. 1010, 251; EX. 1004, ¶77.)

Beattie describes that for "light delivery to the perineum, the patient was positioned in stirrups in the lithotomy position to expose the inner labia and vulva on an adjustable gynaecological examination couch.) (EX. 1013, Beattie 344-45.) Table 1 of Beattie discloses the maximum doses of UV radiation

administered to patients varied from 19.2 to 130 J/cm^2. (EX. 1013, Beattie table 1.)

As described above, the "target tissue" of the '511 patent is the tissue underlying the epithelium. *See* Section VIII.A *supra*. A POSITA would have understood that the dose of UVA1 phototherapy described in Beattie would necessarily heat tissue underlying the treated epithelial surface because the threshold energy required for heat to penetrate the epidermis is 5 J/cm². (EX. 1010, 251; EX. 1004, ¶77; EX. 1003, ¶108.)

c. Claim 43c: remodeling the therapeutic zone of target tissue,

As described above in Section IX.A.1.c., Edwards discloses this limitation.

Figure 1 of Kreuter shows fibroblasts synthesizing new collagen represented by the pink coloration in the dermal in the bottom half of Figure B, which was not occurring to the necessary degree prior to UVA1 phototherapy. (EX. 1010, 253, Fig. 1; Ex. 1004, ¶80.). The synthesis of new collagen by the fibroblasts contributes to the normalization of the dermal architecture and leads to the return to normal size of the collagen bundles. *See* EX. 1010, 253, Fig. 1. Thus, Kreuter taught remodeling of target tissue underlying the extragenital epithelium where ultraviolet energy is delivered to and through that epithelial surface to heat the target tissue.

A POSITA would understand that the impact of the UVA1 treatment of extragenital LS would be replicated in the treatment of the genital LS. This was confirmed in Beattie, which discloses treatment of vulvar LS with ultraviolet radiation understood to be sufficient to heat sub-epithelial tissue as in Kreuter. (EX. 1003, ¶¶108-109 ; EX. 1004,¶77.). Because Kreuter together with Beattie teach remodeling of by heating a therapeutic zone of female genital tissue underlying the vulva.

d. Claim 43d: wherein the heating includes heating a portion radiating outward from the introitus to Hart's line.

As described above in section IX.A.1.d., Edwards discloses this limitation.

Smith notes that the "entire vulvar area (from the clitoris to the anus) may be involved" and going on to note that the "most common areas where lichen sclerosus is found are on the labia majora and labia minora." (EX. 1014, 106.) Smith also describes that LS can lead to the "fusion of the labia minora" and can cause the vaginal opening to become smaller and interfere with intercourse. (EX. 1014, 106.)

Beattie describes that for "light delivery to the perineum, the patient was positioned in stirrups in the lithotomy position to expose the inner labia and vulva on an adjustable gynaecological examination couch." (EX. 1013, 344-45.) Therefore, Beattie expressly discloses this limitation as the described treatment

of the inner labia and vulva would include the "heating a portion radiating outward from the introitus to Hart's line" limitation.

Even absent disclosure in Beattie, it would have been obvious to a POSITA that Krueter itself taught heating (and remodeling) a portion of genital tissue "radiating outward from the introitus to Hart's line" given that it was well known that application of radiant energy to heat and remodel any target tissue underlying a simple squamous epithelial tissue, which was known to line both the mucosal and non-mucosal vulvar tissue. (EX. 1010, 18:1-7 (the disclosed treatment "may even be used in cosmetic procedures … to remove wrinkles by shrinking the collagenated skin tissues ….").)

e. Reasons to combine Edwards, Kreuter, Beattie, and Smith.

Kreuter, Beattie, and Smith all describe the use of UVA1 phototherapy for the treatment of lichen sclerosus. (EX. 1012, Kreuter at 251-252; EX. 1013, Beattie at 343; EX. 1014, Smith at 119.) Beattie and Smith both specifically reference Kreuter and note the positive therapeutic results achieved by Kreuter in extragenital LS. (EX. 1013, Beattie at 343, 344; EX. 1014, Smith at 119.) Beattie sought to extend Kreuter's earlier successes in treating extragenital LS with UVA1 phototherapy to see if similar results could be achieved with respect to genital LS. (EX. 1013, Beattie at 343, 344, 346.) Beattie's results showed that UVA1 phototherapy was in fact beneficial in the management of genital LS. (*See e*.g. Ex 1013, Beattie at 343, 345.) Smith discloses that LS can occur

in genital tissue as well as other parts of the body and that UVA1 phototherapy can reduce or clear LS. (EX. 1014, Smith at 105, 119.) Accordingly, a POSITA would be motivated to combine Kreuter, Beattie, and Smith because they all disclose methods of treatment for the same medical issue using the similar forms of therapy and Beattie and Smith both specifically note the effectiveness of Kreuter's UVA1 phototherapy.

A POSITA would be motivated to combine the known elements from Kreuter, Beattie, and Smith because they would have yielded only predictable results and the combined elements would be performing the same functions to yield the expected results.

A POSITA would have been motivated to further combine the teachings of Edwards with Kreuter, Beattie, and Smith because each reference is related to the treatment of genital tissues, through the application of penetrating energy, to correct an unwanted condition. (*See e.g.*, EX. 1006, Edwards at 3:5-13; EX. 1012, Kreuter at 254; EX. 1013, Beattie at 344-346; EX. 1014, Smith at 119.) More specifically, each reference discloses a treatment that can reshape female genital tissue through the manipulation of collagen using a penetrating form of energy. (*See e.g.*, EX. 1006, Edwards at 3:5-13, 7:39-42; EX. 1012, Kreuter at 252-253; EX. 1013, Beattie at 343-346; EX. 1014, Smith at 107, 119.) Additionally, each reference also discloses a treatment targeting unwanted conditions with genital tissue that can affect sexual function. (*See e.g.*, EX.

1006, Edwards at 3:11-13; EX. 1014, Smith at 119-120.) A POSITA would be motivated to combine Edwards with Kreuter, Beattie, and Smith based on the substantial similarity in method of treatment and the area effected by the treatment.

A POSITA would have been motivated to combine the teachings of Edwards with Kreuter, Beattie, and Smith because Edwards sought to remodel the vaginal wall by applying therapeutic heating energy to targeted tissue. (EX. 1006, Edwards at 3:5-13, 13:14-22, 13:54-56.).) A POSITA would have been motivated to look to the treatments for conditions which were improved by the induction of new collagen in the target tissue and/or treatments relating to the appearance of genital tissue as abnormal or deformed. While Kreuter, Beattie, and Smith may be directed to the treatment of a different disorder, LS, they similarly described the use of radiant energy to remodel tissue at least in part based on the radiant energy heating the collagen containing tissue under the epithelium and cause the synthesis of new collagen. (EX. 1004, Tucker Decl. ¶37, 103-112.) Given that it was well known that collagen remodeling occurred in both the RF treatment of Edwards, and the phototherapy described in Kreuter, Beattie and Smith, a POSITA would be motivated to combine Edwards with Kreuter, Beattie, and Smith.

Edwards states that it is advantageous to have a safe, simple treatment to correct the unwanted genital condition. (*See e.g.*, EX. 1006, Edwards at 2:5-

13.) A POSITA would be motivated to review other non-invasive treatment methods successful in treating unwanted genital conditions to further Edwards pursuit of a safe, simple treatment. Beattie discloses that the UVA1 phototherapy was "well tolerated" by patients and "relatively easy to deliver." (EX. 1013, Beattie at 346.) Accordingly, a POSITA would have been motivated to combine the teachings of Edwards with Kreuter, Beattie, and Smith to pursue further gains in safety and simplicity for non-invasive treatments to correct the unwanted genital conditions.

Further, a POSITA would know that Designer Laser Vaginoplasty (DVL) used to aesthetically modify a patient's labia were well known and utilized similar methods of treatment on the vaginal wall and on the tissue radiating outward from the introitus to Hart's line. (*See* Section VI.D, *supra*; EX. 1011, pp.1, 2; EX. 1003, ¶¶96, 125.)

A POSITA would understand that the laser techniques practiced by Dr. Matlock, in additional to any ablative aspects, necessarily heated the target tissue. (EX. 1003, ¶¶92-102.) This heating of the target tissue necessarily caused a remodeling of at least a portion of the therapeutic zone of the target tissue by way of the denaturation of collagen. (EX. 1003, ¶¶98-100.)

2. Claim 51

a. Limitations a-c.

Claim limitations 51a-c are identical to claims 43a-c, and thus for the reasons described above in Sections IX.B.1a-c., Kreuter discloses these

limitations.

b. Claim 51d: wherein the heating includes heating a mucosal surface of the labia minora.

As discussed above section IX.B.1d., Beattie expressly discloses the treatment of the labia minor. Further, the treatment of the labia minora would have been obvious to a POSITA in light of the disclosures of Kreuter. (EX. 1004, ¶83, 112.) That heat could be used to denature collagen and remodel tissue, including the labia was well known before the filing of the application leading to the '511 patent. (EX. 1001, 1:35-61; EX. 1003, ¶32.)

Ollivier describes the use of radiant energy – specifically lasers – by physicians performing electrosurgery on female genital tissue. (EX. 1011, 2.) In response to patients' complaints regarding urinary incontinence and subpar sexual function, physicians were surgically modifying the vulva, labia, and vagina to achieve their pre-pregnancy function and appearance. (*Id*. at 2-3; EX. 1004 ¶85.)

A POSITA would have understood that during the performance of these ablative female genital tissue electrosurgeries, thermal affects were necessarily occurring in the areas surrounding the ablated tissue. (EX. 1004 ¶86; EX. 1003 ¶¶92-102.) In other words, the remodeling of collagen-containing dermal tissue was a necessary consequence of these surgeries by virtue of the properties of the heat used and its proliferation to nearby tissues that were not ablated, but were nonetheless at a sufficient temperature to effectuate change. (EX. 1004, ¶62;

EX. 1003, ¶¶92-102.)

A POSITA would have understood that RF energy could be applied to female genital tissue to cause collagen denaturation, thus remodeling it. (EX. 1004, ¶87.) A POSITA would have understood that the application of heat to sub-surface, dermal tissue throughout the body to induce collagen growth – one component of remodeling – and further suggested its curative properties when applied to the vulva. (EX. 1004, ¶88.).

3. Claims 44 and 52: The method of claim [] wherein heating the target tissue comprises heating it to a temperature between 45 degrees C and 80 degrees C.

The optimal conditions for the denaturation of collagen were already known to those in the field in light of Edwards as described above in Section IX.A.3.

4. Claims 45 and 53: The method of claim [], wherein heating comprises delivering energy by contacting the epithelium with a treatment tip, the tip including an energy delivery element.

Edwards disclose this limitation as described above in Section IX.A.4.

5. Claims 46 and 54: The method of claim [], wherein the heating is controlled by a feedback control, such that temperature does not go higher than a predetermined temperature

Edwards disclose this limitation as described above in Section IX.A.5.

6. Claims 47 and 55: The method of claim [], wherein the method further comprises cooling the epithelium.

Edwards disclose this limitation as described above in Section IX.A.6.

7. Claims 48 and 56: The method of claim [], wherein the method comprises contacting the epithelium with a treatment tip at a one or more contact sites during a procedure, the tip comprising an energy delivery element adapted to heat the target tissue.

As described above in section IX.B.4, Edwards discloses contacting the epithelium in both the anterior and posterior wall and thus discloses this limitation.

8. Claims 49 and 57: The method of claim [], wherein the energy includes any of radiofrequency energy, microwave energy, or ultrasound energy.

Edwards describes that "In a preferred embodiment, these electrodes 423 are disposed to deliver RF energy. However, in other embodiments the electrodes 423 may also deliver microwave energy, ELF (extremely low frequency energy), laser and other forms of therapeutic energy." (EX. 1006, 7:37-42.) .

9. Claims 50 and 58: The method of claim [], wherein heating comprises delivering energy by ultrasound energy.

Edwards describes the use of various energy sources including ultrasound. (EX. 1006, 5:29-33.)

X. CONCLUSION

Based on the foregoing, claims 43-58 of the ’511 recite subject matter that is unpatentable. The Petitioner requests institution of an *inter partes* review to cancel these claims.

Respectfully Submitted,

/James Trainor/
Lead Counsel
James Trainor, Reg. No. 52,297

Back-up Counsel
Dimitrios Drivas, Reg. No. 32,218

CERTIFICATION OF WORD COUNT UNDER 37 CFR § 42.24(d)

Pursuant to 37 C.F.R. §§ 42.24(d) and 42.24(a)(1), I hereby certify that the number of words in this Petition is 13,929 excluding the table of contents, table of authorities, mandatory notices under § 42.8, certificate of service, certificate of word count, and the listing of exhibits.

Respectfully Submitted,

/James Trainor/
Lead Counsel
James Trainor, Reg. No. 52,297

CERTIFICATE OF SERVICE

I, Tammy Miller, hereby certify that I am a resident of the State of California and over the age of eighteen years, and not a party to the within action; my business address is 3000 El Camino Real, 5 Palo Alto Sq., 9th Floor, Palo Alto, California, 94306. On October 20, 2017, I caused the within documents:

- Petition for *Inter Partes* Review of U.S. Patent No. 8,961,511 and accompanying exhibits referenced therein

to be served via Federal Express on the following attorney of record for Patent Owner as listed on PAIR:

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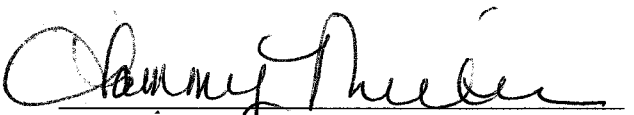
I declare that I am employed in the office of the above captioned attorney at whose direction the service was made.



Tammy Miller

Table of Exhibits for U.S. Patent 8,961,511 Petition for *Inter Partes* Review

Exhibit	Description
1001	U.S. Patent No. 8,961,511 ("'511")
1002	File History of U.S. Patent No. 8,961,511 ("'511FH")
1003	Declaration of Roger Dmochowski, M.D. ("Dmochowski Decl.")
1004	Declaration of Robert D. Tucker, M.D. ("Tucker Decl.")
1005	U.S. Published Application 2004/0000316 ("Knowlton '316)
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1023	C.V. of Roger Dmochowski, M.D.
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