

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

DENSO CORPORATION AND CLARION CO. Ltd.
Petitioners

v.

BEACON NAVIGATION GmbH
Patent Owner

Case IPR2013-00026
Patent 6,029,111

Before GLENN J. PERRY, THOMAS L. GIANNETTI and
TREVOR M. JEFFERSON, *Administrative Patent Judges*.

PERRY, *Administrative Patent Judge*.

FINAL WRITTEN DECISION
35 U.S.C. § 318(a) and 37 C.F.R. § 42.73

I. BACKGROUND

A. Introduction

Petitioners, Denso Corporation (“Denso”) and Clarion Co., Ltd. (“Clarion”), filed a Petition on October 18, 2012 for *inter partes* review of claims 1-28 of U.S. Patent No. 6,029,111 patent (“the ’111 patent”)¹ pursuant to 35 U.S.C. §§ 311-319.

On March 18, 2013 we granted the petition, and instituted this *inter partes* review of claims 1-3, 5, 6, 10-13, 17-20, and 22 on fewer than all of the grounds of unpatentability alleged. Paper 12. During the course of this *inter partes* review, claims 1, 10, and 17 were cancelled as a result of an *ex parte* reexamination,² leaving only claims 2, 3, 5, 6, 11-13, 18-20, and 22 for continued consideration.

Patent Owner, Beacon Navigation GmbH (“Beacon”), filed a Patent Owner Response. Paper 19 (“PO Resp.”). Petitioner filed a reply. Paper 25 (“Pet. Reply”). Patent Owner did not file a motion to amend claims.

Counsel for both Petitioners and Patent Owner were present and presented argument at an oral hearing³ held on December 13, 2013.

The Board has jurisdiction under 35 U.S.C. § 6(c). This final written decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73.

Petitioner has shown by a preponderance of the evidence that claims 2, 3, 5, 6, 11, 12, 18-20, and 22 are unpatentable.

¹ The ’111 patent issued on February 22, 2000 on an application filed December 28, 1995.

² A Reexamination Certificate issued March 28, 2013 in *ex parte* reexamination 90/012,070, which was initiated prior to institution of this *inter partes* review. Ex. 3001

³ A transcript of the oral hearing is included in the record. Paper 33.

B. The '111 Patent

The '111 patent describes a navigation system in which “information from a Global Positioning System⁴ (GPS) [is used] to obtain velocity vectors, which include speed and heading components, for propagating or ‘dead reckoning’ the vehicle position from a previous position to a current position.” Ex. 1001, 2:28-33.

The '111 patent states that:

GPS position data alone is not accurate enough for certain applications, such as turn-by-turn route guidance in automobile applications, because its error may be 100 [meters] and there is considerable position drift, even when stationary. GPS velocities are much more accurate than the position data, 1 [meter per second] or thereabouts, and can be used to propagate a known position forward and be more accurate over time than the GPS position solution.

Ex. 1001, Abstract; 2:36-43.

The '111 patent invention “uses information from a GPS to obtain velocity vectors, which include speed and heading components.” Ex. 1001, 2:28-31. These velocity vectors are used in place of sensor⁵ signals to add dead reckoning capability to a GPS navigation system and allow a vehicle's current position to be “calculated by adding displacements obtained from the GPS velocities to the previous position.” Ex. 1001, 2:45-47.

Figure 3 of the '111 patent is reproduced below.

⁴ The Global Positioning System (GPS) is a space-based satellite navigation system that provides data to a GPS receiver enabling it to determine its position and velocity.

⁵ *E.g.*, speed sensor (speedometer), accelerometer, odometer (distance), and heading sensor, etc.

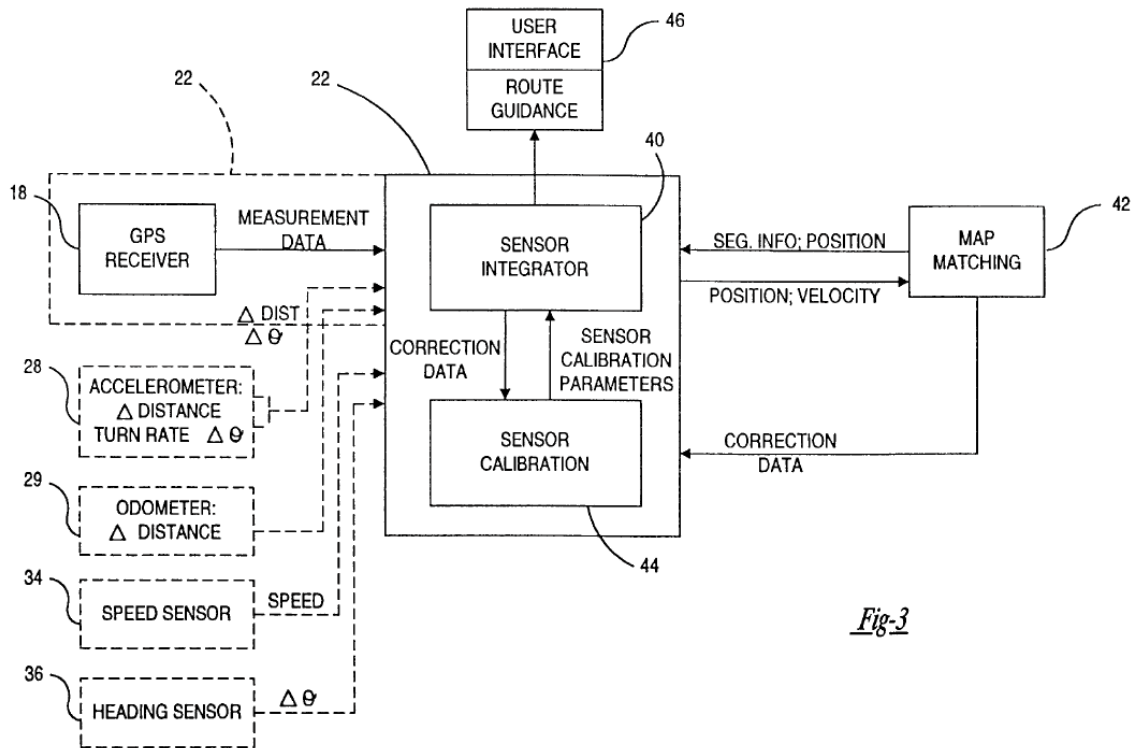


Fig-3

Figure 3 of the '111 patent is a block/data flow diagram of an embodiment of the invention.

GPS receiver 18 provides position information, velocity information, pseudo-ranges, and delta pseudo-ranges to a sensor integrator 40. Sensor integrator 40 uses the velocity information to determine a current position for the vehicle. GPS velocity information is derived from a set of delta ranges. Sensors including accelerometer 28, odometer 29, speed sensor 34, and heading sensor 36 provide input independent of GPS-determined position and velocity. Sensors are calibrated by sensor calibration 44 based on GPS receiver 18 measurement data. *See generally* Ex. 1001, 5:27 to 10:19.

C. Prior Art References Alleged to Support Unpatentability

The following table summarizes the prior art references asserted in instituted grounds:

Name	Description	Date	Exhibit
Maki	5,193,064	Oct. 9, 1990	Ex. 1004
Geier	5,416,712	May 28, 1993	Ex. 1005
Anderson	5,684,476	May 8, 1995	Ex. 1008
Endo ⁶	JP App. No. 1992-121618 (English translation)	April 22, 1992	Ex. 1012

D. Grounds of Unpatentability

The following table summarizes the challenges to patentability:

Claims	Grounds	Reference
Claims 2, 6, and 18	§ 102	Maki
Claims 2, 3, 6, 13, 18, and 20	§ 102	Geier
Claims 2, 3, 5, 11, 12, 18-20, and 22	§ 102	Anderson
Claims 2, 3, 11, 18, and 20	§ 102	Endo

II. CLAIM CONSTRUCTION

A. Principles of Law

In an *inter partes* review, claim terms in an unexpired patent are interpreted according to their broadest reasonable construction in light of the specification of the patent in which they appear. 37 C.F.R. § 42.100(b); Office Patent Trial Practice Guide, 77 Fed. Reg. 48756, 48766 (Aug. 14,

⁶ This reference previously was referred to by Petitioner in *Denso Corp. and Clarion Co. Ltd. v. Beacon Navigation GmbH*, and reflected in our Decision to Institute in IPR2013-00026, Paper 12 (Mar. 18, 2013) as “Yoshinori” which is the inventor’s given name.

2012). Claim terms are also given their ordinary and customary meaning, as would be understood by one of ordinary skill in the art in the context of the entire disclosure. *In re Translogic Tech., Inc.*, 504 F.3d 1249, 1257 (Fed. Cir. 2007).

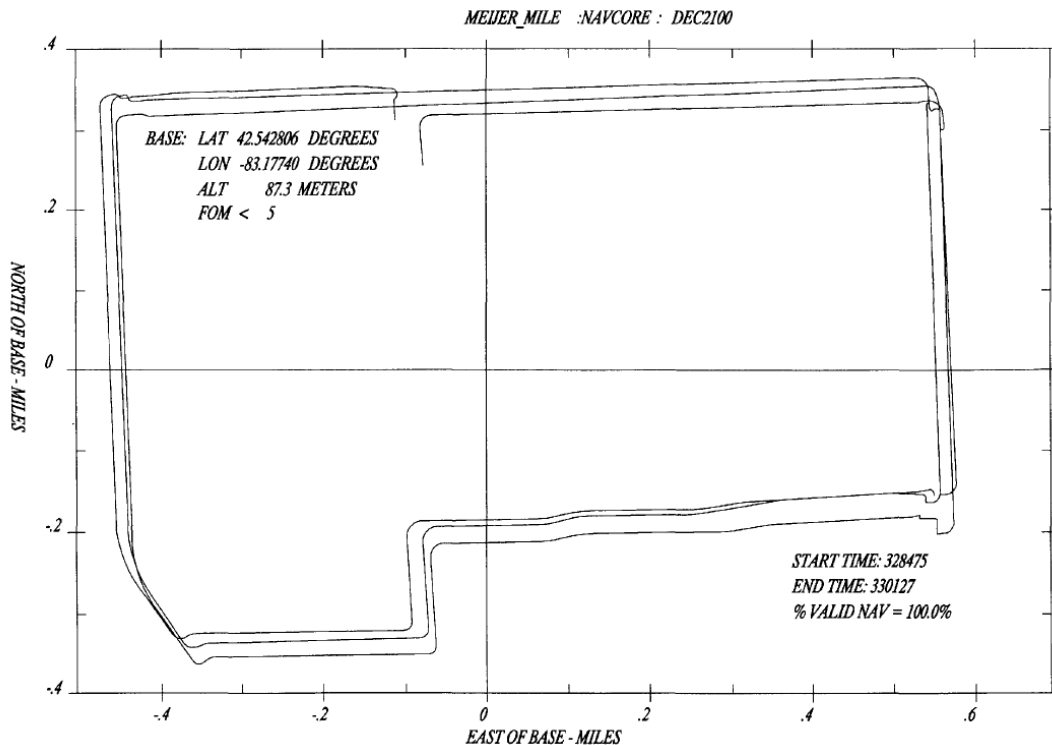
To establish anticipation, each and every element in a claim, arranged as is recited in the claim, must be found in a single prior art reference. *Net MoneyIN, Inc. v. VeriSign, Inc.*, 545 F.3d 1359, 1369 (Fed. Cir. 2008); *Karsten Mfg. Corp. v. Cleveland Golf Co.*, 242 F.3d 1376, 1383 (Fed. Cir. 2001).

If an inventor acts as his or her own lexicographer, the definition must be set forth in the specification with reasonable clarity, deliberateness, and precision. *Renishaw PLC v. Marposs Societa' per Azioni*, 158 F.3d 1243, 1249 (Fed. Cir. 1998). Neither Petitioner nor Patent Owner contends that the specification of the '111 patent, as filed, coined a new meaning for any term, different from the ordinary recognized meaning for any term. However, as discussed below, Patent Owner contends that “position” has a meaning limited by its particular usage in the patent.

B. “Position”

All of the claims, either directly or through claim dependency, include the term “position.” Patent Owner offers a construction of “position” on which it bases arguments distinguishing the claims at issue from the prior art references. For example, in distinguishing Maki, Patent Owner argues that as used in the '111 patent, the term “position” refers to “a geographical location that is ultimately displayed on a map.” PO Resp. 9.

In support of its construction, Patent Owner points to the '111 patent embodiment illustrated in Figures 4A-4C. Figure 4A is reproduced below.



Ex. 1001 Figure 4A

The '111 patent describes Figures 4A and 4C as showing “graphic plots of vehicle position using raw GPS position data, and Figures 4B and 4D show graphic plots of vehicle position using GPS velocity information.”

Ex. 1001, 3:26-29. Patent Owner argues that position refers only to longitude and latitude as plotted on a map such as shown in Figure 4A. We are not persuaded by this argument. Although we agree that the use of latitude/longitude/altitude coordinates is an often-utilized way to describe position, it is not the only way to do so.

Patent Owner notes the use of “position” in the following specification text as supporting its construction that “position” only refers to “a geographical location that is ultimately displayed on a map”:

The map matching block 42 provides road segment information for the road segment that the vehicle is determined to be travelling on, such as heading, and a suggested position. The sensor integrator 40 can update the heading component of the velocity information with the heading provided by the map matching block 42 to update the current position. If the map matching block 42 indicates a good match, then the map matched position can replace the current position. If not, the sensor integrator propagates the previous position to the current position using the velocity information. As such, the sensor integrator 40 determines the current position and provides the current position to a user interface and/or route guidance block 46.

PO Resp. 9-10 quoting Ex. 1001, 6:13-28.

The '111 patent does not provide a specific definition of the word “position.” It uses the word “position” in various ways and manners throughout the specification, not all of which refer to a position plotted or to be plotted on a map. For example, the patent states “[f]rom this information, the user computes the satellite's precise *position* and clock offset.” Ex. 1001, 1:38-40. (emphasis added). Here, the word “position” refers to the position of a satellite, not to the position of a GPS receiver being plotting on a map. The satellite's position is never plotted on a map. Another example is found in the description of Figures 4A and 4C of the patent. That description uses “position” to refer to “raw data” that is not plotted on a map, but used as an intermediate value to calculate data that is plotted on a map. Another example is a portion of the specification that describes correcting bias errors in differential GPS: “A [r]eference [s]tation receiver measures ranges from all visible satellites to its surveyed *position*.” Ex. 1001, 4:59-61. (emphasis added). The *surveyed position* is a fixed position

of a reference station, not the position of a GPS receiver being plotted on a map. Thus, within the four corners of the '111 patent, we find uses of the word “position” that are outside of Patent Owner’s construction. Based on this intrinsic evidence alone, Patent Owner’s proposed construction is too narrow.

Petitioner argues that claim 2 puts no further limitation on the term “position.” Pet. Reply 1. We agree.

We construe the word “position” as referring to a location.⁷ Our construction does not require that “position” only refer to a location that is ultimately plotted on a map. For example, a “position” may be that of a GPS satellite or a location represented by a signal that is used in an intermediate calculation.

Our construction of the term “position” includes a location actually plotted on a map and more. Based on context, a signal can represent a “position” that is not ultimately displayed on a map. In GPS technology, numerous position calculations and determinations are made that never are plotted on a map. For example, ephemeris data describing the orbit of a GPS satellite need not be plotted on a map in order to provide a useful basis from which to determine the position of a GPS receiver on the earth. The ephemeris data describing satellite position must be known in order for GPS to provide its determinations, but the GPS receiver does not plot satellite position on a map.

⁷ Typically position is described with respect to some reference frame or an object whose location is known.

It is well known how to translate a position given in one coordinate system to an equivalent representation in another coordinate system by mathematical transformation using matrix and other mathematical techniques well known to GPS engineers.

No persuasive evidence has been presented that the '111 patent inventor acted as his or her own lexicographer, and crafted a narrow definition of “position” limiting it to a geographical location that is ultimately displayed on a map.

III. DISCUSSION

A. Real Parties-In-Interest Under 37 C.F.R. § 42.8(b)(1)

Patent Owner argues that this *inter partes* review should be dismissed for non-compliance with 37 C.F.R. § 42.8(b)(1) in that Petitioners have not identified all real parties-in-interest.

According to Patent Owner, at least Mazda Motor Corporation and Mazda Motor of America, Inc. (“Mazda”), who are represented by Denso’s *inter partes* review counsel in related litigation and who have sought a stay in the related litigation on the basis of the Petition for *inter partes* review, are in cooperation with Petitioner Denso. PO Resp. 5-6. According to Patent Owner, Mazda has engaged in the strategic planning, preparation, and review of the Petition for *inter partes* review, thereby making them related parties-in-interest to this proceeding. *Id.* at 5. Likewise, according to Patent Owner, Nissan Motor Co. Ltd., and Nissan North America, Inc. (“Nissan”), who are represented by Clarion’s *inter partes* review counsel in related litigation and who have sought a stay in the related litigation on the basis of the Petition for *inter partes* review, are in cooperation with Clarion

and have engaged in the strategic planning, preparation, and review of the present petition for *inter partes* review, thereby making them related parties in interest to this proceeding. *Id.* 5. Patent Owner further states: “It is also likely that other parties in the litigations regarding infringement of the ’111 patent are in privity with Denso and Clarion.” *Id.* 5. We disagree with Patent Owner’s conclusion. The only relationship alleged by Patent Owners between the named real parties-in-interest and the alleged real parties-in-interest not named is that of being co-defendants or concurrent defendants in related litigation. The mere fact that parties are co-defendants or concurrent defendants in litigation does not make them real parties-in-interest. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48759.

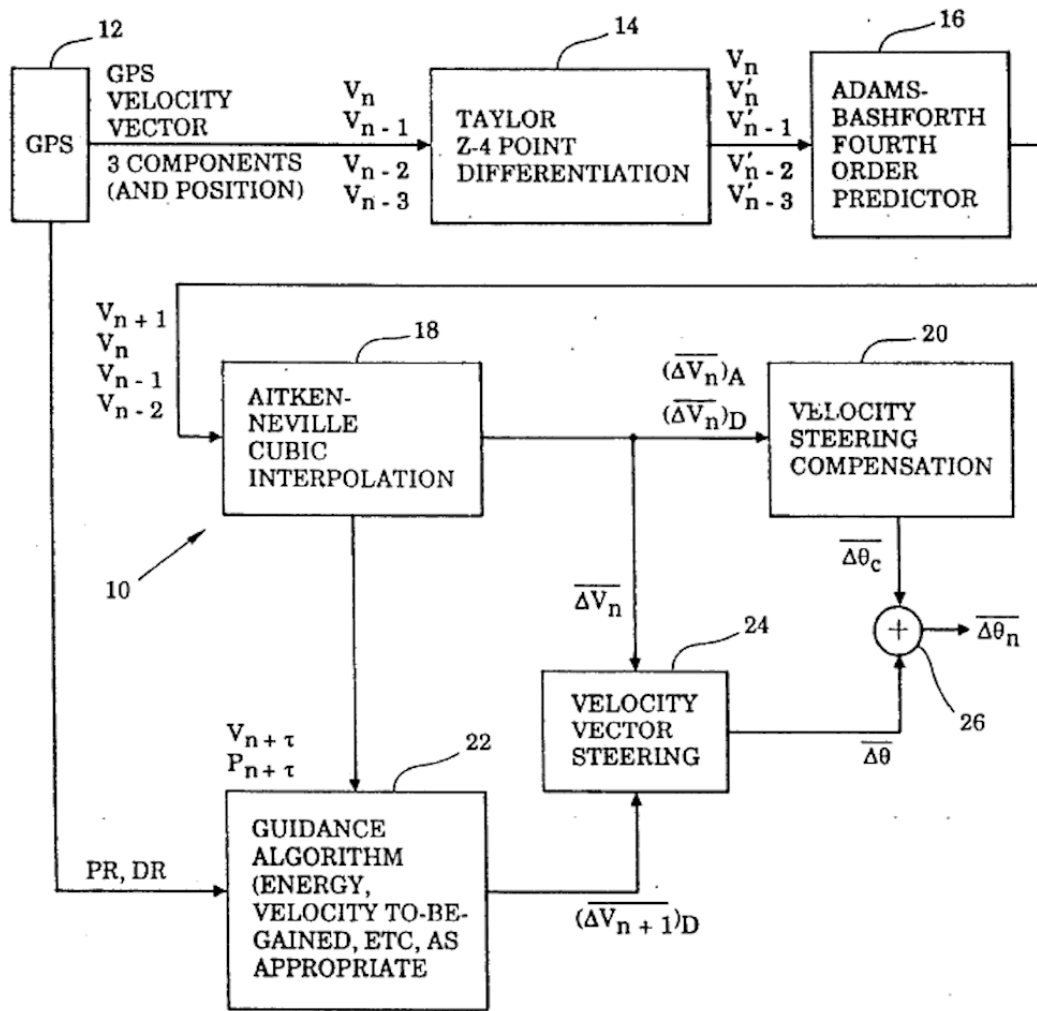
Patent Owner argues that the alleged additional real parties-in-interest have engaged in strategic planning, preparation, and review of the Petition. There is, however, no evidence that the alleged real parties-in-interest guide or otherwise control this *inter parties* review. *See* Office Patent Trial Practice Guide, 77 Fed. Reg. 48759.

We are not persuaded that any real parties-in-interest have been omitted.

B. Anticipation by Maki of claims 2, 6, and 18

1. Maki Disclosure

Maki describes a “method and arrangement for integrating a Global Positioning System and an Inertial Navigating System without the use of accelerometers to provide a velocity steering signal that is utilized in the guidance of a flying vehicle, such as a space craft.” Ex. 1004, Abstract. Maki Figure 1 is reproduced below.



Maki Figure 1

Maki Figure 1 is a block diagram demonstrating how GPS-derived signals from GPS 12 are used to develop a compensated velocity vector steering signal (Velocity Steering Compensation 20 and Velocity Vector Steering 24) to guide a spacecraft. Maki at 2:46-64 describes that a preceding sampled GPS-derived position and velocity vectors is used to predict current position and velocity vectors. These predicted position and velocity vectors are used to determine a steering rate vector for guiding the vehicle. Maki col. 3, line 55 to col. 4, line 7 describes how the predicted velocity vector is determined using blocks 14, 16 and 18 shown in Maki

Figure 1. It further describes that

[t]hese computations are performed *for each of the three components* of velocity. The current value of position can be obtained by the same means, or by *integrating velocity over a time period and adding it to the last GPS position update*. (emphasis added)

2. Claim 2

Claims 1 (which has been cancelled) and 2 are reproduced below with disputed limitations emphasized.

1. An improved navigation system having a GPS receiver which provides GPS velocity information, said navigation system calculating a displacement based upon said GPS velocity information over a time interval, *said vehicle navigation system adding said displacement to a previous position to obtain a current position*. (emphasis added).

2. The system of claim 1 *wherein said system determines east and north displacements from said GPS velocity information and applies said east and north displacements to said previous position to obtain said current position*. (emphasis added).

Petitioner points to Maki 2:46-64 and 3:55 to 4:7, described above, as meeting the limitations of claim 2. Petitioner argues that Maki inherently discloses “east and north displacements.” According to Petitioner’s expert, Dr. Michalson, international regulations require airplane navigation to be referenced to the WGS-84⁸ reference frame. Ex. 1017 ¶ 18. He further explains that displacement based on WGS-84 is indistinguishable from the North-East-Down (“NED”) reference frame when a calculated displacement

⁸ “WGS” stands for the “World Geodetic System,” which is a standard for use in cartography and navigation. The latest revision is WGS-84.

covers a relatively short distance because a change in latitude in WGS-84 corresponds to a change in north displacement in NED. Ex. 1017 ¶ 20. Further, Dr. Michalson testifies that it is a fundamental function of any navigation system that disclosure of one reference frame inherently discloses the others, and that the '111 patent recognizes the equivalence of these reference frames and the fundamental nature of the transformations between them through its disclosure of the ECEF, WGS-84 and NED frames. Ex. 1017 ¶ 21 (citing '111 patent, 6:65-7:24). Patent Owner does not challenge the Michalson assertions regarding WGS-84 and reference frame equivalence.

Patent Owner argues that Maki does not anticipate claim 2 because Maki does not disclose “said vehicle navigation system adding said displacement to a previous position to obtain a *current position*” (emphasis added). PO Resp. 9. According to Patent Owner, Maki’s “value of position” is not an actual position consistent with its proposed construction of “position,” it is a “variable” for input into calculations. There is no actual conversion of the value of position to coordinates that can be plotted on a map. PO Resp. 10.

We agree with Patent Owner’s understanding of Maki, that the described “value of position” represents a location that is only used in an intermediate calculation and is not plotted on a map. However, Maki also describes integrating position to obtain a displacement. Ex. 1004, 4:2-7.

As we construe “position,” it does not matter that actual position coordinates are not determined and plotted on a map. Maki clearly teaches integrating velocity to obtain a displacement in position. The velocity that is integrated is a GPS-derived velocity. The fact that Maki teaches how to

compute a velocity steering signal does not diminish its teaching of integrating a GPS-derived velocity to obtain a displacement. We, therefore, find this argument unpersuasive.

Patent Owner further argues that Maki does not disclose “wherein said system determines *east* and *north* displacements from said GPS velocity information and applies said east and north displacements to said previous position to obtain said current position.” PO Resp. 11. According to Patent Owner, Maki does not specifically mention “east” and “north.” PO Resp. 12. We agree.

We are not persuaded by Petitioner’s argument that east and north displacements inherently are taught by Maki. Petitioner’s argument begins with the proposition that international regulations require airplane navigation to be referenced to the WGS-84 geodetic frame. Ex. 1017 ¶ 18. This may be so, but Maki does not describe guidance for an airplane. It describes guidance for a space vehicle. We find no mention of WGS-84 in Maki and we are not persuaded to infer that WGS-84 is utilized.

As Petitioner argues, Maki describes a “velocity vector.” Patent Owner’s expert, Dr. Dafesh, agrees that a velocity vector can be expressed in components to the east and to the north, regardless of the direction in which it points. Ex. 1019, 128:25 to 129:3. Further, Dr. Dafesh, admits that “position” is “not limited to being relative to a geographical reference.” Ex. 1019, 74:22-75:4. However, there is no evidence presented demonstrating that the position vector is resolved into components at all, a precursor to resolving into “east” and “north” components. For this reason, we are not persuaded that Maki inherently teaches east and north displacements as

claimed. Petitioner has not carried its burden with respect to anticipation by Maki of claim 2.

3. Claim 6

Claim 6, depending from claim 1, additionally requires GPS velocity information to be calculated from delta range measurements. Patent Owner does not separately argue claim 6 with respect to Maki and relies on the argument made with respect to claim 2 that Maki does not disclose “said vehicle navigation system adding said displacement to a previous position to obtain a *current position*.” We are not persuaded by this argument because Maki describes integrating velocity to obtain a position displacement. No arguments are directed to the limitation added by claim 6. We, therefore, conclude that claim 6 is anticipated by Maki.

4. Claim 18

Claims 17 (which has been cancelled) and 18 are reproduced below (with limitations in dispute italicized).

17. A method of determining a current position from a previous position including the steps of:

providing GPS velocity information;

calculating a displacement based upon said GPS velocity information over a time interval; and

using said displacement to propagate a previous position to a current position.

18. The method of claim 17 wherein said displacement comprises

east and north displacements said method further including the step of
applying said east and north displacements to said previous position to obtain said current position.

Claim 18, as with claim 2, requires resolving east and north position displacements. For the same reasons stated with respect to claim 2, we are not persuaded that Maki describes resolving the predicted position vector into components. We, therefore, conclude that Petitioner has not met its burden with respect to anticipation by Maki of claim 18.

C. Anticipation by Geier of claims 2, 3, 6, 13, 18 and 20

1. Geier Disclosure

Geier describes “global positioning system (GPS) devices that use dead-reckoning [(DR)] apparatus to fill in as backup during periods of GPS shadowing such as occur amongst obstacles, e.g., tall buildings in large cities.” Ex. 1005 1:10-13; Abstract. As shown in Geier Figure 2, reproduced below, a GPS “velocity solution” is derived from GPS navigation computer 44.

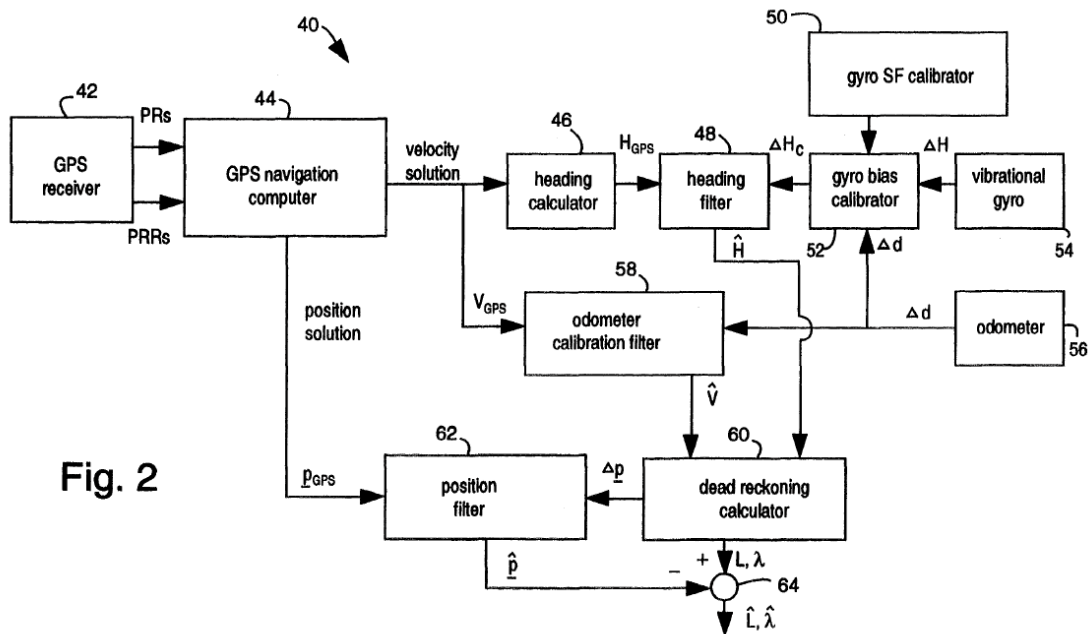


Fig. 2

Geier Figure 2

Geier Figure 2 shows the use of a velocity solution from a GPS navigation computer 44 by a dead reckoning calculator 60. Geier blends GPS solutions and dead-reckoning using Kalman filters (Ex. 1005, 2:44-46) to solve the problem of temporary loss of GPS satellite tracking. Ex. 1005, 1:51-63.

2. Claims 2 and 6

Patent Owner argues that Geier “blends” calculations from GPS velocities with other velocity data and therefore does not teach using “GPS velocity” information.” PO Resp. 18-20. We disagree. As explained in Geier:

A velocity estimate (V) and a heading estimate (H) are received by a dead reckoning (DR) calculator 60. A position filter 62 receives both a DR change of position signal (Δp) and a GPS position solution (p_{GPS}). (emphasis added)

Ex. 1005 at 5:1-4.

This passage indicates that dead reckoning calculator 60 provides a dead reckoning position calculation that is a function of the velocity estimate. Geier Figure 2 shows that a “velocity solution” is produced upstream of dead reckoning calculator 60, which receives two inputs, both of which are a function of the velocity solution. The velocity solution from GPS navigation computer 44 is used by heading calculator 46 to provide an input to dead reckoning calculator 60.

Claim 2 requires that the “system determines east and north displacements from said GPS in response to claim velocity information and applies east and north displacements from said GPS velocity information and applies said east and north displacements to said previous position to obtain said current position.” We have reviewed the portions of Geier cited by Petitioner as describing the features of claim 2 (Ex. 1005, 2:30-41; 4:21-26; 5:20-22; 4:56-62; 5:41-45 and Figure 2). Although there is no explicit mention there of “east” and “north,” it is clear that position is resolved into components for display. The ’111 patent discusses the equivalence of various reference frames and the fundamental nature of the transformations among them through its disclosure of the ECEF, WGS-84 and NED frames. See Ex. 1001, 6:65-7:24. In our view, resolving vector components is so well recognized that it usually goes unmentioned. We determine that one of ordinary skill at the time of the ’111 patent invention would have inferred the teaching of “east” and “north” vector components, even though Maki is not explicit as to their use. See *In re Preda*, 401 F.2d 825, 826 (CCPA 1968), which instructs us that “in considering the disclosure of a reference, it is proper to take into account not only specific teachings of the reference but

also the inferences which one skilled in the art would reasonably be expected to draw therefrom.”

Therefore, we determine that Petitioner has demonstrated that claim 2 is anticipated by Geier.

Patent Owner does not separately argue dependent claim 6. For the reasons set forth above, we find that Petitioner also has demonstrated that claim 6 is anticipated by Geier.

3. Claims 3, 18, and 20

Patent Owner argues that Geier “does not teach that GPS velocity information is not available.” PO Resp. 20-23. We disagree and note two passages of Geier that describe blocking of GPS information:

Another advantage of the present invention is that a system is provided that automatically switches to a calibrated dead-reckoning solution when GPS satellite signals are *blocked* for any reason.

See Ex. 1005, 2:61-64 (emphasis added).

In some situations, such *blockage* can prevent all the overhead GPS satellites from being tracked and such outages can last for several minutes. GPS signals also become unavailable to vehicles when moving through underground or underwater tunnels.

See Ex. 1005, 1:53-58 (emphasis added).

Patent Owner’s expert, Dr. Dafesh, agrees that Geier explicitly teaches instances where GPS velocity information is not available. Ex. 1019, 161:20-25.

Claim 3 requires “sensors providing information used to propagate position if said GPS velocity information is not available, said navigation system *determines calibration information from said GPS velocity information* to calibrate said sensors.” (emphasis added). According to Geier, GPS-derived information is used to correct the “odometer scale factor, thereby improving the estimate of distance traveled input to the dead reckoning calculations.” Ex. 1005, 5:29-31.

Claim 20 requires that sensor information be used to propagate position in the event GPS velocity is not available. It further requires that calibration information from GPS velocity be used to calibrate sensors. For the reasons discussed with respect to claim 3, containing similar features, we conclude that claim 20 also is anticipated by Geier.

Claim 18 depends from claim 17 and further requires that displacements calculated are “east” and “north” displacements. For reasons stated above with respect to claim 2, we determine that “east” and “north” displacements would have been inferred by one of ordinary skill in the GPS arts. We conclude, therefore, that claim 18 is also anticipated by Geier.

4. Claim 13

Claims 10 (cancelled, but from which claim 13 depends) and 13 are reproduced below with disputed portions emphasized.

10. An improved navigation system comprising:

a GPS receiver which provides GPS velocity information, said navigation system using GPS velocity information to propagate a previous position to a current position, said system determines east and north displacements by integrating said GPS velocity

information and applies said east and north displacements to said previous position to obtain said current position; and

sensors providing information used to propagate vehicle position if said GPS velocity information is not available, said navigation system determines calibration information from said GPS velocity information to calibrate said sensors.

13. An improved navigation system according to claim 10 wherein said navigation system calculates said GPS velocity based upon a plurality of delta range measurements, said navigation system calculating each said delta range measurement based upon a different *pair of pseudorange measurements, each said pair of pseudorange measurements being received from a different GPS satellite*, said navigation system calculates said displacement by integrating said GPS velocity over a time interval between said first and second pseudorange measurements. (emphasis added)

Patent Owner argues that claim 13 does not teach a “pair of pseudo-range measurements being received from different GPS satellites,” and calculating “displacement by integrating said GPS velocity over a time interval between said first and second pseudo-range measurement.”

A GPS receiver determines its position and velocity by determining its range (pseudo-range) with respect to each of multiple satellites, each of which has a known position at a known time defined by ephemeris data describing the satellite’s orbit. A GPS receiver computes its position and velocity from these pseudo-range determinations.

As Geier states:

GPS receiver 16 is such that it computes a complete vehicle position/velocity solution from signals received from *at least three* GPS satellites and it computes pseudo ranges (PRs) and pseudo range rates (PRRs) from signals received from GPS satellites tracked by the receiver.

Ex. 1005, 4:21-26.

This passage describes that pseudo-ranges are determined with respect to multiple satellites. Patent Owner's expert, Dr. Dafesh, in his deposition, confirms that Geier teaches computing pseudo-ranges and pseudo-range rates (rate of change of a pseudo-range) from signals received from multiple satellites. Ex. 1019, 141:18-22.

With regard to the period of time during which pseudo-range calculations are made, Geier Figure 2 shows the use of Kalman filters (heading filter 48 and odometer calibration filter 58). Dr. Dafesh, at his deposition, indicated that Kalman filters are "iterative." Ex. 1019, 151:19-25. According to Petitioner's expert, Dr. Michalson, Kalman filters are iterative filters that perform calculations based on current measurements and most recent measurements and are calculated based on the time interval between two measurements. Ex. 1017 ¶ 29. Dr. Michalson further testifies that

"[a] person of ordinary skill in the art would understand that the calculations required for a Kalman filter to update its state based on current measurements must be completed before the next set of measurements are sent to the filter. This iterative process is fundamental to the operation of a Kalman filter."

Id. ¶ 29. “Since the outputs to calculator 60 are calculated over a time interval between measurements, one of ordinary skill in the art would understand that the displacement Δp calculated by calculator 60 is necessarily calculated over the time interval between measurements.” *Id.*

¶ 29. This testimony is unchallenged.

We, therefore, conclude that the limitations of claim 13 are disclosed by Geier.

D. Anticipation by Anderson of claims 2, 3, 5, 11, 12, 18-20 and 22

1. Anderson Disclosure

Anderson discloses a “field navigation system” for locating a vehicle. Ex. 1008 Title, Abstract. An embodiment shown in Anderson Figure 2, reproduced below, locates a vehicle 50 in a field mapped on a Cartesian coordinate system having a vertical axis labeled “N” (North). Ex. 1008, Figure 2. By implication the horizontal axis represents “East.”

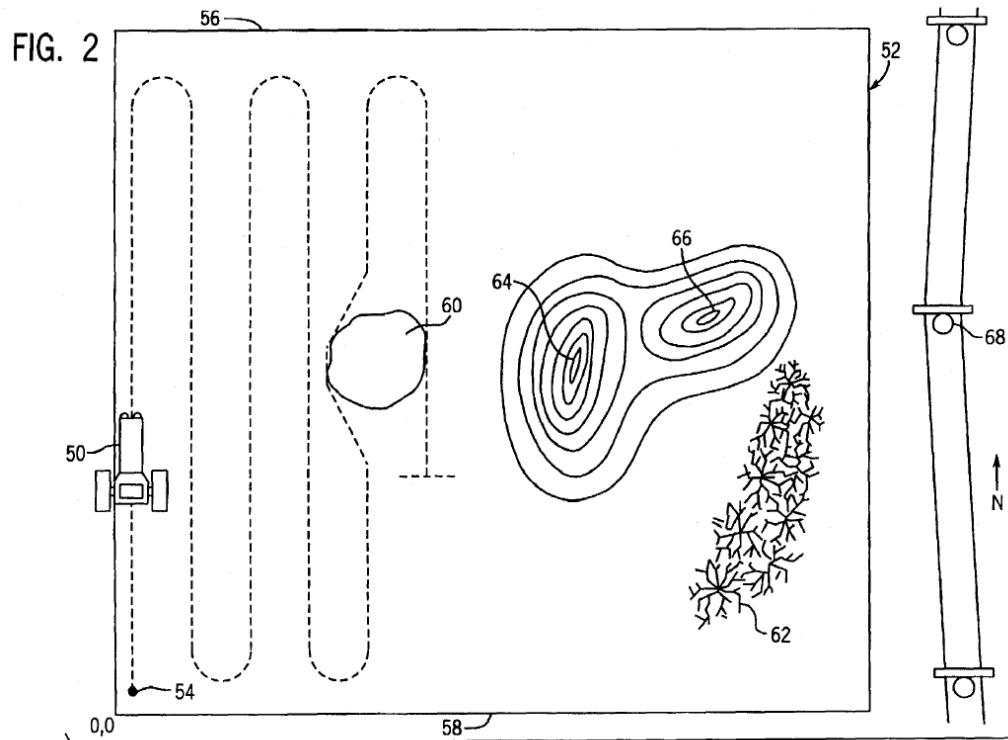


Exhibit 1008 Figure 2

The Anderson system includes sensors for measuring heading (flux compass 12 shown in Anderson Figure 1) and speed (radar gun 24 shown in Anderson Figure 1). It also includes a GPS Receiver (block 20 in Anderson Figure 1). A “position computer” 18 receives input from the sensors and from the GPS and drives a display 32 indicating vehicle position. Ex. 1008, 7:46-57. It is evident from this passage that speed is integrated to obtain a displacement of position from a previous position to obtain a current position. Anderson describes using GPS to derive a velocity signal. Ex. 1008, 12:29-39. It is evident that Anderson updates speed from the GPS. A new position is determined based on updated speed. Ex. 1008, Figure 3 (block 84), 7:47-57, and 12:29-39. Anderson specifically mentions north and east components of displacement at 12:50-55.

2. Claims 2 and 18

With regard to claim 2, Patent Owner argues that Anderson does not teach the claimed “current position” based on Patent Owner’s proposed construction of “position,” which, according to Patent Owner should be construed as a geographical location that is ultimately displayed on a map, such as latitude and longitude coordinates, as shown in Figure 4A of the ’111 patent. PO Resp. 29. As stated above, we disagree with Patent Owner’s narrow construction of “position.”

Patent Owner argues that the claimed “current position” is not taught by Anderson. *Id.* According to Patent Owner, Anderson’s calculated north and east displacements do not constitute latitude and longitude per Patent Owner’s construction of “position” because a displacement is not a *coordinate*. Petitioners point to Anderson’s Figure 3 description at 12:50-55 for support:

[t]he updated speed from task 80 and the updated heading from task 82 are received by a task 84 which calculates a new position of the vehicle at selected time intervals. North and [E]ast displacements from the initial position of the vehicle in the corresponding selected time interval are calculated using well known trigonometric functions.

Ex. 1008, 12:50-55.

Our construction of “position” is not so limited. The difference between an initial coordinate pair and a current coordinate pair constitutes a displacement of position between those coordinate pairs. We determine, therefore, that Anderson explicitly discloses obtaining a “position.” Anderson uses an updated speed and updated heading from task 82 to

calculate “a new position of the vehicle at selected time intervals.” Ex. 1008, 12:50-52. Specifically, “[n]orth and east displacements from the initial position of the vehicle in the corresponding selected time interval are calculated.” *Id.*, 12:52-55.

Figure 2 of Anderson, showing vehicle position, is nearly identical to Figures 4B and 4D of the '111 patent. Both use a Cartesian coordinate system in which the Y-axis represents north and X-axis represents east.

Anderson Figure 3 shows that updated velocity is a direct input to task 84 which calculates a new position. Anderson states at 9:10-19:

Display 32 optionally reports system status to the operator and prompts the operator for a response. Display 32 optionally includes a map of all or part of the area of vehicle operation along with the current vehicle location. Position can be indicated as a point on the map, as latitude and longitudinal, or as a linear offset from the starting point. In the preferred embodiment, the current position is displayed as north and east offsets from an initial position represented as (0,0).

We, therefore, conclude that the limitations of claim 2 are disclosed by Anderson.

Claim 18 also requires east and north displacements. With regard to claim 18, Patent Owner repeats the same arguments made with respect to claim 2. PO Resp. 36. For the same reasons stated with respect to claim 2, we conclude that the limitations of claim 18 are disclosed by Anderson.

3. Claims 3 and 20

Patent Owner argues with respect to claim 3 that Anderson does not teach “sensors providing information used to propagate position if said GPS velocity information is not available.” PO Resp. 30-31. We disagree.

Anderson describes situations in which GPS velocity information is not available. See, for example, Ex. 1008, 5:23-27. We interpret “obstructed” to represent one situation in which GPS velocity information is not available. Patent Owner’s expert, Dr. Dafesh, indicates on cross-examination that this passage indicates that Anderson teaches GPS velocity information not being available in some contexts. See Ex. 1019, 194:6-13.

Patent Owner points to Ex. 1008, 5:61-64:

A flux compass is used to provide the heading information along with the GPS receiver 20 because GPS receivers such as the Tremble Acutime receiver do not update heading information at speeds below 8 k.p.h.

Patent Owner views this portion of Anderson as supporting its view that Anderson does not teach using sensors to provide information when GPS velocity information is not available. We draw the opposite conclusion. Because GPS receivers are inaccurate at low speeds, this passage suggests that a flux compass (another sensor) is used to provide heading information when the GPS signal is unreliable (for practical purposes unavailable). In our view, this portion supports Petitioner’s position that Anderson teaches using other sources of information when GPS signals are not available.

Claim 20 depends from claim 17 and further requires sensors that are calibrated based on GPS-derived velocity. Patent Owner makes the same argument, made with respect to claim 2, that Anderson fails to describe

propagating “a previous position to a current position.” PO Resp. 37. For reasons already stated, we are not persuaded by this argument.

Patent Owner also argues that Anderson does not teach “providing sensor information used to propagate position if said GPS velocity information is not available.” *Id.* For the same reasons we stated with respect to claim 3, we are not persuaded by this argument.

4. Claims 5, 12, and 19

Claim 5 recites “a zero motion detection system which provides a zero motion signal upon detecting a zero motion state to resolve ambiguity of low velocity GPS information.” An embodiment of the ’111 patent “zero motion detect system” is shown in Figure 5 of Ex. 1001 and described at 10:20-44.

Patent Owner correctly notes that the zero motion detect system compares motion signals to a threshold to determine whether a “zero motion state” exists. However, that threshold is not necessarily zero. Rather, the threshold is set to establish a zero motion state when the GPS velocity is too low to be reliable.

Patent Owner argues that Anderson does not disclose a “zero motion detection system which provides a zero motion signal upon detecting a zero motion state to resolve ambiguity of low velocity GPS information.” PO Resp. 33. Anderson states:

In addition, at low speeds under 1 m.p.h. the radar speed signal 26 provided by radar gun 24 is used by position computer 18 as the main speed measurement of the vehicle speed even if selective availability is turned off. This is because at speeds below 1 m.p.h. GPS receiver 20 does not provide adequate accuracy.

Ex. 1008, 5:27-32. Patent Owner argued during the hearing that “1” (as in “below one m.p.h.”) is not “zero” (as in “zero motion”), and that an anticipation challenge cannot be based on the language of the reference. Hearing Transcript, Paper 33, pp. 38-42. We disagree. *See In re Preda*, 401 F.2d 825, 826 (CCPA 1968). We determine that one of ordinary skill in the GPS arts would recognize (and in fact the references tell us) that at low speeds, GPS velocity is inaccurate and would also recognize that the Anderson discussion referring to “below 1 m.p.h.” refers to the same condition described in other texts (including the ’111 patent) as “zero motion.” *See e.g.* Anderson 5:27-32.

Claim 12 depends from claim 10 and further requires zero motion detection to resolve ambiguity of low velocity GPS information. Patent Owner repeats the argument made with respect to claim 5 that Anderson fails to teach propagating “a previous position to a current position.” PO Resp. 36. As stated with respect to claim 5, a radar gun is used to provide a more accurate measure of speed than can be provided by the GPS. The claim language (similar to that of claim 5) encompasses the teaching of Anderson.

With respect to claim 19, Patent Owner repeats its argument made with respect to claim 2 that Anderson fails to anticipate propagating “a previous position to a current position.” PO Resp. 36.

Patent Owner also argues with respect to claim 19 that Anderson does not teach the claimed “zero motion state.” PO Resp. 37. For the reasons set forth above, we are not persuaded by this argument.

We conclude that claims 5, 12 and 19 are anticipated by Anderson.

5. Claims 11 and 22

Claim 11 is reproduced below with disputed limitations emphasized.

11. The system of claim 10 wherein said sensors is an *orthogonal axes accelerometer*. (emphasis added)

Patent Owner argues that Anderson’s reference to “accelerometers and altimeters” does not teach specifically “orthogonal axes accelerometer” as recited in claim 11. Patent Owner’s expert, Dr. Dafesh, indicates in his declaration that there are many different types of accelerometers besides orthogonal axes accelerometers. Ex. 2005, 6-7. According to Patent Owner, it does not necessarily follow that Anderson uses an “orthogonal axes accelerometer.” PO Resp. 34-35. We disagree.

Anderson states: “Accelerometers and altimeters are other optional supplements to location system 10.” Ex. 1008, 11:24-25. We read the Anderson disclosure from the perspective of one of ordinary skill in the GPS art. Such a person would understand the use of the word “accelerometers” in context to mean orthogonal axes accelerometers which are commonly used in navigation systems to develop a signal representing resolved components of acceleration. Navigation systems depend upon resolving displacements and velocities along orthogonal axes. Thus, Anderson discloses to one of ordinary skill in the GPS art an orthogonal axes accelerometer.

Independent claim 22 reads as follows (with disputed portions emphasized):

22. A method of determining a current position from a previous vehicle position including the steps of:

providing GPS velocity information;

determining east and north displacements by integrating said GPS velocity information over a time interval;

applying said east and north displacements to said previous position to obtain said current position;

providing longitudinal and lateral acceleration information by an *orthogonal axes accelerometer*;

determining longitudinal and lateral calibration information from said GPS velocity information; and

calibrating said orthogonal axes accelerometer with said calibration information.

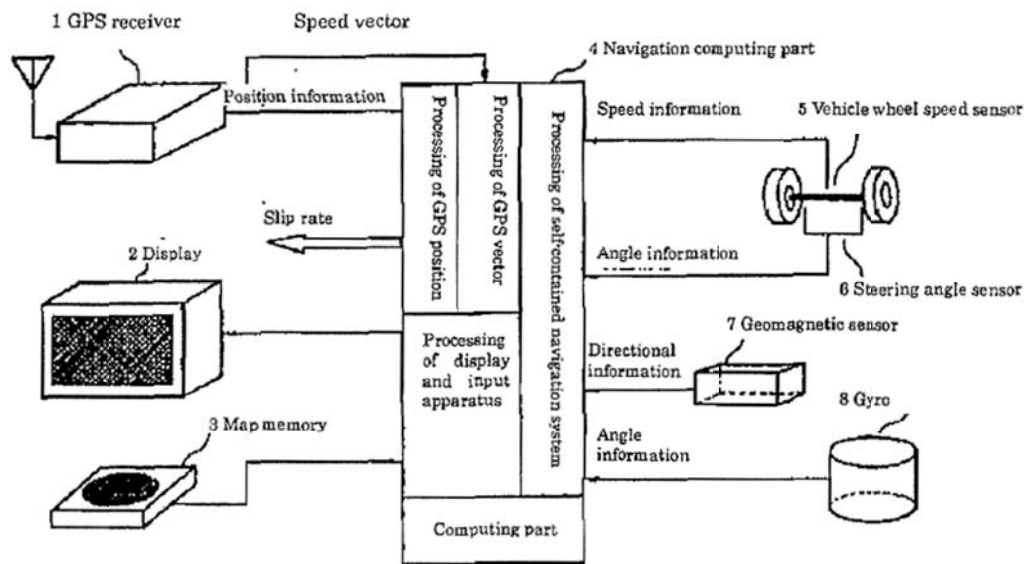
Patent Owner acknowledges the similarity of claim 22 to claims 1, 10 and 17. PO Resp. 38. Patent Owner argues, as it did with respect to claim 11, that Anderson fails to teach an “orthogonal axes accelerometer. PO Resp. 39. For the reasons stated with respect to claim 11, we are not persuaded by this argument.

We conclude that claims 11 and 22 are anticipated by Anderson.

E. Anticipation by Endo of claims 2, 3, 11, 18 and 20

1. Endo Disclosure

Endo describes a navigation apparatus using both GPS technology and sensors. Endo Figure 1 is reproduced below.



Endo Figure 1

Endo describes navigating using a self-contained navigation system (using input from sensors) as being subject to accumulated error. It also describes navigating using GPS technology that is subject to accuracy limits. Ex. 1012, 107. The system includes a wheel speed sensor, steering angle sensor (sensing change in direction), an optical fiber gyro (heading), and a geomagnetism sensor (direction). Ex. 1012, 108. Embodiments are described that utilize both self-contained and GPS systems. Endo identifies a problem of sensor error in a self-contained navigation system, also in the right column of page 109. Endo also describes correction of such sensor error:

“[P]osition determining means integrates the first velocity vector and calculates a self-location by adding the relative position information to the

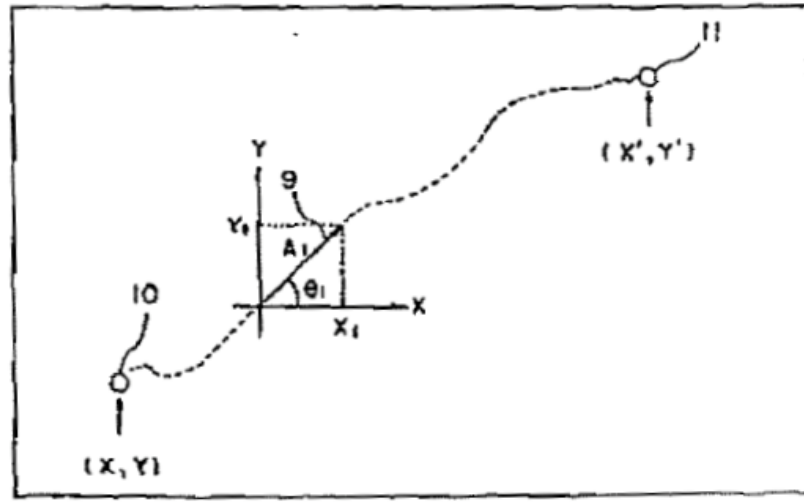
initial position.” Ex. 1012, 110, left column.

2. Claims 2, 3, 18, and 20

Patent Owner argues that Endo does not anticipate claims 2, 3, 11, 18 and 20. PO Resp. 39-42.

With regard to claims 2, 3 and 18, Patent Owner argues that Endo does not anticipate based on Patent Owner’s proposed construction of “position.” PO Resp. 40. Patent Owner asserts that “position” is limited to a geographical location ultimately displayed on a map, such as latitude and longitude coordinates.” PO Resp. 40. According to Patent Owner, Endo does not describe “adding said displacement to a previous position to obtain a current position.” *Id.* Also, according to Patent Owner, determining distance along the X- and Y-axes does not correlate to coordinates such and latitude and longitude. *Id.* Therefore, Patent Owner argues, Endo does not teach obtaining the “current position” of claim 2. PO Resp. 41. We are not persuaded by Patent Owner’s assertions.

Endo Figure 3 is reproduced below.



Endo Figure 3

Endo describes integrating velocity to obtain a position displacement:

The current position (X' , Y') can be calculated by integrating the distance traveled per unit time along X axis and Y axis from the initial position (X , Y) by the time between the start of navigation and the current time.

...

In Figure 3, the positive direction of X-axis is east, the positive direction of Y axis is north, initial position is (X , Y) and current position is (X' , Y'). Also, the velocity vector obtained from the GPS receiver is shown as A_i , which is the distance traveled per each unit time, and direction.

Ex. 1012, 113. Upon cross-examination, Patent Owner's expert, Dr. Dafesh, agreed that these passages teach obtaining a current position by adding displacement to a previous position. Ex. 1019, 198:4-7.

We, therefore, conclude that Petitioner has established that the limitations of claims 2, 3, 18, and 20 are disclosed by Endo.

3. Claim 11

Patent Owner repeats the above argument made with respect to claims 2 and 3 regarding “current position” with respect to claim 11. PO Resp. 41. For the same reasons, we are not persuaded.

In addition, Patent Owner argues that Endo does not disclose an “orthogonal axes accelerometer.” Patent Owner’s expert, Dr. Dafesh, states that Endo does not mention among its recitation of sensors an accelerometer. Ex. 2005 ¶ 26. We agree. Unlike Anderson, Endo does not disclose an accelerometer of any kind.

According to Petitioner, the use of orthogonal axes accelerometers were well known automotive sensors to one having skill in the art at the time of Endo. Therefore, Petitioner argues, the claims represent a “predictable variation” of what is taught by Endo. Pet. Reply 15. That may be so. However, Petitioner’s challenge is based on anticipation, which requires the reference to disclose expressly or inherently all features of the claim.

With respect to Anderson, we determined that explicit mention of an accelerometer infers to one of ordinary skill the use of an orthogonal axes accelerometer. However, in Endo there is no mention of an accelerometer.

Furthermore, there is no persuasive evidence to suggest that as to Endo, the presence of an orthogonal axes accelerometer is inherent. Nor is there evidence to suggest that the use of an orthogonal axes accelerometer would have been inferred by one of ordinary skill at the time of the invention. Unlike Anderson, which described an accelerometer, Endo does not.

As such, Petitioner has not met its burden in establishing unpatentability of claim 11 based on Endo.

IV. CONCLUSION

The '111 patent issued with claims 1-28. Our Decision to Institute instituted *inter partes* review of claims 1-3, 5-7, 10-12, 17-20 and 22. Claims 1, 10 and 17 were cancelled by separate reexamination which concluded during the course of this *inter partes* review.

Petitioner has met its burden of proof, by a preponderance of the evidence, in showing that:

A. Claim 6 of the '111 patent is unpatentable under 35 U.S.C. § 102(e) over Maki;

B. Claims 2, 3, 6, 13, 18 and 20 of the '111 patent are unpatentable under 35 U.S.C. § 102(e) over Geier;

C. Claims 2, 3, 5, 11, 12, 18-20 and 22 of the '111 patent are unpatentable under 35 U.S.C. § 102(e) over Anderson; and

D. Claims 2, 3, 18 and 20 of the '111 patent are unpatentable under 35 U.S.C. § 102(e) over Endo.

Petitioner has not met its burden in establishing that claims 2 and 18 are unpatentable under 35 U.S.C. § 102(e) based on Maki and that claim 11 is unpatentable under 35 U.S.C. § 102(e) based on Endo.

This is a final decision.

V. ORDER

In consideration of the foregoing, it is hereby:

ORDERED that claims 2, 3, 5, 6, 11-13, and 18-20 and 22 of U.S. Patent No. 6,029,111 are determined to be UNPATENTABLE; and

FURTHER ORDERED that because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

For PETITIONER:

Paul R. Steadman
Matthew D. Satchwell
DLA Piper
paul.steadman@dlapiper.com
matthew.satchwell@dlapiper.com

Mark K. Weinstein
Robert S. Hill
QUINN EMANUEL URQUHART & SULLIVAN, LLP
marcweinstein@quinnemanuel.com
roberthall@quinnemanuel.com

For PATENT OWNER:

Lance D. Reich
LEE & HAYES, PLLC
lance@leehayes.com
lhocket@leehayes.com