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Datasheet for the decision of 5 September 2006

Case Number: T 0781/04 - 3.5.03

Application Number: 00300249.0

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Language of the proceedings: EN

Title of invention:
On-board GPS sensor systems

Applicant:
Ford Global Technologies, Inc.

Opponent:
-

Headword:
On-board GPS sensor systems/FORD

Relevant legal provisions:
EPC Art. 123(2), 83, 84, 54, 56

Keyword:
"Inventive step - (yes) after amendment"

Decisions cited:
-

Catchword:
-

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Case Number: T 0781/04 - 3.5.03

D E C I S I O N
of the Technical Board of Appeal 3.5.03
of 5 September 2006

Appellant: Ford Global Technologies, Inc.
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Representative: Messulam, Alec Moses
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Decision under appeal: **Decision of the Examining Division of the European Patent Office posted 27 February 2004 refusing European application No. 00300249.0 pursuant to Article 97(1) EPC.**

Composition of the Board:

Chairman: A. S. Clelland
Members: A. Ritzka
M.-B. Tardo-Dino

Summary of Facts and Submissions

I. This appeal is against the decision of the examining division dated 27 February 2004, refusing European patent application No. 00 300 249.0 for the reason that the subject-matter of claims 1 and 2 lacked novelty, whilst that of claim 3 lacked an inventive step, having regard to the disclosure of:

D6: DE 197 42 394 A

In the course of the examination procedure the documents

D1: US 5 430 654 A
D2: US 5 101 356 A
D3: EP 0 437 372 A

were also discussed.

II. The notice of appeal, a statement of grounds of appeal with a set of new claims 1 to 3 to replace the set of claims on which the appealed decision was based and a payment order for the appeal fee were filed on 08 April 2004 using the EPO's proprietary online system known as epoline®.

III. In a communication of 20 December 2004 the board informed the appellant that his appeal was apparently not admissible since it had been filed by electronic mail and therefore did not comply with the written form required by Article 108 EPC. Subsequently, the appellant filed the notice of appeal, the statement of the grounds of appeal and the set of new claims by fax

of 24 December 2004, confirmed by letter received on 7 January 2005. It was requested that the appeal be deemed to have been filed correctly. An auxiliary request was subsequently made that the appellant be re-established in his rights. In the interlocutory decision of 30 November 2005 the main request was refused and the auxiliary request was allowed.

IV. Claim 1 reads as follows:

"A system for deriving a value of a parameter defining an aspect of dynamics of a vehicle (10) traversing a multi-dimensional inertial reference frame, the system comprising:

plural sensors (14,16,30,32,34,36) each disposed at a different situs on the vehicle (10), each sensor being in radio communication with a positioning system having multiple stations each of which repeatedly broadcasts its respective position, and each sensor being capable of presenting information describing at least one of its position and velocity with reference to the multi-dimensional inertial reference frame as the vehicle (10) traverses the inertial reference frame; and

a processor (18,40) for processing information presented by the sensors (14,16,30,32,34,36) with other vehicle-related information to derive information representing an angle (α) between the vehicle centreline and one axis of the inertial reference frame,

characterised in that;

the sensors (14,16,30,32,34,36) are each adapted to present information referenced to the inertial reference frame that defines velocity vectors (V_f,V_r)

indicative of instantaneous velocity of the respective sensor,

the sensors include at least one placed forward of the centre of gravity (CG) of the vehicle (10) and at least one placed rearward of the centre of gravity whereby the velocity vectors (V_f,V_r) are respectively indicative of the velocity of the front of the vehicle and the rear of the vehicle,

the processor (18,40) is adapted to execute a first algorithm to process the velocity vector information from the sensors (14,16,30,32,34,36) with information describing the geometric relationship of the sensors on the vehicle (10), the information including dimensional data that relates the situs of the centre of gravity (CG) to the situs of each of the sensors (14,16,30,32,34,36), and with the information representing the said angle (α) so as to derive a velocity vector V_{cg} that defines the instantaneous velocity of the centre of gravity (CG) of the vehicle (10) with respect to the inertial reference frame,

the processor (18,40) is adapted to execute a further algorithm for calculating an angle ($\alpha+\beta$) equal to the sum of the vehicle centreline angle α and a sideslip angle β,

the processor (18,40) is adapted to subtract the angle α from the said sum so as to provide the angle β to represent the angle between the longitudinal centreline of the vehicle (10) and the velocity vector V_{cg}, and

means are provided to use the sideslip angle β to perform a warning and/or control function."

Claim 2 is an independent claim directed to a method for deriving a value of a parameter defining an aspect of dynamics of a vehicle traversing a multi-dimensional inertial reference frame, the method comprising steps corresponding to the features of claim 1.

Reasons for the Decision

1. *Admissibility*

In its interlocutory decision of 30 November 2005 the board allowed the appellant's auxiliary request for reestablishment of rights. The appeal is accordingly admissible.

2. *Article 123(2) EPC*

2.1 Claim 1

The features of the characterising portion have been added to claim 1 as originally filed and the term "moving object" replaced by "vehicle". The information derived by the processor has now been specified as "information representing an angle between the vehicle centreline and one axis of the inertial reference frame".

This amendment is based on the application as published, see column 4, line 25 to column 5, line 29 and column 6, lines 16 to 18.

Although the term "vehicle" is only used in the context of "moving vehicles" at various passages of the

description, e.g. column 1, line 3, the amendment consisting of replacing "moving object" by "vehicle" is based on the description, since in the claim the term is used in the context of "dynamics of a vehicle" and "vehicle traversing a multi-dimensional inertial reference frame" which implies that the vehicle is moving.

Claim 1 states that the velocity vectors are respectively indicative of the velocity of the front of the vehicle and the rear of the vehicle. Although the description, column 5, lines 2 to 6 states that velocity vectors V_f and V_r are indicative of the magnitude of the instantaneous velocity of the respective sensors, it is implicit that these correspond to the velocity of the front of the vehicle and the rear of the vehicle respectively, since according to column 4, lines 36 to 38 one sensor is disposed forward of the vehicle's centre of gravity, while the other is disposed aft.

Claim 1 accordingly meets the requirements of Article 123(2) EPC.

2.2 Claim 2

Claim 2 is a method claim corresponding to claim 1. For the reasons set out in point 2.1 it fulfils the requirements of Article 123(2) EPC.

2.3 Claim 3

Claim 3 adds to claim 2 that the information from the sensors is processed to compare the track of the

vehicle with a map of a defined travel lane to detect violation of a boundary of the defined lane by the track of the vehicle. This subject-matter is based on column 7, lines 47 to 54. Thus, claim 3 fulfils the requirements of Article 123(2) EPC.

3. *Article 83 EPC*

The implementation of the claimed subject-matter requires a positioning system which can determine the position and velocity of the sensors with a high degree of accuracy. The board notes that the department of first instance did not question whether this requirement was at the date of filing of the application met by the GPS system as used in the preferred embodiment of the invention. The board accordingly concludes, in the absence of evidence to the contrary, that the skilled person would, at the date of filing of the application, have been able to carry out the invention.

4. *Article 84 EPC*

In the board's view the claims are clear and concise and are supported by the description, see also point 2 above.

5. *Articles 54 and 56 EPC*

5.1 Claim 1

5.1.1 Novelty

In the board's view the two most relevant prior art documents are D2 and D3.

D2 discloses an attitude sensing system comprising three GPS antennas connected to respective receivers, see D2, column 3, lines 8 to 13. The outputs of the GPS receivers simultaneously supply the output RF carrier signal from the GPS satellite information to a phase comparator which provides a microprocessor with the phase angle between the three possible pairs of receiver signals, see D2, column 3, lines 13 to 27. The microprocessor determines the attitude information based on the phase information and precalibrated reference information stored in a memory bank, see D2, column 3, lines 49 to 53. The system may be employed in moving vehicles on the ground, see D2, column 4, lines 24 to 27.

D3 discloses a system for determining direction or attitude based on the carrier phase of signals received from a set of GPS satellites, see page 3, lines 40 and 41. The system includes an antenna array with three antennas which are separately connected to respective multichannel receivers which sample the carrier phase of GPS signals as received at the antennas, see page 4, line 57 to page 5, line 2. The phase measurement information is transferred to a microprocessor system

and processed to yield directional and/or attitude information, see page 5, lines 5 to 7.

The system according to claim 1 differs from each of the systems of D2 and D3 inter alia in placing one sensor, i.e. receiver, forward of the centre of gravity of the vehicle and one rearward of the centre of gravity and in using a processor adapted to execute a first algorithm to process the velocity vector information from the sensors with information describing the geometric relationship of the sensors on the vehicle, the information including dimensional data that relates the situs of the centre of gravity to the situs of each of the sensors, and with the information representing an angle between a vehicle centreline and one axis of an inertial reference frame so as to derive a velocity vector that defines the instantaneous velocity of the centre of gravity of the vehicle with respect to the inertial reference frame, and to execute a further algorithm for providing an angle between the longitudinal centreline of the vehicle and the velocity vector of the centre of gravity of the vehicle. Thus, the system according to claim 1 is novel with respect to the disclosure of each of these documents.

5.1.2 Inventive step

The problem underlying the claimed subject matter is to provide an on-board sensor system for more precise and cost-effective on-board measurement of parameters related to vehicle dynamics, see paragraph [0006]. This problem is solved inter alia by using sensors adapted to provide velocity vectors indicative of instantaneous velocity of the respective sensors and placed forward

and rearward of the vehicle's centre of gravity. Based on the sensors' velocity vectors and positions, a velocity vector of the centre of gravity and the angle between the longitudinal centreline of the vehicle and the velocity vector of the centre of gravity, referred to in the application as the sideslip angle, are determined. The system may use conventional GPS sensors, providing a cost-effective solution.

None of the prior art documents mentions the determination of a sideslip angle as defined in the pending application or the use of velocity vectors provided by positioning system sensors as the basis for further calculations.

D2 discloses an attitude measuring system, primarily for satellites but which may be used in moving vehicles on the ground for determining azimuth directions. However, in such a context the azimuth direction is a measure of the orientation of the vehicle, whereas the sideslip angle requires measurement of a component in a direction different to the direction of the longitudinal centreline of the vehicle. According to the preferred embodiment of D2, the attitude of a vehicle is determined based on phase differences of RF carrier signals received at three fixed position antennas separated from each other by a calibrated distance. There is no suggestion that the system be duplicated to provide separate velocity vectors and to derive a velocity vector for the vehicle's centre of gravity and a sideslip component.

A similar argumentation applies with respect to D3, which also discloses determining directional and/or

attitude information based on phase measurement information.

D1 is concerned with improving the accuracy of GPS data and to this end duplicates the GPS antennas and receivers and averages the result. The heading of a vehicle is determined based on the positions of at least two sensors. However, a velocity component of the centre of gravity normal to the longitudinal centreline of the vehicle is neither mentioned nor inferable from the sensor positions alone, the individual velocities of the sensors not being mentioned.

D6 relates to a position determining system using pairs of emitters disposed on opposite sides of a road. Vehicles travelling on the road are provided with two front-mounted sensors which receive the emitters' signals, but neither a velocity component of the centre of gravity vertical to the longitudinal centreline of the vehicle nor a sideslip angle as defined in the pending application are mentioned in D6 or can be inferred from D6. Since the system of D6 requires road-mounted emitters it does not lend itself to application in one of the attitude determining systems of D1 and D2 or the accuracy-improving system of D3.

Thus, the subject-matter of claim 1 involves an inventive step with respect to the disclosure of the prior art documents discussed above.

5.2 Claim 2

Since the subject-matter of independent claim 2 corresponds mutatis mutandis to the subject-matter of claim 1, the argumentation set out in point 5.1 applies.

Order

For these reasons it is decided that:

1. The decision under appeal is set aside.

2. The case is remitted to the department of first instance for grant of a patent on the basis of claims 1 to 3 as filed with the statement of grounds of appeal.

The Registrar: The Chairman:

D. Magliano A. S. Clelland