United States Court of Appeals for the Federal Circuit

ZOLTEK CORPORATION,
Plaintiff-Appellant

v.

UNITED STATES,
Defendant-Appellee

2014-5082

Appeal from the United States Court of Federal Claims in No. 1:96-cv-00166-EJD, Judge Edward J. Damich.

Decided: February 19, 2016

DEAN A. MONCO, Wood, Phillips, Katz, Clark & Mortimer, Chicago, IL, argued for plaintiff-appellant. Also represented by JOHN S MORTIMER; MEREDITH MARTIN ADDY, Katten Muchin Rosenman LLP, Chicago, IL.

GARY LEE HAUSKEN, Commercial Litigation Branch, Civil Division, United States Department of Justice, Washington, D.C., argued for defendant-appellee. Also represented by DAVID M. RUDDY, JOYCE R. BRANDA, JOHN FARGO.

Before NEWMAN, CLEVENGER, and MOORE, *Circuit Judges.*

NEWMAN, *Circuit Judge.*

*Z*oltek Corporation seeks compensation from the United States for use, with the authorization and consent of the Departments of the Air Force and Navy, of the patented method of producing carbon fiber sheet products as claimed in United States Reissue Patent No. Re 34,162 issued January 19, 1993 ("the '162 patent"). The '162 patent is a reissue of U.S. Patent No. 4,728,395, issued March 1, 1988 to inventor George Boyd and assigned to Mr. Boyd's employer Stackpole Fibers Company. The patent was acquired by Zoltek Corporation with its acquisition of Stackpole in 1988.

Litigation history

On March 25, 1996, Zoltek filed suit in the United States Court of Federal Claims (CFC) alleging that the process used to produce carbon fiber sheet materials for the B-2 Bomber and the F-22 Fighter Plane infringed the '162 patent. This is the third appeal in this action. The factual background is set forth in the prior opinions of the CFC and this court.

In the first appeal, this court answered a certified question to hold that the patentee has no cause of action against the United States when any step of the patented method is practiced outside of the United States, as for the F-22 Fighter. *Zoltek Corporation v. United States*, 442 F.3d 1345, 1353 (Fed. Cir. 2006) (Plager, J., dissenting) (*Zoltek I*).

On remand, the CFC granted Zoltek's request for leave to amend its complaint to substitute as defendant Lockheed Martin, the general contractor for the F-22 Fighter, and then granted Zoltek's motion to transfer the count relating to the F-22 Fighter to the United States District Court for the Northern District of Georgia, where it was "reasonably plausible" that the court had jurisdic-

tion over an infringement suit against Lockheed. *Zoltek Corporation v. United States* 85 Fed. Cl. 409, 422 (2009). On Lockheed's motion, this aspect was certified for appeal.

The Federal Circuit then acted *en banc* (in part) and reversed its ruling in *Zoltek I*. This court recognized the liability of the United States for infringement by acts that are performed with its authorization and consent. 28 U.S.C. § 1498(a) ("Whenever an invention described in and covered by a patent of the United States is used or manufactured by or for the United States without license of the owner thereof or lawful right to use or manufacture the same, the owner's remedy shall be by action against the United States in the United States Court of Federal Claims for the recovery of his reasonable and entire compensation for such use and manufacture."). By statute the contractor is immunized from liability. *Id*. ("use or manufacture … by a contractor … shall be construed as use or manufacture for the United States"). This court dismissed Lockheed as a party, negated the proposed transfer to Georgia, and remanded to the Court of Federal Claims for inclusion of counts for infringement with respect to both the F-22 Fighter and the B-2 Bomber. *Zoltek Corporation v. United States*, 672 F.3d 1309, 1311 (Fed. Cir. 2012) (*en banc*) (*Zoltek II*).

On remand, the CFC separated trial of the issues of validity and infringement, and denied discovery as to infringement with respect to the F-22 Fighter. Zoltek sought mandamus from this court concerning these actions; the petition was denied. *In re Zoltek Corporation,* 526 F. App'x 956, 957 (Fed. Cir. 2013) (non-precedential). Trial proceeded in the CFC, limited to validity. The government challenged the '162 patent under sections 101, 103, and 112 of Title 35. The CFC sustained patent eligibility under section 101; that ruling is not appealed.

At trial, each side presented an expert witness, Dr. Brian Sullivan for the government and Mr. Zsolt Rumy for Zoltek. The CFC held the asserted claims invalid on the grounds of obviousness and inadequate written description. *Zoltek Corporation v. United States*, No. 96-166 C, 2014 WL 1279152 (Fed. Cl. Mar. 31, 2014) ("CFC Op."). Zoltek appeals, arguing that the CFC applied incorrect laws of written description and obviousness, that the CFC did not apply the appropriate burdens and standards of proof, and that the CFC erred in its conclusions.

Zoltek also argues that the issues were improperly bifurcated. We conclude that in the circumstances of this case, taking note of the government's official invocation of state secret privilege, the CFC acted within its discretion in limiting trial initially to the issues of validity. However, as we next discuss, we conclude that the trial court erred in its judgment of patent invalidity.

The Boyd Invention

The '162 patent is directed to a method of manufacturing carbon fiber sheet products whose electrical resistivity is pre-selected and value-controlled by the described method. This method is based on Boyd's discovery of a non-linear relationship among the heat treatment conditions, partial carbonization, and surface resistivity[1] of sheet products.

The method as claimed in the reissue patent starts with a previously oxidized and stabilized carbonizable fiber, a product known in the prior art and commercially available. This oxidized fiber is then partially carbonized

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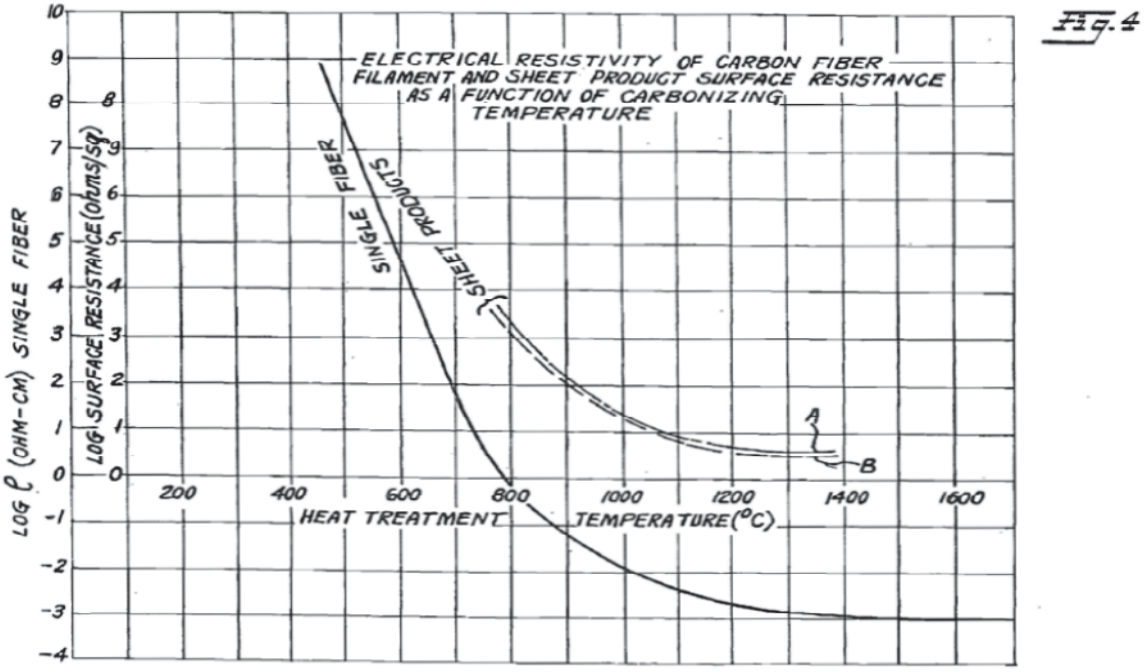
[1] Throughout these proceedings, the terms resistivity and resistance were often used interchangeably. The correctness of these usages is not at issue.

in accordance with the relationship discovered by Boyd, to produce a partially carbonized fiber whose sheet products have the desired pre-selected surface electrical resistance.

This method permits production of carbonized sheets of pre-selected and uniform electrical resistance, and thus uniform pre-selected insulating properties. The '162 specification states that theretofore carbon fiber sheets having specified surface electrical resistance were available only by including other materials, such as glass or aluminum filaments, with the carbonized fibers. '162 patent, col.1 ll.49–60.

Patent Figure 4 shows the foundation discovery of resistivity as a function of carbonizing temperature:



The lower curve represents the volume resistivity for single fibers at the carbonizing temperature, and upper curves A and B show surface resistivities for one half

ounce per square yard and one ounce per square yard sheet products incorporating the designated partially carbonized fibers. The patent describes and exemplifies the preparation of fibers having the preselected partial carbonization, and the production of sheet products having the desired electrical properties. *Id.*, col.4 ll.19–23 ("[T]he temperature-resistivity of the single carbonized fiber is translated into the *preselected desired* surface resistance of the resultant *partially* carbonized fiber sheet product produced with such fibers.").

It is not disputed that the non-linear relationship shown in Figure 4, and its application to achieve the results described in the '162 patent, were not previously known. The government's expert, Dr. Sullivan, stated to be one of the nation's preeminent experts with a "thirty-year career in research and design relating to carbon fiber science," U.S. Br. 22, testified that his calculations pertaining to his reproduction of the Figure 4 curve were based on data that were not in the prior art and were selected retrospectively. No reference showed the relationship between volume or surface-resistivity of carbon fiber sheet products and treatment temperature of carbon fibers.

The CFC held claims 1–22 and 33–38 of the reissue patent invalid on two grounds, (1) that they did not meet the written description requirement, and (2) that the claimed invention would have been obvious to a person of ordinary skill in this field at the time of the invention.

I

Written Description

The claimed method is summarized in reissue claim 1, shown as in the reissue patent, with deletions from the original claim in brackets and additions in italics—for these changes are the basis of the CFC's ruling of invalidity on the ground of inadequate written description:

> 1. A method of manufacturing a plurality of different value controlled resistivity carbon fiber sheet products employing a carbonizable fiber starting material; said method comprising **[**oxidizing and stabilizing the carbonizable fiber starting material at an elevated temperature of the order of 220 degrees Centigrade to effect molecular aromatic rearrangement of the fibers,**]** selectively *partially* carbonizing **[**the**]** *previously* oxidized and stabilized fiber starting material for a predetermined period in an oxygen free atmosphere within a furnace at **[**a**]** selected temperature *values* within a temperature range from 370 degrees Centigrade to about 1300 degrees Centigrade by soaking the stabilized fiber starting material at the selected temperature for the predetermined period of time to provide a **[**desired**]** *preselected known volume* electrical resistivity to the *partially* carbonized fibers *corresponding to that volume electrical resistivity value required to provide the preselected desired surface resistance value for the finished sheet products*, and thereafter processing the *partially* carbonized fibers into **[**desired electrical resistivity**]** *homogeneous* carbon fiber sheet products **[**having the form of non-woven paper or woven or knitted fabric sheet products**]** having *the* preselected desired surface electrical **[**resistivities**]** *resistances*.

The CFC held that the original patent did "not support the elimination of the oxidation and stabilization step" from the reissued claims, and that this rendered the claims "invalid for lack of written description." CFC Op. at *20-21. The CFC explained that the reissue "impermissibly broadens the patented process by reducing the number of steps required for infringement." *Id.* at *21. The CFC stated that "although the step is *found* in the reissue patent, its elimination from the claimed process

goes beyond the written description of the invention in the original '395 patent." *Id.* at n.10 (emphasis in original).

The elimination of the preparation of the starting material broadened the reissue. However, a broadening reissue is not improper if filed within two years of issuance. A patentee is entitled to a reissue "enlarging the scope of the claims," when, as here, the reissue application is filed "within two years from the grant of the original patent." 35 U.S.C. § 251(d).

The CFC also held that the broadened claim is not supported in the specification, holding that it is irrelevant that the omitted oxidizing and stabilizing step is fully described in the specification as well as being in the prior art. The CFC held that the preparation of the known starting material must be included in the claim, that it is insufficient that the reissue claim requires that these steps be performed, and that whether these steps were known to the prior art is "irrelevant to the question of whether the written description requirement is satisfied." CFC Op. at *19.

There was no argument as to insufficiency of either the prior art or the content of the specification, in describing the starting material. There was no allegation that a person of ordinary skill in this field would not understand the description in the specification. The original specification plainly, and without dispute, describes that the starting material is an oxidized and stabilized fiber, cites references showing this known material, and describes its preparation. That a previously oxidized and stabilized starting material was known to a person of ordinary skill in the field was recognized by the reissue Examiner in his statement that:

> Ex[amine]r agreed with applicant that partial oxidation & heat stabilization temp. need not be recited in the claims since this temp. is within the

> prior art & claims do not have to recite what is well known in the prior art.

Examiner Interview Summary, Reissue Application No. 07/483,531 (May 5, 1992).

The CFC had previously construed the reissue claims as supported by the specification, finding that the reissue claims were substantially the same as in the parent patent and properly supported. The court stated:

> [I]t can hardly be said that the oxidizing and stabilizing step was removed from Reissue '162. On the contrary, when the step was removed the examiner rejected the application until Zoltek added "previously" in the claims to refer back to this description of the method which requires it unless a previously oxidized and stabilized material is purchased.

Opinion on Defendant's Motion for Partial Summary Judgment on Matters Relating to Reissue filed on January 15, 1999, No. 96-166 C (Fed. Cl. Sept. 13, 1999) (unpublished).

The government argues that the asserted claims are not supported in the specification because the specification does not state that these steps need not be performed by the same entity. The question of who performs steps of a fully described invention, including preparation of a known starting material, is not a matter of the written description requirement.

The purpose of the written description requirement is to assure that the public receives sufficient knowledge of the patented technology, and to demonstrate that the patentee is in possession of the invention claimed. *See In re Skvorecz*, 580 F.3d 1262, 1269 (Fed. Cir. 2009). The requirement is applied in the context of the state of knowledge at the time of the invention. *Capon v. Eshhar*, 418 F.3d 1349, 1358 (Fed. Cir. 2005). The written de-

scription "need not include information that is already known and available to the experienced public." *Space Sys./Loral, Inc. v. Lockheed Martin Corp.*, 405 F.3d 985, 987 (Fed. Cir. 2005); *see Enzo Biochem, Inc. v. Gen-Probe Inc.*, 323 F.3d 956, 970 (Fed. Cir. 2002) ("[The written] description is the *quid pro quo* of the patent system; the public must receive meaningful disclosure in exchange for being excluded from practicing the invention for a limited period of time.").

Here, the '162 specification describes the preparation of the starting material, and states that it is commercially available. '162 patent, col.4 ll.45-55 ("[T]he carbonizable tow is supplied to an oxidation operation 14 where it is stabilized by being heated in atmospheric oxygen to a temperature of about 220 degrees Centigrade . . . . The resulting oxidized tow is sold under the trademark 'PYRON.'"). The government does not argue that a person of ordinary skill would not be able to make or acquire the starting material based on the description in the specification.

The written description requirement relates to whether the patentee possessed the invention that is claimed. There was no suggestion that a person of ordinary skill would not have understood that Boyd was in possession of the invention that he claimed. *See Centocor Ortho Biotech, Inc. v. Abbott Labs.*, 636 F.3d 1341, 1348 (Fed. Cir. 2011) ("To satisfy the written description requirement, the applicant must convey with reasonable clarity to those skilled in the art that, as of the filing date sought, he or she was in possession of the invention, and demonstrate that by disclosure in the specification of the patent.") (internal quotation marks omitted); s*ee also Alcon Research Ltd. v. Barr Labs., Inc.*, 745 F.3d 1180, 1191–92 (Fed. Cir. 2014) ("Critically, Barr adduced no evidence, let alone clear and convincing evidence, that was probative of whether an ordinarily skilled artisan would not have understood from the disclosures of Al-

con's . . . patents that the patentees invented, or possessed, the methods of the asserted claims. Without that evidence, there was no basis on which to find a lack of adequate written description.").

The CFC stated its concern that the reissue patent claims could be infringed by an entity that did not itself make the starting material, but purchased the known starting material from a commercial source. However, the reissue statute provides that reissue is available "by reason of the patentee claiming more or less than he had a right to claim . . . for the invention disclosed in the original patent." 35 U.S.C. § 251(a). A validly obtained reissue does not violate the written description requirement if the patentee can reach an enlarged scope of possible infringement.

It is not an improper broadening amendment when a reissue applicant, with the considered agreement of the reissue Examiner, substitutes a preparatory step known to those skilled in the art at the time of the invention with a requirement to start with the product of that known preparatory step. The CFC's emphasis on who might infringe the broadened reissue claims is an issue of infringement, not written description.

We conclude that the CFC erred in holding reissue claims 1–22 and 33–38 invalid for failure to meet the written description requirement of section 112. That ruling is reversed.

II

Obviousness

The science of carbonized fiber materials had been the subject of study well before the Boyd patent application was filed, as exemplified in the references cited during patent prosecution and in these proceedings.

The CFC relied on the government's expert Dr. Sullivan, who cited references concerning carbon fiber products and developed a mathematical formula from which he generated a graph duplicating that in Figure 4 of the '162 patent. To produce this graph, Dr. Sullivan used data from the '162 patent record, from a Zoltek publication issued in 2000, and various references and articles. He cited:

[1] Akio Shindo, *Studies on Graphite Fiber*, Government Industrial Research Institute of Osaka (1961), is a research report discusses the manufacture and use of carbon fibers of polyacrylonitrile. Shindo states that increasing heat-treatment temperature of the fiber results in increased conductivity of the fiber. Shindo does not show or suggest the non-linear relationship between temperature and resistivity that was discovered by Boyd, or the use of such relationship to control surface resistivity.

[2] Kitago, U.S. Patent No. 3,998,689 (Dec. 21, 1976), describes the production of carbon fiber sheets by a process that combines chopped carbon fibers with other ingredients to form a slurry, which is shaped into a sheet, saturated with a resin, and then carbonized, to form a conductive sheet product. Kitago provides data for sheets carbonized at 1000°C and 2000°C, showing significantly lower resistivity at the higher temperature. Kitago does not show or suggest the non-linear relationship discovered by Boyd, or the use of such relationship to control surface resistivity.

[3] Layden, U.S. Patent No. 4,080,413 (Mar. 21, 1978), shows carbonization of chopped polyacrylonitrile fiber sheets over the range of 1000°C to 1260°C, to produce hard, inflexible products with extremely low surface resistivities, suitable for use as fuel cell electrodes. Leyden does not show or suggest the non-linear relationship

discovered by Boyd, or the use of such relationship to control surface resistivity.

[4] Topchjiev, U.K. Patent No. 979,122 (Jan. 1, 1965), entitled "Method of Producing Semiconductive Polymer Materials," uses oxidized and stabilized carbon fibers that are heat treated to produce materials with semiconductor properties electrical conductivity. Topchjiev does not show or suggest the non-linear relationship discovered by Boyd, or the use of such relationship to control surface resistivity.

[5] D.B. Fischbach & Kunio Komaki, *Electrical Resistance of Carbon Fibers*, University of Washington (1979), is an article that explains that increasing the treatment temperature results in decreased volume resistivity. This article does not show or suggest the non-linear relationship discovered by Boyd, or the use of such relationship to control surface resistivity.

These references variously show the heat treatment of carbonized fibers and their resistivities or conductivities at various treatment temperatures. On cross-examination, Dr. Sullivan agreed that these references alone do not establish obviousness. The following exchange took place:

> Q. And the Fischbach and Komaki article . . . the Topchjiev patent . . . the Layden patent . . . all disclose nothing more than what was disclosed in the Otani reference before the Patent Office, correct?
>
> A. I believe that is correct, yes.
>
> Q. And I believe it's also your testimony — prior testimony that the Topchjiev patent and the Layden patent, by themselves, would not be sufficient to render the Zoltek patent obvious, correct?
>
> A. Yes, I think that is correct.

Trial Tr. 269:5–15.

Instead, Dr. Sullivan relied on a mathematical formula he derived from the Rule of Mixtures,[2] citing several articles, *viz.*, "Theory of Reinforced Materials" by Z. Hashin (1972), "Analysis of Composite Materials—A Survey" by Z. Hashin (1981), "An Analysis Model for Spatially Oriented Fiber Composites" by B.W. Rosen et al. (1977), and "Mechanics of Composite Materials" by R. Christensen (1979). The position of Dr. Sullivan was summarized at trial as follows:

> Q.: So, to sum up your testimony, Dr. Sullivan, you're asserting that it would be obvious to a person of ordinary skill in the art, as of October 1984, to rely upon four publications which do not mention surface resistivity, partially carbonized or semi-conductive carbon fibers, or the method to control the surface resistivity of carbon fiber sheet products made from the — made from the partially carbonized fibers and controlling the volume resistivity of the partially carbonized fiber, the 1972 Hashin and the 1977 Rosen articles referring to structural fibers, that it would have been obvious to a person of ordinary skill in the art, as of October of 1984, to construct the mathematical methodology you described on your direct examination

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[2] The Rule of Mixtures is a rule of materials science in which a weighted mean is used to predict properties, including electrical conductivity, of a composite material made up of continuous and unidirectional fibers. It is a mathematical equation by which properties of the individual components of a mixture are weighted by their volume fractions.

> to obtain carbon fiber sheet products having a controlled surface resistivity?
>
> [Objection]
>
> THE COURT: . . . . do you want the question broken out or —
>
> THE WITNESS: No, because that is my testimony.

Trial Tr. 245:12–246:8.

No reference mentions "surface resistivity" or "the required limitation to pre-select individual fiber volume resistivities to produce sheet products with desired surface resistivities." Zoltek Br. 4–5 (citing record). Dr. Sullivan testified that he was not aware of anyone, including himself, who had previously used the mathematical formula he created to determine carbonization temperature-resistivity relationships.

The '162 patent teaches carbonized sheets that "require no insulating elements such as glass fiber in order to adjust the surface resistances of the sheet product to a desired surface resistance volume." '162 patent, col.2 ll.7–11. The novelty of such sheets was not disputed. The patent prosecution and trial records contain a letter from George Rodgers, a materials engineer at Northrup Grumman (the general contractor for the B-2 Bomber), who stated:

> In December 1983, the Material & Processes Department of Northrop Advanced Systems Division ordered four rolls of carbon fiber paper from Stackpole Fibers Co. The product was unique in that the carbon fibers were not fully carbonized, increasing the volume resistivity of the fiber which in turn increases the surface resistivity of the paper. . . . At the time the order was placed, Northrop Materials & Processes had never seen a

> material of this type before and was not aware of any other company that could supply material in this form with varying electrical properties.

Letter from George Rodgers dated August 6, 1987, Prosecution File Wrapper 187. By deposition on August 18, 2009, Mr. Rodgers testified that, with regard to the accuracy of the contents of that letter, viewed in hindsight, "I wouldn't change anything." Rogers Dep. 34:6.

Dr. Sullivan also testified that he had no basis to disagree with the Rodgers letter. Specifically, he testified:

> Q. Okay. And the last sentence reads, "At the time the order was placed, Northrop Materials & Processes had never seen a material of this type and were not aware of any other company that could supply material in this form with varying electrical properties." Do you see that?
>
> A. I do.
>
> Q. Okay. And you have no basis to disagree with that statement, do you?
>
> A. No, I don't.

Trial Tr. 274:16–25.

There is no teaching or suggestion in the prior art to select the data that Sullivan selected, and to plug the selected data into the mathematical equation that Sullivan devised. As summarized by Zoltek, "Sullivan used the variable fiber volume resistivities shown [in] the file history of the '395 parent patent at various temperatures and constant volume resistivities for each remaining component of the sheet products in making his calculations." Zoltek Br. 23 (citing record). This is not evidence of obviousness. *See EWP Corp. v. Reliance Universal, Inc.*, 755 F.2d 898, 907 (Fed. Cir. 1985) ("Patentability under the statute, § 103, is a decision made on the basis of a hypothesis: Would the invention have been obvious 'to a

person having ordinary skill in the art to which the subject matter pertains' in the light of all knowledge conveyed by 'prior art' as defined by statute and case law.").

Zoltek also points to several errors made by Dr. Sullivan, to which Sullivan admitted on cross-examination. Zoltek mentions "Sullivan's erroneous fiber volume fraction (0.3), fiber density (1.81 g/cm^3), and resin volume fraction (0.54)." Zoltek Br. 24 n.5. With respect to Dr. Sullivan's testimony that he used a volume fraction of 0.3 in his Rule of Mixtures calculation purportedly reflective of the Zoltek patented product, Zoltek's expert Mr. Rumy testified:

> In the paper process, you can't even make that kind of conduct — that kind of concentration of carbon fibers, only possibly by taking a regular paper product that is made probably no more than 10 to 15 percent carbon content, and then you compress it. But we — that's — that would be destroying our entire invention.

Trial Tr. 326:22–327:2.

As another error, while the Rule of Mixtures requires the use of volume fractions of each component of a composite mixture, Dr. Sullivan used a weight percent for each component in order to place data points on the Figure 4 template. *See* Zoltek Br. 28.

These errors taint Dr. Sullivan's reproduction of Figure 4. Indeed, Dr. Sullivan made several confessions of error in his selection or calculation of data points to produce the graph he created to track Figure 4. As another example:

> Q. . . . So, you've inserted a uniform density of 1.81 grams per cubic centimeter, which is the density of fully carbonized fibers, when there should have been a gradually increasing density from

> 1.36 through the temperature range shown on [your spreadsheet], correct?
>
> [Objection for lack of foundation; overruled]
>
> A. It is true that the carbon fiber density will change with heat treatment temperature and that it probably is true that a different value, other than a uniform 1.81, would have been more appropriate
>
> Q. Okay.
>
> A. I will concede that.

Trial Tr. 257:2–19.

Zoltek also points to Dr. Sullivan's admission that his critical fiber volume fraction, 0.3%/30%, fundamental to his calculations based on the Rule of Mixtures, was wrong and that Dr. Sullivan used data from a 2000 Zoltek User's Guide directed to fully carbonized composites at a temperature of 1400°C, a reference published fourteen years after the '162 patent's filing date.

Dr. Sullivan conceded that there were errors in his calculations, stating that the reason was that he did not have complete information. That is not surprising, for there was not complete information in the prior art—weighing against the government's argument that it would have been obvious to a person of ordinary skill to recreate the Boyd graph from known information. Dr. Sullivan's plaint that he could not accurately duplicate Boyd's discovery because of lack of information is powerful evidence of non-obviousness—not the contrary.

Dr. Sullivan stated that he obtained some of the values he used in his calculations from the '162 patent itself. However, for the volume fraction of carbon fiber, described by Dr. Sullivan as by far the most important element in the equation, he ignored the figure in the patent (0.83) and used a value of 0.3, which he testified

came from a Zoltek 2000 User's Guide. Zoltek points out that this Guide was directed to an entirely different product, and also that the Guide was written fourteen years after the '162 patent application was filed. There was no showing that the information on which Dr. Sullivan relied was available to persons of skill at the time of the Boyd invention. Zoltek states, and Dr. Sullivan did not contradict, that Dr. Sullivan selected values from various sources in order to fit the template of Boyd's results.

Neither the government's attorney argument, nor Dr. Sullivan's testimony, nor the opinion of the Court of Federal Claims, points to any suggestion in the prior art to select the data selected by Dr. Sullivan and create the mathematical formula to construct a graph to track Figure 4. *See KSR Int'l Co. v. Teleflex, Inc.*, 550 U.S. 398, 418–19 (2007) ("Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does. This is so because inventions in most, if not all, instances rely upon building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.").

Even Dr. Sullivan called his reconstruction of Figure 4 "somewhat arbitrary." Trial Tr. 259:18. Hindsight reconstruction for litigation ends is not of probative value. *See Outside the Box Innovations, LLC v. Travel Caddy, Inc.*, 695 F.3d 1285, 1298 (Fed. Cir. 2012) ("Precedent recognizes the pitfalls of judicial hindsight exercised at the time of litigation . . . .").

The Court has recognized "the distortion caused by hindsight bias" and "arguments reliant upon *ex post*

reasoning" in determining obviousness. *KSR*, 550 U.S. at 421; *see InTouch Technologies, Inc. v. VGO Commc'ns, Inc.*, 751 F.3d 1327, 1351 (Fed. Cir. 2014) ("It appears that [the expert] relied on the . . . patent itself as her roadmap for putting what she referred to as pieces of a 'jigsaw puzzle' together."); *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553 (Fed. Cir. 1983) ("To imbue one of ordinary skill in the art with knowledge of the invention in suit, when no prior art reference or references of record convey or suggest that knowledge, is to fall victim to the insidious effect of a hindsight syndrome wherein that which only the inventor taught is used against its teacher.").

The government does not attempt to rehabilitate Dr. Sullivan's errors. Instead, the government's argument appears to be that since Dr. Sullivan is a renowned scientist in this field, and since Dr. Sullivan was able to reproduce the Figure 4 graph, it was obvious to do so. This was error, since, as we have repeatedly cautioned, "[t]hat which may be made clear and thus 'obvious' to a court, with the invention fully diagrammed and aided . . . by experts in the field, may have been a break-through of substantial dimension when first unveiled." *Uniroyal, Inc. v. Rudkin-Wiley Corp.,* 837 F.2d 1044, 1051 (Fed. Cir. 1988) (internal quotation marks omitted); *see also KSR*, 550 U.S. at 421 ("A factfinder should be aware, of course, of the distortion caused by hindsight bias and must be cautious of arguments reliant upon *ex post* reasoning") (citing *Graham v. John Deere Co.*, 383 U.S. 1, 36 (1966) as "warning against a temptation to read into the prior art the teachings of the invention in issue and instructing courts to guard against slipping into use of hindsight") (internal quotation marks omitted); *W.L. Gore*, 721 F.2d at 1553 ("It is difficult but necessary that the decisionmaker forget what he or she has been taught at trial about the claimed invention and cast the mind back to the time the invention was made (often as here many years),

to occupy the mind of one skilled in the art who is presented only with the references, and who is normally guided by the then-accepted wisdom in the art.").

There was not clear and convincing evidence of obviousness of the Boyd discovery and its use to produce carbon fiber sheets of pre-selected homogeneous electrical resistance. The CFC's ruling of invalidity on the ground of obviousness is reversed.

CONCLUSION

The Court of Federal Claims erred in holding the asserted claims of the '162 patent invalid under sections 103 and 112. The judgment of invalidity is reversed. We remand for resolution of all remaining issues.

REVERSED AND REMANDED