

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

VISIONSENSE CORP.,
Petitioner,

v.

NOVADAQ TECHNOLOGIES INC.,
Patent Owner.

Case IPR2017-01426
Patent 8,892,190 B2

Before HYUN J. JUNG, MICHAEL L. WOODS, and
AMANDA F. WIEKER, *Administrative Patent Judges*.

JUNG, *Administrative Patent Judge*.

DECISION
Institution of *Inter Partes* Review
37 C.F.R. § 42.108

I. INTRODUCTION

Visionsense Corp. (“Petitioner”) filed a Petition (Paper 4, “Pet.”), requesting institution of an *inter partes* review of claims 1–3 of U.S. Patent No. 8,892,190 B2 (Ex. 1001, “the ’190 patent”). Novadaq Technologies Inc. (“Patent Owner”) timely filed a Preliminary Response (Paper 11, “Prelim. Resp.”). Under 35 U.S.C. § 314, an *inter partes* review may not be instituted “unless . . . there is a reasonable likelihood that the petitioner would prevail with respect to at least 1 of the claims challenged in the petition.”

Upon consideration of the Petition and Preliminary Response and for the reasons explained below, we determine that Petitioner has shown that there is a reasonable likelihood that it would prevail with respect to at least one of the challenged claims, and we institute an *inter partes* review of claims 1–3 of the ’190 patent.

A. *Related Proceedings*

The parties indicate that there are no related litigation matters. Pet. 7; Paper 6, 1 (listing only related patent applications).

B. *The ’190 Patent (Ex. 1001)*

The ’190 patent issued November 18, 2014, from an application filed March 13, 2012, which claims priority through continuation applications to application number PCT/US00/22088, filed on August 11, 2000, and a provisional application filed September 24, 1999. Ex. 1001, [22], [45], [60], [63], 1:8–16.

The ’190 patent pertains to “procedures for observing blood flow through the cardiovascular system.” *Id.* at 1:20–22. In one aspect, a method provides for analysis of patency of a portion of a blood vessel. *Id.* at 4:18–

20. Patency refers to freedom from occlusions, which occur when a blood vessel narrows to the point that it becomes completely blocked. *Id.* at 1:31–32, 1:59–60. The method can be employed “for assessing blood flow in a portion of animal tissue wherein the tissue . . . is being or has undergone an invasive procedure.” *Id.* at 5:19–22; *see also id.* at 3:12–16. In an invasive procedure, “one or more incisions are made in the tissue of an animal, or entry of an instrument into an orifice of an animal is undertaken,” which continues “until the incisions are sutured, or the instrument is withdrawn.” *Id.* at 4:35–42. An illustrative treatment includes joining a blood graft to vessel ends or bypass. *Id.* at 4:59–65. “Bypass includes . . . attaching ends of a graft vessel at locations upstream and downstream of the stenosis, occlusion or other problem,” and “an anastomosis, i.e., the junction of the native and graft vessels, is created.” *Id.* at 5:1–3, 5:12–13.

The method would allow evaluating the “extent of blood flow through vasculature located downstream of a treated vessel” to assess the success of the treatment. *Id.* at 5:22–25. Such a method includes “administering a fluorescent dye . . . , obtaining at least one angiographic image of blood flowing through the tissue portion; and evaluating the at least one angiographic image to assess blood flow in the tissue portion.” *Id.* at 5:25–30. “Angiographic images may be obtained beneath the surface of these tissues to a depth not exceeding that which permits the vasculature of interest to be evaluated.” *Id.* at 5:52–53.

The ’190 patent states that “[f]luorescent dyes emit radiation of a known wavelength when excited by radiation of a particular wavelength.” *Id.* at 6:66–67. According to the ’190 patent, “wavelengths for both absorption and emission radiation associated with such dyes” and “[d]evices

capable of detecting emissions from . . . fluorescent dyes” are well known. *Id.* at 7:12–13, 8:22–24. After administering a fluorescent imaging agent, “a device capable of exciting any of the agent,” such as a laser, and “a device capable of detecting the radiation emitted,” such as a camera capable of obtaining multiple images over time, “are activated.” *Id.* at 7:51–54, 7:63–65, 8:22–25. Leading and trailing images are acquired before and after the images of interest, which can be used to determine the “rate and volume of blood flow through the treated vessel and adjacent original vessel.” *Id.* at 10:2–17. The “camera and laser may be located external to the patient.” *Id.* at 8:61–62.

The ’190 patent provides an example in which the fluorescence imaging technique was used on a mouse femoral artery. *Id.* at 10:66–67. The skin over the artery was “resected to expose the vasculature of interest,” and a “camera was positioned so that the field of view included the femoral artery and its branches.” *Id.* at 11:55–56, 12:9–10.

C. Illustrative Claim

The ’190 patent has 3 claims, all of which Petitioner challenges. Pet. 7. Claims 1 and 3 are independent, and claim 1 is reproduced below:

1. A method for assessing blood flow moving through a vessel graft anastomosed in fluid communication with an interconnected group of blood vessels in an animal, the vessel graft and at least a portion of the blood vessels being exposed during a surgical procedure on the animal, the method comprising the steps of:

(a) administering a fluorescent dye to the animal such that the dye enters the vessel graft and the interconnected group of blood vessels;

(b) exciting the fluorescent dye within the vessel graft and said exposed portion of the interconnected group of blood vessels

with a source of illumination, thus causing the dye to emit radiation;

(c) capturing the radiation emitted by the fluorescent dye with a camera capable of imaging a series of angiographic images within the vessel graft and said exposed portion of the interconnected group of blood vessels, the images including at least an image of a fluorescent wavefront corresponding to an interface between the flowing blood that first contains the fluorescent dye introduced, such image being captured by the camera as the fluorescent wavefront transitions through the exposed vessel graft and interconnected group of blood vessels; and

(d) evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels.

Ex. 1001, 13:36–14:16.

D. Asserted Grounds

Petitioner challenges the claims as follows:

| Reference(s) | Basis | Claims Challenged |
|--|----------|-------------------|
| Little ¹ | § 102(b) | 1 and 2 |
| Little, Flower I ² , and Flower II ³ | § 103(a) | 1–3 |
| Flower I, Flower II, and Little or Goldstein ⁴ | § 103(a) | 1–3 |

¹ John R. Little et al., *Superficial Temporal Artery to Middle Cerebral Artery Anastomosis*, 50 J. Neurosurg. 560–569, (1979) (Ex. 1002).

² US 6,351,663 B1, filed Sept. 10, 1999, issued Feb. 26, 2002 (Ex. 1003).

³ US 5,394,199, filed May 17, 1993, issued Feb. 28, 1995 (Ex. 1005).

⁴ James A. Goldstein et al., *Intraoperative Angiography to Assess Graft Patency After Minimally Invasive Coronary Bypass*, 66 Ann Thorac Surg 1978–82, (1998) (Ex. 1007).

| Reference(s) | Basis | Claims Challenged |
|---|----------|-------------------|
| Jibu ⁵ , Flower I, and Little or Goldstein | § 103(a) | 1–3 |

In support of its proposed grounds, Petitioner relies on a Declaration of David J. Langer, M.D. (Ex. 1017, “Langer Declaration” or “Langer Decl.”). Patent Owner relies on a Declaration of Brian Wilson (Ex. 2002).

II. ANALYSIS

A. Claim Construction

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2144–46 (2016) (upholding the use of the broadest reasonable interpretation standard).

Petitioner states that the “plain language of the claims appears understandable under the broadest reasonable construction” but makes comments regarding certain limitations. Pet. 19–20 (citing Ex. 1001, 1:36–41, 4:15–17). Petitioner also “reserves the right to respond to any claim construction arguments made by the patent owner.” *Id.* at 19. Patent Owner states that it “agrees that the broadest reasonable construction of vessel graft is not limited as to particular vasculature” (Prelim. Resp. 8) and proposes interpretations for several other terms (*id.* at 8–12).

For the purposes of determining whether Petitioner demonstrates a reasonable likelihood of prevailing in its challenges, we need only consider

⁵ Japanese Laid Open Patent Publication No. H9-309845, published Dec. 2, 1997 (Ex. 1004).

Patent Owner's proposed interpretation of "exposed." *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999) (Only those terms in controversy need to be construed, and only to the extent necessary to resolve the controversy).

Patent Owner contends that the "ordinary meaning of 'exposed' is laid open to view" and thus, "should be construed as meaning that the vessel graft and at least a portion of the blood vessels are laid open to view," that is "any tissue covering the vessels is removed so that the vessels are viewable." Prelim. Resp. 8–9 (citing Ex. 1001, 11:55–56; Ex. 2004 (excerpt of *Merriam Webster's Medical Desk Dictionary*)).

On the current record, we are not persuaded that "exposed" requires removing tissues so that the vessels are viewable. Patent Owner cites a portion of the '190 patent that comes from a section titled "Example" and that is introduced with the statements "advantages of the present invention are further illustrated by the following example" and "particular details set forth therein should not be construed as a limitation on the claims." Ex. 1001, 10:38–42. In describing the example, the '190 patent states "skin over the femoral vasculature was resected to expose the vasculature of interest," which is one of several measures taken to "facilitate imaging of the vessels of interest." *See id.* at 11:52–56. Also, before the example, the '190 patent states that "[a]ngiographic images may be obtained beneath the surface of these tissues to a depth not exceeding that which permits the vasculature of interest to be evaluated" and that "the camera and laser may be located external to the patient." *Id.* at 5:52–55, 8:61–62.

Furthermore, Patent Owner cites a definition of "expose," specifically "2: to lay open to view: as . . . b: to reveal (a bodily part) esp. by dissection."

Prelim. Resp. 8–9 (citing Ex. 2004); Ex. 2004, 3–4. The cited definition indicates that a bodily part need not be laid open to view only by dissection. The cited definition does not exclude being laid open to view by other means.

In view of the foregoing, we preliminarily interpret “exposed” as being “laid open to view” by any means.

B. Level of Ordinary Skill

Petitioner asserts a level of ordinary skill. Pet. 18 (citing Langer Decl. ¶ 10). We adopt the Petitioner’s level of ordinary skill for purposes of this Decision.

C. Anticipation based on Little

Petitioner contends that claims 1 and 3 are anticipated by Little (Ex. 1002). Pet. 9, 26–31. In support of these contentions, Petitioner cites to Little and the Langer Declaration. *See id.* at 26–31.

1. Little (Ex. 1002)

Little states that fluorescein angiography was performed on patients undergoing “superficial temporal artery (STA) to middle cerebral artery (MCA) anastomosis.” Ex. 1002, 560. Little also states that fluorescein angiography “provided immediate assessment of anastomotic patency and clearly displayed the distribution of blood entering the epicerebral circulation through the STA.” *Id.*

According to Little, the “technique of fluorescein angiography has been described in detail elsewhere.” *Id.* at 562. Little describes sodium fluorescein being injected rapidly through a catheter and serial photographs being taken with a motorized camera. *Id.* Figure 1 of Little is reproduced below.

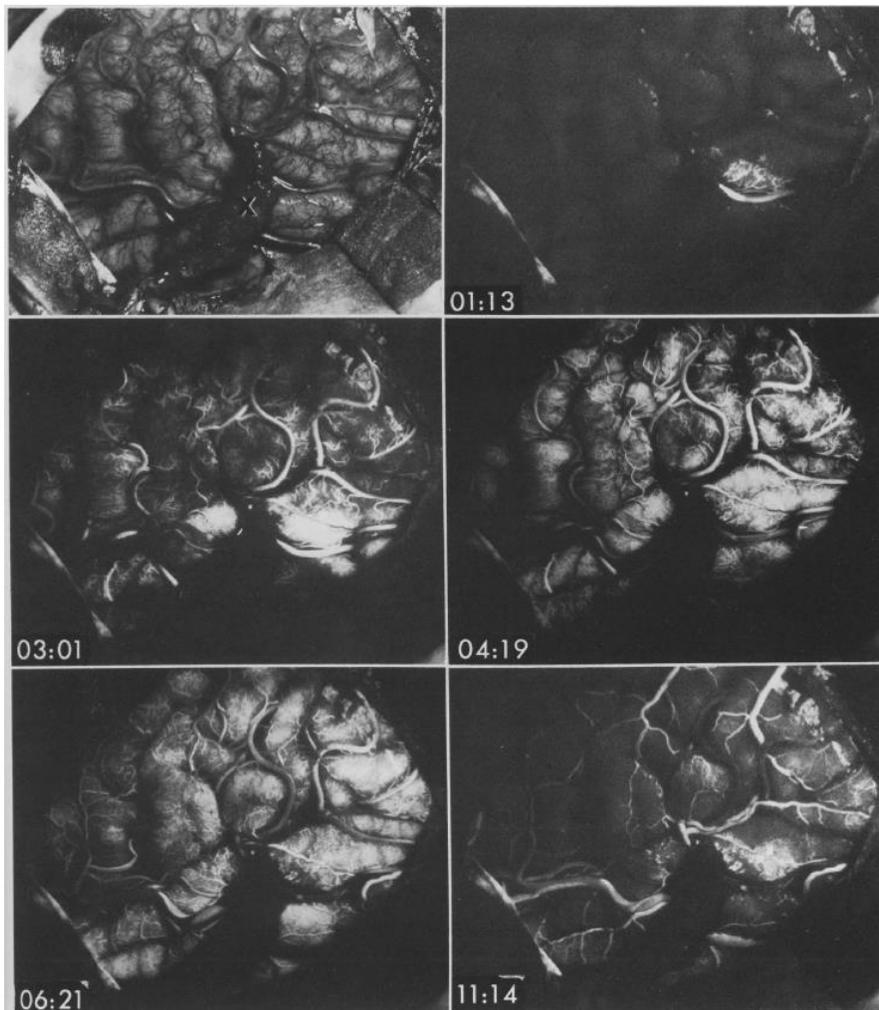


Figure 1 is a “[f]luorescein angiography after anastomosis.” *Id.* at 563. “Fluorescein angiography showed the distribution of blood supplied by the STA through anastomosis.” *Id.* at 564. “The superficial temporal artery was covered by a generous cuff of connective tissue and fat (X).” *Id.* at 563. “At 01:13 seconds following injection of fluorescein, filling of the cortical receptor artery was observed.” *Id.*

2. Claims 1 and 2

Petitioner refers to the preamble of claim 1 as the “Vessel Graft Preamble,” step (a) of claim 1 as the “Administering Step,” step (b) as the “Illuminating Step,” step (c) as the “Wavefront Capture Step,” and step (d)

as the “Evaluation Step.” *Id.* at 26–30. This Decision also refers to the preamble and steps of claim 1 using Petitioner’s labels.

Petitioner contends that Little discloses the limitations of claims 1 and 2. Pet. 26–31 (citing Ex. 1002, 560, 562–564, Figs. 1, 2; Langer Decl. ¶¶ 35, 37, 39, 41, 43–45, 47, 48); *see also id.* at 20–21 (asserting what Little discloses). In particular, for the Evaluation Step, Petitioner cites Figure 1 of Little and argues that its images show “filling of the cortical receptor artery, the site of the vessel graft upstream of the anastomosis,” “the evaluation of the cortical branches,” and “a comparison between the blood flow through the vessel graft area and the flow in the interconnected vessels.” *Id.* at 29–30 (citing Ex. 1002, 563, 564). Petitioner also argues that the caption of Figure 1 “notes transition of blood with fluorescent dye to the artery downstream of the graft, thus demonstrating the evaluation of the graft.” *Id.* at 29 (citing Ex. 1002, 562, 563). Petitioner also cites to paragraphs 43–45 of its Langer Declaration. *Id.* at 30. As for claim 2, Petitioner argues that Little discloses “modifying said anastomosed vessel graft based on results of said evaluation step, thereby improving resultant blood flow through said vessel graft.” *Id.* at 30–31 (citing Ex. 1002, 562; Langer Decl. ¶¶ 47, 48).

Patent Owner responds that Little fails to disclose “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft.” Prelim. Resp. 23–24. Patent Owner argues that Little does not image the blood flow in the vessel graft “due to the covering of the vessel graft by a generous cuff of connective tissue and fat.” *Id.* at 24 (citing Pet. 28–29 (citing Ex. 1002, Fig. 1)). Patent Owner contends that Little describes an STA-to-MCA anastomosis, in which the STA is the vessel graft that is attached to the MCA. *Id.* at 25 (citing Ex. 1002, 560; Ex. 2002, 6–7). Patent Owner also

contends that Little states that the STA or vessel graft is covered by connective tissue and fat and thus, the vessel graft is not visible in any of Figures 1–4 of Little. *Id.* at 25–27 (citing Ex. 1002, 562, Fig. 1; Ex. 2002, 6–8, 10, 11). Patent Owner further contends that no fluorescence radiation is captured in the area of the vessel graft. *Id.* at 27–30 (citing Ex. 2002, 8–11). Patent Owner also asserts that Petitioner mischaracterizes Little. *Id.* at 28 (citing Pet. 29; Ex. 1002, 562; Langer Decl., 19; Ex. 2002, 9)

Based on similar arguments that Little does not image the blood flow in the vessel graft, Patent Owner also responds that Little fails to disclose “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels” because Little does not disclose images that capture blood flow through the vessel graft and that Little fails to disclose the “vessel graft . . . being exposed” because Little’s STA is not laid open to view. Prelim. Resp. 24, 30–34 (citing Pet. 20, 26–27, 30; Ex. 1002, 564; Ex. 2002, 10–12).

Patent Owner’s arguments are persuasive. Petitioner provides insufficient evidence that Little discloses “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft,” as required by claim 1. We agree with Patent Owner that the figures of Little do not show radiation from the dye within the vessel graft because, in Figure 1, the vessel graft “was covered by a generous cuff of connective tissue and fat” (Ex. 1002, 563). The other figures of Little also do not show radiation from within a vessel graft. *See* Ex. 1002, Figs. 2–4. Further, the cited paragraphs of Petitioner’s Langer Declaration state that Figure 1 shows “filling of the cortical receptor artery, the site of the vessel graft upstream of the anastomosis” and “transition of blood with fluorescent dye to the artery downstream of the

graft.” Langer Decl. ¶ 43. The Langer Declaration does not address sufficiently “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft,” as required by claim 1. Further, Petitioner’s arguments and evidence for claim 2 do not add to its arguments regarding the Wavefront Capture Step. *See* Pet. 30–31.

Thus, we determine that the information presented in the Petition fails to show a reasonable likelihood that Petitioner would prevail in proving claims 1 and 2 are anticipated by Little.

D. Obviousness Based on Little

Petitioner contends that Little (Ex. 1002), Flower I (Ex. 1003), and Flower II (Ex. 1005) would have rendered obvious claims 1–3 of the ’190 patent, with citations to these asserted references and the Langer Declaration (Ex. 1017). Pet. 31–39.

1. Flower I (Ex. 1003)

Flower I “relates generally to methods for diagnosing and treating conditions associated with abnormal vasculature.” Ex. 1003, 1:8–10. According to Flower I, “[f]luorescent dyes . . . have been used for years in connection with angiography to diagnose and treat vascular abnormalities that occur in the eye.” *Id.* at 1:12–15. “Angiograms are images of blood vessels, obtained by injecting a fluorescent dye into the blood stream prior to obtaining an image.” *Id.* at 1:35–37. A “camera begins capturing images, i.e., angiograms . . . at specific time intervals” to “provide a record of the extent of dye movement.” *Id.* at 1:45–47.

Flower I provides a “method for enhancing clarity of fluorescent dye angiograms using relatively high dye concentrations” that “allows blood vessels . . . to be more readily identified, and thereafter treated” or “for

determining the direction of blood flow within a vessel.” *Id.* at 2:19–25, 2:46–47. The enhancement is provided by introducing “relatively small, yet highly dye-concentrated, boluses of a fluorescent dye composition” at spaced time intervals, which is believed to generate more photons upon exposure to radiation at a dye “wave front.” *Id.* at 3:63–65, 4:26, 4:36–45. The preferred fluorescent dye is indocyanine green (“ICG”). *Id.* at 5:46.

2. *Flower II (Ex. 1005)*

Flower II relates to a “pixel-by-pixel subtraction of an image from a succeeding image in an ICG angiographic sequence of images.” Ex. 1005, 3:56–59. According to Flower II, the resulting image sequence “shows fluorescence arising only from structures where the most rapid movement of blood occurs.” *Id.* at 3:59–61.

Flower II states that “of great interest to scientists studying the eye, is the choriocapillaris, one of three blood vessel layers of the choroid,” and “with respect to clinical choroidal angiography, ICG angiography provides the best temporal and spatial resolution.” *Id.* at 1:20–22, 2:13–15. After injecting an ICG dye bolus, Flower II describes that ICG angiograms can “show the complete cycle of dye passage.” *Id.* at 2:30–32. Flower II also states that “progression of a sharply defined wavefront is more easily tracked through the capillary network than an ill-defined one.” *Id.* at 2:40–42.

3. *Claims 1–3*

As discussed above, Petitioner argues that Little anticipates claims 1 and 2. Pet. 31–35 (citing Ex. 1002, 560, 562, 563, 564, Fig. 1). Petitioner also argues that, to the extent that Little does not disclose fully the Wavefront Capture Step and the Evaluation Step of claim 1, these steps would have been obvious in view of Flower I and Flower II. Pet. 32–33

(citing Ex. 1003, 4:36–46; Ex. 1005, 2:28–29, 2:40–42; Langer Decl. ¶ 53), 34–35 (citing Ex. 1003, 8:46–49, 9:23–26, 10:8–19; Ex. 1005 Abstract, 2:40–42, 3:56–62; Langer Decl. ¶¶ 58–59); *see also id.* at 31 (arguing Flower I and Flower II use ICG dye which was well known to persons skilled in the art).

In particular, for the Wavefront Capture Step, Petitioner contends that Flower I teaches or suggests “angiographic observation of the wavefront of the fluorescent dye as it transmits through the blood vessels” (*id.* at 32 (citing Ex. 1003, 4:36–46)) and that Flower II similarly recognizes “angiographically tracking a sharply-defined fluorescent-dye wavefront through a vascular network” (*id.* at 32–33 (citing Ex. 1005, 2:40–42)). Petitioner asserts that, in view of Flower I and Flower II, one of ordinary skill in the art would have been motivated to “angiographically capture the wavefront in tracking the flow of dye through a vascular graft.” *Id.* at 33 (citing Langer Decl. ¶ 53).

For the Evaluation Step, Petitioner contends that Flower I teaches or suggests “methods for using fluorescent dyes to evaluate vascular abnormalities” (*id.* at 34–35 (citing Ex. 1003, 8:46–49, 9:23–26, 10:8–19)) and Flower II teaches or suggests a “method for generating angiograms to show blood flow through certain blood vessels, including aberrant vessels” (*id.* at 35 (citing Ex. 1005 Abstract, 2:40–42, 3:56–62)). Petitioner asserts that, in view of Flower I and Flower II, one of ordinary skill in the art would have understood that “widely-known fluorescent dye evaluative techniques, could be used to track the flow of dye in a clinical situation such as that described in Little.” *Id.* at 35 (citing Langer Decl. ¶¶ 58–59). Petitioner also

provides arguments for claim 3. *Id.* at 36–39 (citing Ex. 1003, 1:42–47, 5:41–55, 10:3–7; Ex. 1005, 4:64–65; Langer Decl. ¶¶ 62–64, 66–68).

Patent Owner responds that, for claims 1 and 2, Little fails to teach or suggest “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft,” “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels,” and the “vessel graft . . . being exposed,” as required by claim 1, for the same reasons asserted in connection with the anticipation challenge based on Little. Prelim. Resp. 34–38.

Patent Owner also responds that Flower I and Flower II fail to cure the deficiencies of Little. *Id.* In particular, Patent Owner contends that Flower I and Flower II fail to cure the deficiencies because “they are not directed to vessel graft procedures,” “do not provide any teaching that the vessel graft should be imaged,” do not teach or suggest tracking dye through a vascular graft, and do not teach or suggest exposing vessels for imaging. *Id.* at 35–36, 38, 40.

At this stage, Petitioner provides sufficient argument and evidence indicating that the combination of Little, Flower I, and Flower II teaches or suggests “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft” and “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels.” *See* Pet. 32–35 (citing Ex. 1003, 4:36–46, 8:46–49, 9:23–26, 10:8–19; Ex. 1005 Abstract, 2:28–29, 2:40–42, 3:56–62; Langer Decl. ¶¶ 53, 58–59), 36–39 (arguments for claim 3) (citing Ex. 1003, 1:42–47, 5:41–55, 10:3–7; Ex. 1005, 4:64–65; Langer Decl. ¶¶ 62–64, 66–68). Also, as discussed above, on the current record, we are

not persuaded to adopt an interpretation of “exposed” as requiring removing tissues so that the vessels are viewable.

Furthermore, Petitioner provides sufficient argument and evidence that one of ordinary skill would apply Flower I and Flower II to Little. *See* Pet. 33, 35 (citing Langer Decl. ¶¶ 53, 58–59). Petitioner’s declarant testifies that Flower I and Flower II provide motivation because they disclose a known technique that can be applied to Little with predictable results. *See* Langer Decl. ¶¶ 53, 58–59 (citing Ex. 1003, 4:36–46, 8:46–49, 9:23–26, 10:8–19; Ex. 1005 Abstract, 2:28–29, 2:40–42, 3:56–62); *see also* Ex. 1003, 8:46–49 (stating “[i]llustrative of body tissues associated with suitable cavities” is the “heart.”), 9:23–27 (stating “[c]onventional . . . surgical intervention, may also be used . . . in combination with the treatment methods of the present invention.”), 10:12–19 (stating “the method of visualizing and treating blood vessels” is “equally applicable to . . . determining blood flow direction”); Ex. 1005, 2:40–41 (stating that a “progression of a sharply defined wavefront is more easily tracked”).

Petitioner, thus, demonstrates a reasonable likelihood of prevailing in its challenge of claims 1–3 as rendered obvious by Little, Flower I, and Flower II.

E. Obviousness Based on Flower I

Petitioner contends that Flower I (Ex. 1003), Flower II (Ex. 1005), and Little (Ex. 1002) or Goldstein (Ex. 1007) would have rendered obvious claims 1–3 of the ’190 patent, with citations to these asserted references and the Langer Declaration (Ex. 1017). Pet. 39–46.

1. Goldstein (Ex. 1007)

Goldstein studies intraoperative angiography performed to confirm graft patency during a minimally invasive coronary artery bypass grafting. Ex. 1007, 1978. It finds that “intraoperative identification of graft compromise facilitated timely graft revision . . . thereby ensuring a widely patent graft and excellent flow before chest closure.” *Id.* at 1981.

Goldstein states that “[a]fter anastomosis was completed but before closure of the thoracotomy incision, graft angiography was performed.” *Id.* at 1979. The “graft, anastomoses, and native vessel were analyzed for patency and flow.” *Id.* Goldstein’s imaging system is a “digital x-ray imaging system” with a “pulsed fluoroscopic system . . . capable of 30 frames per second dynamic acquisition and playback.” *Id.* The images “can be viewed . . . as still images.” *Id.* Figure 1 of Goldstein is reproduced below.

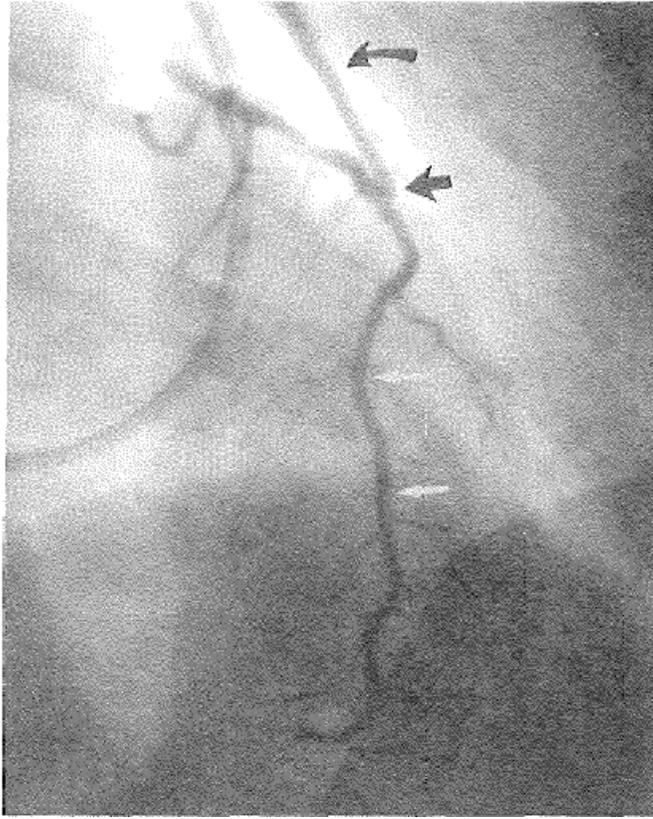


Figure 1 is an intraoperative angiogram showing an artery graft (curved arrow) with anastomosis (dark, straight arrow) with excellent flow into another artery (white arrows). *Id.* at 1980.

2. Claims 1–3

Petitioner contends that Flower I teaches or suggests the Vessel Graft Preamble, the Administering Step, the Illuminating Step, the Wavefront Capture Step, and the Evaluation Step. Pet. 39–42 (citing Ex. 1003 3:4–17, 4:36–46, 8:46–49, 9:23–26, 10:8–19, 10:38–50; Ex. 1005 Abstract).

Petitioner also contends that Flower II teaches or suggests administering dye by way of boluses (*id.* at 40 (citing Ex. 1005, 9:39–43; Langer Decl. ¶ 71)), teaches or suggests the Illuminating Step (*id.* at 41 (citing Ex. 1005, 10:13–16)), recognizes the “utility of angiographically tracking a sharply-defined fluorescent-dye wavefront through a vascular network” (*id.* (citing Ex. 1005,

2:40–42; Langer Decl. ¶ 73)), and teaches or suggests a “method of generating angiograms to show blood flow through certain blood vessels” (*id.* at 41–42 (citing Ex. 1005, 2:40–42, 3:56–62)). Petitioner asserts that Flower I and Flower II “provide a general teaching for using fluorescence imaging to evaluate blood flow through vessels and diagnosing abnormal vasculature.” *Id.* at 42 (citing Langer Decl. ¶ 74).

Petitioner argues that Little teaches or suggests extracorporeal illumination (*id.* at 41 (citing Ex. 1003; Langer Decl. ¶ 72)) and evaluation of blood flow through a vessel graft relative to interconnected vessels (*id.* at 42 (citing Ex. 1002, 563, Fig. 1)). Petitioner cites Goldstein as also teaching the evaluation of blood flow through a vessel graft relative to interconnected vessels. *Id.* (citing Ex. 1007, 1980, Figs. 1–3).

Petitioner contends that one of ordinary skill in the art would have concluded that the method of Flower I would be applicable to Little or Goldstein. *Id.* at 40 (citing Ex. 1002, 560; Ex. 1007, 1979; Langer Decl. ¶ 70). Petitioner also argues that the “[a]pplication of the evaluative techniques described in the Flower references to the clinical settings in Little and Goldstein is obvious.” *Id.* at 42 (citing Langer Decl. ¶ 75).

For dependent claim 2, Petitioner contends that both Little and Goldstein teach or suggest the Modifying Step. *Id.* at 42–43 (citing Ex. 1002, 562; Ex. 1007, 1979, 1980; Langer Decl. ¶ 77). For claim 3, Petitioner addresses only two limitations found in addition to those in claim 1 and argues that Flower I teaches or suggests the 800–850 Wavelength Requirement and 15 Image/Second Requirement. *Id.* at 43–44 (citing Ex. 1003, 1:42–47, 5:41–55, 10:3–7). Petitioner also cites Flower II for the 800–850 Wavelength Requirement and 15 Image/Second Requirement. *Id.*

at 44 (citing Ex. 1005, 3:56–62). Petitioner contends that one of ordinary skill in the art would be motivated to use ICG, and that Flower I and Flower II would have rendered obvious the use of frame rates in excess of 15 frames per second. *Id.* at 44 (citing Ex. 1005, 1:63–2:9; Langer Decl. ¶¶ 79, 80).

Petitioner provides reasons for combining Flower I, Flower II, and Little so that claim 3 would have been obvious. Pet. 45–46 (citing Langer Decl. ¶¶ 82–85). According to Petitioner, one of ordinary skill in the art would be motivated to “use these in the experiments described in Little to simplify the imaging and enhance the recording and playback.” *Id.* at 45 (citing Langer Decl. ¶ 82). Petitioner also asserts that Flower I and Flower II would motivate trying their process to look at grafts and that using the ICG-based methods of Flower I and Flower II would yield predictable results. *Id.* at 45–46 (Ex. 1003, 3:14–17; Ex. 1005 Abstract; Ex. 1016, 272; Langer Decl. ¶¶ 83, 84).

On the current record, Petitioner provides sufficient argument and evidence to demonstrate a reasonable likelihood of prevailing on its challenge based on Flower I, Flower II, and Little or Goldstein.

Patent Owner responds that Petitioner’s proposed combination of Flower I, Flower II, and Little or Goldstein fails to teach or suggest “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels.” Prelim. Resp. 40–41. In particular, Patent Owner argues that Petitioner “fails to establish any teaching of comparing the degree of blood flow through the vessel graft to the degree of blood flow through the interconnected group of blood vessels” because Little “imag[es] blood flow in downstream vessels,” Goldstein “determin[es] whether there is blood flow

or not in the vessel graft and the portion of the native vessel downstream from the anastomosis,” and Flower I and Flower II “are not directed to vessel grafting.” *Id.* at 41. Patent Owner contends that Flower I, Flower II, and Goldstein fail to teach or suggest “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels,” as required by the challenged claims, because Goldstein does not assess the degree of blood flow in the vessel graft, does not assess the degree of blood flow in the interconnected group of blood vessels, and does not compare the two. *Id.* at 42–45 (citing Ex. 1007, 1978–1981, Figs. 1, 4). Patent Owner also contends that Goldstein “simply determin[es] that blood is present in an area,” does not “make a relative assessment,” evaluates a single image, and “does not show how fast the blood flowed through the area.” *Id.* at 46–47.

Petitioner, however, proposes applying Flower I, which teaches “obtaining . . . angiographic images . . . as the dye enters the blood vessels . . . and continues to flow through the blood vessels” (Ex. 1003, 10:46–50), and Flower II, which teaches angiograms that “show the complete cycle of dye passage” with a “sharply defined wavefront” (Ex. 1005, 2:30–32, 2:40–42), to the intraoperative angiography of Goldstein that would help to “provide[] timely data that could influence intraoperative treatment” (Ex. 1007, 1980). *See* Pet. 39–42. Moreover, Goldstein states that its “digital x-ray imaging system” is “capable of 30 frames per second dynamic acquisition and playback” and that its images “can be viewed . . . as still images.” Ex. 1007, 1979. At this stage of the proceeding, Petitioner presents sufficient argument and evidence that Flower I, Flower II, and Goldstein, through a series of images, can assess the degree of blood flow in the vessel graft,

assess the degree of blood flow in the interconnected group of blood vessels, and compare the two.

Patent Owner also cites its arguments against Petitioner’s anticipation challenged based on Little and obviousness challenge based on Flower I, Flower II, and Little. Prelim. Resp. 42; *see also id.* at 48–49 (arguing that Flower I, Flower II, and Goldstein fail to teach or suggest the “vessel graft . . . being exposed” for the reasons asserted against the obviousness challenge based on Little, Flower I, and Flower II). For the reasons stated above, we determine that Petitioner demonstrates a reasonable likelihood of prevailing in its challenge based on Flower I, Flower II, and Little, but not Little alone.

Patent Owner also responds that Goldstein fails to teach or suggest “any of its imaged blood vessels were exposed for imaging” and that “x-ray angiography does not require exposure of blood vessels.” *Id.* at 48–49. As discussed above, the current record does not persuade us to adopt an interpretation of “exposed” as requiring removing tissues so that the vessels are viewable.

Patent Owner further responds that Petitioner provides insufficient reasoning for its proposed combination of Flower I, Flower II, and Goldstein. Prelim. Resp. 49–50. Patent Owner contends that “Petitioner does little more than state the legal conclusion [of obviousness] by itself.” *Id.* at 50. Petitioner, however, argues, *inter alia*, that Flower I and Flower II would motivate trying their process to look at grafts, and using the ICG-based methods of Flower I and Flower II would yield predictable results. Pet. 45–46 (citing Langer Decl. ¶¶ 82–85).

For the reasons above and on the current record, Petitioner demonstrates a reasonable likelihood of prevailing in its challenge of claims 1–3 as rendered obvious by Flower I, Flower II, and Little or Goldstein.

F. Obviousness Based on Jibu

Petitioner contends that Jibu (Ex. 1004), Flower I (Ex. 1003), and Little (Ex. 1002) or Goldstein (Ex. 1007) would have rendered obvious claims 1–3 of the '190 patent, with citations to these asserted references and the Langer Declaration. Pet. 46–51.

Patent Owner responds that “Petitioner has failed to meet its evidentiary burden of providing a copy of *Jibu* in its original Japanese and an affidavit attesting to the accuracy of the English translation of *Jibu*.” Prelim. Resp. 50; *see also id.* at 51–52 (arguing Jibu should not be considered as evidence).

This Decision considers the submitted translation of Jibu on the merits; however, as directed below in the Order, Petitioner must file Jibu’s original application and an affidavit attesting to the accuracy of Jibu (Ex. 1004). 37 C.F.R. § 42.63.

1. Jibu (Ex. 1004)

Jibu provides “near-infrared ray fluorescent tracer and fluorescence imaging method.” Ex. 1004, 1. The “near-infrared tracer is introduced into a living body, the living body is irradiated with excitation light, and the near-infrared ray fluorescent light is detected from the tracer.” *Id.* The tracer allows “extracorporeally measuring the inner state of a living body sample.” *Id.* at 3. The tracer can be used to detect cancer cells, position and size of a tumor, and flow of neuronal axon. *Id.* at 6. Figures 3–5 of Jibu show reflected light images and infrared fluorescent images at various times after

administering indocyanine green and high-density lipoprotein or ICG-HDL. *Id.* at 7, 9–10.

2. *Claims 1–3*

Petitioner argues that Jibu teaches “real time imaging (e.g., during surgery),” Little teaches a similar technique for reviewing grafts, and Goldstein teaches fluoroscopic x-ray equipment to image the heart before and after vessel grafts during surgery. Pet. 48 (citing Ex. 1002, 560; Ex. 1007, 1978; Ex. 1004, 15–16; Langer Decl. ¶¶ 86, 87). Petitioner contends that one of ordinary skill in the art would be motivated to apply Jibu’s technique to the graft surgery of Little or Goldstein. *Id.* (citing Langer Decl. ¶ 88).

Petitioner also argues that Jibu teaches or suggests the steps of claim 1. *Id.* at 49–50 (citing Ex. 1004, 3, 8, 10, 11, 15). Petitioner further argues that Jibu teaches or suggests the requirements of claims 2 and 3. *Id.* at 50–51 (citing Ex. 1004, 7–8, 10, 13–16; Ex. 1006; Ex. 1009, 19–20; Ex. 1010, 5–6; Langer Decl. ¶¶ 93, 95, 96). Petitioner contends that in view of Jibu’s capture technique and Flower I’s recommendation of observing the wavefront or Little’s teaching of wavefront imaging during graft surgery, the Wavefront Capture Step would have been obvious. *Id.* at 49 (citing Ex. 1002, 562; Ex. 1003, 4:36–46; Langer Decl. ¶ 91).

Patent Owner responds that Jibu does not cure the deficiencies of Flower I, Little, and Goldstein. Prelim. Resp. 50. Patent Owner also responds that the combination of references fail to teach or suggest “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels.” *Id.* at 51. In particular, Patent Owner contends that Jibu is not

directed to vessel grafting, imaging of vessels, and assessment of blood flow within vessels. *Id.* at 52–53 (citing Pet. 46–51; Ex. 1004, 8).

At this stage, Petitioner provides sufficient argument and evidence that a person having ordinary skill in the art would have applied Jibu’s intraoperative fluorescent techniques to Little’s or Goldstein’s graft surgeries or to observe Flower I’s vascular abnormalities. Pet. 48 (citing Langer Decl. ¶ 88). Petitioner’s asserted application of Jibu’s technique to the graft surgery of Little is sufficient for the step of “capturing the radiation emitted by the fluorescent dye . . . within the vessel graft,” as required by claim 1. *Id.* at 49 (citing Ex. 1002, 562; Ex. 1003, 4:36–46; Langer Decl. ¶ 91). Petitioner’s argument and evidence are sufficient to indicate that Jibu’s technique allows capturing the radiation within a vessel graft “covered by [the] generous cuff of connective tissue and fat” present in Little. *Id.* (citing Ex. 1002, 562; Ex. 1003, 4:36–46; Langer Decl. ¶ 91). Also, for the reasons discussed above, at this stage of the proceeding, Petitioner sufficiently demonstrates that Goldstein teaches or suggests “evaluating the angiographic images to assess blood flow through the vessel graft relative to blood flow through the interconnected group of blood vessels.” *Id.* at 49–51 (citing Langer Decl. ¶ 92).

Petitioner also provides arguments based on related foreign applications. *Id.* at 47–48. We agree with Patent Owner that those arguments are not relevant to the challenged claims. *See* Prelim. Resp. 53–54.

Therefore, Petitioner demonstrates a reasonable likelihood of prevailing in its challenge of claims 1–3 as rendered obvious by Jibu, Flower I, and Goldstein.

III. CONCLUSION

For the foregoing reasons, we determine that the information presented in the Petition in view of the Preliminary Response shows a reasonable likelihood that Petitioner would prevail in proving the unpatentability of claims 1–3 of the '190 patent.

At this stage of the proceeding, the Board has not made a final determination as to the patentability of any challenged claim or any underlying factual and legal issues.

IV. ORDER

Accordingly, it is:

ORDERED that, pursuant to 35 U.S.C. § 314(a), an *inter partes* review is hereby instituted as to claims 1–3 of U.S. Patent No. 8,892,190 B2 on the grounds that

claims 1–3, under 35 U.S.C. § 103(a), are unpatentable over Little, Flower I, and Flower II,

claims 1–3, under 35 U.S.C. § 103(a), are unpatentable over Flower I, Flower II, and Little or Goldstein, and

claims 1–3, under 35 U.S.C. § 103(a), are unpatentable over Jibu, Flower I, and Little or Goldstein;

FURTHER ORDERED that *inter partes* review commences on the entry date of this Order, and pursuant to 35 U.S.C. § 314(c) and 37 C.F.R. § 42.4, notice is hereby given of the institution of a trial;

IPR2017-01426
Patent 8,892,190 B2

FURTHER ORDERED that the trial is limited to the grounds of unpatentability listed above, and no other grounds of unpatentability are authorized for *inter partes* review;

FURTHER ORDERED that Petitioner file the original application related to Jibu (Ex. 1004) and an affidavit attesting to the accuracy of Jibu (Ex. 1004) within ten business days of the entry date of this Decision; and

FURTHER ORDERED that Patent Owner has five business days after being served with the original application and affidavit to serve an objection.

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