United States District Court,
D. Massachusetts.

COGNEX CORPORATION,
Plaintiff.
v.
ELECTRO SCIENTIFIC INDUSTRIES, INC,
Defendant.

No. Civ.A. 01-10287-RCL

July 30, 2002.

Owner of patent for method of placing surface mounted devices on electronic circuit boards sued competitor for infringement. Construing claims, the District Court, Lindsay, J., held that: (1) "universal description language means" performed function of creating description of shapes of devices; (2) "planning means" performed function of generating plan for locating devices through sequential application of more than one vision tool; (3) "video means" performed function of generating representation of image of at least part of device; and (4) "inspection means" performed function of examining features of device, through sequential application of at least two vision tools, so as to estimate device's position with progressive certainty.

Claims construed.

5,371,690. Construed.

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MEMORANDUM ON CONSTRUCTION OF CLAIMS

LINDSAY**, District Judge.**

[1] This is a patent infringement action in which the plaintiff, Cognex Corporation ("Cognex"), alleges that the defendant, Electro Scientific Industries, Inc. ("ESI") infringed Cognex's United States patent numbered 5,371,690 ("the '690 patent"). There are two steps to an infringement analysis: the first is to determine "the meaning and scope of the patent claims asserted to be infringed" and the second is to compare "the properly construed claims to the device accused of infringing." Markman v. Westview Instruments, Inc., 52 F.3d 967, 976 (Fed.Cir.1995) (en banc), *aff'd,* 517 U.S. 370, 116 S.Ct. 1384, 134 L.Ed.2d 577 (1996). While the second step presents a question of fact for the fact-finder, the first step is a question of law for the court. Id. at 979. It is this first step, known as claim construction, that I must now perform. Both parties briefed their

proposed claims constructions and presented evidence, at a two-day *Markman* hearing beginning on July 8, 2002, in support of their respective contentions.

Discussion

[2] [3] In construing the claims of a patent, the court looks first to the words of the claim. Teleflex, Inc. v. Ficosa N. Am. Corp., 299 F.3d 1313, 1324 (Fed.Cir.2002) ("We begin our claim construction analysis, as always, with the words of the claim."). The court interprets the claim terms in light of the intrinsic evidence: the written description and the drawings in the specification and the prosecution history. Id. at 1325 ("The intrinsic evidence may provide context and clarification about the meaning of claim terms."); Vitronics Corp. v. Conceptronic, Inc., 90 F.3d 1576, 1582 (Fed.Cir.1996) ("Such intrinsic evidence is the most significant source of the legally operative meaning of disputed claim language.").

[4] To begin the analysis, the court presumes that claim terms carry their ordinary meaning, as understood by someone of ordinary skill in the art of which the invention is a part. Teleflex, 299 F.3d at 1325. "Determining the limits of a patent claim requires understanding its terms in the context in which they were used by the inventor, considered by the examiner, and understood in the field of the invention." Toro Co. v. White Consol. Indus., Inc., 199 F.3d 1295, 1299 (Fed.Cir.1999). A court may consult several sources of evidence to identify this ordinary meaning. These sources include the standard intrinsic sources (claims, specification, and prosecution history) as well as dictionaries and technical treatises. *Id.;* Bell Atlantic Network Servs., Inc. v. Covad Communications Group, Inc., 262 F.3d 1258, 1267 (Fed.Cir.2001) ("Dictionaries and technical treatises, which are extrinsic evidence, hold a 'special place' and may sometimes be considered along with the intrinsic evidence when determining the ordinary meaning of claim terms."). However, dictionaries are frequently of limited usefulness. For technical terms, the Federal Circuit "caution[s] against the use of non-scientific dictionaries 'lest dictionary definitions ... be converted into technical terms of art having legal, not linguistic significance.' " Bell Atlantic, 262 F.3d at 1267 (quoting Multiform Desiccants, Inc. v. Medzam, Ltd., 133 F.3d 1473, 1478 (Fed.Cir.1998)). As for common, non-technical terms, "the dictionary definitions of common words are often less useful than the patent documents themselves in establishing the usage of ordinary words in connection with the claimed subject matter." Toro Co., 199 F.3d at 1299. In sum, "[j]udges ... may ... rely on dictionary definitions when construing claim terms, so long as the dictionary definition does not contradict any definition found in or ascertained by a reading of the patent documents." Vitronics, 90 F.3d at 1584 n. 6.

The written description and drawings of the specification are particularly important sources for claim construction. A court may use the specification, first, to identify the ordinary meaning of disputed claim terms. Id. at 1582 ("[T]he specification is always highly relevant to the claim construction analysis. Usually it is dispositive: it is the single best guide to the meaning of a disputed term."). "The specification, of which the claims are part, teaches about the problems solved by the claimed invention, the way the claimed invention solves those problems, and the prior art that relates to the invention. These teachings provide valuable context for the meaning of the claim language." Eastman Kodak Co. v. Goodyear Tire & Rubber Co., 114 F.3d 1547, 1554 (Fed.Cir.1997), *overruled on other grounds by* Cybor Corp. v. FAS Technologies, Inc., 138 F.3d 1448 (Fed.Cir.1998) (en banc).

[5] The specification may also on occasion narrow or otherwise alter the meaning of claim terms. The categories of cases in which this may occur-and especially the emphasis on such cases-used by the various Federal Circuit opinions are not entirely consistent. Indeed, some of the categories seem to overlap. Nevertheless, I have identified in the relevant precedents four main ways in which the patent specification

may modify the meaning of claim terms.

The best-established method is that by which "the patentee acted as his own lexicographer and clearly set forth a definition of the disputed claim term in either the specification or prosecution history." CCS Fitness, Inc. v. Brunswick Corp., 288 F.3d 1359, 1366 (Fed.Cir.2002). While the definition of a term in the specification must be expressed "clearly," it need not be done explicitly. "Indeed, [the Federal Circuit] ha[s] specifically held that the written description of the preferred embodiments 'can provide guidance as to the meaning of the claims, thereby dictating the manner in which the claims are to be construed, even if the guidance is not provided in explicit definitional format.' " Bell Atlantic, 262 F.3d at 1268 (quoting SciMed Life Systems, Inc. v. Advanced Cardiovascular Systems, Inc., 242 F.3d 1337, 1344); *see also* Vitronics, 90 F.3d at 1582 ("The specification acts as a dictionary when it expressly defines terms used in the claims or when it defines terms by implication."); *but cf.* Teleflex,299 F.3d at 1325 ("[A]n inventor may choose to be his own lexicographer if he defines the specific terms used to describe the invention 'with reasonable clarity, deliberateness, and precision.' ") (quoting In re Paulsen, 30 F.3d 1475, 1480 (Fed.Cir.1994)). For example, "when a patentee uses a claim term throughout the entire patent specification, in a manner consistent with only a single meaning, he has defined that term 'by implication.' " Bell Atlantic, 262 F.3d at 1271 (quoting Vitronics, 90 F.3d at 1582).

A second category is when the claim term, if given its ordinary meaning, " 'so deprive[s] the claim of clarity' as to require resort to the other intrinsic evidence for a definite meaning.' " CCS Fitness, 288 F.3d at 1367 (quoting Johnson Worldwide Associates, Inc. v. Zebco Corp., 175 F.3d 985, 990 (Fed.Cir.1999)). In this situation, it is not the claim term itself that is ambiguous, but the claim as a whole.

Third, "[t]he patentee may demonstrate an intent to deviate from the ordinary and accustomed meaning of a claim term by including in the specification expressions of manifest exclusion or restriction, representing a clear disavowal of claim scope." Teleflex, 299 F.3d at 1325. The specification must include "clear statements of scope" that limit the claim term. Id. at 1328.

Finally, several Federal Circuit cases suggest that characteristics of the invention that the specification describes as, or otherwise indicates are, "important" may modify the meaning of claim terms. For example, in *Toro Co.,* the court construed the claims of a patent for a convertible vacuum/blower that provided for a "cover" "including" a "restriction ring." Toro Co., 199 F.3d at 1301. The court stated:

It is a matter of interpretation of the words 'including' and 'cover' to determine whether, as a matter of law, the claim requires that the cover and the ring are attached to each other.... The specification described the restriction ring as 'buil[t] ... as part of the air inlet cover,' and does not suggest that the cover and the ring may be two distinct components to be inserted and removed separately. To the contrary, the specification describes the advantages of the unitary structure as important to the invention.

Id. Similarly, in *Laitram Corp.,* the Federal Circuit held that:

While claims are not necessarily limited by the written description, it is relevant that nothing in the written description suggests that the driving surfaces can be anything but flat. Indeed, the *benefits* of having flat driving surfaces are stated in the 'Summary of the Invention' portion of the written description.

Laitram Corp. v. Morehouse Industries, Inc., 143 F.3d 1456, 1463 (Fed.Cir.1998), (emphasis added). Subsequent cases have confirmed these holdings. *SciMed* cited *Toro Co*. with approval, SciMed, 242 F.3d at

1342, and *CCS Fitness* distinguished *Toro Co*. because "nothing in the intrinsic evidence here describes" a component of the preferred embodiment "as important to the invention." CCS Fitness, 288 F.3d at 1369.

[6] Nonetheless, while "the claims must be read in view of the specification, ... limitations from the specification are not to be read into the claims." Teleflex, 299 F.3d at 1326 (citations omitted). In particular, the claims are not limited to the scope of the preferred embodiment, CCS Fitness, 288 F.3d at 1366 ("An accused infringer ... [cannot] narrow a claim term's ordinary meaning ... simply by pointing to the preferred embodiment...."), even if the specification reveals only one embodiment, Teleflex, 299 F.3d at 1327 ("[T]he number of embodimentsdisclosed in the specification is not determinative of the meaning of disputed claim terms."); *see also,* CCS Fitness, 288 F.3d at 1366 ("[A] patentee need not 'describe in the specification every conceivable and possible future embodiment of his invention.' ") (quoting Rexnord Corp. v. Laitram Corp., 274 F.3d 1336, 1344 (Fed.Cir.2001)).

The third intrinsic source of evidence for claim construction, along with the claims and the specification, is the prosecution history. This history includes a "complete record of all the proceedings before the Patent and Trademark Office, including any express representations made by the applicant regarding the scope of the claims." Vitronics, 90 F.3d at 1582. The prosecution history, like the specification, can assist the court in understanding the meaning of claim terms to one of ordinary skill in the art. Also like the specification, the prosecution history can modify the meaning of claim terms either because the patentee has acted as his or her own lexicographer, Teleflex, 299 F.3d at 1325, or because it includes "expressions of manifest exclusion or restriction," id. at 1326.

[7] If a claim term, read in light of the intrinsic evidence, is still ambiguous, the court may turn to extrinsic sources of evidence to resolve the ambiguity. Bell Atlantic, 262 F.3d at 1269.

This additional extrinsic evidence includes such evidence as expert testimony, articles, and inventor testimony. This extrinsic evidence may be used only to assist in the proper understanding of the disputed limitation; it may not be used to vary, contradict, expand, or limit the claim language from how it is defined, even by implication, in the specification or file history.

Id. (citations omitted). Similarly, only when the intrinsic evidence is inconclusive may the court consult the prior art "to demonstrate how a disputed term is used by those skilled in the art." Vitronics, 90 F.3d at 1584. When the implications of two pieces of extrinsic evidence, such as the testimony of two witnesses of ordinary skill in the art, are contradictory, they are inconclusive. CCS Fitness, 288 F.3d at 1368.

[8] An additional consideration in claim construction is the doctrine of claim differentiation. Under this doctrine, "each claim in a patent is presumptively different in scope." Wenger Manufacturing, Inc. v. Coating Machinery Systems, Inc., 239 F.3d 1225, 1233 (Fed.Cir.2001). Claim differentiation does not require "that every limitation must be distinguished from its counterpart in another claim, but only that at least one limitation must differ." Kraft Foods, Inc. v. Int'l Trading Co., 203 F.3d 1362, 1368 (Fed.Cir.2000); *see also* Wenger, 239 F.3d at 1233 ("Claim differentiation ... is clearly applicable when there is a dispute over whether a limitation found in a dependent claim should be read into an independent claim, and that limitation is the only meaningful difference between the two claims.").

[9] "However, claim differentiation is not a 'hard and fast rule of construction,' and cannot be relied upon to 'broaden claims beyond their correct scope.' " *Id*. (quoting Kraft Foods, 203 F.3d at 1368); *see also* Toro Co., 199 F.3d at 1302 ("[T]he doctrine of claim differentiation does not serve to broaden claims beyond

their meaning in light of the specification and does not override clear statements of scope in the specification and the prosecution history."). Thus, "although different claims should be presumed to cover different inventions, 'if a claim will bear only one interpretation, similarity [with another claim] will have to be tolerated.' " Laitram, 143 F.3d at 1463 (quoting Laitram Corp. v. Rexnord, Inc., 939 F.2d 1533, 1538 (Fed.Cir.1991) (alterations in original)).

[10] [11] The foregoing rules are modified slightly in the case of means-plus-function claim limitations. When construing a means-plus-function limitation, the court must first identify the function recited in the claim, and then identify the structure in the specification that performs that function. Micro Chemical, Inc. v. Great Plains Chemical Co., 194 F.3d 1250, 1258 (Fed.Cir.1999). In performing this task, however, the court must be careful not to "import functional limitations that are not recited in the claim, or structural limitations from the written description that are unnecessary to perform the claimed function." Wenger, 239 F.3d at 1233. When, as with the '690 patent, there is "a means-plus-function claim in which the disclosed structure is a computer, or microprocessor, programmed to carry out an algorithm, the disclosed structure is not the general purpose computer, but rather the special purpose computer programmed to perform the disclosed algorithm." WMS Gaming Inc. v. International Game Technology, 184 F.3d 1339, 1349 (Fed.Cir.1999).

The '690 Patent

The '690 patent describes a method and apparatus for the placement of surface mounted devices (SMDs) on electronic circuit boards. The invention includes a component that stores a description of the size and shape of the SMDs to be installed. During the assembly of a circuit board, the invention examines a video image of an SMD through a planned sequence of "vision tool" software algorithms. After identifying the SMD and its position and orientation, the invention places the SMD at the appropriate place on a circuit board. In the industrial assembly of circuit boards, the whole process can occur at speeds too fast for the eye to follow.

Cognex alleges that ESI infringes apparatus claims 1, 2, 7, and 8, and the corresponding method claims 35, 36, 41, and 42 of the '690 patent. However, I need not construe all of these claims. Claims 2, 7, and 8 and depend, directly or indirectly, from claim 1, just as claims 36, 41, and 42 depend from claim 35. ESI has not briefed any proposed construction for these claims, and neither party discussed them at the *Markman* hearing. Claim 35, in its turn, is almost identical to claim 1, except for the substitution of the word "step" for the word "means." Both parties agree that the aspects of claim 35 that are in dispute are the same as those of claim 1 that are in dispute. I will therefore limit my analysis to claim 1 of the '690 patent. This claim provides:

An apparatus for inspecting a surface mounted device to estimate a position thereof, said estimation including at least one of an axial placement and an angular orientation estimation, said apparatus comprising:

A. UDL means for storing a UDL signal representative of a shape of at least a portion of a surface mounted device to be inspected,

B. planning means, coupled with said UDL means, responsive to at least said UDL signal for generating a plan signal representative of a plan for application of a plurality of successive vision tools to an image signal, each vision tool for inspection of a selected feature of a surface mounted device to determine characteristics thereof and, thereby, to estimate a position of the device itself, wherein said plan reduces

with inspection of each successive feature an uncertainty in the estimate of the position of said device,

C. video input means for generating an image signal representative of at least a portion of a surface mounted device being inspected, and

D. inspection means, coupled with said video input means, and in communication with said planning means, for

i) applying to said image signal a plurality of successive vision tools, each such vision tool for inspection of a selected feature of said surface mounted device to estimate a position of the device itself in accord with said plan and for generating in connection with application of each such vision tool an output signal representative of said estimate,

ii) reducing with application of each such vision tool an uncertainty in said estimate of the position of said device.

Before turning to the particulars of the claim construction, I must address three preliminary matters that are predicates for my analysis. The parties have disputed both the nature of the "art" to which the '690 patent pertains and the identity of that mysterious and elusive creature, the "person of ordinary skill in the art." Also, although the parties agree that the disputed limitations in claim 1 are means-plus-function limitations, I nonetheless must address that issue briefly.

Cognex's expert witness, Dr. Martin Kaliski ("Dr. Kaliski"), at one point described the relevant art as "the use of ... machine vision tools, interconnected in some fashion for the purpose of inspection of surface-mounted devices." Tr. 1:22:24-1:23:1. FN1 Shortly thereafter, on cross-examination, he called it "the use of existing or to be developed vision tools in a particularly novel way, coupled with the ability to describe geometrically a variety of parts." Tr. 1:26:1-4. In contrast, Dr. Joseph Mundy ("Dr. Mundy"), ESI's expert witness, identified the relevant art as "machine vision." Tr. 2:19:5; 2:20:9-10; 2:102:18-20. He defined machine vision as

FN1. For the sake of brevity, I cite to the transcript of the *Markman* hearing in the format day:page:line.

a large tapestry of elements acquired from other fields, such as mathematics, optics, physics of illumination, some knowledge of the human visual system, so, therefore, biology. Of course, basic computer science is very important in terms of understanding how data structures might be used in effective and efficient ways in implementing machine vision algorithms and so on. There might be a dozen fields or so that have been woven together to form the fabric of machine vision.
Tr. 2:20:20-2:21:4.
[12] I find that the first definition offered by Dr. Kaliski is too narrow. If the definition is limited to the inspection of SMDs, the "art" would exclude the Roth patent, over which the patent examiner had at first rejected the patent application that eventually resulted in the '690 patent. *See* File Wrapper, Ex. 7 (Examiner's Action, Apr. 19, 1993, at 6). Dr. Kaliski's second definition is also unsatisfactory. The phrase "in a particularly novel way" is too ambiguous to define the field of the art, unless, of course, Dr. Kaliski meant by that phrase "for the inspection of SMDs," in which case this definition, like the first, is too narrow. However, I also conclude that the field of machine vision as a whole is too broad a definition of the art. Instead, I define the relevant art as the creation and deployment of machine vision methods for the

inspection of manufactured components.

I next turn to the question of the identity of the person of ordinary skill in the art. The parties' experts agreed, in part, on the nature of the skills and training of a person of ordinary skill in the art. Both agreed that such a person would have at least a Master's degree in electrical engineering or a similar field such as computer science and mathematics, supplemented by at least one or two years of practical experience. Tr. 1:23:19-23; 1:24:3-5 (Dr. Kaliski); Tr. 2:18:13-2:19:25 (Dr. Mundy). Dr. Mundy would also require, however, that this person have "educational experience in machine vision," encompassing course work at at least the senior undergraduate level. Tr. 2:18:20-24. Such a person would have carried out a machine vision project either in graduate school or as part of his or her on-the-job training. Tr. 2:18:25-2:19:25. According to Dr. Mundy, such a person would also be familiar with some of the seminal works on machine vision, such as Perkins' *A Model-based Vision System for Industrial Parts* (1978), Bolles' *Recognizing and Locating Partially Visible Objects: the Local Feature Focus Method* (1982), and Goad's *Special Purpose Automatic Programming for 3D Model-based Vision* (1983). Tr. 2:76:10-2:77:4.

[13] I substantially concur with Dr. Mundy's view. Thus, I define the person of ordinary skill in the art as an individual with at least a Master's degree in electrical engineering, mathematics, or computer science; with some sophistication in computer science either from course work (at the senior undergraduate level or above) or from project experience; with a familiarity with the seminal works in the machine vision literature; and with experience working on a machine vision project either as a student or on the job. I would only add that, because of the way that I define the art, this machine vision project experience would most likely involve an industrial application of machine vision.

I now consider the final preliminary question. The parties agree that the disputed limitations in claim 1 are in means-plus-function form. Even so, I must still independently decide this question. *See* Rodime PLC v. Seagate Technology, Inc., 174 F.3d 1294, 1302 (Fed.Cir.1999) ("Th[e] concession [that the disputed limitations are means-plus-function limitations], however, does not relieve this court of its responsibility to ... decide ... whether the claim element disputed by the parties invokes s. 112, para. 6 in the first instance. Only by undertaking this inquiry can this court ensure consistency in statutory application. Moreover, this court's claim interpretation affects entities beyond the parties to this case."), *cert. denied,* 528 U.S. 1115, 120 S.Ct. 933, 145 L.Ed.2d 812 (2000).

[14] Means-plus-function claims are allowed under 35 U.S.C. s. 112, para. 6, which states that:

[a]n element in a claim for a combination may be expressed as a means or step for performing a specified function without the recital of structure, material, or acts in support thereof, and such claim shall be construed to cover the corresponding structure, material, or acts described in the specification and equivalents thereof.

35 U.S.C. s. 112, para. 6. The "use of the word 'means' creates a presumption that s. 112, para. 6 applies ... and ... the failure to use the word 'means' creates a presumption that s. 112, para. 6 does not apply." Personalized Media Communications, LLC v. Int'l Trade Comm'n, 161 F.3d 696, 703-04 (Fed.Cir.1998). However, these presumptions may be rebutted. Because all of the relevant limitations in the '690 patent use the word "means," I consider only the rules that might overcome the presumption created by that word. There are two such rules. First, if a claim element uses the word "means" but fails to specify a function,s. 112, para. 6 does not apply. Rodime, 174 F.3d at 1302. Second, if a claim element uses the word "means" and specifies a function, but goes on to recite sufficient structure or material for performing that function in

the claim itself, then s. 112, para. 6 again does not apply. *Id*. Under these tests, there is nothing in claim 1 of the '690 patent that overcomes the presumption that the "means" elements are means-plus-function elements. Each of the elements recites a function. *See, e.g.,* '690 patent, col. 22, ll. 42-44 ("UDL means for storing a UDL signal...."); id. col. 22, ll. 56-58 ("video input means for generating an image signal...."). Nor do the elements recite any structure. *See* id., col. 22, ll. 42-67; id. col. 23, ll. 1-5. Therefore I agree with the parties that the contested elements of claim 1 of the '690 patent are means-plus-function elements.

Having dealt with these preliminary matters, I now turn to the construction of the disputed terms in claim 1 of the '690 patent. I note, in passing, that the '690 patent "is not drafted in a manner that facilities confident claim construction." Asyst Technologies, Inc. v. Empak, Inc., 268 F.3d 1364, 1370 (Fed.Cir.2001).

1. UDL Means

[15] I begin with element A of claim 1: "UDL means for storing a UDL signal representative of a shape of at least a portion of a surface mounted device to be inspected." '609 patent, col. 22, ll. 42-44.

The first disputed term is "UDL." Cognex proposes that "UDL" be defined as "a Universal Description Language for SMD components which is capable of describing shapes of features of a wide-variety [sic] of SMDs to be inspected, in a manner that favors available vision tools, regardless of component or feature shape or configuration, without the need to specify an SMD component or package type." Cognex Slide 34; FN2 *see also* Plaintiff Cognex Corporation's Opening Memorandum on Claim Interpretation (*Markman*) Issues ("Cognex's Opening Memorandum") at 18.

FN2. I cite to the slides that the parties presented at the *Markman* hearing, and which they submitted to the court as bound volumes, by the name of the party and the number that appears on the slide.

ESI, in its definition of "UDL means," asserts that the UDL "allows the user to specify a part description based on one or more primitive shapes without reference to any information about part types." ESI Slide 067; *see also* Defendant Electro Scientific Industries, Inc.'s Reply Brief on Claim Construction ("ESI's Reply Brief"), Ex. A, at 1 ("The UDL ... means allows the user to specify information to be used in the inspection of at least a portion of an SMD."). ESI also argues that the UDL must include four "important components" described in the specification: "imaging setup, geometric description, positional uncertainty, and placement criteria." *Id*.

Both parties agree that "UDL" is a novel term that was coined by the patentee. Defendant Electro Scientific Industries, Inc.'s Opening Brief on Claim Construction ("ESI's Opening Brief") at 4; Plaintiff Cognex Corporation's Rebuttal Brief on Claim Interpretation (*Markman*) Issues ("Cognex's Rebuttal Brief") at 8 n. 5. Therefore, I must turn to the patent specification to seek the definition of the term. J.T. Eaton & Co. v. Atlantic Paste & Glue Co., 106 F.3d 1563, 1568 (Fed.Cir.1997) (holding that the definition of "a term with no previous meaning to those of ordinary skill in the art ... must be found somewhere in the patent"). Although Cognex urges that I look only to the "Summary of the Invention" and not to the "Detailed Description of the Illustrated Embodiment,"Tr. 2:83:19-2:84:4, I note that "UDL" is an acronym and that the only place in the specification that indicates what "UDL" stands for ("Universal Description Language") is the very description of the preferred embodiment that Cognex counsels me to ignore. *See* '690 patent, col. 10, ll. 31-34.

When I asked Cognex at the *Markman* hearing to explain the source for its proposed definition of "UDL," Cognex indicated only two lines that specifically defined the term. *See* Tr. 2:85:11. These lines, that do not even refer to the UDL by name, are not particularly helpful. *See* '690 patent, col. 2, ll. 23-24 ("The apparatus includes an element for storing a description of the component to be inspected."). Even the sort of "library" of component designs that the '690 patent attributes to the prior art, id., col. 1, ll. 50-52, will have "description[s] of the component[s] to be inspected." Furthermore, the other portions of the "Summary of the Invention" to which Cognex has drawn my attention explain only what the UDL *can* be, not what it *must* be. *See* '690 patent, col. 2, ll. 43-65. As Cognex has gone to great pains to emphasize, "can" is the equivalent of "need not" in this context. *See, e.g.,* Cognex Slides 47-52.

I therefore turn to the rest of the specification. The four "important components" to which ESI directs my attention are found in the description of the preferred embodiment. A court should not import limitations from the embodiments to the claims. However, as indicated by *Toro Company* and subsequent cases, characteristics that the specification describes as "important" to the invention may limit the scope of the claim terms. Toro Co., 199 F.3d at 1301. In this context, I also note that the '690 patent, as drafted, *requires* me to look at the description of the preferred embodiment to understand the meaning of "UDL," because only there does it indicate that this acronym stands for "Universal Description Language." I therefore conclude that it is appropriate to include these "important components" in the definition of the UDL.

Cognex also argues that the doctrine of claim differentiation supports its construction of claim 1. Specifically, Cognex argues that ESI's interpretation of element A would incorporate into claim 1 limitations found in claims 4, 5, 7, 8, and 9. Tr. 1:80:15-1:82:14. Claim 4 provides that the UDL signal be representative of "rectangular segments," '690 patent, col. 23, l. 16; claim 5 provides that it represent "at least one of a position, orientation and dimension of each said rectangular segment," id., col. 23, ll. 20-21; claim 7 provides that it represent "expected conditions" of inspection, id., col. 23, l. 28; claim 8 provides that it represent "at least one of expected lighting conditions, video resolution, pickup tool type and motion control parameters," id., col. 23, ll. 32-34; and claim 9 provides that it represent "an expected position, and uncertainty therein, of the surface mounted device to be inspected," id., col. 23, ll. 37-38.

I agree, and even ESI concedes, Tr. 2:112:9-12, that the UDL signal provided for by claim 1 need not be based on rectangular segments. Thus both claims 4 and 5 are adequately differentiated from my construction of claim 1. Claims 7, 8, and 9 present a more serious obstacle to ESI's proposed claim construction. The first two claims provide for a UDL signal that represents the expected conditions under which the inspection of a SMD will occur. These additional limitations correspond to the "imaging setup" that the specification describes as one of the "important components" of the UDL. *See* '690 patent, col. 10, ll. 34-50. Claim 9, according to Cognex, includes an additional limitation that correspondsto the "positional uncertainty" component. Tr. 1:82:7-14. Although these correspondences between limitations that I ascribe to claim 1 and limitations found in dependent claims gives me pause, I nevertheless conclude that the UDL means provided for by claim 1 must include all of the "important components" described in the specification. "The doctrine of claim differentiation can not broaden claims beyond the scope that is supported by the specification.... The presumption that separate claims have different scope is a guide, not a rigid rule." ATD Corp. v. Lydall, Inc., 159 F.3d 534, 541 (Fed.Cir.1998) (citations omitted).

I thus conclude that the UDL means performs the function of creating a description of the shapes of SMDs, including attributes of these shapes. Specifically, it performs the functions indicated as the four "important components" of the UDL means in the specification: geometric description, imaging setup, positional uncertainty, and placement criteria. The first of these indicates that the UDL means describes the shape of

the components, while the other three allow the system to know what a shape world look like in an image and roughly where to locate it. The structures that correspond to this function are disclosed by elements 26 and 32 of figure 1 of the patent, corresponding to a console and a disk file, as well as by the text from column 10, line 24 to column 12, line 46.

2. Planning Means

[16] I next examine element B of claim 1, the planning means. Cognex argues that the only function performed by the planning means is to "generat[e] a plan signal representative of a plan." '690 patent, col. 22, ll. 46-47; Cognex's Rebuttal Brief at 10. In other words, according to Cognex, the planning means need not develop the plan, but must only convey a previously generated plan, "generating" as little as one line of code that "points to" a plan file. Tr. 1:51:15-24. ESI, by contrast, asserts that the function of the planning means is to "automatically generate[ ] an inspection plan prior to runtime." ESI's Reply Brief, Ex. A (Summary of ESI's Construction of the Asserted Claims of the '690 Patent) at 2.

It is true that claim 1, read in isolation, describes the function of the "planning element" as "generating a plan signal representative of a plan" rather than as "generating a plan." However, the phrase "generating a plan signal representative of a plan" is ambiguous. On one hand, the claim language does not specifically state that the planning means creates the plan. On the other hand, if the planning means merely encodes a pre-existing plan, then the use of "generating," rather than the "storing" of element A, is confusing.

Because I find that the claim language is ambiguous, I turn to the specification for illumination. I conclude that Cognex's proposed interpretation is inconsistent with the Summary of the Invention and the description of the preferred embodiment. I note that by examining the specification I am not importing limitations from the specification to the claims. Instead, I am looking to the specification to construe claim terms that I find to be ambiguous when read in isolation.

Near the beginning of the "Summary of the Invention," the specification states that "one aspect" of the invention "includes a planning element for devising a plan for inspecting features of the surface mounted device to determine their characteristics and, from them, to estimate a position of the device itself. " '690 patent, col. 2, ll. 20, 25-28. Later, in the "Detailed Description of the Illustrated Embodiment," the specification devotes more than seven columns to a description of the planning element. Id., col. 12, l. 47 - col. 19, l. 58. At no point is there any suggestion that the planning element does anything other than generate a plan.

Even if the word "planning" before "means" in element B is, as Cognex asserts, "a shorthand way of referring to that claim element later on," Tr. 1:85:7-8, the word choice cannot be devoid of meaning. It is illogical to suppose that a person of ordinary skill in the art would conclude that he should ignore the word "planning" in interpreting the claim. It is even more illogical to suggest that the patentee chose to describe a means as the "planning" means, even though its function is not to plan. If its function were only to generate a signal of a pre-existing plan, then it would have been far more reasonable to call it the "plan signaling means." Cognex has also suggested that the word "planning" should not be given its ordinary meaning, because "[p]lanning means what the claim language says it means," Tr. 1:87:16-17: not to generate a plan, but to generate a plan signal representative of a plan. But the claims cannot be read in isolation of the specification, and the specification uses "planning" in its ordinary sense. *See, e.g.,* '690 patent, col. 2, ll. 25-28.

I therefore conclude that ESI is correct that the function of the planning means is to generate a plan for locating SMDs through the sequential application of more than one vision tool.

Another point of debate with respect to element B is the meaning of the term "vision tool." Claim 1 states that the plan is "for application of a plurality of successive vision tools to an image signal, each vision tool for inspection of a selected feature of a surface mounted device to determine characteristics thereof and, thereby, to estimate a position of the device itself." '690 patent, col. 22, ll. 47-52. Both parties agree that the term "vision tool" refers to a software algorithm that analyzes a representation of an image of an SMD.

The parties disagree, however, as to whether a vision tool must estimate the position of an SMD, as ESI argues, or instead must only determine a characteristic of an SMD, as Cognex argues. Tr. 1:96:19-24. To resolve this dispute I look first to the language of the claim. Element B provides that each vision tool inspects "a selected feature of a surface mounted device to determine characteristics thereof...." '690 patent, col. 22, ll. 49-51. So far we have Cognex's definition. However, the next clause continues "and, thereby, to estimate a position of the device itself." Id., col. 22, ll. 51-52. As drafted, it is unclear whether this function should be attributed to the vision tool or to the planning means. However, it would be incongruous for the planning means, which functions primarily before runtime, to perform the function of estimating the position of the SMD, which can occur only at runtime. In any case, the ambiguity is resolved by the text of element D, which reads, in part: "each such vision tool for inspection of a selected feature of said surface mounted device to estimate a position of the device itself...." Id., col. 22, ll. 63-66. From this language, it is clear that the vision tool itself must estimate the position of the SMD. Therefore, I conclude that a vision tool is a software algorithm that inspects a feature of an SMD to estimate its position.

In sum, I conclude that the function of the planning means is to generate a plan for estimating the position (including orientation) of SMDs through the sequential application of more than one vision tool. This planning is based, at least in part, on a UDL description of the SMD and primarily occurs before runtime. The plan must reduce the uncertainty of the estimate of the position of the SMD with each application of a vision tool. (I postpone consideration of the debate over the term "uncertainty" to my discussion of element D.) A vision tool is a software algorithm that inspects a feature of an SMD to estimate its position. The corresponding structure for element B is element 24 of figure 1, described in the text at column 7, line 11 to column 10, line 4 (describing the vision tools) and column 12, line 47 to column 19, line 36 (describing the planning element).

3. Video Input Means

[17] The parties do not dispute the meaning of the video input means element. *See* Cognex's Opening Memorandum at 22. The function of this element is to generate a representation of an image of at least part of an SMD. The corresponding structure is element 12 in figure 1-a video camera-that is connected to a computer.

4. Inspection Means

[18] I next consider the final element of claim 1, the "inspection means," which reads:

D. inspection means, coupled with said video input means, and in communication with said planning means, for

i) applying to said image signal a plurality of successive vision tools, each such vision tool for inspection of

a selected feature of said surface mounted device to estimate a position of the device itself in accord with said plan and for generating in connection with application of each such vision tool an output signal representative of said estimate,

ii) reducing with application of each such vision tool an uncertainty in said estimate of the position of said device.

'690 patent, col. 22, l. 59-col. 23, l. 5. Cognex's proposed construction simply quotes the claim language to identify the functions of the inspection means. *See* Cognex's Opening Memorandum at 22; Cognex Slide 61. ESI proposes the following functions:

During runtime, the inspection means executes the previously generated plan by applying at least two vision tools in succession, each of which inspects a selected feature of an SMD to estimate a position of the SMD as a whole.... After each inspection of a selected feature according to the plan, the computer generates an output signal representing the updated estimate of the position of the SMD as a whole ... [and] calculates a reduces a numerical "uncertainty" representing the accuracy of the estimated part position.

ESI's Reply Brief, Ex. A (Summary of ESI's Construction of the Asserted Claims of the '690 Patent), at 4.

The main point of dispute between the two parties is whether the "uncertainty" that the inspection means reduces at each step must be numerical.FN3 Cognex's expert witness, Dr. Kaliski, suggested that "the ultimate estimate of the position has to be a number, but the uncertainty with inspection of each successive feature doesn't have to be numerically expressed." Tr. 1:60:25; 1:61:1-3. As Cognex's counsel put it, the reduction need not be numerical; it "can be inherent." Tr. 1:92:15.

FN3. Cognex has disputed ESI's definition of the term "inspection" as "[m]easurement of a position of a feature." Tr. 1:96:4-17. However, it is undisputed that a function of the "inspection means" is to apply vision tools that "estimate a position of the device" and to generate "an output signal representative of said estimate."'690 patent, col. 22, l. 65-col. 23, l. 2. I therefore conclude that, however one defines "inspection," the "inspection means" performs the function of measuring the position of an SMD.

At no point in claim 1 does the word "numerical" or its equivalent appear. While the preferred embodiment does incorporate a numerical representation of the uncertainty, this aspect of the embodiment does not necessarily limit the claim. The parties agree that when the plan takes the form of a tree, there must be a numerical estimate of the uncertainty for the inspection means to choose between two branches of the tree. I note, however, the plan need not necessarily be in tree form. If the plan is linear, the planning element will generate a plan that necessarily reduces uncertainty at each step. Thus, there is no need to represent that uncertainty numerically.

I conclude that the function of the inspection means is to examine features of a SMD, through the sequential application of at least two vision tools, so as to estimate the SMD's position. After the application of each vision tool, the inspection means must determine the uncertainty in the estimate of the SMD's position; this uncertainty need not be numerically expressed, but it must be reduced with each application of a vision tool. The structure corresponding to this function is indicated by element 34 in figure 1 of the patent, a computer program that includes a reference to a plan file, and is described in the text at column 7, line 11 to column 10, line 4 (describing the vision tools) and column 19, line 59 to column 21, line 61 (describing the

inspection means).

SUMMARY

In summary, and as described in greater detail above, I construe the disputed terms as follows:

"A. UDL means for storing a UDL signal representative of a shape of at least a portion of a surface mounted device to be inspected,"

The UDL means performs the function of creating a description of the shapes of SMDs, including attributes of these shapes. Specifically, it performs the functions indicated as the four "important components" of the UDL means in the specification: geometric description, imaging setup, positional uncertainty, and placement criteria. The first of these indicates that the UDL means describes the shape of the components, while the other three allow what a shape would look like in an image and roughly where to locate it. The structures that correspond to this function are disclosed by elements 26 and 32 of figure 1 of the patent, corresponding to a console and a disk file, as well as by the text from column 10, line 24 to column 12, line 46.

"B. planning means, coupled with said UDL means, responsive to at least said UDL signal[,] for generating a plan signal representative of a plan for application of a plurality of successive vision tools to an image signal, each vision tool for inspection of a selected feature of a surface mounted device to determine characteristics thereof and, thereby, to estimate a position of the device itself, wherein said plan reduces with inspection of each successive feature an uncertainty in the estimate of the position of said device,"

The function of the planning means is to generate a plan for estimating the position (including orientation) of SMDs through the sequential application of more than one vision tool. This planning is based, at least in part, on a UDL description of the SMD, and primarily occurs before runtime. The plan must reduce the uncertainty of the estimate of the position of the SMD with each application of a vision tool. A vision tool is a software algorithm that inspects a feature of an SMD to estimate its position. The corresponding structure for element B is element 24 of figure 1, described in the text at column 7, line 11 to column 10, line 4 (describing the vision tools) and column 12, line 47 to column 19, line 36 (describing the planning element).

"C. video input means for generating an image signal representative of at least a portion of a surface mounted device being inspected,"

The function of this element is to generate a representation of an image of at least part of an SMD. The corresponding structure is element 12 in figure 1-a video camera-that is connected to a computer.

"**D. inspection means, coupled with said video input means, and in communication with said planning means, for**

i) applying to said image signal a plurality of successive vision tools, each such vision tool for inspection of a selected feature of said surface mounted device to estimate a position of the device itself in accord with said plan and for generating in connection with application of each such vision tool an output signal representative of said estimate,

ii) reducing with application of each such vision tool an uncertainty in said estimate of the position of said device."

The function of the inspection means is to examine features of a SMD, through the sequential application of at least two vision tools, so as to estimate the SMD's position. After the application of each vision tool, the inspection means must determine the uncertainty in the estimate of the SMD's position; this uncertainty need not be numerically expressed, but it must be reduced with each application of a vision tool. The structure corresponding to this function is indicated by element 34 in figure 1 of the patent, a computer program that includes a reference to a plan file, and is described in the text at column 7, line 11 to column 10, line 4 (describing the vision tools) and column 19, line 59 to column 21, line 61 (describing the inspection means).

SO ORDERED.

D.Mass.,2002.
Cognex Corp. v. Electro Scientific Industries, Inc.