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9 U.S.P.Q.2d 1962

CORNING GLASS WORKS, Plaintiff/Cross-
Appellant,

v.

SUMITOMO ELECTRIC U.S.A., INC., Sumitomo
Electric
Industries, Ltd. and Sumitomo Electric Research
Triangle, Inc., Defendants/Appellants.

Nos. 88-1192, 88-1193.

**United States Court of Appeals,
Federal Circuit.**

Feb. 22, 1989.

William K. West, Jr., Cushman, Darby and Cushman, Washington, D.C., argued for plaintiff/cross-appellant. With him on the brief were George T. Mobbille, Chris Comuntzis, Duane M. Byers and Lynn E. Eccleston. Also on the brief were Italo H. Ablondi, F. David Foster, Sturgis M. Sobin and Peter J. Koenig, Ablondi & Foster, Washington, D.C.

Lars I. Kulleseid, Fish & Neave, of New York City, argued for defendants/appellants. With him on the brief were W. Edward Bailey, Daniel M. Gantt, Thomas J. Vetter and Mark H. Bloomberg. Also on the brief were Alfred L. Michaelsen and K. McNeill Taylor, Jr., Corning Glass Works, Corning, N.Y., of counsel.

Before RICH, NIES and BISSELL, Circuit Judges.

NIES, Circuit Judge.

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Sumitomo Electric U.S.A., Inc. (SEUSA), Sumitomo Electric Industries, Ltd. (SEI), and Sumitomo Electric Research Triangle, Inc. (SERT), (collectively Sumitomo) appeal from the judgment of the United States District Court for the Southern District of New York, 671 F.Supp. 1369, 5 USPQ2d 1545 (S.D.N.Y.1987) (Conner, J.), holding Sumitomo liable for infringement of claims 1 and 2 of United States Patent No. 3,659,915 ('915) and claim 1 of United States Patent No. 3,884,550 ('550), all directed to the structure of optical waveguide fibers. On appeal, Sumitomo challenges the validity of both patents and the finding of infringement of the '915 patent by one of its accused products. Corning Glass Works cross-appeals from the portion of the judgment holding that Sumitomo does not infringe another of its patents, United States Patent No. 3,933,454 ('454), which claims a method of making optical waveguide fibers. We affirm the judgment in all respects.

BACKGROUND¹

A. General Technology

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The inventions involved in this case relate to optical waveguide fibers of the type now widely used for telecommunications, such as long-distance telephone transmissions. Such fibers were developed as a medium for guiding the coherent light of a laser a distance suitable for optical communications.

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It had long been known that light could be guided through a transparent medium that was surrounded by another medium having a lower refractive index (RI). A glass fiber surrounded by air, for example, will function as a conduit for light waves, because air has a lower RI than glass. To prevent scratches, imperfections, or foreign materials on the fiber surface from scattering light away from the fiber, glass fibers were clad with a glass layer having a lower RI. Before 1970, however, these glass-clad, glass-core fibers, referred to generally as "fiber optics," were capable of transmitting light of practical intensity only for very short distances due to high attenuation of the glass fibers then available. While suitable for illumination or for imaging systems, as in endoscopic probes, they could not be used for optical communications.

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Another impediment to the use of conventional fiber optics for optical communications was the need that the fiber limit the transmitted light to preselected rays or "modes." In contrast, conventional fibers were designed to pass the maximum amount of incident light. The relatively large core diameter of conventional fibers permitted modes of light to enter the core over a fairly wide range of angles which, provided they entered at less than the critical angle, would be propagated along the fiber. Upon entering a fiber core, the light modes travel to the cladding and then back into the core, thus "bouncing" back and forth in a zig-zag path along the length of the fiber. The shallower the angle at which the modes enter the core, the less they will "bounce" and the sooner they will reach the receiving end of the fiber. When the number of modes are restricted, intelligibility of the information transmitted increases. The optimum restriction is achieved when only a single mode is transmitted, and by limiting the core diameter, that purpose is accomplished.

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By the mid-1960's, worldwide efforts were ongoing to develop long-distance lightwave transmission capability. In particular, the British Post Office sought an optical waveguide with an attenuation of 20 db/km, the approximate transmission efficiency of the copper wire commonly used in telephone communications.

B. The '915 Invention

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Corning's work on optical waveguides began in 1966, when it was contacted by the British Post Office. Drs. Robert D. Maurer and Peter C. Schultz, working at Corning, developed the world's first 20 db/km optical waveguide fiber by early 1970. That achievement was due, in part, to the development of a fiber with a pure fused silica cladding and a fused silica core containing approximately three percent by weight of titania as the dopant in the core.² It was also due to the careful selection of the core diameter and the RI differential between the core and the cladding.

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Bell Laboratories confirmed the attenuation measurements of Corning's fibers and considered Corning's achievement an important breakthrough, making long-distance optical telecommunications possible. Dr. Maurer first publicly reported the achievement of a 20 db/km optical waveguide fiber at the Conference on Trunk Telecommunications by Guided Waves held in London, England. That announcement created enormous interest and was the subject of many articles in both technical and general publications. The inventors' advancement in technology won them accolades from various societies and institutes, for which they were presented with many prestigious awards and honors. In addition, the invention of the '915 patent has achieved impressive commercial success on a worldwide basis. The district court determined that "[t]he 915 patent clearly covers a basic, pioneering invention." 671 F.Supp. at 1377, 5 USPQ2d at 1551.

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The '915 patent discloses a fused silica optical waveguide fiber capable of limiting the transmitted light to preselected modes for use in optical communication systems. Specifically, such a fiber is disclosed as having a doped fused silica core and a fused silica cladding (doping optional), wherein the RI of the core is greater than that of the cladding. Prior to the filing date of the application for the '915 patent, the inventors had experimented with dopants which increased the RI of fused silica, e.g. titania, and the '915 specification mentions only such positive dopant materials. At the time the application was filed, the inventors did not know of specific dopants that would decrease the RI of fused silica, although it had been known in the art since 1954 that the introduction of fluorine decreases the RI of certain multicomponent glasses.

C. The '550 Invention

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Corning's titania-doped fibers required heat treatment to reduce attenuation to an acceptable level. An undesirable result of that treatment was a lowering of the mechanical strength of the fibers. Consequently, Corning sought to develop a low attenuation fiber which did not require heat treatment. In 1972, Drs. Maurer and Schultz found a solution in doping a fused silica core with germania, which also had the advantage of transmitting more light than using titania.

D. The '454 Invention

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Corning recognized that when optical waveguide fibers were produced by flame hydrolysis, they contained hydroxyl ions. The residual hydroxyl ions absorbed light at certain wavelengths used in optical communications and, if they remained, would increase the attenuation of the fiber at those wavelengths. Working at Corning, Dr. Robert D. DeLuca invented a process to overcome this inherent problem by introducing a chlorine-containing drying atmosphere into the furnace during the "consolidation" phase.

E. District Court

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Corning is the assignee of the three patents at issue. SEI and its subsidiaries, SERT and SEUSA, are engaged in the manufacture and sale of optical waveguide fibers. This appeal involves two suits which were consolidated: an action by SERT³ seeking a declaration of invalidity and noninfringement of Corning's '915 and '454 patents with a counterclaim by Corning alleging SERT's infringement of those patents, and a suit by Corning against SEUSA and SEI asserting infringement of the '915, '550, and '454 patents.

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The trial court held, inter alia, that claims 1 and 2 of the '915 patent and claim 1 of the '550 patent were not invalid and were infringed by Sumitomo. It found no infringement of the '454 patent. These rulings are the subject of this appeal and cross-appeal.

II

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Validity and Infringement of Claims 1 and 2 of '915 Patent

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* On appeal Sumitomo attacks the validity of the '915 claims in issue solely on the ground that they are anticipated by the prior art United Kingdom Patent No. 1,113,101 ('101). Anticipation requires that every limitation of the claim in issue be disclosed, either expressly or under principles of inherency, in a single prior art reference. *Kalman v. Kimberly-Clark Corp.*, 713 F.2d 760, 771, 218 USPQ 781, 789 (Fed.Cir.1983), cert. denied, 465 U.S. 1026, 104 S.Ct. 1284, 79 L.Ed.2d 687 (1984). While recognizing that the '915 patent discloses innovative work by the inventors in the field of fiber optics, Sumitomo maintains that the structure as claimed is identical to the fiber structure disclosed in the '101 reference.

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In this case, the question of anticipation turns on claim interpretation, a question of law. *Loctite Corp. v. Ultraseal Ltd.*, 781 F.2d 861, 866, 228 USPQ 90, 93 (Fed.Cir.1985). If the claims are given Sumitomo's suggested interpretation, the '101 patent anticipates; otherwise, it does not. In particular, the dispute focuses on the interpretation and effect of the words "An optical waveguide" in claim 14 which reads (paraphrasing and identification provided):

An optical waveguide comprising

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(a) a cladding layer formed of a material selected from the group consisting of pure fused silica and fused silica to which a dopant material on at least an elemental basis has been added, and

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(b) a core formed of fused silica to which a dopant material on at least an elemental basis has been added to a degree in excess of that of the cladding layer so that the index of refraction thereof is of a value greater than the index of refraction of said cladding layer, said core being

formed of at least 85 percent by weight of fused silica and an effective amount up to 15 percent by weight of said dopant material.

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Sumitomo asserts that the above claim is anticipated by the disclosure in the '101 patent of a substantially transparent luminescent glass in the form of a fiber comprised of a doped silica core (up to 15% dopant) having a sheath of silica. While nothing in the '101 patent either expressly or impliedly discusses the use of the '101 fiber as an optical waveguide, Sumitomo points to testimony to the effect that the '101 fiber "inherently" could function as a "waveguide," albeit at most for a few meters. Per Sumitomo, Corning has merely specified a new use for an old structure by calling it "An optical waveguide." Thus, it urges that the words "An optical waveguide" in the claim should be ignored because the "preamble is not a limitation when it merely states a purpose or intended use and the remainder of the claim completely defines the invention."

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Corning counters that the preamble words "An optical waveguide" constitute a limitation of the invention which must be interpreted as that term is defined in the '915 specification. "An optical waveguide" is there defined as follows:

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[T]ransmitting media [for frequencies around 10^{15} hz] are hereinafter referred to as "optical waveguides." ... [A]n optical waveguide should allow only preselected modes of light to propagate along the fiber.

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United States Patent No. 3,659,915, col. 1, lines 34-39. In describing the physical attributes of an optical waveguide, the specification continues:

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Optical waveguides are a unique type of optical fiber in that many of the physical characteristics and parameters must be carefully coordinated.... [A]s explained by N.S. Kapany if an optical fiber is to function as an optical waveguide, that is, limiting the transmitted light to preselected modes, the diameter of the core, the index of refraction of the core and the index of refraction of the cladding layer must be carefully coordinated.

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Id. at col. 1, lines 49-51, 65-70. The specification then sets forth in detail the complex equation for the structural dimensions and refractive index differential necessary, in accordance with the invention, for an optical waveguide fiber comprising a fused silica core and cladding to transmit preselected modes of light. As so defined, per Corning, claim 1 of the '915 patent includes structural limitations not disclosed for the prior art '101 fibers. Without these limitations, Corning argues, an optical fiber does not function as the "optical waveguide" of the invention. Thus, per Corning, the claim does not merely specify a new use for the old product, and

paragraphs labeled (a) and (b) of the claim do not completely define the structure of the invention.

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No litmus test can be given with respect to when the introductory words of a claim, the preamble, constitute a statement of purpose for a device or are, in themselves, additional structural limitations of a claim. To say that a preamble is a limitation if it gives "meaning to the claim" may merely state the problem rather than lead one to the answer. The effect preamble language should be given can be resolved only on review of the entirety of the patent to gain an understanding of what the inventors actually invented and intended to encompass by the claim. Here, the '915 specification makes clear that the inventors were working on the particular problem of an effective optical communication system not on general improvements in conventional optical fibers. To read the claim in light of the specification indiscriminately to cover all types of optical fibers would be divorced from reality. The invention is restricted to those fibers that work as waveguides as defined in the specification, which is not true with respect to fibers constructed with the limitations of paragraphs (a) and (b) only. Thus, we conclude that the claim preamble in this instance does not merely state a purpose or intended use for the claimed structure. See *Kropa v. Robie*, 187 F.2d 150, 152, 88 USPQ 478, 481 (CCPA 1951). Rather, those words do give "life and meaning" and provide further positive limitations to the invention claimed. See *Loctite*, 781 F.2d at 866, 228 USPQ at 92; *Perkin-Elmer Corp. v. Computervision Corp.*, 732 F.2d 888, 896, 221 USPQ 669, 675 (Fed.Cir.), cert. denied, 469 U.S. 857, 105 S.Ct. 187, 83 L.Ed.2d 120 (1984). Thus, contrary to Sumitomo's argument, the core and cladding limitations specifically set out in paragraphs (a) and (b) are not the only limitations of the claim. See, e.g., *Diversitech Corp. v. Century Steps, Inc.*, 850 F.2d 675, 677-78, 7 USPQ2d 1315, 1317 (Fed.Cir.1988) (affirming district court's use of claim preamble as a limitation). The claim requires, in addition, the particular structural relationship defined in the specification for the core and cladding to function as an optical waveguide.

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Viewed in this manner, the fact that the '101 luminescent fiber could inherently transmit information for a few meters becomes irrelevant. The '101 patent does not disclose all the limitations of the claimed "optical waveguide" as that term is structurally defined by the '915 inventors.

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While Sumitomo correctly states the general proposition that a court may not redraft a claim for purposes of avoiding a defense of anticipation, *McCarty v. Lehigh Valley R.R.*, 160 U.S. 110, 116, 16 S.Ct. 240, 242, 40 L.Ed. 358 (1895); *E.I. Du Pont de Nemours & Co. v. Phillips Petroleum Co.*, 849 F.2d 1430, 1433, 7 USPQ2d 1129, 1131 (Fed.Cir.1988), that proposition does not apply to this case. This is not a case where "extraneous" limitations from the specification are being read into the claim wholly apart from any need to interpret what the patentee meant by particular words or phrases in the claim. *Du Pont*, 849 F.2d at 1433, 7 USPQ2d at 1131. Here, the question is what effect to give to words in the claim. "It is entirely proper to use the specification to interpret what the patentee meant by a word or phrase in the claim." *Id.*

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In sum, we are unpersuaded of legal or factual error in the district court's finding that the '915 claims are not anticipated by the prior art '101 patent.

B

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The infringement issue on appeal involves only Sumitomo's S-3 fibers which were found to infringe under the doctrine of equivalents. A claim in a patent provides the metes and bounds of the right which the patent confers on the patentee to exclude others from making, using, or selling the protected invention. See *Graver Tank & Mfg. Co. v. Linde Air Prods. Co.*, 339 U.S. 605, 607, 70 S.Ct. 854, 855, 94 L.Ed. 1097 (1950). As explained in *Autogiro Co. of America v. United States*, 384 F.2d 391, 155 USPQ 697, 181 Ct.Cl. 55 (1967):

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The claims of the patent provide the concise formal definition of the invention. They are the numbered paragraphs which "particularly [point] out and distinctly [claim] the subject matter which the applicant regards as his invention." 35 U.S.C. Sec. 112. It is to these wordings that one must look to determine whether there has been infringement.

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384 F.2d at 395-96, 155 USPQ at 701. "These wordings" of a claim describe and point out the invention by a series of limiting words or phrases (limitations). In the determination of infringement, the words of the claim must first be interpreted, *id.* at 396, 155 USPQ at 705, and, as properly interpreted, they must be "read on" the accused structure to determine whether each of the limitations recited in the claim is present in the accused structure. *Envirotech Corp. v. Al George, Inc.*, 730 F.2d 753, 758, 221 USPQ 473, 477 (Fed.Cir.1984). However, to hold a patentee to the precise claim language in all cases could turn "the patent grant into a hollow and useless thing." *Graver Tank*, 339 U.S. at 607, 70 S.Ct. at 855. As explained in *Graver Tank*:

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"To temper unsparing logic and prevent an infringer from stealing the benefit of an invention" a patentee may invoke this doctrine [of equivalents] to proceed against the producer of a device "if it performs substantially the same function in substantially the same way to obtain the same result." *Sanitary Refrigerator Co. v. Winters*, 280 U.S. 30, 42 [50 S.Ct. 9, 13, 74 L.Ed. 147]. The theory on which it is founded is that "if two devices do the same work in substantially the same way, and accomplish substantially the same result, they are the same, even though they differ in name, form, or shape." *Machine Co. v. Murphy*, 97 U.S. 120, 125 [24 L.Ed. 235 (1877)].

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Graver Tank, 339 U.S. at 608, 70 S.Ct. at 856 (footnote omitted). The district court found that this test for infringement was met, stating:

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Although fiber S-3 is not within the literal language of either claim 1 or 2 of the '915 patent, it performs substantially the same function in substantially the same way to obtain the same result as the optical waveguide fiber described in those claims of the '915 patent.

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Corning Glass Works v. Sumitomo Elec. U.S.A., Inc., 671 F.Supp. 1369, 1387, 5 USPQ2d 1545, 1559 (S.D.N.Y.1987).

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In the instant case, there is no dispute that the accused S-3 fiber performs substantially the same overall function to obtain the same overall result as the claimed invention. The question then is whether it does so in "substantially the same way." As stated in Perkin Elmer Corp. v. Westinghouse Electric Corp.:

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Perkin-Elmer's repeated assertions that the claimed and accused devices perform substantially the same function and achieve substantially the same end result are not helpful. That circumstance is commonplace when the devices are sold in competition. That a claimed invention and an accused device may perform substantially the same function and may achieve the same result will not make the latter an infringement under the doctrine of equivalents where it performs the function and achieves the result in a substantially different way. Graver Tank & Mfg. Co. v. Linde Air Products Co., 339 U.S. 605, 608, 70 S.Ct. 854, 856, 94 L.Ed. 1097, 85 USPQ 328, 330 (1950); see, e.g., Sealed Air Corp. v. U.S. International Trade Comm'n, 645 F.2d 976, 984, 209 USPQ 469, 476 (CCPA 1981).

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822 F.2d 1528, 1531 n. 6, 3 USPQ2d 1321, 1323-24 n. 6 (Fed.Cir.1987).

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The accused S-3 fibers are optical waveguides as defined in the claims at issue in that the fibers have the differential in RI between core and cladding and the structural dimensions necessary for the preselection of particular modes of light waves. Thus, these limitations of claim 1 which, as above indicated, are required by the preamble are met in the accused S-3 fibers. Also, there is no dispute over a literal reading of paragraph (a) on these fibers. Corning concedes, however, that all of the limitations of paragraph (b) do not literally read on the accused fibers. Although each claim limitation may not literally be found in the accused structure, the "substantially the same way" prong of the Graver Tank test is met if an equivalent of a recited limitation has been substituted in the accused device, see Graver Tank, 339 U.S. at 610, 70 S.Ct. at 857; see also Pennwalt Corp. v. Durand-Wayland, Inc., 833 F.2d 931, 937, 4 USPQ2d 1737, 1741 (Fed.Cir.1987) (in banc), cert. denied, --- U.S. ---, 108 S.Ct. 1226, 1474, 99 L.Ed.2d 426 (1988); Perkin-Elmer Corp., 822 F.2d at 1533, 3 USPQ2d at 1325; Atlas Powder Co. v. E.I. Du Pont De Nemours & Co., 750 F.2d 1569, 1579-80, 224 USPQ 409, 416 (Fed.Cir.1984).

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Applying these principles, the district court found that the accused S-3 fibers infringed the '915 claims. In so ruling, the district court recognized that the claim limitation calling for addition of a dopant to the core was not literally met in the accused S-3 fibers. 671 F.Supp. at 1387, 5 USPQ2d at 1559. Nevertheless, the court found that the substitution of "fluorine ... dopant which negatively alters the index of refraction of fused silica[] in the cladding" equivalently met the limitation requiring the addition to the core of "a dopant which positively alters the index of refraction of fused silica." Id. at 1386-87, 5 USPQ2d 1559.

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Sumitomo alleges clear error in the court's finding of equivalency. Per Sumitomo, nothing was substituted in the core of the S-3 fiber for a dopant which performed the function of increasing the core's refractive index, and, therefore, "an element" required by the claim, namely, a doped core, is entirely missing. Sumitomo asserts, that where an element of a claim is entirely missing, there is no infringement. The premise on which Sumitomo relies, known as the "All Elements" rule, see 4 D. Chisum, Patents Sec. 18.03 (1986), correctly states the law of this circuit adopted in banc in Pennwalt. See Pennwalt Corp., 833 F.2d at 935, 4 USPQ2d at 1739-40 (infringement requires that each element of a claim or its substantial equivalent be found in the accused device). However, we do not agree that an "element" of the claim is entirely "missing" from the S-3 fibers.

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Sumitomo's analysis illustrates the confusion sometimes encountered because of misunderstanding or misleading uses of the term "element" in discussing claims. "Element" may be used to mean a single limitation, but it has also been used to mean a series of limitations which, taken together, make up a component of the claimed invention.⁵ In the All Elements rule, "element" is used in the sense of a limitation of a claim. See *Julien v. Zeringue*, 867 F.2d 1569, 1571 (Fed.Cir.1989) ("If a claim limitation or its substantial equivalent is not present, there can be no infringement." (emphasis added)). Sumitomo's analysis is faulty in that it would require equivalency in components, that is, the substitution of something in the core for the absent dopant. However, the determination of equivalency is not subject to such a rigid formula.⁶ An equivalent must be found for every limitation of the claim somewhere in an accused device, but not necessarily in a corresponding component, although that is generally the case.

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Corning urges that the question of equivalency here is a narrow one: Is the substitution of a negative dopant in the cladding equivalent to a positive dopant in the core? When the limitations of paragraph (b) are analyzed individually, the accused S-3 fibers literally meet the limitation that the fiber be composed of a core of fused silica as well as the limitation that "the index of refraction [of the core] is of a value greater than the index of refraction of said cladding layer." The question of equivalency then does center on the part of the claim following the word "core," namely, "to which a dopant material ... has been added to a degree in excess of that of the cladding layer." If those limiting words are met equivalently, no "element," i.e., limitation, of the claim is missing.

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In determining whether an accused device has an equivalent to a required limitation, the Supreme Court has advised:

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What constitutes equivalency must be determined against the context of the patent, the prior art, and the particular circumstances of the case. Equivalence, in the patent law, is not the prisoner of a formula and is not an absolute to be considered in a vacuum. It does not require complete identity for every purpose and in every respect. In determining equivalents, things equal to the same thing may not be equal to each other and, by the same token, things for most purposes different may sometimes be equivalents. Consideration must be given to the purpose for which an ingredient is used in a patent, the qualities it has when combined with the other ingredients, and the function which it is intended to perform. An important factor is whether persons reasonably skilled in the art would have known of the interchangeability of an ingredient not contained in the patent with one that was.

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Graver Tank, 339 U.S. at 609, 70 S.Ct. at 857.

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This court has not set out in its precedent a definitive formula for determining equivalency between a required limitation or combination of limitations and what has been allegedly substituted therefor in the accused device. Nor do we propose to adopt one here. We note that the district court resolved the question by comparison of the function/way/result of the substitution with the function/way/result of the limitation in the context of the invention; that is, the court made a subsidiary analysis comparable to the overall function/way/result analysis mandated for determining infringement of the claim under the doctrine of equivalents. In particular, after explaining how the negative dopant of the S-3 fiber worked, it found:

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[t]he use of fluorine as a [negative] dopant in the cladding thus performs substantially the same function in substantially the same way as the use of a [positive] dopant in the core to produce the same result of creating the refractive index differential between the core and cladding of the fiber which is necessary for the fiber to function as an optical waveguide.

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671 F.Supp. at 1387, 5 USPQ2d at 1559.

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The district court's "function/way/result" equivalency analysis with respect to a claim limitation appears to be a helpful way to approach the problem and entirely in accord with the analysis actually made in Graver Tank, 339 U.S. at 609-10, 70 S.Ct. at 856-57. Support for this approach is found in our precedent. As one of our predecessor courts stated:

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It is fundamental patent law that infringement is not avoided by substituting for an element in a claimed device another element which is its full equivalent, i.e., does substantially the same thing in substantially the same way to get substantially the same result. Equivalency is a question of fact and must be resolved in each instance by analyzing the function of the elements or parts concerned.

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Tektronix, Inc. v. United States, 445 F.2d 323, 329, 170 USPQ 100, referencing 165 USPQ 392, 395-96 (Ct.Cl.1970). Although not stated exactly as above, this court has made that type of analysis repeatedly in determining whether a substitution was, in the context of the entire claim, an equivalent of a limitation. In *Atlas Powder*, for example, the court used the following similar language to assess the equivalency of the substituted ingredient:

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Where, as here, the accused product avoids literal infringement by changing one ingredient of a claimed composition, it is appropriate for a court to consider in assessing equivalence whether the changed ingredient has the same purpose, quality, and function as the claimed ingredient.

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750 F.2d at 1579-80, 224 USPQ at 416. See also *Perkin-Elmer Corp. v. Westinghouse Elec. Corp.*, 822 F.2d at 1531-35, 3 USPQ2d at 1323-27 (substituted loop-coupling not equivalent because it did not produce the same structural-functional-operational interrelationships achieved by tap-coupling specified in claim); *Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 962, 220 USPQ 592, 600 (Fed.Cir.1983) (substituted hole in duct " 'performs substantially the same function in substantially the same way to obtain the same result' as ... blower inlet" of the claim), cert. denied, 469 U.S. 835, 105 S.Ct. 127, 83 L.Ed.2d 69 (1984); *Caterpillar Tractor Co. v. Berco, S.p.A.*, 714 F.2d 1110, 1115, 219 USPQ 185, 187 (Fed.Cir.1983) (thinner driving flange in accused seal did not affect the mode of operation or result obtained by flange in claimed invention).

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Finally, Sumitomo asserts that because the prior art, namely, United States Patent No. 3,320,114 (the Litton patent) teaches that a differential in the RI can be achieved between core and cladding in a fiber optic by negative doping of the cladding, Corning cannot assert equivalency between positive dopant in the core and negative dopant in the cladding. To do so, per Sumitomo, would "expan[d] the claim to encompass what was already in the public domain, i.e., a fiber with a pure undoped core." Contrary to Sumitomo's argument, the substitution of an ingredient known to be an equivalent to that required by the claim presents a classic example for a finding of infringement under the doctrine of equivalents. *Graver Tank*, 339 U.S. at 609, 70 S.Ct. at 856 (important factor [in determining equivalency] is whether persons reasonably skilled in the art would have known of the interchangeability). Nothing is taken from the "public domain" when the issue of equivalency is directed to a limitation only, in contrast to the entirety of the claimed invention. This is such a case. The Litton patent teaches nothing about optical waveguides. Thus, the finding of equivalency in the substitution of a negative dopant in the cladding takes nothing from the "public domain."

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With respect to our standard of review, we are mindful that:

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A finding of equivalence is a determination of fact. Proof can be made in any form: through testimony of experts or others versed in the technology; by documents, including texts and treatises; and, of course, by the disclosures of the prior art. Like any other issue of fact, final determination requires a balancing of credibility, persuasiveness and weight of evidence. It is to be decided by the trial court and that court's decision, under general principles of appellate review, should not be disturbed unless clearly erroneous.

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Graver Tank, 339 U.S. 609-10, 70 S.Ct. at 857. A finding is clearly erroneous only if the reviewing court on the entirety of the evidence of record is left with a firm and definite conviction that a mistake has been made. *Anderson v. City of Bessemer City*, 470 U.S. 564, 573, 105 S.Ct. 1504, 1511, 84 L.Ed.2d 518 (1985). The evidence in this case which consists of expert testimony concerning the operation of the negative dopant, the prior art, and the claimed invention amply support the district court's finding that an equivalent of the limitation in the claim was substituted in the accused device. We are unpersuaded the finding of equivalence is clearly erroneous.⁷

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In sum, we are unpersuaded of error either in the district court's understanding of the law; in its finding that adding negative dopant to the cladding is equivalent to adding positive dopant to the core in the context of the claimed invention; or in its finding that the S-3 fiber is an infringement of the inventions of claims 1 and 2 of the '915 patent.^{III}

Validity of Claim 1 of the '550 Patent

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Sumitomo asserts that claim 18 of the '550 patent is invalid by reason of a statutory bar under 35 U.S.C. Sec. 102(b) (1982) based on a Japanese patent application of Corning which was published more than a year prior to the filing date of the corresponding United States application. Claim 1 of the '550 patent requires that germania be used in the core of the waveguide in excess of 15%. The district court found that the use of germania was not taught by the Japanese application. While conceding that the Japanese application does not expressly disclose germania as a dopant, Sumitomo seeks to rely on the principle that a reference may anticipate if the teaching is inherent in the cited prior art reference. *Verdegaal Bros. Inc. v. Union Oil Co. of Cal.*, 814 F.2d 628, 631, 2 USPQ2d 1051, 1053-54 (Fed.Cir.), cert. denied, --- U.S. ---, 108 S.Ct. 95, 98 L.Ed.2d 56 (1987) (anticipation may be shown if limitation is inherent in prior art reference).

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Sumitomo's argument regarding inherency is, specifically, that the use of the term "dopant" in the Japanese publication, together with a listing of polyvalent metal oxide dopants, "does not exclude germania." That argument approximates one for infringement, rather than inherency, and is confusing at best. Indeed, Sumitomo supports its novel section 102(b) argument by reference to the infringement analysis in *Specialty Composites v. Cabot Corp.*, 845 F.2d 981, 986,

6 USPQ2d 1601, 1604 (Fed.Cir.1988). Under Sumitomo's theory, a claim to a genus would inherently disclose all species. We find Sumitomo's argument wholly meritless whether considered under section 102(b) or under 35 U.S.C. Sec. 103 (1982) to which it makes a passing reference. The Japanese application is a reference only for that which it teaches. As this court stated in *In re Benno*, 768 F.2d 1340, 226 USPQ 683 (Fed.Cir.1985):

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The scope of a patent's claims determines what infringes the patent; it is no measure of what it discloses. A patent discloses only that which it describes, whether specifically or in general terms, so as to convey intelligence to one capable of understanding.

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768 F.2d at 1346, 226 USPQ at 686. Given the district court's full analysis of the merits of the anticipation defense, Sumitomo's convoluted argument that the district court must have thought the Japanese application was not prior art at all is wholly without substance.

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Sumitomo also argues that claim 1 would have been obvious to one of ordinary skill in the art in view of United Kingdom Patent No. 1,108,509 ('509), which does disclose germania in the core. Sumitomo argues that the district court found that the '509 patent describes conventional fiber optics, e.g., those used in image intensifiers and television camera tubes, formed of multicomponent glasses containing between 35% and 62% germania together with numerous other materials. Sumitomo, however, ignores the court's finding that such conventional fiber optics contained light-absorbing impurities which made them wholly unsuitable for optical waveguide use. Neither of those findings have been shown to be clearly erroneous.

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Sumitomo asserts the claim in issue is not limited to waveguide fibers pointing to an amendment of claim 1 which changed "waveguide" to "optical fiber." However, this amendment was made in conjunction with other amendments that limited the permissible percentage of light attenuation and purity level of the core material. Read together, we conclude, as did the district court, that the amendments continued to limit the claim to waveguide fibers. Thus, the court correctly distinguished the claimed invention from the '509 patent on this basis.

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Sumitomo asserts error in the court's statement that the percentage of germania in the glasses of the '550 invention was "minor" when used as a "dopant in fused silica." Sumitomo points out that the claim is not limited to a "minor" percentage of germania and argues that the court's statement is a "striking example" of the court's "lack of understanding" of the subject matter. We disagree. Sumitomo merely lifts an isolated statement from the text of the court's lengthy analysis. The district court was plainly aware of the high range of germania permitted by the claim itself inasmuch as the court expressly referred to it. Considering the entirety of the district court's discussion, we are unpersuaded that it exhibited any "lack of understanding" of the claim or was even referencing the claim language of claim 1 which we note is not limited to fused silica. We agree that the '550 invention would not have been obvious from the teachings of the '509 patent alone or in conjunction with the Japanese application. Accordingly, the judgment insofar

as it held that the '550 patent had not been proved invalid under sections 102(b) or 103 is affirmed.

IV

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Corning's Cross Appeal: Infringement of Claim 1 of the '454 Patent

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Corning contends that the district court clearly erred in not finding infringement of claim 1 of the '454 patent by SERT's process.⁹

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Claim 1 of the '454 patent recites the following steps:

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In the method of forming a glass article comprising the steps of

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depositing on a starting member a coating of flame hydrolysis-produced glass soot to form a soot preform,

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consolidating said soot preform to form a dense glass layer free from particle boundaries, and

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forming said dense glass layer into a desired shape, said consolidation step being characterized in that it comprises

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heating said soot preform to a temperature within the consolidation temperature range for a time sufficient to cause said soot particles to fuse and form a dense glass layer, and simultaneously

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subjecting said soot preform to a stream of a substantially dry, hydrogen-free, chlorine containing atmosphere that is substantially free from contaminants that would adversely affect the optical properties of said glass article, said chlorine permeating the interstices of said soot preform during the consolidation thereof and replacing hydroxyl ions by chlorine ions, thereby resulting in a glass article that is substantially water-free.

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Col. 13, lines 13-35 (emphasis added).

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The district court found that SERT's process does not meet the limitations of a chlorine-containing atmosphere, during consolidation, wherein the chlorine permeates the interstices of the soot preform and replaces the hydroxyl ions with the chlorine ions either literally or by equivalent steps. Only the court's finding regarding nonequivalency is challenged on appeal.

77

The SERT process substitutes a particular compound (SERT compound) for the chlorine used for dehydration during the consolidation phase of the claimed process. Corning argues that the SERT compound performs the same function of dehydration in the SERT process as chlorine serves in the claimed process. In explaining why the use of the SERT compound was not the substantial equivalent for use of chlorine, the district court stated, "There is no evidence that [the SERT compound] functions in a comparable manner" (emphasis added). Latching onto the words "no evidence," Corning contends that the district court was grossly in error inasmuch as, per Corning, it presented "ample evidence ... without credible contradiction," that the SERT compound is a well-known dehydration agent able to perform the same function as chlorine. Sumitomo, in response, points to evidence that was before the court which, inter alia, showed that the SERT compound did not permeate the interstices of the soot preform. In context, the district court's statement cannot be taken to mean that there was no effort by Corning to prove that the SERT compound functioned in a manner comparable to chlorine and that Corning's evidence was not considered or weighed, as Corning suggests. The obvious care and attention to this complex case which is reflected in the district court's detailed and lucid explanations of its rulings belie Corning's argument that the court ignored any evidence. It is clear to us that the court's statement simply means that the court found the evidence Corning presented did not establish that chlorine and the SERT compound were equivalents in the context of the invention even though they might be equivalents in other contexts. Reviewing the court's finding that the SERT compound does not function in a manner comparable to chlorine in the invention in light of all the evidence of record, we are not left with the definite and firm conviction that a mistake has been made in this respect.

78

We need not dwell on the district court's further findings that the SERT process did not meet the limitation, either literally or equivalently, that the dehydration and consolidation steps occur "simultaneously." Nor do we need to review the district court's analysis of prosecution history estoppel. We note only that we are unpersuaded of legal or factual error on these issues as well.

V

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The judgment of the district court is affirmed in all respects.

AFFIRMED.

1

In its opinion, 671 F.Supp. 1369, 5 USPQ2d 1545 (S.D.N.Y.1987), the district court fully expounds the technological and historical background surrounding the inventions at issue. Provided here is that background necessary to understand the disposition of the issues. See also *Corning Glass Works v. United States Int'l Trade Comm'n*, 799 F.2d 1559, 230 USPQ 822 (Fed.Cir.1986), a related case, for additional background information

2

Dopants are chemicals added to another material (here, fused silica) to alter one or more of its properties (here, the RI). The effect of the titania was to increase the RI of the core

3

SEI later joined SERT's action

4

Because we conclude that claim 1 is not anticipated, claim 2, which is dependent on claim 1, need not be separately discussed

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See *Perkin-Elmer Corp. v. Westinghouse Electric Corp.*:

References to "elements" can be misleading.... [C]larity is advanced when sufficient wording is employed to indicate when "elements" is intended to mean a component ... of an embodiment of an invention and when it is intended to mean a feature set forth in or as a limitation in a claim.

822 F.2d at 1533 n. 9, 3 USPQ2d at 1325 n. 9.

6

A patentee is, for example, free to frame the issue of equivalency, if it chooses, as equivalency to a combination of limitations. *Winans v. Denmead*, 56 U.S. (15 How.) 330, 343, 14 L.Ed. 717 (1853)

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The finding of equivalence does not depend on the status of the invention as a "pioneer," a finding disputed by Sumitomo on appeal

8

Claim 1 of the '550 patent reads as follows:

An optical fiber comprising a cladding layer formed of high purity glass, and a core of high purity germania containing glass having an index of refraction above that of the cladding layer, said high purity germania containing glass having a cation impurity level not exceeding ten parts per million of transition elements and a germania content in excess of 15% by weight, said optical fiber having light attenuation of less than about 80 db/km at the utilization wavelength or wavelengths of light.

9

Because our review of this issue involves certain proprietary information involving SERT's process, we have not discussed the process with particularity