United States Court of Appeals for the Federal Circuit

IBORMEITH IP, LLC,
Plaintiff-Appellant,

v.

MERCEDES-BENZ USA, LLC, AND **DAIMLER AG,**
Defendants-Appellees.

2013-1007

Appeal from the United States District Court for the District of New Jersey in No. 10-CV-5378, Judge Faith S. Hochberg.

Decided: October 22, 2013

PATRICK F. SOLON, Niro, Haller & Niro, of Chicago, Illinois, argued for plaintiff-appellant. With him on the brief was OLIVER D. YANG.

SCOTT W. DOYLE, Shearman & Sterling, LLP, of Washington, DC, argued for defendants-appellees. With him on the brief were JONATHAN R. DEFOSSE and MICHEL E. SOUAYA.

Before LOURIE, PROST, and TARANTO, *Circuit Judges.*

TARANTO, *Circuit Judge.*

Ibormeith IP, LLC, the assignee of U.S. Patent No. 6,313,749, appeals a district court's grant of summary judgment of indefiniteness in favor of defendants Mercedes-Benz USA, LLC, and Daimler AG (collectively, "Mercedes"). We affirm.

BACKGROUND

U.S. Patent No. 6,313,749, entitled "Sleepiness Detection for Vehicle Driver or Machine Operator," addresses the monitoring of conditions affecting, or behavior reflecting, a vehicle driver's sleepiness and the issuing of a warning to the driver before the driving is unduly impaired. '749 patent, col. 1, lines 5-17; *id.* at col 2, lines 55-62. The monitor disclosed in the patent may take into account multiple factors associated with sleepiness, including natural body-clock (circadian) rhythm, the magnitude and number of corrective steering actions the driver is taking, the cabin temperature, the monotony of the road, and how long the driver has been driving. *Id.* at col. 2, lines 55-62; *see id.* at col. 12, line 25 through line 39. Some factors involve actions or conditions at the moment, like steering behavior and light conditions, which are measured by sensors in the vehicle. *See id.* at col. 3, lines 43-45; *id.* at col. 6, lines 14-17; *id.* at col. 6, lines 61-64. Others involve general or driver-specific background information, such as circadian rhythm or a driver's recent sleep patterns and alcohol consumption, which are not measured by sensors but must be input into the monitor by other means (*e.g.*, by the programmer or the driver). *Id.* at col. 3, lines 45-49. The factors are "individually weighted, according to contributory importance, and combined in a computational decision algorithm or model, to provide a warning indication of sleepiness." *Id.* at col. 3, lines 39-42.

Claims 1 and 9 of the '749 patent are the two independent claims at issue. Both claims contain a "computa-

tional means" element that is undisputedly subject to the requirements of 35 U.S.C. § 112(f) for claims to means of performing specified functions.[1] Claim 1 requires that the means take account of sleepiness-related time-of-day information to determine the likelihood of driver sleepiness and to produce an output that, according to a separate claim element, triggers a warning. '749 patent, col. 16, lines 21-30. Claim 1 reads:

> A sleepiness monitor for a vehicle driver, or machine operator, comprising:
>
>> a sensor for sensing a driver or operator control input;
>>
>> a memory for storing an operational model that includes a physiological reference model of driver or operator circadian rhythm pattern(s) and a vehicle or machine operating model or algorithm;
>>
>> computational means for weighting the operational model according to time of day in relation to the driver or operator circadian rhythm pattern(s) and for deriving, from the weighted model, driver or operator sleepiness condition and producing an output determined thereby; and
>>
>> a warning indicator triggered by the computational means output, to provide a

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[1]   When this case arose, what is now section 112(f) was designated paragraph 6 of 35 U.S.C. § 112.   The Leahy–Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011), changed the internal organization of section 112. It made no other change of relevance to this appeal. For convenience we refer to section 112(f).

> warning indicator of driver or operator sleepiness.

Id. at col. 16, lines 13-30.

Whereas claim 1 does not specify what driver conduct or other conditions may factor into the determination along with sleepiness-related time-of-day information, claim 9 focuses on the driver's steering. Claim 9 reads:

> A sleepiness monitor for a driver and vehicle, comprising:
>
> > a sensor for sensing a steering movement, about a reference position;
> >
> > a memory, for storing a circadian rhythm pattern or time-of-day physiological reference profile of pre-disposition to sleepiness; and
> >
> > computational means for computing steering transitions and weighing that computation according to time of day, to provide a warning indication of driver sleepiness.

Id. at col. 16, lines 50-61.

Ibormeith sued Mercedes for infringing claims 1, 5, 8, and 9 of the '749 patent. Before and at a claim-construction hearing held on April 25, 2012, Mercedes argued that the means-plus-function "computational means" limitations in independent claims 1 and 9 were indefinite. (If so, the dependent claims 5 and 8 would also be invalid, because they incorporate the elements of independent claim 1.) The district court reserved its ruling on claim construction and indicated that a motion for summary judgment concerning indefiniteness should be pursued as a threshold issue. With the parties' agreement, the court directed that expert discovery take place on that issue.

That process occurred, and Mercedes moved for summary judgment of indefiniteness. On September 5, 2012, after receiving the parties' briefs, the district court ruled that the asserted claims were invalid because the "computational means" limitations were indefinite. *Ibormeith IP, LLC v. Mercedes-Benz USA, LLC*, 889 F. Supp. 2d 677 (D.N.J. 2012). The court granted summary judgment for Mercedes.

To comply with section 112(f), the specification of Ibormeith's patent has to disclose a structure for performing the functions claimed in the "computational means" limitation, the statute providing that the claim limitation covers that disclosed structure and its equivalents. If there is no such structure, the claim limitation is indefinite, *i.e.*, fails to "particularly point[] out and distinctly claim[]" the invention, because there is insufficient definition of something that, by virtue of section 112(f), is incorporated into the claim. *See, e.g.*, *Function Media, LLC v. Google, Inc.*, 708 F.3d 1310, 1319 (Fed. Cir. 2013); *Blackboard, Inc. v. Desire2Learn Inc.*, 574 F.3d 1371, 1382-83 (Fed. Cir. 2009). Ibormeith argued that the required structure is an algorithm, or any of several algorithms, it said could be found in three portions of the specification: (1) column 2, lines 55-62; (2) column 3, lines 5-30; and (3) Table 10. *Ibormeith*, 889 F. Supp. 2d at 685. The district court held that those passages are inadequate to disclose the needed structure.

As to claim 1, the district court concluded that the cited passages did not disclose an algorithm for "weighting the operational model according to time of day in relation to the driver or operator circadian rhythm pattern(s) and for deriving from the weighted model, driver or operator sleepiness condition and producing an output determined thereby." *Id.* at 685-91. The court explained that column 2, lines 55-62, and column 3, lines 5-30, described the claimed functions but did "not disclose the algorithm by which the computational means performs those func-

tions." *Id.* at 685-86. The court also concluded that Table 10 did not disclose an algorithm for performing all of claim 1's "computational means" functions. *Id.* at 686-90. It reasoned that, although one skilled in the art might understand Table 10, along with Figures 3 and 17, to disclose a structure corresponding to the "weighting the operational model" function, Table 10 does not disclose an algorithm for deriving a score for "driver . . . sleepiness condition" or an "output." *See id.* at 687-90. Even putting aside Ibormeith's insistence that the various elements listed in Table 10 are merely options for inclusion in a calculation, the district court concluded: "Neither Table 10 nor any other clearly identified portion of the specification states the steps to obtain the listed elements' scores, or how to weight them according to their relative importance." *Id.* at 687-88.

The district court also concluded that claim 9's "computational means" limitation was indefinite because the specification does not contain an algorithm that adequately provides structure for the claimed functions. *Id.* at 691-93. The court reasoned that, although Table 10 appears to disclose an algorithm for the "computing steering transitions" function of claim 9, the specification "fails to disclose the steps necessary to actually perform that suggested algorithm." *Id.* at 692. The court rejected Ibormeith's argument that no algorithm is required for the "providing a warning indication" function because that function is intended to be carried out by a visual display panel (hardware) and not the computational means. *Id.* at 693. The court stated: the specification does "not explain how the monitor determines when the computation of steering transitions and time of day weighing leads to the issuance of a warning." *Id.*

Ibormeith appeals. We have jurisdiction under 28 U.S.C. 1295(a)(1).

DISCUSSION

Ibormeith recognizes that the structure required for "computational means" in claims 1 and 9 must be an algorithm—a sequence of computational steps to follow—that must be found in the specification. *See Typhoon Touch Techs., Inc. v. Dell, Inc.*, 659 F.3d 1376, 1384 (Fed. Cir. 2011); *In re Freeman*, 573 F.2d 1237, 1245 (C.C.P.A. 1978). It is clear, as the district court ruled, that the only substantial question is whether such an algorithm is found in Table 10, along with Figures 3 and 17 and any other specification material that may clarify the meaning of Table 10. As Ibormeith agrees, whether there is adequate disclosure is a question of law that we decide *de novo*. *Typhoon Touch*, 659 F.3d at 1383.

Section 112(f) allows patentees to put structural details into the specification and build into the literal coverage of the claim a certain scope for equivalents in performing a defined function. *See Chiuminatta Concrete Concepts, Inc. v. Cardinal Indus., Inc.,* 145 F.3d 1303, 1310 (Fed. Cir. 1998). The price of using this form of claim, however, is that the claim be tied to a structure defined with sufficient particularity in the specification. *E.g.*, *id.* at 1308; *Functional Media*, 708 F.3d at 1317; *Typhoon Touch*, 659 F.3d at 1383-84. For a claim to be definite, a recited algorithm, or other type of structure for a section 112(f) claim limitation, need not be so particularized as to eliminate the need for any implementation choices by a skilled artisan; but it must be sufficiently defined to render the bounds of the claim—declared by section 112(f) to cover the particular structure and its equivalents—understandable by the implementer. *See AllVoice Computing PLC v. Nuance Comm'cns, Inc.*, 504 F.3d 1236, 1245-46 (Fed. Cir. 2007). Here, we conclude, the disclosed algorithm does not adequately define the structure.

Table 10 of the patent, reproduced below, is entitled "Sleep Propensity Algorithm – Definition."

TABLE 10

Sleep Propensity Algorithm - Definition $$S\ mod = S\ circ + S\ zerox + S\ rms + S\ light + S\ temp + S\ sleep + S\ road + S\ trip$$	
Elemental	Bound Limit
S mod	$0 < S\ mod < 1$
S circ	$0 < S\ circ < 1$
S zerox = (F zerox/100) (Z ref-Z)	$0 < S\ zerox$
S rms = (F rms/100) (R-R ref)	$0 < S\ rms$
S light = (F light/100) (I ref -I)	$0 < S\ light$
S temp = (F temp/100) (T -T ref)	$0 < S\ temp$
S sleep = (F sleep/100) (H ref - (HXQ))	$0 < S\ sleep$
S road = (F road/100) (G ref -G)	$0 < S\ road$
S trip = (F trip/100) × D	$0 < S\ trip$

'749 patent, col 12, lines 25-40.

Beneath the heading, "Table 10," is what looks like a mathematical equation: "S mod = S circ + S zerox + S rms + S light + S temp + S sleep + S road + S trip." *Id.* The table also provides that the values for the S mod (driver sleepiness) and S circ (circadian rhythm) "elementals" (or factors) are positive but less than 1 and that the other disclosed factors are all positive. *Id.* These factors are defined in Table 11, which is entitled "Algorithm Elementals – S." *Id.* at col. 12, lines 40-53. In addition to Tables 10 and 11, the patent specification includes 22 other tables. *See id.* at col. 11, line 5, through col. 16, line 10. The patent specification also states that Table 10 contains a legend relevant to Figure 17 of the patent. *See id.* at col. 5, lines 51-52. The patent adds that the tables "are generally self-explanatory and will not otherwise be discussed." *Id.* at col. 10, lines 34-35.

Related to the algorithm are Figures 3 and 17 of the '749 patent. Figure 3 is a graph depicting the likelihood of falling asleep at different times during the day. '749 patent at Fig. 3; *id.* at col. 5, lines 25-27. Figure 17, shown below, appears to reflect the same reference models as Figure 3. It too depicts how sleepiness varies depending on time of day, but it includes three warning lines meant to represent warning threshold levels.
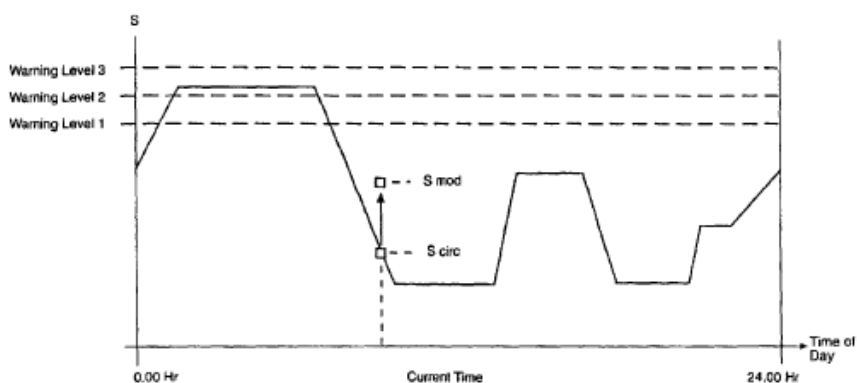

Figure 17

Id. at Fig. 17; *id.* at col. 5, lines 50-52.

In Ibormeith's view, Table 10 identifies factors that may be related to driver drowsiness, but there is no disclosure of even a single concrete relationship between the various factors that are used to compute an outcome to warn of driver drowsiness. Ibormeith's expert, Dr. Jochem, opined that the algorithm is not based on simple adding of already weighted inputs. In his expert report, Dr. Jochem described the disclosed computational means as an algorithm "template." J.A. 617-18 ¶ 54 ("I believe that the patent authors meant for Table 10 to be used as a template for constructing a specific formula(s) or equation(s) to compute sleepiness."); *see also* J.A. 618 ¶ 57 (explaining that while circadian rhythm pattern and corrective steering actions are mandatory factors for

claims 1 and 9, respectively, "[t]he other terms are optional" and that "some terms are less important than others"); J.A. 621 ¶ 70 ("it is very important to note that it is obvious in the patent specification that the examples given are meant to be just that—examples of a possible way to implement the described algorithm"). He further stated that the '749 patent requires one who implements the drowsiness detection system to determine which factors to use in the algorithm, how to obtain them, how to weight them (for example, by multiplication or addition), how to combine them, and when to issue the warning. *See, e.g.*, J.A. 621 ¶ 71 ("the use of specific numerical values in the context of the algorithm description does not limit the algorithm to use only those values"); J.A. 662 (testifying that the method of weighting, either by adding or multiplying, is determined by the implementer); J.A. 686 (testifying at his deposition that the claim terms are optional); J.A. 660 (Dr. Jochem testifying that weighting could be performed by multiplication or a function that has some linear or nonlinear terms); J.A. 666 (Dr. Jochem testifying that weighting can mean "the value you would [as]sign to a constant value in an algorithm," "the output of a function that has some linear and nonlinear terms," or multiplication).

In determining that the specification does not sufficiently disclose an algorithm providing the structure for "computational means," we take Ibormeith and its expert at their word in insisting on the breadth, rather than specificity, of what Table 10 discloses. With means-plus-function claiming, the narrower the disclosed structure in the specification, the narrower the claim coverage. To succeed ultimately in proving that the "computational means" elements cover the accused Mercedes products (vehicles with a feature called Attention Assist), Ibormeith's argument therefore needs to be based on a reading of Table 10 that is broad enough to reach the accused products. With consequences of such importance,

Ibormeith's position as to Table 10's breadth is fairly treated as a binding admission.

That position, however, fails in the necessary attempt to steer a course that permits proof of infringement yet avoids invalidity. Even if Table 10 could be read as providing a single, definite algorithm that simply adds all of the disclosed variables—a possibility we need not rule on—Ibormeith and its expert assert that it does not so provide, but instead equally covers all ways of taking into account the listed variables, or some subset of the variables, that a skilled artisan would find appropriate. Such a reading of Table 10 leaves the disclosure without an algorithm whose terms are defined and understandable. If, as Dr. Jochem testified, the algorithm in the '749 patent is not disclosing addition, then the S circ factor in Table 10 merely indicates that weighting based on circadian patterns occurs. Neither Table 10 nor the associated tables disclose how to perform the weighting of the S circ or any other factor. Table 10 merely lists inputs without specifying any single formula or function or algorithm defining the contribution of any of the inputs to a computation. As recognized by Mercedes's expert Dr. Knipling, a person of ordinary skill in the art "would need to devise his or her own method for determining driver drowsiness based on the factors generally disclosed in Tables 10, 11 and 12." J.A. 805 ¶ 19.

With its insistence that Table 10 does not disclose arriving at a warning threshold by simply adding the disclosed factors—*e.g.*, S circ (circadian-rhythm factor), S zerox (steering direction changes), and S rms (magnitude of corrective steering actions)—Ibormeith cannot rely on Figures 3 and 17 to supply the structure that Table 10 does not. Ibormeith does not argue that the weighting function of claim 1 is limited to a structure allegedly disclosed in Figures 3 and 17, which in any event do not specify anything about other inputs. At best, the two figures provide raw circadian information that a person of

ordinary skill in the art *could* use to design his or her own method of weighting. A description of an algorithm that places no limitations on how values are calculated, combined, or weighted is insufficient to make the bounds of the claim understandable.

Ibormeith's argument that the disclosed algorithm provides as much specificity as the patents in *Typhoon Touch*, 659 F.3d 1376, and *WMS Gaming, Inc. v. Int'l Game Tech.*, 184 F.3d 1339 (Fed. Cir. 1999), is incorrect. In *Typhoon Touch*, the claim term at issue was "means for cross-referencing said responses with one of said libraries of said possible responses." 659 F.3d at 1383. This court found the disclosed algorithm sufficient because the specification stated that "cross-referencing entails the steps of data entry, then storage of data in memory, then the search in a library of responses, then the determination if a match exists, and then reporting action if a match is found." *Id.* at 1386. The described process of straightforward matching of user-entered data with data in memory was a routine, concrete algorithm.

In *WMS Gaming*, the claim term at issue—concerning slot machines that use a reel for generating responses to what in a traditional slot machine is a user's pull of the lever—was "means for assigning a plurality of numbers representing said angular positions of said reel, said plurality of numbers exceeding said predetermined number of radial positions such that some rotational positions are represented by a plurality of numbers." 184 F.3d at 1346-47. A figure in the patent depicted a series of concentric circles (like a dart board) that showed the relationship between 44 stop positions on a virtual reel with 22 stop positions on a physical reel. *See id.* at 1347-48; *see also* U.S. Patent No. 4,448,419 at Fig. 6. This court found that an algorithm was sufficiently disclosed because the relationship between the virtual stop positions and the physical stop positions was limited by the figure. *See id.* at 1349-50. *WMS Gaming*, like *Typhoon Touch*, did

not rely on a specification passage like the one in the '749 patent, which, Ibormeith itself insists, does not indicate which factors should be used and in what combination and with what relative weights.

For these reasons, the judgment of the district court is affirmed.

AFFIRMED