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Paper 16
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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

FUJITSU NETWORK COMMUNICATIONS, INC.,
CORIANT OPERATIONS, INC., CORIANT (USA) INC., and
CIENA CORPORATION
Petitioner,

v.

CAPELLA PHOTONICS, INC.,
Patent Owner.

Cases IPR2015-00727[1]
Patent RE42,678 E

Before JOSIAH C. COCKS, KALYAN K. DESHPANDE, and JAMES A. TARTAL, *Administrative Patent Judges*.

TARTAL, *Administrative Patent Judge.*

FINAL WRITTEN DECISION

35 U.S.C. § 318(a) and *37 C.F.R. § 42.73*

[1] IPR2015-01961 was joined with IPR2015-00727 on March 21, 2016, by Order in IPR2015-01961, Paper 14 (IPR2015-00726, Paper 26).

I. INTRODUCTION

Petitioner, Fujitsu Network Communications, Inc., Coriant Operations, Inc., Coriant (USA) Inc., and Ciena Corporation filed petitions requesting an *inter partes* review of claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53 and 61–65 of U.S. Patent No. RE42,678 E ("the '678 patent"). Paper 1 ("Pet."). Paper 1 ("Petition" or "Pet."); *see also* IPR2015-01961, Paper 7.

Claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53 and 61–65 of the '678 patent were previously held to be unpatentable in *Cisco Systems, Inc., Ciena Corporation, Coriant Operations, Inc., Coriant (USA) Inc., and Fujitsu Network Communications, Inc., v. Capella Photonics, Inc.*, IPR2014-01276, (PTAB Feb. 17, 2016) (Paper 40) (the '1276 case). The grounds of unpatentability asserted by Petitioner in this case rely on prior art, evidence, and arguments not asserted in the '1276 case. Likewise, Patent Owner, Capella Photonics, Inc., advances arguments and evidence in response in this case that were not asserted by Patent Owner in the '1276 case.

Based on the information provided in the Petition, and in consideration of the Preliminary Response (Paper 7) of Patent Owner, we instituted a trial pursuant to 35 U.S.C. § 314(a) of: (1) claims 1, 9, 10, 13, 17, 19, 44, 53, 61, 64, and 65 as obvious over Bouevitch[2] and Carr[3] under 35 U.S.C. § 103(a), and (2) claims 1–4, 19–23, 27, 29, 44–46, and 61–63 as

[2] U.S. Patent No. 6,498,872 B2, issued Dec. 24, 2002 (Ex. 1002, "Bouevitch")
[3] U.S. Patent No. 6,442,307 B1, issued Aug. 27, 2002 (Ex. 1005, "Carr").

obvious over Bouevitch and Sparks[4] under 35 U.S.C. § 103(a). Paper 8 ("Institution Decision"); *see also* IPR2015-01961, Paper 14.

After institution of trial, Patent Owner filed a Response (Paper 20, "Response" or "PO Resp.") and Petitioner filed a Reply (Paper 25, "Pet. Reply"). The Petition is supported by the Declaration of Joseph E. Ford, Ph.D. (Ex. 1037).[5] The Response is supported by the Declaration of Dr. Alexander V. Sergienko (Ex. 2033).

[4] U.S. Patent No. 6,625,340 B1, issued Sep. 23, 2003 (Ex. 1006, "Sparks")

[5] At the time of filing, the Petition was supported by the Declaration of Timothy J. Drabik, Ph.D. Ex. 1016. After institution of trial, and prior to his deposition, Dr. Drabik passed away. *See* Paper 14. Over the opposition of Patent Owner, Petitioner's motion to file as supplemental information the Declaration of Joseph E. Ford in support of the petition was granted (Paper 17), and Patent Owner's Request for Reconsideration of that decision was denied (Paper 21). Patent Owner's further attempts to obtain additional discovery of Dr. Drabik's "notes, comments, and edits" after his death were denied as not relevant to this proceeding as Petitioner no longer relies on Dr. Drabik's declaration as support for the Petition. Paper 24. Patent Owner was informed that "the panel will not consider the content of [Dr. Drabik's] Declaration as a part of any Final Written Decision." Paper 17, 4–5. Patent Owner further argues that Dr. Ford's testimony is based on hindsight reasoning and bias, and should be given little if any weight because Patent Owner was unable to depose Dr. Drabik before his death and a paper published by Dr. Ford purportedly conflicts with Dr. Ford's declaration as it "does not cite to a single reference about wavelength-selective switches that pre-date [Patent Owner's] 2001 priority date." PO Resp. 45–49. We have considered each of Patent Owner's arguments and reiterate that Patent Owner had the opportunity to cross-examine Dr. Ford prior to filing its Patent Owner Response. We are not persuaded that Dr. Ford's testimony should be afforded little or no weight based on the arguments asserted by Patent Owner.

A transcript of the Oral Hearing conducted on May 24, 2016, is entered as Paper 35 ("Tr.").

We issue this Final Written Decision pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons that follow, Petitioner has shown by a preponderance of the evidence that claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53 and 61–65 of the '678 patent are unpatentable.

II. BACKGROUND

A. The '678 patent (Ex. 1001)

The '678 patent, titled "Reconfigurable Optical Add-Drop Multiplexers with Servo Control and Dynamic Spectral Power Management Capabilities," reissued September 6, 2011, from U.S. Patent No. RE 39,397 ("the '397 patent"). Ex. 1001. The '397 patent reissued November 14, 2006, from U.S. Patent No. 6,625,346 ("the '346 patent"). *Id.* The '346 patent issued September 23, 2003, from U.S. Patent Application No. 09/938,426, filed August 23, 2001.

According to the '678 patent, "fiber-optic communications networks commonly employ wavelength division multiplexing (WDM), for it allows multiple information (or data) channels to be simultaneously transmitted on a single optical fiber by using different wavelengths and thereby significantly enhances the information–bandwidth of the fiber." *Id.* at 1:37–42. An optical add-drop multiplexer (OADM) is used both to remove wavelengths selectively from a multiplicity of wavelengths on an optical fiber (taking away one or more data channels from the traffic stream on the fiber) and to add wavelengths back onto the fiber (inserting new data channels in the same stream of traffic). *Id.* at 1:45–51.

The ’678 patent describes a “wavelength-separating-routing (WSR) apparatus that uses a diffraction grating to separate a multi-wavelength optical signal by wavelength into multiple spectral channels, which are then focused onto an array of corresponding channel micromirrors.” *Id.* at Abstract. “The channel micromirrors are individually controllable and continuously pivotable to reflect the spectral channels into selected output ports.” *Id.* According to Petitioner, the small, tilting mirrors are sometimes called Micro Electro Mechanical Systems or “MEMS.” Pet. 6. The WSR described in the ’678 patent may be used to construct dynamically reconfigurable OADMs for WDM optical networking applications. Ex. 1001 at Abstract.

Figure 1A of the ’678 patent is reproduced below.

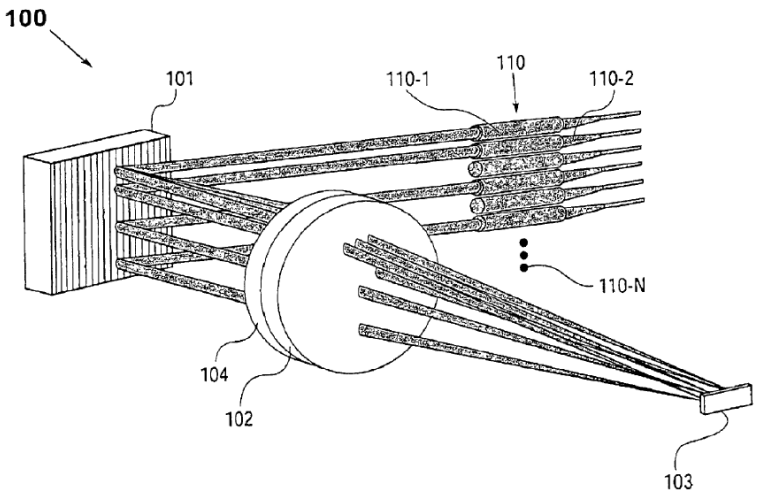

Fig. 1A

Figure 1A depicts wavelength-separating-routing (WSR) apparatus 100, in accordance with the ’678 patent. WSR apparatus 100 is composed of an array of fiber collimators 110 (multiple input/output ports, including input port 110-1 and output ports 110-2 through 110-N), diffraction grating 101 (a wavelength separator), quarter wave plate 104, focusing lens 102 (a

beam-focuser), and array of channel micromirrors 103. Ex. 1001, 6:57–63, 7:55–56.

A multi-wavelength optical signal emerges from input port 110-1 and is separated into multiple spectral channels by diffraction grating 101, which are then focused by focusing lens 102 into a spatial array of distinct spectral spots (not shown). *Id.* at 6:64–7:2. Channel micromirrors 103 are positioned such that each channel micromirror receives one of the spectral channels. *Id.* at 7:2–5.

Figure 1B of the ’678 patent is reproduced below.

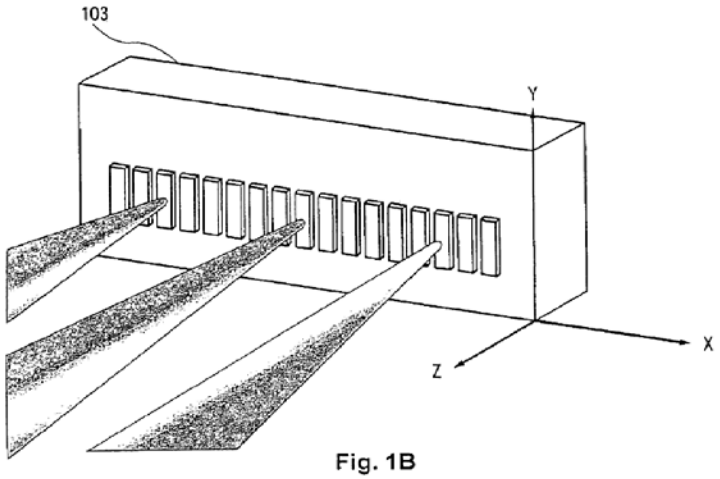

Fig. 1B

Figure 1B depicts a close-up view of the array of channel micromirrors 103 shown above in Figure 1A. *Id.* at 8:6–7. The channel micromirrors “are individually controllable and movable, e.g. pivotable (or rotatable) under analog (or continuous) control, such that, upon reflection, the spectral channels are directed” into selected output ports by way of focusing lens 102 and diffraction grating 101. *Id.* at 7:6–11.

According to the ’678 patent:

> [e]ach micromirror may be pivoted about one or two axes. What is important is that the pivoting (or rotational) motion of each

> channel micromirror be individually controllable in an analog manner, whereby the pivoting angle can be continuously adjusted so as to enable the channel micromirror to scan a spectral channel across all possible output ports.

Id. at 9:8–14.

Figure 3 of the ’678 patent is reproduced below.

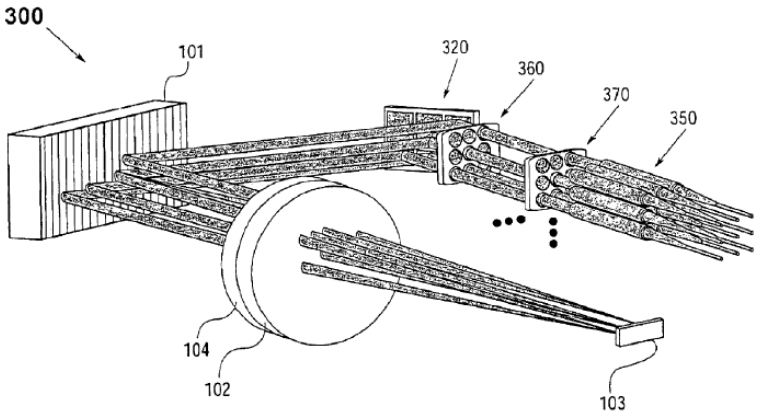

Fig. 3

Similar to Figure 1A, above, Figure 3 also shows a WSR apparatus as described by the ’678 patent. *Id.* at 10:25–26. In this embodiment, two-dimensional array of fiber collimators 350 provides an input port and plurality of output ports. *Id.* at 10:31–32. First and second two-dimensional arrays of imaging lenses 360, 370 are placed in a telecentric arrangement between two-dimensional collimator-alignment mirror array 320 and two-dimensional fiber collimator array 350. *Id.* at 10:37–43. “The channel micromirror 103 must be pivotable biaxially in this case (in order to direct its corresponding spectral channel to any one of the output ports).” *Id.* at 10:43–46.

The WSR also may incorporate a servo-control assembly (together termed a "WSR-S apparatus"). *Id.* at 4:65–67. According to the '678 patent:

> The servo-control assembly serves to monitor the power levels of the spectral channels coupled into the output ports and further provide control of the channel micromirrors on an individual basis, so as to maintain a predetermined coupling efficiency of each spectral channel in one of the output ports. As such, the servo-control assembly provides dynamic control of the coupling of the spectral channels into the respective output ports and actively manages the power levels of the spectral channels coupled into the output ports.

Id. at 4:47–56.

Figure 5 of the '678 patent is reproduced below.

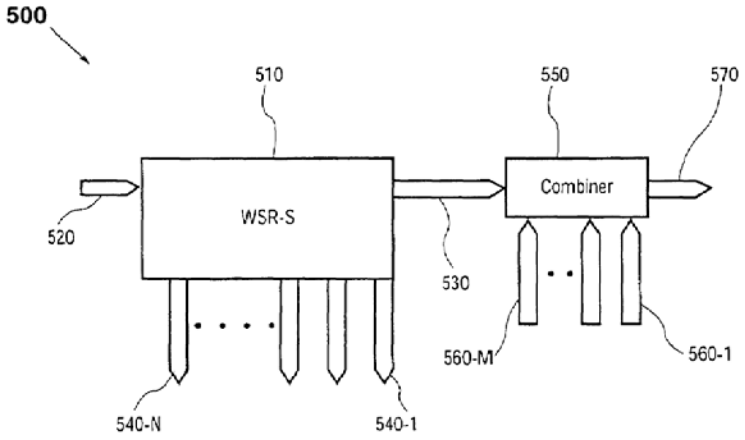

Fig. 5

Figure 5 depicts OADM 500 in accordance with the '678 patent composed of WSR-S (or WSR) apparatus 510 and optical combiner 550. *Id.* at 12:40–44. Input port 520 transmits a multi-wavelength optical signal, which is separated and routed into a plurality of output ports, including pass-through port 530 and one or more drop ports 540-1 through 540-N. *Id.* at 12:44–48. Pass-through port 530 is optically coupled to optical combiner 550, which

combines the pass-through spectral channels with one or more add spectral channels provided by one or more add ports 560-1 through 560-M. *Id.* at 12:52–56. The combined optical signal is then routed into an existing port 570, providing an output multi-wavelength optical signal. *Id.* at 12:56–58.

B. Illustrative Claims

Challenged claims 1, 21, 44, and 61 of the '678 patent are independent. Challenged claims 2–4, 9, 10, 13, 17, 19, and 20 ultimately depend from claim 1; claims 22, 23, 27, and 29 ultimately depend from claim 21; claims 45, 46, and 53 ultimately depend from claim 44; and, claims 62–65 ultimately depend from claim 61. Claims 1, 21, and 61 of the '678 patent are illustrative of the claims at issue:

> 1. A wavelength-separating-routing apparatus, comprising:
>
> a) multiple fiber collimators, providing an input port for a multi-wavelength optical signal and a plurality of output ports;
>
> b) a wavelength-separator, for separating said multi-wavelength optical signal from said input port into multiple spectral channels;
>
> c) a beam-focuser, for focusing said spectral channels into corresponding spectral spots; and
>
> d) a spatial array of channel micromirrors positioned such that each channel micromirror receives one of said spectral channels, said channel micromirrors being *pivotal about two axes and being* individually and continuously controllable to reflect [[said]] *corresponding received* spectral channels into *any* selected ones of said output ports *and to control the power of said received spectral channels coupled into said output ports*.

Ex. 1001, 14:6–23 (emphases in original, "[[ ]]" indicating matter in the first reissue that forms no part of the second reissue, and matter in italics indicating additions made by second reissue).

> 21. A servo-based optical apparatus comprising:
>
> a) multiple fiber collimators, providing an input port for a multi-wavelength optical signal and a plurality of output ports;
>
> b) a wavelength-separator, for separating said multi-wavelength optical signal from said input port into multiple spectral channels;
>
> c) a beam-focuser, for focusing said spectral channels into corresponding spectral spots; and
>
> d) a spatial array of channel micromirrors positioned such that each channel micromirror receives one of said spectral channels, said channel micromirrors being individually controllable to reflect said spectral channels into selected ones of said output ports; and
>
> e) a servo-control assembly, in communication with said channel micromirrors and said output ports, for maintaining a predetermined coupling of each reflected spectral channel into one of said output ports.

Ex. 1001, 15:29–48.

> 61. A method of performing dynamic wavelength separating and routing, comprising:
>
> a) receiving a multi-wavelength optical signal from an input port;
>
> b) separating said multi -wavelength optical signal into multiple spectral channels;
>
> c) focusing said spectral channels onto a spatial array of corresponding beam-deflecting elements, whereby each beam-deflecting element receives one of said spectral channels; and
>
> d) dynamically and continuously controlling said beam-deflecting elements [[, thereby directing]] *in two dimensions to direct* said spectral channels into [[a plurality]] *any selected ones of said* output ports *and to control the*

> *power of the spectral channels coupled into said selected output ports*.

Ex. 1001, 18:55–19:3 (emphases in original, with "[[ ]]" indicating matter in the first reissue that forms no part of the second reissue, and matter in italics indicating additions made by second reissue).

III. ANALYSIS

A. Claim Construction

The Board interprets claims using the "broadest reasonable construction in light of the specification of the patent in which [they] appear[]." 37 C.F.R. § 42.100(b). We presume a claim term carries its "ordinary and customary meaning," which is "the meaning that the term would have to a person of ordinary skill in the art in question" at the time of the invention. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007). A patentee may, however, act as their own lexicographer and give a term a particular meaning in the Specification, but must do so with "reasonable clarity, deliberateness, and precision." *In re Paulsen*, 30 F.3d 1475, 1480 (Fed. Cir. 1994). Only terms which are in controversy need to be construed, and then only to the extent necessary to resolve the controversy. *Vivid Techs., Inc. v. Am. Sci. & Eng'g, Inc.*, 200 F.3d 795, 803 (Fed. Cir. 1999).

1. "continuously controllable"

Claims 1 and 44 require "a spatial array of channel micromirrors . . . being individually and continuously controllable." Ex. 1001, 14:16–20; 17:43–47. Similarly, claim 61 requires "dynamically and continuously controlling said beam-deflecting elements." *Id.* at 18:65–66. Petitioner asserts that the broadest reasonable interpretation of "continuously

[controllable/controlling/pivotable]," in light of the specification, is "under analog control." Pet. 9–10. According to Petitioner, the '678 patent identifies "under analog control" as an example of continuous control. *Id*. Petitioner identifies the following disclosures of the '678 patent as supporting its proposed construction:

> The patent explains that "[a] distinct feature of the channel micromirrors in the present invention, in contrast to those used in the prior art, is that the motion . . . of each channel micromirror is under *analog control* such that its pivoting angle can be *continuously adjusted*." ([Ex. 1001], 4:7–11). Another passage in the specification states that "[w]hat is important is that the pivoting (or rotational) motion of each channel micromirror be individually *controllable in an analog manner, whereby the pivoting angle can be continuously adjusted* so as to enable the channel micromirror to scan a spectral channel across all possible output ports." ([Ex. 1001], 9:9–14). Yet another passage states that "channel micromirrors 103 are individually controllable and movable, e.g., pivotable (or rotatable) under analog (or continuous) control." (*Id.*, 7:6–8).

Pet. 9–10.

Dr. Ford also explains that "[e]lectrostatically driven MEMS mirrors may be driven with an analog voltage for continuous positioning control," and states that a person of ordinary skill in the art "would have known that MEMS mirrors based on analog voltage control can be tilted to any desired angle in their operating range." Ex. 1037 ¶¶ 57, 157.

Patent Owner contends that no express construction should be given to any claim term. PO Resp. 19. Additionally, according to Dr. Sergienko, "[a]nalog controlled mirrors can operate under continuous control." Ex. 2033 ¶ 48. However, there is no evidence that analog controlled mirrors

always operate under continuous control or that only analog mirrors operate under continuous control.

Accordingly, based on all of the evidence presented, we are not persuaded that "continuously controllable" is limited to "analog control" or that "analog control" necessarily corresponds to "continuous" control under all circumstances. We determine that "continuously controllable," in light of the specification of the '678 patent, encompasses "under analog control such that it can be continuously adjusted."

2. "*servo-control assembly*" and "*servo-based*"

Challenged claims 2–4, 21–23, and 45 recite a "servo-control assembly." Petitioner asserts that the broadest reasonable interpretation of "servo-control assembly" in light of the specification is "assembly that uses automatic feedback to control a device in response to a control signal." Pet. 10–11. Challenged claims 21–25, 27, and 29 recite a "servo-based optical apparatus." Petitioner asserts that "servo-based" means "using automatic feedback to control a device in response to a control signal." *Id*. at 11. Patent Owner offers no construction of the terms. We are not persuaded that "servo" necessarily means "feedback" or "feedback-based" merely because the '678 patent describes a processing unit within a servo-control assembly as using power measurements from the spectral monitor to provide feedback control of the channel mirrors. *See* Pet. 13–14.

The '678 patent does not use the term "servo-based" outside of the preamble of challenged claims 21–25, 27, and 29. "If . . . the body of the claim fully and intrinsically sets forth the complete invention, including all of its limitations, and the preamble offers no distinct definition of any of the

claimed invention's limitations, . . . then the preamble is of no significance to claim construction because it cannot be said to constitute or explain a claim limitation." *Pitney Bowes, Inc. v. Hewlett-Packard Co.*, 182 F.3d 1298, 1305 (Fed. Cir. 1999) (citations omitted). The bodies of claims 21–25, 27, and 29 fully and intrinsically set forth the complete invention; therefore, the use of "servo-based" in the preamble does not serve as a limitation and need not be construed for purposes of this decision.

With respect to "servo-control assembly," the '678 patent states that it "serves to monitor the power levels of the spectral channels coupled into the output ports and further provide control of the channel micro-mirrors on an individual basis." Ex. 1001, 4:47–50. Further, "[i]f the WSR apparatus includes an array of collimator-alignment mirrors . . . the servo-control assembly may additionally provide dynamic control of the collimator-alignment mirrors." *Id*. at 4:56–60. According to the '678 patent, "[a] skilled artisan will know how to implement a suitable spectral monitor along with an appropriate processing unit to provide a servo-control assembly in a WSP-S apparatus according to the present invention, for a given application." Ex. 1001, 12:11–15.

Based on the specification, a "servo-control assembly" encompasses a spectral monitor and processing unit to monitor spectral channel power levels and control channel micro mirrors on an individual basis. *See id*. at 11:10–36.

3. "port"

Claim 1 recites "multiple fiber collimators, providing an input port . . . and a plurality of output ports." Ex. 1001, 14:8–10. By comparison, claim

61 does not recite a collimator, but instead requires "receiving a multi-wavelength optical signal from an input port," and "controlling said beam deflecting elements . . . to direct said spectral channels into . . . output ports." *Id.* at 18:57–19:1. Neither Petitioner nor Patent Owner offer an express definition of "port." Instead Patent Owner argues that "[n]owhere in the '678 patent or the prosecution history is there an indication that the ports are to be construed to encompass circulator ports." PO Resp. at 39. We disagree.

There is no dispute that the ordinary and customary meaning of "port" encompasses circulator ports and, indeed, any "point of entry or exit of light." *See* Dr. Sergienko Deposition Transcript (Ex. 1041), 43:16–23, 45:12–13 ("The circulator ports are ports with constraints."). Nor does the '678 patent equate the term "port" to "collimator," as both "port" and "collimator" appear separately in the claims of the '678 patent. Ex. 1001, 14:8–10. We have considered the testimony of Dr. Sergienko as well (Ex. 2033 ¶¶ 102–123) and find that even if certain fiber collimators serve as ports in the '678 patent, that does not redefine the term "port" to mean "collimator." *See id.* at ¶ 102.

Although the broad scope of a claim term may be intentionally disavowed, "this intention must be clear," *see Teleflex, Inc. v. Ficosa N. Am. Corp.*, 299 F.3d 1313, 1325 (Fed. Cir. 2002) ("The patentee may demonstrate an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope."). "However, this intention must be clear, and cannot draw limitations into the

claim from a preferred embodiment." *Conoco, Inc. v. Energy & Envtl. Int'l.*, 460 F.3d 1349, 1357–58 (Fed. Cir. 2006).

Patent Owner fails to show any "expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope" with respect to the use of "port" in the '678 patent. Patent Owner argues that "[t]he inventors of the '678 patent realized that including optical circulators in an OADM was a significant drawback" and that "the claimed ROADMs do not require circulators." PO Resp. 13–14. Patent Owner further argues that by looking at the specification "as a whole," the '678 patent employs fiber collimators as ports and that the prosecution history does not indicate "that the ports are to be construed to encompass circulator ports." *Id.* at 39. To the contrary, Petitioner demonstrates that a provisional application to the '678 patent in fact uses circulator ports as "ports." Pet. Reply 19–20 (citing Ex. 2012, 4, Fig. 9). We have considered all of the arguments advanced by Patent Owner in its effort to redefine "port" as excluding "circulator ports" (PO Resp. 38–43) and find insufficient support for Patent Owner's contention that the '678 patent disavows or otherwise precludes circulator ports from the scope of the term "port." We determine that "port," in light of the specification of the '678 patent, encompasses "circulator port."

3. Additional Claim Terms

Petitioner addresses the additional claim terms "in two dimensions," "beam-deflecting elements," and "channel micromirror." Pet. 8–9, 12–14. Patent Owner contends that no term requires express construction. PO Resp. 19. For purposes of this decision, no express construction of any additional claim terms is necessary.

B. References Asserted as Prior Art

Petitioner relies on Bouevitch, Carr, and Sparks with respect to its assertion that the challenged claims would have been obvious.

1. Bouevitch

Bouevitch describes an optical device for rerouting and modifying an optical signal, including modifying means such as a MEMS array and a liquid crystal array which function as an attenuator when the device operates as a dynamic gain equalizer (DGE) and as a switching array when the device operates as a configurable optical add/drop multiplexer (COADM). Ex. 1002, Abstract. According to Petitioner, the COADM described in Bouevitch "uses MEMS mirrors with one axis of rotation." Pet. 31.

2. Carr

Carr describes a MEMS mirror device comprised of a mirror movably coupled to a frame and an actuator for moving the mirror. Ex. 1005, Abstract. Petitioner contends "Carr discloses a two-dimensional array of double-gimbaled mirrors that can be tilted about two perpendicular torsion bars to any desired orientation," as well as power control or attenuation by tilting the MEMS mirrors such that only a portion of input signals enter the output fibers. Pet. 31–32 (citing Ex. 1005, 3:44–47, 3:66–4:2, 11:13–20).

3. Sparks

Sparks describes an optical switch arranged to misalign the optical beam path to provide a predetermined optical output power. Ex. 1006, Abstract. According to Sparks, "[t]he system operates by controlling the movable micromirrors (16, 26), which are fabricated using MEMS technology and are capable of two axis movement, to carefully align the

beams so as to ensure that the maximum possible input optical signal is received at the output of the switch." *Id*. at 4:43–46.

C. Asserted Obviousness Over Bouevitch and Carr

Petitioner asserts that claims 1, 9, 10, 13, 17, 19, 44, 53, 61, 64, and 65 would have been obvious over Bouevitch and Carr. Pet. 31–44.

1. Claim 1

Claim 1, directed to a wavelength-separating-routing apparatus, requires "multiple fiber collimators, providing an input port . . . and a plurality of output ports." Ex. 1001, 14:6–10. Petitioner contends that Bouevitch describes microlenses 12a and 12b, corresponding to the recited "multiple fiber collimators." Pet. 36. Petitioner's declarant, Dr. Ford, equates microlenses 12a and 12b to fiber collimators. Ex. 1037, ¶¶ 146–151, 162. Petitioner further asserts that the microlenses of Bouevitch, in conjunction with fiber waveguides and circulators, provide an input port (labeled "IN") and a plurality of output ports (labeled "OUT EXPRESS" and "OUT DROP"). Pet. 36–37; Pet. Reply 18; *see also* Ex. 1037 ¶ 162[1pre] and [1a] (citing, *inter alia*, Ex. 1002, 14:14–21, Fig. 11).

Patent Owner argues that, under its proposed claim construction of "port," Bouevitch discloses at most two ports because the '678 patent equates "port" to "collimator." PO Resp. 38–42. For the reasons explained above in our claim construction analysis for "port," we reject Patent Owner's claim construction for "port." Failing to provide any express meaning to a term, "port," and then arguing that the term nevertheless fails to encompass a certain structure in the prior art (a structure Patent Owner's own experts identifies as a "port") is not persuasive. *See* Ex. 1041, 45:12–

13. Accordingly, we do not agree with Patent Owner's contention that the only ports disclosed by Bouevitch are collimator lenses 12a and 12b. *See* PO Resp. at 40–42. Petitioner has shown, as discussed above and as supported by Dr. Ford, that Bouevitch discloses the recited "multiple fiber collimators, providing an input port . . . and a plurality of output ports," as recited by claim 1.

Patent Owner does not dispute Petitioner's contention that Carr and Bouevitch together disclose the remaining limitations of claim 1. In particular, claim 1 requires "a wavelength-separator" for separating the multi-wavelength optical signal input into multiple spectral channels. Petitioner identifies diffraction grating 20 of Bouevitch as corresponding to the recited "wavelength-separator." Pet. 37–38. Petitioner also identifies Bouevitch's diffraction grating 620, spherical reflector 610, and modifying means 150 as corresponding to the recited "beam-focuser" of claim 1 of the '678 patent. *Id.* at 38.

Petitioner further identifies MEMS mirror array 50 of Bouevitch as corresponding to the recited "a spatial array of channel micromirrors." *Id.* (citing Ex. 1002, 14:48–55). Petitioner also identifies the two-dimensional array of movable gimballed mirrors shown in Carr Figures 1a and 2b as corresponding to the claimed "spatial array of channel micromirrors." *Id.* at 38–39. For each of the channel micromirrors, claim 1 further requires that they be "*pivotal about two axes*" and be "individually and continuously controllable to reflect *corresponding received* spectral channels into *any* selected ones of said output ports *and to control the power of said received spectral channels coupled into said output ports*." Petitioner identifies the

double gimballed mirror 21 which "can be tilted to any desired orientation." *Id.* (quoting Ex. 1005, 3:47–48). Carr further discloses intentional misalignment for power control. *See id.* at 35–36 (quoting Ex. 1005, 11:11–23, *see also* Fig. 9). As Explained by Dr. Ford, "Carr discloses effecting closed-loop power control or attenuation by tilting MEMS mirrors to introduce misalignment of channel wavelength beams," and "Carr specifically teaches that its analog, continuous micromirrors would be useful for power control applications in WDM systems." Ex. 1037 ¶¶ 116, 156. In summary, for the reasons discussed above, we agree with Petitioner that Bouevitch and Carr disclose all of the recited limitations of claim 1. *See* Pet. 31–36. Thus, the remaining issue is whether Petitioner has provided "some articulated reasoning with some rational underpinning to support the legal conclusion of obviousness." *KSR Int'l Co. v. Teleflex Inc*., 550 U.S. 398, 418 (2007).[6]

With respect to a rationale for combining Bouevitch and Carr, Petitioner contends that the use of the two-axis mirror of Carr in Bouevitch: (1) is the use of a known technique to improve similar devices, (2) is a simple substitution of one known element for another yielding predictable

[6] The question of obviousness is resolved on the basis of underlying factual determinations including (1) the scope and content of the prior art, (2) any differences between the claimed subject matter and the prior art, (3) the level of skill in the art, and (4) secondary considerations, i.e. objective evidence of unobviousness. *See Graham v. John Deere Co*., 383 U.S. 1, 17–18 (1966). We have considered each of the Graham factors and incorporate our discussion of those considerations, to the extent there is a dispute, in our evaluation of the reasoning that supports the asserted combination. We further observe that, in this proceeding, evidence of secondary considerations has not been offered for evaluation.

results, and (3) would be obvious to try as there are only two options for tilting MEMS mirrors: one-axis and two-axis mirrors. Pet. 32–35. Petitioner's rationale for combining Bouevitch and Carr is supported by Dr. Ford. Ex. 1037 ¶¶ 152–161. In particular, Dr. Ford explains that "providing the MEMS mirrors of Bouevitch with two-axis tilt capability enables the spatial positioning of returning beams in both transverse directions at the face of microlens array 12," thereby reducing errors in system alignment. *Id.* at ¶ 153; *see also id.* at ¶ 155 (stating that "[t]here are only two options for tilting MEMS mirrors: one-axis and two-axis mirrors" and that "[b]ecause Carr already disclosed the use of two-axis mirrors (which were available by the '678 Patent's priority date), a [person having ordinary skill in the art] would have a high expectation of success upon trying two-axis mirror control in Bouevitch.")

Patent Owner disputes the sufficiency of the rationale provided in the Petition. PO Resp. 23–36. Petitioner demonstrates that the thrust of Patent Owner's arguments do not refute Petitioner's contentions, but instead argue that the asserted combination would not have been obvious for other reasons. *See* Pet. Reply 12–13 (citing Ex. 1040 (noting that Dr. Sergienko agreed that two-axis mirrors were known in the art and provided certain benefits over single axis mirrors)).

First, Patent Owner argues that a person of ordinary skill "would have never used two-axis mirrors in Bouevitch's system to control power through intentional misalignment, because doing so would destroy Bouevitch's principle of operation." PO Resp. 24. Patent Owner contends that Bouevitch discloses "a *folded* 4-*f* system that autocorrects for any

unintentional misalignments" and that this advantage would be lost if combined with Carr because Carr controls power through "*intentional* misalignment." *Id.* at 26–27. Patent Owner further argues that Bouevitch "uses a different method to control power . . . by attenuation at the MEMS devices, not intentional misalignment." *Id.* at 28.

There is no dispute that Bouevitch discloses methods other than misalignment for power control. We agree with Petitioner, however, that Bouevitch discloses that the "degree of attenuation is based on the degree of deflection provided by the reflector (i.e., the angle of reflection)." Pet. 40 (quoting Ex. 1002, 7:35–37). Patent Owner argues in response that Bouevitch is referring to "constructive or destructive interference," not misalignment. PO Resp. 29. In reply, Petitioner notes that Dr. Sergienko was unable to identify any portion of Bouevitch to support Patent Owner's theory of attenuation based on interference. Pet. Reply 8 (citing Ex. 1040, 90:8–22). Indeed, the paragraph cited by Patent Owner from Dr. Sergienko's declaration in support of the assertion that Bouevitch "refers" to power control through interference, in fact, says no such thing. PO Resp. 29 (citing Ex. 2033 ¶ 99 (stating that Bouevitch refers to modifying means for power control and that another reference (Ex. 2031) illustrates power control through interference)). We find persuasive Petitioner's explanation that had Bouevitch intended to refer to interference-based attenuation instead of angular misalignment, then Bouevitch would have addressed altering distances, not angles of tilt. *See* Pet. Reply 8–10 (citing Ex. 1040, 126:9–127:7) (explaining that Mechanical Anti-Reflection Switch (MARS) modulator device operates in a "'surface-normal manner'

by *vertically moving* the partially reflective membrane," and noting that Dr. Sergienko agreed the MARS device does not vary the angle of reflection). We further see no inconsistency between Bouevitch's disclosure of methods to prevent *unintentional* misalignment with other methods that incorporate *intentional* misalignment for power control. "The prior art's mere disclosure of more than one alternative does not constitute a teaching away from any of these alternatives because such disclosure does not criticize, discredit, or otherwise discourage the solution claimed in the . . . application." *In re Fulton*, 391 F.3d 1195, 1201 (Fed. Cir. 2004). For the same reasons, we are not persuaded that applying intentional misalignment for power control as disclosed by Carr would destroy Bouevitch's principle of operation.

Second, Patent Owner argues that Petitioner's combination of Bouevitch and Carr is improper hindsight because it relies on knowledge beyond the level of ordinary skill at the time of the claimed invention and includes knowledge gleaned only from the applicant's disclosure. PO Resp. 31–36. Patent Owner argues that Dr. Ford assumed "wavelength-selective switches were known at the time of the invention, when, in fact, they were not." *Id.* at 31. Patent Owner's argument is premised on its contention that Dr. Ford published a paper in 2006 which did not contain any citations "to confirm that wavelength-selective switches were known when the '678 patent was filed." *Id.* at 32. Patent Owner's argument is not persuasive evidence that wavelength switches were unknown at the relevant time. To the contrary, Dr. Ford's declaration in this proceeding identifies references supporting the contention that wavelength-selective switches were known

and described prior to Patent Owner's priority date. *See* Ex. 1037 ¶ 52 (citing Ex. 1002, 5:15–38; Ex. 1027, 1:56–67). That those same references were not cited in an article by Dr. Ford in 2006 is of little relevance to our determination of obviousness in this proceeding.

Next, Patent Owner argues that one of Petitioner's motivations for combining Bouevitch with Carr comes from the '678 patent because: (1) Petitioner contends dual axis mirrors compensate for system alignment errors from well-known problems like imperfect assembly or temperature changes; (2) Petitioner and Dr. Ford provide no citation that such problems were "well-known"; and (3) the '678 patent states certain prior art provided "no mechanisms implemented for overcoming degradation in the alignment owing to environmental effects such as thermal and mechanical disturbances over the course of operation." PO Resp. 34–35. We find persuasive Petitioner's reply that Bouevitch and Carr, rather than the '678 patent, sufficiently provide the motivation for the asserted combination. *See* Pet. Reply 16 (describing a "*two-axis MEMS device with 'highly accurate lateral alignment'* that 'permits precise control of the mirrors, a more robust structure, greater packing density, larger mirror sizes, and larger mirror rotation angles than are conventionally obtained and easier electrical connection to the mirrors'" (quoting Ex. 1005, 4:9–17 (emphasis added)) and discussing "alignment problems" and concerns with "small temperature fluctuations" (quoting Ex. 1002, 10:9–10, 65–65)).

Finally, Patent Owner argues that Petitioner's motivations to combine "drastically over simplify the subject matter of the claimed inventions," and no ordinary skilled person would combine Bouevitch and Carr because it

"would have injected complexity into Bouevitch's system without any added functionality." PO Resp. 36. We find Patent Owner's argument conclusory and not persuasive because it fails to address the benefits of a two-axis mirror disclosed by Carr which would be apparent to one of skill in the art without hindsight. We also find persuasive Petitioner's contention that it would have been obvious to try, because, as Dr. Ford testified, (1) there were only two solutions to the known need to deflect light beams with MEMS: 1-axis or 2-axis, (2) a person of ordinary skill would have had a high expectation of success to try two-axis mirror control in Bouevitch, and (3) the result of the combination would be predictable. *See* Pet. 33; Pet. Reply 12; Ex. 1037 ¶ 155. While Dr. Sergienko states that a person of ordinary skill "would have considered many factors" before substituting a two-axis mirror for a one-axis mirror, the references of record reflect that there are routinely complex design considerations in the fiber optic communications field. Ex. 2033 ¶ 142. Patent Owner does not explain persuasively why combining the teachings of Bouevitch and Carr would be beyond the skill of a skilled artisan, even if feats of engineering are contemplated.

Petitioner has articulated sufficiently reasoning with some rational underpinning to support the legal conclusion of obviousness based on the asserted combination of Bouevitch and Carr. With regard to incorporating the teaching of a two-axis mirror in Carr with Bouevitch, we are persuaded that it is a simple substitution, notwithstanding the fact that it may require substantial engineering as a practical matter. Further, the asserted combination of Bouevitch and Carr yields a predictable result. *See KSR*, 550

U.S. at 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."). For the foregoing reasons, Petitioner has established by a preponderance of the evidence that claim 1 would have been obvious over Bouevitch and Carr.[7]

2. Claims 9, 10, 13, 17, 19, 44, 53, 61, 64, and 65

In addition to addressing the elements of claim 1, we agree with Petitioner's identification of how claims 9, 10, 13, 17, 19, 44, 53, 61, 64, and 65 would have been obvious over Bouevitch and Carr, as supported by the declaration of Dr. Ford. Pet. 40–44; Ex. 1037 ¶162. Patent Owner has not raised additional arguments with respect to claims 9, 10, 13, 17, 19, 44, 53, 61, 64 beyond those asserted with respect to claim 1, addressed above. We have assessed the information provided and determine that Petitioner has established by a preponderance of the evidence that claims 9, 10, 13, 17, 19, 44, 53, 61, 64 would have been obvious over Bouevitch and Carr.

D. Asserted Obviousness Over Bouevitch and Sparks

Petitioner asserts that claims 1–4, 19–23, 27, 29, 44–46, and 61–63 would have been obvious over Bouevitch and Sparks. Pet. 44–57. Petitioner provides a claim chart identifying how the references disclose the elements of each claim. *Id.* at 48–57. Petitioner's contentions are supported by Dr. Ford. Ex. 1037 ¶ 163–175. In summary, Petitioner relies on Bouevitch as disclosing the same features Petitioner contends Bouevitch discloses in the combination with Carr, as discussed above. Petitioner

[7] Patent Owner provides no persuasive evidence of secondary considerations to support the patentability of claims of the '678 patent.

further relies on Sparks as disclosing a MEMS array with elements individually and continuously controllable in two dimensions to reflect channels and control power, as claimed. *See* Pet. 45, 49–50; *see also* Ex. 1006, 4:43–45 (describing an optical switch comprising arrays of MEMS capable of two axis movement). Specifically, Sparks discloses using movable micromirrors capable of two axes movement so that "each of the channels passing through the switch may be attenuated to whatever degree necessary to achieve the desired effect." Ex. 1006, 2:30–35; 4:39–47.

Petitioner has shown, as discussed above and as supported by Dr. Ford, that Bouevitch discloses the "multiple fiber collimators, providing an input port . . . and a plurality of output ports," as recited by claim 1. Patent Owner does not dispute Petitioner's contention that Sparks and Bouevitch together disclose the remaining limitations of claims 1–4, 19–23, 27, 29, 44–46, and 61–63. Petitioner also has demonstrated that the rationale for the asserted combination of Bouevitch and Carr similarly applies to the combination of Bouevitch and Sparks. For example, Petitioner contends that a person of ordinary skill "would have been motivated to combine the two axis movable MEMS mirrors of Sparks in the COADM of Bouevitch based on the teachings of the references, common sense and knowledge generally available to a [person of ordinary skill], as the proposed combination would merely be substituting known elements to yield predictable results," and that "using the known two-axis mirrors of Sparks in the Bouevitch COADM entails nothing more than the use of known techniques to improve similar devices." Pet. 45–46.

Patent Owner disputes the sufficiency of the rationale provided in the Petition for the combination of Bouevitch and Sparks on the same bases Patent Owner argued with respect to the combination with Carr discussed above. PO Resp. 23–36 (arguing that Petitioner's "proposed combinations (1) conflict with Bouevitch's principle of operation and (2) are based on nothing but impermissible hindsight," and "[a]s such, a [person of ordinary skill] would have had no reason to combine Bouevitch with either Carr or Sparks."). For the reasons explained above, we are not persuaded by Patent Owner's assertion that the "*intentional* misalignment techniques taught by Carr and Sparks conflict with Bouevitch's optical design." *Id.* at 28. Nor are we persuaded that the motivation to combine Bouevitch and Sparks comes from the '678 patent and amounts to impermissible hindsight. *See* PO Resp. 31–36. As noted above, Bouevitch discusses "alignment problems" and concerns with "small temperature fluctuations." Ex. 1002, 10:9–10, 64–65. Petitioner notes that Sparks also explains that the disclosed two-axis MEMS mirrors are fabricated to "*carefully align the beams* so as to ensure that the maximum possible input optical signal is received at the output of the switch" if desired. Pet. Reply 16 (quoting Ex. 1006 at 4:42–47 (emphasis added)).

Petitioner has articulated sufficient reasoning with some rational underpinning to support the legal conclusion of obviousness based on the asserted combination of Bouevitch and Sparks. With regard to incorporating the teaching of a two-axis mirror in Sparks with Bouevitch, we are persuaded that it is a simple substitution, notwithstanding the fact that it may require substantial engineering as a practical matter. Further, the asserted

combination of Bouevitch and Sparks yields a predictable result. *See KSR*, 550 U.S. at 416 ("The combination of familiar elements according to known methods is likely to be obvious when it does no more than yield predictable results."). For the foregoing reasons, Petitioner has established by a preponderance of the evidence that claims 1–4, 19–23, 27, 29, 44–46, and 61–63 would have been obvious over Bouevitch and Sparks.

E. Conclusion

Petitioner has shown by a preponderance of the evidence that claims 1, 9, 10, 13, 17, 19, 44, 53, 61, 64, and 65 would have been obvious over Bouevitch and Carr, and that claims 1–4, 19–23, 27, 29, 44–46, and 61–63 would have been obvious over Bouevitch and Sparks.

IV. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that, based on a preponderance of the evidence, claims 1–4, 9, 10, 13, 17, 19–23, 27, 29, 44–46, 53 and 61–65 of U.S. Patent No. RE42,678 are unpatentable; and,

FURTHER ORDERED that, because this is a Final Written Decision, the parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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