United States District Court,
D. Minnesota.

MEDTRONIC, INC,
v.
ADVANCED CARDIOVASCULAR SYSTEMS, INC.

No. 97-CV-2459(JMR/FLN)

Jan. 12, 2000.

Suit was brought alleging infringement of patent for coronary stent. Upon defendant's motion for judgment as a matter of law for noninfringement, the District Court, Rosenbaum, J., held that patent claims were not literally infringed or infringed under doctrine of equivalents.

Motion granted.

Affirmed, 248 F.3d 1303.

5,653,727. Not Infringed.

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ORDER

ROSENBAUM**, District Judge.**

In this patent suit, plaintiff, Medtronic, Inc. ("Medtronic"), claims the ACS RX Multi-Link Stent ("the Multi-Link Stent") manufactured by defendants, Advanced Cardiovascular Systems, Inc., and Guidant Corporation (collectively "Guidant"), infringes a patent held by Medtronic. The case was tried for 12 days, after which each side rested, having presented all evidence.The case concluded almost immediately thereafter, however, without closing argument or jury deliberation. It did so because both parties agreed the Court's final claim construction disposed of the matter.

The case was concluded pending this Court's final Order-here presented-and any possible appeals. The following is the Court's ruling on Guidant's motion for directed verdict, pursuant to Rule 50(a) of the Federal Rules of Civil Procedure ("Fed. R. Civ.P."). The Court finds that, as a matter of law, there is no legally sufficient evidentiary basis upon which a jury could find that Guidant's accused device infringes Medtronic's patent. The motion is therefore granted.

I. ***Procedural Background***

Much of this case's history is set forth in the Court's Order, dated June 10, 1999. The matters immediately relevant to this motion, however, have occurred relatively recently. They largely concern this Court's duty to construe and define for the jury the claims of Medtronic's '727 patent. The device in question is a coronary stent. FN1

FN1. A coronary stent holds the lumen of a heart artery open when that artery has been blocked by disease or otherwise.

In order to define the patent claims, the Court held the hearing suggested in Markman v. Westview Instruments, Inc., 52 F.3d 967, 979 (Fed.Cir.1995) (en banc), *aff'd,* 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). FN2 The hearing was held August 31, 1999, more than a month prior to trial. Before the hearing, the Court offered proposed claim construction definitions. All sides briefed any proposed modifications of these proffered terms, and the Court took evidence from all parties.

FN2. The parties were joined during the *Markman* hearing by Boston Scientific, a party to another patent infringement suit concerning the same patent, *Medtronic, Inc. v. Boston Scientific Corporation, et al.,* No. 99-CV-752 (JMR/FLN). This second case is also before the undersigned. The Court's claim construction Order was applicable to both cases.

During the *Markman* hearing, the Court invited further briefing on the construction of Claims 1 and 11 of the '727 patent concerning the "means for connecting adjacent elements together." The Court issued a second Order, dated September 16, 1999, further refining the claim definitions. These included a second effort to define the means-plus-function term in Claims 1 and 11.

The parties submitted a third set of briefs after the September 16, 1999, Order. Thereafter, and prior to trial, the Court took the construction of this particular term under advisement and informed the parties that the language in question would be finally construed prior to the jury's deliberations. FN3 The parties were advised the Court would give preliminary instructions of law prior to opening statements. Included in these instructions was a full set of the Court's claim constructions- *with one exception-the definition of Claims 1 and 11's means-plus-function language*. This history makes clear the parties knowledge that this claim was much in play.

FN3. On October 18, 1999, at side bar, in response to Guidant's counsel's observation that the Court "reserved ruling on the definition of means plus function," and an inquiry whether reference to the means-plus-function claim language during opening statements would be allowed, the Court observed: "[I]t would be prudent for you to just lay off that one." Trial Transcript, Vol. I-a, at 22.

Jury selection began on October 18, 1999. The jury was instructed, as described above, prior to opening statements. The trial proceeded through November 17, 1999, when both Medtronic and Guidant rested. On that date, the Court issued its final claim constructions. With the exception of the means-plus-function term, each claim was defined as it had been at the beginning of trial. The Court, then, advised counsel of its definition of the means-plus-function claim language:

Means for connecting adjacent elements together: This is a means-plus-function description. This sort of description has a "function" portion describing what it does, and a "means" portion describing how that function is performed. The means is a corresponding structure in the patent's specification.

Here, the function is connecting adjacent elements together. It describes a way to allow close-lying parts of the device to be connected.

The means for achieving this function is an end-to-end connection by means of helical winding. The means also encompasses other means for accomplishing this same function, so long as the alternative means are not substantially different from the means I have described.

After receiving this definition, Medtronic conceded that, using this definition, Guidant's accused device could not be found to infringe the '727 patent. For its own tactical reasons, Medtronic did not oppose Guidant's Rule 50(a) motion, while maintaining its objection to the construction of the means-plus-function language.

In this Order, the Court fully explains its claim construction. It also rules on each aspect of defendants' Rule 50(a) motions which were taken under advisement during the trial.

II. ***The Background of the Patent in Suit***

This case concerns the technology involved in intravascular coronary stents. These devices hold open heart blood vessels which have been obstructed. Each party manufactures these devices.

In 1987, Dominik M. Wiktor ("Wiktor") applied for a patent on such a stent. The patent was issued in 1989 as U.S. Patent No. 4,886,062 (the " '062 patent"). This patent, entitled "Intravascular Radially Expandable Stent and Method of Implant," included thirteen claims and six drawings. Figure 3 of the '062 patent is shown here as Figure A.

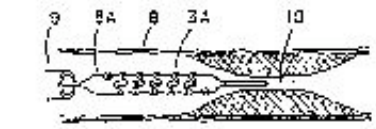


FIG. 3

Figure A

As seen in that figure, and at trial, the stent is a single wire bent into a zig-zag shape and wound helically into a cylindrical shape by wrapping it around a mandrel. The device is placed over an expandable balloon and introduced into a narrowed blood vessel. When the stent is placed at the point of an arterial blockage or narrowing, the balloon is inflated. The stent, thereby, expands into the walls of the vessel. The balloon is deflated, and the stent, being made of low-memory metal,remains in place, in the expanded condition, as the balloon is removed. The expanded metal stent holds the blood vessel open, increasing the vessel's blood carrying capacity.

The '062 patent does not refer to any means whereby its adjacent elements are held together, nor does it refer to its windings as separate elements.

In 1989, Medtronic, at this time Wiktor's assignee, applied for a continuation in part of the '062 patent; this application was issued in 1992 as U.S. Patent No. 5,133,732 (the " '732 patent"), entitled "Intravascular Stent. " The '732 patent added a number of figures, including Figures 7 and 8, which are central to a number of Medtronic's arguments below.

The '732 patent is focused significantly on the problem of longitudinal overstretch or movement. This condition occurs when a stent lengthens or when its parts shift in relation to each other. The coronary arteries are not long, and when stent overstretch occurs, it can have adverse patient implications. The '732 patent presented a response to such problems by, among other possibilities, installing either a bar, spot-welded in a lengthwise fashion to the stent coil, or by extending a number of the wave-like parts of the stent and using them to "hook" between successive windings of the coil. Significantly, the '732 patent never refers to the successive windings of the stent-coil as separate "elements"-that usage is introduced later.

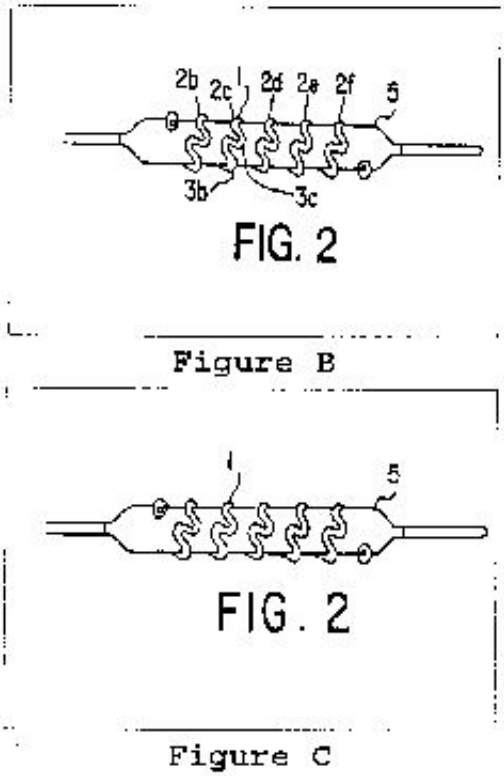
In 1996, Medtronic applied for a continuation of the '732 patent, which was issued as U.S. Patent No. 5,653,727 on August 5, 1997, also entitled "Intravascular Stent" (the " '727 patent"). It again named Dominik M. Wiktor ("Wiktor") as inventor, and Medtronic as assignee. At the same time Medtronic applied for this continuation patent, it filed a preliminary amendment amending the written description and three of the figures, as well as adding claims 5 through 39. As required, Wiktor and Medtronic represented that the newly-added terms and phrases were merely descriptive of the original material, and asserted that no new matter was added by the preliminary amendment.

It is fair to say these 1996 filings somewhat changed the conceptual description of the patented device. The device was now described as a series of successive individual elements. These now-identified elements

were, in fact, the successive windings of the wire over 360 degrees. *See, e.g.,* '727 Patent 8 :3-13 (Claim 1). The '727 patent does not suggest the "elements" ever were, or could be, actually separated (they are, after all, simply continuing lengths along a folded wire). But the added drawings now label each serial winding as a separate element.FN4 *Compare* Figure B ('727 patent, Fig. 2 (identifying windings as 2b, 2c, 2d, etc.)) *with* Figure C ('732 patent, Fig. 2 (portraying the identical drawing with the windings labeled collectively as 1)).

FN4. The fact that the wire is never physically separate does not, of course, preclude Medtronic from conceptually separating the stent into elements. Guidant does not challenge such conceptual separation without physical separation. The Court does not consider this point relevant to its determination, but simply notes it for clarification.

Figure B



The changed material also added claims for "means for connecting adjacent wire elements together." This means-plus-function claim, as mentioned above, is part of every claim asserted by Medtronic. If Guidant's accused product does not infringe this means-plus-function claim, Medtronic's infringement case falls.

III. ***The Markman Requirements and Means-Plus-Function Claims***

[1] [2] It is axiomatic that the claims of a patent define its boundaries, and the definition of those boundaries is a matter of law for the Court to determine. *See* Markman, 52 F.3d at 970-71, 979. A court primarily

discerns those boundaries from three sources: "[t]he claims, the specification, and the prosecution history." *Id*. at 979 (quoting Unique Concepts, Inc. v. Brown, 939 F.2d 1558, 1561 (Fed.Cir.1991)). In certain circumstances, it is also appropriate to consider expert testimony. *See id*. (citing Fonar Corp. v. Johnson & Johnson, 821 F.2d 627, 631 (Fed.Cir.1987)). It is also established that extrinsic evidence-"all evidence external to the patent and prosecution history, including expert and inventor testimony, dictionaries, and learned treatises"-may be used to help explain the relevant technology and aid the Court in properly construing the language, but extrinsic evidence cannot be used to vary or contradict the claim language itself. *Id*. at 979-81. The trial court's determination is, of course, subject to *de novo* review on appeal.

[3] Means-plus-function claims present particular requirements, as defined in both statute and case law. *See* 35 U.S.C. s. 112; B. Braun Med. v. Abbott Labs., 124 F.3d 1419 (Fed.Cir.1997). By using such claims, the patentee can obtain patent protection for a means for performing a specific function, but it can be read only to cover "the corresponding structure ... described in the specification and equivalents thereof." 35 U.S.C. s. 112, para. 6.

[4] Thus, in interpreting the present means-plus-function claim, the Court must look to the written description to find a structure corresponding to the means in the claim. In other words, in this case, the Court must find-within the patent's terms-those means which correspond to the function of "connecting adjacent elements together." '727 Patent, Claims 1 and 11. This correspondence must provide a clear link or association connecting the function and the means; the link can be created through the specification or the prosecution history. *See* B. Braun, 124 F.3d at 1424. This clear link is required in return for the convenience of using the means-plus-function claim approach. *See id*.

IV. *Construction of "Means for Connecting Adjacent Elements Together"*

[5] With the Federal Circuit's proper legal approach firmly in mind, the Court turns to the construction of the '727 patent's critical Claims 1 and 11. Each of these claims includes "means for connecting adjacent elements together." The Court concludes, as set forth in its final claim construction, stated above, that the only structure clearly linked to the function of connecting adjacent elements together is the end-to-end helical winding (and its equivalents).

This conclusion is, first, grounded in the language in the patent's specification. Claims 1 and 11 require a "means for connecting adjacent elements together." Having found the "function," the Court turns to the patent's specification to find the structure to which this claim refers. The answer is found at 4:5-7. This is the only reference in the patent's specifications to elements being connected.

The critical language reads: "The adjacent wire elements 2 *b-f* are flexibly connected together in an end-to-end fashion by means of the helical winding of the flat band 3 *a*." Now, having found the function in Claims 1 and 11, and the means described in the specifications, at 4:5-7, the Court took the Federal Circuit's guidance in *Markman* and defined the means-plus-function language as:

Here, the function is connecting adjacent elements together. It describes a way to allow close-lying parts of the device to be connected.

The means for achieving this function is an end-to-end connection by means of helical winding. The means also encompasses other means for accomplishing this same function, so long as the alternative means are not substantially different from the means I have described.

Plaintiff vociferously challenges this *Markman* claim definition.

Medtronic's major contention is that, in adopting this language, the Court misapprehends the two structures shown and described in Figures 7 and 8 of the '727 patent. In this same regard, Medtronic alludes to other textual references for structures it proposes as falling within the claim language. *See* Figures D & E ('727 Patent, Figs. 7 & 8, respectively); '727 patent at 4:56-59 ("[M]eans can take several forms including a straight wire placed on the outside of the tubular shaped stent spotwelded to each individual coil of alternately using a simple suture thread and tying each coil to the next."); 4:60-63 ("Another method found acceptable is to arrange the sinusoidal wave shape pattern where one wave shape out of a series is longer and can be bent to catch the wave of the adjacent coil."); 4:67-5:2 ("[T]he means includes a single lengthwise wire attached, for example, by welding to loops of the coil."); 5:2-4 ("In another embodiment, the loop of the coil is hooked over an adjacent loop to restrain longitudinal movement.").

Medtronic argues Figures 7 and 8, and references to attachment means other than end-to-end connections, are properly understood as defining the "means for connecting" described in Claims 1 and 11. Medtronic is incorrect. Medtronic then asserts that Figures 7 and 8 do not satisfy the Court's construction of the language of Claims 1 and 11. Medtronic is again incorrect. Finally, Medtronic roundly asserts that the Court's definition "reads out" Figures 7 and 8 of the '727 patent. Medtronic is incorrect, yet again.

The structures shown in Figures 7 and 8 are, respectively, (a) a longitudinal bar spotwelded to successive turns of the helically twisted wire stent [Figure 7], and (b) a modified version of the generally sinusoidal wire waves, so contrived that one wave of each winding is extended lengthwise, to allow it to "catch" the preceding winding [Figure 8].

Figure D

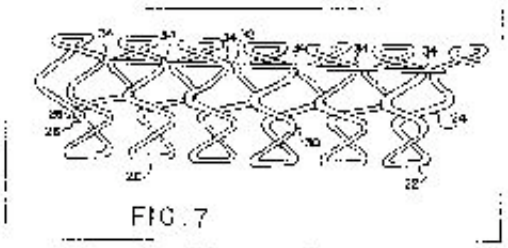


Figure D

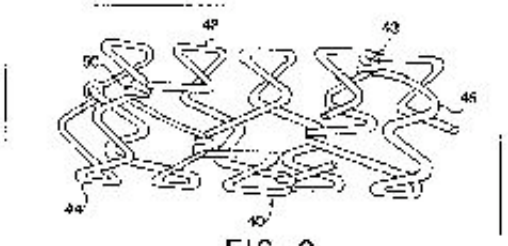


Figure E

The first and strongest rebuttal to Medtronic's arguments is found in the '727 patent's specification itself. As an initial matter, there is no language in the specification paragraph describing Figures 7 and 8 which makes any reference, whatsoever, to Claim 1 and 11's "means for connecting adjacent elements together." The patent specification-as written by Medtronic-carefully describes the Fig. 7 and 8 structures as portraying "means to prevent longitudinal overstretch." '727 Patent, 5:24-28.

Despite the lack of any textual connection in the description, Medtronic nonetheless urges the Court to consider the various graphical and textual references to bars, hooks, and tying as also constituting means for connecting adjacent elements together. Intuitively, Medtronic's argument has appeal. In a literal sense, for example, the wire welded to the outside of the stent certainly is attached to each adjacent element, and it is therefore tempting to conclude that the wire is a "means for attaching adjacent wire elements together." That temptation is tempered, however, by *B. Braun* 's unambiguous direction to the Court to find a " *clear* [ ] link or association" between the function and the proffered means. B. Braun, 124 F.3d at 1424 (emphasis added). Such a link is entirely absent here.

Every reference suggested by Medtronic is clearly in the context of preventing longitudinal movement, whether stretch or otherwise. While the means of preventing such movement may coincidentally perform an attachment function, such coincidence is not sufficient under the strict requirements of the means-plus-function doctrine. As noted, clarity of connection is the quid pro quo for the convenience of using such claims, and that clarity is lacking. *See* B. Braun, 124 F.3d at 1424. Each and every textual reference to these Medtronic-proposed alternative means of connecting is in paragraphs related to overstretch or longitudinal movement; not one contains a reference to connecting adjacent elements together.

Medtronic, as noted, also argues that Figures 7 and 8 compel a different construction of the means-plus-function claim when examined in the context of the prosecution history, and that the Court's construction of the claim "reads out" Figures 7 and 8. This argument is misplaced.

As a preliminary matter, Figures 7 and 8 clearly do, in fact, include the end-to-end connection by means of helical winding, as provided in the Court's claim construction. The figures depict stents made of a single wire, bent into various shapes and wrapped helically around a mandrel. Both depict a helix, defined as "a three-dimensional curve that lies on a cylinder ... and cuts the elements at a constant angle." *American Heritage Dictionary* (2d College Edition 1982). Thus, if the bar and hook of the figures are indeed means for connecting adjacent elements together, they perform this function *in addition to* the already-in-place end-to-end helical winding. As a result, the Court's construction in no way reads Figures 7 and 8 out of the patent.

When examined in the context of the prosecution history, Figures 7 and 8, along with their descriptions in the patent's specifications, fail to provide the clear link required to be considered a means for the function in question. Medtronic notes that the prosecution history includes a statement declaring the "longitudinal connecting means" disclosed in Figures 7 and 8 to be an improvement. But the fact that the bar and hooks literally "connect" the elements together does not transform them into a means for connecting adjacent elements together in the context of the means-plus-function claim.

Medtronic properly notes that reading preferred embodiments out of a patent "is rarely, if ever, correct." Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1583-84 (Fed.Cir.1996). The flaw in its argument, however, is that the Court's claim construction absolutely does not do so. Figures 7 and 8, and the patent's specification and prosecution history, disclose end-to-end helical winding and its equivalents as the only

means for connecting adjacent wire elements together within the means-plus-function claim. Both figures fall within the Court's claim construction and are not read out by it.

Finally, the Court notes that its claim construction was reached without reliance on extrinsic evidence. The testimony at trial was helpful as background on the technologies involved and as confirmation of the Court's conclusions, but the Court's construction does not vary or contradict the patent language.

As noted, once the Court's claim construction was in place, Medtronic conceded it could not prevail on a question of infringement, because that claim language is part of every claim asserted, and because Guidant's product does not include end-to-end helical connections. Accordingly, because there is no legally sufficient evidentiary basis for a reasonable jury to find for Medtronic, judgment as a matter of law, pursuant to Fed.R.Civ.P. 50(a), must be granted.

V. *Infringement: Zig-zags lying flat with respect to the cylinder*

Independent Claims 1 and 11, upon which all other asserted claims depend, each include the limitation that the stent have "zig-zags lying flat with respect to the cylinder which permit the wire elements to be expanded from a first diameter covering 360 degrees of the cylinder to a second, expanded diameter covering 360 degrees of the expanded cylinder." Guidant asserts that, as a matter of law, its product does not read on that limitation. As such, Guidant claims a finding of noninfringement should be made on this basis as well. The Court agrees.

Under *Markman,* and without objection by Medtronic, the phrase "the zig-zags lying flat with respect to the cylinder" was construed for the jury as: "The zig-zag-shaped structure lies upon or follows the surface of a tube or cylinder without protruding off the cylinder surface." In other words, the stent structure forms a cylindrical shape, with no part or structure protruding from the curved plane defined by the cylinder surface. A key question is whether this "lying flat" restriction applies only in the unexpanded state, or whether the patent also requires that the structure lie flat when expanded.FN5

FN5. At the *Markman* hearing, the Court made clear that the construction included both the unexpanded and expanded state, noting that the then-proposed language (which the Court later adopted for its final claim construction) "covers both expanded and unexpanded [states]." Transcript, at 40. Further, in this same regard, the Court rejected as redundant and surplusage, an added term saying the structure lay flat in both the pre-expansion and in the expanded state. *See id*. Notwithstanding these *Markman* hearing rulings, the Court here revisits the issue to amplify its conclusions.

It is clear and uncontroverted that the accused product, when expanded, features certain portions which protrude into the artery surface. Photographs and models introduced at trial established and displayed these protrusions. *See, e.g.,* Figure F (micrograph of expanded Multi-Link Stent). Medtronic agrees these protrusions exist in the expanded Multi-Link device. Medtronic does, however, dispute that the protrusions preclude a finding of infringement.

Figure F

The Court finds that the '727 patent's claim language itself strongly implies that the Wiktor/Medtronic stent must remain cylindrical after expansion. *See* '727 Patent Claim 1(b)(1) ("the zig-zags lying flat with respect to the cylinder which permit the wire elements to be expanded from a *first diameter* covering 360 degrees of the *cylinder to a second, expanded diameter* covering 360 degrees of the expanded *cylinder* ") (emphasis added); id. Claim 11(b)(1) (same).

The Court notes that, mathematically, "diameter" is defined as a "straight line passing through the cent[er] of a circle (or sphere), and terminated by its circumference (or surface)." *Oxford English Dictionary* 313 (1985). Therefore, the patent's own words suggest a regular circular shape. Similarly, a "cylinder," when used without any qualifiers, is a shape with no protrusions off of its surface; it is a circle extended into space. Thus, the claim language does not support Medtronic's view that the stent's zig-zags must lie flat only with respect to the unexpanded state. If the expanded state has a diameter and is cylindrical, it is presumptively flat with respect to that cylinder. From this, the Court considers that its *Markman* construction, covering both expanded and unexpanded stents, is entirely consistent with the '727 patent's claim language.

Medtronic protests that such a conclusion contradicts the claim language in its larger context, thus rendering other claim language meaningless and unsupported by the patent's specification. Though Medtronic perhaps now wishes it had phrased its claims differently, the Court's construction does not rob the claims of meaning, which, of course, would be frowned upon. *See* Ethicon Endo-Surgery, Inc. v. U.S. Surgical Corp., 93 F.3d 1572, 1578 (Fed.Cir.1996).

Medtronic makes much of the fact that an expanded stent necessarily conforms to the distended or misshapen artery into which it is expanded. It argues from this fact that the stent must, perforce, assume a shape which does not lie flat, making the concept of "lying flat with respect to the cylinder" an impossibility in its expanded state. The Court considers this argument to be something of a sophistry.

Certainly, the patient's diseased artery is unlikely to be occluded in a perfectly cylindrical fashion. And, therefore, an expanding device pushed into its internal aspect will not maintain its perfectly cylindrical shape. But this does not mean its component parts cannot lie in a generally even plane with the shape it assumes, which remains largely cylindrical. In fact, that seems to be precisely what is observed in the

expanded Wiktor/Medtronic device described in the '727 patent.

This observation of the Wiktor/Medtronic invention is contrasted with the accused Multi-Link stent. The Multi-Link stent is configured from a laser-cut stainless steel tube. In its unexpanded state, it is a smooth, somewhat flexible tube. Initially, then, the accused device's parts do lie flat with respect to the cylinder from which it is cut. But the Multi-Link stent assumes an entirely different configuration when expanded: its cut-shape is so configured that, when expanded, its expanded portions *intentionally protrude* from off its cylindrical surface. *See* Figure F (depicting the expanded Multi-Link Stent). Though neither side presented evidence on the point, it is clear the accused stent demonstrates these protrusions whether or not implanted in a perfectly cylindrical diseased artery.

U.S. Patent No. 5,514,154 issued to Guidant, covering the Multi-Link device, specifically refers to this expanded-protrusion concept. The Court is well aware that a later patent, obtained on an accused device, does not protect or insulate it from a claim of infringement. *See* Atlas Powder Co. v. E.I. du Pont De Nemours, 750 F.2d 1569, 1580 (Fed.Cir.1984). On the other hand, the Court points to this second patent to emphasize the fact that, while the '727 patent explicitly calls a shape "lying flat with respect to the cylinder," the accused device is particularly designed so that it does *not* lie flat in its expanded state.

Medtronic also contends this claim construction ignores the purpose of the language's inclusion. As stated in its summary judgment motion before trial, "The stent must have a low profile during delivery so that it can circumvent the irregular contours and serpentine course of the coronary arteries." Brief at 13-14. The Court does not doubt the truth of that statement, but these words do not resolve the present question of the stent's shape upon expansion, relating as they do only to the unexpanded state.

The '727 patent's specification provides some indication of the shape the Medtronic stent should have upon expansion. It describes its Figure 6 (included herein as Figure G) as portraying a stent "firmly implanted and imbedded in compressed plaque 7, providing both adequate support as well as *a smooth lumen void of all protrusions,* a very desirable feature and condition, since any protrusions are conductive to turbulent blood flow and potential formation of thrombosis." '727 Patent, 6:22-27 (emphasis added).

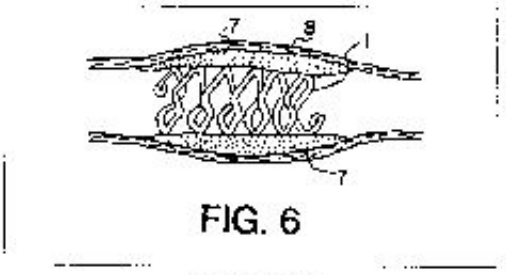


Figure G

It is possible to read this language as relating only to internal protrusions-that is, those extending into the blood flow, rather than into the vessel wall. But when the Court looks at the patent figure it describes, it is evident that there are no protrusions in either the unexpanded or in the expanded state. Though Figure 6 lacks great clarity, it appears that the stent remains cylindrical as it embeds itself in the plaque in the artery.

In remaining cylindrical, both its internal and external shapes remain "flat with respect to the cylinder." Indeed, the structure of the stent depicted in Figure 6 is such that if the internal shape remains cylindrical, so too must the external shape.

The Court notes, incidentally, that here, as in the means-plus-function context, both Figures 7 and 8 lie firmly within the terms of the '727 patent as construed. Certainly Medtronic's devices have particular locations which are thicker than others (thus keeping them, at least to some extent, from being perfectly "flat with respect to the cylinder"), but those portions are not part of the zig-zags. Instead, they consist of the bar external to the zig-zags (Figure 7) and the hooked portion which is not part of the regular zig-zag shape (Figure 8).

Medtronic's patent, itself, requires this small departure from the "lying flat" requirement. In Figure 7, the bar is welded to the helical stent; at least at the welding point, the stent is the thickness of its base wire, plus the thickness of the welded bar. Similarly, in Figure 8, the base wire is wound around itself at the site where the elongated zig-zag reaches back to "grip" the preceding coil; at this point the stent becomes three wire-thicknesses in depth. In each case, the stent seemingly departs from the "lying flat" restriction.

It ill befits Medtronic to deny this point. If it does so, it is Medtronic which reads Figures 7 and 8 out of its own '727 patent. Any other conclusion would read those figures out of the patent's boundaries regardless of whether the lying flat relates solely to the unexpanded state-the extra thickness caused by the bar and the hooks is present both pre- and post-expansion. Thus, the Court's definition conforms with *Vitronics* in its conclusion that the zig-zags must lie flat with respect to the cylinder in both the expanded and unexpanded state.

[6] With that conclusion in mind, the Court turns to defendant's motion pursuant to Fed.R.Civ.P. 50(a). As noted, the "zig-zags lying flat with respect to the cylinder" language is integral to every asserted claim. Based on the record herein, and the evidence during trial, the Court concludes as a matter of law that the Multi-Link Stent does not lie flat with respect to the cylinder in the expanded state, as necessary for a finding of literal infringement of the '727 patent. Instead, its expanding elements protrude outward from the plane of the cylinder formed by the rest of the stent. Those elements are an essential part of its expanding elements, unlike Medtronic's bar or hooking structures in Figures 7 and 8.

Accordingly, the accused device cannot literally infringe the '727 patent, and no contrary conclusion could be supported by the evidence. Accordingly, judgment in favor of Guidant is appropriate.

[7] Nor can Medtronic argue for infringement of this claim language under the doctrine of equivalents. Any argument that the differences between a cylindrical stent with a flat exterior (with that flatness a specific claim limitation) and a stent designed to protrude outward are insubstantial is absurd. Although the doctrine of equivalents allows some flexibility in a patent's claims encompassing insubstantially different products, it cannot make black into white, or up into down-and it cannot make protrusions flat. Because the Multi-Link Stent's zig-zags do not lie flat with respect to the cylinder, judgment is appropriate under Fed.R.Civ.P. 50(a) under both literal infringement and the doctrine of equivalents.

VI. ***Generally Sinusoidal in Shape***

[8] Dependent Claim 2 and independent Claim 11 of the '727 patent require the zig-zags to be "generally sinusoidal in shape." This is illustrated in each of Figures 1-8. In each case, the base structure is a piece of

wire bent into the sinusoidal shape. All of the asserted claims except for Claims 1, 6, 8, and 9 include this limitation. The Court, with the assent of both Medtronic and Guidant, construed this phrase as: "[a] further description of the zig-zag shape. The shape does not come to sharp angles, but is more the shape of the mathematical sine wave." The parties agreed with this *Markman* claim construction.

The accused Multi-Link Stent is made of rings, laser-cut from a metal tube. The rings are cut into a series of "U" and "W" -shaped curves. Each ring is attached to the ring which precedes and follows it by a bar which is also cut from the same metal tube. At the point where the bar is located, the metal is cut into a "Y" form with the tail of the "Y" extending to the next ring. *See* Figure H (showing the Multi-Link Stent "flattened").

***823**

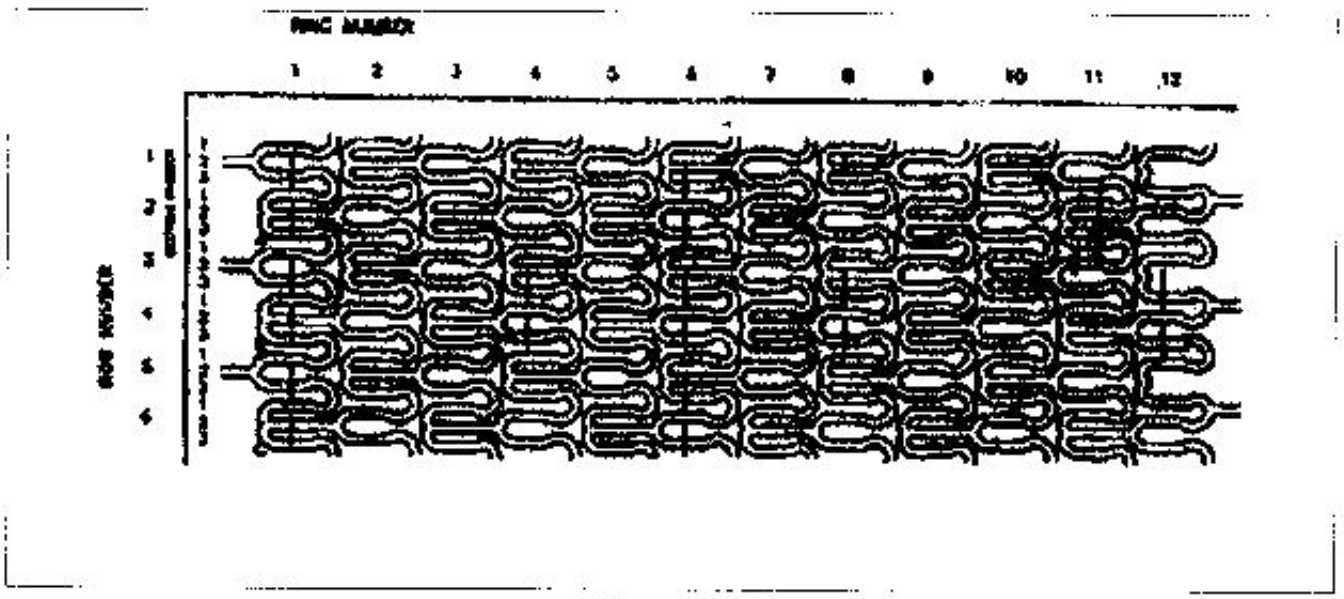


Figure H

The accompanying illustration (Figure I) shows the shape of a sine wave. Beyond the illustrated shape, however, the Court notes that a sine wave has at least two additional mathematic characteristics: First, a sine curve is, in fact, a "function." This means it has one, and only one, defined value at each point along the horizontal X-axis. It cannot, perforce, be perpendicular to-or rise directly parallel to-the Y-axis, and it cannot "double back" on itself. These facts lead to the second characteristic: A sine wave can have its mathematic derivative taken at every point along its curve. It is not possible to do so with a shape which is parallel to the "Y" axis, or which "doubles back" upon itself.

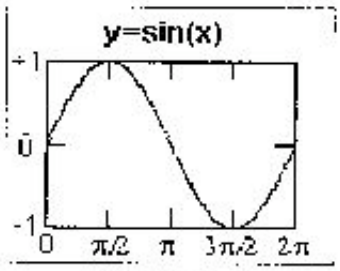


Figure I

The Court now contrasts these factors with the expanding rings of the accused Multi-Link device. *See* Figure J.FN6 The accused device's complex shape, whatever else it is, is neither a sine wave, nor is it "generally sinusoidal" in shape. Each ring has a portion which runs directly parallel to the "Y" axis, and each has parts at the end of the "W"-shaped portion which double back on themselves. These facts make it impossible for the Multi-Link to literally satisfy the "generally sinusoidal" restrictions of the '727 patent.

FN6. Figure J is a portion of Figure 5 in U.S. Patent No. 5, 649,952, issued to Guidant. The Court uses the figure simply because it provides a convenient demonstration of what the Multi-Link Stent looks like, but is cognizant of the requirement that the asserted claims be compared to the accused product, not to any other patent.

***824**

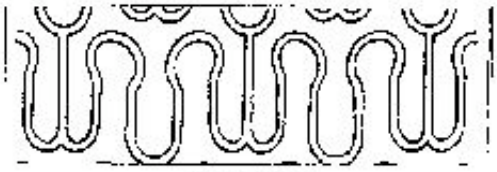


Figure J

Figure J

The Court further notes that the word "generally" sinusoidal may well serve to cover the vastly elongated "sinusoidal" wave occasionally seen in Figure 8 of the '727 patent (Figure E herein). This is the elongated wave which reaches out to "grab" the next successive winding of Medtronic's helical stent. But this elongation aspect of the "generally sinusoidal" shape is not seen in the accused device either.

Because the Court finds, as a matter of both mathematics and of fact, that the Multi-Link Stent is not generally sinusoidal in shape, the accused product cannot literally infringe this claim. The Court also concludes that a series of curves which are not sine waves cannot be insubstantially different from a sinusoidal shape, as such a finding would eliminate any meaning for the claim limitation. Accordingly, the doctrine of equivalents cannot support a finding of infringement either, and judgment pursuant to

Fed.R.Civ.P. 50(a) is appropriate as to Claims 2, 11, 12, 15, 17, 19, and 20.

VII. ***Other*** Rule 50(a) ***Motions***

Plaintiff and defendants made a number of other motions under Rule 50(a) related to validity and infringement. Because the Court finds there could be a legally sufficient evidentiary basis for a jury verdict on the other claims, such judgment is denied.

VIII. ***Conclusion***

For the reasons set forth above, and based on the records, proceedings, and submissions herein, IT IS ORDERED that:

Defendant's motion for judgment as a matter of law for noninfringement is granted.

LET JUDGMENT BE ENTERED ACCORDINGLY.

D.Minn.,2000.
Medtronic, Inc. v. Advanced Cardiovascular Systems, Inc.