United States Court of Appeals for the Federal Circuit

02-1457, -1458, -1481, -1482

CORDIS CORPORATION,

Plaintiff-Appellant,

v.

MEDTRONIC AVE, INC.,

Defendant-Cross Appellant,

and

BOSTON SCIENTIFIC CORPORATION and SCIMED LIFE SYSTEMS, INC.,

Defendants.

MEDTRONIC AVE, INC.,

Plaintiff-Cross Appellant,

and

ARTERIAL VASCULAR ENGINEERING, INC.,

Counterclaim Defendant-Appellee,

v.

CORDIS CORPORATION,

Defendant/Counterclaimant-Appellan

and

JOHNSON AND JOHNSON and EXPANDABLE GRAFTS PARTNERSHIP,

Defendants.

- 2 –

Gregory L. Diskant, Patterson, Belknap, Webb & Tyler LLP, of New York, New York, argued for plaintiff-appellant Cordis Corporation. With him on the brief were Eugene M. Gelernter, William F. Cavanaugh, Jr., and Michael J. Timmons.

Raphael V. Lupo, McDermott Will & Emery, of Washington, DC, argued for defendant-cross appellant Medtronic AVE, Inc., and counterclaim defendant-appellee Arterial Vascular Engineering, Inc.,. With him on the brief were Donna M. Tanguay, Mark G. Davis, and Natalia V. Blinkova. Of counsel on the brief were D. Michael Underhill, Richard S. Meyer, Eric J. Maurer, and Gerald P. Konkel, Morgan Lewis & Bockius LLP, of Washington, DC.

George E. Badenoch, Kenyon & Kenyon, of New York, New York, for amicus curiae Boston Scientific Corporation, Scimed Life Systems, Inc, and Medinol Ltd. With him on the brief was Charles R. Brainard.

Appealed from: United States District Court for the District of Delaware

Chief Judge Sue L. Robinson

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JOHNSON AND JOHNSON and EXPANDABLE GRAFTS PARTNERSHIP,

Defendants.

DECIDED: August 12, 2003

Before NEWMAN, BRYSON, and GAJARSA, Circuit Judges.

BRYSON, Circuit Judge.

Cordis Corporation appeals from a final judgment of the United States District Court for the District of Delaware. Cordis seeks review of (1) a summary judgment that defendant Medtronic AVE, Inc., ("AVE") did not literally infringe two of Cordis's patents, and (2) a judgment as a matter of law ("JMOL") that AVE did not infringe those patents under the doctrine of equivalents. Because we disagree with the district court's claim construction and its application of prosecution history estoppel, we reverse the judgment and remand for further proceedings.

I. Background

The development of balloon-expandable coronary stents marked a significant advance in the treatment of coronary artery disease by providing an alternative to balloon angioplasty and bypass surgery. In balloon angioplasty, an inflated balloon crushes built-up plaque against the arterial wall to improve blood flow. The balloon is withdrawn at the end of the procedure, however, which allows the artery to close again over time. A stent of the sort disclosed in the patents at issue in this case is mounted on an angioplasty balloon and is forced to expand against the arterial walls when the balloon is inflated. When the balloon is deflated and withdrawn, the stent retains its shape and remains in the artery to keep it open. Because the stent's diameter depends on how much the balloon expands, the stent can be used in arteries of differing diameters. Prior art stents that were designed to remain in arteries had predetermined expanded diameters. Accordingly, they were liable to migrate from the desired location if they were too small or to rupture the artery if they were too large.

A

The two patents at issue in this case are owned by Cordis. U.S. Patent No. 4,739,762

("the '762 patent") discloses an expandable stent composed of a tubular member having a wall surface of substantially uniform thickness with "a plurality of slots formed therein" parallel to the longitudinal axis of the tubular member. After the stent is transported in its unexpanded form to the intended location within the patient's body, an outwardly directed radial force (as by the inflation of the balloon) causes the stent to expand. The stent can be expanded and deformed according to the diameter of the body passageway in which it is located. See '762 patent, col. 3, ll. 33-51. Certain claims of the '762 patent specify that the tubular member is "thin-walled" and "smooth."

Approximately ten years after issuing the '762 patent, the PTO reexamined the patent in light of several prior art references. During the reexamination, the examiner rejected several claims in view of, inter alia, U.S. patents to Ersek and to Kornberg. The Ersek patent claims a fixation device with projecting edges that can be used as a substitute for sutures; the device serves to hold a prosthesis in place within a body passageway. Ersek recites that his device is preferably formed from expanded metal sheeting and is produced by forming a series of staggered parallel slits in a metal sheet and then stretching the sheet in a direction perpendicular to the slits to open the slits into apertures. The resulting projecting edges embed themselves into the tissue wall upon expansion of the sleeve.

In response to the examiner's rejection, Cordis amended various claims of the '762 patent to include the "substantially uniform thickness" limitation that was already present in claim 23. Cordis argued that the limitation distinguished its patent from the Ersek patent, noting that "[t]he expanded metal Ersek sleeve has bridge portions that are several times as thick as the strands." In its discussion of the Ersek patent, Cordis relied in part on an affidavit of Dr. Erik Antonsson that addressed the dimensions of a model of the Ersek device. Cordis also distinguished the Ersek patent based on its contention that Ersek did not disclose either a "smooth" surface or a "thin-walled" tubular member. The examiner then confirmed the claims of the '762 patent that

are asserted in this case. The examiner distinguished the Ersek patent on the ground that the Ersek sleeve is not smooth because "the bridge has a thickness which is twice as great as the strand."

The other Cordis patent at issue in this case is U.S. Patent No. 5,195,984 ("the '984 patent"). That patent adds the feature of flexibility by including a connector member to link one tubular member of the stent to another. The written description provides that the claimed device, with its connector member, "permits tissue of an elongated section of a body passageway to be supported by an elongated graft; and provides the necessary flexibility to negotiate the bends and curves in tortuous body passageways, such as the vascular system." '984 patent, col. 4, ll. 20-25. The examiner initially rejected claims of the '984 patent as anticipated by or obvious in light of a U.S. patent to Wiktor. After the applicant distinguished the Wiktor patent, the examiner allowed the claims without amendment. The '984 patent is unrelated to the '762 patent, but the written descriptions of the two are very similar.

B

Cordis filed suit, charging AVE and others with patent infringement. AVE produces stents that are formed by first bending wire rings into a sinusoidal shapes and then connecting the bent rings together, as shown below.

Cordis alleged, inter alia, that AVE's stents infringe claims 23, 51, and 54 of the '762 patent and claims 1 and 3 of the '984 patent. All of the asserted claims recite a "wall surface having a substantially uniform thickness and a plurality of slots formed therein."

The district court construed the claim language referring to a "plurality of slots formed [in the wall surface]" to be limited to devices in which the slots are formed by the removal of material. No material is removed from a pre-existing wall to form the slots in AVE's accused stents; rather, the slots are formed when wire-like material is bent into sinusoidal rings, which are then connected in line. Because the court concluded that the accused products did not satisfy the "plurality of slots formed therein" limitation, the court granted AVE's motion for summary judgment of no literal infringement.

The district court construed the reference to a "wall surface having a substantially uniform thickness" to mean that the thickness of the wall may not vary by more than 0.001 inch. The court reached that conclusion based on the patentee's citation, during reexamination, of the Antonsson affidavit, which reported that the wall of a device modeled on the Ersek patent was between 0.0035 inches and 0.0045 inches in thickness.

After a two-week trial, a jury found that AVE's stents infringed the asserted claims of the '762 and '984 patents under the doctrine of equivalents and awarded Cordis $271 million in damages. On post-trial motions, however, the district court granted JMOL of noninfringement, holding that Cordis was barred from asserting that AVE's stents had features that were equivalent to the "plurality of slots formed therein" and "substantially uniform thickness" limitations. In addition, the court granted a conditional new trial with respect to literal infringement of the "substantially uniform thickness" limitation.

II. "A Plurality of Slots Formed Therein"

With regard to the grant of summary judgment of no literal infringement, the district court ruled that the phrase "slots formed therein" requires that the slots be manufactured by removing material from a pre-existing wall surface. We disagree. Slots can be "formed" in a wall surface by means other than removing material, such as by constructing the wall with

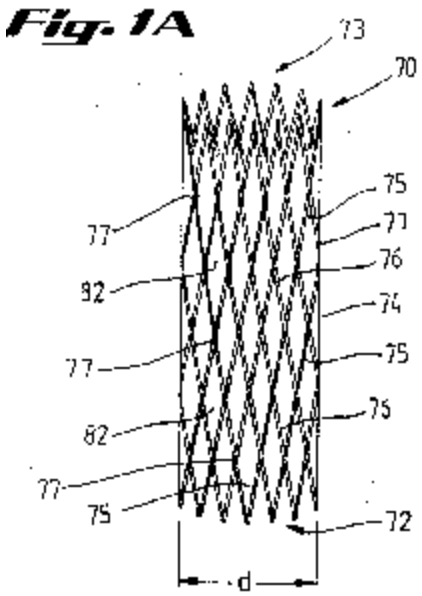
openings built into it.

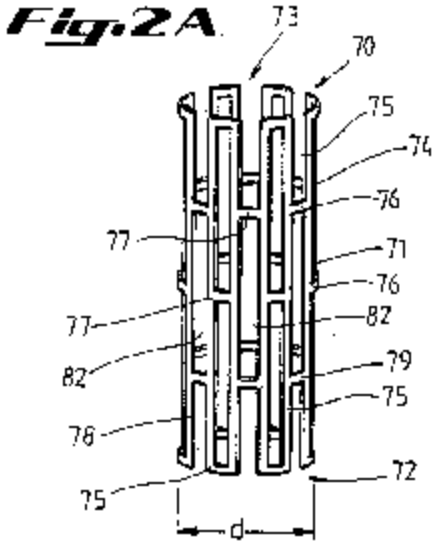
Nothing about the phrase "slots formed therein" suggests that the slots must be formed by a particular process; the phrase certainly does not indicate that the wall must be formed first and the slots formed later. A piece of wire mesh can fairly be described as a metal surface with holes formed in it, but that description does not mean that the screen was made by starting with a solid piece of metal and drilling holes in it. The phrase "slots formed therein" describes the physical characteristics of the product, not the method of its manufacture.

We also reject AVE's contention that the '762 patent's definition of a slot as an "opening" indicates that the stent must be made by forming an opening in previously solid material. An opening can arise by leaving a gap during the construction of a wall surface as well as by removing material from the surface. Because the language "formed therein" does not require the removal of material as the method of formation, we decline to superimpose a process limitation on the product claims at issue. See Vanguard Prods. Corp. v. Parker Hannifin Corp., 234 F.3d 1370, 1372 (Fed. Cir. 2000) (holding that the limitation of a thin layer "integral therewith" described the product and did not designate a specific manufacturing process, and that a "method of manufacture, even when cited as advantageous, does not of itself convert product claims into claims limited to a particular process").

The specifications of the '762 and '984 patents do not define the "slots formed therein" as openings created by the removal of material from a pre-existing wall surface. AVE relies on the statement "[p]referably, tubular member 71 is initially a thin-walled stainless steel tube having a uniform thickness and a plurality of slots are formed in the wall surface 74 or tubular member 71." '762 patent, col. 6, ll. 41-44; '984 patent, col. 5, ll. 64-67. But the use of the term "preferably" makes clear that the language describes a preferred embodiment, not the invention as a whole.

The district court based its holding that the "[s]lots must be formed in the wall surface of a tubular member, as by the removal of material" in part on the progression of the written description of the '762 patent from its parent, U.S. Patent No. 4,733,665 ("the '665 patent"). Specifically, the district court relied on the fact that one of the embodiments disclosed in the '665 patent was not carried over into the specification of the '762 patent application, which was filed as a continuation in part ("CIP"). The '665 patent discloses two differing embodiments, which are shown in Figures 1A and 2A:





The written description of the '665 patent states, "Preferably, tubular shaped member 71 [of Figure 1A] is made of continuous, stainless steel wire woven in a criss-crossed tubular pattern to form what can be generally described as a wire mesh tube." '665 patent, col. 6, ll. 49-52. Because the wire is criss-crossed, the tube is twice as thick at the cross points as at other points on the structure. That embodiment is not present in the specification of the '762 patent or the '984 patent.

Like the district court, AVE relies on the absence of the Figure 1A embodiment from the '762 and '984 patents as indicating that Cordis disclaimed bent-wire stents lacking a pre-existing wall surface from which material is removed to create the slots. We reject this basis for narrowing the claims. In neither patent is there any language surrendering bent-wire stents, and the fact that the patentee chose not to include Figure 1A from the '665 patent as an embodiment in the '762 specification does not indicate that the patentee was no longer claiming any stent composed of bent wire. Rather, it is likely that the patentee chose not to include that embodiment because its overlapping members caused it not to be of substantially uniform thickness, smooth, or thin-walled (all features claimed in the '762 patent, but not in the '665 patent).

A patentee may choose not to carry forward a particular embodiment from a parent patent to a CIP because that embodiment does not satisfy a limitation that was added in the CIP. That choice, however, does not mean that the scope of the CIP is limited to the preferred embodiment that was carried forward. Thus, we reject AVE's contention that the failure to include a wire mesh embodiment in which wires have been bent and overlapped to form the stent should limit the construction of the claims to exclude all embodiments created by bending wire in any form.

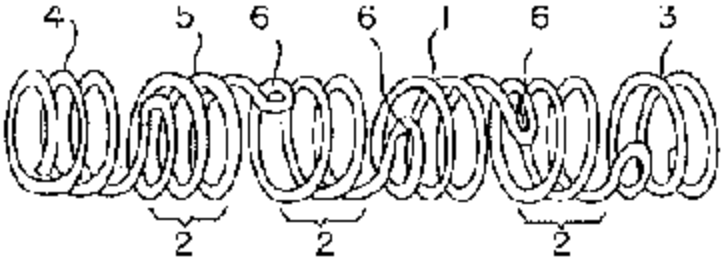
The district court compared the methods of making the preferred embodiments of the '665 patent and concluded that the difference between the Figure 1A and Figure 2A embodiments is that "the elongate bars of the 'thin bar' [Figure 2A] embodiment 'may be formed integral with one another,'" a method of manufacture that the district court found to be "singularly descriptive of the slotted tube preferred embodiment." However, expert testimony established that one of skill in the art would understand "formed integral with one another," in

the context of the patents at issue, to refer to formation from a single piece of material, which does not require construction by removal of material from a pre-existing piece of metal.

We also disagree with the district court's conclusion that it is significant that the '665 patent claims a "plurality of intersecting elongate members" while the '762 patent claims a "wall surface having . . . a plurality of slots." Claiming a wall having slots is essentially the same as defining a hole in terms of the structure that forms the hole.

We next consider statements made in the prosecution history of the '984 patent regarding the prior art Wiktor patent to determine whether the patentee effected a disclaimer of claim scope. Such a disclaimer requires clear and unmistakable statements of disavowal. See Omega Eng'g, Inc. v. Raytek Corp., Nos. 01-1546, 02-1478, slip. op. at 17 (Fed. Cir. July 7, 2003).

Dr. Schatz, the inventor of the '984 patent, characterized Wiktor as disclosing "a coiled wire stent which is a 'tubular shape of coiled wire wound in a special manner comprising a number of groups of turns 2.'" The coiled wire stent in Wiktor has openings spiraling around its circumference as shown herein:



In response to the examiner's rejection of the application for the '984 patent in view of the Wiktor patent, Dr. Schatz stated:

> Wiktor does not disclose a plurality of "thin-walled tubular members, each having first and second ends and a wall surface disposed between the first and second ends, the wall surface having a substantially uniform thickness and a plurality of slots formed therein, the slots being disposed substantially parallel to the longitudinal axis of each tubular member". Wiktor discloses a single stent, or graft made up of coiled wire. There is no wall surface having a plurality of slots, nor slots disposed parallel to the longitudinal axis of each tubular member. Applicant's claimed invention is not "coiled wire wound in a special manner comprised of a number of groups of turns" as illustrated in Wiktor.

The first sentence of Dr. Schatz's statement about Wiktor is a general allegation that Wiktor does not disclose the precise combination of elements claimed in the '984 patent. That statement cannot be read to disclaim any device not containing a pre-existing wall from which material is removed. Dr. Schatz more specifically distinguishes the Wiktor patent in his statement that "[t]here is no wall surface having a plurality of slots, nor slots disposed parallel to the longitudinal axis of each tubular member." Clearly, he is correct that Wiktor does not have slots disposed parallel to the longitudinal axis of the member; even if the openings in Wiktor do constitute slots, they are perpendicular to the longitudinal axis of the member. It is not clear,

however, what Dr. Schatz meant by "no wall surface having a plurality of slots." He could have meant either that coiled wire is not a wall surface or that the openings in the coil do not constitute slots. The statement is amenable to multiple reasonable interpretations and it therefore does not constitute a clear and unmistakable surrender of all stents that lack a pre-existing wall surface from which material is removed to form the slots. In addition, the statement does not clearly disclaim any stents made of bent wire on the ground that a stent made of wire lacks any "wall surface," as AVE contends.

Rather than supporting a narrow construction of the "slots formed therein" limitation, the prosecution history of the '762 patent—and particularly the reexamination—indicates that the patentee did not intend for the phrase "slots formed therein" to require the removal of material. For example, the examiner, in discussing the Kornberg patent, stated that "Webster's Ninth New Collegiate Dictionary defines 'slot' as 'a narrow opening or groove.' The spaces between the Kornberg struts certainly meet this definition. The slots are formed in the tubular member since the struts are part of the wall of the tubular member." The examiner's remarks indicate that he understood that "slots formed therein" describes the location of the slots, not how they are made. The patentee did not dispute that statement by the examiner. The examiner also described the Ersek patent's device as having "a plurality of slots 23 formed therein" even though Ersek's slots are not made by removing material. The patentee distinguished the Ersek patent, but did not dispute that Ersek's device has a plurality of slots formed therein. Accordingly, the patentee did not rely on the method of manufacturing as a means of distinguishing the invention from the prior art. Because the prosecution histories of the '762 and '984 patents do not support the narrow reading of the "slots formed therein" limitation, we conclude that the district court erred in construing the "slots formed therein" limitation in the two patents to require that the slots be formed by removing material from a pre-existing wall surface.

Because we disagree with the district court's construction of the "plurality of slots formed therein" limitation, we reverse the district court's grant of summary judgment of no literal infringement based on that limitation. For the same reason, we also reverse the district court's ruling on the doctrine of equivalents, which was based on the court's construction of that limitation.

III. "Substantially Uniform Thickness"

Cordis also challenges the district court's construction of the "substantially uniform thickness" limitation and the court's related ruling on prosecution history estoppel. We agree with Cordis that the court's claim construction was unduly narrow and that the court's estoppel ruling was erroneous. Accordingly, we reverse the court's order granting JMOL of noninfringement under the doctrine of equivalents and its grant of a conditional new trial on literal infringement as to that limitation.

A

The district court construed the "substantially uniform thickness" limitation to require that the thickness of the stent's wall surface not vary by 0.001 inch or more. Cordis contends that the district court erred by imposing the numerical restriction of 0.001 inch with respect to that limitation.

The patents do not set out any numerical standard by which to determine whether the thickness of the wall surface is "substantially uniform." The term "substantially," as used in this context, denotes approximation. See Epcon Gas Sys., Inc. v. Bauer Compressors, Inc., 279 F.3d 1022, 1031 (Fed. Cir. 2002). Thus, the walls must be of largely or approximately uniform thickness. Moreover, the written descriptions of the two patents state only that the expansion of the tubular member is uniform "along the length of tubular member 71" in part because of the uniform thickness of the wall surface, specifically pointing to the "same uniform thickness" of the connecting members 77, the elongate members 75, and members 78 and 79. '762 patent, col. 7, ll. 21-33; '984 patent, col. 6, ll. 47-54. Accordingly, the "substantially uniform" limitation also requires that the thickness of the wall surface be sufficiently uniform along its length and between members to allow uniform expansion of the stent. The question presented here is whether there is anything in the prosecution history of either patent that justifies giving the "substantially uniform thickness" limitation an even narrower construction.

In its discussion of the Ersek patent during reexamination of the '762 patent, Cordis argued that, according to the Antonsson affidavit, the Ersek device is not smooth and that "the wall thickness [of an Ersek model] 'varied at different points' and 'ranged from a minimum thickness of 0.0035 inches to a maximum thickness of 0.0045 inches.'" Cordis noted that the Antonsson affidavit addresses a model of an Ersek device in its expanded configuration, but that the thickness of the Ersek device is not substantially uniform in either its unexpanded or expanded configuration. Based on those statements, the district court construed the "substantially uniform thickness" limitation to require variations in wall surface thickness of less than 0.001 inch.

The commentary on Dr. Antonsson's measurement of a model, however, does not constitute a "clear and unmistakable" disclaimer, see Omega Eng'g, slip. op. at 17, excluding stents that vary in thickness by 0.001 inch or more. Cordis did not suggest that the variation of 0.001 inch was the basis for distinguishing its invention from Ersek or that Cordis's claimed stents vary by less than 0.001 inch in thickness. Rather, Cordis's basis for distinguishing Ersek appears to have been that Ersek's walls were at least twice as thick at the intersections of strands as along the strands themselves. The alleged disclaimer based on Dr. Antonsson's measurements in the reexamination proceedings was at best ambiguous. See IMS Tech., Inc. v. Haas Automation, Inc., 206 F.3d 1422, 1439 (Fed. Cir. 2000) ("In light of the ambiguity of the patentee's statements and the subject matter actually disclosed in the references, we cannot say that the patentee clearly disavowed coverage of [the contested subject matter].").

In addressing Ersek, Cordis focused on the double thickness of the bridge portions of Ersek's walls. For example, in its response to the examiner's reexamination rejection of claims in light of Ersek, Cordis stated:

> As shown . . . in Ersek Figure 5 . . . the wall of [the Ersek device] is of varying thickness because the strands of the sleeve have twisted out of the plane of the starting material. Moreover, the bonds or bridges at the junctions of the strands protrude inwardly and outwardly of the plane of the starting material, and as a

result the Ersek sleeve 16 has a non-uniform wall of varying thickness.

Since the bonds or bridges extend generally radially outwardly of the sleeve 16, the sleeve has 100% variance in thickness as compared to the thickness of the starting material in the areas of the bonds or bridges.

Figure 5 of the Ersek patent is shown herein:

Cordis reiterated its contention that Ersek did not have a wall surface with a substantially uniform thickness in that submission:

> Clearly, the Ersek sleeve cannot be fairly said to have a wall surface with "a substantially uniform thickness". The expanded metal Ersek sleeve has bridge portions that are several times as thick as the strands. . . . The strands extending between the bridge portions are twisted to have inwardly and outwardly projecting edges. This irregular and variable configuration is rough and is the antithesis of "substantially uniform thickness". The use of the term "substantially uniform" does not exclude some variations in dimension between the inner and outer surfaces of the wall. Even so, it is clear that Ersek's rough and irregular wall does not have substantially uniform thickness. Antonsson Affidavit, paragraph 10.

At Cordis's request, Dr. George Andros submitted a declaration to the PTO as a part of the reexamination of the '762 patent. Dr. Andros stated that "[t]he Ersek fixation sleeve does not have a substantially uniform wall thickness, nor is it thin walled. The expanded metal sleeve is twice as thick in some areas as in others, and the thickness of the wall varies throughout." Cordis thus focused on the double thickness of the bridge portions of the Ersek device, not on Dr. Antonsson's assertion that the thickness of the Ersek device varied by up to 0.001 inch along

the strands.

Based on our review of the prosecution history, we conclude that a reasonable reading of the patentee's statements would not lead one to conclude that variations greater than 0.001 inch fall outside the scope of the '762 patent. Because there is no clear and unmistakable disclaimer of any variation in thickness of 0.001 inch or more, the district court erred in imposing that numerical restriction on the "substantially uniform thickness" limitation. The discussion of the Ersek patent does, however, support the conclusion that the owner of the '762 patent disclaimed coverage of any device with a variation of at least 100 percent. In any event, quite apart from any disclaimer, a wall that varies in thickness by as much as 100 percent cannot be said to be of "substantially uniform thickness" either literally or by equivalents.

B

AVE contends that, under either party's construction, its stents have a variable thickness because they have a round or ellipto-rectangular cross-section and thus do not infringe because the cross-sectional thickness of its stent walls varies by more than 100 percent. We disagree and conclude that a stent formed from struts with circular or ellipto-rectangular cross-sections can have a wall of substantially uniform thickness.

First, both AVE's and Cordis's experts agreed that persons of ordinary skill in the art equate thickness with diameter in the case of round struts. Second, according to the patents' claims, it is the wall surface that needs to have a uniform thickness, and the full circumference of the round strut is not involved in making up the wall surface. The district court described the wall surface by stating that "[t]he outer surface of the tubular member must be disposed in a common cylindrical plane." That common "cylindrical plane" is formed by an imaginary circle that intersects with the outermost point of each round strut. The thickness of the wall is equal to the diameter of each round strut, i.e., the distance between the outer point that intersects the wall surface and the corresponding inner point that intersects a similar imaginary cylindrical surface on the inside of the tubular member. Thus, a stent with round struts can have a substantially uniform thickness as long as the round struts have substantially the same diameter.

We recognize that the '762 patent specifically references struts with a rectangular or square cross-section, '762 patent, col. 7, ll. 34-41, and that the '984 patent states that the cross-section of the struts may be "square, rectangular, or other," '984 patent, col. 6, ll. 58-63. That description, however, does not exclude circular or ellipto-rectangular struts, which would also facilitate uniform expansion of the stents.

C

The court concluded that allowing equivalents for the "substantially uniform thickness" limitation would vitiate the 0.001 inch variation requirement adopted by the court. Because we have rejected the 0.001 inch variation requirement, we reject that ground of the district court's doctrine of equivalents ruling.

AVE argues on appeal that the citation to the Antonsson affidavit during reexamination of the '762 patent created an argument-based estoppel. We reject AVE's argument to preclude infringement of the limitation through an equivalent. To invoke argument-based estoppel, the

prosecution history must evince a "clear and unmistakable surrender of subject matter." Litton Sys., Inc. v. Honeywell, Inc., 140 F.3d 1449, 1458 (Fed. Cir. 1998). Just as the Antonsson affidavit failed to serve as a clear and unmistakable disclaimer in the claim construction analysis, it also fails to serve as a clear and unmistakable surrender of anything greater than 0.001 inch to bar coverage through the doctrine of equivalents. We have noted that the prosecution disclaimer standard "is the same standard applicable, in the context of doctrine of equivalents, to the doctrine of argument-based estoppel . . . and that our precedent has recognized a relation between the doctrines of argument-based estoppel and prosecution disclaimer." Omega Eng'g, slip op. at 17 n.1.

IV. "Substantially Parallel" Connector Members

AVE offers another basis for upholding the grant of JMOL with respect to the '984 patent, arguing that the connector members in the accused devices are not disposed in a "substantially parallel relationship with respect to the longitudinal axis of the tubular members," as required by the claims of the '984 patent. For a connector member to be "substantially parallel" to the tubular members, the district court stated, the connector member "must run in substantially the same direction as the longitudinal axis of the adjacent tubular members. . . . This means 'that the slots and the connectors run in the same direction and are substantially aligned with one another.'" AVE contends that its connector members are perpendicular to the tubular members. In making that argument, AVE focuses on the relative width and length of its connector members to establish the direction in which the members lie.

Substantial evidence supports the jury's conclusion that the limitation as construed is satisfied in the accused devices. In AVE's stents, a connector member is found at the area where each sinusoidal ring is attached to the next sinusoidal ring. The span of the member along the longitudinal axis of the tubular members of the stent is shorter than the span perpendicular to that axis. Cordis's expert, however, explained that in determining how the connector members are disposed, one should look at what elements are being connected and draw a line between them to see where the relevant axis is. The expert testified that the shape of the connector member is not important and that it does not matter which dimension of the connector member is longer. What is significant, he stated, is the axis along which the member connects the stent elements. He testified that "the connector member must be in alignment with the slots so it's connecting the slots together in a longitudinal arrangement," and he explained that the connector member in the accused devices satisfied that requirement. The jury was entitled to credit that testimony and to conclude that AVE's connector members are aligned with the adjacent slots, both of which are substantially parallel to the longitudinal axis of the tubular members.

V. Validity

The district court denied AVE's motion for JMOL as to the validity of the two patents in suit. The court rejected AVE's motion regarding the '762 patent on the merits and held that AVE had not raised its validity defense with respect to the '984 patent. AVE cross-appeals the district court's judgment on the issue of validity with respect to both patents. AVE has not demonstrated, however, that the district court erred in concluding that AVE raised its validity defense only with respect to the '762 patent. Accordingly, we address the invalidity argument

only as it applies to the '762 patent.

The district court declined to overturn the jury's verdict that the written description of the '762 patent supports the construction of the term "plurality of slots" employed by the district court. AVE argues that the patent must be declared invalid because the district court's construction of "plurality of slots" to include tubular members composed solely of "half-slots" (slots bounded on three sides by the wall surface) rendered the asserted claims invalid for lack of a written description. AVE contends that the written description supports only a construction that requires both "complete slots" (slots bounded on all four sides) and half-slots, with the half-slots located only at the ends of each tubular member. The district court, however, did not restrict the "plurality of slots" limitation to half slots or complete slots, or any combination of the two.

Paragraph 1 of section 112 of the Patent Act provides that the "specification shall contain a written description of the invention." To fulfill the written description requirement, the patent specification must describe an invention in sufficient detail that one skilled in the art can clearly conclude that the inventor invented what is claimed. Lockwood v. Am. Airlines, Inc., 107 F.3d 1565, 1572 (Fed. Cir. 1997); In re Gosteli, 872 F.2d 1008, 1012 (Fed. Cir. 1989). The disclosure as originally filed does not, however, have to provide in haec verba support for the claimed subject matter at issue. See Fujikawa v. Wattanasin, 93 F.3d 1559, 1570 (Fed. Cir. 1996).

This court will reverse a denial of JMOL only "if the jury's factual findings are not supported by substantial evidence or if the legal conclusions implied from the jury's verdict cannot in law be supported by those findings." Door-Master Corp. v. Yorktowne, Inc., 256 F.3d 1308, 1312 (Fed. Cir. 2001). The burden at trial was on AVE to establish by clear and convincing evidence that the written description requirement was not met, in light of the presumption of validity; whether the written description requirement has been satisfied is a question of fact that is reviewed for substantial evidence when resolved by a jury. Abbott Labs. v. Syntron Bioresearch, Inc., Nos. 02-1203, 02-1257, slip. op. at 20-21 (Fed. Cir. July 10, 2003); see also Tronzo v. Biomet, Inc., 156 F.3d 1154, 1158 (Fed. Cir. 1998).

We conclude that the record supports a finding that AVE failed to prove that the written description requirement was not satisfied in this case. The term "slot" is explicitly defined in the specification of the '762 patent as "an opening whose length is substantially greater than its

width." '762 patent, col. 7, ll. 17-19. In describing the preferred embodiment, the term "slot" is used to describe both openings that are fully bounded and those that are bounded on only three sides. For example, the written description recites, "Alternating slots disposed about the circumference of tubular member 71 at both the first and second ends 72, 73 of tubular member 71 will only have a length equal to approximately one-half of the length of a complete slot 82, such half-slot 82 being bounded by members 78, 79, at both the first and second ends 72, 73 of tubular member 71." '762 patent, col. 7, ll. 7-13; '984 patent, col. 6, ll. 30-36 (emphasis added). Both half-slots and complete slots are labeled as 82 and are described at times simply as "slots"; that term thus encompasses both types of openings. The claim does not limit the order or mixture of the slots. The term "plurality of slots" simply means multiple slots, not multiple kinds of slots.

It is true that the preferred embodiment detailed in the written description contains alternating complete and half-slots at the ends of the tubular members. As our case law makes clear, however, "[a]n applicant is not required to describe in the specification every conceivable and possible future embodiment of his invention." Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1344 (Fed. Cir. 2001). "A specification may, within the meaning of 35 U.S.C. § 112 para. 1, contain a written description of a broadly claimed invention without describing all species that [the] claim encompasses." Utter v. Hiraga, 845 F.2d 993, 998 (Fed. Cir. 1988).

This case is thus analogous to Lampi Corp. v. American Power Products, Inc., 228 F.3d 1365, 1378 (Fed. Cir. 2000), in which we upheld the district court's conclusion that the written description was sufficient to support half-shells that are not identical when the patent drawings only showed identical half-shells. We stated that "[i]t is a familiar principle of patent law that a claim need not be limited to a preferred embodiment" and that the "drawings in the patent are merely a 'practical example' of the invention." Id.

AVE cites Gentry Gallery, Inc. v. Berkline Corp., 134 F.3d 1473 (Fed. Cir. 1998), to support its cross-appeal. In Gentry Gallery, we concluded that the written description requirement was not satisfied because while "the original disclosure clearly identifies the console as the only possible location for the controls," the claims did not limit the location of the control to the console. Id. at 1479. Gentry Gallery thus applied the "proposition that a broad claim is invalid when the entirety of the specification clearly indicates that the invention is of a much narrower scope." Cooper Cameron Corp. v. Kvaerner Oilfield Prod., Inc., 291 F.3d 1317, 1323

(Fed. Cir. 2002). In the present case, the entirety of the specification does not reflect that the invention goes to the narrower scope of a mixture of half and complete slots. Such a mixture was not conveyed as critical to the invention nor was it described as the only feasible design in the disclosure. Rather, as in Johnson Worldwide Associates, Inc. v. Zebco Corp., 175 F.3d 985, 993 (Fed. Cir. 1999), "the patent disclosure provides ample support for the breadth of the term [ ]; it does not 'unambiguously limit[ ]' the meaning of [the term]" to the narrower embodiment.

In this case, substantial evidence supports a finding that AVE failed to prove by clear and convincing evidence that the claims are invalid for failure to satisfy the written description requirement. We therefore sustain the judgment that the asserted claims of the '762 and '984 patents are not invalid under 35 U.S.C. § 112, para. 1 and affirm the denial of JMOL on that issue.

REVERSED and REMANDED.