United States Court of Appeals for the Federal Circuit

CISCO SYSTEMS, INC.,
Appellant

v.

CIRREX SYSTEMS, LLC,
Cross-Appellant

2016-1143, 2016-1144

Appeals from the United States Patent and Trademark Office, Patent Trial and Appeal Board in No. 95/001,175.

Decided: May 10, 2017

DAVID L. MCCOMBS, Haynes & Boone, LLP, Dallas, TX, argued for appellant. Also represented by DEBRA JANECE MCCOMAS; GREGORY P. HUH, JULIE MARIE NICKOLS, Richardson, TX.

TAREK N. FAHMI, Ascenda Law Group, PC, San Jose, CA, argued for cross-appellant.

Before PROST, *Chief Judge,* WALLACH and CHEN, *Circuit Judges.*

CHEN, *Circuit Judge*.

This case arises from Cisco Systems, Inc.'s (Cisco) request for *inter partes* reexamination before the U.S. Patent and Trademark Office of all claims of U.S. Patent No. 6,415,082 ('082 patent), which is owned by Cirrex Systems, Inc. (Cirrex). The '082 patent originally issued with claims 1–34, and Cirrex added claims 35–124 during reexamination and subsequently amended and canceled several original claims.[1] As relevant here, the Examiner found claims 56, 57, 76, 102, and 103 patentable and rejected claims 38–41, 43–47, 49–50, 58–61, 75, 84–87, 89–93, 95–96, 104–107, and 121 for lack of written description support. The Board affirmed. *Cisco Sys., Inc. v. Graywire LLC*, No. 2012-006121, 2013 WL 4782204 (P.T.A.B. Sept. 5, 2013).

Cisco appeals the Board's patentability finding for claims 56, 57, 76, 102, and 103, and Cirrex cross-appeals the Board's rejections. Because all the claims on appeal are unpatentable for lack of written description support, we affirm, in part, and reverse, in part.

BACKGROUND

The '082 patent is directed to the field of fiber optic communication signals. '082 patent col. 1 ll. 14–15. Fiber optic communication signals use light energy made up of multiple different wavelengths within one fiber optic cable, and it can be useful to separate an optical beam into its individual wavelength components to allow a

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[1] Of the original claims, claims 21–25 were amended and claim 32 was canceled. J.A. 3. Of the added claims, claims 42, 77, 79, 88, and 123 were canceled, claims 56, 57, 76, 102, and 103 were found patentable by the Examiner, and claims 1–31, 33–41, 43–55, 58–75, 78, 80–87, 89–101, 104–122, and 124 were rejected on various grounds by the Examiner. J.A. 3–4.

logical operation to be performed selectively on a particular wavelength, such as adding or deleting, or changing the intensity of, the data signal carried on each specific wavelength. The "single optical beam" comprises several different wavelengths, which "can include separate information channels that are carried by a first optical beam" having one particular wavelength and "a second optical beam" having a second particular wavelength. *Id.* col. 1 ll. 40–50. "In other words, multiple channels of information can propagate along an optical waveguide as a single beam of light energy." *Id.* col. 1 ll. 27–30.

To separate individual wavelengths from an optical beam, the '082 patent describes an optical network assembly that uses a planar lightguide circuit (PLC). *Id.* col. 1 ll. 14–17, 20–24, col. 2 l. 65–col. 3 l. 2, col. 4 ll. 10–36. The PLC, together with a series of filtering devices, splits the single, composite optical beam into multiple channels based on individual wavelengths. *Id.* col. 4 ll. 10–22. The combination PLC and filtering device "separate[s] the optical energy into at least two beams, where a first beam can contain a first information channel and a second beam can contain a second information channel." *Id.* col. 2 ll. 50–53. The PLC is also attached to external optical waveguides which direct the beams of individual wavelengths of light away from and back into the PLC. *Id.* col. 2 ll. 45–65. These external optical waveguides can include amplifiers (which increase the intensity of the light beam) and attenuators (which decrease the intensity of the light beam) to create optical systems that can perform equalization or discrete attenuation, and diverting elements (which can divert or introduce a light beam of a specific wavelength). *Id.* col. 4 ll. 10–60, col. 14 l. 58–col. 15 l. 40. The parties do not dispute the technical features of beam splitting, amplifying, or attenuating of light beams.

To modify an individual wavelength of light, the '082 patent describes using a "diverting element" (1000) outside the PLC to divert a light beam of wavelength lambda three (λ_3) and replace λ_3 with a different light beam of wavelength λ_3', then adding λ_3' back into the PLC. This "embodiment can function as an optical switch" using a "diverting element . . . that diverts a channel signal out of an optical circuit while introducing a new signal content along the same channel into the optical circuit." *Id.* col. 4 ll. 48–53. The "PLC and filtering device combination can form a drop or add configuration where one channel of information propagating within a multichannel or multiplexed optical beam can be either dropped from or added to the multichannel or multiplexed beam." *Id.* col. 4 ll. 12–16. Figure 10 shows a cross-connect feedback loop that uses a diverting element 1000 that diverts λ_3 and introduces λ_3'.

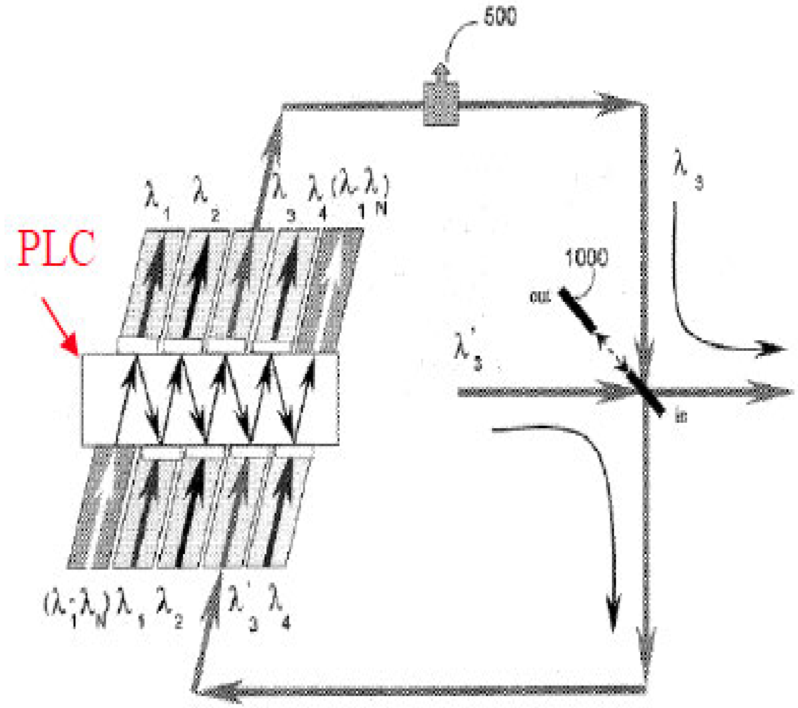


Fig. 10 *annotated*

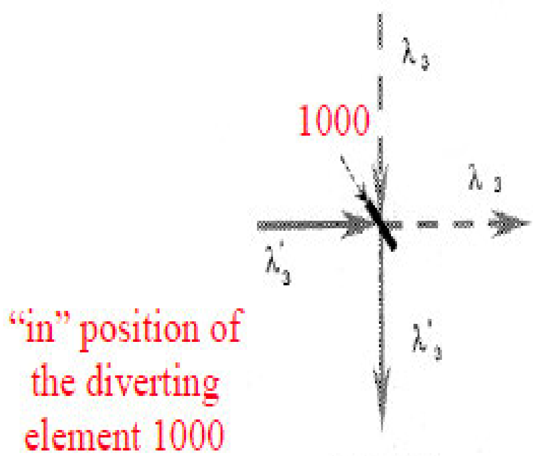


Fig. 11 *annotated*

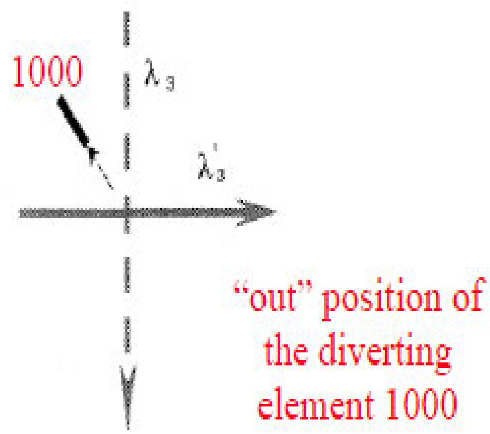


Fig. 12 *annotated*

Id. fig.10 (as annotated by Cisco). As shown in Figure 10, the diverting element 1000 is a double-sided mirror. *Id.*

col. 14 ll. 7–9. Figure 11 shows the diverting element in the "in" position, which diverts λ_3 and introduces λ_3'. *Id.* col. 14 ll. 47–52. Figure 12 shows the diverting element in the "out" position, in which λ_3 is not diverted. *Id.* col. 14 ll. 53–57.

The use of the illustrated cross-connect feedback loop allows a fiber optic communication system to transmit multiple channels of information on one fiber optic cable, without sacrificing the ability to manipulate the information being transmitted along each individual wavelength of light. *Id.* col. 1 ll. 25–30. This maximizes efficiency because multiple wavelengths of information can be sent simultaneously rather than having to be sent in seriatim. *Id.* col. 1 ll. 25–30.

The PLC (210E) itself is disclosed in more detail in Figure 7 of the '082 patent:

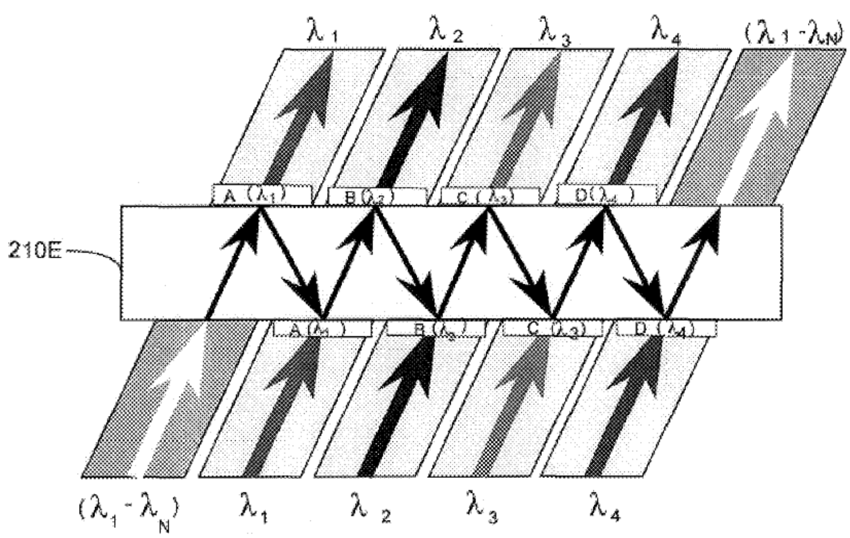


Fig. 7

'082 patent fig.7. Figure 7 shows an exemplary embodiment of PLC 210E containing a four-channel drop-add. The bottom left-hand corner shows an optical beam input with optical energy of wavelengths λ_1–λ_n introduced into

PLC 210E. *Id.* col. 13 ll. 22–23. Individual light wavelengths λ_1–λ_4 are, in succession, "dropped" by filtering out (*i.e.*, beam splitting)[2] through the top of the PLC, and later "reintroduced" through the bottom of the PLC. *Id.* col. 13 ll. 24–26. As the optical beam transits within the PLC, reflecting up and down in a zig-zag fashion, the individual wavelengths—λ_1, λ_2, λ_3, and λ_4—are successively filtered out of the optical beam, with each wavelength traveling through the top of the PLC and then within its own individual optical waveguide. Because PLC 210E is part of a feedback loop circuit, Figure 7 shows how those individual wavelengths λ_1, λ_2, λ_3, and λ_4 are ultimately reintroduced through the bottom of PLC 210E.

In this way, PLC 210E demultiplexes incoming optical energy so that individual wavelengths of light are separated and redirected outside the PLC on a channel-by-channel basis before they are returned to the PLC and remultiplexed together, after which the remultiplexed optical energy exits PLC 210E through the top right-hand corner. *Id.* col. 13 ll. 31–38. When Figure 7 is considered in combination with Figures 10–12 above, the data signals carried by the individual wavelengths of light that are returned to the bottom of PLC 210E can be different from the data signals carried by the individual wavelengths of light that originally exited the top of the PLC, through the use of diverting elements.

Another way to modify an individual wavelength of light is shown in Figure 13, which discloses using amplification or attenuation material (1300) to increase or de-

[2] The filters located on top of PLC 210E contain special materials that allow certain wavelengths of light to pass through while other wavelengths of light reflect back into the PLC, thereby achieving the zig-zag pattern in the PLC. '082 patent col. 10 ll. 1–53.

crease the intensity of an individual wavelength of light before it is returned to the PLC. As illustrated in Figure 13, and described in the specification, the amplification or attenuation material is located outside PLC 210E and is positioned within each individual optical waveguide path.

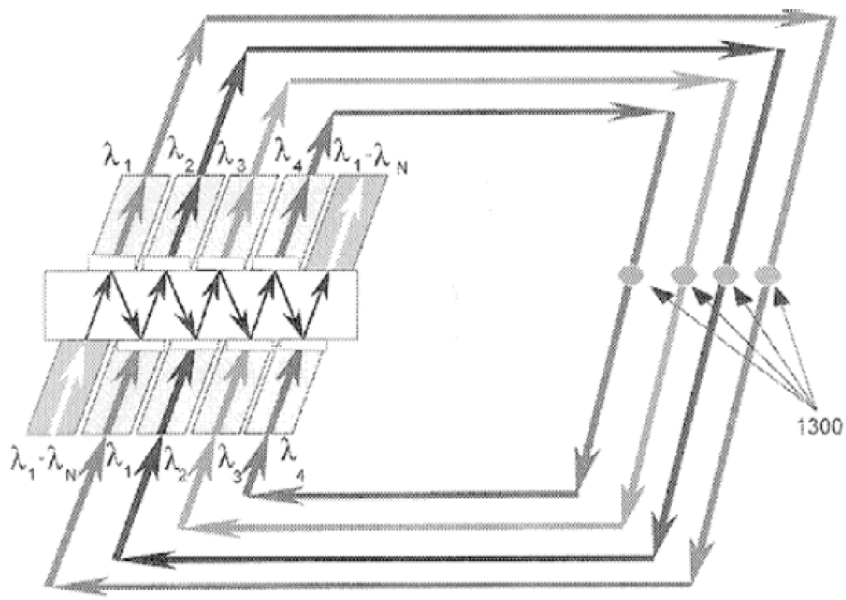


Fig. 13

Id. fig.13. The '082 patent explains several ways in which light energy can be amplified (such as by using a pump laser light with an optical filtering device) or attenuated (such as by using absorbing material of a certain length), and the parties do not dispute the specifics of how the amplification or attenuation is accomplished. *Id.* col. 15 ll. 9–43. One reason that light energy intensity for a specific wavelength should be turned up or down is to improve transmission of the beam, while reducing transmission losses, as the beam travels over long distances or between multiple destinations. *Id.* col. 3 ll. 2–9. This ability to apply "selective" flattening or amplification to "each channel" outside the PLC can be used to (1) equalize the intensities of light across all channels, or (2) "discretely attenuate" individual channels outside the PLC, without attenuating all the channels at the same time. *Id.* col. 4 ll. 56–60, col. 6 ll. 31–35, col. 15 ll. 8–10. The '082 specification does not disclose why equalization of light energy across all channels is useful, but it does disclose that amplification can vary dramatically with the wavelength of light being amplified, and discrete attenuation can counter this variation in amplification. *Id.* col. 14 l. 59–col. 15 l. 5.

The '082 specification further makes clear that "discrete attenuation" is distinct from "collective attenuation."

> In the assembly illustrated in FIG. 13, the channels operating at wavelengths lambda one (λ_1) through lambda four (λ_4) are attenuated discretely by gain flattening elements 1300. . . .
>
> . . . .
>
> The assembly illustrated in FIG. 13 supports a *discrete channel approach to signal amplification* which is *different* from the *common approach of collectively amplifying the channels*. In the illustrated embodiment, the elements 1300 depicted can be amplifiers that apply selective gain to each spectral region. The spectral regions may contain one or numerous channels.

Id. col. 14 l. 64–col. 15 l. 40 (emphases added). As the '082 specification explains, the discrete approach to attenuation or amplification is distinct from the collective approach because each wavelength of light is separately amplified or attenuated, whereas in the collective approach, the same amplification or attenuation is applied to all wavelengths of light in the same way. The '082 specification also briefly mentions that the attenuation material can be positioned at various places in an optical architectural assembly, including inside the zig-zag path of PLC 210E, but it does not disclose how placing attenuation material inside PLC 210E would result in the equalizing of the intensities of different wavelengths of light or the discrete attenuation of different wavelengths of light inside the PLC. *Id.* col. 15 ll. 22–24.

Turning to the claims, the parties separated the claims into three different groups: the equalization claims, the discrete attenuation claims, and the diverting element claims. All three groups contain claims that depend from claim 1, reproduced below:

> 1. A cross-connect waveguide system comprising:
>
> a *planar lightguide circuit* having one or more *optical paths*;
>
> a plurality of optical waveguides coupled to said planar lightguide circuit;
>
> a *plurality of filtering devices* for feeding light energy into said optical paths of said planar lightguide circuit or receiving light energy from said optical paths of said planar lightguide circuit; and
>
> a *diverting element* for feeding first light energy at a predetermined wavelength having first information content away from said *planar lightguide circuit*, and for feeding second light energy at said predetermined wavelength having second information content into said *planar lightguide circuit*, wherein said *diverting element* is remotely configurable and is controlled with optically encoded information.

Id. col. 18 l. 61–col. 19 l. 10 (emphases added). As noted, the optical waveguides are flexible fiber optic cables that can feed light signals away from or into a PLC. *Id.* col. 2 l. 53–63. The filtering devices pass through certain wavelengths of light while reflecting other wavelengths. *Id.* col. 10 ll. 1–53.

Claims 56, 76, and 102 are the equalization claims. Claims 56 and 102 recite that "the [PLC] is operative to equalize the intensities of light energy traveling in the plurality of optical paths of the [PLC]." J.A. 2786, 2792. Claim 76 recites "equalizing the intensities of light energy while the light energy is traveling in the plurality of optical paths of the [PLC]." J.A. 2789.

Claims 57 and 103 are the discrete attenuation claims. They recite that "the [PLC] further comprises a gain flattening element to discretely attenuate light energy traveling in the [PLC]." J.A. 2786, 2792.

Claims 38–41, 43–47, 49–50, 58–61, 75, 84–87, 89–93, 95–96, 104–107, and 121 are the diverting element claims. These claims recite a diverting element inside a PLC. J.A. 26. Representative claim 46 recites that "the diverting element is disposed along an optical path section that spans from a first side of the [PLC] to a second side of the [PLC] and is operative to process light traveling on the optical path section." J.A. 1558. Thus, claim 46 states that the diverting element is inside the PLC, but it does not recite how the diverting element would divert the light beam inside the PLC.

Relevant, for our purposes, all of the challenged claims recite that either equalization or discrete attenuation is performed *inside* the PLC, or that the diverting element is located *inside* the PLC.

During reexamination, the Examiner rejected claims 1–34, which originally issued with the '082 patent. J.A. 296, 299–306. Cirrex disputed those rejections and added new claims 35–124. J.A. 3, 341–59. In response, the Examiner initially rejected Cirrex's newly presented equalization and discrete attenuation claims for lack of written description support, but he later withdrew those rejections. J.A. 948, 1172. He maintained his rejections of Cirrex's new diverting element claims for lack of written description support. J.A. 20. The Board affirmed. J.A. 2–3, 42–43.

Cisco appeals the patentability finding for the equalization and discrete attenuation claims. Cirrex cross-appeals the rejection of the diverting element claims. We have jurisdiction under 28 U.S.C. § 1295(a)(4) (2012).

DISCUSSION

I. Standard of Review

In construing the claims, the Board applies the broadest reasonable interpretation consistent with the specification. *Cuozzo Speed Techs., LLC v. Lee*, 136 S. Ct. 2131, 2142–45 (2016). "We review intrinsic evidence and the ultimate construction of the claim de novo." *SightSound Techs., LLC v. Apple Inc.*, 809 F.3d 1307, 1316 (Fed. Cir. 2015).

"Whether a patent claim is supported by an adequate written description is a question of fact." *AbbVie Deutschland GmbH & Co., KG v. Janssen Biotech, Inc.*, 759 F.3d 1285, 1297 (Fed. Cir. 2014). "We review the Board's conclusions of law de novo and its findings of fact for substantial evidence." *Blue Calypso, LLC v. Groupon, Inc.*, 815 F.3d 1331, 1337 (Fed. Cir. 2016). Substantial evidence "means such relevant evidence as a reasonable mind might accept as adequate." *Id.* (internal quotation marks omitted).

II. Claim Construction

We begin with claim construction. Cisco argues that even though the parties agreed before the Board that the claimed "equalization" and "discrete attenuation" functions must occur inside the PLC, the Board improperly altered the construction for these limitations when it applied the written description analysis.

Equalization is recited in claims 56 and 102 as "equaliz[ing] the intensities of light energy traveling in the plurality of optical paths of the [PLC]." J.A. 2786. Claim 76 similarly recites "equalizing the intensities of light energy while the light energy is traveling in the plurality of optical paths of the [PLC]." J.A. 2789. Consistent with this claim language, the parties agreed before the Board that the recited equalization must occur "while the light energy is within the PLC." J.A. 3386, 3561.

Discrete attenuation is recited in claims 57 and 103, which explain that "the [PLC] further comprises a gain flattening element to discretely attenuate light energy traveling in the [PLC]." J.A. 2786, 2792. Given this claim language, the parties agreed before the Board that the recited discrete attenuation must also occur while the light energy is traveling inside the PLC. J.A. 3386, 3561.

The problem for Cirrex in this case is that the '082 specification lacks any disclosure or suggestion of how placing attenuation material inside the PLC—which would necessarily impact the collective wavelengths in the PLC in the same way—would result in equalizing the intensities of different wavelengths traveling in the PLC, or discretely attenuating a particular wavelength in the PLC. Cirrex, however, argued to the Board that the intensities of the wavelengths inside the PLC could be equalized with respect to the intensity of a wavelength *outside* the PLC rather than requiring that the equalization apply only to wavelengths inside the PLC. Cirrex's rather creative theory is the following: first, attenuation material could be placed somewhere inside the PLC, and all the wavelengths inside the PLC would travel through the attenuation material and thus be attenuated in the same way; and second, when one wavelength λ_3 is filtered out and soon thereafter replaced with a substitute wavelength λ_3' coming from outside the PLC, under Cirrex's theory, "equalization" can be achieved if the intensity of the collective wavelengths in the PLC had been attenuated to the same level of intensity as the intensity of the newly introduced wavelength λ_3' which had not been subject to the attenuation material. Even if this were possible (and nothing in the specification describes such an embodiment), Cirrex's theory at best equalizes the intensities of the collective wavelengths inside the PLC with a wavelength that is *outside* the PLC; the equalization claims, however, require the PLC to equalize the intensities of different wavelengths as they are "traveling *in* the plurality of optical paths of the [PLC]." J.A. 2786 (emphasis added). Cirrex's position also appears backwards because it changes the intensities of the other wavelengths λ_1, λ_2, and λ_4 to match a specific wavelength λ_3', without first equalizing the wavelengths λ_1, λ_2, and λ_4 inside the PLC. Cirrex's position assumes that the intensities of the wavelengths λ_1, λ_2, and λ_4 inside the PLC are already equal instead of using the attenuation material to equalize those intensities while those wavelengths are inside the PLC.

We thus agree with Cisco that the correct construction for the equalization claims requires that the individual wavelengths of light energy be equalized as to the other wavelengths of light energy inside the PLC while those wavelengths are inside the PLC. When the Board concluded that these claims also encompassed an embodiment in which light energy inside the PLC is equalized to light energy outside the PLC, the Board incorrectly altered the construction, contrary to the claims' plain language, as well as the parties' agreement that the equalization must occur while the light energy is inside the PLC.

Cirrex relies on the same out-of-the-box theory to support its proposed construction of the claimed "discrete attenuation" function. In Cirrex's hypothetical, the collective wavelengths inside the PLC travel through the attenuation material, and the newly arriving wavelength λ_3' is added to the PLC without having undergone attenuation. Cirrex believes that this circumstance is "discrete attenuation" as recited in the claims because some (but not all) of the wavelengths λ_1, λ_2, and λ_4 are attenuated, leaving at least one wavelength λ_3' unattenuated.

We agree with Cisco, however, that when the attenuation applies to all the light wavelengths λ_1–λ_4 traveling inside the PLC, that attenuation cannot be discrete attenuation; it is best understood to be collective attenuation, even if an unattenuated light wavelength λ_3' is later introduced into the PLC. The '082 specification makes clear that the discrete approach to attenuation is distinct from the collective approach to attenuation. As the specification notes for an alternative embodiment using amplification material:

> The assembly illustrated in FIG. 13 supports a *discrete channel approach to signal amplification* which is *different* from the *common approach of collectively amplifying the channels*. In the illustrated embodiment, the elements 1300 depicted can be amplifiers that apply selective gain to each spectral region. The spectral regions may contain one or numerous channels.

'082 patent col. 14 l. 64–col. 15 l. 40 (emphases added). Thus, discrete attenuation is distinct from collective attenuation because in the discrete approach, each wavelength of light is separately amplified or attenuated, whereas in the collective approach, the same amplification or attenuation is applied to all wavelengths of light in the same way.

To be sure, the '082 specification does mention placing "attenuation material within the zigzag-depicted optical path within the PLC 210E," along with other possible placement locations in the overall larger network assembly. *Id.* col. 15 ll. 17–26. The '082 specification does not, however, disclose or even remotely suggest that placing attenuation material in the PLC results in *discrete* attenuation. To the contrary, placing attenuation material inside the PLC will not result in discrete attenuation because no one disputes that the attenuation material acts to attenuate all the wavelengths of light traveling inside the PLC. The fact that an additional wavelength λ_3' may be later introduced into the PLC to replace a filtered-out wavelength λ_3 does not transform a collective attenuation into "discretely attenuat[ing] light energy traveling *in* the [PLC]," as claimed. J.A. 2786 (emphasis added).

Thus, we correct the Board's construction of equalization to clarify that the individual wavelengths of light energy inside the PLC must be equalized with respect to other wavelengths of light energy while those wavelengths are traveling inside the PLC. We also correct the Board's construction of discrete attenuation to clarify that discrete attenuation does not encompass using the same attenuation element inside the PLC to attenuate all wavelengths of light in the same way.

III. No Written Description for the Equalization and Discrete Attenuation Claims

Turning next to the Board's finding of patentability of the equalization and discrete attenuation claims over Cisco's objection for lack of written description support, we note first that the '082 patent issued with original claims 1–34, and Cirrex later added claims 35–124 during reexamination, of which claims 56, 57, 76, 102, and 103 were found patentable. Because none of the added claims were part of the '082 patent's original disclosure, Cirrex cannot rely on them for written description support. *See Gentry Gallery, Inc. v. Berkline Corp.*, 134 F.3d 1473, 1479 (Fed. Cir. 1998) (The patentee's "original disclosure serves to limit the permissible breadth of his later-drafted claims.").

The written description requirement provides that a patentee must "clearly allow persons of ordinary skill in the art to recognize that [he] invented what is claimed." *Ariad Pharm., Inc. v. Eli Lilly & Co.*, 598 F.3d 1336, 1351 (Fed. Cir. 2010) (en banc) (quoting *Vas-Cath Inc. v. Mahurkar*, 935 F.2d 1555, 1563 (Fed. Cir. 1991)). "[T]he test for sufficiency is whether the disclosure of the application relied upon reasonably conveys to those skilled in the art that the inventor had possession of the claimed subject matter as of the filing date." *Id.* "[T]he level of detail required to satisfy the written description requirement varies depending on the nature and scope of the claims and on the complexity and predictability of the relevant technology." *Id.*

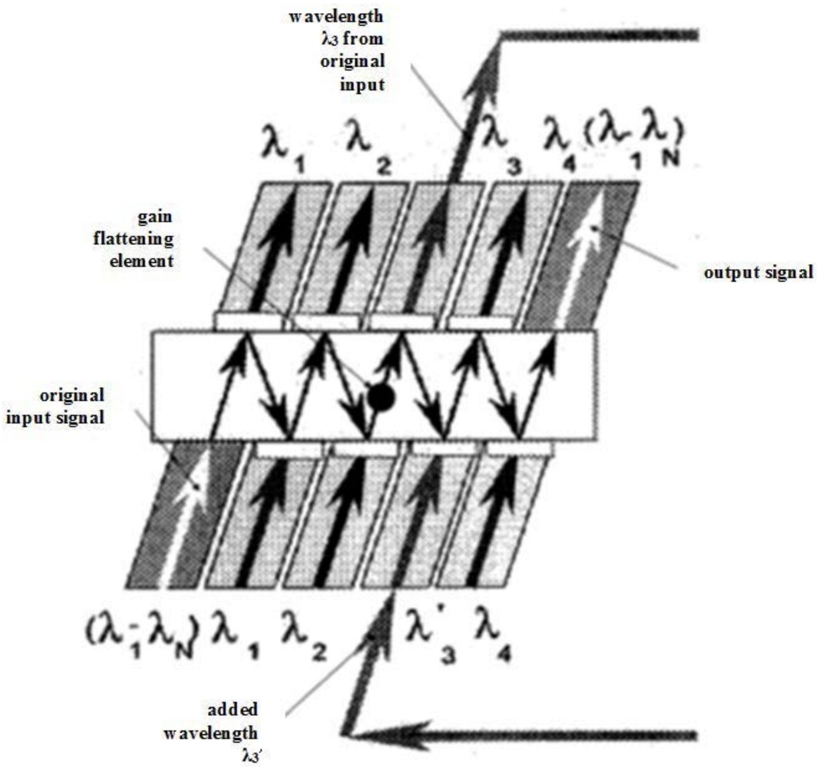
In *Gentry Gallery, Inc. v. Berkline Corp.*, a patentee amended his claims to remove a limitation reciting the placement of controls for a set of two parallel recliners on a console between the two recliners. 134 F.3d 1473, 1479 (Fed. Cir. 1998). We reversed the district court's conclusion upholding the claims' validity because the specification specifically contemplated the central console as the only location for the controls. *Id.* Although *Gentry Gallery* "did not announce a new 'essential element' test mandating an inquiry into what an inventor considers to be essential to his invention and requiring that the claims incorporate those elements," it "applied and merely expounded upon the unremarkable proposition that a broad claim is invalid when the entirety of the specification clearly indicates that the invention is of a much narrower scope." *Carnegie Mellon Univ. v. Hoffmann-La Roche Inc.*, 541 F.3d 1115, 1127 (Fed. Cir. 2008) (quoting *Cooper Cameron Corp. v. Kvaerner Oilfield Prods., Inc.*, 291 F.3d 1317, 1323 (Fed. Cir. 2002)).

Similarly, in *PIN/NIP, Inc. v. Platte Chemical Co.*, we explained that "[w]hile it is legitimate to amend claims or add claims to a patent application purposefully to encompass devices or processes of others, there must be support for such amendments or additions in the originally filed application." 304 F.3d 1235, 1247 (Fed. Cir. 2002). On appeal, we reversed the district court's validity finding. We held that the challenged claim reciting "the spaced, sequential application of the two separate chemicals" to certain tubers was invalid for lack of written description support because the "originally filed application, which is devoid of any mention or even implication that the two chemicals can be applied in a spaced, sequential manner, does not support the later-added claim." *Id.* at 1247–48.

Here, in asserting written description support for its equalization and discrete attenuation claims, Cirrex argued a modified version of Figure 10, illustrating a possible location of the attenuation material inside the PLC to the Board as follows:

> One simple example is illustrated below, using the PLC of Figure 10 of the '082 patent to illustrate. In this example, a gain flattening element has been added to the "zig-zag" path of the PLC. Even if this element is not wavelength-selective, the gain flattening element would affect the signal strength of wavelengths λ_1, λ_2, λ_3, and λ_4 of the original input, but not the signal strength of added wavelength λ_3'. For example, the gain flattening element may increase (or decrease) the signal strengths of wavelengths λ_1, λ_2, and λ_4 (that is, a discrete spectral region which contains one or more channels) to equal the signal strength of added wavelength λ_3', thus equalizing the signal strength of each of the four wavelengths of light in the output signal (λ_3 has been dropped from the output signal).

J.A. 3375.



Patent Owner's Modified Fig. 10

’082 patent fig.10 (as modified by Cirrex).

The Board agreed with Cirrex, finding that the claimed equalization function encompassed the equalization of λ_1, λ_2, and λ_4 against λ_3', even though λ_3' was not inside the PLC. J.A. 11. The Board also found that placing an attenuation element inside the PLC could support the discrete attenuation claims because even though all the wavelengths of light λ_1–λ_4 inside the PLC were collectively attenuated, the addition of an unattenuated wavelength of light λ_3' from outside the PLC meant that some wavelengths of light were attenuated and other wavelengths were not attenuated. J.A. 12.

We disagree. Under the correct claim construction, as explained earlier, the claimed functionality of equalization and discrete attenuation must occur inside the PLC with respect to the wavelengths "traveling in the [PLC]," not to wavelengths outside of the PLC. This construction does not encompass the equalization of wavelengths λ_1, λ_2, and λ_4 already inside the PLC with a wavelength λ_3' coming from outside the PLC. Similarly, placing an attenuation element inside the PLC will not result in discrete attenuation because the attenuation element attenuates all the wavelengths of light inside the PLC. The fact that an additional wavelength λ_3' may be later introduced into the PLC to replace an original wavelength λ_3 does not transform a collective attenuation into discrete attenuation.

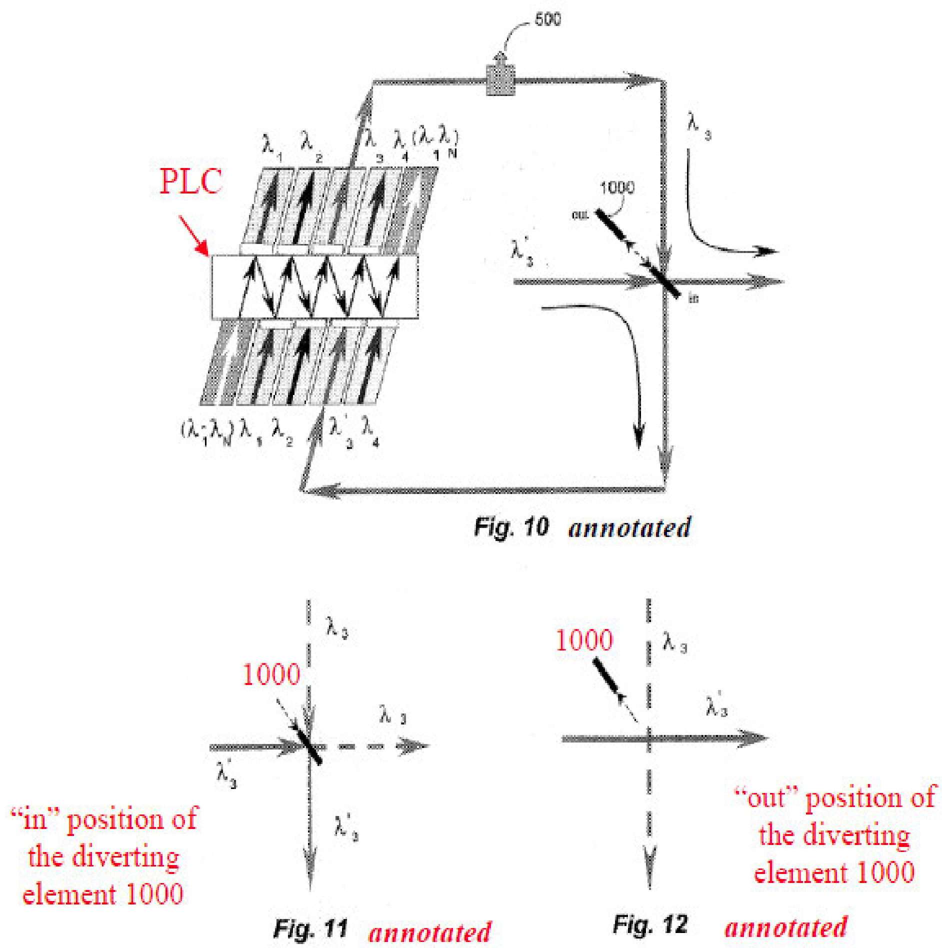
We also agree with Cisco that the claims are directed to subject matter that is indisputably missing from the '082 specification, *i.e.*, the claims "cover a mechanism for acting on individual channels of light ***within*** the PLC to discretely attenuate one of several channels" or "a mechanism for acting on individual channels of light ***within*** the PLC to make their several intensities equal." Cisco Opening Br. at 44 (emphases in original). The '082 specification does not meet the quid pro quo required by the written description requirement for the disputed claims because demultiplexing light to manipulate separately the intensities of individual wavelengths of light while the light is still inside the PLC is a technically difficult solution that the '082 specification does not solve, let alone contemplate or suggest as a goal or desired result. Nothing in the '082 specification explains how individual wavelengths of light are separately manipulated while those wavelengths are still inside the PLC. Nor is there anything in the specification that suggests that the inventor contemplated that approach. To the contrary, the '082 specification expressly describes using the PLC to separate wavelengths of light to allow the manipulation of each individual wavelength—*outside* the PLC—before it is rerouted back into the PLC for remultiplexing.

Under the correct claim construction for the equalization and discrete attenuation claims, there is no substantial evidence in the record to support the Board's finding that claims 56, 57, 76, 102, and 103 of the '082 patent have sufficient written description support. Thus, we reverse the Board's findings of patentability for these claims.

IV. Cirrex's Cross-Appeal of the Diverting Element Claims

Cirrex cross-appeals the Board's rejections of the diverting element claims for lack of written description support, arguing that the Board cited Figures 10 and 13 of the '082 patent and their accompanying descriptions, but it did not consider Figure 11. Cirrex argues that Figure 11 provides sufficient support for a diverting element inside a PLC, as claimed.

The Board compared Figures 10 and 13 and found that both figures disclose a PLC and a separate element located outside the PLC. It found that the '082 specification does not provide for a separate embodiment with a diverting element inside the PLC, and therefore, the totality of the disclosure did not establish that the inventors possessed an embodiment with a diverting element inside the PLC.



’082 patent figs.10–12 (as annotated by Cisco).

Cirrex contends that Figure 11 fills in the perceived gap in disclosure because Figure 11 shows a diverting element in the *optical path* that diverts the existing optical channel content and replaces it with new content. Cirrex points to the ’082 specification’s explanation that photolithographic techniques can be used to cast the *optical paths within a PLC* into desired circuit patterns. Based on these two disclosures, Cirrex contends that the ’082 patent necessarily discloses that the diverting element is inside the PLC. Cisco responds that Figure 11 shows an “element in an optical path” of an optical circuit, but it never states that this optical path is "within a PLC." Cisco Reply Br. at 11.

We affirm because Figure 11 does not show a diverting element inside a PLC. The PLC is shown on the left-hand side of Figure 10, and the diverting element 1000 is shown on the right-hand side of Figure 10, *outside the PLC*. The diverting element 1000 can be set to a position that is either "in" or "out" of the optical path of light beams λ_3 and λ_3'; these positions correspond to diverting or not diverting the light beams, in the form of a switch. The diverting element 1000 is clearly located outside the PLC in Figure 10, and nothing in Figure 11 suggests that the diverting element has been moved to inside the zig-zag area within the PLC.

We agree that the Board reasonably read the written description and figures in the '082 patent to conclude that the specification does not show a diverting element inside a PLC. The Board properly compared Figures 10 and 13 and did not need to specifically refer to Figure 11 because Figures 11 and 12 are blow-ups of the diverting element of Figure 10. The Board necessarily considered Figure 11 based on its review of Figure 10 when it concluded that "[t]he diverting element is similarly illustrated in Fig. 10, and without an accompanying recitation that the diverting element can be within the PLC." J.A. 27.

The fact that there are optical paths inside the PLC (*e.g.*, the zig-zag pattern in Figure 10) does not by itself require Cirrex's reading of the specification, given that optical paths also exist outside the PLC, as shown by λ_3 and λ_3' in Figure 10. It is immaterial for resolving the written description issue in this case that photolithographic techniques can be used to cast optical paths within a PLC because Figure 10 shows that optical paths also exist outside the PLC, and nothing in Figure 10 or Figure 11 shows that the diverting element is inside the PLC. There is also no disclosure in the '082 specification of where inside the PLC the diverting element would be placed or how that diverting element would divert the light beams inside the PLC.

Substantial evidence supports the Board's finding of lack of written description support for the diverting element claims. Because we affirm the Board's finding of lack of written description support, we need not and do not reach the Board's alternate grounds for unpatentability of the diverting element claims.

CONCLUSION

We have considered Cirrex's remaining arguments and find them unpersuasive. We reverse the Board's finding of patentability for the equalization and discrete attenuation claims because the '082 patent lacks written description support for those claims. We affirm the Board's rejection of the diverting element claims for lack of written description support. We do not reach the Board's alternate grounds for unpatentability of the diverting element claims.

No costs.

AFFIRMED-IN-PART AND REVERSED-IN-PART